

Wireless Communication for Hearing Devices and Integration into Wireless Body Area Networking (WBAN)

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Overview

- Wireless revolution catching up with Hearing enabling compelling use cases
- Ultra Low Power (ULP) Magnetic Induction Radios making it happen
- NXP's MI Radio Chip
- HearCom Personal Hub based Architecture
- Convergence Vision towards integrated Healthcare WBAN

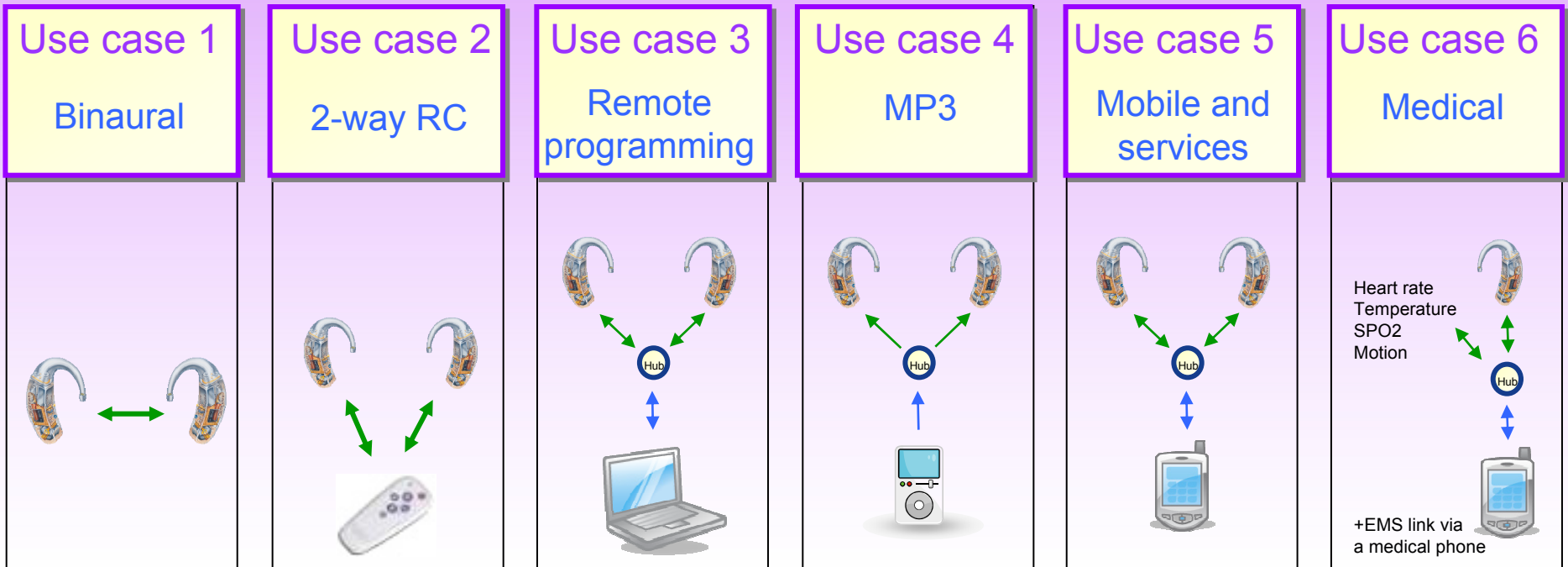
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Connectivity in Hearing Aids

Advanced Hearing Capabilities

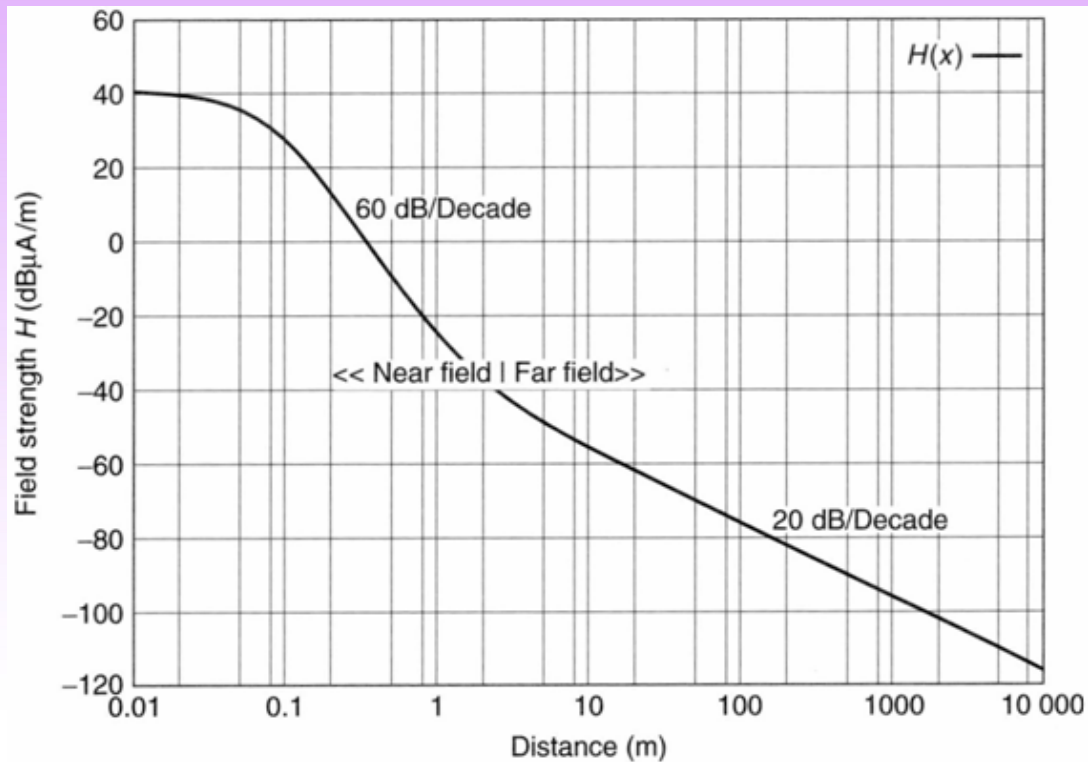
Convergence with CE & Medical



 ULP Radio
 Bluetooth™



Radio Propagation Near Field for ULP



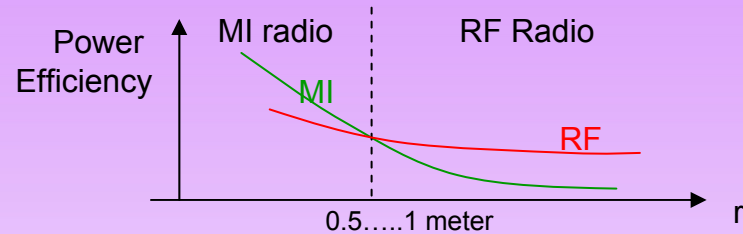
- Far field, zone
 - propagating effects dominate
 - roll-off proportional to $1/r$
- Near field zone
 - induction effects dominate
 - roll-off proportional to $1/r^3$



Key Advantages of MI Radio

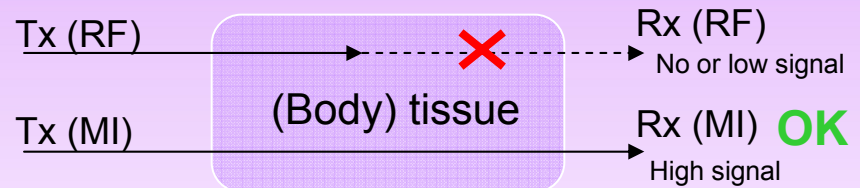
1

MI is **more power efficient** than RF on short distance



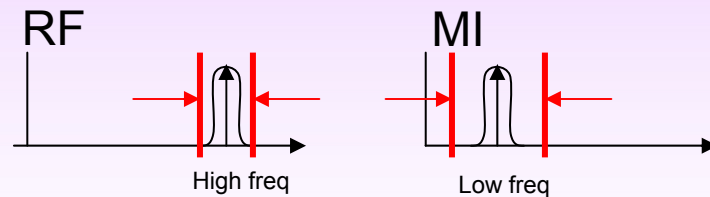
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MI goes **through (body) tissue** with low degradation of signal strength, whereas RF doesn't



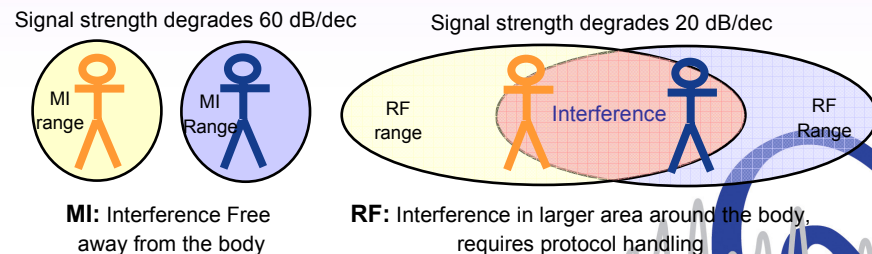
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MI **doesn't need a crystal** to keep spectrum within regulated BW boundaries, whereas RF does



4

Steep degradation of MI signal strength as function of distance **reduces interference** level, therefore increases robustness



Key Ingredients towards Hearing WBAN System

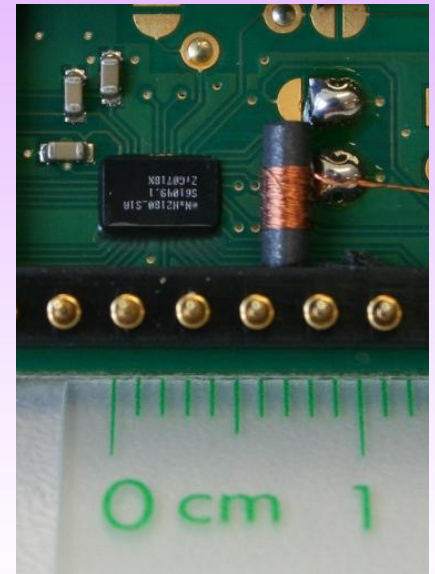
- Transceiver: ULP MI Radio
- Protocol: ad hoc networking, audio streaming, data transfer and control messaging
- Codec: Speech & Music compression
- Processing: ULP processor such as CoolFlux DSP
- Personal Hub: Bluetooth as gateway to the external world



NXP Semiconductors' NxH2180

Highly integrated monolithic IC featuring

- ▶ **MI Radio** transceiver
+
- ▶ **CoolFlux DSP** core
+
- ▶ Highly efficient coprocessor for audio coding
- ▶ Embedded flash for program & data storage
- ▶ Digital audio and control interfaces
- ▶ On chip power management
- ▶ Crystal-less operation
- ▶ Available as flip chip and in LFBGA-81 package



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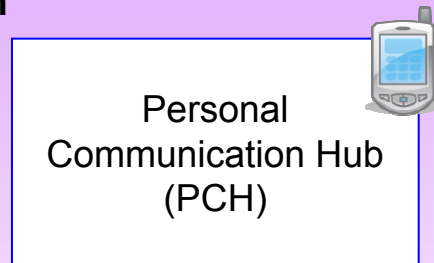
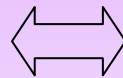


Integration with the HearCom Personal Communication System (PCS)

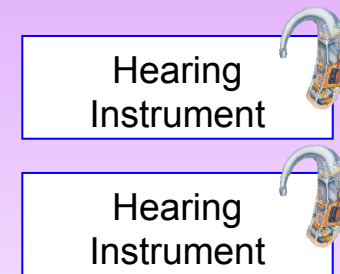
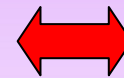
Services:

- Speech recognition server
- Announcements
- Telephone
- Radio/television
- Theater/church audio

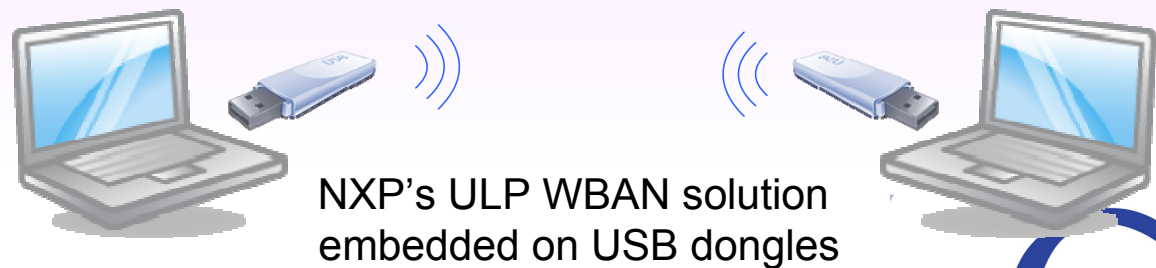
WiFi
Bluetooth
3G
Internet



WBAN



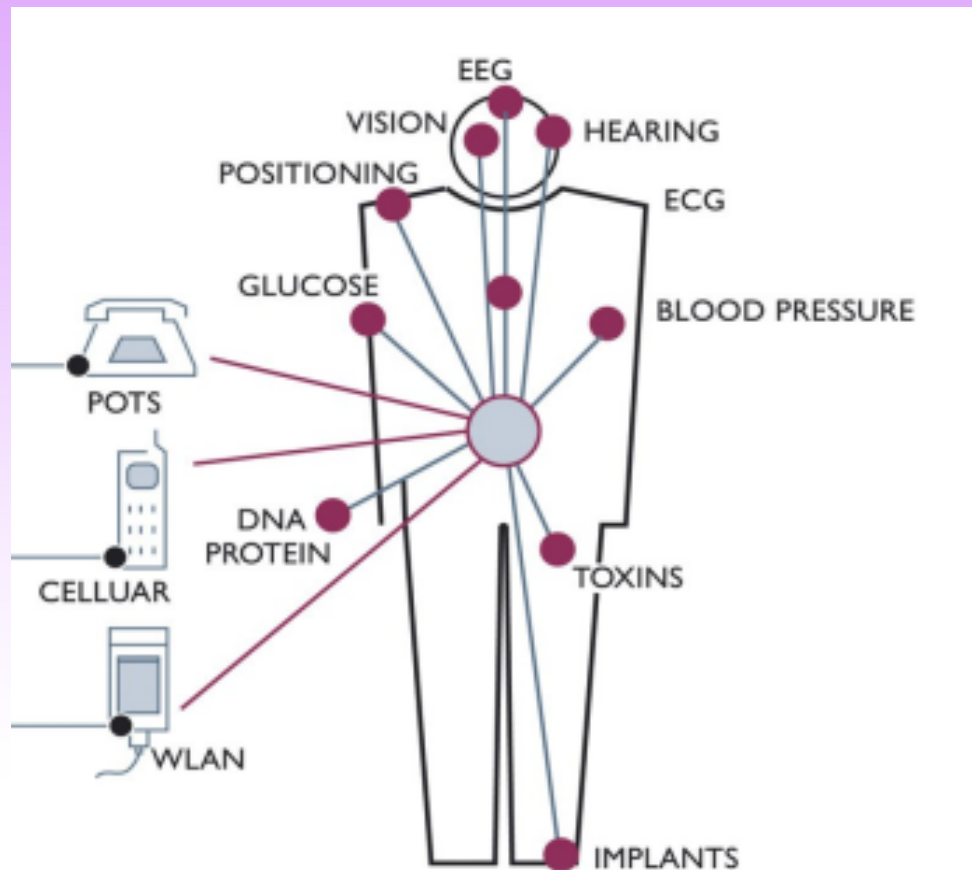
Personal Communication Link
demonstration enabled on PC platform



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Wireless Hearing as precursor WBAN for Health Care



Drawing by courtesy of IMEC

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Conclusions

- Hearing Devices becoming wireless terminals
- HearCom Personal Communication System demonstrative for further future potential
- Merchant enabling ULP Radio chips available now from NXP
- We see start here of Healthcare WBANs
- Convergence with Consumer Electronics may help create interoperability standardization

