EUMETNET

The Network of European Meteorological Services

PROGRAMME ON RADIO-FREQUENCIES PROTECTION (EUMETFREQ)

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Subject: Response to the Radio Spectrum Policy Group (RSPG) public consultation on "A coordinated EU spectrum approach for scientific use of radio spectrum"

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NOTE: This document has been prepared within the relevant EUMETNET programme and represent the views of all participating European Meteorological Services.

1 Introduction

EUMETNET would like to thank the EU RSPG for the opportunity to comment on the current report on **"A coordinated EU spectrum approach for scientific use of radio spectrum"** issued on 15 May 2006 as well as on the possibility that was given to attend the RSPG ad-hoc group that addressed this issue.

By this document, EUMETNET would like to provide comments to this Report and also re-emphasise the critical importance of radio-frequencies for the whole meteorological community.

2 About EUMETNET

EUMETNET is a network grouping 21 European National Meteorological Services from Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom and 6 other associated countries, Bulgaria, Croatia, Czech Republic, Romania, Slovak Republic and Slovenia. (see : **www.eumetnet.eu.org**)

The need for meteorological information that spreads over national borders is rapidly rising within Europe, due to the explosion of cultural, scientific and commercial relations, and to the development of programmes that organise the management of natural and industrial risks.

EUMETNET's primary objectives are the development of exchanges between European National Meteorological Services (NMSs) and the optimisation of the observation network needed for efficient weather prediction on a European scale.

EUMETNET provides the European NMSs with a framework within which co-operative programmes are organised in the fields of basic meteorological activities, such as observing systems, data processing, basic forecasting products, training, research and development.

EUMETNET favours the transfer of expertise between NMSs to allow the development of European standards; the improvement of measurement performances; the accessibility of products on a European scale and the improvement in the service quality. Through EUMETNET Programmes, the NMSs develop their collective capability to serve environment management and climate monitoring and to bring to all European users the best available

Among these programme, the EUMETFREQ programme was developed to coordinate EUMETNET members' activities in the protection of radio-frequencies they collectively use, recognising the crucial importance of radio-frequencies for the meteorological activities and the increasing pressure and demand on radio spectrum.

3 Importance of radio-frequencies for the meteorological community

Radio-frequencies represent scarce and key resources for the meteorological community, organised within the World Meteorological Organisation (WMO), to produce and collect the observation data upon which predictions and warnings are processed, and to disseminate weather, water and climate information and early warnings to various economic sectors and the public. To this respect it should also be understood that all related frequency applications are inter-dependent and represent a global meteorological system.

Among these radio-frequency applications, satellite passive sensing represents a very specific application on both a technical (due to the interference susceptibility of the highly sensitive passive sensors) and a regulatory basis (through proposed exceptions to the provisions of RR footnote **5.340**), that is increasingly threatened by interference from active radiocommunication applications.

Spaceborne passive sensing of the Earth’s surface and atmosphere has an essential role and an increasing importance in both operational and research meteorology, in particular for mitigation of weather and climate-related disasters, and in the scientific understanding, monitoring and prediction of climate change and its impacts. The impressive progress made in the recent years in weather and climate analysis and forecasts, including warnings for dangerous weather phenomena (heavy rain, storms, cyclones) that affect all populations and economies, is to a great extent attributable to spaceborne observations and their assimilation into numerical models.

Space-borne passive sensing for meteorological applications is performed in bands allocated to the Earth exploration-satellite (passive) and meteorological satellite service. Passive sensing requires the measurement of naturally-occurring radiations, usually of very low power levels, which contain essential information on the physical process under investigation.

The relevant frequency bands are mainly determined by fixed physical properties (e.g. molecular resonance). The properties cannot be changed or ignored. These frequency bands are, therefore, an important natural resource. Even low levels of interference received at the input of the passive sensors may degrade passive sensor operations. In addition, in most cases the sensors are not able to discriminate between these natural radiations and man-made radiations. In this respect, RR footnote **5.340** enables the passive services to deploy and operate their systems in the most critical passive-sensing frequency bands.

It should be stressed that bands below 100 GHz are of particular importance, as they provide an “all-weather” capability since clouds are nearly transparent at these frequencies.

Several geophysical parameters contribute, at varying levels, to natural emissions, which can be observed at a given frequency that present unique properties. Therefore, measurements at several frequencies in the microwave spectrum must be made simultaneously in order to isolate and to retrieve each individual contribution, and to extract the parameters of interest from the given set of measurements.

As a consequence, interference that could impact a given “passive” frequency band could thus have a negative impact on the overall measurement of several atmospheric component.

Therefore, passive frequency bands cannot be considered on their own. Rather, they should be viewed as a complete system. Current scientific and meteorological satellite payloads are not dedicated to one given band but include many different instruments performing measurements in the entire set of passive bands.

Also, meteorological radars as well as wind-profiler radars perform an important part in the meteorological observation processes. Radar data are input to the Numerical Weather Models either for nowcasting (i.e. immediate early warnings) or short-term and medium-term forecasting. Currently in Europe, there are more than 30 wind-profiler radars and 160 meteorological radars that perform precipitation and wind measurements and that play a crucial role in the immediate meteorological and hydrological alert processes. Meteorological radar networks represent the first line of defence and prevention against loss of life and property in flash floods, severe storms events and tropical cyclones such as recently in Louisiana (US) with the Hurricane Katrina, in Boscastle (UK), and in several cases in south of France or eastern Europe.

Also of great importance is the availability of sufficient and well-protected frequency spectrum for telemetry/telecommand as well as for the downlink of the collected data from the Earth exploration and meteorological satellites.

Last but not least, radiosondes operating in the 400 MHz and 1680 MHz bands also represent important radio applications for the meteorological and climate community providing in situ atmospheric measurements performed by about 900 stations worldwide and representing more than 1 million launches per year. These in-situ measurements provide crucial data for all meteorology and climate operations and research, as well as for calibrating satellite-based passive and active measurements.

EUMETNET would also like to stress that the Fourteenth World Meteorological Congress (Geneva, May 2003), attended by 170 Member countries, amongst them all European Union countries, expressed its serious concern at the continuous threat to radio frequency bands allocated for meteorological and related environmental systems and adopted Resolution 3 (Cg-XIV) – *Radio frequencies for meteorological and related environmental activities* – in which the 187 WMO Member countries are urged to make all efforts to do their utmost to ensure the availability and protection of suitable radio frequency bands required for meteorological and related environmental operations and research.

Radio-frequencies represent scarce and key resources for the meteorological community to produce and collect the observation data upon which predictions and warnings are processed, and to disseminate weather, water and climate information and early warnings to the various economic sectors and the public. It should be understood that all related frequency applications are interdependent and represent a global meteorological system, already harmonised and coordinated with 187 Member countries under the WMO auspices.

EUMETNET hence stresses the fact that a lack of any of this system's radio components, either related to observation or data dissemination, would put at risk the whole meteorological process and operation; This is the reason why the 187 WMO Member countries, as expressed in the attached Resolution 3 (Cg-XIV), appealed to the International Telecommunication Union and its Member Administrations:

- **to ensure the availability and absolute protection of the radio-frequency bands which, due to their special physical characteristics, are a unique natural resource for spaceborne passive sensing of the atmosphere and the Earth surface,**
- **to give due consideration to the WMO requirements for radio frequency allocations and regulatory provisions for meteorological and related environmental operations and research**

4 EUMETNET Comments to the RSPG public consultation

EUMETNET welcomes the RSPG initiative toward a RSPG opinion on a "coordinated EU spectrum approach for scientific use of radio spectrum" and the related Report in public consultation and would like to thank RSPG for the invitation to attend the ad-hoc working group that addressed this issue, hence giving the opportunity to present the impact of meteorology and the critical importance of radio-frequencies on related activities.

To this respect, EUMETNET believes that this Report currently reflects the overall importance of scientific and meteorological services and raises the most important points, societal as well as economic value of meteorological services, international governmental commitments through the WMO World Weather Watch or the GEO/GMES initiatives and recognition of the essential passive bands covered by RR footnote **5.340**.

Recognising the importance taken by the European Commission in frequency management issues in Europe, either in RSPG or RSCOM, EUMETNET would also like in particular to stress the WMO Resolution 3 (Cg-XIV) as given in Annex 3 of the RSPG Report to consistently appeal the European Commission toward the same consideration and to support the positions expressed by its 25 Members within WMO :

- to ensure the availability and absolute protection of the radio-frequency bands which, due to their special physical characteristics, are a unique natural resource for spaceborne passive sensing of the atmosphere and the Earth surface,
- to give due consideration to the WMO requirements for radio frequency allocations and regulatory provisions for meteorological and related environmental operations and research

Indeed, even though recognising that frequency management can be improved to provide more flexibility and responses to spectrum demand from the industry, EUMETNET is of the view that spectrum management cannot solely be driven by business and economical aspects and that overall including in particular societal impacts should be part of the decision making process.

Along this line, EUMETNET would like to highlight the following recent examples for which, to its view, meteorological applications have been and are put at risk by Decisions mainly driven by industry considerations :

- **Commission Decision 2005/50/EC of 17 January 2005** on "*the harmonisation of the 24 GHz range radio spectrum band for the time-limited use by automotive short-*

range radar equipment in the community" that has, under the pressure of the automotive industry and despite scientific and meteorological communities complaints, authorised SRR in-band emissions in the essential 23.6-24 GHz passive band, even though covered by RR footnote **5.340** that states that "all emissions are prohibited". It is recognised that this authorisation is only made on a temporary basis (up to 2013) but EUMETNET is of the view that it represents a very bad precedent and hence appeals the European Commission to stick with its commitments that it " *has an exceptional character and must not be considered as a precedent for the possible introduction of other applications in the bands where ITU Radio Regulations footnote 5.340 applies, be it for temporary or permanent use"*. Indeed, as stated above, passive bands represents unique natural resources and essential observations for the meteorological activities and, as shown in annex 1 presenting current interference to existing passive sensors over Europe, impacts of radio transmitters cannot be neglected, justifying EUMETNET concerns.

- **Commission Decision 2005/513/EC of 11 July 2005** on "*the harmonised use of radio spectrum in the 5 GHz frequency band for the implementation of wireless access systems including radio local area networks (WAS/RLANs)"* that has authorised unlicensed/mass market telecommunications applications in an essential frequency radar band for both military and meteorological applications. The importance of meteorological radars is described above and it has also to be highlighted that there are in Europe more than 140 meteorological radars in the 5 GHz. Despite the mandatory application of Dynamic Frequency Selection (DFS) to ensure protection of radars, serious interference events have already been experienced by the meteorological community, as shown in annex 2. EUMETNET also note the European Commission position that, under the RTTE directive, such DFS feature is not technologically neutral, hence leaving the industry to decide on "*the mitigation techniques that give at least the same protection as the detection, operational, and response requirements described in EN 301 893 to ensure compatible operation with radiodetermination systems*". Referring to the interference events in Annex 2 produced by RLAN with inadequate DFS feature, EUMETNET is seriously concerned that only industry will be deciding on the level of protection of meteorological radars.

On this basis, EUMETNET believes that elements in section 4 of the RSPG Report providing economic and societal impacts of meteorological services provide relevant and sufficient materials to justify the highest care given to meteorological applications to maintain current level of protection of scientific services in their related frequency bands.

As a conclusion, EUMETNET certainly welcomes and is in favour of the adoption of a RSPG opinion on "*a coordinated EU spectrum approach for scientific use of radio spectrum*" that would recognise, in particular, the current and increasing importance of weather, water and climate activities, including multi-hazard early warnings and safety of life implications, and the high dependency of these activities on radio-frequencies, either active or passive, that cannot be put at risk.

This Opinion, and in particular the elements provided in section 9 of the RSPG report, would represent a clear political framework and guideline among European Union Members and the European Commission toward protection of radio spectrum used for scientific and meteorological services.

ANNEX 1

Interference to passive sensors in the 10.6-10.68 GHz band

1 Introduction

Under Agenda Item 1.2 (WRC-07), sharing analyses between the EESS (passive) and the SRS (passive) on one hand and the fixed and mobile services on the other hand in the band 10.6-10.68 GHz are to be conducted to determine appropriate sharing criteria.

The use of fixed and mobile services are currently covered by footnote **5.482** that states in particular that "In the band 10.6-10.68 GHz, stations of the fixed and mobile, except aeronautical mobile, services shall be limited to a maximum equivalent isotropically radiated power of 40 dBW and the power delivered to the antenna shall not exceed –3 dBW….."

In its current position given in the CEP Brief, EUMETNET stressed that current deployments of FS links in certain administrations already create significant levels of passive measurement degradation in this band.

This document presents detailed corresponding information showing such degradation that demonstrates that current limits in RR footnote **5.482** are not adequate and supporting current work undertaken in ITU-R to define adequate sharing criteria that would protect EESS (passive) in the 10.6-10.68 GHz band.

Also, on a more general basis, it clearly shows that interference to passive sensors is not a chimera and EUMETNET would certainly like to highlight this example in the light of agenda item 1.20 (WRC-07) or all issues related to protection of passive sensors such as the SRR 24 GHz issue, appealing European countries to ensure a full protection of **5.340** passive bands.

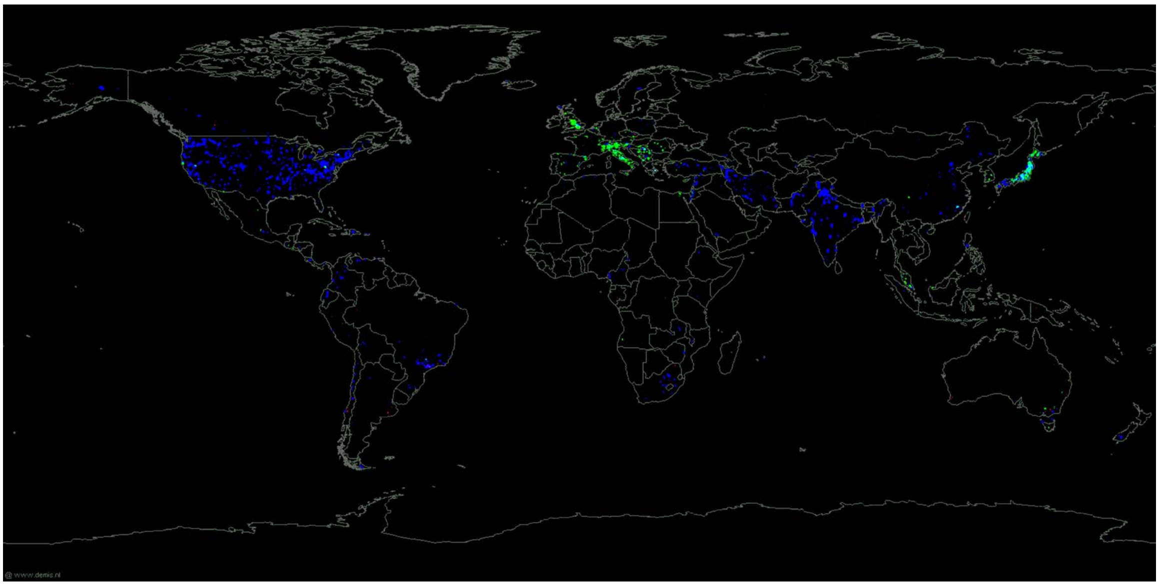
2 Global image of Radio Frequency interference

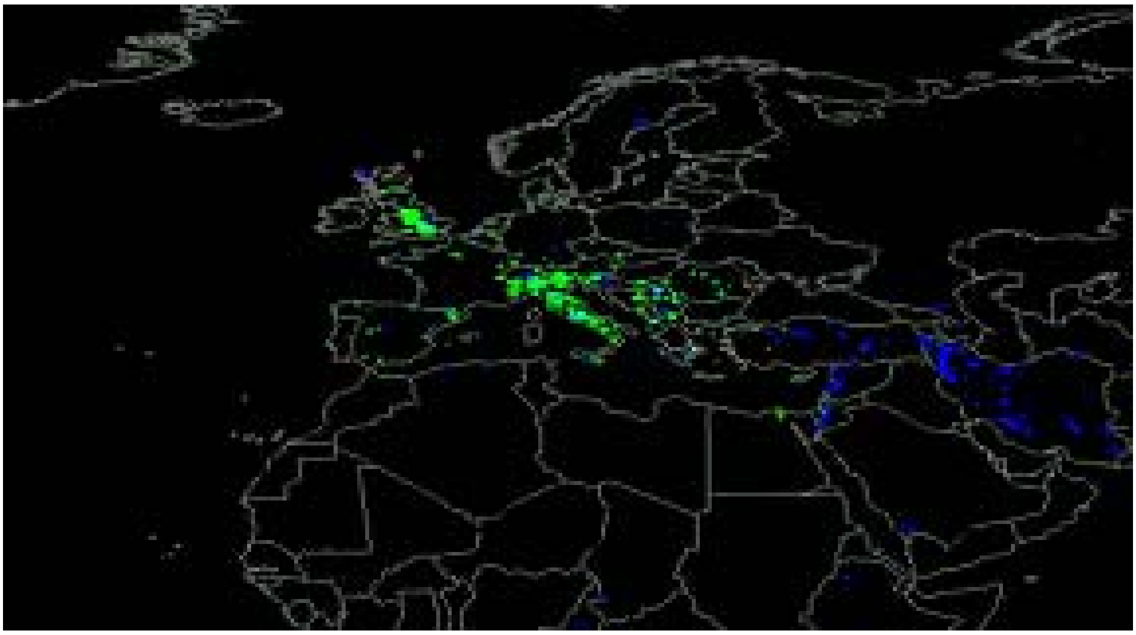
Low levels of interference received at the input of passive sensors would degrade passive sensor operations acknowledging that, in particular, the sensors are not able to discriminate between these natural radiations and man-made radiations.

On the other hand, when levels of interference are very high, at several order of magnitude compared to the sensitivity, the corresponding levels may be detected as not natural and have to be disregarded.

The following picture has been drawn by Chris Kidd from the University of Birmingham (UK) and is a global composite image of Radio frequency interference in different Microwave frequencies derived from one month of AMSR sensor data (August 2004) (blue is the 6-7 GHz, green 10.6 GHz and red 18.8 GHz).

This picture is based on negative polarisation differences (i.e. H-pol > V-pol) using a 5K negative polarisation criteria, recognising that negative polarisation higher than 5K can only occur at these wavelengths through man-made emissions in H-pol.





These plots shows large degradation due to interference over **Japan**, and, within Europe, mainly **UK** and **Italy**.

However, it should be noted that this figure only shows one form of interference (Horizontal polarisation emissions) and, over all, fails to show how extensive undetectable interference are. However it is reasonable to assume that in regions of extensive detectable RFI there is likely to be larger areas of undetectable interference.

Therefore detectable interference, at high levels, is a symptom of a problem but absence of detectable RFI does not imply that there is not a problem. The plot illustrates that the problem is real and growing (given that such signatures were not detectable a few years ago).

3 Conclusions

As for all passive bands, measurements are currently operational and are used on a world-wide basis, exchanged between the meteorological organisations in all regions to be inputted in Numerical Weather Models. It should be noted that measurements over, for example, UK and Italy, are not only used for weather forecasts over these countries but lead to global modelling of the atmosphere used by all National Weather Services (NWS).

It is hence a global responsibility from each individual country vis-a-vis all others, in particular with regards to their international commitments related to the World Weather Watch of the World Meteorological Organisation.

ANNEX 2

Interference to meteorological radars from RLAN 5 GHz

1 Introduction

Meteorological radars represent key observation stations used for meteorological and environmental measurements and survey, essential to provide short-term alert in case of severe weather conditions (such as flooding, cyclones, hurricanes) endangering populations and strategic economical domains such as transportations, energy or agriculture, as the first line of defence against loss of life and property in flash flood events such as recently in Boscastle (UK) or in several cases in south of France.

There are currently in Europe more than 160 meteorological radars and about 140 in the 5600-5650MHz band for which the detection and monitoring of storms at range relies upon detecting signals just above the environmental noise meaning that even 1dB loss of sensitivity would have a measurable impact on the effective radar coverage.

Following last WRC03 conclusions, related Decision ECC(04)08 and corresponding EC Decision 2005/513/EC, meteorological radars in the 5600-5650 MHz band, as well as all radar types in the 5470-5725 MHz band, have to share the band with RLAN applications under specific regulation such as power limits, power control and Dynamic Frequency Selection (DFS), this latter DFS feature being the main tool that would allow compatibility between RLAN and radars. These RLAN devices are described in ETSI standard EN 301 893.

However, it should be noted that the first version of this standard were not specifying adequately DFS feature and it appears now that such equipments are regularly producing interference to operational meteorological radars in these countries, justifying *de facto*, if needed, the necessity of adequately specified DFS to ensure proper protection of radars in the 5470-5750 MHz band.

Some of these interference events are reported in this documents, also compared to similar interference highlighted during testing performed in Canada.

2 Testing performed in Canada

At the last WP 8B meeting (September 05), Canada presented a contribution (8B/293) giving experimental and analytical interference results from 5 GHz RLAN to meteorological radars, concluding on the absolute necessity of DFS.

In particular, experimental studies were performed in a real environment with a RLAN equipment located at 10.6 km from a radar and transmitting a 38 dBm power. It should be noted that, compared with the current European regulation for which a maximum power of 30 dBm is required, this situation is comparable to an RLAN located at roughly 4 km.

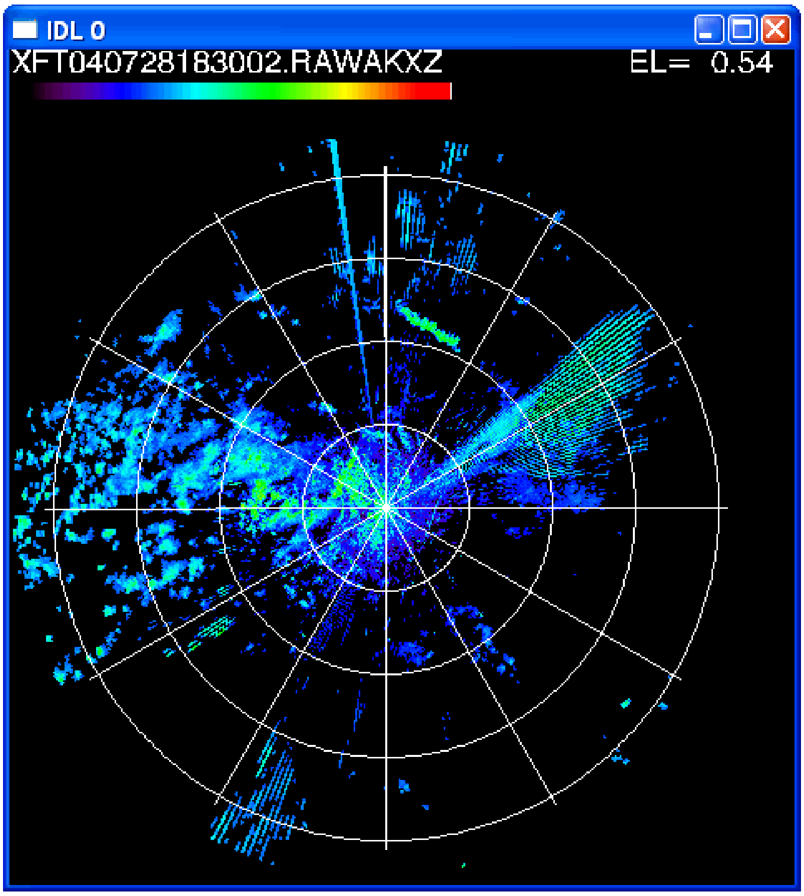


FIGURE 1 (FIGURE 2 FROM DOC 8B/293)

Interference effects of 38 dBm RLAN the CWSR98 Radar. RLAN located at Carleton Place, 10.6 Km from the radar and ~ 345 degree Azimuth. There is a streak at ~345 degrees WRT North. The RLAN is located within the streak. Scale circumferential gradations are ~40 Km

The RLAN is located 345° North and this experiment shows interference effect in a number of azimuth, either at the coverage edge or at all distances in the 345° azimuth or in the range 50-90°.

3 Interference on operational radars in Hungary and Poland

Meteorological services from Hungary and Poland have been recently alerted by interference events that occurred to their radars that have been shown as being produced by 5 GHz RLAN based on a the initial ETSI standard.

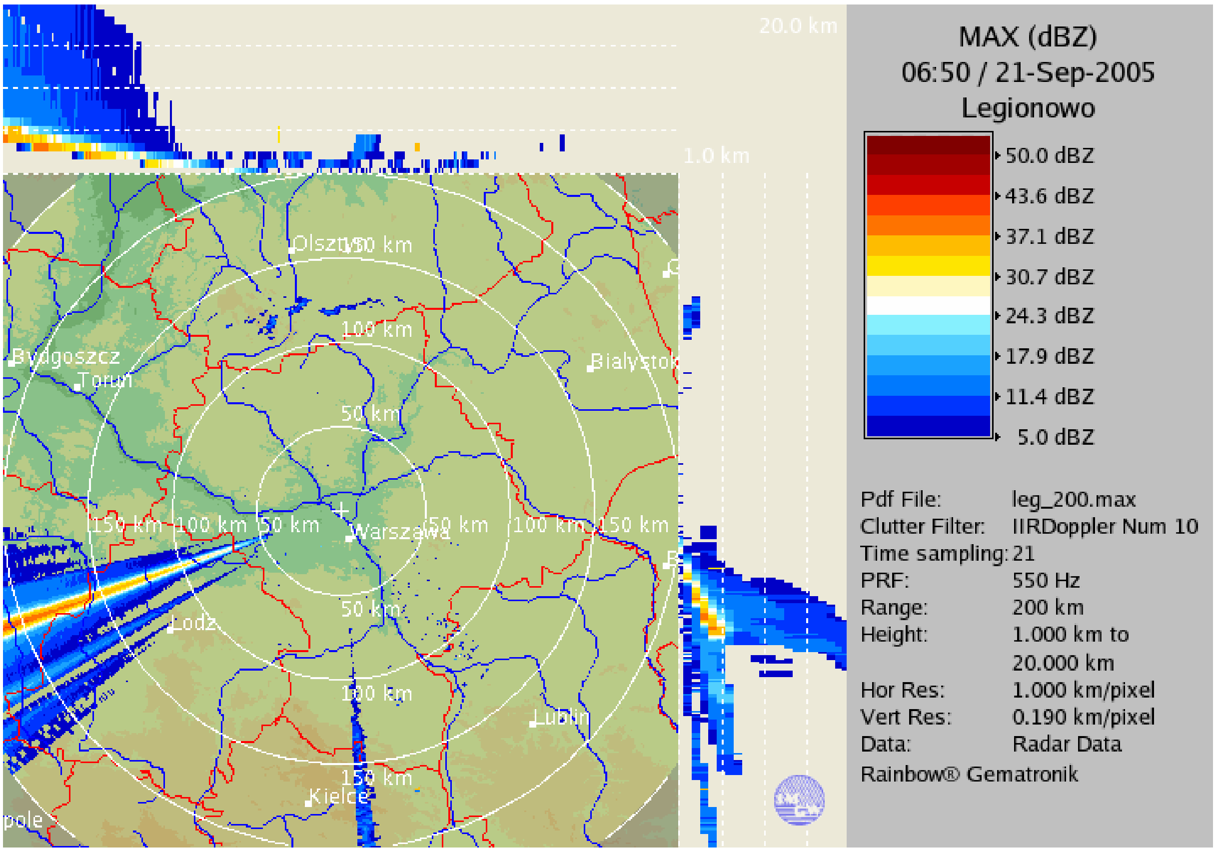


FIGURE 2

RLAN interference to Legionowo (Poland) meteorological radar (sept 05).

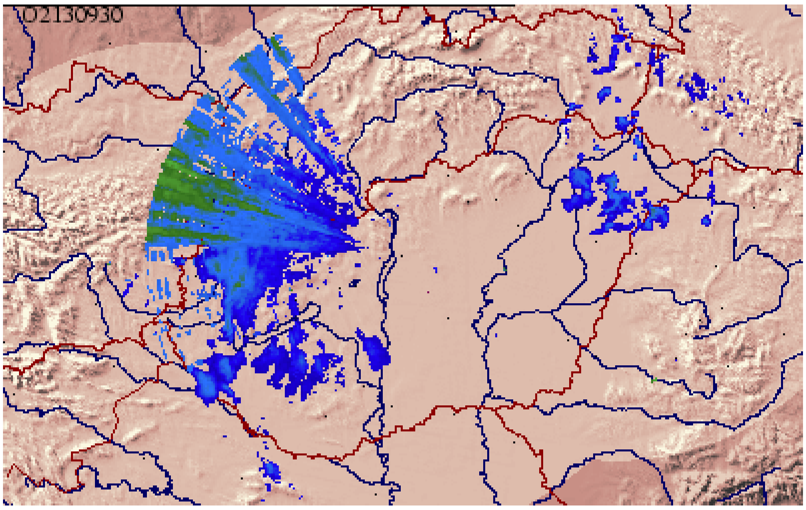


FIGURE 3

RLAN interference to Budapest (Hungary) meteorological radar (Feb 06).

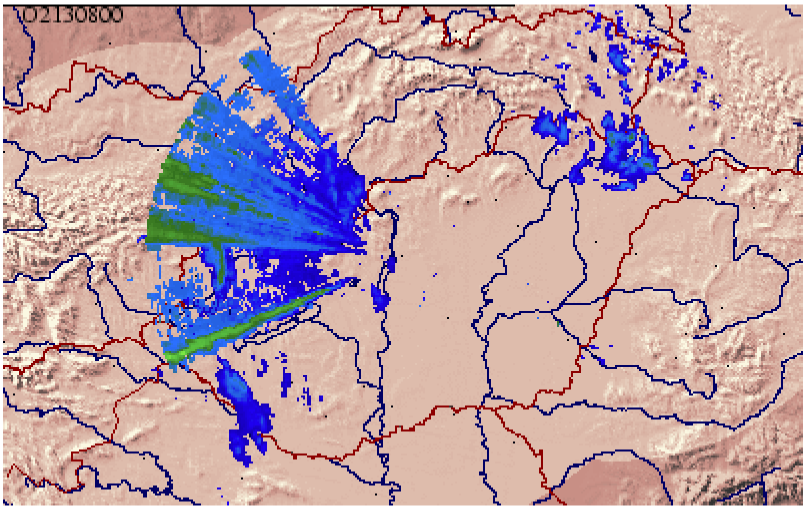


FIGURE 4

RLAN interference to Budapest (Hungary) meteorological radar (Feb 06).

These elements shows large similarity with the Canadian testing in that RLAN interference impacts the radar measurements over large azimuth and distances which render radar data totally non exploitable, situation that is clearly critical in zones that are known as being susceptible to flooding.

In the case of figure 2 (Poland), it is worth noting that the impact of RLAN is comparable in rain precipitation levels (dBz) to heavy rain (between 20 and 50 dBz), that will lead to wrong information on the precipitation data used in nowcasting and also in the rain accumulation data that are crucial to survey flooding risks.

The national Polish Radiocommunication administration alerted, it took more than one year to find the source of the interference, mainly due to the weak power of the RLAN signal (radar is much more sensitive than typical measuring tool) It then appeared that this source was a RLAN transmitter operating on frequency with peak very close to the radar frequency and located very close to the radar site.

The RLAN transmitter found by the frequency management authority was equipped with that device but **DFS mode was switched off**. since the operator has a possibility to switch the DFS device on or off at any time.

It should also be noted that, since the beginning of this year, a similar false echo appeared on the image from Poznan radar site.

Also, in the case of figure 3 and 4 (Hungary), it should be noted that the a number of similar interference events occurred during the last 2 years. The National Frequency Authority stopped these interference last July but the interference recently reappeared in February 2006. In this situation, this radar cannot be used operationally anymore, meaning that precipitation on half of Hungarian territory cannot be monitored.

It should be noted that these images reflects the impact of interference on precipitation measurements but that these interference may have even more higher impact on wind Doppler measurements that are difficult to present or even detect.

4 Conclusion

This document presents evidence of interference that occurred to operational meteorological radars in Hungary and Poland from 5 GHz RLAN designed on the basis of the previous ETSI standard.

It is also worth noting that, apparently, similar problems occurred in the Czech Republic as well as in Germany.

It is worth noting that these elements are comparable with similar interference highlighted during testing performed in Canada for RLAN without DFS feature, proving, if needed, the necessity of DFS and the inadequacy of the previous version of ETSI standard in ensuring protection of radars in the 5470-5725 MHz band.

Indeed, the issue is not limited to those countries that have already authorised these old fashioned 5 GHz RLAN equipment since, by principle, these RLANs benefit from a free circulation within the EU and, even though not authorised in used in some countries, could be placed on the market in these countries.

Meteorological radars take part of processes related to safety of life and safeguarding strategic European economical domains that results in short-term alert in case of severe meteorological and environmental events such as flooding, severe storms or even pollution monitoring. These radars cannot be put at risk with an uncontrolled deployment of unlicensed radio equipment as RLAN, at least if these equipment are not compliant with the up-to-date EC and ECC regulations and ETSI standard.

On this basis, these elements are presented to ECC in a view to justify the need for mandatory Dynamic Frequency Selection (DFS) feature applied to 5 GHz RLAN, under the specification described in the last ETSI standard version (EN 301 893) and to possibly find a solution with regards to RLAN based on former ETSI standard.
