Trends in dosimetry and standardisation

J. Wiart et col

Whist lab.

http://whist.institut-telecom.fr/

Telecom ParisTech, Telecom Bretagne & Orange Labs

Summary

- context
- Trends in real exposure assessment
- Trends in children exposure
- Trends in standards
- conclusion

COST Actions in dosimetry

Action BM0704: Emerging EMF Technologies and Health Risk Management

- **Working groups**
  - Monitoring and Measurement
  - Computational Dosimetry

- **Workshop**
  - 18-20 May, Lubjana: workshop with ICNIRP and WHO dedicated to Children
  - 28-29 Oct, Vienna: Workers' EMF Exposure: Recent Developments and Future Challenges
  - 30- 1 Dec, Paris : Dosimetry meets epidemiology

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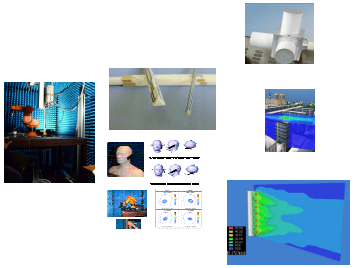
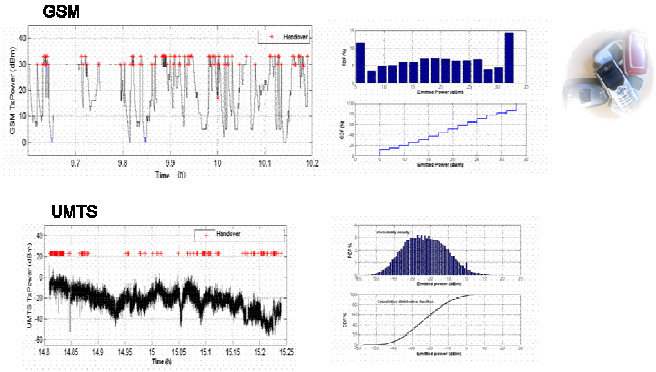
Real exposure analysis

- Exposure methods have been dedicated to « worst case »
- Useful to establish area zone and check compliance

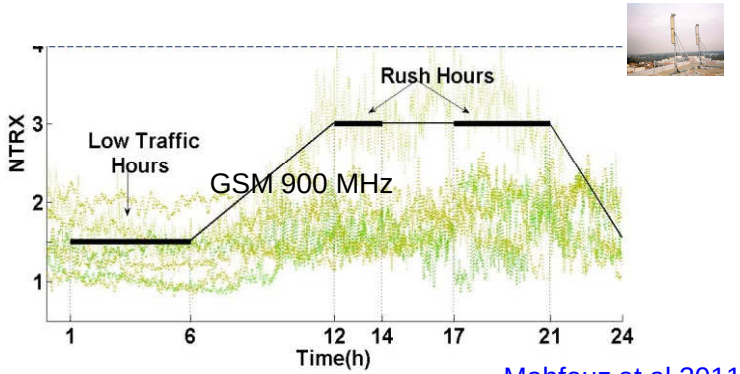


- Not suitable to assess real exposure as requested in epidemiological studies or in public information

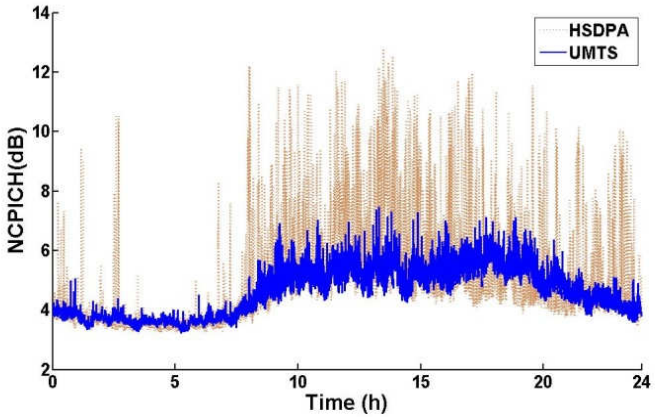


Gati et al

GSM ➔ mean : 0,5 W/Kg
UMTS ➔mean 0,01 W/kg

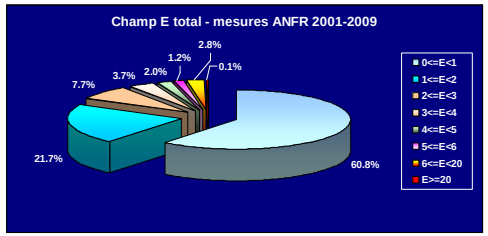


Mahfouz et al 2011

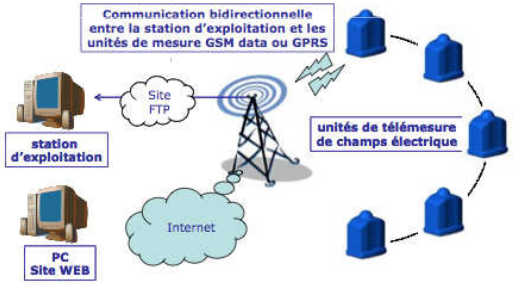


RF Exposure assessment: monitoring

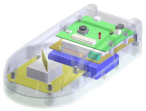
- Collecting measurements performed under request
  - E.g ANFR



- Combine measurements, simulations and statistical modeling
  - ANR Samper



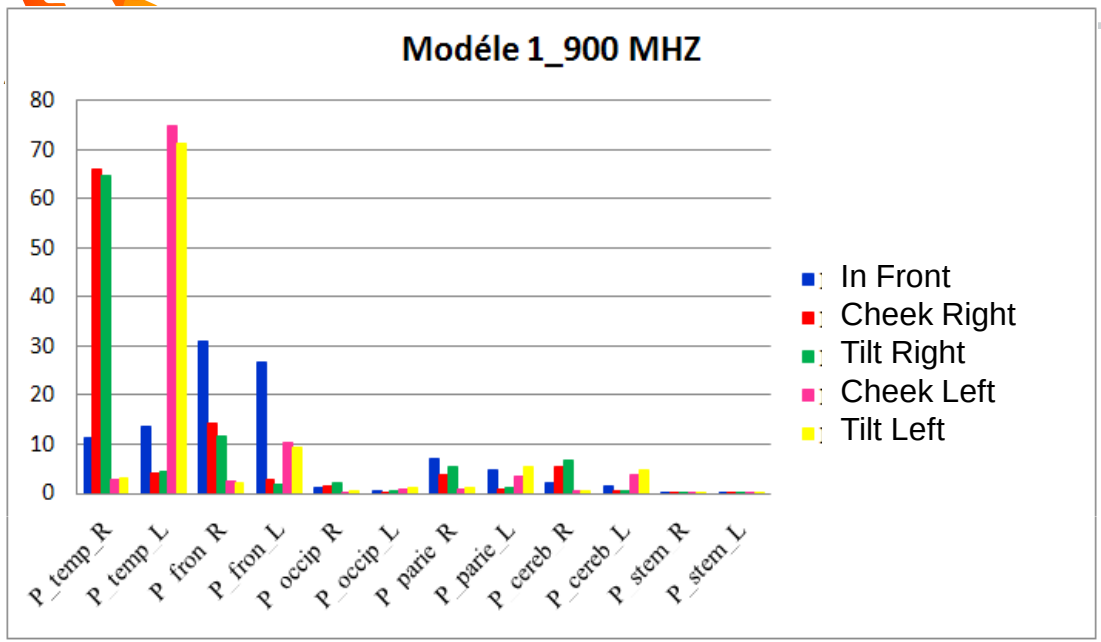
- Personal exposure assessment

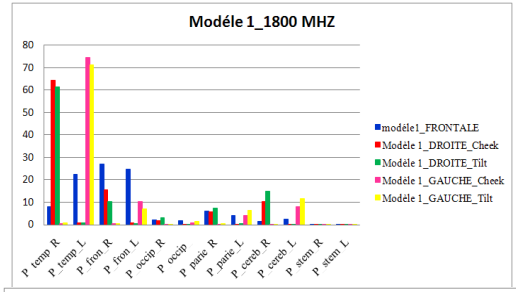


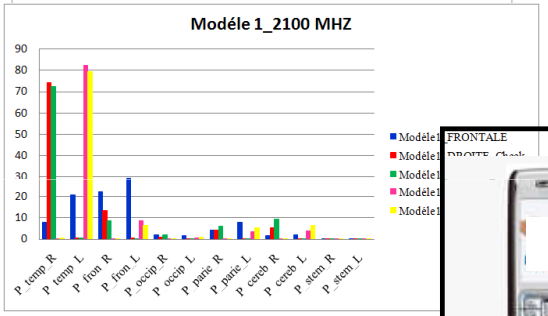
Viel et al

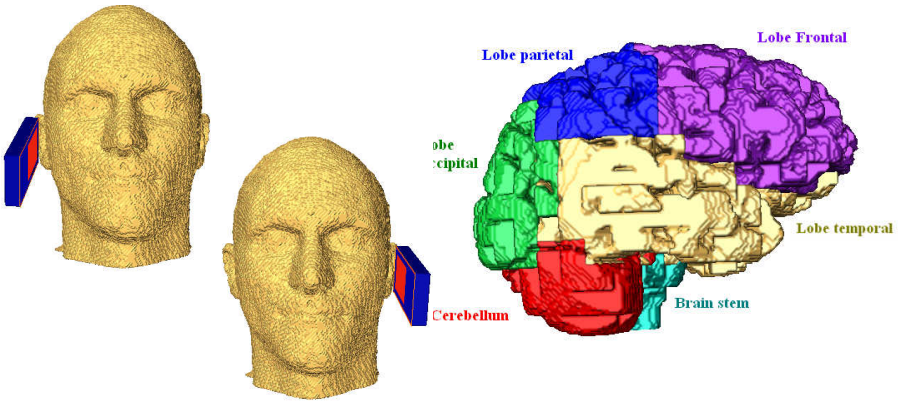
FM	Tetrapol	TV 485	GSM Tx	GSM Rx	DCS Tx	DCS Rx	DECT	UMTS Tx	UMTS Rx	WiFi MW	Total field
0.044	0.005	0.016	0.013	0.018	0.012	0.015	0.037	0.036	0.037	0.038	0.201

Relative absorbed power in Brain

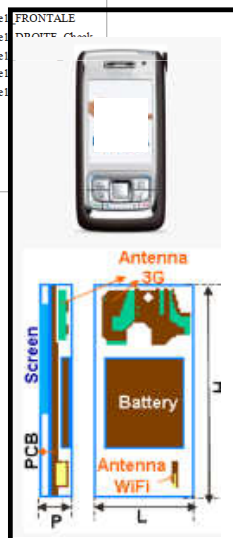






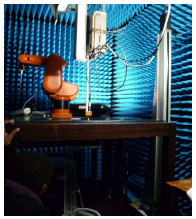


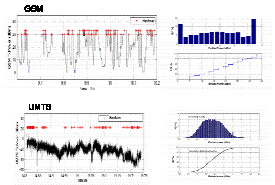
- 60% in the temporal lobe
- 10% in the frontal lobe
- Laterality is very important



GSM 900
GSM 1800
UMTS 2100

Brain Exposure vs sources





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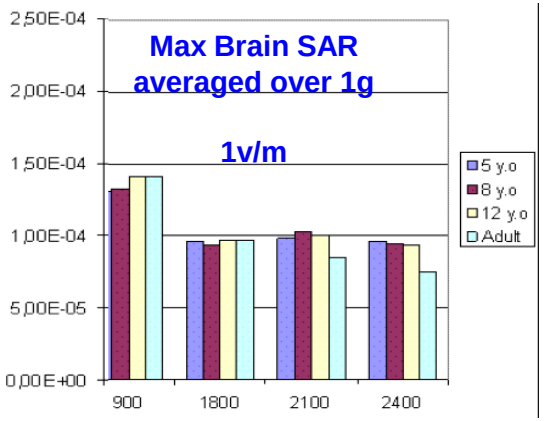
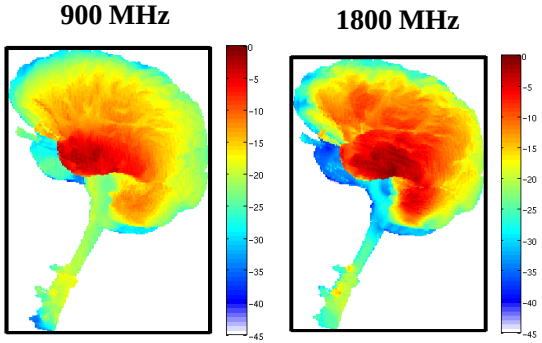


1 V/m➔ 10^{-4} W/Kg
0,1 V/m ➔ 10^{-6} W/Kg

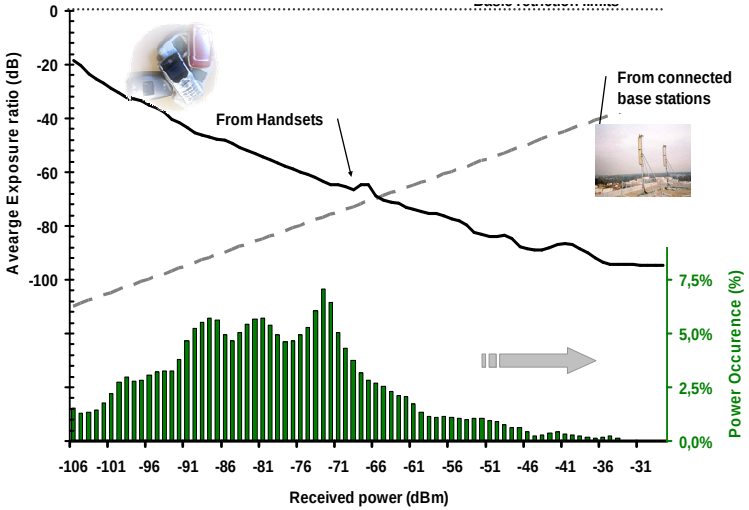
Cheek position
Normalised SAR to the maximum in Brain

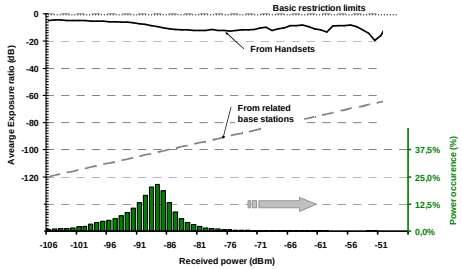


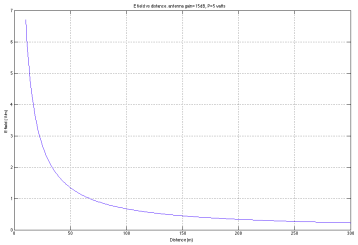
Gahnmi et al

minute ←→ Month

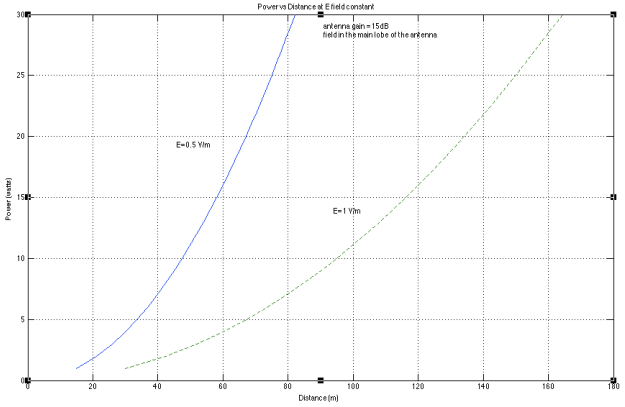
Total exposure







Distance , power control, signal to noise ratio… play important roles



New concept : Index of exposure

- The exposure to access point cannot be considered as independant of the exposure to mobile phone
- The standards are dealing with the maximum
- The global exposure is therefore a composition of exposure encountering during various scenarios (home, travelling, working…) *as the cost of living is calculated based on prices of various goods and services.*

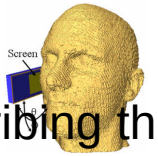
$$F = \sum \beta_i SubF_i\,(protocol, network\ density, usage, power\ control, architecture)$$

Trends in child exposure

Influence of the phone position

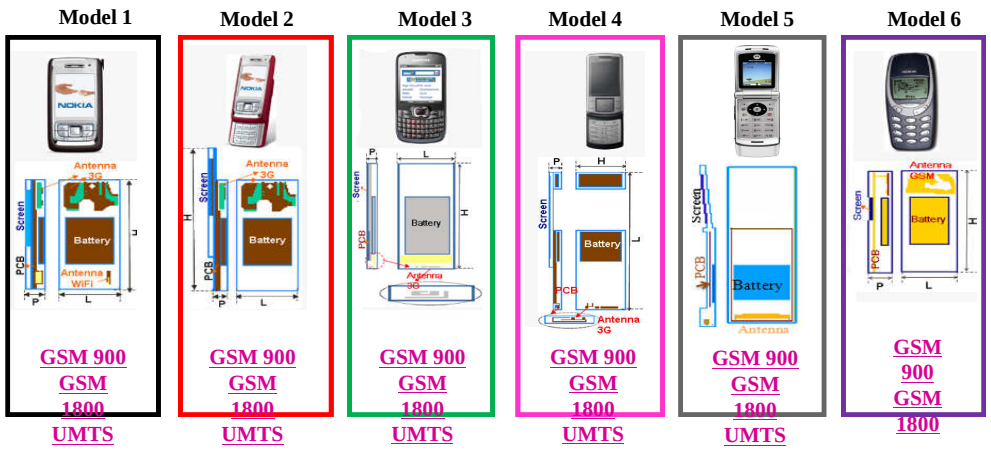
mobi-kids
Study on Communication Technology, Environment and Brain Tumours in Young People

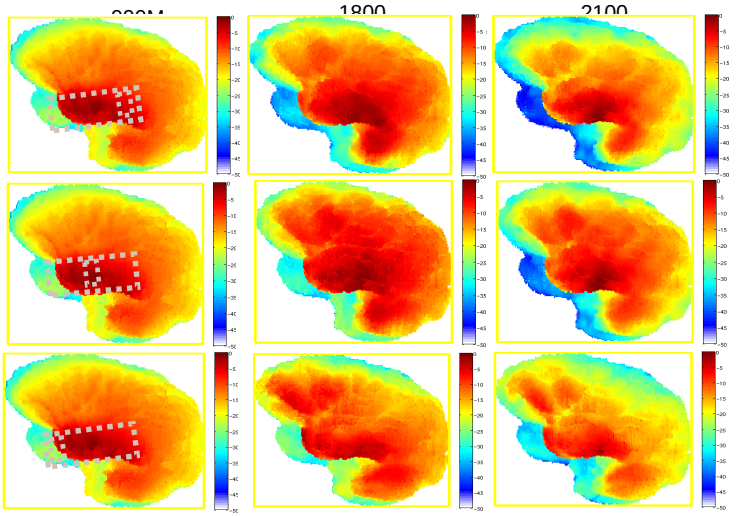
Different phone models have been designed



4 parameters describing the phone position.
80 positions selecting using LHS

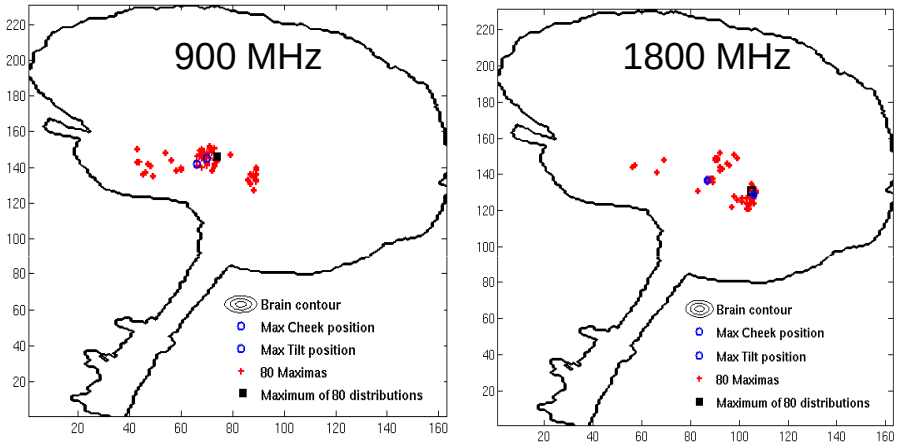
Normalized SAR distribution

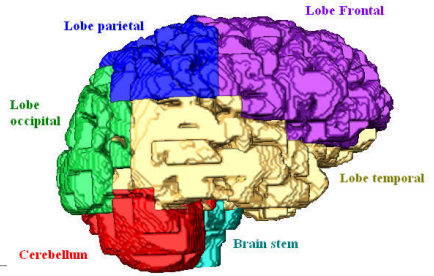


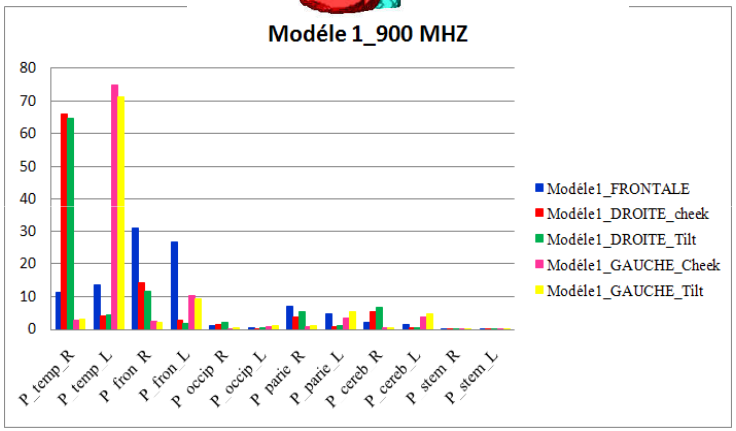


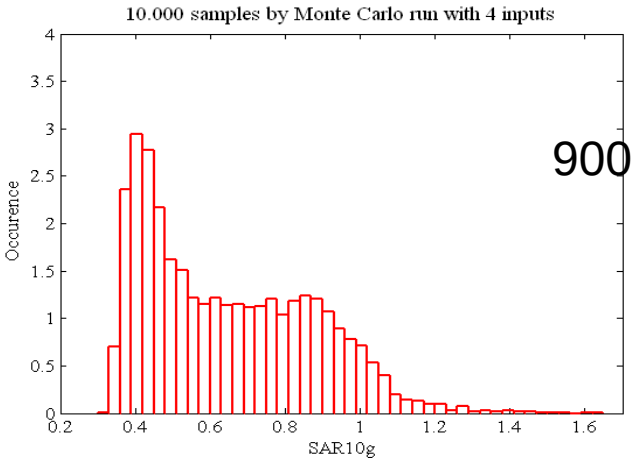
Phone position influence

Maximum locations

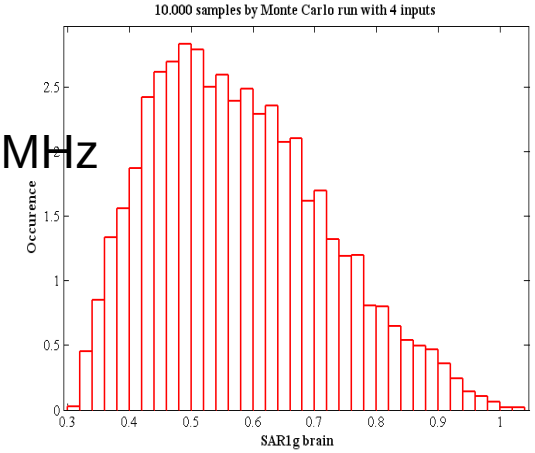




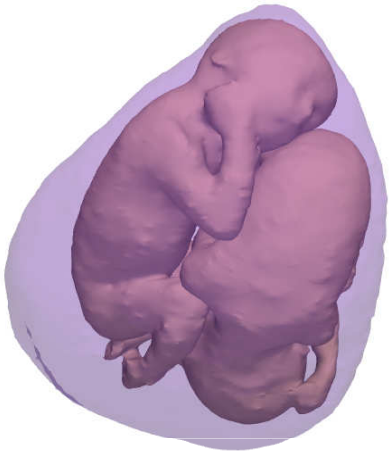




900 MHz



Fetus exposure

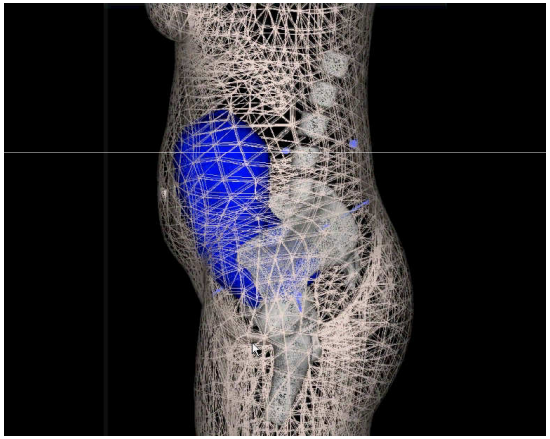


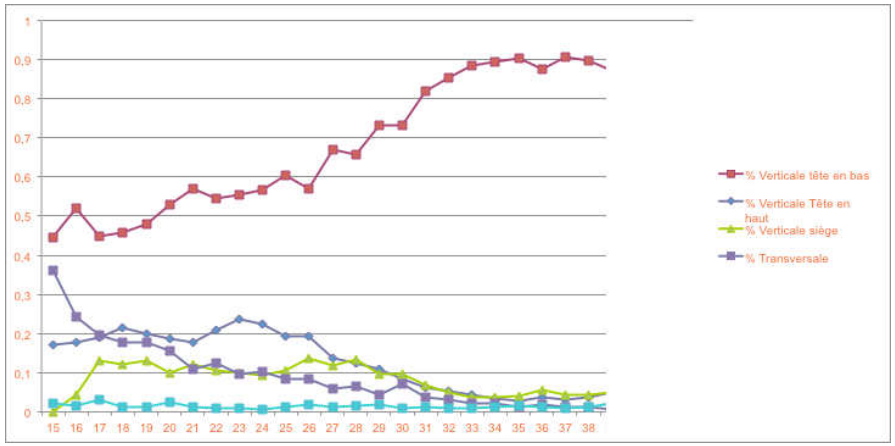
JST ANR FETUS PROJECT

-Investigation

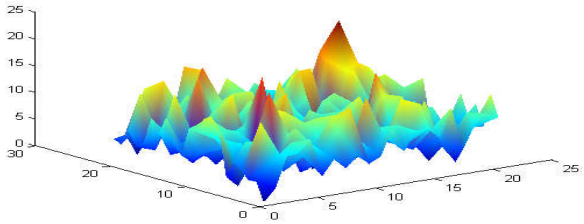
Fat thickness

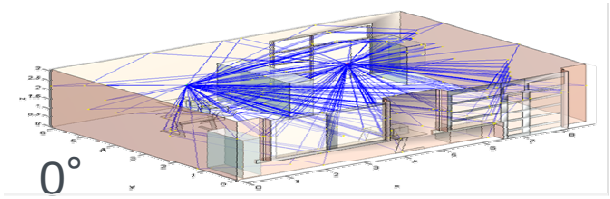
Fetus position

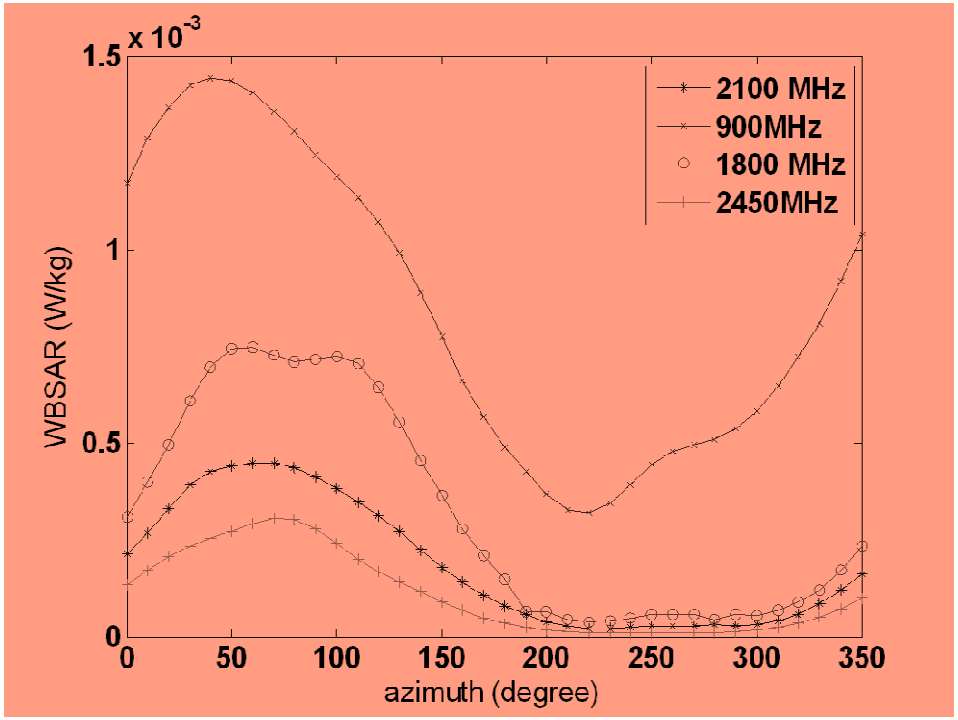


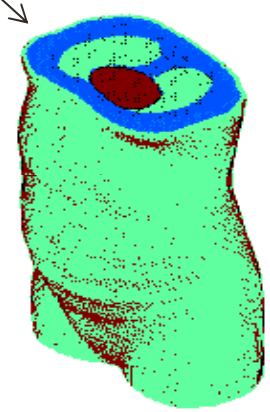


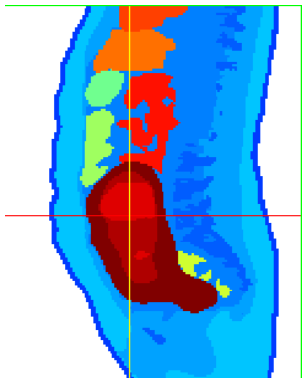
Fetus exposure to far sources





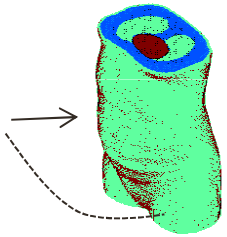


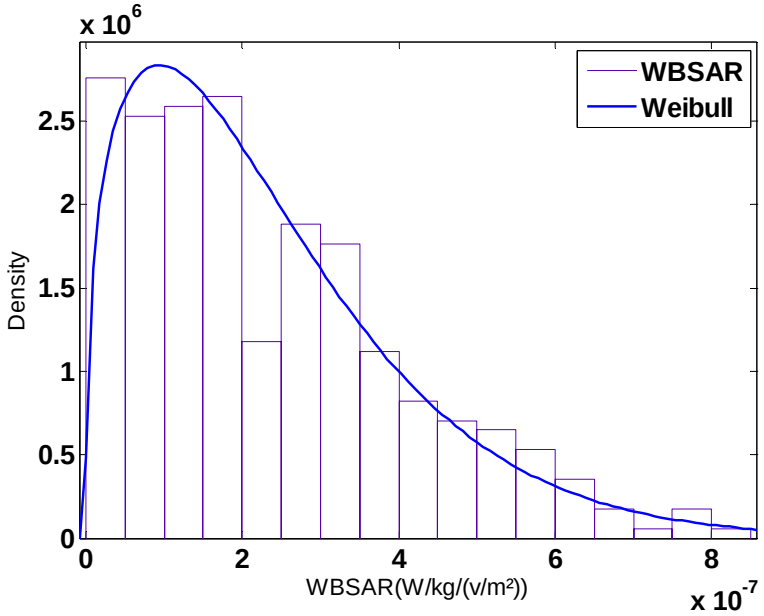


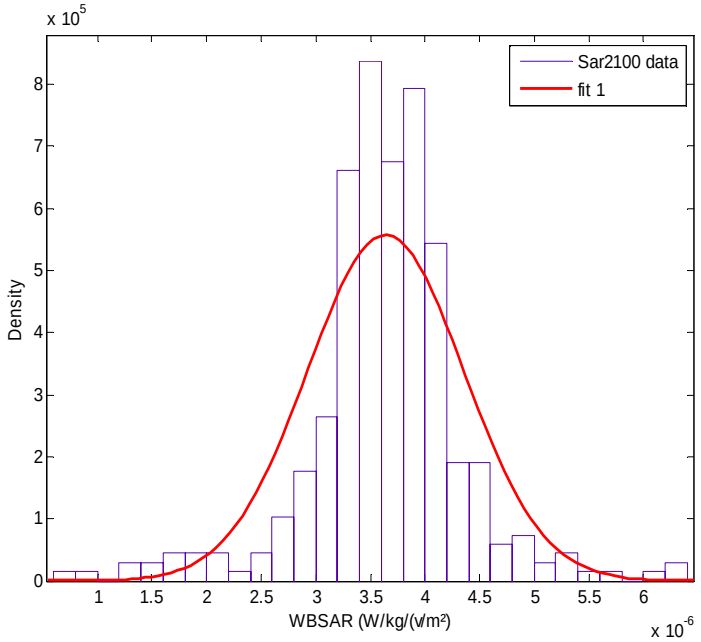


WBSAR distribution for the fetus and the pregnant woman at 2.1 GHz

5 random azimuth angles, 20 sets of 5 amplitudes Log-Normally distributed and 5 phases having continuous uniform distribution are generated







WBSAR distribution for the fetus (on the left) and for the pregnant woman (on the right) exposed to five plane waves for 340 different excitations with a variation coefficient of 74%.

Laterality

Most of PDA have today

- proximity sensor
- Accelerometer
- Magnetometer

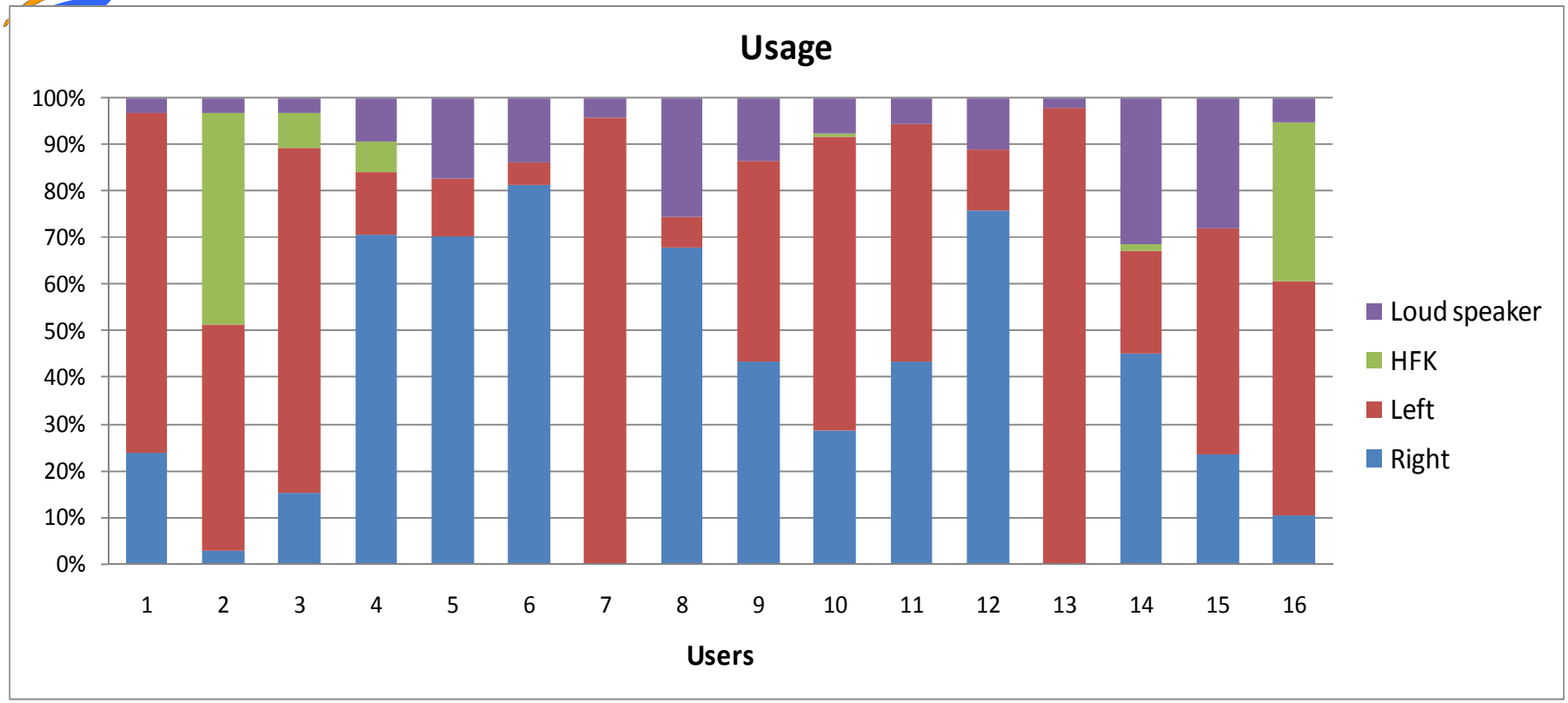
Android allows to get

- the sensors measurement
- the call duration
- the type of network use

Xmobisense use these facilities to get

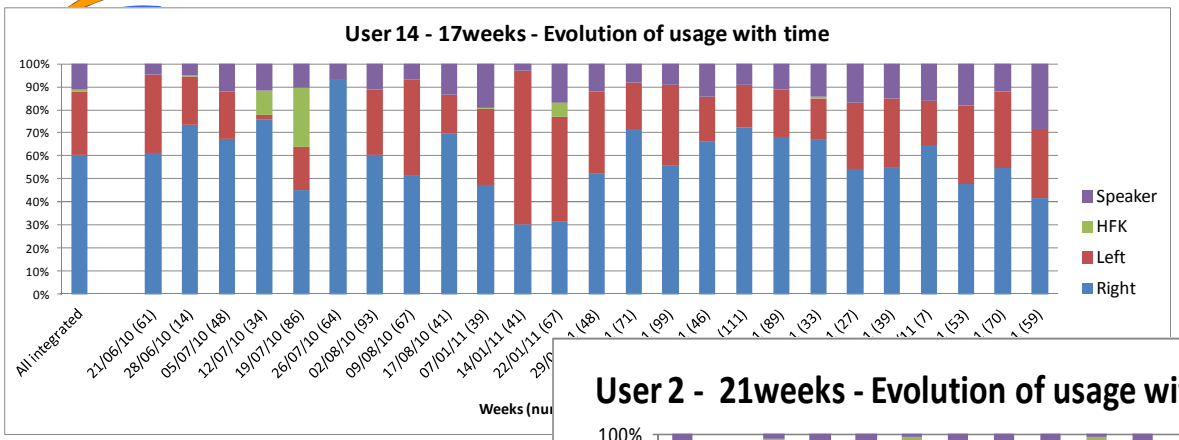
- laterality
- usage
- duration
- network use

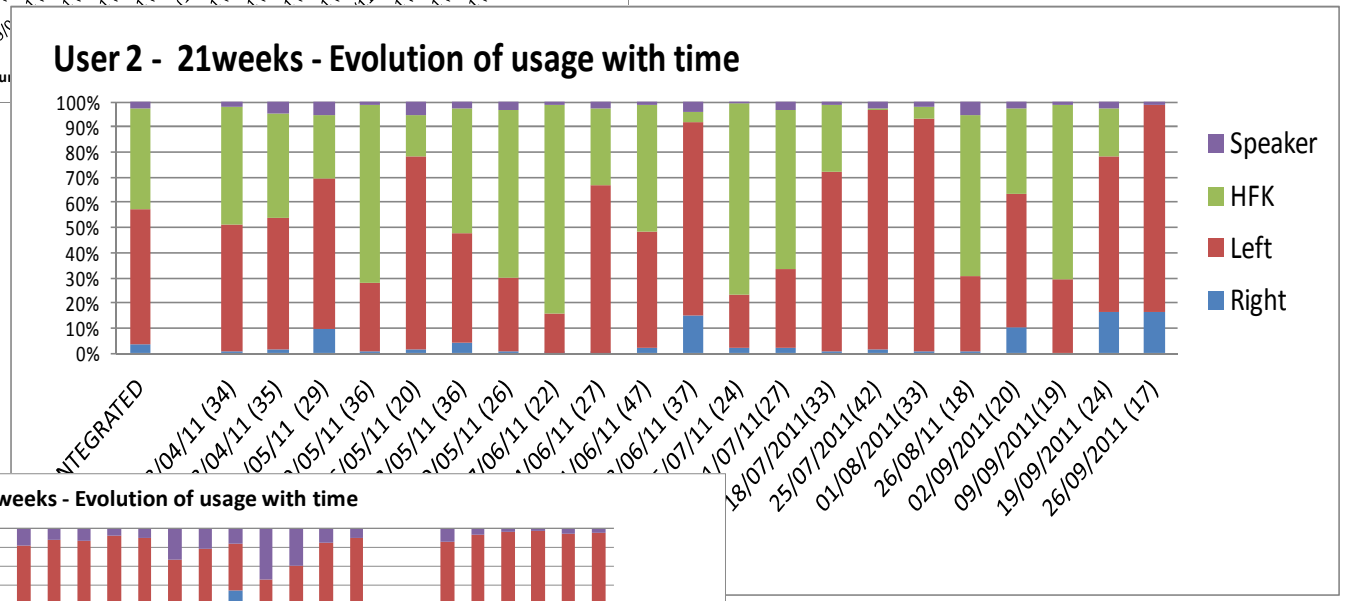
Laterality vs people

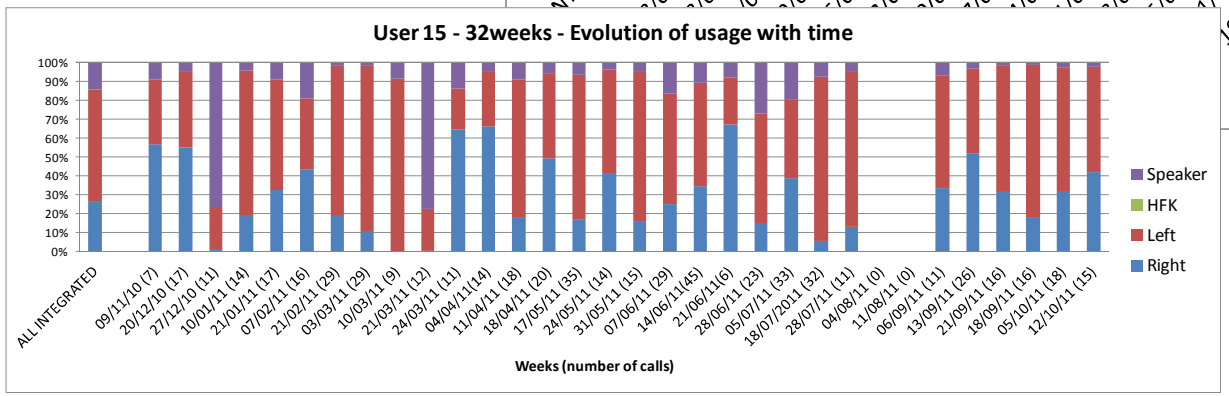


- large variability in the usage depending on people
- limited use of HFK

Usage vs week: cases of users

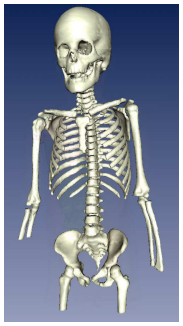


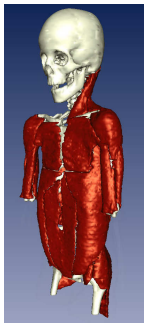




Children exposure

ANR Kidpocket project

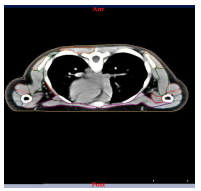




- Create children models
- Deform the models
- Analyse the exposure

Partners

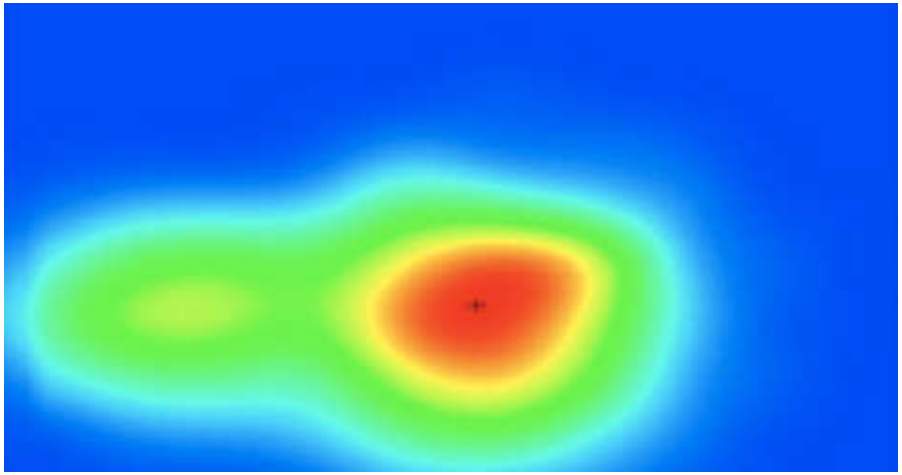
Orange labs
Telecom ParisTech
Telecom Bretagne
IGR
Phimeca
INRIA
PRES MLV
UPMC

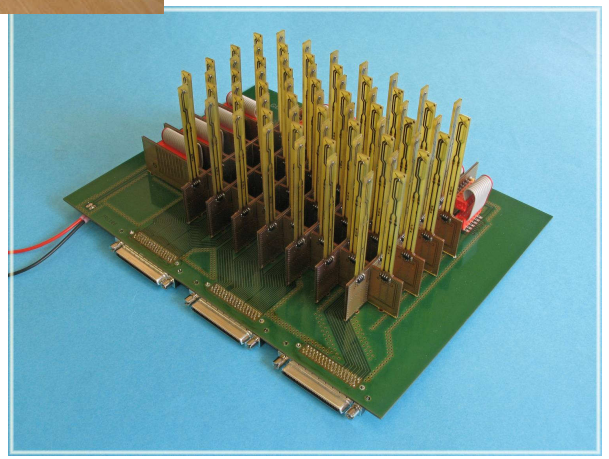


Trends in standards

MERODAS

- ANR
  - Telecom Bretagne
  - Femto besançon
  - Satimo
  - Orange Labs





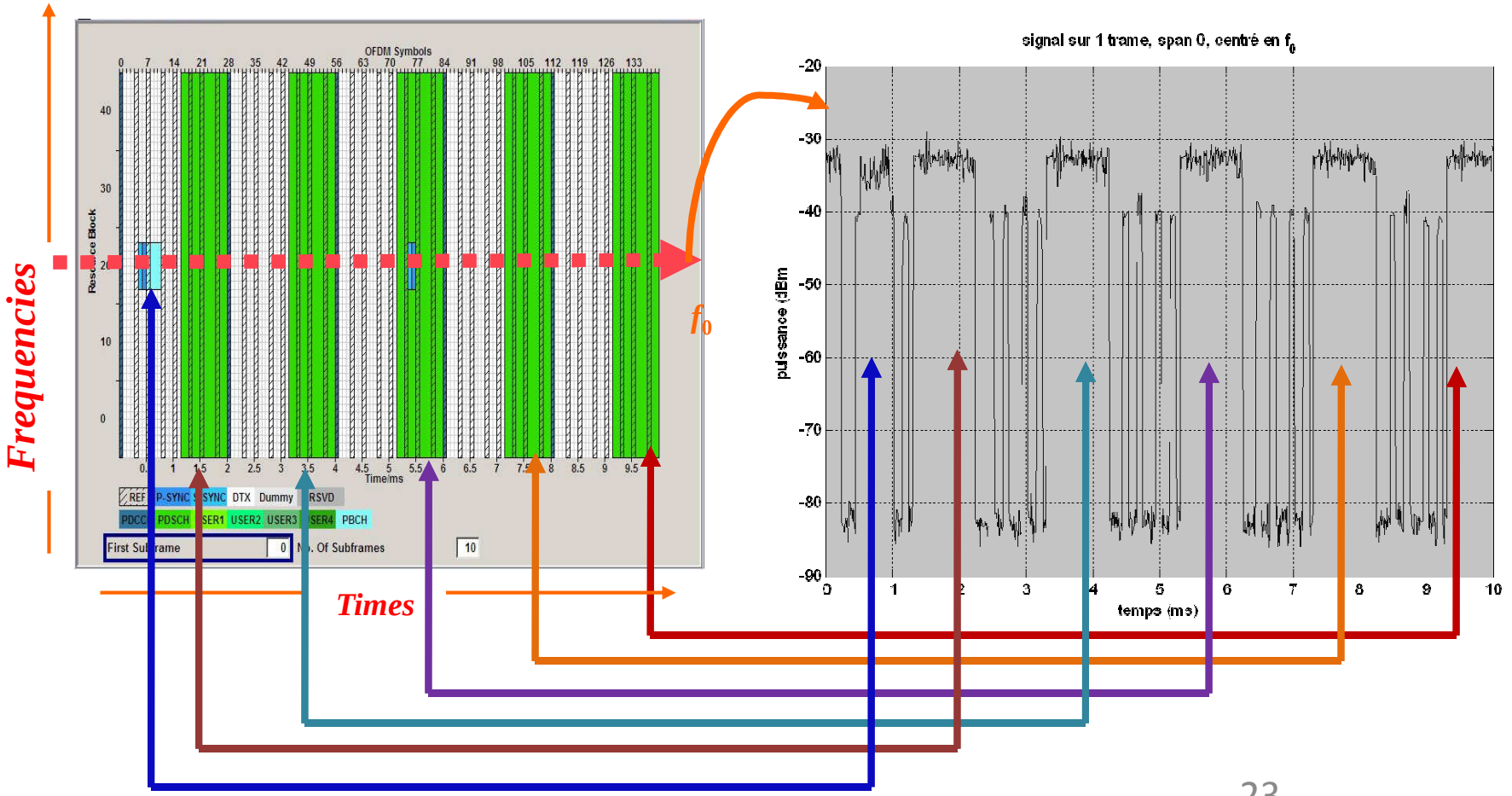
standards.

- IEEE and IEC
  - Close cooperation between IEEE 1528 and IEC 62209
- 62209- 2 « Body Worn »
  - 62209-2 is a basic. A product has been discussed in Cenelec WG
  - Product is under discussion within European NC
- 62209-1 « head »
  - maintenance
  - Quick SAR but not the hand influence.
- 62232 « base station »
  - Effort to simplify the existing standard
  - Harmonization with EN50583, EN50400 and EN50492
- ITU
  - On going effort to harmonize with IEC

In situ measurement (EN 50492)

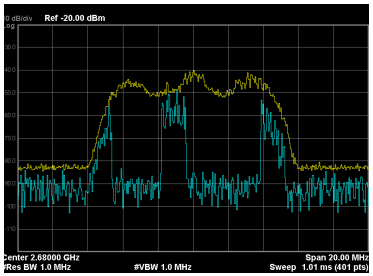
- Under maintenance to add a technical annex dedicated to LTE measurement
- Should be send to vote by the end of this year.

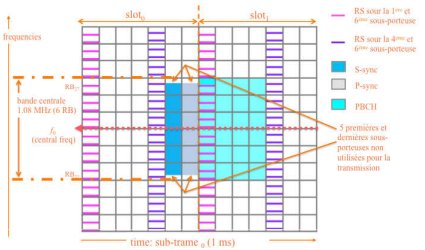
RF Exposure assessment: LTE

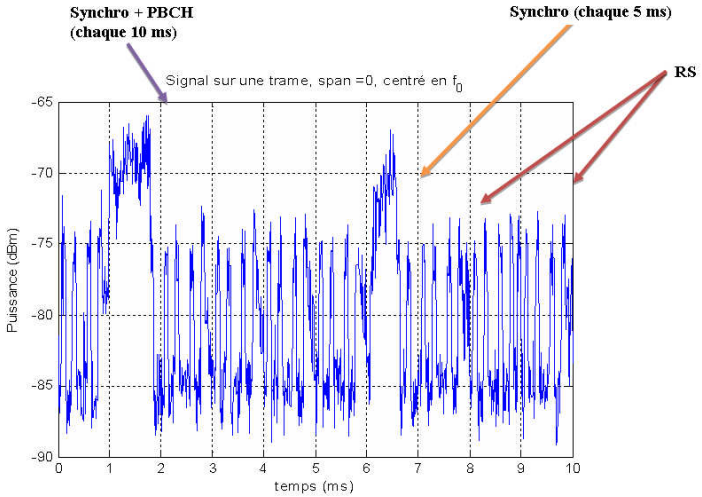


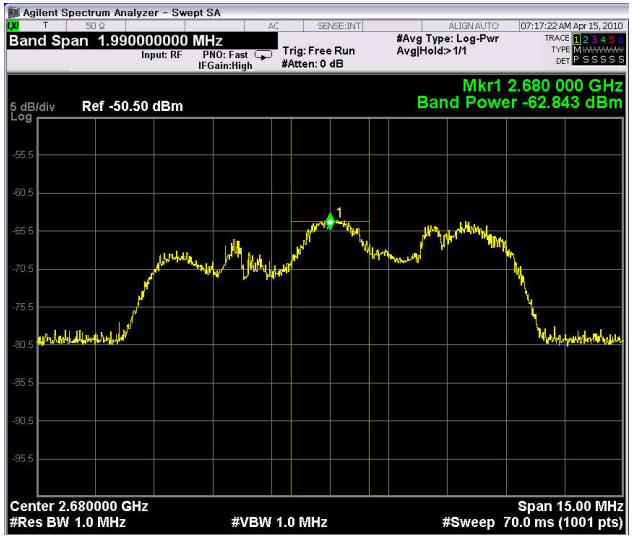
LTE

- Lte
  - Wide band (10 Mhz)
  - OFDM
  - Time & frequency
- How measure









As conclusion

Dans la confusion trouver la simplicité
De la discorde faire jaillir l'harmonie
Au milieu de la difficulté se trouve l'opportunité

Albert Einstein,
Trois règles de travail