Practical experience gained during the introduction of digital terrestrial television broadcasting (DTTB) in Germany

The switchover in Berlin-Brandenburg
The German TV Market

- 36.2 million TV households
- More than 25 channels in German language are distributed
- TV advertising turnover 7249 million EUR in 2002

The audience has the following choices:
- Terrestrial with 3 to 12 channels free to air
- Cable with more than 30 analogue and digital channels for a monthly cable fee of about 12 - 15 EUR
- Satellite with more than 35 free to air analogue and digital channels
- Additional Pay-TV offers, starting from 5 EUR per month
The Decline of Terrestrial Reception in Germany and Berlin / Brandenburg

Total costs for analogue terrestrial distribution: approx. 250 mill. EUR p.a.

Source: AFG/GfK Fernsehforschung, Methodenbericht und ARD
In total, more than 9000 TV broadcast stations are in operation in Germany:

- over 300 high power stations
- over 9000 low power stations

<table>
<thead>
<tr>
<th></th>
<th>Public broadcasters</th>
<th>Commercial broadcaster</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ARD</td>
<td>ZDF</td>
</tr>
<tr>
<td>High power stations</td>
<td>94</td>
<td>104</td>
</tr>
<tr>
<td>Low Power stations</td>
<td>2821</td>
<td>2869</td>
</tr>
<tr>
<td>Coverage of population [%]</td>
<td>99.3</td>
<td>98.9</td>
</tr>
</tbody>
</table>

Source: IDR 2000
### Project North Germany
- Cooperation between the Media Institutes, the Technical University of Braunschweig, NDR, ZDF, RB and Deutsche Telekom
- 26 transmitters, MFN, 2k FFT
- Multi Media Mobile M³ Presentation during Expo 2000
- Data Broadcast Applications, e.g. Internet Push Services with telematics and tourist information

### Project Berlin
- Cooperation between MABB / GARV, Deutsche Telekom and SFB
- 6 DVB-T networks for Berlin in trial operation with 20 TV programmes, 2k and 8k
- Data Broadcast Applications
- Market research in 1999

### Project North Rhine-Westphalia
- Cooperation between RTL, SAT1, VOX, VIVA and Deutsche Telekom
- MFN 2k FFT, SFN repeater
- Mobile reception
- Statistical multiplex
- Market research 1999
- Trial operation suspended end of 2000
- VHF trial network operated by WDR

### Project Saxony
- Cooperation between SLM and Deutsche Telekom
- Local programme distribution
- Multiplex management
- Trial operation suspended end of 2000

### Project Bavaria
- Cooperation between IRT, BMT, BR, R&S and Deutsche Telekom
- SFN – field trials
Launch Scenario 2000
Recommendations Concerning DTTB

The “Digital Broadcasting” Initiative on the digitisation of radio and television recommended:

- The analogue TV transmission should end as soon as possible, at the latest in 2010
- The simulcast phase must be kept as short as possible
- Portable indoor reception is to be made possible right from the beginning - albeit not necessarily in rural areas
- From the beginning at least 12 programme equivalents, later at least 20
- A picture quality comparable to PAL
- Starting digitisation in regions (islands) with high population density
- Successive increase of the number of DTTB islands
- The islands and the right moment for the switchover are identified by the Länder (Federal States)
Intention of Germany for the Nation-wide DTTB Coverage after the RRC 04/06

Full area coverage of the whole country with (at least) 6 DVB-T networks:

■ 3 coverages intended for public broadcasters
■ 3 coverages intended for commercial broadcasters

with following intended structures

■ 1 nation-wide, federal state boundaries have **not** to be respected (e.g. ZDF)
■ 4 nation-wide, federal state boundaries have to be respected (ARD, 3 x commercial)
■ 1 nation-wide, federal state boundaries have to be respected, regional (ARD 3)
Possible structure of the layer for the public broadcaster ZDF
Possible structure of a layer for commercial broadcasters or for the public broadcaster ARD
Possible structure of the layer for the regional public broadcaster (ARD 3)
The Switchover - Island by Island
Forced Switch Off after a Short Simulcast

Independent start of DTTB in areas (islands) with a high density of population

Switch off of all analogue TV transmitters in the identified DTTB island after a short simulcast phase (6 -12 months)

Coverage of the whole country
Density of Population in Germany

This map gives an example of possible DTTB islands in Germany, investigation 1999

- 16 areas with a high density of population
- 32 million potential viewers
- 39% of the population of Germany
Planned DTTB Islands in Germany

This map gives an up-to-date overview of planned DTTB islands in Germany

Next region Cologne-Bonn will start in summer 2004

- In operation since November 2002
- Starting from 2004 until 2005 or 2006

Source: DVB-T-Projekte and IDR-BNA
Bayerische Medien Technik, www.bmt-online.de
Berlin Goes Digital

February 13, 2002:
The agreement between the media law authority of Berlin-Brandenburg (mabb), the public broadcasters ARD, ORB, SFB and ZDF and the commercial broadcasters ProSiebenSAT.1 Media AG and RTL Television on the switchover to DTTB in Berlin and Potsdam is signed.

By the summer of 2003, television broadcasts in the Berlin/Potsdam area will switch completely from analogue to digital transmission. A Memorandum of Understanding to this effect was signed by ARD, ORB, SFB, ZDF, ProSiebenSAT.1 Media AG, RTL Television and the Berlin-Brandenburg regulatory authority for commercial broadcasting (NNVRB) on 23 February 2002, making the German capital the first area in Germany to undergo this switchover.

Digital terrestrial television (DVB-T) will take over completely from the traditional analogue terrestrial TV transmission under a decision taken by the German federal government on 25 August 1998. This was based on a recommendation tabled by the Digital Broadcasting Working Group (DRG), fixing the maximum period for switchover to 2006 at the latest.

More programmes, new services, reception everywhere

The switchover to digital terrestrial television will bring the following benefits to all audiences: Many services currently available only via cable or satellite, including Profiles, Regional, Super RTL, Kabel 1 or N24 will then be seen their first terrestrial transmission. Furthermore, new digital services offered by the broadcasters will also be available, e.g., ZDFmediathek and ZDFinfo.

A further advantage linked with cable viewers will not have to meet any additional costs, nor will they need to carry out any defensive installations as is the case with satellite reception. As a rule, a small red aerial will be sufficient for high-quality reception of television images.

Digitization of terrestrial transmission is a preconition for the development and distribution of new services, thanks to digitization, portable reception with portable receivers and even mobile reception in cars, buses and trains will be possible. Additional services accompanying television, e.g., an electronic programme guide, may also be offered.

Terrestrial television transmitters to be switched over to digital technology

If the viewers who will benefit above all from the switchover of terrestrial transmission to digital technology. The third stage of transmissions alongside cable and satellite will then continue to be open for all. Viewers who have so far not opted for satellite or cable, currently receive services via analogue transmitters. Following the beginning of pilot transmissions, which commenced in 1999 in the Berlin-Potsdam region, high-performance transmitters, they will receive up to 20 television services anywhere in the coverage area. All programmes and services will be available to the homes without the need for an additional aerial or GNT system.

The Memorandum of Understanding is signed
DTTB in Berlin and the City of Potsdam
A New TV Age Begun

Launch Ceremony on October 31, 2002 with the managing directors of the public broadcasting corporations, the association of private broadcasters and the media law authority of Berlin-Brandenburg

- Two SFN networks cover Berlin and the city Potsdam in portable indoor quality, distributing 8 TV programmes.
DTTB in Berlin and the City of Potsdam
The Network Structure

Scholzplatz
Channels 5, 7, 27

Schäferberg
Channels 25, 27, 33, 44, 56
Channels 5, 7 since August 2003

Alexanderplatz
Channels 5, 7, 25, 27, 33, 44, 56

Play-out centre

(Frohnau)
planned

(Rüdersdorf)
planned

Deutsche Telekom AG, TSI Media&Broadcast, Matthias Georgi
BR Information Meeting on RRC-04/05, Geneva 2003, Page 16
DTTB in Berlin and the City of Potsdam
Prediction of the Coverage Area

Channel 5, SFN
16 QAM, FEC 3/4, 1/8 GI

Coverage target
indoor, outdoor and fixed location probability 95%

Transmitter sites
Alexanderplatz 10 kW e.r.p.
Scholzplatz 10 kW e.r.p.
DTTB in Berlin and the City of Potsdam
Prediction of the Coverage Area

Channel 44, SFN
16 QAM, FEC 2/3, 1/8 GI

Coverage target
indoor, outdoor and fixed location probability 95 %

Transmitter sites
Alexanderplatz 120 kW e.r.p.
Schäferberg 50 kW e.r.p.

Portable indoor reception
Portable outdoor reception
Fixed antenna reception
DTTB in Berlin and the City of Potsdam
Conversion from Analogue to Digital

Channel

<table>
<thead>
<tr>
<th>e.r.p. [kW]</th>
<th>Analogue transmitters</th>
<th>Digital transmitters converted from analogue</th>
</tr>
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<tbody>
<tr>
<td>*planned</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>110</td>
<td>50, 30, 30</td>
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<tr>
<td>25</td>
<td>250</td>
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<td>27</td>
<td>120</td>
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<td>33</td>
<td>280</td>
<td>50, 30, 30, 30</td>
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<td>39</td>
<td>120</td>
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<td>44</td>
<td>120</td>
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<td>56</td>
<td>110</td>
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<tr>
<td>65</td>
<td>100</td>
<td>50, 30, 30, 30, 30</td>
</tr>
</tbody>
</table>
## DTTB in Berlin and the City of Potsdam
The Switchover from Analogue to Digital

### Chart:

<table>
<thead>
<tr>
<th>Channel</th>
<th>Description</th>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>05</td>
<td>ARD/ZDF/ORB/SFB</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
</tr>
<tr>
<td>07</td>
<td>Das Erste</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
</tr>
<tr>
<td>22</td>
<td>FAB</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
</tr>
<tr>
<td>25</td>
<td>SAT.1</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
</tr>
<tr>
<td>27</td>
<td>ORB</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
</tr>
<tr>
<td>29</td>
<td>VOX</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
</tr>
<tr>
<td>33</td>
<td>ZDF</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
</tr>
<tr>
<td>39</td>
<td>SFB/B1</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
</tr>
<tr>
<td>41</td>
<td>BBC</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
</tr>
<tr>
<td>44</td>
<td>ProSieben/SAT.1/RTL/RTL2</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
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<tr>
<td>47</td>
<td>ProSieben-Simulcast</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
</tr>
<tr>
<td>51</td>
<td>RTL2-Simulcast</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
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<tr>
<td>56</td>
<td>RTL</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
</tr>
<tr>
<td>65</td>
<td>TV-Mux</td>
<td>1.11.2002</td>
<td>3.02.2003</td>
</tr>
</tbody>
</table>

- = analogue
- = No analogue service or reduced e.r.p.
- = digital

X = Channel no longer in use

Monday, 04.08.2003
DTTB in Berlin and the City of Potsdam
Technical Parameters of the Networks

<table>
<thead>
<tr>
<th>Channel Frequency</th>
<th>5 177.5 MHz</th>
<th>7 191.5 MHz</th>
<th>25 506 MHz</th>
<th>27 522 MHz</th>
<th>33 570 MHz</th>
<th>44 658 MHz</th>
<th>56 754 MHz</th>
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</thead>
<tbody>
<tr>
<td>Transmitter sites</td>
<td>Alexanderplatz</td>
<td>Alexanderplatz</td>
<td>Alexanderplatz</td>
<td>Alexanderplatz</td>
<td>Alexanderplatz</td>
<td>Alexanderplatz</td>
<td>Alexanderplatz</td>
</tr>
<tr>
<td>e.r.p. polarisation*</td>
<td>10 kW Schäferberg 5kW -V Scholzplatz 10 kW</td>
<td>10 kW Schäferberg 5kW -V Scholzplatz 10 kW</td>
<td>20 kW Schäferberg 50 kW</td>
<td>120 kW Schäferberg 50 kW</td>
<td>120 kW Schäferberg 50 kW</td>
<td>10 kW Schäferberg 20 kW</td>
<td></td>
</tr>
<tr>
<td>Modulation</td>
<td>16-QAM</td>
<td>16-QAM</td>
<td>16-QAM</td>
<td>16-QAM</td>
<td>16-QAM</td>
<td>16-QAM</td>
<td>16-QAM</td>
</tr>
<tr>
<td>Code rate</td>
<td>3/4</td>
<td>2/3</td>
<td>2/3</td>
<td>2/3</td>
<td>2/3</td>
<td>2/3</td>
<td>2/3</td>
</tr>
<tr>
<td>Guard interval</td>
<td>1/8</td>
<td>1/8</td>
<td>1/8</td>
<td>1/8</td>
<td>1/8</td>
<td>1/8</td>
<td>1/8</td>
</tr>
<tr>
<td>Net bit rate [Mbit/s]</td>
<td>14,51</td>
<td>12,90</td>
<td>14,75</td>
<td>14,75</td>
<td>14,75</td>
<td>14,75</td>
<td>14,75</td>
</tr>
</tbody>
</table>

* if not indicated horizontal polarisation, V means vertical polarisation
DTTB in Berlin and the City of Potsdam
TV Programmes Channel by Channel

<table>
<thead>
<tr>
<th>5</th>
<th>7</th>
<th>25</th>
<th>27</th>
<th>33</th>
<th>44</th>
<th>56</th>
</tr>
</thead>
<tbody>
<tr>
<td>BBC WORLD</td>
<td>mdr Fernsehen</td>
<td>RTL</td>
<td>Das Erste</td>
<td>ZDF</td>
<td>SAT1</td>
<td>EURO SPORT</td>
</tr>
<tr>
<td>FAB</td>
<td>NDR</td>
<td>RTL</td>
<td>RBB BERLIN</td>
<td>3sat</td>
<td>7</td>
<td>ProSieben</td>
</tr>
<tr>
<td>WDR Fernsehen</td>
<td>arte</td>
<td>super</td>
<td>RBB BRANDENBURG</td>
<td>K+KA</td>
<td>Kabel 1</td>
<td>DSF</td>
</tr>
<tr>
<td>SÜDWEST Fernsehen</td>
<td>VOX</td>
<td>PHOENIX</td>
<td>ZDF.digitext</td>
<td>N24</td>
<td>Live</td>
<td></td>
</tr>
</tbody>
</table>
DTTB in Berlin and the City of Potsdam
First Results

- No serious handling and reception complaints
- Approx. 180,000 set-top boxes sold until end of August
- Over 30 different receiver types are on the market
- Positive press feedback
- Coverage prediction corresponds very well with the results gained by measurements
- Mobile reception is possible with DVB-T in an SFN with an 16-QAM 8k-system
DTTB in Berlin and the City of Potsdam
Development of Sales of Set-top Boxes

Number of sold set-top boxes

0  40 000  100 000  136 400  170 000
01.11.02  31.12.02  28.02.03  30.04.03  30.07.03

DTTB in Berlin and the City of Potsdam
First Experiences

- The transition from perfect reception to no reception is very rapid. Customers do not understand that.

- The receiving and handling quality of the set-top boxes varies widely

- The quality of antennae for portable reception is not very satisfactory

- Impulsive noise seems to be a problem in the case of portable indoor reception, especially in the VHF-Band

- The analogue Video Programming System (VPS) can not be used with existing analogue video recorders
**DTTB in Berlin and the City of Potsdam**

**Conclusion**

The launch of DTTB in Berlin has proven that:

- The switchover took place at the right time
- There is a market for DTTB, even if cable and satellite market share is big
- The island concept - forced switch off combined with extremely short simulcast phase for a few selected programmes - has proven as an adequate approach for the introduction of DTTB especially in areas with congested spectrum usage
- The technology is mature
  - from the receiver perspective (reliable, reasonable prices)
  - from a network operators perspective (coverage prediction, switch over of transmitter networks, SFN management)

Without a fast switchover DTTB in Germany would have no chance of being accepted by consumers and broadcasters
Additional Information

- General information: www.bmwi.de
- Launch Scenario 2000*: www.bmwi.de
- Special information: www.ueberall-tv.de
- Berlin - Brandenburg: www.garv.de
- Bavaria: www.bmt-online.de
- Northern Germany: www.dvb-t-nord.de
- Middle Germany: www.digitalerrundfunk.de
- North Rhine-Westphalia: www.lfm-nrw.de
- Baden-Württemberg: www.lfk.de
- T-Systems*: www.t-systems-mediabroadcast.com

* Information in English language available

Please use the embedded hyperlinks above.
DVB-T: The Everywhere Television

Thank you for your kind attention!

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