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CEPT ECC
Electronic Communications Committee

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Subject: WRC-12 A.I. 1.17 options of Method A1

Summary:
This contribution shows, by means of a simple Monte Carlo simulation tool, the potential impact of the cumulative effect of interference from the mobile service (MS) to the broadcasting service (BS).

Proposal:
Considering that the cumulative effect of interference from multiple base station is not negligible, arrangements to take it into account may be identified, according to Option II.
It is worth reminding that this possibility would not be open if Option I were supported.

Background:
CPG12(2010) 042 Annex V AI 1.17 Draft ECP

2. METHODS SUPPORTED BY CEPT
2.1 Issue A
2.1.1 Situation internal to the GE-06 area:
For issue A, the GE-06 Agreement is a key regulatory element in the course of this agenda item, for the countries that are party to the agreement. CEPT supports "No change" for countries that are party to this agreement (method A1). Three options are associated to method A1 in the draft CPM text. These are in relation with the cumulative effect of the base stations of the mobile service to the broadcasting service, as follows:

Option I: No additional arrangements;

Option II: Optional arrangements to take account of a potential impact of the cumulative effect of interference from the mobile service (MS) to the broadcasting service (BS). The cumulative effect of interference to the broadcasting service from the identified mobile service could be addressed in a draft Resolution **749 (Rev. WRC-12)**;

Option III: Mandatory arrangements to take account of a potential impact of the cumulative effect of interference from the MS to the BS. The cumulative effect of interference to the broadcasting service from the identified mobile service is addressed in draft Resolution **749 (Rev. WRC-12)** (see § 3/1.17/6).

1. Introduction

This contribution shows, by means of a simple Monte Carlo simulation tool, the cumulative interference generated by multiple base stations on a neighbouring broadcasting network.

2. Simulation scenario

In order to shed some light on the compatibility issues between cellular and broadcast systems, we performed a very simple Monte Carlo simulation on a considered area (100 iterations) , where both a DVB-T transmitter and a cellular network are present. The DVB-T transmitter and the mobile network serve non–adjacent areas, whose reciprocal position depends on the parameter configurations considered in the different simulations.

The proposed methodology is based on the evaluation of the cumulative distribution of the ratio C/(N+I) and of the consequent degradation of DVB-T and mobile radio system performance due to the mutual interference (BS vs DVB-T and DVB-T vs BS).

The methodology and the tool are the same already used in a previous Italian contribution to CPG PTD [1]. This contribution assessed the reciprocal interference between DVB-T network and mobile radio systems to compare the different behaviours of the two radio links.

The analysed scenario comprised a mobile radio system and a DVB-T transmitter. Two different aspects have been considered (Figure 1):

- Case study 1: interference generated by a certain number of BSs versus DVB-T receivers
- Case study 2: one DVB-T transmitter which acts as external interferer versus several mobile radio BSs

For the scope of the current situation, i.e. the assessment of the interference of multiple base stations, we restrict to case study 1 above.

The power spectrum of a DVB-T signal is flat in its 8 MHz channel, and this allows us to assume that the generated interference can be assimilated to AWGN.

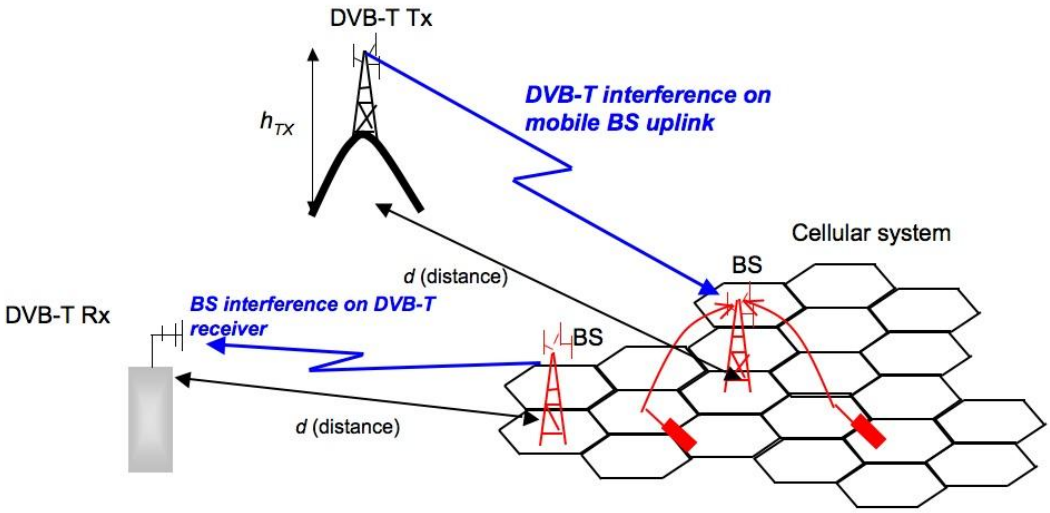

Figure 1. Simulation scenario

2.1 Cellular layout and system parameters

The main simulation parameters are shown in Table 1.

Table 1. MAIN SIMULATION PARAMETERS	
Operating frequency	800 MHz
Propagation model	Hata Urban
Mobile system	
Mobile system cell radius	2 Km
Number of BSs in central area	4 to 42
LTE bandwidth	5 MHz
Cluster size	3
BS antenna height	30 m
BS Rx antenna gain	15dB
BS transmitted power	43 dBm
BS ERP	58 dBm (43 + 15)
DVB-T system	
DVB-T transmitter height	200 m
DVB-T ERP	60 dBm
Receiver antenna (Yagi) height	10 m
Receiver antenna (Yagi) noise figure	7 dB
Receiver antenna (Yagi) feeder loss	5 dB
DVB-T received field at DVB-T cell edge	58.2167 dBμV/m
Number of VB-T receivers per iteration	200

3. Simulation results

The values in Table 2**Errore. L'origine riferimento non è stata trovata.** represent the coverage reduction inside the DVB-T cell with respect to the case of absence of co-channel interference, that is the noise-limited case. The considered minimum C/N has been set equal to 21 dB. Whenever the DVB-T service degradation is lower than 1%, the interfering effect of the mobile network has been considered as negligible. The minimum distance between the mobile area and the DVB-T coverage edge for which the service degradation is acceptable (that is not higher than 1%) has been referred to as *guard distance*.

Table 2. DVB-T SERVICE DEGRADATION [%] (MINIMUM C/N=21 dB)

	Distance between DVB-T cell edge and the centre of the mobile service area					
No. of BSs	**5 km**	**10 km**	**20 km**	**30 km**	**40 km**	**50 km**
4	22.92%	10.04%	1.91%	0.45%	0.14%	0.06%
9	37.15%	19.92%	4.58%	1.11%	0.35%	0.12%
25	65.22%	43.05%	13.99%	3.82%	1.19%	0.41%
42	81.44%	59.50%	23.78%	7.35%	2.29%	0.76%

From the table above it is straightforward to evaluate the impact of the number of interfering base stations on the DVB-T service degradation. This impact is non negligible. As an example, if we impose a degradation threshold of 1%, we observe that the minimum distance between the two systems is 30 Km if 4 base stations are present, while it increases to 50 Km for 42 base stations.

4. Conclusions

Considering that the cumulative effect of interference from multiple base station is not negligible, arrangements to take it into account may be identified, according to Option II.

It is worth reminding that this possibility would not be open if Option I were supported.

5. References

[1] "WRC-12 AI 1.17 – Broadcasting vs mobile: theoretical analysis of mutual interference", doc. CPGPTD(10)109, Pozzallo, Italy, Aug 2010