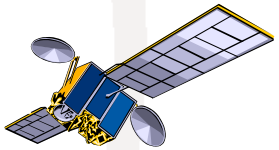
Broadcasting-Satellite Service Plans and Lists (Appendices 30 & 30A)



Mark Griffin
Space Services Department
ITU Radiocommunication Bureau (BR)

World **R**adiocommunication **S**eminar 2010 (WRS-10)
Geneva, **S**witzerland, 6-10 December 2010

Outline

- Frequency Bands
- Plans / Lists
- Main Regulatory Aspects
- Processing of New Submissions
- Compatibility Analysis

Frequency Bands Plan / Lists

How to get them in the RR?

Article 5 Table of Frequency Allocations

And footnotes

Region 1	Region 2	Region 3
11.7-12.5 FIXED BROADCASTING **BROADCASTING-SATELLITE** MOBILE except aeronautical mobile	**11.7-12.1** FIXED 5.486 FIXED-SATELLITE (space-to-Earth) Mobile except aeronautical mobile	**11.7-12.2** FIXED MOBILE except aeronautical mobile BROADCASTING **BROADCASTING-SATELLITE**
	12.1-12.2 FIXED-SATELLITE (space-to-Earth)	
	12.2-12.7 FIXED MOBILE except aeronautical mobile BROADCASTING **BROADCASTING-SATELLITE**	**12.2-12.5** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile BROADCASTING
12.5-12.75 FIXED-SATELLITE (space-to-Earth) (Earth-to-space)		**12.5-12.75** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile BROADCASTING-SATELLITE
	12.7-12.75 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE except aeronautical mobile	

Frequency Bands Plan / Lists

- Article 5 (Allocation Table & Footnotes) of the Radio Regulations (RR)

- Footnotes of Articles 9 and 11 of the RR (see Appendices 30 and 30A…)

Frequency Bands Plan / Lists

- Article 5 (Allocation Table & Footnotes) of the Radio Regulations (RR)
- Footnotes of Articles 9 and 11 of the RR
- Article 2 of Appendices 30 and 30A

ARTICLE 2 of AP30 (WRC-03)

Frequency bands

2.1 The provisions of this Appendix apply to the broadcasting-satellite service in the frequency bands between 11.7 GHz and 12.2 GHz in Region 3, between 11.7 GHz and 12.5 GHz in Region 1 and between 12.2 GHz and 12.7 GHz in Region 2 and to the other services to which these bands are allocated in Regions 1, 2 and 3, insofar as their relationship to the broadcasting-satellite service in these bands is concerned.

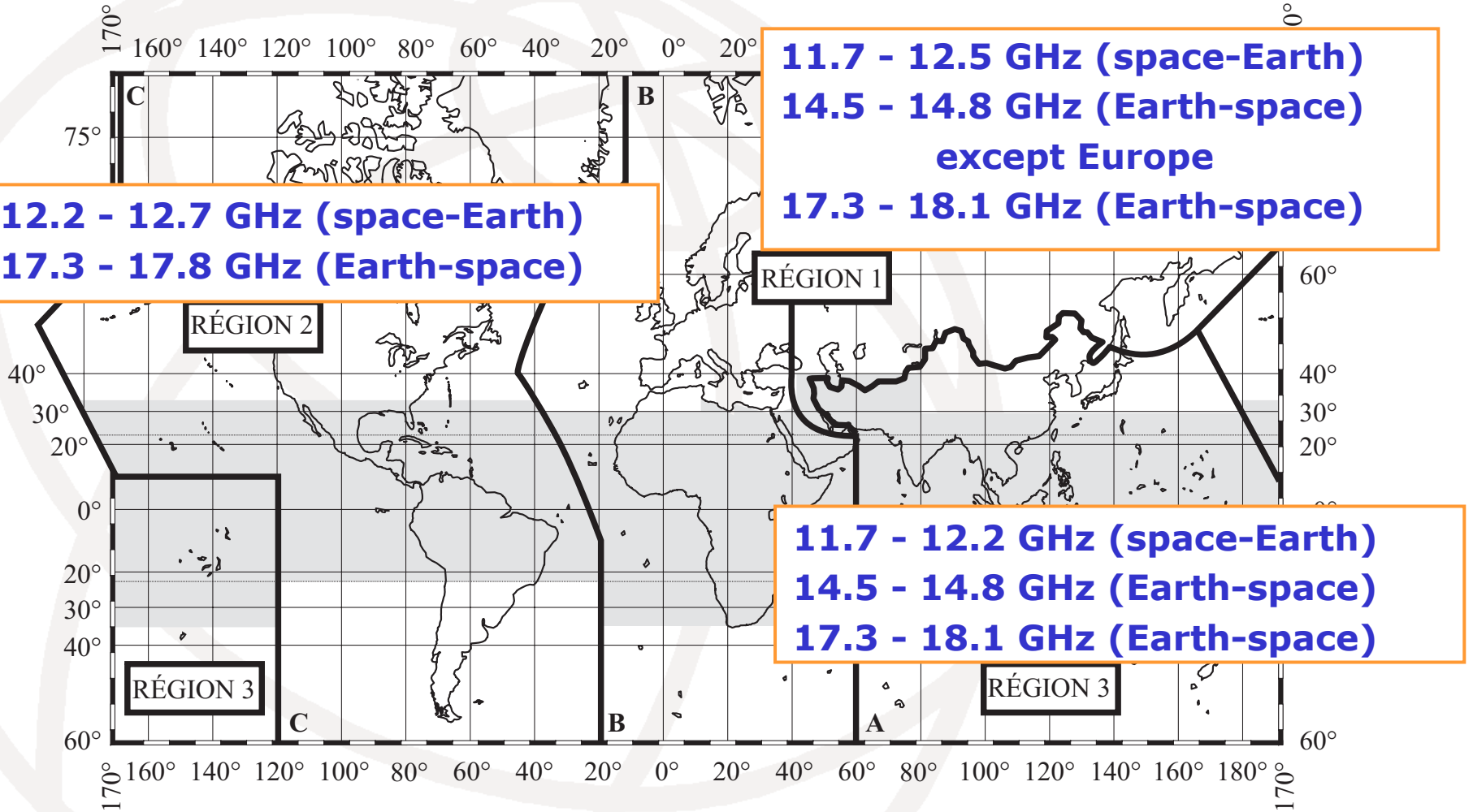
ARTICLE 2 of AP30A (WRC-03)

Frequency bands

2.1 The provisions of this Appendix apply to the feeder-links in the fixed-satellite service (Earth-to-space) in the frequency bands 14.5-14.8 GHz and 17.3-18.1 GHz for the broadcasting-satellite service in Regions 1 and 3, and 17.3-17.8 GHz for the broadcasting-satellite service in Region 2 and to other services to which these bands are allocated in Regions 1, 2 and 3 so far as their relationship to the fixed-satellite service (Earth-to-space) in these bands is concerned.

Frequency bands

BSS Plan/Lists coverage



5-01

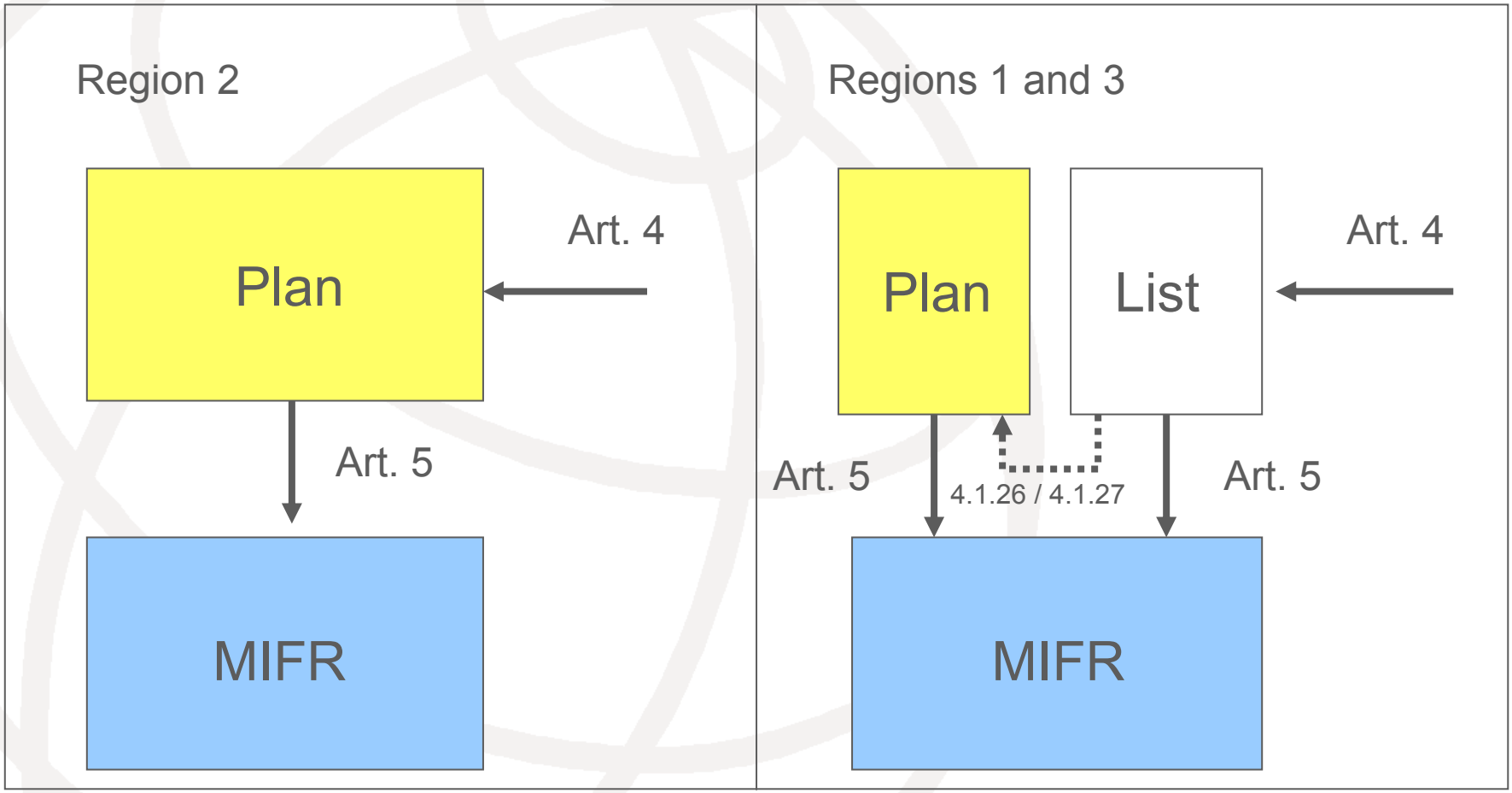
Plan / Lists

History, description, compatibility

HISTORY

- **Appendix 30 Downlink Plans**
  - Regions 1 and 3 Plan (223 entries)
    1977 rev. in 1997, 2000
  - Region 2 Plan (170 entries)
    1983 included in the RR in 1985
- **Appendix 30A Feeder-link Plans**
  - Regions 1 and 3 Plans (301 entries)
    1988 rev. in 1997, 2000
  - Region 2 Plan (168 entries)
    1983 included in the RR in 1985

AP30/30A Procedure



Technical data used?

Annex 5 of Appendix 30 - Annex 3 of Appendix 30A

- Type of modulation (digital for R1&3), Polarization, C/N, Protection ratio, System noise, Channel, Antenna, Necessary bandwidth, satellite station keeping etc.
- Most of them are characteristics used for establishing Plans ⟶ can be different for modifications
- However, when "shall" is used ⟶ has to be observed

Elements of Plans

National assignments in:

- Articles 10 & 11 of AP30 (downlink)
- Articles 9 & 9A of AP30A (feeder-link)

Description:
orbital position, channels, polarisation, power levels, antenna patterns, emission designation, beam coverage, grouping ...

Plan - Region 2 in numbers

- Downlink and Feeder-link together (OEPM)
- 32 channels for a cluster
- Cluster concept
- Same status given to assignments in the Plan resulting from the application of Article 4 procedure if brought into use
- Currently 173 entries

Plans - Regions 1 and 3 in numbers

WRC-2000 developed a new Plan that included:

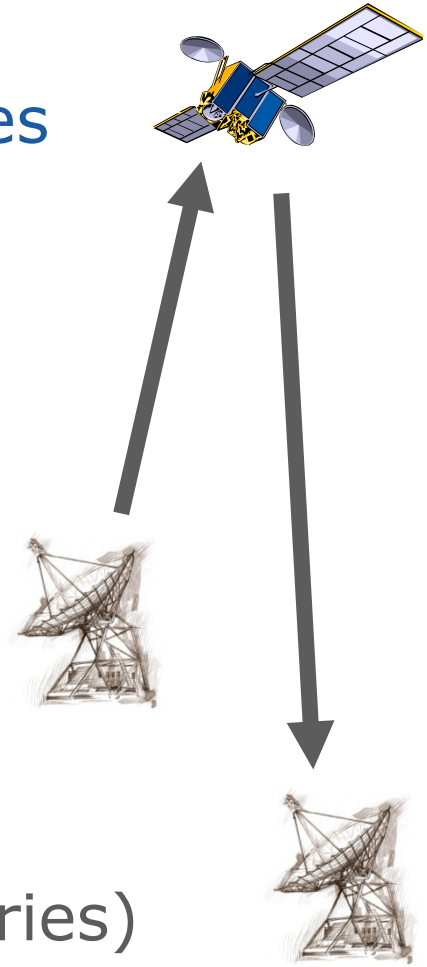
- 10 channels in Region 1
  12 channels in Region 3

- 223 downlink entries
  301 feeder-link entries

- 5 extended-coverage national beams for 15 administrations
- 30 "composite" beams

Lists - Regions 1 and 3 in numbers

Regions 1 and 3 Lists of Additional Uses created by WRC-2000:



- AP30 Downlink List
  - 12 GHz (currently 54 entries)

- AP30A Feeder-link List
  - 14 GHz / 17 GHz (currently 51 entries)

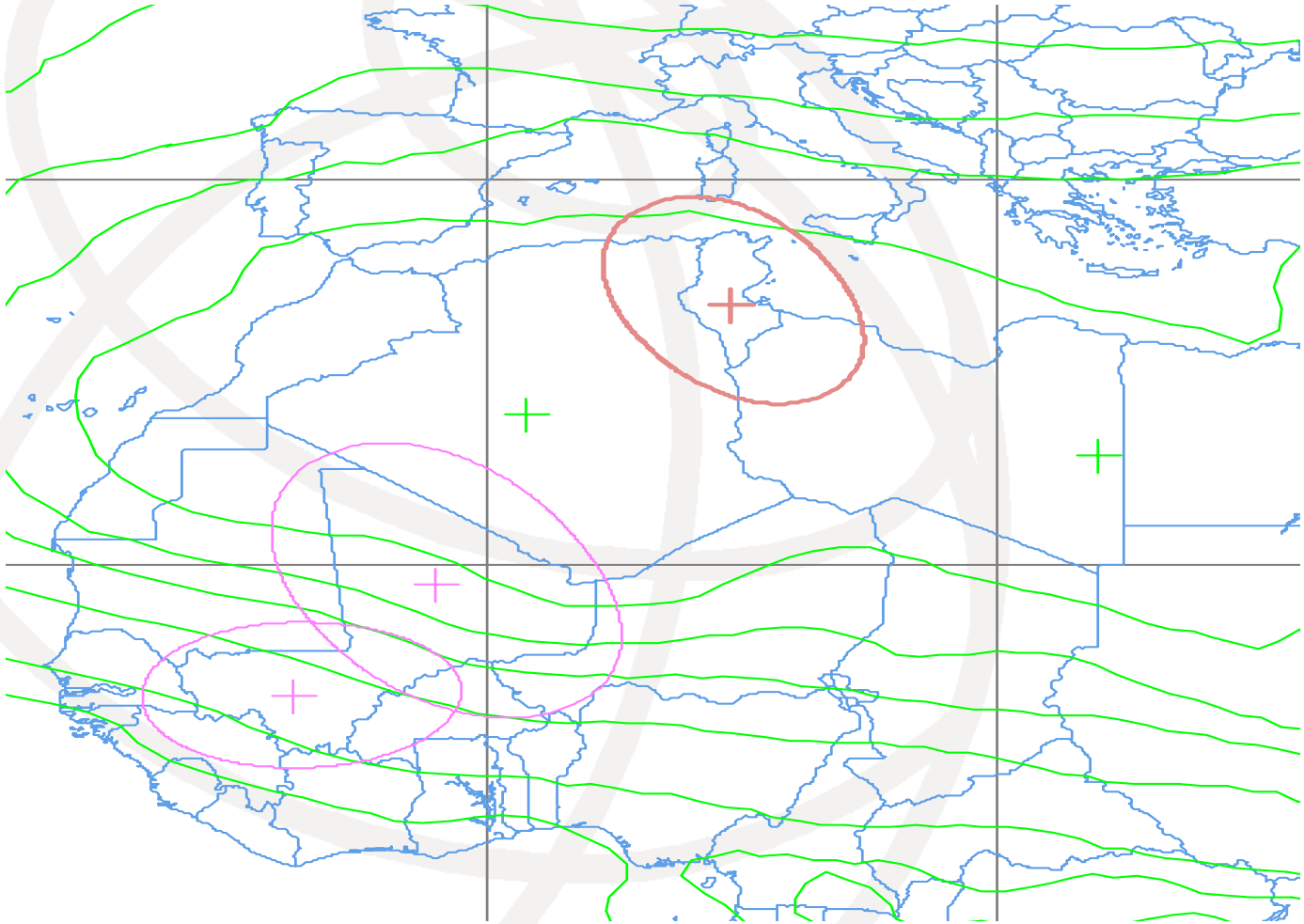
Elements of Lists (1)

- Separated from the Plans
  Annexed to MIFR
- Lists are evolving
  Updates are published by BR
- Assignments in the Lists must be compatible with the Plans and other services
- Digital modulation only

Elements of Lists (2)

- Data elements submitted - Appendix 4
- Non-monopolisation provisions
- 15 year time limit
- Provisions for use of assignments on a non-interference basis in case of disagreements
- Provision to accommodate assignments for new ITU Member States
- Limitation on application of the grouping concept

Plan & List Beams



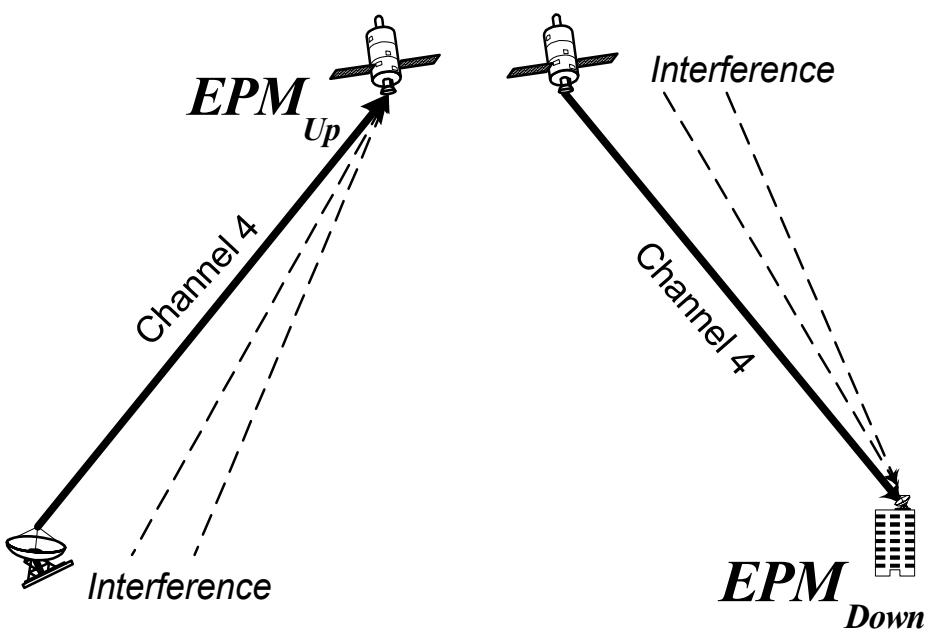
Establishment of the Plans (Lists)

- Compatibility among assignments in Plan and List
  - EPM or OEPM

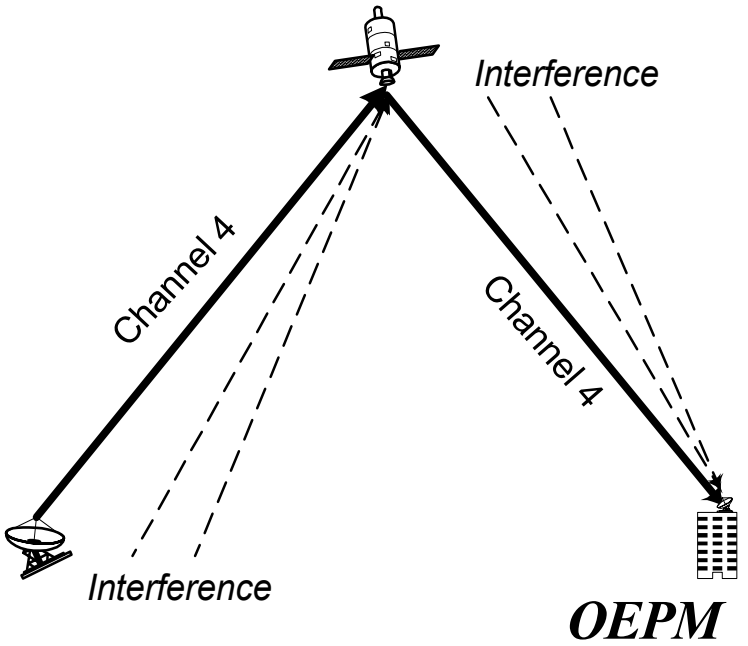
- Compatibility between Plan and other services or Plan in other Regions
  - PFD, ΔT/T
  - Regulatory mechanism:

    Remarks in Art. 10 and 11 of AP30,
    Art. 9 and 9A of AP30A,
    Art. 9 and 11 of RR for specific feeder-link earth station

Difference between EPM and OEPM



Regions 1 and 3 Approach
(separated links)



Region 2 Approach
(overall link analyses)

Compatibility Criteria
Region 2 Plan Assignments

Overall Equivalent Protection Margin (OEPM) is used:

$$OEPM = -10 \log\left(\sum_{i=1}^{5} 10^{(-M_i/10)} \right)$$

M_i = protection margin = $\dfrac{C}{I_{i_{aggr}}} - PR_i$ (dB)

i = interference type
(1=co-channel,
2&3=upper & lower first adjacent channels,
4&5=upper & lower second adjacent channels)

PR_i = protection ratio for a given interference type i

Compatibility Criteria
Regions 1 & 3 Plan Assignments

Equivalent Protection Margin (EPM) is used:

$$EPM = -10 \log \left(\sum_{i=1}^{3} 10^{(-M_i/10)} \right)$$

M_i = protection margin $= \frac{C}{I_{i_{aggr}}} - PR_i$ (dB)

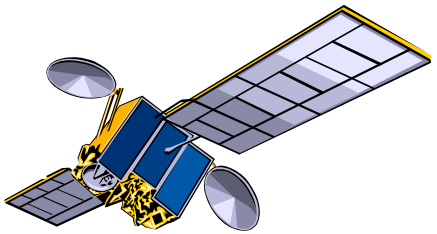
i = interference type
(1=co-channel,
2 & 3 = upper & lower first adjacent channels)

PR_i = protection ratio for a given interference type i

Main regulatory aspects

Main Regulatory Aspects

BSS Downlink/ Feeder-link



- Modification/Addition (Article 4)
- Notification/Implementation (Article 5)
- Due diligence information (Resolution 49)

Main Regulatory Aspects

Feeder-link earth station

- Modification/Addition (Article 9 of RR)
- Notification/Implementation (Article 11 of RR)

Space Operation/TT&C in the Guardbands

- Coordination (Article 2A)
- Notification (Article 11 of RR)

Main Regulatory Aspects

Terrestrial

Coordination w.r.t Plan/List (Article 6)

FSS

Coordination w.r.t. Plan/List (Article 7)

Article 5 Notification

- Final characteristics for Plan and Lists assignments
- Confirmation of date of bringing into use
- Recorded in MIFR
  (not taken into account in subsequent technical examination)
- Appendix 4 data should be submitted not earlier than 3 years but not later than 3 months before planned date of bringing assignments into use
- Published in Part I-S → Part II-S or Part III-S
- data in MIFR in: BR IFIC and
  - http://www.itu.int/ITU-R/go/space-plans-mifr/en

Article 5 Examination

- conformity with the Convention, Table of Allocations, other provisions
- conformity with the Plan and List including coordination requirement in the Remarks column
- Allowed characteristics different from those in the Plan and List in provision 5.2.1 *d)*
- Methodology to check the conformity with the Plan and List is in the ROP

Article 4
Modification / Addition

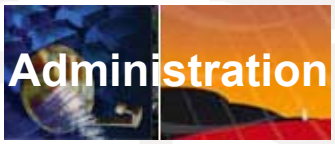
- Change of characteristics of assignments in the Plan (Region 2)
- Addition of assignments in the List (Regions 1&3) and in the Plan (Region 2)

- 8 years Regulatory period
  - to complete Article 4 procedure to be included in the Plan and the List
  - to bring assignments into use (confirmation though notification procedure)
  - to submit due diligence information (Res.49)

Processing of New Submissions

Article 4

Processing of Article 4 Submissions (1)



ITU-BR

Submission of validated Appendix 4 data
(8 years before planned date of bringing into use)

Fail

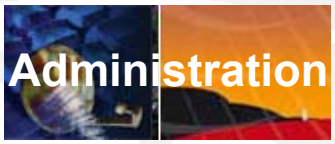
Validation Check

OK

Acknowledgement by telefax

Publication of the submitted information as received
(BR IFIC &
SNL Part C http://www.itu.int/ITU-R/space/snl/)

Processing of Article 4 Submissions (2)



ITU-BR

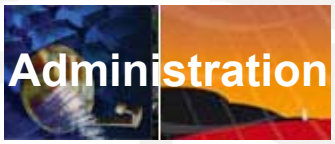
Completeness examination and telefax

Reply must be sent within 30 days (receivability ROP)

Regulatory/technical examination

Publication of Part A Special Section (BR IFIC) that contains the filed satellite network characteristics and potentially affected administrations. Results of the Bureau's MSPACEg calculations are also in the BR IFIC

Processing of Article 4 Submissions (3)



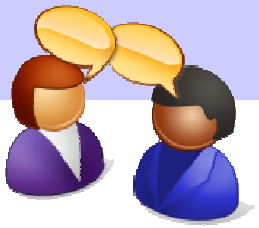
ITU-BR

Administrations should examine each BR IFIC to see if their assignments are affected and respond within 4 months

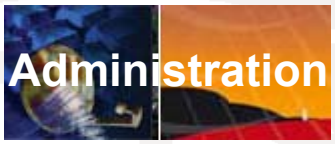
Affected administrations that do not comment within the 4 month period are deemed to have agreed

SpaceCom software compulsory from 1 July 2009 (CR/305 on Res.55)

After the 4 month period has expired, the BR prepares a list of agreements required and publishes it in a Part D Special Section.



Processing of Article 4 Submissions (4)



ITU-BR

Submission of validated Appendix 4 data (final characteristics) with agreement (request for Part B publication)

Fail

Validation Check

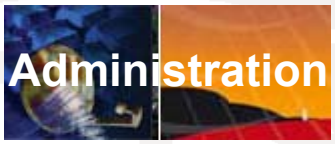
OK

Acknowledgement by telefax

Completeness examination

Reply must be sent within 30 days (receivability ROP)

Processing of Article 4 Submissions (5)



ITU-BR

Regulatory/technical examination

Publication of Part B Special Section (BR IFIC) that contain the final characteristics

Submission of notification (confirmation of bringing into use), Res.49 due diligence information

Request for extension of period of operation for assignments in the List (15 years), if required

Compatibility

Examination, publications, data

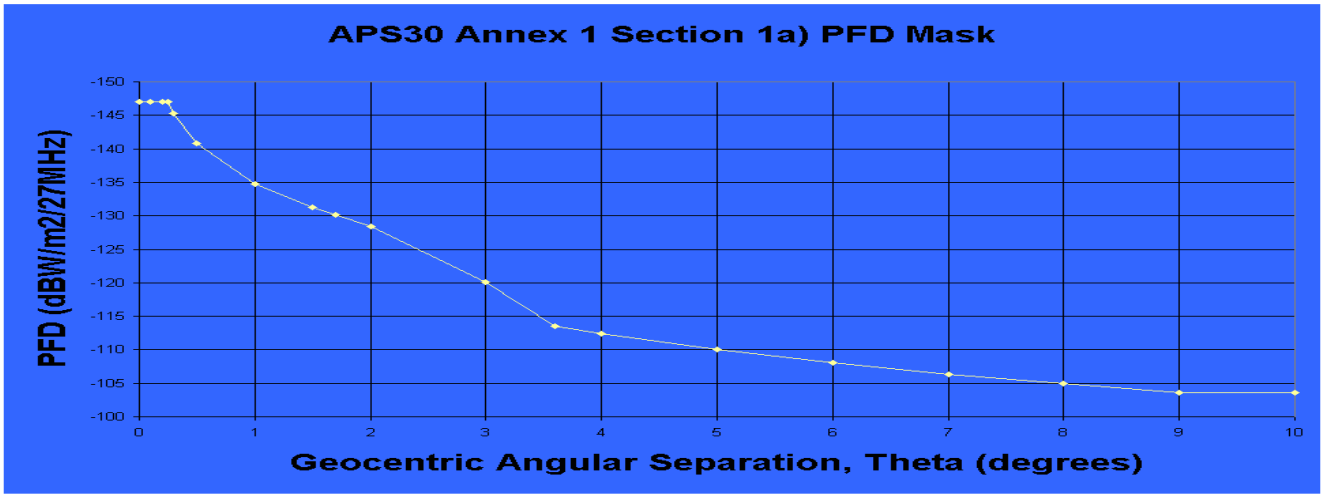
Compatibility between Plan and List Assignments

- Region 2 Plan based on OEPM
- Regions 1 & 3 Plan and List based on:

  - 9 degree Coordination Arc
  - EPM and PFD (downlink)
  - EPM, PFD at any point in the GSO and Off-axis e.i.r.p (uplink)

Compatibility Criteria for Regions 1 & 3 List Assignments

- Based on both EPM and (hard & trigger) PFD criteria
  - EPM criteria as per the Regions 1 & 3 Plan
  - PFD criteria also used to identify affected assignments as per Annex 1 of AP30



Article 4 Examination (Appendix 30, Region 2)

- Protection of the Region 2 Plan

  SPS/MSPACE: OEPM calculations

- Protection of Regions 1 & 3 Plan and List

  GIBC(PFD space)/GIMS: PFD

- Protection of Terrestrial Services

  GIBC(PFD terrestrial)/GIMS: PFD

- Protection of Regions 1 & 3 FSS

  GIBC(PFD space)/GIMS: PFD

Article 4 Examination (Appendix 30A, Region 2)

- Protection of Region 2 Plan
  SPS/MSPACE: OEPM calculation

- Protection of Regions 1 & 3 Plan and List
  GIBC (Appendix 8): delta T/T

Article 4 Examination (Appendix 30, Regions 1 & 3)

- Protection of the Regions 1 & 3 Plan and List
  SPS/MSPACE: EPM & PFD calculations
- Protection of Region 2 Plan
  GIBC(PFD space)/GIMS: PFD
- Protection of Terrestrial Services
  GIBC(PFD terrestrial)/GIMS: PFD
- Protection of Region 2 and Region 3 FSS
  GIBC(PFD space)/GIMS: PFD

Article 4 Examination (Appendix 30A, Regions 1&3)

- Protection of Regions 1&3 Plan and Lists
  SPS/MSPACE: EPM calculation
- Protection of Region 2 Plan
  GIBC(Appendix 8): delta T/T
- Protection of Region 2 FSS receiving feeder-link space station (17.8-18.1GHz)
  GIBC(Appendix 8): delta T/T

Publication of Results of Examination

- Article 4 procedure
  - **Special Sections AP30-30A/E, AP30/E and AP30A/E**
    - Part A: Publication of proposed characteristics and administrations considered affected
    - Part D: Establishment of requirements for agreement
    - Part B: Final characteristics entered into the Plan/List
    - Part C: Cancellation
  - SPS_ALL_IFICnnnn, MSPACEg_results_IFICnnnn

Publication of Results of Examination

- Article 5 procedure
  - Part I-S, II-S and III-S of BR IFIC
  - SNS-on-Line or SPS_ALL_IFICnnnn
- Article 2A procedure
  - Special Section AP30-30A/F/C
  - Special Section AP30-30A/F/D
  - SNS-on-Line or SPS_ALL_IFICnnnn
- Article 7 procedure
  - Special Section CR/C
  - SNS-on-Line or SRS_ALL

Plan and List data

- All Plan and List assignment data can be found on the BR IFIC and the ITU website at:
  - http://www.itu.int/ITU-R/go/space-plans/
- Contained in the SPS database (SNS format)
- Contains the technical characteristics and reference situation for all Plan, List and pending Article 4 assignments
- The SPS database is evolving and is updated regularly

Useful Website addresses for more information

- http://www.itu.int/ITU-R/go/space-plans/
  (General information relating to Space Plans)

- http://www.itu.int/en/ITU-R/space/plans/Pages/SpaceCap_FAQ.aspx
  (Guidelines for capturing Appendix 4 data)

- http://www.itu.int/ITU-R/space/snl/
  (SNL-on-Line; list of published networks, networks in the backlog)

- http://www.itu.int/sns/plans.html
  (SNS-online; online query on SPS_ALL database)

Questions?

Article 5: Table of Frequency Allocations

<table>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="3">11.7-12.5
FIXED
BROADCASTING
BROADCASTING-SATELLITE
MOBILE except aeronautical mobile</td><td>11.7-12.1
FIXED 5.486
FIXED-SATELLITE (space-to-Earth)
Mobile except aeronautical mobile</td><td rowspan="2">11.7-12.2
FIXED
MOBILE except aeronautical mobile
BROADCASTING
BROADCASTING-SATELLITE</td></tr>
<tr><td>12.1-12.2
FIXED-SATELLITE (space-to-Earth)</td></tr>
<tr><td rowspan="2">12.2-12.7
FIXED
MOBILE except aeronautical mobile
BROADCASTING
BROADCASTING-SATELLITE</td><td>12.2-12.5
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile
BROADCASTING</td></tr>
<tr><td>12.5-12.75
FIXED-SATELLITE (space-to-Earth) (Earth-to-space)</td><td>12.7-12.75
FIXED
FIXED-SATELLITE (Earth-to-space)
MOBILE except aeronautical mobile</td><td>12.5-12.75
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile
BROADCASTING-SATELLITE</td></tr>
</table>

Return

- **5.487** In the band 11.7-12.5 GHz in Regions 1 and 3, the fixed, fixed-satellite, mobile, except aeronautical mobile, and broadcasting services, in accordance with their respective allocations, shall not cause harmful interference to, or claim protection from, broadcasting-satellite stations operating in accordance with the Regions 1 and 3 Plan in Appendix **30**. (WRC-03)

- **5.490** In Region 2, in the band 12.2-12.7 GHz, existing and future terrestrial radiocommunication services shall not cause harmful interference to the space services operating in conformity with the broadcasting-satellite Plan for Region 2 contained in Appendix **30**.

Return

ARTICLE 2 of AP30 (WRC-03)

Frequency bands

2.1 The provisions of this Appendix apply to the broadcasting-satellite service in the frequency bands between 11.7 GHz and 12.2 GHz in Region 3, between 11.7 GHz and 12.5 GHz in Region 1 and between 12.2 GHz and 12.7 GHz in Region 2 and to the other services to which these bands are allocated in Regions 1, 2 and 3, insofar as their relationship to the broadcasting-satellite service in these bands is concerned.

ARTICLE 2 of AP30A (WRC-03)

Frequency bands

2.1 The provisions of this Appendix apply to the feeder-links in the fixed-satellite service (Earth-to-space) in the frequency bands 14.5-14.8 GHz and 17.3-18.1 GHz for the broadcasting-satellite service in Regions 1 and 3, and 17.3-17.8 GHz for the broadcasting-satellite service in Region 2 and to other services to which these bands are allocated in Regions 1, 2 and 3 so far as their relationship to the fixed-satellite service (Earth-to-space) in these bands is concerned.

Return

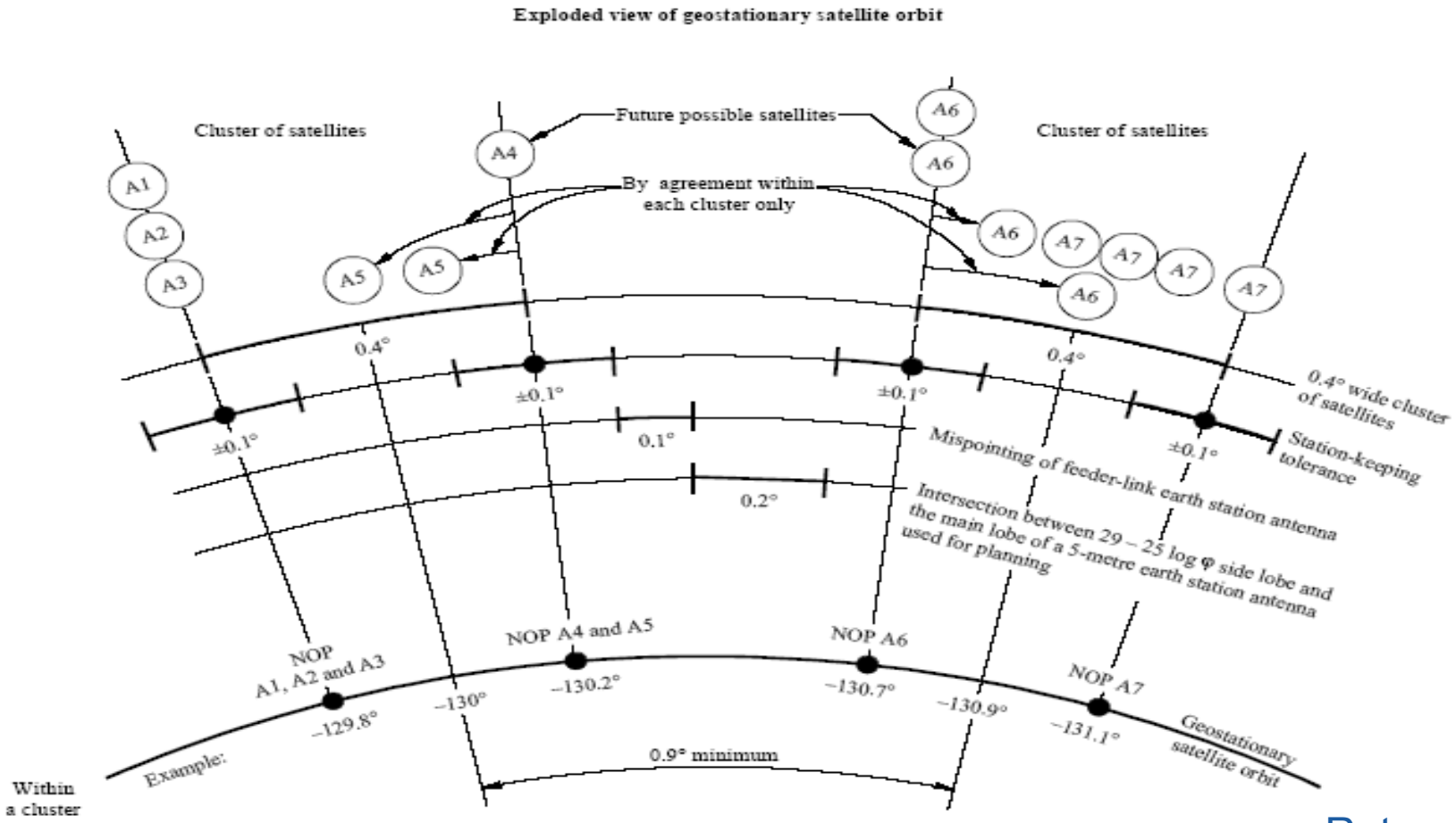
Original Plan (e.g. Region 2)

12 224.00 MHz (1)

1	2	3	4		5		6	7	8	9	
ALS00002	−166.20	1	−149.66	58.37	3.76	1.24	170	1	59.7	9/GR1	10
ALS00003	−175.20	1	−150.98	58.53	3.77	1.11	167	1	60.0	9/GR2	10
ARGINSU4	−94.20	1	−52.98	−59.81	3.40	0.80	19	1	59.9	9/GR3	
ARGSUR04	−94.20	1	−65.04	−43.33	3.32	1.50	40	1	60.7	9/GR3	10
B CE311	−64.20	1	−40.60	−6.07	3.04	2.06	174	1	61.6	8 9/GR7	10
B CE312	−45.20	1	−40.27	−6.06	3.44	2.09	174	1	61.0	8 9/GR9	10
B CE411	−64.20	1	−50.97	−15.27	3.86	1.38	49	1	62.6	8 9/GR7	10
B CE412	−45.20	1	−50.71	−15.30	3.57	1.56	52	1	62.7	8 9/GR9	10
B CE511	−64.20	1	−53.10	−2.90	2.44	2.13	104	1	63.0	8 9/GR7	10
B NO611	−74.20	1	−59.60	−11.62	2.85	1.69	165	2	62.8	8 9/GR8	10
B NO711	−74.20	1	−60.70	−1.78	3.54	1.78	126	2	62.8	8 9/GR8	10
B NO811	−74.20	1	−68.76	−4.71	2.37	1.65	73	2	62.8	8 9/GR8	
B SU111	−81.20	1	−51.12	−25.63	2.76	1.05	50	1	62.8	8 9/GR6	10
B SU112	−45.20	1	−50.75	−25.62	2.47	1.48	56	1	62.2	8 9/GR9	
B SU211	−81.20	1	−44.51	−16.95	3.22	1.36	60	1	62.5	8 9/GR6	10
B SU212	−45.20	1	−44.00	−16.87	3.20	1.96	58	1	61.3	8 9/GR9	
BAHIFRB1	−87.20	1	−76.06	24.16	1.81	0.80	142	1	61.6		
BERBERMU	−96.20	1	−64.77	32.32	0.80	0.80	90	2	56.8		
BERBER02	−31.00	1	−64.77	32.32	0.80	0.80	90	1	56.9	2	10
BOLAND01	−115.20	1	−65.04	−16.76	2.49	1.27	76	1	67.9	9/GR5	
CAN01101	−138.20	1	−125.63	57.24	3.45	1.27	157	1	59.5	9/GR10	10
CAN01201	−138.20	1	−112.04	55.95	3.35	0.97	151	1	59.6	9/GR10	10
CAN01202	−72.70	1	−107.70	55.63	2.74	1.12	32	1	59.6		

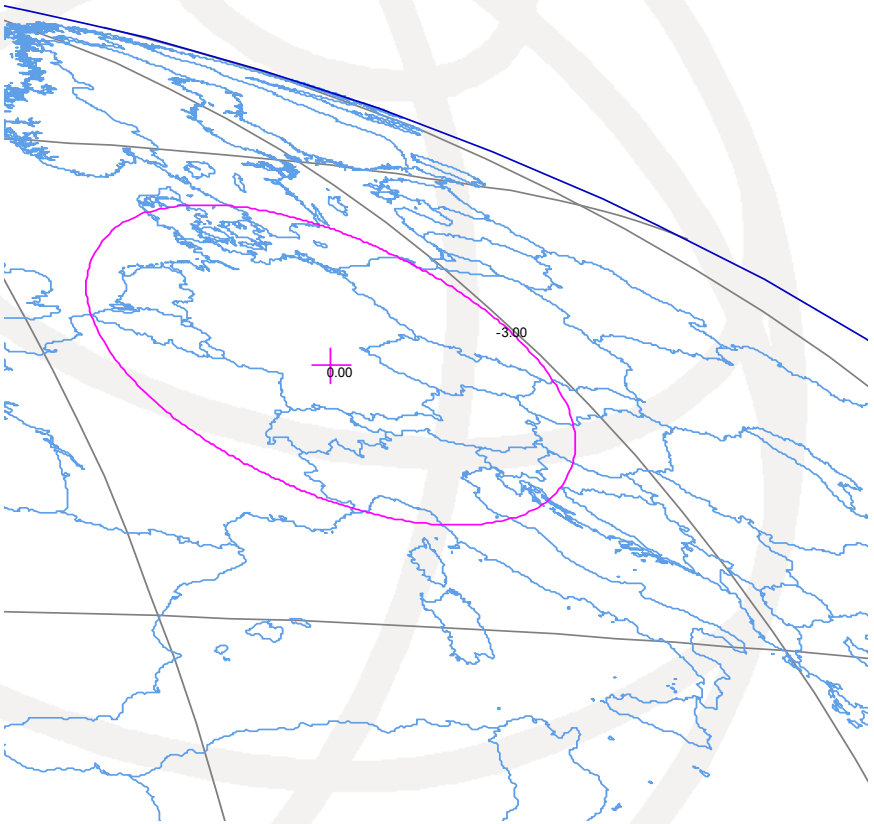
Return

Cluster Concept



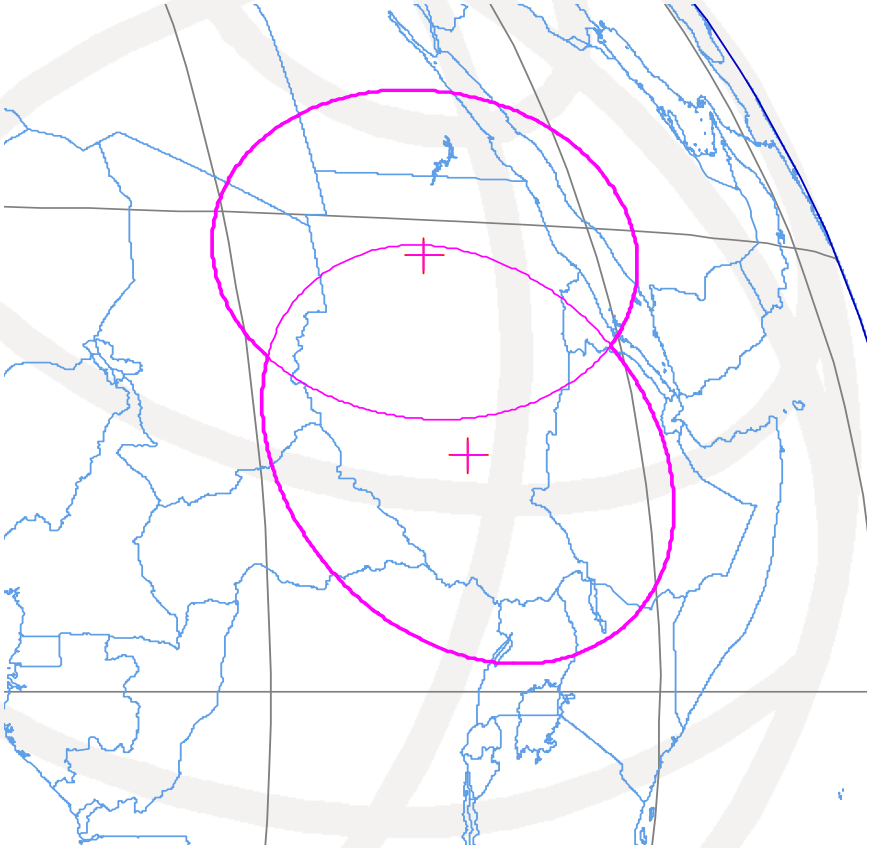
Return

An example of extended-coverage national beams



Return

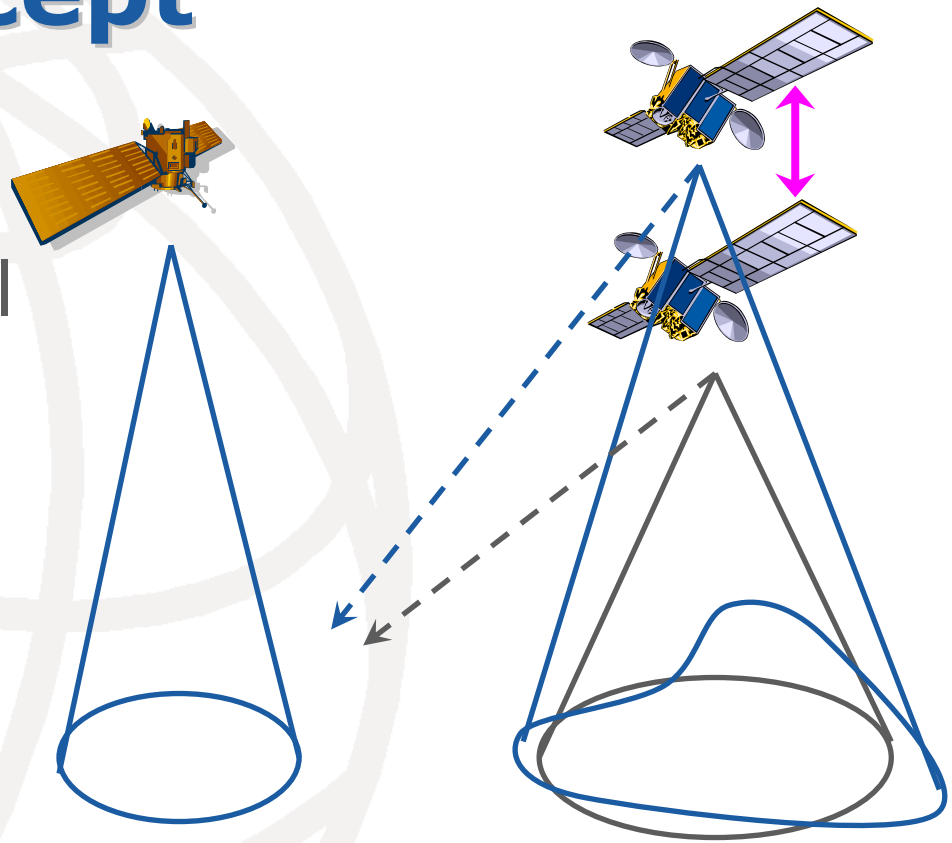
Example of a composite beam



Return

Grouping Concept

- The worst interference signal is selected
- No interference calculation between them
- All assignments in the group are protected



Return

Remarks Column in Article 10

12 224.00 MHz (1)

1	2	3	4		5		6	7	8	9	
ALS00002	−166.20	1	−149.66	58.37	3.76	1.24	170	1	59.7	9/GR1	10
ALS00003	−175.20	1	−150.98	58.53	3.77	1.11	167	1	60.0	9/GR2	10
ARGINSU4	−94.20	1	−52.98	−59.81	3.40	0.80	19	1	59.9	9/GR3	
ARGSUR04	−94.20	1	−65.04	−43.33	3.32	1.50	40	1	60.7	9/GR3	10
B CE311	−64.20	1	−40.60	−6.07	3.04	2.06	174	1	61.6	8 9/GR7	10
B CE312	−45.20	1	−40.27	−6.06	3.44	2.09	174	1	61.0	8 9/GR9	10
B CE411	−64.20	1	−50.97	−15.27	3.86	1.38	49	1	62.6	8 9/GR7	10
B CE412	−45.20	1	−50.71	−15.30	3.57	1.56	52	1	62.7	8 9/GR9	10
B CE511	−64.20	1	−53.10	−2.90	2.44	2.13	104	1	63.0	8 9/GR7	10
B NO611	−74.20	1	−59.60	−11.62	2.85	1.69	165	2	62.8	8 9/GR8	10
B NO711	−74.20	1	−60.70	−1.78	3.54	1.78	126	2	62.8	8 9/GR8	10
B NO811	−74.20	1	−68.76	−4.71	2.37	1.65	73	2	62.8	8 9/GR8	
B SU111	−81.20	1	−51.12	−25.63	2.76	1.05	50	1	62.8	8 9/GR6	10
B SU112	−45.20	1	−50.75	−25.62	2.47	1.48	56	1	62.2	8 9/GR9	
B SU211	−81.20	1	−44.51	−16.95	3.22	1.36	60	1	62.5	8 9/GR6	10
B SU212	−45.20	1	−44.00	−16.87	3.20	1.96	58	1	61.3	8 9/GR9	
BAHIFRB1	−87.20	1	−76.06	24.16	1.81	0.80	142	1	61.6		
BERBERMU	−96.20	1	−64.77	32.32	0.80	0.80	90	2	56.8		
BERBER02	−31.00	1	−64.77	32.32	0.80	0.80	90	1	56.9	2	10
BOLAND01	−115.20	1	−65.04	−16.76	2.49	1.27	76	1	67.9	9/GR5	
CAN01101	−138.20	1	−125.63	57.24	3.45	1.27	157	1	59.5	9/GR10	10
CAN01201	−138.20	1	−112.04	55.95	3.35	0.97	151	1	59.6	9/GR10	10
CAN01202	−72.70	1	−107.70	55.63	2.74	1.12	32	1	59.6		

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