

Digital Television Laboratory and Field Test Results - Brazil

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FES/ITU/URTNA SYMPOSIUM
ON NEW TV BROADCASTING TECHNOLOGIES FOR AFRICA

Facts - Brazil

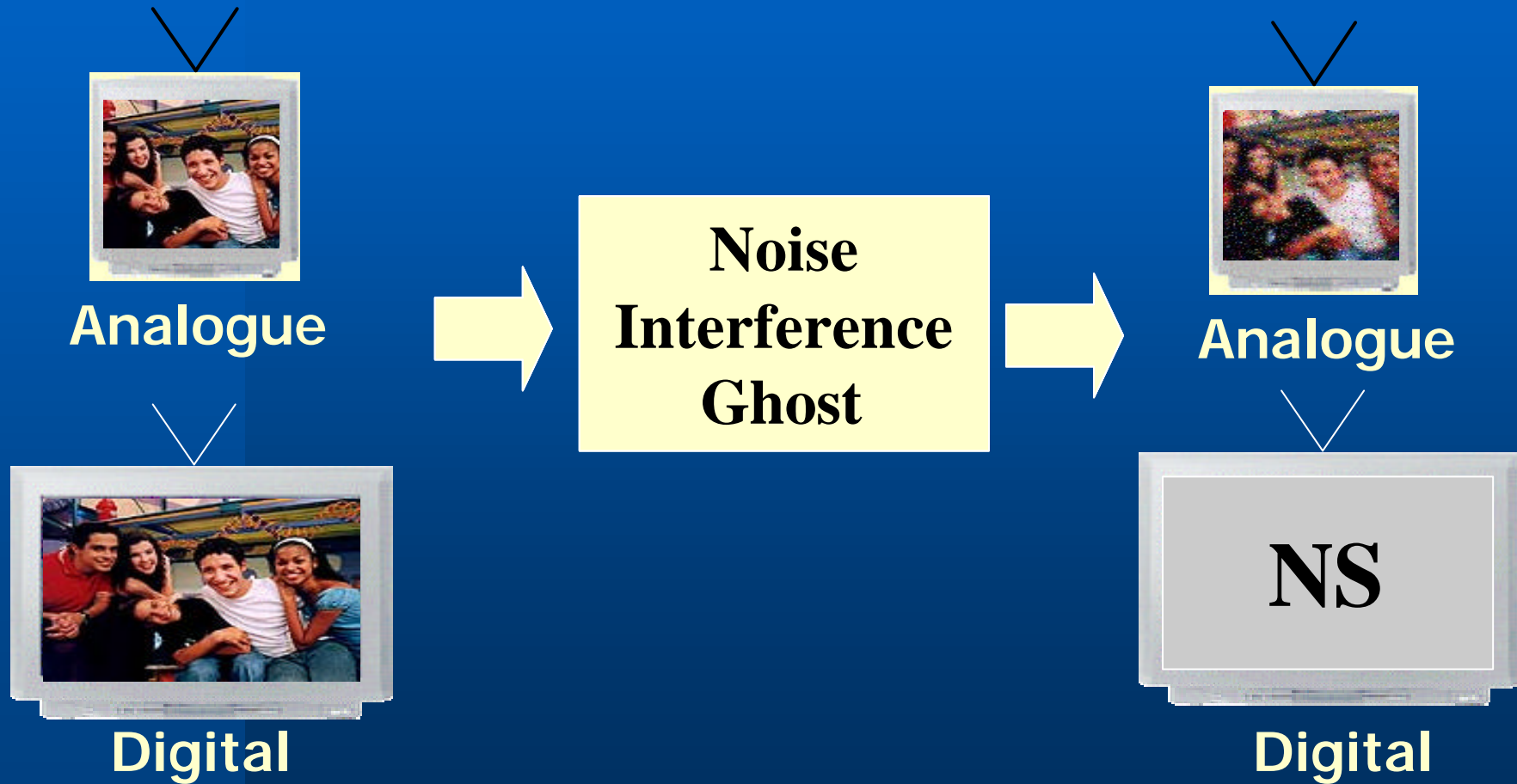
- 160 Million people
- GNP US\$ 800 Billion (1998)
- 37 Million TV Households
- 7 % Cable Penetration
- 95% Off The Air Reception
- 1999 sales TV Sets – 4 Millions
 - 1996 sales – 9 Millions
- Unique distribution of people in large cities
 - São Paulo City
 - 10.2 Million people
 - 3.2 Million TV households
 - 5,4 Million Automobiles



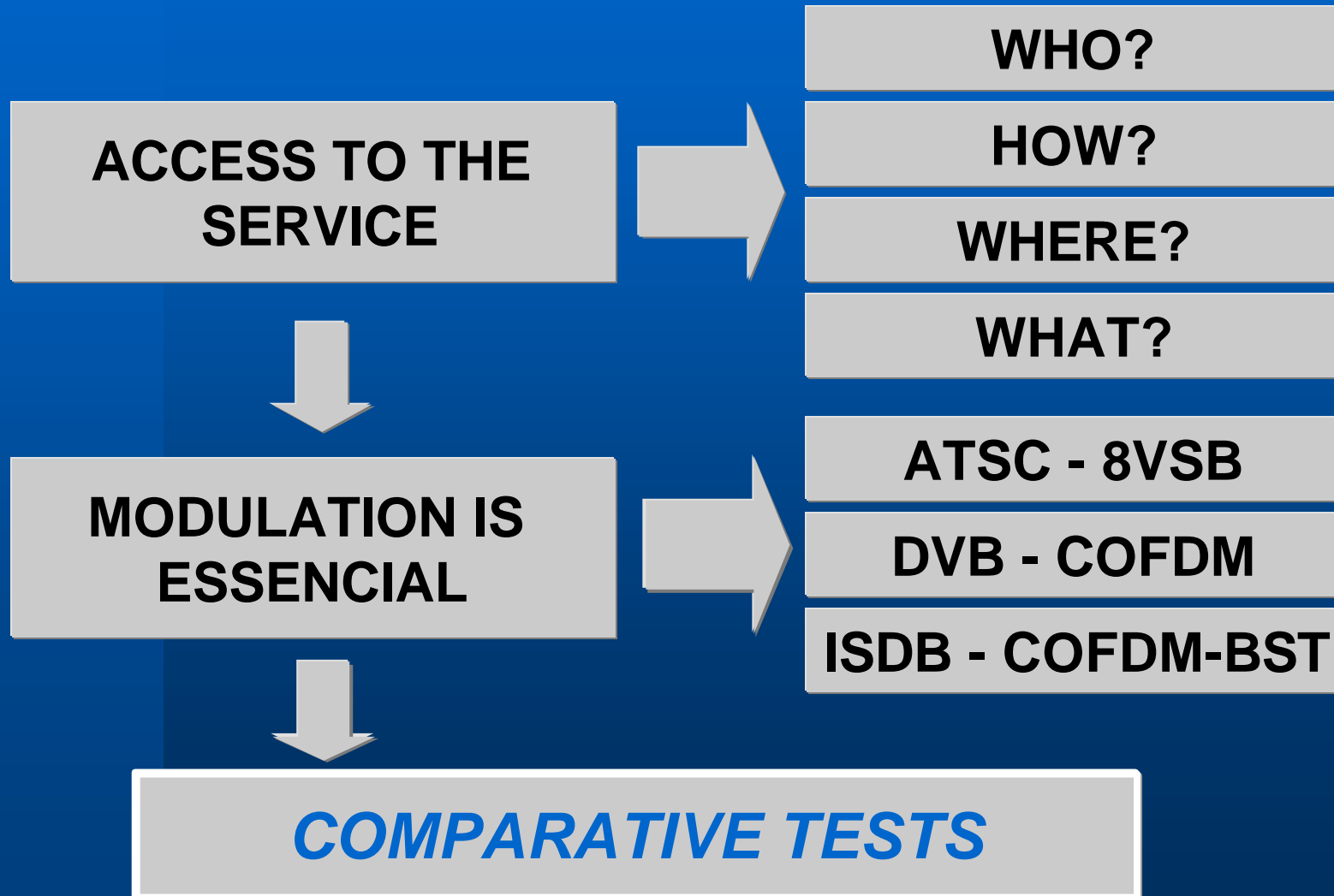
ABERT/SET Group

- In 1994 a joint study group was formed by TV Stations, Universities, Research Centers and Industry Engineers.
- In 1998 the Telecommunications Agency of the Brazilian Government (ANATEL) issued a public consultation for Digital Terrestrial TV Tests.
- From October 1999 to April 2000 the ABERT SET Group conducted the test in São Paulo City, under supervision of ANATEL.

Introduction



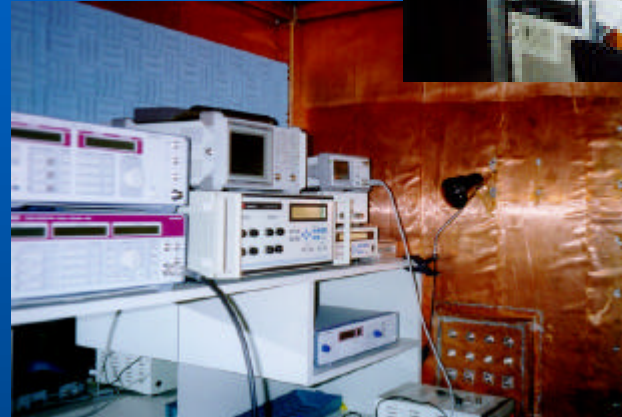
Introduction



Laboratory and Field Tests

Laboratory Tests

- Evaluation of C/N
- Impulse noise
- Multipath
 - Static multipath
 - Multiple echoes
 - Doppler effect
- Interference
- Peak-to-average ratio
- Mobile Reception Simulation



Laboratory Tests

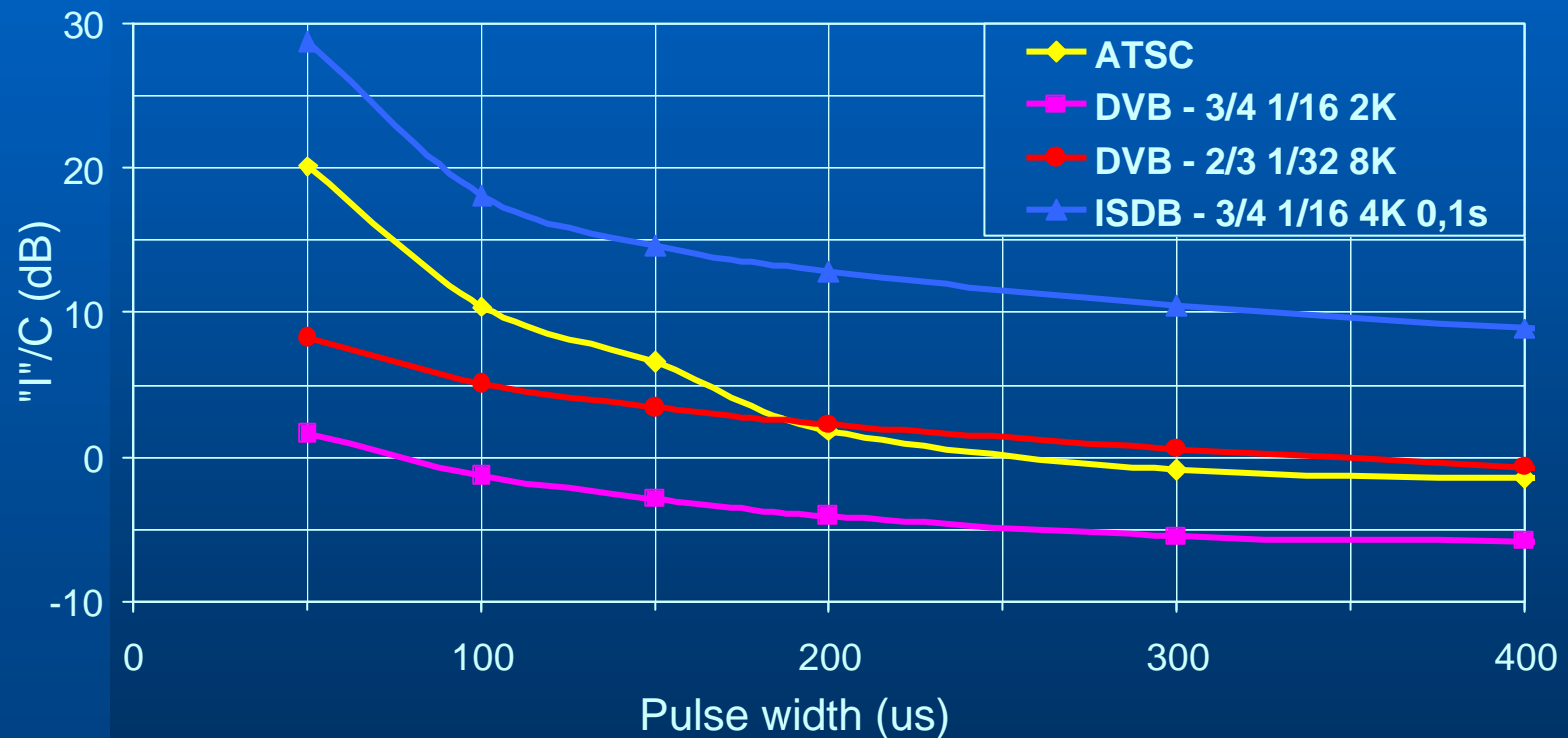
Basic Configurations

	ATSC	DVB-2K	DVB-8K	ISDB-4K
Modulation	8VSB	COFDM	COFDM	COFDM-BST
Pay Load (Mbps)	19,39	19,75	18,06	19,33
FEC	2/3	3/4	2/3	3/4
Guard Interval	-	1/16	1/32	1/16
FFT	-	2k	8k	4k
Time Interleaver	-	-	-	0,1s

Laboratory Tests - Results

Impulse Noise

Interference to carrier ratio as a function of the noise pulse width

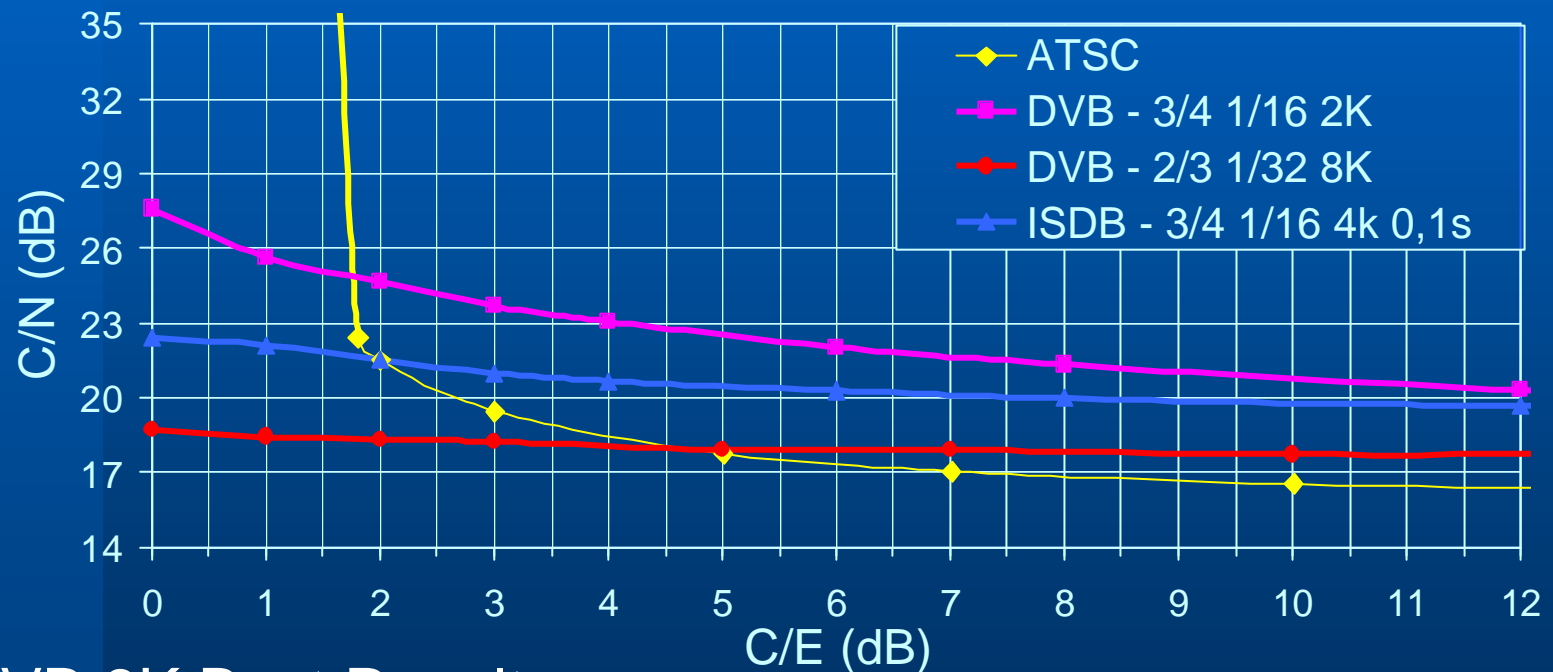


- ISDB 4K – Best Results (Time Interleaving)
- DVB 8K Better than DVB 2K (5dB)

Laboratory Tests - Results

Multipath

Carrier to noise ratio as a function of the carrier to echo ratio
Comparison for post-echo = 8us

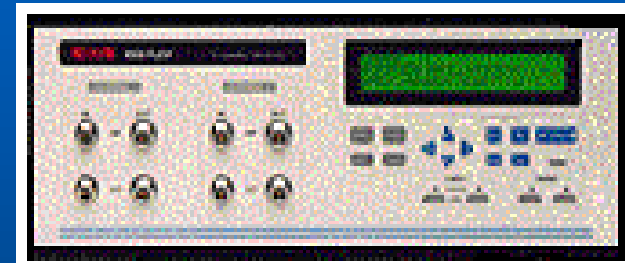


- DVB 8K Best Result
- OFDM results are function of FEC and Receiver implementation

Laboratory Tests

Mobile Reception Simulation

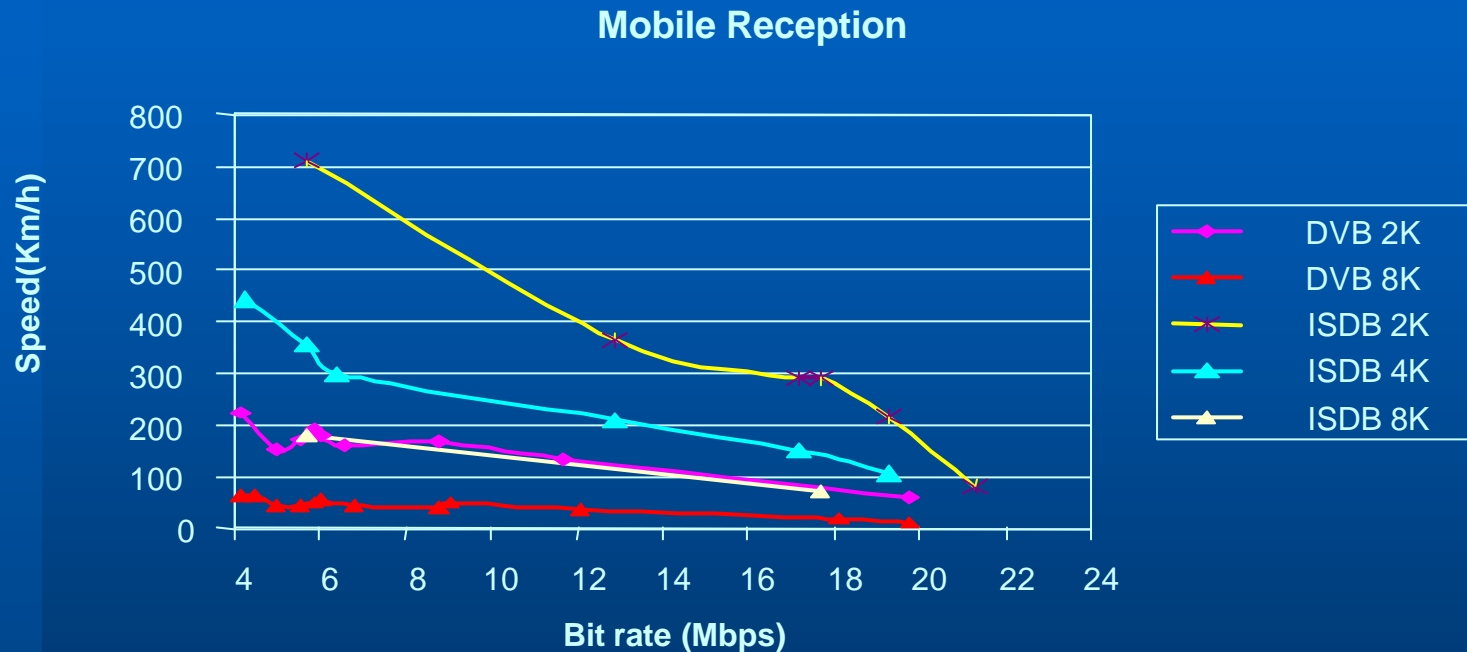
- Set up of the RF Channel Emulator
- Typical urban
- TAS 4500



Path	1	2	3	4	5	6
Relative Delay (us)	0	0.2	0.5	1.6	2.3	5
Modulation Type	Rayleigh					
Relative Loss (dB)	3	0	2	6	8	10
Fading Power Spectrum	Classical 6dB					

Laboratory Tests - Results

Mobile Reception Simulation



- ATSC did not work at 1.8 km/h
- Number of carriers is a key performance factor
- ISDB 4K has similar performance to the DVB 2K
- DVB 8K only portable Rx.

Field Tests



- **TX**

- UHF Channel 34 (593 MHz)
- 2,5 KW (Average) Digital TX
- HAAT ~ 150m
- 12 KW ERP

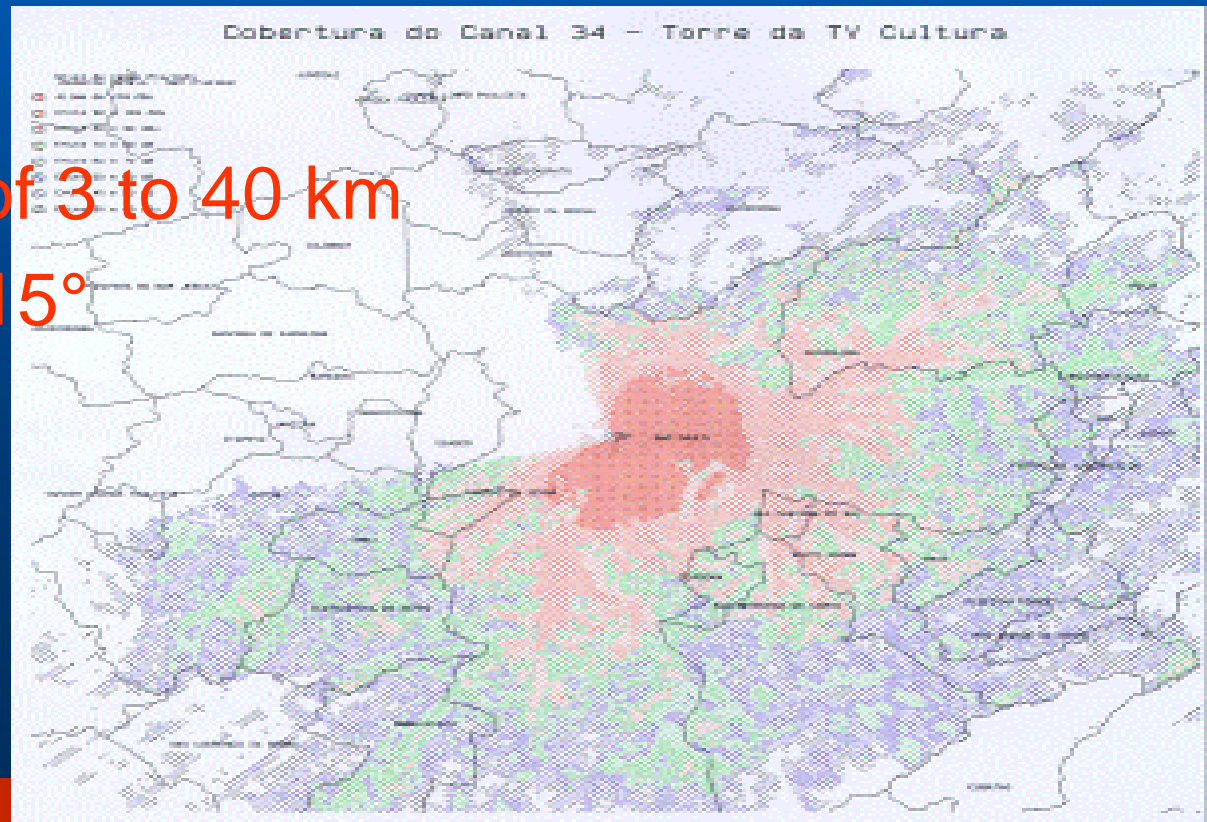
Field Tests

- Coverage
- Indoor reception
- Gap-filler (On Channel Repeater)
- Mobile Reception



Field Tests

- 7 months of tests
- More than 1000 Measurements
- 127 points
 - Distances of 3 to 40 km
 - Radials of 15°

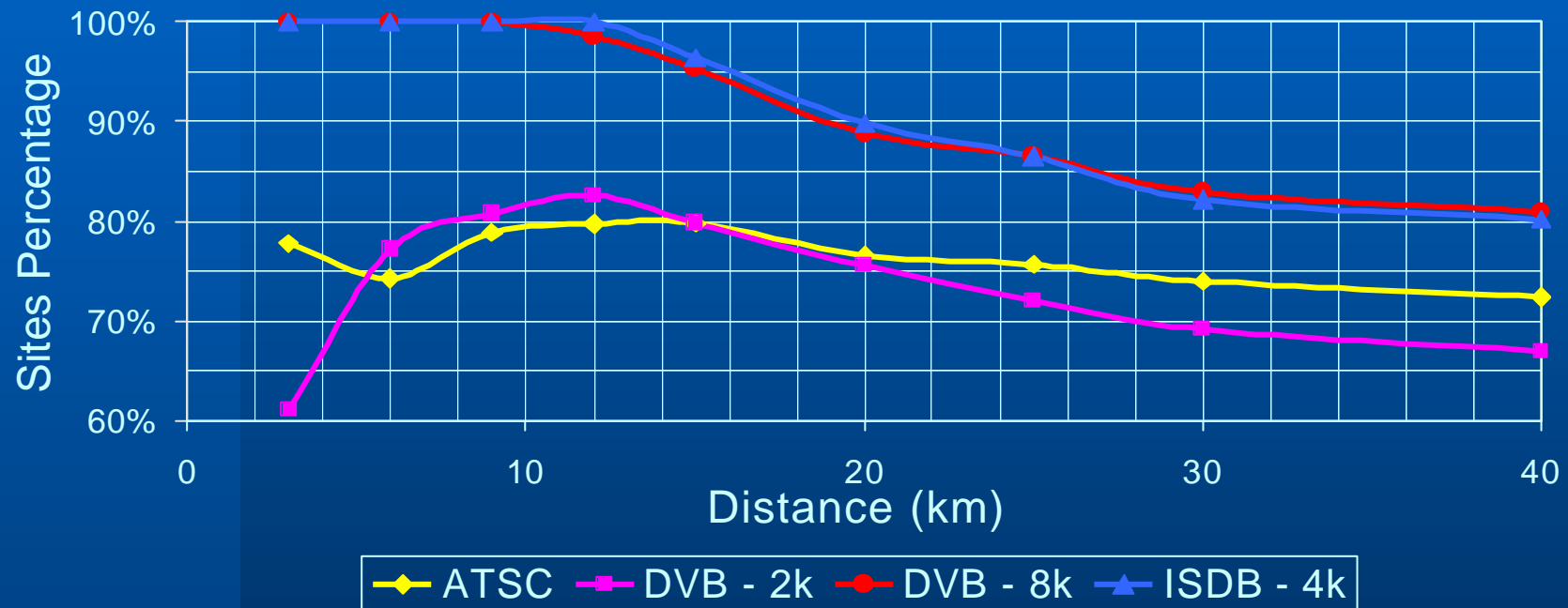


Field Test – Results

Coverage

Successful Reception Percentage -

Cumulative function - Criteria: Margin - $F(50,90) > 0$ and Errors < 5

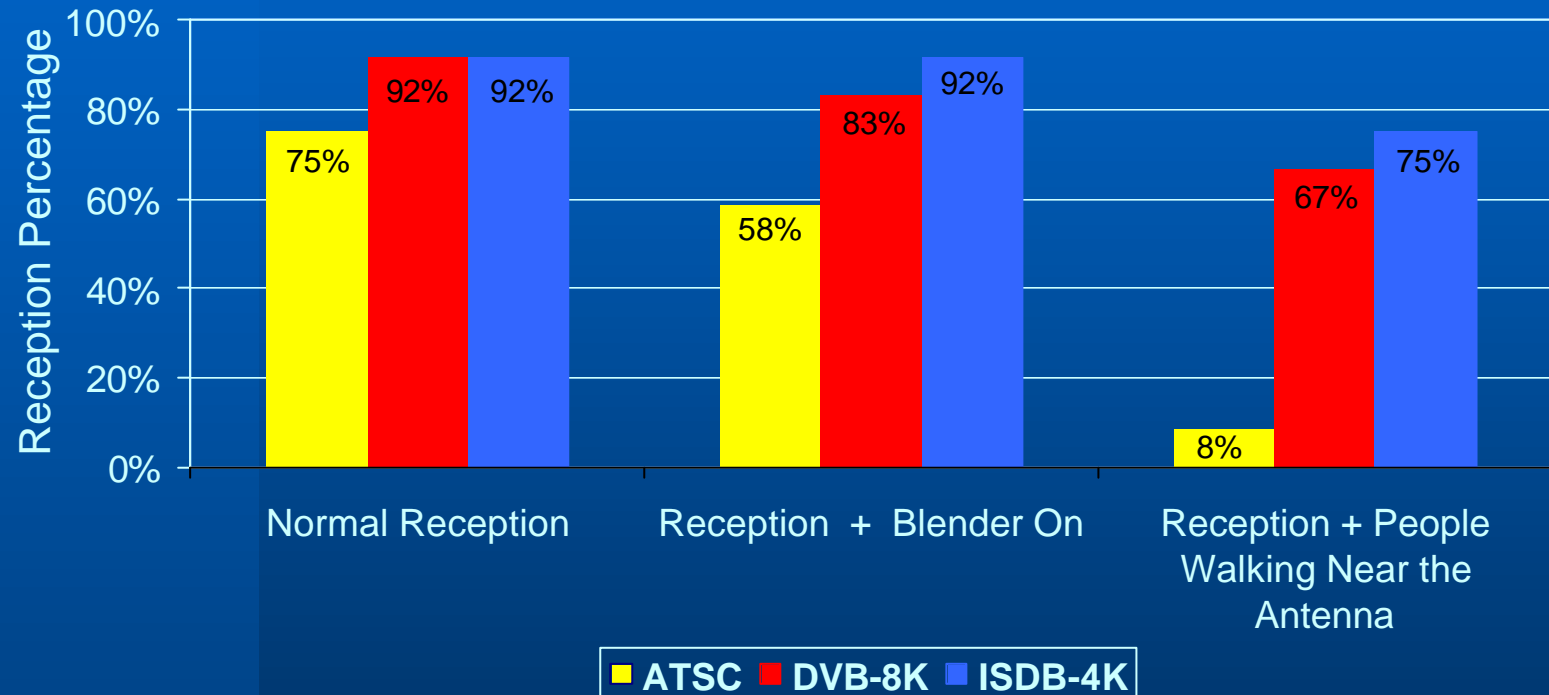


- DVB 8K similar to ISDB 4K
- ATSC similar to DVB 2K (inadequate)
- ISDB 4K Higher Payload (+1.2 Mbps)

Field Test – Results

Indoor

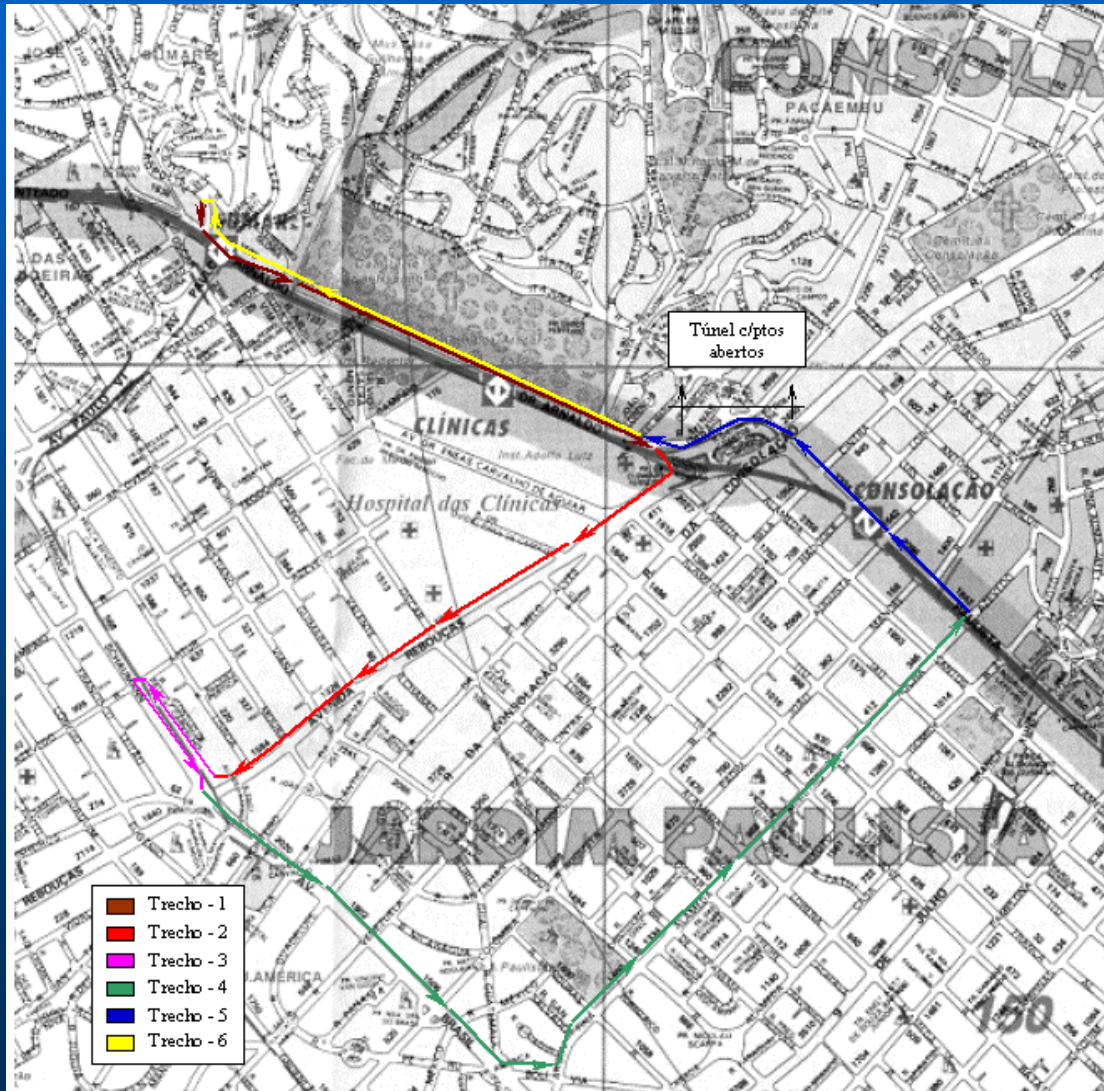
Indoor Reception Results



- Only in sites with a good outdoor Rx. margin
- ISDB similar to DVB 8k
- ATSC Inadequate

Field Test – Results

Mobile Rx



- 10 km route within 6 km radius of the TX.
- The chosen route has a high diversity of urban environments.

Field Test – Results

Mobile Rx

<i>System configuration</i>	<i>PAYLOAD (Mbps)</i>	<i>Number of Failures</i>
<i>ATSC</i>	<i>19.39</i>	<i>Unfeasible</i>
<i>DVB-2K</i>	<i>4.39</i>	<i>1</i>
<i>DVB-2K</i>	<i>5.85</i>	<i>Many</i>
<i>DVB-8K</i>	<i>4.52</i>	<i>Many</i>
<i>ISDB-2K</i>	<i>11.45</i>	<i>0</i>
<i>ISDB-4K</i>	<i>11.45</i>	<i>0</i>

- ATSC unfeasible
- DVB 8K unfeasible

Digital Broadcasting in Brazil

HDTV



SOCCER



MOVIE

- **New experience in watching TV**
- **Guarantee competitiveness for broadcasters on the internal and external market**

Mobile and Portable Reception

“Any time Anywhere”

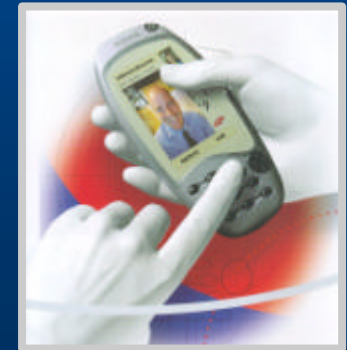
Mobile

(not necessarily portable)



Portable

(must also be mobile)



Convergence Model



Business Model

HDTV or
Multiple
Programs

MOBILE

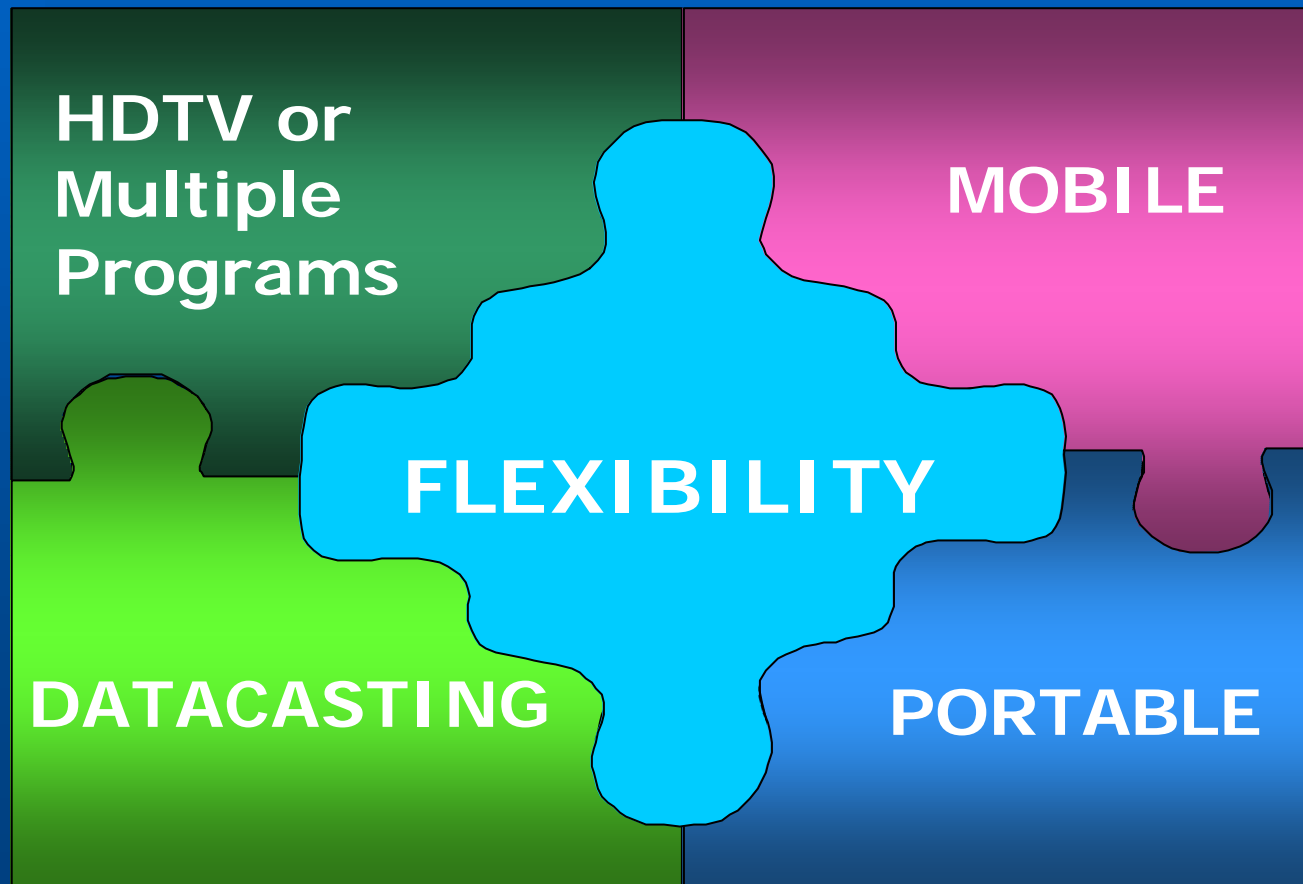
**ABERT/SET
MODEL**

DATACASTING

PORTABLE



ABERT/SET Business Model



Business model x DTV Standard

	<i>ATSC</i>	<i>DVB-T</i>	<i>ISDB-T</i>
<i>Fixed Rx</i>	Poor performance	Good performance	Best performance
<i>Mobile Rx</i>	-	Poor performance	Best performance
<i>HDTV Fixed Rx</i> <i>SDTV Mobile Rx</i>	-	Poor performance	Best performance

Digital Broadcasting in Brazil

- Brazilian participation on ISDB-T
- Brazilian participation on research
- Technological support to DTV implementation in Brazil
- Education and training of Brazilian people
- Access to the technology licensing
- Non-discriminatory royalties
- Adequate provision of electronic components

Thank you for your attention

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