SEMINAR ON SCIENCE SERVICES IN PREPARATION FOR WORLD RADIOCOMMUNICATION CONFERENCE 2027 (WRC-27)
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Session 7

Working Party 7C Overview

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Session 7: Working Party 7C Overview

Topics:

- Working Party 7C Structure
- Earth exploration-satellite service & meteorological-satellite service (definitions, bands, technical performance, and protection criteria)
- WRC-27 AIs which WP7C is designated as the responsible group for

Working Party 7C Structure

SG7

(Science Services)

Chair : Mr. Markus Dreis (EUMETSAT)

WP7A (Time Signals)

WP7B (Space Radiocommunication)

WP7C (Remote Sensing)

Chair : Mr. Bruno Espinosa (ESA)

WP7D (Radio Astronomy)

WG7C-1

(Active Sensors)

Chairs : Mr. Takahiro Mitome (Japan)

WG7C-2

(MetAids and Space Weather)

Mr. Eric Allaix (France)

WG7C-3

(Passive Sensors)

Mr. John Zuzek (USA)

(Temporally)

Definition of Earth exploration-satellite service(EESS) in RR

1.51 *Earth exploration-satellite service:* A *radiocommunication service* between *earth stations* and one or more *space stations*, which may include links between *space stations*, in which:

- information relating to the characteristics of the Earth and its natural phenomena, including data relating to the state of the environment, is obtained from *active sensors* or *passive sensors* on Earth *satellites*;
- similar information is collected from airborne or Earth-based platforms;
- such information may be distributed to *earth stations* within the system concerned;
- platform interrogation may be included.

This service may also include *feeder links* necessary for its operation.

1.182 *active sensor:* A measuring instrument in the *earth exploration-satellite service* or in the *space research service* by means of which information is obtained by transmission and reception of *radio waves*.

1.183 *passive sensor:* A measuring instrument in the *earth exploration-satellite service* or in the *space research service* by means of which information is obtained by reception of *radio waves* of natural origin.

Definition of MetAids, Space weather, and meteorological-satellite service in RR

1.50 *meteorological aids service:* A radiocommunication service used for meteorological, including hydrological, observations and exploration.

1.52 *meteorological-satellite service:* An *earth exploration-satellite service* for meteorological purposes.

29B.1 § 1 Space weather sensors may operate under the meteorological aids service in the subset MetAids (space weather) allocations. (WRC-23)

29B.2 § 2 The importance of space weather observations and their service designation are highlighted in Resolution **675 (WRC-23)**. (WRC-23)

Resolution **675** (**WRC-23**)

1 that the following definition for space weather shall be used:
space weather: natural phenomena, mainly originating from solar activity and occurring beyond the major portion of the Earth's atmosphere, that impact Earth's environment and human activities;

Frequency Allocation to Earth exploration-satellite service

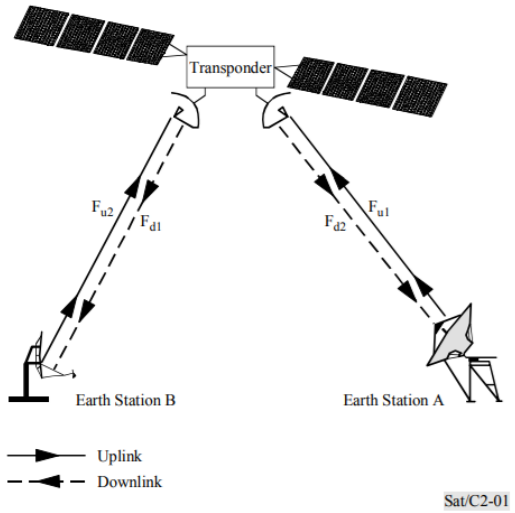
See details in RR Article 5 Frequency Allocation Table and relevant footnotes !
https://www.itu.int/pub/R-REG-RR-2024

Data Link:
EESS(Earth – space): (uplink)
401-403MHz, 1 525-1 535MHz, **2 025-2 110MHz**, **7 190-7 250MHz**, 13.75-14GHz, 28.5-30GHz, **40-40.5GHz**, **65-66GHz**

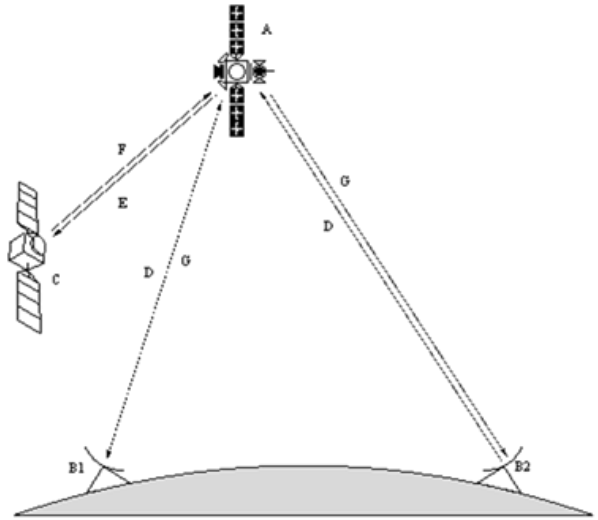
EESS(space – Earth): (downlink)
1 525-1 535MHz, **2 200-2 290MHz**, **8 025-8 400MHz**, 13.75-14GHz, **25.5-27GHz**, 37.5-40GHz, 40-40.5GHz, **65-66GHz**

EESS(space – space): (inter-satellite link)
1 525-1 535MHz, **2 025-2 110MHz**, **2 200-2 290MHz**, 13.75-14GHz, 29.95-30 GHz(telemetry, tracking, and control), **65-66GHz**

Note: **in Bold : Primary allocation,** not in Bold: secondary allocation.



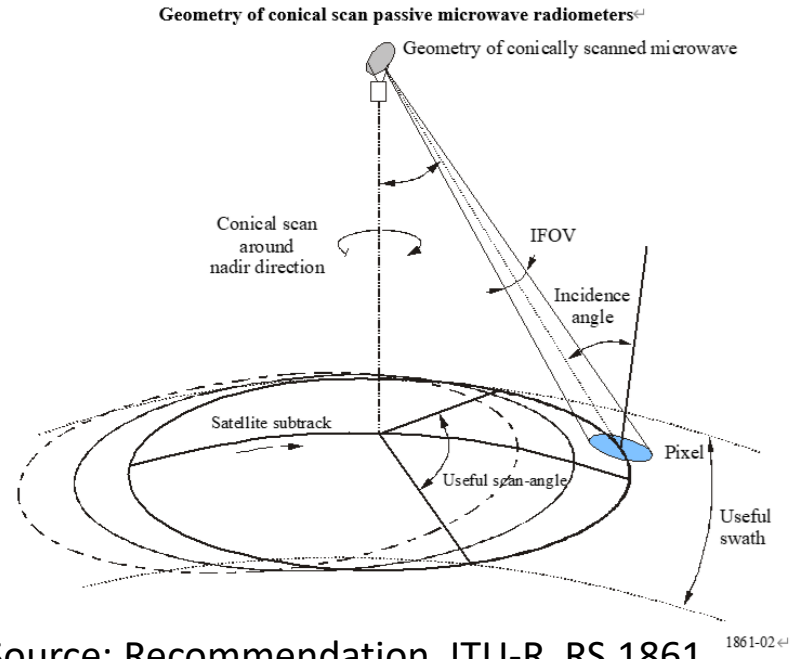
Source: ITU-R HANDBOOK ON SATELLITE COMMUNICATIONS



Source: Rec. ITU-R SA.1018-1

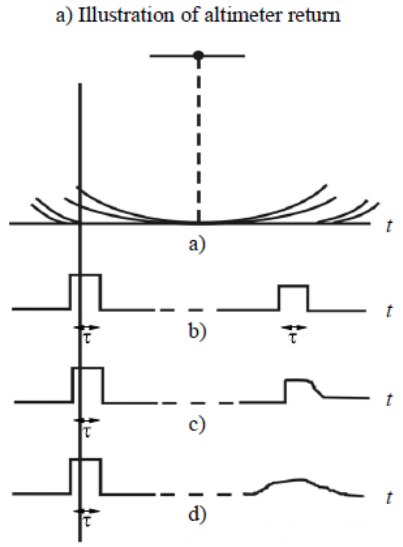
Frequency Allocation to EESS(passive) and EESS(active)

EESS(passive):
1 525-1 535MHz, 2 655-2 690MHz, **2 690-2 700MHz**, **10.6-10.7GHz**, 3.75-14GHz, **15.35-15.4GHz**, **18.6-18.8GHz**, **21.2-21.4GHz**, **22.21-22.5GHz**, **23.6-24GHz**, **31.3-31.8GHz**, **36-37GHz**, **50.2-50.4GHz**, **52.6-59.3GHz**, **65-66GHz**, **86-92GHz**, **100-102GHz**, **109.5-111.8GHz**, **114.25-122.25GHz**, **148.5-151.5GHz**, **164-167GHz**, **174.8-191.8GHz**, **200-209GHz**, **226-231.5GHz**, **235-238GHz**, **239.2-242.2GHz**, **244.2-247.2GHz**, **250-252GHz**



Source: Recommendation ITU-R RS.1861

EESS(active):
40-50MHz, 432-438MHz, **1 215-1 300MHz**, 1 525-1 535MHz, 3 100-3 300MHz, **5 250-5 570MHz**, **8 550-8 650MHz**, **9 200-9 800MHz**, 9 800-9 900MHz, **9.9-10.4GHz**, **13.25-13.75GHz**, 13.75-14GHz, **17.2-17.3GHz**, 24.05-24.25GHz, **35.5-36GHz**, **65-66GHz**, **94-94.1GHz**, **130-134GHz**



Source: ITU-R Earth Exploration–Satellite Service Handbook

Note: **in Bold : Primary allocation,** not in Bold: secondary allocation.

EESS Performance and Protection Criteria

You can download ITU-R Recommendations and Reports from the following URL.

https://www.itu.int/en/publications/ITU-R/Pages/default.aspx

e.g.

ITU-R Recommendations
ITU-R Reports

You can download ITU RR from the following URL.

https://www.itu.int/pub/R-REG-RR-2024

EESS(Active) Performance and Protection in ITU-R Recommendations/Reports

Rec. ITU-R RS.577 Frequency bands and required bandwidths used for spaceborne active sensors operating in the Earth exploration-satellite (active) and space research (active) services

Rec. ITU-R RS.1166 Performance and interference criteria for active spaceborne sensors

Rec. ITU-R RS.2042 Typical technical and operating characteristics for spaceborne radar sounder systems using the 40-50 MHz band

Rec. ITU-R RS.2105 Typical technical and operational characteristics of Earth exploration-satellite service (active) systems using allocations between 432 MHz and 238 GHz

Rec. ITU-R RS.2043 Characteristics of synthetic aperture radars operating in the Earth exploration-satellite service (active) around 9 600 MHz

Rec. ITU-R RS.2066 Protection of the radio astronomy service in the frequency band 10.6-10.7 GHz from unwanted emissions of synthetic aperture radars operating in the Earth exploration-satellite service (active) around 9 600 MHz

EESS(Passive) Performance and Protection in ITU-R Recommendations/Reports

Rec. ITU-R RS.1813 Reference antenna pattern for passive sensors operating in the Earth exploration-satellite service (passive) to be used in compatibility analyses in the frequency range 1.4-450 GHz

Rec. ITU-R RS.1858 Characterization and assessment of aggregate interference to the Earth exploration-satellite service (passive) sensor operations from multiple sources of man made emissions

Rec. ITU-R RS.1859 Use of remote sensing systems for data collections to be used in the event of natural disasters and similar emergencies

Rec. ITU-R RS.1861 Typical technical and operational characteristics of Earth exploration-satellite service (passive) systems using allocations between 1.4 and 275 GHz

Rec. ITU-R RS.1883 Use of remote sensing systems in the study of climate change and the effects there of

Rec. ITU-R RS.2017 Performance and interference criteria for satellite passive remote sensing

Rep. ITU-R RS.2178 The essential role and global importance of radio spectrum use for Earth observations and for related applications

EESS(Passive) Performance and Protection in ITU-R Recommendations/Reports

Rep. ITU-R F.2239 Coexistence between fixed service operating in 71-76 GHz, 81-86 GHz and 92-94 GHz bands and passive services

Rep. ITU-R M.2500 Coexistence between the high-speed railway radiocommunication system between train and trackside operating in the frequency bands 92-94 GHz, 94.1-100 GHz and 102-109.5 GHz, and radioastronomy service and Earth exploration-satellite service (EESS) (active) and EESS (passive) services

EESS(Passive) Protection Criteria in RR articles and resolutions

Protection of EESS(passive) cold sky calibration from unwanted emission of NGSO FSS

5.550CA Non-geostationary-satellite systems in the fixed-satellite service operating with an apogee altitude above 407 km and below 2 000 km in the frequency band 37.5-38 GHz shall not exceed an unwanted emission e.i.r.p. density of −21 dB(W/100 MHz) per space station for angles greater than 65.0° from nadir relative to the space station in the fixed-satellite service in the frequency band 36-37 GHz in order to protect the Earth exploration-satellite service (passive) operating in the latter frequency band. (WRC-23)

Protection of EESS(passive) from unwanted emission of HAPS

RESOLUTION **167** (**REV.WRC-23**)

3 that, in order to ensure the protection of the Earth-exploration satellite service (EESS) (passive), the level of unwanted power density in the frequency band 31.3-31.8 GHz into the antenna of a HAPS ground station operating in the frequency band 31-31.3 GHz shall be limited to −83 dB(W/200 MHz) under clear-sky conditions, and may be increased under rainy conditions to mitigate fading due to rain, provided that the effective impact on the passive satellite does not exceed the impact under clear-sky conditions;

4 that, in order to ensure the protection of the EESS (passive), the level of unwanted emission e.i.r.p. density per HAPS transmitter operating in the frequency band 31-31.3 GHz into the frequency band 31.3-31.8 GHz shall be limited to:

$-\theta - 13.1$	dB(W/200 MHz)	for	$-4.53^\circ \leq \theta < 22^\circ$
−35.1	dB(W/200 MHz)	for	$22^\circ \leq \theta < 90^\circ$

where θ is the elevation angle in degrees at the platform height;

WRC-27 AIs which WP7C is designated as the responsible group for

Agenda Item 1.17

*to consider regulatory provisions for receive-only space weather sensors and their protection in the Radio Regulations, taking into account the results of ITU Radiocommunication Sector studies, in accordance with Resolution **682 (WRC-23)**;*

Agenda Item 1.18

*to consider, based on the results of ITU Radiocommunication Sector studies, possible regulatory measures regarding the protection of the Earth exploration-satellite service (passive) and the radio astronomy service in certain frequency bands above 76 GHz from unwanted emissions of active services, in accordance with Resolution **712 (WRC-23)**;*

Agenda Item 1.19

*to consider possible primary allocations in all Regions to the Earth exploration-satellite service (passive) in the frequency bands 4 200-4 400 MHz and 8 400-8 500 MHz, in accordance with Resolution **674 (WRC-23)**;*

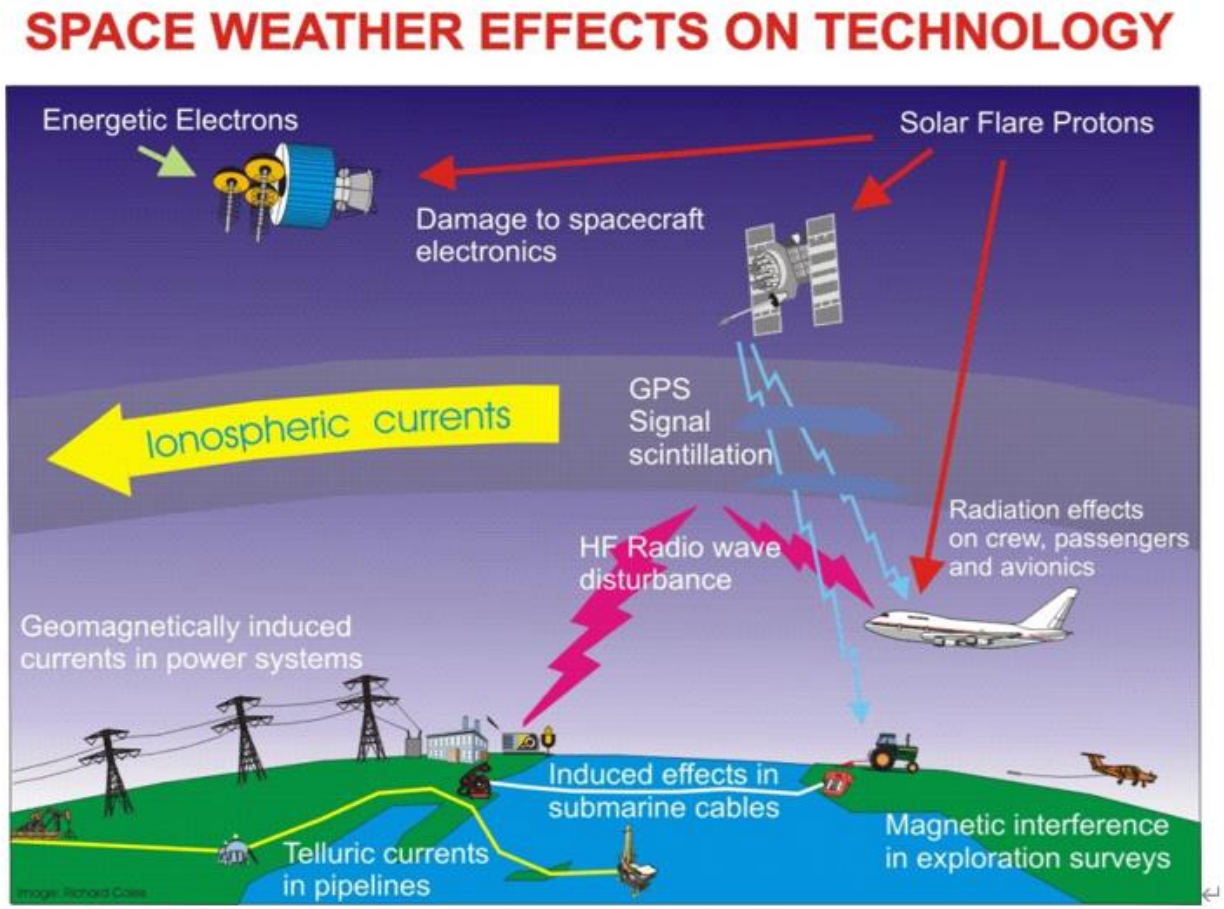
Background of WRC-27 Agenda Item 1.17

Space weather refers to electromagnetic conditions in the space environment near Earth.

These conditions can affect radiocommunications, broadcasting, satellite positioning, electric power grid and aviation operations. They can also expose aircraft passengers and crew to elevated radiation levels.

As such, monitoring and predicting space weather conditions are of crucial importance.

To support these efforts, regulatory recognition and protection have been needed for space weather observation systems, including receive-only sensors that detect low-level emissions from sources such as the Sun, the Earth's atmosphere and other celestial bodies.



Source: Report ITU-R RS.2178

Background of WRC-27 Agenda Item 1.17

Under AI 1.17, regulatory provisions for receive-only space weather sensors and their protection in the RR, including potential new primary allocations to MetAids (space weather), will be considered, in accordance with Resolution **682(WRC-23)**.

As a foundational step, WRC-23 defined the term “space weather” and included space weather observations within the scope of the meteorological aids service by designating a subset indicated as MetAids (space weather) in the RR (Article **29B** and Resolution **675** (**WRC-23**)). Consideration under WRC-27 Agenda Item 1.17 will build upon this groundwork laid at WRC-23.

Work plan and progress of WRC-27 Agenda Item 1.17

Working Document on CPM text for WRC-27 Agenda Item 1.17

- Draft CPM text on AI 1.17 is under development.
- CPM text shall be submitted by October 2026.

Liaison Statement to/from corresponding groups(WPs 3L, 3M, 4C, 5A, 5B, 5C, 5D, 6A, 7B, 7D)

- Exchanging information relevant to AI 1.17 with corresponding groups

Working Document towards a PDN Report ITU-R RS.[SW_STUDIES]

- A new report on AI 1.17, sharing analysis between MetAids(space weather) and incumbent services is under development.
- The new report shall be adopted before WRC-27.

Working Document towards a PDN Rec. ITU-R RS.[RXSW_PROTECT_CRITERIA]

- A new recommendation on Protection criteria of receive-only space weather sensors in MetAids (space weather) is under development.
- The new recommendation shall be adopted before WRC-27.

Background of WRC-27 Agenda Item 1.18

Resolution **712** (**WRC-23**) consists of two resolves,

- **resolves 1**: compatibility studies between the EESS (passive) and the corresponding active services in adjacent frequency bands as listed in Table 1 below:
- **resolves 2**: compatibility studies between the RAS and the active satellite services in certain adjacent and nearby frequency bands listed in Table 2 below with a view to setting the relevant threshold levels for unwanted emissions from any GSO and non-GSO space stations and revising and updating Resolution 739 (Rev.WRC-19) accordingly:

WP 7C is designated as the responsible group for the **resolves 1**, **WP 7D** is designated as the responsible group for the **resolves 2**, and WPs 3J/3M/4A/4C/5A/5B/5C are designated as contributing groups.

TABLE 1

EESS (passive) frequency bands to be studied and corresponding active services to be included

EESS (passive) frequency band	Active service frequency band	Active service
86-92 GHz	81-86 GHz	Fixed-satellite service (FSS) (Earth-to-space), mobile service (MS)
	92-94 GHz	MS, radiolocation service (RLS)
114.25-116 GHz	111.8-114.25 GHz	Fixed service (FS), MS
164-167 GHz	158.5-164 GHz	FS, FSS (space-to-Earth), MS, mobile-satellite service (MSS) (space-to-Earth)
	167-174.5 GHz	FS, FSS (space-to-Earth), inter-satellite service (ISS), MS
200-209 GHz	191.8-200 GHz	FS, ISS, MS, MSS, radionavigation service (RNS), radionavigation-satellite service (RNSS)
	209-217 GHz	FS, FSS (Earth-to-space), MS

TABLE 2

RAS frequency bands to be studied and corresponding active services to be included

Radio astronomy frequency band	Active satellite service frequency band	Active satellite service (space-to-Earth)
76-81 GHz	71-76 GHz	Fixed-satellite service (FSS), mobile-satellite service (MSS), broadcasting-satellite service (BSS)
130-134 GHz	123-130 GHz	FSS, MSS, radionavigation-satellite service (RNSS)
164-167 GHz	167-174.5 GHz	FSS
226-231.5 GHz	232-235 GHz	FSS

Work Plan and Progress of WRC-27 Agenda Item 1.18

Working document on draft CPM TEXT FOR WRC-27 AGENDA ITEM 1.18

- The draft CPM text will be prepared by WP 7C (resolves 1) and WP 7D (resolves 2).
- The draft CPM text on AI 1.18 is under development.
- CPM Text shall be submitted by October 2026.

Liaison statements to/from contributing groups(WPs 3J, 3M, 4A, 4C, 5A, 5B, 5C)

- Exchanging information relevant to AI 1.18 with corresponding groups

Working document towards a PDN Report ITU-R RS.[1.18 – EESS]

- A new report on AI 1.18, sharing analysis between EESS(passive) and incumbent services is under development.
- The new report shall be adopted before WRC-27.

Background of WRC-27 Agenda Item 1.19

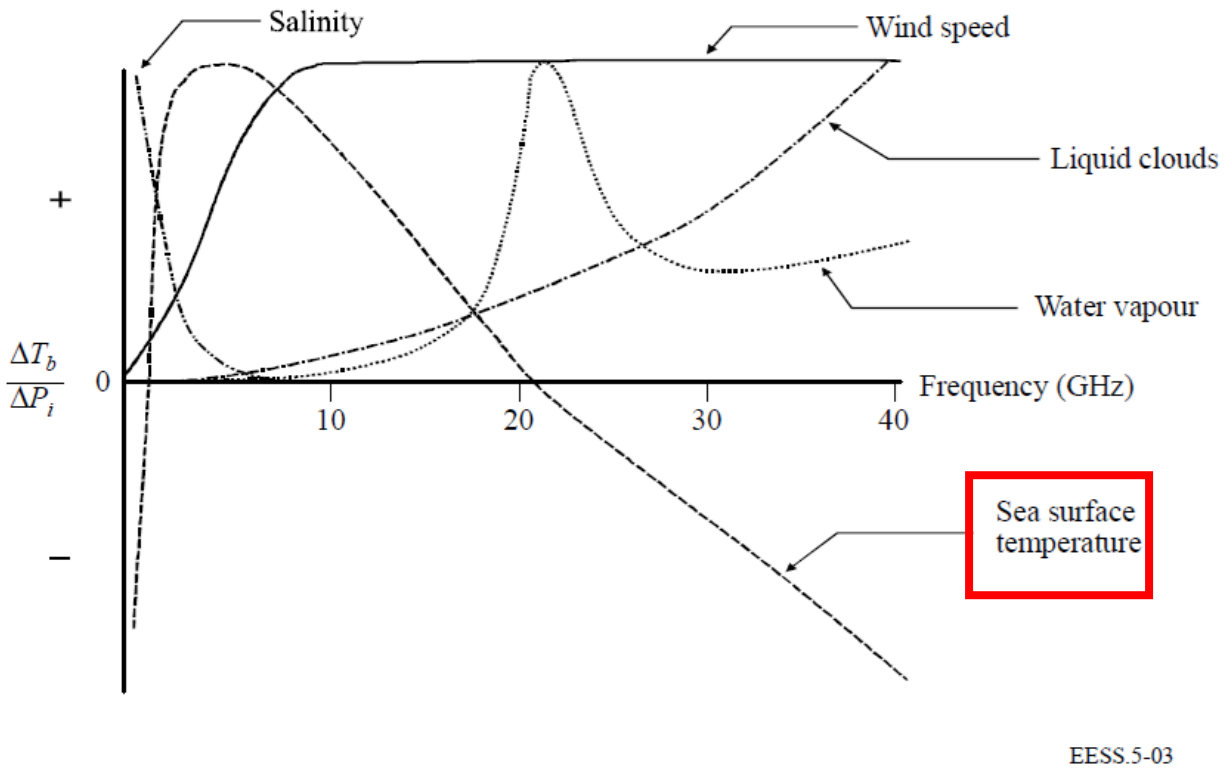
The sea surface temperature (SST) measurements currently performed in the 6/7 GHz range under the ITU RR No. 5.458

5.458 In the band 6 425-7 075 MHz, passive microwave sensor measurements are carried out over the oceans. In the band 7 075-7 250 MHz, passive microwave sensor measurements are carried out. Administrations should bear in mind the needs of the Earth exploration-satellite (passive) and space research (passive) services in their future planning of the bands 6 425-7 075 MHz and 7 075-7 250 MHz.

As WRC-23 has identified the frequency bands 6 425 - 7 125 MHz or 7 025 - 7 125 MHz for terrestrial component of IMT (RR Nos. 5.457D, 5.457E and 5.457F), Resolution **674** (**WRC-23**) was adopted to study possible primary allocations in all Regions to the EESS(passive) in the frequency bands 4 200 - 4 400 MHz and 8 400 - 8 500 MHz.

FIGURE 5-3

Sensitivity of brightness temperature to geophysical parameters over ocean surface



Source: ITU-R Earth Exploration–Satellite Service Handbook

Background of WRC-27 Agenda Item 1.19

Resolution **674** (**WRC-23**) invites ITU-R to consider possible primary allocations in all Regions to the EESS (passive) in 4 200 - 4 400 MHz and 8 400 - 8 500 MHz bands.

These two new frequency bands are potential candidate bands that would complement the sea surface temperature (SST) measurements currently performed in the 6/7 GHz range under the ITU RR No. 5.458.

The **SST** is the key parameter for air-sea interactions and widely used in weather and climate prediction, coastal disaster prevention, fisheries management, and ecosystem conservation. Satellites in the EESS (passive) enable daily measurements of SST on the entire globe, even in the presence of clouds.

Work Plan and Progress of WRC-27 Agenda Item 1.19

Working document on draft CPM TEXT FOR WRC-27 AGENDA ITEM 1.19

- The draft CPM text on AI 1.19 is under development.
- CPM Text shall be submitted by October 2026.

Liaison statements to/from contributing groups (WPs 3J, 3M, 4A, 5A, 5B, 5C, 5D, 7B)

- Exchanging information relevant to AI 1.19 with corresponding groups

Working document towards a PDN Report ON WRC-27 AGENDA ITEM 1.19

- A new report on AI 1.19, Sharing and compatibility studies between EESS (passive) and incumbent services is under development.
- The new report shall be adopted before WRC-27.

WRC-31 preliminary agenda items related to WP7C

Preliminary Agenda Item 2.10

*to consider a possible new primary allocation to the Earth exploration-satellite service (Earth-to-space) in the frequency band 22.55–23.15 GHz, in accordance with Resolution **664 (Rev.WRC-23)**;*

Preliminary Agenda Item 2.11

*to consider an upgrade of the secondary allocation to the Earth exploration-satellite service (space-to-Earth) in the frequency band [37.5-40.5 GHz] or possible new worldwide frequency allocations on a primary basis to the Earth exploration-satellite service (space-to-Earth) in certain frequency bands within the frequency range [40.5-52.4 GHz], in accordance with Resolution **685 (WRC-23)**;*

Preliminary Agenda Item 2.12

*to consider possible new allocations to the Earth exploration-satellite service (active) in the frequency bands [3 000-3 100 MHz] and [3 300-3 400 MHz] on a secondary basis, in accordance with Resolution **686 (WRC-23)**;*

Preliminary Agenda Item 2.13

*to consider studies on coexistence between space-borne synthetic aperture radars operating in the Earth exploration-satellite service (active) and the radiodetermination service in the frequency band 9 200–10 400 MHz, with possible actions as appropriate, in accordance with Resolution **722 (WRC-23)**.*