

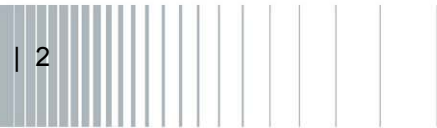
# Managing DVB-T2 Broadcast Transmission Networks

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# Agenda

- | DVB-T and DVB-T2 Basics
- | Comparison between DVB-T and DVB-T2
- | DVB-T2 Configurations and Coverage
- | DVB-T2 Measurements



# DVB-T2: Benefits over DVB-T

## **New Modulation, FEC and Transmission modes**

- | 30 - 60% More Bandwidth enables more HDTV, SDTV and IP services

## **Multiple Input streams (Physical Layer Pipes = PLPs)**

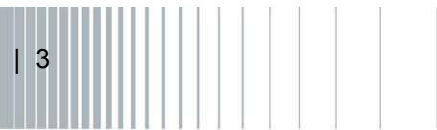
- | Common (e.g. SI) Data and service specific (Video, audio) streams
- | Independent and Flexible Operation with multiple service providers

## **Dynamically variable modulation and FEC**

- | Mobile (time/frequency sliced) and Fixed Services in same bandwidth
- | Optimal bandwidth utilization for different service types

## **Direct Support for non-TS formats e.g. IP**

- | No Transport Stream packetization overhead
- | Repeated (null packets) or common (SI) data need not always be sent
- | No conversion simplifies interoperability



# DVB-T vs DVB-T2

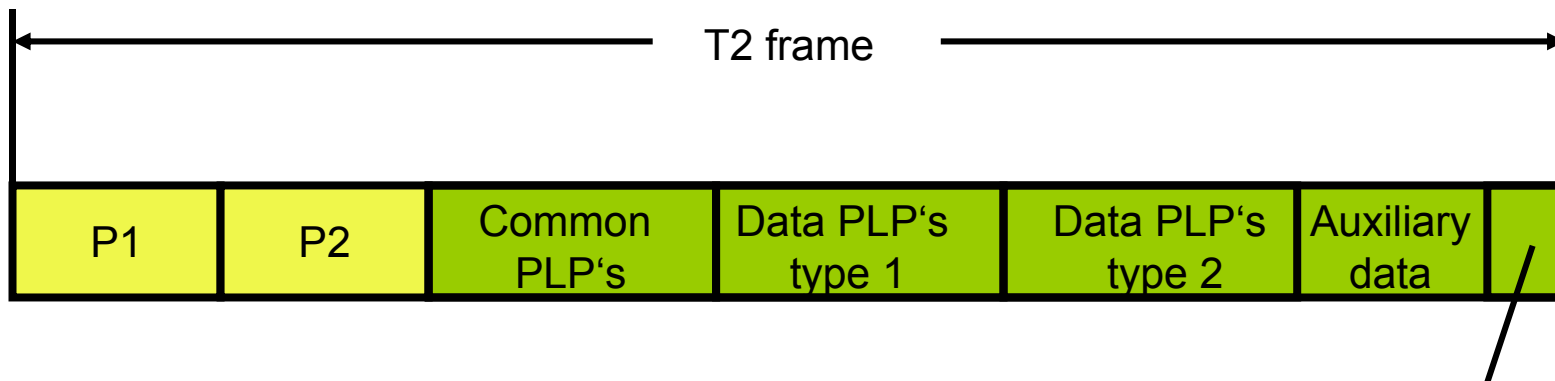
	DVB-T	DVB-T2
Modulation	QPSK, 16QAM, 64QAM	QPSK, 16QAM, 64QAM, <b>256QAM</b>
FEC	Conv. Coding + RS $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}$	<b>BCH + LDPC</b> $\frac{1}{2}, \frac{3}{5}, \frac{2}{3}, \frac{3}{4}, \frac{5}{6}$
Guard Interval	$\frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}$	$\frac{1}{4}, \frac{19}{256}, \frac{1}{8}, \frac{19}{128}, \frac{1}{16}, \frac{1}{32}, \frac{1}{128}$
FFT Size	2k, 4k, 8k	<b>1k</b> , 2k, 4k, 8k, <b>16k, 32k</b>
Scattered Pilots	8% of Total	<b>1%, 2%, 4%, 8%</b> of Total
Continual Pilots	2.6% of Total	<b>0.35%</b> of Total

# DVB-T2 Capacity Improvements

	DVB-T	DVB-T2
Modulation	64QAM	256QAM
FFT Size	2k	32k
Guard Interval	1/32	1/128
FEC	2/3 CC + RS(8%)	3/5 LDPC + BCH
Scattered Pilots	8%	1%
Continual Pilots	2.6 %	0.5%
P1/P2 Overheads	0%	0.5%
Bandwidth	Standard	Extended
Capacity	24Mbit/s	36.1 Mbit/s

**4 MPEG-4 HDTV in one channel**

# DVB-T2: Physical Layer Frame



**P1:** 1K FFT Symbol Indicating Start of T2 Frame

**P2:** Indicate how (L1) and when (L2) PLPs are transmitted

**Common PLP:**

- | Contains data shared with multiple PLPs e.g. SI Tables

**Type 1 PLP:**

- | Sent in single “slice” once per T2-Frame

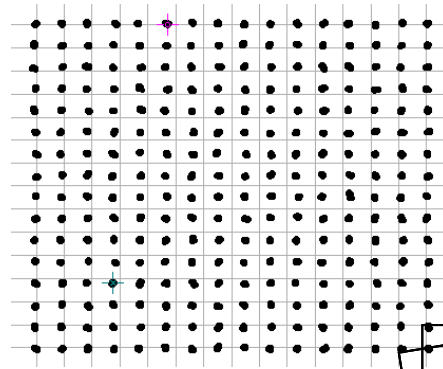
**Type 2 PLP:**

- | Sent in two or more “sub-slices” per T2-Frame

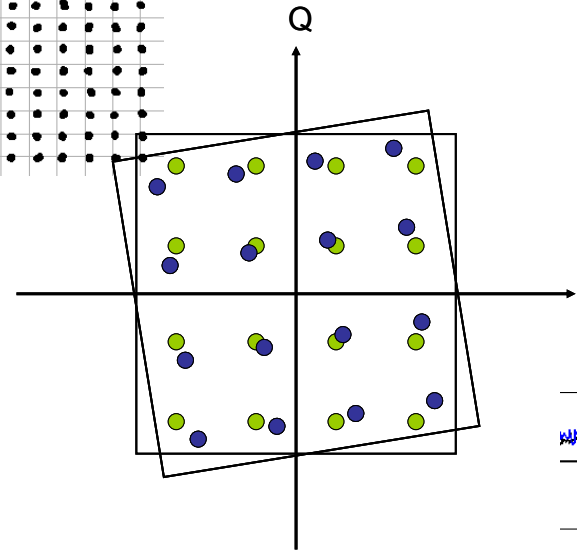
Dummy cells

# DVB-T2: RF Enhancements

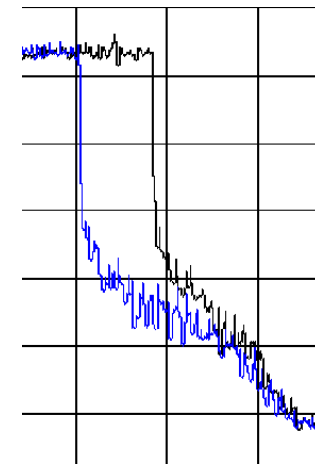
I Modulation 256 QAM



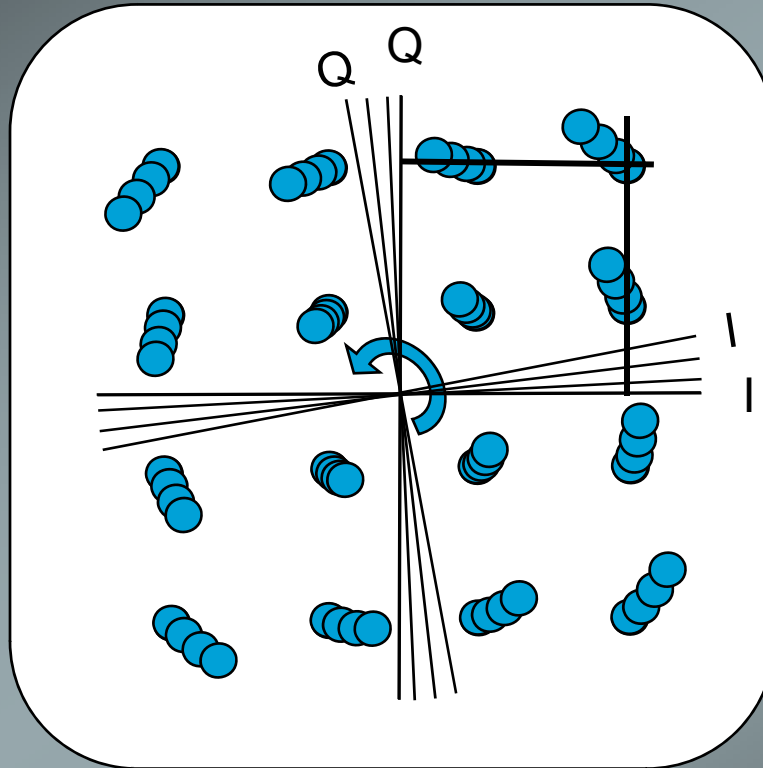
I Rotated & Q-Delayed Constellations



I Extended 32k carrier mode



# Rotated and Q-delayed Constellations



Mod.	QPSK	16QAM	64QAM	256QAM
$\Phi$ (degrees)	29.0	16.8	8.6	$\text{atan}(1/16)$

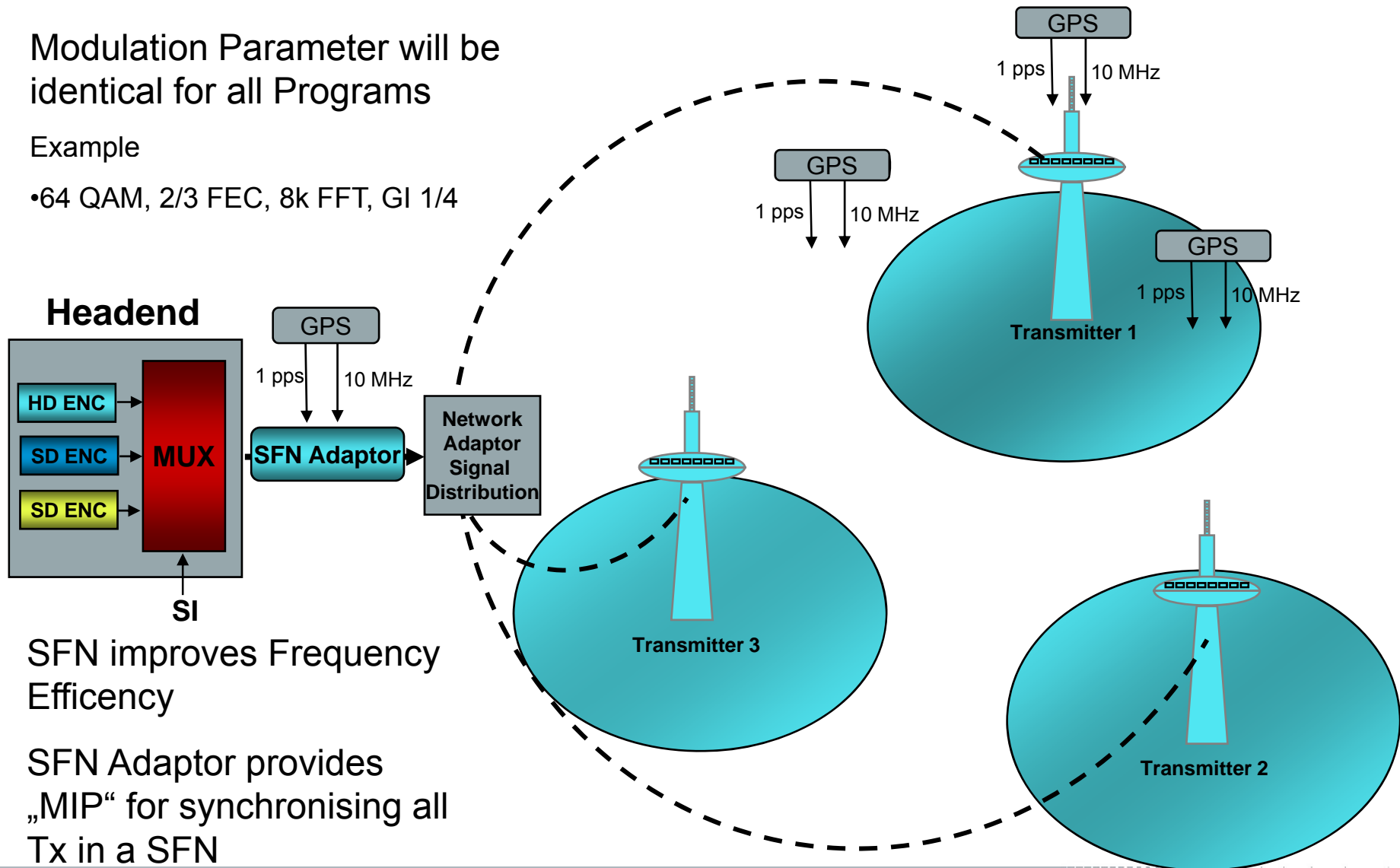


# Basics of DVB-T Network

Modulation Parameter will be identical for all Programs

Example

- 64 QAM, 2/3 FEC, 8k FFT, GI 1/4

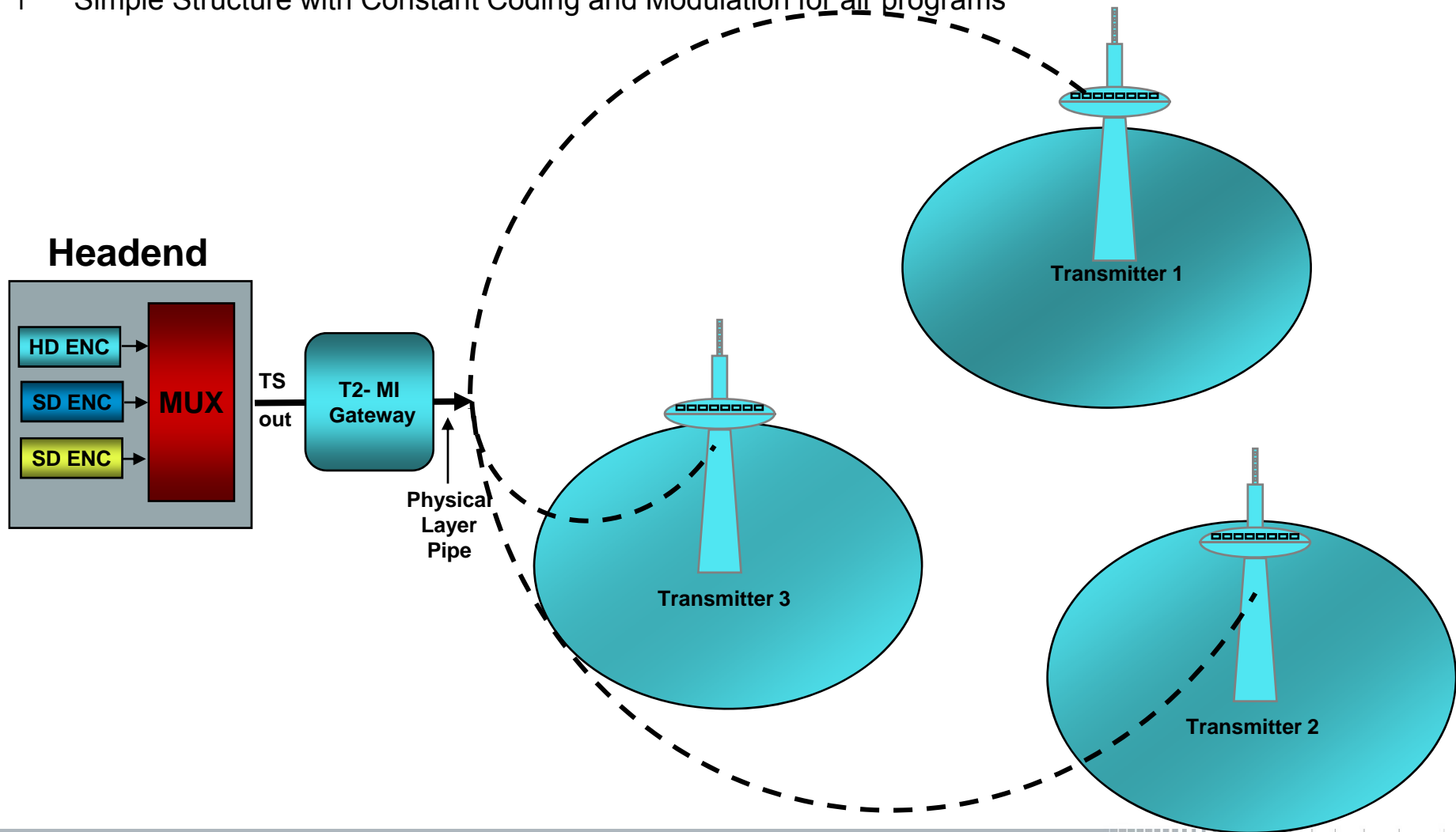


SFN improves Frequency Efficiency

SFN Adaptor provides „MIP“ for synchronising all Tx in a SFN

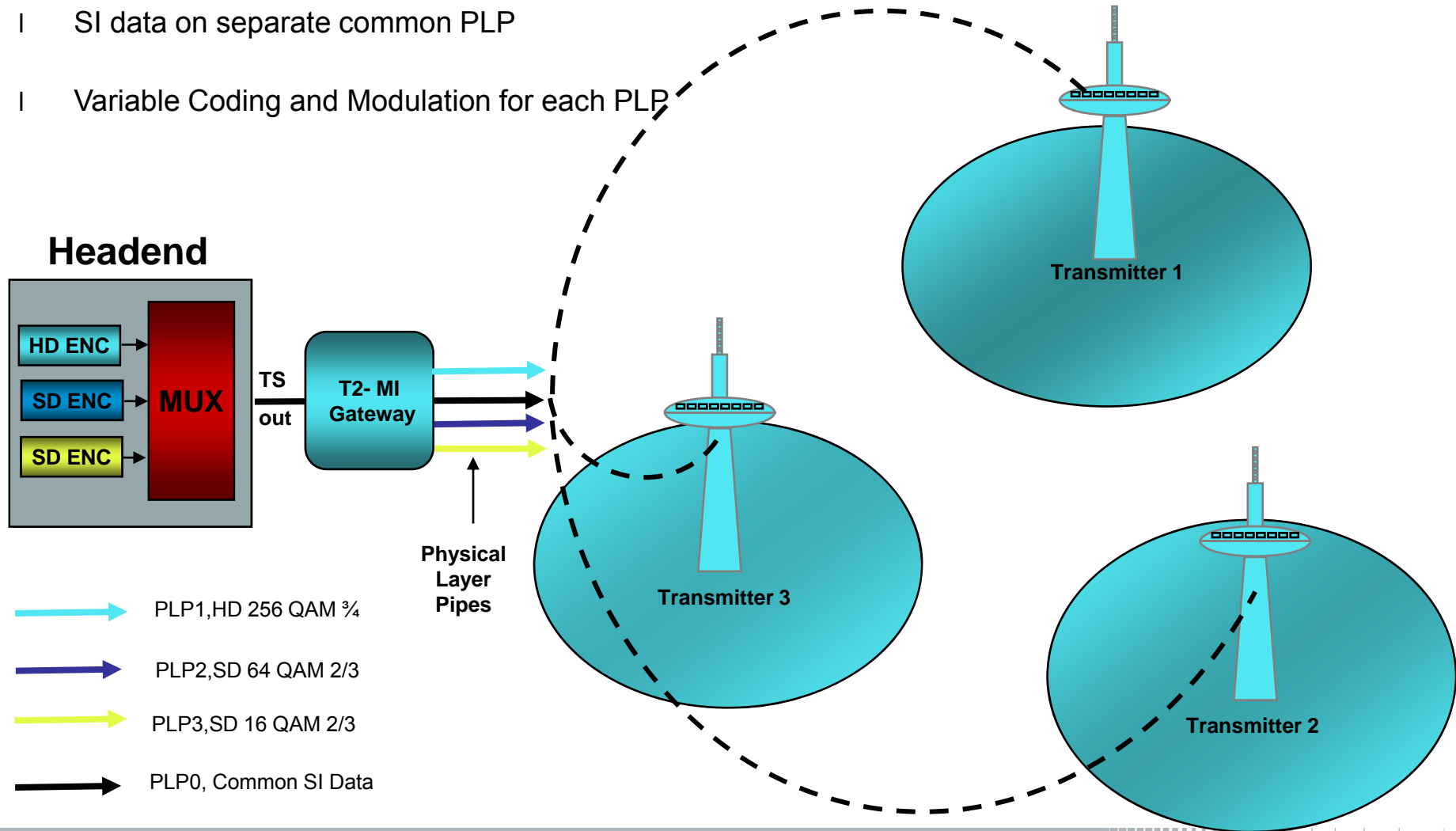
# Basics of DVB-T2 Network

- | Complete Transport Stream Mapped to one **PLP (Physical Layer Pipe)**
- | Simple Structure with Constant Coding and Modulation for all programs



# Basics of DVB-T2 Network

- I Services in Transport Stream Mapped to individual PLPs
- I SI data on separate common PLP
- I Variable Coding and Modulation for each PLP



# DVB-T2 recommended Configurations

8MHz Channel, 32K FFT, 1/128GI, PP7

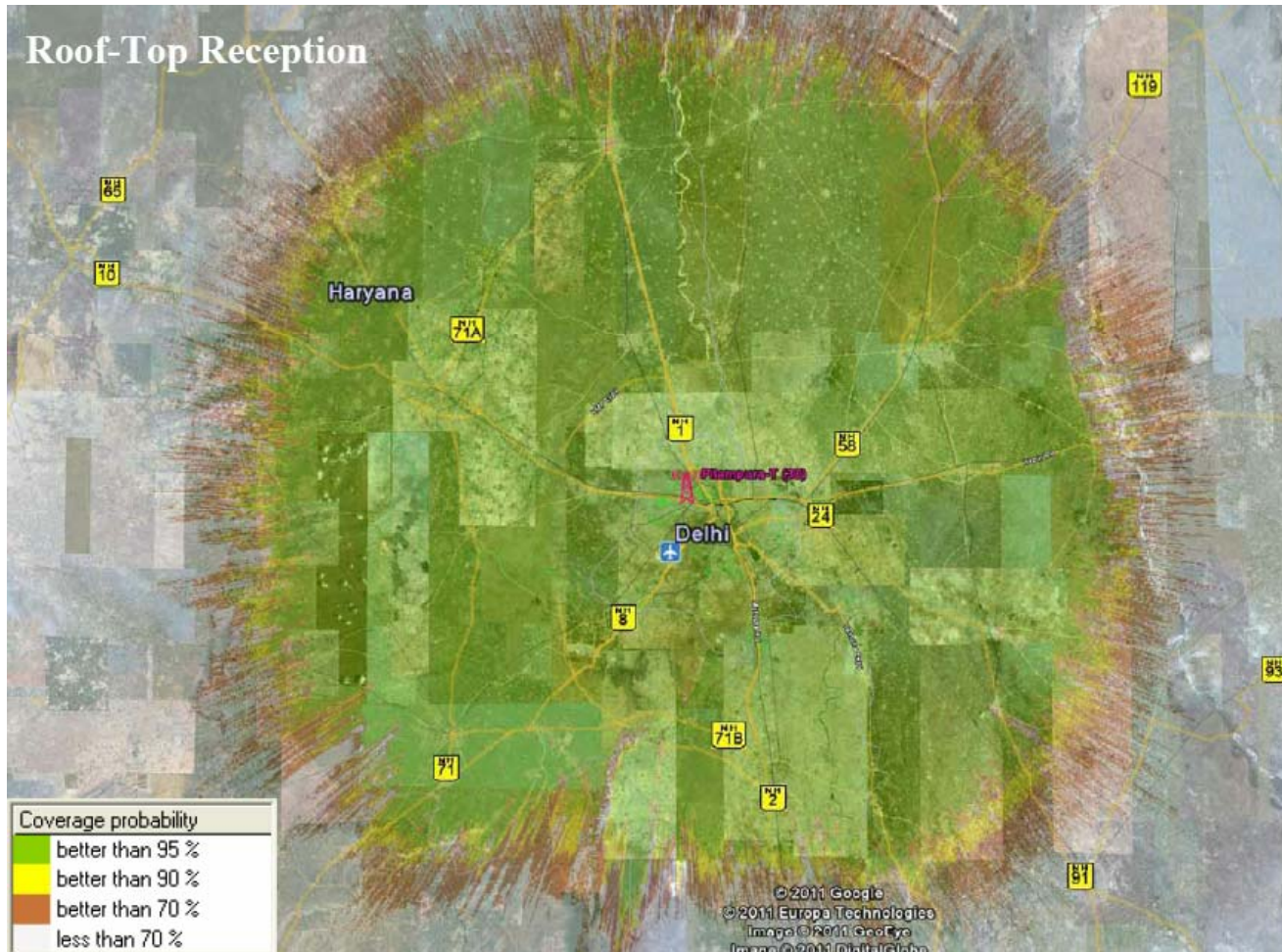
Modulation	Code rate	Absolute maximum bit-rate			Recommended configuration			
		Bitrate Mbit/s	Frame length $L_F$	FEC blocks per frame	Bitrate Mbit/s	Frame length $L_F$	FEC blocks per frame	
QPSK	1/2	7.49255	62	52	7.4442731	60	50	
	3/5	9.003747			8.9457325			
	2/3	10.01867			9.9541201			
	3/4	11.27054			11.197922			
	4/5	12.02614			11.948651			
	5/6	12.53733			12.456553			
16-QAM	1/2	15.03743	60	101	15.037432	60	101	
					24.13628			24.136276
	4/5	24.13628			25.16224			25.162236
64-QAM	1/2	22.51994	46	116	22.481705	60	151	
					36.1463			36.084927
	4/5	36.1463			37.68277			37.618789
256-QAM	1/2	30.08728	68	229	30.074863	60	202	
					45.25828			45.239604
	3/4	45.25828			48.29248			48.272552
	4/5	48.29248			50.34524			50.324472

Good coverage for 2 HDTV programs (MPEG4)

High Bitrate for 4 HDTV programs (MPEG4)

# Coverage I – DVB-T

DVB-T , 64QAM, CR 2/3, Guardinterval 1/4, Bitrate 19,9MBit/s



ERP: 30 kW – Reception Mode: Roof Top – Polarization: Horizontal

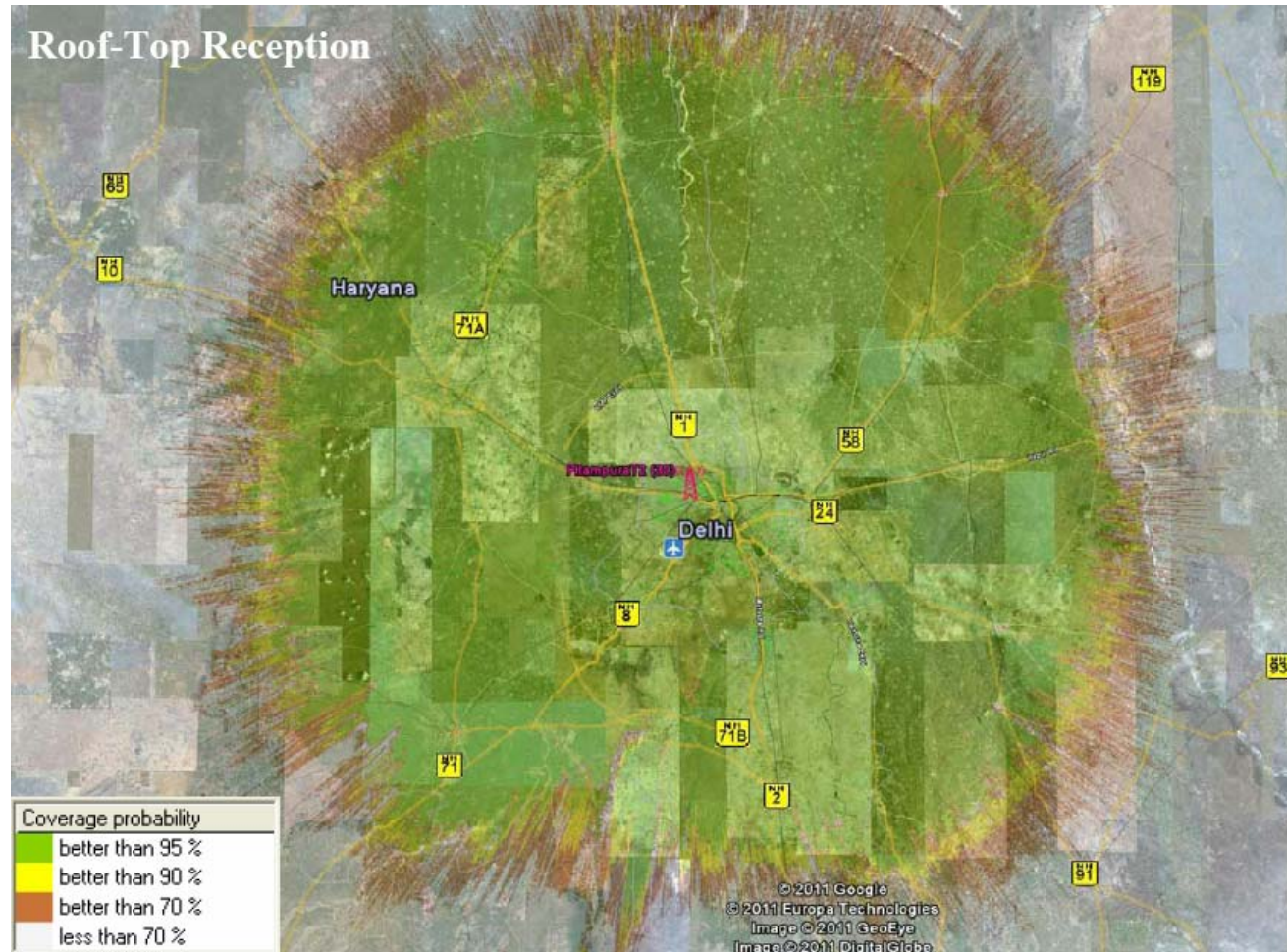
Antenna height: 245m – Vertical 8 stock bays





# Coverage II – DVB-T2

DVB-T2 , 256QAM, CR 3/5, 32k Ext, Guardinterval 1/128, Bitrate 36,1 MBit/s



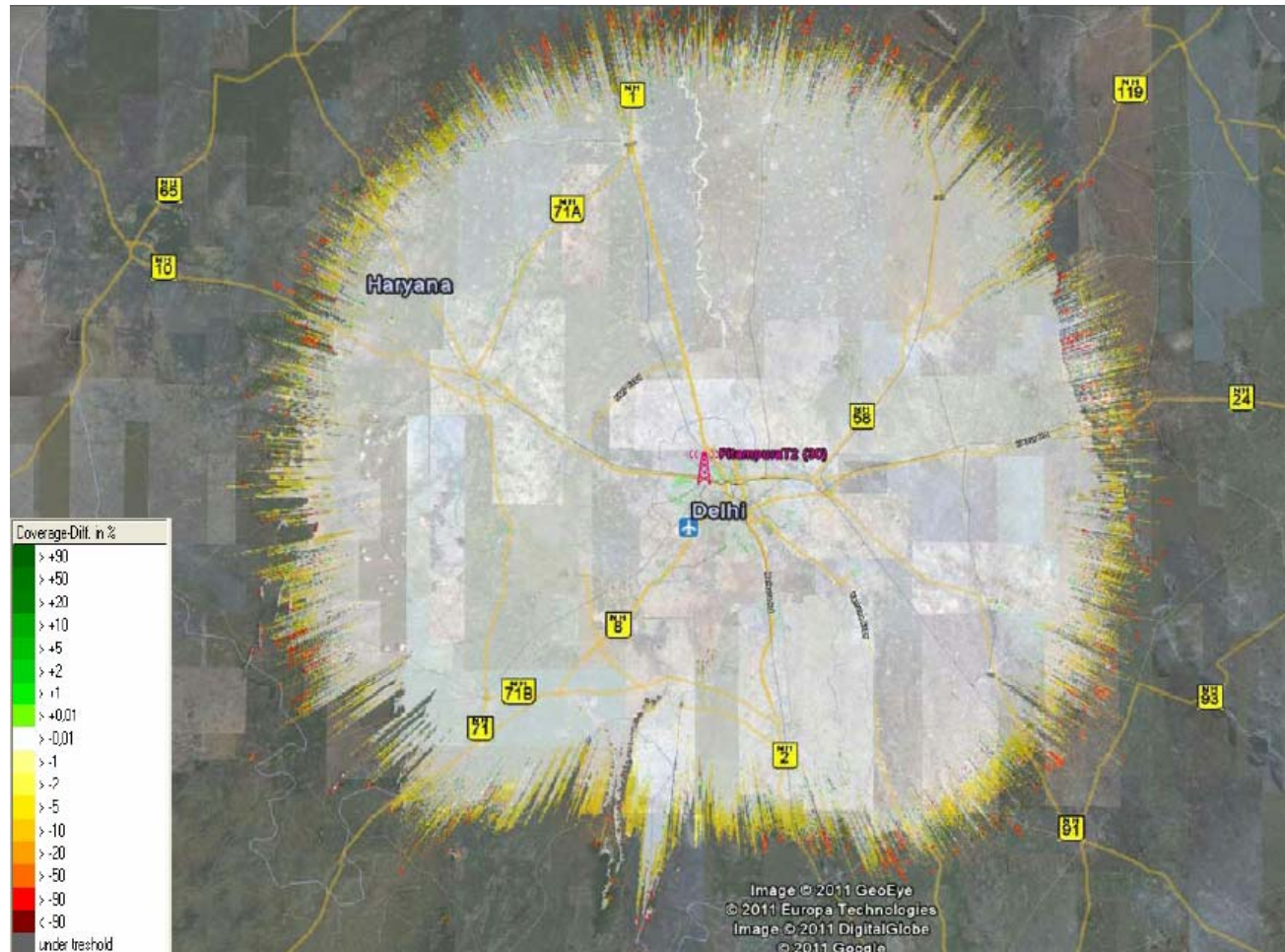
ERP: 30 kW – Reception Mode: Roof Top – Polarization: Horizontal

Antenna height: 245m – Vertical 8 stock bays



# Coverage Comparison

DVB-T vs DVB-T2



## Area

Almost identical

## Bitrate

81% higher in DVB-T2

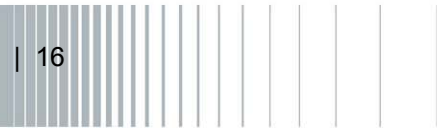
ERP: 30 kW – Reception Mode: Roof Top – Polarization: Horizontal

Antenna height: 245m – Vertical 8 stock bays

# Coverage Propagations Hanoi

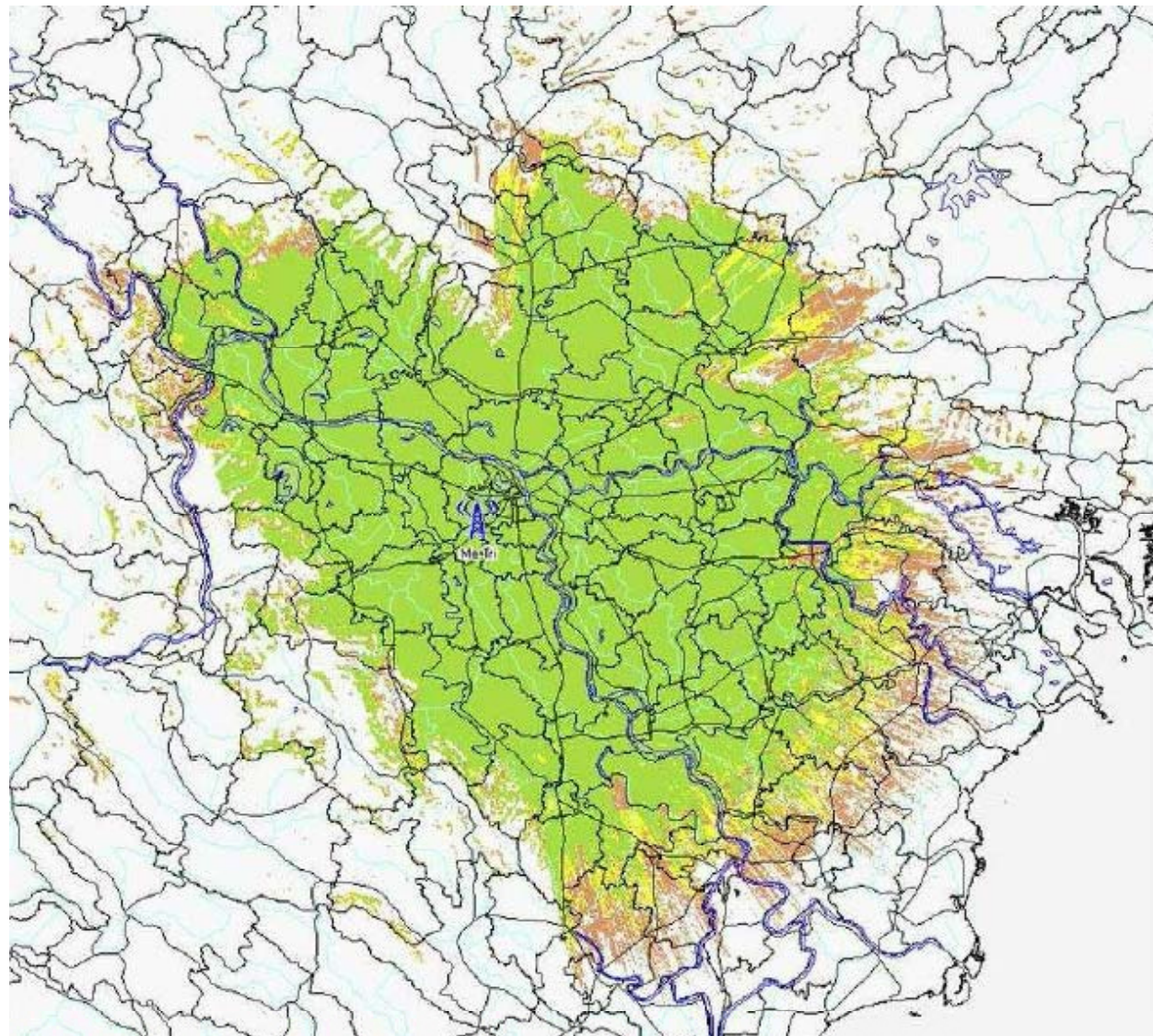
## Used/supposed site data and integrated data base values

- Transmitter site: VOV Me Tri
  - Location:  $20^{\circ} 59' 51.8''$  North,  $105^{\circ} 47' 07.7''$  East
  - ERP: 20 kW / Antenna: ND / vertical assumption 6 bays/stocked
  - Antenna height: 145 m above ground level
  - Polarisation: Horizontal
  
- Reception Mode: Roof Top / portable outdoor
  
- Propagation: Kuhlmann-Eibert-Metzger (Developed by MEDIA BRODACST)
  - Receiving antenna: Band IV\_V ITU model
  - Coverage Probability: 95% for all propagations





# Coverage I - DVB-T – Roof Top







## DVB-T Coverage

System:  
64 QAM, 8k, CR  $\frac{3}{4}$   
Guard interval 1/8

**24,8 Mbit/s**  
**C/N 18,6 dB**

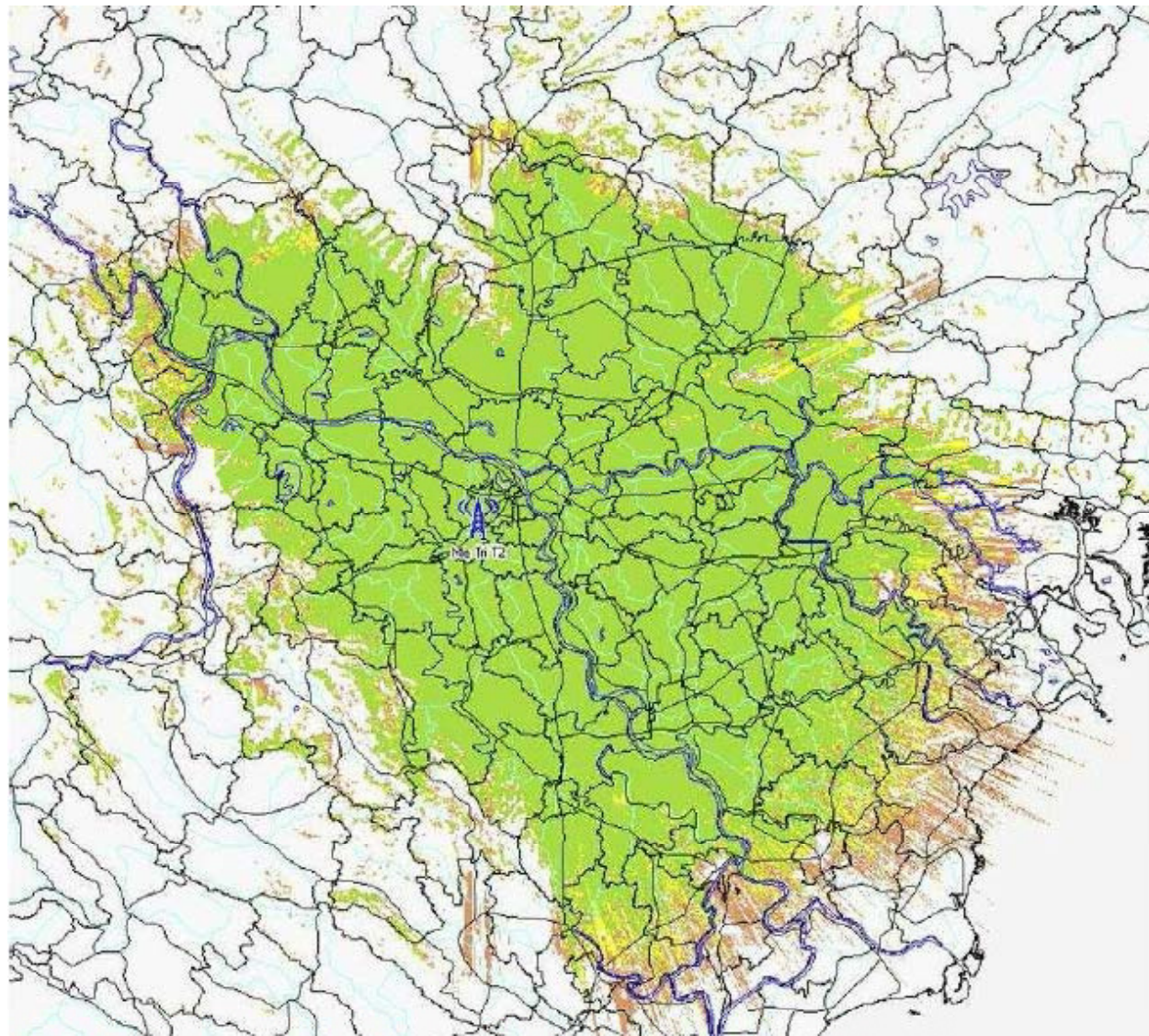
### Coverage probability

-  better than 95 %
-  better than 90 %
-  better than 70 %
-  less than 70 %





# Coverage II – DVB-T2 – Roof Top



## DVB-T2 Coverage

System:

16 QAM, 32k etx.





CR 5/6

Guard interval 1/32

**23,8 Mbit/s**

**C/N 13,4 dB**

### Coverage probability

-  better than 95 %
-  better than 90 %
-  better than 70 %
-  less than 70 %

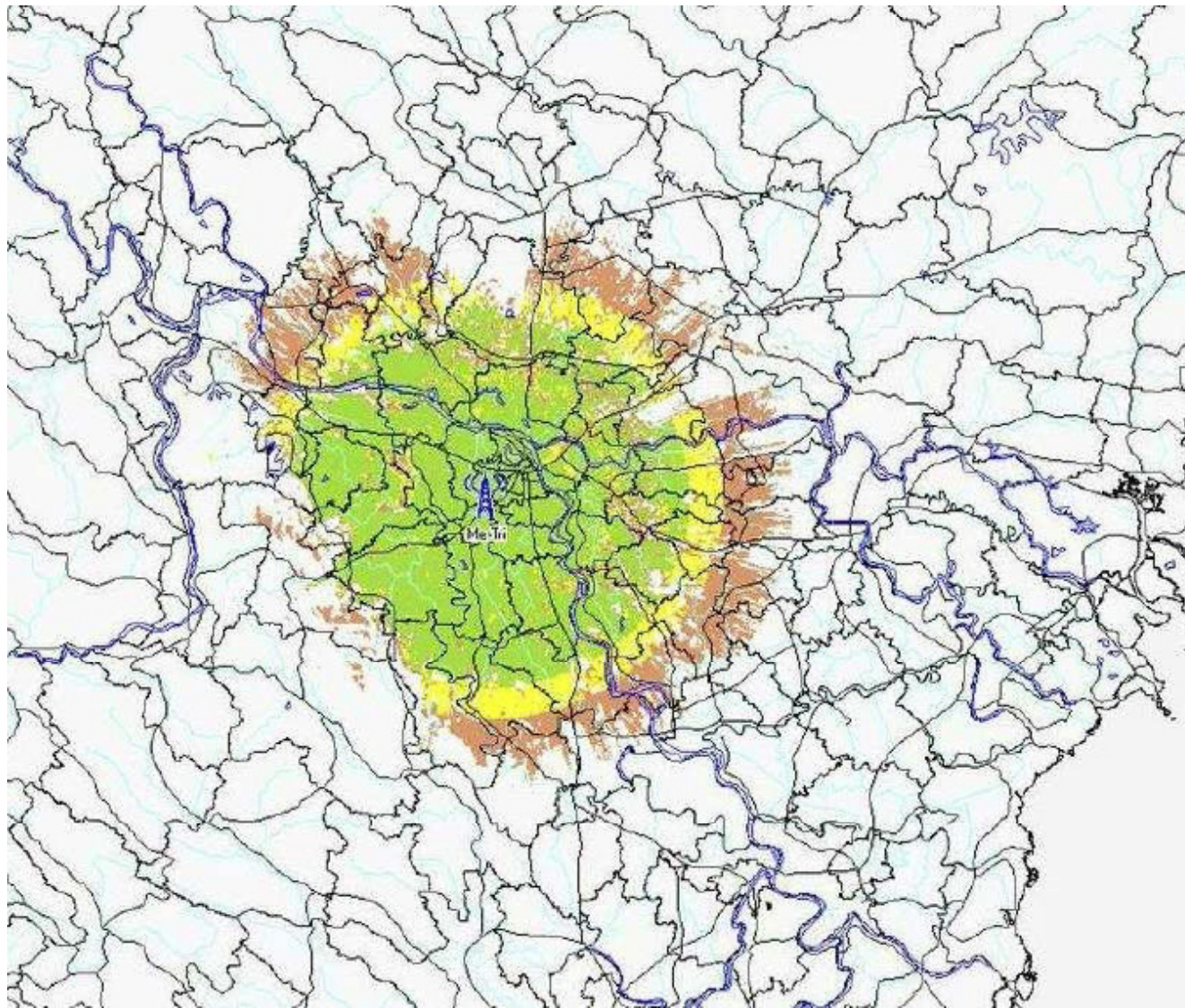




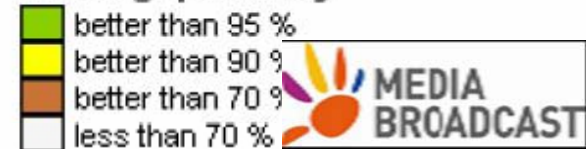
# Coverage II – DVB-T – Portable Outdoor

## DVB-T Coverage

System:  
64 QAM, 8k, CR  $\frac{3}{4}$   
Guard interval  $\frac{1}{8}$



### Coverage probability

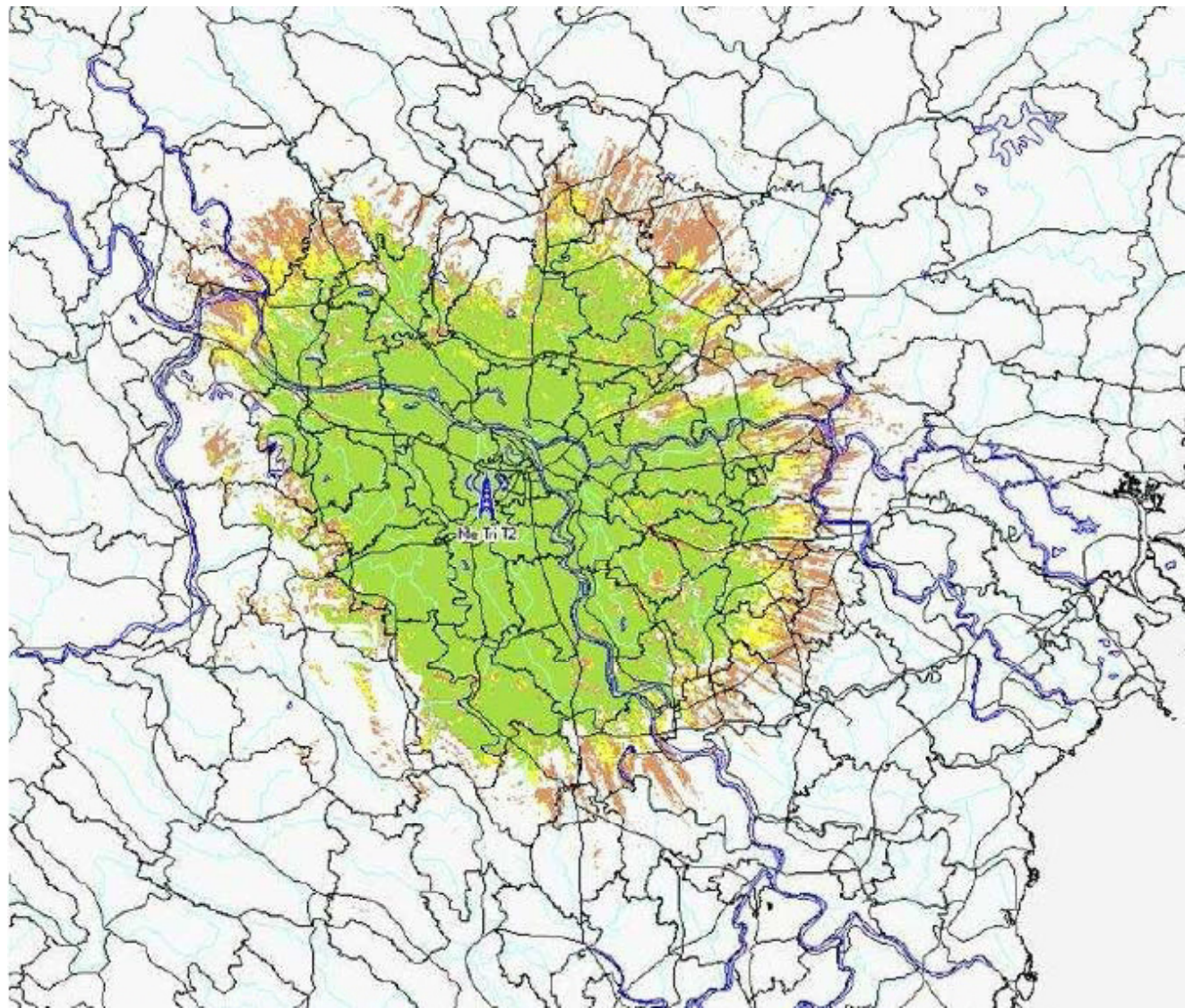




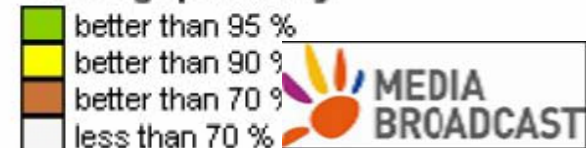
# Coverage II – DVB-T2 – Portable Outdoor

## DVB-T2 Coverage

System:  
16 QAM, 32k etx.  
CR 5/6  
Guard interval 1/32



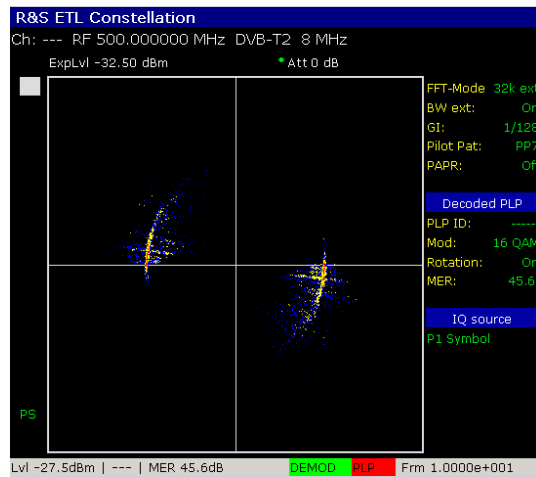
### Coverage probability



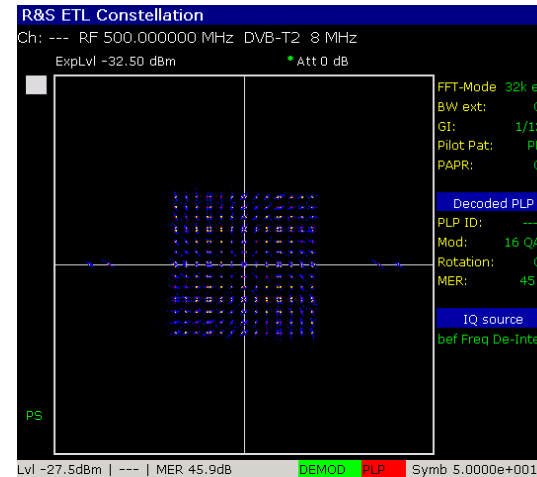
# DVB-T2 Measurements I

I DVB-T2 Measurements are more complex than DVB-T

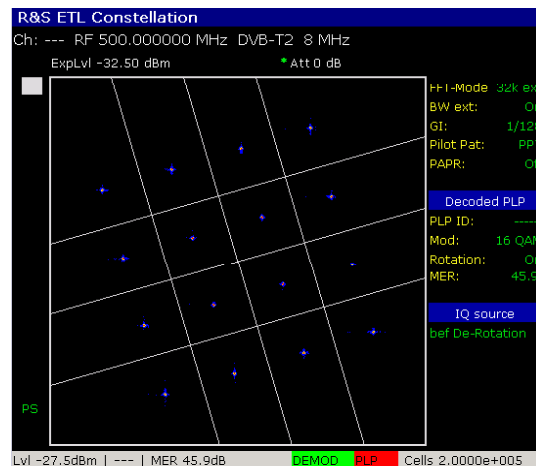
## Examples



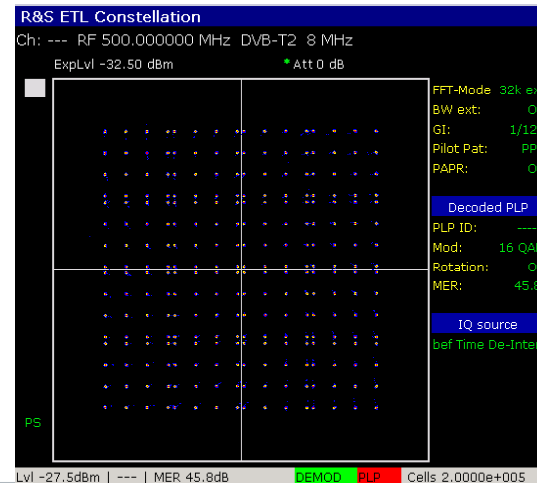
P1 Symbol



OFDM Cells  
before  
Frequency  
De-  
Interleaving



PLP Cells  
before De-  
Rotation

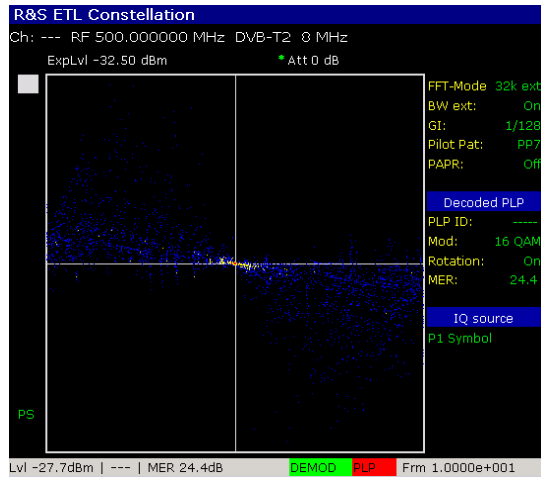


PLP Cells  
before  
Time  
Interleaving

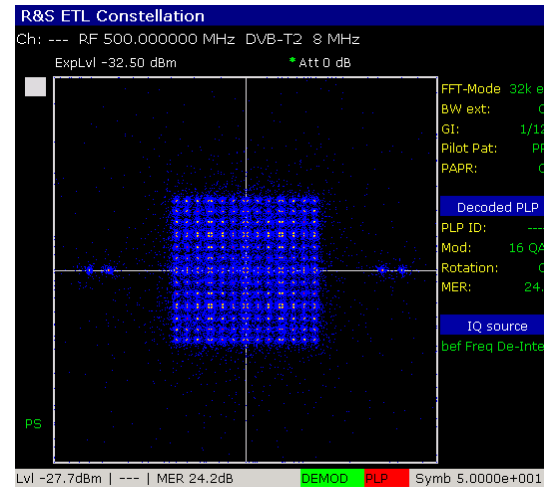
# DVB-T2 Measurements II

I DVB-T2 Measurements are more complex than DVB-T

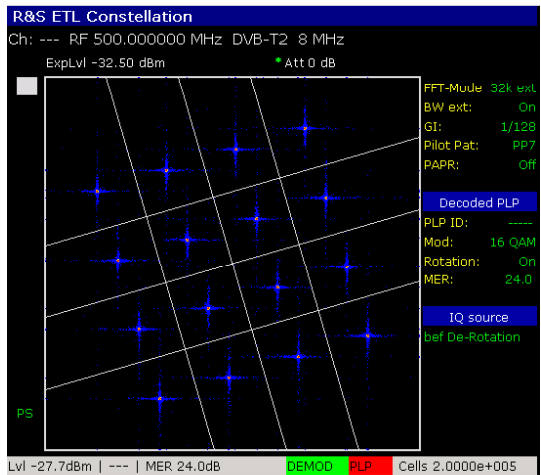
Examples: **BUT WHO CAN TELL WHICH ONE IS GOOD, ACCTEPTABLE OR BAD**



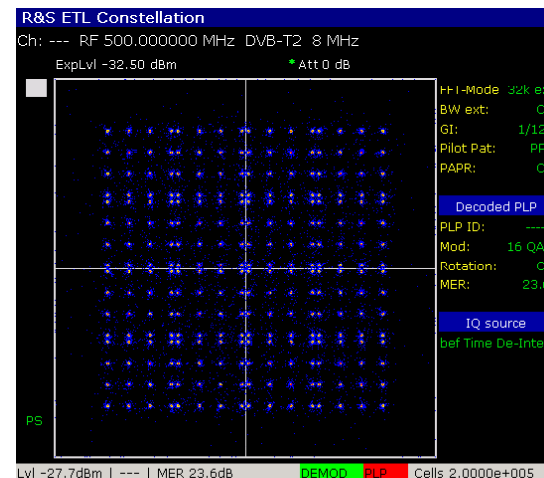
P1 Symbol



OFDM Cells  
before  
Frequency  
De-  
Interleaving



PLP Cells  
before De-  
Rotation

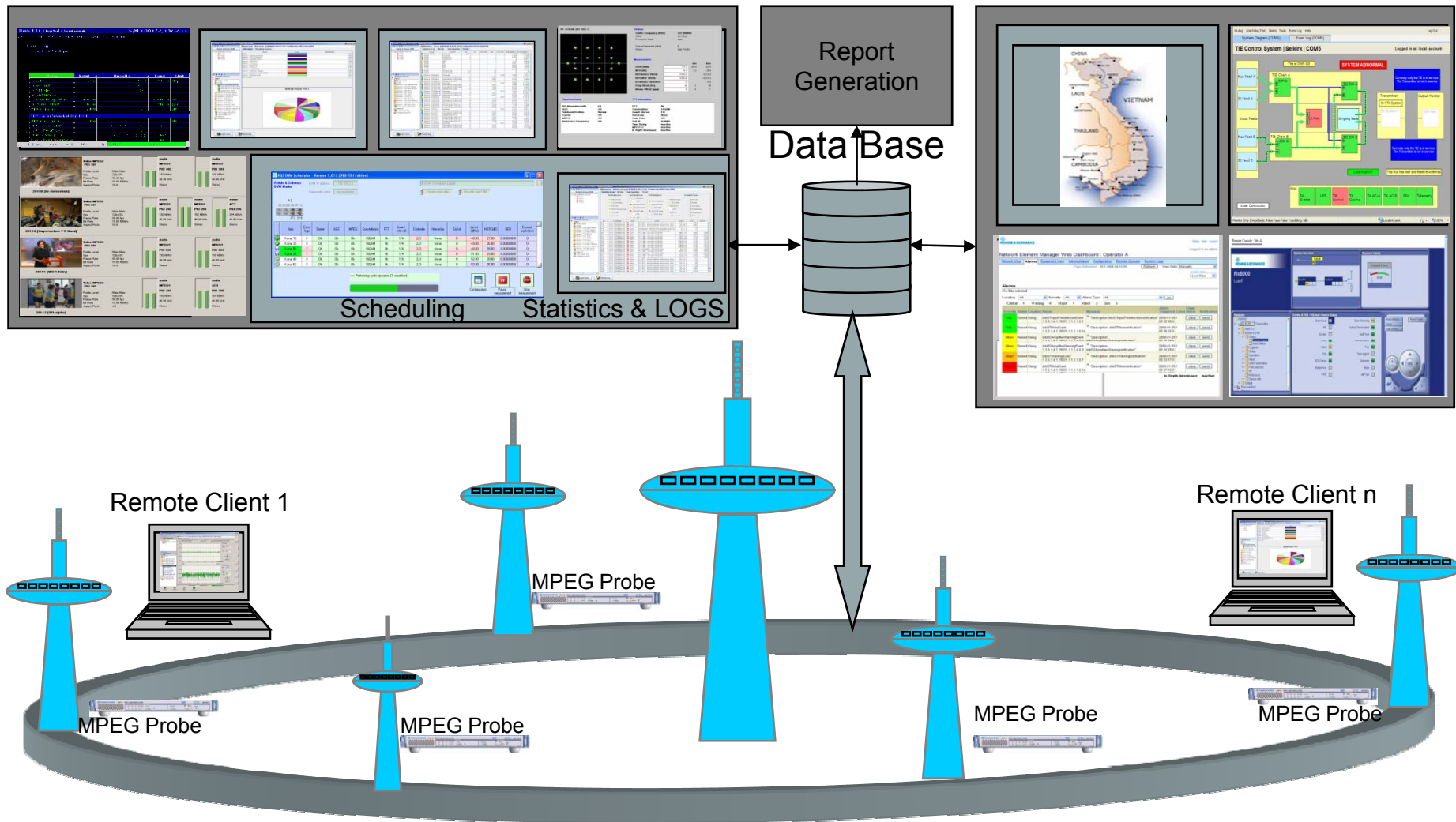


PLP Cells  
before  
Time  
Interleaving

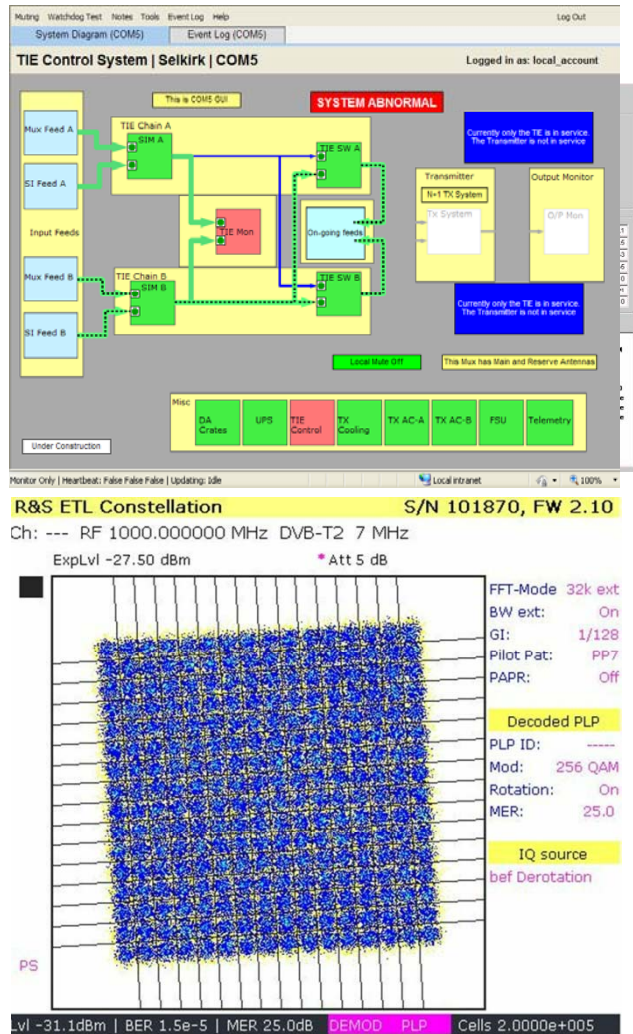


# Network Management Centre

# Transmission Centre

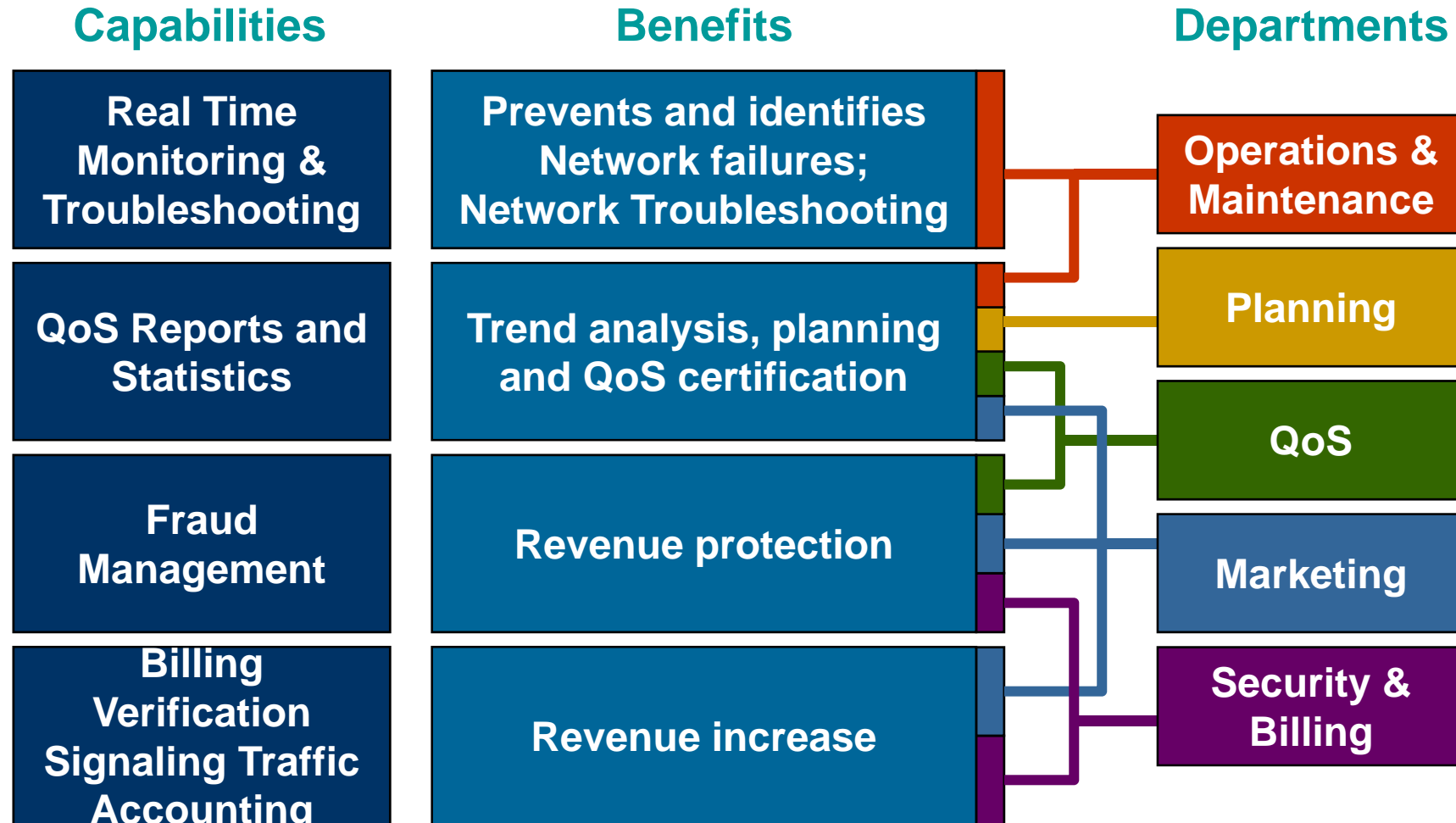


# Simply Manage your Transmitter Network





# Crossfunctional Support of a Network Monitoring & Management System



# The added Value

High Availability of Transmitter Network by reducing Downtime

- | Keep Network Availability high
- | Verification of Service Level Agreements (SLA)
- | Keep and maintains the Quality of Service (QoS)

Immediate Action for Service Teams in case of Transmitter / Network Problems

- | Switching & Monitoring redundancy concepts (Headends, Transmitters, Exciter or Power Amplifier Faults)
- | Maintain a SFN configuration
- | Easy Localization of Faults by ideal positioning of Monitoring Probes

Verifies and captures Quality of Service Data between

- | Content Provider
- | Broadcaster
- | Network Operator

# Summary

- | Modern Measurement & Monitoring Systems will:
  - | Help to manage complex Networks & Technologies with a wider flexibility
  - | Become smaller and have more processing power
  - | Have intuitive GUI (easy to use)
  - | Cover a broad range of standards
  - | Have new measurement features
  
- | Engineers
  - | Have to understand technologies
  - | Have to learn, understand and make correct interpretations from measurement results
  - | Have to understand system architectures



**NO MEASUREMENT SYSTEM CAN TAKE OVER THIS JOB !**

Thank you for your attention !

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