

## Features

### Signal recording

Recording of 48 kHz complex signals with analog input, bandwidth 40 kHz

### Signal playback

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

### Channel simulator (Option O1)

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.

- 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  $\pm 500$  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)

A dynamic profile option (O2) makes it possible to change all simulator parameters dynamically and allows the introduction of configurable interferers.

- 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)

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

- 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

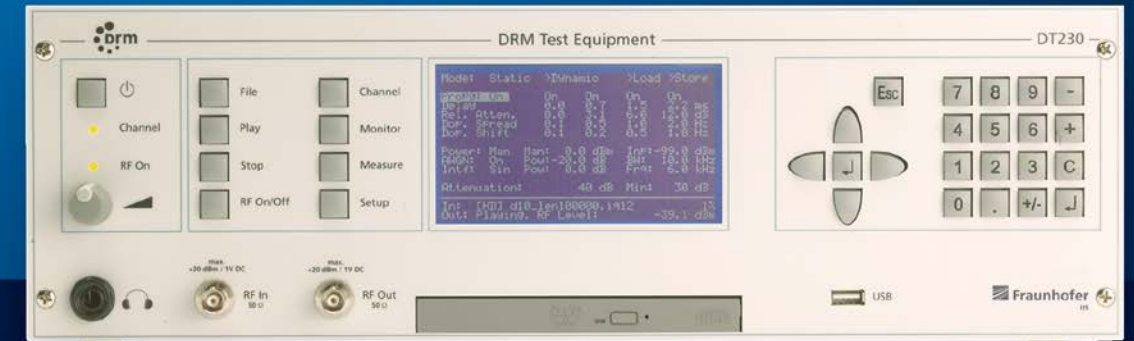
### Real-time modulation option (Option O4)

Option O4 provides real-time modulation features for the DRM Test Equipment DT230. For instance, together with a Fraunhofer DRM ContentServer™ a real-time modulation chain can be set up.

- 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



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# DRM Test Equipment DT230

- Playback of DRM signals
- Recording of DRM signals
- Channel simulation
- Receiver performance analysis
- Real-time modulation

## Professional test equipment for the DRM system

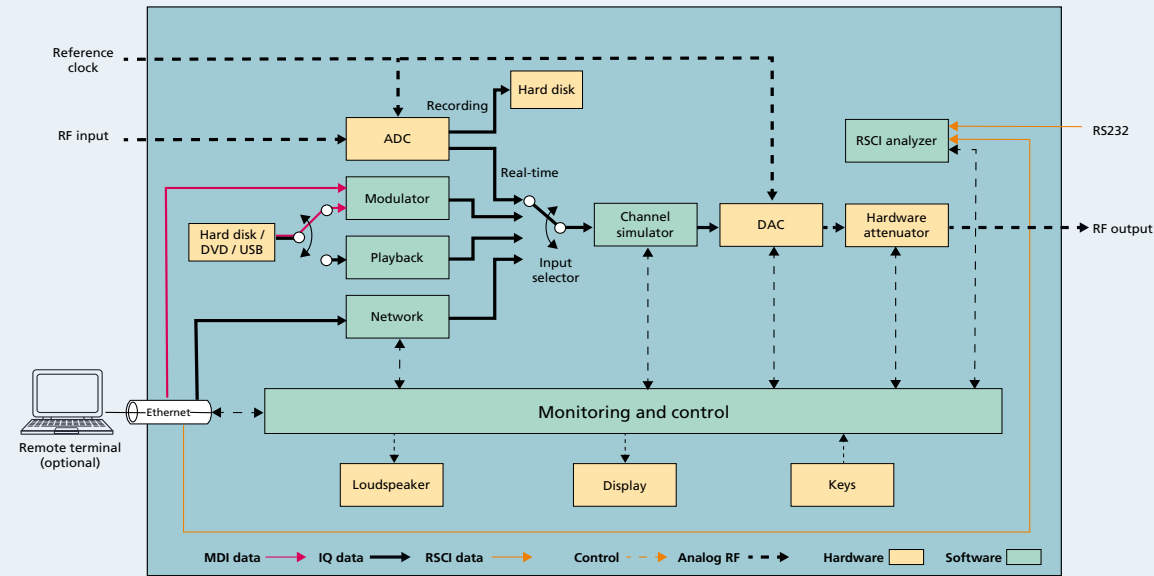
- Stand-alone unit
- Easy to use due to comfortable LCD menus
- Software update via built-in DVD drive
- Full remote control by remote PC via Ethernet (channel simulator module, dynamic profile option, receiver performance, real-time modulation)
- 10 MHz reference input
- Available with different options
- Later upgrade of options possible

## Applications

- DRM signal playback for demonstration purposes, transmitter testing and receiver tests
- DRM signal recorder for generating "real-world" patterns and for recording of signals for further analysis
- DRM signal playback and channel simulator for the development of DRM front ends and DRM baseband decoders
- DRM signal playback, channel simulator and RSCI (Receiver Status and Control Interface) analyzer for performance tests of DRM receivers and for DRM real-time modulation (laboratory tests and demonstrations)

## Concept

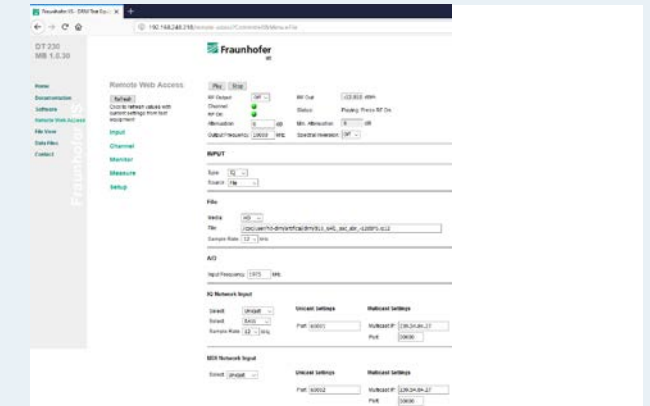
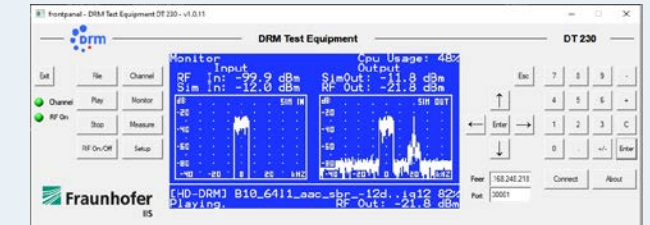
The DRM Test Equipment DT230 is a professional piece of test equipment for the DRM system. It can play back complex baseband DRM signals and record RF bandpass signals by using a direct sampling A/D and D/A solution for the frequency range from 100 kHz up to 27.4 MHz.



Left:  
Architecture of the DRM Test Equipment DT230

Top right:  
Remote front panel executable on Windows and Linux PCs

Bottom right:  
Remote access via web browser



## Mechanical specifications

- Width: 43.2 cm
- Height: 13.3 cm, 14.5 cm with pedestals
- Depth: 40.6 cm, 46.0 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 100BASE-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