Assesment of the Urban Electromagnetic Environment for Home Telemedicine

V. Ramos, **N. Carranza**,
J. García, J. L. Monteagudo

Telemedicine and Information Society Research Area
Health Institute Carlos III

Outline

1. Introduction
2. Material and Methods
    - 2.1. Measuring Method
    - 2.2. Data Analysis
3. Results
4. Discussion and Conclusions

Instituto de Salud Carlos III

Introduction

- Increasing popularity of wireless technologies
  - Wi-Fi, Wi-Max, cell phones, cordless phones…
- Wireless technology is changing
  - Exposure characteristics (frequency and modulation)
  - Usage pattern (phone, text messaging, web surfing)
  - Antennas closer to the hand or body
- Unprecedent levels of electromagnetic fields
- Background level of Electromagnetic Fields has risen exponentially

Instituto de Salud Carlos III

Introduction

- Advances in telemedicine instrumentation. Examples:
  - Body-attached sensors with built-in wireless telemetry
  - Pacemakers with wireless telemetry
  - Wireless transmision of ECG
  - ...

Large number of wireless links coexist in the same area

Electromagnetic environment is shared

Instituto de Salud Carlos III

Introduction

Questions

- Are there interferences between telemedicine systems and wireless links?
- Is the use of home telemedicine systems safe?
- Are the electromagnetic environments actually present in urban homes characterized?

Instituto de Salud Carlos III

Introduction

ABOUT MEDICAL EQUIPMENT

- ✓ International Electrotecnical Commission (IEC) Standard IEC 60601-1-2
- ✓ Minimum immunity level of 3 (V/m) for non-life supporting devices
- ✓ The device is still expected to work properly and failures are only allowed to very strict tolerances

Instituto de Salud Carlos III

Introduction

✓ International guidelines for limiting exposure to electromagnetic fields → ICNIRP 98

✓ Standards to cope with human exposure, for Medical devices EMC → IEC 60601-1-2

☹ Standars do not cover the emerging home telemedicine scenarios

☹ Literature is scarce on data for measured EM environments in home telemedicine and EMC

Instituto de Salud Carlos III

Introduction

Objetives

- ✓ Measures of Electromagnetic Fields in urban homes
- ✓ Reporting common sources and levels of RadioFrequency emmisions in the environment
- ✓ Characterization of electronic environments present in urban homes
- ✓ Potential safe use of home telemedicine systems

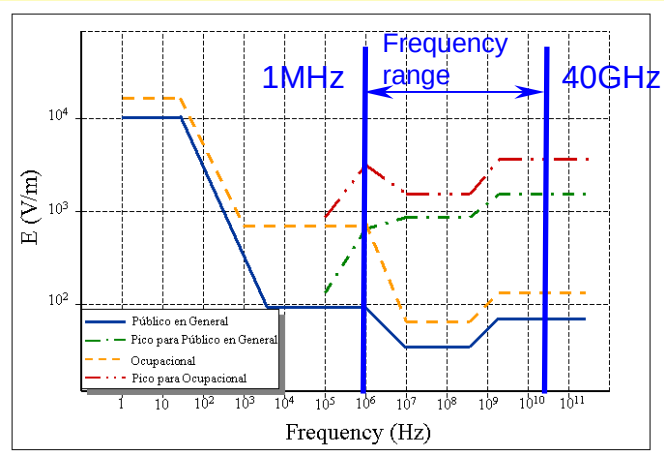
Instituto de Salud Carlos III

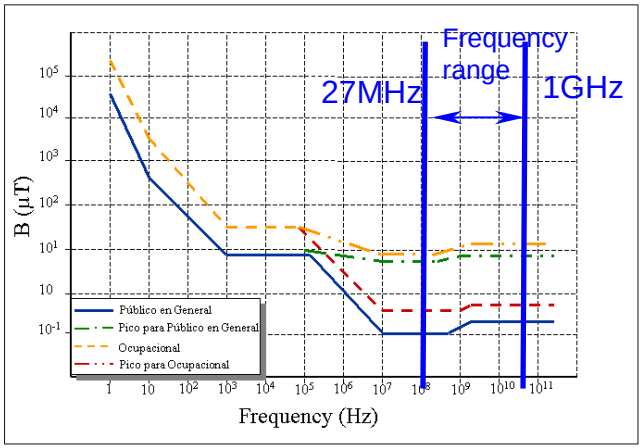
Material and Methods

Initial Measures in Madrid. Years 2003 and 2004

Radman XT
Radiation Monitor

- Measures according to the standard ICNIRP-98
- Frecuency range
  - E field, 1 MHz – 40 GHz
  - H field, 27 MHz – 1 GHz
- The Resolution of the data is 0,625% of the standard limit value
- Measure the strongest field component isotropically,





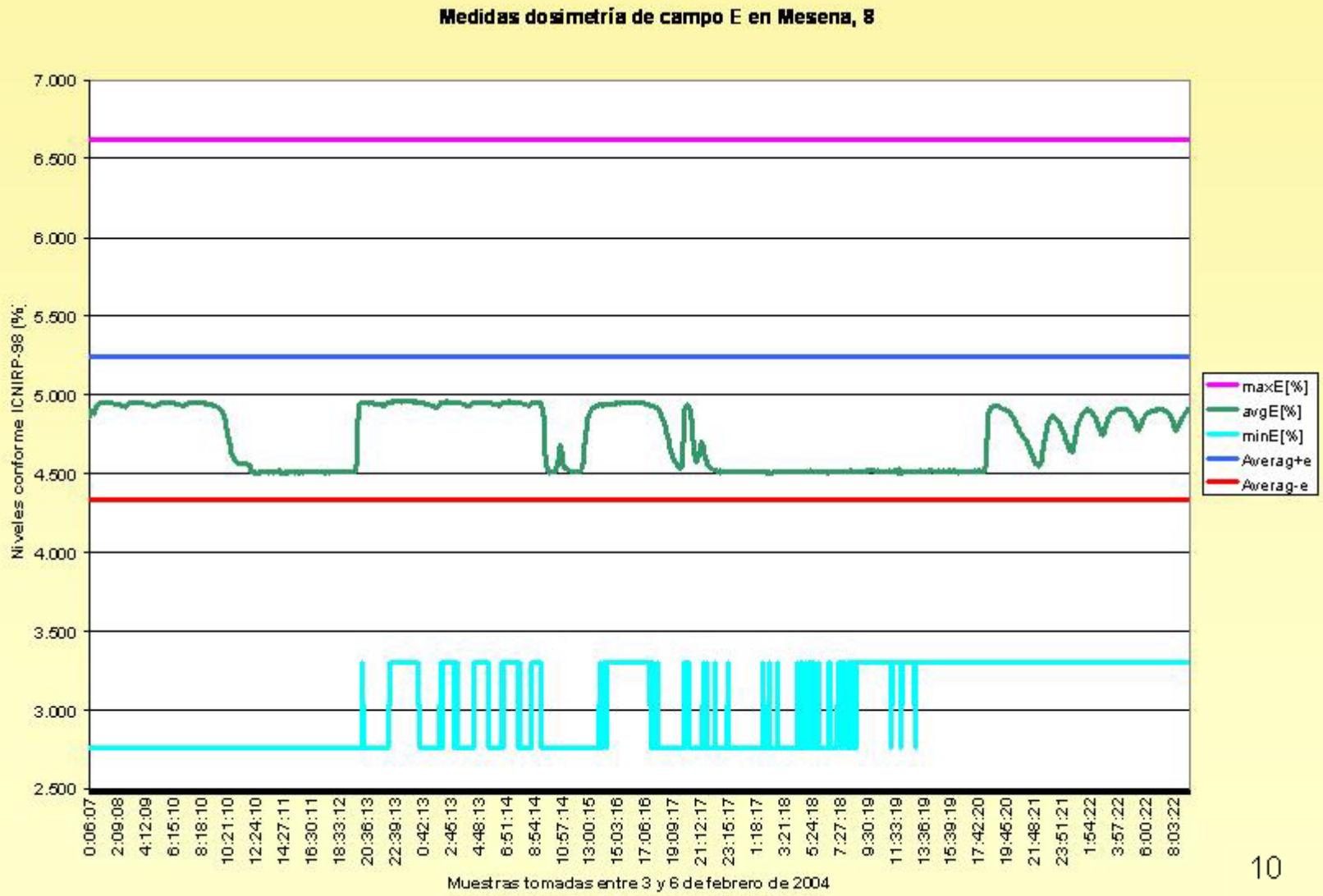
Instituto de Salud Carlos III

Material and Methods

- ✓ Measures performed at 46 sites in Madrid
- ✓ Obtained the E and H maxima, average and minima
- ✓ Store interval set at 3 minutes
- ✓ Recorded values for 3.5 days

Instituto de Salud Carlos III

Material and Methods



Instituto de Salud Carlos III

Material and Methods

- ✓ Measures performed at 46 sites in Madrid
- ✓ Obtained the E and H maxima, average and minima
- ✓ Store interval set at 3 minutes
- ✓ Recorded values in 3 days

- ✓ Results:
  - ✓ Baseline levels are safe in accordance to ICNIRP-98
  - ✓ Levels stable with time, no related to the location in the city

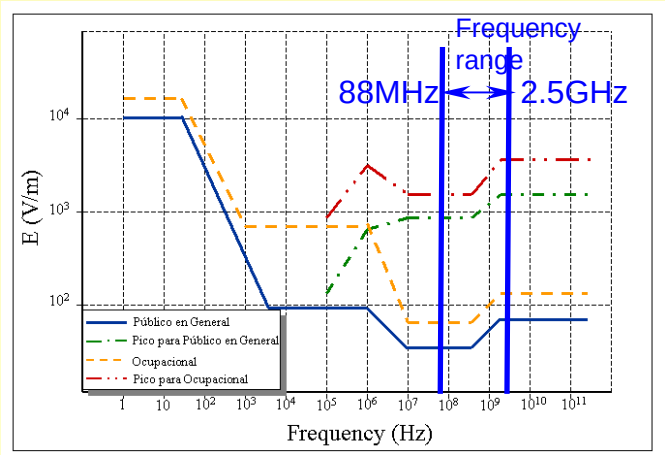
Instituto de Salud Carlos III

Material and Methods

Current measures

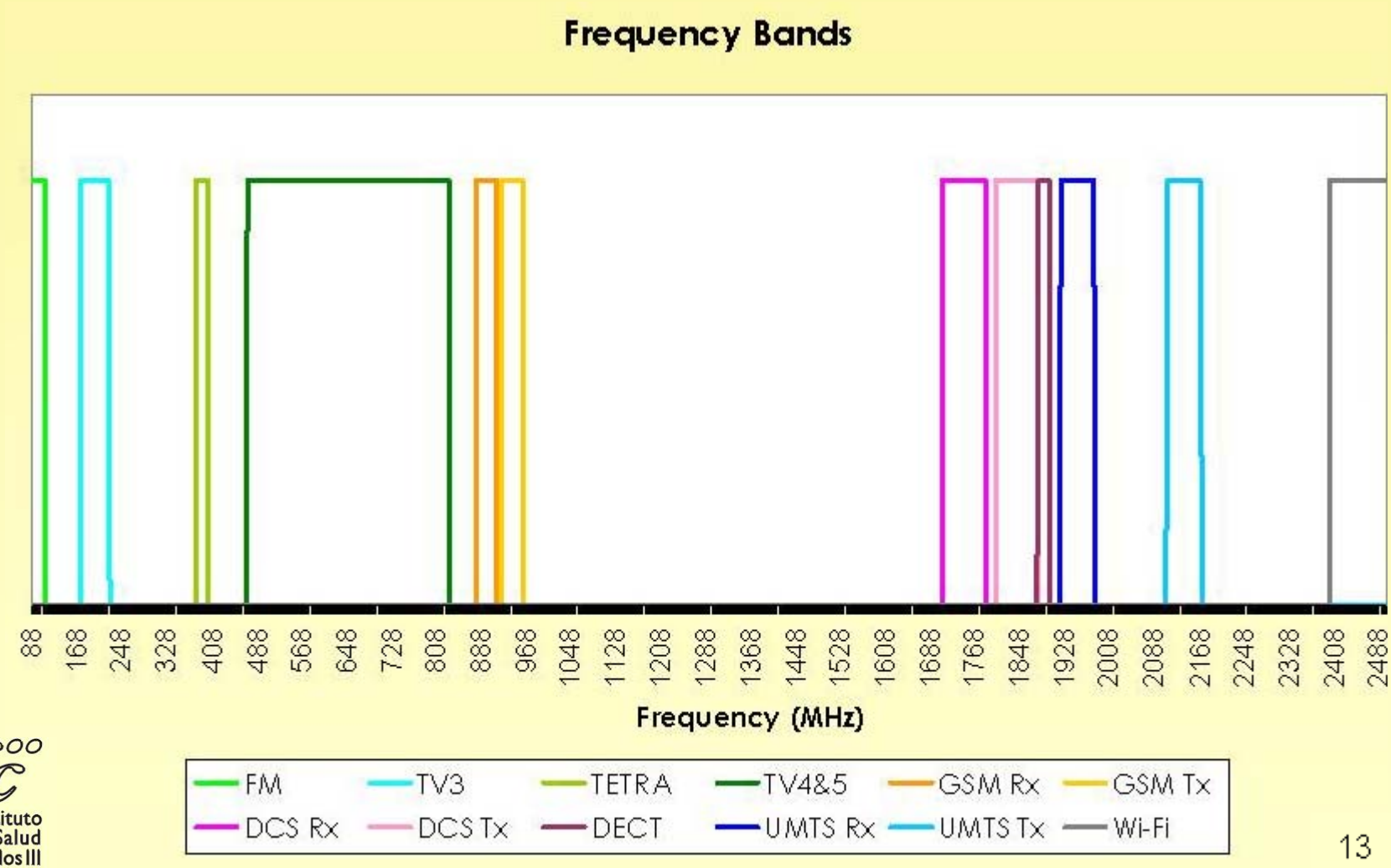
Antennessa EME SPY 120

- Measures: E field and according to the standard ICNIRP-98
- 12 frequency bands: FM, TV3, TETRA, TV4&5, GSM Rx&Tx, DCS Rx&Tx, DECT, UMTS Rx&Tx, Wi-Fi.
- Frequency range: 88 MHz – 2.5 GHz.
- Detection limits: 0.05 V/m – 5 V/m



Instituto de Salud Carlos III

Material and Methods



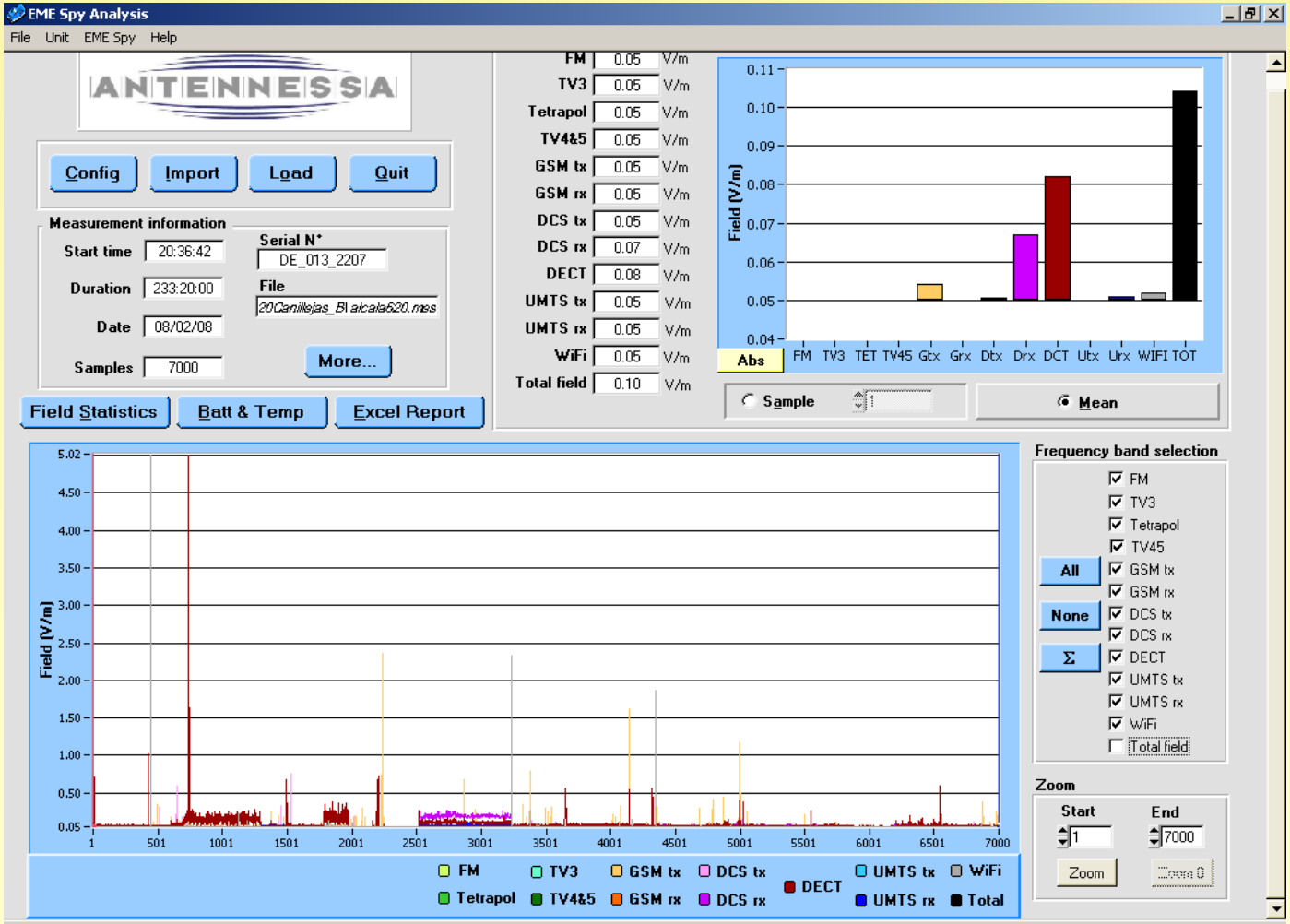
Material and Methods

- ✓ Measures performed at 12 sites in Madrid
- ✓ Obtained the E field in V/m, μW/m and %ICNIRP
- ✓ Sampling rate set every 2 minutes
- ✓ Recorded values for 10 days

Instituto de Salud Carlos III

Results

Results in site A620



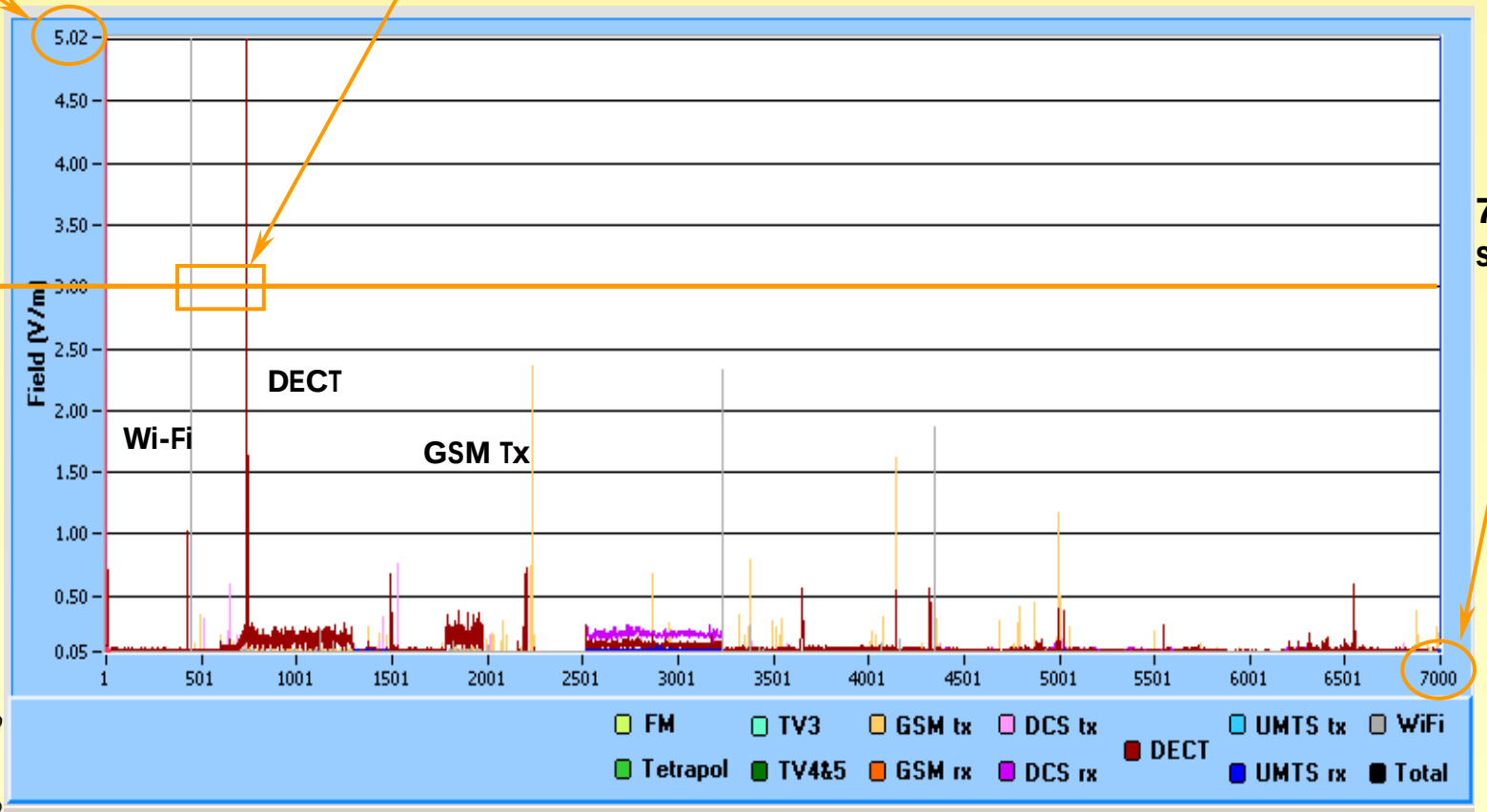
Instituto de Salud Carlos III

Results

Max value: 5 V/m

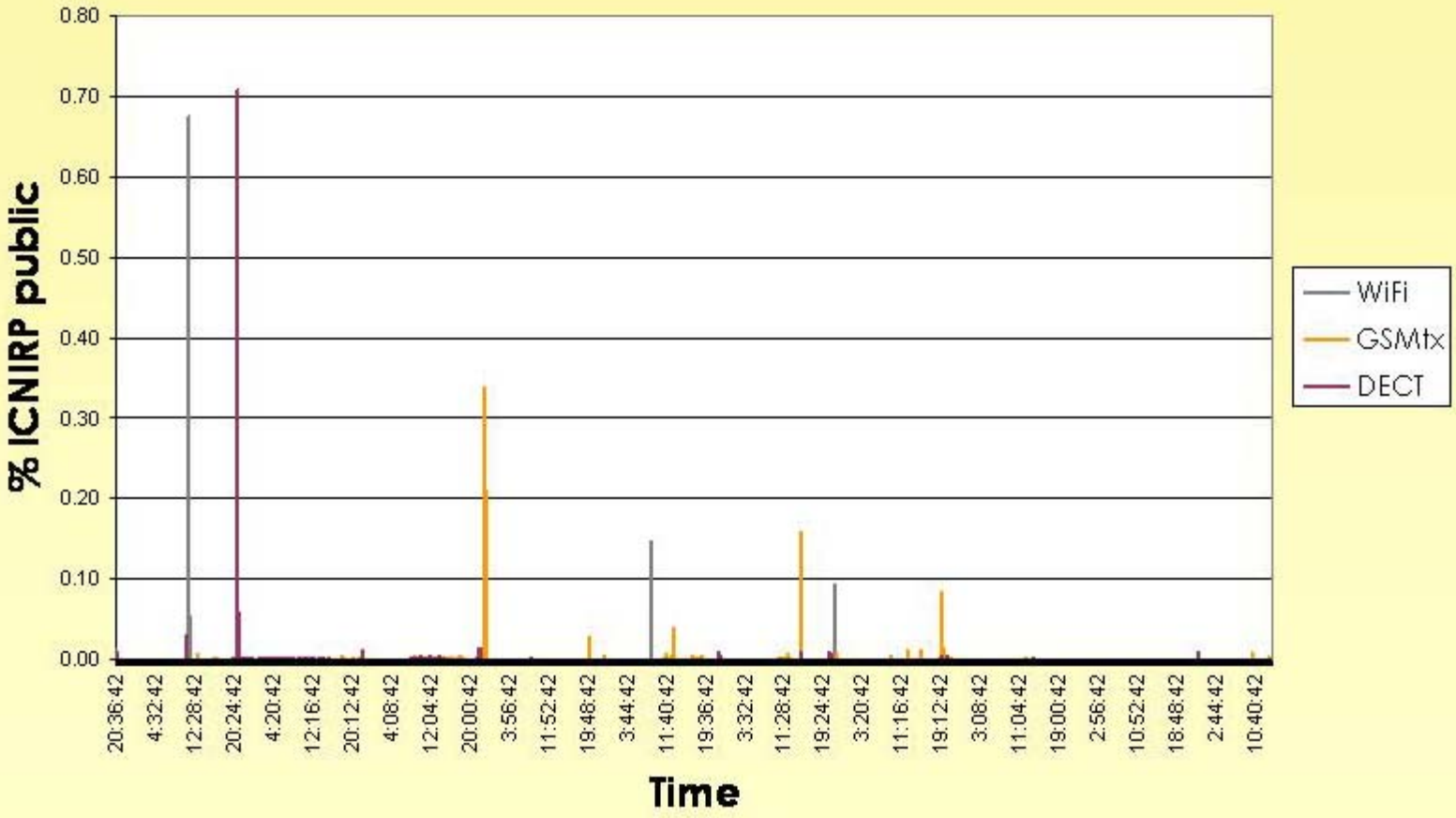
Peaks over 3 V/m

International Electrotecnical Commission (IEC) Standard IEC 60601-1-2



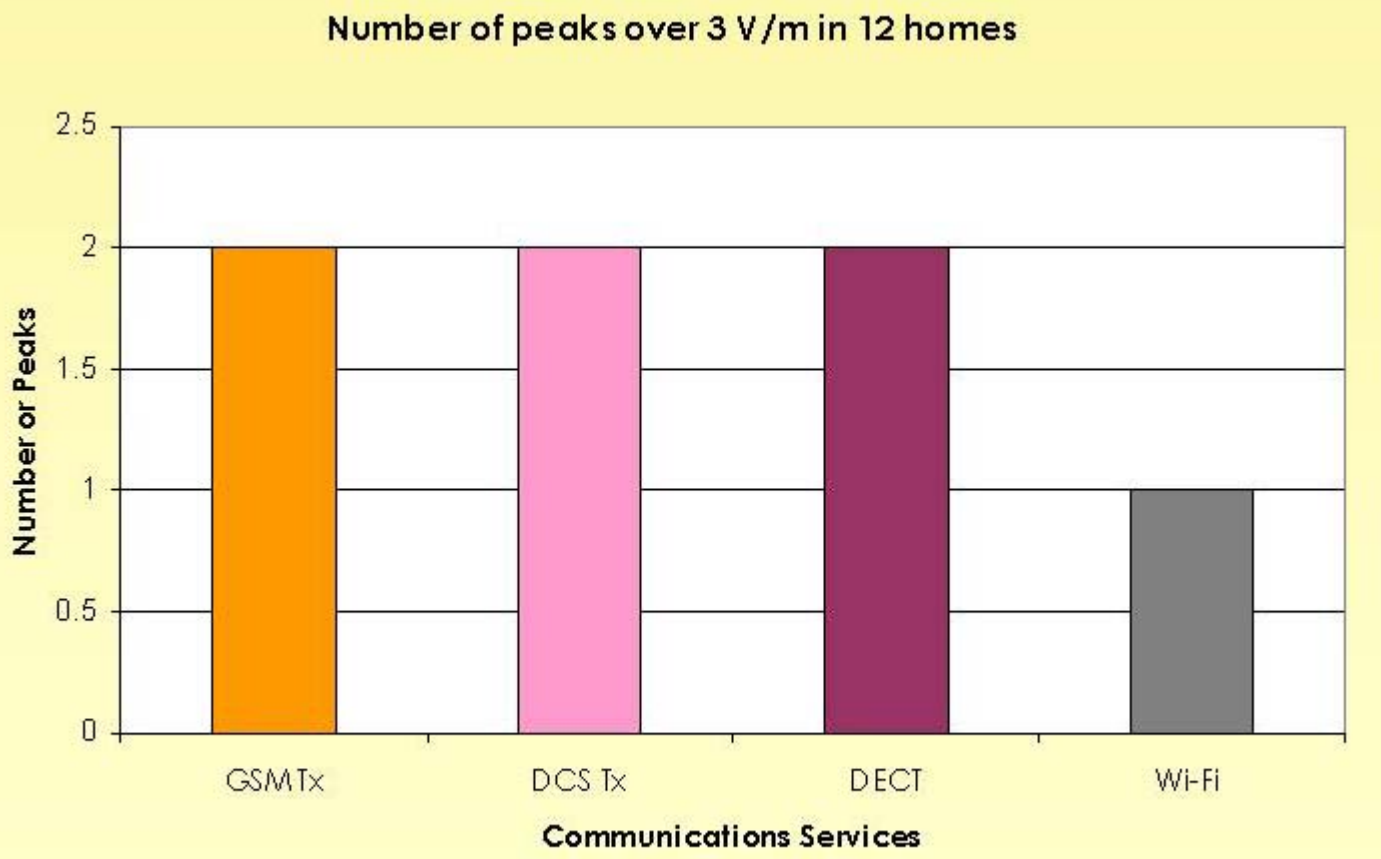
Instituto de Salud Carlos III

Results



Instituto de Salud Carlos III

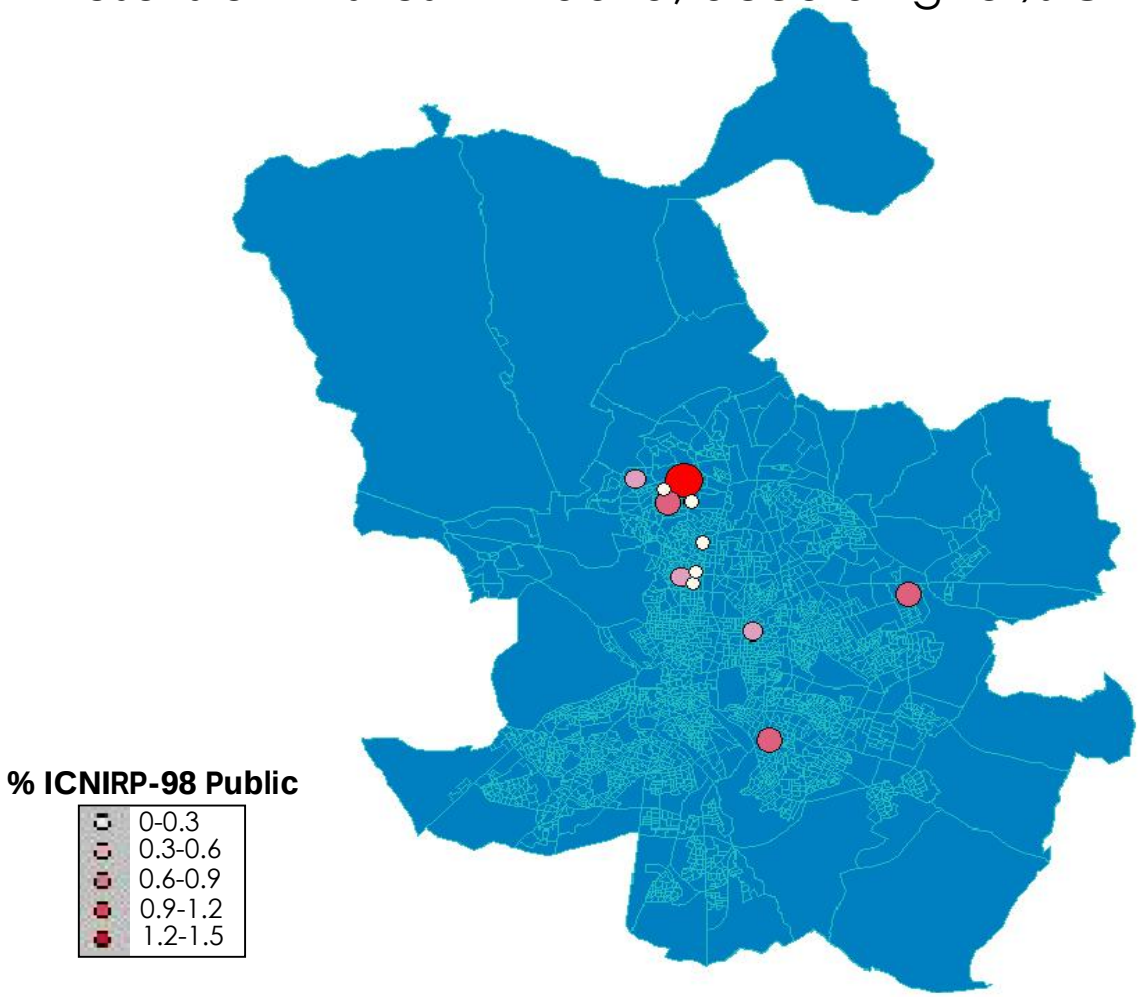
Results



Instituto de Salud Carlos III

Results

Results of 12 sites in Madrid, according to %ICNIRP-98



Instituto de Salud Carlos III

Conclusions

✓ The measured levels seem to be quite stable with time

✓ Nevertheless, there are high-level peaks in some frequency bands

→Possibility of RFI problems for medical devices

→ Necessary to asses EM conditions regarding home telemedicine risk analysis

Instituto de Salud Carlos III

Conclusions

✓ Wireless technology has increased its use, and has change the exposure characteristics

✓ Real time, reliable, safe wireless medical systems are expected to be deployed for home and personal care

✓ The reliability of these technologies has been improved, but it is far from evident which applications use exclusive frequency bands

✓ New solutions must consider issues with respect to electromagnetic compatibility and regulatory compliance

✓ It is necessary a local assessment and risk analysis prior to the installation of a home telemedicine application

COMITE NATIONAL FRANÇAIS DE RADIOELECTRICITE SCIENTIFIQUE

U.R.S.I.

EM 08 PARIS

Thank you
Merci beaucoup

Noemí Carranza
ncarranza@isciii.es

Telemedicine and Information Society Research Area
Health Institute Carlos III

Instituto de Salud Carlos III