DRM Broadcast Equipment

Content Servers

Digidia
F-35650 Le Rheu, France
www.digidia.fr

Fraunhofer IIS
D-91058 Erlangen, Germany
www.iis.fraunhofer.de

Spark
D-54347 Neumagen-Dhron, Germany
www.drm-sender.de

Modulators

Digidia
F-35650 Le Rheu, France
www.digidia.fr

Fraunhofer IIS
D-91058 Erlangen, Germany
www.iis.fraunhofer.de

Nautel
Hackett's Cove, NS B3Z 3J4, Canada
www.nautel.com

NTi
D-79507 Lörrach, Germany
www.nti-online.de

RIZ
HR-10000 Zagreb, Croatia
www.riz.hr

RF Mondial
D-30167 Hannover, Germany
www.rfmondial.de

SAT-Schneider
D-04736 Waldheim, Germany
www.sat-schneider.de

Spark
D-54347 Neumagen-Dhron, Germany
www.drm-sender.de

Thomson Broadcast
CH-5300 Turgi, Switzerland
www.thomson-bm.ch

TRANSRADIO
D-13587 Berlin, Germany
www.broadcast-transradio.com

Transmitters

Continental Electronics
Dallas, TX 75227, USA
www.contelec.com

Continental Lensa
CL-8431534 Recoleta, Chile
www.cecchile.com

Harris
Mason, OH 45040, USA
www.harris.com

Nautel
Hackett's Cove, NS B3Z 3J4, Canada
www.nautel.com

RIZ
HR-10000 Zagreb, Croatia
www.riz.hr

SAT-Schneider
D-04736 Waldheim, Germany
www.sat-schneider.de

Thomson Broadcast
CH-5300 Turgi, Switzerland
www.thomson-bm.ch

TRANSRADIO
D-13587 Berlin, Germany
www.broadcast-transradio.com

Aerial Systems

Fritzel-hofi
D-91614 Mönchsroth, Germany
www.hofi.de

Kintronic Labs
Bluff City, TN 37618, USA
www.kintronic.com

SAT-Schneider
D-04736 Waldheim, Germany
www.sat-schneider.de

TCI International
Fremont, CA 94538, USA
www.tcibr.com

Thomson Broadcast
CH-5300 Turgi, Switzerland
www.thomson-bm.ch

TRANSRADIO
D-13587 Berlin, Germany
www.broadcast-transradio.com

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drmRADIO.dk

110405-en revision 8.6

Receive news and music in noise free stereo from Europe and around the world

Listen to international stations like the BBC, Deutsche Welle, RTL, Radio France and Voice of Russia

Read textradio, view weather charts, photos and selected websites everywhere without Internet

Long-range DRM digital Radio

The DRM System
DRM is an international digital radio standard that offers listeners noise free reception of long, medium and shortwaves world-

wide up to 30 MHz. In addition to one or more stereo radio programmes, DRM transmits textradio, graphics, photos and data. The system has been expanded with DRM+, which utilises frequencies above short waves to the FM band and beyond to 174 MHz. DRM is ETSI Standard ES 201 980 and recommended by the ITU.

Digital Broadcasting
It is possible to transmit digitally even on a small budget. DRM is non-proprietary with non-commercial software of high

quality for modulation, decoding, logging and coverage verification. Small linear transmitters up to 10-25 kW are well suited for DRM, whereas larger transmitters on medium- and especially longwaves require tuning of the aerial system. Shortwaves are unproblematic, and DRM is a low cost shortcut to feed remote FM transmitters.

Digital Receivers
The long-range DRM world receivers in digital stereo are very popular and often include both DAB and FM capability. In

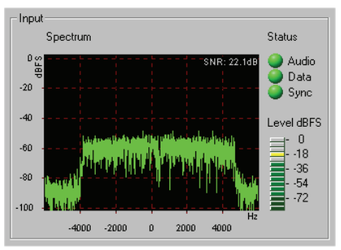
addition, they can also receive oldfashioned AM in mono, for example on medium waves. Operation is simple, and a knowledge of the programme frequencies is not required. Instead a list of programme names is displayed, similar to DAB or digital tv. The price of a DRM radio receiver is presently from around 150 euros.

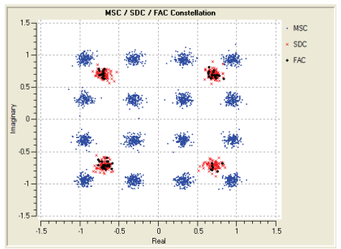
The DRM System

Digital Modulation
The modulation in DRM is a coded Orthogonal Frequency Division Multiplexing (OFDM), which is also used for DVB and DAB. It spreads a digital bit stream over a large number of lower bitrate carriers. Errors in the transmission path are suppressed by interleaving the bit stream in frequency and time and adding error correction. The final data stream is transmitted several bits at a time with radio symbols that are combinations of phase angle and amplitude.

Signal Configuration
The DRM signal may contain several data streams. Fast access (FAC) is coded onto four radio symbols and describes signal configuration. The next (SDC) is coded with four or 16 symbols and describes content so that the receicer may decode it. The main signal (MSC) is coded with 16 or 64 symbols (QAM) and contains streams such as radio programmes, textradio, graphics, photos and data. At reception, the total delay is 0.8-2.4 seconds.

Receiver Sensitity
A DRM bit error rate of 0.0001 corresponds to 36 dB carrier/noise ratio for AM at 30 percent modulation. ITU-R BS.1615 states conversion factors for receiver sensitity on internal aerials that correspond to DRM from 39-52 dBµV/m on longwaves, 33-46 dBµV/m on mediumwaves and 13-26 dBµV/m on shortwaves. The equivalent figures in ITU-R BS.704 for AM are 66, 60 og 40 dBµV/m (at least 14 dB or 25 times more powerful transmitters).



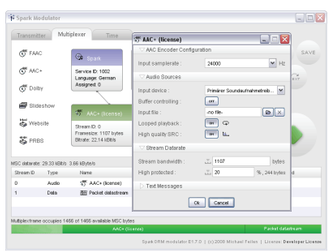


Digital Broadcasting

Spectrum Availability
ITU Circular Letter CCRR/20 stipulates that DRM broadcasts are compliant with the GE75 frequency plan, if the power of the digital transmissions is 7 dB under the internationally assigned power. A 750 kW AM assignment gives a parallel right to 150 kW DRM providing the national authority isues a supplementary notification to the ITU Radiocommunications Bureau, and the broadcaster may alternate between 750 kW analogue and 150 kW digital.

Encoders and Modulators
Encoding of the DRM signal can take place in the modulator, or centrally as MDI (Multiplex Distribution Interface) for distribution via UDP/IP. Programming and data are then fed to a content server, with the modulator at the transmitter site acting as only a client. In addition to commercial hardware-based products at various price levels, non-commercial PC software of high quality for MDI or direct modulation of the transmitter is available.

Test Transmissions
Modern I/Q modulated transmitters, AM or SSB amplifiers can normally be converted to transmit DRM at 15-40 percent of the rated power, whilst transmitters with A/RFP may have too low bandwidth. Manufacturers will often modify their existing transmitters to AM/DRM for a fee, but the free software-based modulator Spark may also be used for initial tests with linear exciters such as the NTi DiRaGen 30, or to generate I/Q signals and MDI.



Digital Receivers

Consumer Receivers
The DRM standard for long-range transmitters was published in 2003, a commercial receiver module was developed in 2005, and consumer receivers became available in quantity from 2007. The market is thus still limited to only a dozen or so models, in a situation similar to the quiet on the DAB market ten years ago. The latest generation of receivers have colour graphics displays, and can exploit virtually all the features of DRM.

Car Radios
Car radios have good reception properties on long-, medium and shortwaves, and are an excellent alternative to expensive communications receivers, even in boats. Use only whip aerials from well reputed manufacturers, and supply separately from the +12 V connector for automatic aerials on the radio; not through the aerial cable. Ground radio and aerial securely to chassis, and run the aerial and supply cables far from other installations.

PC Frontends
It is quite easy to modify an AM radio to a DRM front end. Web shops offer ready-made converter modules at just 25 euros, and it is also possible to acquire a complete DRM front end for less than 100 euros. PC software may be found on the Internet to decode the converter signal to audio, radiotext, graphics, photos and data. The software will automatically update the worldwide DRM schedules so that stations may be selected on a list.

Long-range Reception

Wave Propagation
Radiowaves behave like light, travel in straight lines and are in principle limited to the horizon. However, just like light they may be reflected and refracted, and this can happen in the D, E and F ionised layers that extend from 50 to 400 km above the surface of the earth. The layers are created by the rays from the sun and absorb and reflect radio waves depending on their frequency, the solar activity, season and time of day, affecting the propagation.

Ground and Reflected
The direct wave may extend beyond the horizon as a stable ground wave, and at longwave frequencies below 300 kHz ground wave propagation is dominant up to 1.000-1.500 km. For medium- and shortwaves, the ground wave reaches up to 400 km, with the first reflection normally hitting the ground some 750-2.000 km away from the transmitter. No reception is possible in the skip zone between the ground wave and the first reflection.

Fading and Interference
A reflected wave hitting the ground or sea may reflect again. After a couple of hops, the reception zones tend to overlap. As the overlapping waves have covered varied distances, they may interfere to slowly cancel and reinforce the signal at the receiver. This fading is audible in analogue, but completely masked with digital modulation. By comparison, man-made interference is often more localised and easier to cancel using suitable aerials.