**Data Documentation for Patch antennas characterization for enhanced microwave imaging**

**General Information**

This dataset corresponds to the measurements of two microstrip patch antennas, collected using the facility described in [1]. The available measurements contained within the dataset allow a complete characterization of the field radiated by these antennas. These fields can be introduced in enhanced microwave imaging algorithms that consider the field radiated by the transmitting and receiving antennas of the microwave imaging system [2] (modified Delay and Sum algorithm), [3] (modified Phase Shift Migration imaging algorithm). The patch antennas that are characterized are the ones presented in [4].

The files "Emeas\_leftPatch\_z30cm.zip" and "Emeas\_rightPatch\_z30cm.zip", correspond to the copolar component (Ex component) of the electric field radiated by the patch antennas (left and right as depicted in the figure “PictureDataset.png”). More precisely, it corresponds to the S21 parameter, which is proportional to the electric field radiated by the patch antenna.

Measurements were conducted within the frequency range from 22 GHz to 28 GHz, with a frequency step of 15 MHz. Measurements were collected on a domain of size Lx × Ly = 70 cm × 70 cm, discretized every δx,y = 5 mm (0.42 wavelengths at the center frequency of 25 GHz). The distance between the patch antenna (antenna under test) and the measurement plane was 30 cm. An Open-Ended Waveguide was used as probe antenna.

The measured electric field was backpropagated from the measurement plane to the patch antenna aperture plane using the backpropagation algorithm described in [5]. The electric fields on the aperture plane are provided in the files “Eap\_leftPatch.zip” and “Eap\_rightPatch.zip” for the left and right patch antennas, respectively. The aperture fields were calculated on a planar domain having the same size as the measurement plane, that is, Lx × Ly = 70 cm × 70 cm, and also discretized every δx,y = 5 mm.

[1] A. Arboleya, Y. Alvarez, and F. Las-Heras, “Millimeter and submillimeter planar measurement setup,” in 2013 IEEE Antennas and Propagation Society International Symposium (APSURSI), 2013, pp. 1–2.

[2] Y. Alvarez Lopez and F. Las-Heras, “On the use of an equivalent currents-based technique to improve electromagnetic imaging,” IEEE Transactions on Instrumentation and Measurement, vol. 71, pp. 8004113, 2022.

[3] Y. Alvarez López and F. Las-Heras Andrés, "Improved Methods for Fourier-based Microwave Imaging," Sensors, Vol. 23, pp. 9250, 2023.

[4] A. F. Berdasco, J. Laviada, M. E. de Cos Gómez and F. Las-Heras, “Performance Evaluation of Millimeter-Wave Wearable Antennas for Electronic Travel Aid,” in IEEE Transactions on Instrumentation and Measurement, vol. 72, pp. 1-10, 2023, Art no. 4507510, doi: 10.1109/TIM.2023.3320736.

[5] J. Hanfling, G. Borgiotti, and L. Kaplan, “The backward transform of the near field for reconstruction of aperture fields,” in 1979 Antennas and Prop. Society Intl. Symposium, vol. 17, 1979, pp. 764–767.

**Name of dataset:**

Patch antennas characterization for enhanced microwave imaging

**Name of data files in data set:**

“Eap\_leftPatch.txt”

“Eap\_rightPatch.txt”

“Emeas\_leftPatch\_z30cm.txt”

“Emeas\_rightPatch\_z30cm.txt”

 “PlotApertureFields.m”

“PlotEmeas.m”

“PictureDataset.png”

 **Dataset language:**

English

**Date the data set was last modified:**

7 January 2025

**Funder:**

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 **How to cite data:**

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**Methodology for data collection:**

Please refer to the description given in the general information.

**Data collector(s):**

Yuri Álvarez López (alvarezyuri@uniovi.es)

**Date of data collection:**

Measurement campaign conducted in June 2024.

**Person to contact with questions:**

Yuri Álvarez López (alvarezyuri@uniovi.es)

**Data entry:**

8 January 2025

**Software (including version #) used to prepare data set:**

Matlab (any version from 2012a onwards is compatible to run the \*.m script for data visualization)

**Data processing that was performed:**

Please refer to the description given in the general information. No specific data processing was conducted.

**Variables**

Files “Emeas\_leftPatch\_z30cm.txt” (compressed as \*.zip) and “Emeas\_rightPatch\_z30cm.txt” (compressed as \*.zip):

- Column 1: dummy column (not for use)
- Column 2: x coordinate, in mm
- Column 3: y coordinate, in mm
- Column 4: z coordinate, in mm. It can be discarded and replaced by a value of 30 cm
- Column 5: dummy column (not for use)
- Columns 6 to 406: S21 parameter, amplitude, in dB. Each column corresponds to a single frequency within the frequency range from 22 GHz to 28 GHz, spaced every 15 MHz.
- Columns 407 to 807: S21 parameter, phase, in degrees. Each column corresponds to a single frequency within the frequency range from 22 GHz to 28 GHz, spaced every 15 MHz.
- Columns 808 to 1208: S11 parameter, amplitude, in dB. Each column corresponds to a single frequency within the frequency range from 22 GHz to 28 GHz, spaced every 15 MHz.
- Columns 1209 to 1609: S22 parameter (S11 parameter of the probe antenna), amplitude, in dB. Each column corresponds to a single frequency within the frequency range from 22 GHz to 28 GHz, spaced every 15 MHz.

Files “Eap\_leftPatch.txt” (compressed as \*.zip) and “Eap\_rightPatch.txt” (compressed as \*.zip):

- Column 1: x coordinate, in cm
- Column 2: y coordinate, in cm
- Columns 3 to 403: Real part (in natural units) of the copolar component (Ex component) of the electric field of the patch antenna on the antenna aperture. Each column corresponds to a single frequency within the frequency range from 22 GHz to 28 GHz, spaced every 15 MHz.
- Columns 404 to 804: Imaginary part (in natural units) of the copolar component (Ex component) of the electric field of the patch antenna on the antenna aperture. Each column corresponds to a single frequency within the frequency range from 22 GHz to 28 GHz, spaced every 15 MHz.

**File Overview**

“Eap\_leftPatch.zip” ZIP file containing the copolar component (Ex component) of the backpropagated electric field on the aperture plane of the patch antenna (the left one as depicted in “PictureDataset.png”). The ZIP file has a single \*.txt file.

“Eap\_rightPatch. zip” ZIP file containing the copolar component (Ex component) of the backpropagated electric field on the aperture plane of the patch antenna (the right one as depicted in “PictureDataset.png”). The ZIP file has a single \*.txt file.

“Emeas\_leftPatch\_z30cm. zip” ZIP file containing the field radiated by the patch antenna (left one as depicted in “PictureDataset.png”). More precisely, the S21 parameter, which is proportional to the measured electric field. The ZIP file has a single \*.txt file.

“Emeas\_rightPatch\_z30cm. zip” ZIP file containing the field radiated by the patch antenna (right one as depicted in “PictureDataset.png”). More precisely, the S21 parameter, which is proportional to the measured electric field. The ZIP file has a single \*.txt file.

 “PlotApertureFields.m” Matlab script to import the “Eap\_leftPatch.txt” and “Eap\_rightPatch.txt” files (after decompressing the ZIP files) and plot the electric fields on the aperture plane.

“PlotEmeas.m” Matlab script to import the “Emeas\_leftPatch\_z30cm.txt” and “Emeas\_rightPatch\_z30cm.txt” files (after decompressing the ZIP files) and plot the measured electric field on the acquisition plane.

“PictureDataset.png” Picture of the patch antennas and the measurement setup.