**Annex 4**

**Computer-aided techniques for frequency coordination for the FS**

**1.Introduction**

In the annexed Appendix to this Annex 4 a document about the NBTC/ITU Workshop on Cross-Border Frequency Coordination on June 29-30, 2015 in Bangkok, Thailand gives an overview on this topic for both radio communication services, Mobile Service and Fixed Service.

**2. DLL (Dynamic Link Library) - Kernel**

According to the harmonized calculation procedure defined in the relevant Annexes of the HCM agreement for FS DLL for FS have been developed to conduct the

calculation

1. of field strength along border lines and shifted lines caused by one FS transmitter,
2. of distance between a FS station to the border line and
3. of interference contribution as increase of the noise floor level at one FS receiver caused by one FS transmitter from a different country.

The DLL provides the calculation procedure only for single calculations:

It calculates only from one transmitter to points of a border or shifted line or from one FS transmitter to one FS receiver.

Thereby the main output is, whether the acceptable threshold degradation (TD) at the receiver is within or above the defined trigger value of 1 dB degradation.

Regarding the propagation between these points the latest relevant recommendation of ITU-R REC P.452 is taken into consideration.

Necessary harmonized topographical terrain data is taken into account.

The exact points of border (and shifted) lines have to be defined and fixed by bi- and multilateral agreement.

Input Data of FS transmitter and receiver position and their characteristics such as transmitter power, antenna pattern and orientation, receiver sensitivity and transmitter and receiver filter characteristics have to be provided, some mandatory others have defaults (see HCM software description for details).

**3. Surrounding programs**

In order to manage the necessary amount of calculations, since for the compatibility check of a new receiver all relevant interfering FS transmitter stations have to be taken into account, a suitable surrounding program can fulfil such a task by integrating the FS DLL.

Within the frame work of the HCM agreement the shell CalcFiSH (**Calc**ulation **Fi**xed **S**ervice **H**CM) was developed as such a surrounding program also enabling the

execution of test calculations. Such calculations should be taken as reference in the case, that for the same calculation relation 2 authorities engaged in a coordination process get to different calculation results resulting in different status contribution for coordination result.

Beside this CalcFiSH shell developed by the HCM members there are also quite a few surrounding programs on the market.

Most of those enable also additional further functionalities such as graphical support and support functions for link planning and many more.