

# All Raw Data for the Manuscript “Concept of a Radiofrequency Device for Osteopenia/Osteoporosis Screening” (Prepared for Scientific Reports, 2020)

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## DATA CONTENT

The single zipped file AllRawData\_MATLABDataScriptsRevised013120.zip contains:

1. This note
2. Measured uncalibrated S11 (RF reflection coefficient, amplitude and phase), measured uncalibrated S21 (RF transmission coefficient, amplitude and phase) for all 72 subjects in \*.csv format. Left and right wrists are given separately, with 144 files in total. Frequency: 30 kHz-2GHz, 200 steps.
3. Cable de-embedded S11 (amplitude and phase), cable de-embedded S21 (amplitude and phase) for all 72 subjects in \*.mat format. Left and right wrists are given separately, with 144 files in total. Frequency: 30 kHz-2GHz, 200 steps. MATLAB scrip wrapper\_deembedding.m does de-embedding. It can be executed at any time.
4. MATLAB script master.m with all de-identified subject data:
  - % Field 1: Unique file name/subject identifier (D = de-embedded data)
  - % Field 2: Weight, lb
  - % Field 3: Height, ft
  - % Field 4: Age in years
  - % Field 5: Osteo Potential - 1(healthy=young), 2(likely healthy), 3(likely osteopenia), 4(osteopenia), 5 (osteoporosis)
  - % Field 6: Left wrist circumference, inches
  - % Field 7: Right wrist circumference, inches
  - % Field 8: Sex
  - % Field 9: Special remarks (e.g. African American, etc.) ALL SPECIAL
  - % REMARKS HAVE BEEN DELETED IN THIS PUBLIC VERSION
5. Explanation for Field 5:
  1. Category 1 (healthy young adults, 23-30 years old). Unknown bone density but young age ( $\leq 30$ ). 5 subjects in total (2 female, 3 male);
  2. Category 2 (low risk factor category, 42-94 years old). Unknown bone density (no DXA data) but (all together): no history of bone fractures, no medication, and no family history of bone fracture/osteoporosis. 32 subjects in total (24 female, 8 male). Note that clinical risk factors can have a larger impact on fracture risk than one standard deviation decline in bone density [79],[80]. Therefore, we feel comfortable considering them at low risk without explicit BMD information;
  3. Category 3 (unknown risk factor category, 44-77 years old). Unknown bone density (no DXA data) but at least one of the following: family history of osteoporosis, low BMI, history of bone fractures, women after menopause. 12 subjects in total (10 female, 2 male);
  4. Category 4 (osteopenia or low bone density, 55-90 years old). Osteopenic bone density (T-score between  $-1.0$  and  $-2.4$ ) according to the most recent DXA exam (obtained within the last year) and prescribed medications such as various calcium/magnesium supplements (600-1000 mg). 18 subjects in total (17 female, 1 male);
  5. Category 5 (osteoporosis, 55-86 years old). Osteoporotic bone density (T-score of  $-2.5$  or below) according to the most recent DXA exam (obtained within the last year) and prescribed medications such as bisphosphonates. 5 Subjects in total (5 female, 0 male).

6. Other MATLAB processing scripts that plot the normalized/non-normalized data, and perform a single binary statistic (the Youden's J statistic) for the finally selected 60 subjects: For the unbiased study, we eliminated Category 3 (unknown risk factor category). As a result, we ended up with two groups (60 subjects in total) suitable for binary classification:

Group 1 osteopenic/osteoporotic (Categories 4 and 5 together, 55-90 years old, mean 77.5/STD 10.1). T-score of -1.0 or below according to the most recent DXA exam and prescribed medications. 23 subjects in total (22 female, 1 male).

Group 2 healthy (Categories 1 and 2 together: low risk category, 23-94 years old, mean 60.2/STD 16.6). Unknown bone density (no DXA data) but young adults or (all together): no history of bone fractures, no medication, and no family history of osteoporosis. 37 subjects in total (26 female, 11 male).

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