DRM+
Digital Radio in FM-Band

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ABSTRACT

This paper briefly describes a new extension of digital radio broadcasting standard *Digital Radio Mondiale* (DRM) called **DRM+**. As it has not been standardized yet, the article brings fragmentary information about DRM+.

Keywords

DRM, DRM+, AAC+ v2, MPEG4, DAB, Digital Broadcasting, Radio Channel, FM.

1. INTRODUCTION

Since Digital Radio Mondiale (**DRM**), System A in Recommendation *ITU-R BS.1514*, has been running as ITU standard *ETSI ES 201 980* of digital radio broadcasting it has proved its high qualities [1]. It currently targets the **LW** (Long Waves), **MW** (Middle Waves) and **SW** (Short Waves) frequency bands up to **30MHz** [2] [11].

In 2005 **DRM** consortium decided to start working on a new extension **DRM+** (also called DRM120 or DRM Plus) with maximum operating frequency goes up to **120MHz**. The work is expected to be completed by 2008 to 2010.

It will affect following analog bands:

- 47,0 MHz ÷ 68,0MHz (VHF band 1, analog TV broadcasting in Europe)
- 65.8 MHz ÷ 74,0 MHz (OIRT VHF band)
- 76,0 MHz ÷ 90,0 MHz (VHF in Japan)
- 87,5 MHz ÷ 108,0 MHz (VHF band, analog FM radio)

2. DESCRIPTION

2.1 Narrow Band Broadcasting

Currently, DRM is designed for lower frequency bands and uses maximally 20 kHz widest channels. It only allows carrying very low bit rates channels, typically between 25 and 55 kbps.

DRM was standardized in 2003. Since that some coding techniques were improved. DRM+ uses superior turbo codes that replace convolution coding. As a result of turbo codes increase robustness and consequently increase bit rate or decrease transmitting power.

Table 1. Shows approximate bit rates used by DRM+ in transmission Mode A, FEC= 0, 6 (Forward Error Correction), source coding MPEG-4 AAC+ v2.

Table 1. Evaluation bit rate DRM+

Channel bandwidth [kHz]	16 QAM [kbps]	64 QAM [kbps]
30	63	90
40	83	119
50	104	150
60	125	180
70	146	210
80	167	240
90	188	270
100	208	300

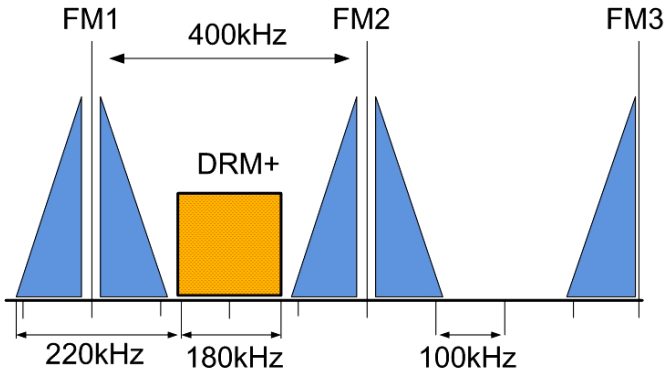

Figure 1. Spectrum DRM+ in FM band

2.2 Carrier-To-Noise Ratio

Up to the present, there have not been published required C/N (Carrier-To-Noise Ratio) figures for DRM+ yet. The general consensus is that 20dB C/N ensures assured robust reception.

Let have a 64 kbps bit rate as an example. 64 kbps is much lower than 104 kbps capacity possible using 16 QAM CR = 0,6 (Code Rate) on a 50 kHz channel (see Table 1.)

$$CR = \frac{useful\ bit\ rate}{gross\ data\ rate} \qquad (2.1)$$

$$gross\ data\ rate\ = \frac{useful\ bit\ rate}{CR} =$$

$$\frac{104\ kbps}{0,6} = 173\ \ kbps$$

The new CR for 64 kbps is:

$$CR_{new} = \frac{64\ kbps}{173\ kbps} = 0,37 \qquad (2.2)$$

A reduction CR of 0,6 to 0,37 highly increase protection equivalently around 5dB. Consequently, DRM+ will require minimal C/N = 15 dB (a realistic estimation says about 17 dB).

2.3 Power Difference for Transmission

A simple way how to estimate the distribution costs for groups of DRM+ stations is to group the same number of stations as are grouped on a DAB (Digital Audio Broadcasting) multiplex of six stations. Then it enables to apply an overall factor to the DAB distribution costs per station curve as for DRM+, because this includes the cost savings enabled by a medium to large number of stations sharing resources on a number of multiplexes.

The following table calculates the overall factor to be applied to the DAB distribution costs curve for transmission at 60 MHz [10].

Table 2. Cost factor for DAB distribution at 60 MHz

Parameter	DRM+ Value	Relative Value	Equation	Difference in power at 60 MHz
Transmission frequency	60 MHz	220 MHz (Band III)	$20\log\frac{f_2}{f_1}$	-11.3 dB
Antenna loss	2.5m	1.5m (FM)	$-10\log\frac{l_2}{l_1}$	+2.2 dB
Signal bandwidth	6 stations x 50 kHz	1,710 kHz (DAB)	$10\log\frac{B_2}{B_1}$	-7.6 dB
C/N	17 dB	15.0 (DAB)	$\frac{C}{N_2}-\frac{C}{N_1}$	+2.0 dB
Correction factor	-	-	-	+3 dB
Total (dB)	-	-	-	**-11.7 dB**
Total factor	002D	-	-	**0.068**

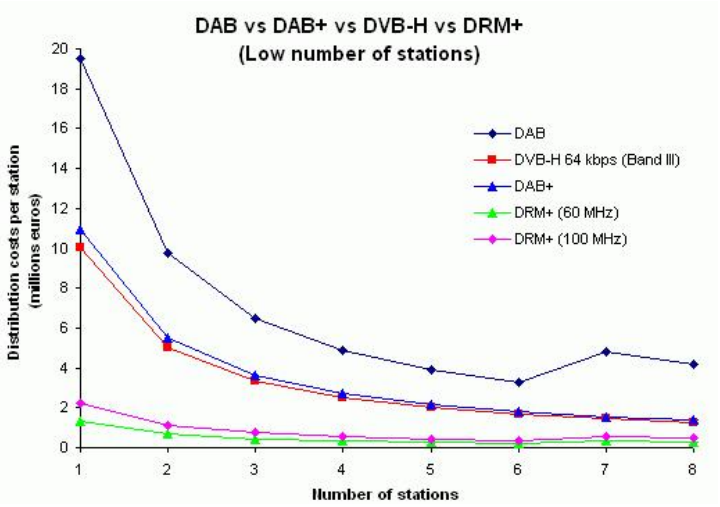

Figure 2. The distribution costs per station for currently used digital broadcasting systems.

3. DRM+ EXPERIMENT

The DRM+ trial takes a place in Kaiserslautern, Germany. From 1st of March to 31st of May 2008 the University of Applied Sciences Kaiserslautern will broadcast on the FM frequency 87.6 MHz, in DRM+ digital quality from its own experimental radio station to the city of Kaiserslautern. The experiment will carry out field measurements in the surrounding countryside. The measurements will investigate whether analog FM radio programs can be broadcast through DRM+ with additional data without signal quality degradation. A portable and mobile reception is also going to be tested [7][8][9.]

Technical details:

Frequency: 87,6 MHz

Power [kW]: 30 W (ERP) DRM+

30 W (ERP) FM

Antenna: Rundstrahlung (ND)

Polarization: vertical

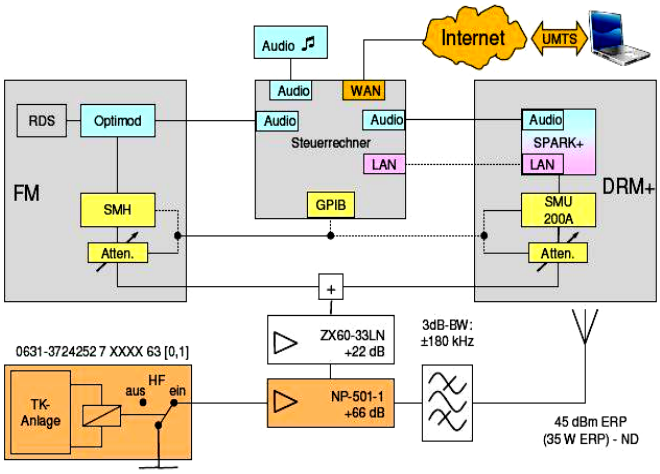

Figure 3. DRM+ experiment in Kaiserslautern, Germany – FM & DRM+ simulticast

4. CONCLUSION

Nevertheless, in the time of writing this paper was known just fragmentary information about DRM+; it appears to be a perspective narrow band digital radio broadcasting system and could gradually replace the analog FM radio in the future. DRM+ as well as original DRM system, cannot be considered as a competing system to DAB rather than a complementary one.

DRM+ is suitable for a local transmission and sub-regional single radio station although it can be extended to a bigger single frequency network. Moreover, inter/nationwide coverage can be guaranteed by DRM.

Accordingly, many chip manufacturers, who are addressing market and developing receivers that will be able to switch between the varieties of bands (such as DAB, DRM, FM, AM etc.) that will be used around the globe.

5. DRM Members

Commercial Radio Australia (Australia); TDP, TDP Radio, RTBF (Belgium);Nautel Ltd., Radio Canada International/CBC (Canada); Academy of Broadcasting Science of China, Communications University of China, Southeast University Nanjing (China); RIZ Transmitters (Croatia); **HFCC (Czech Republic)**;Aalborg University (Denmark); ESPOL, HCJB Global (Ecuador); Digita Oy, Kymenlaakso Polytechnik (Finland); CCETT, DIGIDIA, DRF Committee, Radio France, NRL – National Union of Free Radios, TDF, Thomson Broadcast & Multimedia (France); ADDX, APR, Atmel Germany GmbH, Deutsche Welle, DeutschlandRadio, DLM, Sender Europa 1, Fraunhofer IIS, Georg-Simon-Ohm – University of Applied Sciences Nuremberg, Harman/Becker Automotive Systems GmbH, IRT, LMK Rheinland-Pfalz, Medienanstalt Sachsen-Anhalt, Micronas GmbH, Nero AG, Panasonic Automotive Systems Europe, Robert Bosch GmbH, Sony Deutschland GmbH, SWR Südwestrundfunk, TRANSRADIO SenderSysteme Berlin AG, T-Systems Media&Broadcast GmbH, University of Applied Sciences Kaiserslautern, University of Applied Sciences Merseburg, University of Hanover, University of Kaiserslautern, University of Kassel, University of Ulm, VPRT (Germany); Antenna Hungaria, National Communications Authority Hungary (Hungary); Analog Devices (India), Basamad College, Tehran (Iran); RAI Way, ST Microelectronics (Italy); Hitachi Kokusai Electric Inc., NEC Corporation, NHK (Japan); Telecommunications Technology Association (Korea); Libyan Jamahiriya Broadcasting (Libya); Broadcasting Center Europe (Luxembourg); Asia Pacific Broadcasting Union (Malaysia); La Red de Radiodifusoras y Televisoras Educativas y Culturales de México (Mexico); Agentschap Telecom, CATENA Radio Design, NXP Semiconductors, OLON, Radio Netherlands, Stiching DigiRadio, Technical University Delft (Netherlands); Radio New Zealand International (New Zealand); Voice of Nigeria (Nigeria);

Senter for Kristen Kringkasting,Telenor/Norkring (Norway); RTP-Rádio e Televisão de Portugal (Portugal); RTRN/Voice of Russia (Russia); Government of Catalonia, Cadena SER - Sociedad Española de Radiodifusión, Universidad del Pais Vasco (Spain); Coding Technologies (Sweden); EBU, International Committee of the Red Cross, ITU, VSP – Verband Schweizer Privatradios (Switzerland); Arab States Broadcasting Union (Tunisia); BBC, Christian Vision, Digital One Ltd., RadioScape Plc., VT Communications, WRN (U.K.); Broadcast Electronics, Inc., Dolby Laboratories, Inc., Dolby Laboratories Licensing Corp., Continental Electronics Corp., Harris Corp., Broadcast Communications Division - IBB/VOA, National Association of Short-wave Broadcasters, TCI International, Inc., Texas Instruments, Inc., Via Licensing Corp. (U.S.A.) and Vatican Radio (Vatican City).

6. REFERENCES

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