Interference from Italian DTT stations into mobile networks on channels 66-69

Report for GSMA

2110/GSMA_INT/R/5

9th July 2009

ÆGIS spectrum engineering

Table of Contents

1 INTRODUCTION

Although support appears to be growing in European countries for adoption of the proposed refarming of the 790 – 862 MHz band, a number of countries are still planning to continue to deploy broadcasting services in this band. This report focuses on one such country, namely Italy. In the report, we have analysed the potential impact that ongoing Italian DTT transmissions in this band would have on mobile services in neighbouring countries.

According to the ITU GE-06 plan, Italy is planning to transmit high power DTT broadcasts from a number of sites that are likely to cause interference should mobile networks be deployed on the same frequencies in neighbouring countries. The interference would affect mobile base station receivers, which due to their elevation and directionality are much more sensitive to incoming interference than mobile terminals. The effect of interference to base stations is also much greater, since all communication in that sector is lost rather than just individual terminals. The affected frequencies will be channels 66 – 69 inclusive, corresponding to the proposed FDD uplink band.

CEPT Draft Report 29 addresses cross-border co-ordination issues and notes that if countries do harmonise the channels 61 – 69 for mobile services cross-border co-ordination will need to be developed similar to that specified in ECC Rec(08)02 for GSM and other services in the 900 MHz band. The Draft Report defines trigger field strengths for international co-ordination, based on the GE-06 Agreement. The trigger levels for mobile base stations range from 8.2 to 18 dBµV/m, depending on the type of mobile system and whether a 10 metre or 20 metre antenna height is assumed.

Our analysis has identified three transmission sites in particular that are likely to cause interference to mobile networks in neighbouring countries, namely Mt Serpeddi, Mt Virgine and Valcava. A further seven sites are likely to generate more localised interference. The frequencies most affected are channels 66 and 67 (830 – 846 MHz). In practice, the actual radiation from these sites towards neighbouring countries may be less than the limits assumed in the GE-06 plan and these patterns should be verified with the broadcast network operators. If this is not the case, it should be possible to re-engineer the interfering sites by modifying the antenna patterns to reduce the interference to Italy's neighbours.

2 DTT TRANSMITTERS INTENDING TO USE CHANNELS 66 – 69

The following high power (>2kW ERP) Italian DTT transmitters are listed in the GE-06 plan as operating on channels 66 – 68 inclusive (channel 69 is not used).

Table 1 High power Italian DTT transmitters operating on channels 61 - 69

Site	Channel(s)	ERP (dBW)	Pol
CA9 Del Vento	67	37	V
Capo Spartivente	68	34	V
Fiuggi	67	40	H
Genova-M.Fasce	66	46	H
M.Serpeddi	67	37	H
M.Soro	67	40	H
M.Vergine	66	44	H
Maschito	67	36.5	V
Monte Poro	68	45.7	H
Monti Martani	67	34.4	H
Penegal	67	33.1	H
Perdifumo	67	39.3	
Scrisi	66, 67	42.9	V
Torino Eremo	66	45	H
Valcava	67	49	H
Valverde San Gregori	67	42.1	H

The location of these sites is shown below:

Figure 1 Location of high power DTT transmitters using channels 66-68

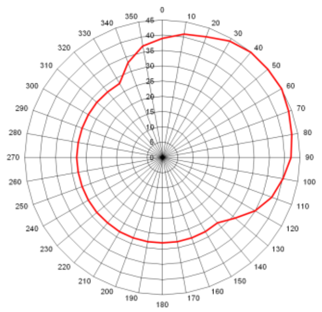
3 FACTORS DETERMINING THE EXTENT OF INTERFERENCE

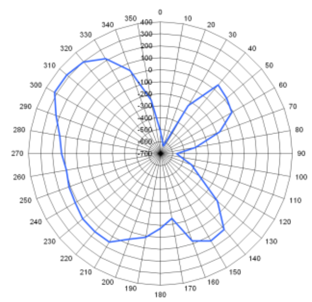
The likelihood of interference arising in neighbouring countries from a particular TV transmitter essentially depends on three factors, namely the location, ERP and effective height[1]. The latter two parameters vary by azimuth depending on the local terrain and whether a directional antenna is deployed. The charts below show the directional ERP and effective height for each of the sites shown in figure 1. All data is sourced from the ITU GE-06 database.

Figure 2 Directional ERP and effective height (metres) of Italian High Power Transmitters

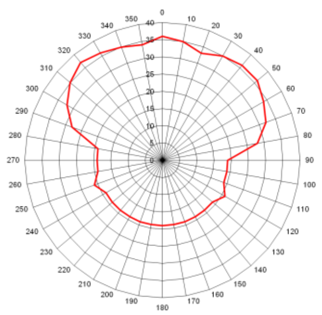
Directional ERP **Effective Height (metres)**

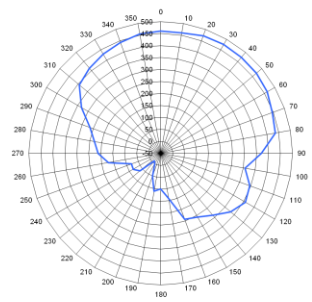
Antrodoco:





CA9 Del Vento:

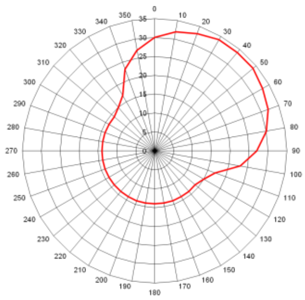


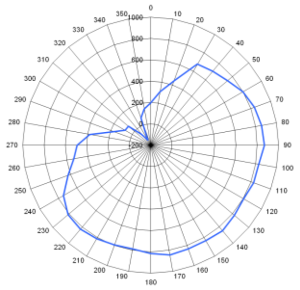


[1] Effective height is defined as is the height of the antenna above terrain height averaged between distances of 3 to 15 km in the direction of the receiving/mobile antenna.

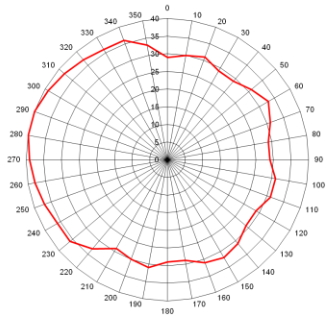
Directional ERP **Effective Height (metres)**

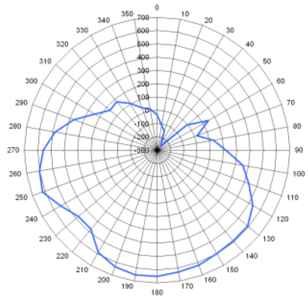
C. Spartivento



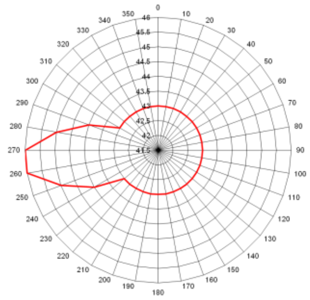


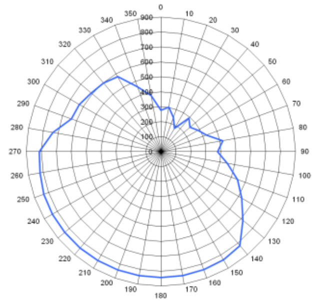
Fiuggi



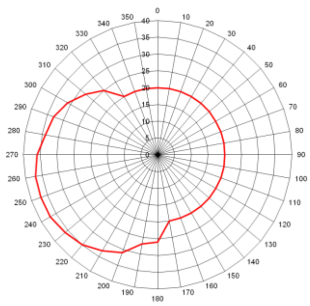


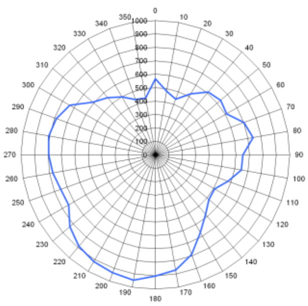
Genova





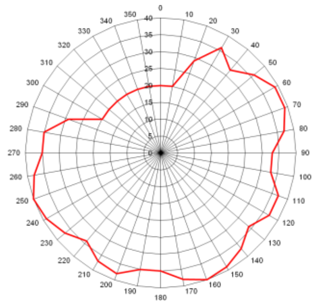
M. Serpeddi

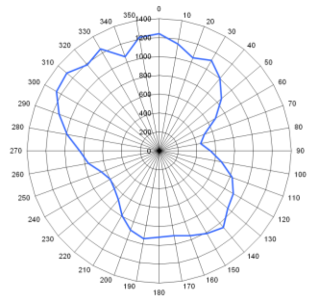




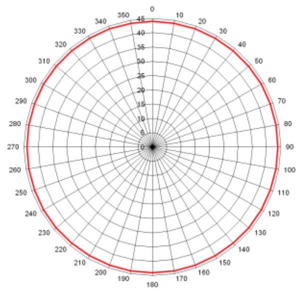
Directional ERP **Effective Height (metres)**

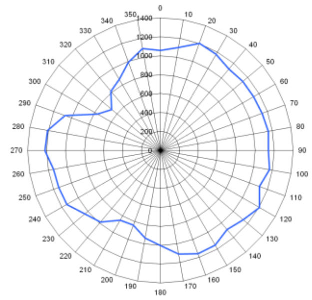
M. Soro



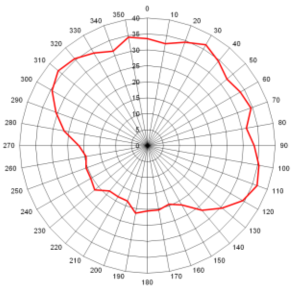


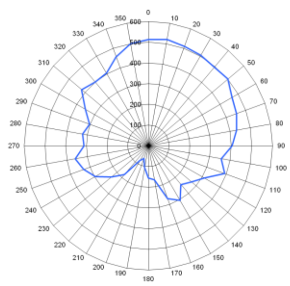
M. Virgine



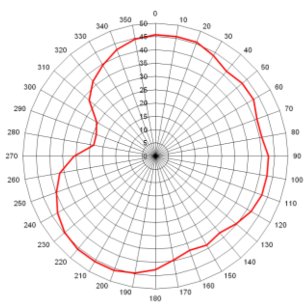


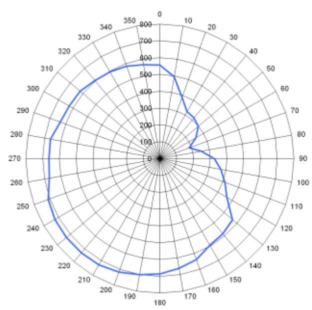
Maschito





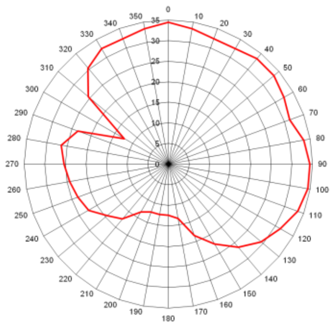
M. Poro

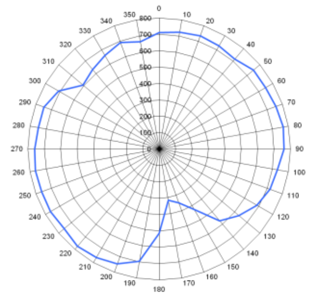




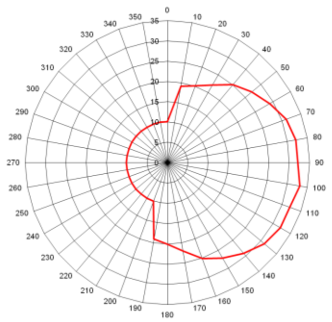
Directional ERP **Effective Height (metres)**

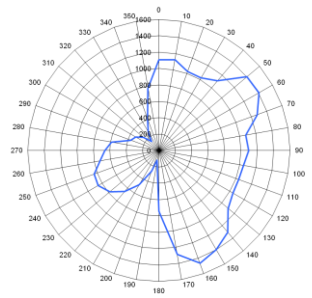
M. Martarni



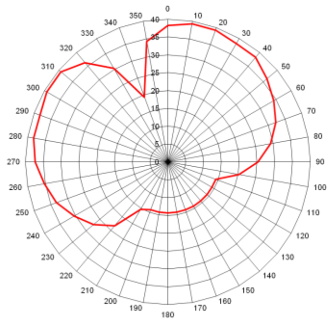


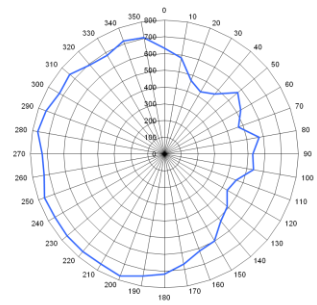
Penagal





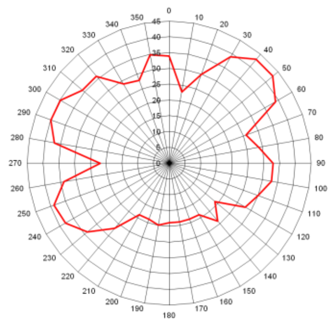
Perdifumo

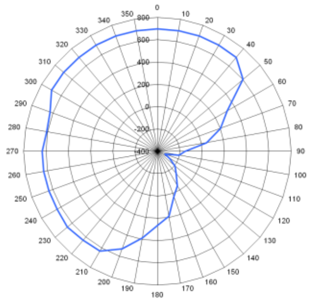




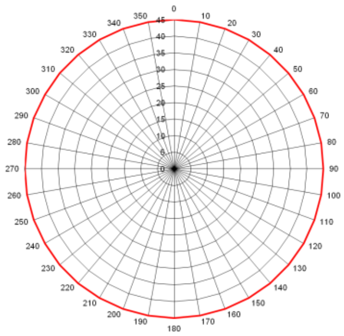
Directional ERP	**Effective Height (metres)**

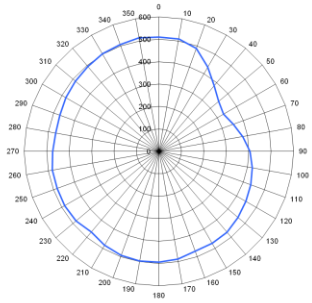
Scrisi



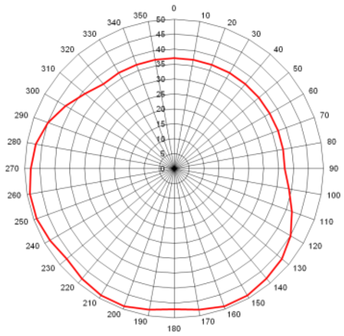


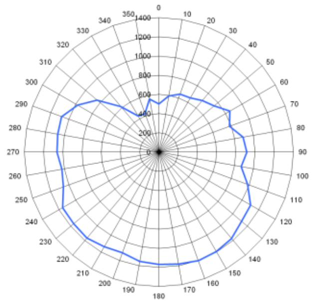
Turin





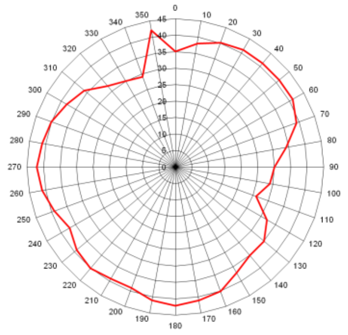
Valcava

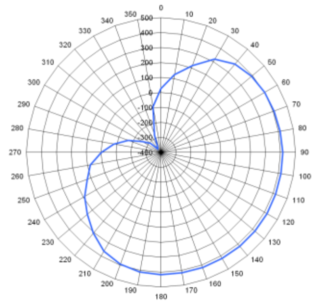




Directional ERP **Effective Height (metres)**

Valverde San





Note that certain sites (e.g. Mt Virgine and Valcava) radiate high power in all directions, whereas others (e.g. C. Spativente) are highly directional and some sites (again including Mt Virgine and Valcava) are highly elevated in all directions whereas others are shielded by surrounding terrain over part of their azimuths.

The following table summarises the likely impact of interference from each transmitter based on its location, ERP and effective height:

Table 2 Assessment of likely impact of interference to neighbouring countries from specific transmitter sites

Site	**Likelihood of interference to neighbouring countries**
CA9 Del Vento	Relatively low ERP in most directions and good shielding from surrounding terrain. Low Impact
Capo Spartivento	Moderate height and ERP in direction of Balkans. Medium Impact
Fiuggi	Moderate height and ERP in direction of Corsica. Medium Impact
Genova-M.Fasce	High ERP and moderate height in direction of France and Corsica. Medium Impact
M.Canate	Moderate height and ERP in direction of Slovenia / Croatia. Medium Impact
M.Serpeddi	Elevated height and moderate ERP with clear sea path to North Africa. **High Impact**
M.Soro	Elevated height and moderate ERP towards Greece. Medium Impact
M.Vergine	Elevated height and ERP in all directions. **High Impact**
Maschito	Relatively low height and ERP. Low Impact
Monte Poro	Moderate height and ERP towards Balkans. Medium Impact
Monti Martani	Moderate height and ERP towards Balkans. Medium Impact
Penegal	Moderate height and ERP towards Slovenia / Austria. Medium Impact
Perdifumo	Moderate height and ERP towards Corsica. Medium Impact
Scrisi	Moderate height and ERP towards Balkans. Medium Impact

Site	Likelihood of interference to neighbouring countries
Torino Eremo	High ERP and moderate height towards France. **High Impact**
Valcava	Moderate height and ERP in direction of France, Switzerland, Slovenia / Croatia. **High Impact**
Valverde San Gregori	Moderate height and low EIRP. Low Impact

From this initial assessment, four sites have been identified as providing a particularly high risk of interference into neighbouring countries, namely Mt Vergine, Mt Serpeddi, Turin and Valcava. Of these the most serious appears to be Mt Vergine, which has a very high effective height and ERP in all directions.

In the following section we have modelled the exported interference from these three sites and from a number of the medium risk sites for 1% of time to the most likely affected neighbouring countries, using ITU Propagation Model P.1812. Three levels of interference are shown, namely:

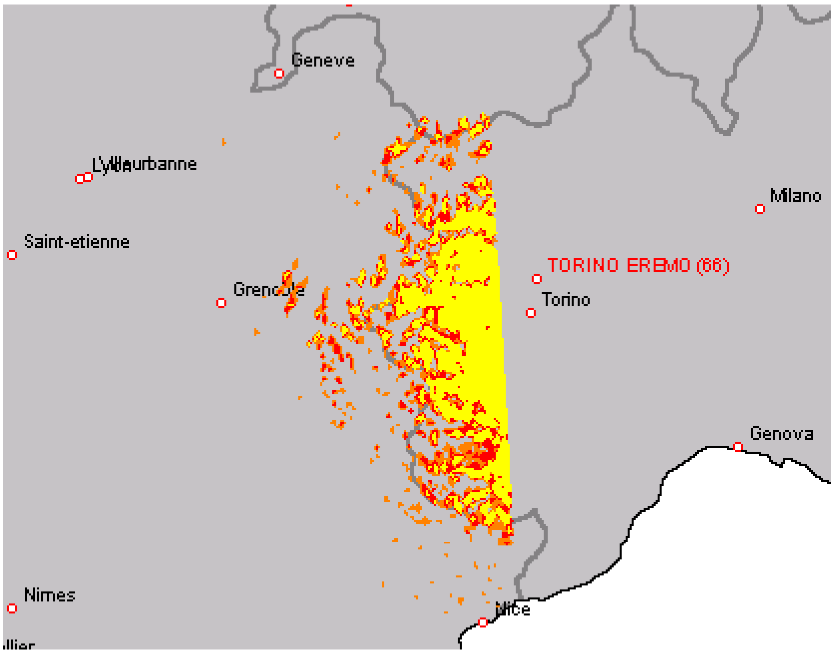
- 0 – 10 dBμV/m
- 10 – 20 dBμV/m
- >20 dBμV/m

10 dBμv/m corresponds approximately to the lower threshold currently being considered by CEPT as a trigger for cross-border co-ordination between TV transmitters and mobile base stations. Hence we consider 0-10 dBμv/m to constitute a small risk of interference, 10-20 dBμv/m to constitute a moderate risk and >20 dBμv/m to constitute a relatively high risk. Note that we have not taken account of any polarisation discrimination in our analysis at this stage as we do not wish to pre-judge the type of antenna system that might be deployed in future mobile base stations.

4 MODELLED INTERFERENCE FROM IDENTIFIED HIGH IMPACT SITES

4.1 Turin (channel 66)

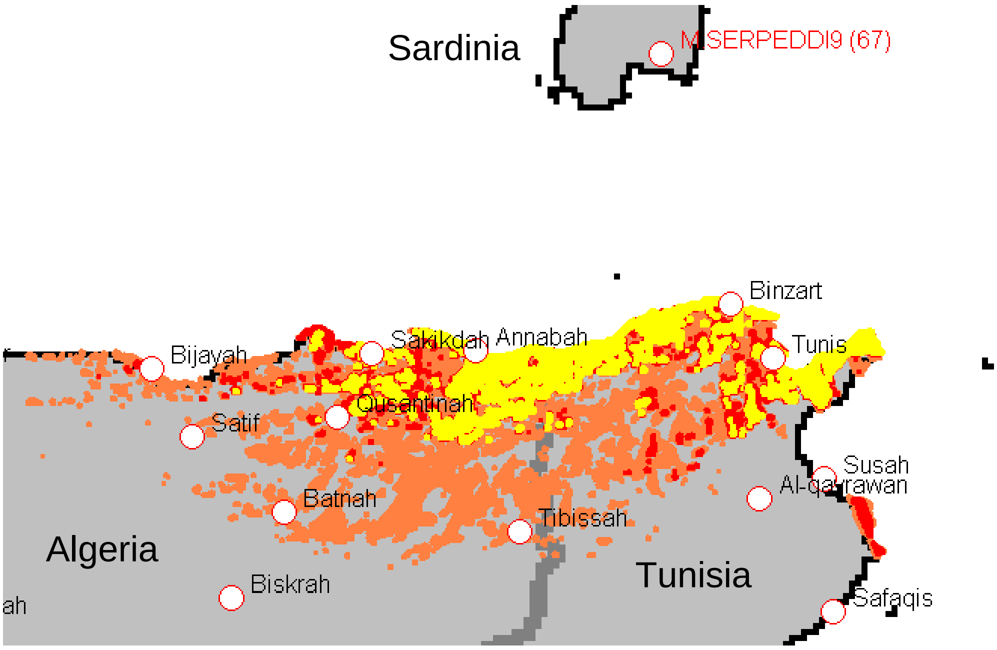
Figure 3 Interference from Turin into France



There is no significant interference into any other neighbouring country.

4.2 Mt. Serpeddi, Sardinia (channel 67)

Figure 4 Interference from M. Serpeddi (Sardinia) into Algeria and Tunisia



There is no significant interference into any other neighbouring country.

4.3 Mt. Virgine (channel 66)

Figure 5 Interference from Mt Virgine into the Balkans and Corsica

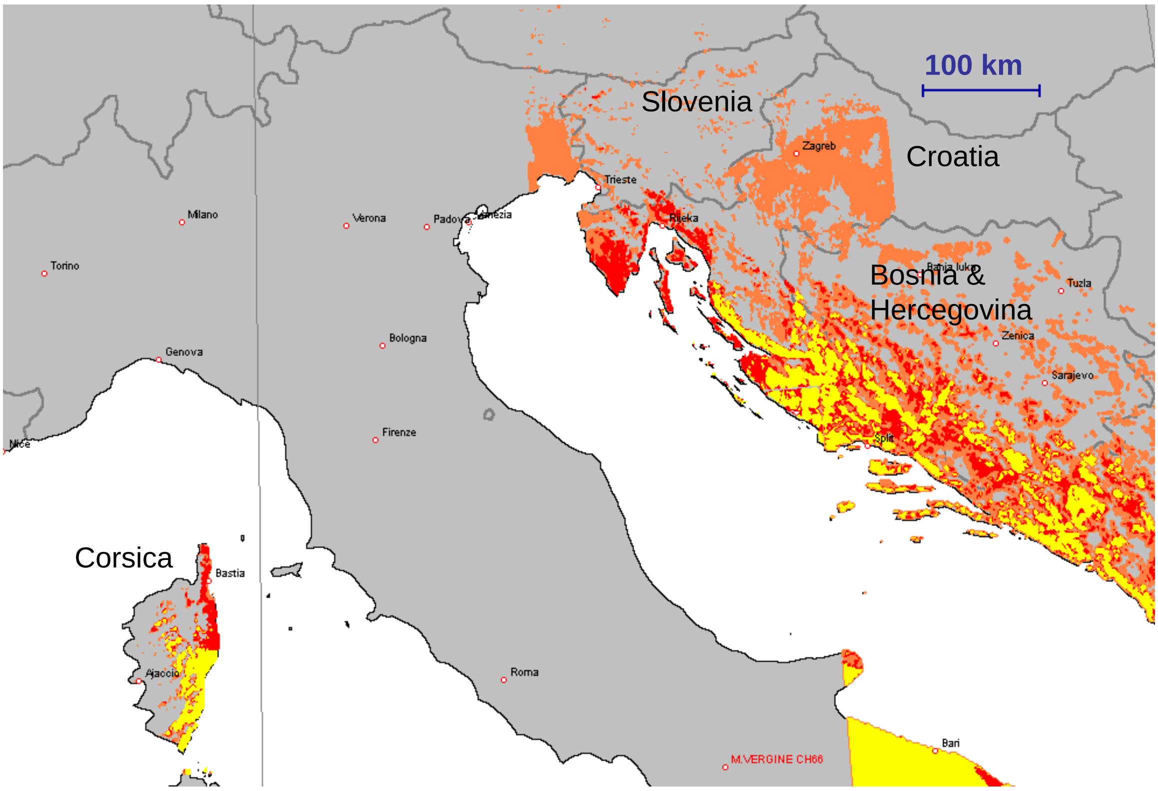
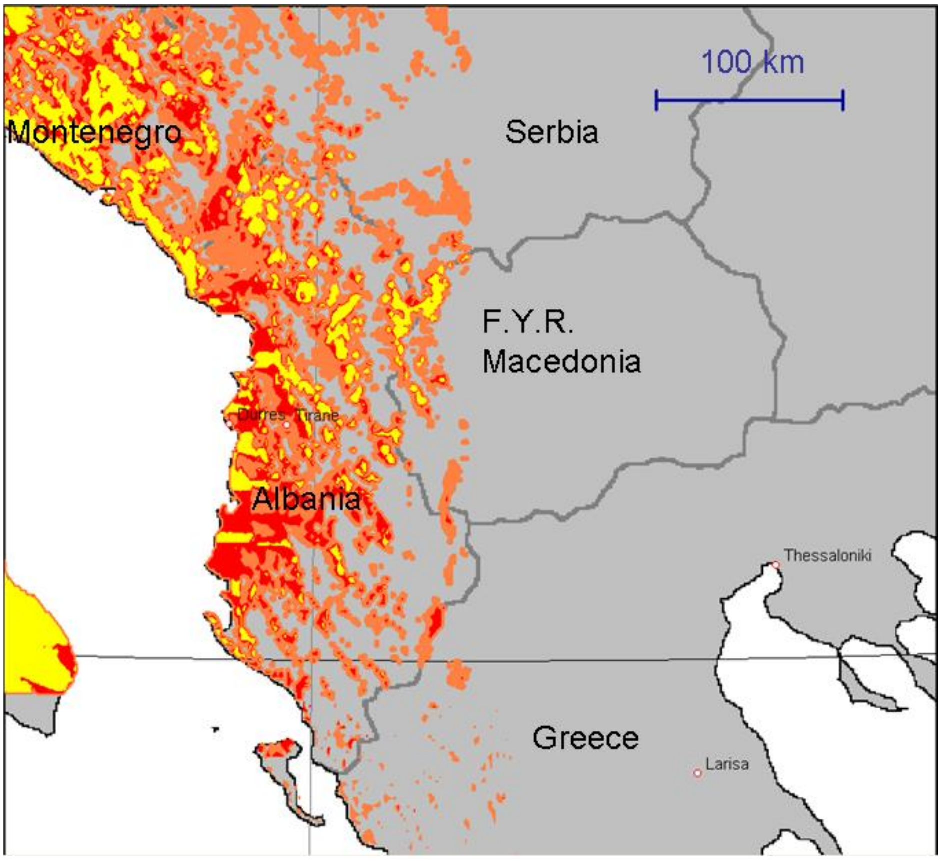


Figure 6 Interference from Mt Virgine into Montenegro and Albania



4.4 Valcava (channel 67)

Figure 7 Interference from Vaclava into Slovenia, Croatia and Corsica

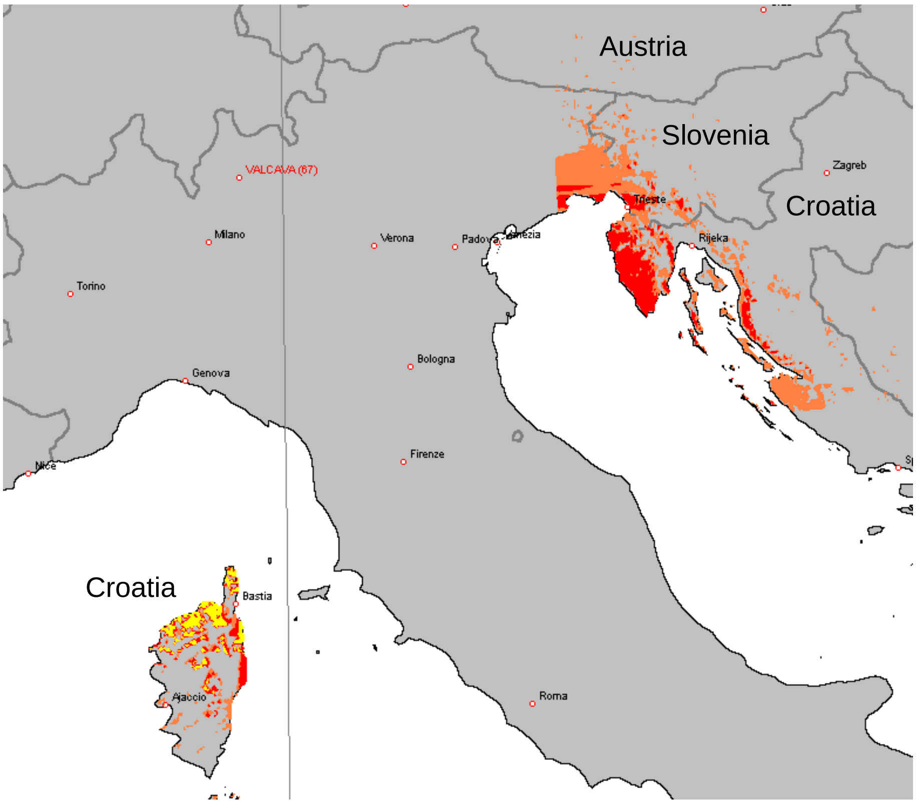
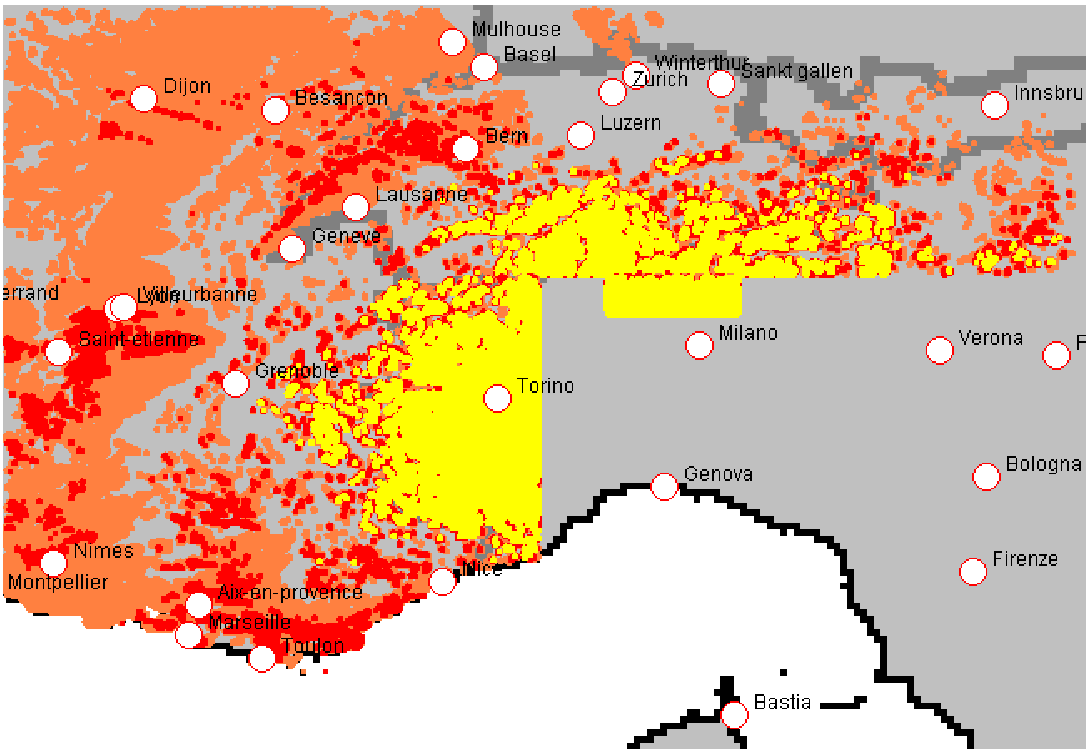


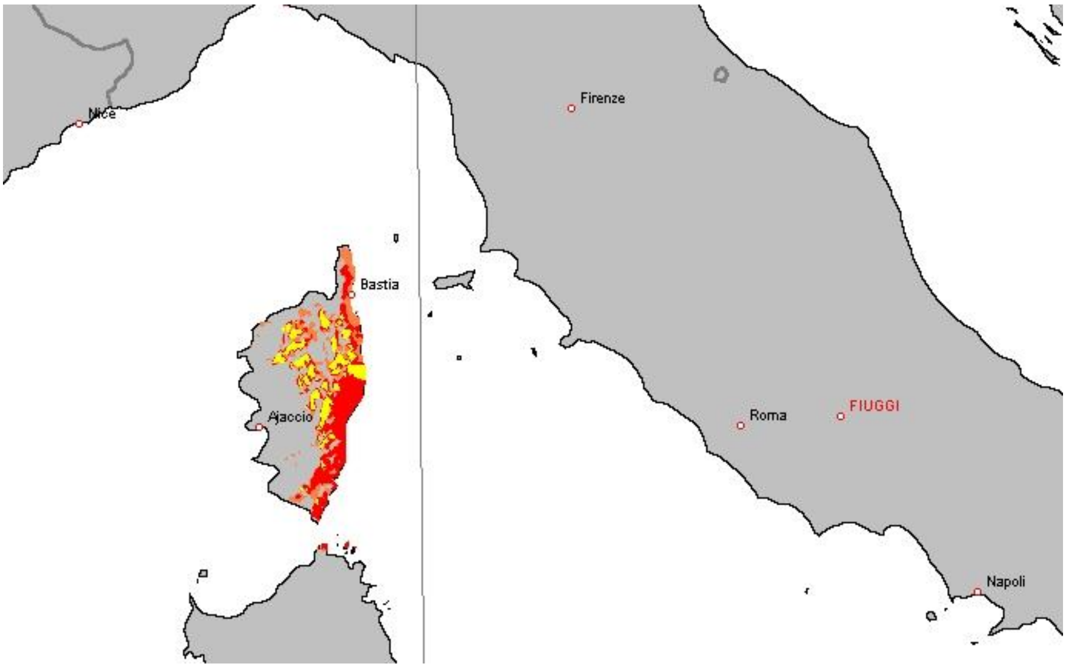
Figure 8 Interference from Valcava into Switzerland and France



5 MODELLED INTERFERENCE FROM MEDIUM IMPACT SITES

5.1 Cap Fiuggi (channel 67)

Figure 9 Interference from Cap Fiuggi into Corsica



5.2 Mt Martani (channel 67)

Figure 10 Interference from Mt Martani into Corsica

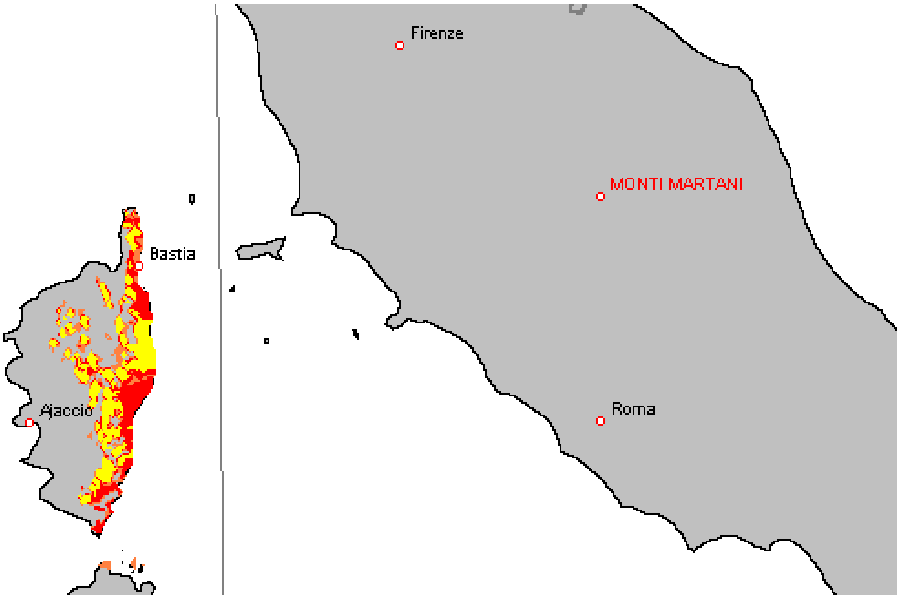
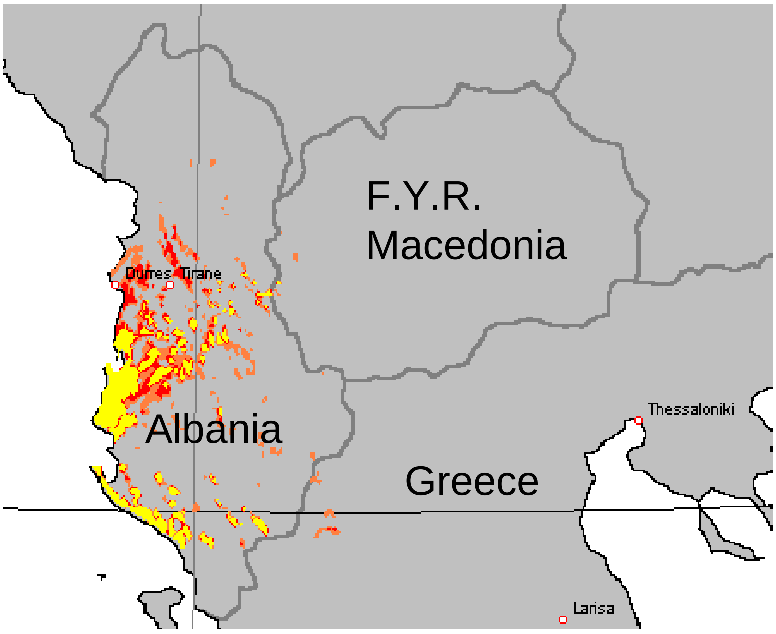


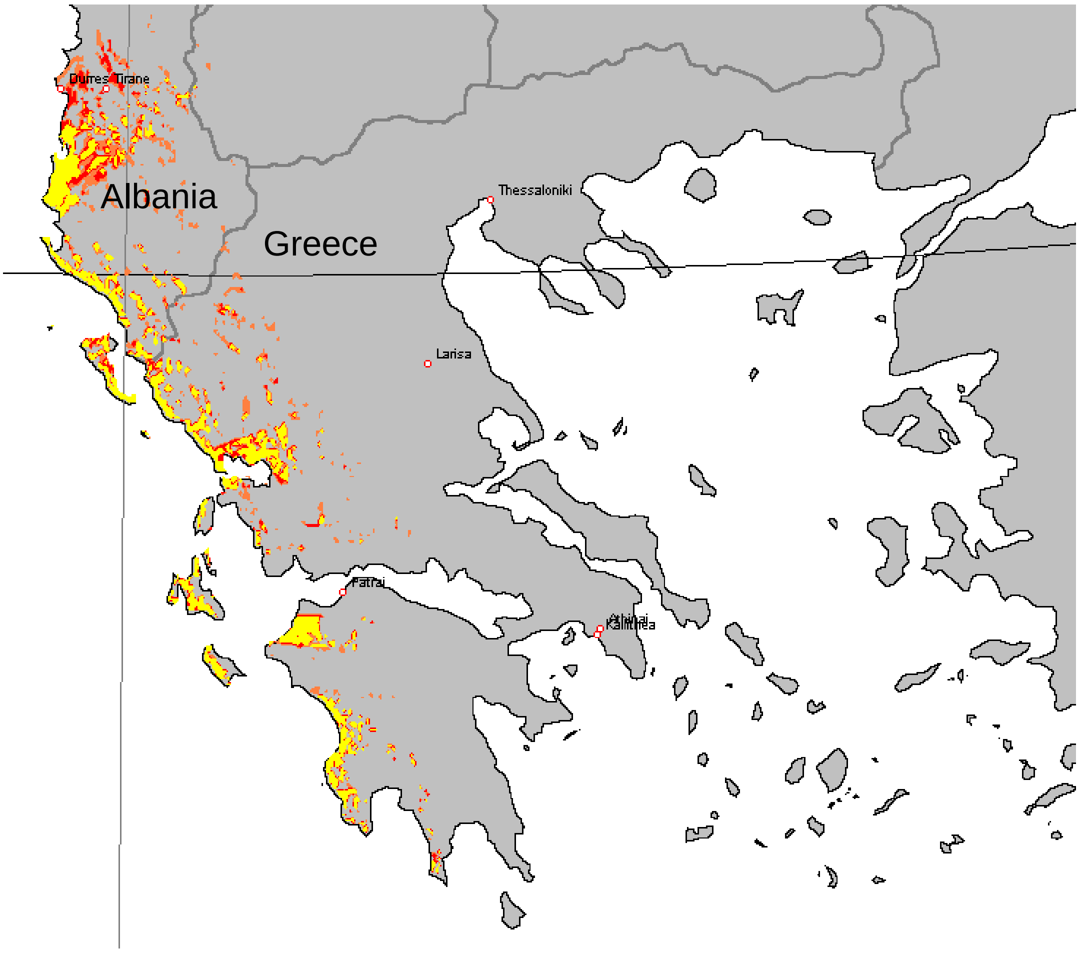
Figure 11 Interference from Mt Martani into Albania



There is no significant interference north of Albania.

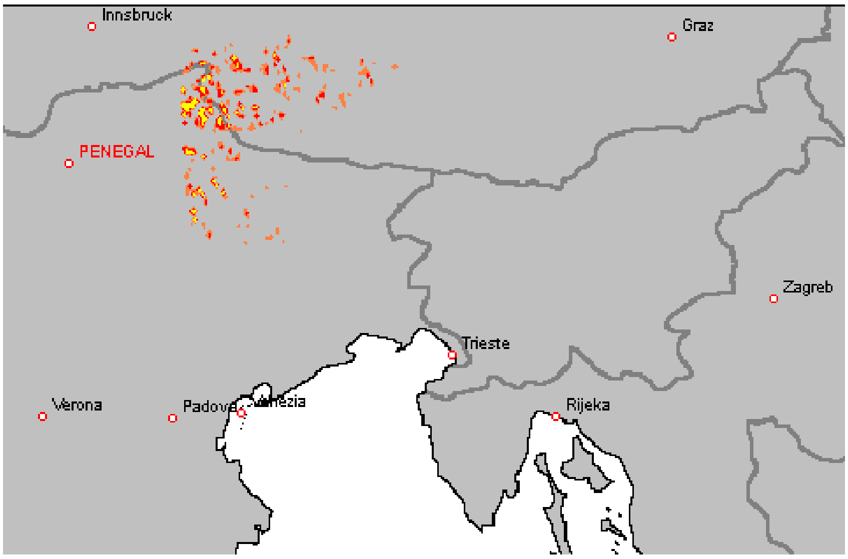
5.3 Capo Spartivento (channel 68)

Figure 12 Interference from Capo Spartivento into Albania and Greece



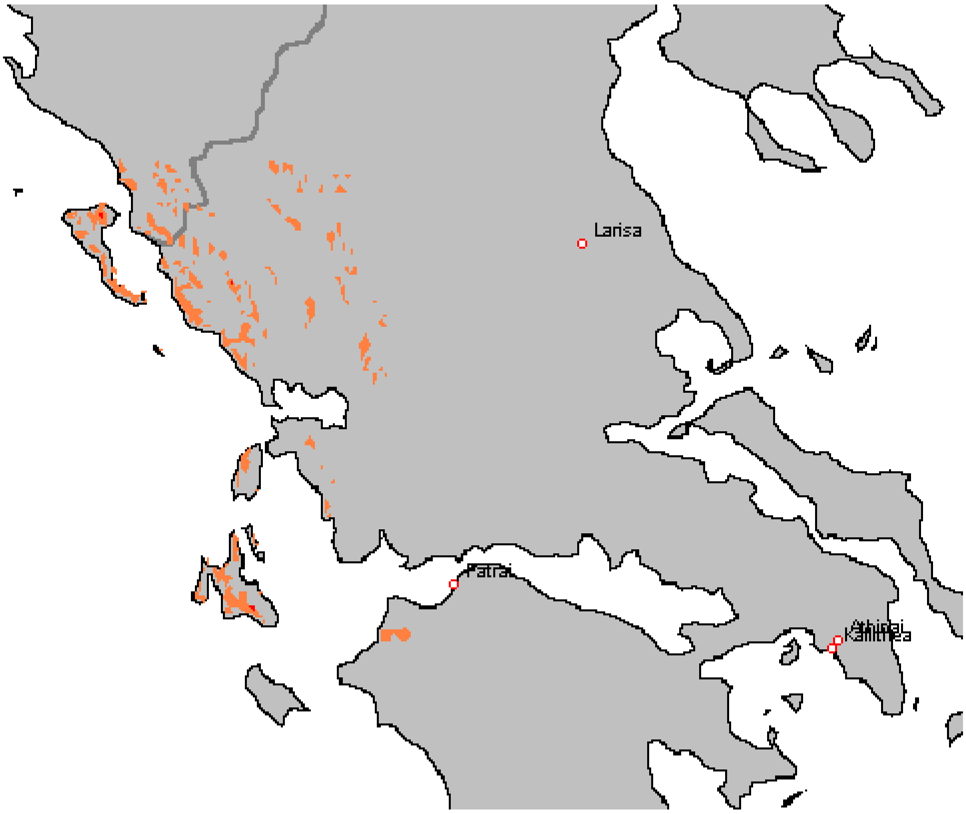
5.4 Penagal (channel 67)

Figure 13 Interference from Penagal into Austria



5.5 Mt Soro, Sicily (channel 67)

Figure 14 Interference from Mt Soros into Greece



5.6 Scrisi (channels 66 and 67)

Figure 15 Interference from Scrisi into Albania

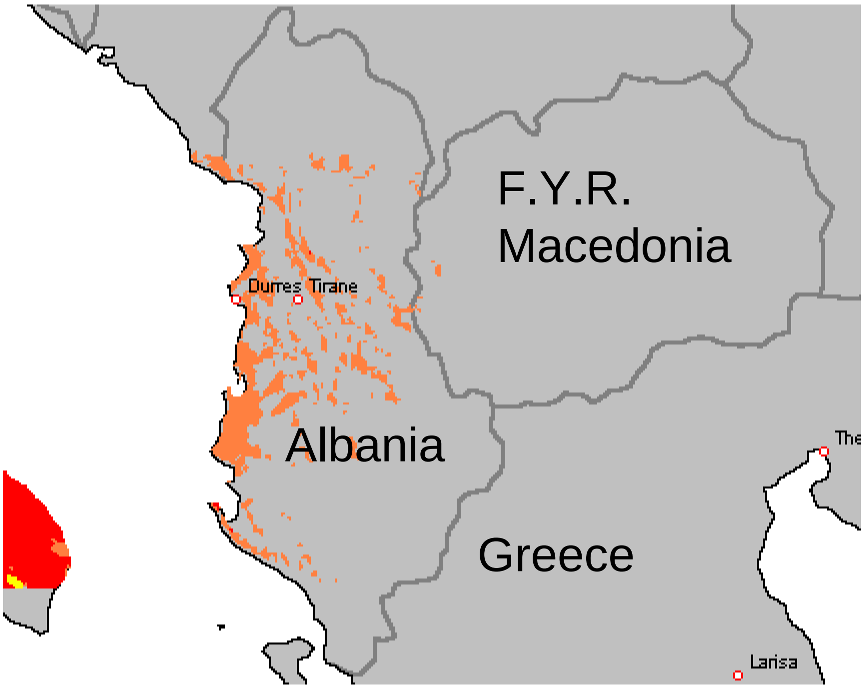
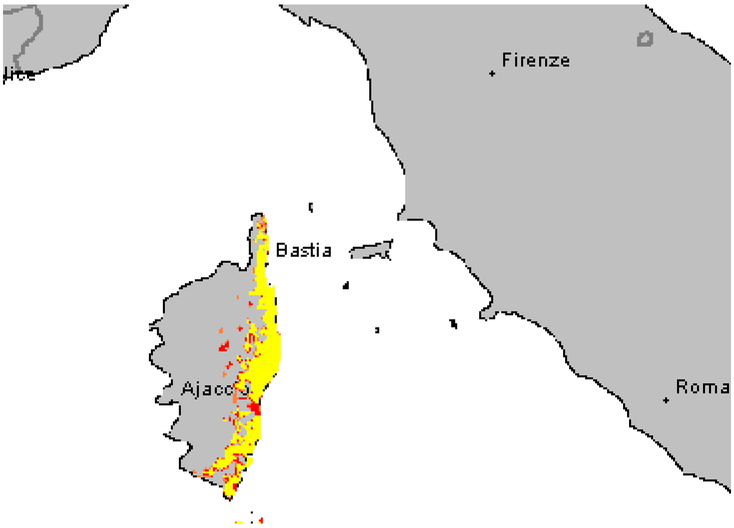


Figure 16 Interference from Scrisi into Corsica



6 CONCLUSIONS

It is clear from the foregoing analysis that there is a substantial risk of interference into neighbouring countries from high power TV transmissions in Italy, assuming that these continue while neighbouring countries adopt the harmonised mobile band in channels 61 – 69. The most affected channels are 66 and 67. Interference on channel 66 emanates from two sites, namely Turin and Mt Virgine. Mt Virgine is particularly problematic as its location, height and high non-directional ERP cause interference in all directions, affecting most of the Adriatic coastal area from Slovenia to Greece and the eastern half of Corsica. Turin causes localised interference in some of the border regions of France.

Interference on channel 67 is also significant, with Valcava generating interference into much of Switzerland and parts of mainland France as well as Corsica and parts of the Adriatic. Mt Serpeddi in Sardinia affects Northern Tunisia and parts of Algeria, whilst Fuiggi and Martani both affect Corsica. Martani also affect parts of the Adriatic. Interference on channel 68 is limited to Western Greece and Albania, emanating from Cap Spartiventi.

The extent of interference from the Valcava site beyond the Alps is perhaps surprising, given the terrain and the reduced power in that direction. The interference may be overstated due to limitations of the propagation model, which is based on are based on measurements made over 'rolling terrain' rather than extreme topography such as the Alps. In general, the predicted short-term field strength will be largely independent of the details of the terrain profile (with the exception of very local clutter), and will be influenced mostly by the refractivity statistics in the lower atmosphere. While it might be expected that Alpine areas would be less likely to support the stratified atmospheric conditions that give rise to ducting, no measurement data relating to paths of this type exists in the ITU-R Study Group 3 databases. In the absence of such data, the likelihood that actual field strengths may be similar to those predicted cannot be discounted. .

In practice the actual radiation from these sites towards neighbouring countries may be less than the limits assumed in the GE-06 plan, and the actual characteristics should therefore be verified with the broadcast network operators. If this is not the case, it should be possible to re-engineer the interfering sites by modifying the antenna patterns to reduce the interference to Italy's neighbours, if necessary using low-power fill-in transmitters to restore any coverage that may be lost as a result (in most cases this should not be necessary as a directional antenna is already planned).

The cumulative estimated interference on each channel, based on our analysis, is shown below.

Figure 17 Cumulative interference on channel 66

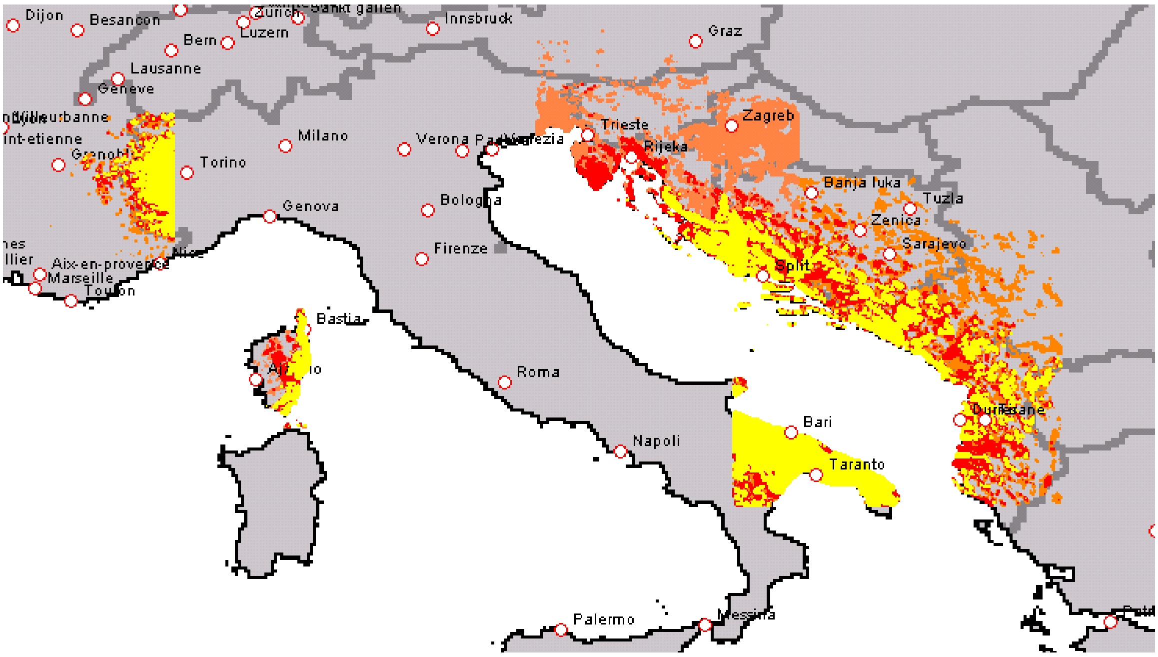


Figure 18 Cumulative interference on channel 67

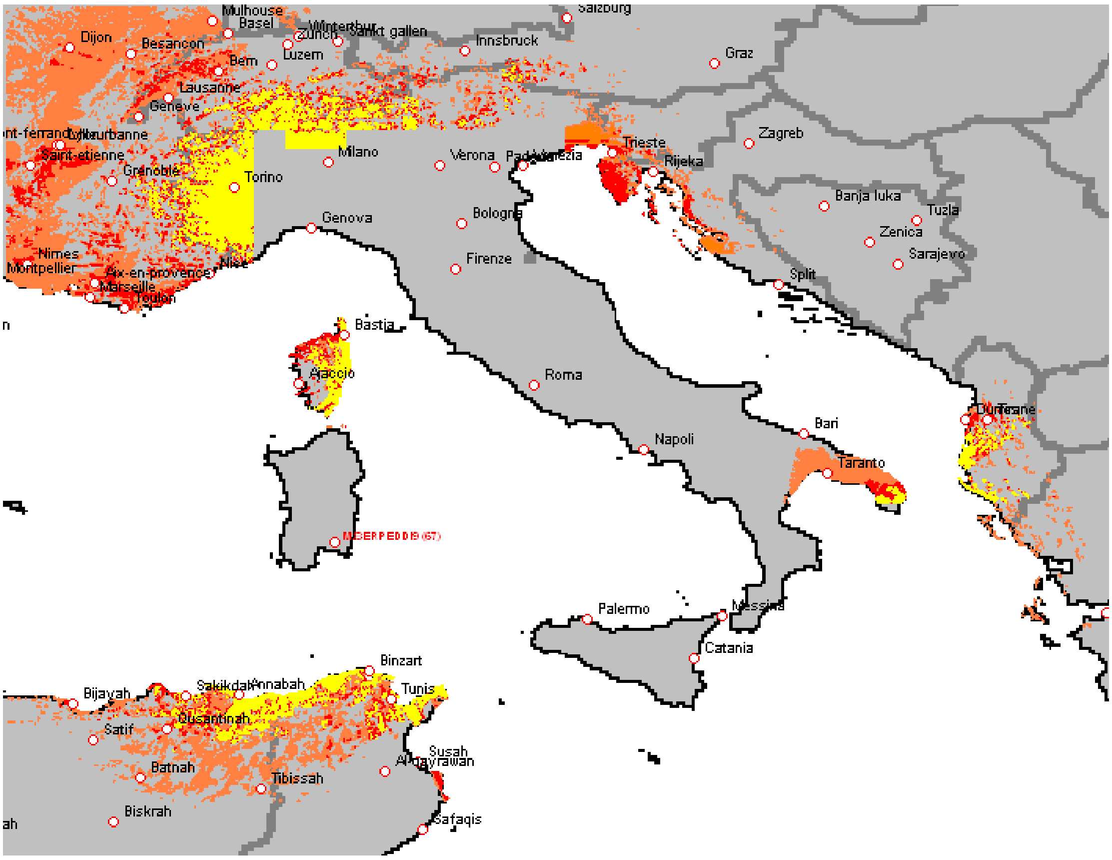


Figure 19 Cumulative interference on channel 68