

Regulatory Framework for RF Safety in Mauritius



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Friday, September 04, 2009

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This Session

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 - Base Station Site Selection
 - Base Station authorisation process
 - Exposure Limits adopted by the ICT Authority
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Part I: Background

- The ICT Authority issues licences to deploy and operate wireless (Radio Frequency) networks.
- The licensees have to comply with conditions related to use of spectrum, power levels, out-of-band emissions, Quality of Service, Roll-out obligations among others.
- While the Authority issues licences, it attempts to fulfill one of its main objectives, which is to encourage the optimum use of information and communication technologies in business, industry and the country at large, introduction of new technology and the investment in infrastructure and services

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Background

- Under section 18(1)(n) of the ICT Act 2001 (as amended), the ICT Authority has the function to *“ensure the safety and quality of every information and communication services including telecommunication service and, for that purpose, determine technical standards for telecommunication network, the connection of customer equipment to telecommunication networks”*

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Concerns Raised about Radio Base Stations (RBS)

- Effects on Health
- Effects on the Environment (Aesthetic)
- Effects on TV reception
- Effects on other electronic equipment (Electromagnetic Compatibility (EMC))

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Radio Base Station (RBS) Site Selection

- Radio Base Stations are installed in order to provide network coverage and capacity
- When operators select a RBS site the following main criteria are considered:-
 - The geographic area the planned service must cover;
 - The amount of usage the planned service must handle;
 - Interference from and to adjacent sites;
 - The physical terrain;
 - The availability of land or rooftops;
 - Cost factors
 - Rules and Regulations in place

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Radio Base Station (RBS) Site Authorisations

Typical Base Station installed on a Roof top

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ICTA Actions to ensure safety

- Authorize Base Stations prior to their setting up
- Measure Human Exposure to EMF according to adopted measurement protocol

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ICTA Base Station Authorisation Process

An operator having been issued with a building permit, may not install its antennas and operate the base station without the express authorisation of the Authority

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Exposure Limits Adopted by the ICT Authority

- The International Commission on Non-Ionizing Radiation (ICNIRP) limits have been adopted by the ICT Authority as the reference limits for general public exposure pursuant to section 18(1)(n) of the ICT Act 2001 (as amended) and in accordance with the ITU-T Rec.K.52

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Exposure Limits Adopted by the ICT Authority (cont'd)

Source: WHO © ICT Authority of Mauritius

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Numerical Far-Field RF exposure Evaluation - Principles

- The power from base station antennas is radiated in conical fan-shaped beams essentially directed towards the horizon with a slight downward tilt
- The beams from the antennas spread out with distance and reach the ground level at distances in the range 50-300m. The radio wave levels at these distances are much less than those directly in front of the antennas and can easily be calculated

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Numerical Far-Field RF exposure Evaluation - Principles

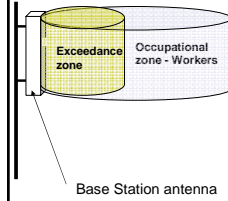
- The Authority uses ITU-T Rec.K.52 for numerical far-field RF exposure evaluation
- This recommendation seeks to provide the techniques and procedures for assessing the compliance of telecommunication installations with national or international EMF safety limits such as the ICNIRP limits

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Numerical Far-Field RF exposure Evaluation – Exposure zones



- EMF exposure assessment should be performed for all locations where people might be exposed to EMF
- Compliance zone – potential exposure to EMF below the applicable limits for general public
- Occupational zone – potential exposure to EMF is below the applicable occupational limits but above the general public limits
- Exceedance zone – potential exposure to EMF exceeds both occupational and general public limits.

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Numerical Far-Field RF exposure Evaluation - procedure

- The assessment of the exposure level shall consider:-
 - The worst emission conditions;
 - The simultaneous presence of several EMF sources, even at different frequencies
- The following parameters should be considered:-
 - The maximum EIRP of the antenna system
 - The antenna gain
 - The frequency of operation; and
 - Various characteristics of the installation, such as antenna location, antenna height, beam direction, beam tilt and the assessment of the probability that a person could be exposed to the EMF

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Numerical Far-Field RF exposure Evaluation – Installation Classification Scheme

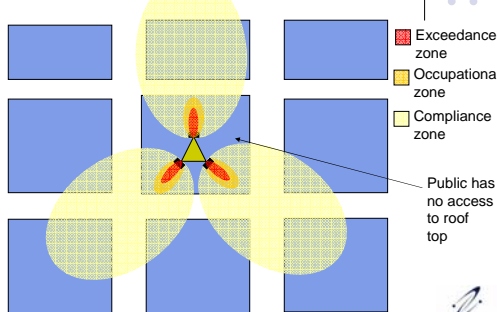
- **Inherently compliant:** These installations produce fields that comply with relevant exposure limits a few centimetres away from the source. Particular precautions are not necessary
- **Normally compliant:** These installations contain sources that produce EMF that can exceed relevant exposure limits. However as a result of normal installation practices and typical use of these sources for communication purposes, the exceedance zone of these sources is not accessible to people under ordinary conditions. Examples include antennas mounted on sufficiently tall towers or narrow-beam earth stations pointed at the satellite

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Numerical Far-Field RF exposure Evaluation – Installation Classification Scheme



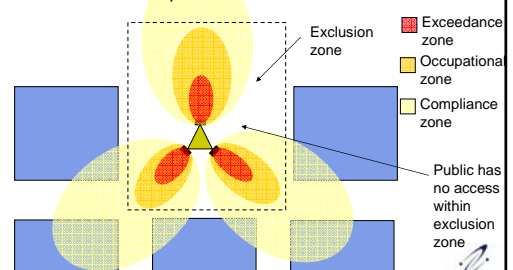
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Normally compliant installation



Numerical Far-Field RF exposure Evaluation – Installation Classification Scheme

- **Provisionally compliant:** These installations require special measures to achieve compliance



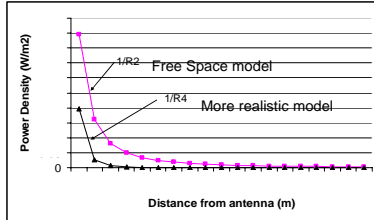
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Provisionally compliant installation



Numerical Far-Field RF exposure Evaluation – Determination of Class of installation

The ITU-T Rec. K.52 is based on a Free Space model. This implies a worst case evaluation.



[ITU-T K.52 procedure](#) (click)

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In-Situ Measurement

- The ICT Authority has adopted an in-situ measurement protocol for the determination of RF fields in the vicinity of RBS for the purpose of determining general public exposure to RF fields
- The protocol is mainly based on ECC Rec. (02)(04) and on IEC standard 62232
- Measurements are carried out in the far-field, i.e. at a distance much greater than the wavelength
- Hence only Electric Field Strength (V/m) is measured

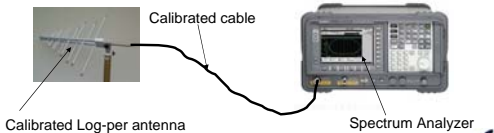
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In-situ measurement Equipment

- The Authority carries out frequency selective field measurements
- [Measurement Process](#) (click)
- This technique employs spectrum analysis or channel decoding to isolate and identify RBS source frequencies.



$$E \text{ [dB}\mu\text{V/m]} = P_{\text{meas}} \text{ [dBm]} - 13 + L_{\text{cable}} \text{ [dB]} + K_{\text{ant}} \text{ [dB/m]}$$

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Measurement Procedures – The sweeping method

- The sweeping method is used to find the maximum field values within a volume such as a room.
- With a view to ensuring reproducible measurements, only emitted time invariant signals or parts thereof are suitable to be measured (e.g. The Broadcast Control Channel (BCCH) for GSM)

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Accurate measurements

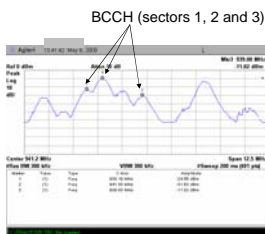
- Accurate measurements are highly dependent on:-
 - A sound knowledge of the technology (e.g. DVB-T, UMTS, GSM, DECT, WiMAX, etc...)
 - Correct adjustments of the spectrum analyzer (i.e. Frequency range (span), Resolution Bandwidth, Video Bandwidth, Sweep time, detector type, etc...)

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Accurate Measurements (Example 1: GSM)



PRINCIPLE

- Measure time constant channels (BCCH)
- Extrapolate their exposure to the maximal channel number
- Ignore TCH exposure
- Summarize exposures of all sectors

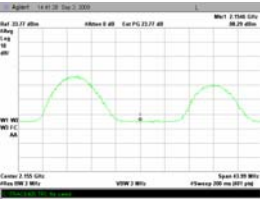
BCCH is transmitted with constant power regardless of present traffic

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Accurate Measurement (UMTS)



- Operators can be separated by different frequencies
- Different stations cannot be separated (Single Frequency Network (SFN))
- Present load is not known
- Either measure exposure to P-CPICH, through decoding, and extrapolate or assume "no traffic load" and extrapolate (P-CPICH usually make up 10% – 15% of maximum power)

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Measurement Uncertainty

Component	Influence factor	Specified uncertainty (k=1)	Distribution	Division factor	Standard uncertainty (k=1) (k=2)
Spectrum Analyser	Frequency	0.5	Normal (k=2)	2	0.25
Spectrum Analyser	Resolution	1	Normal (k=2)	2	0.5
Spectrum Analyser	Amplitude Accuracy	1	Normal (k=2)	2	0.5
Spectrum Analyser	Input Attenuator Switching Uncertainty	1.5	Normal (k=2)	2	0.75
Spectrum Analyser	Resolution Bandwidth Accuracy	0.04	Normal (k=2)	2	0.02
Spectrum Analyser	Gain	0.5	Normal (k=2)	2	0.25
Spectrum Analyser	Compression	0.5	Normal (k=2)	2	0.25
Spectrum Analyser	Resolution Bandwidth Switching Uncertainty	0.5	Normal (k=2)	2	0.25
Antenna	Calibration uncertainty	0.5	Normal (k=2)	2	0.25
Antenna	Calibration	1.0	Normal (k=2)	2	0.5
Repeatability	Lineal	2.5	Normal (k=2)	2	1.15
Repeatability	Repeatability	1.0	Normal (k=2)	2	0.5
Combined standard uncertainty, $u_c(X) = \sqrt{\sum_{i=1}^N c_i^2 u_{i,c}^2}$ where $c_i = 1$					1.62
Expansion factor $k=2$					1.96
Expanded uncertainty (k=2) $U = k \cdot u_c(X)$					3.18

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Evaluating Compliance of RBS to Reference levels

- Once measurements have been carried out for all frequency bands, the total exposure quotient is calculated based on power flux density as follows:-

$$\sum_{i=1}^N \frac{S_i^{mcas}}{S_i^{guid}} = \frac{S_1^{mcas}}{S_1^{guid}} + \frac{S_2^{mcas}}{S_2^{guid}} + \frac{S_3^{mcas}}{S_3^{guid}} + \dots + \frac{S_N^{mcas}}{S_N^{guid}} < 1$$

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Part II: DEMONSTRATION (Measuring Exposure to UMTS)

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Exposure evaluation

- [emf meas.xls](#)

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Part III: The consultation

- The objectives of this consultation are to firstly take stock of the difficulties, concerns and views of all relevant stakeholders as well as the actions they are already undertaking in the area of concern
- Secondly reflect on the measures which may be taken collectively in view of addressing the said difficulties and concerns with the primary aim of re-establishing public confidence in radio infrastructures and their operations.

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Who should contribute?

- You are all encouraged to participate actively in this consultation process
- The Authority will also encourage the general public to give its views and to contribute

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Scope

- The scope of the consultation is limited to Radio Base Stations as such customer equipment, including mobile phones, are not included given that the concerns are different.

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Expected Outcome of Consultation

- The main deliverable of the consultation is expected to be a set of recommendations concerning the following non-exhaustive aspects:-
 - How to communicate with the public on issues of RF safety in a transparent manner
 - How to deal with complaints
 - How to take precautionary measures
 - Which RF safety radiation limit to adopt
 - Base stations site selection guidelines
 - Ways and means of reassuring the public
 - Involving the public in the base station site selection process
 - Evaluation of RF radiation through calculations, simulations and measurement

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How to contribute?

- Through the ICTA discussion Forum – [RF Radiation, Heath and the Environment](#)
- OR
- *By email – icta@intnet.mu*
- OR
- *Send a letter – The Executive Director
ICT Authority
12th Floor, The Celicourt
6 Celicourt Antelme Street
Port-Louis*

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Thank You



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