

Fully and Partially Metalised 3D Printed FSS Elements

B. Sanz-Izquierdo and E. A. Parker

Antennas Research Group, School of Engineering and Digital Arts, University of Kent

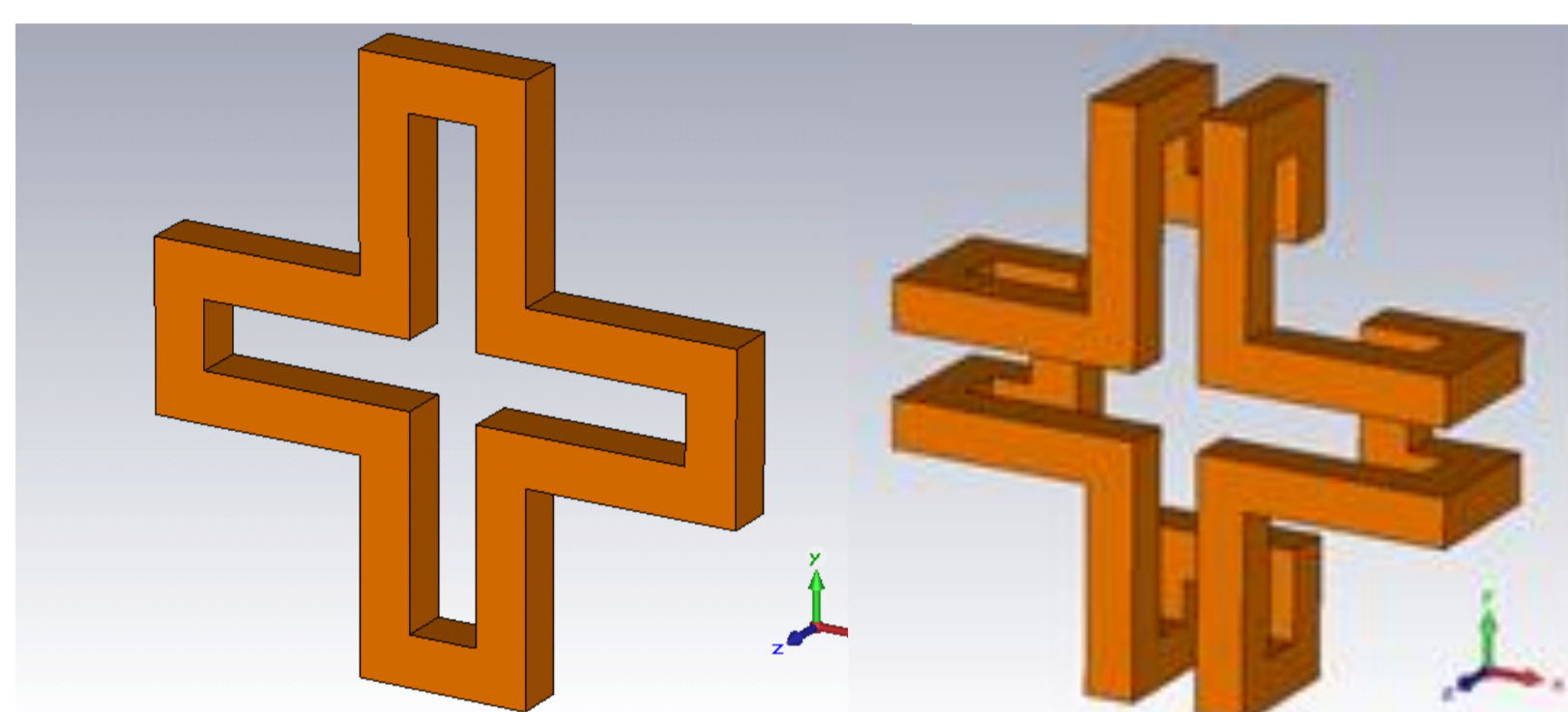
Introduction

Additive manufacturing (AM) or 3D printing (3DP) enables the bottom-up fabrication of objects from a digital model. Complex objects that were difficult or impossible to produce using standard methods can now be manufactured.

There is significant interest in applying 3D printing technology to aerospace applications. It is very probable that future RF components will be integrated into 3D printed parts.

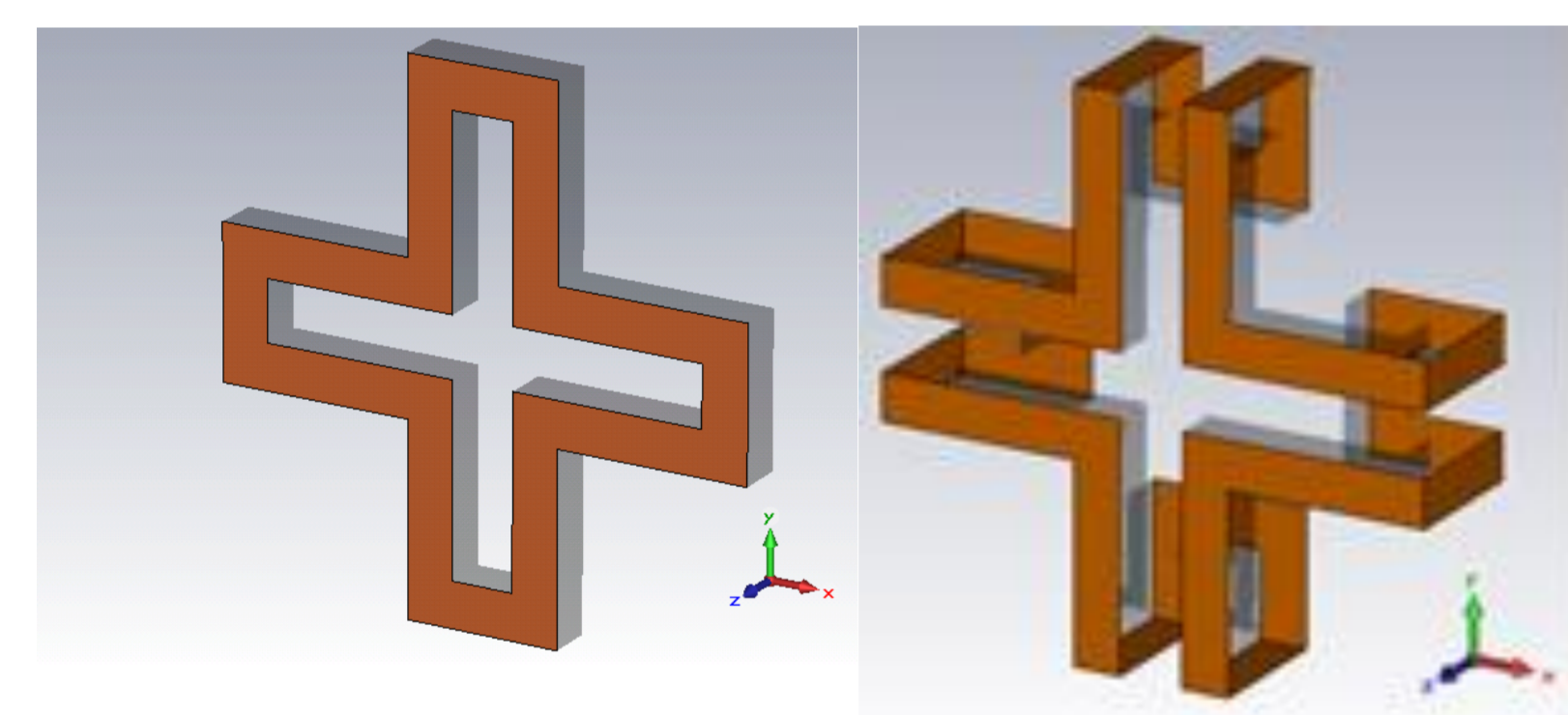
This paper describes the transmission performance of full-metal (volumetric) frequency selective structures and compares them with those of 3D FSS made by partially metallizing the same 3D shapes, thereby controlling induced current paths. 3D printing is used here to fabricate the core of the structures [1], which are based around a new concept of folding FSS elements in three-dimensions [2].

Designs – “Four-legged loaded” loop



Volumetric, entirely metallised

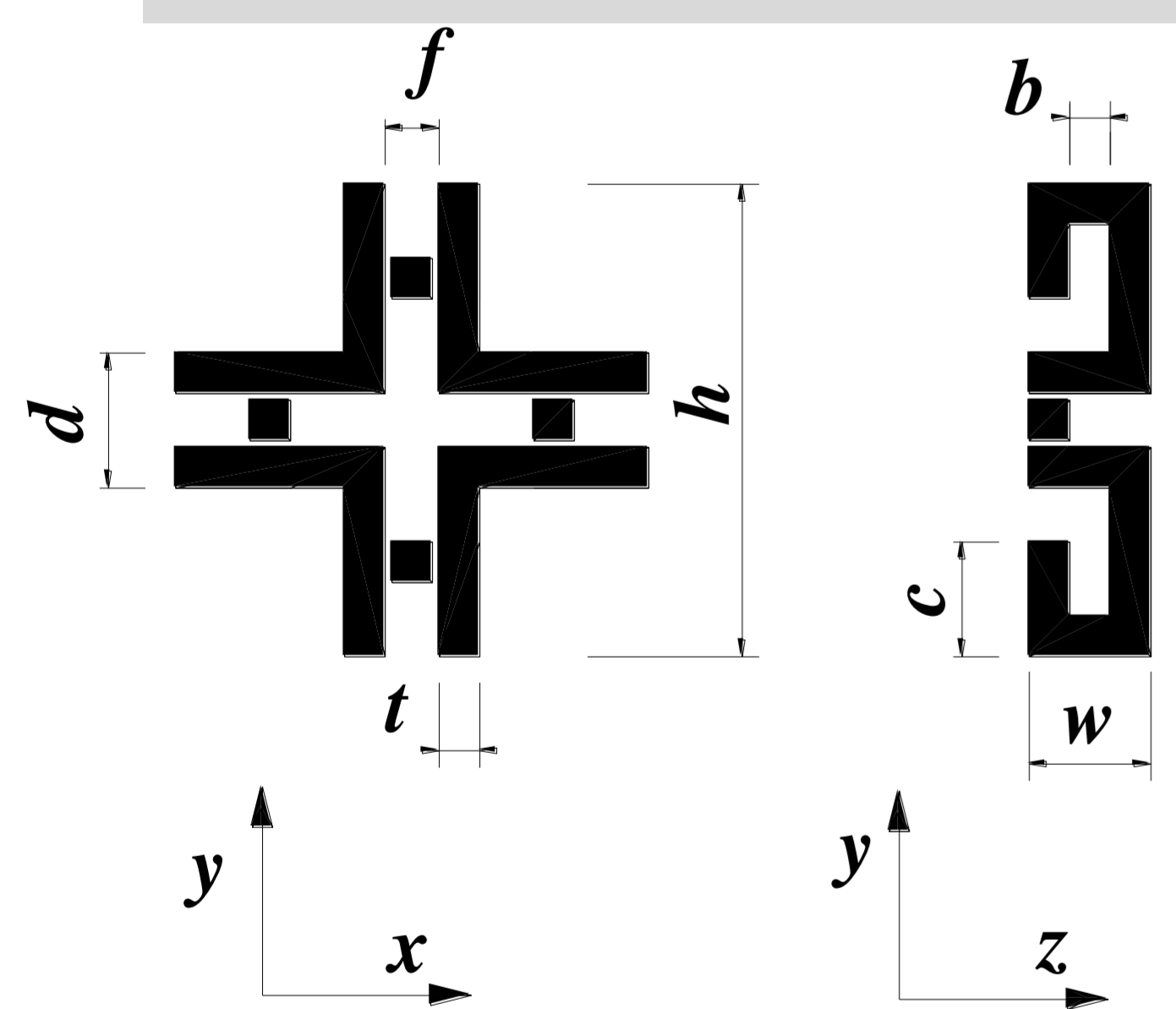
- a) original
- b) 3D folded



Partially metallised

- c) original
- d) 3D folded

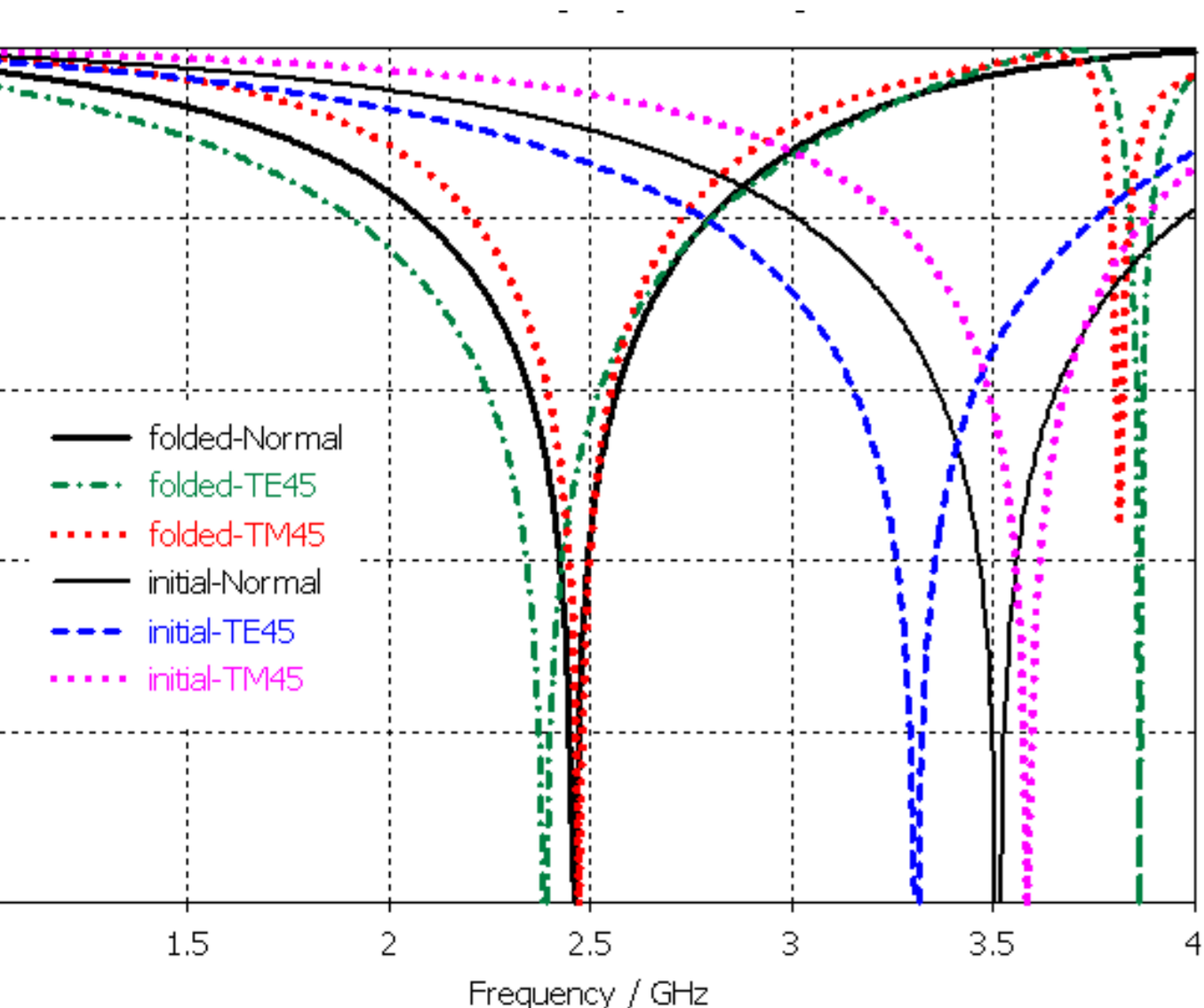
Dimensions



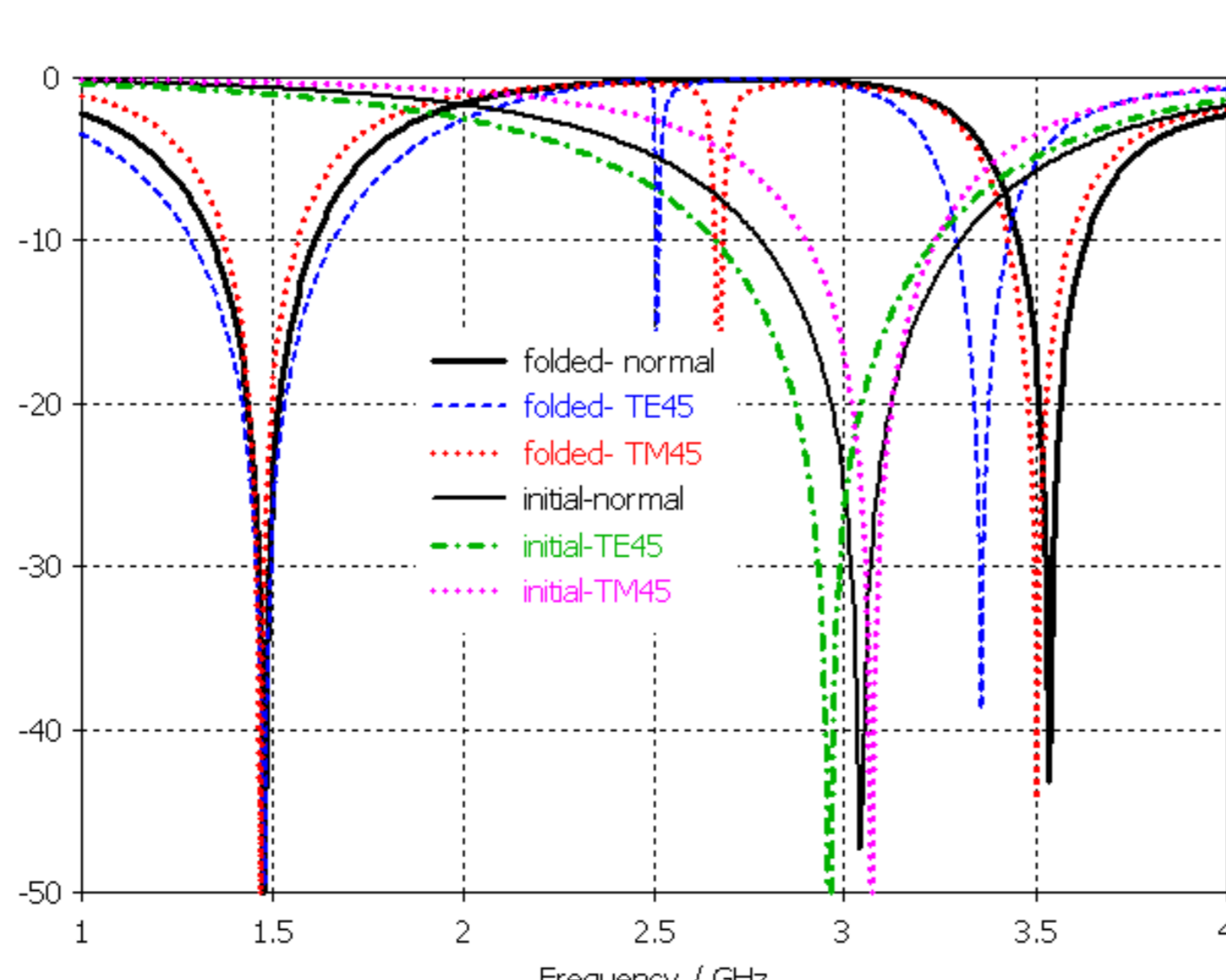
Parameter	Dimensions (mm)
h	35
w	9
d	10
f	4
b	3
c	8.5
t	3
p	38

Simulations

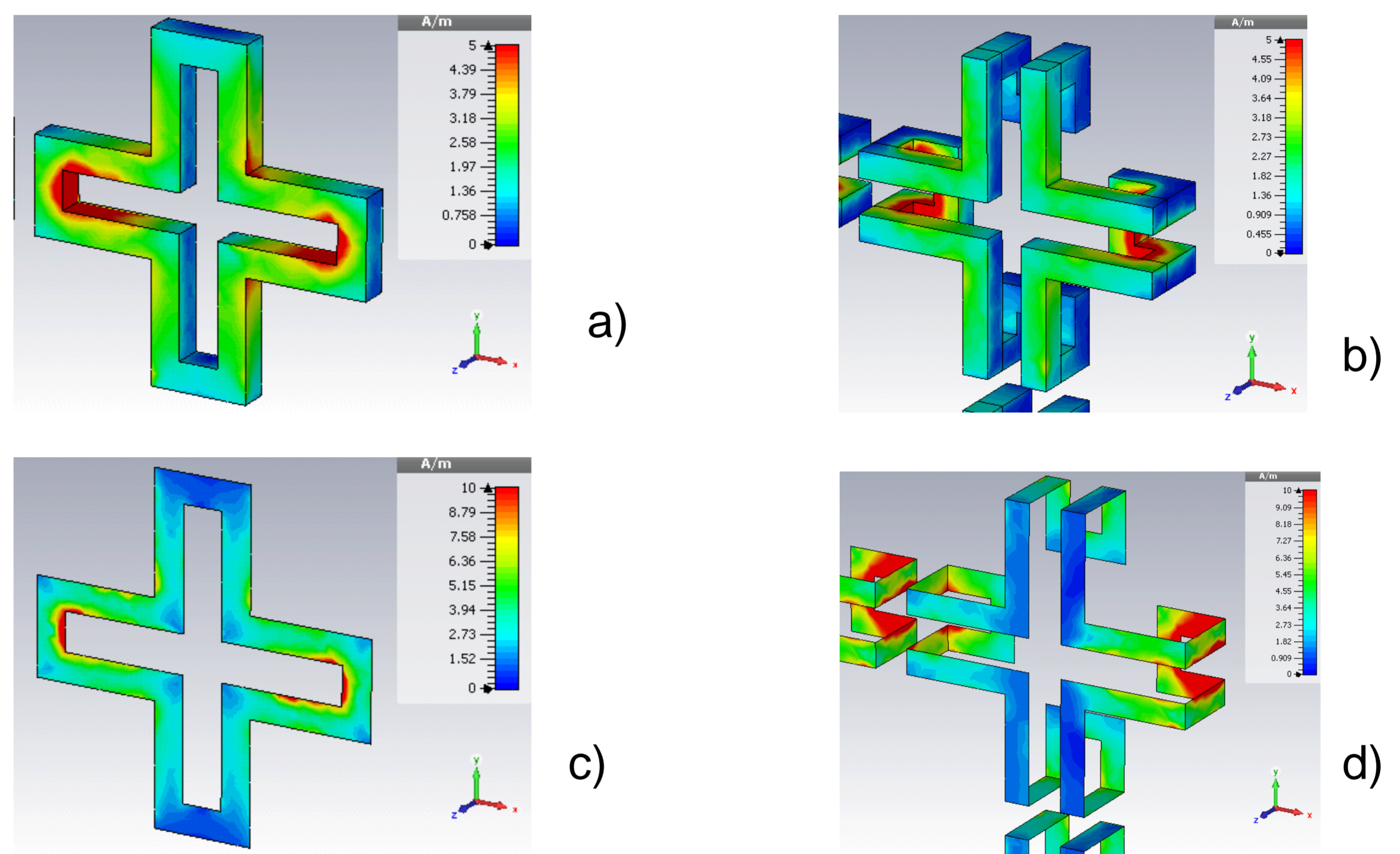
Volumetric, entirely metallised



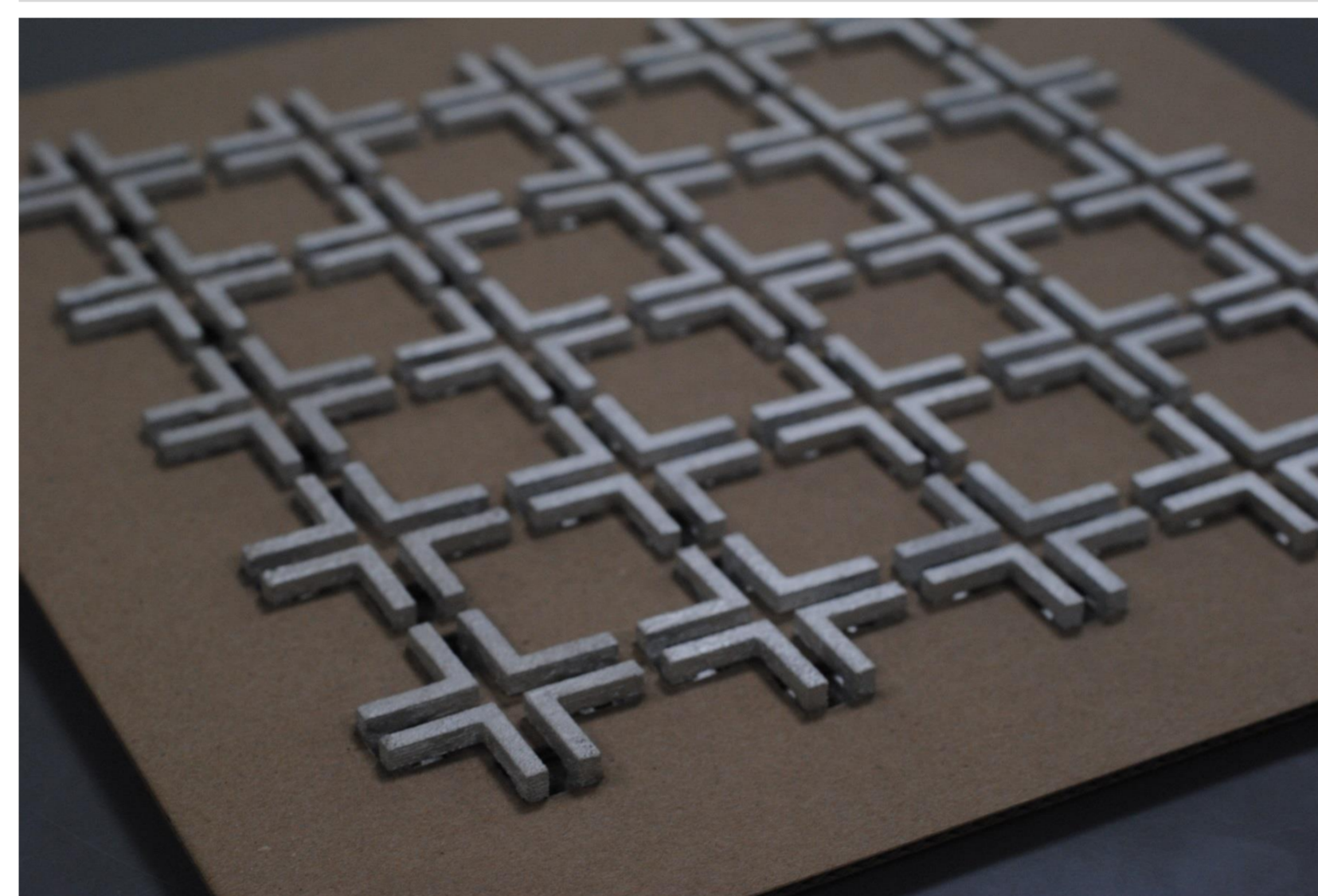
Partially metallised



Surface currents



Fabrication



Volumetric, entirely metallised

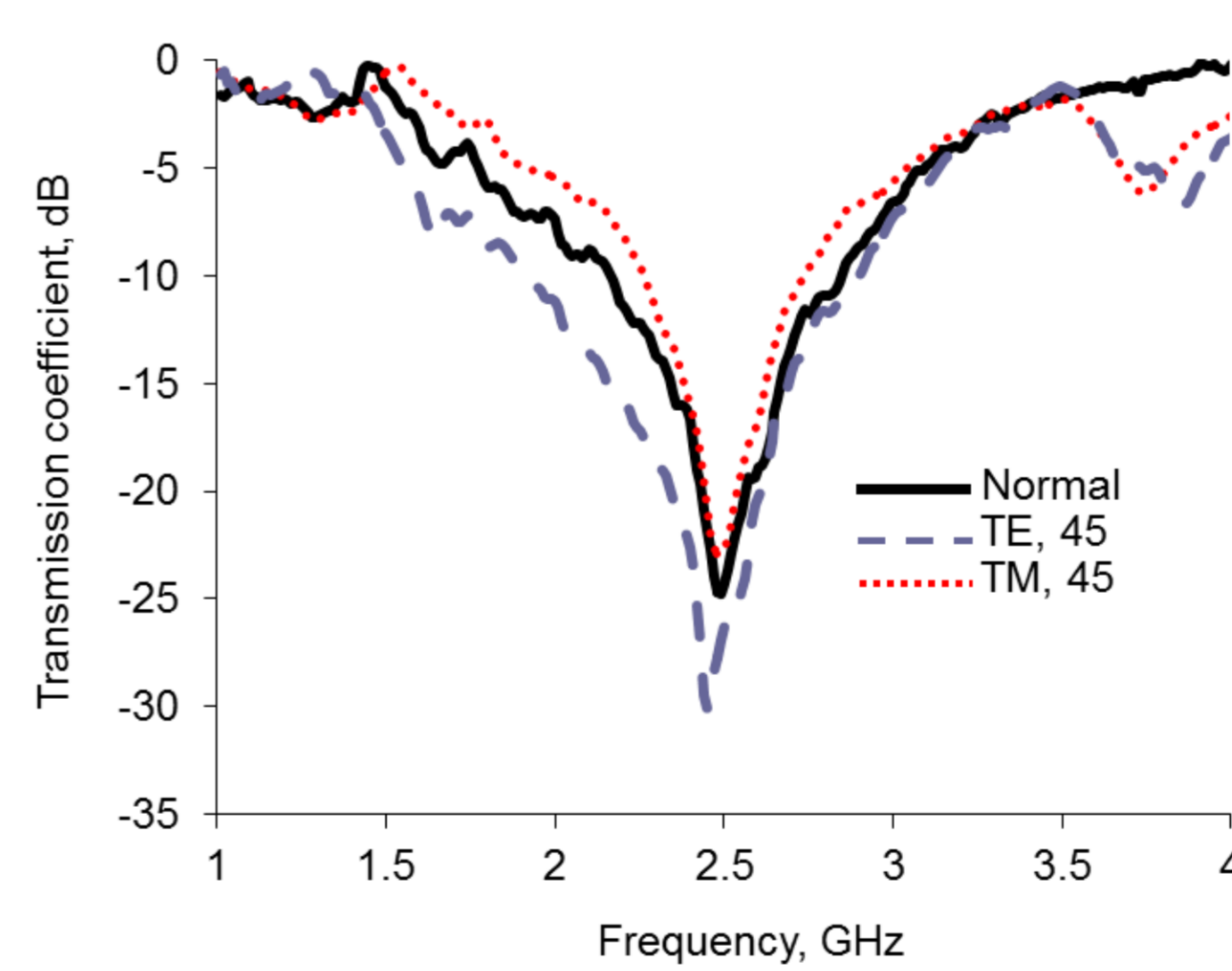
- Elements fabricated with Z650 printer from Zcorp
- Plaster based material
- Elements fully coated using silver conductive paint

Partially metallised

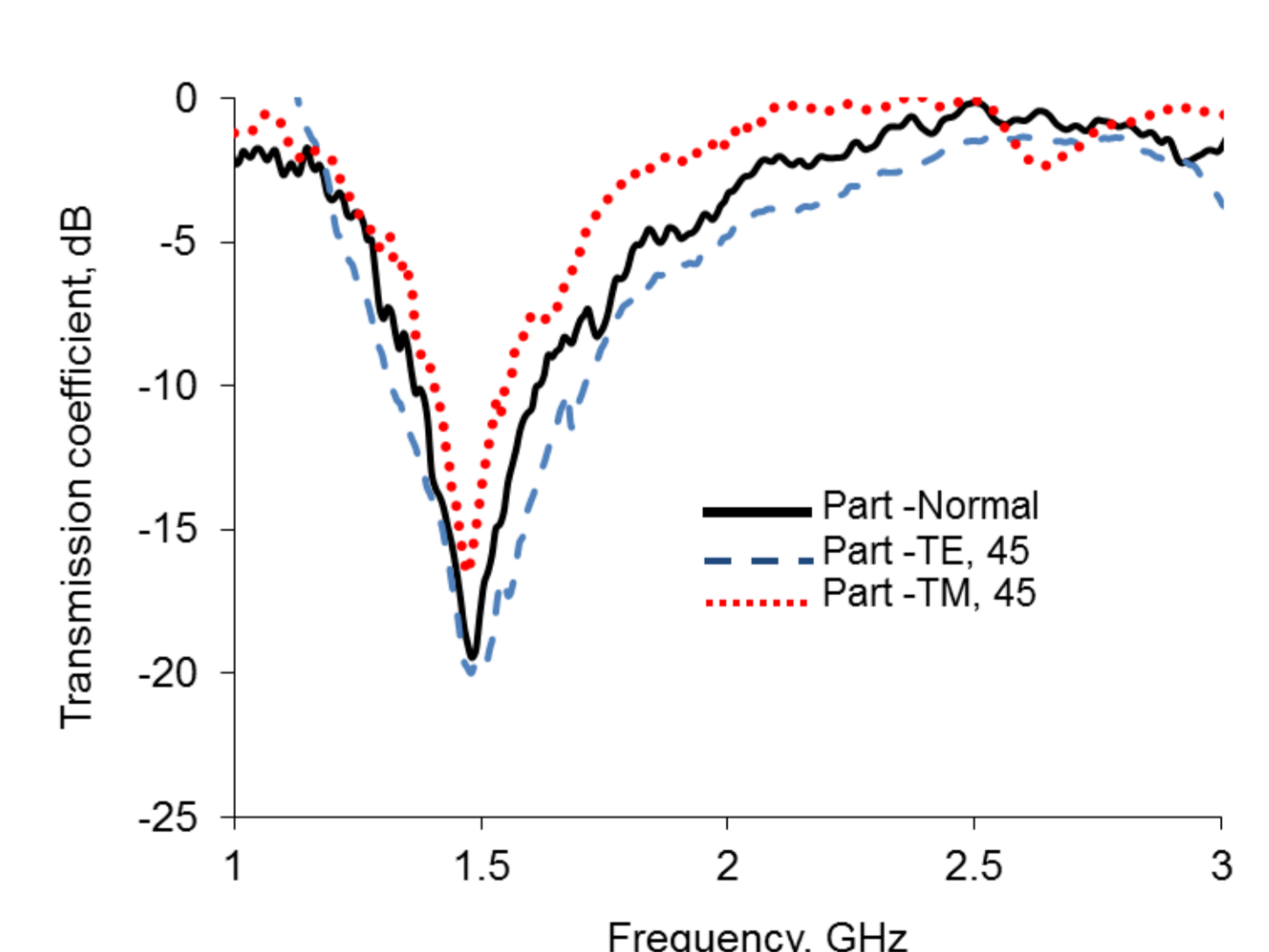
- Inexpensive FDM machine (modified MBOT 3D printer)
- Plastic based material. Polylactic acid (PLA) material
- Elements partially coated using silver conductive paint

Measurements - 3D folded loops

Volumetric, entirely metallised



Partially metallised



Conclusions

This study has demonstrated the possibility of developing complex frequency selective structures using additive manufacturing techniques. Work is progressing on the fabrication of FSS using 3D printing with metal.

Acknowledgements

This work was supported by a grant from the UK Royal Society.

References:

- [1] B. Sanz-Izquierdo and E.A. Parker, “3D Printing Technique for Fabrication of Frequency Selective Structures for Built Environment”, *IET Electron. Letters*, Vol. 49, No. 18, pp. 1117 – 1118, 2013
- [2] B. Sanz-Izquierdo and E.A. Parker, “3D Printing of Elements in Frequency Selective Arrays”, *IEEE Trans. Antennas Propag.*, Vol. 62, No. 12, p.p. 6060 - 6066, Dec. 2014

Contact:

b.sanz@kent.ac.uk , e.a.parker@kent.ac.uk

School of Engineering, University of Kent, Canterbury, Kent CT2 7NT, UK

Tel: +44 (0)1227 827315, Website: <http://www.eda.kent.ac.uk>