



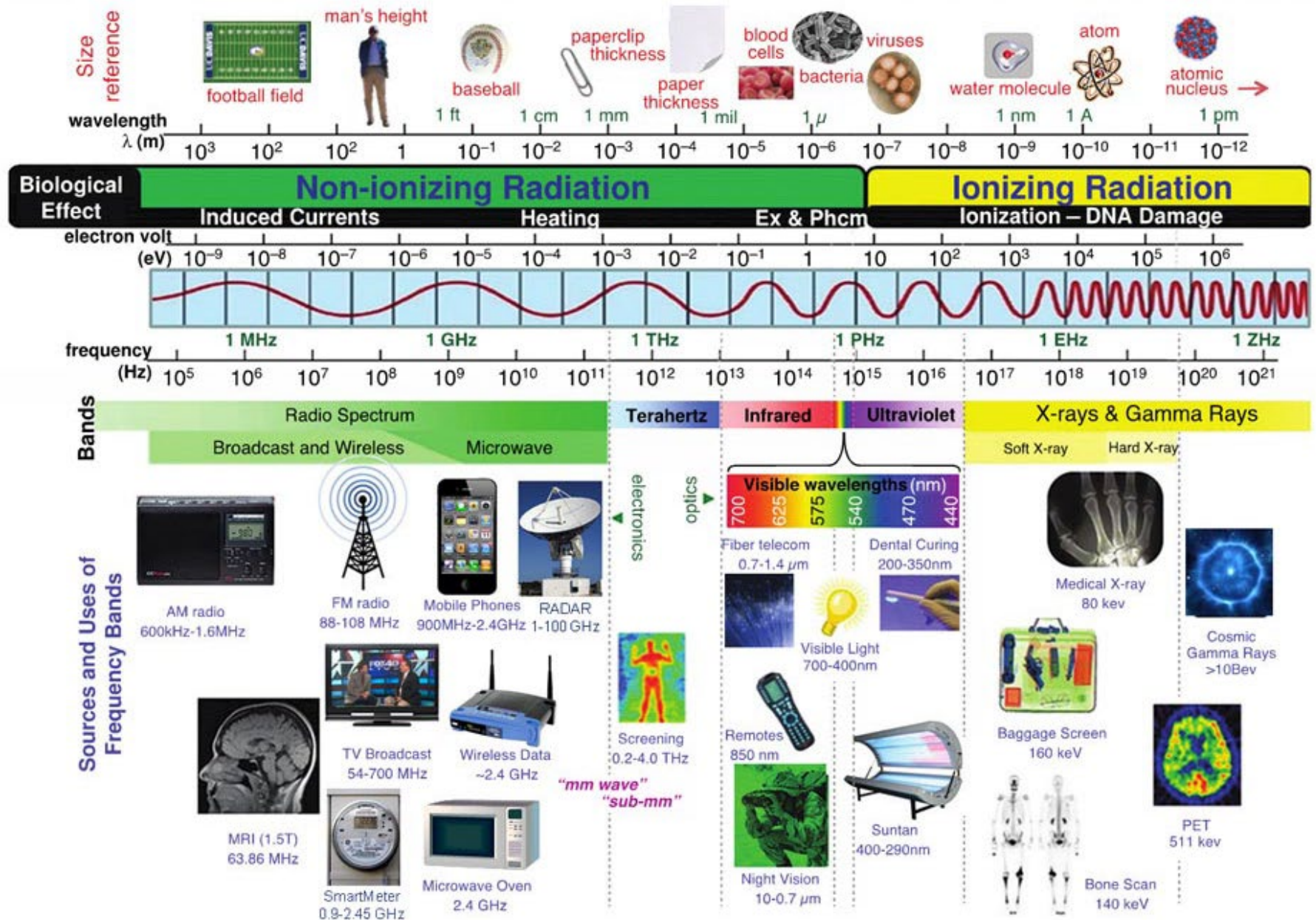
The RF Energy Company

RF Energy for medical applications

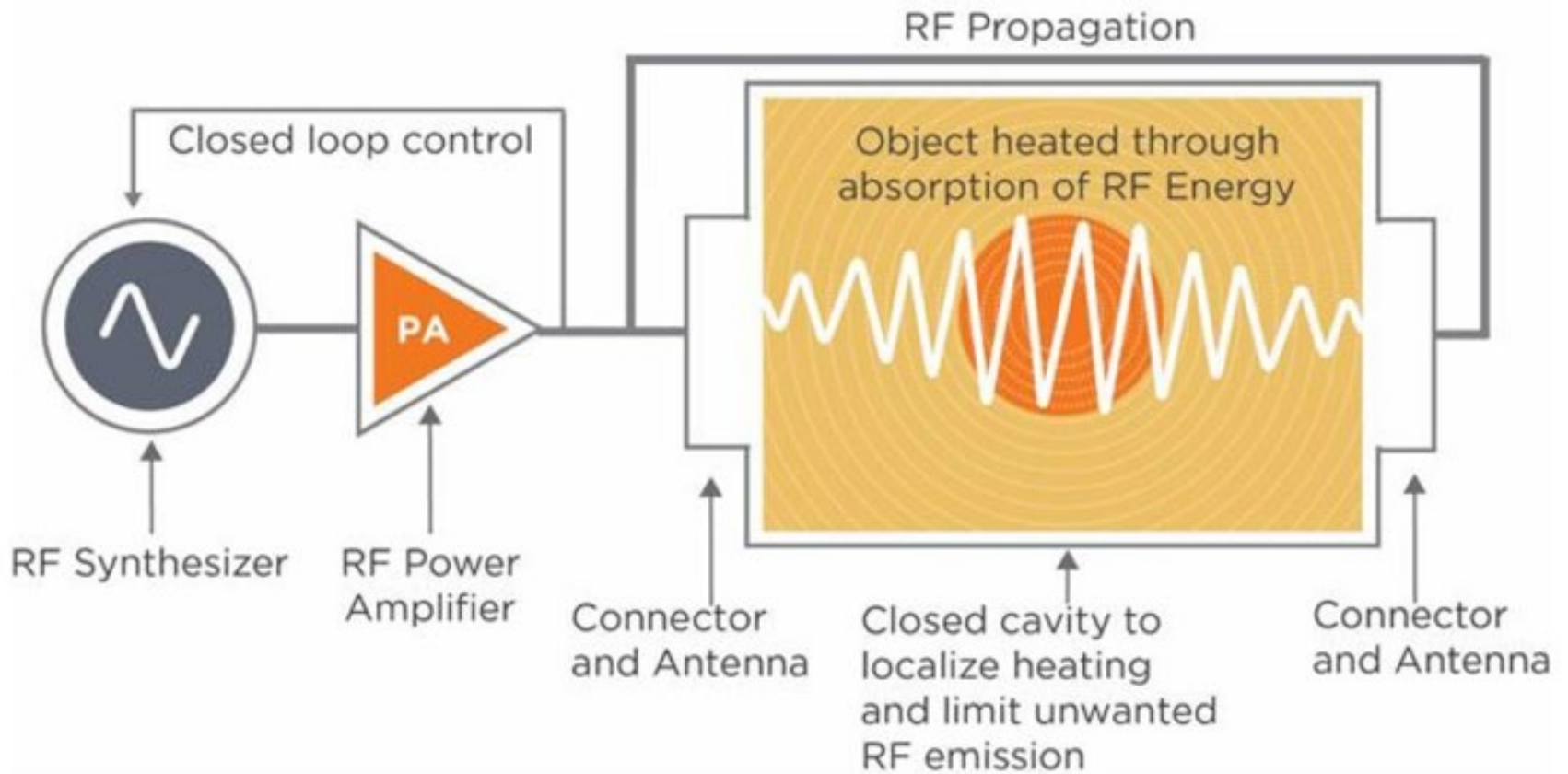
Topic outline

- Intro RF-Energy
- Hyperthermia
- Heating liquids
- blueTemp

Electromagnetic Spectrum - Overview

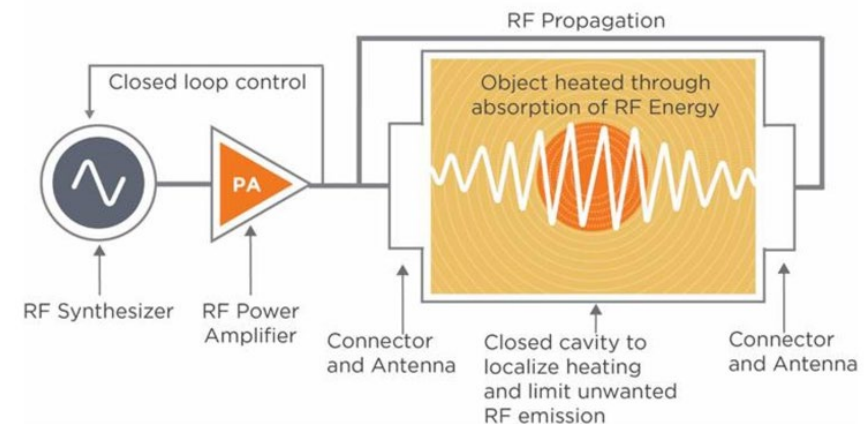


Solid-State-generated RF As Energy Source + applicator with load = RF Energy Application = precision dielectric heating



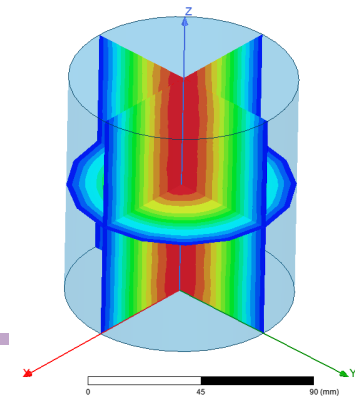
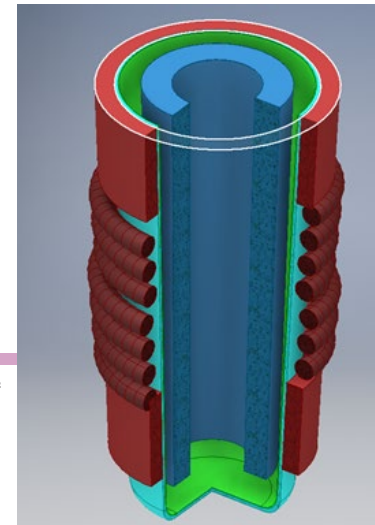
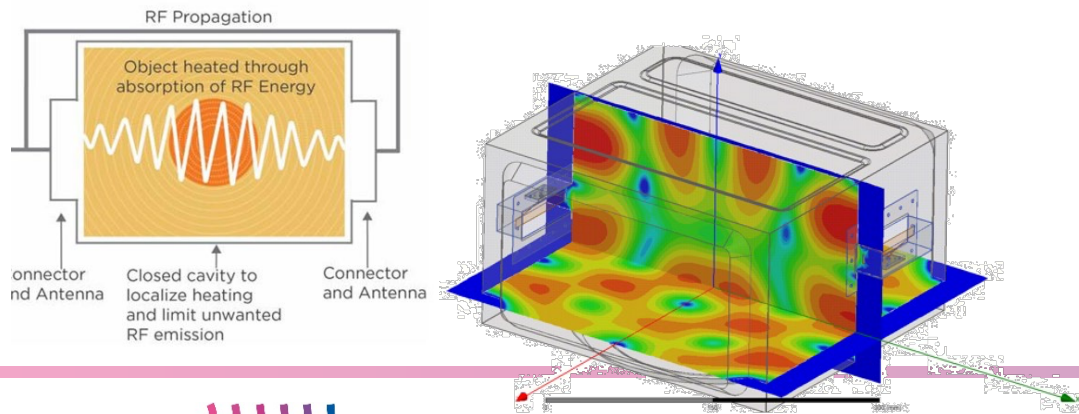
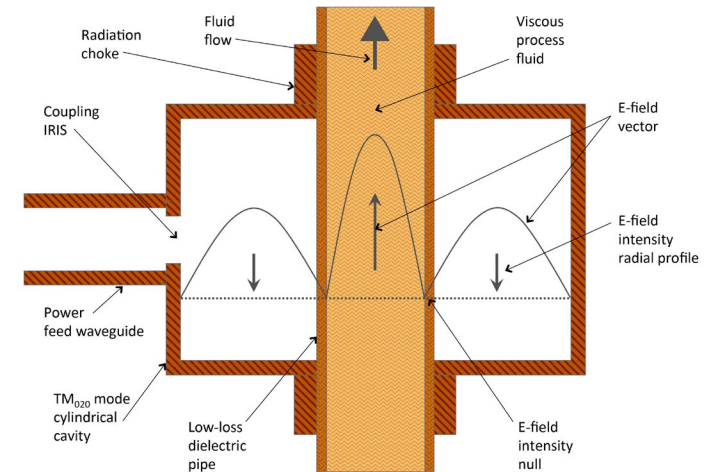
SSRFE & feedback

- Amplifiers measure forward and reflected RF power (and phase)
 - Calorimetric process control & quality
 - "Network analyzer" functionality
 - "talk to your load"
- Large dynamic energy range (μJ -> MJ)
 - $\mu\text{s} * \text{W}$ -> $\text{ks} * \text{kW}$
- Agile!
 - μs timescale
 - Swift response to arcing
 - Electronics and process protection



Precision energy delivery

- Into the load/process
 - Engineer localized energy density
 - Strongly dependent on applicator type and wave-length
 - Single- vs. multimode applicators
 - $P_{\text{in-load}} = P_{\text{delivered}} * \text{applicator efficiency}$
 - -> modeling + simulations



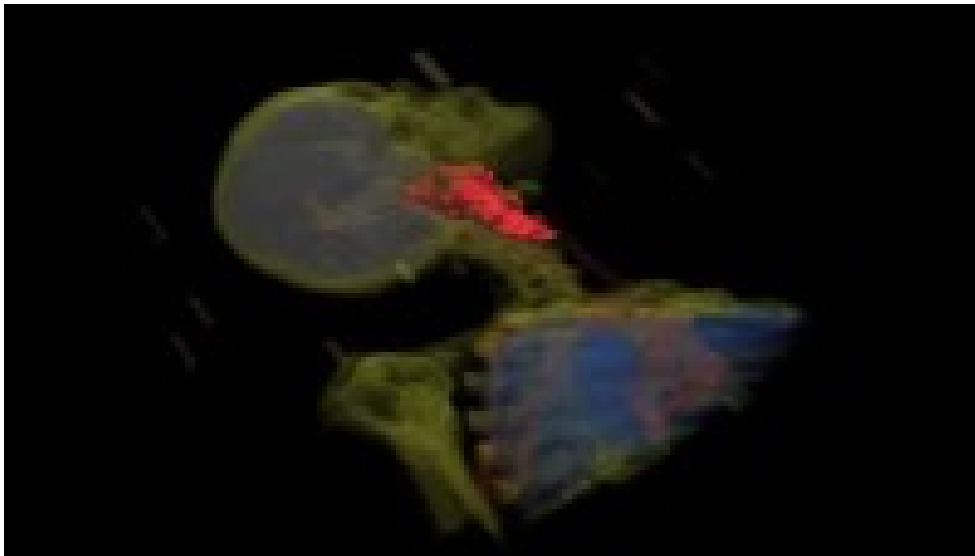
Precision energy delivered: “egg sample”



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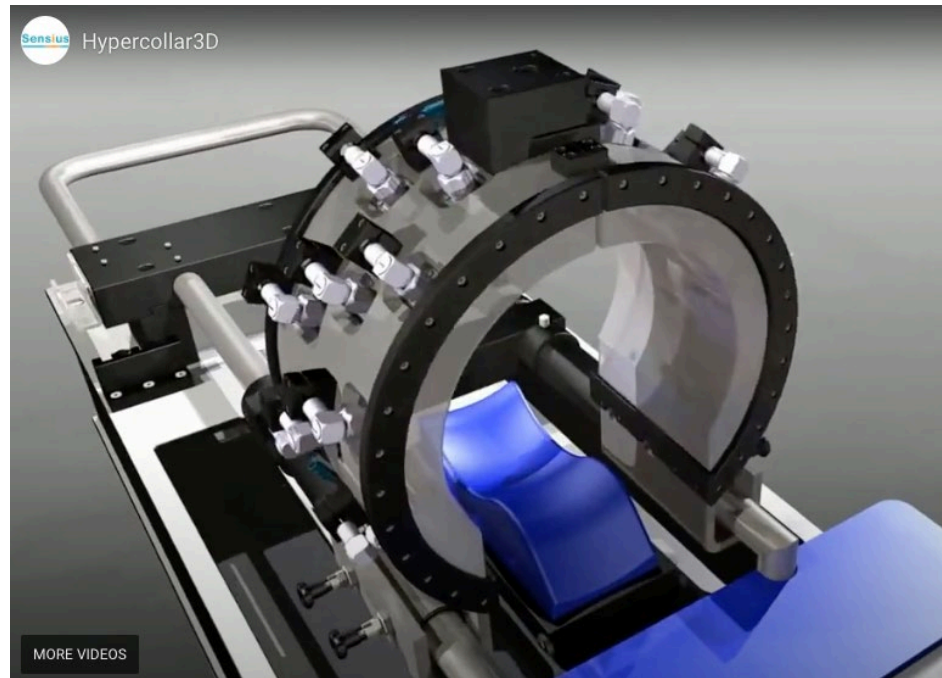
SSRFE Precision Energy Delivery: Hyperthermia treatment

- Superposition of coherent, multi-channel wavefronts permit the exact “focusing” of maximum energy deposition at the location of the tumor
- Lot of modeling required



SSRFE Precision Energy Delivery: Hyperthermia system

- ≤ 20 channels
- Antennae in water boluses in contact with body

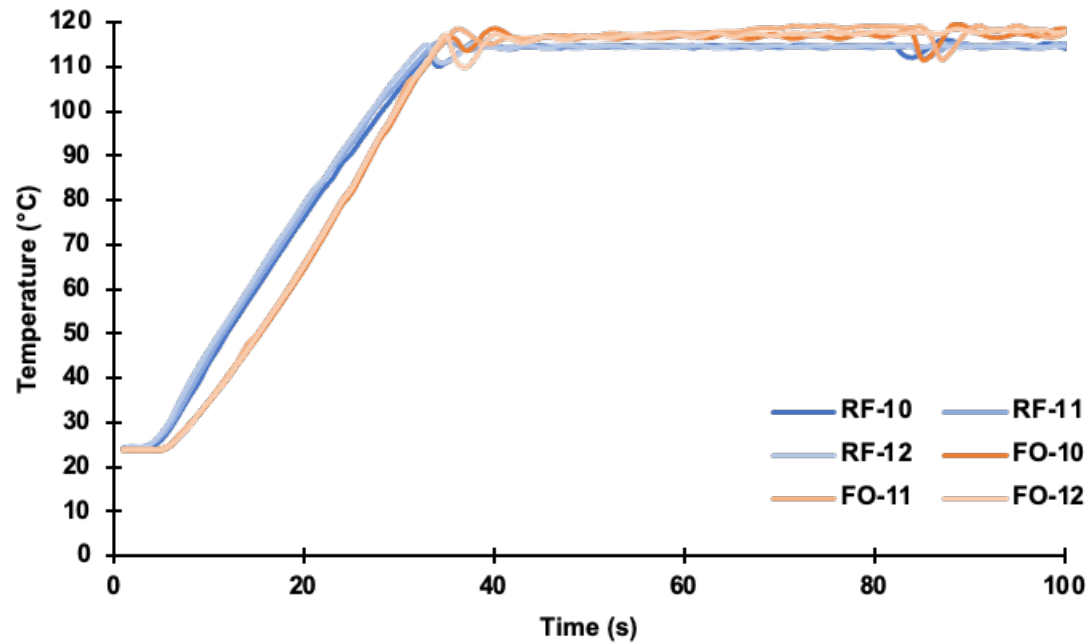


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Heating liquids – 27MHz

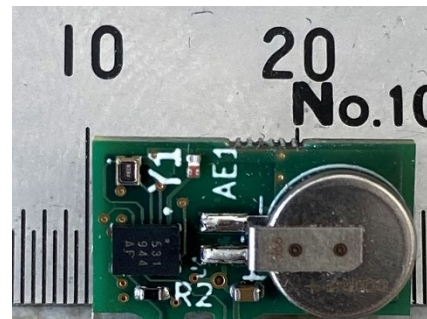
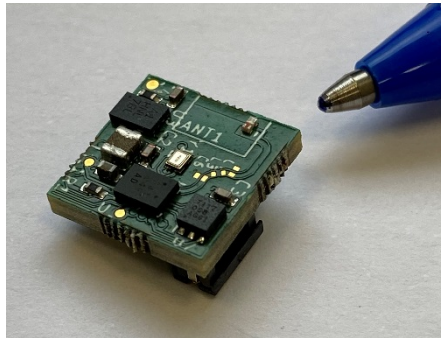
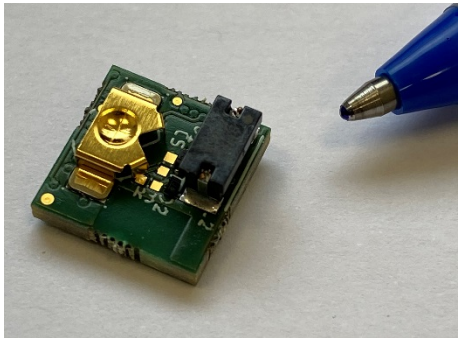
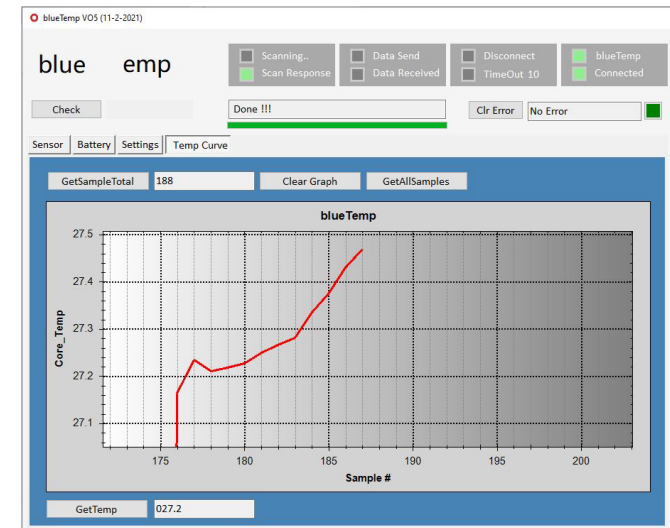


Heating liquids – 2.45GHz



blueTemp sensor

- Real time wireless temperature transmitter/logger
- $\leq 10 \times 10 \times 6 \text{ mm}$
- Can take any shape
- Any application ($-25^{\circ}\text{C} - 125^{\circ}\text{C}$)
 - Body core temperature monitoring!
- Different encapsulations



We think in solutions



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content subject to NDA