

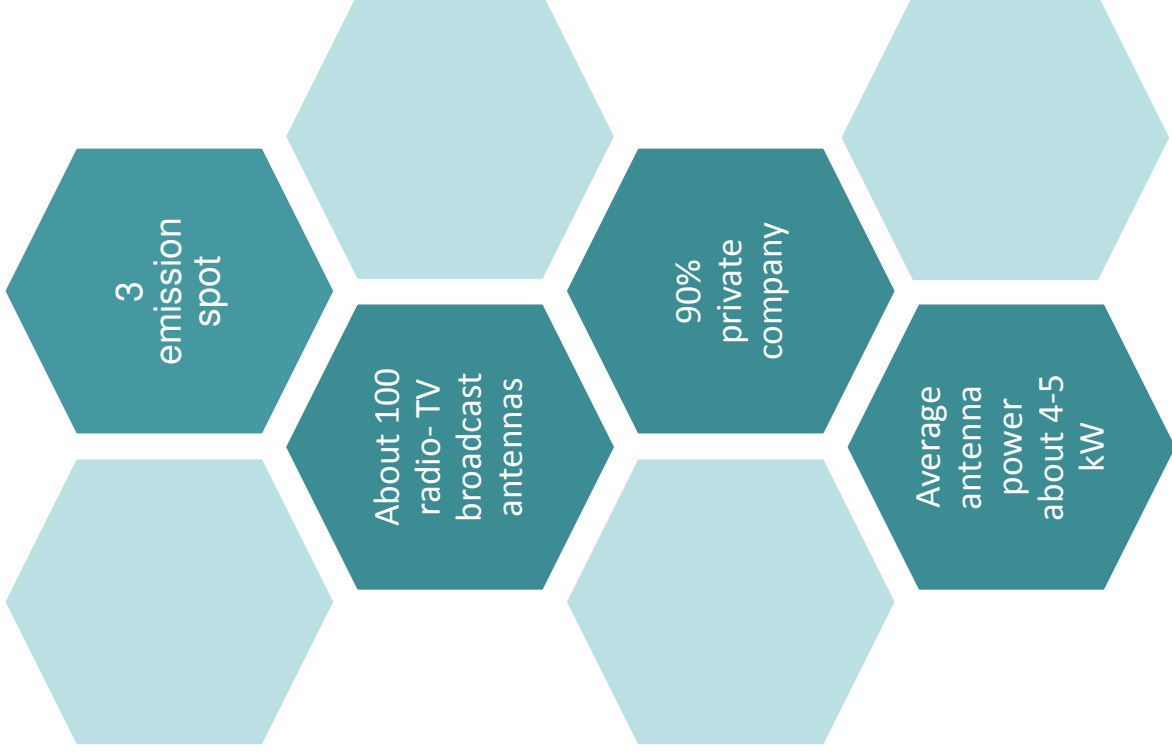


# Remote control of broadcast transmissions

*Enrica Caputo – Arpa Piemonte, Radiation Department*



# BROADCAST ANTENNA SITE (Torino hill)

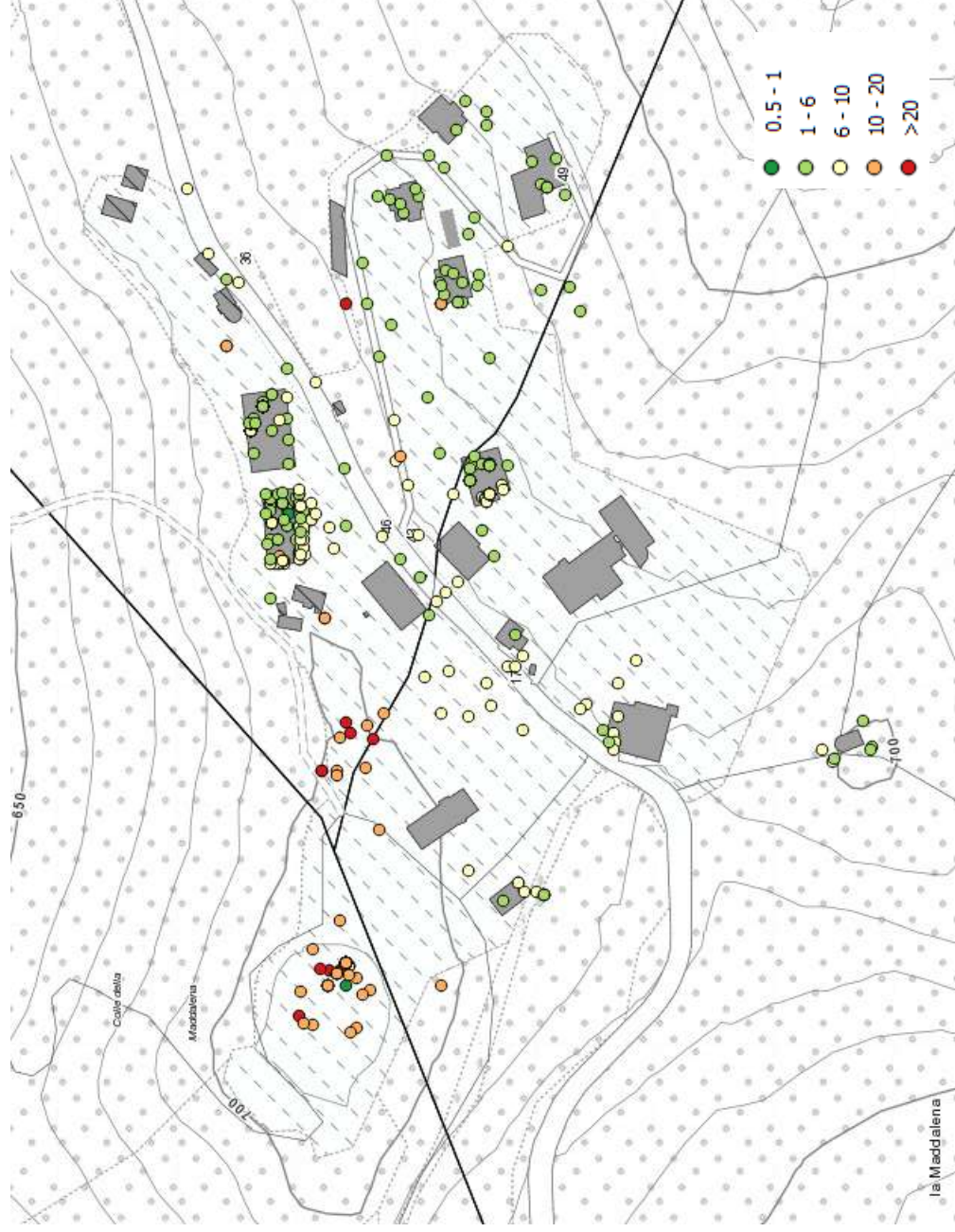




## BROADCAST ANTENNA SITE (Torino hill)

Narrow band and broad  
band measurements  
since 1996

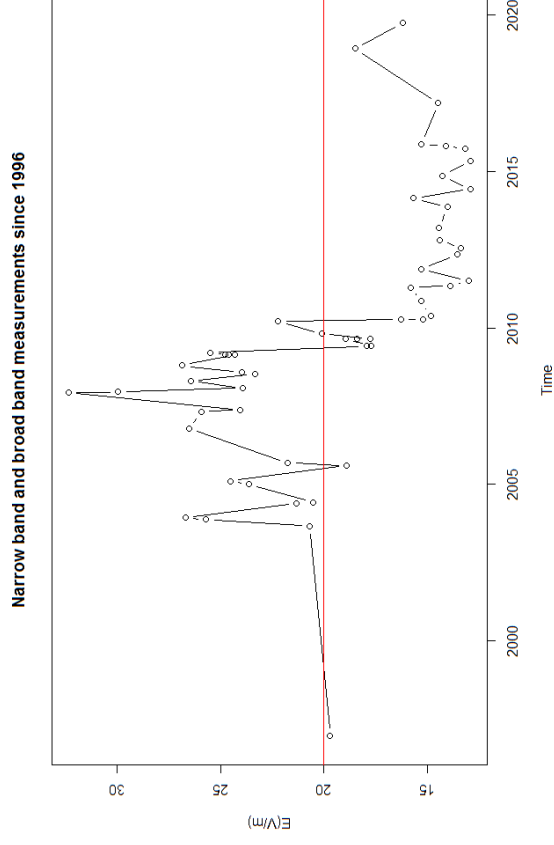
National exposure limits  
not respected



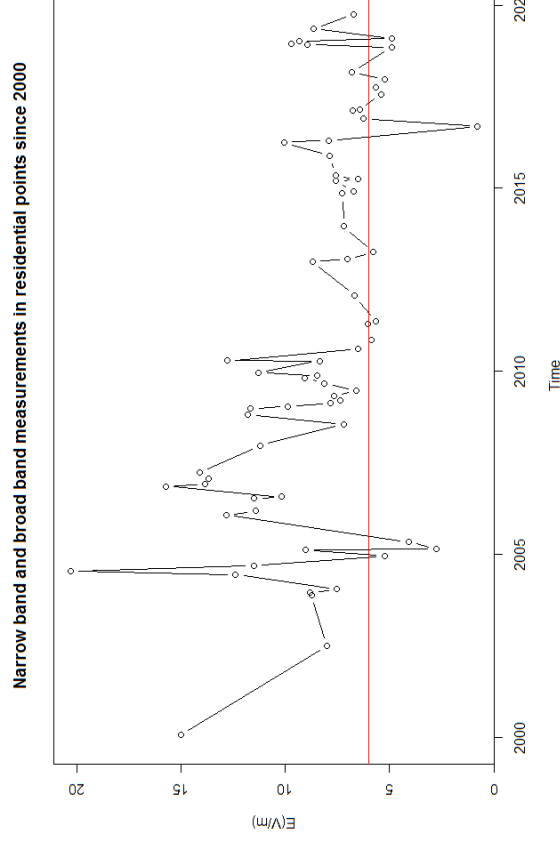


# BROADCAST ANTENNA SITE (Torino hill)

Narrow band and broad band measurements near emission spot



Narrow band and broad band measurements in residential points near emission spot





# **AUTOMATIC MONITORING SYSTEMS OF RF ELECTROMAGNETIC FIELD EMITTED FROM BROADCAST SITES SMART**

**Monitoring system = omnidirectional receiving antenna + spectrum analyzer HP 8594E + PC**

**Receiving antenna is in line of sight with broadcast site**





## SMART

Two dedicated software was realized to record and to store in a database amplitude levels of each radio frequency signal (one acquisition per hour)

To record → Labview

To store → R

Data acquisition is continuous h24 with hourly remote download spectra

Spectrum analyzer HP 8594E (Number of points 801)  
RBW 30 kHz, VBW 30 kHz, Detector RMS, Trace maxhold 6”

Frequency range 88 MHz-108MHz  
span=4.5 MHz → 5 overlapped records\*  
span=10 MHz → 3 overlapped records\*

Each hour 3 spectra are saved in a specific server (we can see and control every spectrum)



**SMART**

**Spectrum analyzer HP 8594E (Number of points 801)  
RBW 30 kHz, VBW 30 kHz  
Frequency range 88 MHz-108MHz  
Span 10 MHz →3 overlapped records**

Record	CF (MHz)	START (MHz)	STOP (MHz)
1	90.5	85.5	95.5
2	99.5	94.5	104.5
3	108.5	103.5	113.5

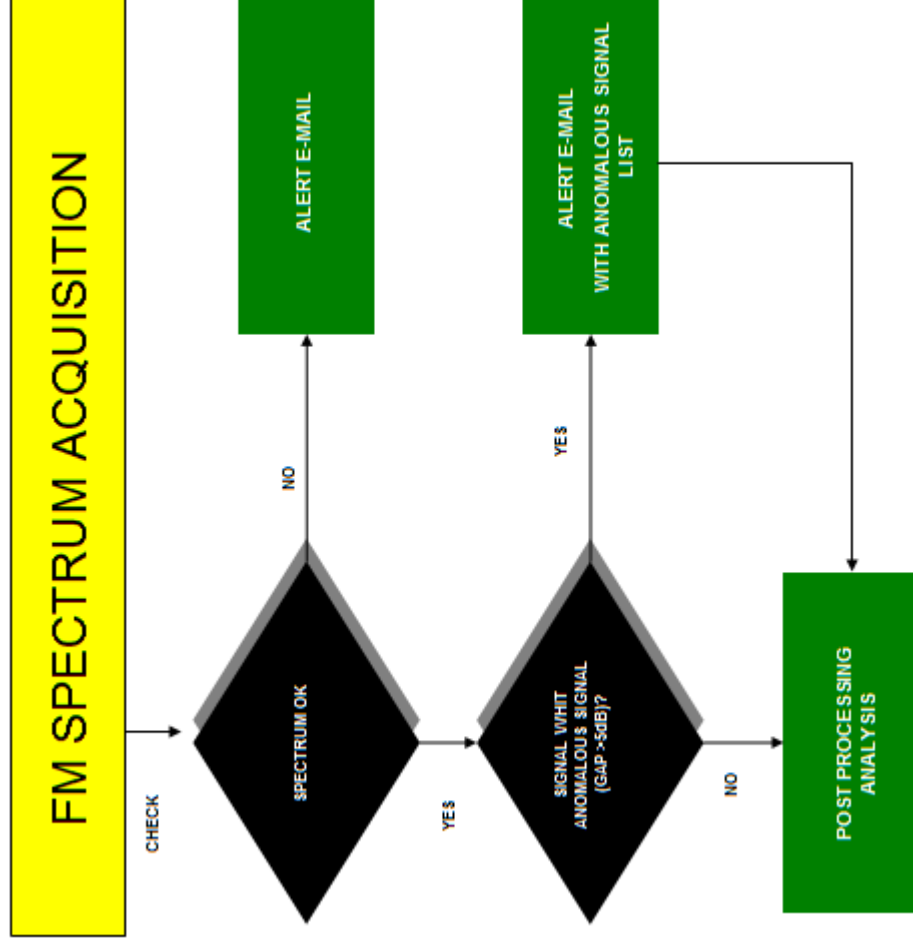
$$f = CF + \frac{(i - 401) \cdot SPAN}{800}$$







SMART



Flowcart of data storage and analysis



**SMART**



## **Database storage: automatic R script**

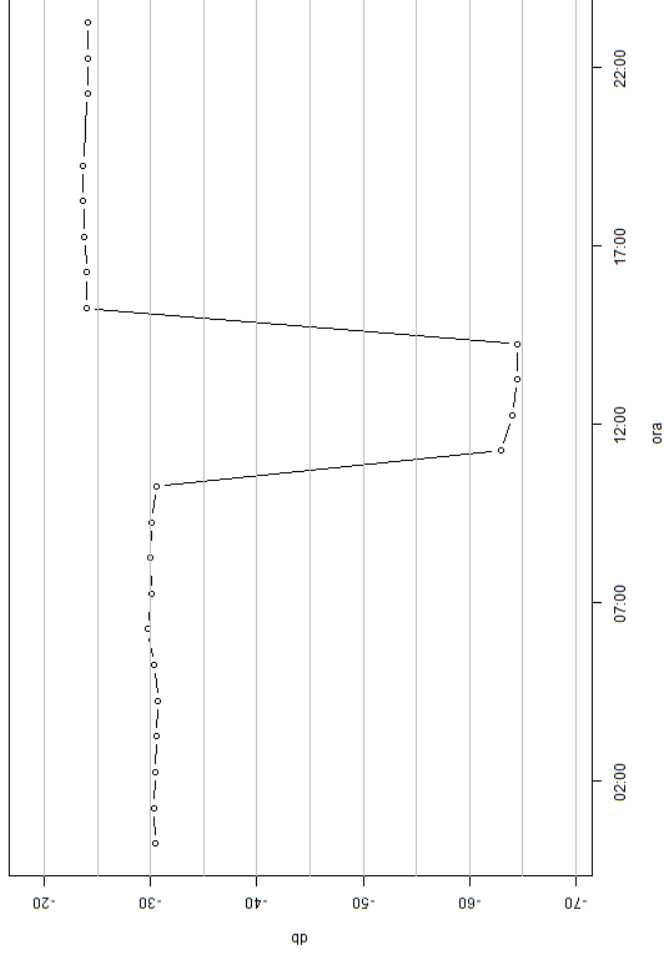
- 1. Controls if spectra files are correctly saved**
- 2. Extracts the values in spectra files to have 801 point  
whit right frequencies**
- 3. Saves FM spectrum in a ACCESS database**
- 4. Controls anomalous time variations of signal levels**
- 5. Notifies anomalous time variations by email**



SMART

Once a day a specific automatic R script analyses time variation of signal levels on 24 h and creates graphical images for signal with amplitude gap >5dB

94.2 MHz - RADIO ALFA Andamento temporale 2019-11-26





**SMART**

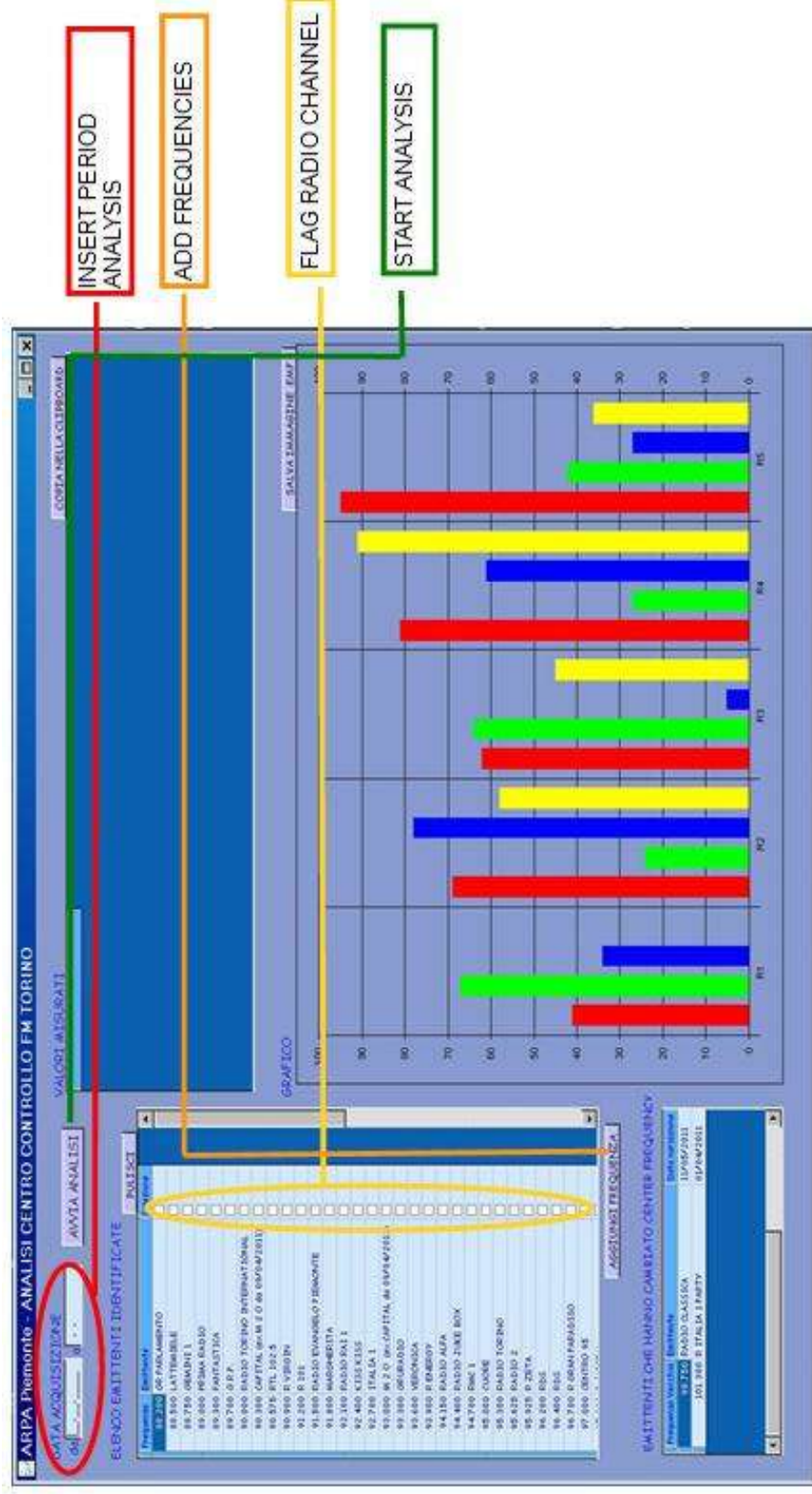
## **Once a day an Arduino System**

- **records RDS information of FM radio broadcasters to identify sources**
- **records ID of FM radio broadcasters (PI code)**

**Once a day a R automatic script match Arduino data with SMART data and notifies differences between values**

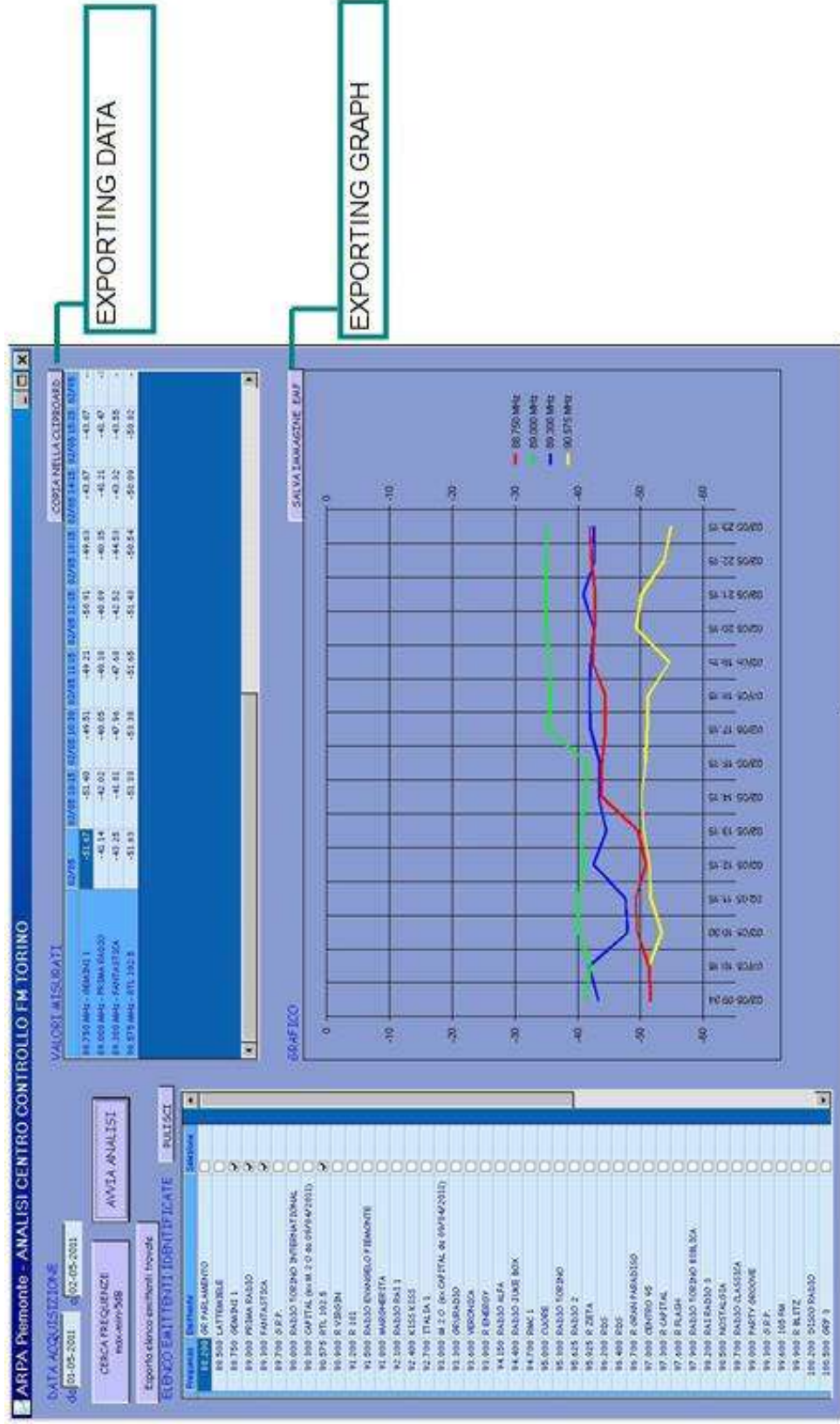


# POST PROCESSING ANALYSIS





# POST PROCESSING ANALYSIS



4 RF BROADCAST SIGNALS SELECTED

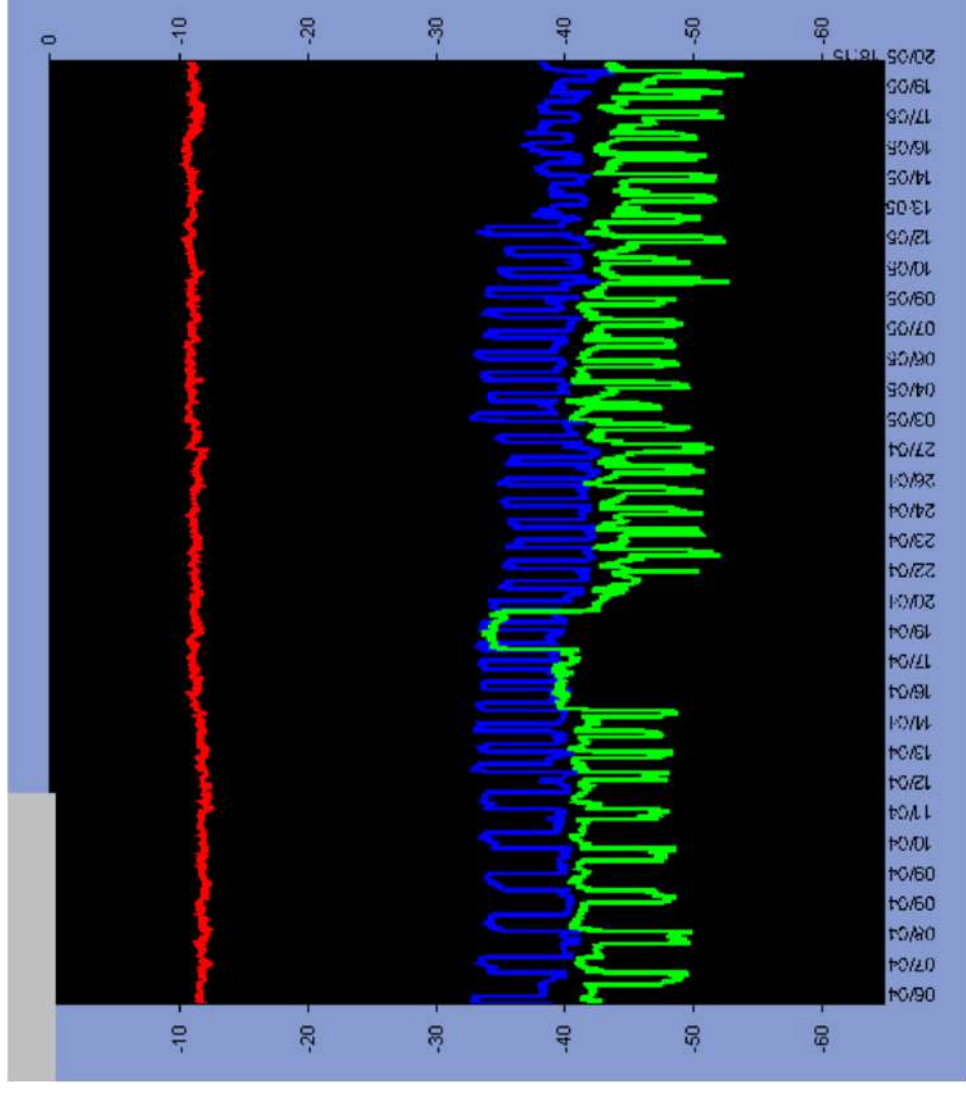


## POST PROCESSING ANALYSIS

**Signals emitted from 2 broadcast transmitters : daily time variation**

**In the nighttime rf power provided to transmitters was lowered of about 6 dB**

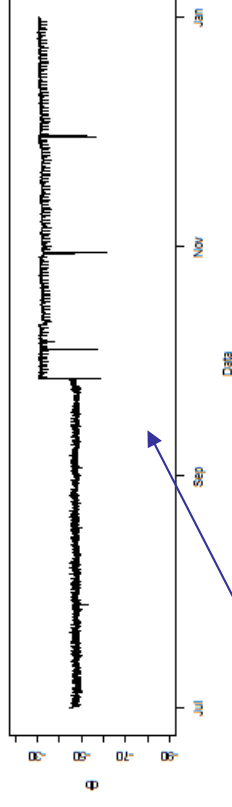
**Real working conditions of telecommunication systems**



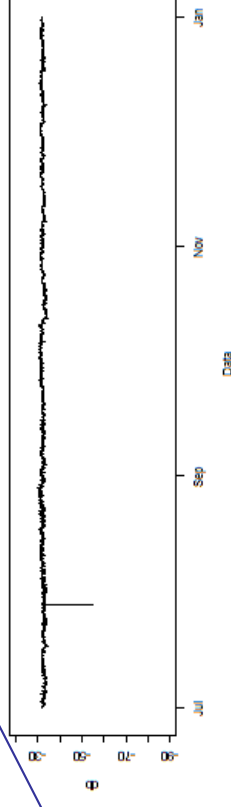


## POST PROCESSING ANALYSIS

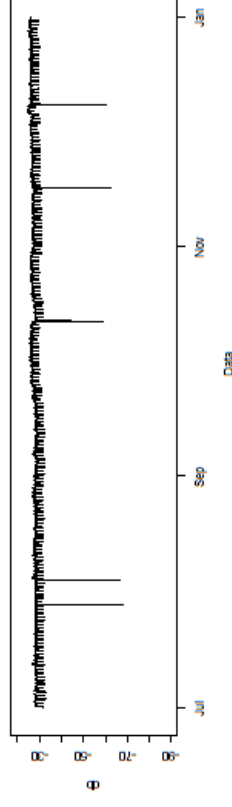
93.300 MHz Andamento temporale 01/07/2018 - 31/12/2018



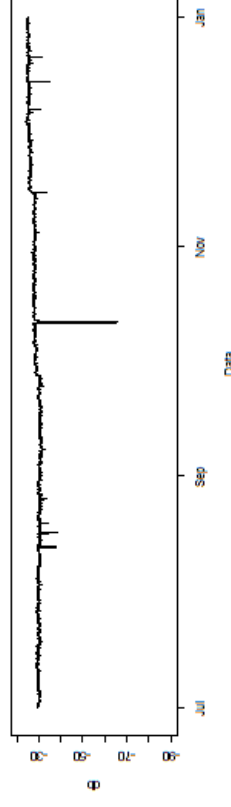
93.600 MHz Andamento temporale 01/07/2018 - 31/12/2018



93.900 MHz Andamento temporale 01/07/2018 - 31/12/2018



94.200 MHz Andamento temporale 01/07/2018 - 31/12/2018



**Extracting long period data  
we can analyze immediately  
Anomalous signals**

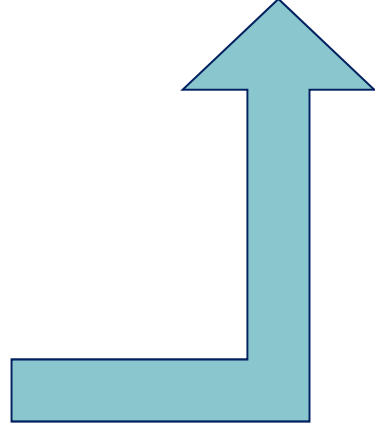




## BROADCAST ANTENNA SITE (SkyPark)

SkyPark, Skylogic's teleport in Turin, is one of the world's largest platforms for bidirectional, IP protocol, broadband transmissions.

- 14 parabolic antennas
- 5 - 6 m diameter
- Frequency band  $K_u$  (12 – 18 GHz), K (18 – 27 GHz)
- Transmission power 80 W - 303 W





## BROADCAST ANTENNA SITE (SkyPark)

**Population is very worry about this site (probably because antennas are very big)**

**SPOT measurements  
CONTINUOUS measurements  
CONTINUOUS monitoring of electrical characteristics**





# BROADCAST ANTENNA SITE (SkyPark)



## SPOT measurements

LUOGO DI MISURA	Punti di misura in direzione di Tor 14 ed a distanza di 1 metro			CAMPO ELETTRICO (V/m)
	Posizione	Distanza (Metri)	Altezza (Metri)	
Via Centallo 72 (Interno teleporto Skylogic)	Catenella di sicurezza	15	1.5	Letto 1.12
	Punto 1	25	6.2	29.64 (max 31.02)
	Punto 1	25	5.1	2.21(Max 2.92)
	Punto 2	25	6.2	9.12 (max 9.72)
	Punto 3	25	6.2	30.64 (max 31.2)
	Punto 4	25	6.2	14.66 (max 16.28)
	Punto 5	54	9.50	3.65 (max 3.84)
Strada fronte civico 62 int 16	Punto 6	54	9.50	4.83(max 4.92)
	Punto 7	55	8.75	2.17



## BROADCAST ANTENNA SITE (SkyPark)

### CONTINUOUS measurements

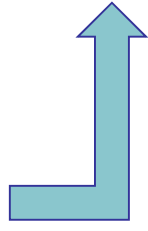
CENTRALINA VIA CENTALLO 62/26 (s.n. 0330J11109) SENSORE EP 408 (1 MHz ÷ 40 GHz)	
PERIODO	dal 01.11.10 al 01.12.10
LIVELLO MASSIMO	< 0.8
LIVELLO MINIMO	< 0.8 V/m
LIVELLO MEDIO	< 0.8 V/m
% < 0.8 V/m	100 %



## BROADCAST ANTENNA SITE (SkyPark)

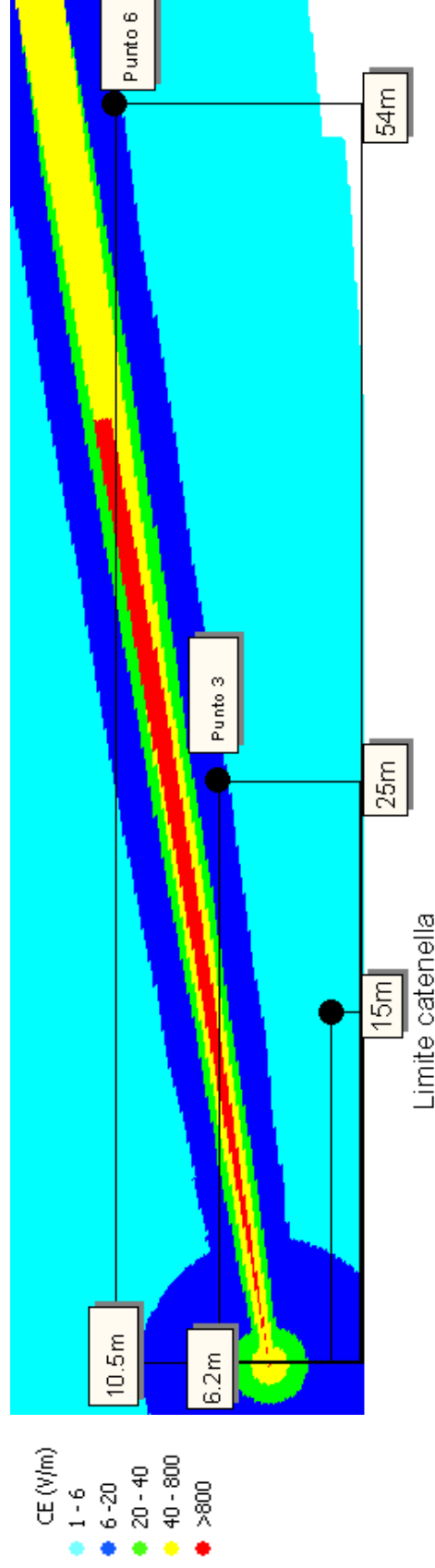
All parabolas are pointed towards geostationary satellites and, therefore, they should have a fixed radiation direction (within  $\pm 0.5^\circ$ ).

Why we are interested in?



High P + High Gain

### Example of vertical section





## BROADCAST ANTENNA SITE (SkyPark)

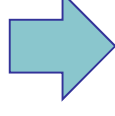
**CONTINUOUS** monitoring of electrical characteristics

Every day Skylogic downloads on a ARPA FTP server the transmission power and direction values recorded every 15 minutes for each of the 14 antennas.

A dedicated tool (R automatic script) was realized to copy values and to store them in a database.

R script controls data update, sends alerts if there are missing or anomalous values and creates calendarplot diagrams for each antenna. Anomalous data are values which are higher than authorized

Calendarplot diagrams are publishing on ARPA website

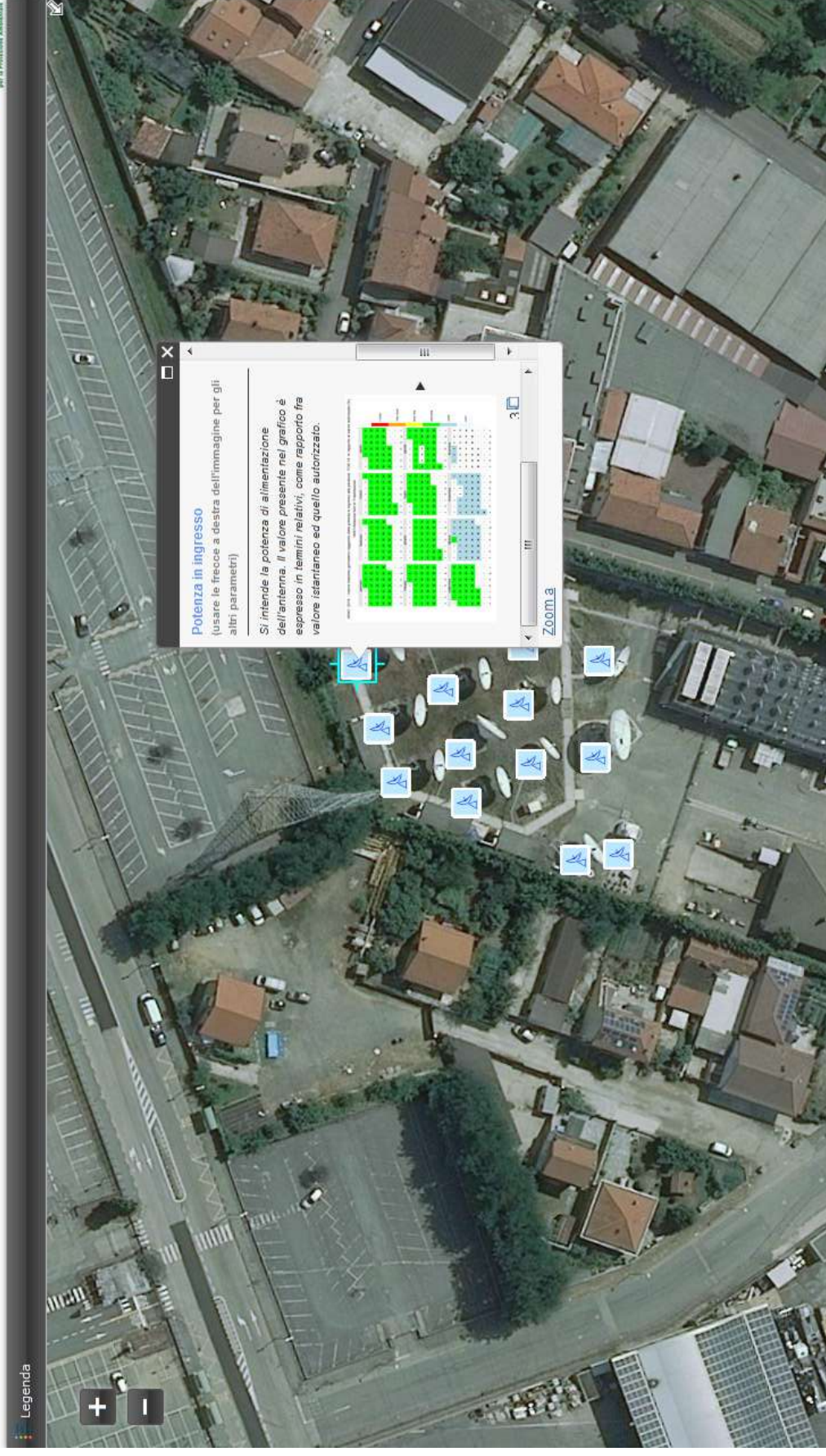


```
http://webgis.arpa.piemonte.it/arpaviewer/index.html?webmap=926286fc1c3c4fe39108e93fcd437338&gcsextent=7.721,45.1048,7.7236,45.1064&displayli  
der=true&displaylegend=true&displaytitle=true&title=Teleporto%20SKYLOGIC  
%20a%20Torino
```



# BROADCAST ANTENNA SITE (SkyPark)

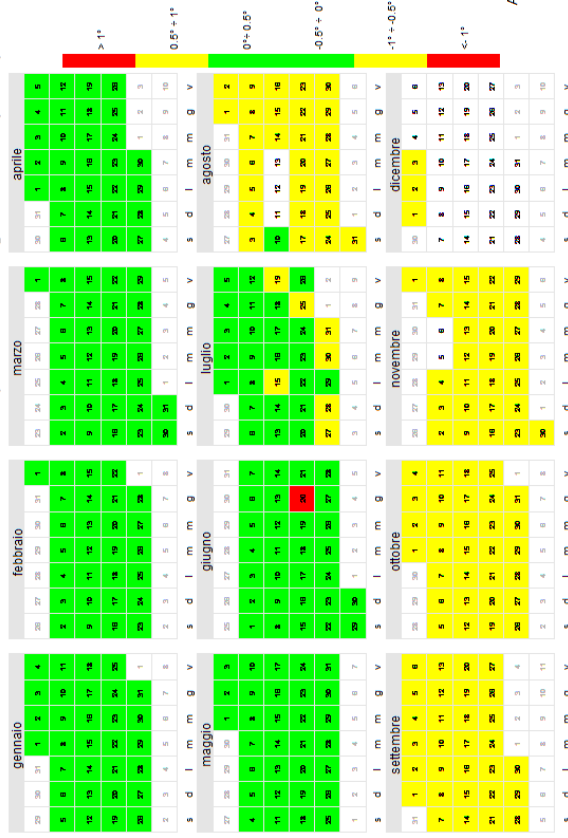
Teleporto SKYLOGIC a Torino



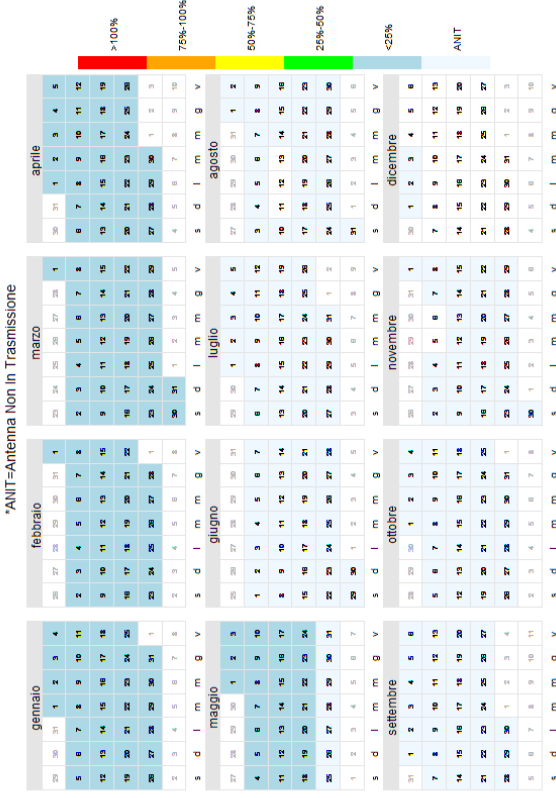


# BROADCAST ANTENNA SITE (SkyPark)

ANNO 2019 - Parabola TOR-18 - Differenza massima giornaliera fra elevazione istantanea e autorizzata\*  
 \*N.B. valido solo nel caso di antenna in trasmissione (verificare sull'immagine relativa alla potenza)



ANNO 2019 - Valore massimo giornaliero raggiunto dalla potenza in ingresso alla parabola TOR-18 in rapporto al valore autorizzato (%)



**Difference between real and authorized elevation is higher than 0.5°  
 It's a real problem?**

**NO, TOR-18 antenna is not in transmissison since june 2019**