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W. Fischer

# Digital Video and Audio Broadcasting Technology

A Practical Engineering Guide

Third Edition

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Walter Fischer

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## Preface

It is not so long ago that the second English edition of this book appeared. In many countries, the switch-over from analog to digital television has now been completed, especially in terrestrial television. Everyone is talking about high-definition TV - HDTV - which is supported by virtually every TV display on the market today. The reason that the HDTV supply chain is not as yet gapless is not to be found in the technology but only in the lack of available HD source material. However, this is expected to change from 2010 onward. The number of studios which are being re-equipped with the new technology is ever increasing. Suitable compression standards for HDTV have been around for years and there is now also sufficient bandwidth available with the second generation of DVB transmission standards.

In comparison with digital television, digital audio broadcasting - DAB - still has its problems. Although DAB is on the air in many countries, it is still largely unknown to the general public, Good old FM radio is still the Number One audio transmission medium. It will be interesting to find out what will happen in this respect in the next few years. Will DVB also "gobble up" DAB?

What is now the third edition of the English version has been updated further to match the facts of present conditions. This book contains all the modern source encoding standards for digital television and digital audio broadcasting. Nevertheless, one or the other areas will still seem to be slightly inadequate to the liking of some readers. As the author, my aim is not simply to copy standards - which I may even have misunderstood in one point or the other - as the standards themselves are publicly available and more or less comprehensible in their form although their interpretation sometimes presents problems. Rather, I am mainly concerned with passing on the knowledge I have actually acquired myself.

The fact that this book has now been published in four languages and thus has found unexpectedly wide circulation all over the world is my greatest compensation for all the work done since 2001. The depth of technical knowledge presented in many chapters would have been impossible to achieve without the numerous discussions with my colleagues from the Broadcasting Division at Rohde&Schwarz. Many more impulses also

came from many readers and participants in seminars, and my special thanks are due to the team of my publishers, Springer Verlag and to my translator, collaboration with whom had been outstanding.

Moosburg an der Isar, near Munich, August 2009

Walter Fischer

## **Preface to the Second English Edition**

A few years have passed since the first English edition of this book appeared in the bookshops. Digital television has become a fact of life in many countries, conveyed to the viewer either by satellite, by cable or terrestrially through the rooftop antenna, and there are now also first indications of a fourth distribution path through IPTV, television by Internet, not to forget Mobile TV which is being mentioned more and more frequently in advertising. All these are reasons why it became necessary to update and expand much of the book. But there are also some new chapters such as DAB, Data Broadcasting, Mobile TV in the form of DVB-H, and T-DMB, DRM, etc. Sections on modern source encoding methods such as MPEG-4 have also been amended, incorporating many suggestions from readers and participants in seminars.

My previous publications "Digital Television - A Practical Guide for Engineers" and "Digitale Fernsehtechnik in Theorie und Praxis" have found warm acceptance by a wide circle of readers and both works have also been used as welcome support material in numerous seminars.

My lectureship in the subject of "Television Engineering" at the Munich University of Applied Science, which I am carrying on in the spirit of Prof. Mäusl's lectures on the subject, is also providing me with new impulses in the ways in which knowledge of the subject can be imparted and in the selection of contents, whilst at the same time enriching my own experience.

Since the last edition, many new findings and experiences have been gathered by myself in many seminars throughout the world but also by me personally participating when the DVB-T networks were being switched on in Bavaria. Some of these findings and experiences will be found again in this book.

Many thanks to my publishers, Springer Verlag, especially to Dr. Merkle and Mrs. Jantzen, and to Horst von Renouard, the translator of this book, and to my colleagues from Rohde&Schwarz, for their excellent collaboration in producing the finished book.

Moosburg an der Isar, near Munich, August 2007

Walter Fischer





## Preface to the First English Edition

The world of television engineering has long fascinated me and from the day I wrote my diploma paper on "The Generation of Test Lines" at the Fachhochschule München (Munich University of Applied Sciences) under Prof. Rudolf Mäusl in 1983, it has never released its grip on me. My research for this paper led to contacts with Rohde&Schwarz who were subsequently to become my employers. I worked there as development engineer until 1999, always in video test engineering but within various fields of products and activities. For many years, this activity involved analog video testing and there mainly video insertion test signals (VITS), but from the mid-nineties onward, the focus shifted more and more to MPEG-2 and digital video broadcasting (DVB) and then quite generally to the field of digital television. Naturally, as a consequence of my work as a development engineer I also became intensively engaged in the field of firmware and software development and my involvement with the programming language C and C++ led me into the domain of software training where I was increasingly active in-house from the early nineties onward. I have lost count of the number of seminars and of the participants in these seminars who succeeded in implanting in me a joy in this type of "work". Whatever the cause, it was in the course of these, perhaps forty seminars that I discovered my love for instructing and in 1999 I chose this to be my main occupation. Since March 1999, I have been active as instructor in the field of television engineering, main subject "digital television", in the Rohde&Schwarz Training Center. Since then, I have travelled more than 500,000 km by air all over the world, from Stockholm to Sydney, to provide instruction about the new field of digital television and especially about test engineering and transmitter technology.

A key event in my professional life has been a seminar request from Australia in July 1999 which resulted in, thus far, 7 trips to Australia with a total stay of about half a year, more than 50 seminar days and almost 400 participants. From this has sprung a love for this far-distant, wonderful continent which, I am sure, will be apparent between the lines throughout this book. One of the main suggestions to write this book as a résumé of my seminars came from the circle of participants in Australia. These trips gave rise to significant impulses and I have gained a large amount of prac-

tical experience during my seminars "Down Under" and during the construction of their DVB-T network, which proved to be invaluable in the creation of this book. I owe special thanks to my colleague, Simon Haynes from Rohde&Schwarz Australia, who provided me with the closest support for the seminars and with helpful suggestions for this book. We often talked about publishing the contents of the seminars but I had underestimated the effort involved. The original documentation for the seminars did not easily lend itself to being directly for the book. Virtually all the texts had to be completely revised, but now I had plenty to occupy me during the 100 days or so of travelling a year, even at night, an important factor with all the boredom of being absent from home.

My readers will be people who have a practical interest in the new subject of "Digital Television", engineers and technicians who want to or have to familiarize themselves with this new field and the book, therefore, contains only a minimum ballast of mathematics although, by the nature of things, there have to be some.

In the meantime, I have been able to extend my seminar travels to other countries as, for example, Greenland, and to gather numerous impressions there, too. However, although it is very nice to see the world as a result of one's professional activities, it is not easy for one's family or for oneself, for that matter. For this reason, I would like to take this opportunity to express special thanks to those who had to stay at home for whom I was then not available. To some extent this also applies to the time when this book was written. In particular, I thank my daughter Christine for her help in writing the manuscript.

I would like to thank Horst von Renouard from London for his successful translation. As chance would have it, he, too, had spent many years in Australia and also comes from the field of television engineering. He thus was able to empathize with what I was trying to express and to convey this in his translation. And while I am on the subject of translation, my gratitude is due also to the Rohde&Schwarz Translation Department who also contributed some chapters which were required in advance for seminar purposes.

To my former patron, Prof. Rudolf Mäusl, who initiated me into the world of television engineering as no-one else could have done, my heartfelt thanks for our many conversations and for all his helpful suggestions. His lectures at the Fachhochschule and his way of imparting knowledge have always been of guiding influence on me and, I hope, have also been a positive influence on how this book has turned out. His many publications and books are models in their field and can only be recommended.

Many thanks also to my publishers, Springer Verlag, to Dr. Merkle, Mrs. Jantzen and Mrs. Maas for their active support, and for the opportunity to have this book published by this renowned publishing house.

And many thanks for the many discussions and suggestions by the participants in my seminars throughout the world, in Australia, Austria, Canada, the Czech Republic, France, Germany, Greenland, Latvia, Mexico, the Netherlands, Portugal, Spain, Sweden, Switzerland, Turkey, the United States and all the other countries in which I have been or from which participants have come to Munich or elsewhere in order to join me in finding out about the complex subject of digital television.

To the present day, there have been worldwide seminars on the subject of analog and digital television for just on 300 days, with about 2000 participants from all corners of the world. These international seminars present a rich personal experience and I am filled with gratitude at the many contacts made, some are still ongoing via email.

Moosburg an der Isar, near Munich, June 2003

Walter Fischer



## Foreword

Without a doubt, this book can definitely be called a reference work and is a true “Engineering Guide to Digital Television”. Walter Fischer is an outstandingly knowledgeable author and an expert in his chosen field. I have known him since the beginning of the eighties when he attended my lectures at the Fachhochschule München (Munich University of Applied Sciences). He attracted attention even then with his excellent knowledge and with the way he tackled new and complex problems. After he had concluded his studies, continuing contacts with my erstwhile employer Rohde & Schwarz then provided him with the opportunity to give free rein to his talent in their Department of Television Test Engineering.

In 1988 the Fernseh- und Kinotechnische Gesellschaft (Television and Cinematographic Association) awarded him their Rudolf Urtel Price for independently developing a test method for determining the parameters of a video channel by means of the Fast Fourier Transform (FFT).

After a long period of developing test instruments for analog and digital television signals and equipped with the extensive knowledge in digital television practice gained from this, he finally realized his long-standing ambition to change over into the field of teaching. For some years now he has been active for the Rohde&Schwarz Training Center and is passing on this knowledge in seminars all over the world. I may add that I, too, have been able to benefit from Walter Fischer’s expertise in my own relatively brief volume on digital television.

I wish Walter Fischer continuing success, particularly with regard to a good acceptance of this reference work throughout the world.

Aschheim near Munich, February 2003

Professor Rudolf Mäusl

