SAFE SPACE: OPTIMISING MATERIALS AND DESIGN FOR EFFECTIVE EM SHIELDING IN PHONE CASES

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Background

As advanced technologies develop, sensitive data can be compromised through Electromagnetic (EM) waves emitted by devices, leading to unauthorised access of data.

Objective

To find out the best material and design for a phone case to effectively shield EM waves emitted from an iPhone 11 Pro Max, whilst keeping the basic functions of the phone.

Factors considered

Shielding Effectiveness	Malleability	Cost	Weight

Experimental Equipment

Emissions recorded by placing iPhone set-up in a GTEM cell connected to a Spectrum Analyser to plot out readings.

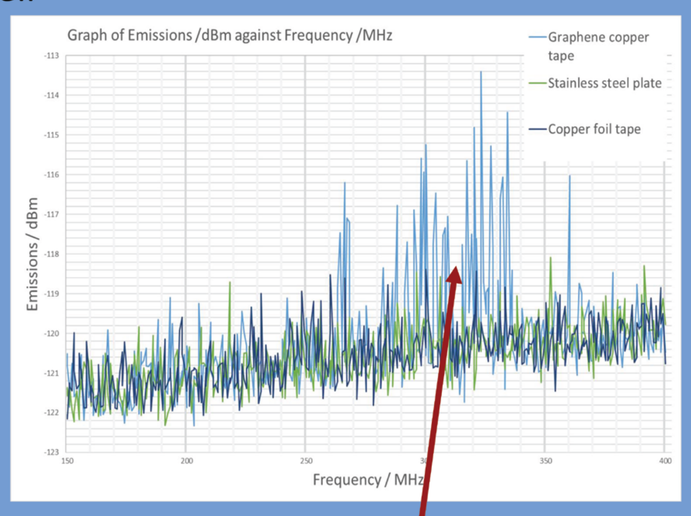
Phone in phone stand

Phone stand set-up placed in GTEM cell

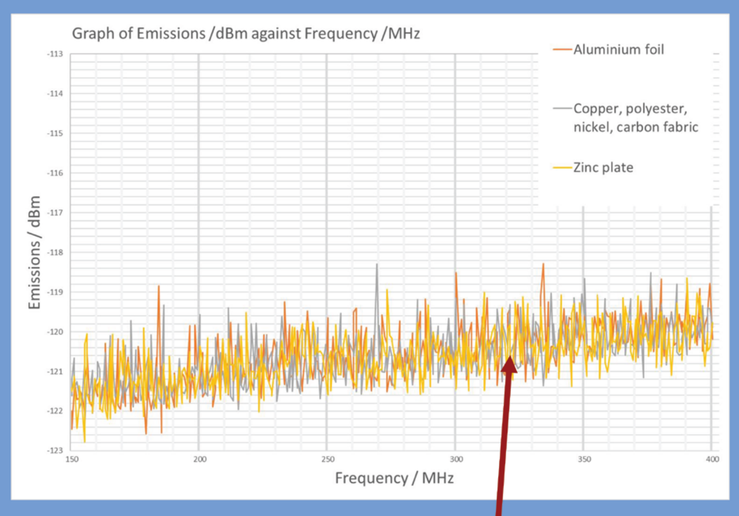
Each pouch was placed in the GTEM cell

The phone was enclosed in a pouch made from each of the 9 materials

1. Shielding Effectiveness

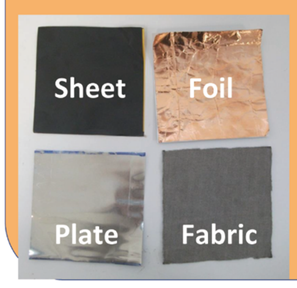


Graphene-Copper demonstrating poor shielding effectiveness, resulting in high emissions captured by the antenna in the GTEM cell



Materials like Aluminium and Zinc could shield the phone relatively well

2. Malleability



Foils were the easiest to work with in making a phone case.

3. Cost

Aluminium foil and Black Copper fabric were the cheapest materials tested costing $0.01 and $0.03 per 100cm².

4. Weight

After weighing, Aluminium foil and Black Copper fabric were the lightest, weighing 0.40g and 0.79g per 100cm².

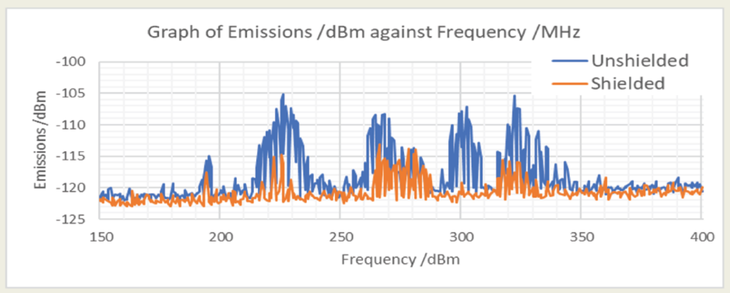
Design

Back camera covered by clear radiofrequency film
+
camera slider made out of shielding material

Charging port covered by dust plug made out of shielding material
+
Speaker hole covered by wire mesh

Conclusion

Using our final prototype design with Aluminium as the shielding material, a significant reduction of leaked waves was recorded.



Future Works

Future studies could focus in depth on 3D printing these casings using TPU material coated with Aluminium, or directly printing with a specialised filament to further increase shielding effectiveness.