

ANTENNA DESIGN COURSE

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CHAPTER 7

ANTENNA CHARACTERIZATION

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7.1 Anechoic Chambers and TEM Cells

The usual way for measuring (characterizing) antennas is by using anechoic chambers or TEM cells. In the following sections these two options are commented.

7.1.1 Anechoic Chambers

In Fig. 1 the interior of an anechoic chamber is shown.

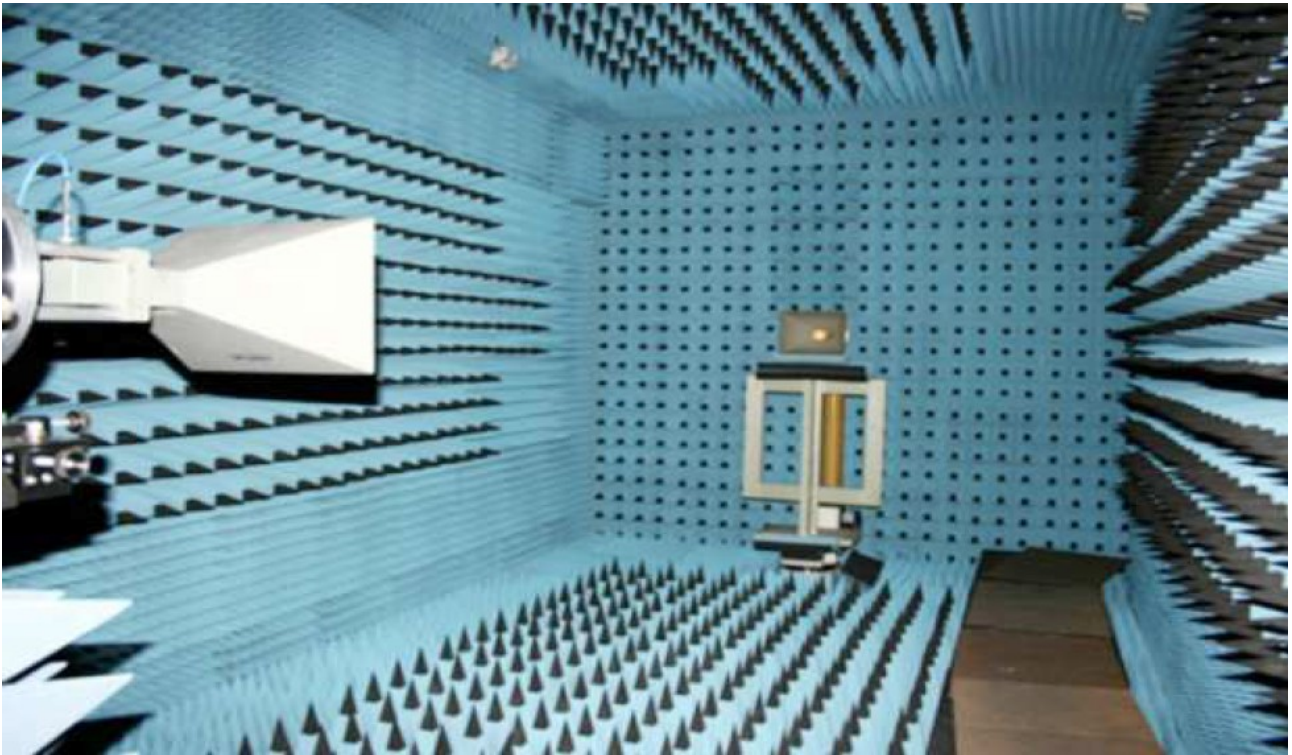


Fig. 1: Interior of an anechoic chamber (source [PhDAC]).

The interior of the anechoic chamber is recovered with a material able of “capturing” the electromagnetic field for avoiding reflections and to enable a “clean measure” of the received signal through the line of sight path.

Ferrite particles were traditionally used as absorbent material. Although this type of material absorbs incident waves well, it is not very flexible. In recent years, carbon has been used as the main absorbent element in part because of its ease of obtaining. They are semiconductor materials with high resistance and high thermal conductivity to dissipate power well due to the Joule effect [PhDAC].

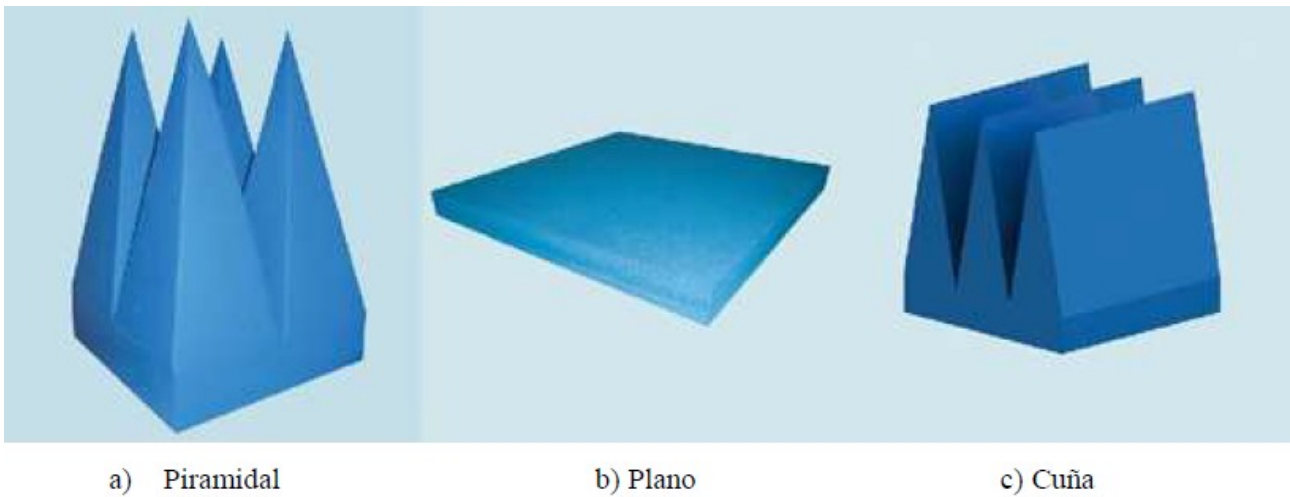


Fig. 2: Absorbent material with different shapes (source [PhDAC]).

A very interesting PhD Thesis about anechoic chambers can be read in [PhDAC], which also can be accessed through the following link.

<C:\Users\Benigno\DOCENCIA\Diseno de Antenas\Documentos\PhD Thesis Anechoic Chamber.pdf>

Anechoic chambers are not affordable for many radio frequency laboratories. Then a more affordable option is the use of GTEM Cells to characterize antennas.

7.1.2 GTEM Cells

GTEM cells, which comes in different sizes, are a much more affordable alternative than anechoic chambers, that is the reason why often these ones are good alternatives for antenna characterization.

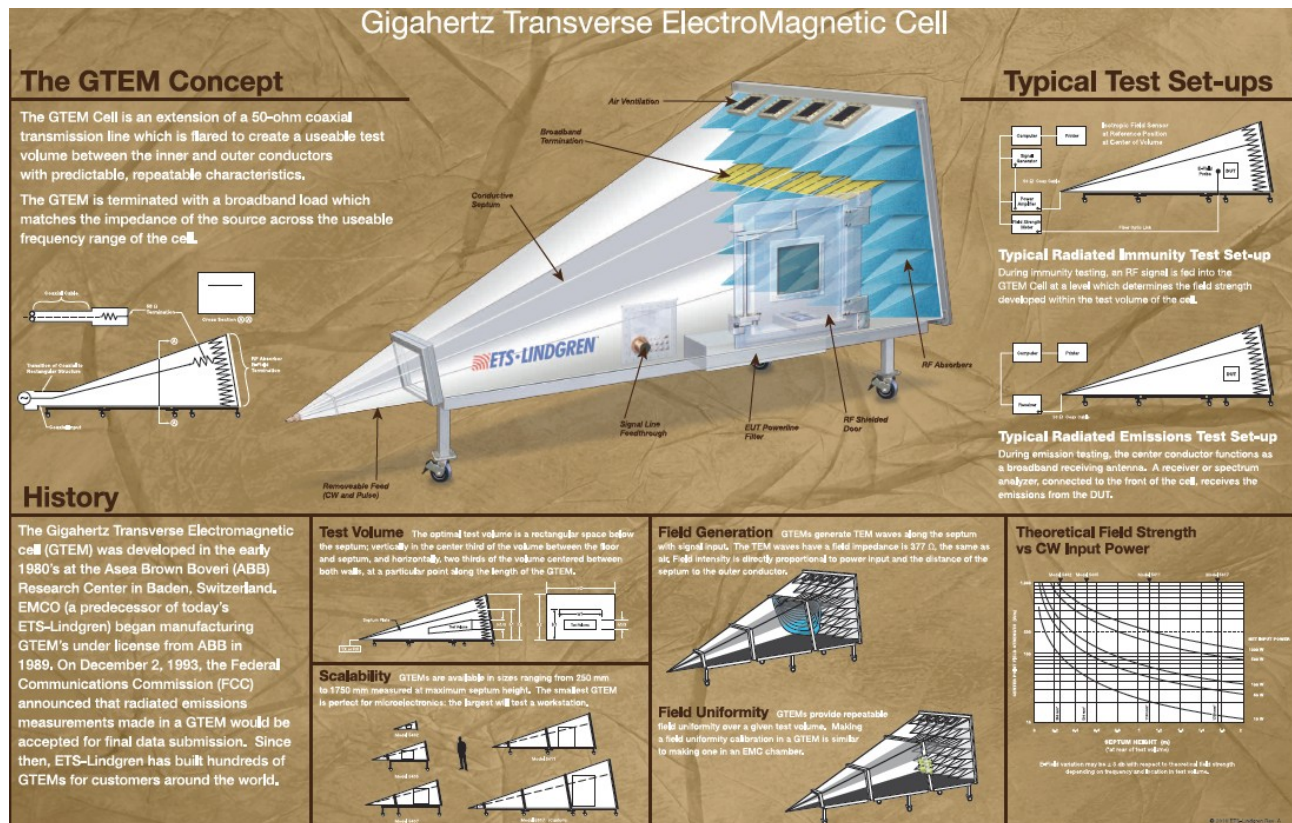


Fig. 3: GTEM cell (source ETS-Lindgren web page).

7.2 Characterization without Using Anechoic Chambers and TEM Cells

Also a raw antenna characterization can be performed without using anechoic chamber or GTEM cells if certain cares are taken. In [SPI03] is discussed how to perform an antenna characterization in open space.

7.2.1 General Considerations

In Fig. 4, the setup used for the antenna characterization in open space is shown.

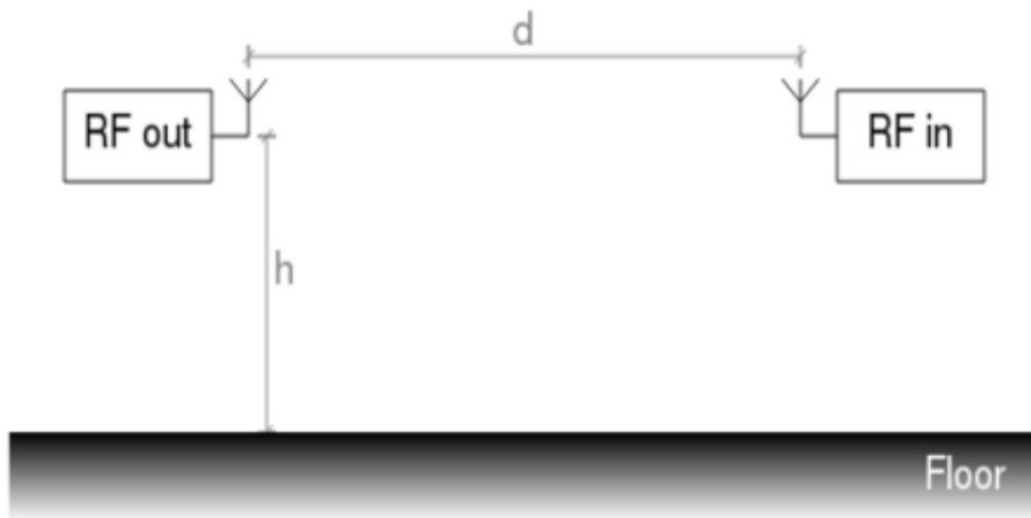


Fig. 4: Setup for radiation pattern measurements (source [SPI03]).



Fig. 5: Open space with good conditions for radiation pattern measurements (source [SPI03]).



Fig. 6: Fiberglass tripod, for not altering the electromagnetic field measurements.

7.2.2 Instruments

By the moment we have instruments to characterize antennas up to a frequency of 8 GHz. For that purpose we usually use a Vector Network Analyzer, a Signal Generator and a Spectrum Analyzer.

For the measures of the S11 parameter, a Rohde & Schwarz ZVB 8 Vector Network Analyzer (which operates in a range of 300 kHz to 8 GHz) is used.

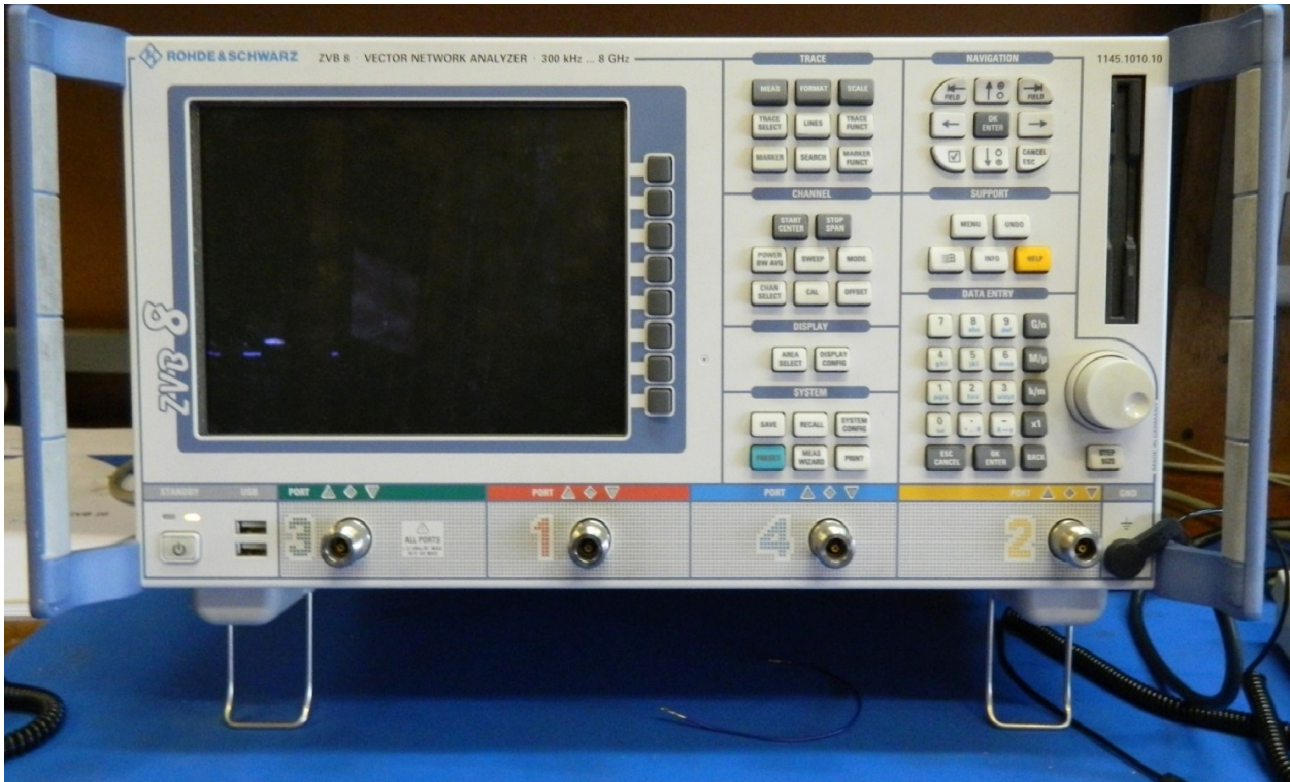


Fig. 7: Vector Network Analyzer.

As a signal generator, a RF Generator Agilent E4438C, which operates in the range of 250 kHz to 3 GHz is used.



Fig. 8: Signal Generator.

As a Spectrum Analyzer, an Agilent EXA Signal Analyzer N9010 A (which operates between 9 kHz and 7 GHz) is used.



Fig. 9: Spectrum Analyzer.

As it was previously said, in [SPI03] a work explaining how to make antenna characterization without using anechoic chambers or GTEM cells is presented. This work can also be read in the following link.

C:\Users\Benigno\DOCENCIA\Diseno de Antenas\Documentos\SPI03_180917_AntChar_CameraReady.pdf

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[PhDAC] José Ramón Almagro Clemente, "Desarrollo e Implantación de un Sistema de Medida de Antenas en Cámara Anechoica", Universidad de Alcalá, Madrid, España, pgs. 293, Available: <https://dialnet.unirioja.es/servlet/tesis?codigo=96931>, 2013.

[SPI03] Benigno Rodríguez, Juan P. González, Leonardo Steinfeld, Javier Schandy, Fernando Silveira, "Antenna Characterization without Using Anechoic Chambers or TEM Cells", In Proc. of the 10th Latin America Networking Conference (LANC 2018), Sao Paulo, Brazil, 2018.

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