Radio Systems Operationality versus Radiation Hazard Regulations

GILLES Thierry, Royal Military Academy, CISS Department, LEMA
Thierry.gilles@rma.ac.be

I. INTRODUCTION

Civilians and militaries make extensive use of electromagnetic radiating systems, mainly for detection, communication or jamming purposes. An important economical and performance criterion for such systems is their operational range, that is partly governed by the radiated power. International, national or even regional radiation hazard regulations, along with electromagnetic compatibility standards, most often dictate an upper limit to the radiated power.

II. IMMISSION LIMITS

In some cases, those limits may have a serious cost or operationality impact. A notorious and very recent example of a conflictuous situation is the deployment of the 4G networks over Brussels, that have been delayed, not to say jeopardized, due to the very severe and cumulative immission limits applicable to those telecommunication systems in the Brussels Capital Region only [1][2], whereas less severe and non cumulative limits apply over the rest of Belgium [3][4]. Confronted to immission limits, two possible solutions for speech and data communication systems to emit less power while maintaining sufficient coverage is to use lower frequencies and improve the sensibility of the receivers. Lower frequencies have better propagation characteristics, but offer less available bandwidth and require larger antennas. Anyway, frequencies are a scarce and expensive resource and cannot freely be chosen : they are attributed by national bodies. On the other hand, the sensibility of receivers may globally be improved over the years, but it is still strongly variable among the many manufacturers of mobile phones, smartphones and tablets, imposing the service providers to dimension its network for the average user.

Another example of military (but also civilian) systems that might suffer from immission limits are the jammers. Those systems must use large powers to ensure a wide denial or protection area where adverse communications must be blocked. As the jamming power must be limited to avoid excessive exposure of the personnel operating in the neighbourhood (drivers, patrollers, deminers, ..), the wisest possible use of the power over the jammed frequencies and adapted operational procedures or constraints are a must.

Immission limits apply to specific geographical areas accessible to humans (e.g. domestic living places, workplaces), where the average electric and magnetic field generated by one or more independent electromagnetic sources may not exceed a frequency dependant threshold. Those threshold values are supposed to safeguard people from adverse effects of electromagnetic emissions. Considering the wide variety of possible adverse effects of non ionizing electromagnetic radiation (from headache to cancer) and the lack of evidence that such effects can be attributed to electromagnetic radiation, the only recognized effect that serves as a basis for radiation hazard regulations worldwide in the radio frequency range is the temperature increase due to wave absorption by the human body. To account for possible other non thermal effects, countries and regions apply a safety factor that may vary between 5 and

100, giving rise to apparently permissive standards, such as the one enforced by Belgian defense during operations abroad [5], and very severe regulations, such as the one imposed to the Brussels Capital Region [1]. For radiating systems supposed to operate in various geographical regions, such as some military deployable systems (radios, jammers, …), but for example also the Road Police mobile speedometers, the strictest limit must be obeyed either by the equipment itself, or by the way the equipment is used when its power can be adjusted.

III. EMISSION LIMITS

Some categories or radiating equipments must obey emission standards. Emission standards do not apply to geographical areas, but are a limit imposed to the equivalent isotropic power that may be radiated by an individual equipment, wherever it is being operated. Just to name a few, (semi) active RFID tags and their associated readers, WiFi access points, or even again the speedometers used by the Road Federal Police may not emit more than a legally prescribed equivalent isotropic radiated power, otherwise they cannot be commercialized [6]. This time the main objective is not people protection from radiation hazard, but electromagnetic compatibility between systems. Of course those emission limits are such that the radiating systems are able to operate within a reasonable area, regardless of any immission limits within that area.

IV. CONCLUSION

Finding the best compromise between operationality of a radiosystem, interoperationality between electronic systems and human health preservation is not an easy task, especially with the multiplication of mobile transmitting and receiving systems and sensitive electronic devices. The ever growing risk of interferences between systems on one side, and the economical or operational impacts of severe radiation hazard regulations based essentially on the precaution principle on the other side, should not be underestimated.

REFERENCES

[1] MINISTERE DE LA REGION DE BRUXELLES-CAPITALE, “Ordonnance relative à la protection de l'environnement contre les éventuels effets nocifs et nuisances provoqués par les radiations non ionisantes,” 01 Mars 2007

[2] MINISTERE DE LA REGION DE BRUXELLES-CAPITALE, “ Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif à certaines antennes émettrices d’ondes électromagnétiques,” 30 Octobre 2009

[3] REGION WALLONNE, “Décret relatif à la protection contre les éventuels effets nocifs et nuisances provoqués par les rayonnements non ionisants générés par des antennes émettrices stationnaires,” 03 Avril 2009

[4] VLAAMSE OVERHEID, “Besluit van de Vlaamse Regering tot wijziging van het besluit van de Vlaamse Regering van 1 juni 1995 houdende algemene en sectorale bepalingen inzake milieuhygiëne wat betreft de normering van vast en tijdelijk opgestelde zendantennes voor elektromagnetische golven tussen 10 MHz en 10 GHz,” 13 Januari 2011

[5] North Atlantic Treatise Organisation, “Evaluation And Control Of Personnel Exposure To Radio Frequency Fields - 3 Khz To 300 Ghz,” 13 Februari 2003

[6] Ministère de l’Economie, de l’Energie, du Commerce extérieur, et de la Politique scientifique, “Arrêté ministériel modifiant l’arrêté ministériel du 19 octobre 1979 relatif aux radiocommunications privées,” 22 Décembre 2004