

AN005 TEM Cell Measurement of 2.4GHz Devices

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1. Objective

The objective of this article is to demonstrate how the EM601 TEM Cell can be used for measuring the spectrum of 2.4 GHz devices such as Bluetooth and WiFi.

2. Measurement Setup

With the large field injection area of 50 x 50 mm, the EM601 series of TEM Cells is readily suitable for measuring the spectrum USB Bluetooth and WiFi devices such as those shown in Figure 1. The only additional equipment required is a computer, for powering and activating the device, and a spectrum analyzer. For the measurements presented herein, an Agilent E4448A spectrum analyzer was used.



Figure 1: USB Bluetooth and WiFi devices.

In order to fit the Bluetooth device into the cell, it was removed from its plastic enclosure and a cable soldered to its connector terminals. The modified device is shown in Figure 2. A copper clad PCB was used as the TEM cell cover, and an aperture the size of a USB connector was milled for mounting USB devices, or exiting a cable. Figure 3 depicts the Bluetooth device inside the cell, and its' USB cable exiting.



Figure 2: Modified Bluetooth device.

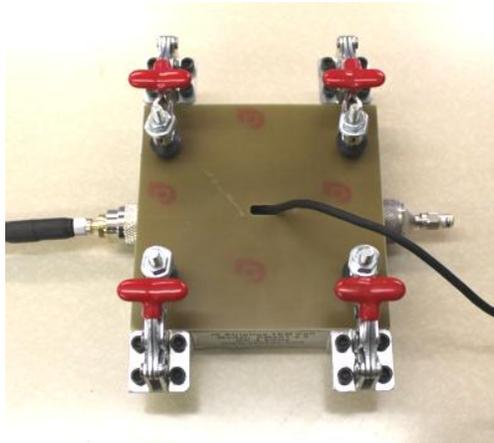


Figure 3: Bluetooth device inside cell.

Measuring the WiFi device was simpler in that it readily fit into the cell, and only required a USB cable to be connected externally as shown in Figure 4.



Figure 4: WiFi device.

3. Measurements

The measurements were taken with an Agilent E4448A 3 Hz – 50 GHz spectrum analyzer with the settings: 3 MHz RBW, 50 MHz VBW, 10.375 ms sweep time, 10 dB attenuation, 3 Hz start frequency, and 6 GHz stop frequency. Port 1 of the TEM cell was connected to the spectrum analyzer, and Port 2 was terminated in 50 Ω . The first measurement taken was of the TEM cell fully covered and no device inside. The empty cell spectrum measurement is shown in Figure 5.

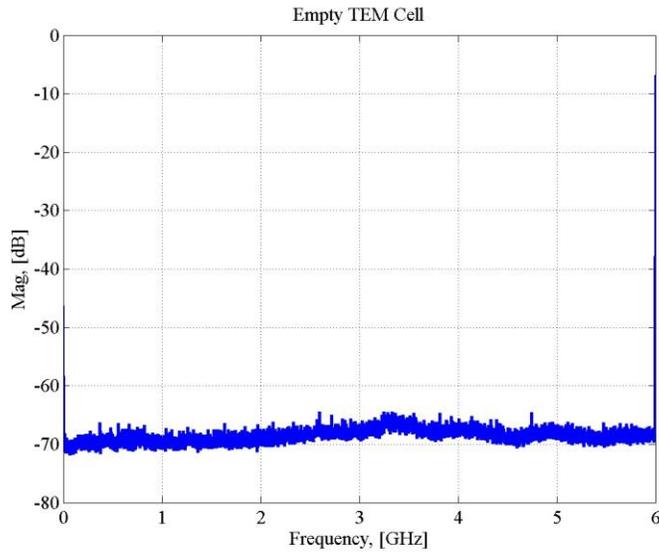


Figure 5: Empty TEM cell measurement.

The measured spectra of the Bluetooth, and WiFi devices are shown in Figure 6. For each device measurement they were connected to a computer and fully functional. The Bluetooth device was put into search for a new device mode.

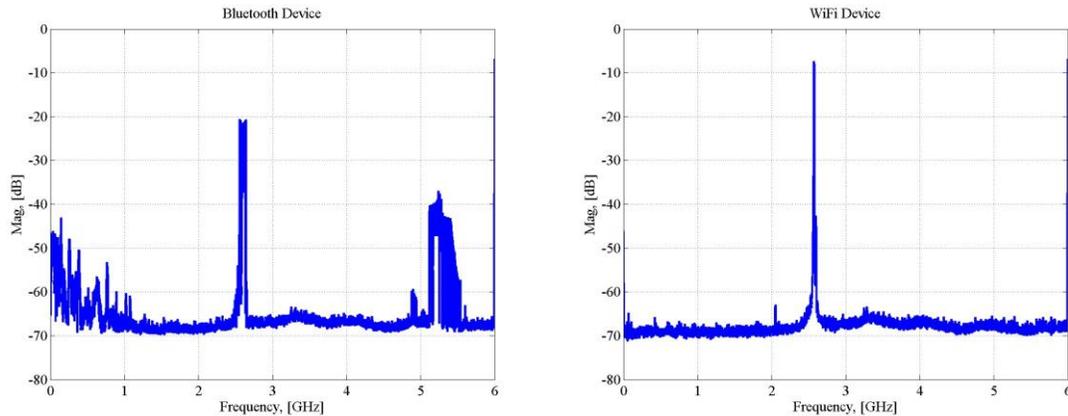


Figure 6: Spectra of Bluetooth and WiFi devices.

A graph with all plots overlaid is shown in Figure 7. As can be seen, the devices both operate in the 2.4 GHz band, and there is potential for interference when both devices are present and operating.

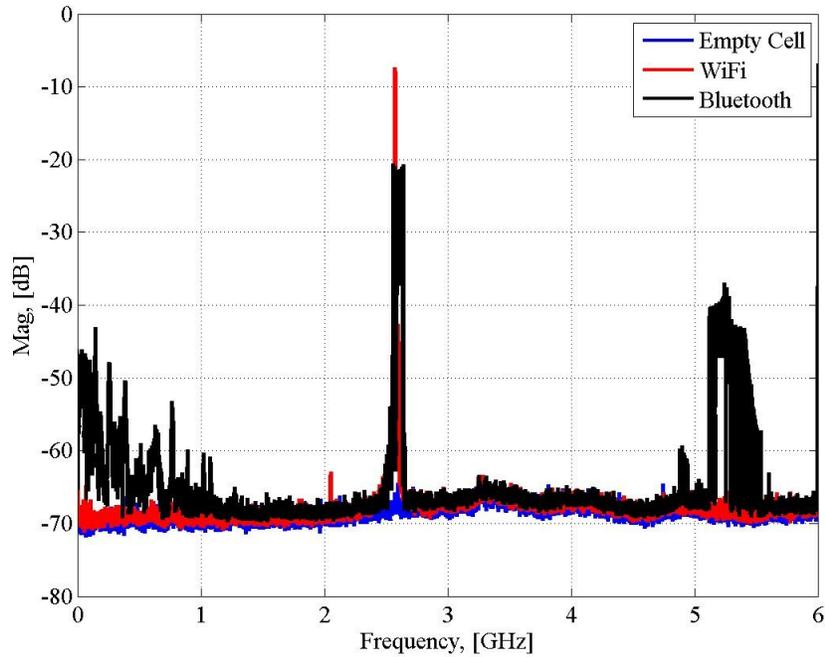


Figure 7: Overlaid spectra.

4. Conclusions

The EM601-4.5 TEM Cell is well suited for measuring 2.4 GHz device spectra. Further, the TEM cell cover can be customized to suit any device that can fit into the large 50 x 50 mm cell of the EM601.

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