

# DRM on MF and LF, coverage and technical requirements

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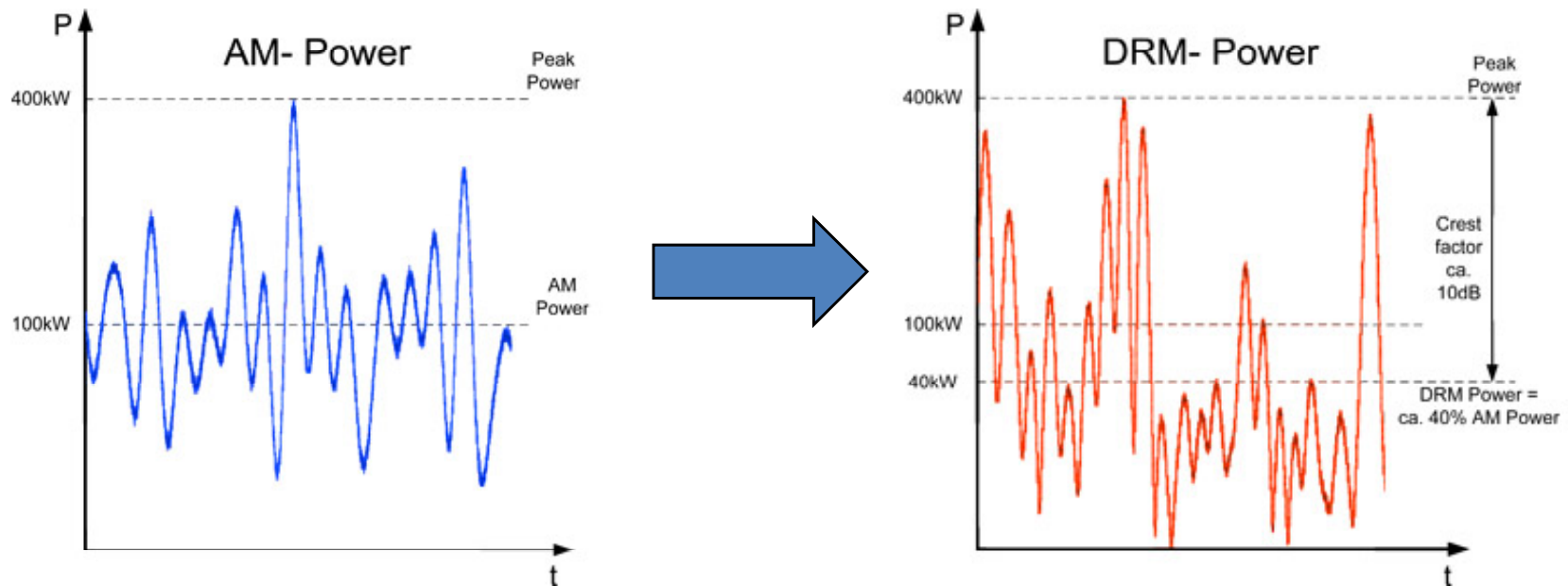
## DRM 30

The perfect solution for wide area coverage on  
Long Wave, Medium Wave and Short Wave



# DRM 30 – The perfect solution for wide area coverage

## Comparison of reception distance AM vs DRM



# DRM 30 – Comparison of reception distance AM vs DRM

DRM : minimal usable field strength (dBuV/m) to get a BER of  $1 \times 10^{-4}$  (ITU)

Modulation	Protection Level No.	Robustness (9kHz)
16 QAM	0	33,1
	1	35,2
64 QAM	0	38,6
	1	39,8
	2	41,6
	3	43,2

# DRM 30 – Comparison of reception distance AM vs DRM

Coverage Distance as a function of necessary field strength for DRM reception:

Necessary Field Strength [dBuV/m]	DRM-Mode Parameter	Coverage Distance (1,2 MW Transmitter)
43.1	Mode A, 16QAM, Coderate 0,5	1270
48.6	Mode A, 64QAM, Coderate 0,5	1120
49.8	Mode A, 64QAM, Coderate 0,6	1096
53.2	Mode A 64QAM, Coderate 0,78	1000

# DRM 30 – The perfect solution for wide area coverage

## Comparison of reception distance AM vs DRM :

Ground conductivity 10mS/m (estimated for the exemple)  
Transmission Frequency : 153kHz

Minimal field strength for AM reception: 60dBuV/m  
Transmitter power : 1,2 MW  
**Coverage diameter: 886 km**  
**Power consumption (m=0,35): 1,46 MW**

Minimal field strength for DRM reception: 43dBuV/m  
Transmitter power : 1,2 MW  
Transmitted power DRM : 765 kW (using Digital Power Enhancement )  
**Coverage diameter : 1270 km**  
**Power consumption : 880 kW**



# DRM 30 – The perfect solution for wide area coverage

Zehlendorf, Germany in 2006

Transmitter Station Zehlendorf (MB)

Broadcaster DeutschlandRadio

Transmission frequency 177kHz

Output Power 500/240kW

Bandwidth 9kHz

Transmitter TRAM/P500L

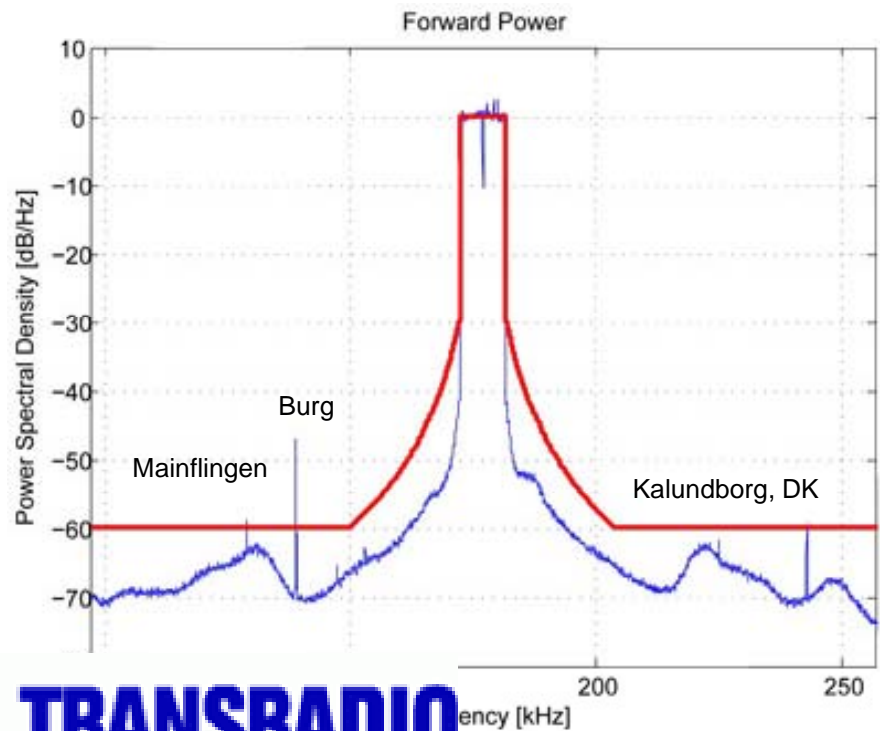


TRANSRADIO DRM Transmitter TRAM/P 500L

# DRM 30 – The perfect solution for wide area coverage

## Zehlendorf, Germany in 2006

Worlds first DRM transmitter on long wave, which completely met the requirements of the out-of-band emissions of ETSI EN 302 245-1 and ITU SM.1541



Burg, Mainflingen and Kalundborg are signals received from other stations [www.drm.org](http://www.drm.org)



# DRM 30 – The perfect solution for wide area coverage

Cremlingen, Germany in 2005

Transmitter Station  
Cremlingen (MB)  
Germany

Broadcaster  
DeutschlandRadio

Transmission  
frequency 756 kHz

Output Power 800/400 kW

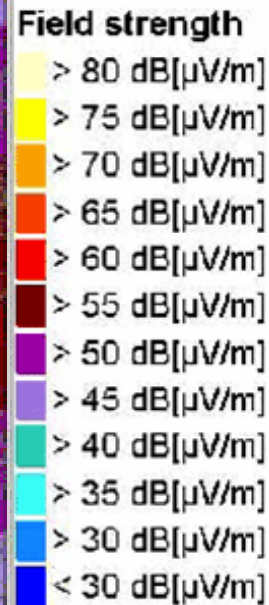
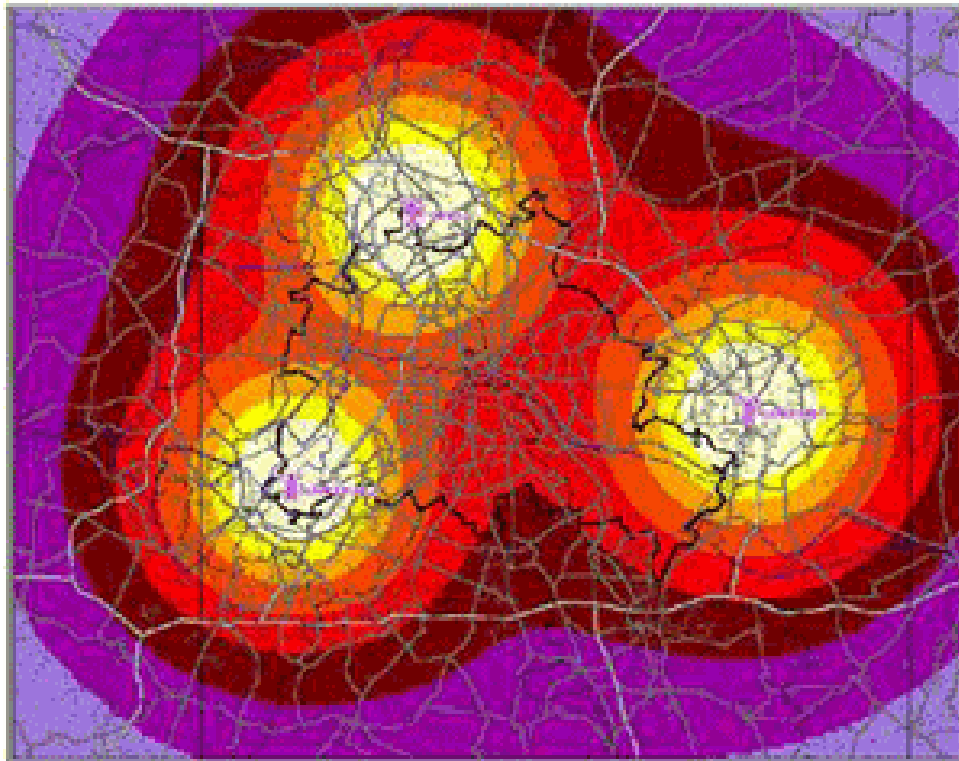
Bandwidth 9 kHz



800 kW transmitter TRAM/P800 756kHz

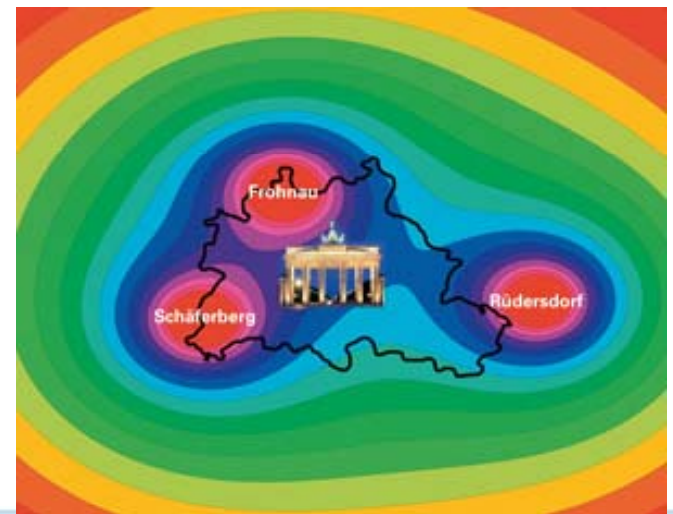
# DRM 30 – The perfect solution for wide area coverage

## Single Frequency Network Solutions with DRM



3 transmitters, each set to 500W digital output power. The program is provided by one studio site in the city of Berlin

Distributed via ISDN lines  
Synchronisation by GPS



# DRM 30 – Technical Requirements

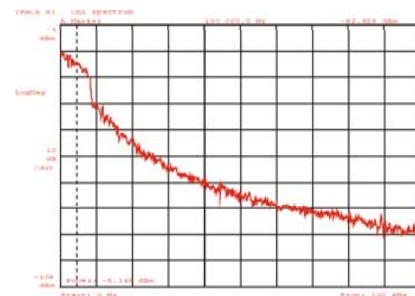
DRM in Practice

DRM exciter

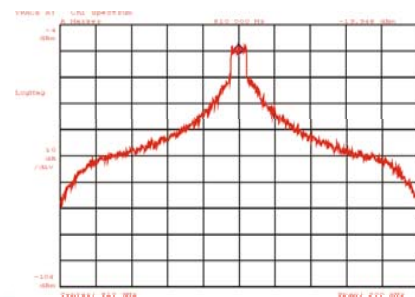
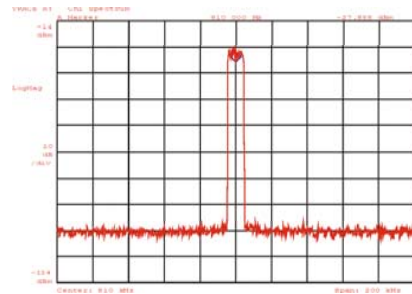
Transmitter



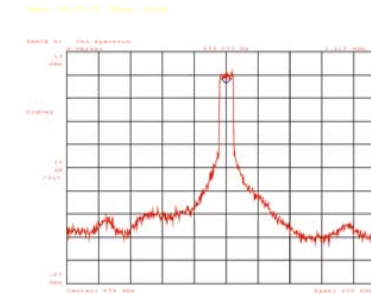
Amplitude



Phasemodulated RF

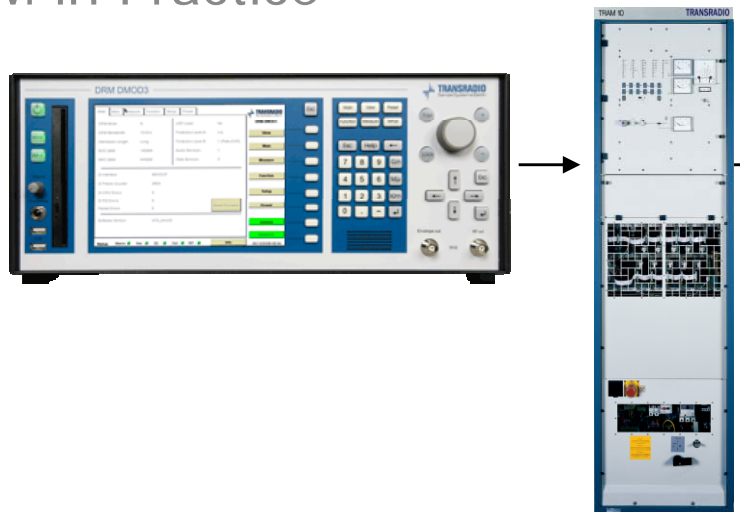


Output signal of the transmitter



# DRM 30 – Technical Requirements

DRM in Practice

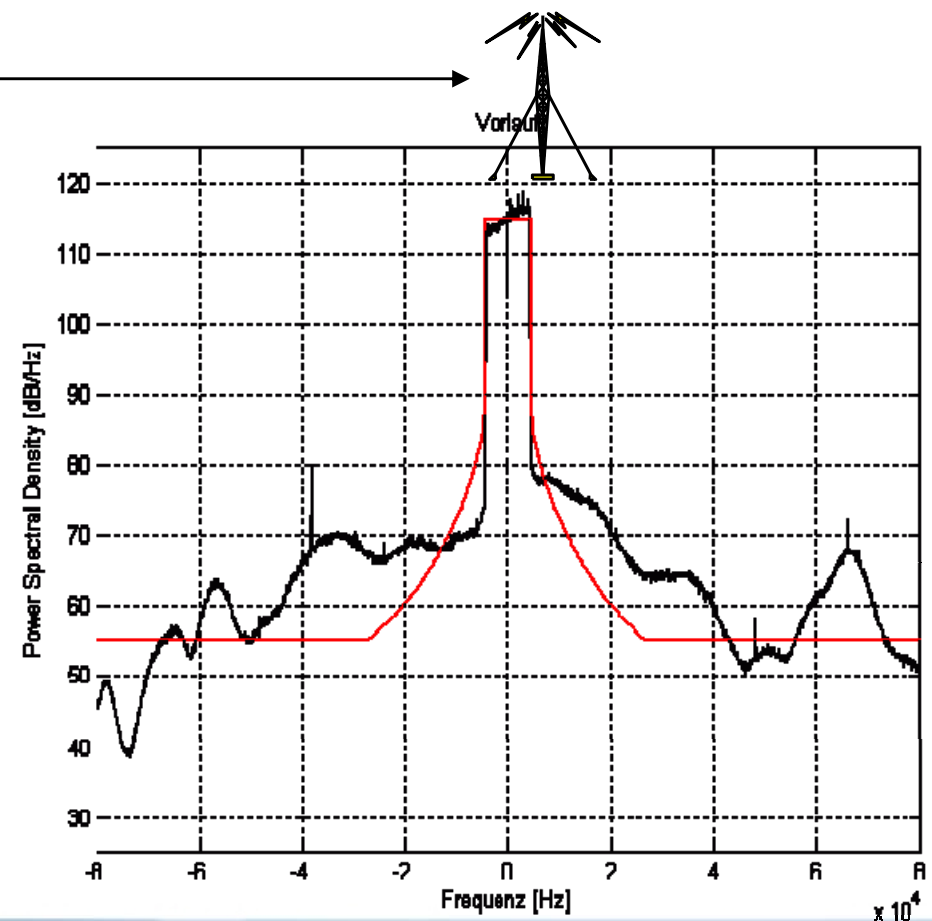


**DRM Exciter**

**TX**

- DRM spectrum not compliant with ITU spectrum mask
- Mask violation up to 15dB!

**Small bandwidth  
Antenna**

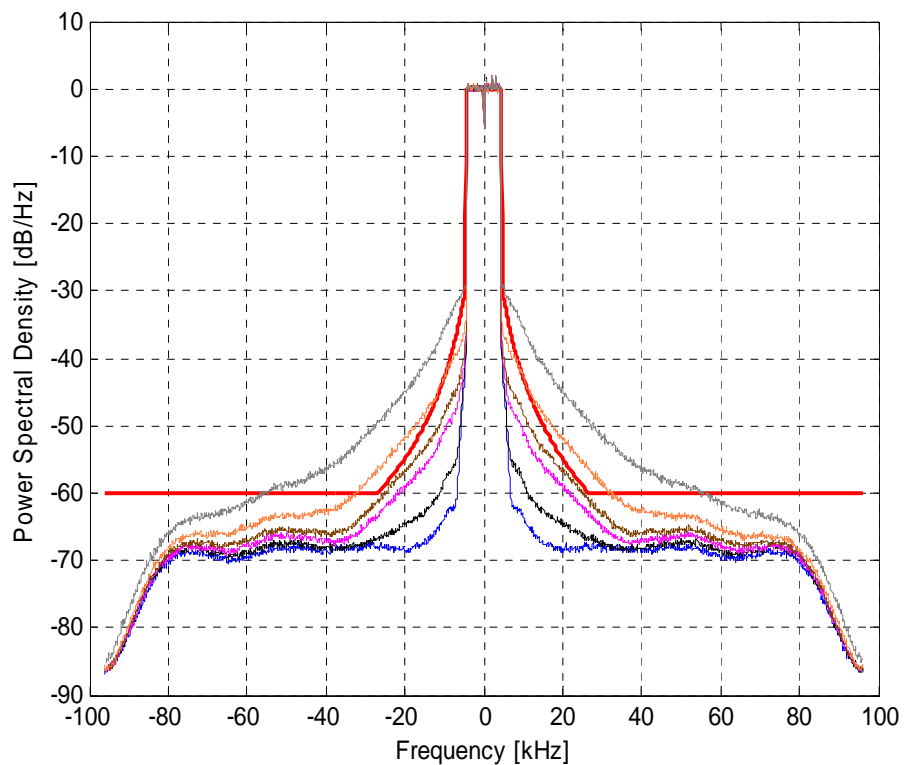




# DRM 30 – Technical Requirements

DRM 30 , Parameter settings

## DC Offset



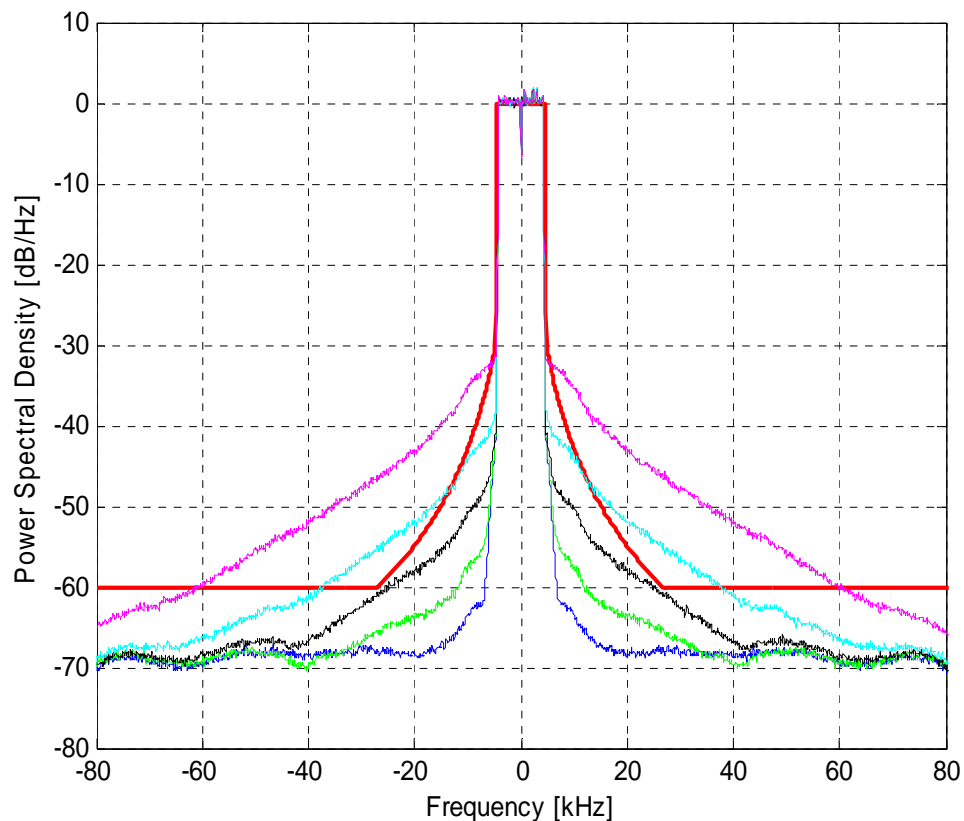
error [%]	Color
0	Blue
0.2	Black
0.7	Magenta
1.0	Brown
2.0	Orange
5.0	Grey

- Operating the transmitter with the correct DC-offset is crucial.
- DC-offset error < 1 % to fulfill the DRM mask.

# DRM 30 – Technical Requirements

DRM 30, Parameter settings

## Time Delay



error [ $\mu\text{s}$ ]	Color
0	Blue
0.25	Green
1	Black
2	Cyan
5	Magenta

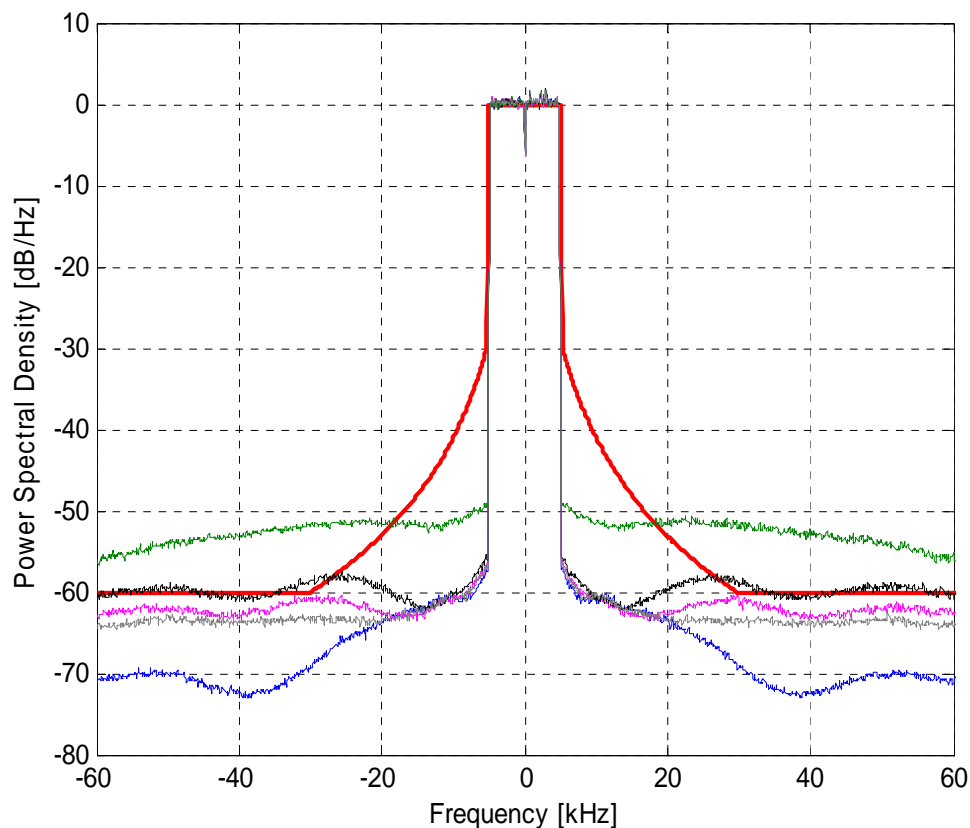
Time Delay between envelope & RF path  $< 1 \mu\text{s}$  to fulfill the DRM mask



# DRM 30 – Technical Requirements

DRM 30, Parameter settings

## Band Limitation of Envelope Path



Cut-Off-Frequency (3dB) in kHz	Color
20	Green
30	Black
35	Magenta
40	Gray
No filter	Blue

DRM RF Bandwidth: 10kHz

At least 3.5 times the RF bandwidth necessary for DRM to fulfill DRM mask

## DRM Exciter requirements

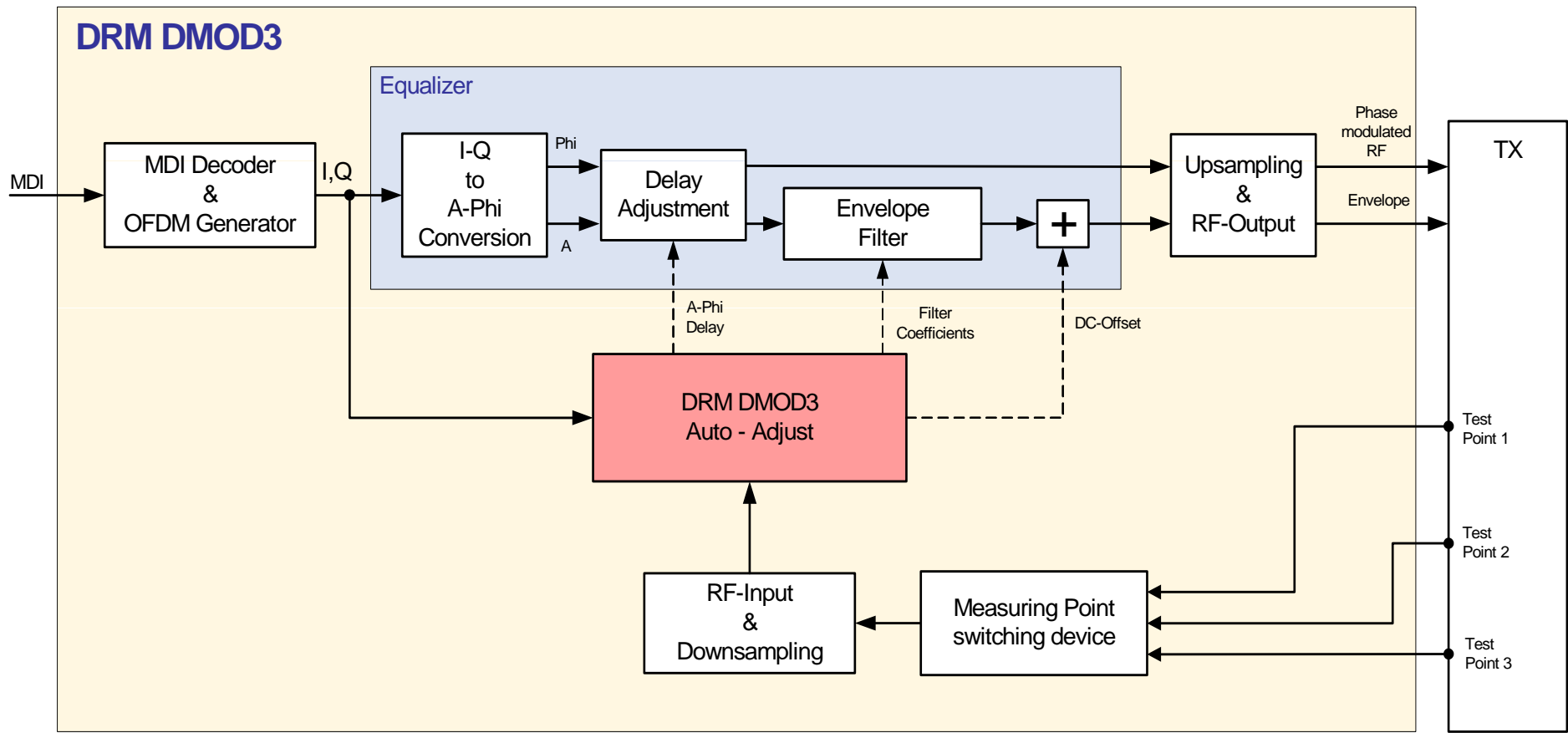
- SCS; AM and DRM on one 9kHz channel
- MCS on two 9 (10) kHz channels
- Fast and easy switchover between modes
- Integrated GPS receiver for single frequency networks (SFN) and highest frequency precision
- Feed back channel for optimization of the transmission system
- Integrated audio encoder
- Integrated synthesizer,  
Frequency range 9kHz to 27 MHz



# DRM 30 – Technical Requirements

DRM 30, Parameter settings

## Automatic Equalizer Adjustment I



# DRM 30 – Technical Requirements

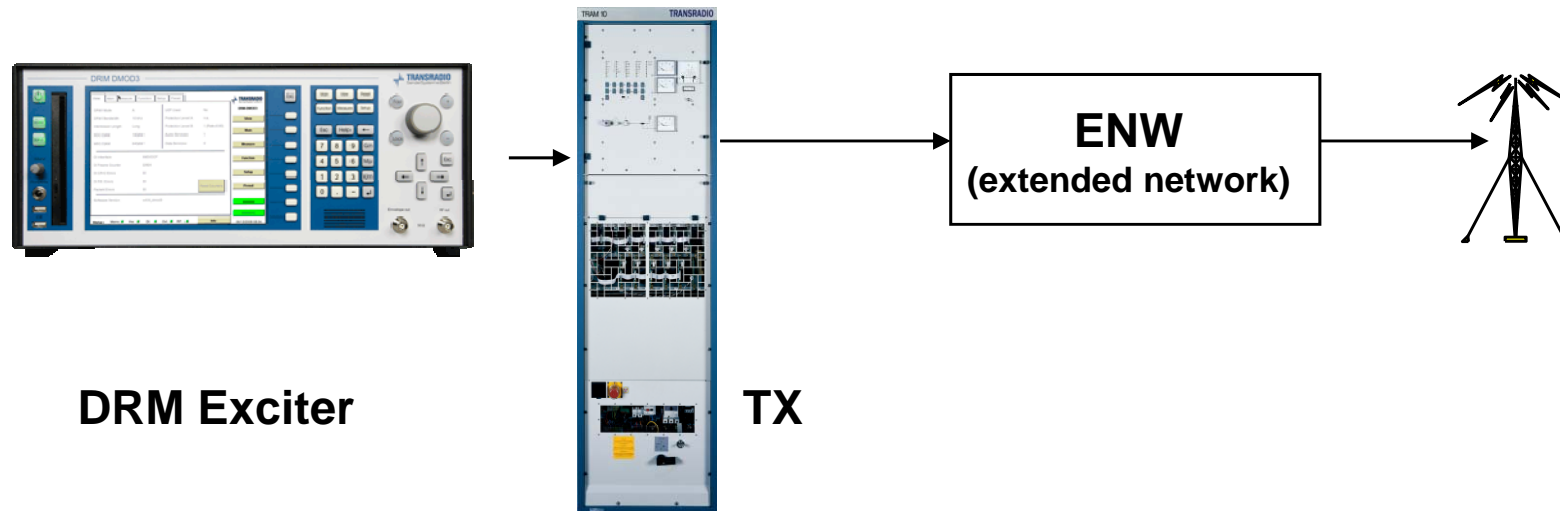
Minimum requirements for DRM Antennas

**VSWR < 1,05 at  $\pm$  5 kHz from carrier**

**VSWR < 1,10 at  $\pm$  10 kHz from carrier**

# DRM 30 – Technical Requirements

DRM in Practice; here on Longwave



- DRM spectrum compliant with ITU spectrum mask!
- Equalizer settings calculated with DRM signal only

# DRM 30 – Technical Requirements

Donebach, Germany in 2008

Transmitter Station  
Donebach (TSI)  
Germany

Broadcaster  
DeutschlandRadio

Transmission  
frequency 153 kHz

Output Power 500/240 kW

Bandwidth 9 kHz





# DRM 30 – The perfect solution for wide area coverage

The best of both worlds...

- Coverage better than AM
- Quality like VHF/FM
- Low cost by Energy saving
- Field proven technology

**DRM - We have your solution!**

# Thank you

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