

Signal Analysis for Radio Monitoring

Edition 2018



EACH SIGNAL IS INFORMATION

Dipl.- Ing. Roland Proesch

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**Description of techniques to analyse
unknown waveforms**

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Disclaimer:

The information in this book has been collected over years. The main problem is that there are not many open sources to get information about this sensitive field. Although I tried to verify this information from different sources it may be that there are mistakes. Please do not hesitate to contact me if you discover any wrong description.

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3. General

For years shortwave radio has been used for communication beyond the line of sight. With the introduction of worldwide satellite services in the geostationary or low earth orbits HF radio communication lost more and more in interest.

But with the introduction of new, sophisticated modems and digital broadcast services in high quality HF communication has seen a renewal during the last years.

Shortwave radio, however, has some qualities that will ensure its attractiveness for some time. The most important one for commercial users is that there is no charge for using the ionosphere.

In the military context this translates to low cost, potentially global communication that has the important attributes of national ownership and military control.

And in comparison to satellite services shortwave communication is harder to disrupt.

The good old radio for shortwave has been perfected during the last years in several ways. Information data rates of a few tens of bits per second were increased to more than 19200 bit/s by sophisticated modem techniques and error correction. Algorithms were created to adapt transmission parameters to channel quality or initiate a change to a better channel. Passive and active channel analysis, i.e. sending and measuring test signals on assigned pool frequencies have been developed to solve problems of channel distortions.

There are new signals "on air" nearly every month. That makes it very difficult to keep track of them. And they often sound the same way.

This book shall give an introduction how to work with signals on shortwave and get that information which is necessary to identify the different waveforms. It will show some techniques for measurement the main parameter of digital signals.

It will also show some tools which I have used over the years to come to a result in a relative short time frame.

You are not bound to those tools described in this book. There are many others with a similar functionality which will do the job.

And please keep in mind:

Signal analysis is not an easy task!

If you are doing it only occasionally it will be difficult to get satisfactory results. Signal analysis needs a constant practice.

And sometimes it may be a good idea not to choose an obvious way to do signal analysis.

Most signal analysis tasks are performed on recorded signals. For a successful work you will need good recordings. Information that is lost i.e. by noise can never be reconstructed.

4. Introduction

Tools

Audio Tools

Adobe Audition 1.5 or 3.0

Adobe Audition 1.5 is professional audio editing software designed for demanding audio and video professionals, Adobe Audition offers advanced audio mixing, editing, and effects processing capabilities.

This software is a complete audio studio: it can handle digital audio tasks within a single application. It has the possibility to work with mono and stereo waveforms. They can be edited, viewed, audio effects can be added. Wave files or parts of them can be played in loops for measurement on the signals. With the help of many audio effects and DSP tools, signals can be improved for further analysis. Waves can be edited, stored or the sampling rate can be changed up. Files can have a sample rate up to 10 MHz, including standard rates such as 44.1 kHz (CD quality), 88.2 kHz, 96 kHz (DVD quality), and 192 kHz.

The software makes it easy to work with recorded audio files from the receiver. Signals can be analysed down to a single sinus wave which makes finger printing very easy. Distorted signals can be filtered with a graphical equalizer. It is also possible to adjust the level of the signal for the complete waveform or parts of it.

Recorded signals can be re-sampled and stored in different forms.

The following picture shows the main screen of Adobe Audition 1.5: