MDO of Mobile Phone

Antenna, SAR, HAC and Temperature

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MDO of Mobile Phone

- **Objectives:**
  - Maximise transmitted power of two GSM bands and at the same time minimise E-fields around ear piece for hearing aid compatibility. Also minimise SAR values to human head.
- **Requirements:**
  - Realistic phone model (template given size and “must” use modules, as display, battery, antenna volume, etc.) with realistic materials.
- **Computational domain (drawing with values TBD later) :**
  - Simplified mobile phone
  - Sources
  - Boundaries
- **Modelling:**
  - Antenna performance:
    - Antenna matching
    - Total Radiated Power (TRP)
  - Hearing Aid Compatibility (HAC)
    - E-fields above earpiece from specified height and area
  - SAR (human head)
  - Surface temperature of keypad

MDO of Mobile Phone

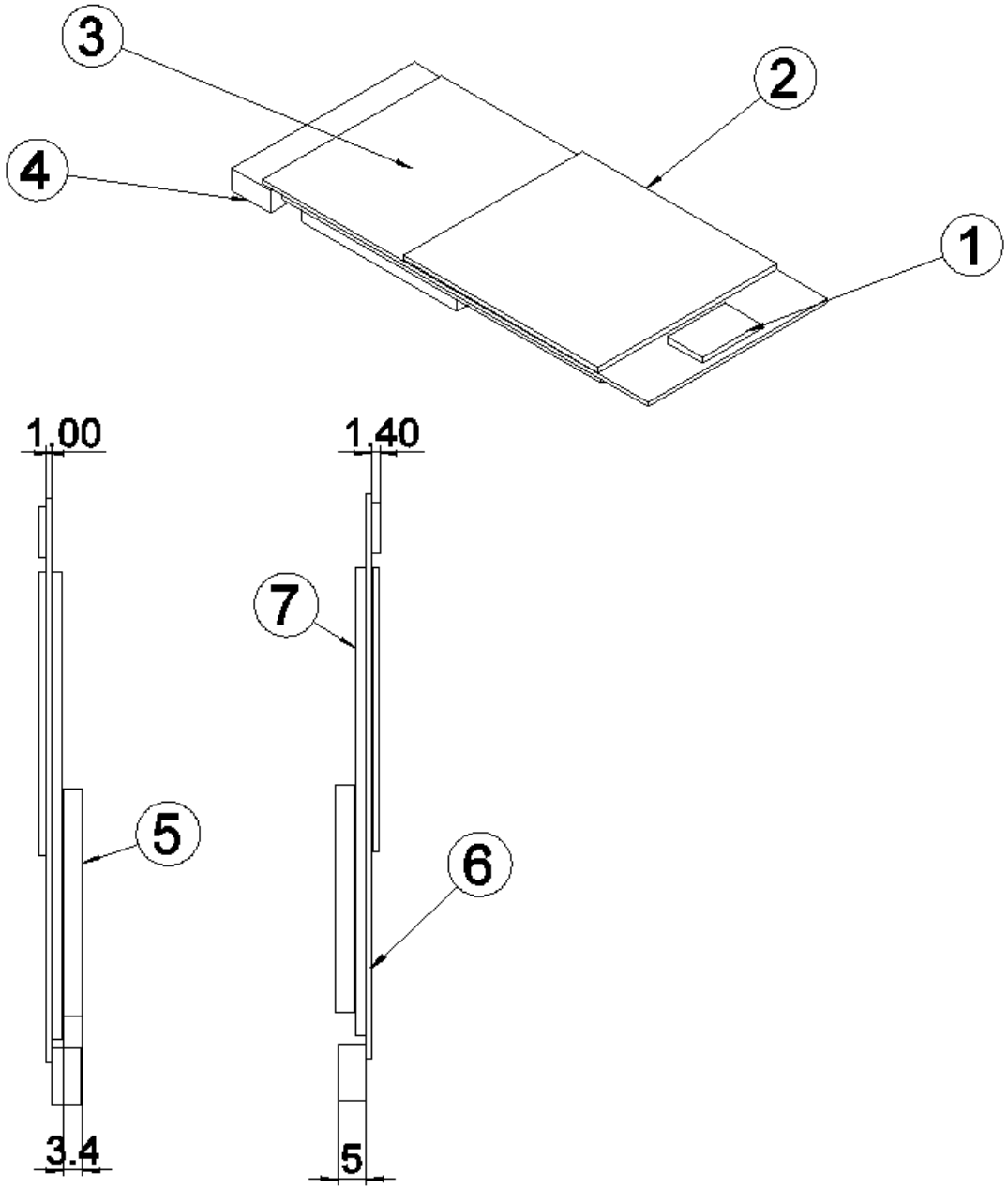
- **Boundary and/or initial conditions for computations :**
  - Case 1:
    - Antenna and HAC optimisation
  - Case 2:
    - Antenna, HAC, SAR and Thermal optimisation
- **Optimization:**
  - Antenna bandwidth in 850/900MHz and 1800/1900MHz bands
  - S_{11} of antenna feed
  - Minimise E-field for HAC
  - Minimise SAR values
  - Minimise temperature on keypad and temperature difference on display glass
- **Design parameters:**
  - Antenna element dimensions
  - Grounding points of mechanical structure
  - Dimensions and groundings of thermal conductor
  - Location

MDO of Mobile Phone

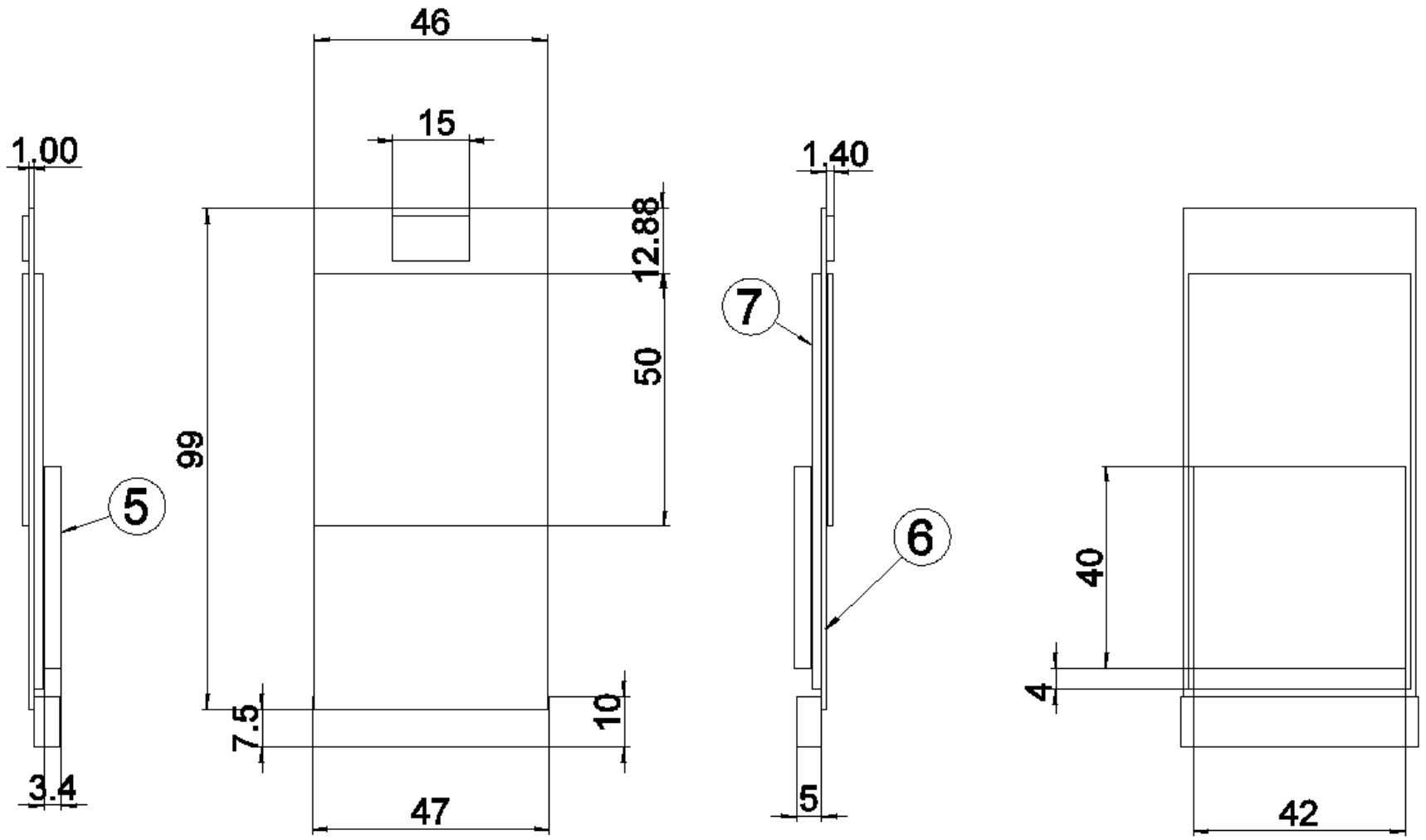
- **Objective function definition:**
  - S_{11} < -6dB with in each band (BWs TBD)
  - E-field < 266.1V/m@GSM850MHz, 84.1V/m@1900MHz (ANSI C63.19/M3) on the earpiece area
  - SAR < xx W/kg in human head (EN50360/1)
  - Temperature of keypad t_{keypad}< 60^{o}C (ABS/PC), 45^{o}C (steel)
  - Temperature difference on display, Δt_{disp} < 10^{o}C at any point
- **Results (to be installed on the Database later) :**
  - CAD fiels (IGES and SAT format)
- **Data to be stored requested from Analysis**
  - TBD
- **Data to be stored requested from Optimization (to be installed on the Database later:**
  - TBD

Model for the phone

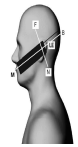
1. Ear piece
2. Display
3. Keypad
4. Antenna
5. Battery
6. PWB
7. Shield for components

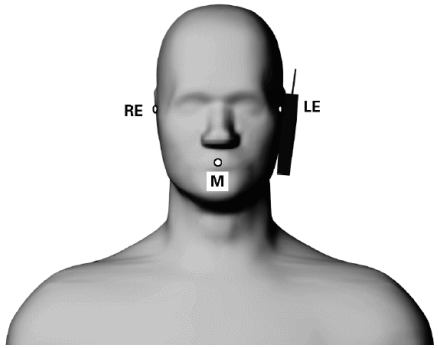


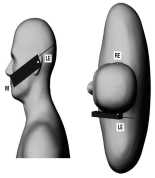
Dimensions

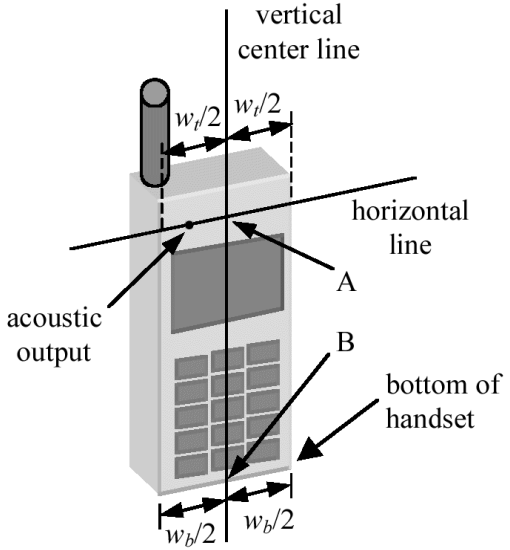


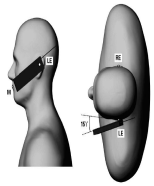
SAR, EN50360/1



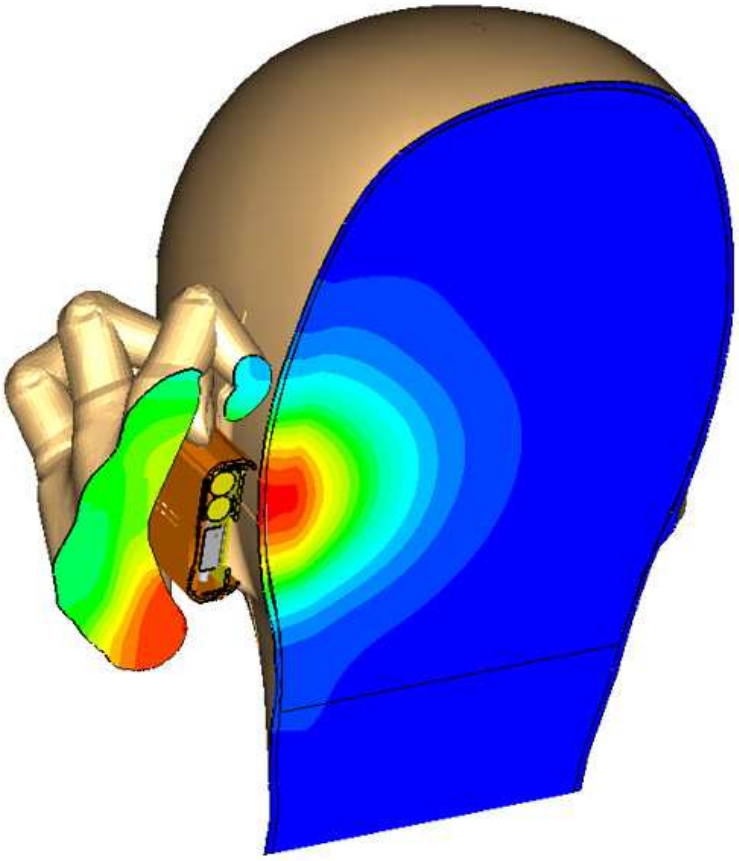


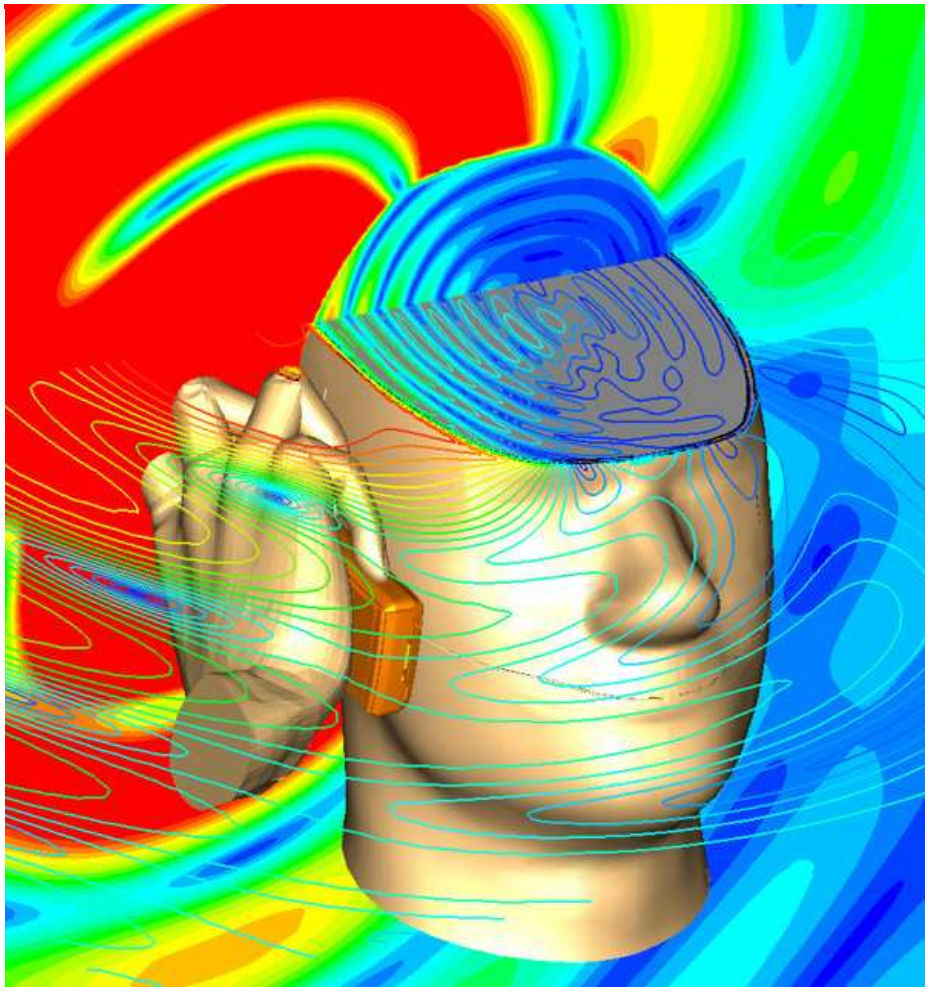






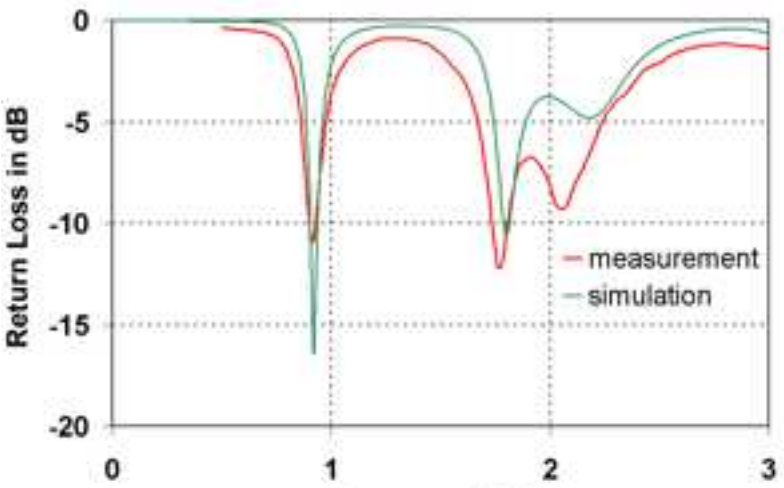
SAR

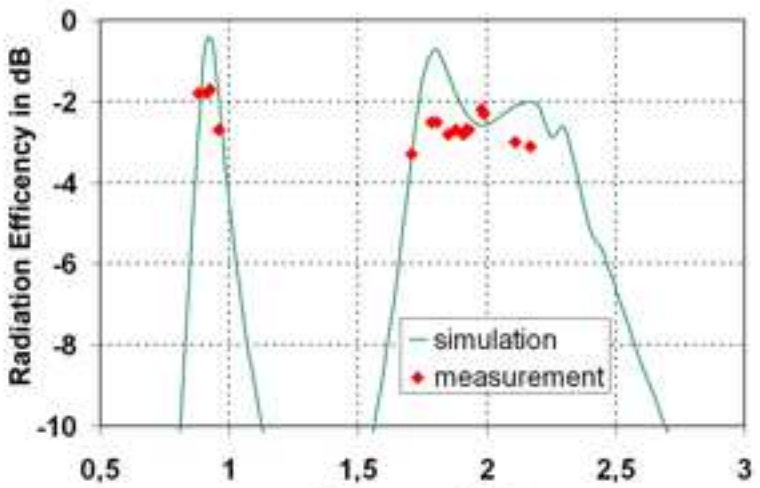


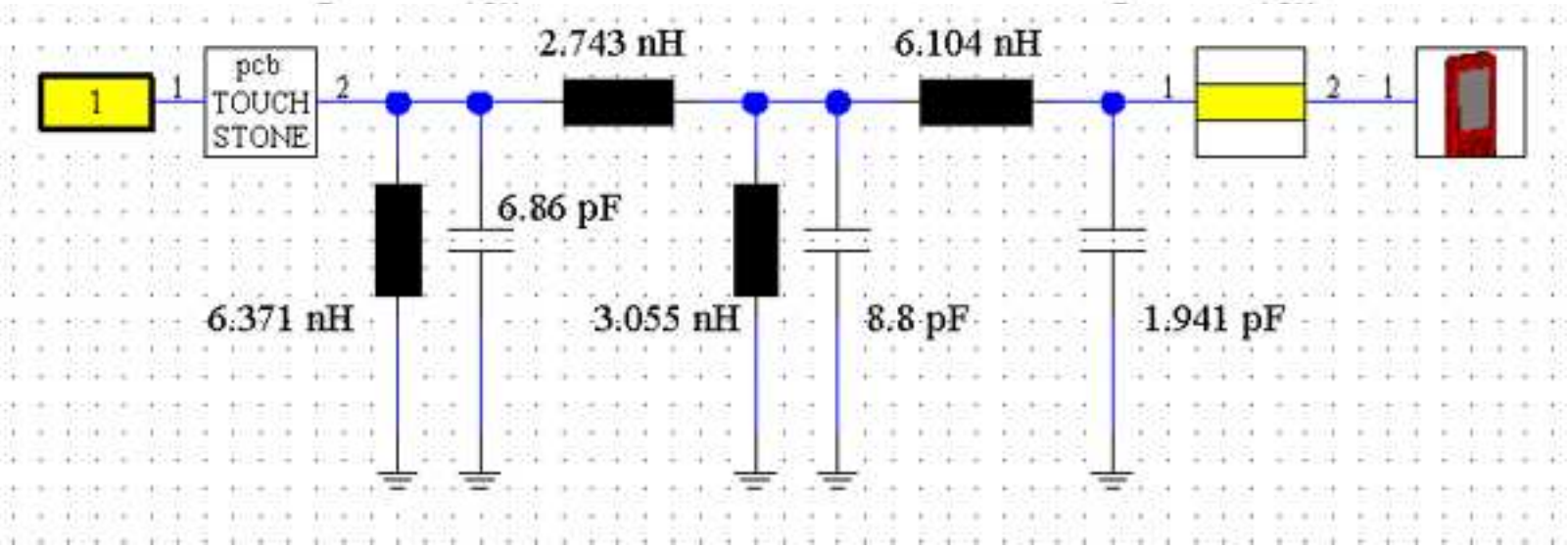


HAC, ANSI C63.19/M3

Antenna


Return Loss in dB
0
-5
-10
-15
-20
0
1
2
3
measurement
simulation


Radiation Efficency in dB
0
-2
-4
-6
-8
-10
0,5
1
1,5
2
2,5
3
simulation
measurement


1
1
pcb
TOUCH
STONE
2
2.743 nH
6.104 nH
1
2
1
6.86 pF
6.371 nH
3.055 nH
8.8 pF
1.941 pF