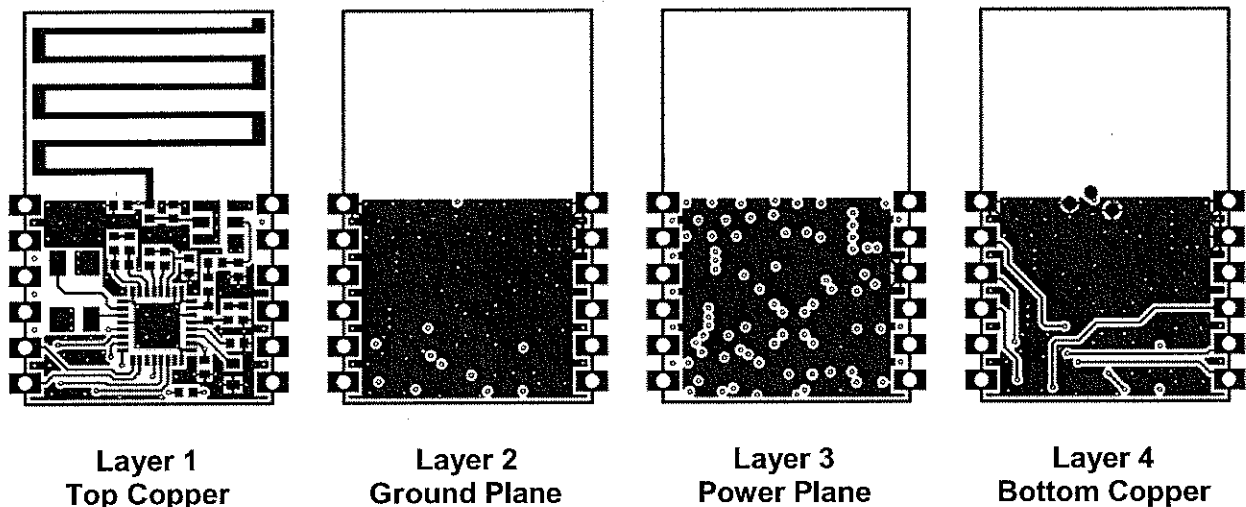
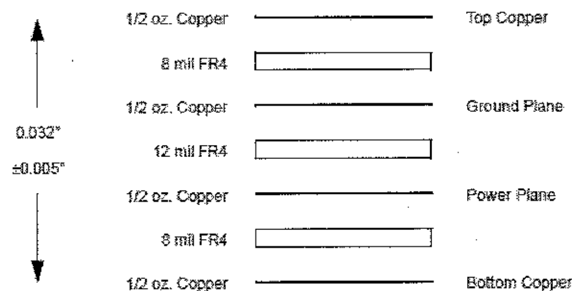
MRF89XAM9A RF Shielding Description

This document describes the construction of the RF shielding on the MRF89XAM9A module and effectiveness.

For effective RF shielding and electro-magnetic compatibility (EMC) performance the module PCB stack-up is an important factor in effectively reducing radiation. The MRF89XAM9A module has an integral four-layer PCB design with internal ground and power planes to provide RF shielding and noise immunity. The PCB is constructed with high temperature FR4 material, four copper layers with a FR4 layer thickness of 0.008 inches and an overall board thickness of 0.032 inches. The layers stack up is shown below from left to right:



The PCB layer stack-up is shown below:



Multi-layer boards using ground and power planes provide significant reduction in radiated emission over two layer PCBs. A four-layer board can produce 15 dB less radiation than a two-layer board (Ott, 2009).

The choice of 0.008 inches between the layer 1-top copper and layer 2-ground plane provides a tightly coupled RF signal layer with the low-impedance ground plane. This has the advantage of minimizing signal loop areas and therefore produces less differential mode radiation, reduces the plane impedance (inductance) hence reducing the common-mode radiation from the board, and decrease the crosstalk between traces.

The choice of ground plane-layer 2 and power plane-layer 3 adjacent to one another is to create an inter-plane capacitance to provide decoupling. Additional decoupling is provided by capacitors C2, C3, C7 and C8.

Construction of the PCB is explained in the MRF89XAM9A Data Sheet.

The effectiveness of the RF shielding is demonstrated in the test report (HBCS P11002 FCC Part 15.247 DTS Test Report). Conducted spurious data under section 5 shows that the harmonics are around 50dB below the fundamental frequency. Also Radiated Spurious emission under section 6 of the test report shows levels are around 20dB below the peak FCC limits. Please refer to the test report for more details.

References:
Ott, H. W. (2009). *Electromagnetic Compatibility Engineering.* Hoboken, New Jersey: John Wiley & Sons.

Sincerely,

Steven Bible
Applications Engineering Manager
Microchip Technology Inc.