



A Short History of the Medicine of Mobile Telephony

David Black MBChB MD FAFOEM MIEEE

Waiuku Medical Centre

26-30 Constable Road, Waiuku 2123

david@evx.nz

A photograph of the Waiuku Health Plus building, a modern structure with large windows and a sign that reads 'Waiuku Health Plus' in blue lettering.

Waiuku Health Plus

Waiatarua Television Transmitter





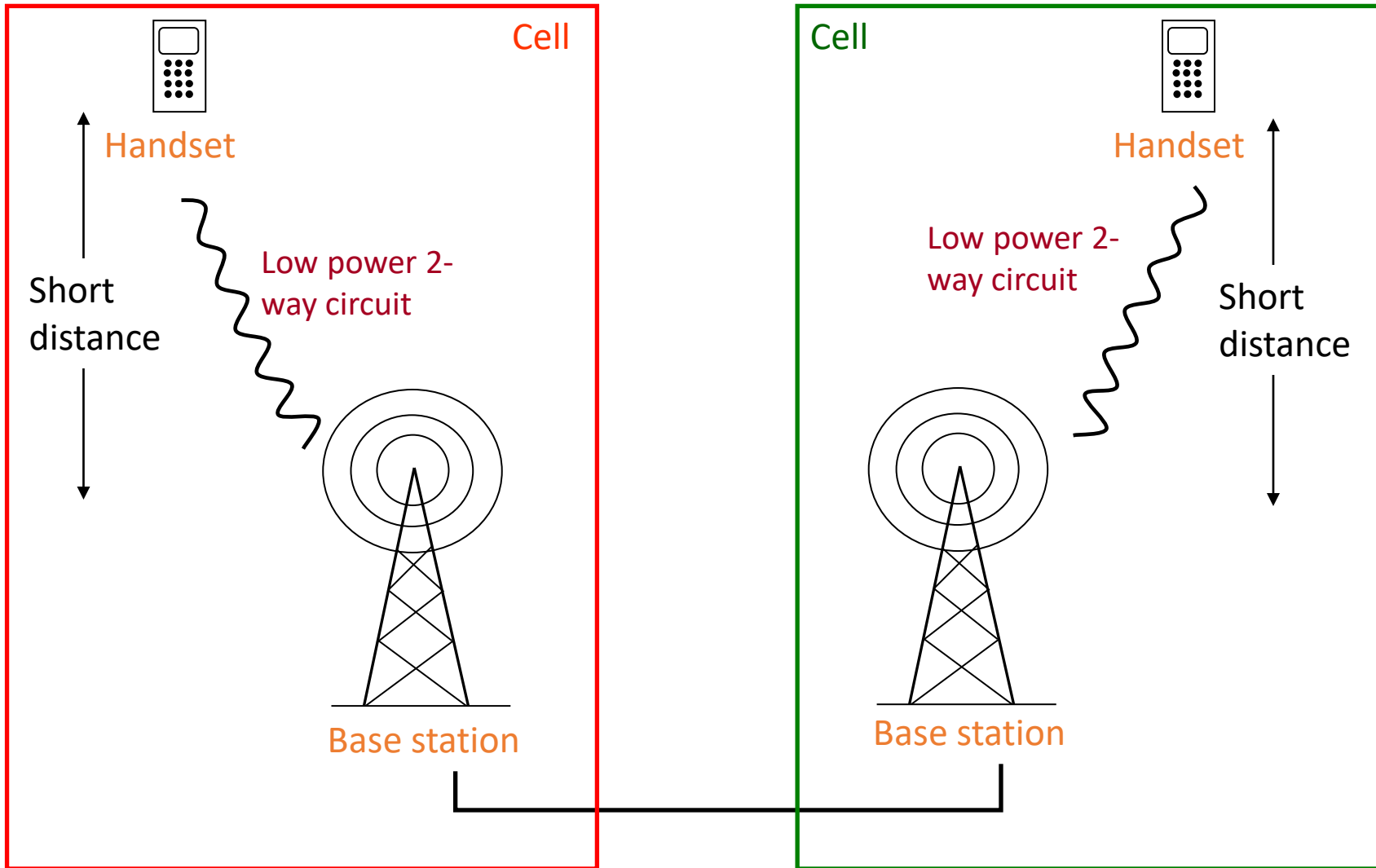
Mobile Telephone Base Stations

New arrival on the landscape

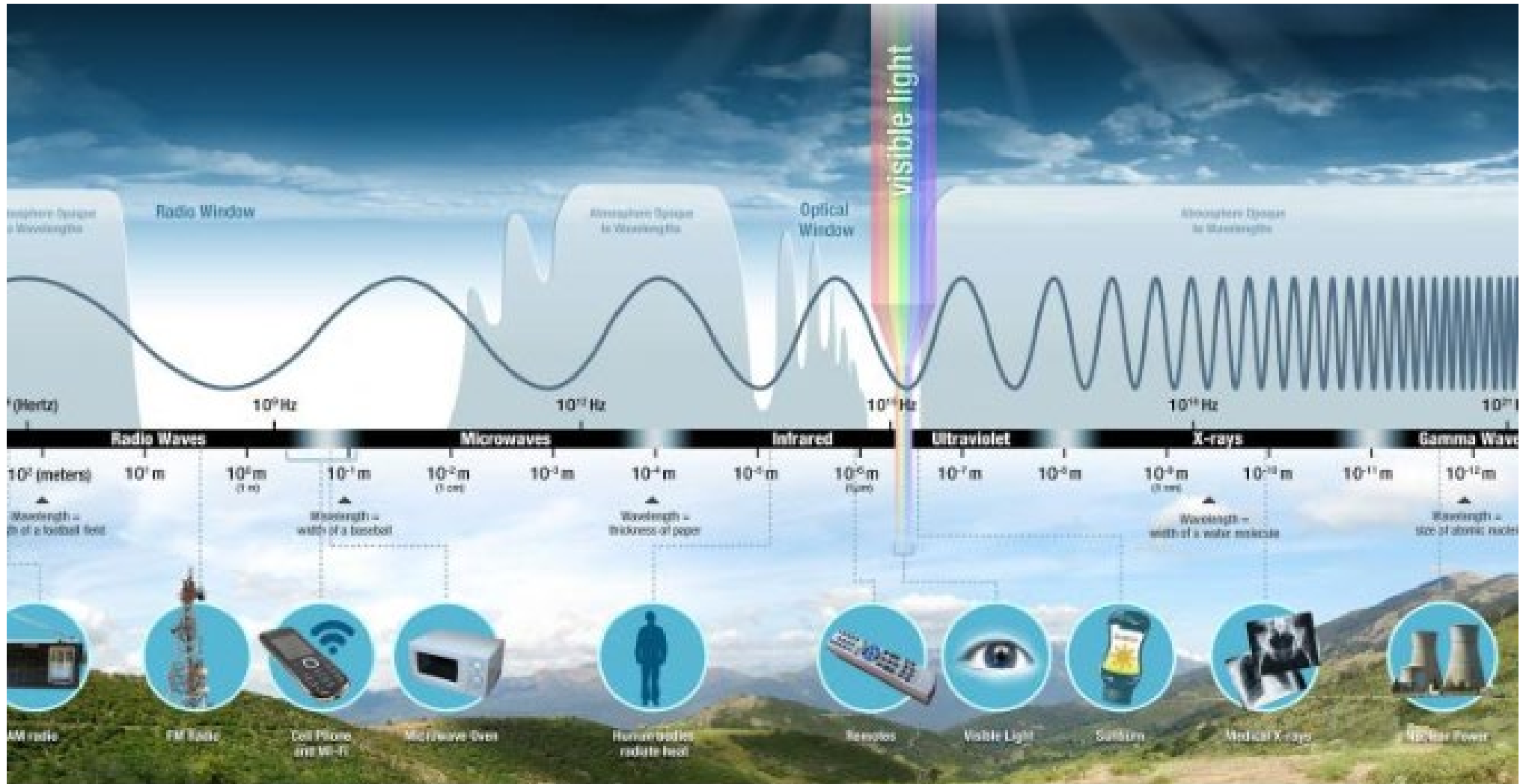
Mobile Phones (Cellphones)



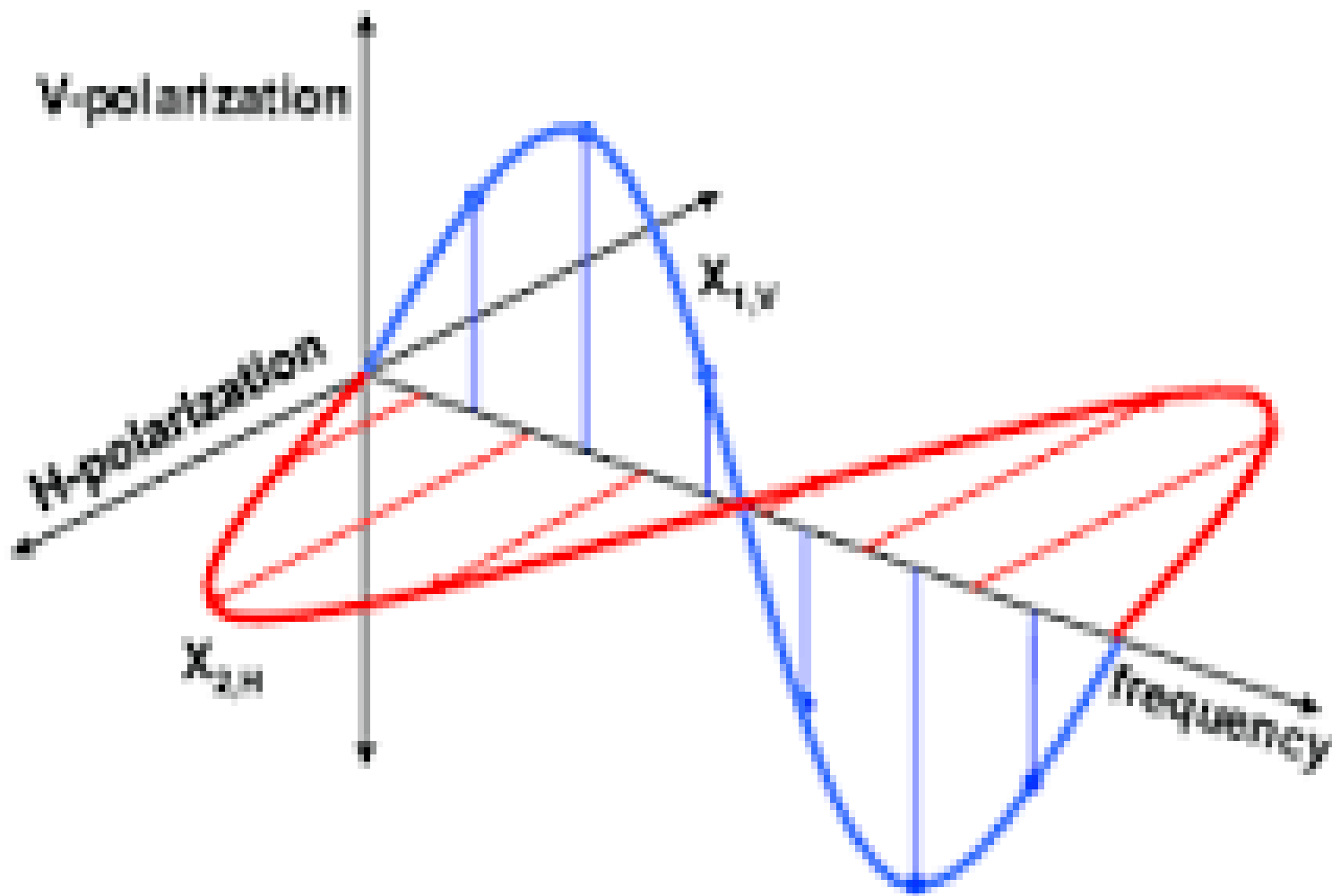
- Common use by 1995
- 100-250mW transmitters regulated by adaptive power control
- Well under safety limits
- Duration of use limited by cost



Electromagnetic Spectrum (NASA)



Orthogonal Wave



Hermann P. Schwann PhD 1915-2005



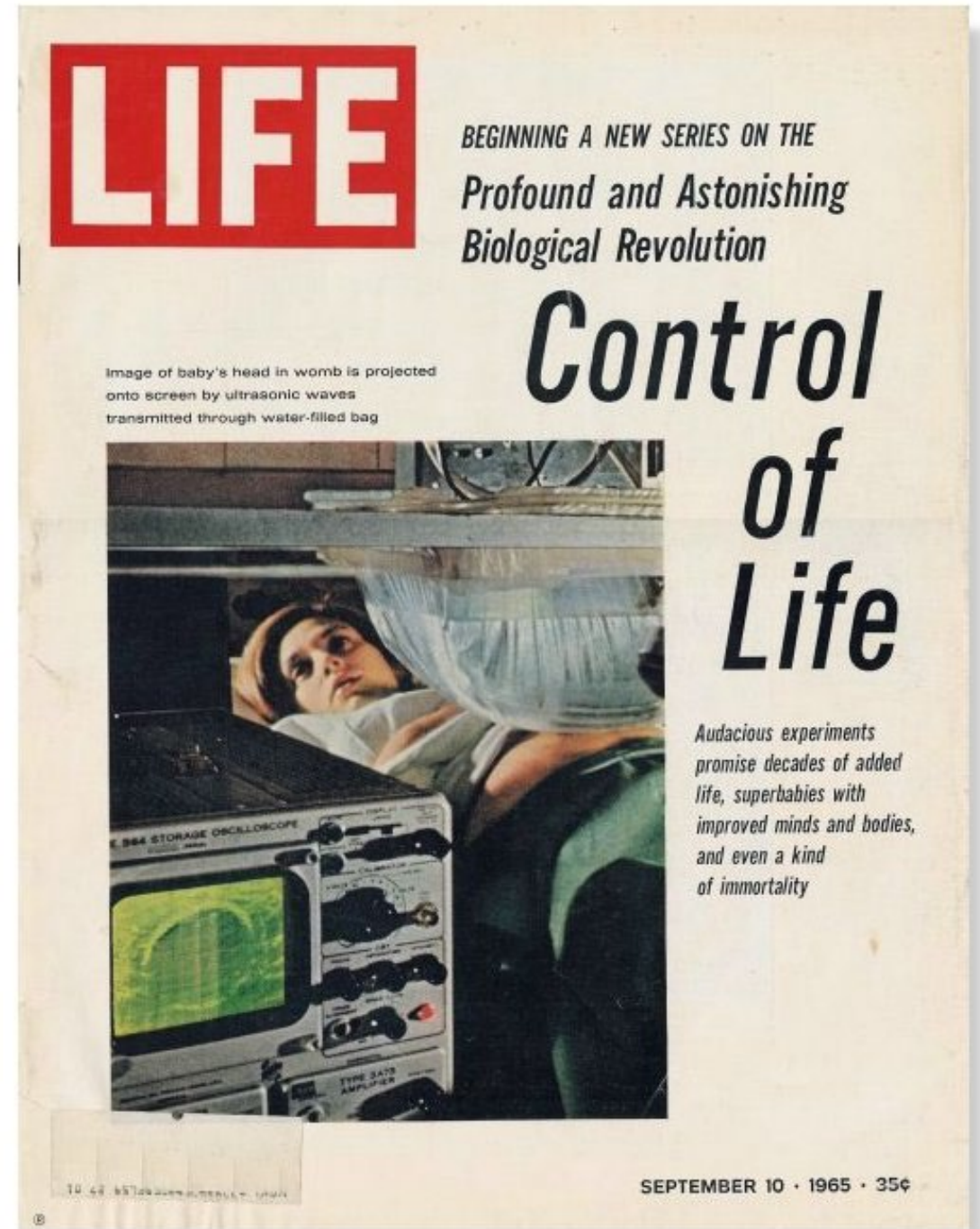
- 1936–38 with Telefunken on high frequency measuring techniques.
- Research associate, later Associate Director, Max Planck Institute of Biophysics in Frankfurt in 1937
- 1947 Aeromedical Equipment Laboratory of the U.S. Naval Base in Philadelphia.
- Joined the University of Pennsylvania in 1950, retired as the Alfred Fitler Moore Professor Emeritus in 1983

Power Density Threshold for Biological Effects Schwan (1953)

- Letter to the U.S. Navy in 1953, proposing a safe limit for human exposure to microwave energy, based on power density and thermal analysis.
- Chaired the committee that established the first (1965) U.S. exposure limit for radiofrequency energy, for the American National Standards Institute (ANSI Standard).
- ANSI evolved into the present IEEE C95.1 standard and was widely influential in the development of exposure limits around the world.

Marvin Ziskin M.D. 1936-2022

Ultrasound with George Evans 1965



Specific Absorption Rate (SAR)

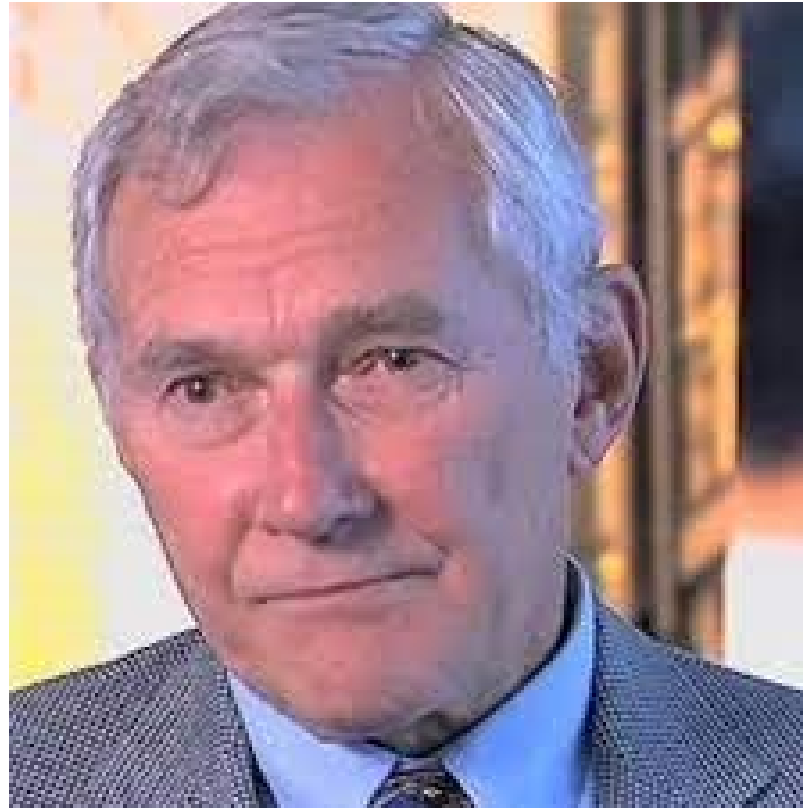
- SAR is a measure of the rate of RF radiofrequency energy absorption by the body from the source
- Measured in Watts per Kilogram (W/Kg)
- Equivalent Power density (W/m^2) varies with frequency

The Bioelectromagnetic Society (BEMS) Presidents

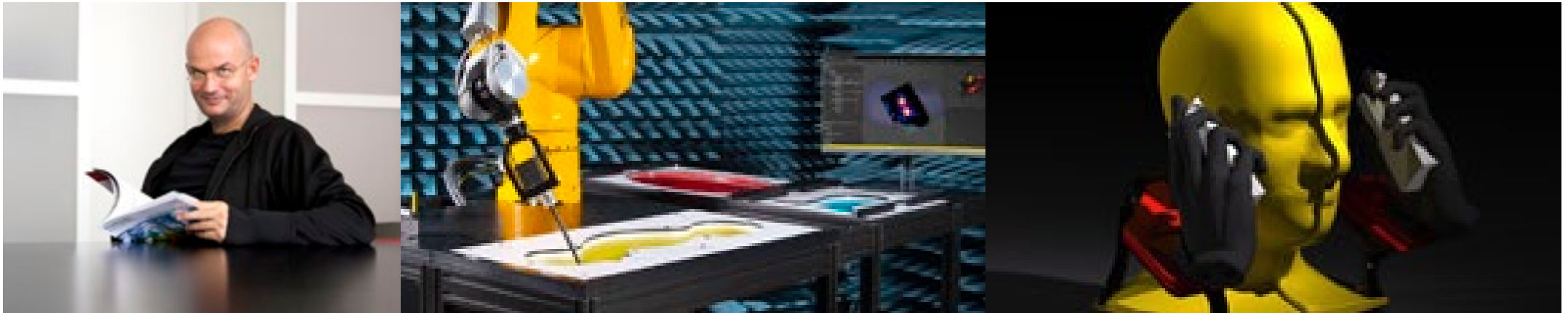
Arthur Guy, Michael Murphy, David Black, Frank Prato, Andrew Wood, Marthinus van Wyk



Michael Repacholi PhD 1944- WHO EMF Project



Niels Kuster PhD 1957- Dosimetric Assessment System (DASY)



Michael Murphy PhD



USAF Brooks Base, San Antonio TX

Weightless 2



Professor Eleanor Adair (1926-2013)



USAF Experiments at Brooks 1990's Following up on Schwan et al



Adair & Black – Bioelectromagnetics 2003

Bioelectromagnetics Supplement (2003)

Thermoregulatory Responses to RF Energy Absorption

Eleanor R. Adair (1) and David R. Black (2)

1 Air Force Senior Scientist Emeritus, Hamden, Connecticut, USA

2 University of Auckland, New Zealand

- A tutorial on the fundamentals of thermoregulation with a review of the current literature concerned with physiological thermoregulatory responses of humans and laboratory animals in the presence of radio frequency (RF) and microwave fields.

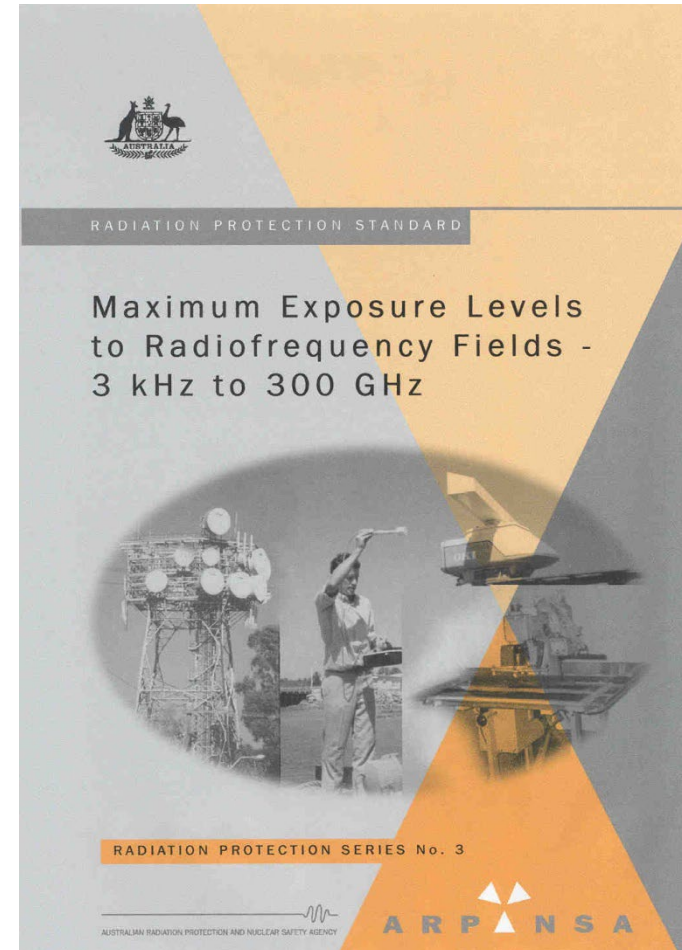
Modern Standards- designed to protect

- RF Workers
 - Fit for the work they do
 - With some RF Safety knowledge
- ***Against all established effects***
- General Public
 - Of any health status
 - Without any RF skills or knowledge
- ***Against all established effects***



Two tier standards

- Origins may have been in idea of cumulative effect
- May also have been a political compromise
- Occupational levels safe with less margin
- RF absorption physiology now well understood

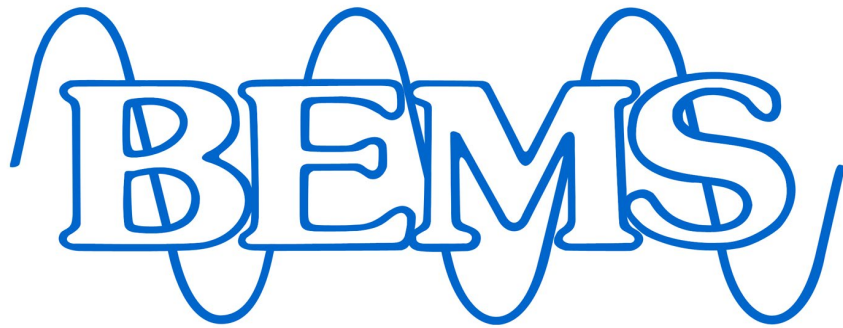


Two tiers provides a buffer zone

- Above occupational level may be still safe
- First effects trivial but noticed
- Next effects reversible
- Tissue damage generally at much at higher levels



BEMS et al 2023 and forward



BEMS



IEEE ICES

Thank you for
your kind
attention