

Geneva 2006: a step forward

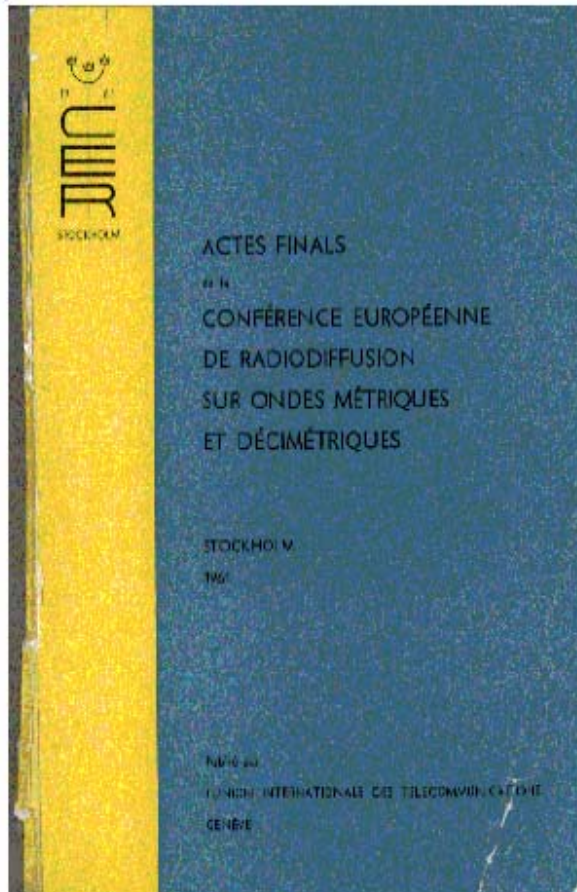
Antonio Sassano



Fondazione Ugo Bordoni

Roma, 23 Aprile 2008

What is a Plan?

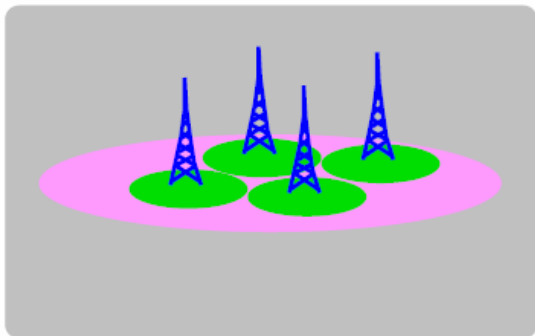
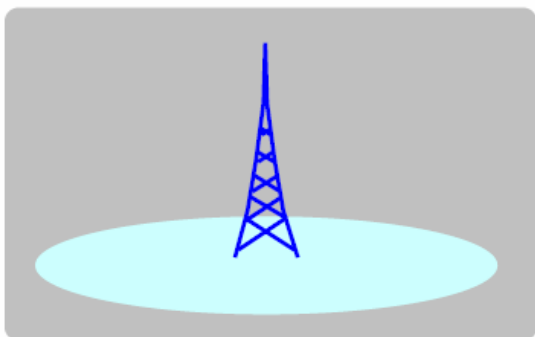


- As an example, Stockholm 61 contained:
 - A list of transmitters with their characteristics
 - Protection rules for these transmitters and their service area
 - Coordination rules to allow for addition and modification of transmitters

FRB-No.	ERP	TX-Name	Freq.	Ch.	Ctry	Pol.	Longit.	Latit.	Heffm.	Ant.H.	Sys	Offset	Patt
10008095	15,4	GLEN CONVINTH	519,25	27	G	V	004W29 16	57N25 07	147	18	I	0	D
61015748	6	TARBERT	519,25	27	G	V	005W25 00	55N51 00	92	40	I	0	ND
91003671	6	BLAENLLECHAU	519,25	27	G	H	003W27 00	51N40 00	122	40	I	20	ND
61015730	30	PONTYPOOL	519,25	27	G	V	003W02 00	51N41 00	280	40	I	0	ND
61015616	27	ABERDARE	519,25	27	G	V	003W24 00	51N42 00	165	40	I	-20	ND
61015632	10	BEDLINO	519,25	27	G	V	003W18 00	51N42 00	227	40	I	0	ND
61015628	31,8	BARGOED	519,25	27	G	V	003W14 00	51N42 00	220	40	I	20	ND
61015619	0	ACHINASKELPICK	519,25	27	G	H	003W13 00	58N30 00	90	40	I	-20	ND
61015721	3	NANT Y MOEL	519,25	27	G	V	003W32 00	51N38 00	161	40	I	0	ND
61015753	19,5	UBLEY	519,25	27	G	V	002W40 00	51N20 00	171	40	I	-20	ND
61015683	10	FROME	519,25	27	G	V	002W19 00	51N14 00	38	40	I	20	ND
61015757	10,8	WEST LAVINGTON	519,25	27	G	V	002W00 00	51N16 00	100	40	I	20	ND
61015662	24	CHARTHAM	519,25	27	G	V	001E01 00	51N16 00	105	40	I	20	D
102003919	4	PORTBURY	519,25	27	G	V	002W43 06	51N28 19	35	12	I	20	D
61015723	15,4	NEWNHAM	519,25	27	G	V	000E48 00	51N17 00	97	40	I	-20	ND
61015621	9,5	ALDBOURNE	519,25	27	G	V	001W37 00	51N28 00	53	40	I	0	ND
101011221	7	BARRY 485	519,25	27	G	H	003W14 00	51N25 00	20	15	I	20	D
61015629	11,5	BARTON HOUSE	519,25	27	G	V	002W34 00	51N27 00	65	40	I	20	ND
61015654	17	CALNE	519,25	27	G	V	002W00 00	51N26 00	53	40	I	0	ND
61015764	10	KOUTELI	519,25	27	GRC	H	022E02 00	38N01 00	-60	40	G	0	ND
61015761	32	BORSA	519,25	27	GRC	H	022E41 00	37N44 00	-110	40	G	0	ND
61015763	27	KALLITHEA	519,25	27	GRC	H	021E49 00	37N33 00	620	40	G	0	ND
61015766	50	SILO	519,25	27	GRC	H	025E57 00	41N10 00	600	40	G	8	ND
61015765	30	PARNIS	519,25	27	GRC	H	023E42 00	38N09 00	962	40	G	0	ND
61015767	60	THESSALONIKI	519,25	27	GRC	H	022E46 00	40N47 00	211	40	H	-8	D
61015762	32	GORANOI	519,25	27	GRC	H	022E27 00	36N56 00	371	40	G	0	ND
102032694	13	VAGASHUTA	519,25	27	HNG	H	021E32 46	48N25 14	199	25	G	0	D
102009763	14,8	BIKAL	519,25	27	HNG	H	018E16 00	46N19 00	100	0	G	-8	ND
102032692	3,5	OZD_FARKASLYUK	519,25	27	HNG	H	020E18 32	48N11 07	112	15	G	-8	D
102032690	10	BUKKSZENTKERESZT	519,25	27	HNG	H	020E39 00	48N04 00	400	0	G	0	D
102032691	10	LUCFALVA	519,25	27	HNG	H	019E41 00	48N02 00	300	0	G	-8	ND
102032693	7,8	SZARVASKO	519,25	27	HNG	H	020E20 08	47N59 03	203	17	G	2	D
98002888	21,5	GYONGYOS	519,25	27	HNG	H	019E58 00	47N47 00	426	40	G	0	D
61015768	57,8	SEREGELYES	519,25	27	HNG	H	018E35 00	47N07 00	75	40	K	8	ND
102032689	31,8	BUDAPEST_INTERCON	519,25	27	HNG	H	019E03 04	47N29 43	51	50	G	-8	D
102009778	27	JAK	519,25	27	HNG	H	016E33 00	47N08 00	100	0	G	6	ND
102009815	27	SZIGETVAR	519,25	27	HNG	H	017E47 09	46N03 01	131	117	G	-8	ND
102009817	24,8	SZILVAGY	519,25	27	HNG	H	016E37 00	46N42 00	100	0	G	8	D
98002887	30	FARKASFA	519,25	27	HNG	H	016E19 00	46N55 00	111	40	G	0	D
61015769	60	LOPIK	519,25	27	HOL	H	005E03 00	52N01 00	361	40	G	-8	ND

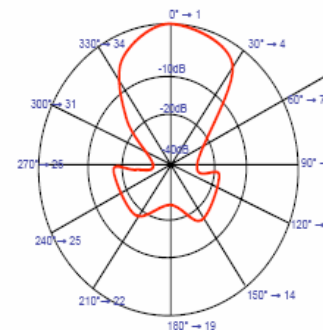
GE06: Digital changes the rules

Two types of *planning objects*: **Assignments** and **Allotments**



Assignment is a “fully specified transmitter”

- Site
- Frequency
- Antenna Diagram
-

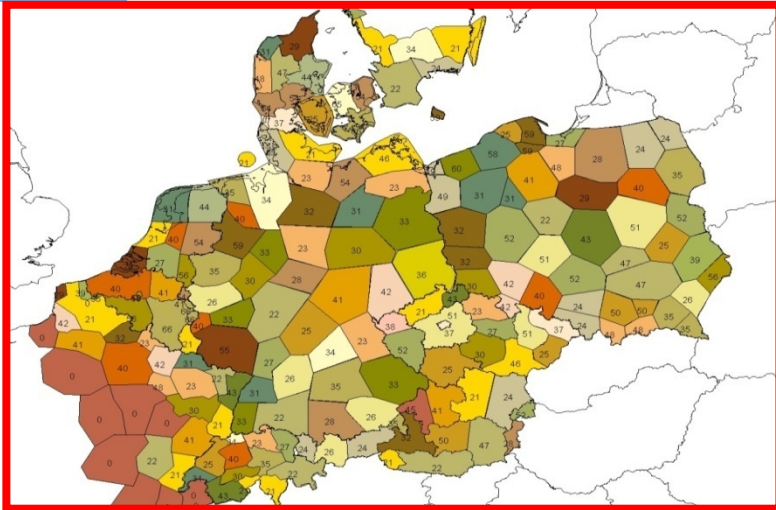


Allotment is a **geographic area** where:

- A **SFN** using frequency f can be designed
- The actual structure of the SFN is left open

- **STOCKHOLM '61** had only assignments
- *Allotments* ease a “flexible” approach to digital coverage

GE06: Current status



- Bilateral agreements*
- Need for more resources*
- Re-planning the band 61-69?*
- Flexible use of TV spectrum?*

- Key question:** *the rôle of allotment and assignment*
 - SFN sub-networks?*
 - Protected areas?*
 - Changing the Plan?*

Our answer: *allotment/assignments define thresholds*

- Network operators are free to design their networks*
- Different services in the same band (in different countries)*

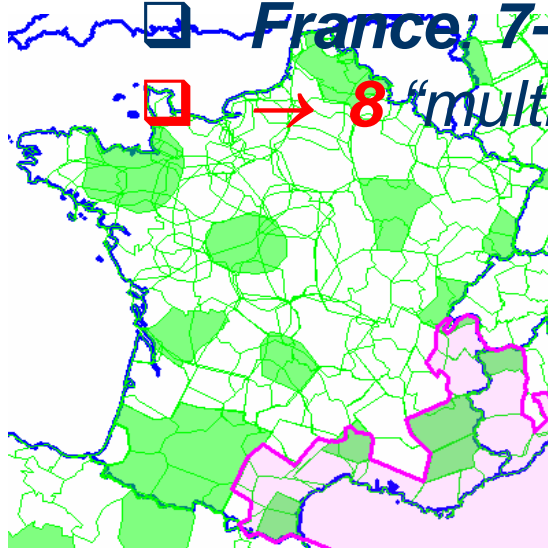
Rôle of the Allotments

□ Hypothesis 1: puzzle

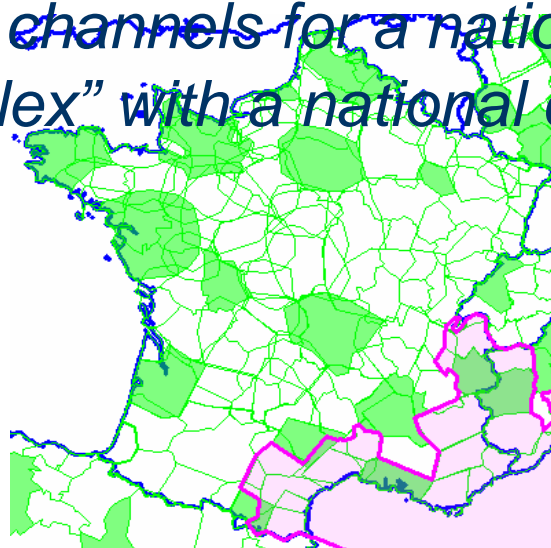
- **pieces** Networks are composed by **SFN sub-networks**
- One SFN sub-network per allotment (like puzzle pieces)

□ **France: 7-8 channels for a national cover**

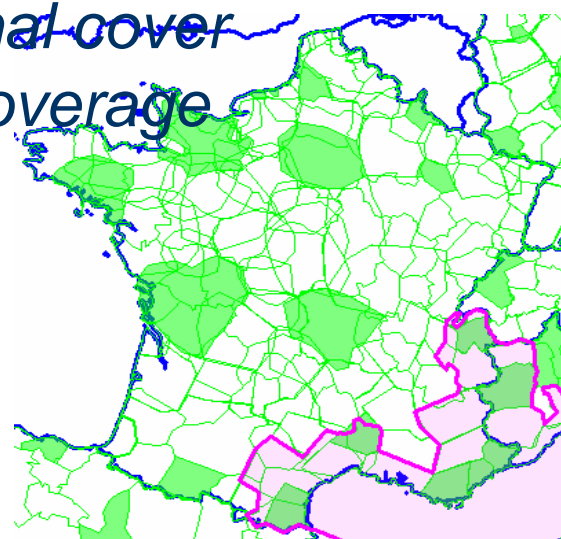
□ **8 “multiplex” with a national coverage**



Ch 24



Ch 22

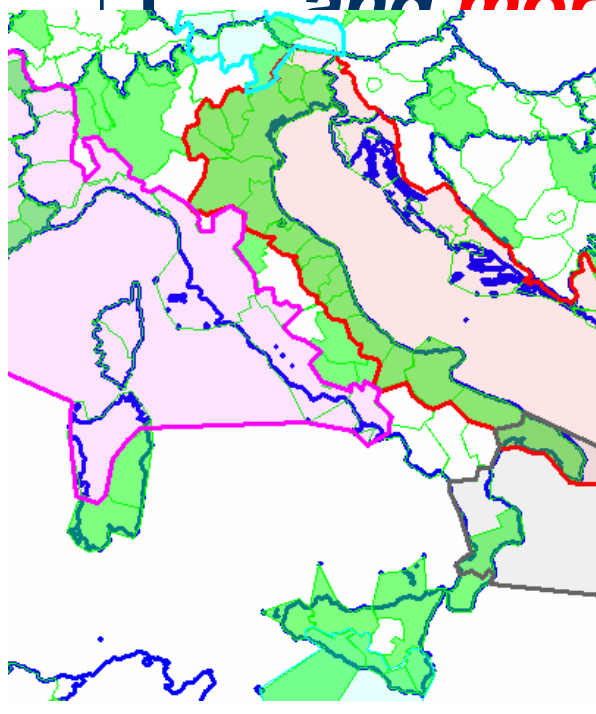


Ch 30

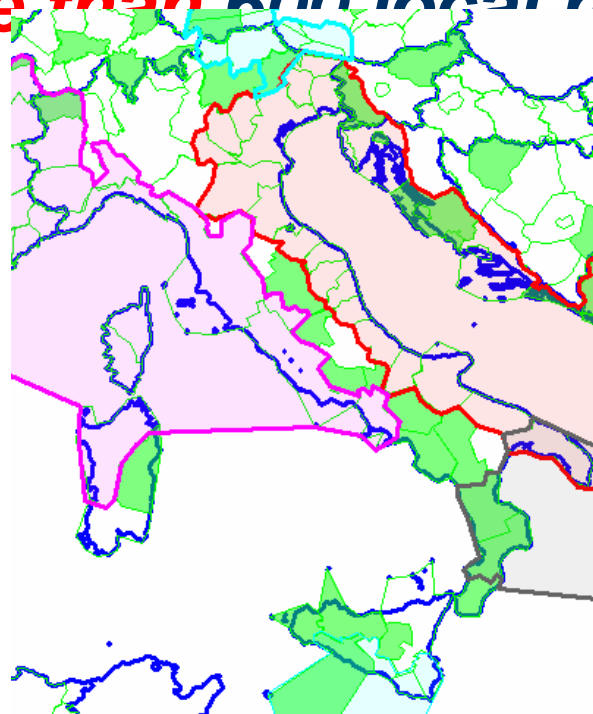


Italian puzzle

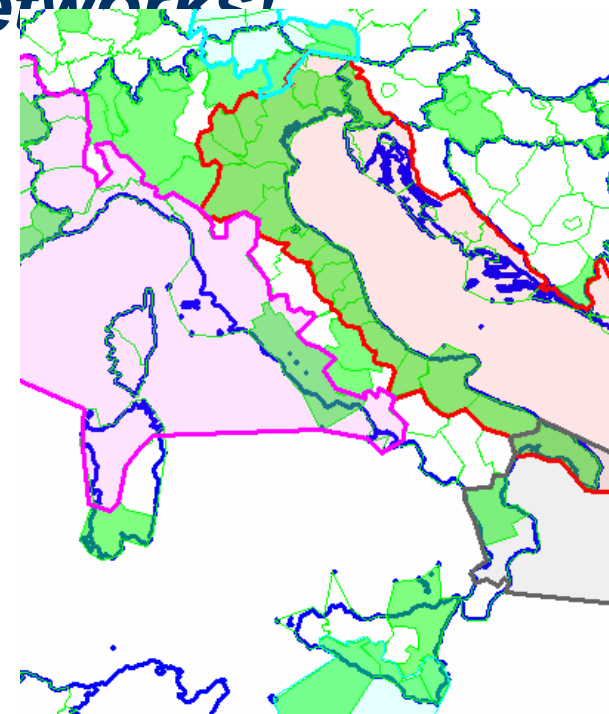
- ❑ **8-10 multiplex with national coverage**
- ❑ **But ... we have *more than 20 national A/D networks***
- ❑ ***and more than 600 local networks!***



Ch 25



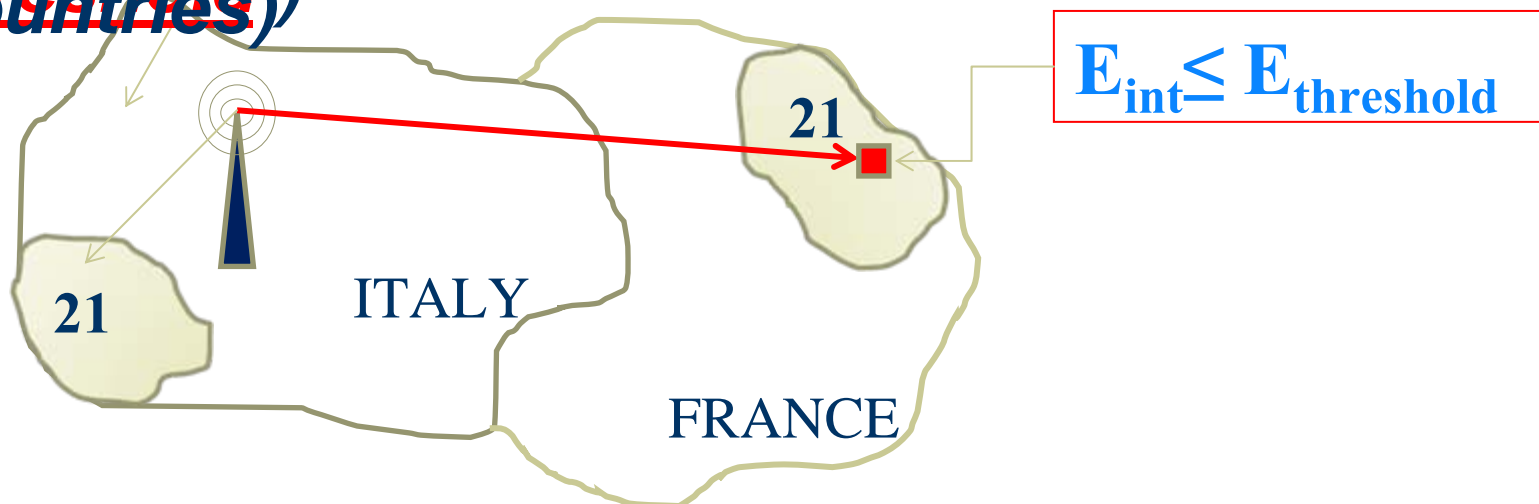
Ch 27



Ch 48

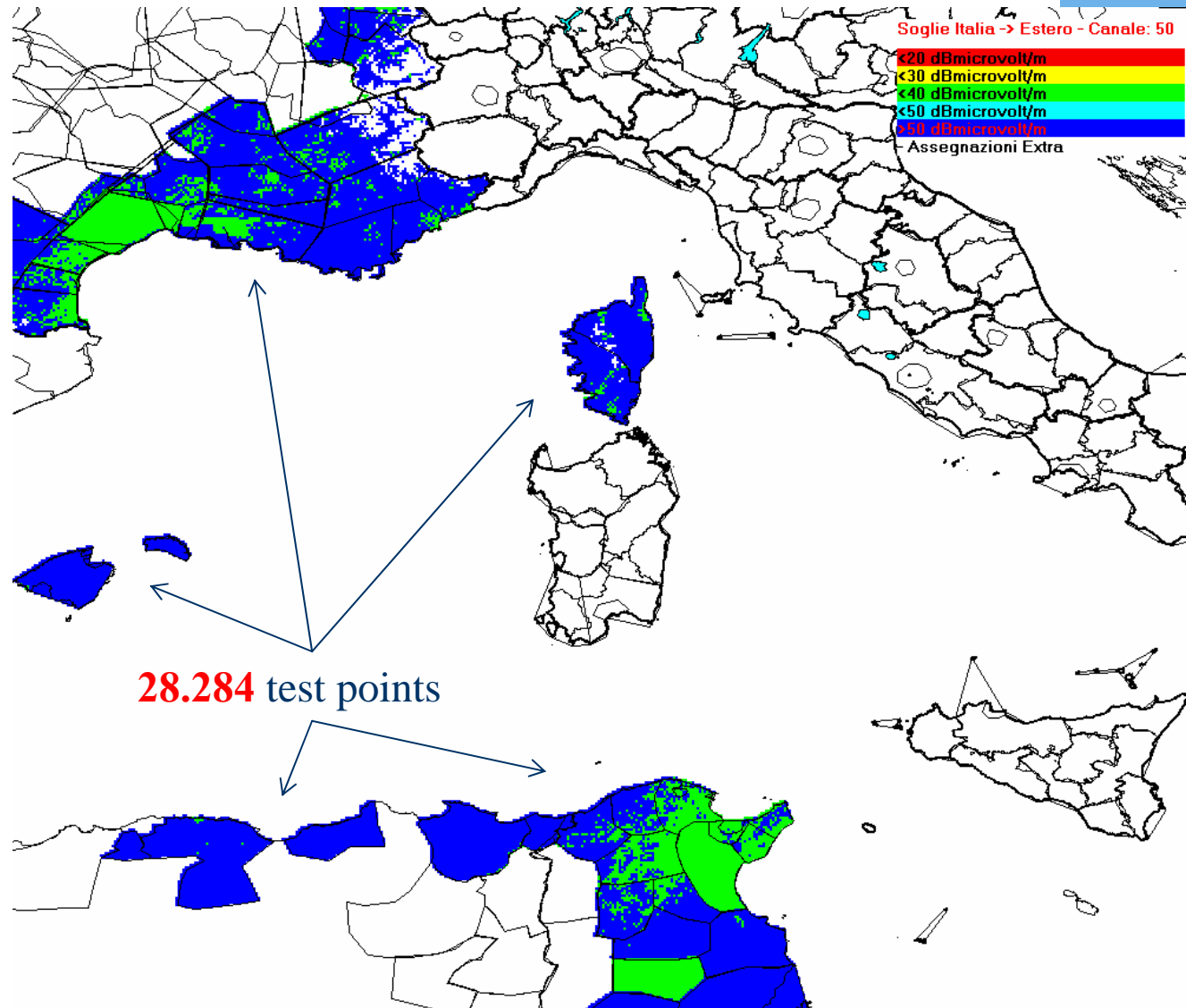
New Ideas needed: **the step forward**

- ❑ **Allotment and Analog Services** define protected areas
- ❑ **Assignments raise the threshold** (in neighboring countries)



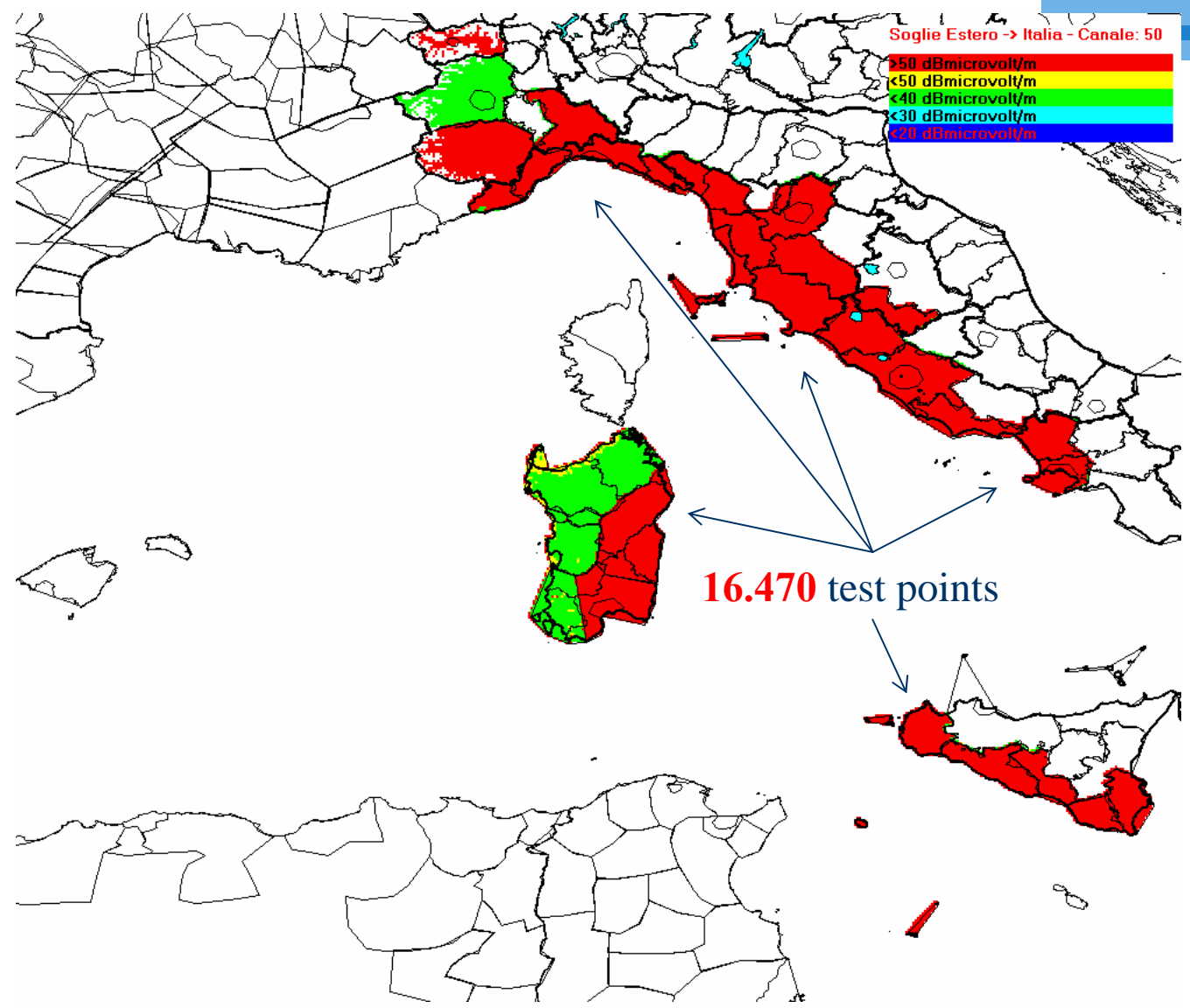
- ❑ **A channel can be used everywhere** (in both countries)

Thresholds Channel 50 (France, Spain, Tunisia, Algeria)





Thresholds Channel 50 - Italy

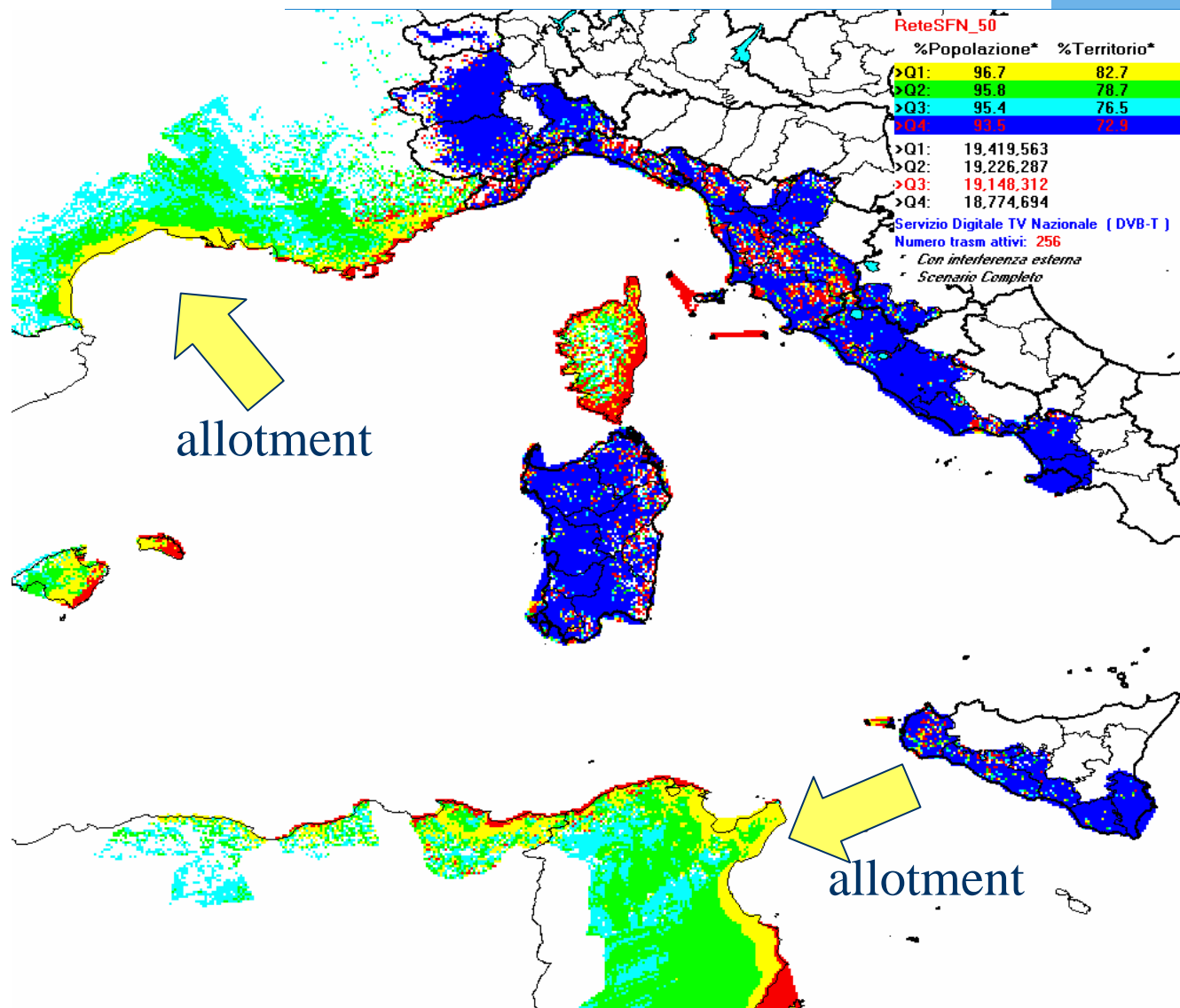




Planning with thresholds (our proposal)

- ❑ **Administrations** agree on threshold values (checking that reasonably good networks can be designed while respecting the agreed constraints)
- ❑ **Network operators** design their networks in full freedom; only one constraint: the power-sum of the interferers must be smaller than the agreed threshold
- ❑ The **Optimization problem** is now that of maximizing the (population) coverage while the threshold constraints are satisfied (by the power sum)

Reference Network Channel 50 (95.4%)





Conclusion: optimization is crucial

Network Planning and Coverage

Optimization

- Interference minimization
- Service maximization
- Better use of spectrum
- Better use of international agreements

Time Shift Optimization

Optimal Design of the A/D Transition

- Optimal Decomposition of the process
(design of **Technical Areas**) → (clustering)
- Design of **Transition Schedule** →
(partition+scheduling)



A single question to our panel

- ❑ **The step forward is not for free.** Sophisticated algorithmic tools and a higher comprehension of the theoretical framework are needed to solve the network design problem (Simulation based heuristics, PLI methods);
- ❑ Checking the compatibility of pair of allotments is not enough (and not needed). **Network Design is not any longer a “cut and try” game;**
- ❑ **Are the Network Operators aware of the increased computational difficulty of this new paradigm? Are they bracing themselves against this new task?**