# Border coordination of the fixed and mobile services

N. Vassiliev Radiocommunication Bureau, ITU



# **General aspects of coordination**

#### Goals of coordination

- To ensure interference-free operation in border areas
- To assist in long-term planning of frequencies
- To promote efficient spectrum utilisation

#### Types of coordination

- Coordination between operators (e.g. MOB in 900MHz)
- Coordination between administrations (including BR's assistance)

#### Steps of coordination

- Identifying need for coordination(affected countries), often using assumed characteristics and worst case conditions
- Detailed coordination, using real parameters and terrain

#### Initiation

- When planning based on calculated values
- When operating based on measured values



# **Criteria for identifying need for coordination**

- Maximum allowed field strength interference E trigger (land mobile services broadcasting,)
  - Mostly used. Coord. required if interference level exceeds E<sub>trigger</sub>
- Coordination distances (broadcasting, fixed services, radars)
  - Simple. Coordination is required if distance to the border (or to station) exceeds the coordination distance
- Coordination area (broadcasting, space services)
  - Used not often. Coordination required if coordination area around station overlaps the boundary of neighboring country or protected station
- Triggering power-flux density (fixed service)
  - Not often. Coordination required if PFD exceeds triggering value



# **Result of coordination -> agreement**

#### **Typical structure of coordination agreement**

- Radiocommunication services and frequency bands, preferably with channeling arrangements
- Permissible interference level\* (often called as coordination triggers), acceptable interference
- Propagation model and interference calculation method\*
- Coordination method (preferential frequencies, channeling separations, protection at the border, protection of specific stations)
- Measurement method (to be used at stage of operation)
- Methods for data exchange and procedure resolving cases of harmful interference, including contact point

\* Usually decided based on internationally, regionally, bi-directionally agreed documents (RR, ITU-R Recommendations, regional standard documents)



## **Reference information**

- RRB Rules of Procedure, Part B4 coordination distances for protection of FS/MS vs. FS/MS in the bands around 900 MHz
- ITU-R Draft Handbook on coordination of FS: <u>Doc. 5C/171</u> (mainly based on contributions from Europe)
- European reference documents:
  - ERC <u>Rec. 01-01</u> Border coordination of UMTS
  - ECC <u>Rec. (05)08</u> Frequency Planning and coordination for the GSM 900, GSM 1800, E-GSM and GSM-R land mobile systems
  - ECC <u>Rec. (08)02</u> Frequency planning and frequency coordination for GSM / UMTS / LTE / WiMAX in 900 and 1800 MHz bands
  - HCM agreement coordination of fixed and land mobile service between frequencies between 29.7 MHz and 43.5 GHz
- Multi-country agreements concluded with BR's assistance (e.g. for Gulf countries for the mobile service in 900 MHz, 1.7/1.8 and 2 GHz)



## Some coordination approaches

#### Land mobile service

- Cellular systems: preferential frequencies/ preferential codes (for CDMA) in combination with field strength values
- Other LMS, e.g. PMR, recommended channeling arrangements and triggering field strength
- Fixed service
  - Coordination distances
  - Preferential frequencies in combination with power-flux density values
  - Coordination of individual stations



## **Example of coordination criteria for LMS (1)**

Permissible cross-border interference for initiating co-ordination



Interference shall not exceed 12 dB(µV/m) at 80 km inside a neighboring country

7

### **Example of coordination criteria for LMS (2)**

Notes to the Table at the previous slide :

- The values given refer to channel bandwidth  $\leq$  25 kHz except for GSM and UMTS/IMT2000.
- For all other digital wide band land mobile applications below 470 MHz (channel bandwidth: > 25 kHz) the following value should be added:

**6 x log<sub>10</sub> (channel bandwidth in kHz/25 kHz) dB** if the interferer is a wideband system.

Administrations concerned may agree to apply parameters other than the set values in the table.



## **Preferential frequencies (1)**

- Method: countries share frequency channels and determine conditions of their use
- Example: totally 124 channels in 800/900 MHz
- Country A uses channels 1-6, 19-34, 55-74, 91-110 as preferential and country B uses 7-18, 35-54, 75-90, 111-124 as preferential
- For preferential frequencies coordination is not required if field strength from every carrier of a base station at 15 km inside neighboring country does not exceed (Rec. ECC(05)08): 19 dB(µV/m) 900 MHz 25 dB(µV/m) 1800 MHz
- For preferential frequencies coordination is not required if field strength from every carrier of a base station at the border does not exceed:

19 dB(μV/m) 900 MHz 25 dB(μV/m) 1800 MHz



## **Coordination of fixed service – example (1)**

HCM agreement: coordination is required if the distance to a border is less than coordination distance indicated in the Table

Frequency range [GHz]			Co-ordination distance [km]
1	-	5	200*
>5	-	10	150*
>10	-	12	100
>12	-	20	80
>20	-	24.5	60
>24.5	-	30	40
>30	-	39.5	30
>39.5	-	43.5	20

\*The co-ordination distance for frequencies below 10 GHz is limited to 100 km for r antenna heights below 300m above sea level.

Notes: 1) stations that may cause interference to another country or need protection shall be coordinated regardless of the distance.

2) administrations may agree on other distances



#### **Coordination of fixed service – criteria**

- Permissible threshold degradation (TD) = permissible interference (HCM Agreement)
- Threshold is the minimum level of wanted signal at the receiver which provides a given quality of reception (BER)
- In presence of interfering signal (I), this level should be increased to preserve the same quality of reception
- TD is the value of this increase
- The permissible TD caused by interference from a foreign fixed station must not exceed 1 dB\*
- Interference causing TD = 1dB is permissible interference

\*Administrations concerned may agree to apply another value



**Coordination of fixed service – criteria (2)** 

(1)

#### Calculation of the permissible TD (Annex 9 to HCM)

 $TD = 10 \log (1 + 10^{(1-N)/10})$ 

where

I (dBW) : interfering power level at receiver from one interfering source

N (dBW) or FKTB: noise power level in the receiver bandwidth

 $I = P_{Tx}$ -Atot (dBW) (2)

where

P<sub>Tx</sub> (dBW) : radiated power of interfering transmitter

<sup>A</sup>tot (dB) : attenuation between transmitter output and receiver input. It is calculated by equation (3) in the next slide:



#### **Coordination of fixed service – criteria (3)**

 $A^{A}_{tot} = ATx + Aprop - GTx - GRx + ARx + Aant + MD + NFD + ATPC$  (3)

A<sub>Tx</sub>(dB) : transmitter feeder loss (between transmitter and antenna)

 $G_{Tx}$  (dB) : transmitter antenna gain

G<sub>Rx</sub> (dB) : receiver antenna gain

A<sub>Rx</sub> (dB) : receiver feeder loss (between antenna and receiver)

A<sub>ant</sub>(dB) : attenuation which is function of antenna diagram and polarisation discrimination

MD(dB): Masks discrimination

NFD(dB): Net Filter discrimination

ATPC(dB) : dynamic range of transmitter power control (if exists)

A<sub>prop(dB):</sub> propagation loss calculated according Recommendation ITU-R P.452-13, "Prediction procedure for stations on the surface of the Earth at frequencies above 0.1 GHz"

Then, the interfering power value(I) is calculated using equation (2). TD can be calculated by equation (1)

If calculated TD > 1dB agreed, the coordination is required



### Conclusiones

The radio signal spill over is unavoidable

- The best solution is to have channeling arrangement between concerning administrations !
- The above solution may not cover all frequencies because of some difficulties and disadvantages
- Consequently, for frequencies without channeling arrangements the most practical solution is coordination between administrations taking into account the agreed criteria and methods !





