

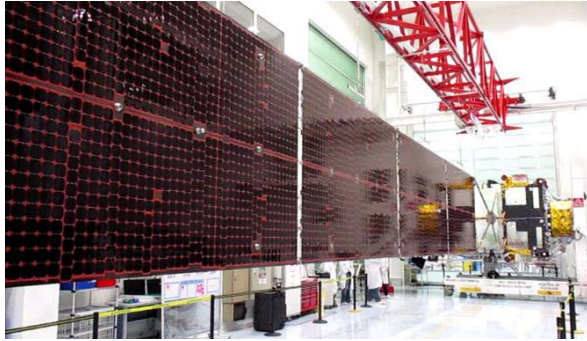


Earth Stations in Motion (ESIM) Studies in the Ka-Band (WRC-19 A.I. 1.5) and other ITU-R relevant issues

WRC19 requirement for studies in bands 17.7-19.7GHz (space to earth) and 27.5-29.5GHz (earth to space)

Inmarsat new satellites

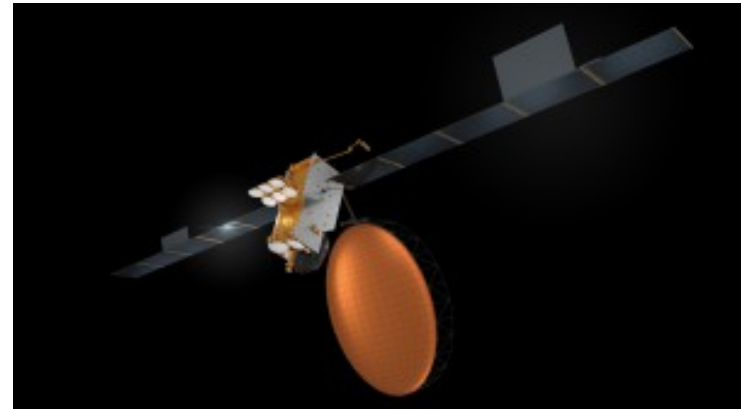
L, S and Ka-band systems



Europasat (S-band: 1980-2010MHz/
2170-2200MHz
Launch in June 2017)



Inmarsat-5 F4 (Ka-band, launch in May 2017)



Inmarsat-6 (L & Ka-bands, launch in 2020)

Coexistence IMT/MSS at 1 518 MHz/L-Band

Inmarsat extended L-band (1 518-1 525 MHz)

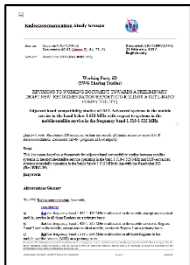
(CEPT ECC Report 263) The results of the simulations show that there will be some interference irrespective of the selected frequency separation.

(ITU-R Draft New Recommendation) Adjacent band compatibility studies of IMT-Advanced systems in the mobile service in the band below 1 518 MHz with respect to systems in the mobile-satellite service in the frequency band 1 518-1 525 MHz

recommends

- 1 that IMT systems deployed in the band 1 492-1 518 MHz and MSS systems deployed in the band 1 518-1 525 should take into account Annex 1 containing the technical measures to ensure coexistence between MSS in the frequency band 1 518-1 525 MHz and IMT in the frequency band 1 492-1 518 MHz;
- 2 that emissions from IMT base stations operating in the band 1 427-1 518 MHz should not exceed the following levels:
 - a) Unwanted emissions in the band 1 518-1 520 MHz: [TBD] dBm/MHz e.i.r.p.,
 - b) Unwanted emissions in the band 1 520-1 525 MHz: -30 dBm/MHz e.i.r.p.,
- 3 that where administrations wish to provide protection of ship earth stations in harbours, or aircraft earth stations at airports, there may be a need to apply additional mitigation techniques to IMT BSs in the vicinity of seaports and airports for the frequencies at the top end of the 1492-1518 MHz frequency band to avoid harmful interference to MESS;
- 4 that where administrations wish to provide enhanced level of protection of land earth stations, there may be a need to apply additional mitigation techniques to IMT BSs for the frequencies at the top end of the 1 492-1 518 MHz frequency band to avoid harmful interference to MESSs including:
 - c) limit on IMT base station emissions in the band 1 512-1 517 MHz: [TBD] dBm e.i.r.p.;
 - d) [additional measures TBD]].

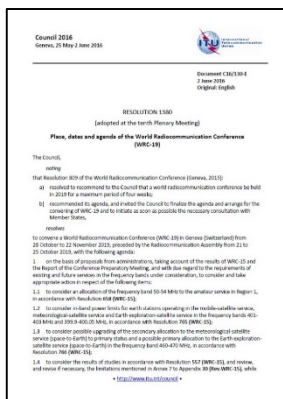
The value of -30 dBm/MHz is proposed for OOB emissions above 1520 MHz
the same value should also be adopted for 1518-1520 MHz
Important that extra protection is provided (e.g. coordination distances) for airports and harbours





WRC-19 agenda items

Issues of interest



Inmarsat participation

Active participation in
ITU Radiocommunication Study
Groups

Key role of Regional Groups

CITEL
ATU
APT

ASMG
RCC
CEPT

AI	ESIMs in shared Ka-band	AI 1.14	HAPS	AI 1.6	NGSOs in Q/V band	AI 1.11	Railway systems
AI 1.5							
AI 1.8	GMDSS	AI 7	ITU satellite filing procedures	AI 9.1.3	NGSO FSS in C-band	AI 1.12	Intelligent Transport Systems
AI 1.10	GADSS	AI 9.1.1	S-band IMT sharing	AI 9.1.9	New FSS (E-s) allocation in 51.4-52.4 GHz	AI 1.16	RLANS
AI 1.13	IMT above 6 GHz	AI 9.1.7	Unlicensed VSATs	AI 9.1.4	Sub-orbital vehicles	AI 4	Review of Res. & Rec
						AI 8	Deletion of countries from footnotes



ESIMs (WRC-19 agenda item 1.5)

17.7-19.7 / 27.5-29.5 GHz



- ➔ These bands are allocated to a number of other services on a primary and secondary basis. Use by ESIMs therefore requires additional studies.
- ➔ Constraints on ESIMs (e.g., pfd limits as in ECC/DEC(13)01), will be required to ensure compatibility with other services in parts of the band. Appropriate conditions can be defined to allow ESIMs operation throughout the bands studied.

WRC-19 Agenda Item 1.5 – Resolution 158

Defines the ITU-R studies required for WRC-19

1. To study characteristics and user requirements of different types of ESIMs in the bands **17.7-19.7 GHz and 27.5-29.5 GHz**, including the use of spectrum to provide the envisioned services and the degree to which flexible access to spectrum can facilitate sharing with other services
2. To study sharing and compatibility between ESIMs and current and planned stations of existing services allocated in the bands 17.7-19.7 GHz and 27.5-29.5 GHz to ensure protection of, and not impose undue constraints on, those services
3. To develop, for different types of earth stations in motion and different portions of the frequency bands studied, technical conditions and regulatory provisions for their operation, taking into account the results of the studies above

1. User requirements and flexible spectrum access to facilitate sharing

2. Sharing studies with other services

3. Propose technical and regulatory provisions for ESIMs

Flexible Access to Spectrum (1)

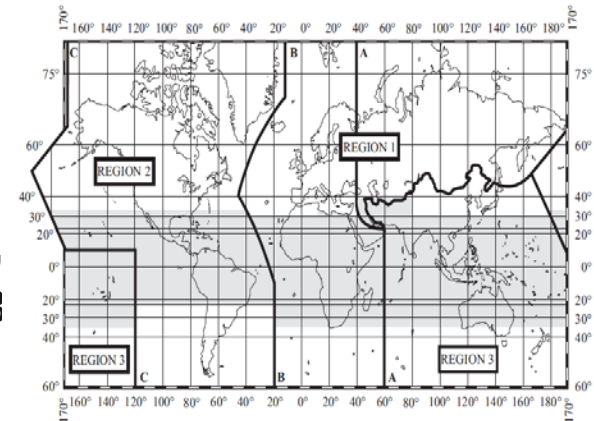
Sharing with other services

- Different services occupying the bands within the scope of AI 1.5: fixed service, mobile service, EESS (passive), space research (passive), EESS (Earth-to-space) fixed-satellite service (GSO, non-GSO, non-GSO MSS feeder links)
- Sharing will lead to different constraints in different geographic areas. For example:
 - Some parts of the band 27.5-29.5 GHz are designated to the Fixed Service in Europe – consequently ESIMs are not authorised for use in the territory of CEPT countries in those parts of the band.
 - Use of some parts of the bands 29.1-29.5 GHz are used for non-GSO MSS feeder links, which leads to some no-go areas for GSO FSS earth stations.

Flexible Access to Spectrum (2)

HDFSS

- Some bands in the ranges 17.7-19.7 GHz and 27.5-29.5 GHz are identified for “high-density applications in the fixed-satellite service” (HDFSS) – see RR No. 5.516B
 - 18.3-19.3 GHz (space-to-Earth) in Region 2,
 - 27.5-27.82 GHz (Earth-to-space) in Region 1,
 - 28.35-28.45 GHz (Earth-to-space) in Region 2,
 - **28.45-28.94 GHz (Earth-to-space) in all Regions,**
 - 28.94-29.1 GHz (Earth-to-space) in Region 2 and 3
 - 29.25-29.46 GHz (Earth-to-space) in Region 2
- These bands typically have no terrestrial systems deployed to enable deployment of VSATs with no need for detailed interference evaluation. These bands may therefore be ideal for ESIMS...
- But the bands are not well harmonised between the ITU Regions – only 28.45-28.94 GHz (490 MHz) of uplink spectrum is harmonised among all Regions



Flexible Access to Spectrum (3)

- Different sharing conditions in different countries and different areas will lead to some areas where ESIM operations is probably not possible/possible with restrictions in some frequency bands...
- ...but in any area, there should be some frequencies on which ESIMs may operate without risk of interference to others, and without major risk of interference to ESIMs.
- Constraints will vary depending on whether ESIMs are land, aeronautical or maritime. E.g. use of aeronautical ESIMs might be feasible in areas used by terrestrial services considering aircraft altitude.

Regulatory issues raised within WP 4A

See discussion in Working Document: doc 4A/196 Annex 16

- ➔ Use of ESIMs raises some regulatory issues, identified by WP 4A for further consideration:
 - Responsibility for coordination,
 - Requirements for licensing
 - Responsibility for dealing with interference
- ➔ The same issues have risen before, for example in the context of ESVs (C-band and Ku-band) and AMSS (Ku-band) but are raised again for agenda item 1.5.
 - Expected that these issues will be addressed in the CPM Report and might need action at WRC-19 to address.

Other services/applications to be considered

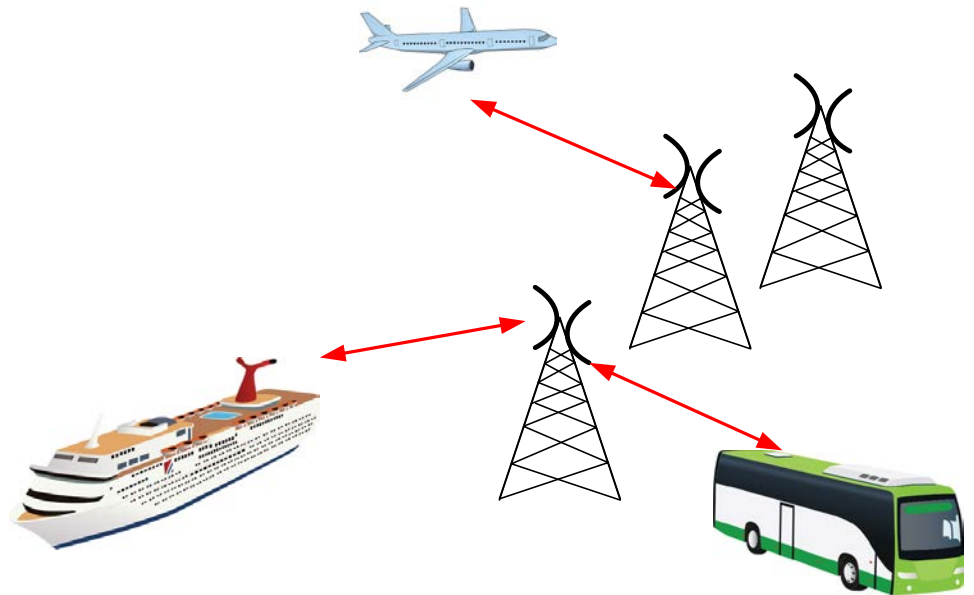
Uplink band (27.5-29.5 GHz) – RR Article 5

27.5-28.5	FIXED 5.537A FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 MOBILE 5.538 5.540
28.5-29.1	FIXED FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.523A 5.539 MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540
29.1-29.5	FIXED FIXED-SATELLITE (Earth-to-space) 5.516B 5.523C 5.523E 5.535A 5.539 5.541A MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540

Sharing with Fixed Service in the band 17.7-19.7 GHz and 27.5-29.5 GHz (1/2)

Overview of scenarios

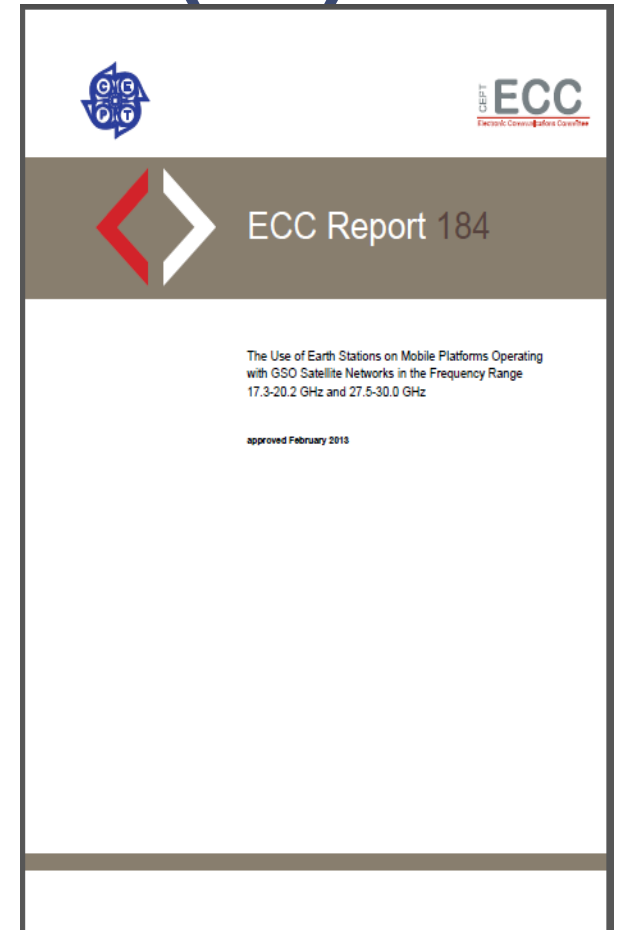
- Three scenarios: aircraft ESIMs, maritime ESIMs, land ESIMs
- In the uplink band (27.5-29.5 GHz), ESIMs could cause interference to fixed link receivers
- In the downlink band (17.7-19.7 GHz), ESIMs will have to accept interference from fixed links



Sharing with Fixed Service in the band 17.7-19.7 GHz and 27.5-29.5 GHz (2/2)

CEPT regulatory measures

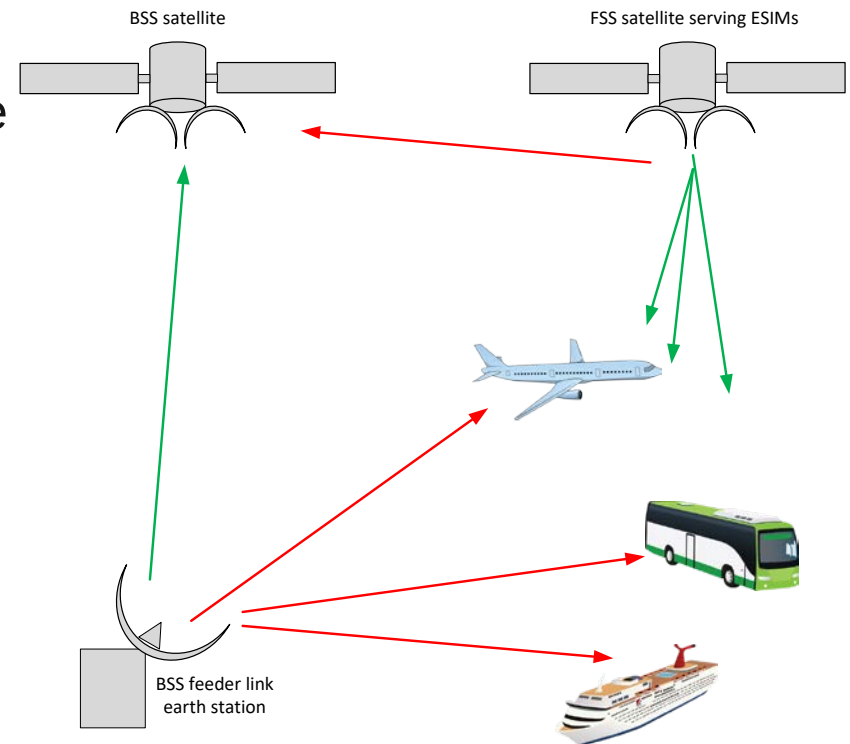
- ➔ ECC Report 184, contains the results of CEPT studies from 2013 for ESIMs operations in 17.3-20.2 GHz and 27.5-30 GHz
- ➔ Determines technical measures that are included in ECC Decision (13)01:
 - PFD values on the ground, to protect fixed links from aircraft ESIMs
 - PFD at the coast, to protect fixed links from maritime ESIMs



Sharing with BSS feeder links in the band 17.7-18.4 GHz

Preliminary analysis of sharing

- ➔ Interference potential:
 - From satellite serving ESIM to satellite receiving BSS feederlink From BSS feeder link earth station to ESIM. (Note: same situation applies for FSS satellite service stationary earth stations, dealt with by inter-system coordination and RR Appendix 8)
 - Interference to land ESIM and maritime ESIM depends on distance from feeder link earth station to ESIM. ESIM must be geographically close
 - Interference to aircraft ESIM may occur when aircraft flies through the beam of the feeder link earth station.



Preliminary analysis of sharing

Summary of sharing issues

Service	Downlink band	Uplink band	Preliminary view
Fixed service	X	X	Conduct sharing studies, to develop new mechanisms for protection of FS from ESIMs
Mobile service	X	X	Seeking characteristics from WP 5A. If necessary, sharing studies probably similar to FS
EESS (passive) and SR (passive)	X		No need for detailed studies
EESS (E-s)		X	No need for detailed studies.
Non-GSO FSS, subject to epfd limits (RR 5.484A, 22.5C, 22.51)	X	X	The interference environment is unchanged compared to fixed VSATs, so no detailed studies are required.
Non-GSO FSS, not subject to epfd limits, (RR 5.523A, 9.11A)	X	X	The interference environment is unchanged compared to fixed VSATs, so no detailed studies are required.
Non-GSO MSS feeder links, 19.3-19.7 GHz, RR5.523D	X	X	The interference environment is unchanged compared to fixed VSATs, so no detailed studies are required.
BSS feeder links 17.7-18.1 GHz, 18.1-18.4 GHz (RR 5.516, 5.520)	X		Conduct sharing studies, but on the premise that ESIMs will not claim protection from BSS feeder uplinks

Input in to ITU-R

- ➔ Administration are invited to support by
 - To carry out detailed research and study on national (and/or sub-regional basis) on the impact of ESIMs operations in the uplink and downlink in the Ka bands identified;
 - Prepare the report on the findings of the study work for possible submission to ITU-R WP 4A;
 - Continue to support the findings in regional and international forums related to WRC19;
 - Liaise with our experts