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# Mobile telephony and health: the experience of Peru

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- In Peru it has been conducted a nationwide diagnosis on non-ionizing Radiations for Telecommunications including broadcasting radiostations for TV, FM and AM radio and another nationwide diagnosys for Electricity Networks and preliminary surveys on microwave ovens. But because of the time this report is only targeted to mobile communications

- The objective of this presentation is to give a broad overview of the main actions that have been done in Peru about research on health effects, measurement of levels and compliance with international standards for health protection from non- ionizing radiations related to Peruvian mobile telephony networks.

It includes:

- The assessment of health effects, which is based on several important international documents specially those which were conducted within the frame of the International Electromagnetic Field Project from the World Health Organization (WHO) and

- The results of the main Peruvian assessments on telecommunications am mobile services and systems carried out from 2000- 2006.

This work was carried out on a nationwide basics through representative samples of the sources which included the measurement at more than 500 locations for telecommunications networks using broadband electromagnetic field analyzers and narrow band using spectrum analyzers.

# 1. Introduction

Mobile communications services in Peru have performed the biggest growth of telecommunication systems.

According to the Peruvian Supervisory Body for Private Investment in Telecommunications (OSIPTEL), in March, 2008 the penetration rate for the mobile communications in Peru was about 60.84 % with approximately 17 millions users, surpassing largely the amount of fixed telephony networks users.

But parallel to this very vigorous expansion of the Peruvian mobile networks some population sectors have developed a serious concern.

This is the reason why INICTEL-UNI has approached the study of this issue.

On one hand, this study presents an update of the review carried out in Peru of main health studies performed primarily within the frame of the WHO International Electromagnetic Fields Project.

On the other hand, it was done a research on regulation related to electromagnetic fields from telecommunications

Finally it was characterized the exposure nationwide presenting the results of evaluations carried out in terms of the compliance of ICNIRP Guidelines.

# 2. Review of Health Effects

## 2.1 Sources for the Review of Health effects

In order to evaluate health effects from electromagnetic fields (EMF) related to mobile telephony and telecommunication networks

On one hand it was carried out a review of publications from international organizations such as:

The Institute of Electrical and Electronic Engineers (IEEE), the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the World Health Organization (WHO).

## 2.1 Sources for the Review of Health effects

It also was conducted a review of national documents from

- The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA),
- The French Agency of Environmental and Occupational Health Safety (AFSSET),
- The Direction General of Health of France, European Commission (EC),
- The Health Council of the Netherlands, Independent Expert Group on Mobile Phones (IEGMP),
- The National Radiological Protection Board (NRPB) of the United Kingdom,
- The Royal Society of Canada.
- Finally it was reviewed the information on published results from the Interphone Study.

## 2.2 Identification of biological and health effects

Based on the documents of the most important international and national reviews performed in the last years we accept

- That the only established effect for radiofrequency and for mobile telephony is thermal effect.

- Exposure to field levels producing SAR values bigger than 4 W/kg could be outside thermoregulatory body capacity and produce harmful effects

- There are other health effects that are being researched such as brain tumuour, leukemia or other cancers, cataracts, effects on blood brain barrier, brain activity, cognitive function and male fertility but up to date there is no convincing evidence for any of these possible effects to get the status of established effect, so it is necessary to do a continuous follow up of the research on health effects.

- With regard to the Interphone Study there are preliminary reports of several national components but in order to have a real picture of the results it is necessary to have the final report so it is very important to include a follow up of the Interphone results in the Peruvian program for EMF

## 3. Measurements

*3.1 Geographical Distribution and Number of Measurement Locations*

For the national assessment they were carried out measurements of electric field strength of the main services in the frequency band 50 MHz to 2 GHz, including FM Radio, Television, Trunking , Mobile Telephony and Personal Communication Service (PCS) in Lima city and other 6 cities: Cuzco, Huancayo, Ica, Iquitos, Pucallpa y Trujillo with a total of 174 measurement locations. For mobile telephony in 2005 was carried out an evaluation of 40 base stations in Lima city.

*3.2. Equipment*

The equipment used for the radiofrequency measurements were:

(a) Antennas type adjustable dipole (25 - 520 MHz), logarithmic periodical (200 - 1000 MHz) and horn (1 - 18 GHz).

(b) Spectrum Analyzers (9 kHz - 3 GHz) that together with the antennas allowed carrying out detailed measurements of the electric field levels

(c) 02 electromagnetic field analyzer (300 kHz - 40 GHz) with two probes one for 3 kHz to 3 GHz and other for 300 kHz to 40 GHz.

(d) Portable computers, GPS, Digital Photographic Cameras, Compasses, Altimeters, Odometers.

# BROADBAND MEASUREMENT

- **Equipment**
  - **Electromagnetic Field Analizer, 10 kHz- 60 GHz**
  - **Probe 300 kHz- 40 GHz**
  - **Personal Computer**

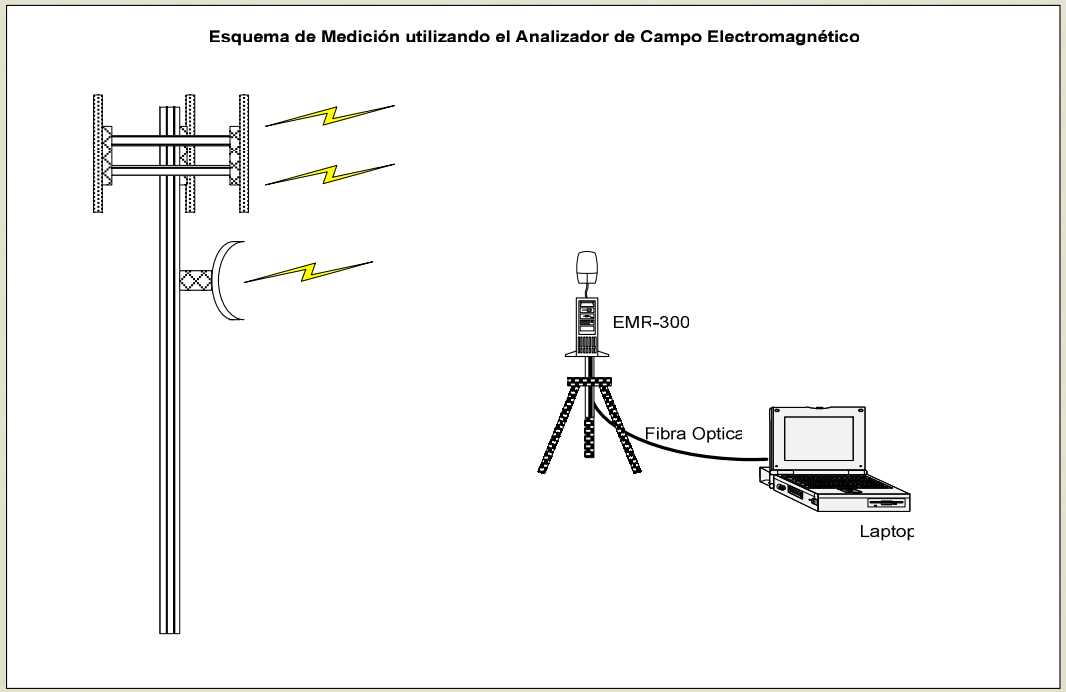


Fig. 1 System used for Broadband Measurement

# NARROW BAND MEASUREMENT

- **Equipo utilizado : Analizador de Espectros**
  - **Analizador de Espectros:  9 KHz- 3GHz**
  - **Antena Log- Periódica : 30 MHz- 1800 MHz**
  - **Computadora Portátil Pentium**

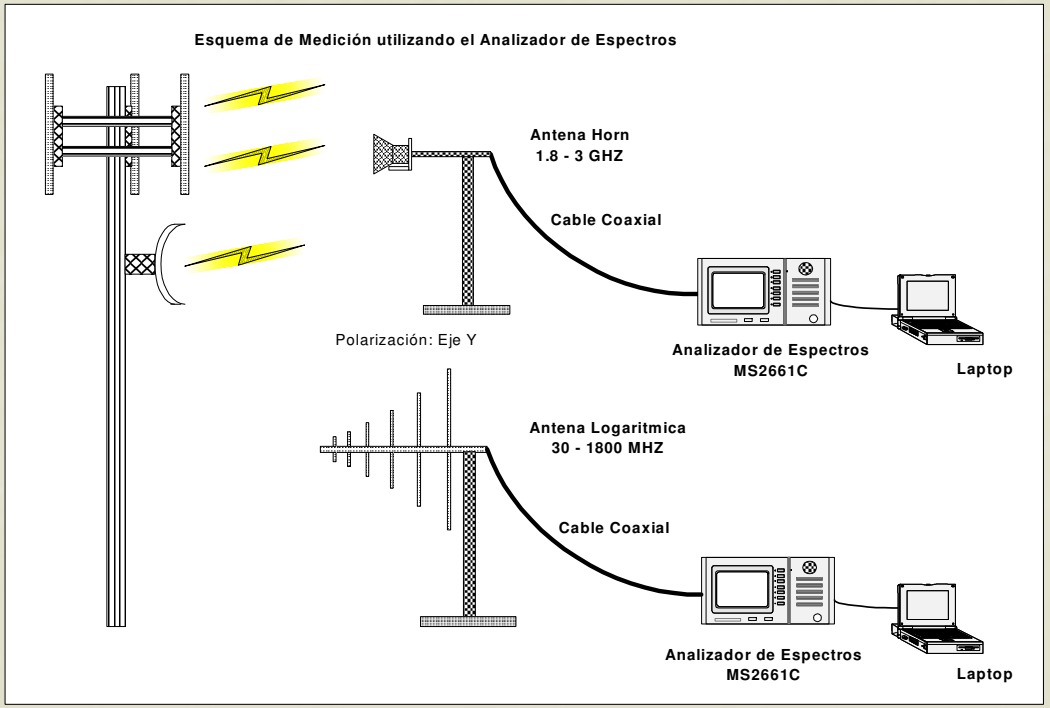


Fig. 2 System used for Narrow Band Measurement

# 4. Peruvian Regulation

The Environmental Quality Standards for Non Ionizing Radiation (ECAs- RNI) [0-300 GHz] D.S 010-2005-PCM, was set up by the Peruvian National Council for Environment (CONAM) and endorses ICNIRP guidelines for general public exposure.

The Maximum Permissible Limits for Telecommunication Activities (LMP-RNI for telecommunications) [9 kHz- 300 GHz] D.S. 038-2003-MTC was issued by the Ministry of Transports and Communications of Peru and endorses ICNIRP guidelines for general public and occupational exposure in the frequency range of telecommunication systems.

# 5. Results of measurements

*5.1. Broadband measurements*

For the general assessment they were evaluated the main telecommunication services in the following way: TV VHF (54-216 MHz); FM (88-108 MHz); TV UHF (470-805 MHz); Trunking (851-869 MHz); Mobile Telephony (869-891 MHz) and (880-890 MHz) and PCS (1930-1945 MHz) and from a total sample of 174 measurement locations only 9 locations in the Morro Solar hill had levels above general public ICNIRP limits (5.2 % of the total points).

From specific measurements of base stations it was shown that the highest exposure level was 1.5 % of ICNIRP general public limits.

In a survey for base stations in Lima city it was proven that many times its impossible to follow the protocol, according to measurement distance, i.e. to 2m, 10m, 20m, 50m and 100m; due to inaccessibility to some places such as inside houses, or difficulties to measure, such as in roads with heavy vehicular traffic. So, the measurements were carried out in accessible places without keeping in mind these distances, following the azimuth and having line of sight with the antennas. In Fig. 3 it can be seen the electromagnetic field levels for all base stations being the highest level 2.9 %, in Fig. 4 it can be observed a typical variation of electromagnetic field for relatively long distances and in Fig. 5 it can be shown a typical variation of electromagnetic field for distances shorter than 20 m.

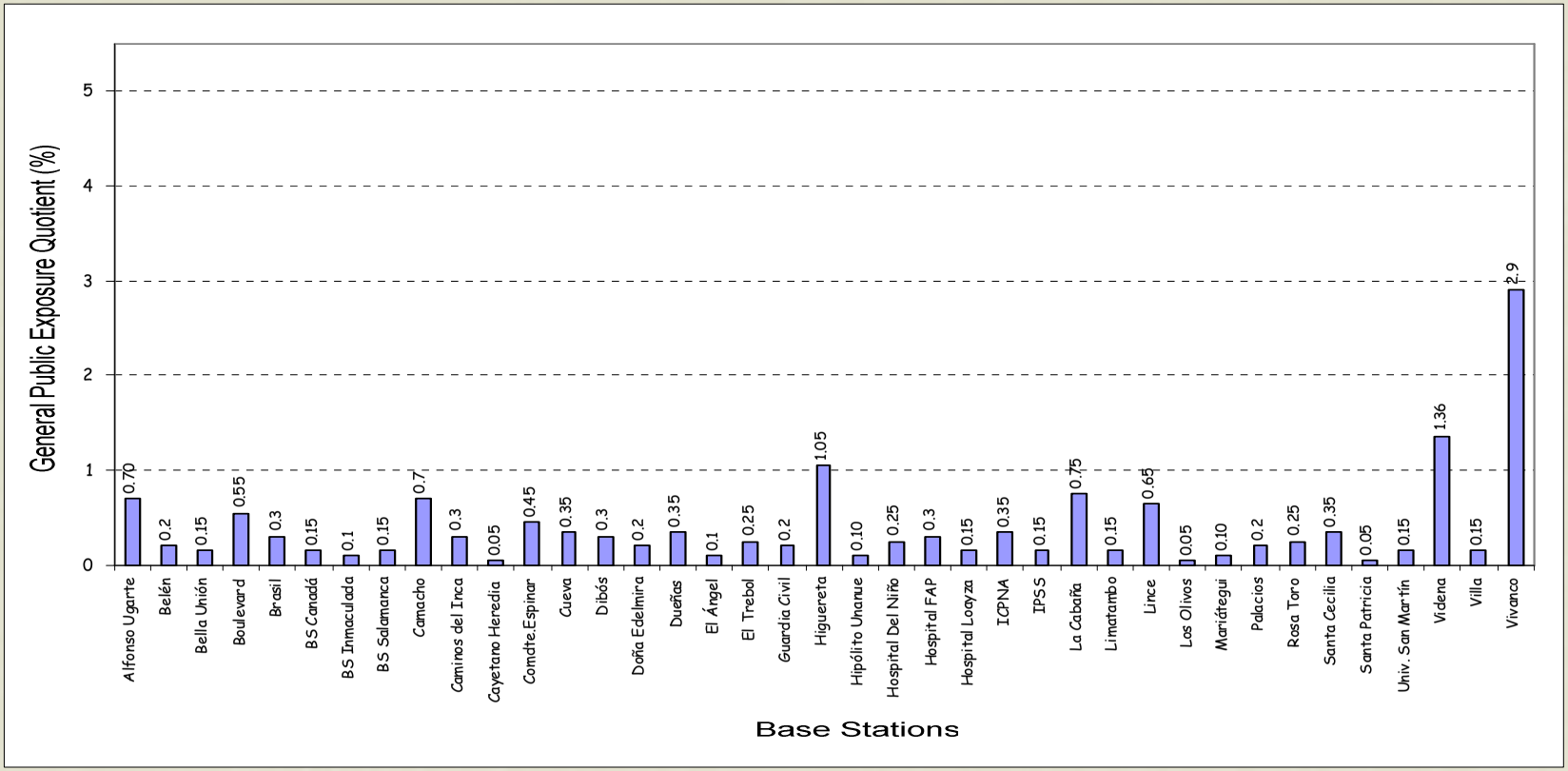


**Figure 3:** General Public Exposure Quotient for Base Station- broadband measurements


**Figure 4**: Variation of the General Public Exposure Quotient for distances longer than 20 m

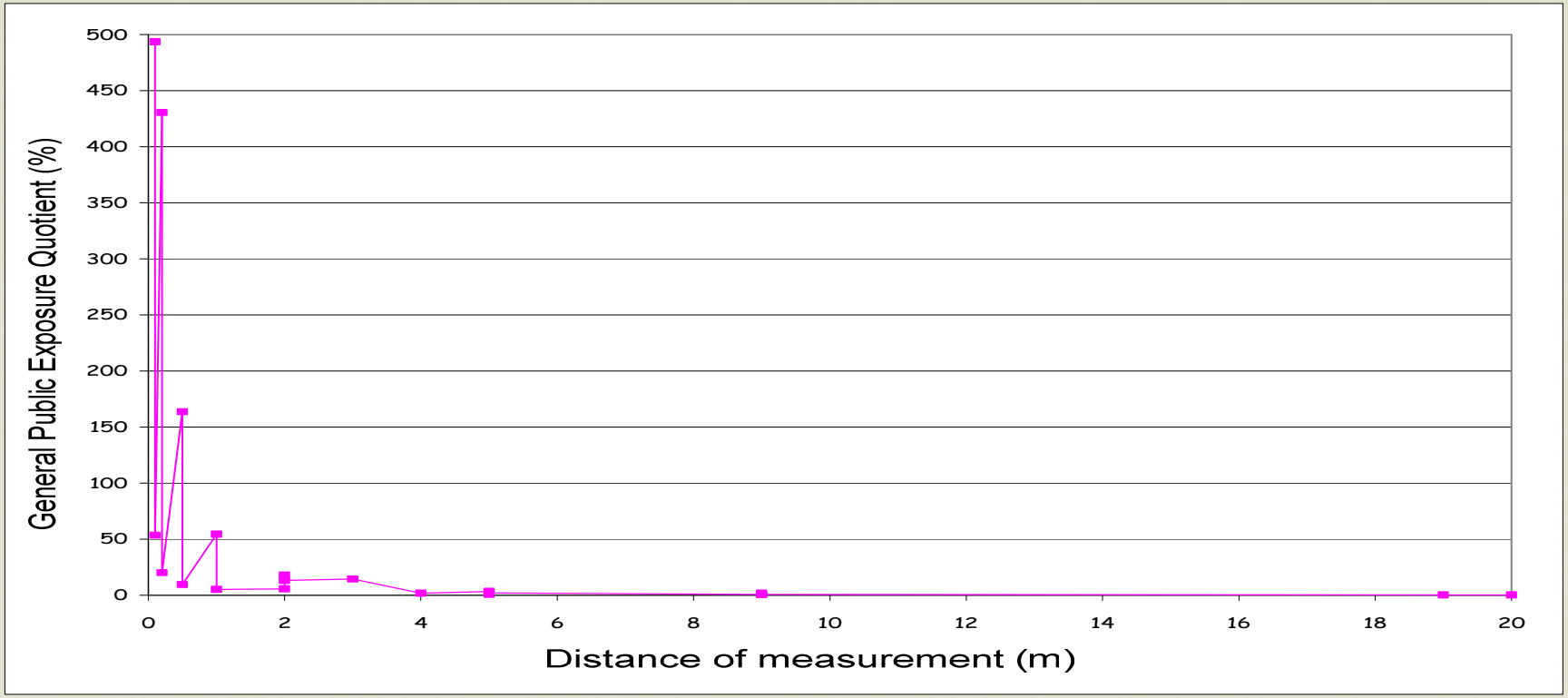


**Figure 5**: Variation of the General Public Exposure Quotient for distances shorter than 20 m

5.2 Narrow band measurements.

For the general assessment Fig.6 presents the exposure quotient for the different services in the following way: TV VHF (54-216 MHz); FM (88-108 MHz); TV UHF (470-805 MHz); Trunking (851-869 MHz); Mobile Telephony (869-891 MHz) and PCS (1930-1945 MHz).

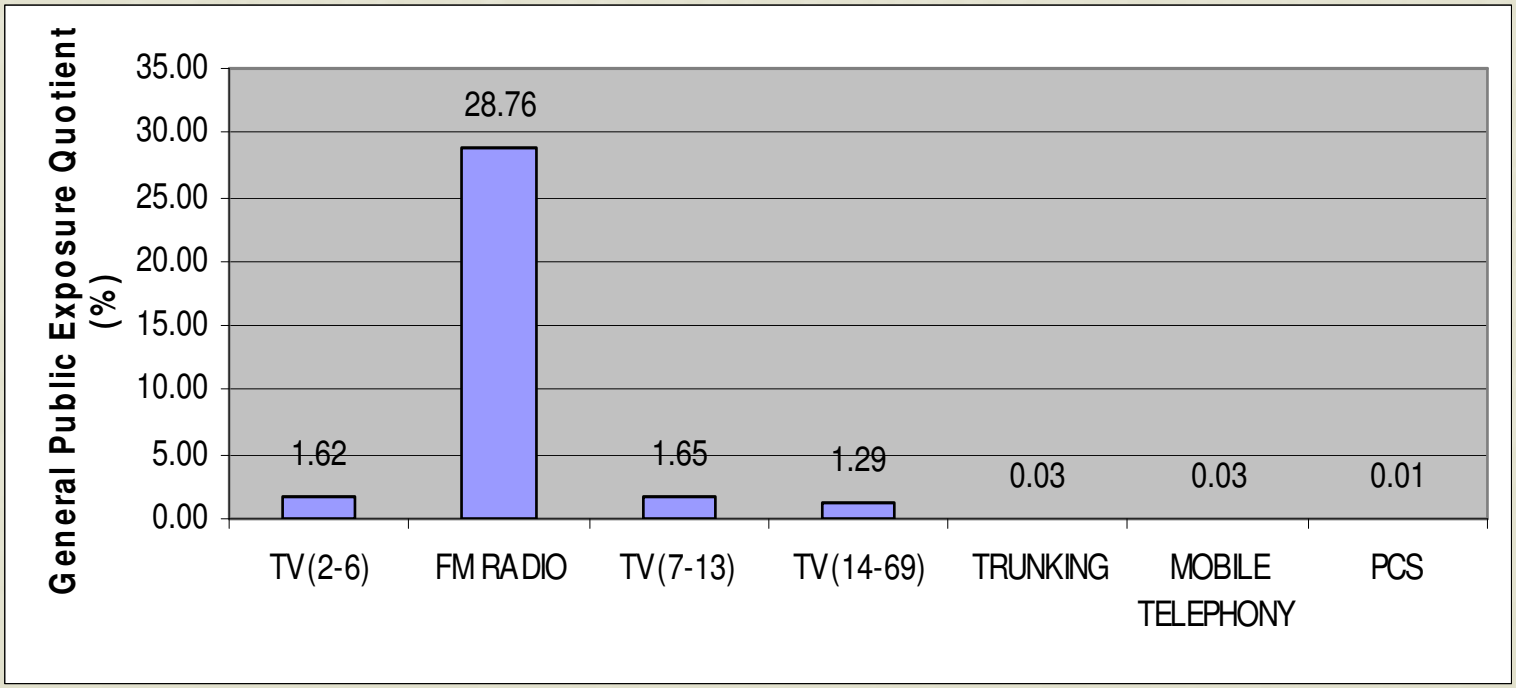


**Figure 6**: Average of General Public Exposure Quotient contribution for Telecommunication Services

For the base stations evaluation Fig. 7 shows the contribution of the different services in the vicinity.

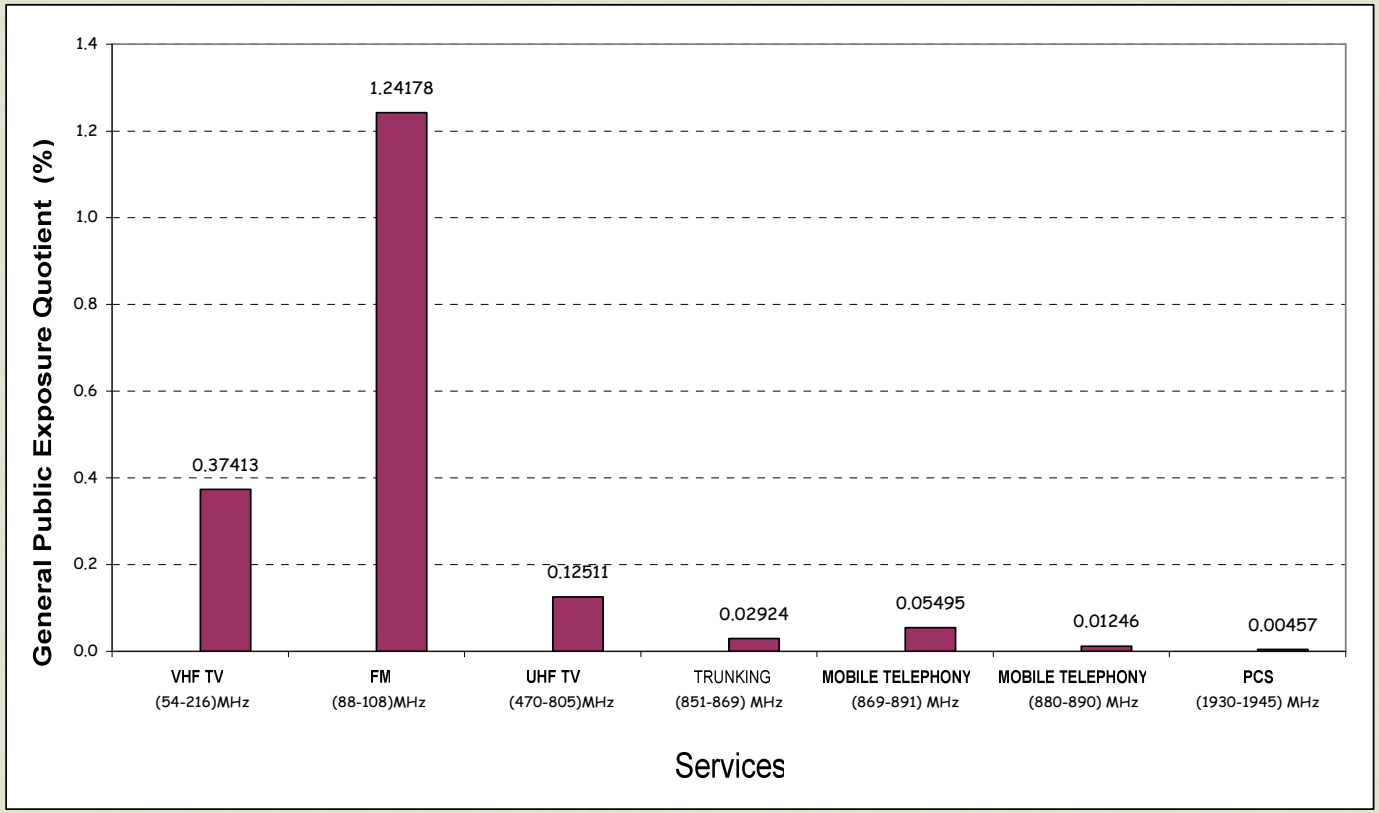


**Figure 7:** General Public Exposure Quotient for Telecommunication Services near base stations

**Fig. 8 View of the Morro Solar Hill in Chorrillos- Lima**

# 6. Conclusions and Recommendations

- ICNIRP limits are based on established health effects and are designed to protect people's health. ICNIRP guidelines are the most accepted guidelines for non-ionizing radiation and they are endorsed by the World Health Organization (WHO), the International Union for Telecommunications (ITU), the International Labor Office (ILO) and more than 30 countries all over the world including administrations of health, telecommunications and environment.

- In general, in Peru the concern on non-ionizing radiation from telecommunication networks specially from mobile communications networks it is a problem of risk perception. In order to manage the social alarm it is recommended the implementation of very good communication programs.

- It is necessary to establish a permanent coordination between the national authorities for telecommunications and local governments in order to prevent people from invading the zones near or below energy lines and the sites of radio stations for telecommunications.

- The general assessment on EMF from telecommunications demonstrated that most of the telecommunication stations comply with general public ICNIRP limits. From a sample of 174 measurement locations only 9 locations in the Morro Solar hill had levels above general public ICNIRP limits (5.2 % of the total points).

- The average level of electromagnetic fields from FM radio are the biggest one (nearly 29 % of general public ICNIRP limits, and the values from PCS are the lowest ones (approximately 0.01 %)

- No one of the measurements exceeded the maximum exposure limits, except EB – Cerro Camacho,where the measurements were carried out at very short distances.

- From the measurements performed it was possible to have a good picture of the electric field variation vs.distance. The level at some cm. of the antenna is the highest and could be several times above the general public limits and decay quickly in such a way that at 1m. of the antenna they are below 5 % and at 20 m. it can be below 1%, then it can raise a little until a maximum that can be below 1,5 % in the range between 50 to 150 m, finally, the level fall completely.

- The maximum value gotten was 2.90% of ICNIRP limits, but the contribution of the mobile base stations was only 0.0038 % and the minimum values are 0.05%.

- From the narrow band measurement, it was observed that the highest level of the maximum electric field corresponds to FM radio with 3.06 V/m (1.24 % of the public exposure limit), followed by TV VHF and UHF with 1.68 and 1.18 V/m (0.37 % and 0.13 % of the public exposure limit respectively); mobile telephony with 0.95 V/m (0.06 % of the public exposure limit); trunking with 0.69 V/m (0.03 % of the public exposure limit) and PCS with 0.41 V/m (0.005 % of the public exposure limit).

¡THANK YOU VERY MUCH!

¡O BRIGADO!