PROCEEDINGS OF SCIENCE

Recommendations to mitigation experts from the latest RFI experiences

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We report about two issues that emerged during recent years relating to frequency management for radio astronomy in Italy. First, there are the consequences of the switchover from analogue to digital modulation by the TV broadcasters. Second, there are the regulatory aspects concerning the installation of a wind farm close to the Sardinia Radio Telescope. Finally we report about some operational aspects.

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1. From Analog to Digital modulation

Monitoring strategies of radio interferences to the radio astronomy service will need to change dramatically when monochromatic carriers will not anymore be part of the modulation schemes used. The much higher spectral and power efficiency of digital modulation schemes currently drives almost all the radio spectrum users toward this new development.

Radio astronomers should be aware that the spectral distribution of the new types of modulated interference signals is very similar to the radio astronomical signals. This forecasts a few unwanted consequences:

1. it will be harder to discriminate among different interferers;
2. a larger incidence of transient interferers is to be expected;
3. existing mitigation techniques that rely on some easy detection of a single carrier need to be upgraded;
4. the identification of the interfering source (coded ID) will be not anymore be simple like checking for a logo on the bottom right corner of a TV screen;
5. future receiver designs shall take into account a higher spectral occupancy of the spectrum with, maybe, higher total power applied to the receiver front-ends;
6. the out of band emissions of digitally modulated system, based on direct experience, seem to be worse than the agreed upon standards.

As an example, Fig. 1 compares the two spectra: the first is a typical TV analogue spectrum, while the second is a new digital flat-top pattern (Fig. 1).

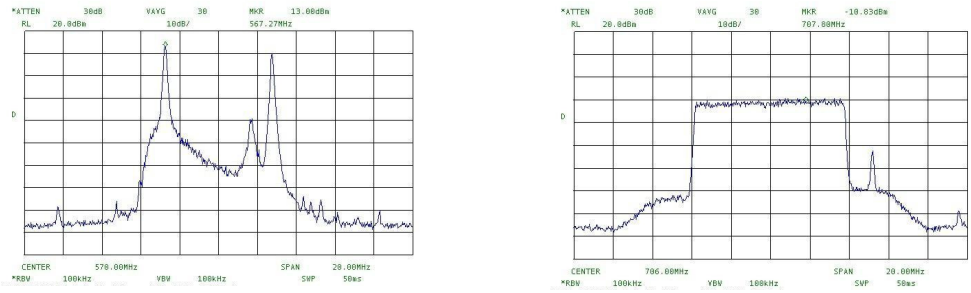

Figure 1 – A direct comparison between the spectral power density of an old TV analog transmission and a new digital pattern.

In order to monitor and identify these emissions, it should be noted that the RA-769 levels can be reached with radio astronomical observations, where long integration times are used. As a result the monitoring equipment needs to fill a gap in sensitivity of typically 20 - 40 dB.

The first available choice to increase the sensitivity in the monitoring instrumentation is to utilize antennas with high directivity and higher gain, but at the expense of the time needed to survey the same range of Azimuth (and Elevation) angles.

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The second choice, only available up to now, has been to shrink the spectrum analyzer bandwidth around the carrier of the interfering signal. The monochromatic spectral distribution has allowed to improve the S/N ratio, in direct proportion with the measurement bandwidth.

The third choice, we mostly rely on, is to make use of a mobile laboratory, in order to get closer to the location of the interferer, thus obtaining the signal at a direct line of sight and/or at a smaller distance.

2.The wind park case for the Sardinia Radio Telescope

The Italian Administration is the legal authority in a conflict situation with any interferer in Italy. For this reason, we have requested assistance in all future contacts with the company that is building a wind mill park, just 5 km away from SRT.

In Italy, Art. 97 of the Unique Text of the General Code for Communication says:

1. "Whoever makes activities that, in any way, produces damage to a communication service, is punishable under the Penal Code.
2. "Assured of the above, it is prohibited to jam or produce interference to a communication service.

We expect that this strict wording against any interferer could help us in the case of possible RFI interference from a wind mill park. However this park is not classified as a telecommunication service, but as power plant producing about 20 MWatt @ 50 Hz. Therefore, in first instance it could be considered as not responsible for any RFI to the radio astronomy observations.

We expect that this strict wording against any interferer could help us in the case of possible RFI interference from a wind mill park. The operator could claim to be exempt from special RFI specs, because the park is not classified as a telecommunication service, but as a power plant producing about 20 MWatt @ 50 Hz.

SRT is a radio astronomy station, recognized even at the ITU level, that has the right not to suffer from RFI, at least in the protected (exclusive) bands, from any source of interference, which includes power plants.

3. Conclusions

The new panorama of digital signals that is now rapidly spreading across all of the radio spectrum will substantially modify the strategy (and attitude) that the radio astronomers need to establish both in monitoring radio frequency interference as well as in optimizing their mitigation algorithms. Only in this manner will they be able to maintain or even improve the sensitivity of their present radio astronomical observations.

More than ever, the observational scientists should feel committed to provide precise feedback reports about RFI events during their observations. Without such information, neither the people working in the regulatory nor in the monitoring fields will be able to act positively and in time to protect future observations.

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We assume that all readers would be interested to see the SRT in its current state with separate bus alidade structures. Eventually this becomes a real radio telescope (Fig. 2).

Figure 2 – SRT antenna still in two parts: the main dish, now on ground, will be raised soon on top of the alidade structure in a single lift procedure, which is a first in the world, for such a large and heavy backup structure.

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