DRM TEST EQUIPMENT
DT230
Professional Test Equipment for the DRM System

- Stand-alone unit
- Easy to use due to comfortable LCD menus
- Software update via built-in DVD drive
- Full remote control by remote PC via Ethernet
- 10 MHz reference input
- Available with different options
- Later upgrade of options possible

Applications

DRM signal playback for
- Demonstration purposes
- Transmitter testing
- Receiver tests

DRM signal recorder for
- Generation of “real-world” patterns
- Recording of signals for further analysis

DRM signal playback and channel simulator for
- Development of DRM front ends
- Development of DRM baseband decoders

DRM signal playback, channel simulator and RSCI (Receiver Status and Control) analyzer for
- Performance tests of DRM receivers
- DRM real-time modulation for
- Laboratory tests
- Demonstrations

Concept

The DRM Test Equipment DT230 is a professional piece of test equipment for the DRM system. It can play back complex baseband DRM signals and record RF bandpass signals by using a direct sampling A/D and D/A solution for the frequency range from 100 kHz up to 27.4 MHz.

An optional channel simulator module (O1) models all relevant properties of the short wave ionospheric propagation channel according to the stationary Watterson model approach (ITU-R F. 1487). Simulations may be used for the evaluation of a DRM receiver’s performance namely its front end and baseband decoding under controlled conditions.
A dynamic profile option (O2) makes it possible to change all simulator parameters dynamically and allows the introduction of configurable interferers.

A further option (O3) features an automatic evaluation of receiver performance. A Perl-based framework for the automatic generation of test reports is provided.

Option O4 provides real-time modulation features for the DRM Test Equipment DT230. For instance, together with a Fraunhofer DRM ContentServer™ R4 a real-time modulation chain can be set up. The Fraunhofer DRM ContentServer™ R4 performs live encoding of audio sources and data applications. The MDI output stream can carry all possible DRM signaling and reconfiguration options. The data are modulated by the DRM Test Equipment DT230 onto RF signals according to ETSI ES 201 980 V2.1.1. The input data format for the modulation option is MDI (Multiplex Distribution Interface) according to the application protocol ETSI TS 102 820 V1.2.1 and to the DCP (Distribution and Communications Protocol) ETSI TS 102 821 V1.2.1. Real-time input is possible via Ethernet. In addition, pre-generated MDI files can be played back from the DRM Test Equipment’s built-in hard disc.

**Mechanical Specifications**

- Width 43.2 cm
- Height 13.3 cm, 14.5 cm with pedestals
- Depth 40.6 cm, 46 cm with connectors
- Weight 10 kg
- 19” rack mounting possible

**Environmental Specifications**

Operating Range
- Temperature range: 10–30°C
- Humidity: 20–80% non-condensing

**Power supply**
- Voltage range: 110–230 V, 50 – 60 Hz AC
- Input power consumption 230 V, max. 3 A, 110 V, max. 6 A
- Average power consumption ca. 150 W, Power factor 0.9

**Interfaces**

Internal Properties
- Frequency stability ±20 ppm using internal reference
- Synchronization of Test Equipment to external 10 MHz reference clock possible

RF Input
- BNC connector, impedance 50 Ω
- Center frequency range 100 kHz up to 27.4 MHz, (12 kHz to 100 kHz uncalibrated)
- Input level full scale at 0 dBm sine
- Level accuracy: ±0.3 dB for input signals -40 dBm up to 0 dBm
- Analog bandwidth within ±0.1 dB ripple: 40 kHz

RF Output
- BNC connector, impedance 50 Ω
- Center frequency range 100 kHz up to 27.4 MHz, (12 kHz to 100 kHz uncalibrated)
- Output level 0 dBm for full scale sinus signals
- Built-in hardware attenuator 0 dB to 120 dB
- Level accuracy ±0.5 dB
- 40 kHz analog bandwidth with ±0.1 dB ripple
- Spurious free dynamic range better than 60 dB at 0 dBm sine output
- First harmonic below 45 dBc at 0 dBm sine output
- Fulfils DRM spectrum mask using filtered DRM files

10 MHz Reference Input
- BNC connector, impedance 50 Ω
- PLL locks within ±10 ppm
- Reference input level 0 dBm to 10 dBm
Relays
- 3pin XLR jacks, work as single pole double-throw switch
- Relays can switch 24V AC at 1A

Control Interfaces
- Ethernet 100 Base T-port
- Two 9 Pin D-SUB Male interfaces (RS232)

Additional Interfaces
- Power socket (110 – 230 V AC)
- Headphones output with volume control
- Built-in loudspeaker with volume control
- Line output
- Two USB 2.0 connectors

Features
The following features are available as basic model B1:

Signal Playback
- Including 4 GB of pre-generated DRM files (about 400) on internal hard disk
- Playback of signals from: CD/DVD, USB stick, internal hard disk

Signal Recording
- Recording of 48 kHz complex signals with analog input, bandwidth 40 kHz
The following features are optional:

Channel Simulator (Option O1)

- According to Watterson channel model as defined in ITU-R F.1487
- Bandwidth min. 40 kHz
- 4 Paths, each path features
  - Relative attenuation up to 20 dB
  - Multipath up to 100 ms
  - Doppler shift up to ±500 Hz
  - Doppler spread up to 20 Hz
- Adjacent or on-channel DRM or AM interferer within bandwidth of channel simulator min. 40 kHz
- AWGN noise generator

Channel Simulator Dynamic Profile (Option O2, requires Option O1)

- All parameters of the Channel Simulator can be changed dynamically by user-defined profiles
- Update of all values synchronously every 100 ms, linear interpolation between sampling points
- Freely configurable impulse interferer simulation

Receiver Performance Measurement (Option O3)

- BER analyzer
  - based on evaluation of RS232 RSCI (Receiver Status and Control Interface) input, ETSI TS 102 349 V1.2.1
- Remote control by Ethernet connection with external PC
- Controlled by Perl-based scripts
- Script-based testing with full control over all settings of B1, O1 and O2
- Automatic test report generation using LaTeX
- Generation of plots using GNUplot

Real-time Modulation Option (Option O4)

- MDI input according to ETSI ES 201 980 V2.1.1
- Real-time input via Ethernet, UDP/IP unicast and multicast
- Monitoring of input buffer level
- Synchronous modulation possible with reference frequency of 10 MHz
- No SFN synchronization possible
- Playback of pre-generated MDI files from internal hard disk
- Fully interoperable with all Channel Simulator Options (O1 and O2)

DRM modulation:

- Modes A, B, C, D
- Half bandwidth (4.5/5 kHz)
- Nominal bandwidth (9/10 kHz)
- Double bandwidth (18/20 kHz)
- 4 QAM SDC
- 16 QAM SDC
- 16 QAM MSC, all code rates
- 64 QAM MSC, all code rates
- Equal error protection
- Unequal error protection
- Long/short interleaving

Option O4 must not be used for regular broadcasting.
For dedicated broadcasting equipment please refer to:
http://www.transradio.de/int/index.html
For further information, please visit

WWW.IIS.FRAUNHOFER.DE/DRM