



Cross Broder RF Interference Management

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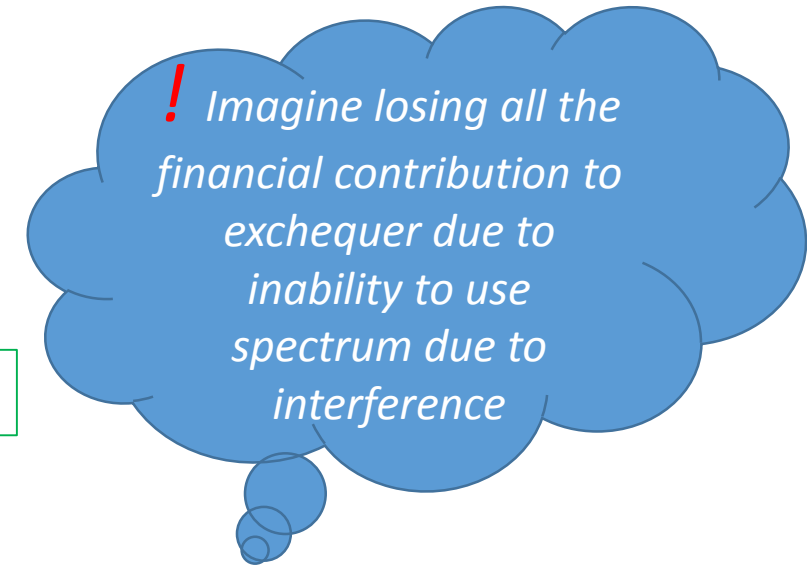
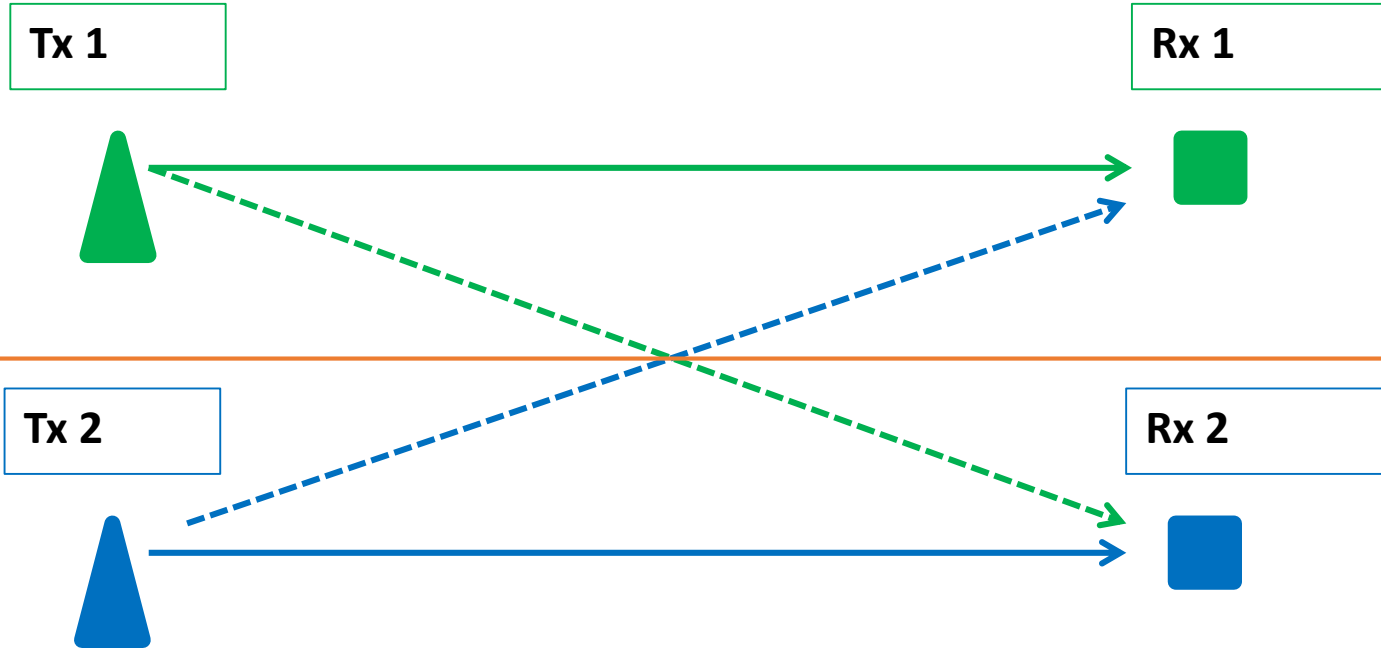


What to expect in these slides

- ✓ Interference?
- ✓ Approaches to address cross border RF interference issues
- ✓ Advantages and Dis-advantages of Coordination
- ✓ Situation in Asia-Pacific
- ✓ Going Forward and suggestions to address the issue
- ✓ Conclusion



Interference



International border

Interference:

Any signal received from Transmitter different than the intended one

RR 1.166 (interference):

The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radiocommunication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.





International concept of Interference

- **1.167 Permissible interference:**

- *Observed or predicted interference which complies with quantitative interference and sharing criteria contained in these Regulations or in ITU-R Recommendations or in special agreements as provided for in these Regulations.*

- **1.168 Accepted interference:**

- *Interference at a higher level than that defined as permissible interference and which has been agreed upon between two or more administrations without prejudice to other administrations.*

- **1.169 Harmful interference:**

- *Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with Radio Regulations (CS).*



International roles of SM

- Supporting harmonized global frequency allocations,
- Providing and supporting common standards to achieve the highest level of interoperability and to enable successful interconnection between various systems,
- **Contribution and supporting regional agreements on utilization of specific frequency bands,**
- **Protection of governed national frequency assignments while recognizing frequency assignments of other governments,**
- **Protection of internationally assigned frequency from harmful interference,**
- Encouraging new technologies to move toward industrial methods utilizing radio frequency spectrum and orbital positions more efficiently,
- Exchanging gained experience and profession to promote spectrum management activity of concerned administrations,
- **To cooperate with international treaties with the aim of promotion of availability and reliability of radiocommunication anywhere anytime**





Approaches to address cross border RF interference issues



Managing cross Border Interferences

Global Frameworks

- International Organizations

Regional Frameworks

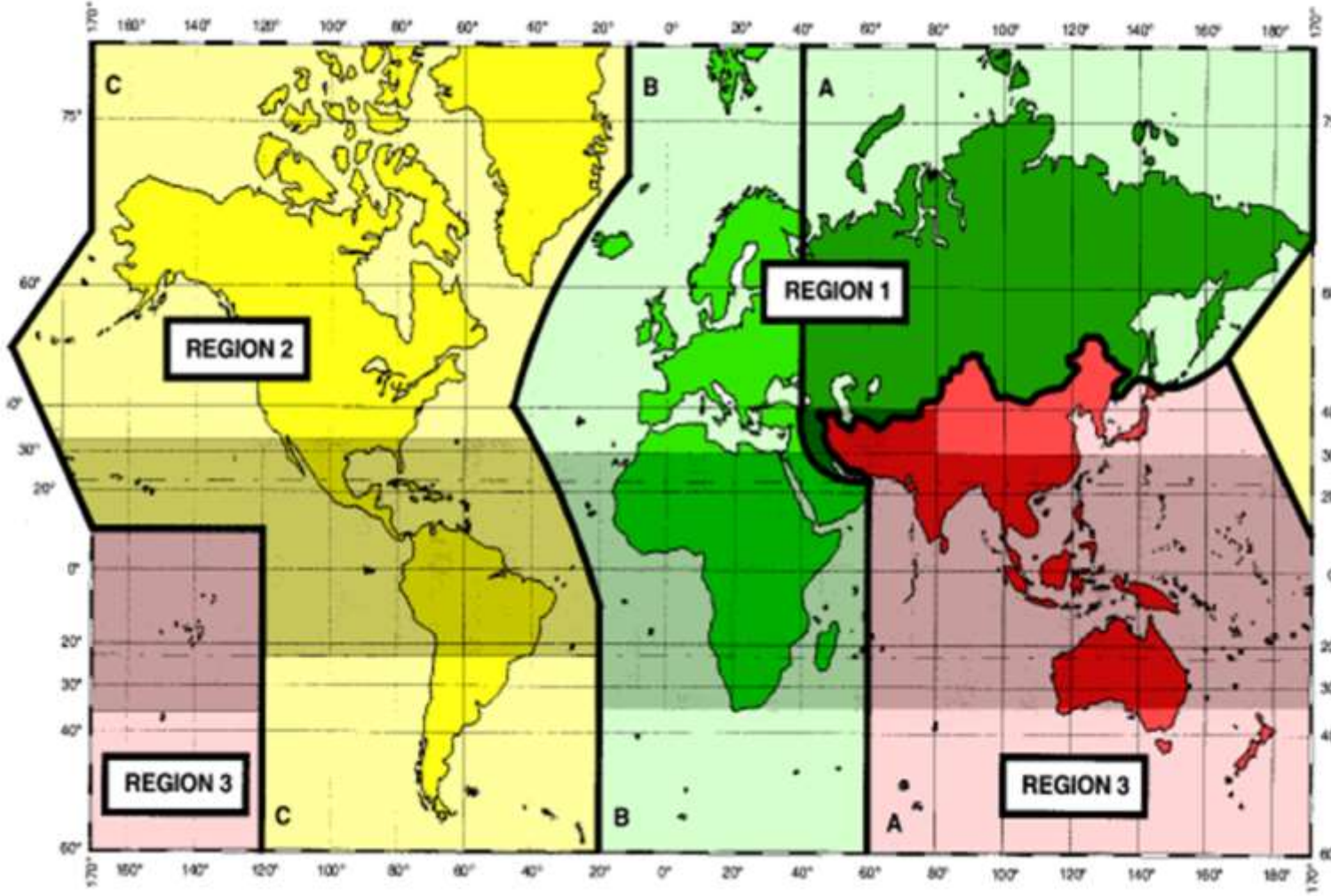
- Regional Organizations

Bilateral/MultiLateral/subregional Frameworks

- Agreements between countries



Frequency Coordination at Global Level



The shaded part represents the Tropical Zones as defined in Nos. 5.16 to 5.20 and 5.21

➤ Example

- ITU Radio Regulations
 - Article 5 Allocation Table
 - Annexures for plans

➤ Pros:

- Easier to implement with global backing of Admins
- More acceptance once agreed
- Economies of scale

➤ Cons

- Difficult to agree to a global solution
- Flexible and not tailor made for any region/country situation





Frequency Coordination at Regional Level

Regional co-ordination on spectrum Management

Exchange information and experiences to foster the harmonization of spectrum management rules

Facilitating efficient and flexible use of the spectrum

Coordinating the Use of Technical Standards across Regions

Managing interference by establishment of a common framework

Prepare common positions to be presented to regional, then global instances

➤ Example

➤ APT Plans

➤ Pros:

➤ Relatively easier to implement due to acceptance of regional Admins

➤ Economies of scale

➤ Cons

➤ Less difficult to agree than a global solution



➤ *Challenge to agree if region is diverse*

➤ Still Flexible and not tailor made for any geographical situation





Regional Organizations

Name	Official website
APT - Télécommunauté Asie-Pacifique - Asia-Pacific Telecommunity - Telecomunidad Asia-Pacífico, BANGKOK, Thailand	www.apr.int
ASMG- Arab Spectrum Management Group	http://asmg.ae
ATU - Union africaine des télécommunications - African Telecommunications Union - Unión Africana de Telecomunicaciones, NAIROBI, Kenya	www.atu-uat.org
CANTO - Association des entreprises nationales de télécommunications des Caraïbes - Caribbean Association of National Telecommunication Organizations - Asociación de Organizaciones Nacionales de Telecomunicaciones del Caribe, PORT OF SPAIN, Trinidad and Tobago	www.canto.org
CEPT - Conférence européenne des Administrations des postes et des télécommunications - European Conference of Postal and Telecommunications Administrations - Conferencia Europea de Administraciones de Correos y Telecomunicaciones, VALLETTA, Malta	www.cept.org
CITEL - Commission interaméricaine de télécommunications - Inter-American Telecommunication Commission - Comisión Interamericana de Telecomunicaciones, WASHINGTON, D.C., United States	www.citel.oas.org
COMTELCA - Commission technique régionale des télécommunications - Telecommunications Regional Technical Commission - Comisión Técnica Regional de Telecomunicaciones, TEGUCIGALPA, M.D.C., Honduras	www.comtelca.org
COPTAC - Conférence des Postes et Télécommunications de l'Afrique centrale - Conference of Posts and Telecommunications of Central Africa - Conferencia de Correos y Telecomunicaciones de África Central, YAOUNDE, Cameroon	n/a
CTU - Union des télécommunications des Caraïbes - Caribbean Telecommunications Union - Unión de Telecomunicaciones del Caribe, PORT-OF-SPAIN, Trinidad and Tobago	http://www.ctu.int/
ETSI - Institut européen des normes de télécommunication - European Telecommunications Standards Institute - Instituto Europeo de Normas de Telecomunicaciones, SOPHIA ANTIPOLIS CEDEX, France	www.etsi.org
LAS - Ligue des Etats Arabes - League of Arab States - Liga de los Estados Árabes, CAIRO, Egypt	www.arableagueonline.org
RCC - Communauté régionale des communications - Regional Commonwealth in the Field of Communications - Comunidad Regional de Comunicaciones, MOSCOW, Russian Federation	  www.rcc.org.ru



Bilateral

Bilateral / Multi-Lateral / sub-regional Arrangement

Cross-border co-ordination by harmonizing the use of frequency spectrum.

develop means of resolving instances of unexpected harmful interference

➤ Example

- Trilateral meeting between IND-MLA-SNG
- Agreements of Thailand with Neighbors

➤ Pros:

- Relatively easier to agree
- Very specific solution to a particular problem

➤ Cons

- Difficult to implement
 - *To common from neutral administrations to implement*
- Difficult to plan nationally with multiple arrangements with several neighbors



Advantages and Dis-Advantages of Coordination





Advantages of Coordination

- × AIM: **Optimise spectrum usage**
- × Administrations obliged to co-ordinate frequencies before assigning them
- × Administrations obliged to ensure harmonised application of technical provisions
- × Quick assignment of preferential frequencies
- × Transparent decisions through agreed assessment procedures
- × Quick assessment of interference through data exchange



Advantages of Coordination

- × **The agreement may also cover issues related to coordinated use of Infrastructure belonging to different Admins for RF monitoring**

Neighboring countries are increasingly endeavoring to provide harmonized radio communications to facilitate cross-frontier operations by adopting common specifications. This phenomenon is a very marked one encourages the countries concerned to set up harmonized or even integrated monitoring facilities by using identical procedures and, under certain circumstances, a common infrastructure.

This would make monitoring services more efficient and also lead to lower and, therefore, more readily acceptable financial investments for monitoring infrastructure.

- × **Resolution ITU-R 23 refers to the need of**

Cooperation between monitoring stations of different administrations should be encouraged and improved with a view to exchanging monitoring information concerning terrestrial and space stations emissions, and to settling harmful interference caused by transmitting stations that are difficult to identify or cannot be identified;





Advantages of Coordination

Coordinated use of Infrastructure belonging to different Admins for Monitoring: **Examples**

× **Collaboration below 30 MHz**

- **Avoiding overlapping of activities by monitoring stations covering the same area**
close cooperation can be organized between these stations so that they can take part, in turn, in a specific monitoring programme. For this purpose, the part of the spectrum to be monitored can be divided into sub-bands that each monitoring station taking part in the programme will explore in turn in accordance with a predetermined timetable
- **Arrangements can be implemented either for particular purposes, for instance during special monitoring programmes organized by the Bureau, or they can be of a more permanent nature**
- **Determination of the location of a transmitter and its identification, particularly in the case of harmful interference**



Advantages of Coordination

× Collaboration Above 30 MHz

• First category:

Cases in which the regional authorities on both sides of the frontier are authorized to enter into direct contact, for example, only when the frequencies concerned are the direct responsibility of the regional center (frequencies to be specified), on the basis of RR No. 16.3; the cooperation can be to

- *carry out measurements from their own territory on transmitters in the neighboring country, at its request, and transmitting the results to it;*
- *authorizing a mobile team from the neighboring country to come and take measurements itself;*
- *mutual assistance in both cases.*

• Second category:

- *Joint establishment of a plan for the distribution of monitoring stations in frontier areas;*
- *Definition of the interfaces to enable each country to take measurements of transmitters located on its own territory from any station in the frontier area;*
- *Establishment of a schedule for installing harmonized monitoring facilities.*





Advantages of Coordination

• Third category:

- *Exchange of lists of authorized networks in the frontier areas of each country, together with their technical characteristics, so that “foreign” transmitters are no longer regarded as unknown;*
- *Exchange of such lists using automatic remote data transmission procedures.*

The first category is to be regarded as the initial step while the second and third categories constitute longerterm objectives.

Arrangements of this kind exist in many parts of the world, particularly in congested areas.

- The longstanding arrangements among Canada, Mexico, and the USA constitute a typical example of such cooperation.
- The need for such collaboration is also exigent in the European area where, for instance, France, Germany and Switzerland entered into an agreement of the first category in 1993





Dis-advantages of Coordination

- × Increase in administrative work and costs (complex procedures, longer turnaround times, topographical database)
- × Detailed input data required from operators (geographical data, antenna parameters)
- × Customers affected by changes in usage rights: Various consequences
- × Limits also to preferential frequencies, limits may vary from case to case
- × More work in application processing.

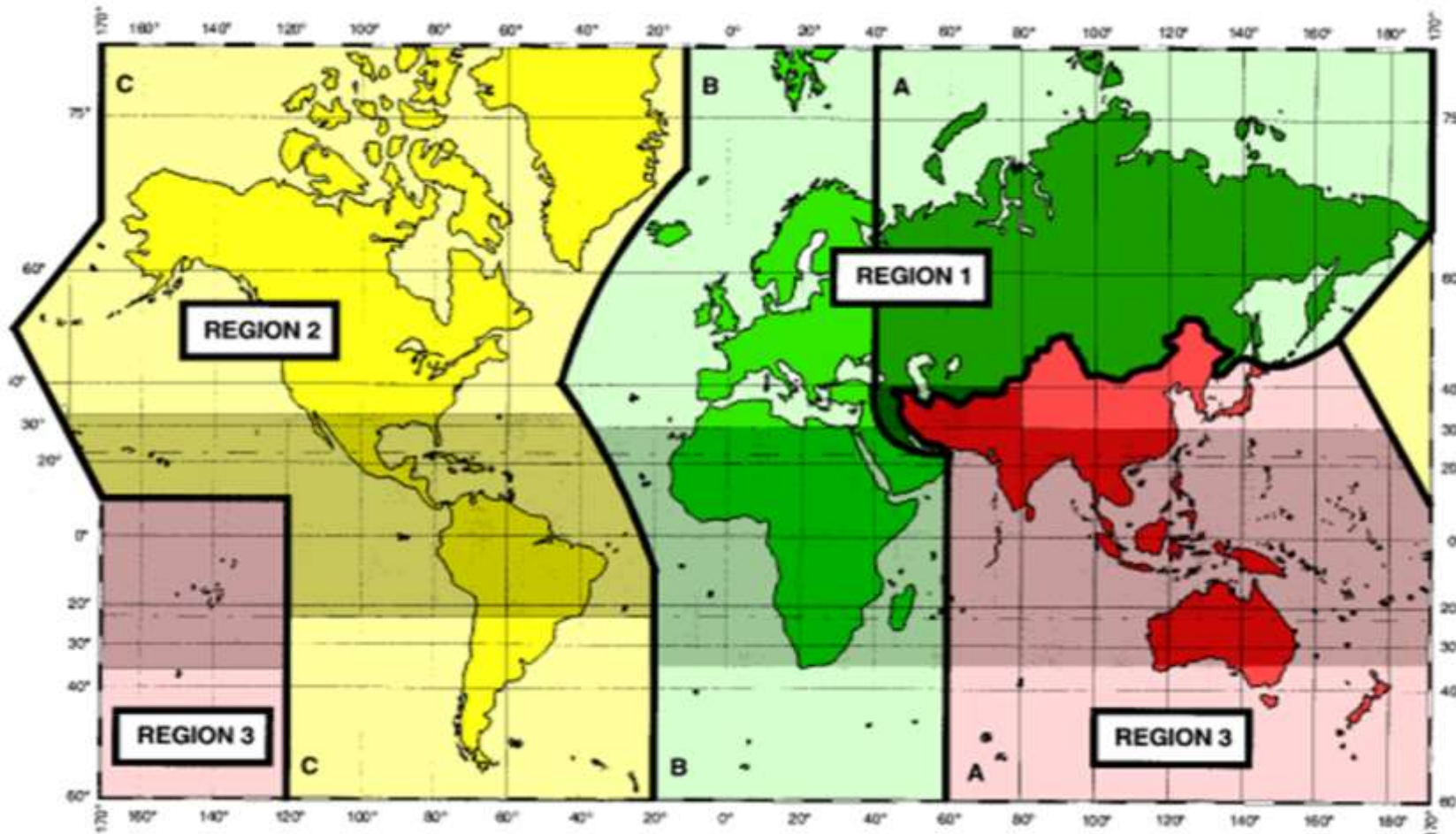


Situation in Asia-Pacific





Welcome To ASP: Predominantly Region 3



Note the diversity in

- **Geography**

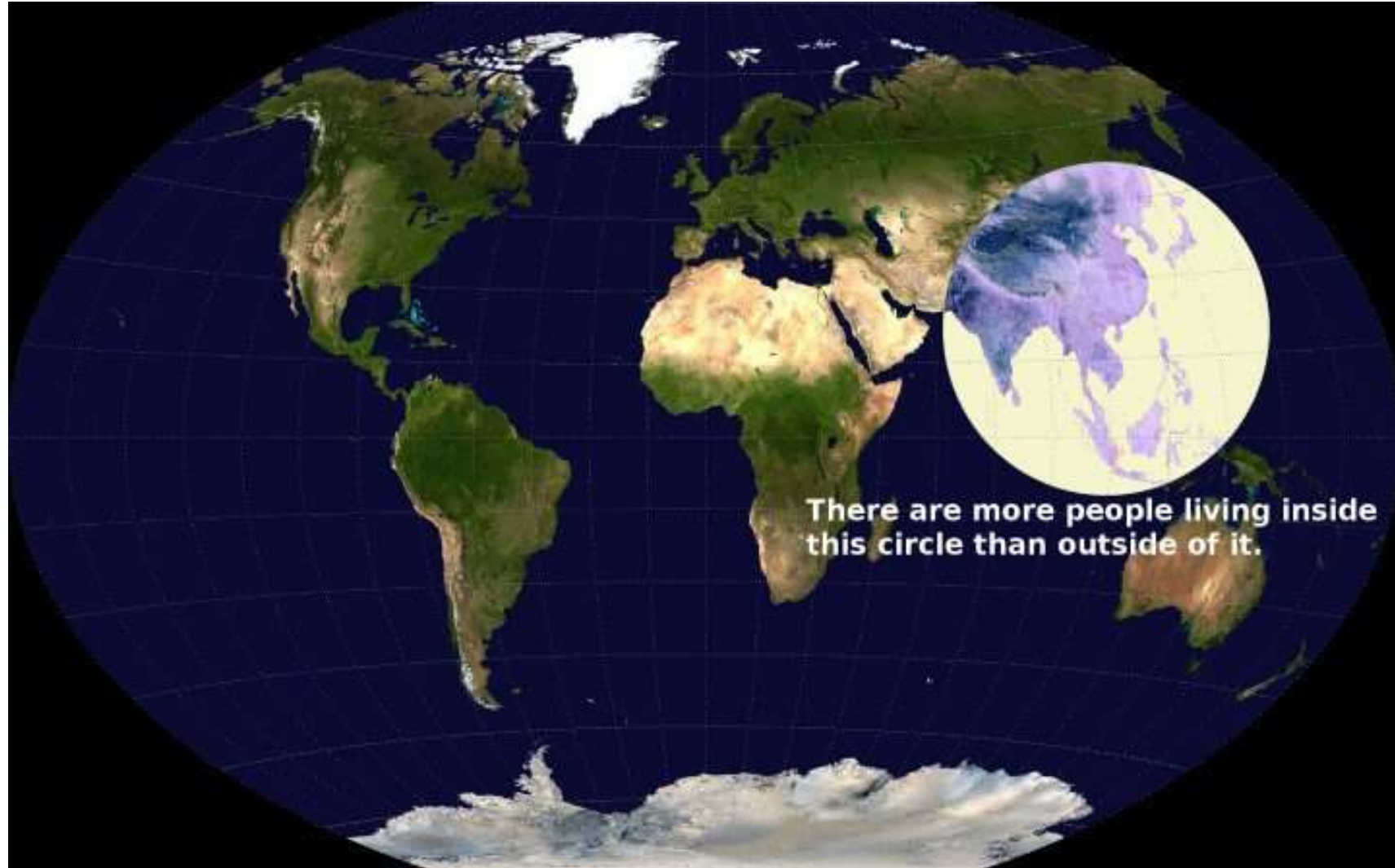
- *Archipelagos*
- *Island states*
- *Landlocked*
- *Himalayas*

- **Level of Development in ICTs**

- *IDI index rankings range from 1 to 164*



Understanding the need of Framework on cross border RF Management



Source: <http://brilliantmaps.com/population-circle/>





Cross Border RF Interference Mitigation

- **Some Facts**

- *Significant population concentration on the border areas of countries in e.g. Cambodia - Lao P.D.R – Thailand - Vietnam etc.*
- *Interference Issues always exist has primarily due to nonexistence of any formal agreement on the management of this issue at regional and/or sub-regional level.*

- **Some Examples of Sub-regional approaches in ASEAN to address the issue**

- ***Indonesia-Malaysia-Singapore** under the trilateral forum between the three countries;*
- ***Singapore-Malaysia-Brunei** using Frequency Assignment and Coordination, Singapore, Malaysia and Brunei Darussalam (FACSMAB) platform.*
- *Bilateral agreements of Lao P.D.R with Vietnam and Thailand separately.*
- *Activities of **SAARC** in South-Asia*



Recognition of Cross Border RF Interference issue

➤ ASEAN

ASEAN ICT MASTERPLAN 2020

6.1.3 (*Harmonize Telecommunication Regulations*)

“Recognizing the potential for cross-border spectrum conflict in light of new technologies such as unlicensed and dynamic spectrum allocation, this aims to develop a guideline, based on best practices, for managing such developments regionally) “

➤ SAARC

Recognized Areas of Cooperation





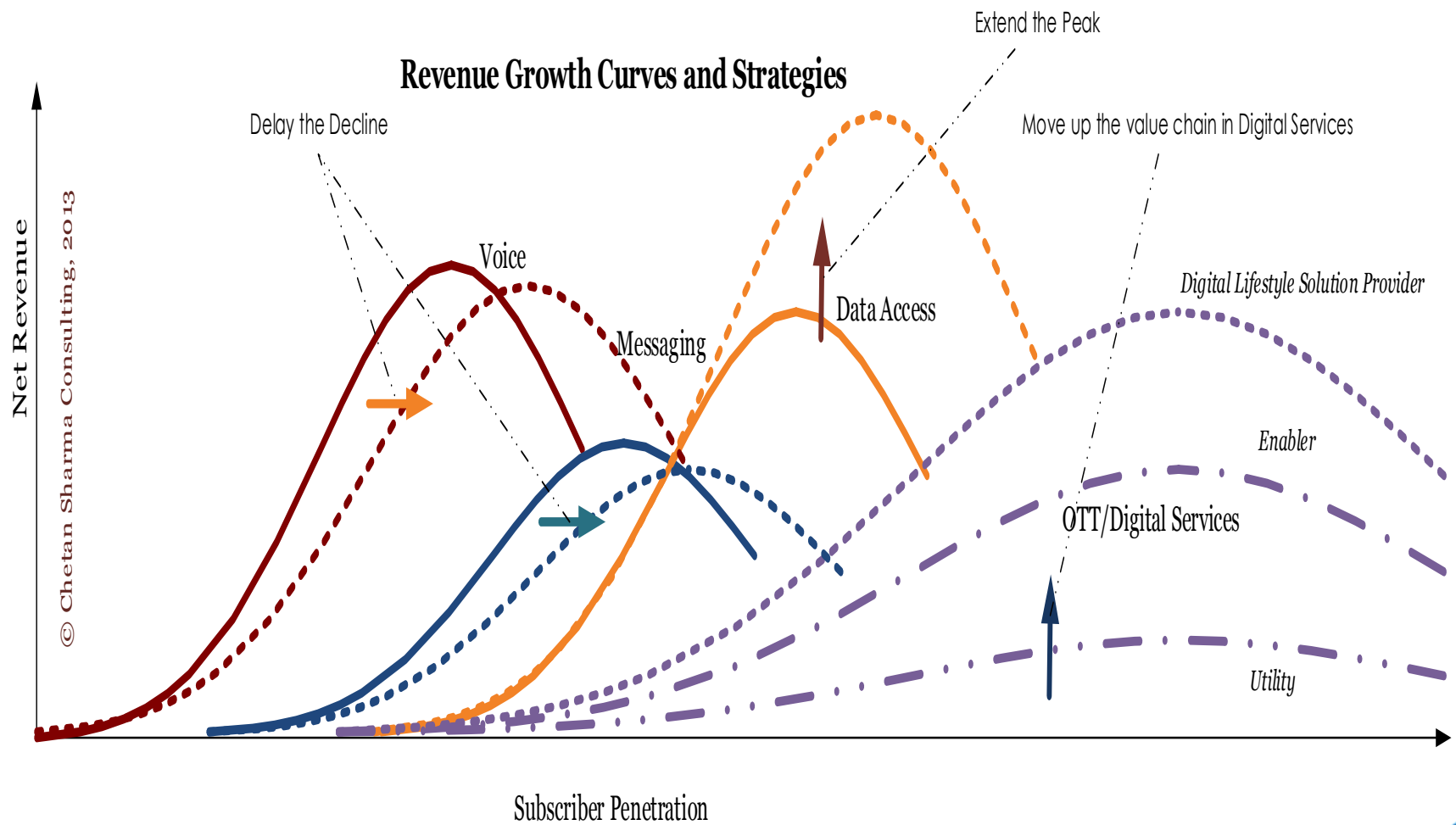
Going Forward and suggestions to address the issue





What we know now?

4th wave of growth in telecom sector



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Current wave is defined by its complexity

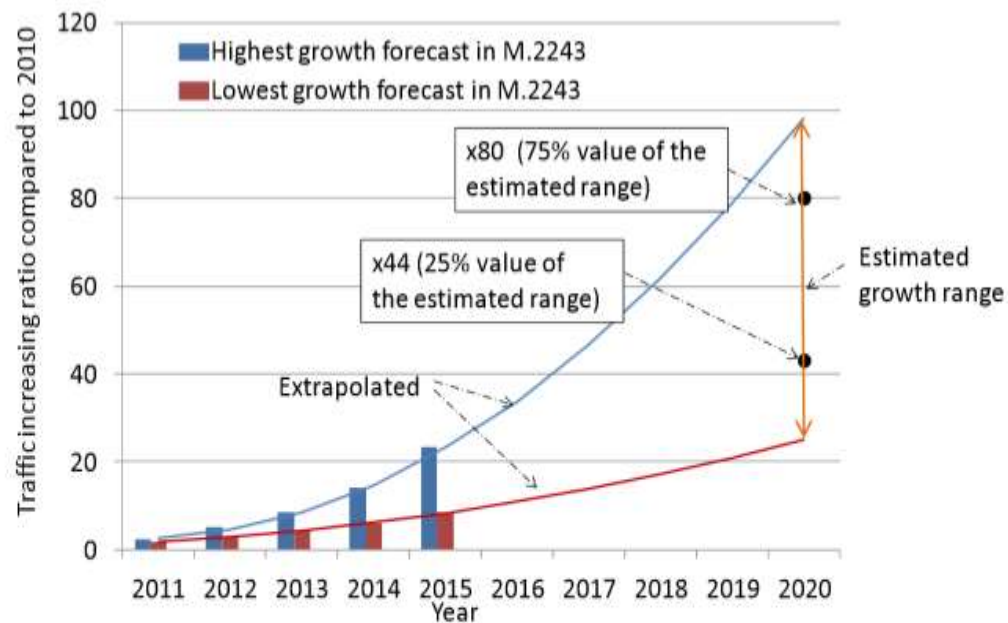




What we know now?

Demand of Content – Internet Traffic Explosion

Mobile Data Traffic Growth



37% of Internet traffic during prime time is online video



Video ~ 70% of internet traffic by 2014	Smartphones 2.5 billion devices by 2015 32x increase per km ²	Mobile Internet ~ 70% of mobile traffic by 2014	Machine-to-Machine 3x growth in the next five years
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Mobile broadband networks are at the heart of this trend ...

Source: ITU Report M.2290-U and Alcatel-Lucent

Alcatel-Lucent





What we know now?

More sensitive Networks

BS reference sensitivity levels for FDD based BS as per 3GPP TS 25.104 V12.1.0 (2013-09)

BS Class	Reference measurement channel data rate	BS reference sensitivity level (dBm)	BER
Wide Area BS	12.2 kbps	-121	BER shall not exceed 0.001
Medium Range BS	12.2 kbps	-111	BER shall not exceed 0.001
Local Area / Home BS	12.2 kbps	-107	BER shall not exceed 0.001

Source: 3GPP TS 25.104 V12.1.0 (2013-09)





Principle of Cross border coordination

➤ Traditional way

- Case to case basis: Resolve when issue arises
 - *Takes long time as network has already been rolled out*
- Longstanding multiple arrangements designed around lower frequencies (HF or Max VHF)
 - *Difficult to plan nationally with multiple arrangements with several neighbors*

➤ Better Way

- Assign spectrum only when coordination is achieved with neighboring countries
- One common coordination framework
 - *Easier to implement*



Granting Access to Spectrum

UK : Study Case

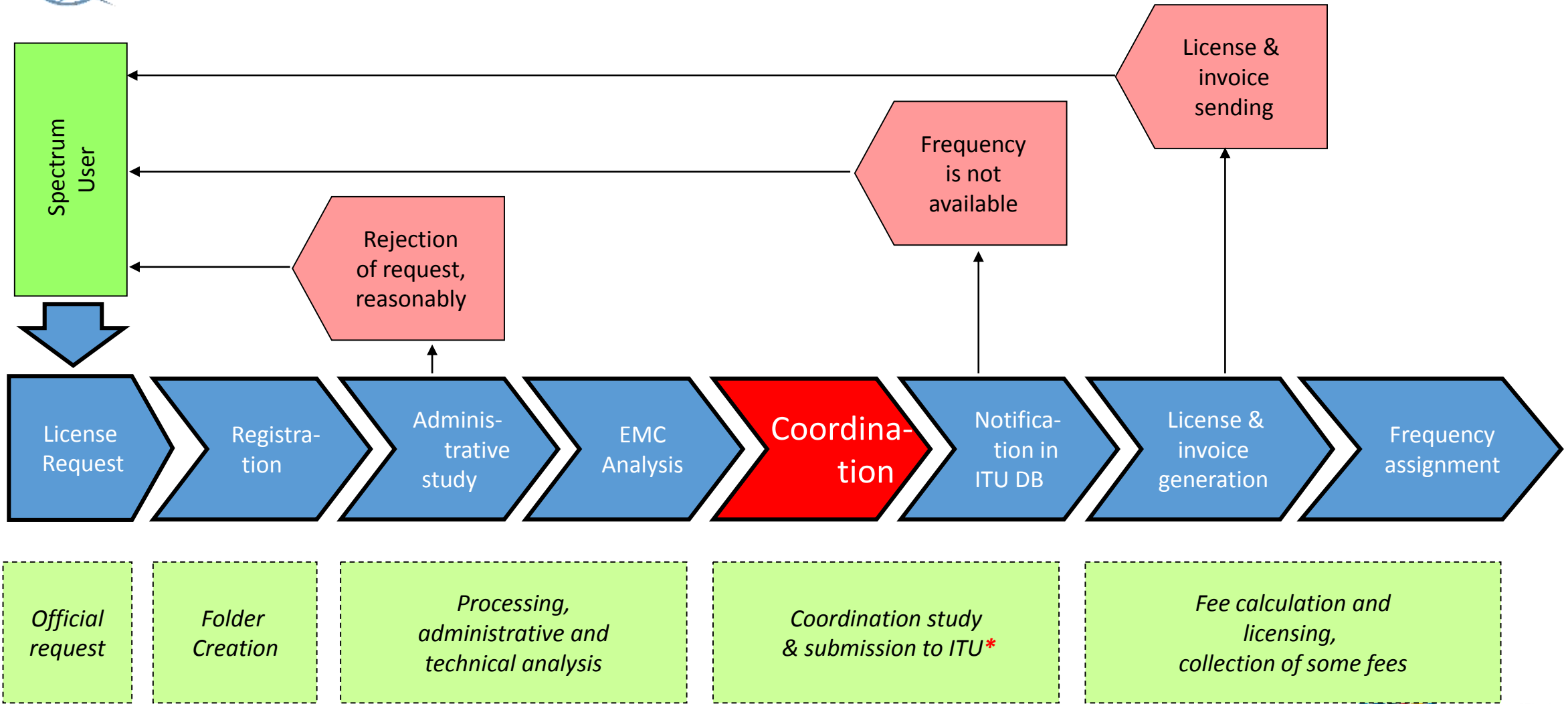
SM method	% of spectrum allocated in the UK <i>(source: Ofcom)</i>	
	Year 2000	Year 2010
Administrative	96 %	22 %
Market	0 %	71 %
Commons <i>(Unlicensed Spectrum)</i>	4 %	7 %

The Cross border interference coordination is different as it involves two administrations working under different national frameworks.

**Effective
implementation
requires
Administrative way
of Management**



General Procedure for Licensing



* ITU notification is not required for each cases, and that a bi/multilateral agreement is stronger than the RR (see Article 6 of the RR)





Example - National Spectrum Licensing workflow

✘ Request for Licensing received by office

- + *Ensure all the technical parameters are there in application (establish a minimum required info. criteria)*
- + *Detailed backend technical evaluation*

Need for Coordination Established



How to coordinate?

Co-ordination request and all technical characteristics of radio network/equipment sent to all administrations affected to enable accurate assessment of interference

Administrations affected assess possibility of interference to own stations;

No possibility of interference: obliged to agree to request

If assessments produce different results, administrations can agree to operation on a trial basis; **field strength calculations replaced with agreed field strength measurements**



A cross border Agreement - Components

1. Definitions
2. General
3. Technical provisions
4. Procedures
5. Report of harmful interference
6. Revision of this Agreement
7. Accession to this Agreement
8. Withdrawal from this Agreement
9. Status of co-ordinations prior to this Agreement
10. Languages of the Agreement
11. Entry into force of Agreement
12. Annexes for technical and administrative details

Rec. ITU-R SM.1049-1

*(A METHOD OF SPECTRUM MANAGEMENT TO BE USED FOR
AIDING FREQUENCY ASSIGNMENT FOR TERRESTRIAL SERVICES
IN BORDER AREAS)*

ITU, with support from its partners, is assisting countries in ASP to prepare frameworks that countries can use to further develop a multi country cross-border interference management solution





Conclusion

- **Issues of Cross Border Interference are going to grow in future**
- **A regional framework required to prevent rather than cure cross border interference issues**
- **Regional or sub-regional solutions more effective in implementation and addressing very specific problems**
- **ITU remains ready to support in development of harmonized solutions to growing problem.**



I T h a n k U “Committed to
connecting the
WORLD”

Major ITU-ASP SM Events in 2017

**Regional Workshop on Managing Spectrum in the age of wireless
communication Management**
Bangkok-Thailand, 3-4 May2017

ITU COE training on Spectrum Engineering and Cross border Coordination
Xian, China, 11 – 15 September 2017

ITU Study Group Meetings
ITU-D (Res. 9) and ITU-R SG1

Your active participation in and contribution to these events is most welcome!

