

T-Systems
Media&Broadcast

www.t-systems-
Broadcast-Technologies
mediabroadcast.com

Januar 2007

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Digital Broadcast Technologies

Agenda

- Digital Video Broadcasting – Terrestrial (DVB-T)
- Digital Video Broadcasting – Handheld (DVB-H)
- DAB / DMB
- Other
- Summary

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Digital Broadcast Technologies

Spektrum

Nutzung des Frequenzspektrums

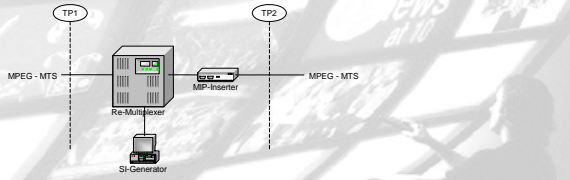
Legend:
 - UHF (blue line)
 - GSM (up link) (red line)
 - GSM (down link) (orange line)
 - L-Band (light blue line)
 - GSMI (up link) (green line)
 - GSMI (down link) (light green line)
 - WDMA (up link) (yellow line)
 - WDMA (down link) (light yellow line)

BB: 40 MHz (with SAT-part)

Problem: Protection Ratio (18 MHz)

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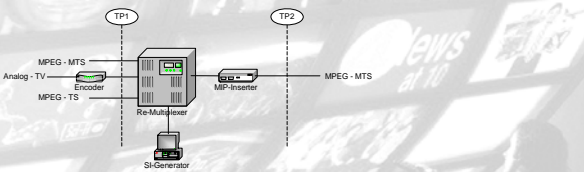
Digital Video Broadcasting – Terrestrial (DVB-T).
Reference System DVB-T (Multiplex).



- Insertion local Service-Informationen
- SFN-Synchronisation

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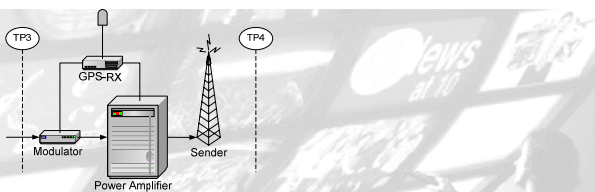
Digital Video Broadcasting – Terrestrial (DVB-T).
Reference System DVB-T (Multiplex local).



- Hinzufügen eines TS zu einem MTS
- Ersetzen eines TS durch einen lokalen TS
- Codieren lokaler analoger Programme
- Near Seamless Splicing (störungsfreies Überblenden)
- Einpflegen der lokalen Service-Informationen
- SFN-Synchronisation (bei Bedarf)

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Digital Video Broadcasting – Terrestrial (DVB-T).
Reference System DVB-T (Transmitter).



- Aufbereiten des OFDM-Signals
 - SFN-Synchronisation (bei Bedarf)
 - Leistungsverstärkung
- Modulator gehört zum Sender

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DVB-T introduction in Berlin.

Schedule: introduction in three phases.



DVB-T was introduced in Berlin at the initiative of broadcasters and Medienanstalt Berlin-Brandenburg (Berlin-Brandenburg media authority), and the introduction consisted of three phases:

DVB-T: DasÜberallFernsehen



Nov. 02

1st phase: Starting in November 2002, regular digital broadcasting of a **first group of eight channels** (four public and four private channels) began. Analog broadcasting of these channels also continued.



Febr. 03

Aug. 03



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DVB-T: DasÜberallFernsehen



Nov. 02

Febr. 03

Aug. 03

2nd phase: at the end of February, **analog broadcasting of the four private channels was switched off**; from that time on, these channels were available only through digital reception. Analog broadcasting of the public channels was continued, at **lower broadcast-power levels**. The capacity that became available when the four analog channels were taken off the air was then used for transmission of the new digital service.



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DVB-T: DasÜberallFernsehen



Nov. 02

Febr. 03

Aug. 03

3rd phase: On 4 August 2003, **all remaining analog broadcasting was switched off**, bringing introduction of DVB-T in Berlin to a successful completion.

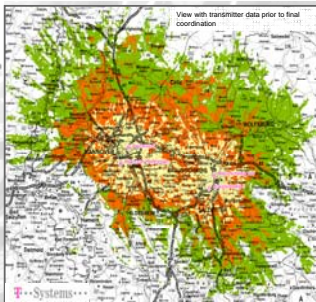


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DVB-T introduction in northern Germany. Hannover / Braunschweig area.



DVB-T: DasÜberallFernsehen



24 May 2004:
4 bouquets (16 channels)

8 November 2004:
6 bouquets (24 channels)

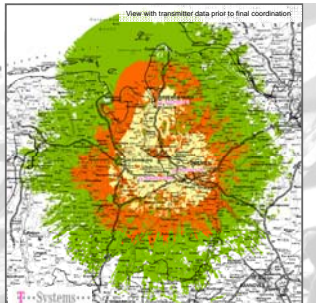
Provided via
Room antenna
Outdoor antenna
Roof antenna

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DVB-T introduction in northern Germany. Bremen / Unterweser area.



DVB-T: DasÜberallFernsehen



24 May 2004:
4 bouquets (16 channels)

8 November 2004:
6 bouquets (24 channels)

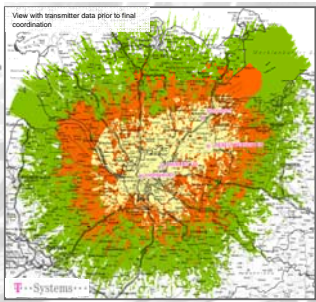
Provided via
Room antenna
Outdoor antenna
Roof antenna

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DVB-T introduction in northern Germany. Bereich Hamburg / Lübeck.



DVB-T: DasÜberallFernsehen



4 November 2004:
4 bouquets (16 channels)

March 2005:
6 bouquets (24 channels)

Provided via
Room antenna
Outdoor antenna
Roof antenna

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DVB-T.

A worldwide standard.



Some European neighbors, such as **UK** and **Spain**, are already operating DVB-T networks. Others, such as **France** and the **Netherlands**, are currently making the transition to the new technology. And the new system's popularity is not limited to Europe – other regions of the world have also chosen the European DVB-T standard (areas marked in orange on the map at right).



- ASTC (Advanced Television Systems Committee)
- DVB-T (Digital Video Broadcasting – Terrestrial)
- Decision in favor of DVB-T expected
- ISDB-T (Integrated Services Digital Broadcasting – Terrestrial)
- Undecided



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DVB-T.

Receiver Equipment



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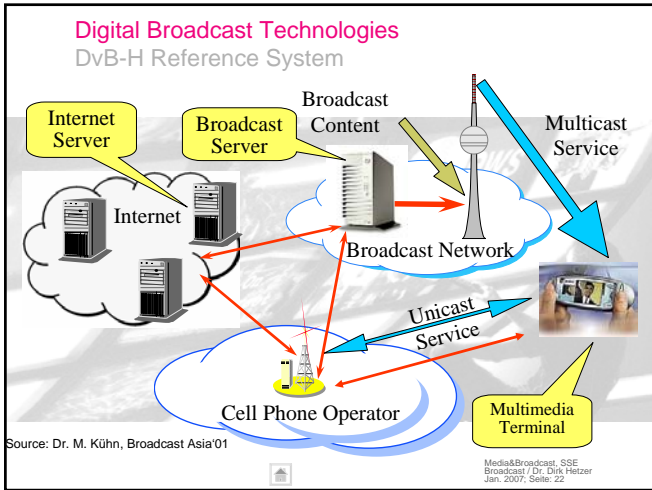
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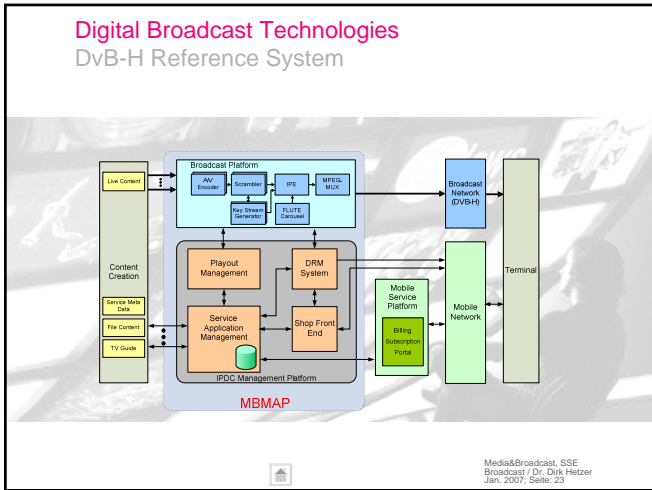


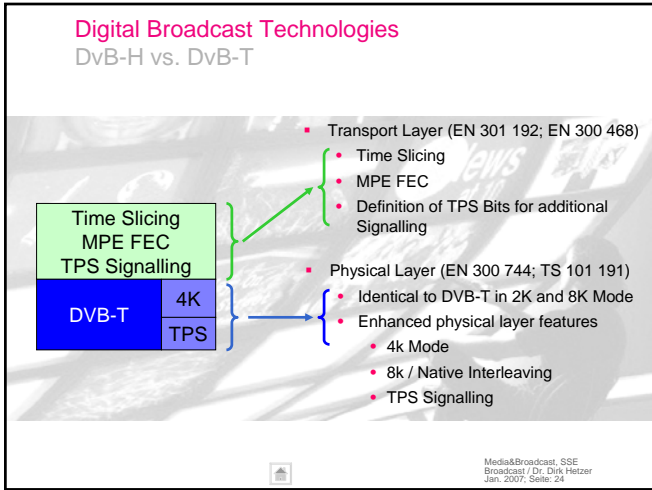
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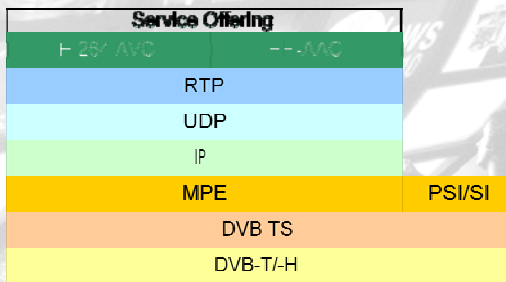






Digital Broadcast Technologies

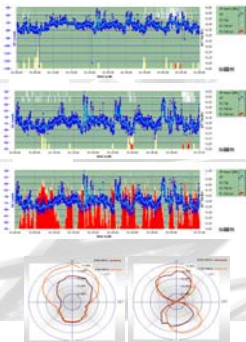
DvB-H Protocol Stack



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DvB-H Terminals



- Lab- and field trials with 6 different terminal types
- These trials gave interesting findings
- All tested terminals showed less sensitivity than assumed in current network planning
- Values range from -7dB up to -18dB less sensitivity in AWGN channel than required in the DVB-H implementation guideline (46,2dBuV/m)

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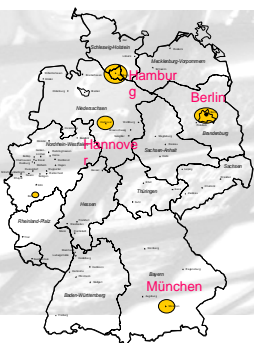
DvB-H Terminals



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DvB-H Trial Germany 2006



- 4 locations controlled by a central play-out @ T-Systems in Berlin
- Approx. 1000 handsets have been sent out to VIP users (press, politics, regulation)

Region	Transmitter	ERP in kW	Antenna Height in m	UHF-Channel
Berlin	Alexanderplatz	20	358	39
	Schäferberg	50	205	39
Hamburg	HHT	50	254	53
	Höltigbaum	10	155	53
Hannover	Telemax	20	276	40
München	Olympiaturm	20	284	38

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DvB-H Trial Germany 2006

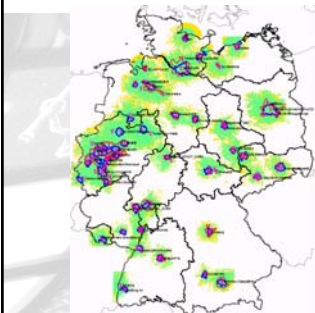


- 14 TV Services
 - H.264AVC CBR @ 256kbps
 - QVGA 320x240 @ 12.5fps
 - Audio HE-AAC @ 64kbps
- 6 Radio Services
 - HE-AACv2 @ 64kbps
- ESG Automatic
 - DVB-IPDC (CBMS)
 - BMC0 Profile 1
 - Bootstrapping
 - program plan import

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DvB-H Roll-out Planning Germany 2007



- Planning for the foreseen roll-out Q4/2007 has already been started
 - Based on population coverage
 - Network planning
 - Head-end/IPDC system
 - Contribution and distribution networks

portable outdoor reception		
Location	pop coverage	
probability	Million	%
> 95 %	40	49
> 70 %	46	57
< 70 %	36	43

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DvB-H Challenges



- **OMA BCAST** support (ESG, SCP)
- Interactivity
- Adaptation to the MNO infrastructures
- **Statistical Multiplex** on radio and TV services
- Roaming and handover
- Network planning **optimization**
- Network optimization (structure, GAP fillers)

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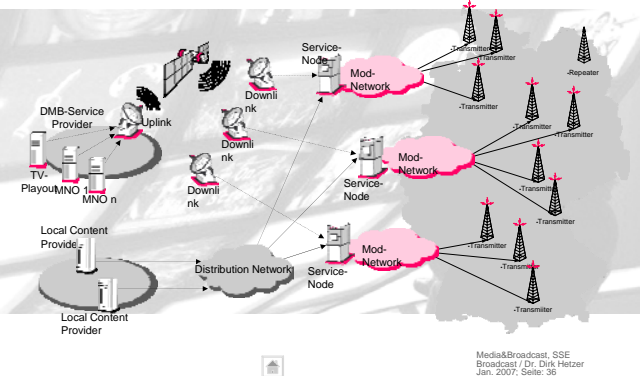


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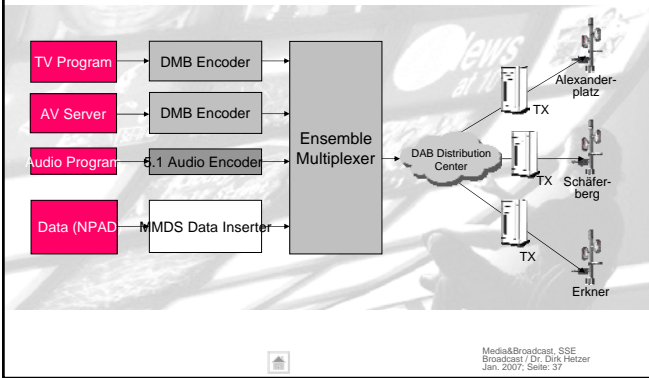
DMB System



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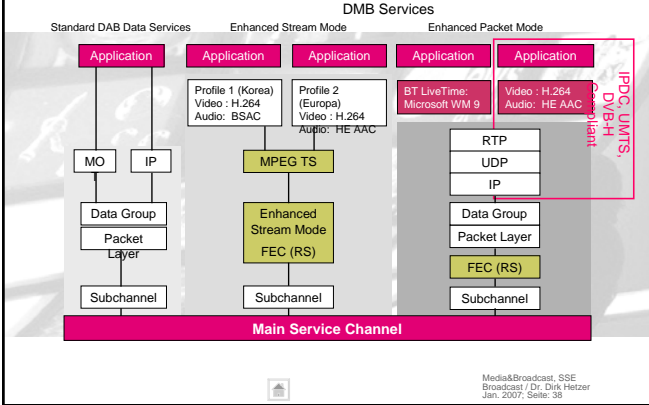
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DMB System Example IFA Berlin



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DAB / DMB Protocol



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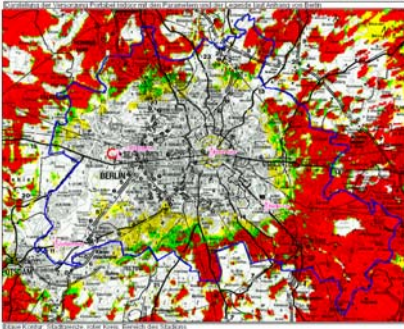
DMB Roll-out

City	Trans.	Mobile Usage		portabel indoor	
		City area		City area	
		Inhab.	area	Inhab.	area
Köln	2	966.223	401 km²	790.484	290 km²
Dortmund	3	582.462	277 km²	524.958	243 km²
Gelsenkirchen	3	278.100	103 km²	262.028	94 km²
Frankfurt	2	646.199	244 km²	563.464	202 km²
Hamburg	6	1.698.926	735 km²	1.378.689	589 km²
Hannover	2	513.497	204 km²	472.233	164 km²
Berlin	4	3.279.859	868 km²	2.026.556	538 km²
München	1	1.206.938	306 km²	818.057	214 km²
Nürnberg	1	485.332	179 km²	410.135	135 km²
Stuttgart	2	581.059	198 km²	497.006	157 km²
Kaiserslautern	2	96.698	110 km²	85.383	89 km²
Leipzig	3	491.685	298 km²	411.986	246 km²
total	31	10.826.978	3.903 km²	8.241.079	2.970 km²
percentage		13,1 %	1,1 %	10 %	0,8 %

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DMB Example Berlin L-Band



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DMB Example Mobile Terminal

Samsung SGH-P900

Gewicht: 124 g

Maße: 94,5x47,5x26,6 mm

Netze: TriBand - 900/1800/1900 MHz - Kein UMTS!

Display: 240x320 Pixel mit 262144 Farben

Besondere Funktionen:

- DAB- und DMB-Empfänger (derzeit nur L-Band) mit TV-Out für Anschluss an größere Bildschirme und Beamer
- Rekorderfunktion für DMB-Streams
- 128 MB Speicher intern und mittels MicroSD-Karte erweiterbar
- 2 Mega-Pixel Digital-Kamera
- MP3-Player
- MPEG-4- Videoplayer
- Organizer



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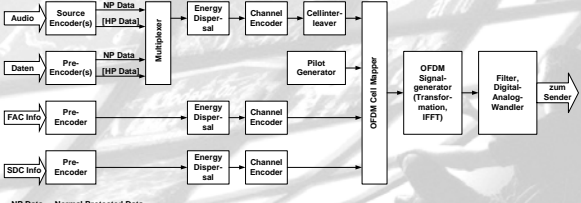
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Digital Broadcast Technologies DRM System



NP Data ... Normal Protected Data
HP Data ... High Protected Data

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Digital Broadcast Technologies DRM Transmission

OFDM- Parameter

Parameter	Robustness Mode			
	A	B	C	D
Tu [ms]	24	21 1/3	14 2/3	9 1/3
Tg [ms]	2 2/3	5 1/3	5 1/3	7 1/3
Ts = Tu + Tg [ms]	26 2/3	26 2/3	20	16 2/3

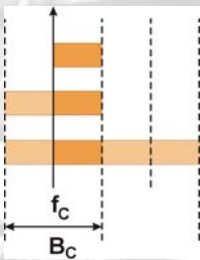
Tu ... used symbols
Tg ... guardinterval
Ts ... total symbols

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Digital Broadcast Technologies DRM Transmission

Mögliche Bandbreiten des DRM-Signals bei Kanalraster Bc von

- | | |
|--------------|---------------|
| 9 kHz | 10 kHz |
| 4,5 kHz | 5,0 kHz |
| 9,0 kHz | 10,0 kHz |
| 18,0 kHz | 20,0kHz |



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DRM Transmission Modus

- Mode A: Bodenwellenausbreitung mit geringem Fading (Standardmode für Lang- und Mittelwelle)
- Mode B: Zeit- und Frequenzselektive Kanäle (KW und Raumwellenausbreitung bei MW)
- Mode C: wie Mode B, aber für schneller veränderliche Kanäle
- Mode D: Höchste Robustheit für schnell veränderliche Kanäle mit langen Echolaufzeiten



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DRM Parameter

Parameter	LW/MW	KW normal	KW robust
B [kHz]	9,0	10,0	10,0
Mode	A	B	B
Modulation	64 QAM	64 QAM	16 QAM
PL	PL1	PL1	PL1
Datenrate [kBit/s]	23,6	21,0	14,6



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DRM Endsystems



Roberts MP40



Murphy Richards
→ pricing: 199€



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DRM+

- Erweiterung des DRM Systems für Band I und II (UKW)
- Kompatibel zum vorhandenen Kanalraster
- Basierend auf OFDM mit einer Bandbreite von 100kHz
- Schrittweise Einführung ist geplant (Sender für Sender)



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Summary

- DvB-T will generate a new digital period
- DvB-H / DMB as basis for mobile TV with interactive channels
- DRM / DRM+ / DAB as basis for digital radio
- DxB converging on IP core possible



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