



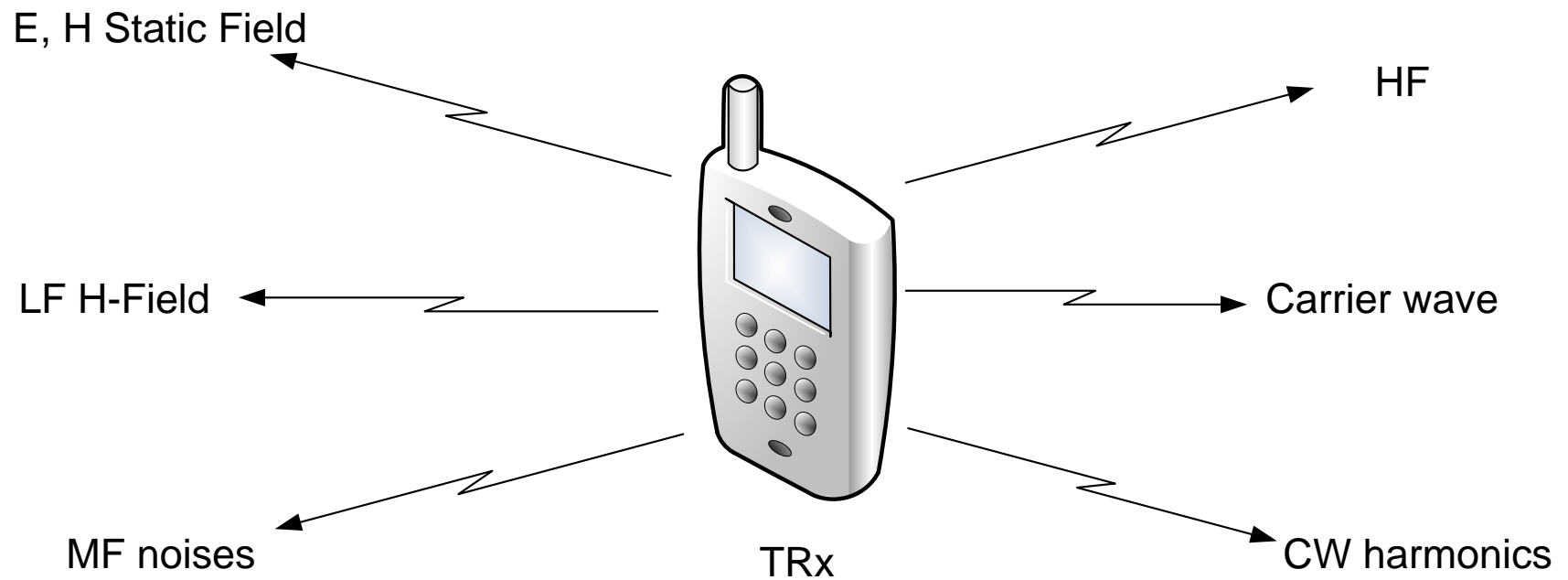
Politechnika Wroclawska

# MOBILE TELEPHONY & BIOEXPERIMENTS

Pawel Bienkowski, Hubert Trzaska  
Technical University of Wroclaw, Poland  
Antonio Sarolic, University of Split, Croatia



# Radiations from a transceiver (TRX)





# Radiations from a transceiver (TRX)

- Static fields, in the majority the H-field generated due to the Biot-Savart law by wiring between a battery and an output power amplifier.
- Low frequency fields, generated in similar way. Identical to the CW envelope.
- Medium frequency fields, generated by control system of a device.
- High frequencies, generated by intermediate frequencies of a device, local oscillators' radiation, clock (-s), harmonics of all frequencies present inside a device, usually in the range from single megahertz till several hundred of megahertz..
- Carrier wave frequency.
- Harmonics of the carrier wave - to add: an envelope of the harmonics is almost identical to that at the carrier frequency.



# Static H-field

Let's assume:  $P = 0.1 \text{ W}$ ,  $V = 3\text{V}$ ,  $\eta = 0.7$ ,  
thus

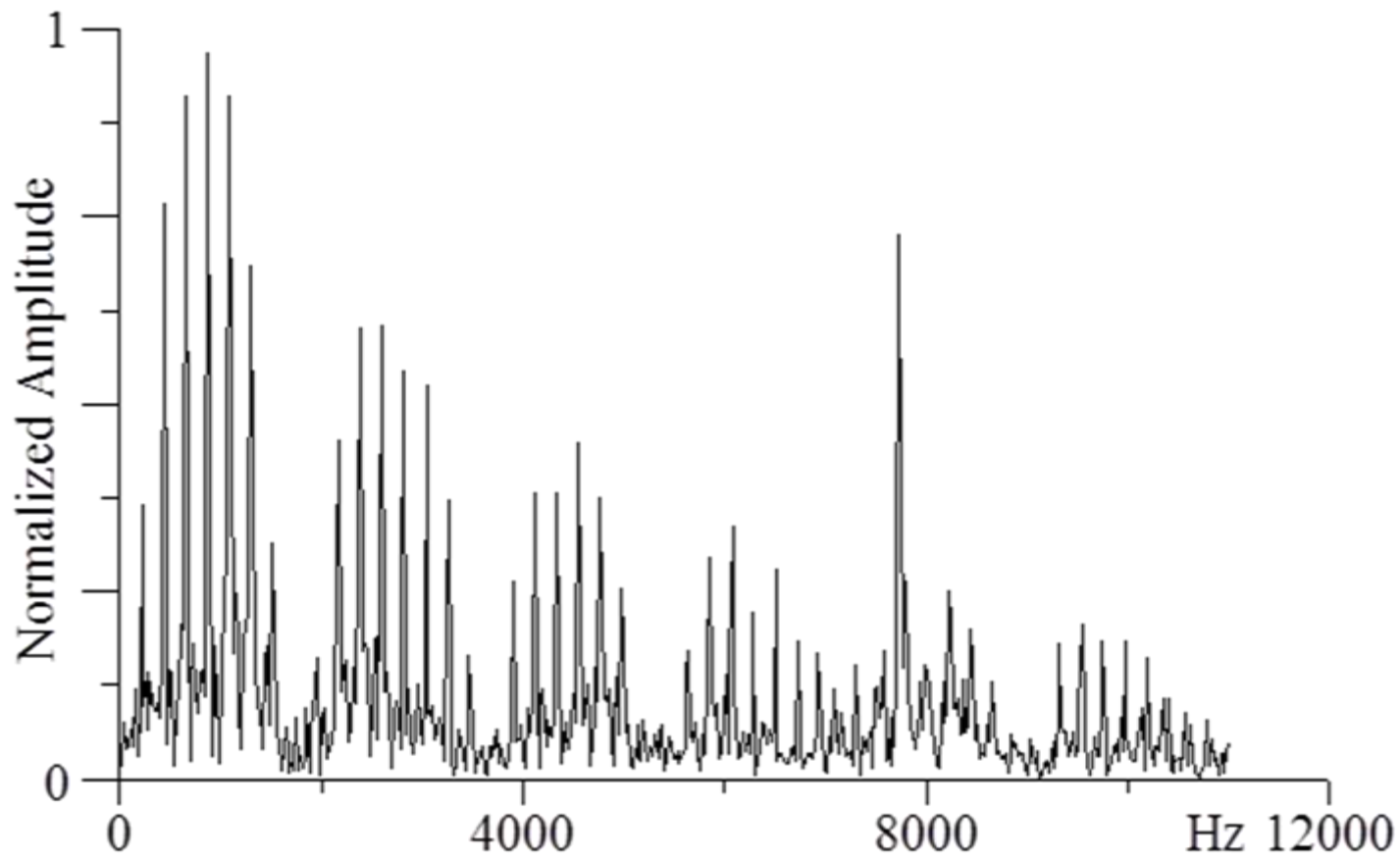
$$I = P/V\eta \approx 16 \text{ mA},$$

for  $r = 0.5 \text{ cm}$

$$H = I/2\pi r \approx 0.5 \text{ A/m}$$

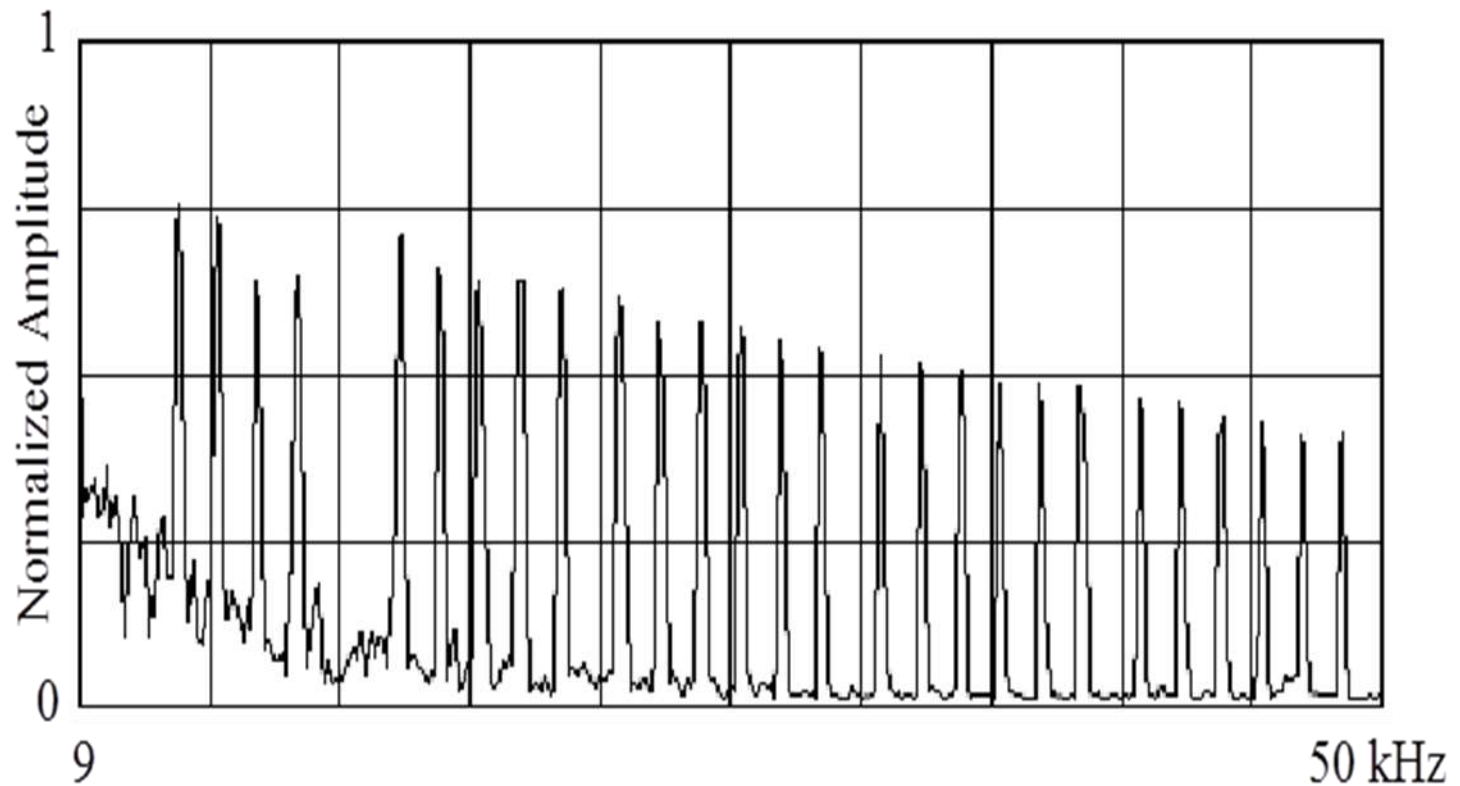


# LF H-field



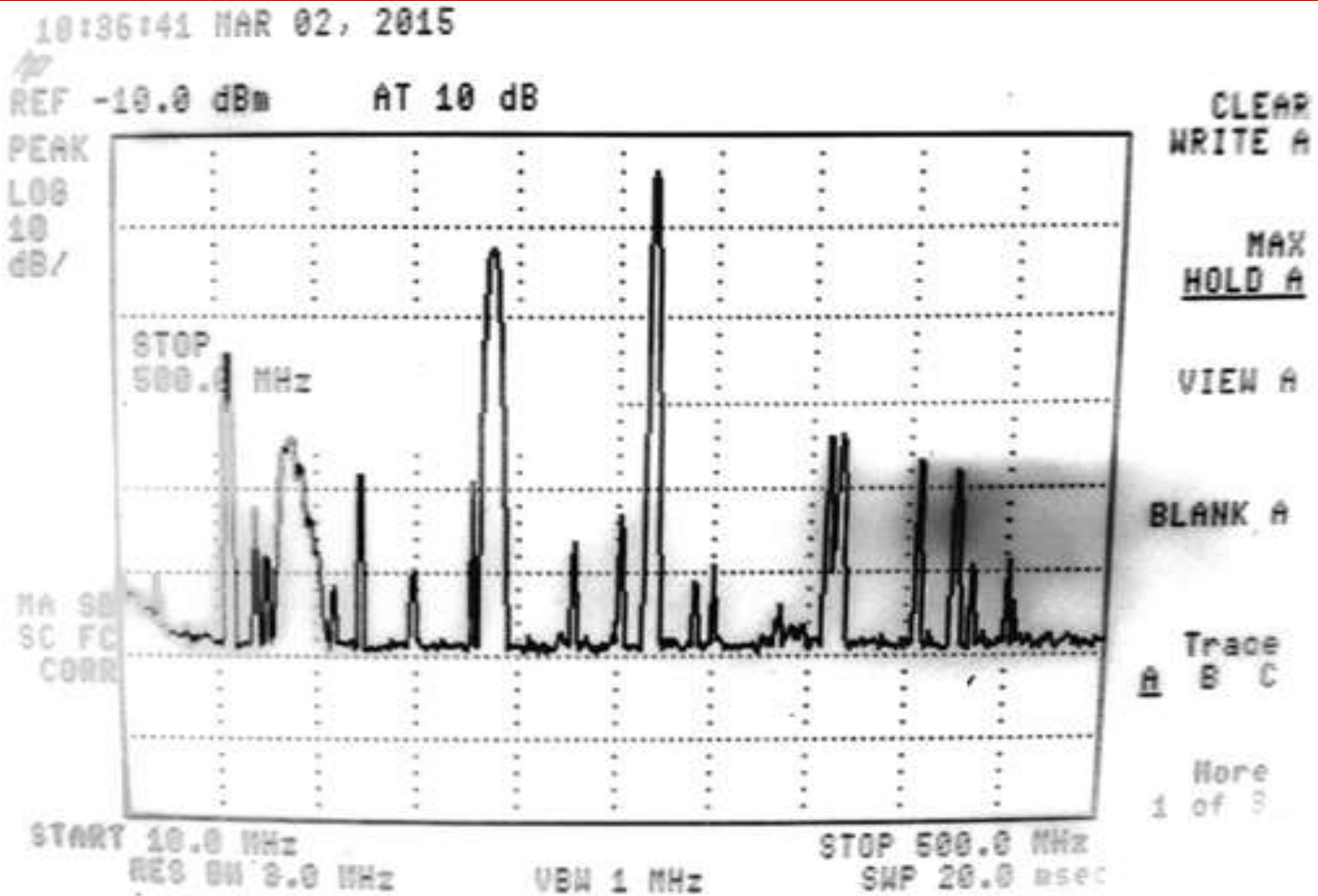


# MF noises



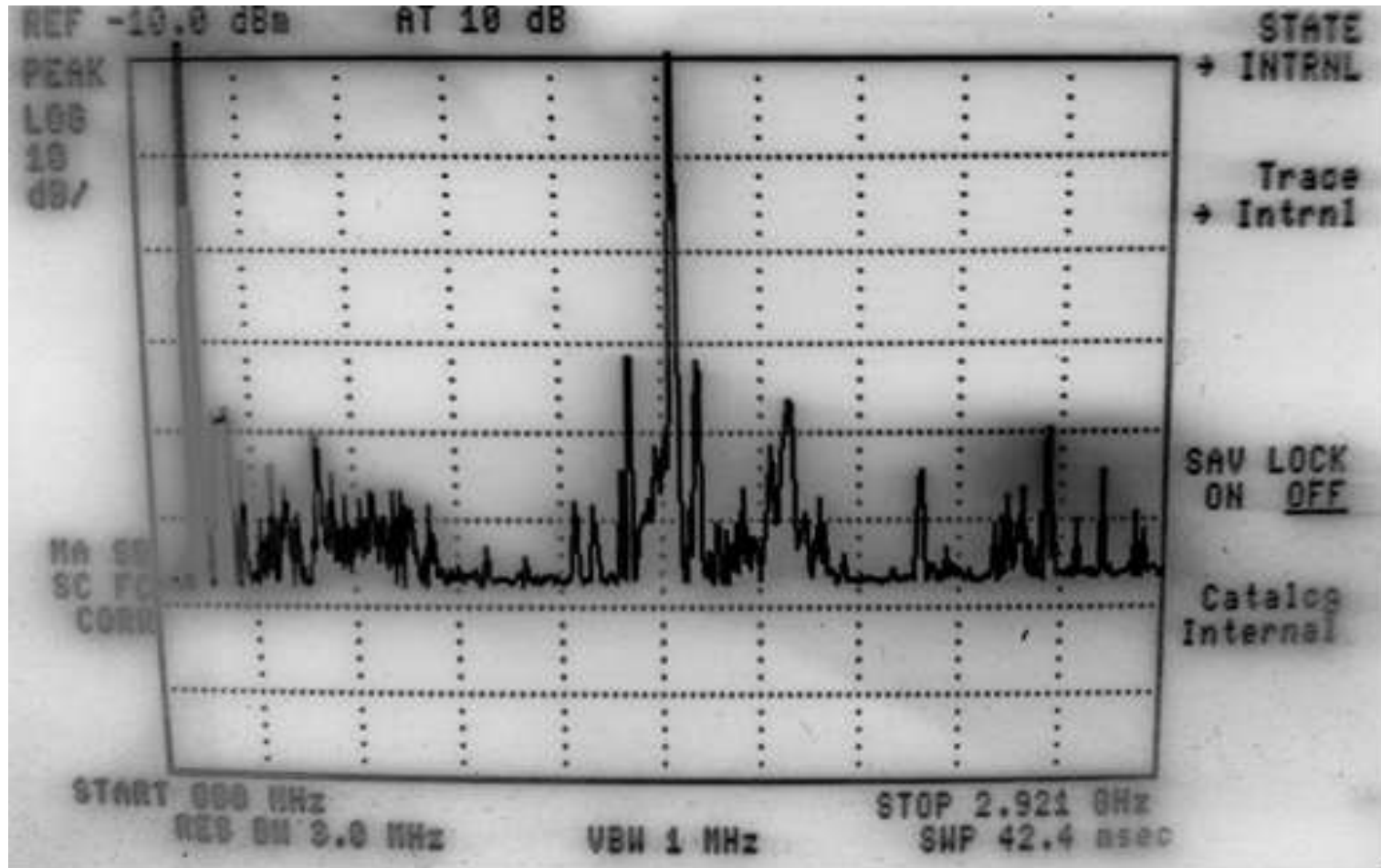


# RF





# CW + harmonics







# Questions

In bioexperiments usually only CW is applied (sometimes with modulation).

- What a role may be played by achromatic exposure (synergetics, role of accords, Prof. Garkavi)?
- What a role may be played by selective fringes (Dr. Clark)?



# Doubts

Emissions from a device cover range of natural  $\alpha$  and  $\beta$  rhythms.

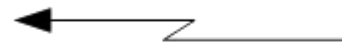
The emissions cover wide range of frequencies applied in electrotherapy.

Can they play any role in vivo?



# Simple checking the radiations

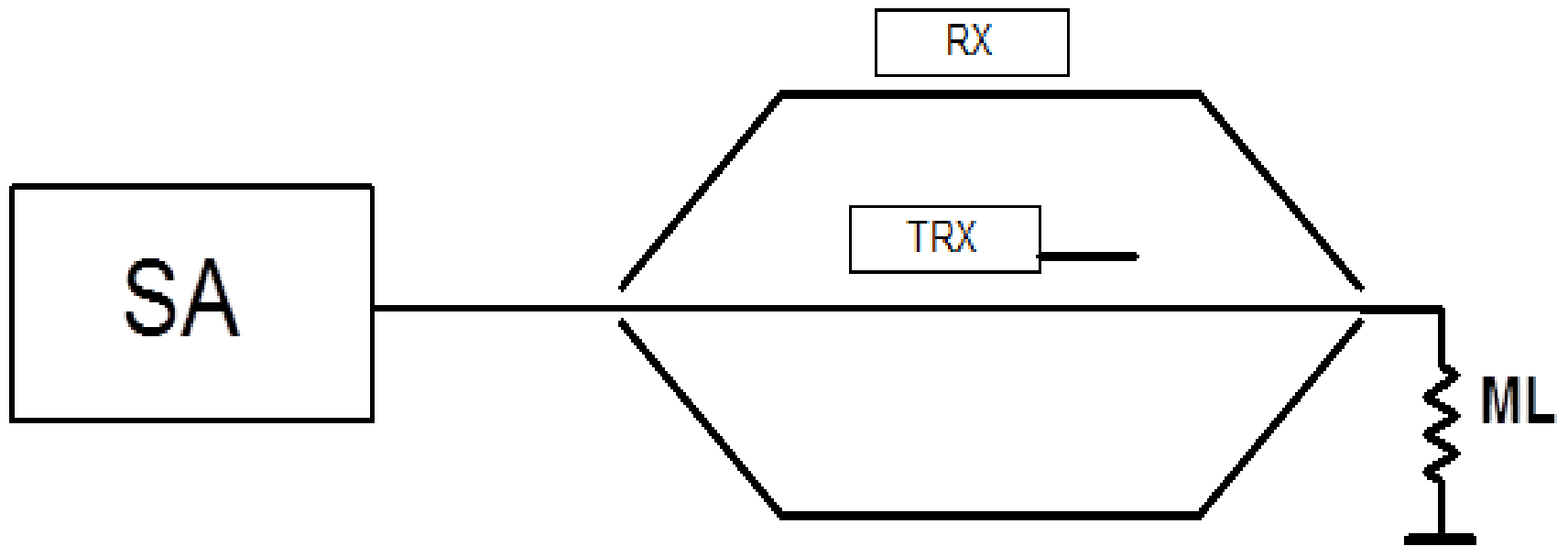
AM LW  
RX



TRx

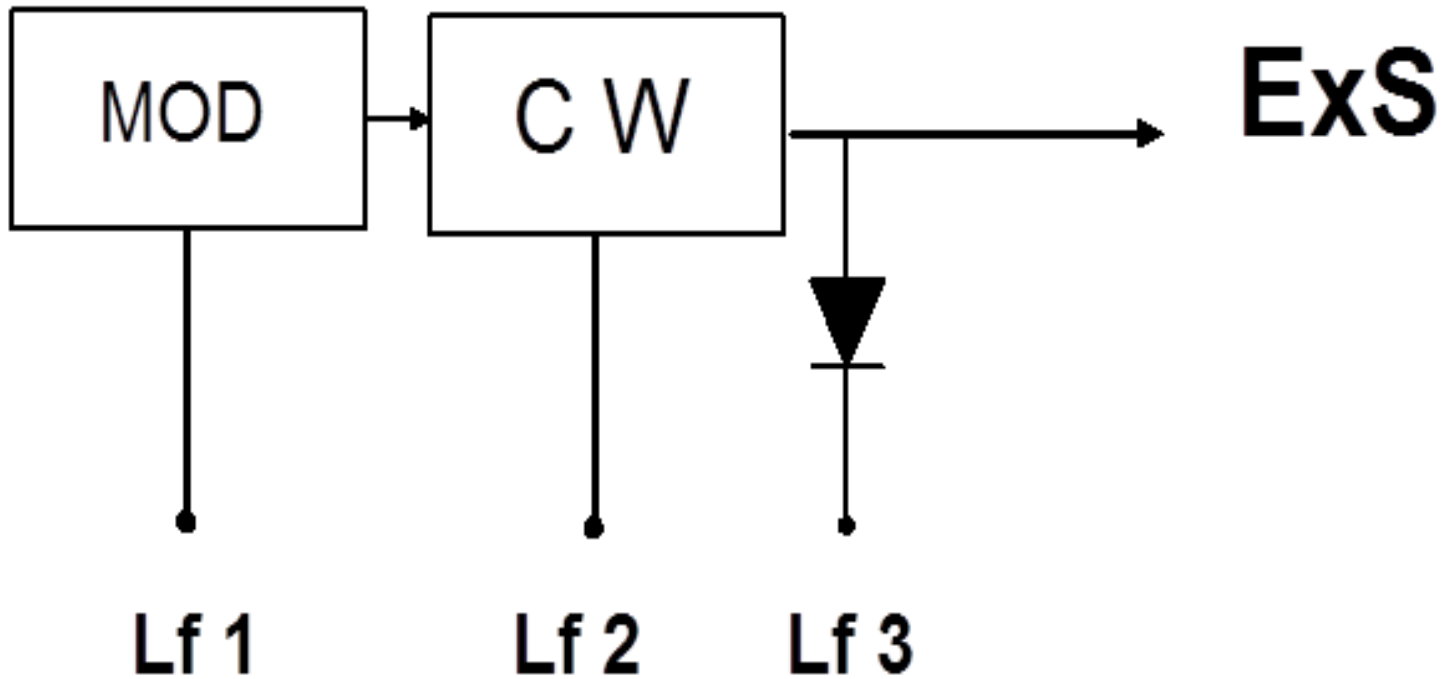


# Radiations measurement





# OUR PROPOSALS: CW + HARMONICS + LF



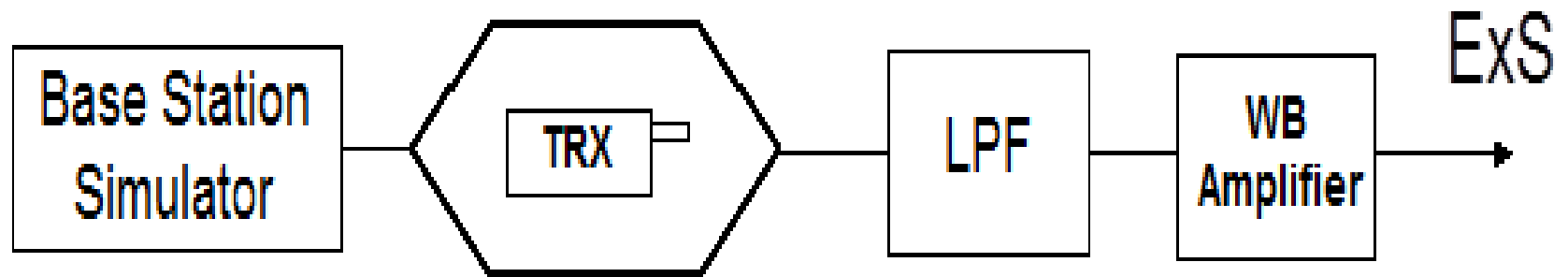


## CW + Lf

- No one portable device is able to continuous work with full power, it is better to replace it by a generator.
- The Lf may be extracted from an external modulating generator (Lf1), from the CW generator if it has appropriate modulation (Lf2) or from the CW generator envelope detection (Lf3).



# OTHER RADIATIONS





## Other radiations

Other radiations may be taken from an original TRX which work is controlled by a base station stimulator.

The TRX is placed in a TEM cell in order to protect the system against external emissions.

The LPF cuts off frequencies around CW, at which works the stimulator.





# Final comments

- Presented results of measurements show presence of a wideband radiation from a mobile terminal.
- All the radiations are not taken into account in laboratory bioexperiments.
- It may be a reason of disagreement between results of experiments performed in different labs.
- Several solutions are presented.
- They may be adopted and implemented in practice of any team.
- The last shows an important role of experienced technician in technical side of experiments preparation.



**Muchas gracias amigos**

Thanks a million for your patience