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Roland Beutler

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Roland Beutler
Sdwestrundfunk
Stuttgart
Germany
Roland.Beutler@ swr.de

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To Kai and Chris

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Preface

Frequency management and network planning of terrestrial digital broadcasting systems are both fields of activity that are certainly not part of natural sciences. They cannot even be classified as engineering science. Without doubt, communication science and electronic engineering constitute the basis for frequency management or network planning. However, none of these academic disciplines cover all aspects.

Typical frequency planning problems exhibit such a high level of complexity that very sophisticated mathematical methods have to be consulted in order to find solutions. Furthermore, a profound knowledge in physics is also required, since in any case, any transmission of information is governed by the Maxwell equations. This is independent from the way the transmission is actually accomplished, that is if either terrestrial transmitter networks are used, cable connections, or satellite links.

Combining methodologies from natural and engineering sciences is still not enough to fully covers the whole variety of different tasks planners are confronted with in the field of frequency and network planning. There are also technical aspects related to the operation of transmitter sites that are directly connected to economic questions. Moreover, every planning strategy must be embedded into a corresponding media political milieu.

Different countries have different approaches and strategies when it comes to providing broadcasting services. Therefore, different rules for regulation might be valid in different countries. However, since electromagnetic waves do not stop at national boundaries there is always an international administrative and political aspect of frequency management and network planning. Politics and economics impose important constraints on the planning process, which in the end very often leads to a situation that mathematical algorithms are not able to provide

acceptable solutions. Under such conditions frequency plans or network designs are drawn up by negotiations between administrations of neighboring countries.

Frequency or network planner is not a job people are usually taking up intentionally, as they choose the focus of their academic studies, for example. In most cases pure chance plays a major role. Hence, it comes as no surprise that in the field of frequency and network planning people from nearly all technically oriented faculties can be found. There are engineers from communication science to electronics accompanied by mathematicians and last but not least a lot of physicists.

Very likely all of them share one common experience, namely the first step on the new ground called frequency or network planning proves to be rather weary. Basically, this is connected to the fact that, in particular, network planning is an activity where a lead in knowledge gives a direct competitive edge. Consequently, successful planning approaches are published only to the extent that an ascendancy in the market of network providers is not lost by giving away secret expertise. Such an attitude is very common, as can be seen, for example, from the situation on the radio or TV receiver market. All manufactures need to build their products in accordance with well-known published standards. Nevertheless, there are good and bad receivers on the market to be bought at nearly the same price.

Besides the lack of officially published documentation, the highly practically oriented working methods of the planners have to be considered a real obstacle for any novice. Many of the ideas will never be published in articles. Most of the work is carried out by project groups developing new concepts that are not documented very elaborately. Once the new ideas have been put into practice, most of the presentations and manuscripts vanish again.

Clearly, the results of international frequency planning conferences are memorized very carefully and detailed. The documentation prepared under such circumstances must contain precise directions as to how to make use of the planning results. But at the same time they represent some kind of a very compressed, condensed information. For a newcomer this might lead to nearly the same level of forlornness as having no documentation at all.

The background and the experience of the author during his confrontation with frequency and network planning gave umbrage to his first book on frequency and network planning for digital terrestrial broadcast-

ing that was published in 2004. It was meant to give an insight into the problems and thereby emerging strategies to find solutions for them. This book again addresses the field but with a slightly different focus. The first book introduced basic concepts and tried to illustrate them by putting forward several detailed, but artificial examples. This approach was chosen because it is quite obvious in view of the manifold of different tasks under the umbrella of frequency and network planning that no exhaustive presentation of the whole field can be provided. Rather, it was intended to sketch the principal ideas.

In contrast, in addition to giving an idea about the characteristics of typical planning problems this book discusses the results of important international planning conferences that define the constraints frequency and network planning are subject to.

As a consequence, this book starts with a presentation of several relevant digital terrestrial broadcasting systems. Their different characteristics are described to some extent. Then, an overview about the structure of international spectrum management is given. The major organizations and bodies are presented together with their tasks. Chapter 4 lays the foundations of coverage prediction, which is the crucial element for both frequency management and in particular network planning. The characteristics of the terrestrial radio channel are addressed, which are the starting point for the development of wave propagation models. The chapter ends with a presentation of methods for coverage assessment. Frequency planning basics follow in the next chapter. All relevant quantities and parameters are introduced and explained in detail. Much emphasis is put on mathematical algorithms and strategies to create flexible and robust planning tools. Chapter 6 deals with network planning for digital terrestrial broadcasting. Again, the focus is on the presentation of mathematical methods that are suitable in order to optimize network structures. In particular, the application of stochastic optimization algorithms is discussed. These methods open the door to cope with very different planning scenarios taking into account different aspects including network costs.

Starting with Chapter 7, the character of the book becomes less theoretical as those international frequency planning conferences are described, which are relevant in relation to digital terrestrial broadcasting. The book ends with an outlook to future developments, in particular the perspectives of terrestrial broadcasting in general.

In each section of the numerous references other documents are given. However, the selection of documents referenced in this book has to be considered as a subjective subset of what might be relevant. Nevertheless, it gives first indications and hints for further reading.