CERD Bratislava

26-27 March 2007

DVB-H Receiver Quality and its effect on Network Cost

DiBcom

The Heart of Mobile TV

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Outline

- **DiBcom, the Heart of Mobile TV**
- DVB-H in the world
- DVB-H receiver Quality and its effect on Network Cost
- Conclusion

Six years of leading innovation in Mobile TV Markets

Our Mission

The Leading Provider of High-performance, Low-cost, Low-power IC solutions to the Fast-Growing Mobile TV Industry

Automobile
(mobility)

Laptops/PCs
(mobility/ portability)

Portable LCD TV
(portability)

Cell Phones
(mobility)

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The Heart of Mobile TV

2000

2006

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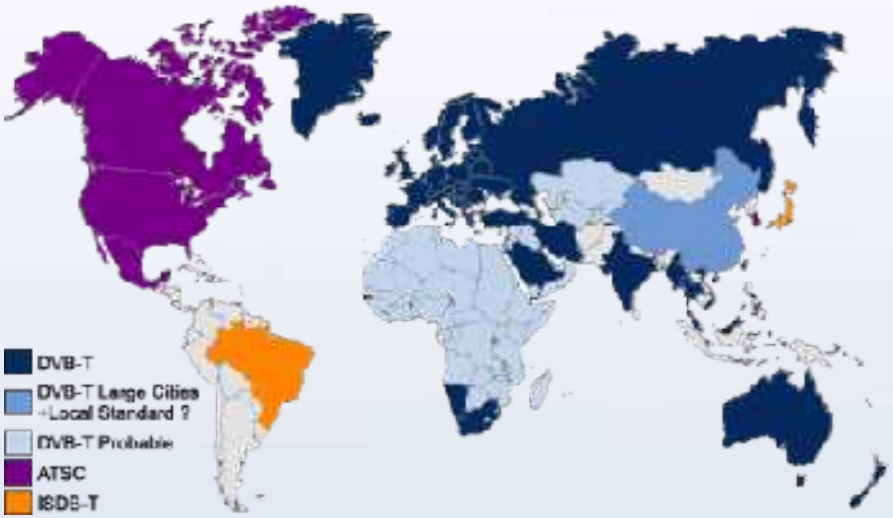
DVB-T & DVB-H: 250m people today, 500m by 2008

DVB-T Commercial Service On-Air in 2005

- Covers more than 240 million people
- 20-40 channels available
- Europe: UK, Germany, France, Italy,
- Spain, Sweden, Netherland, Finland, Norway
- Asia: Taiwan, 18 cities in China, Australia

- **DiBcom sold more than 3M units in DVB-T in '06**



DVB-H technology launched in 2006 in Europe, the US and Asia

- USA city coverage starts as of 2006 with Modeo and HiWire
- 500 K customers in italy
- DVB-H is a new opportunity to allocate specific spectrum for mobile TV
- Simple transition from DVB-T to DVB-H
- **DiBcom sold more than 1.4M units in DVB-H in '06**

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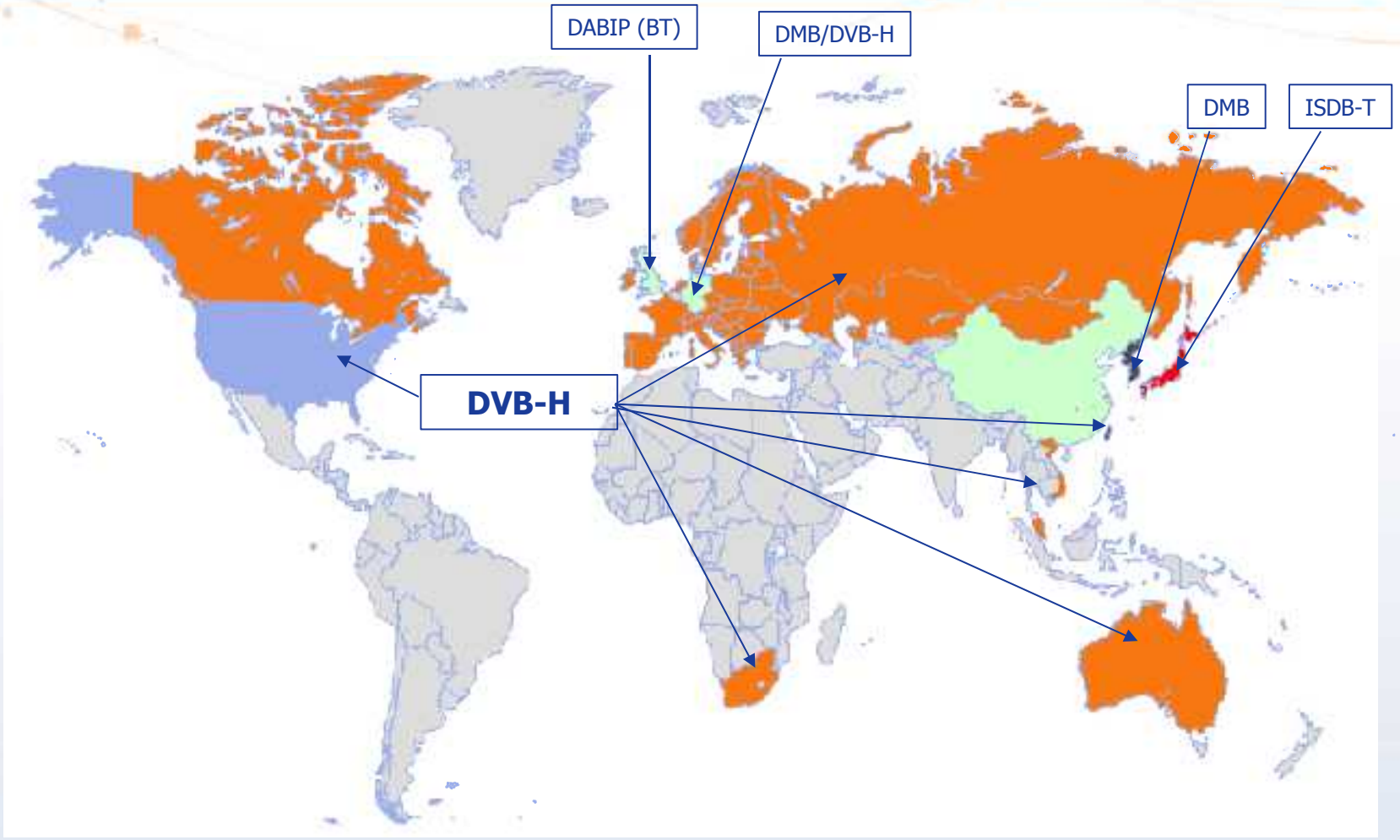
The end of narrowband … DVB-H dominating, +DVB-SH tomorrow



DVB-H / DVB-SH

DVB-H/MediaFlo

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DVB-H launch in 2007 in Europe

Source: Alcatel

2006 Availability

2007 Availability

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Mobile TV in the United States 2006-2007

- Modeo has acquired a license to broadcast DVB-H nationwide at 1.672 GHz. DVB-H can use different frequencies such as UHF, L-Band and higher.
- First mobile phone at 1.672 GHz developed by HTC for Modeo
- Hiwire (Aloha Partners subsidiary) owns licenses for 2 UHF channels per market providing 12 MHZ of spectrum for DVB-H. Plans to launch commercial services in 2007

DVB-H Cell Phones with DiBcom inside

HTC, Modeo, U.S.A.

SAGEM
My Mobile TV,
Trials Paris, France

LG U900
H3G in Italy

SAMSUNG
H3G, TIM in Italy

NEW :SAGEM Communication
Trials in Paris, France
TIM, Italy; South-Africa

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Benefits of DiBcom "Proven Performance" DVB-H receivers

DiB7070-H

(with integrated Silicon Tuner)

DiB9080-H

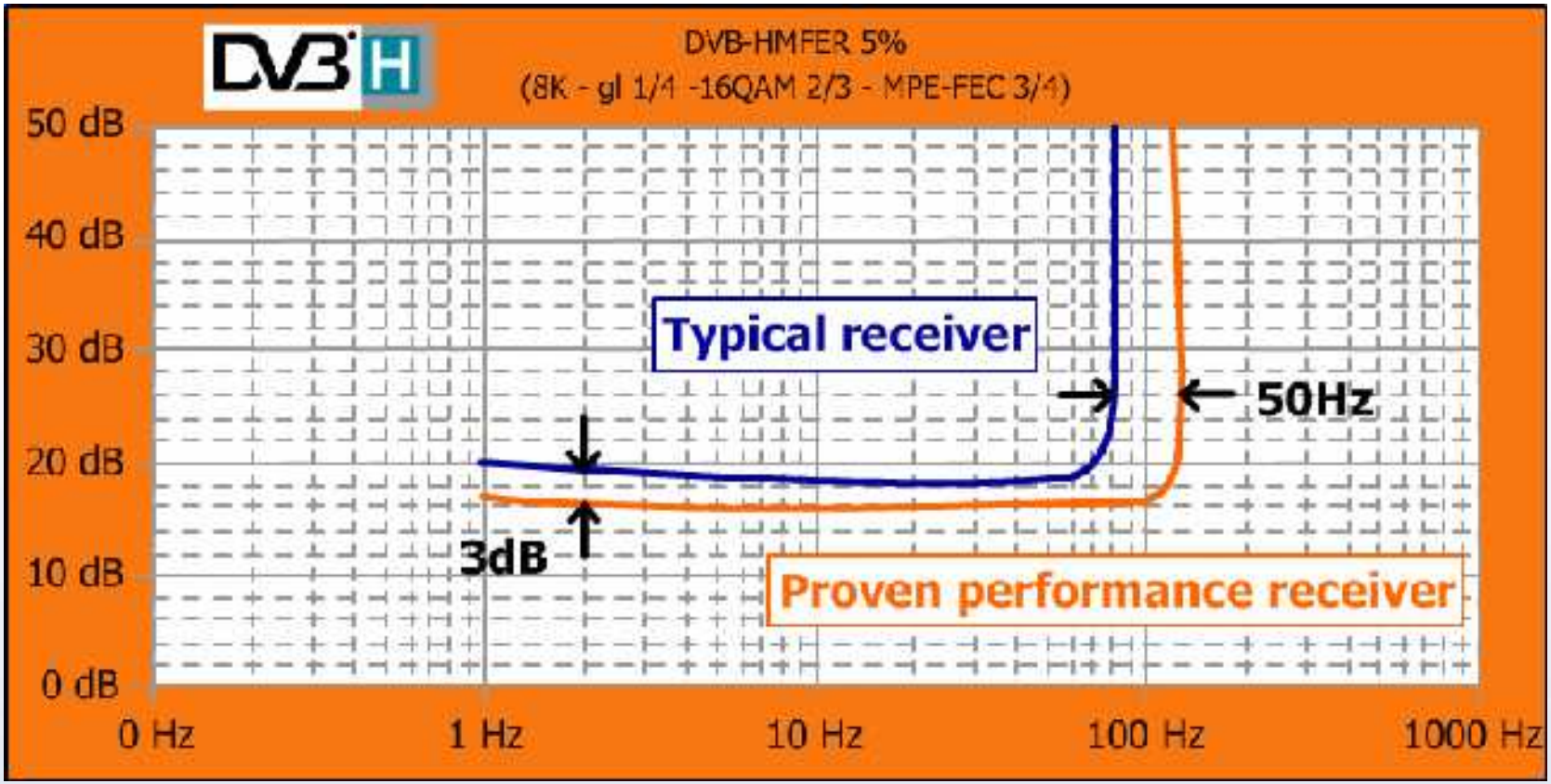
(7 x7 mm²)

- *Use the "Proven performance " DVB-H DiBcom receiver **DiB707x-H** or **DiB908x-H** with:*
  - ***Enhanced C/N** : 3 dB better than those of the "Typical Receiver"*
  - ***Enhanced Doppler compensation** offering 50% more speed than the typical receiver*

Proven Performance Advantage: Quality of reception

- High Doppler compensation due to:
  - channel estimation Doppler bandwidth
  - FFT leakage compensation algorithm
  - Advanced estimation algorithm to reduce the noise effect on the estimation
- Dynamic FFT window positioning:
  - Fast track of channel profile variation
  - Optimum positioning (no Post / Pre echoes phenomena)
- Co-Channel Interference compensation
  - Blind algorithm
  - Better than MBRAI specification
- Impulse noise compensation
  - Very robust even in mobile environment

DVB-H Proven Performance Receiver (DiBcom)



Extracted from Validation task Force Report

« Proven Performance » DVB-H Receivers
C/N Benefits

Enhanced C/N
(3 dB better than Typical receivers)

Coverage improvement

+ 50 % end-users

DVB-H « Typical Performance » in UHF (80% indoor coverage / Broadcast approach)

EIRP=100 kW

indoor reception : -11 dB

σ_{comp} *= 8 dB*

8k 16QAM CR:1/2 GI:1/4 FEC 3/4

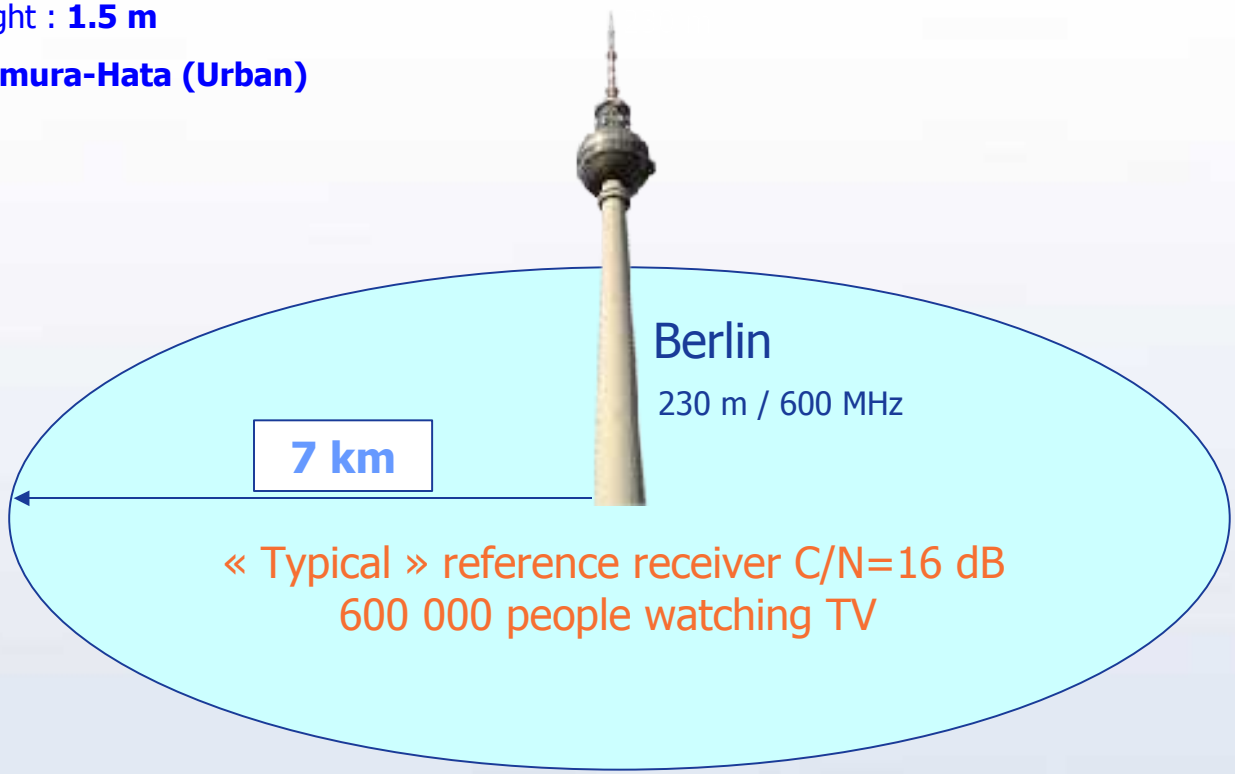
Rec. Noise Figure : **4 dB**

Receiver antenna height : **1.5 m**

Propag. Model. : **Okomura-Hata (Urban)**

Frequ. Carrier : **600 MHz**

Rec. Antenna Gain : **-7 dB**

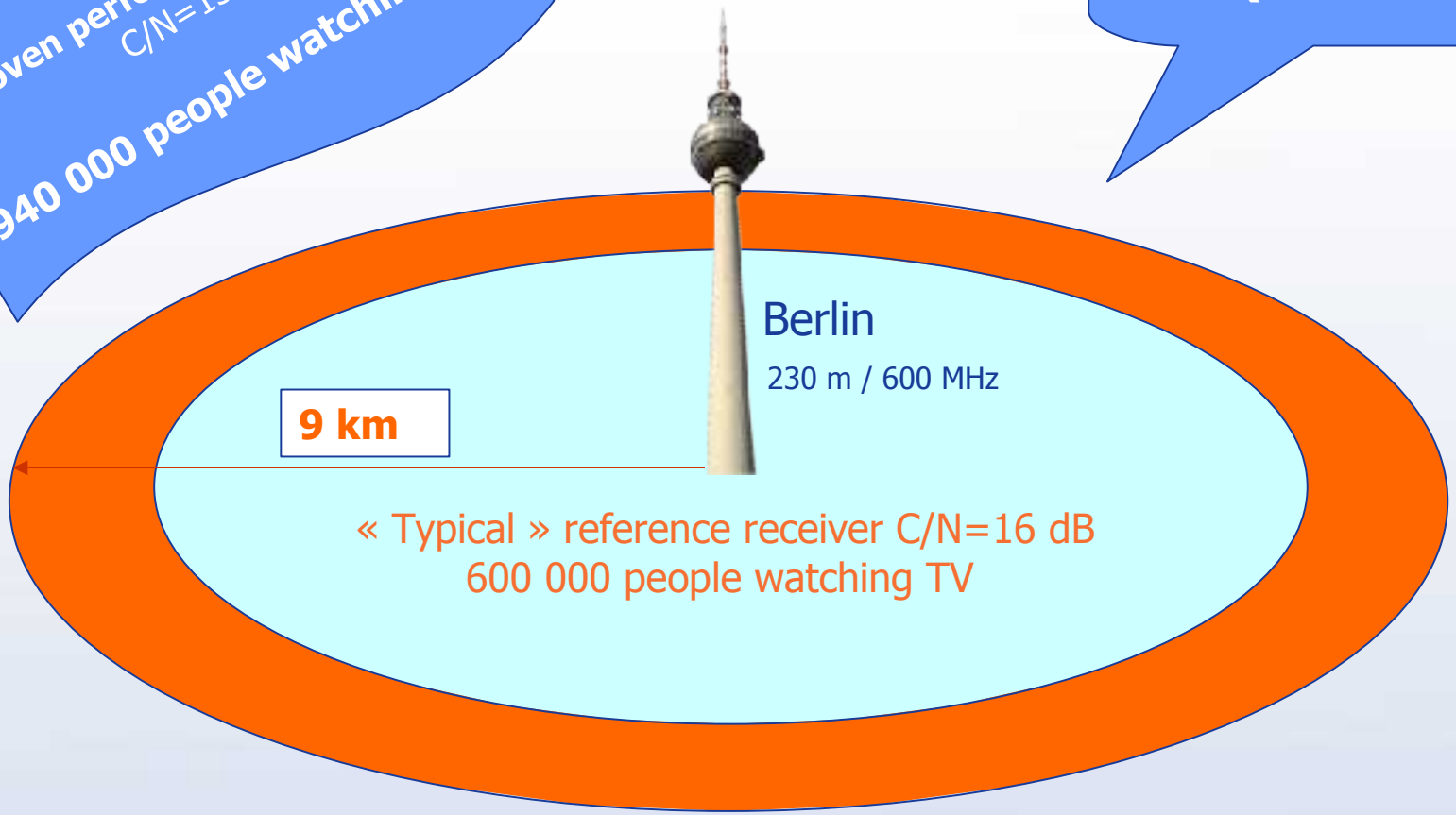


DVB-H « Typical Performance » in UHF (80% indoor coverage / Broadcast approach)

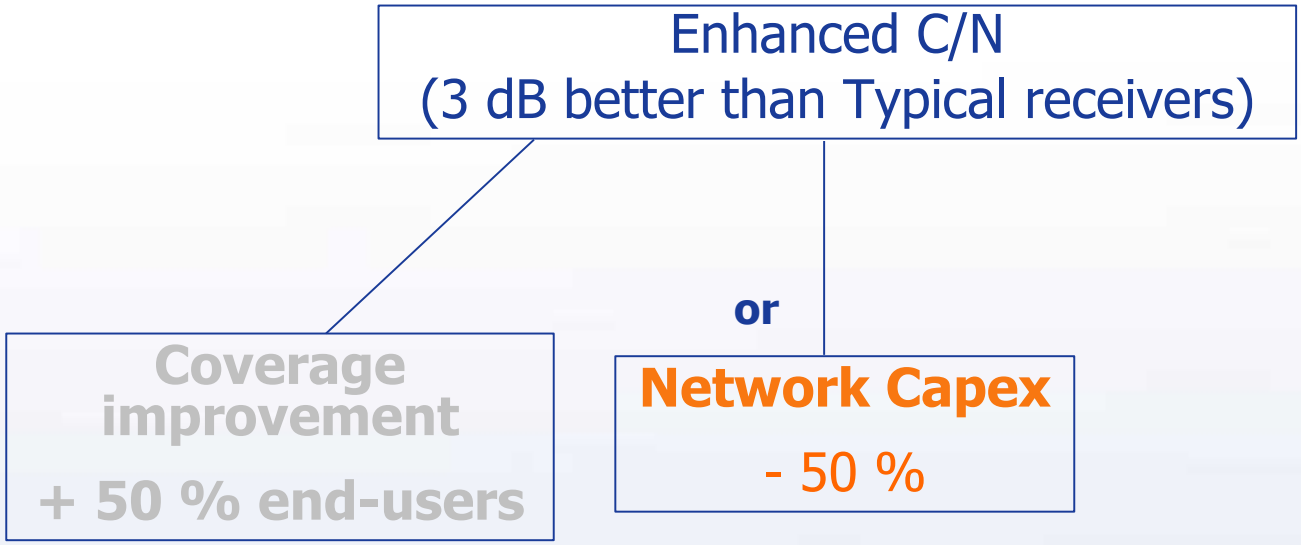
« **Proven performance** » receivers
C/N=13dB
940 000 people watching TV

EIRP=100 kW
indoor reception : -11 dB
σ_{comp} *= 8 dB*

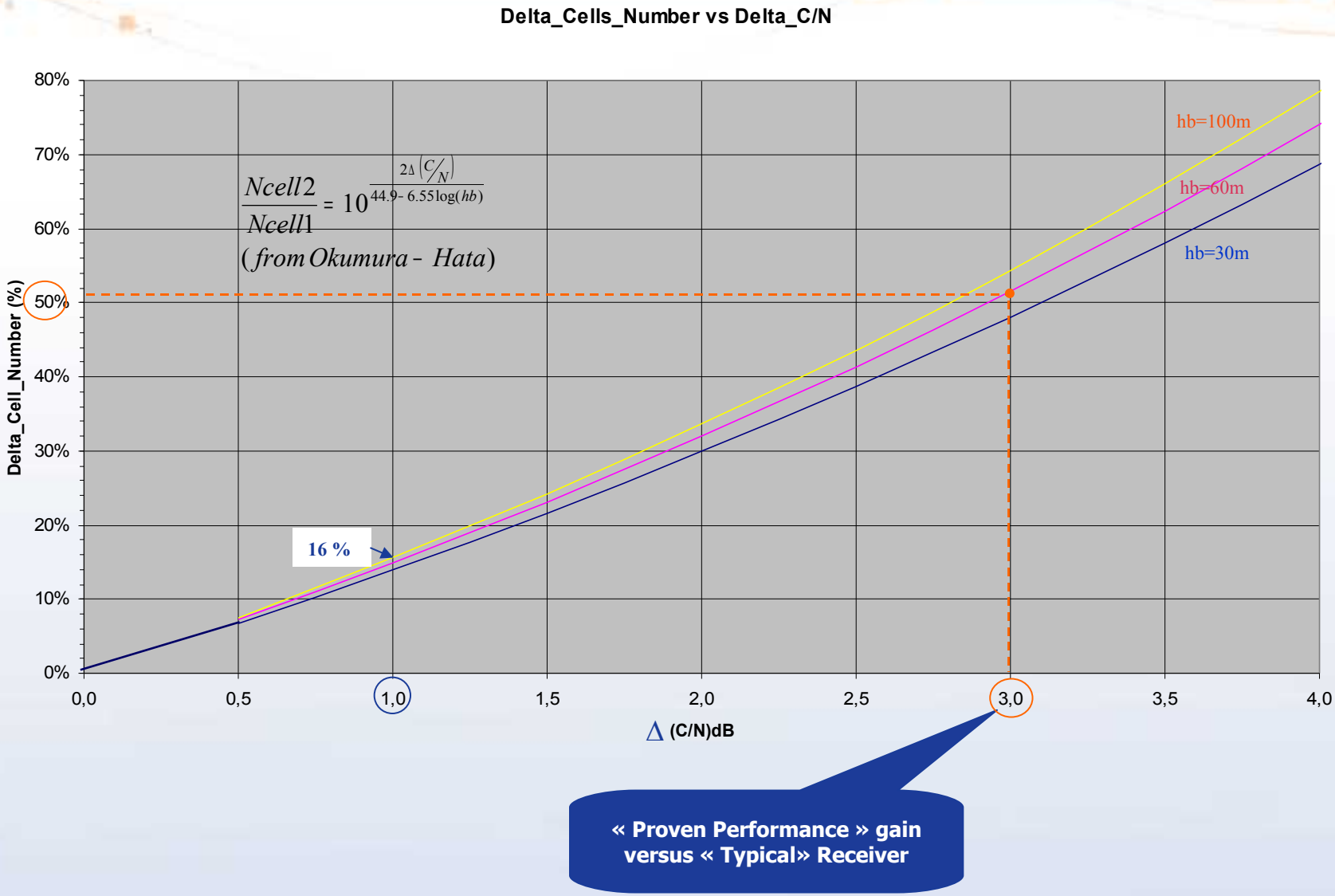
+ 340k end-users (+ 56 %)



« Proven Performance » DVB-H Receivers
C/N Benefits (continued)



Cell Number Gain versus C/N Gain
DVB-H Network Capex Optimisation

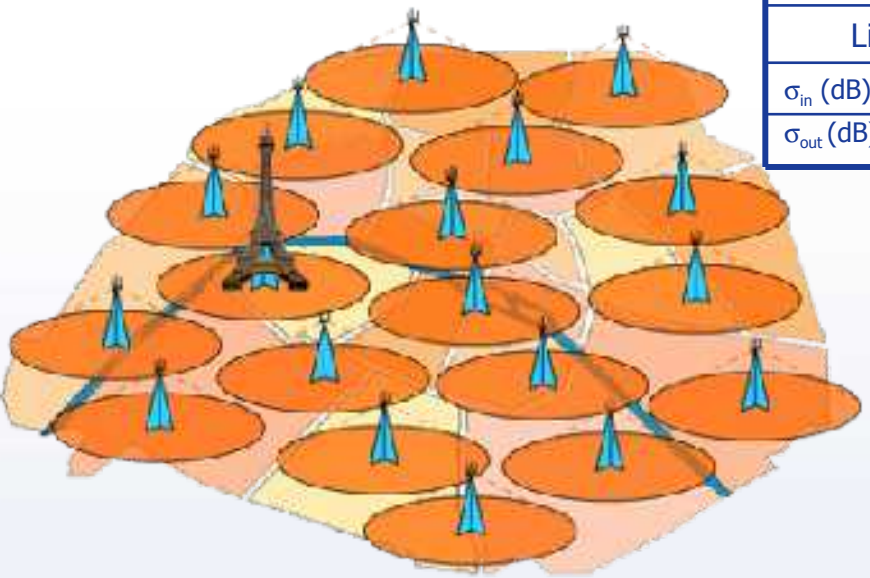


« Proven Performance » gain versus « Typical» Receiver

DVB-H « Proven Performance » benefit in UHF (Cellular approach with small cells)

EIRP(W)			300
hb (m)			30
F (MHz)			600
Lindoor (dB)			11
σ_{in} (dB)	6	σ_{comp} (dB)	8
σ_{out} (dB)	5.5		

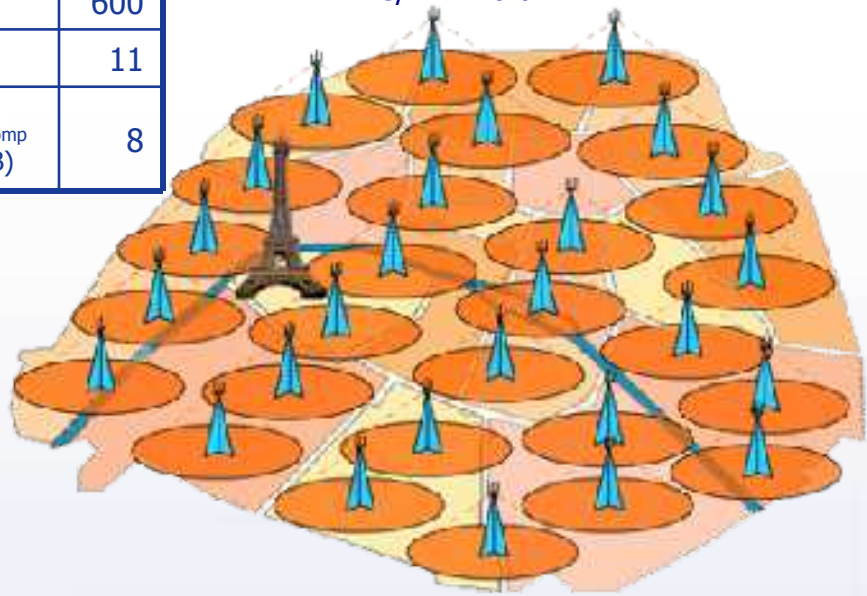
« **Proven Performance** »
DiBcom reference design C/N = 13 dB



Paris city outdoor (95%) **: 18 cells**

Paris city Indoor (80%) **: 56 cells**

« **Typical** » Reference Design
C/N = 16 dB



27 cells

83 cells

ADDED COST : ~50 % !!!

DiBcom Receiver

Typical Receiver

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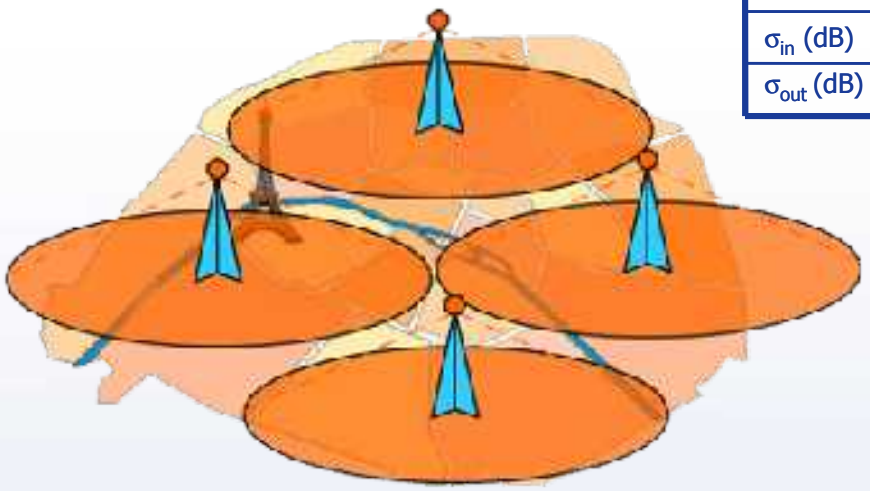
DVB-H « Proven Performance » benefit in UHF (Cellular approach with medium cells)

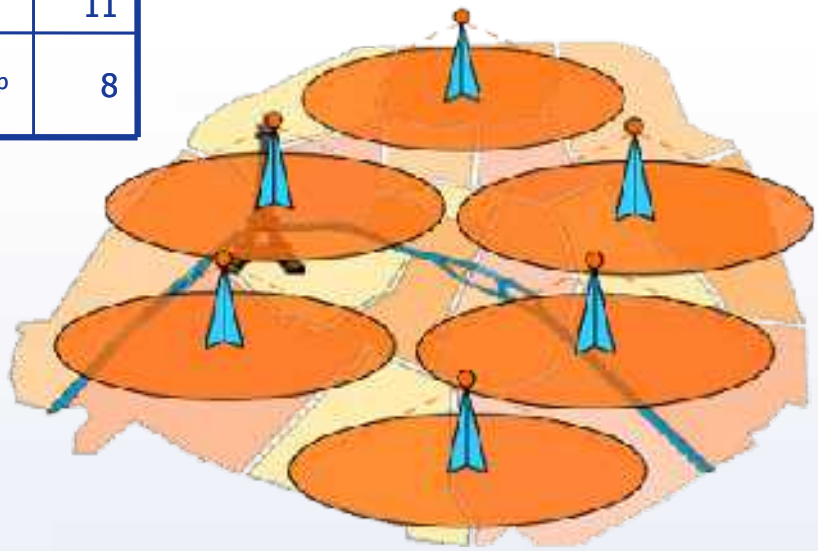
- **« Proven Performance »**
  DiBcom reference design C/N = 13 dB

EIRP (kW)			5
hb (m)			30
F (MHz)			600
Lindoor (dB)			11
σ_{in} (dB)	6	σ_{comp} (dB)	8
σ_{out} (dB)	5.5		

« Typical » Reference Design

C/N = 16 dB





Paris city outdoor (95%) : **4 cells**

Paris city Indoor (80%) : **12 cells**

6 **cells**

17 **cells**

DiBcom Receiver

ADDED COST : ~50 % !

Typical Receiver

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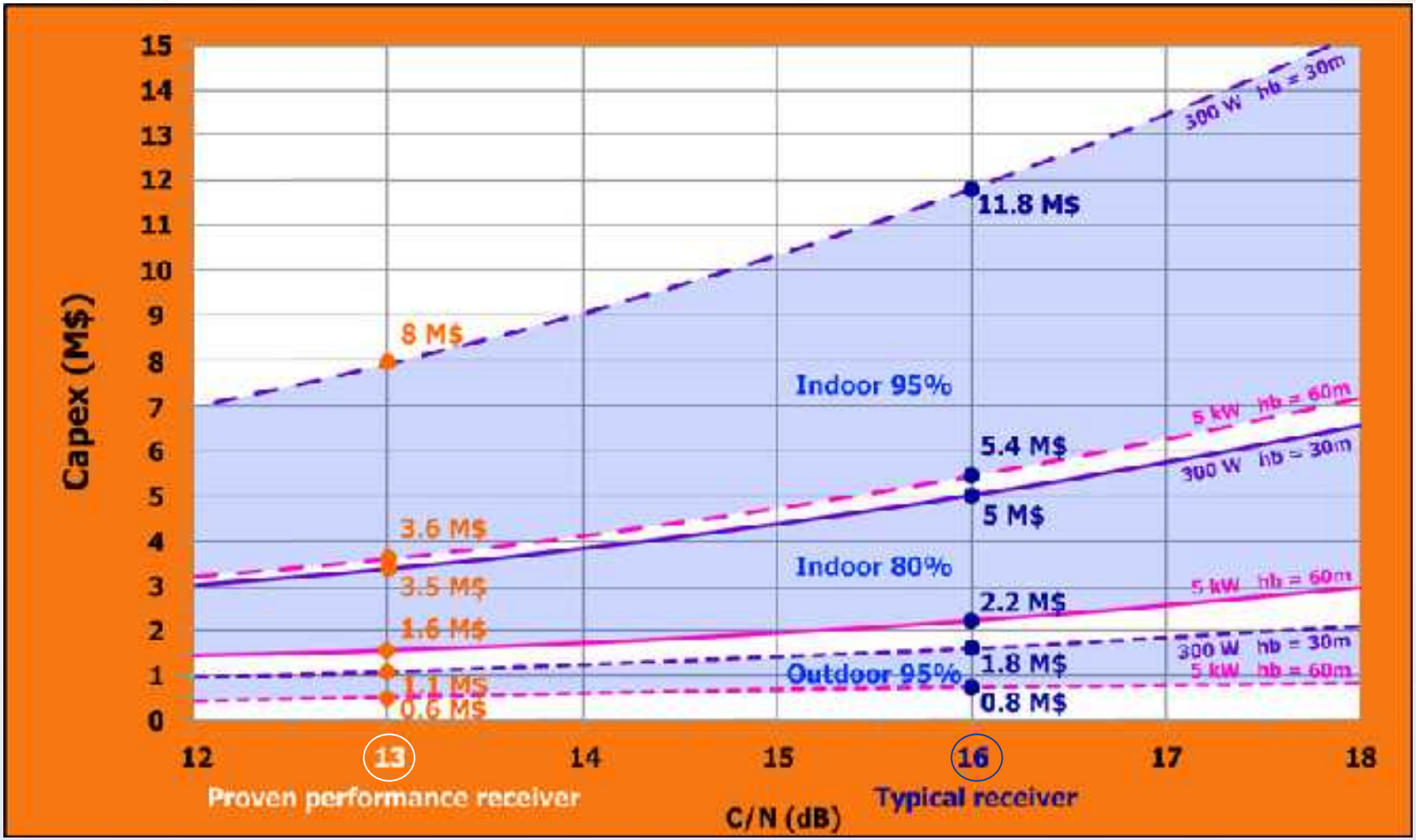
DVB-H Network Capex for Paris city (105 sq km) hb=30m for 300W and hb = 60m for 5 kW

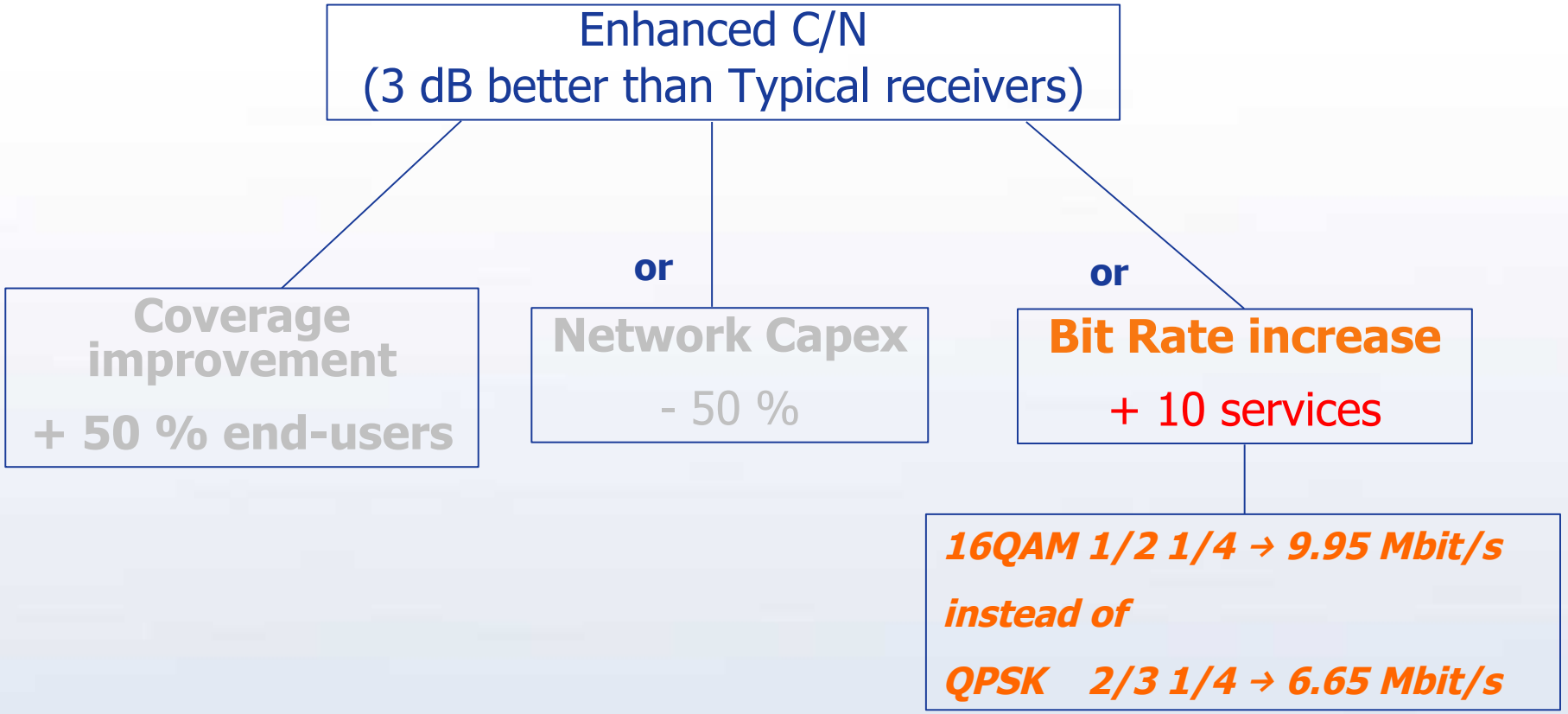


Commercial Example : Italian H3G coverage

Source Wall Street Journal, June 1, 2006

"3 Italia is building its own network, estimating costs at €220 million for the network."

« Proven Performance » DVB-H Receivers
C/N Benefits (continued)



« Proven Performance » DVB-H Receivers
Speed Benefit

Enhanced Doppler compensation
130 Hz for « Proven Performance » Receiver
[80 Hz for « Typical Performance » Receiver]

Commuting
(Bus, trains,..)

Europe
185 km/h @ 750 MHz, 8MHz, 8k
[114 km/h only for « Typical Receivers »

USA
130 mph @ 1.67 GHz, 5MHz, 2k
[80 mph only for « Typical Receivers »]

High Speed Trains

Europe
370 km/h @ 750 MHz, 8MHz, 4k
[228 km/h only for Typical Receivers »]

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DVB-H trial in Paris
Mobile receiver measurement

Good Reception measured up to 110 km/h

thanks to DiBcom DVB-H Receiver

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CONCLUSION

- DVB-H is the world's most efficient standard for Mobile TV applications
- DVB-H receiver compliance is not sufficient
- Small differences in DVB-H receiver quality (Sensitivity, Doppler compensation,..) can have enormous consequences when it comes to:
  - Network Quality (especially coverage)
  - and cost !
- The "Proven Performance" receiver also known as the "Possible Reference Receiver" (DVB-H Implementation Guidelines) is becoming a "de facto" standard thanks to the world's first DVB-H commercial launch in Italy.

Thank you

DiBcom
The Heart of Mobile TV

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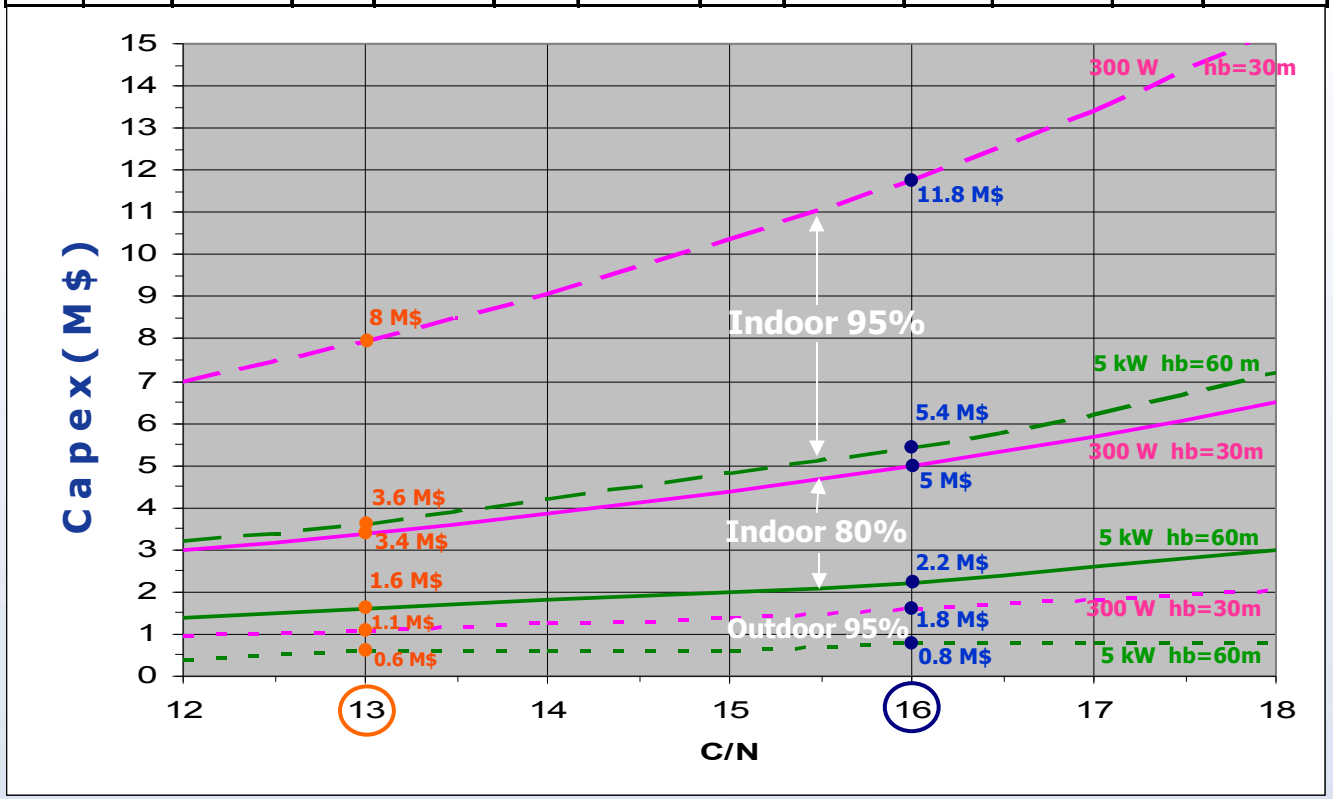
TÜV CERT

BACK-UP SLIDES

DVB-H Network Capex for Paris Intramuros (105 sq km) hb=30m for 300W and hb = 60m for 5 kW

	Outdoor 95%				Indoor 80%				Indoor 95%			
	300W (50k$)		5 kW(200k$)		300W(50k$)		5 kW (200k$)		300W (50k$)		5 kW (200k$)	
C/N	N_Cells	Capex (k$)	N_Cells	Capex (k$)	N_Cells	Capex (k$)	N_Cells	Capex (k$)	N_Cells	Capex (k$)	N_Cells	Capex (k$)
11	17	850	2	400	52	2600	6	1200	123	6150	14	2800
12	19	950	2	400	60	3000	7	1400	140	7000	16	3200
13	22	1100	3	600	68	3400	8	1600	159	7950	18	3600
14	25	1250	3	600	77	3850	9	1800	181	9050	21	4200
15	28	1400	3	600	88	4400	10	2000	207	10350	24	4800
16	32	1600	4	800	100	5000	11	2200	235	11750	27	5400
17	36	1800	4	800	114	5700	13	2600	268	13400	31	6200
18	41	2050	4	800	130	6500	15	3000	306	15300	36	7200



DVB-T / DVB-H DIB3000MC performance in TU6
DVB-T : 8k 16QAM CR2/3 GI1/8
DVB-H : MPE-FEC : 3/4