

Mobile Networks: Exposure Levels

Jack Rowley, PhD
Senior Director, Research & Sustainability
GSM Association

19^{ième} Journée Interaction Onde Personne
Paris, France
20 December 2012



Journal of Exposure Science and Environmental Epidemiology (2012) 22, 304-315
© 2012 Macmillan Publishers Limited All rights reserved 1559-0631/12

www.nature.com/jes

Open

ORIGINAL ARTICLE

Comparative international analysis of radiofrequency exposure surveys of mobile communication radio base stations

Jack T. Rowley¹ and Ken H. Joyner²



Presentation outline

- Study aims.
- Cautions to be observed.
- Findings.
- Observations.
- Conclusions and next steps.



Study aims

- Provide comparative information on RF exposure from international sample of mobile networks.
- Compile database of national RF surveys.
- Investigate similarities and differences
- Investigate chronological trends



Cautions regarding comparisons across surveys

- Broadband versus narrowband measurements.
- Survey techniques differ as does data recorded.
- Different criteria for selecting locations.
- Type of base station.
- Access to 'raw' data.



Countries and total number of points collected

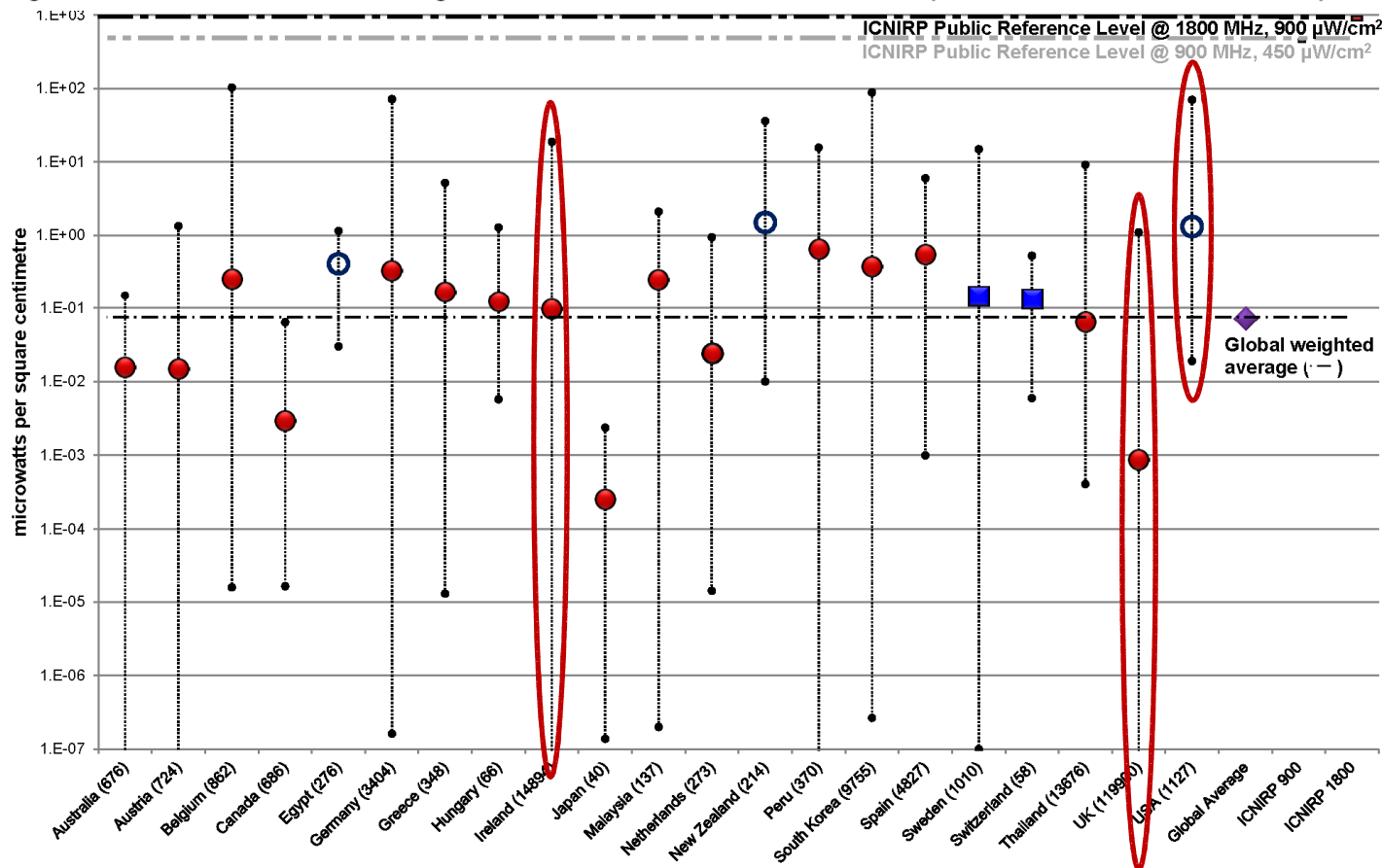
Australia (AU) – 676	Hungary (HU) – 66	South Africa (ZA) – 188,148
Austria (AT) – 724	Ireland (IE) – 14,894	South Korea (KR) – 9,755
Belgium (BE) – 862	Ivory Coast (CI) – 211	Spain (ES) – 4,827
Botswana (BW) – 543	Japan (JP) – 40	Sweden (SE) – 1,010
Canada (CA) – 686	Malaysia (MY) – 137	Switzerland (CH) – 58
Egypt (EG) – 400	Mauritania (MR) – 899	Thailand (TH) – 13,676
France (FR) – 2,000 approx.	Netherlands (NL) – 273	United Kingdom (UK) – 119,900
Germany (DE) – 3,404	New Zealand (NZ) – 214	United States (US) – 1,127
Ghana (GH) – 174	Nigeria (NG) – 212	Zambia (ZM) – 315
Greece (GR) – 348	Peru (PU) – 370	Total number of data points 363,809

- Shaded countries included in figures.
- Based on 173,323 measurement points.



Global overview – 21 countries

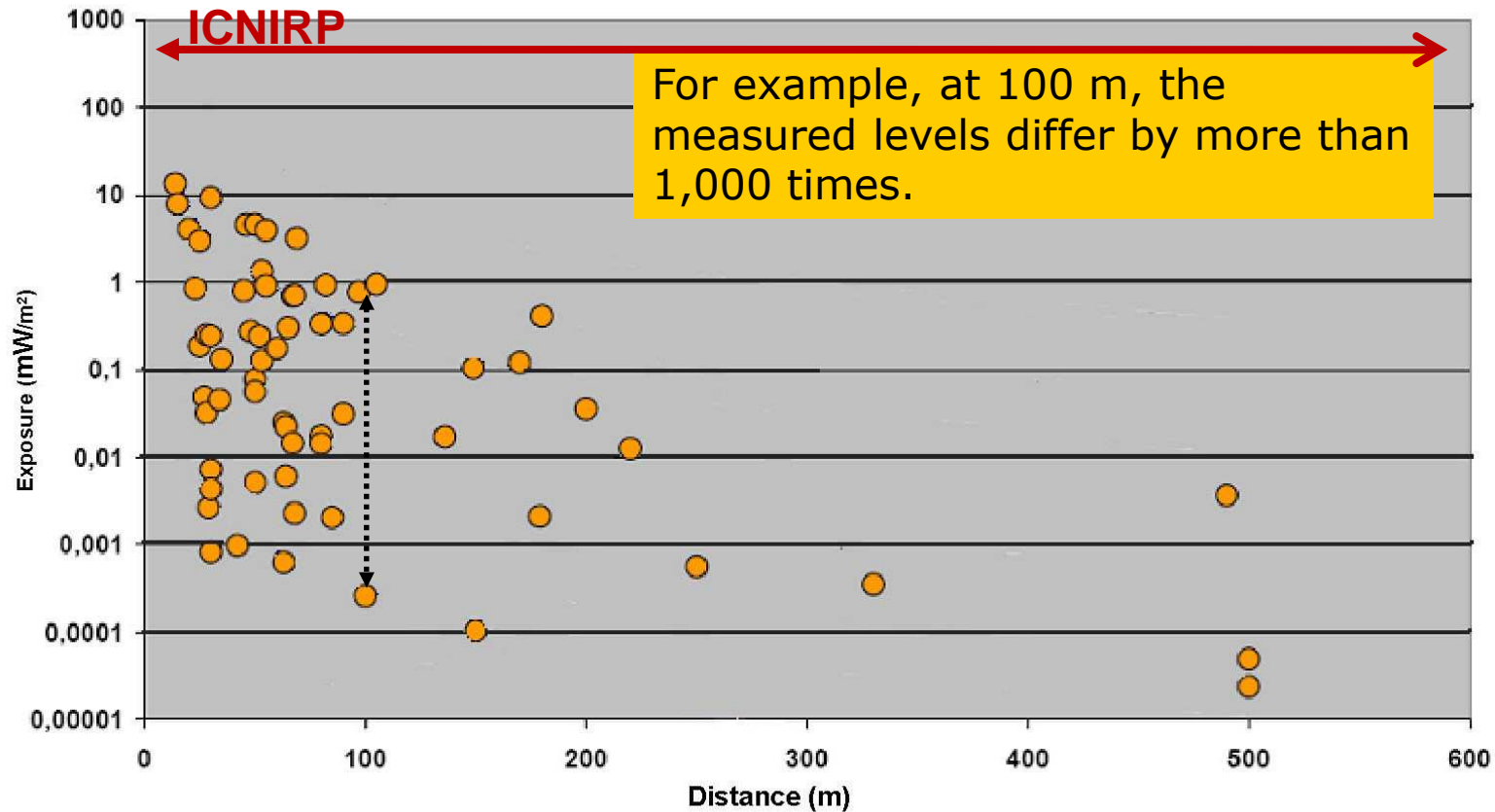
Figure 1. Minimum (●), maximum (●) and narrowband average (●), broadband average (○) or mixed narrowband/broadband average (■) of all survey data for each country with the number of measurement points for the country in brackets. For comparison, the global weighted average marked with dot-dashed line through (◇) and the ICNIRP reference levels for the public at 900 and 1800MHz are also plotted.



- Global average about 5,500 times below ICNIRP public at 800 MHz.



Levels vary significantly at the same distance

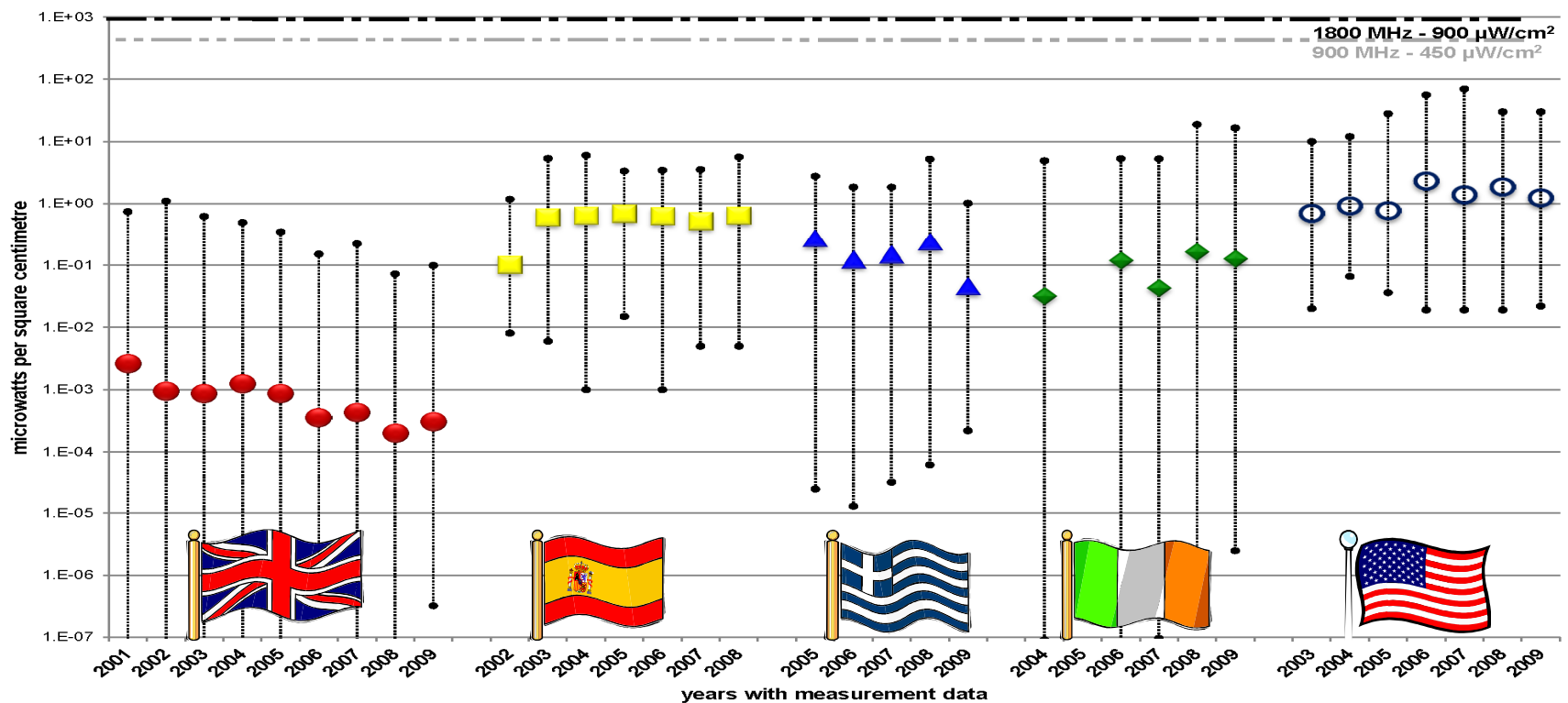


Source: Adapted from Neubauer et al, *Study on the Feasibility of Epidemiological Studies on Health Effects of Mobile Telephone Base Stations*, ARC-IT-0124, March 2005.



Time trends – 5 countries

Figure 2. Minimum (●), maximum (●) and average of the narrowband measurements for the UK (●), Spain (■), Greece (▲) and Ireland (◆); and the broadband measurements for the US (○), with the year of measurement data on the horizontal axis. Note that not all years were available in all countries. For comparison, the ICNIRP reference level for the public at 900 MHz and 1800 MHz are included.

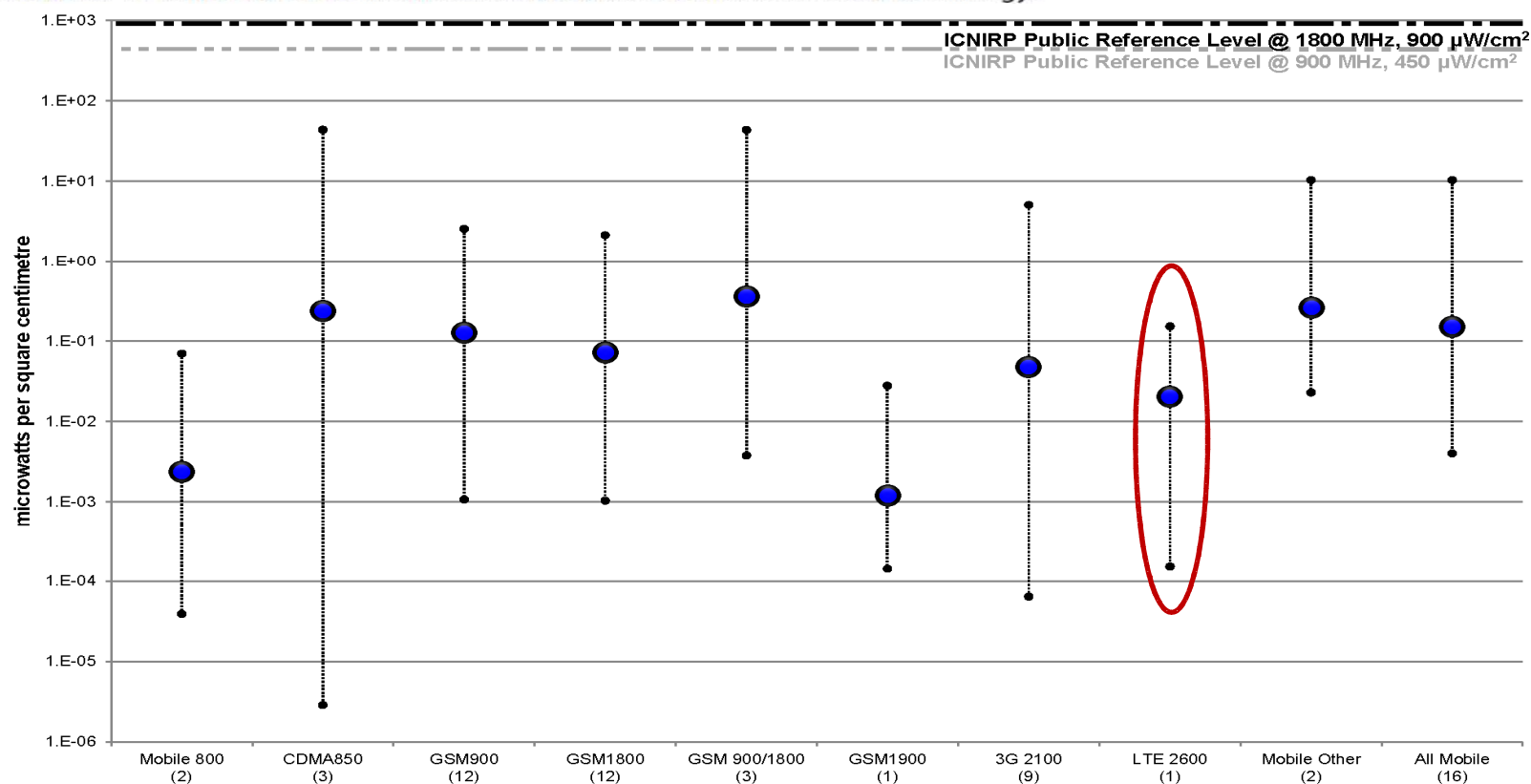


- No significant change in RF exposure since introduction of 3G



Mobile technologies – 16 countries

Figure 3. Minimum (●), maximum (●) and average (●) for each wireless technology. For comparison, ICNIRP reference levels for the public at 900 and 1800 MHz are also plotted. *Mobile Other* refers to mobile technologies either not identified in the source survey or not included (e.g., PDC) in one of the other mobile technologies categories. *All Mobile* is the result of averaging over all mobile technologies. Only narrowband measurements (from 16 countries) could be used. The weighted averages for all available measurement years for each country were then averaged over the number of countries with measurements for each mobile technology. The figure in brackets on the horizontal axis label is the number of countries for which measurements were available for each technology.



- Similar exposures regardless of mobile technology.



Observations from current data

- RF exposures in public areas are typically several orders of magnitude below the ICNIRP reference levels.
- Broadband measurements typically higher than narrowband.
- There is little change in exposure since the introduction of 3G.
 - Geographic and in-building coverage has likely improved.
- All mobile technologies resulted in similar ranges of exposure.



Globally deployed mobile technologies



- Total connections, excluding M2M, stand at 6.6 billion in 2012 globally.
- Total unique mobile subscribers stands at 3.2 billion in 2012 globally.
- About 1.5 billion unconnected due to lack of mobile coverage.

Mobile communications usage trends (UK)

Figure 5.78 Average monthly outbound mobile call minutes per connection, by subscription type

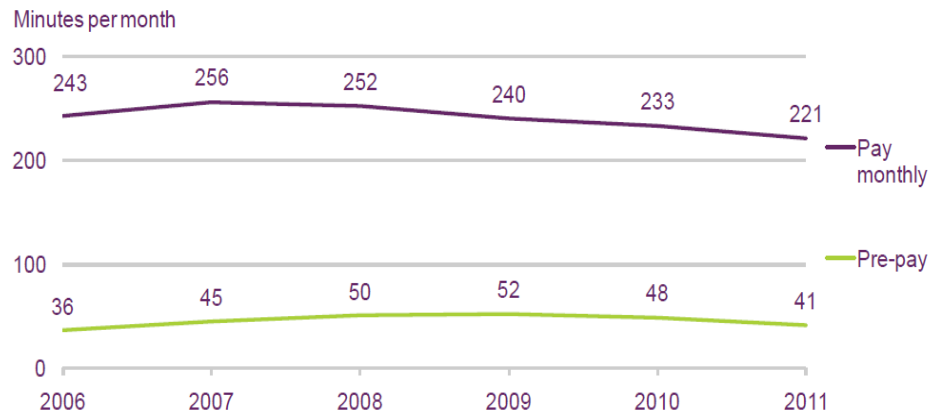


Figure 5.79 Average monthly mobile messaging volumes per person

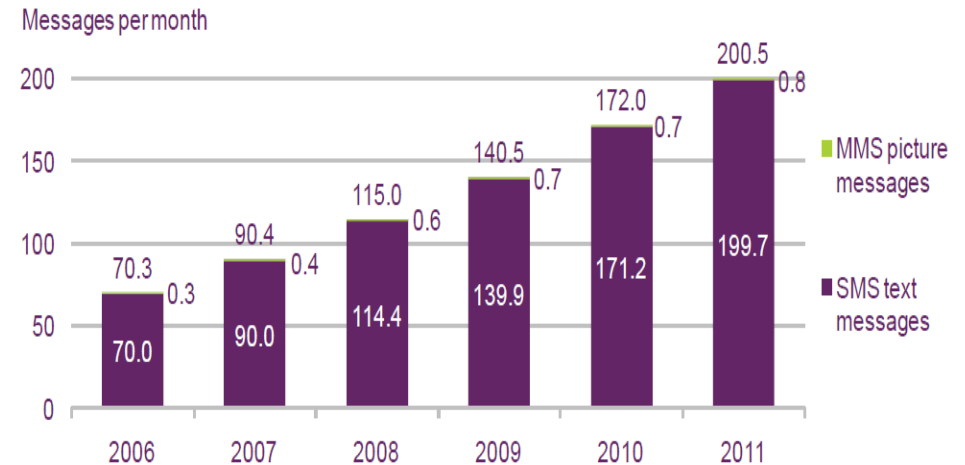
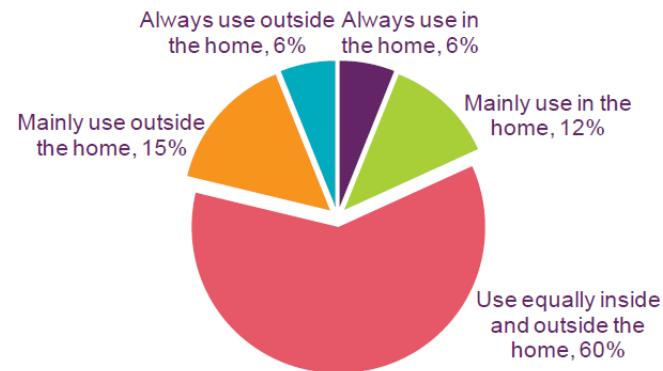


Figure 5.83 Location of internet access using a mobile handset

Proportion of mobile data users



OFCOM, 2012; ITU, 2012



Trends for base station installations



Press release: Small Cells Outnumber Traditional Mobile Base Stations

By Dimitris Mavrakis October 31, 2012

Follow @dmavrakis 1,513 followers

Report claims milestone driven by femtocell networks hitting scale and also notes emergence of the Small Cell as a Service model

Informa Telecoms & Media today issued its latest quarterly small-cell market status report which highlights that the global number of small cells now exceeds the total number of traditional mobile base stations. The report shows that between October and November 2012, the number of small cells has surpassed 6 million (6,069,224) with macrocells worldwide totaling 5,925,974. Although the bulk of these numbers (over 80%) are made up of residential femtocells, which will alone overtake the total number of macrocells early next year, they also include enterprise and public-access small cells. There are now 45 small-cell deployments including nine of the top 10 operators by revenue globally.

- 5,925,974 macro sites installed at end of 2012 globally.
- 6,069,224 small cell sites installed at end of 2012 globally.
- Future networks likely to be more heterogeneous mix of sites.

<http://www.informatandm.com/>



Conclusions and next steps

- In public areas exposures from mobile networks are typically small fraction of the ICNIRP reference levels.
- We plan to extend analysis to additional countries.
 - Developing markets.
 - Countries with differing RF exposure limits.
- Monitor effect of technology and network evolution on exposures.



Acknowledgements

- My co-author Dr Ken Joyner.
- All the institutions and investigators who shared data with us.



Thank You

- **Contact:** Dr Jack Rowley
- **Job title:** Senior Director
Research & Sustainability
- **email address:**
jrowley@gsma.com
- **Tel:** +353 86 806 0849
- **Website:** www.gsma.com/health

The image displays a collage of content related to GSMA's Health & Environment initiatives. At the top, a 'Resources' section highlights the 'July 2012 – GSMA Health & Environment Newsletter' dated July 31, 2012. Below this is a navigation bar for the 'Health & Environment' website, featuring links for 'About Us', 'What we do', 'Membership', and 'Newsroom'. The main content area includes a large banner for 'Mobile and Health' with the subtitle 'Science and policy related to the safety of wireless technology'. A grid of six smaller images represents various topics: 'GSMA Research', 'Mobile Devices', 'Health', 'Mobile Networks', 'Science Overview', and 'Research'. A prominent video player is overlaid on the right, showing a video titled 'MOBILE & HEALTH' with the GSMA 'WORLD LIVE' logo. The video player interface includes a play button, a progress bar, and a timestamp of 00:06. Below the main content, there are additional images: one showing a person using a mobile phone, another with silhouettes of people, and a third showing a person on a bicycle. The GSMA logo is visible in the bottom right corner.