FINAL REPORT ITU-D STUDY GROUP 1

# QUESTION 23/1 STRATEGIES AND POLICIES CONCERNING HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

5 TH STUDY PERIOD 2010-2014 Telecommunication Development Sector



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# QUESTION 23/1:

Strategies and policies concerning human exposure to electromagnetic fields



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In support of the knowledge sharing and capacity building agenda of the Telecommunication Development Bureau, ITU-D Study Groups support countries in achieving their development goals. By acting as a catalyst by creating, sharing and applying knowledge in ICTs to poverty reduction and economic and social development, ITU-D Study Groups contribute to stimulating the conditions for Member States to utilize knowledge for better achieving their development goals.

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For the period 2010-2014, Study Group 1 was entrusted with the study of nine Questions in the areas of enabling environment, cybersecurity, ICT applications and Internet-related issues. The work focused on national telecommunication policies and strategies which best enable countries to benefit from the impetus of telecommunications/ICTs as an engine of sustainable growth, employment creation and economic, social and cultural development, taking into account matters of priority to developing countries. The work included access policies to telecommunications/ICTs, in particular access by persons with disabilities and with special needs, as well as telecommunication/ICT network security. It also focused on tariff policies and tariff models for next-generation networks, convergence issues, universal access to broadband fixed and mobile services, impact analysis and application of cost and accounting principles, taking into account the results of the studies carried out by ITU-T and ITU-R, and the priorities of developing countries.

This report has been prepared by many experts from different administrations and companies. The mention of specific companies or products does not imply any endorsement or recommendation by ITU.

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# QUESTION 23/1 Strategies and policies concerning human exposure to electromagnetic fields

# 1. Background

1.1 The deployment of different sources of radiofrequency (RF) Electro Magnetic Fields (EMF) to cater for the Telecommunication and Information Communications Technology (ICT) needs of urban and rural communities has developed rapidly in the past few years. Competition, traffic growth, quality of service demands, network coverage and the introduction of new technologies are the result of the increased communications deployment. This phenomenon has led to public concern about the possible human health hazards of prolonged exposures to radio signals from communications installations.

1.2 The International Telecommunication Union (ITU) statistics database of 2011 indicates that there were about 6 billion mobile cellular subscriptions in 2011. With 5.9 billion mobile-cellular subscription, global penetration reaches 87% and 79% in the developing world<sup>1</sup>. As mobile growth continues, it is anticipated that globally mobile phone users will increase and this means that base stations would increase.

1.3 Societal concerns about the possible harmful effects of exposure to the radio signals from telecommunications installations are exacerbated by the fact that whenever erection of this equipment is done, they are not always consulted. The fact that the evidence of possible harmful effects from RF exposure is inclusive, leads to many conclusions such as there could be a possibility of a health hazard and this perception has been described as serious in some countries in the world. This report is enhanced by looking at what some countries have done to curb such negative perception on RF exposure.

1.4 There is an influx of cell phones from some countries into others and control and monitoring of such devices is difficult. There is also some concern that the SAR of cell phones is difficult to check for compliance or conformity as the devices designed for that purpose may be difficult to acquire. Emissions from base stations need to be monitored which also requires monitoring tools and experts to use such devices.

1.5 In order to build people's (consumers') trust, which is very essential due to the requirement of continued development of radio-communications, ITU Telecommunication Standardisation Sector (ITU-T) Study Group 5 (SG5) and ITU Radiocommunication Sector (ITU-R) Study Group 1 (SG 1) / Work Party 1C (WP 1C) has carried out studies on non-ionizing radiation measurements to provide in particular information on the equipment/instruments and procedures to be used in the measurements.

1.6 ITU Development Sector (ITU-D) Study Group 1 (SG1) Question 23/1 (Q23/1) undertakes studies on the different regulatory and communication mechanisms developed by countries in order to increase awareness and information to populations as well as to facilitate the deployment and operation of radio-communication systems.

1.7 Q23/1 on "strategies and policies concerning human exposure to electromagnetic fields" compiles and analyses the regulatory policies, from different countries, that are being undertaken or considered for authorising installation of radio communication equipment. This has come about because there are perceptions that there is a hazard from prolonged exposure to emissions from radio communication equipment.

<sup>&</sup>lt;sup>1</sup> The World in 2011: ICT Facts and Figures, October 2011

1.8 Since the current studies do not conclusively show any harm to humans, it is important to convey the message to the consumers to curb fear and allow smooth deployment of communication equipment. It has been established that some countries experience rejection of land application (for the purposes on network deployment) by the public telecommunication operators. In some instances individuals who got sick, blame communication service providers claiming that the radio frequency exposures from their equipment is the cause of their sicknesses.

1.9 It was therefore imperative that the ITU take a stand to come up with guidelines for the member countries to avoid rejection of deployment of communication networks at the same time taking precautionary measures not to pose any possible harm due to prolonged RF exposures.

1.10 The World Telecommunications Standardisation Assembly 2012 (WTSA-12) held in Dubai, made the following Resolution:

Resolution 72 on "Measurement concerns related to human exposure to electromagnetic fields"

1.11 Further, the fifth World Telecommunications Development Conference 2010 (WTDC-10) held in Hyderabad India, approved the following:

- Resolution 62 on "Measurement concerns related to human exposure to EMF".
- ITU-D Study Group Question 23/1 on "Strategies and policies concerning human exposure to electromagnetic fields" was approved.

1.12 The Plenipotentiary Conference (PP-10) held in Guadalajara, Mexico, approved the new Resolution 176 on "Human exposure to and measurement of electromagnetic fields" and encouraged Member States in different regions of the world to cooperate in sharing expertise and assist in measurement and training aspects.

1.13 PP-10 Resolution 176 instructs the Director of the Telecommunication Development Bureau (BDT) in collaboration with Directors of the Radiocommunication Bureau (BR) and Telecommunication Standardization Bureau (TSB):

- To encourage Member States to cooperate in sharing expertise and resources.
- To organize regional seminars and workshops.

### 2. Scope and Objectives of this Report

This report is expected to cover the following:

2.1 Compilation and analysis of the regulatory policies concerning human exposure to RF electromagnetic fields that should be considered or being undertaken for authorising the installation of radio communication sites.

2.2 Description of the strategies and methods used for raising the awareness of populations and information to populations regarding the established effects of RF electromagnetic fields due to radio communication systems.

2.3 To propose guidelines on methods for raising awareness of populations along with best practices based on countries' experience in the matter.

2.4 The report is meant to guide Member States in dealing with ensuring compliance with human RF exposure standards and responding to perceptions regarding human exposure to RF.

- 2.5 The report provides the following:
- Information on technical parameters (e.g. RF exposure value limit, minimal distance, antenna height above roof top);
- Technical assessments to establish compliance of the transmitting antennas with relevant RF exposure limits;

- Details on how to deal with siting near community facilities;
- Monitoring of the compliance of installations to RF exposure limits; and
- Guidance on how to measure RF exposure levels.

## 3. Collaboration with other Sectors and Organisations

3.1 Throughout the study period, this question has been coordinating with other sectors and organisations like; ITU-T SG5, ITU-R SG1 WP1C and WHO.

3.2 Liaison statements have been forwarded to ITU-T SG5 and ITU-R SG1 WP1C requesting for information on a summary of technical findings and periodic updates on their work progress related to EMF. The SGs provided detailed information about the relevant activities and expressed that the good collaboration on EMF issues more so that the experts participated in all the Groups, ensured that there was no duplication of efforts. This was beneficial to all the groups.

3.3 As part of its bridging the standarsation gap initiative, ITU-T hosted capacity building events around the globe assisting countries to implement the ITU-T standards. For raising awareness on EMF issues workshops had been held too with the latest one having taken place in Turing, Italy on 9 May 2013 with call of action <sup>2</sup>.

3.4 ITU-R SG1 WP 1C working on "Spectrum monitoring" has approved the 2011 edition of the ITU spectrum monitoring Handbook which contains information on non-ionizing radiation measurements.

3.5 The ITU-R SG6 has also published Recommendation BS.1698 (2005) on "Field evaluation of terrestrial broadcasting systems operating in any transmission frequency band for assessing exposure to non-ionizing radiation". This Recommendation estimates values of RF exposure of broadcasting stations to help develop standards to protect humans from exposure to potentially harmful effects.

- 3.6 ITU-T SG5 has informed the ITU-D of the availability of the new Recommendations:
- K.91 on "guidance for assessment, evaluation and monitoring of human exposure to radio frequency electromagnetic fields",
- K.83 on "monitoring of electromagnetic field levels",
- Recommendation K.70 (06/2007) on "mitigation techniques to limit human exposure to RF signals in the vicinity of radio-communication stations".
- The new ITU-T Question 7/5 on human exposure.
- 3.7 World Health Organisation (WHO) Perspectives

3.7.1 The WHO international EMF Project was established in 1996. Its objectives among others are; to review literature on health effects of EMF exposure, and encourage internationally acceptable harmonized standards. WHO's partners on the subject include, ITU, International Labour Organisation (ILO), International Commission on Non Ionizing Radiation Protection (ICNIRP), United Nation Environment Programme (UNEP) and others. WHO does not perform nor fund research, instead they assess research through scientific workshops and health risk assessments.

<sup>&</sup>lt;sup>2</sup> EMF issues workshop, Turin, Italy, 9 May 2013, details available at <u>www.itu.int/en/ITU-T/climatechange/emf-</u> <u>1305/Documents/Turin-Call-to-Action.pdf</u>.

3.7.2 According to the WHO fact sheet of 193 of 2011<sup>3</sup>, there has not been any adverse health effects established for mobile phone use and studies are ongoing to assess potential long-term effects of mobile phone use. The conclusion in WHO fact sheet 304 is that so far there is no convincing scientific evidence that the RF signals from base stations and wireless networks cause adverse health effects.<sup>4</sup>

# 4. Precautionary Principle Applied to Human Exposure to EMF

4.1 Current public concern focuses on possible long-term health effects caused by exposure to electromagnetic fields at levels below those required to trigger acute biological responses. A draft background report <sup>5</sup> produced for the WHO the International Stakeholder Seminar on Radiofrequency Policies (Paris, France, 5 June 2013) identifies five possibly overlapping categories of policy profiles around the world for risk management of RF exposures. The identified policy categories are:

- Evidence based
- Precautionary approach
- ALARA <sup>6</sup> principle
- Voluntary
- Information and consultation

In the analysis of the responses <sup>7</sup> to the WHO survey the draft report states that out of 85 respondent countries 77 have exposure limits for fixed installations. Among those countries where exposure limits are specified (N=77), the majority follow the ICNIRP limits (N=55); four countries declare they have set their own scientific evidence based limits; two Countries follow the FCC <sup>8</sup> limits and 16 countries have exposure limits that are lower than the international guidelines, under an ALARA (N=3) or a precautionary approach (N=13).

The study of EMF was launched by WHO and numerous other entities in order to provide scientifically sound and objective answers to public concerns about possible hazards of electromagnetic fields. The WHO<sup>9</sup> explains that: 'The Precautionary Principle is a risk management policy applied in circumstances with a high degree of scientific uncertainty, reflecting the need to take action for a potentially serious risk without awaiting the results of scientific research'.

4.2 There are some situations where early warnings of health or environmental hazards have been ignored solely because the proof or high probability of risk has not been scientifically established. Such an attitude leads one to wait until the health or environmental damage occurs, or at least until the reality of the risk is proved, before reacting and taking protective measures. The consequences for human health

<sup>&</sup>lt;sup>3</sup> WHO Fact sheet No 193, Electromagnetic fields and public health: mobile phones, June 2011

<sup>&</sup>lt;sup>4</sup> WHO Fact sheet No 304, Base stations and wireless technologies, May2006

<sup>&</sup>lt;sup>5</sup> Summary Analysis of the 2012 WHO Survey on Risk Management Policies regarding Radiofrequency Electromagnetic Fields. Background Paper Submitted for discussion at the WHO International Stakeholder Seminar on Radiofrequency Policies5 June 2013, Paris, France, May 2013. Authors: Denis Zmirou-Navier, Amit Dhungel and Clémence Varret, Department of Environmental and Occupational HealthEHESP School of Public HealthRennes, France and Lorraine University Medical School, Nancy, France.

<sup>&</sup>lt;sup>6</sup> ALARA = As Low As Reasonably Achieveable

<sup>&</sup>lt;sup>7</sup> The draft report disclaimer states: 'The information contained in this draft report is based on the responses given to the International survey conducted in 2012; it still needs to be validated. The material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader.'

<sup>&</sup>lt;sup>8</sup> FCC = Federal Communication Commission

<sup>&</sup>lt;sup>9</sup> Electromagnetic Fields and Public Health: Cautionary Policies (WHO Backgrounder, March 2000) available at: <a href="http://www.who.int/docstore/peh-emf/publications/facts">www.who.int/docstore/peh-emf/publications/facts</a> press/EMF-Precaution.htm

and the environment are all too well known. The precautionary principle comes into play, disallowing denial of the risk on the grounds that it hasn't been proved, and obliging us, on the contrary, to acquire the means for determining, upstream, the possible environmental and health impacts in the interests of preventing them more effectively.

4.3 The precautionary principle is not a solution to scientific uncertainty but a regular interactive process between action and knowledge. Unlike a fixed rule, it provides points of reference (abstract or specific) that are periodically reviewed, requiring the exercise of judgment in each individual case. It is good to be concerned in advance about hypothetical risks of serious harm in the interests of forestalling them and setting out courses of preventive action entailing effective and appropriate measures. The aim is not to become excessively cautious with respect to prevention, but to take stock of the risk at an early stage.

4.4 In all of this there are two opposing attitudes: the proactive striving for certainty as to the existence and magnitude of the risk on the one hand, and ignorance on the other. A state of ignorance is clearly not conducive to risk management, whereas there are rules that are common to the principles of precaution and prevention: identify, evaluate and grade the risk. In the absence of certainty as to the basic phenomena and existence of the danger, the risk is hypothetical. However, while it may not have been confirmed, this does not mean that it may be viewed as highly improbable or indeed negligible. It is the identified possibility of risk whose precise probability is not yet known. Consequently, the scope of the precautionary principle is, in theory, potentially unlimited.

4.5 The precautionary principle has been put in place to justify action by the authorities in regard to health protection in the face of plausible, serious and irreversible dangers associated with current and future exposure and, where uncertainty prevails, a lack of scientific knowledge. History shows us that the application of appropriate precautionary measures taken as soon as the first warning signs are spotted enable us to avoid the costs associated with asbestos, tobacco, PCBs, x-rays, and so on. In order not to compromise scientific integrity, decision-makers must take into consideration the bias that environmental medicine may encounter as it looks for genuine danger, any such bias being capable of jeopardizing both health and the environment.

4.6 The precautionary principle is based on different levels of proof (or forces of evidence) to justify possible reductions in exposure levels. The level of proof selected depends on factors such as: the nature and balance of the costs incurred by taking action, or by not doing so; the benefit derived from the product or substance in question; availability of alternatives; and so on. Waiting for high levels of scientific proof of causality, or knowledge of the mechanisms involved, can prove highly costly in terms of compensatory damages, healthcare, loss of employment and impaired credibility vis-à-vis the scientific community. The level of proof selected to justify action does not determine any particular measure or type of action. It depends on factors such as the cost of different measures, capital, sources of the risk (i.e. voluntary or imposed). The various stakeholders have to be involved in order to contribute to assessment of the risk management problems and selection of the appropriate levels and types of action to be pursued in order to reduce the exposure.

4.7 Held in Stockholm in 1972, the United Nations Conference on the Human Environment established the first rights and obligations in the sphere of environmental protection. Its Principle 1 states that:

- "Man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being, and he bears a solemn responsibility to protect and improve the environment for present and future generations".
- Within the United Nations system, the precautionary principle was formulated for the first time in 1992, in Principle 15 of the Rio Declaration on Environment and Development: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation", as well as in the United Nations Framework Convention on Climate Change (UNFCCC, 1994) and its Kyoto Protocol (1997).

4.8 The precautionary principle is enshrined in:

a) Article 5.7, concerning precaution, of the WTO Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) (1994), which clearly permits the precautionary taking of measures when a government considers that sufficient scientific evidence does not exist to permit a final decision on the safety of a product or process;

b) The Biosafety Protocol approved in Montreal in January 2000. In fact, the explicit introduction of this principle today in operational articles of the Biosafety Protocol is part of a wider-reaching movement towards giving this principle shape in the legal framework.

Note: The precautionary principle has never been clearly defined in the WTO agreements. The Dispute Settlement Body (DSB), responsible for arbitrating in disputes between members of the organization, has always refused to take any decision as to the actual scope of the precautionary principle, which it does not consider to be a general principle of law. Where there is doubt as to a potential risk, the DSB authorizes trade restrictions on the grounds of application of the principle solely where there is tangible evidence of a hazardous situation.

# 5. Analysis of Regulatory Policies in Some Countries

When coming up with this report, analyses and compilation of the regulatory policies concerning human exposure to electromagnetic fields that are being undertaken for authorizing the installation of radio communication sites by Member States was made. The strategies or methods for providing information to the people regarding the effects of electromagnetic fields due to radio communication systems are also discussed.

#### 5.1 Côte d'Ivoire

Policy: The regulator and other local authorities approve any implementation or modification of radio installation in the Côte d'Ivoire. The precautionary measures to protect the population from RF exposure, particularly in community sensitive areas such as hospitals, schools, crèches, campaign areas and vulnerable people has been exercised. The intent of these precautionary measures was not to avoid communication antennas, but to pay attention to the radiation pattern and to avoid unnecessary exposure. Prior to the deployment of communication antennas, the following are done:

- Technical features assessment to check compliance with the regulatory requirement based on ITU-T Recommendations.
- Validation of the site making sure that the work is according to the building permit.
- Technical analysis for final authorization to the operation of the site.
- In situ measurements are done each year on a national basis according to relevant standards.
- Also underway is a policy project to regulate RF exposure which will:
- Set the minimum values to limit the exposures from RF transmitting facilities in Côte d'Ivoire according to ICNIRP guidelines.
- Determine the obligations for owners of such facilities.

**Provision of information and public involvement**: Public consultation prior to antenna erection is exercised. Broadcasting services are used to relay information about RF signals to the public. There is a FAQ section on the regulator website about non-ionising radiation and SAR. The measurement results to be published.

#### Analysis

The policy may be tried by other member states. It is recommended that the project on setting up minimum values follow the ICNIRP guidelines for limiting exposure to RF sources.

#### 5.2 Brazil

Policy: The exposure limits in Brazil follows the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines. Brazilian Federal Law monitors and ensures that radio communication systems comply with electromagnetic levels recommended by the WHO.

Brazilian radiation levels measurement: Anatel assesses compliance with EMF exposure of radio communication stations installed within 50-meters-radius surrounding hospitals, clinics, schools, day care centers and homes for old people no later than 60 days after the issue of the station's license.

EMF exposure evaluation is within a maximum of 5 years intervals. Anatel performs measurements on planned sites within the annual enforcement plan, according to the law and in response to specific demands from the society and collected from different sources, such as call centers, web services and other public relations channels. Most of these compliance assessments are associated with cellular Base Transmission Stations (BTS) and some of these assessments are due to neighbourhood complaints and concerns regarding EMF exposure.

Provision of information: Anatel released a software that presents the results of the theoretical calculations of the total exposure ratio, estimated using a free space propagation model and the national radio communication station database. Anatel's Enforcement Division measurements are integrated in this software, so that in places where there are no measured values, the calculated values are presented.

The Anatel webpage also has the Specific Absorption Ratio (SAR) of all mobile phones certificated in Brazil. Brazil proposes that the availability of an interactive map with measurements results and theoretical calculations is a good option for ensuring the provision of relevant and accurate information to the public.

#### Analysis

The policy follows WHO and ICNIRP guidelines. The critical areas such as hospitals are being addressed. The fact that complaints are received may imply that people have knowledge on EMF and hence the software based data released was a good way of providing information to the public.

#### 5.3 Republic of Korea

Policy: ICNIRP and IEEE EMF exposure limits are used. EMF environmental assessment on base stations and broadcasting transmitters are reported. All the equipment radiating RF energy are subject to the measurement of EMF levels, except radio equipment of: mobile stations, emergency stations, station located within an area where the general public rarely accesses, e.g. mountains, islands and etc., low power stations such as those that are license exempted wireless microphones, radio controllers, and radio pagers.

Radio stations installed near the public areas are required to report the evaluation result of EMF levels, showing conformity with the limits, before starting the normal operation.

Provision of information: From 2004, two kinds of Newsletters, one for EMF measurement standards (from RRA) and the other one for biological effects (from KIEES), exposure limits and policies, have been published biannually. Guidebooks and CDs which include the information relating to EMF exposure have been published once every two years. A specialized journal has been published once a year for professionals. Workshops on the relationship between EMF and biology have been held once or twice a year since 1999.

#### Analysis

The Republic of Korea is very active on research projects surrounding EMF. The public is also involved through newspapers, CD's, workshops and books. They also use ICNIRP and IEEE standards.

#### 5.4 Israël

Policy: ICNIRP exposure limits are used. The Ministry of Environmental Protection controls the human exposure to electromagnetic fields from base stations. The ISR regulatory framework is based on the: Non-Ionizing Radiation Law, 2006; and Non-Ionizing Radiation Regulations, 2009. The Precautionary Principle is mandatory by the Non-Ionizing Radiation Law. Israel was the first to enforce annual measurements around transmitting base stations. Every citizen can see o line all cellular sites: 8591 station on 10 July 2013 (see xls file <sup>10</sup>). The information includes the name of operator, exact address, coordinates, dates of approval and deployment.

The Noise and Radiation Abatement Department at the Ministry of Environmental Protection implemented an innovative program in 2010 that permits the Commissioner of radiation to monitor all areas involving more than 30, 000 UMTS sectors across the country from his office and receive all data related to radiation of each antenna in the country, 24 hours a day, 365 days a year. The program works by extracting raw data files directly from the cellular operator's radio switch controller. Data is verified for authenticity, analysed, and compared with the limit. Violations are flagged.

In addition, this system may also be used to continuously monitor parameters such as: radio frequency usage versus assigned spectrum; Quality of Service (QoS) parameters such as drop call rates, block calls, return to service time, coverage by area type.

Provision of information: The Israel Monitoring Technology provides highly available data since it is all electronic and may be accessed, analysed and published on the ministry's website, enabling full transparency to the general public. Whenever the system identifies a violation, it enables automation of alerts, both internally to the Ministry and to the operators; a clear log of activities from inception to end. The list of violations is displayed in the web.

#### Analysis

Israel has implemented a user friendly monitoring system which is more efficient and reliable.

Due to the extensive RF exposure to people from broadcasting emitters and cellular base stations and as there is still scientific uncertainty on harmful effects, Israel proposes that alternative cable, fiber optics and satellite telecommunications be prioritised over fixed wireless, off-air TV and wireless internet router. Also cellular sites' collocation among operators should be promoted in order to reduce the number of base stations and human exposure to EMF fields.

#### 5.5 Venezuela

Policy: Administrative Decision No. 581 of CONATEL was published on 3 June 2005. The aim of the Administrative Decision is to establish security conditions for radio exposures produced by fixed radio stations operating in the 3 kHz to 300 GHz range, namely the technical requirements for installation of transmitting antennas and the method for determining whether the exposure limits for such emissions are in line with existing legislation.

The Administrative Decision contains a series of articles on security conditions for radio emissions produced by fixed radio stations operating in the 3 kHz to 300 GHz range, and three (3) supplementary annexes. It applies to all operators of fixed transmitting radio stations operating in the range of frequencies between 3 kHz and 300 GHz.

<sup>&</sup>lt;sup>10</sup> www.sviva.gov.il/subjectsEnv/Radiation/Communication Facilities/cellular/Documents/shidur selulariim peilim 1.xls.

With regard to exposure limits, the Administrative Decision stipulates that the operators of fixed radio stations must ensure that the level of energy received generated by their stations in the various accessible areas does not exceed the exposure limit for the station's operating frequency indicated in the relevant tables, in accordance with the values set out in Venezuelan Standard COVENIN 2238, for the range of frequencies covered by the Administrative Decision.

According to the provisions of Resolution N° 508 of the Ministry of Health, any radio station located in buildings for schools, health centers, nursing homes, orphanages and playgrounds, shall make the necessary adjustments for the purpose of the magnitude of exposure to electromagnetic fields for people in these areas, is ten times less than the value set in Venezuelan Standard COVENIN 2238.

Provision of information: In order to ensure compliance with national legislation, CONATEL measures nonionizing radiation at radio stations nationwide so as to verify the reports of telecommunication operators. It subsequently submits those reports to the Ministry of Health, so that the latter can rule on the incidence of the radio exposures produced by the stations on people's health and thus provide an appropriate, full and timely response to those who feel affected by the deployment and operation of such stations.

In addition, information talks are given to organized communities on the radiation produced by radio stations and its potential impact on people's health. The talks include discussion of national advances in telecommunication services and the basic regulatory, legal and practical rules pertaining to electromagnetic fields in residential areas, for the sole purpose of fostering citizen integration in the development and evolution of the country's telecommunications.

#### Analysis

This is a policy in which, WHO and ICNIRP guidelines are followed. In addition, the Standard COVENIN 2238 is also based on the ICNIRP Recommendations.

The regulator, the mobile operators and competent entities disseminate valuable information to the citizens.

#### 5.6 Hungary

Policy: The health aspects of electromagnetic radiations in Hungary were within a specialised institution -National Research Institute for Radiobiology and Radiohygiene (NRIRR) of the National Public Health Service. Among their duties they take part in the licensing of the construction of radio facilities and carry out individual measurements. However, because of capacity and expertise, the National Media and Infocommunications Authority of Hungary (NMIAH) installed a national EMF monitoring and information network in agreement with the NRIRR.

The measurement programme involves collecting data using twenty five (25) area monitoring instruments by moving them to new locations every two weeks. Measurements spots were selected educational institutions, nurseries and schools situated close to radio facilities. Tests are also carried out occasionally on requests by private individuals.

Provision of information: The measurements results are published on the web.

#### Analysis

The nationwide monitoring system in Hungary and publication of the results in the web are a tool to address the concerns related to the health hazards of the electromagnetic fields and increase awareness of the general public.

#### 5.7 Uzbekistan

Policy: Uzbekistan state policy of issues concerning human exposure to electromagnetic fields is defined in the two laws namely: radiofrequency spectrum and the state sanitary inspection. Radiofrequency spectrum law establishes the ultimate priority of human health and favourable environmental conditions over the utilisation of radio and high frequency equipment. The state sanitary inspection law regulates social relationships serving to ensure sanitary and epidemiological welfare and radiation safety of people, establishes human rights for favorouble environmental conditions and other related rights and guarantees for their realisation.

Organisations which exploit reconstruct or design the radio facilities are obliged to provide the compliance with sanitary norms and rules. Control over compliance with requirements and limits is carried out by the state sanitary and epidemiological agency under the ministry of Health. EMF levels from radio facilities are defined by using both the calculations and the actual measurements.

Provision of Information: Every radio facility transmitting electromagnetic energy to the environment must have a sanitary passport signed by the director and state sanitary inspector and kept at the radio facility.

#### 5.8 Benin

Policy: Benin national regulatory Authority (ATRPT) acquired fixed and mobile monitoring stations including equipment to assess the radiation exposure of population to NIR in early 2012. The equipment carries out measurements of electric field strength at a given point. ATRPT also held in April 2012, a national seminar on the effects of non-ionizing radiation on the health of populations.

During the seminar, three draft regulatory texts were proposed:

- Draft decree on the protection of individuals against the effects of electric, magnetic and electromagnetic fields from 0 to 300 GHz;
- Draft decree on conditions of installation of radio stations;
- Draft decree establishing the technical specifications applicable to telecommunications terminal equipment and radio terminal equipment.

The regulatory framework developed addressed the following:

- The exposure levels used are those set by the INCIRP to the general public. No distinction was made for workers or the general public.
- Emphasis was placed on the precautionary principle. Thus, in schools and similar establishments, nurseries, kindergartens, hospitals, public gardens, the levels of electric, magnetic and electromagnetic fields must not exceed 25% of baseline set for the general public.
- In addition, in order to prevent power fluctuations by operators on the base stations, it is forbidden to operators to direct the main lobes of the antenna to schools, hospitals and other sensitive establishments where the antennas are located less than 100 m of distance from those centers.
- There is an obligation on operators to self-monitor the exposure levels during the deployment of new base stations.
- Operators must build a security fence around their facilities
- With regard to the terminals, the maximum specific absorption rate (SAR) is set to 2W/kg.
- The ATRPT is responsible for monitoring compliance with the exposure levels set by the regulations.

Provision of information: Campaigns to raise public awareness on the effects of non-ionizing radiation on health are carried out.

#### 5.9 India

Policy: The Indian EMF Case Study (available in Document 1/278) and included in Annex 10 to this Report captures some interesting mobile handset usages inputs suggesting very high level of mobile hand set usage in the developing countries. This possibly could be as a result of many call centre activities being handled from mobile phones as compared to fixed phones earlier.

A number of parameters in India and other developing countries that are likely to be different when compared with those from Europe in terms of:

- mobile phone usages,
- number of operators,
- higher levels of population density,
- in-organic growth in urban areas,
- narrow lanes separating buildings,
- lesser spectrum per operator,
- radiated power being 20 Watt per sector, and
- Antennas mounted at lower heights etc.
- Poor coverage conditions also lead handsets to operate at higher levels of power
- Outsourcing of infrastructure installation & maintenance to third parties by operators
- Inadequate technical expertise at field level and local authorities to understand exclusion zone calculations based on ITU K-series Recommendations. This also needs to be seen in the background of monitoring requirements extending to 0.747 million BTSs.

The case study also refers to many other inputs on indian policy initiatives including web reference links for details.  $^{\rm 11}$ 

f) Handbook on Mobile Communication – Radio Waves and Safety

www.dot.gov.in/sites/default/files/Mobile%20Communication-Radio%20Waves%20and%20Safety%2010th%20sept%2012%20final.pdf

h) Measurement of EMF Exposure for BTS Antennas,

<sup>&</sup>lt;sup>11</sup> a) Journey to EMF, available at <u>www.dot.gov.in/access-services/journey-emf</u>,

b) New SAR Values effective from 1.9.2012, available at:

 $<sup>\</sup>underline{www.dot.gov.in/sites/default/files/Revision\%20 of\%20 SAR\%20 Limit\%20 mobile\%20 handsets.pdf$ 

c) Revision of exposure limits effective from 1.9.2012

d) Revised advisory guidelines on installation of mobile towers effective from 1.8.2013

www.dot.gov.in/sites/default/files/Advisory%20Guidelines%20For%20State%20Govts%20effective%20from%2001-08-13.pdf

e) Precautionary Guidelines on Mobile Handset usage

www.dot.gov.in/sites/default/files/Precautionary%20Guidelines%20for%20mobile%20Users.pdf

g) TEC Test Procedures for Mobile Handsets, <u>www.dot.gov.in/sites/default/files/SAR%20Testing.pdf</u>

www.dot.gov.in/sites/default/files/TEC%20Test%20Procedure%20EMFields%20From%20BTS%20Antennae.pdf

i) EMF Complaint Handling System

j) Notice inviting R&D proposals on EMF

www.dot.gov.in/sites/default/files/748%20circular.pdf

k) Indian Presentations at Turin Italy in ITU EMF Workshop on May9, 2013 as referred below also provide a new set of inputs on EMF Policy Overview and Compliance – Overview of Indian Policy - "Electro Magnetic Field(EMF) Radiation from Mobile Towers & Handsets", <u>www.itu.int/en/ITU-T/climatechange/emf-1305/Documents/Presentations/s2part2p3-</u> <u>RKBhatnagar.pdf</u> and - Indian study results on EMF compliance Networks and Devices, <u>www.itu.int/en/ITU-</u> <u>T/climatechange/emf-1305/Documents/Presentations/s3p5-RKBhatnagar.pdf</u>

# 6. ITU Project in Central America on Non-Ionising Electromagnetic Emissions and Regulation on Human Exposure Deployment of Wireless Networks and Associated Infrastructure

6.1 This Project was aimed to analyze the difficulties in the deployment of mobile networks and their associated infrastructure in Central America due to the social apprehension to electromagnetic radiation and to evaluate the regulations regarding the control of the same in those countries. Similarly, the Project developed, based on these studies and evaluations, proposed solutions, which include changes or policy developments; pilot projects; involving social communication measurement of the same; and development of general tools needed to facilitate, at the time of deployment of wireless networks, the social acceptance of the population and their political and civil associations.

In particular, regarding this latter issue, pilot measurements were developed in El Salvador, which are described at the end.

6.2 The difficulties in the deployment of wireless telecommunication networks due to popular apprehension to the antennas and the possible effects of RF exposures have become a difficult to solve problem, and it is among the priority topics for study by the ITU, the Inter-American Telecommunication Commission (CITEL), and the Telecommunication Technical Commission of Central America (COMTELCA).

6.3 This project was aimed to study, propose and implement a pilot project in the Central American Region, with regard to the deployment of mobile telephony masts and infrastructure, as well as to the issue of non-ionizing radiations and health protection, following various resolutions, such as Resolution 176 (Guadalajara, 2010) of the Plenipotentiary Conference of the ITU, 2010 "Human exposure to and measurement of electromagnetic fields," Resolution 72 (WTSA, Johannesburg 2008, Dubai 2012) on measurement issues related to human exposure to electromagnetic fields, and Resolution 62 (WTDC, Hyderabad, 2010). Besides, this project considers providing feedback regarding the lessons learned related to Question 23/1, "Strategies and policies relating to human exposure to electromagnetic fields" to the Study Group 1 of the Development Sector and to the Regional Group on Latin America and the Caribbean of the Study Group 5 of the ITU-T.

6.4 The project was implemented by the Telecommunication Development Bureau of the ITU (BDT), through its Area Office for Central America, Cuba, Mexico and the Dominican Republic in close coordination with the Regional Office for the Americas and the Caribbean and was assisted by outside experts, and by the countries participating in the project.

6.5 The social apprehension to electromagnetic radiation is being expressed by communities and groups of users of telecommunication services that are reluctant to the deployment of antennas for fear to the possible health effects. The Administrations of Central American countries are seeking proposals for solutions that also include the development of general tools necessary to facilitate the deployment of wireless networks and the social acceptance of the population and their political and civil organizations.

6.6 El Salvador, Panama and Honduras joined this project in order to conduct a study to determine the state of affairs in the deployment of wireless networks and their associated infrastructure in their countries due to the social apprehension expressed by the population related to electromagnetic radiations, with the ultimate goal of facilitating the deployment of antennas and their associated infrastructures.

6.7 It was decided to hold meetings with various government departments that may be related to the topic: Telecommunication Regulator, Ministry of Health, Ministry of Environment, National Offices that provide support to Municipalities, Municipal Planning Offices in metropolitan areas and major municipalities, Mayor's Association, operating companies. The goal was, on the one hand, to gather information from various sources, not always related, and also to try to reach a common position in the various branches of the national government involved in the matter.

6.8 We may assess that in two of the three participating countries remain the following features, which are similar to those presented in the rest of Latin America and other regions of the world:

Lack of coherent policies in various areas of government. Lack of integration and of a common policy among different branches of the national government. Lack of a social communication policy related to NIR and health protection. Violation of municipal regulations. Existence of non-authorized facilities at the municipal level. Rejection of facilities by the population. Participation of environmental organizations. Politicization of the issue. Fear to possible health effects of NIR. Onset social alarm. The rejection of facilities, within neighborhoods or local areas, tend to increase.

6.9 There is a conflict that is not technical, it is not commercial and, basically, it is not a health-related problem, but a conflict based on the social perception of the risk and the consequent fear of radiation by the population, which is generating, through the pressure exercised on mayors and municipal legislative bodies by said population, the adoption of these regulatory barriers to the deployment of infrastructure.

6.10 Some countries do not have National Health Legislation, which specifically regulates the use of NIR but, in some cases there are regulations in the telecommunication sector and in other cases the rules of COMTELCA are applied. In all cases, we made specific recommendations for the development of local regulations.

6.11 Taking into account the specific situation of each country and based on the document "Establishing a Dialogue on Risks from Electromagnetic Fields" of the WHO, we made a proposal to manage the social acceptance related to the deployment of antennas for each country, together with a work-plan sustainable over the time to achieve that objective.

6.12 The draft of the Guide of Good Practices for the Installation of Antennas, which includes from a review regarding the operation of mobile telephony and basic knowledge on Non-Ionizing Radiations, to installation methodologies that protect the environment, reduce the visual impact, and contemplate planning regulations, heritage protection, and radiation monitoring, was developed. It is also envisaged to include some guidelines related to municipal licensing procedures, designed to achieve the homogenization of the same in the various municipalities.

6.13 The following equipment and licenses were acquired for El Salvador, where the pilot took place:

- A portable measuring system for NIR.
- Supply, calibration, installation and supervision of 2 permanent measurement equipment for electromagnetic fields and their Control Center with the necessary applications for data management and publication on the Internet, based on ITU-T Recommendation K.83.
- A radiation map of a sector within the Metropolitan Area of El Salvador.

The purchase of equipment was conducted by ITU through a tender, which was won by the company Wave Control.

6.14 This tool is not based on measurement standards to be observed, thus it does not replace control measurements to be carried out by the enforcement authority, and should be considered as an additional tool of social communication to the public for the purpose of reducing fear for possible adverse health effects of NIR. The objective is to measure the levels of NIR at street level and at sensitive places to be set by the public authority. These levels will be monitored on an ongoing basis. It pretends to show the population, in a transparent and understandable way (Web, publications, etc.), that radiation levels are significantly below those established by the rules, aiming to reduce social apprehension.

6.15 The electromagnetic maps were generated walking every street in an area of the Metropolitan Area of San Salvador to get a comprehensive overview of the levels of the electromagnetic field at street level. Measurements were made at street level with electromagnetic field isotropic probes with a frequency range of: 300 kHz to 3 GHz (broadband). The levels present at each point of the city were taken, dynamically, along with the date and GPS position.

6.16 The process was performed by a vehicle and logistics personnel provided by SIGET. The levels were measured in V/m, so that you can make a direct comparison with the levels specified by international standards regarding the limits of human exposure to radio frequency electromagnetic fields. Data were taken and stored and associated with their date and GPS position and were delivered by a geographic information system (GIS), which allows to visualize data graphically on maps, with color coding levels.



6.17 In this map you can see the levels of NIR that people can compare on a scale from blue to red, above which are outside the maximum limits specified by the WHO.

6.18 The following is a similar map of the city of Lomas de Zamora in Argentina, already published with its NIR level scale:



6.19 A small continuous monitoring system was deployed as a pilot, in order to achieve tranquility in various neighborhoods or in neighborhoods with high conflict due to NIR apprehension. People may be able to access SIGET's website and clicking on the green dot will access the measurements of the selected monitor to see the results, as shown in the figure below. The programming system sends reports via e mail with the frequency required to key actors, such as the president of the neighborhood council, the director of the school, neighborhood leaders, non-governmental associations concerned with the matter, etc.

6.20 At the time of preparing this report, the information had not yet been officially released by SIGET, thus it does not include the corresponding link.

Figure 3: Continuous r	nonitoring sy	stem of El Salvador, Joint Project with the ITU
4	SIGET	Sistema de Monitorización de Radiofrecuencia
	A Salvadar James Alexander Ale	Actastra 4-2 13 Month 4-2 13 Mo
Med	Sdas históricas II	Eervalo: 28(02/2013 - 07/03/2013
Ind Qui reg	que el periodo del que ere consultar los datos strados (Otima semana) (Otimo mes)	PrecisionCass: 1050457-050457   Limite normativa: 28.00 V/m Maximus: 2.12 V/m Media: 3.37 V/m
	Desde	
	6 2000-2011 Wareholder	

6.21 For the Salvadoran case, we used a broadband probe and a narrow band probe including the bands in which cellular companies operate in said country.

6.22 Continuous Monitoring Systems in the Americas Region

Besides this project, various countries within the Americas Region are developing their Continuous Monitoring Systems based on the ITU-T Recommendation K.83.

Argentina: In expansion phase

Colombia: Recently installed, (not yet published)

Ecuador: Recently installed, (not yet published)

Brazil: Recently bought, not yet installed

For more information on this project, contact: Héctor Mario Carril, hectormario.carril@ties.itu.int or Miguel Alcaine, ITU Regional Office in Honduras, miguel.alcaine@itu.int

### 7. Guidance to Member States

7.1 It is recommended that Member States adopt the EMF Guidelines as set out by ICNIRP (which are endorsed by WHO<sup>12</sup> and the ITU<sup>13</sup>) instead of inventing their own thresholds. WHO, through its International EMF Project has developed the framework for developing health-based EMF standards which can be used if national standards deviate from international recommendations.<sup>14</sup> The WHO recognizes that countries may choose to adopt other risk management policies for RF exposures.

7.2 At the country level, regulations for limiting exposure EMF can be categorized as either voluntary or mandatory instruments.

<sup>&</sup>lt;sup>12</sup> WHO, Framework for developing health-based electromagnetic field standards, 2006 available at <u>www.who.int/peh-</u> <u>emf/standards/framework/en/index.html</u>

<sup>&</sup>lt;sup>13</sup> ITU, Guidance on complying with limits for human exposure to electromagnetic fields, k.52, December 2004

<sup>&</sup>lt;sup>14</sup> WHO Framework for developing health-based electromagnetic field standards.

7.2.1 Voluntary instruments include guidelines, instructions and recommendations that are not legally mandated, and generally have no legal force, e.g. International guidelines, such as those developed by ICNIRP, IEEE and others, which provide guidance to national agencies, and only become legally binding if the country incorporates them into its own legislation.

7.2.2 Mandatory, compulsory or legally binding regulatory instruments include laws, acts, regulations, ordinances, decisions, and decrees, and require a legislative framework.

7.2.3 WHO's EMF Project felt it would be more helpful to promote existing international standards into a model legislation that would enable national authorities wishing to do so, to incorporate them into their national legislations. Additionally, the WHO Model Legislation <sup>15</sup> would enable all those wishing to develop their own national standards to do so within that framework.

7.3 Measurement standards which describe how compliance with exposure or emission standards may be ensured, based on standards of IEC, IEEE/ICES and CENELEC though individual countries are free to update them in accordance with their National standards. They may provide guidance on how to measure the EMF exposure due to an installation or a product, e.g., phantom measurement for SAR values for mobile phones:

7.3.1 According to ITU Spectrum Monitoring Handbook Chapter 5.6, enforcement of regulations relating to maximum NIR levels permitted from telecommunication devices is performed by the authority responsible for spectrum management taking advantage of the existing expertise in the field. The country experience contributions presented in this report demonstrate that enforcement is mostly done by the Licensing authorities.

7.3.2 The Handbook further recommends NIR measurements to be conducted as follows:

- In association with the issue of radio license;
- Regularly, according to a NIR control and monitoring plan or
- With good cause, i.e. due to public or official demands.<sup>16</sup>
- 7.4 Emitters to be measured include the following:
- Broadcasting and cellular base stations;
- Amateur radio stations;
- Handheld, by only checking supplier's technical specification, as measurement on handheld may be expensive.

#### 7.5 Procedure

7.5.1 Procedures should exist to ensure compliance of mandatory standards. For EMF exposure standards, an agency (which could be national or private) is normally mandated to check compliance through calculations and measurements made in the workplace and other areas. For exposure limits, compliance of devices is usually certified by the manufacturer. (SAR measurement).

7.5.2 The guidance on how to assess human exposure in real situations is presently based on existing IEC/CENELEC standards. Therefore member states are advised to follow the IEC/CENELEC standards. There is also the Electronic Communications Committee (ECC) within the European Conference of Postal and Telecommunications Administrations (CEPT) Recommendation (02)04 (revised Bratislava 2003, Helsinki 2007), on measuring non-ionising electromagnetic radiation (9KHz – 300 GHz) which may be referred to.

<sup>&</sup>lt;sup>15</sup> WHO Model legislation for electromagnetic fields protection, 2006, available at: <u>www.who.int/entity/peh-</u> <u>emf/standards/emf\_model/en/index.html</u>

<sup>&</sup>lt;sup>16</sup> ITU Handbook on Spectrum Monitoring, 2011, available at: <u>www.itu.int/pub/R-HDB-23-2011</u>

7.5.3 ITU Spectrum Monitoring Handbook Chapter 5.6 outlines the measurement procedures explaining; site selection, instrument positioning, precautions, equipment to be used, uncertainties and reporting format.

7.5.4 It is recommended that some guidance on how to control the circulation of cell phones in any country or region be developed to avoid non-compliance or non-conformity equipment.

7.5.5 It is recommended that radiation measurements be made regularly as compliance check. The countries should also encourage collocation and infrastructure sharing to avoid the proliferation of antennas and hence reduce the human exposure and harmful effect perception.

# 8. Conclusion

8.1 It is important to produce reports that will be accessible to the public. This may be published using available media channels in the country. Measured and calculated quantities have to be compared. If the measured or calculated values are higher than the ICNIRP levels, this should be highlighted in the report and applicable provisions should be taken in accordance with the regulations in force.

8.2 It is recommended that a comprehensive measurement report should also contain the following information:

- Purpose and objectives of the measurements;
- Date, start and stop time;
- Geographic co-ordinates, altitudes above ground level, and particular characteristics of the measurement sites;
- List of identified transmitters;
- The used measurement equipment, its serial numbers and calibration status;
- Uncertainty of the measurements.
- Measurement protocol or standard; temperature or weather conditions including humidity.<sup>17</sup>

8.3 Additionally, in order to improve the intelligibility of the report, it is desirable to use graphical representation of the results in the form of maps, diagrams and photos. These may present the measurement results in its locations and also the relative position of main emitters and areas of concern, such as schools, hospitals and houses.<sup>18</sup>

8.4 On the part of public awareness, it is important to provide information on EMF products to the public to reduce perceptions of harmful exposure. The public may be informed about importation of EMF measurement equipment into the country providing SAR. Regional coordination among the neighbouring countries is important in this regard for controlling trafficking these equipment, only authorised ones should be allowed into a country.

8.5 Note that there is a distinction between base station which are installed by the service providers and cell phone handhelds which are personal choices. Control of these devices are at different levels (service providers and customers), which necessitates collaboration and information sharing among the service providers and customers. Therefore, it is recommended that the SAR of each handset is to be available to the public <sup>19</sup> for informed choices.

<sup>&</sup>lt;sup>17</sup> ITU Spectrum Monitoring Handbook Chapter 5.6

<sup>&</sup>lt;sup>18</sup> ITU Spectrum Monitoring Handbook Chapter 5.6

<sup>&</sup>lt;sup>19</sup> www.sartick.com/

# 9. Guidelines

#### 9.1 Scope of Guidelines

The Guidelines are expected to cover the following:

9.1.1 Regulatory policies concerning human exposure to electromagnetic fields that should be considered or being undertaken for authorising the installation of radio communication sites.

9.1.2 To describe the strategies or methods for raising the awareness of populations and information to populations regarding the effects of electromagnetic fields due to radio communication systems.

#### 9.2 Objective of Guidelines

9.2.1 These Guidelines are meant to guide Member States in dealing with perceptions regarding human exposure to EMF.

The guidelines provide the following:

- Information on technical parameters (e.g. radiation value limit, distance, antenna height above roof top);
- Scientific results to proof the safety of tower installation;
- Details on how to deal with sensitive areas such as schools and hospitals;
- Monitoring of installations compliance to radiation limits; and
- Procedure of how to measure radiation levels.

#### 9.3 Principles for Developing the Guidelines

The key principles relevant to the EMF radiation and exposure to human beings are as follows:

9.3.1 Adherence to the ITU Recommendations on EMF limits;

- 9.3.2 Adherence to the ICNIRP Guidelines, as well as the proposed targets;
- 9.3.3 Adherence to WHO, ILO, ICNIRP, UNEP recommendations;

9.3.4 There must be communication to the public about results of EMF measurements made from any communication equipment;

9.3.5 The reports published should show the minimum radiation requirements that should not be exceeded; and

9.3.6 Care is exercised in the deployment of radiocommunication equipment in areas such as hospitals, schools and densely populated areas.

#### 9.4 Obligations of Operators on EMF Radiation

On deployment of their communication equipment, operators shall ensure that:

- 9.4.1 Radiation limits are not exceeded;
- 9.4.2 Distance limit is not exceeded;
- 9.4.3 Test on their equipment is done prior to installation and prior to operation;
- 9.4.4 The tests are to be approved by the Regulator;
- 9.4.5 Consumers are consulted and informed of the new installations;

9.4.6 The general public is made aware of the new installations and the radiation emissions from the equipment published;

9.4.7 Sensitive areas like schools, hospitals should be avoided if possible; and

9.4.8 Big signs like "Danger" should be flagged on the operating radiocommunication equipment.

#### 9.5 Targets

The EMF radiation targets under these Guidelines shall be based on:

9.5.1 International EMF Guidelines as set out by ICNIRP (which are endorsed by WHO), IEEE and other international standardization bodies;

9.5.2 At the country level, regulations for exposure EMF can be either voluntary like these guidelines or mandatory instruments if the country incorporates them into its own legislation;

9.5.3 If international emission standards do not exist for certain devices that emit EMF, Member States should strongly encourage the development of appropriate standards by the appropriate international organization; and

9.5.4 Should there be need for national standards, the framework for developing health-based EMF standards which can be used if national standards are necessary developed by WHO through its international EMF projects should apply.

#### 9.6 Measurements

9.6.1 Measurement standards which describe how compliance with exposure or emission standards may be ensured are proposed by WHO EMF Project.

9.6.2 The guidance on how to assess human exposure in real situations will be based on existing IEC/CENELEC standards.

9.6.3 The Electronic Communications Committee (ECC) within the European Conference of Postal and Telecommunications Administrations (CEPT) Recommendation (02)04 (revised Bratislava 2003, Helsinki 2007, on measuring non-ionising electromagnetic radiation (9KHz – 300 GHz) may be referred to.

9.6.4 The ITU Spectrum Management Handbook Chapter 5.6 recommends NIR measurements to be conducted as follows:

9.6.4.1 in association with the issue of radio license;

9.6.4.2 regularly, according to a NIR control and monitoring plan; or

9.6.4.3 with a good cause, i.e. due to public or official demands.

9.6.5 The Handbook also outlines the measurement procedures explaining; site selection, instrument positioning, precautions, equipment to be used, uncertainties and reporting format.

#### 9.7 Publication of Measurements by Regulators

9.7.1 The Regulator shall publish the measurements submitted by operators and verified by the regulator periodically after the reporting period. The period shall be as determined by the regulator.

9.7.2 The notice published shall specify measurement, reporting period and the required minimum targets.

9.7.3 Published parameters shall be classified into, but shall not be limited to the following classes of the equipment:

- Broadcasting and cellular base stations;
- Amateur radio stations; and
- Handheld (by only checking supplier's technical specification as measurement on handheld may be expensive, because it is difficult to measure Specific Absorption Rate from handhelds and it may not be necessary in each country.)

9.7.4 It is important to produce reports that will be accessible to the public. This may be published on the available media in the country.

#### 9.8 Content and Format of Publication

9.8.1 It is expected that a comprehensive measurement report should contain the following information:

- Measurement results;
- Purpose and objectives of the measurements;
- Date, start and stop time;
- Geographic co-ordinates, altitudes above ground level, and particular characteristics of the measurement sites;
- List of identified transmitters;
- The used equipment and its serial numbers; and
- Uncertainty of the measurements.

9.8.2 Measured and calculated quantities have to be compared. If the quantities of measured or calculated values are higher than the lower set ICNIRP level, this should be highlighted on the report and applicable provisions should be taken in accordance with the regulations in force.

9.8.3 Additionally, in order to improve the intelligibility of the report, it is desirable to use graphical representation of the results in the form of maps, diagrams and photos. These may present the measurement results in its locations and also the relative position of main emitters and areas of concern, such as schools, hospitals and houses.

#### 9.9 Inspection and Investigations

9.9.1 The regulator shall inspect or investigate matters relating to measurement submitted by operators to ensure compliance. For EMF exposure standards, the regulator should be mandated to check compliance through calculations and measurements made in the workplace and other areas. For emission standards, compliance of devices is usually certified by the manufacturer.

9.9.2 Equipment that does not comply with the required standards shall not be allowed to operate.

9.9.3 The operator who submits false measurement shall have its equipment destroyed and banned in the country.

9.9.4 Enforcement of regulations relating to maximum NIR levels from telecommunication devices relies with the authority responsible for spectrum management taking advantage of the existing expertise in the field.

#### 9.10 Amendment of the Guidelines

9.10.1 These Guidelines may be amended taking into consideration the key principles as set out in these guidelines.

9.10.2 Amendment may also be made if there are new targets set by ICNIRP.

9.10.3 Consultation has to be done with all stakeholders including the general public.

9.10.4 Implementation of the amended Guidelines shall be done after a certain period notice of such amendment suitable for the country.

9.10.5 Review of the Guidelines. The review will cover:

- Set targets;
- Measuring equipment;
- Publication;
- Equipment to be measured; and
- Measurement method.

#### I. Annexes

- Annex 1: RF Exposure Units and Standards
- Annex 2: ICNIRP 1998 Exposure Levels and IEEE Levels
- Annex 3: Mandate of Question 23/1 (WTDC-10/139 (Rev.1))
- Annex 4: WTSA-12 Resolution 72 on "Measurement concerns related to human exposure to electromagnetic fields"
- Annex 5: WTDC-10 Resolution 62 on "Measurement concerns related to human exposure to EMF".
- Annex 6: Plenipotentiary Conference (PP-10) Resolution 176 on "Human exposure to and measurement of electromagnetic fields"
- Annex 7: ITU Project in Central America Document
- Annex 8: Q23/1 Workplan
- Annex 9: Documents for Q23/1
- Annex 10: A Case Study from India on EMF

#### II. List of Contributions

III. References

# Annex 1: RF Exposure Units and Standards

<sup>1</sup>Table 1 lists the reference units of the physical quantities used in this report.

Quantity	Symbol	Unit	Symbol
Frequency	f	Hertz	Hz
Electric field strength	E	Volt per metre	V/m
Power	Р	Watts	W
Specific Absorption Rate	SAR	Watt per kilogram or milliWatt per gram	W/kg or mW/g
Power density or power flux density	S	Watt per square metre	W/m²
		mWatt per square cm	mW/cm²

#### Table 1: Physical quantities and units

Various institutions define the allowed limits permitted in specific regions: ICNIRP (1998, *Guidelines*); FCC-Federal Communications Commission (1997, *Bulletin 65*), developed by IEEE (Institute of Electrical and Electronic Engineers) 1991 C95.1 and adopted by ANSI (American National Standards Institute) (1992, ANSI/IEEE C95.1); IEEE 2006 standard (C95.1-2005), not adopted by FCC. ICNIRP (1998 p. 509 table 4 and p. 511 table 7) defines the exposure thresholds of the World Health Organisation (WHO) for EMF. The European Council EC 1999/519 (Annex III, tables 1 and 2) adopted its values. The following tables refer to the exposure limits for general public/ uncontrolled/ unperturbed environment (unlike the controlled/ occupational) for the cellular (UHF bands), where 'f' represents frequency in MHz, unless otherwise stated.

A distinction is made between the exposure levels from cellular base stations and handsets. The hazards from a base station's radiation refer to the field intensity and power density generated, whereas the hazards from handsets are considered by the SAR value. The reason for the two different approaches: the far-field standard (easily computable and measured) is used for the base station case, whereas the near-field standard (SAR and phantom-based measurements) is applied for the handset case. The standards and guidelines give the 'baseline limits' for power density and SAR.

<sup>&</sup>lt;sup>1</sup> See Mazar H. 2009a <u>An Analysis of Regulatory Frameworks for Wireless Communications, Societal Concerns and Risk:</u> the Case of Radio Frequency (RF) Allocation and Licensing

# Annex 2: ICNIRP 1998 Exposure Levels and IEEE Levels

#### <sup>1</sup>Table 2: ICNIRP (1998:511) Reference levels for occupational and general public exposure

Frequency range	Electric field strength (V/m)		Equivalent plan density S	ne wave power <sub>eq</sub> (W/m²)
	general public	occupational	general public	Occupational
1-25 Hz	10,000	20,000		
0.025- 0.82 KHz	250/f(KHz)	500/f(KHz)		
0.82 -3 KHz	250/f(KHz)	610		
3-1000 KHz	87	610	1	
1-10 MHz	87/f <sup>1/2</sup> (MHz)	610/f (MHz)		
10-400 MHz	28	61	2	10
400-2000 MHz	1.375f <sup>1/2</sup> (MHz)	3f <sup>1/2</sup> (MHz)	f/200	f/40
2-300 GHz	61	137	10	50



<sup>&</sup>lt;sup>1</sup> See Mazar H. 2009a and a forthcoming John Wiley & Sons publication, 'Radio Spectrum Management: Policies, Regulations, Standards and Techniques', chapter 13 - Limitations to Radio Frequency Human Exposure.



#### 2.1 Exposure Levels: Cellular Base-Stations

The limits of ICNIRP (1998:511, table 7) and the European Community (EC 1999/519: Annex III, table 2) are identical. The ICNIRP levels have been endorsed by the Commission's Scientific Steering Committee. Table 2 specifies these exposure limits for frequencies of cellular base stations.

Table 3: ICNIRP and EC reference	levels for exposure
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Frequency range	Electric field strength (V/m)	Magnetic field strength (A/m)	Equivalent plane wave power density S <sub>eq</sub> (W/m <sup>2</sup> )	Magnetic Flux Density (μT), B
400-2000 MHz	1.375f <sup>½</sup>	0.0037f <sup>1/2</sup>	f/200	0.0046 f <sup>1</sup> / <sub>2</sub>
2-300 GHz	61	0.16	10	0.2

Table 3 specifies the US thresholds for cellular base stations.

#### Table 4 : FCC exposure limits (FCC 2001:67)

Frequency Range MHz	Electric Field (E) (V/m)	Magnetic Field H (A/m)	Power Density (S) (mW/cm²)
30-300	27.5	0.073	0.2
300-1500			f/1500
1500-100,000			1

Table-4 depicts that the levels in power exposure limits of the US are 4/3 (=200/150) higher than ICNIRP and Europe.

The IEEE maximum permissible exposure 2005 updates are shown in Table 5.

Frequency Range MHz	Electric Field (E) (V/m)	Magnetic Field H (A/m)	RMS power density (S) (W/m²)
100-400	27.5	0.073	2
400-2000			f/200
2000-5000			10

#### Table 5: The 2005 IEEE permissible exposure (IEEE Std C95.1-2005:25, Table 9)

The IEEE C95.1-2005 level for 400-2000 MHz (typical cellular RF bands) is identical (not to FCC nor ANSI levels) to the ICNIRP level ( $f/200 \text{ W/m}^2$ ); the units are also the same.

#### 2.2 Exposures: Cellular Handsets

Specific energy Absorption Rate (SAR) is the time rate of energy absorption per gram of tissue from electromagnetic radiation; it is expressed in watts per kilogram (W/kg). Table 6 compares the rate absorption in ICNIRP, EC and  $FCC^2$ .

#### Table 6: Maximal power from handsets: Specific absorption rate, SAR (W/kg)

ICNIRP	European Community	FCC- USA	
10 MHz–10 GHz; Localis	ed SAR (Head and Trunk)	Portable Devices; General Population/ Uncontrolled	
2.0; averaged over 10 g tissue		1.6; averaged over 1g tissue	

In contrast to the thresholds of power density from cellular base stations, it is important to observe that the US is more risk averse than Europe in the allowed SAR from the cellular terminal. The ICNIRP threshold (adopted by EC) is 2.0 W/kg, while the US limits are 1.6 watts/kg<sup>3</sup> for the partial body. The IEEE (2006:79) has changed the peak spatial average SAR values from 1.6 W/kg for exposure of the public environment to 2 W/kg; moreover, the SAR is to be averaged over 10g tissue as in the ICNIRP and not for 1g as before. These changes were based on the scientific considerations and were also influenced by the desire to harmonize the basic restrictions with ICNIRP, where scientifically justified.

<sup>&</sup>lt;sup>2</sup> ICNIRP1998:509 table 4; EC 1999/519, Annex III, Table 1; FCC 1997:75 (and FCC 2006 CFR 47 § 2.1093).

<sup>&</sup>lt;sup>3</sup> Even the averaging is more stringent in the US, as the limit is averaged over one gram (FCC 2001:75), and not 10 grams as in ICNIRP 1998. Following changes in the IEEE C95.1-2005 standard, the US ANSI may adopt in the future the less stringent European level for SAR and averaging.

# Annex 3: Mandate of Question 23/1 (WTDC-10/139 (Rev.1))\*.

#### Question 23/1 – Strategies and policies concerning human exposure to electromagnetic fields

#### 1. Statement of the situation

The deployment of different sources of electromagnetic fields to cater for the telecommunication and ICT needs of urban and rural communities has developed very rapidly over the past ten (10) years. This has been due to strong competition, ongoing traffic growth, quality of service requirements, network coverage extension and the introduction of new technologies. It has produced concern on the possible effects of prolonged exposure to emissions on people's health.

This concern on the part of populations is growing, aggravated by the feeling that they are not being kept informed of the process for deploying these installations; hence many complaints received by operators and government bodies responsible for radiocommunications/ICTs.

Thus, since the continued development of radiocommunications requires trust on the part of populations, the work carried out in ITU-R Study Group 1 Working Party 1C and ITU-T Study Group 5 under Resolution 72, on measurement concerns related to human exposure to electromagnetic fields, should be complemented by studies on the different regulatory and communication mechanisms developed by countries to increase the awareness of and information to populations and facilitate the deployment and operation of radiocommunication systems.

#### 2. Question for study

The following subjects should be studied:

a) To compile and analyse the regulatory policies concerning human exposure to electromagnetic fields that are being considered or being undertaken for authorizing the installation of radiocommunication sites and Power Lines Telecommunications systems.

b) To describe the strategies or methods for raising the awareness of populations and information to populations regarding the effects of electromagnetic fields due to radiocommunication systems.

c) To propose guidelines and best practices on this matter.

#### 3. Expected outcome

a) A report to the membership presenting guidelines to assist Member States in resolving similar problems faced by regulatory bodies.

b) The report will provide regulatory authorities with guidelines on methods for raising the awareness of populations along with best practices based on countries' experience in the matter.

#### 4 Timeline

A provisional report is to be presented to the Study Group in 2012. It is proposed that the study be completed in 2013, at which date a final report containing guidelines will be submitted

<sup>\*</sup> www.itu.int/ITU-D/study groups/SGP 2010-2014/doc/rgq/2010/D10-RGQ23.1-en.pdf

# Annex 4: WTSA-12<sup>\*</sup> Resolution 72 on "Measurement concerns related to human exposure to electromagnetic fields"

# RESOLUTION 72 (REV. DUBAI, 2012)

## Measurement concerns related to human exposure to electromagnetic fields

(Johannesburg, 2008; Dubai, 2012)

The World Telecommunication Standardization Assembly (Dubai, 2012),

#### considering

*a)* the importance of telecommunications and information and communication technologies (ICT) for political, economic, social and cultural progress;

*b)* that a significant part of the infrastructure needed to help bridge the digital divide between developed and developing countries<sup>1</sup> involves various wireless technologies;

*c)* that there is a need to inform the public of the potential effects of exposure to electromagnetic fields (EMF);

*d)* that an enormous amount of research has been carried out regarding wireless systems and health, and many independent expert committees have reviewed this research;

*e)* that the International Commission on Non-Ionizing Radiation Protection (ICNIRP), the International Electrotechnical Commission (IEC) and the Institute of Electrical and Electronics Engineers (IEEE) are three among a number of pre-eminent international bodies in establishing measurement methodologies for assessing human exposure to EMF, and they already cooperate with many standards bodies and industry forums;

*f)* that the World Health Organization (WHO) has issued fact sheets regarding EMF issues, including mobile terminals, base stations and wireless networks, referencing ICNIRP standards;

*g)* Resolution 176 (Guadalajara, 2010) of the Plenipotentiary Conference, on human exposure to and measurement of electromagnetic fields;

*h)* Resolution 62 (Hyderabad, 2010) of the World Telecommunication Development Conference, on measurement concerns related to human exposure to electromagnetic fields,

#### recognizing

*a)* the work done within ITU Radiocommunication Sector (ITU-R) study groups on radiowave propagation, electromagnetic compatibility (EMC) and related aspects, including measurement methods;

*b)* the work done within Study Group 5 of the ITU Telecommunication Standardization Sector (ITU-T) on techniques for taking radio-frequency (RF) measurements;

<sup>\*</sup> www.itu.int/pub/T-RES-T.72-2012

<sup>&</sup>lt;sup>1</sup> These include the least developed countries, small island developing states, landlocked developing countries and countries with economies in transition.

*c)* that Study Group 5, in establishing measurement methodologies for assessing human exposure to RF energy, already cooperates with many participating standards organizations (PSOs),

#### recognizing further

*a)* that some publications about EMF effects on health create doubt among the population, in particular in developing countries;

*b)* that, in the absence of regulation, people, in particular in developing countries, become more and more doubtful and are increasingly opposing the deployment of radio installations in their neighbourhoods;

c) that the cost of the equipment used for assessing human exposure to RF energy is very high, and that the equipment is more likely to be affordable only in developed countries;

*d)* that implementing such measurement is essential for many regulatory authorities, in particular in developing countries, in order to monitor the limits for human exposure to RF energy, and that they are called upon to ensure those limits are met in order to license different services,

#### noting

the similar activities carried out by other national, regional and international standards development organizations (SDOs),

#### resolves

to invite ITU-T, in particular Study Group 5, to expand and continue its work and support in this domain, including but not limited to:

- i) disseminating information related to this topic through organizing workshops and seminars for regulators, operators and any interested stakeholders from developing countries;
- continuing to cooperate and collaborate with other organizations working on this topic and to leverage their work, in particular with a view to assisting the developing countries in the establishment of standards and in monitoring compliance with these standards, especially on telecommunication terminals;
- iii) cooperating on these issues with ITU-R Study Groups 1 and 6, and with Study Group 1 of the ITU Telecommunication Development Sector (ITU-D) in the framework of Question 23/1;
- iv) strengthening coordination with WHO so that any fact sheet relating to human exposure to electromagnetic fields is circulated to Member States as soon as it is issued,

*instructs the Director of the Telecommunication Standardization Bureau, in close collaboration with the Directors of the other two Bureaux, and within the available financial resources* 

1 to support the development of reports identifying the needs of developing countries on the issue of assessing human exposure to EMF, and submit the reports as soon as possible to ITU-T Study Group 5 for its consideration and action in accordance with its mandate;

2 to hold workshops in developing countries with presentations and training on the use of equipment employed in assessing human exposure to RF energy;

3 to support developing countries while they establish their regional centres equipped with test benches for monitoring conformance of telecommunication terminal equipment and human exposure to electromagnetic waves using, among other things, the modalities listed in Resolutions 44 (Rev. Dubai, 2012) and 76 (Rev. Dubai, 2012) of this assembly, in the context of the development of the regional test centres and of Resolution 177 (Guadalajara, 2010) of the Plenipotentiary Conference,

#### invites Member States and Sector Members

to contribute actively to the work of Study Group 5 in providing relevant and timely information in order to assist developing countries in providing information and addressing measurement concerns related to RF exposure and electromagnetic fields,

#### further invites Member States

to adopt suitable measures in order to ensure compliance with relevant international recommendations to protect health against the adverse effect of EMF.

# Annex 5: WTDC-10<sup>\*</sup> Resolution 62 on "Measurement concerns related to human exposure to EMF"

# RESOLUTION 62 (HYDERABAD, 2010)

## Measurement concerns related to human exposure to electromagnetic fields

The World Telecommunication Development Conference (Hyderabad, 2010),

#### recalling

Resolution 72 (Johannesburg, 2008) of the World Telecommunication Standardization Assembly, on measurement concerns related to human exposure to electromagnetic fields (EMF), which calls for close cooperation with the Directors of the other two Bureaux – Telecommunication Development Bureau (BDT) and Radiocommunication Bureau (BR) – to implement the resolution in view of its importance to developing countries,

#### considering

a) that there is a pressing need for information on the potential effects of human exposure to EMF in order to protect humans from such effects;

b) that there are a number of eminent international bodies involved in establishing measurement methodologies for assessing human exposure to EMF, and these already cooperate with many telecommunication standards bodies, including the ITU Telecommunication Standardization Sector (ITU-T),

#### recognizing

a) that some publications and information about EMF effects on health create doubt among the population, in particular in developing countries<sup>1</sup>, causing these countries to address questions to ITU-T and, currently, to the ITU Telecommunication Development Sector (ITU-D);

b) that, in the absence of regulation, people, particularly in developing countries, become more and more doubtful and are increasingly opposing the deployment of radio installations in their neighbourhoods;

c) that the cost of the equipment used for assessing human exposure to EMF is very high and difficult for many developing countries to afford;

d) that implementing such measurement is essential for many regulatory authorities in developing countries, in order to monitor the limits for human exposure to radio-frequency energy, and that they are called upon to ensure those limits are met in order to license different services,

<sup>\*</sup> www.itu.int/ITU-D/conferences/wtdc/2010/pdf/WTDC10\_DraftPreliminaryReport.pdf

<sup>&</sup>lt;sup>1</sup> These include the least developed countries, small island developing states, landlocked developing countries and countries with economies in transition.

#### resolves to instruct the Director of the Telecommunication Development Bureau

in response to the needs of the developing countries and consistent with the substance of Resolution 72 (Johannesburg, 2008), and in close cooperation with the Director of BR and Director of the Telecommunication Standardization Bureau (TSB):

1 to give the necessary priority to this subject and, within the available resources, allocate the necessary funds for expediting execution of this resolution;

2 to ensure that Programme 1 determines the requirements of developing countries and their regulatory authorities (at regional level) in relation to this resolution, contributes to studies on this subject, takes an active part in the work of the relevant ITU Radiocommunication Sector (ITU-R) and ITU-T study groups, and submits written contributions on the results of its work in this regard, plus any proposals it deems necessary, to ITU-D Study Group 2,

#### instructs Study Group 1

within the framework of their Questions, to cooperate with ITU-T Study Group 5 and ITU-R Study Groups 1, 5 and 6, in order to achieve the following goals:

- prepare an annual report on the progress of work in this area in respect of their Questions;
- contribute to the organization of any seminars on this subject;

• contribute to preparation of the Guide on the use of ITU-T publications on achieving electromagnetic compatibility and safety, and publications relating to measurement methodologies, the need for measurements to be performed by a "Qualified Radio Engineer" and the criteria for a "Qualified Radio Engineer", and system specifications.

# Annex 6: Plenipotentiary Conference (PP-10)<sup>\*</sup> Resolution 176 on "Human exposure to and measurement of electromagnetic fields".

# **RESOLUTION 176 (GUADALAJARA, 2010)**

## Human exposure to and measurement of electromagnetic fields

The Plenipotentiary Conference of the International Telecommunication Union (Guadalajara, 2010),

#### recalling

*a)* Resolution 72 (Johannesburg, 2008) of the World Telecommunication Standardization Assembly, on measurement concerns related to human exposure to electromagnetic fields (EMF);

*b)* Resolution 62 (Hyderabad, 2010) of the World Telecommunication Development Conference, on measurement concerns related to human exposure to EMF;

*c)* relevant resolutions and recommendations of the ITU Radiocommunication Sector (ITU-R) and ITU Telecommunication Standardization Sector (ITU-T);

*d)* that there is ongoing work in the three Sectors relating to human exposure to electromagnetic fields, and that liaison and collaboration between the Sectors and with other expert organizations are important, in order to avoid duplication of effort,

#### considering

*a)* that the World Health Organization (WHO) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) have the specialized health expertise and competence to assess the impact of radio waves on the human body;

*b)* that ITU has expertise in calculating and measuring the field strength and power density of radio signals;

c) the high cost of equipment used for measuring and assessing human exposure to EMF;

*d)* that the considerable development in radio spectrum use has resulted in multiple sources of EMF emissions within any given geographic area;

*e)* the urgent need for regulatory bodies in many developing countries to obtain information on EMF measurement methodologies in regard to human exposure to radio-frequency energy, in order to establish national regulations to protect their citizens;

*f)* that guidelines on limits of exposure to EMF have been established by  $ICNIRP^1$ , the Institute of Electrical and Electronics Engineers (IEEE)<sup>2</sup> and the International Organization for Standardization/International Electrotechnical Commission (ISO/IEC) and that many administrations have adopted national regulations based on these guidelines,

www.itu.int/pub/S-CONF-ACTF-2010/en

<sup>&</sup>lt;sup>1</sup> Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz) – www.icnirp.de/documents/emfgdl.pdf.

<sup>&</sup>lt;sup>2</sup> IEEE Std C95.1<sup>™</sup>-2005, IEEE standard for safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 300 GHz.

#### resolves to instruct the Directors of the three Bureaux

to collect and disseminate information concerning exposure to EMF, including on EMF measurement methodologies, in order to assist national administrations, particularly in developing countries, to develop appropriate national regulations,

*instructs the Director of the Telecommunication Development Bureau, in collaboration with the Director of the Radiocommunication Bureau and the Director of the Telecommunication Standardization Bureau* 

1 to ascertain the requirement for, and as appropriate conduct, regional seminars and workshops in order to identify the needs of developing countries and to build human capacity in regard to measurement of EMF related to human exposure to these fields;

2 to encourage Member States in the various regions to cooperate in sharing expertise and resources and identify a focal point or regional cooperation mechanism, including if required a regional centre, so as to assist all Member States in the region in measurement and training,

instructs the Secretary-General, in consultation with the Directors of the three Bureaux

1 to prepare a report on the implementation of this resolution for submission to the ITU Council at each annual session;

2 to provide a report to the next plenipotentiary conference on measures taken to implement this resolution.

Annex 7: ITU Project in Central America Document\*

<sup>\*</sup> www.itu.int/md/D10-RGQ23.1-INF-0004/

# Annex 8: Q23/1 Work Plan

#### Work Programme 2010-2014

DATE	ACTIVITY / EXPECTED RESULTS	PERSON RESPONSIBLE
September 2010	- Determination of the working method and of the means to carry out the work	BDT, Rapporteur's Group
October 2010 – February 2011	<ul> <li>Compilation and analysis of envisaged or adopted regulatory policies on human exposure to electromagnetic fields authorizing the installation of radiocommunication sites and telecommunication systems over electric power lines</li> <li>Description of strategies or methods for raising awareness and informing people about the effects of electromagnetic fields caused by radio systems</li> <li>Guidelines and best practices</li> </ul>	BDT, Rapporteur's Group
March/April 2011	<ul> <li>Rapporteur's Group meeting:</li> <li>Consideration of contributions received</li> <li>Consideration of relevant documents of others Sectors (ITU-T, ITU-R)</li> <li>Call for contributions from: <ul> <li>World Health Organization</li> <li>International Commission on Non-Ionizing Radiation Protection (ICNIRP)</li> <li>Institute of Electrical and Electronic Engineers (IEEE)</li> </ul> </li> </ul>	BDT, Rapporteur's Group
September 2011	<ul> <li>Rapporteur's Group meeting:</li> <li>Consideration of contributions received</li> <li>Consideration of relevant documents of other Sectors and programmes</li> <li>Call for new contributions</li> <li>Draft guidelines for compliance with relevant international recommendations aimed at protecting health against the harmful effects of electromagnetic fields</li> </ul>	BDT, Rapporteur's Group
March/April 2012	<ul> <li>Rapporteur's Group meeting</li> <li>Consideration of contributions received</li> <li>Consideration of relevant documents of other ITU Sectors and international organizations working on this issue</li> <li>Finalization of guidelines</li> <li>Development of plan of the draft report</li> <li>Call for new contributions</li> <li>Dissemination of information on this topic at workshops and seminars organized for regulators, operators and the public</li> </ul>	BDT, Rapporteur and Vice-Rapporteurs
September 2012	<ul> <li>Rapporteur's Group meeting:</li> <li>Preparation of draft report</li> <li>Consideration of contributions received</li> <li>Call for new contributions</li> </ul>	BDT, Rapporteur's Group
March/April 2013	<ul> <li>Rapporteur's Group meeting:</li> <li>Consideration and adoption of draft report</li> <li>Consideration of contributions received</li> <li>Consideration of relevant documents of other Sectors and programmes</li> </ul>	BDT, Rapporteur's Group

#### Q23/1: Strategies and policies concerning human exposure to electromagnetic fields

DATE	ACTIVITY / EXPECTED RESULTS	PERSON RESPONSIBLE
September 2013	<ul> <li>Rapporteur's Group meeting:</li> <li>Seminar</li> <li>Presentation of draft report</li> <li>Consideration of contributions received</li> <li>Consideration of relevant documents of other Sectors and programmes</li> </ul>	BDT, Rapporteur's Group

# Annex 9: Documents for Q23/1\*

www.itu.int/ITU-D/CDS/sg/rgqlist.asp?lg=1&sp=2010&rgq=D10-RGQ23.1&stg=1

# Annex 10: A case study from India on EMF

This contribution is shared among the members for information and also for comments. ITU is also requested to consider and take appropriate action as per the findings of this contribution. Formation of a Focus Group cutting across ITU-T, ITU-R, ITU-D may be necessary to study the various aspects considering the importance of the issue.

The deployment of different sources of electromagnetic fields to cater for the telecommunication and ICT needs of urban and rural communities has developed very rapidly over the past decade in India. This has been due to strong competition, presence of multiple operators (10 to 12 in each service area) on-going traffic growth, quality of service requirements, network coverage and introduction of new technologies. Indian Territory has been divided into 22 Licensing Service Areas for provision of mobile services in the country. Growing number of towers nearing more residential premises has produced increasing concern on the possible adverse effects of EMF exposure on people's health. In India the issue has been raised by the public as well as by media. Accordingly, India adopted a policy on the EMF radiation covering Base Transmitting Station (BTS) and Mobile Handsets standard in the year 2008.

#### 1. Statement of the situation

1.1 The deployment of different sources of electromagnetic fields to cater for the telecommunication and ICT needs of urban and rural communities has developed very rapidly over the past decade in India. This has been due to strong competition, presence of multiple operators (10 to 12 in each Service area) on-going traffic growth, quality of service requirements, network coverage and introduction of new technologies. Indian Territory has been divided into 22 Licensing Service Areas for provision of mobile services in the country. Licensed Service Area wise subscriber base for landline and mobile customer is enclosed as **Annex 10A**.

1.2 Growing number of towers nearing more residential premises has produced increasing concern on the possible adverse effects of EMF exposure on people's health. In India the issue has been raised by the public as well as by media. Accordingly, India adopted a policy on the EMF radiation covering Base Transmitting Station (BTS) and Mobile Handsets standard in the year 2008. Licensed Service Area wise details of BTS installed in the country is enclosed as **Annex 10B**.

#### 2. Steps taken by Government of India

2.1 In its Fact Sheet No. 304 of 2006, WHO recommended that '*National authorities should adopt international standards to protect their citizens against adverse levels of RF fields. They should restrict access to areas where exposure limits may be exceeded.*' WHO has referred to the International Exposure Guidelines developed by International Commission on Non-Ionizing Radiation Protection (ICNIRP).

2.2 Based on the recommendation of WHO, India adopted ICNIRP norms, in the year 2008, for basic restrictions & reference level for limiting electro-magnetic field exposure from Base Stations as well as for mobile handsets and necessary provisions were made in the Unified Access Service Licence (Mobile Telephone Service operators' license) on 4<sup>th</sup> November, 2008. As per the provisions,

"Licensee shall conduct audit and provide self certificates annually as per procedure prescribed by Telecommunication Engineering Centre (TEC) / or any other agency authorized by Licensor from time to time for conforming to limits / levels for antennae (Base Station Emissions) for general public exposure as prescribed by International Commission on Non-Ionizing Radiation Protection (ICNIRP) from time to time".

The ICNIRP limits/levels are reproduced as detailed below:

Frequency Range	E-Field Strength ( Volt/Meter (V/m))	H-Field Strength (Amp/Meter (A/m))	Power Density (Watt/Sq.Meter (W/Sq.m))
400MHz to 2000MHz	1.375f <sup>½</sup>	0.0037f <sup><sup>1</sup>/<sub>2</sub></sup>	f/200
2GHz to 300GHz	61	0.16	10

(f = frequency in MHz)

2.3 Department of Telecommunications (DoT), Government of India further issued instructions on 8<sup>th</sup> April, 2010 to all the mobile operators regarding implementation of radiation norms on Electro Magnetic Field (EMF) exposure by Base Transceiver Stations (BTSs) by submitting the self certification for each and every BTS. The instructions, inter-alia, include the following:

- (i) All Base Station Transceivers (BTSs) must be self certified as meeting the radiation norms. Self certification is submitted to respective Telecom Enforcement Resource & Monitoring (TERM) Cells of DoT by the telecom service providers.
- (ii) All new BTS sites start radiating only after self certificate has been submitted to relevant TERM Cells.
- (iii) The TERM Cell tests upto 10 per cent of BTS sites randomly at its discretion. Additionally, BTS sites against which there are public complaints are also be tested by TERM Cell.
- (iv) If a site fails to meet the Electro Magnetic Radiation criterion, there is a provision of penalty of Rs.5 lakh (about US\$10,000) per BTS per service provider. Service providers must meet the criterion within one month of the report of TERM Cell in such cases, after which site will be shut down.

2.4 In year 2008, Department of Telecommunications had adopted International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines for mobile handsets also. ICNIRP prescribed the following values for Specific Absorption Rate (SAR) for mobile handset:

For Frequency Range	Whole body average SAR	Localised SAR head &	Localised SAR limbs
10 MHz to 10 GHz	(W/Kg)	trunk (W/Kg)	(W/Kg)
General Public Exposure	0.08	2	4

2.5 For the mobile handsets, DoT, in the year 2008, had issued instructions to the indigenous manufacturers to conform to ICNIRP prescribed Specific Absorption Rate (SAR) limit of 2 W/kg (averaged over 10 gm tissue) in the frequency range of 10 MHz to 10 GHz.

#### 3. Inter-Ministerial Committee

3.1 Subsequently, based on public concern and media reports, Government of India set up an Inter-Ministerial Committee (IMC) on 24.08.2010 consisting of representatives from DoT, Indian Council of Medical Research (Ministry of Health), Department of Biotechnology and Ministry of Environment and Forest to examine the effect of EMF Radiation from mobile base stations and mobile phones.

3.2 Inter-Ministerial Committee (IMC) in its report submitted in the year 2011 examined the environmental and health related concerns and indicated that most of the laboratory studies were unable to find a direct link between exposure to radio frequency radiation and health; and the scientific studies as yet have not been able to confirm a cause and effect relationship between radio frequency radiation and health. The effect of emission from cell phone towers is not known yet with certainty. The interministerial committee (IMC) examined 90 international and national studies/reference papers, related with the EMF radiation, before finalizing its recommendations.

3.3 However, as a precautionary measure, IMC recommended for lowering of the BTS RF exposure limits to  $1/10^{\text{th}}$  of the ICNIRP limit and adoption of Specific Absorption Rate (SAR) level for mobile handsets limits to 1.6 Watt/Kg (averaged over 1 gm of tissue) in place 2.0 Watt/Kg in India.

3.4 The recommendations of the Inter Ministerial Committee were accepted by the Government of India. Accordingly, in respect of BTS, norms for exposure limit for the Radio Frequency Field (Base Station Emissions) were reduced to  $1/10^{th}$  of the limits prescribed by ICNIRP with effect from  $1^{st}$  September 2012. The revised limits/levels for India for BTS Emission is as below:

Frequency Range	E-Field Strength ( Volt/Meter (V/m))	H-Field Strength (Amp/Meter (A/m))	Power Density (Watt/Sq.Meter (W/Sq.m))
400MHz to 2000MHz	0.434f <sup>1/2</sup>	0.0011f <sup>1</sup> / <sub>2</sub>	f/2000
2GHz to 300GHz	19.29	0.05	1

(f = frequency in MHz)

3.5 In respect of Mobile Handsets, the following directions were issued regarding Specific Absorption Rate (SAR) level:

- (i) SAR level for mobile handsets shall be limited to 1.6 Watt/Kg, average over a mass of 1 gram of human tissue.
- (ii) All the new design of mobile handsets shall comply with the SAR level of 1.6 Watt/Kg averaged over a mass of 1 gram tissue with effect from 1<sup>st</sup> September, 2012. However, the mobile handsets with existing designs, which are compliant with 2.0 Watt/Kg averaged over a mass of 10 gram tissue, may continue to co-exist up to 31<sup>st</sup> August 2013.
- (iii) From 1<sup>st</sup> September 2013, only the mobile handsets with revised SAR value of 1.6 Watt/Kg are permitted to be manufactured or imported in India for domestic market.

3.6 DoT has also set-up a laboratory in the Telecommunication Engineering Centre (TEC), for testing of SAR value of mobile handsets imported/manufactured in India.

4. Further, following steps have also been taken by Department of Telecommunications for the awareness of the general public in respect of EMF Radiation:

4.1 General awareness programmes / seminars regarding the steps taken for safety of public health from mobile tower radiation are being conducted by the Associations of Mobile Service Providers in various major cities.

4.2 A 'Precautionary Guidelines for Mobile User' advising to take certain precautions while using/purchasing the mobile handsets has been placed on DoT website.

4.3 An informative guide on 'Mobile Communications-Radio Waves and Safety' has been issued and the same is also available on DoT website. The document covers a basic introduction to radio waves, various terminologies, Do's & Don'ts related to mobile phone usage, clarification of various myths regarding deployment, use of Radio waves / Safety Standards and frequently asked questions relating to Mobile phones & Human health. The document shall help in facilitating the right inputs and creating an environment where everyone can use the radio wave safely.

4.4 <u>Advertisements</u> for ensuring safety from radiations of Mobile Towers & handsets has been issued by DoT which has been published in National & <u>Regional</u> Newspapers.

4.5 A Complaint Handling System for Electro Magnetic Field (EMF) Radiation from Mobile Towers has also been launched by DoT in October 2012 in Mumbai. The online facility is available on DoT website <a href="http://www.dot.gov.in/">www.dot.gov.in/</a> through a link "Public Grievance – EMF Radiation".

4.6 Guidelines for State Government / Local Bodies for issue of clearance for installation of mobile towers at various locations in the licensed service area are under finalization. Similarly, various parameters to be checked by TERM Cell units to monitor the Radiation levels are also under finalization.

4.7 Various steps being taken by the Government of India regarding EMF related issues are available on DoT website <u>www.dot.gov.in</u> under the caption "Journey to EMF".

4.8 Surprise test checks of BTS sites are also carried out by DoT to verify the compliance to revised norms. During surprise check by DoT's TERM Cell Unit more than 100 BTS sites in many parts of the country including Mumbai were found radiating at much higher level than prescribed between the period September 2012 to March 2013.

#### 5. Further Indian Initiatives on Scientific Assessment

5.1 Government of India, Department of Science & Technology (DST) has constituted a committee on 01.10.2012 under the Chairmanship of Former Director General of Indian Council for Medical Research (ICMR), having members from Indian Institute of Technology (IIT) Chennai, Indian Institute of Toxicology Research, Lucknow, Department of Telecom, Ministry of Environment & Forest, ICMR and Department of Science & Technology to examine the possible harmful effects from Cell towers on the population living in the vicinity and for developing the frame of reference for calling out Request For Proposals (RFP) for scientific assessment of health hazards and adverse impact on ecology.

5.2 The Committee has invited R&D proposals in June 2013 on the possible impact of EMF radiation exposure from mobile towers and handsets on life (humans, living organism, flora & fauna and environment) and related initiatives. Eligible Scientist / Organizations – public or private, individually or in collaboration have been requested for submission of their proposal on or before 14<sup>th</sup> August 2013.

#### 6. Submissions

6.1 In a latest development, an Indian Delegation from DoT, Government of India had visited Geneva from 19 to 22 Feb. 2013 to discuss EMF Radiation related health issues with WHO Secretariat and Technical standards with ITU.

6.2 WHO officials suggested that lowering of the EMF radiation limit alone may not be adequate to achieve the desired results, though a strong regulation on siting of BTS Tower antennae could be more important. Few countries have imposed restrictions specifying the horizontal distance in regards to the installation of base station Antenna from sensitive locations in the urban planning itself.

6.3 Indian scenario with more than 10 mobile operators in each service area along with high population density is quite different from Europe

6.4 Officials from International Agency on Cancer Research (IARC) at Lyon, France indicated that in Europe Mobile Towers are not considered as a threat as Antennas are at higher levels /heights and fairly distant apart.

6.5 However, the conditions in India and other developing countries are totally different from those in Europe in terms of:

- mobile phone usages,
- number of operators,
- higher levels of population density,
- in-organic growth in urban areas,
- narrow lanes separating buildings,
- lower body mass index,
- lower fat content,

- lesser spectrum per operator,
- radiated power being 20 Watt per sector,
- higher levels of RF exposure on account of multiple operators having BTSs on same tower, and
- Antennas mounted at lower heights etc.
- Poor coverage conditions also lead handsets to operate at higher levels of power
- Outsourcing of infrastructure installation & maintenance to third parties by operators
- Inadequate technical expertise at field level and local authorities to understand exclusion zone calculations based on ITU K series recommendations. This also needs to be seen in the background of monitoring requirements extending to 0.747 million BTSs as in Annexure II.

Some of the typical Wall mounted BTS installation photographs are enclosed in the **Annex** from city of Mumbai, India.

6.6 During discussions on Indian scenario, IARC felt that their present research that is addressing only Mobile Handsets may have to be reassessed to include Mobile Towers also.

6.7 A research project focusing on measurements of exposure levels from base stations in densely populated areas and areas covered by many base stations, level of usage, and measurements of emissions from regular and counterfeit mobile phones, was considered to be of great scientific interest by IARC. Based on the suggestions from IARC, Mobile Handset usage study was taken up by licensor in India.

6.8 DoT obtained the latest version of ITU's EMF estimator Software and organized an ITU Workshop on 21<sup>st</sup> & 22<sup>nd</sup> May 2013 at Delhi. The Workshop has facilitated Indian Telecom Service Providers for better evaluation on the human exposure to electromagnetic field from multiple sources of communication installation, and for taking steps to reduce the radiation levels in the areas around transmitting stations.

6.9 Minutes of Usage/ Hours of Mobile Hand Usage by Indian Service Providers has been collected from Indian Mobile Operators across various Licensing Service Areas, based on IARC suggestion as in Para 6.7 above. The detailed data is enclosed as **Annex 10C**. There are 22 Licensed Service Areas and on an average, there are 10 Mobile Operators in each Licensed Area.

6.10 Typical Results show that on an average more than 100,000 Mobile users of one operator in one licensed service area have about 2 hours of mobile usage per day. Taking on an average 10 operators in all the 22 service area in India, at least 20 million mobile users have mobile usage of 2 or more hours per day.

6.11 In Europe, the tariff for mobile service is higher than fixed telephone service and the Tele-density for both Mobile & Fixed Lines phones is comparable to the level of 100+ in Europe and that explains lower levels of usage of mobile.

6.12 Whereas, in developing countries the tariff for Mobile & Fixed telephone is almost same and teledensity for mobile telephones are generally above 90% whereas it is less than 10% for Fixed telephones.

6.13 The usage in Indian study is many folds higher than Inter Phone Study inputs that are referenced in IARC's Monograph 102 on EMF published on 24/4/2013 which on Page 421 (Chapter 6 on Conclusions) states "Radiofrequency Electromagnetic fields are possibly carcinogenic to humans (Group 2B)."

6.14 IARC and WHO need to go further from IARC Monographs' 102 findings with focus on latest available inputs from developing world outside Europe. Inputs from Indian Case Study as above, is an example.

6.15 ITU needs to have a relook at all EMF related initiatives through Study Groups. Possibly a new ITU Focus Group on 'EMF Radiation & Health Issues' cutting across ITU-T, ITU-R and ITU-D needs to be constituted.

6.16 Though ITU Recommendations on EMF calculations including exclusion zone distance calculations and EMF Estimator Software are available, but further up-gradation of the software is required. India has already written to Secretary General (ITU) & Director TSB (ITU) with a request to make it more user friendly and a special feature incorporating acceptance of Excel data based BTS data inputs by EMF Estimator software and avoiding manual keying of all the data. Further, linkages with 3D maps have also been requested.

6.17 An ITU Handbook on EMF Radiation should also be taken up by ITU-D under Q 23/1 or proposed Focus Group. It can include ITU's generic guidelines on EMF including safe distances to be maintained for populated location directly falling within the main radiated lobe coverage based on typical shared sites radiating at say 20 Watts/ sector along with other safe usage instructions. The Handbook should also include "How to minimize exposures to EMF Radiations from Mobile Towers and handsets", Do's& Don't related to mobile phone usage, clarifications on various myths regarding deployment, use of Radio waves / Safety Standards and frequently asked questions relating to Mobile phones & Human health. The Handbook shall help in facilitating the right inputs for world telecom community and create an environment where everyone can use the radio wave safely.

# Annex 10A: Wireless / Landline subscribers as on 31<sup>st</sup> March 2013 service area wise in India

SI No.	License Service Area	Number of Wireless Subscriber	Number of Landline Subscriber	
1	Andhra Pradesh	64363622	2239363	
2	Assam	14387664	194395	
3	Bihar	60301859	394129	
4	Delhi	40426200	2962600	
5	Gujarat	51693364	1792030	
6	Haryana	19543589	560474	
7	Himachal Pradesh	7015343	280669	
8	Jammu & Kashmir	6844607	196811	
9	Karnataka	52914789	2443394	
10	Kerala	30692668	3064818	
11	Kolkata	21260064	1144255	
12	Madhya Pradesh	52164292	1120350	
13	Maharashtra	68400365	2466496	
14	Mumbai	30372793	2985057	
15	North East	8960542	189884	
16	Orissa	24601935	374427	
17	Punjab	29462871	1320185	
18	Rajasthan	48601130	1011041	
19	Tamil Nadu (incl. Chennai)	72412392	3109695	
20	Uttar Pradesh (East)	73824150	1048303	
21	Uttar Pradesh (West)	48399485	767118	
22	West Bengal	41159859	548248	
	Total	867803583	30213742	

Total number of subscriber	:	898,017,325
Percentage of Mobile (Wireless) subscriber	:	96.6 %
Percentage of Landline (Wire-line) subscriber	:	3.4 %

# Annex 10B: Number of base stations (service area wise) in India as on 31<sup>st</sup> May 2013

SI No.	Service Area	Number of BTS		
1	Andhra Pradesh	60285		
2	ASSAM	14152		
3	Bihar	44283		
4	Delhi	30900		
5	Gujarat	45950		
6	Haryana	17604		
7	Himachal Pradesh	7021		
8	Jammu & Kashmir	11115		
9	Karnataka	54307		
10	KERALA	32658		
11	Kolkata	19609		
12	MAHARASHTRA	64354		
13	Madhya Pradesh	46423		
14	MUMBAI	25535		
15	North East	8634		
16	Orissa	20795		
17	Punjab	26959		
18	RAJASTHAN	35560		
19.1	Tamil Nadu excluding Chennai	45484		
19.2	Chennai	21835		
20	Uttar Pradesh (East)	45176		
21	Uttar Pradesh (West)	37883		
22	West Bengal	30080		
	Total	746602		

# Annex 10C

Licensing	Top 100	Top 500	Top 1000	Top 5,000	Top 10,000	Top 50,000	Top 100,000
Area	Subsribers						
	Average						
LA1	8.42	6.55	5.90	4.58	4.08	3.03	2.61
LA2	9.57	7.16	6.23	4.36	3.67	2.32	1.83
LA3	7.83	6.33	5.74	4.46	3.97	2.92	2.50
LA4	9.62	6.71	5.84	4.27	3.72	2.62	2.20
LA5	9.12	6.82	6.02	4.50	3.94	2.82	2.40
LA6	11.30	7.97	6.81	4.67	3.97	2.65	2.17
LA7	7.36	5.50	4.83	3.47	2.94	1.84	1.44
LA8	6.19	4.90	4.39	3.25	2.80	1.81	1.43
LA9	7.97	6.19	5.55	4.18	3.64	2.46	1.98
LA10	8.98	6.70	5.95	4.52	4.00	2.93	2.52
LA11	8.03	5.85	5.11	3.70	3.18	2.13	1.72
LA12	8.80	6.53	5.77	4.31	3.76	2.59	2.12
LA13	10.94	7.79	6.73	4.90	4.25	2.92	2.42
LA14	13.93	9.87	8.45	5.76	4.84	3.08	2.45
LA15	8.23	5.93	5.27	3.95	3.44	2.39	1.98
LA16	7.03	5.18	4.61	3.45	3.00	2.01	1.62
LA17	6.62	5.42	4.93	3.86	3.41	2.44	2.05
LA18	10.46	7.50	6.55	4.81	4.18	2.91	2.42
LA19	9.08	6.73	5.90	4.37	3.83	2.71	2.28
LA20	10.94	7.50	6.46	4.69	4.10	2.93	2.49
LA21	9.20	6.96	6.24	4.87	4.33	3.18	2.71
LA22	8.98	6.36	5.57	4.15	3.61	2.45	1.99
LA23	8.20	6.27	5.60	4.24	3.71	2.59	2.14

GSM SERVICE PROVIDER "B" WITH DATA for 22 LICENSING AREAS MOBILE									
HANDSET USAGE IN HOURS/ DAY									
Licensing	Top 100	Top 500	Top 1000	Top 5,000	Top 10,000	Тор 50,000	Тор 100,000		
Area	Subsribers	Subsribers Average	Subsribers	Subsribers	Subsribers	Subsribers	Subsribers Average		
	Average		Average	Average	Average	Average			
LA1	9.72	6.46	5.43	3.62	2.98	1.77	1.36		
LA2	11.66	8.61	7.42	5.08	4.25	2.57	1.95		
LA3	10.86	8.00	7.08	5.24	4.51	2.92	2.31		
LA5	12.86	8.82	7.48	5.11	4.29	2.64	2.01		
LA6	13.42	8.43	6.92	4.40	3.58	2.07	1.57		
LA7	8.58	5.66	4.76	3.03	2.40	1.17	0.78		
LA8	10.04	7.23	6.25	4.37	3.66	2.16	1.57		
LA9	13.34	9.89	8.40	5.52	4.51	2.46	1.65		
LA10	8.73	6.13	5.25	3.55	2.92	1.68	1.25		
LA11	7.81	5.04	4.20	2.62	2.05	0.94	0.59		
LA12	12.66	8.04	6.66	4.37	3.61	2.16	1.62		
LA13	14.96	10.84	9.14	6.23	5.32	3.59	2.93		
LA14	12.41	7.72	6.45	4.26	3.51	2.05	1.52		
LA15	14.92	7.75	6.12	3.82	3.12	1.84	1.40		
LA16	10.92	7.93	6.73	4.40	3.55	1.87	1.29		
LA17	11.09	7.95	6.89	4.80	4.03	2.45	1.86		
LA18	8.89	6.39	5.45	3.67	3.03	1.71	1.22		
LA19	13.00	7.88	6.40	4.20	3.48	2.07	1.55		
LA20	8.08	5.77	5.01	3.54	2.99	1.87	1.46		
LA21	11.31	8.05	6.97	4.90	4.14	2.51	1.88		
LA22	10.35	7.31	6.27	4.27	3.52	1.96	1.40		
LA23	11.08	7.96	6.80	4.67	3.95	2.56	2.04		
Average	11.21	7.63	6.46	4.35	3.61	2.14	1.60		

CDMA SERVI	CDMA SERVICE PROVIDER "C" WITH DATA for 22 LICENSING AREAS MOBILE HANDSET USAGE IN HOURS/ DAY							
Licensing	Top 100	Top 500	Top 1000	Top 5,000	Top 10,000	Top 50,000	Top 100,000	
Area	Subsribers	Subsribers	Subsribers	Subsribers	Subsribers	Subsribers	Subsribers	
	Average	Average	Average	Average	Average	Average	Average	
LA1	7.57	5.41	4.95	3.93	3.25	1.92	1.48	
LA3	9.25	6.99	6.17	4.55	3.91	2.53	2.00	
LA4	8.57	5.98	5.19	3.52	2.87	1.62	1.17	
LA5	5.40	3.85	3.24	2.12	1.71	0.90	0.59	
LA6	9.93	8.13	6.84	4.85	4.04	2.31	1.74	
LA7	8.37	5.50	4.70	3.15	2.60	1.54	1.16	
LA8	4.35	3.00	2.50	1.50	1.11	0.39	0.20	
LA10	0.06	0.01	0.01	0.00	0.00	0.00	0.00	
LA11	4.60	3.41	2.95	2.00	1.64	0.90	0.63	
LA12	6.54	4.82	4.35	2.96	2.37	1.31	0.95	
LA13	8.68	6.14	5.41	4.17	3.43	1.91	1.42	
LA14	9.67	6.93	6.04	4.48	3.82	2.36	1.81	
LA15	8.65	5.95	5.21	3.75	3.14	1.96	1.54	
LA17	5.46	3.98	3.41	2.27	1.82	0.92	0.59	
LA18	6.85	4.52	3.75	2.36	1.88	0.91	0.57	
LA19	9.42	7.36	6.15	4.48	3.75	1.84	1.26	
LA20	5.37	3.90	3.37	2.33	1.95	1.16	0.85	
LA21	10.12	7.15	6.18	4.43	3.76	2.36	1.82	
LA22	8.49	6.17	5.45	3.88	3.21	1.83	1.34	
LA23	7.73	5.54	4.74	3.12	2.53	1.33	0.93	
Average	7.25	5.24	4.53	3.19	2.64	1.50	1.10	

GSM SERVICE PROVIDER "D" WITH DATA for 18 LICENSING AREAS MOBILE											
	HANDSET USAGE IN HOURS/ DAY										
Licensing Area	Top 100	Top 500	Top 1000	Top 5,000	Top 10,000	Top 50,000	Top 100,000				
	Subsribers	Subsribers	Subsribers	Subsribers Average	Subsribers	Subsribers	Subsribers				
	Average	Average	Average		Average	Average	Average				
LA1	9.26	6.72	5.61	3.54	2.83	1.54	1.13				
LA2	9.69	7.46	6.55	4.64	3.89	2.36	1.81				
LA3	10.50	8.16	7.23	5.36	4.59	2.90	2.20				
LA4	7.70	5.24	4.48	3.15	2.69	1.78	1.44				
LA5	12.20	9.13	7.88	5.29	4.38	2.56	1.90				
LA8	7.81	5.71	4.88	3.16	2.46	1.09	0.70				
LA9	12.59	9.56	8.40	6.09	5.22	3.34	2.56				
LA10	8.05	5.72	4.94	3.38	2.81	1.68	1.26				
LA11	9.81	7.08	6.04	4.08	3.38	1.97	1.46				
LA13	8.72	5.74	4.66	2.86	2.27	1.20	0.86				
LA15	7.64	5.47	4.69	3.14	2.59	1.50	1.12				
LA16	8.48	5.98	5.11	3.44	2.84	1.72	1.33				
LA17	10.06	7.60	6.65	4.73	3.98	2.36	1.75				
LA18	6.57	4.11	3.28	1.76	1.29	0.56	0.35				
LA19	8.91	6.87	6.03	4.15	3.43	1.98	1.48				
LA20	9.04	6.45	5.63	4.16	3.65	2.62	2.22				
LA21	10.93	8.29	7.29	5.30	4.53	2.86	2.19				
LA22	9.72	6.98	6.02	4.23	3.58	2.22	1.68				
Average	9.32	6.79	5.85	4.03	3.36	2.01	1.52				

GSM SERVIC	E PROVIDER "E	" WITH DATA fo	or 6 LICENSING	AREAS			MOBILE			
	HANDSET USAGE IN HOURS/ DAY									
Licensing Area	Top 100	Top 500	Top 1000	Top 5,000	Top 10,000	Top 50,000	Top 100,000			
	Subsribers	Subsribers	Subsribers	Subsribers	Subsribers	Subsribers	Subsribers Averag			
	Average	Average	Average	Average	Average	Average				
LA1	9.95	7.13	6.19	4.34	3.68	2.40	1.92			
LA3	11.65	9.20	8.25	6.20	5.41	3.67	2.94			
LA6	13.90	10.85	9.38	6.35	5.31	3.34	2.63			
LA13	11.77	8.84	7.57	5.20	4.39	2.83	2.2			
LA21	12.21	9.69	8.71	6.66	5.88	4.21	3.5			
LA22	12.18	9.52	8.50	6.43	5.63	3.91	3.2			
Average	11.94	9.21	8.10	5.86	5.05	3.39	2.75			

GSM SERVICE PROVIDER "F" WITH DATA for 3 LICENSING AREAS : MOBILE							
	HANDSET USAGE IN HOURS/ DAY						
Licensing Area	Top 100	Top 500	Top 1000	Top 5,000	Top 10,000	Top 50,000	Top 100,000
	Subsribers	Subsribers	Subsribers	Subsribers	Subsribers	Subsribers	Subsribers Average
	Average	Average	Average	Average	Average	Average	
LA6	9.14	5.83	4.71	2.72	2.05	0.92	0.61
LA7	10.55	7.56	6.46	4.22	3.36	1.61	1.05
LA14	11.17	8.45	7.27	4.90	4.01	2.17	1.46
Average	10.29	7.28	6.15	3.94	3.14	1.57	1.04

SERVICE PROVIDER "A to F" WITH DATA for 94 LICENSING AREAS MOBILE HANDSET USAGE							
			IN HOURS/ DAY	r			
Licensing Area	Top 100*94	Top 500*94	Top 1000*94	Top 5,000*94	Тор	Тор	Тор
					10,000*94	50,000*94	100,000*94
	Subsribers Average	Subsribers Average	Subsribers Average	Subsribers Average	Subsribers	Subsribers	Subsribers
					Average	Average	Average
Average Hours/	9.44	6.79	5.86	4.11	3.46	2.15	1.67
Day for Service							
Provider							
Subscribers	9,400	47,000	94,000	470,000	940,000	4,700,000	9,400,000
Mobile Handset	292.74	210.49	181.78	127.47	107.39	66.73	51.81
Usage in Hours /							
Month							
Mobile Handset	3,512.88	2,525.88	2,181.34	1,529.65	1,288.66	800.78	621.74
Usage in Hours /							
Year							

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# II. List of Contributions

- 1. Côte d'Ivoire <u>www.itu.int/md/D10-SG01-INF-0034/</u>
- 2. Brazil www.itu.int/md/D10-SG01-C-0088/
- 3. Republic of Korea <a href="http://www.itu.int/md/D10-SG01-C-0181/">www.itu.int/md/D10-SG01-C-0181/</a>
- 4. Israël <u>www.itu.int/md/D10-SG01-C-0135/</u>
- 5. Venezuela <u>www.itu.int/md/D10-SG01-C-0082</u>/
- 6. Hungary <a href="www.itu.int/md/D10-RGQ23.1-C-0015/">www.itu.int/md/D10-RGQ23.1-C-0015/</a>
- 7. Uzbekistan <u>www.itu.int/md/D10-SG01-INF-0018/</u>
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