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Coexistence of weather radars and telecommunication systems

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Since several years, many weather radars around the world are experiencing an increasing amount of strong interferences caused by artificial radio sources, such as telecommunications systems, with a negative impact on the radar measurements. Northwestern Italy is no exception to this problem. Considering the evolution of the frequency allocation, defined by the International Telecommunication Union (ITU), it appears that the coexistence of weather radars and telecommunication systems is fundamental for reliable and high-quality weather radar observations.

In Italy, like in most European countries, operational weather radars operate at C-band, in the 5.6 GHz frequency band, shared with Radio Local Area Network (RLAN) and Wireless Local Area Network. These telecommunication systems, which spread out in rural areas to support broadband internet access points, should implement hardware and software solutions to avoid interferences with weather radars. Collaborative measurements with the Italian Ministry for the Economic Development showed that many transmitting towers are not implementing interference mitigation tools. As a result, the coexistence of C-band weather radars and WLAN is nowadays an important topic of discussion in the weather radar community.

In addition to C band, Arpa Piemonte manages a X-band radar, currently located near Vercelli, which is showing a continuous increase of radio interferences since the last couple of years. The analysis of the interferences received during the month of October 2017 showed a daily pattern, with interferences detected mostly between 7am and midnight, local time. This typical pattern seems related to out-of-band emissions of some transmitting towers, since no civil communications are allowed in the X-band. This hypothesis is currently being verified with in-field measurement, to assess a possible relation with the 4G mobile communications working in the 1.8GHz band, which could give out-of-band emissions exactly at the X-band radar operating frequency (9.37 GHz). Given the increasing number of X-band radars deployed in Europe, Asia and the United States, such as the Dallas Fort Worth X-band radar network, the coexistence of the these smaller radars with telecommunications system is also a pressing issue and it is the focus of this work.

Even if some mitigation techniques are already implemented in the radar signal processor, further studies on the signal features are needed to improve the mitigation and removal techniques, in particular for the polarimetric measurements. This work will summarize the activities in the above areas. In addition, Arpa Piemonte and CSU are developing techniques to identify the RFI sources, using the regional database of electromagnetic sources, and with in-field measurements. These results will also be discussed.