



International, Regional and National RF Regulation and Standardization

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<http://mazar.atwebpages.com/>

Items which need to be regulated

1. RF allocations to radio services; follow ITU Radio Regulations
2. Assignment of licence and RF to Tx Stations
3. Fee collection: RF License & annual fees
4. Equipment Type approval (?!); EU R&TTE is liberal
5. Coordination with neighbour countries (no borders to the ElectroMagnetic waves)
6. Notifying ITU to the Master International Frequency Register (MIFR) e.g. <http://www.itu.int/ITU-R/eBCD/ePub.aspx>
7. External relations: toward ITU, International and Regional orgs see my PhD thesis <http://eprints.mdx.ac.uk/133/2/MazarAug08.pdf> p. 179

Roles of the National Spectrum Management

1. Avoid and solve interference
2. Design long and short range RF spectrum
3. Support Engineering: propagation, coverage...
4. Coordinate with military wireless services
5. Advance new wireless technologies (such as digital audio and video)
6. Coordinate with other Administrations
7. Advance new technologies and efficient import of equipment

Theories and Policies

1. So begins Leo Tolstoy's Anna Karenina : 'All happy families are alike; each unhappy family is unhappy in its own way'
2. Between 2 points in planar geometry there is only one simple line, but indefinite curves
3. 'Great minds think alike' (Michaelian)
4. 'Stand on the shoulders of giants' (also I. Newton)
5. 'Okham's Razor': 'if you have to choose between competing theories, choose the simplest theory- it is most likely to be true'

How to manage the RF Spectrum

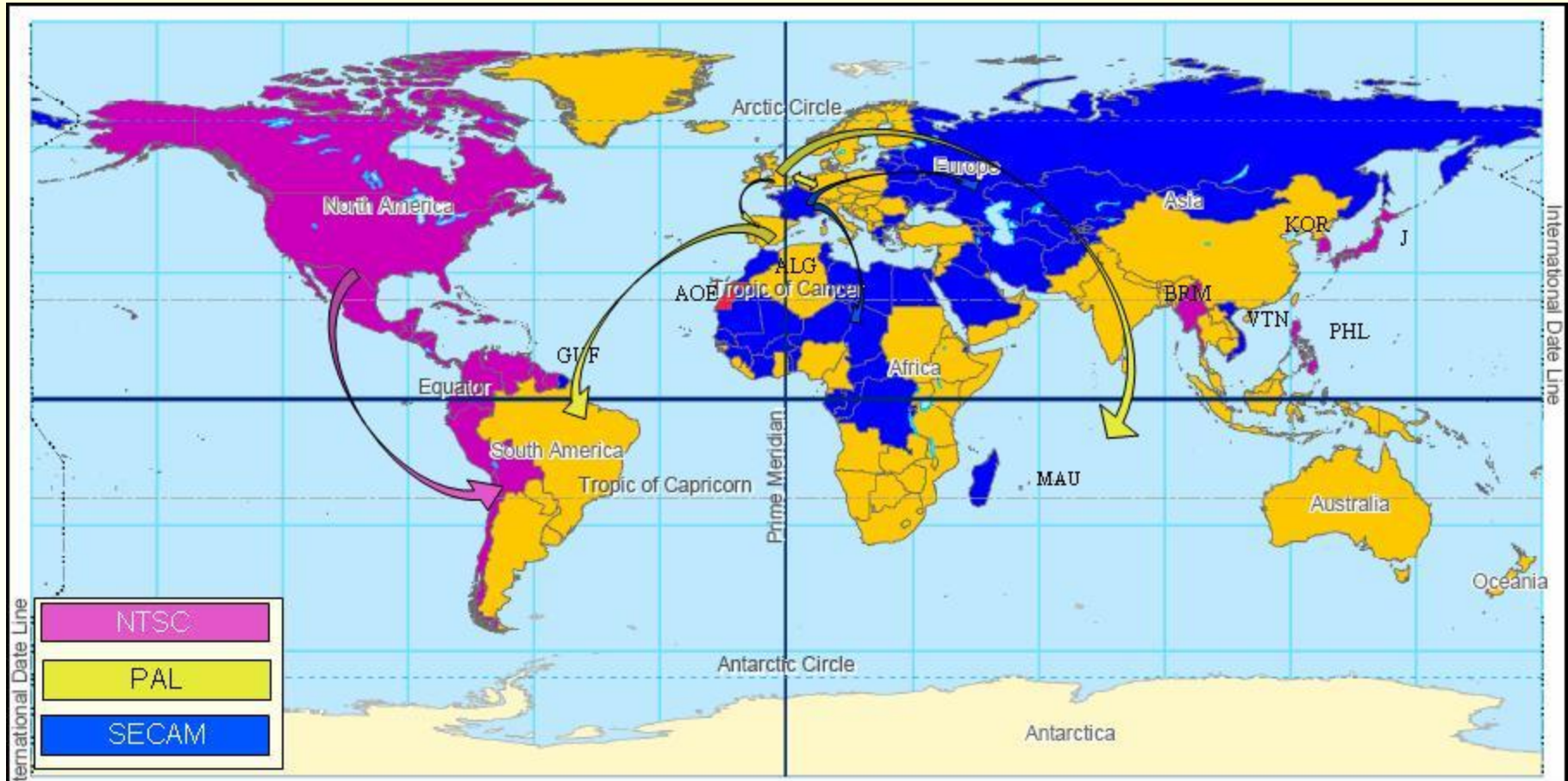
1. Follow Regional Allocations and Assignments; try to ease circulation of equipment
2. Coordinate (bi-lateral and multi-lateral) with your neighbours
3. Don't invent specific allocations; with whom do you want to be identified? Follow its rules and standards
4. Transparency; Light Touch (?); central-based or market-oriented?
5. Try **not** to allocate to fixed transmitters and receivers (e.g. TV from air), if there is an alternative (cable or satellite)
6. Allocate RF spectrum with a vision towards implementing in many cases markets
7. Ensure the effective (reuse) and efficient (bits/hertz) use of the RF Spectrum
8. Decrease Interference by assigning: min power, min bandwidth, max RF

Spectrum Control (Mgmt and Monitoring)

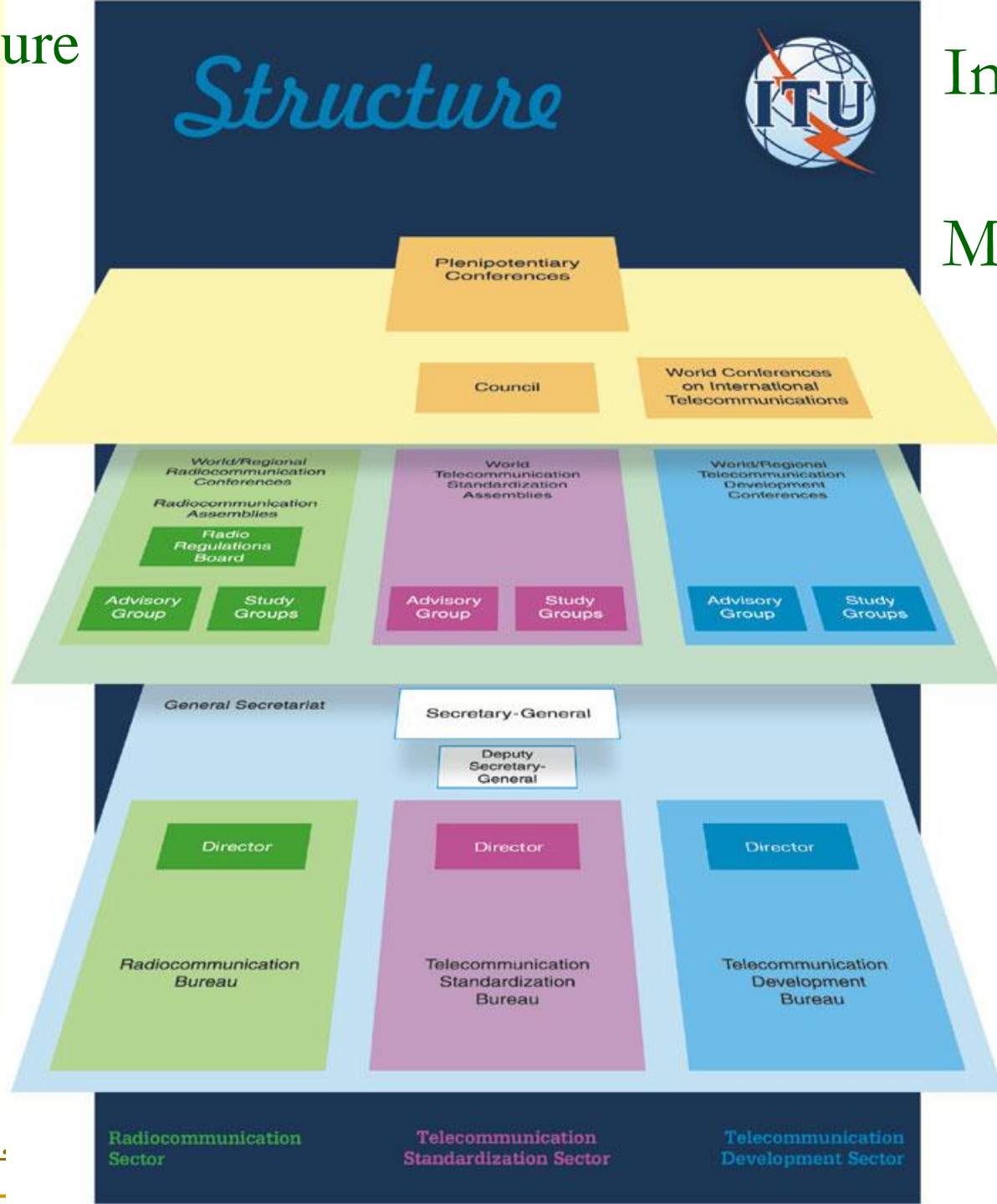


TV colours; analogue TV around the world

Influence of language (English or French) and colonialism



See <http://eprints.mdx.ac.uk/133/2/MazarAug08.pdf> p. 184



ITU Radio Regulations

RR 5.1: Allocation, Allotment and Assignment

Frequency distribution to:	English
Services	Allocation (to allocate)
Areas or countries	Allotment (to allot)
Stations	Assignment (to assign)

Symbols	Frequency range	metric subdivision	Metric abbreviations
VLF	3 to 30 kHz	Myriametric waves	B.Mam
LF	30 to 300 kHz	Kilometric waves	B.km
MF	300 to 3 000 kHz	Hectometric waves	B.hm
HF	3 to 30 MHz	Decametric waves	B.dam
VHF	30 to 300 MHz	Metric waves	B.m
UHF	300 to 3 000 MHz	Decimetric waves	B.dm
SHF	3 to 30 GHz	Centimetric waves	B.cm
EHF	30 to 300 GHz	Millimetric waves	B.mm
	300 to 3 000 GHz	Decimillimetric waves	

World Radio Conference 2012

ITU-R Radio Communications Assembly

ITU-R Study Group Structure

Study Group 1 (SG 1) - Spectrum management

Study Group 3 (SG 3) - Radiowave propagation

Study Group 4 (SG 4) - Satellite services

Study Group 5 (SG 5) - Terrestrial services

Study Group 6 (SG 6) - Broadcasting service

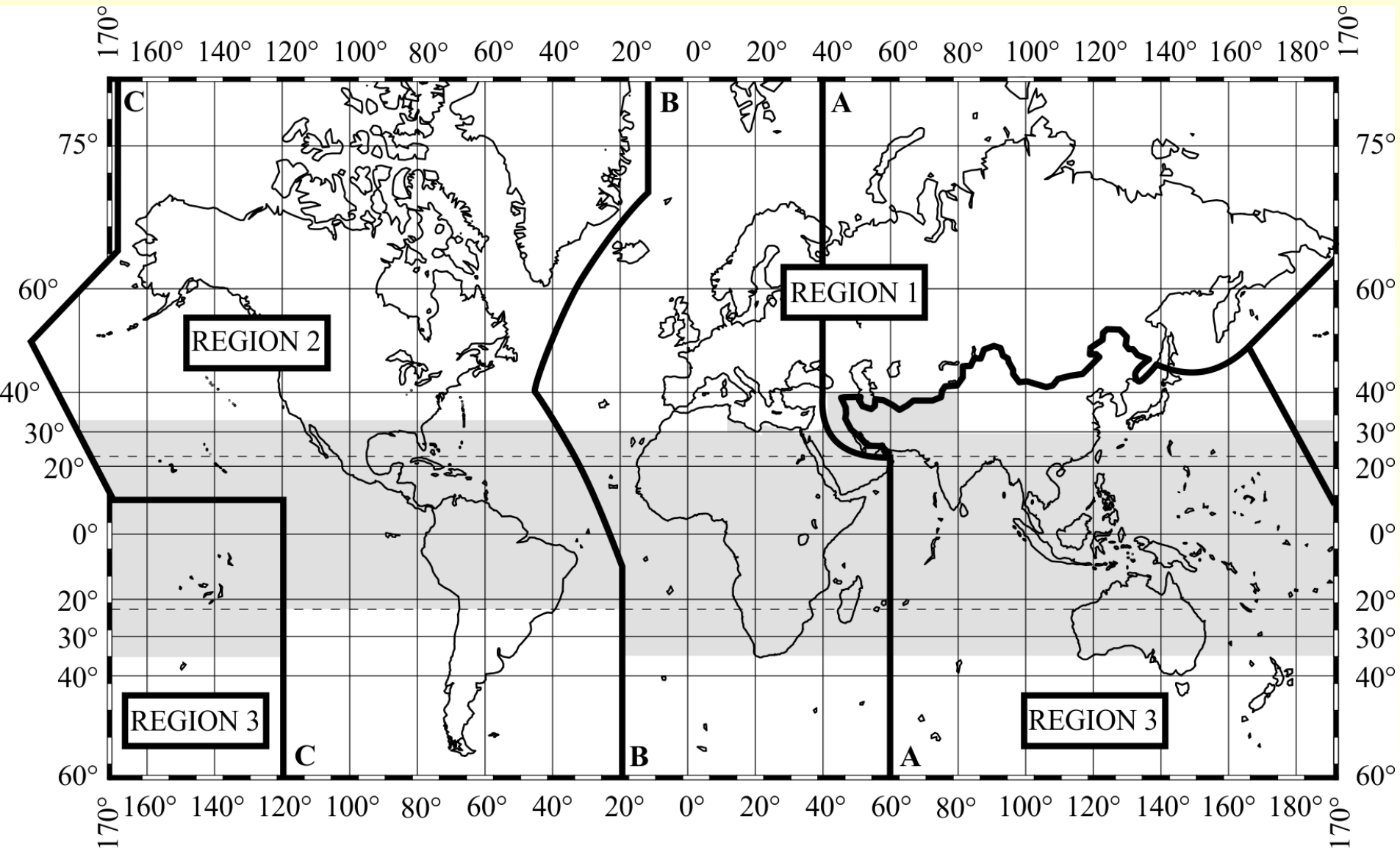
Study Group 7 (SG 7) - Science services

Coordination Committee for Vocabulary (CCV)

Conference Preparatory Meeting (CPM)

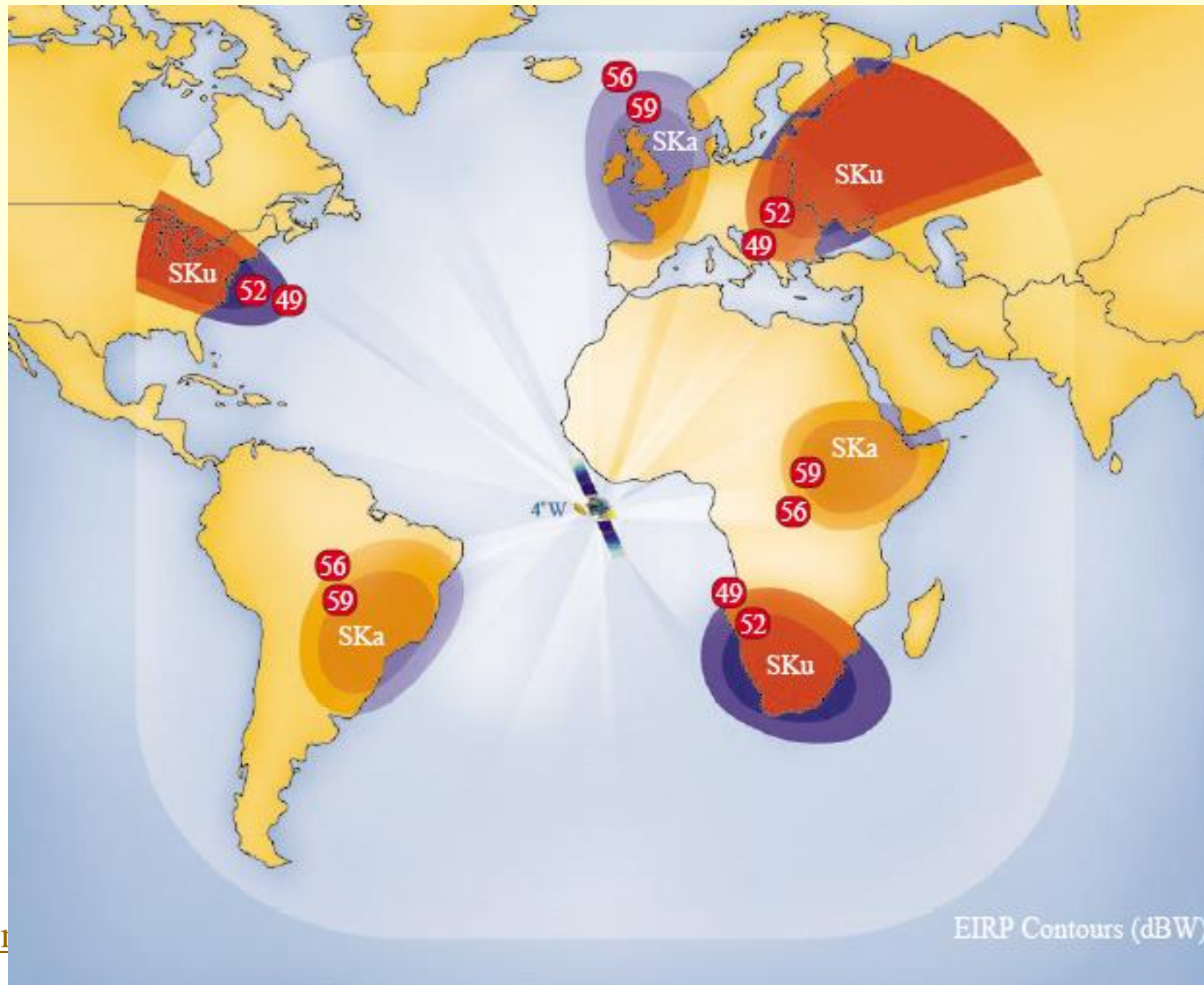
Special Committee (SC)

Three ITU RF Allocation Regions (appears at RR_5-1)



5-01

Coordination is needed for Space; AMOS-3 Steerable beams



Why coordination is needed for HF

Ionospheric “reflections”

Ionosphere is transparent for μ waves but reflects HF waves

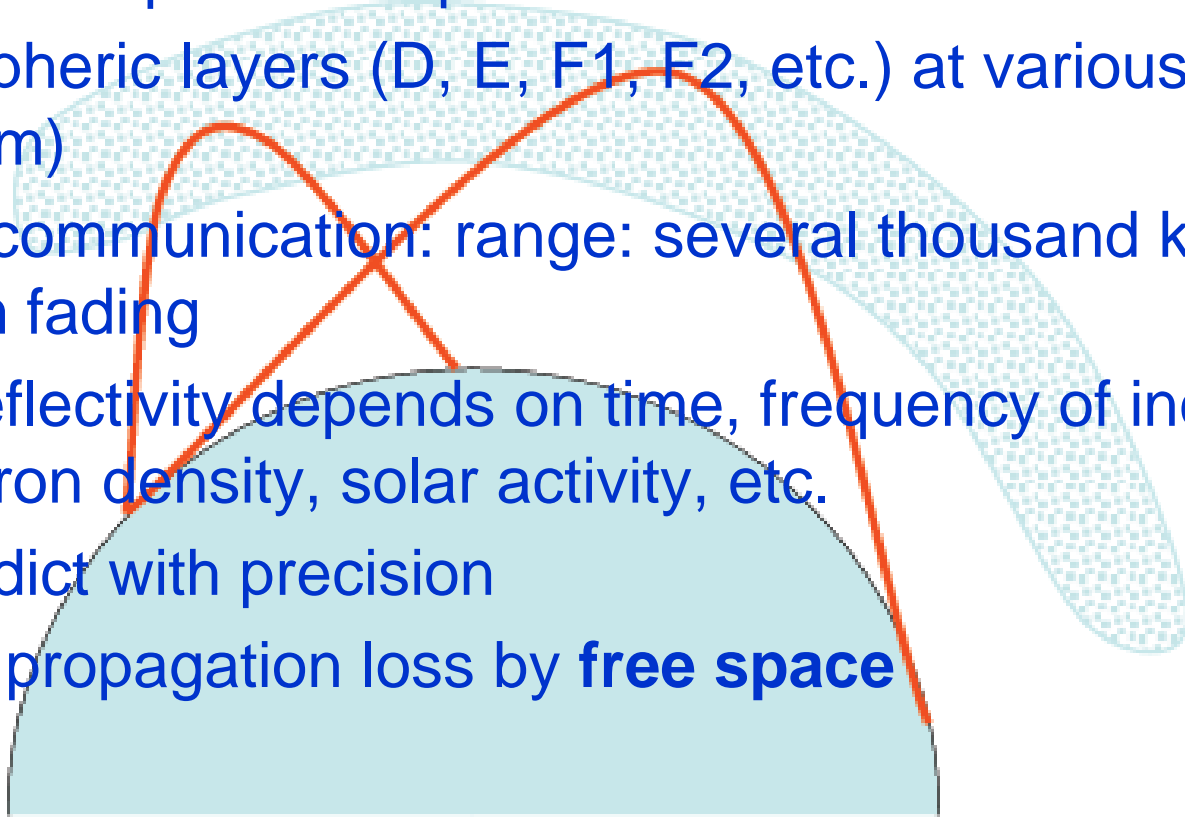
Various ionospheric layers (D, E, F1, F2, etc.) at various heights (50 – 300 km)

Over-horizon communication: range: several thousand km; suffers from fading

Ionospheric reflectivity depends on time, frequency of incident wave, electron density, solar activity, etc.

Difficult to predict with precision

Calculation of propagation loss by **free space**



Main regional telecoms regulators

Name	Regional Intergovernmental Telecoms Regulators
APT	<u>Asia Pacific Telecommunity</u> , 38 countries
ASMG	<u>Arab States Spectrum Management Group</u> , 23 countries (22, without suspended Syria)
ATU	<u>African Telecommunications Union</u> , 44 countries
CEPT	<u>European Conference of Postal and Telecoms Administrations</u> , 48 countries
CITEL	<u>Inter-American Commission of Telecoms</u> , 36 countries
EACO	<u>East African Communications Organization</u> Burundi, Kenya, Rwanda, Tanzania, Uganda (like EAC)
FACSMAB	<u>Frequency Assignment Committee Singapore, Malaysia and Brunei</u>
RCC	<u>Regional Commonwealth in the Field of Communication</u> , 12 countries
REGULATEL	<u>Latin American Forum of Telecom Regulator</u> , 20 Regulators
SADC	<u>Southern African Development Community</u> , 15 countries
TRASA	Telecom Regulators' Association of Southern Africa, 14 countries www.trasa.org.bw/
WATRA	<u>West Africa Telecommunications Regulators Assembly</u> , 15 countries

Standards Development Organizations influencing wireless standardization

Name	Organization (Country)
3GPP	<u>3rd Generation Partnership Project</u>
3GPP2	<u>Third Generation Partnership Project</u>
ARIB	<u>Association of Radio Industries and Businesses</u> (Japan)
ATIS ^{*,**}	<u>Alliance for Telecommunications Industry Solutions</u> ATIS Committee WTSC (<u>Wireless Technologies and Systems Committee</u>)
CCSA	<u>China Communications Standards Association</u> (China)
CDG	<u>CDMA Development Group</u>
GISFI ^{**}	<u>Global ICT Standardization Forum for India</u> (India)
ETSI ^{*,**}	<u>European Telecommunications Standards Institute</u> (Europe)
GS1	<u>Global Standards One</u>
IEEE- SA [*]	<u>Institute of Electrical and Electronics Engineer - Standards Association</u>
ISO ^{*,**}	<u>International Organization for Standardization</u>
SAE	<u>Society of Automotive Engineering</u>
TIA	<u>Telecommunications Industry Association</u> (US)
TTA	<u>Telecommunications Technology Association</u> (Korea)
TTC	<u>Telecommunications Technology Committee</u> (Japan)
UL Standards	<u>Underwriters Laboratories Inc.</u>

3GPP TS 36.101 V12.1.0 (2013-09) Table 5.5-1 E-UTRA LTE operating bands



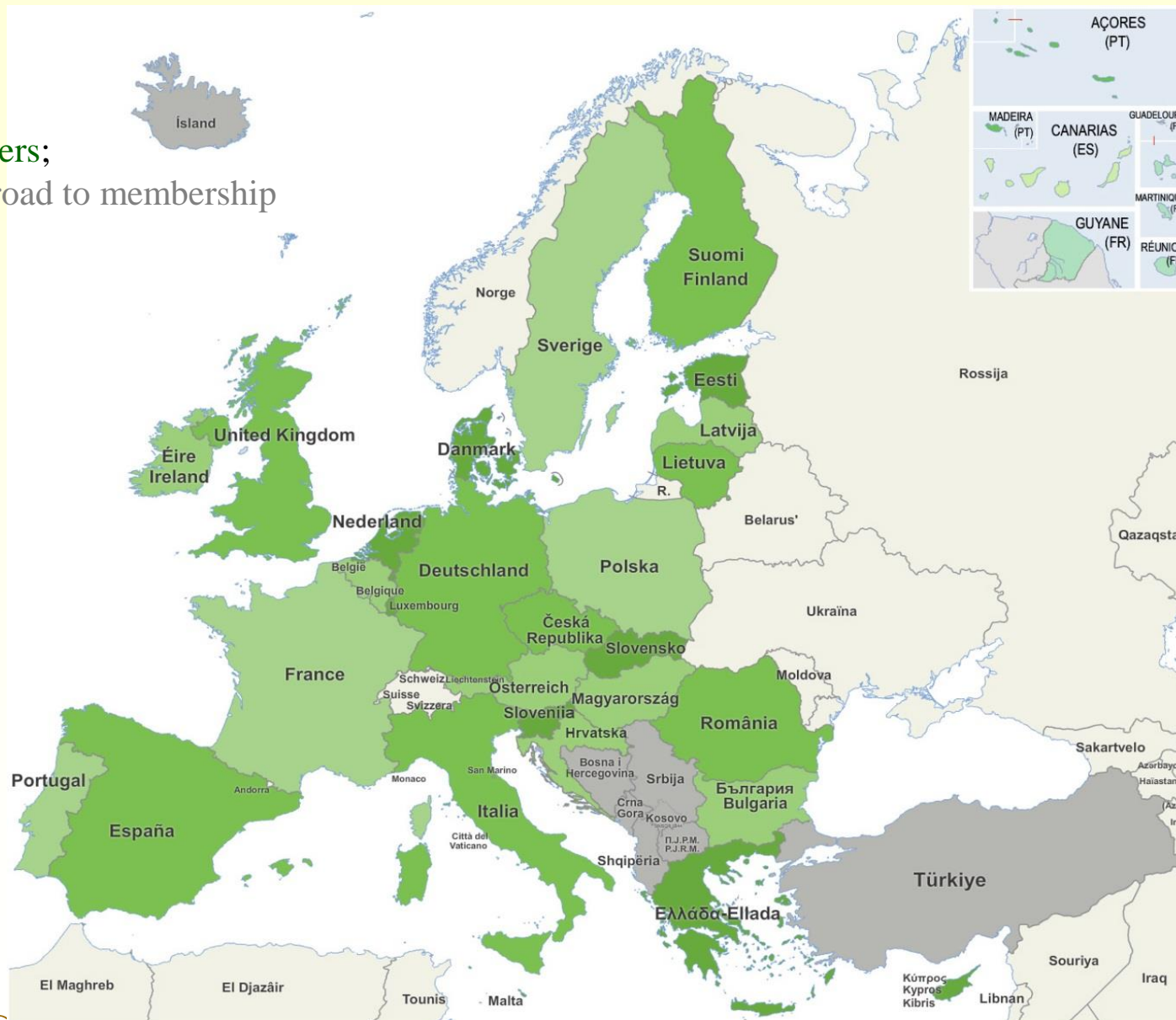
Operating Band	Uplink (UL) operating		Downlink (DL) operating band		Duplex Mode
1	1920 MHz	– 1980 MHz	2110 MHz	– 2170 MHz	FDD
2	1850 MHz	– 1910 MHz	1930 MHz	– 1990 MHz	FDD
3	1710 MHz	– 1785 MHz	1805 MHz	– 1880 MHz	FDD
4	1710 MHz	– 1755 MHz	2110 MHz	– 2155 MHz	FDD
5	824 MHz	– 849 MHz	869 MHz	– 894MHz	FDD
6 ¹	830 MHz	– 840 MHz	875 MHz	– 885 MHz	FDD
7	2500 MHz	– 2570 MHz	2620 MHz	– 2690 MHz	FDD
8	880 MHz	– 915 MHz	925 MHz	– 960 MHz	FDD
9	1749.9 MHz	– 1784.9M Hz	1844.9 MHz	– 1879.9 MHz	FDD
10	1710 MHz	– 1770 MHz	2110 MHz	– 2170 MHz	FDD
11	1427.9 MHz	– 1447.9 MHz	1475.9 MHz	– 1495.9 MHz	FDD
12	699 MHz	– 716 MHz	729 MHz	– 746 MHz	FDD
13	777 MHz	– 787 MHz	746 MHz	– 756 MHz	FDD
14	788 MHz	– 798 MHz	758 MHz	– 768 MHz	FDD
15	Reserved				
16	FDD				
17	704 MHz	– 716 MHz	734 MHz	– 746 MHz	FDD
18	815 MHz	– 830 MHz	860 MHz	– 875 MHz	FDD
19	830 MHz	– 845 MHz	875 MHz	– 890 MHz	FDD
20	832 MHz	– 862 MHz	791 MHz	– 821 MHz	FDD
21	1447.9 MHz	– 1462.9 MHz	1495.9 MHz	– 1510.9 MHz	FDD

Band 6 is not applicable NOTE 1:

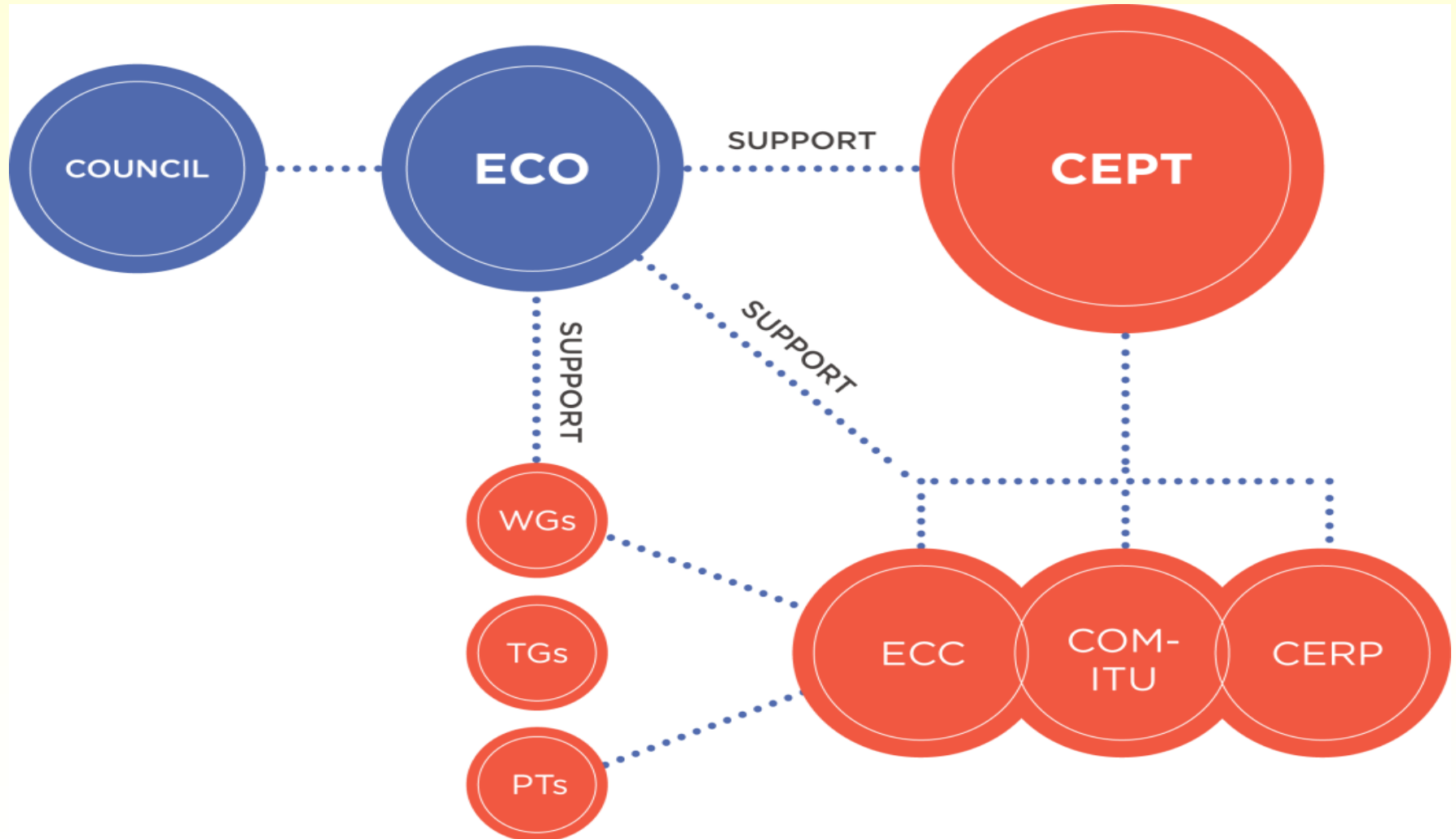
Operating Band	Uplink (UL) operating		Downlink (DL) operating band		Duplex Mode
22	3410 MHz	– 3490 MHz	3510 MHz	– 3590 MHz	FDD
23	2000 MHz	– 2020 MHz	2180 MHz	– 2200 MHz	FDD
24	1626.5 MHz	– 1660.5 MHz	1525 MHz	– 1559 MHz	FDD
25	1850 MHz	– 1915 MHz	1930 MHz	– 1995 MHz	FDD
26	814 MHz	– 849 MHz	859 MHz	– 894 MHz	FDD
27	807 MHz	– 824 MHz	852 MHz	– 869 MHz	FDD
28	703 MHz	– 748 MHz	758 MHz	– 803 MHz	FDD
29	N/A		717 MHz	– 728 MHz	FDD ²
30	2305 MHz	– 2315 MHz	2350 MHz	– 2360 MHz	FDD
31	452.5 MHz	– 457.5 MHz	462.5 MHz	– 467.5 MHz	FDD
...					
33	1900 MHz	– 1920 MHz	1900 MHz	– 1920 MHz	TDD
34	2010 MHz	– 2025 MHz	2010 MHz	– 2025 MHz	TDD
35	1850 MHz	– 1910 MHz	1850 MHz	– 1910 MHz	TDD
36	1930 MHz	– 1990 MHz	1930 MHz	– 1990 MHz	TDD
37	1910 MHz	– 1930 MHz	1910 MHz	– 1930 MHz	TDD
38	2570 MHz	– 2620 MHz	2570 MHz	– 2620 MHz	TDD
39	1880 MHz	– 1920 MHz	1880 MHz	– 1920 MHz	TDD
40	2300 MHz	– 2400 MHz	2300 MHz	– 2400 MHz	TDD
41	2496 MHz	– 2690 MHz	2496 MHz	– 2690 MHz	TDD
42	3400 MHz	– 3600 MHz	3400 MHz	– 3600 MHz	TDD
43	3600 MHz	– 3800 MHz	3600 MHz	– 3800 MHz	TDD
44	703 MHz	– 803 MHz	703 MHz	– 803 MHz	TDD

Map of EU Member States

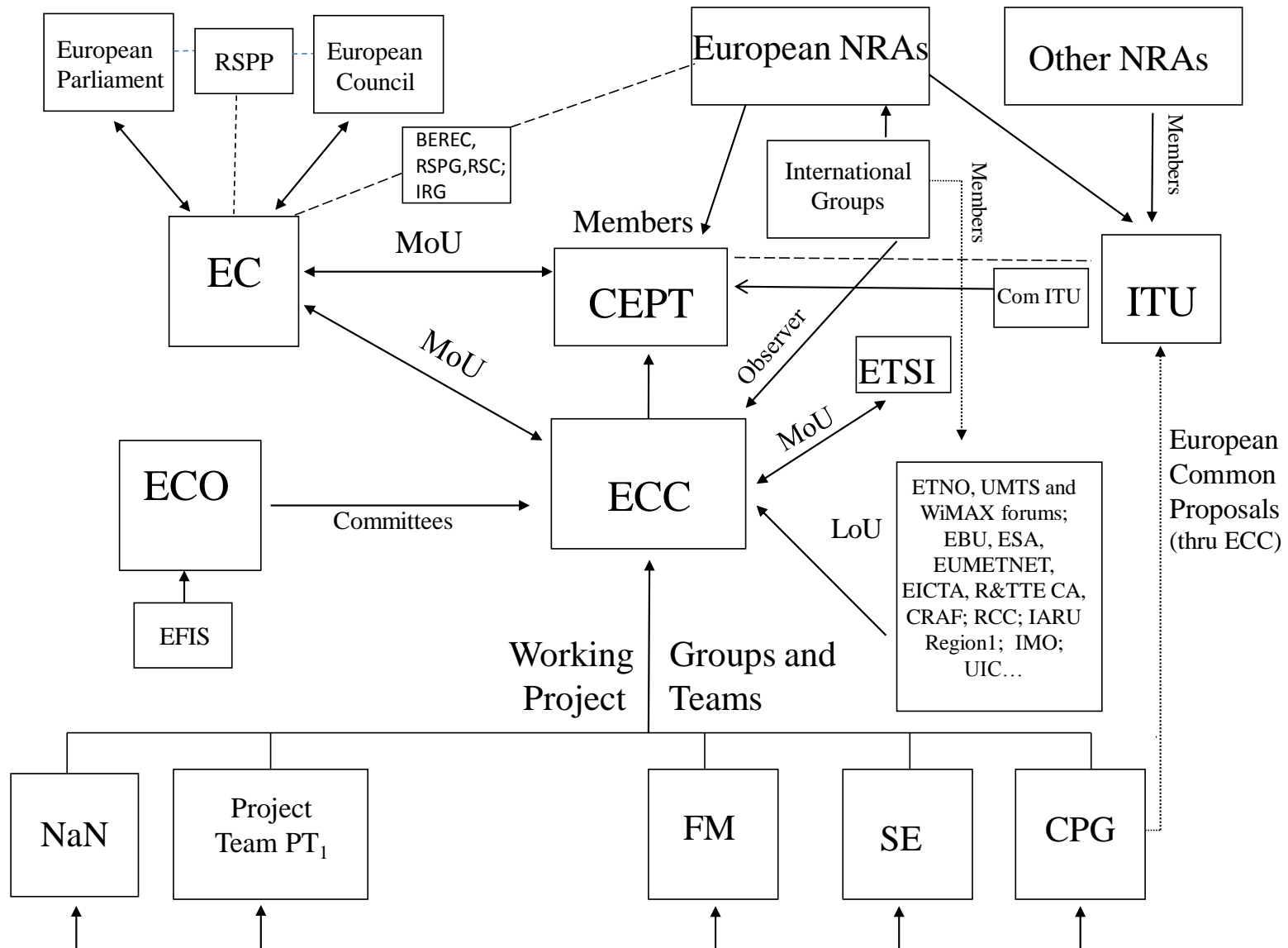
greens members;
grey- on the road to membership



ECO supports CEPT and its three business committees (ECO,
annual report July 2013)



The Main Players in European RF regulation



See <http://eprints.mdx.ac.uk/133/2/MazarAug08.pdf> p. 74

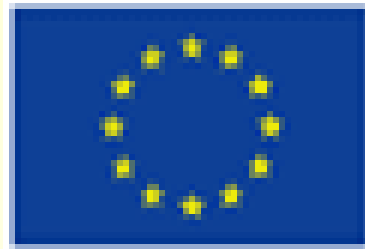
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Key of Abbreviations

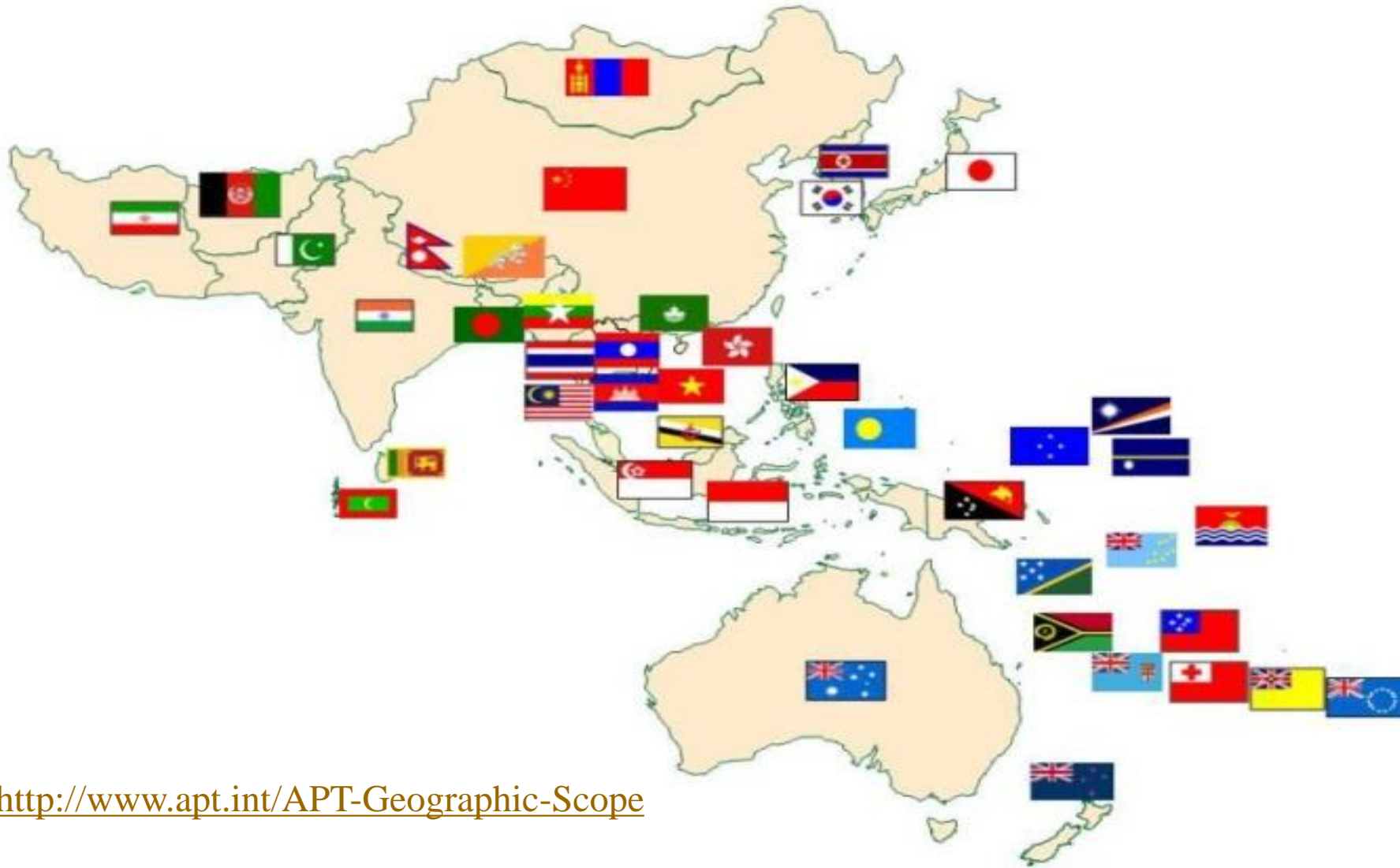
CPG: Conference Preparatory Group (preparations for ITU Conferences); CRAF: Committee on Radio Astronomy Frequencies; EBU: European Broadcasting Union; EC: European Commission; ECC: Electronic Communications Committee (formerly European Radiocommunications Committee ERC); EICTA: European Information and Communications Technology Industry Association; ERG: European Regulators Group (EC body); ERO: European Radiocommunications Office; ESA: European Space Agency; ESOA: European Satellite Operators Association; ETNO: European Telecommunications Network Operators; EUMETNET: European National Meteorological Services; FLO Forward Link Only; FM: Frequency Management; IARU: International Amateur Radio Union; IMO International Maritime Organisation; IRG: Independent Regulators Group (pan-European body); NRA: National Regulatory Authority; NNA: Numbering, Naming and Addressing (non RF); Project Teams PT PT₁: IMT2000, PT₂: TRIS Technical Regulation and Interconnection Standards, PT₉: Maritime issues; Task Groups TG: UWB (TG3) and Digital Dividend (TG4). RA: Radio Affairs (Radio and e-Communications); RRC: Regional Commonwealth in Communications; R&TTE CA: The Radio and Telecommunications Terminal Equipment Compliance Association; RSPG: Radio Spectrum Policy Group (EC body); RSC: Radio Spectrum Committee (EC body); SE: Spectrum Engineering. Industry Stakeholders, namely companies, consultants, industry groups and international agencies, contribute to the ECC Working Groups.

European tables that can optimise the RF spectrum in all Region 1



- THE EUROPEAN TABLE OF FREQUENCY ALLOCATIONS AND UTILISATIONS IN THE FREQUENCY RANGE 9 kHz to 3000 GHz
- ERC RECOMMENDATION 70-03 RELATING TO THE USE OF SHORT RANGE DEVICES (SRD)

Geographic Scope of APT



see <http://www.apr.int/APT-Geographic-Scope>

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ATU

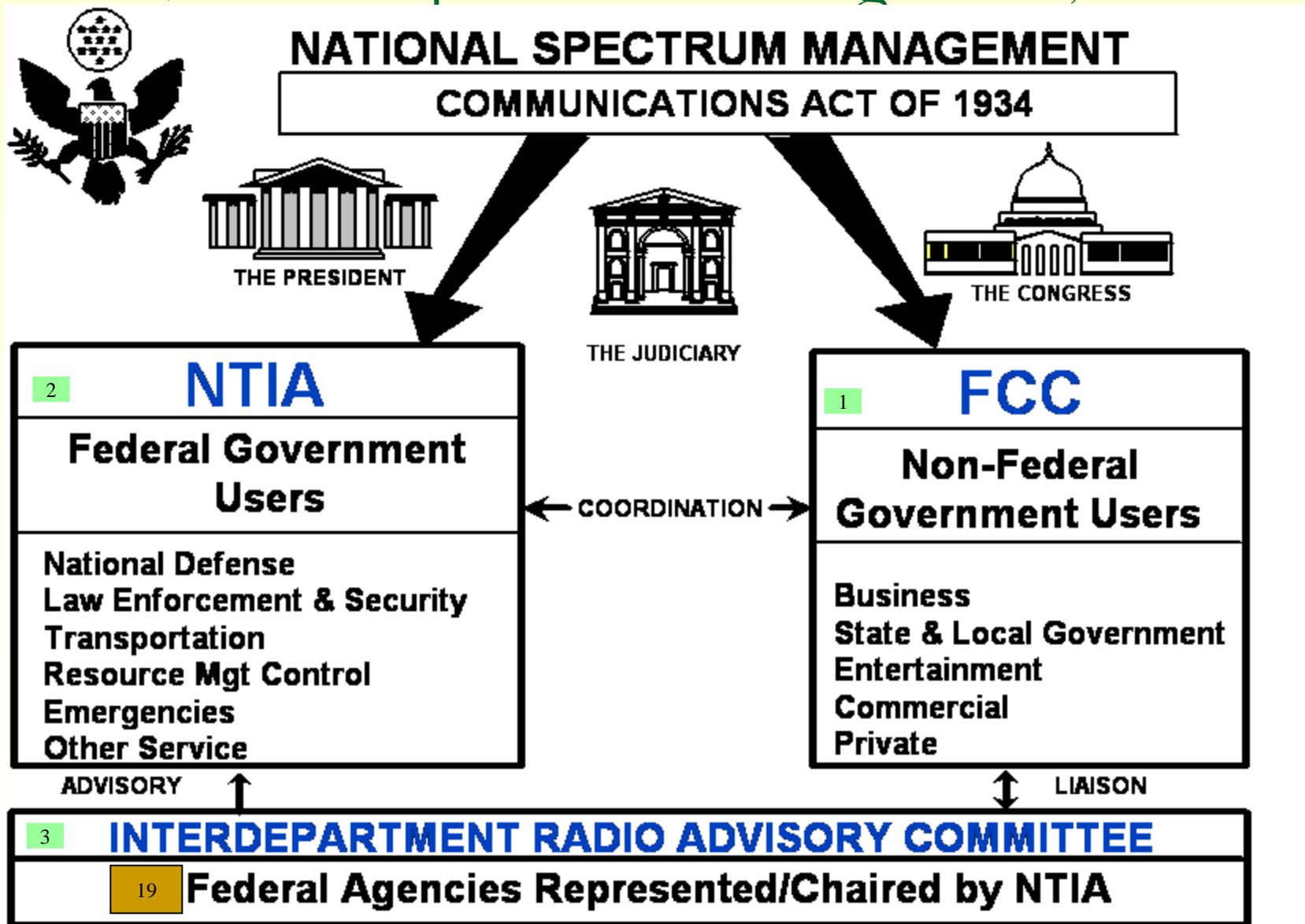
Member States



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<http://atu-uat.org/index.php/en/members/member-states>
<http://mazar.atwebpages.com/>

US National Spectrum Management; Bill Luther



National Telecommunications & Information Administration (NTIA)



NTIA Manual of Regulations & Procedures for Federal RF Management (Redbook)

<http://www.ntia.doc.gov/page/2011/manual-regulations-and-procedures-federal-radio-frequency-management-redbook>

The US Wall Chart

http://www.ntia.doc.gov/files/ntia/publications/spectrum_wall_chart_aug2011.pdf

mazarh@doc.gov; mazar@ties.itu.int

<http://mazar.atwebpages.com/>

US RF Allocations 2011

UNITED STATES FREQUENCY ALLOCATIONS THE RADIO SPECTRUM

RADIO SERVICES COLOR LEGEND

AERONAUTICAL MOBILE	INTER-SATELLITE	RADIO ASTRONOMY
AERONAUTICAL MOBILE SATELLITE	LAND MOBILE	RADIO TERRESTRIAL SATELLITE
AERONAUTICAL RADIOLOCATION	LAND MOBILE SATELLITE	RADIOLOCATION
AMATEUR	MARITIME MOBILE	RADIOLOCATION SATELLITE
AMATEUR SATELLITE	MARITIME MOBILE SATELLITE	RADIO NAVIGATION
BROADCASTING	SATELLITE RADIOLOCATION	RADIO NAVIGATION SATELLITE
BROADCASTING SATELLITE	METEOROLOGICAL	SPACE OPERATION
EARTH EXPLORATION SATELLITE	METEOROLOGICAL SATELLITE	SPACE RESEARCH
FIXED	MOBILE	STANDARD FREQUENCY AND TIME SIGNAL
FIXED SATELLITE	MOBILE SATELLITE	STANDARD FREQUENCY AND TIME SIGNAL SATELLITE

ACTIVITY CODE

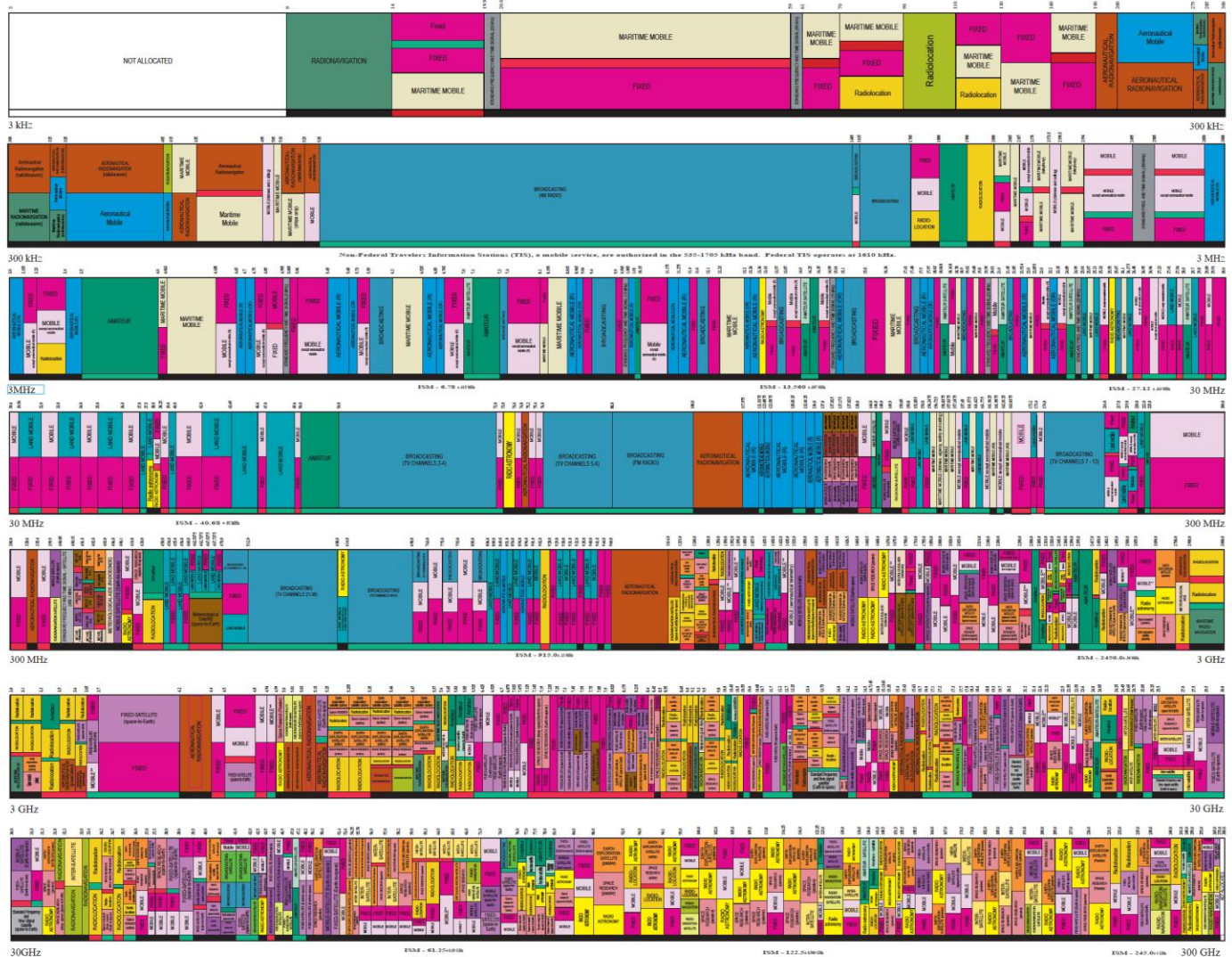
GOVERNMENT EXCLUSIVE	GOVERNMENT NON-GOVERNMENT SHARED
NON-GOVERNMENT EXCLUSIVE	

ALLOCATION USAGE DESIGNATION

SERVICE	EXAMPLE	DESCRIPTION
Primary	FIXED	Capital Letter
Secondary	Mobile	1st Capital with lower case letter

This chart is a graphic representation in color printed of the Table of Frequency Allocations of the FCC and ITU, as such it does not constitute either of those tables. It is intended to provide a visual summary of the Table of Frequency Allocations. Therefore, it cannot be relied upon as a legal document. The Table is available in electronic form at www.fcc.gov.

U.S. DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Office of Spectrum Management
August 2011

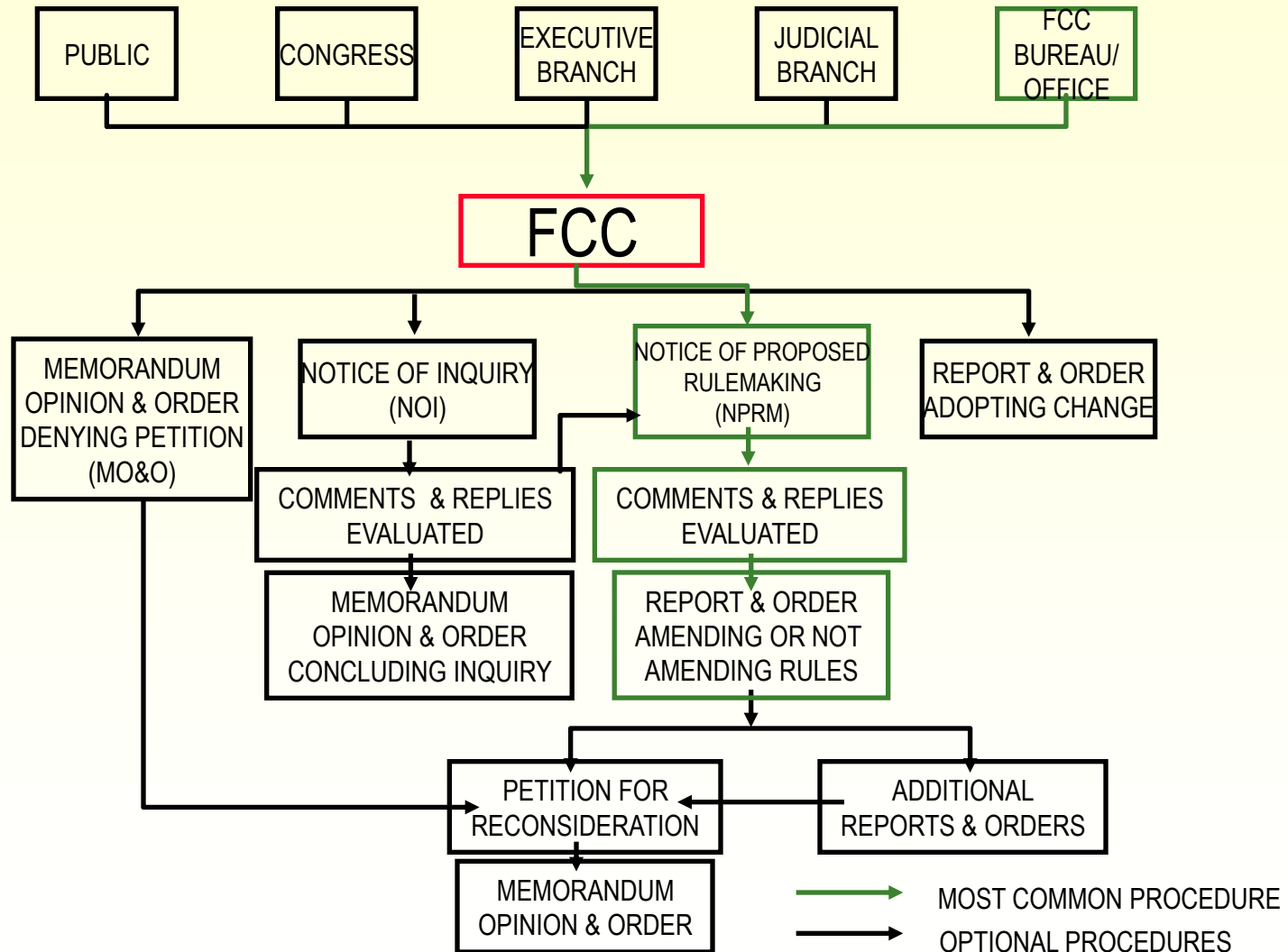


http://www.ntia.doc.gov/files/ntia/publications/spectrum_wall_chart_aug2011.pdf

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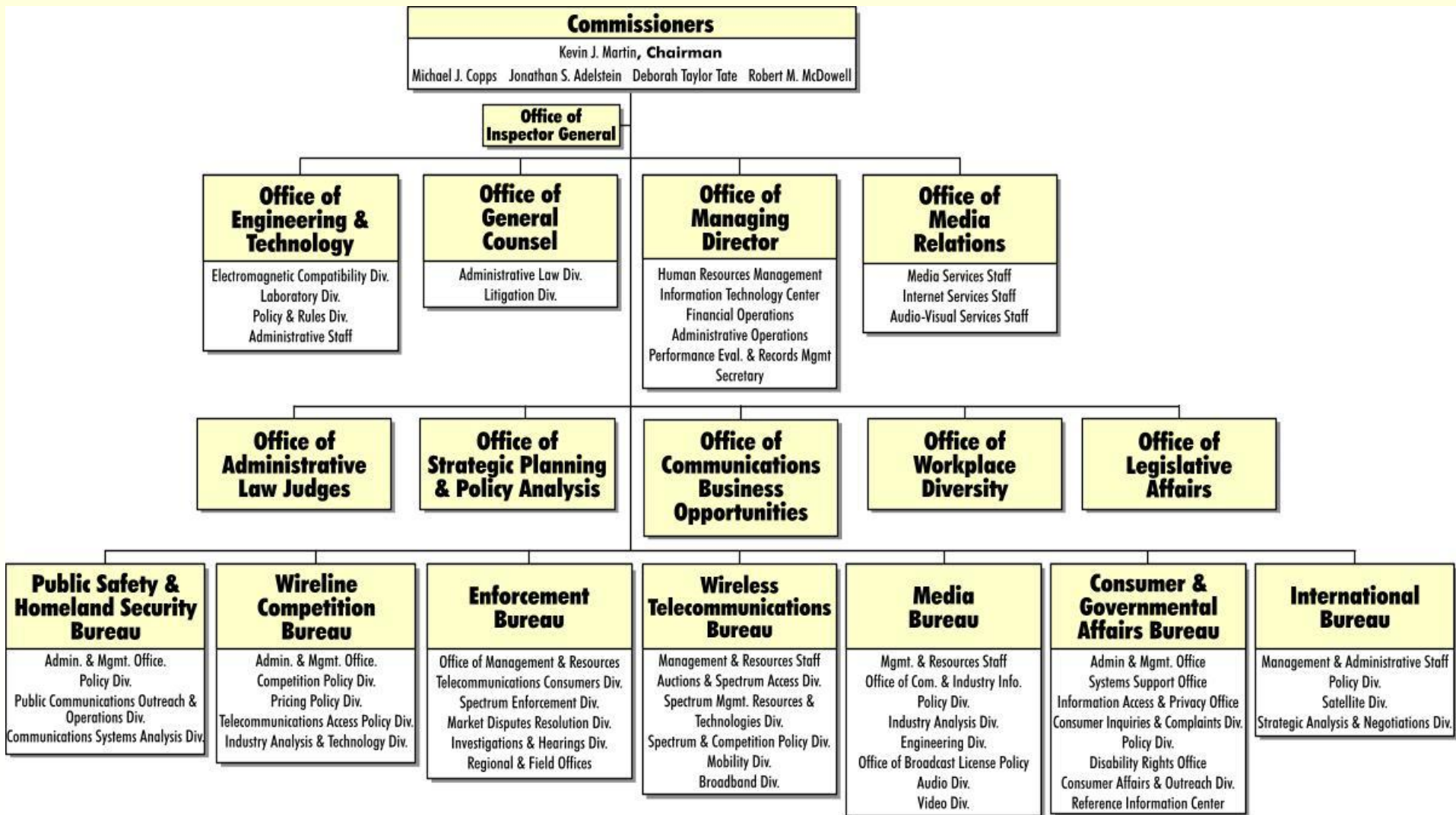
<http://mazar.atwebpages.com/>

How FCC rules are made (Bill Luther)



FCC Organizational Chart

All spectrum users except federal government



CFR 47, the Code of Federal Regulations



National Archives and
Records Administration



1. CFR 47 parts 0 to 19
2. PART 15—Radio Frequency Devices
3. CFR 47 part 22: Public Mobile Services
Subpart H—Cellular Radiotelephone Service

1. **Wireless regulation & standardisation are divided into two major camps: Europe and N. America**
 - ❑ Different approach to top-down mandated standards: collectivism and intervention vs. *individualism* and 'light touch'
 - ❑ Licensing: Part 15 and R&TTE; influence of EU on the rest Europe (& Region 1) is parallel to the influence of the US on Canada
 - ❑ Harmonisation: *E Pluribus Unum*, probability of interference
 - ❑ Europe: 50 Hertz, 9 KHz audio MW AM BW, GSM, 7-8MHz PAL&SECAM TV into DVB-T
 - ❑ N. America: 60 Hertz, 10 KHz audio MW AM BW, CDMA, 6 MHz NTSC TV switched to ATSC

2. **Diverse cellular penetration and digital TV standards are derived from dissimilar coverage zones and population densities**

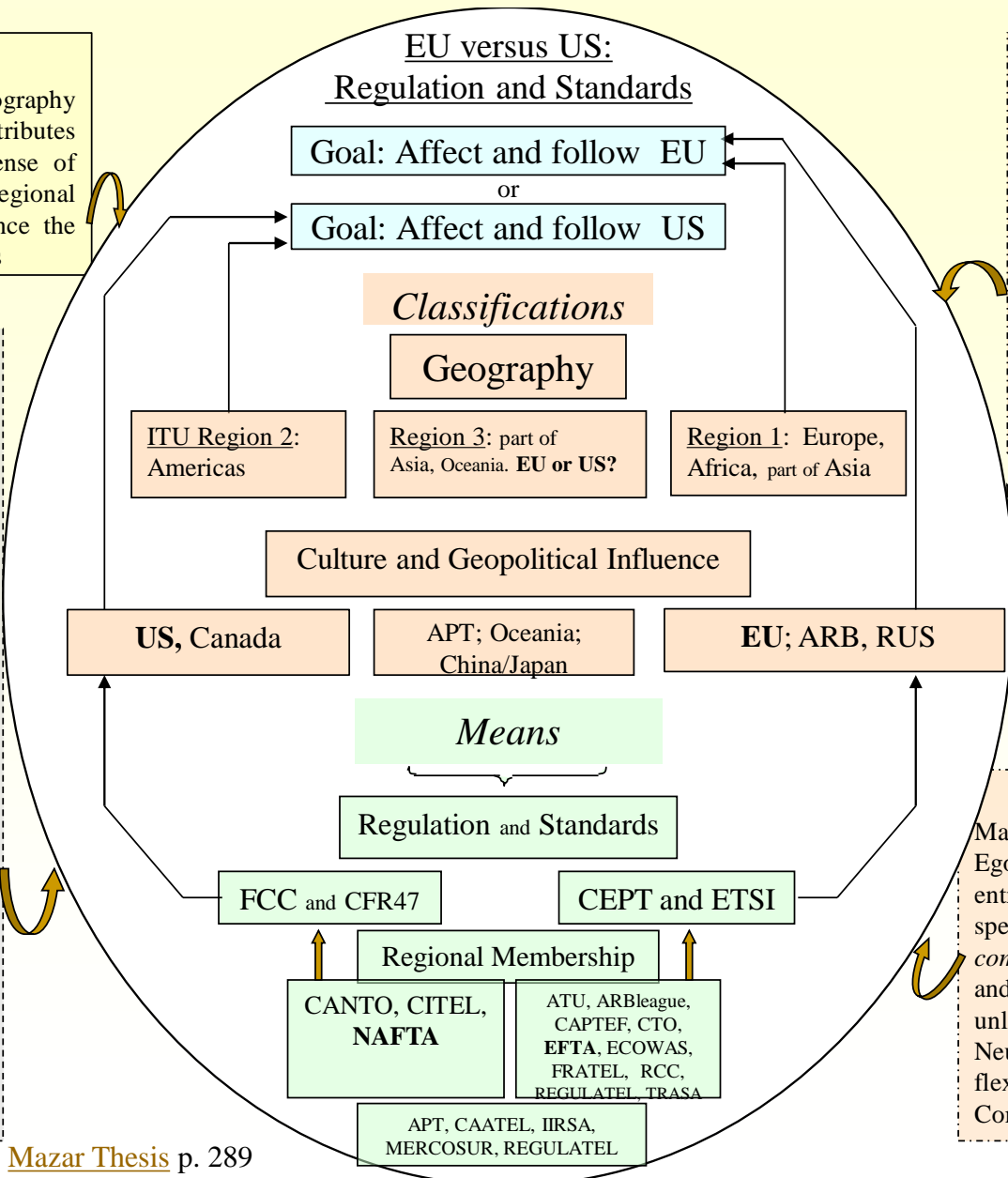
Example: Human Hazards- thresholds

1. At 400-1500 MHz, the allowed ICNIRP and Eur. Power Density for the general public is:
 $f \text{ (MHz)}/200 \text{ [W/m}^2\text{]}$
2. Europe follows ICNIRP levels; but: SUI (0.01 ICNIRP for BTS), Italy (0.03 ICNIRP) and Slovenia (0.1 ICNIRP)
3. US & Canada limit is 4/3 higher: $f(\text{MHz})/150 \text{ [W/m}^2\text{]}$
4. US & Canada threshold on terminal's SAR is 1.6 W/kg (5/4 more risk averse). ICNIRP & EU limit is 2.0 W/kg.

EU versus US; Regulation & Standards

Strategies
 US and EU suspend geography and national cultural attributes (language, tradition, sense of belonging) and regional organisations to influence the regulation and standards

Instincts
 Follow countries that you feel belonging to. Vagueness? Sympathy vs. distrust. Decision making itself is a source of controversy. EU and US: to sell wireless equipment and networked services, e.g. UMTS, SECAM, PAL, DVB-T, or CDMA2000, NTSC and ATSC. Distrust to US leads to EU standards. US \$ vs EU Francophone countries follow France; left driving countries follow UK. 110V/60 Hz mains, 01 country code, transfer of power to the US and US Dollar as official currency reveal the US influence.



Values
 Independent solutions or 'climb atop the shoulders of giants'. dependence vs. sovereignty, national RF allocation & standards. To belong; common understanding and knowledge, collective unconscious and constructs; language, legal origin and colonial heritage; state politics. Subregion and neighbours

Values EU
 Central planning. Harmonisation; civil law. Solidarity. Stringent limits for spurious emissions; worst-case scenarios, precaution. Self Conformity by manufacturers.

Values US
 Market-based solutions. Ego-oriented; individual entrepreneurs. English speaking, Protestantism, common law. More power and bandwidth to unlicensed RF bands. Neutral technology; flexibility; property; trust. Competition and Efficiency

Mazar Thesis p. 289

Any additional Qs?

Between others, additional files are found at

<http://mazar.atwebpages.com/Downloads>

<http://www.moc.gov.il/138-en/MOC.aspx>

[Hyperlink to PhD Thesis](#)

[Hyperlink to the Book](#)

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Dr. Haim Mazar (Madjar)

Thanks for All



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