

ELECTROPOLLUTION IN OUR URBAN ENVIRONMENT

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Abstract. The paper is a descriptive study based on the scientific results coming out *from all over the world* in the last years (2007-2013), concerning an increasing level of electropollution in our urban environment as a dangerous health threat mostly in the big and crowded *urban places*. Electropollution is today subject of serious health damages. The paper mention results of several significant studies including the BioInitiative Report 2012 prepared by 29 authors from ten countries, and covers a series of questions in this field, in our country *to raise awareness* of specialists in *architecture and constructions services*, if we may have designed sustainable, elegant, functionally efficient building complexes, without a prolonged exposure to radiofrequency and microwave radiations coming from the emitting modern technology.

Key words: electromagnetic pollution, space health, sustainable functionality

1. World wide context

Based on the reality of numerous and alone in large urban areas, to be interconnected to the rhythm of daily life in any metropolis of the world, today are needed vast radiofrequency (RF) and microwaves networks, terrestrial antenna towers with wide coverage area used for our modern *utilities and means of communication*: cellular and fixed wireless equipment and WI-FI, WI-MAX, other technologies or wireless networks, broadband over medium or high voltage lines, and *personal electronic equipment*.

Note: A wireless network is any type of *computer network* that uses wireless data connections. Wireless networking is a method by which users (homes, telecommunications networks and enterprise) installations *avoid the costly process of introducing cables into a building*,

or as a connection between various equipment locations.

Wireless infrastructure “can be built for *very little cost compared to traditional wired alternatives*” (Hacker, 2007). Wireless telecommunications networks, as *infrastructure for communication “through the air”* (Fig. 1a) is generally *implemented and administered using radio communication*, implementation (Fig. 1b) which takes place at the physical level (layer) of the *Open Systems Interconnection (OSI) model network structure* (Aravamudhan *et al.*, 2003).

Examples of wireless networks include *cell phone networks*, Wi-Fi local networks and terrestrial microwave networks.

“By far the most successful application of *wireless networking* has been the cellular telephone system” (Goldsmith, 2005).

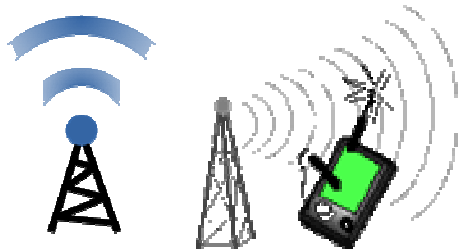


Fig. 1a. Wireless icons

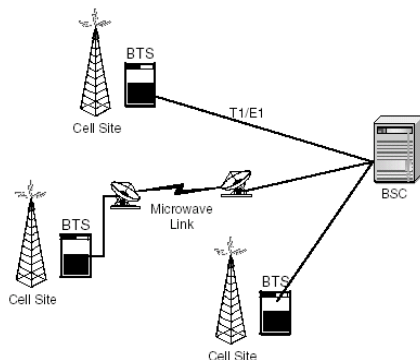


Fig. 1b. Generic radio access network, which comprises the base transceiver stations (BTSs) and the controller element, called the base station controller (BSC). The BTSs are basically the radio elements (RF equipment) on the network side (Aravamudhan *et al.*, 2003)

Wireless applications include “voice, Internet access, web browsing, paging and short messaging, file transfer, subscriber information services, video teleconferencing, entertainment, sensing and distributed control. Coverage regions include in-building, campus, city, regional and global” (Goldsmith, 2005).

Comparing with traditional electric wired traces, the specialists state that “building wireless networks is only partly about saving money. By providing people in your local community with cheaper and easier access to information, they will directly benefit from what the Internet has to offer. The time and effort saved by having access to the global network of information translates into wealth on a local scale, as more work can be done in less time and with less effort.”...“Likewise, the network becomes all the more valuable as more people are connected to it. Communities connected to the Internet at high speed have a voice in a global marketplace, where transac-

tions happen around the world at the speed of light. People all over the world are finding that Internet access gives them a voice to discuss their problems, politics, and whatever else is important to their lives, in a way that the telephone and television simply cannot compete with. What has until recently sounded like science fiction is now becoming a reality, and that reality is being built on wireless networks. But even without access to the Internet, wireless community networks have tremendous value. They allow people to collaborate on projects across wide distances. Voice communications, email, and other data can be exchanged for very little cost. By getting local people involved in the construction of the network, knowledge and trust are spread throughout the community, and people begin to understand the importance of having a share in their communications infrastructure. Ultimately, they realize that communication networks are built to allow people to connect with each other (Hacker, 2007).

Among all above known or estimated positive effects of wireless and mobile telephony applications, really helping the people social connectivity, were in our urban areas would be yet the presence of the electromagnetic pollution, also named as electrosmog? And why is that now topic of international debate and sustained concern for increasing knowledge about serious effects on the health of users?

Notion of electromagnetic pollution or electro-smog assumes the existence of an excessive exposure (of living beings or devices) to electromagnetic fields. Defined as radiated signals, intentionally or not, that can cause disruption to equipment or harm living beings or can affect natural important processes within ecosystems, the electromagnetic pollution could be nowadays a source of environmental invisible polluting factors that come from high levels of cumu-

lated artificial electromagnetic fields, generated in particular by using the above technological diversity in our residential or commercial areas, buildings or monuments, roads and access ways, is today, more than a decade ago, an imperative for analysis and effective measures to prevent or minimize.

One reason to write this paper came because the electromagnetic environment we live in today, provided with all the new generations of wired or wireless technologies, is not a better one than in 1990, 2000 or 2010 (Cobzaru, 1998, 2007, 2008, 2011), according to many detailed documented reports (Frey, 1993; Santini *et al.*, 2003; Cook *et al.*, 2006; Huss *et al.*, 2007; Balmori, 2009; Levis *et al.*, 2011; Carpenter and Sage, 2012).

Public exposure to electromagnetic radiation is not a new phenomenon. "The use of high power devices have besides stimulated many interests in the research of the possible biological effects from human exposition to the electromagnetic radiations in acute or chronic form" (Argiero and Rossi, 1980). At a time their research dealt with national situation (i.e. Livorno city, Italy) concerning the ambient pollution by the radiofrequency electromagnetic waves and the microwaves.

Other previous investigations of exposure to electric, magnetic, or electromagnetic fields (EMF) in households were either about electricity supply EMFs or radio frequency EMFs (RF-EMFs). "We report results from spot measurements at the bedside that comprise electrostatic fields, extremely low-frequency electric fields (ELF-EFs), extremely low-frequency magnetic fields (ELF-MFs), and RF-EMFs. Measurements were taken in 226 households throughout Lower Austria" (Tomitsch *et al.*, 2010).

Another reason to write about this subject was to open for debate in our country, to the general public as client and spe-

cialists as providers of functional, sustainable and healthier built urban environment (architects, electrical engineers, IT and communication services and public health specialists) questions and opinions towards an increased presence of useless artificial electromagnetic field surrounding us, intentionally or not, generated by equipments; that might inspire them to find efficient solutions to minimize consequences for the future of our cities. Therefore the paper submits for reflection:

1. the uncontrolled occupational exposure in the urban working environment in institutions or public service facilities, equipped with highly fluorescent lighting or with specific activity using computers and surveillance or copying equipment, internal wireless communication networks, etc.
2. the uncontrolled exposure for those in their own homes, equipped with many electrical household utilities and/or too much electro-emission equipment on the roof of the buildings (i.e. many microwave radiations equipments located on the roofs or terraces of the buildings, Fig. 8a and Fig. 8b).

„According to the International Telecommunications Union, the number of cell-phone subscriptions has reached 5 billion (mid 2010), with more than half of all users believed to be children and young adults. There are no data for cordless users, but a figure of 2 billion is a reasonable assumption. Given these numbers, even an established modest increase (20-30%) in tumour risk for MP users would result in significant social and health costs and individual suffering, while higher risks could give rise to a health crisis of dramatic proportions. While most technologies carry risks, these should be assessed accurately and responsibly" (Levis *et al.*, 2011).

In 2012, Kent Larson, architect, principal Research Scientist, director of the House_n

Research Consortium, Massachusetts Institute of Technology, state that „cities will account for 90% of the population growth, 80% of the global CO₂, 75% of energy use, but at the same time it's *where people want to be, increasingly. More than half the people now in the world live in cities, and that will just continue to escalate...* The question now is, how can we have all the good things that we *identify with cities without all the bad things?* [...] So with cities, we also *have congestion and pollution and disease* and all these negative things. How can we have the good stuff without the bad? [...] But in the end the main thing we need to focus on are people. Cities are all about people. They're places for people. There's no reason why we can't dramatically *improve the livability and creativity of cities* like they've done in Melbourne with the laneways while at the same time dramatically reducing CO₂ and energy. *It's a global imperative. We have to get this right*” (Larson, 2012).

2. Reference documents and evidences

This paper is not dedicated to standards analyzes. To have *clear general points of views* in the topic of electromagnetic pollution, many scientific reports today bring important reference evidences.

Some of the studies (Hardell *et al.*, 2007) aimed to evaluate *brain tumour risk* among long-term users of cellular telephones (Hardell-group, Department of Oncology, Orebro University Hospital, Sweden), because “*the brain is the target organ of the body with highest near field exposure to microwaves during use of a handheld wireless phone. Thus, fear of an increased risk for brain tumors from RF fields emitted from mobile phones has dominated the debate the last decade. Of equal importance is use of the desktop cordless phones*” (Hardell *et al.*, 2011). “There has been a rapid development of wireless technology since the 1990s and

nowadays most persons use mobile phones and cordless phones. Additionally, most populations are exposed to radiofrequency/ microwave (RF) radiation emissions from wireless devices such as *mobile phone base stations, broadcast transmission towers, pagers and personal digital assistants, wireless networks and other sources of RF radiation*” (Hardell and Sage, 2008).

The use of mobile phone *has a long history in Sweden* and therefore studies performed here offer good possibilities to study this question (Hardell *et al.*, 2011). “Sweden was one of the first countries in the world to adopt this new technology so *studies with longer latencies are possible and health effects from the wireless technology may be especially pertinent in this country for early warnings*” (Hardell and Carlberg, 2009).

Hardell-group has studied the association between use of wireless phones and brain tumors since the 1990s (for overview, see Hardell *et al.*, 2009), including assessment of use of mobile phones and cordless phones. In conclusion their pooled analysis showed “an increased risk for malignant brain tumors and use of mobile or cordless phones. The *risk increased with latency time and cumulative use. Highest risk was found in the group with first use of a wireless phone before 20 years of age*” (Hardell *et al.*, 2011).

Other significant conclusions state and recommend: “*While recognizing that mobile telephony is an outstanding technology of inestimable value, responsible science must raise awareness of the risks involved. We thus conclude that already today there is sufficient epidemiological evidence to warrant application of the precautionary principle aimed at:*

- setting exposure limits that are precautionary;

- *limiting the spread of wireless technology in schools and highly frequented places (libraries, offices, hospital wards);*
- *awareness raising in schools through a campaign on the use of the various wireless transmission technologies;*
- *discouraging the use of mobile phones by minors under 14 years;*
- *epidemiological monitoring of the possible oncogenic action of home and workplace EM exposures” (Levis et al., 2011).*

Among all recent evidences the BioInitiative Report includes *the most extensive record of studies*. The BioInitiative Report - *A Rationale for Biologically-based Exposure Standards for Low-Intensity Electromagnetic Radiation*, was first posted in August 2007, then updates in 2012 - *sifted through 1,800 studies - 1479 pages - over other “five years of science, public health, public policy and global response to the growing health issue of chronic exposure to electro-magnetic fields and radiofrequency radiation in the daily life of billions of people around the world” (Carpenter and Sage, 2012) who live and work in large metropolitan areas or even villages in the proximity of high or medium voltage power lines.*

It documents bioeffects, adverse health effects and public, health conclusions about impacts of non-ionizing radiation (electromagnetic fields including extremely-low frequency ELF-EMF and radiofrequency/microwave or RF-EMF fields). Also helpfully includes RF Color Charts which summarized many studies relevant for cell towers, WI-FI, ‘smart’ wireless utility meters, wireless laptops, baby monitors, cell phones and cordless phones.

The BioInitiative Report was prepared by the BioInitiative Working Group 2012, composed of 29 authors from ten countries [Sweden (6), USA (10), India (2), Italy (2), Greece (2), Canada (2),

Denmark (1), Austria (2), Slovak Republic (1) and Russia (1)]. Within this international group of renowned scientists, researchers, doctors, and public health experts, ten are holding medical degrees (MDs), 21 PhDs, and three MsC, MA or MPHs. Among the authors are *three former presidents of the Bioelectromagnetics Society, and five full members of BEMS.*

In the Preface of this Report, the Organizing Committee thanks the participants *“for their integrity and intellectual courage in dealing with this controversial and important topic.* The great strength of the BioInitiative Report is that it has been done *independent of governments, existing bodies and industry professional societies that have clung to old standards.* Precisely because of this, the BioInitiative Report presents a solid scientific and public health policy assessment that is *evidence-based” (Carpenter and Sage, 2012).*

Meaningful for the aim of this paper are some *general BioInitiative Reports’ conclusions* to be mentioned:

1. *“The global conversation on why public safety limits for electromagnetic and radiofrequency fields remain thousands of times higher than exposure levels that health studies consistently show to be associated with serious health impacts have intensified since 2007. Roughly, 1800 new studies have been published in the last five years reporting effects at exposure levels ten to hundreds or thousands of times lower than allowed under safety limits in most countries of the world. Yet, no government has instituted comprehensive reforms. Some actions have been taken that highlight partial solutions. The Global Actions chapter presents milestone events that characterize the international ‘sea change’ of opinion that has taken place, and reports on precautionary advice and actions from around the world.*

2. The world's populations - from children to the general public to scientists and physicians - are increasingly faced with great pressures from advertising urging the incorporation of the latest wireless device (Fig. 2 and Fig. 3), into their everyday lives.
3. The exposures are invisible, the testing meters are expensive and technically difficult to operate, the industry promotes new gadgets and generates massive advertising and lobbying campaigns that silence debate, and the reliable, non-wireless alternatives (like wired telephones and utility meters) are being discontinued against public will.
4. There is little labeling, and little or no informed choice. In fact there is often not even the choice to stay with safer, wired solutions, as in the case of the 'smart grid' and smart wireless utility metering, an extreme example of a failed corporate-governmental partnership strategy, ostensibly for energy conservation.
5. A collision of the wireless technology rollout and the costs of choosing unwisely is beginning and will grow. The groundwork for this collision is being laid as a result of increased exposure, especially to radiofrequency fields, in education, in housing, in commerce, in communications and entertainment, in medical technologies and imaging, and in public and private transportation by air, bus, train and motor vehicles" (Carpenter and Sage, 2012).
6. "Electrical hypersensitivity is reported by individuals in the United States, Sweden, Switzerland, Germany, Denmark and many other countries of the world. Estimate range from 3% to perhaps 10% of populations, and appears to be a growing condition of ill-health leading to lost work and productivity" (Johansson, 2012).



Fig. 2. Hertzian Parabolic Repeaters of mobile phones systems: deterioration and impact over the environment - overhead view (Next-up organisation France, 2012)



Fig. 3. Cell towers disguised as trees (Rees and Havas, 2009)

3. EMFs exposure and prudent public health planning

The above large and rich documented scientific report concluded that *"we are at a critical juncture in this world-wide debate. The answers lie not only in the various branches of science; but necessarily depend on the involvement of public health and policy professionals, the regulatory, legal and environmental protection sectors, and the public sector"* (Carpenter and Sage, 2012).

In 2010, dr. Samuel Milham, "noted physician-epidemiologist" (Richards, 2010), specializing in public health, awarded for his pioneering work describing the link between occupational exposure to EMFs

and human disease, stated: "When Thomas Edison began wiring New York City with a direct current electricity distribution system in the 1880s, he gave humankind the magic of electric light, heat and power; in the process, though, he inadvertently opened a Pandora's Box of unimaginable illness and death" (Milham, 2010). "If our findings are substantiated, high frequency voltage transients are a new and important exposure metric and a possible universal human carcinogen similar to ionizing radiation" (Milham, 1996; Milham and Morgan, 2008). Furthermore dr. Samuel Milham comments *steps we must take, personally and as a society, "to coexist with this marvelous but dangerous technology"* (Milham, 2010).

Supported in all its content by numerous evidences (including Hardell-group works), the BioInitiative Report in 2012 also concludes: "Public exposure to EMR (power-line frequencies, radio frequency and microwave) is growing exponentially worldwide. There is a rapid increase in electrification in developing countries, even in rural areas. Most members of society now have and use cordless phones, cellular phones, and pagers. In addition, most populations are also exposed to antennas in communities designed to transmit wireless RF signals. Some developing countries have even given up running land lines because of expense and the easy access to cell phones. Long-term and cumulative exposure to such massively increased RF has no precedent in human history.

Furthermore, the most pronounced change is for children, who now routinely spend hours each day on the cell phone. Everyone is exposed to a greater or lesser extent. No one can avoid exposure, since even if they live on a mountain-top without electricity there will likely be exposure to communication-frequency RF exposure. Vulnerable populations (pregnant women, very young children, elderly

persons, the poor) are exposed to the same degree as the general population. Therefore it is imperative to consider ways in which to evaluate risk and reduce exposure. Good public health policy requires preventative action proportionate to the potential risk of harm and the public health consequence of taking no action" (Carpenter and Sage, 2012a).

4. Discussions; Attitudes

Supporting and beneficial attitudes of the specialist and working groups, to develop different actions to raise awareness of people to protect their health from Electromagnetic Radiation (EMR) hazards, include petitions, scientific and experimental biotechnical and ecological projects, some Governments' decisions to reduce its ambient exposure limits to 3V/m (Belgium in 2009) or to adopt the Bioinitiative recommendations of 0.6 V/m (French cities in June 2009).

Among attitudes, organizations and warning messages, in the last years were developed (EMF Refugee, 2012):

- September 2007, the German government warned its citizenry not to use mobile phones (only in emergencies) and WiFi;
- In November 2007, the London Resolution called on governments to protect children from harm posed by EMFs by following the precautionary principle and adopting the Bioinitiative's recommendation and the city of Paris voted to ban WiFi in its Public Libraries.
- In July 2008, Toronto's department of public health issued an advisory warning teenagers and young children to limit their use of cell phones to avoid potential health risks. During the same month, the director of the University of Pittsburgh Cancer Institute called for caution in the use of cell phones while a UK Teacher Union Chief, Philip Parkin called for the suspension of WiFi in all UK schools. Today Camilla Rees, from

the International Institute for Building-Biology® & Ecology in Canada, states that *“this invisible source of exposure for the built environment, is a mistake ever made in the name of progress”* (Rees, 2012);

- In September 2008, the European Parliament noted that EMF exposure limits were obsolete. In January 2009, the Finnish Radiation and Nuclear Safety Authority (STUK) recommended restricting the use of mobile phones by children.
- In April 2009, members of the European Parliament voted for reductions in EMF exposures.
- European experts *propose cell phone ban in schools*, develop within the different ministries (education, environment and health) targeted information campaigns aimed at teachers, parents, and children to alert them to the specific risks of early, ill-considered, and prolonged use of mobiles and other devices emitting microwaves. *Ban all mobile phones, DECT phones or WiFi or WLAN systems* from classrooms and schools, as what some regional authorities, medical associations, and civil society organizations have advocated.



Fig. 4. Use no mobile phones in school zones (EMF Refugee, 2012)

- In May 2009, the French government imposed a ban on cell phones in all primary schools (Fig. 4).
- In October 2010, Swisscom offered free fiber optics to all Swiss schools.

5. Questions for the future Free EMG Zone

The wide and profound topic on electropollution briefly described in this paper, could not be covered in few summarizing chapters.

Essential questions for the future safety of our metropolitan areas, working spaces and educational places (schools, universities) or health facilities (hospitals, nurseries), come out reading the above evidences:

- Is it significant now the EMG pollution impact in our urban environment and its damage area? What should we expect in the future?
- Are there reliable technical solutions for the EMG pathology elements in our living places or therapies applied to the residential or working areas?
- Can we have *urban sustainable construction, functional and efficient* in terms of communication, without a prolonged and uncontrolled exposure to radio frequencies and microwaves generated by technology?
- Can we functionally live today in our metropolitan built spaces without internet and cell phones?
- Which category of personal electronic equipment or components of public facilities may induce a risk for health?
- And, when appropriate, *what can we give up, to prevent or reduce their influence to maintain health and functionality of the built space?*
- Are still there *in the world today or could we create or expand cities without electromagnetic pollution?*
- *Could we avoid serious errors in authorities' decisions (municipalities, local councils, engineers, technical designs verifiers, architects, project managers, who give technical and economical assessments on building too many radio access networks, mobile phone base stations, broadcast transmission towers*

or wireless networks at the expense of urban classical wired electric networks?

Different initiative groups made steps in choosing "clean" EMR places (Fig. 6 and Fig. 7) showing 0.0 V/m measured values for the electric field intensity (Fig. 5), to create a free EMR zone for small communities, to avoid temporarily radiations.



Fig. 5. 0,0 V/m measurement data on the screen of the electric field probe, in 2009, Charousse valley in southern France to avoid radiation (EMF Refugee, 2012)

There are free unoccupied areas (e.g. Durbon, France, Fig. 7) which are currently under study to become a White Zone Health Area and Healing for EHS. These are part of special concerns including cares for the part of the population who has become sensitized and physiologically chronic intolerant at EMR exposures. Examples of electromagnetic Refugees Zones or Shelters are in West Virginia Mountains USA, in France (Fig. 4 and Fig. 6), Italy (Fig. 5), Canada and Sweden.

An interesting and encouraging scientific experimental project initiated in France and Belgium, as a nongovernmental initiative in public health, between 2012-2014, still in development, is a national action called *Faraday Cage Regained Sleep* [French], supported by the independent group of specialists from Next-up organisation France, acting to inform people to raise awareness in this field.



Fig. 6. The first free Refuge Zone for the EHS opened in 2010 in Italy. It is within the Vena del Gesso Regional Park near the town of Brisighella, in the province of Ravenna (Next-up organisation France, 2010)

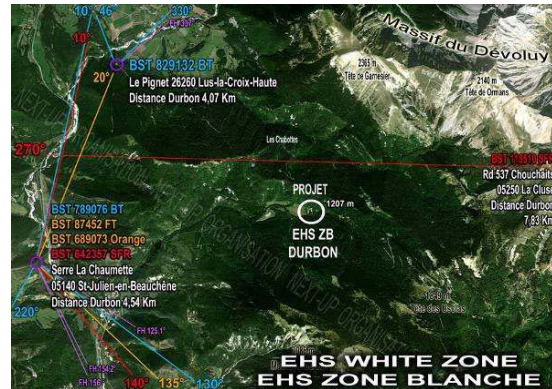


Fig. 7. Project EHS White Zone 2013

The geographic position of the project zone; the ruins of Chartreux de Durbon, France - (Next-up organisation France, 2013)

The project is destined to help especially the electrosensitive affected people or people aggressed by the intense field generated by too many microwave radiations equipments located on the roofs or terraces (Fig. 8a, 8b).

As "anti-EM waves" equipment, the project organizers were distributing to the participants the experimental kit of a Faraday Cage (fig. 9), consisting of:

- grounding carpet, under the bed (opaque metallic canvas HNV80), providing total protection against Low and High Frequency;

- 100% stainless steel frame structure Faraday cages (easy mounting), sitting by 4 soles on the carpet, and two flanges ground connected by connections 16 mm² (Fig. 10);
- veil of protection U.S. military technology against the radiation from artificial High Frequency Microwave, resting for optimizing the conductivity of the discharge of electromagnetic induction on the stainless steel frame grounded (Next-up organisation France, 2014).



Fig. 9. The Faraday Cage of the experimental kit, distributed to the participants, (Next-up organisation France, 2014)



Fig. 8a.



Fig. 8b.

Fig. 8a, 8b. Experimental survey in France, in flats positioned under a big number of antennas on roof terrace in Faraday Cage project (Next-up organisation France, 2014)

This project protection solution uses the properties of a Faraday Cage positioned around the bed zone (Fig. 9), destined to stop the penetration of the HF micro waves in the proximity, then in the persons' body; a field meter objectively measures the level of the electric/ magnetic fields' intensity.

5.1 Faraday Cage components. Notes and recommendations

The protective metallic veil

In case of this project was used as personal protection a high performance protective metallic veil of a good transparency (Fig. 10).



Fig. 10. Characteristics of the protective metallic veil in the Faraday cages used in the French national research project (Next-up organisation France, 2014)
 Composition: polyamide mixture with weaving complex high-tech silver wire;
 Mesh: about 0.7 mm to 0.9 mm;
 Width: 1.40 m; Weight: 40g / m²

If necessary the product could be used as either lining insulated clothing, hats etc.; either outer veil (avoid direct skin contact); the product is especially designed for making Faraday cages or baldachins surrounding the bed (with re-

quired carpet protection and independent earth bonding).

The project' authors, note that "in the dark, the protective metallic veil of the Faraday cage is not an embarrassment to watch TV.

Note: This veil is totally ineffective against EMC extremely LF 50 Hz.

Informative note: Price recorded on the market is from 60/65 euro TTC ml, 1.40 widths."

Warning note: wearing or using RF-reflective fabric can reduce our body exposure, but in some situations it can also increase exposures, so caution is advised.

The wire carpet in metallic cloth

(Commercial ref. HNV80) protection against the Low and High Frequency The opaque fabric special metallic HNV80 was intended to protect against local electromagnetic fields High and Low Frequency (50 Hz).

This type of protection has been selected by Next-up organisation France for carpet, in Faraday cage project.

In practice, this professional product is used for the ministries of defense, sensitive buildings, laboratories, etc. in applications such as interior walls, ceilings or special protections bags, etc.

Nevertheless, one of its best applications remains the ground where it can serve as a protective mat under the Faraday cages (need earth bonding).

Specifications:

- Width: 100 cm, roll of 20 m;
- Attenuation: 80dB; 99.999% shielding effectiveness at 1 GHz, certified in

- Munich, Germany according MILSTD tests 285 and IEEE Standard 299-1997;
- Materials: copper, nickel Nylon support;
- Weight: 85 g/m²;
- Color: Anthracite / Brown;
- Thickness of wire: 0.15 mm;
- Tensile strength: Very good in both directions, ± 50 N/mm;
- Grounding: Can be connected to independent earth bounding being made of metal fibers, in order to eliminate electromagnetic parasitic induction LF and HF (Fig. 11);
- Average price recorded on the market: from 22 € to 28 € per ml.

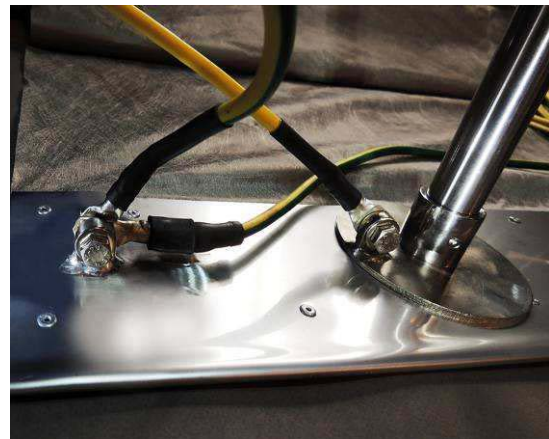


Fig. 11. Earth connections of stainless steel / veil structure and carpet in metallic fabric (Next-up organisation France, 2014)

6. Conclusions

The examples in this paper about the presence of the electromagnetic pollution in our living spaces today are meant to raise awareness and consideration in our country about the seriousness of this topic.

An important break through the reasonable immediate or and long term solutions *is often the business interest against the public health issues.* Therefore the Bio-Initiative report 2012 states:

- "We cannot afford 'business as usual' any longer. It is time that planning for new power lines and for new homes,

schools and other habitable spaces around them is done with routine provision for low-ELF environments. The business-as-usual deployment of new wireless technologies is likely to be risky and harder to change *if society does not make some educated decisions about limits soon*. Research must continue to define what levels of RF related to new wireless technologies are acceptable; *but more research should not prevent or delay substantive changes today that might save money, lives and societal disruption tomorrow*.

- While it is not realistic to reconstruct all existing electrical distributions systems, in the short term; *steps to reduce exposure from these existing systems need to be initiated, especially in places where children spend time, and should be encouraged*.
- A precautionary limit of 0.1 ($\mu\text{W}/\text{cm}^2$) (which is also 0.614 V/m) should be adopted *for outdoor, cumulative RF exposure*. This reflects the current RF science and prudent public health response that would reasonably be set for pulsed RF (*ambient*) exposures where people live work and go to school. This level of RF is experienced as whole-body exposure, and can be a chronic exposure where there is wireless coverage present for voice and data transmission for cell phones, pagers and PDAs and other sources of radio-frequency radiation; however, for the present time, it could *prevent some of the most disproportionate burdens placed on the public nearest to such installations*. Although this RF target level does not preclude further rollout of WI-FI technologies, we also recommend that wired alternatives to WI-FI be implemented, particularly in schools and libraries *so that children are not subjected to elevated RF levels until more is understood about possible health impacts*. This recommendation should be

seen as an interim precautionary limit that is intended to guide preventative actions; and more conservative limits may be needed in the future.

- *Mobile phone - free and WI-FI-free public areas should be established in areas where the public congregates and can have a reasonable expectation of safety; including airports, public shopping, hospitals, libraries, medical clinics, convalescent homes and assisted living facilities, theatres, restaurants, parks, etc.*
- Health agencies and school districts should strongly *discourage or prohibit cell towers on or near (within 1000' of) school properties, should delay any new WLAN installations in school classrooms, pre-schools and day-care facilities; and should either remove or disable existing wireless facilities, or be required to offer classrooms with no RF exposure to those families who choose not to have their children involuntarily exposed*" (Sage, 2012).

Worldwide EMR Action Day aligns with *Earth Day 2014* (19 April) to protect the biological integrity of the natural world and all its inhabitants against unnatural Electro-magnetic Radiation (EMR). Through this endeavor people from around the planet join together in actions to reduce harm from EMR to preserve a healthier life for all (EMR Action Day, 2014).

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