DRM reception – the practical experience

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Abstract. **DRM** (Digital Radio Mondiale) is the most perspective system of the new digital radio broadcasting systems that works below 30MHz. It means that **DRM** sooner or later overtakes a position of present **AM** (amplitude modulated) systems working at Long Wave (**LW**), Medium Wave (**MW**) and Short Wave (**SW**) frequency bands. In contrast to an abroad experience, our ordinary listener does know not so much about this technically and economically advantaged system. This paper deals with practical experience of long distance reception abroad transmitters **DRM** on our territory.

1. Introduction

It seems that the time of the radio broadcasting at **LW**, **MW** and **SW** bands have already gone. The opposite is true **– LW**, **MW** and **SW** bands are before their renaissance. It is obvious that it cannot remain in a classical analogue broadcasting method of an amplitude modulation but there have to be used new digital modulation principles.

In September 2001 ETSI (*European Telecommunications Standards Institute*) published a technical specification of system for digital broadcasting "*ETSI-TS 101980: Digital Radio Mondiale, System Specification*", in which this system recommend for radio broadcasting bellow 30MHz. DRM was approved by ITU-R in October 2002 as "*Recommendation ITU-R BS 1514-1: Digital Sound Broadcasting Bellow 30 MHz*". Nowadays Consortium **DRM** have 90 members from 30 countries and more than 40 associated members. The group called High Frequency Co-ordination Conference (**HCCF**) presents the Czech Republic. **DRM** is broadcast in more than 30 countries all around the word. While **DRM** currently covers the broadcasting bands below 30 MHz, the **DRM** consortium voted in March 2005 to begin the process of extending the system to the broadcasting bands up to **120 MHz**. The design, the development and the testing phases are expected to be completed by 2007-2009. [1], [4]

Since there has not been working a DRM transmitter in the Czech Republic yet, the reception of DRM signals relays just on signals from abroad transmitters. Under this consequence is a long distance reception meant to be more like a hobby for the **DRM** enthusiasts.

2. Type of receivers

At the beginning it has to be said that the long distance reception does not pick up some of the great advantages such as a mobile reception that offers **DRM** broadcasting, the principles of a single frequency network (**SFN**) are meaningless and at least the information broadcasting through a data channel (traffic information, weather forecast e.g.) is uninteresting for a foreign listener. Currently, there are three basic types of the **DRM** receivers.

2.1. Commercial receivers

This type of the receivers is the most spread in the areas perfectly covered by **DRM**. However, the receivers which dispose of DRM standard are just rarely seen on the market. Contemporary the problems linked with the technology **DRM** are caused by an increasing demand for receivers which are now missing on the market or are just presented by narrow choice which is often expensive.

Some of them indicate that many other technologies such as **T-DAB** (Digital Audio Broadcasting - Terrestrial) may be used in different countries around the world. Accordingly, many chip manufacturers who are addressing this market are catering for them and developing systems that will be able to switch between the varieties of bands that will be used around the globe.

Fig. 1. Example of **DRM** commercial receivers

Since we talk about the long distance reception and a few fanciers who will not spend a huge money for expensive receivers, is this kind of receivers not suitable. We have to start looking for the alternatives.

2.2. Software receivers

One of the most reasonable alternatives is a software receiver. It can be guess from the name that this receiver is assembled from "*an ordinary **AM***" receiver and a software demodulator. No special requirements might be needed for the receiver. It should be enough sensitive and able to bring out an intermediate frequency (**IF**) signal after conversion.

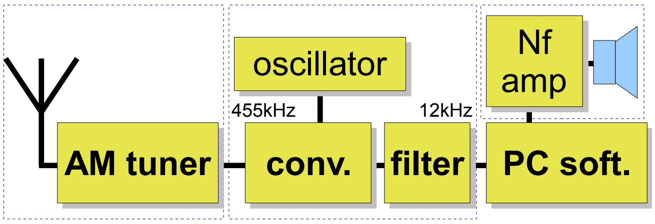

Fig. 2. Software Radio block diagram

A receiver's adjusting consists in finding and bringing out the intermediate frequency (455kHz or 10,7MHz) and inserts an extra converter (**conversion 455kHz into 12kHz**). By that we get a baseband signal which can be brought to a PC sound card. The decoding and the demodulation are done by a special software (e.g. freeware **DREAM** or licensed **DRM Software Radio**).[1]

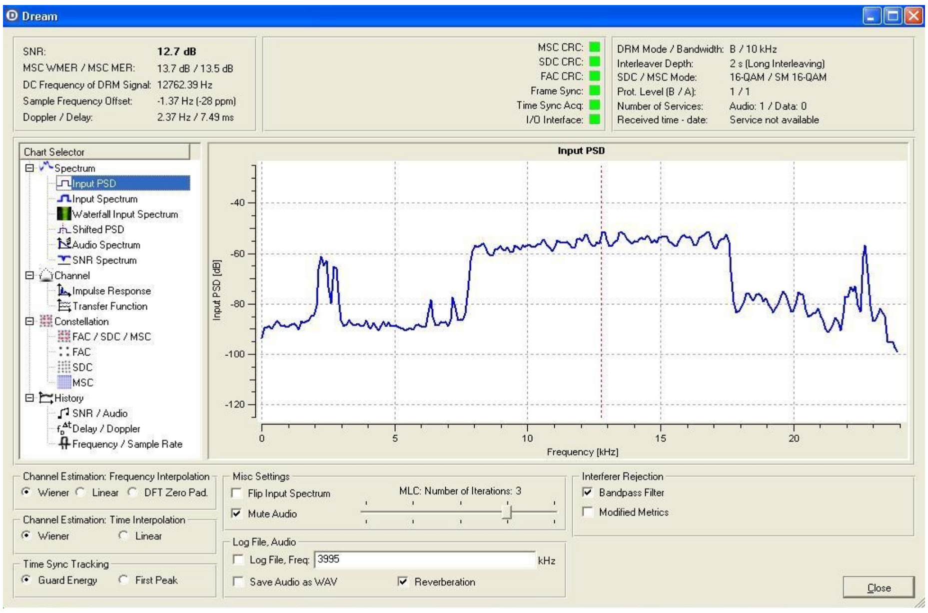

Fig. 3. Software Radio DREAM

2.3. Professional Receivers

The last type of the receivers is the professional communication receivers. This type is more suitable for a research and a development than for an ordinary listener. The resulting factor here is their high price.

Within the framework of the research project **FRVŠ** *(Fond Rozvoje Vysokých Škol)* ***459/2007*** *„Demonstrační pracoviště využívající nové digitální vysílací technologie"* was a laboratory of Radio-communication at The Telecommunications Department equipped by a front-end receiver **WINRADIO WR G313. WR G313** has had an extended bandwidth from **9kHz to 180MHz.** The sensitivity goes up to -116dBm (0.35μV with AM service). By these features G313 enables monitoring not only DRM transmitters in wild frequency range. [2]

Fig. 4. Winradio WR G313 – the remote software and the hardware parts

3. Long distance reception

More than 130 International, National and Local DRM Broadcasters are on Markets Worldwide (updated 7.7.2007) on http://drm.org/livebroadcast. [1] In our case when we talk about the foreign broadcasters, the reception conditions are fully depended on a daytime, a ionosphere condition and a used frequency. That is logical, due to way of a wave propagation which is mostly done by a ionosphere wave. A frequency scanning has to be analyzed and suit to a daytime and the actual wave propagation conditions.

One of the FRVŠ 459/2007 project solutions is focused on searching foreign DRM transmitters in the frequency bandwidth c. 500kHz-15MHz while is used **WR G313** and a broadband matched antenna **LW** (Long Wire).

The captured stations are recorded and compared to the radiation pattern published at [1]. The present results are good beyond expectation. The receiver is able to decode a signal with **SNR≥7dB.** It has to be mentioned that once is DRM signal tuned, it is available in a full quality. If the broadcast is also a data channel (headlines, traffic info., weather forecast etc.), it takes some time than the data are available (usually 3 to 5 min).

In contrast to professional receivers, there was made an experiment with a software radio (overview receiver **SONY ICF-7600DS** with an external decoder and the software **DREAM**). It had been achieved the similar results. However, from time to time

DREAM could not decode a signal due to a decoder overloading by a high level of noise. It can be caused by a high sensitivity level of DREAM and an electrical disturbance.

The choice and placing the receiver's antenna has a considerable sense. Under taken experiences, an indoor antenna has shown as useless. Electrical noise goes from the fluorescent tubes with a poor quality inductor, a laptop with a plastic case, LAN (local area network) networks etc. negatively influence clear reception by DREAM. In this condition "**the magnetic loop antenna**" (MLA) takes a right place. The essence of the loop antenna is that it responds mainly to the magnetic field component of an electromagnetic wave (the H-field component) rather than the electric (E-component). This feature gives the magnetic loop a non-sensitivity of the electrics interferences. It is usually used for receiving in the small places, where cannot be used a proper length antenna as well as in the places with a high electric noise level.[3]

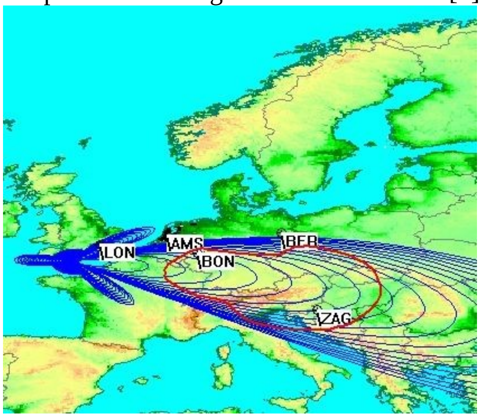

Fig. 6. Radiation pattern of transmitter Rampisham, Great Britain, f=9850 kHz, Power 35kW, program: **Radio Prague** [1]

4. Conclusion

The actual results prove the theoretical advantages of DRM in quality of the signal and the interruption robustness. The type of the receivers does not influence the quality of the output signal. There might be a difference in a remote control comfort. Software Radio is more likely to be overload by electrical noise. The most important component of a radio-communication chain is an antenna, its type and the placement. Although a universal solution does not exist.

We can still hope that a future of DRM in our country will not fall behind the west part of the world for long time and we soon come from a long distance reception to a local.

References

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Appendix: An example of DRM broadcasters

Table 1. Extract from a list of relevant DRM broadcasters

f [kHz]	Program	Sound		Data
		Quality	Bitrate [kbps]	Bitrate [kbps]
693	RAI WAY DRM TEST	AAC SBR stereo	19,60	
855	Berlin	AAC SBR stereo	17,60	0,4+1
1 296	BBC World	AAC SBR stereo	25,90	-
3 995	Deutsche Welle	AAC SBR mono	14,50	-
5 990	RTL	AAC SBR mono	17,40	-
6 085	BR-B5akt	AAC SBR mono	17,50	-
6 095	RTL	AAC SBR stereo	20,90	-
6 175	RMC (Audio)	AAC SBR mono	17,50	-
7 240	Bouquet Flevo NL	AAC SBR mono	17,40	-
7 275	Deutsche Welle	AAC SBR stereo	18,00	0,40
9 460	Deutsche Welle	AAC SBR stereo	18,00	0,40
9 760	VT Digital	AAC SBR stereo	20,70	-
9 770	VT Digital	AAC SBR stereo	21,70	-
9 850	**Radio Prague**	**AAC SBR stereo**	**20,40**	**-**
9 880	Kuvajt	AAC SBR mono	11,60	-
12 060	Voice of Russia	AAC SBR mono	17,40	-
13 620	MOI Kuwait	AAC SBR mono	11,60	-
13 810	Deutsche Welle	AAC SBR stereo	17,40	-
15 715	Deutsche Welle	AAC SBR stereo	20,70	0,40