RF PCB Design and Layout Course

Developed by PRFI on behalf of MIDAS for presentation in five 90 minutes sessions.

Session #1:

1) Introduction: Challenges of designing high performance, high-speed PCBs:

Impact of

- Product complexity,
- Processor speed,
- Technology,
- PSU efficiency,
- Product size,
- Frequency of operation

What is required for a circuit to perform its function

2) Addressing the needs of sensitive analog systems and covering

Components in analog systems

Sensitivity of analog systems, including:

1. Radio spectrum usage
2. Dynamic range of signals
3. Ease of being able to corrupt weak signals

3) Generation and impact of Digital signal noise and covering

- Components in digital systems
- Continuous noise and burst noise
- Characteristics of clock waveform
- Examples of the impact of digital noise on analog systems

Session #2:

4) Mechanisms for interference transfer

a. Conductive cross talk

b. Radiative crosstalk

c. Techniques to minimize interference transfer including:

- Via placement,
- Current in traces and loops,
- loop area,
- separation,
- shielding,
- cavity resonance

d. Guidelines for reducing potential EMI and EMC issues

5) Digital noise generation in ICs

a. CMOS current noise

b. Package effects and decoupling

c. Bond-out to PCB – PCB trace inductance

d. Supply current noise spectrum

e. Decoupling capacitor selection

- Broadband decoupling
- RF decoupling

f. PCB power and ground planes

g. LVDS for high speed data transfer

Session #3:

6) RF Components and Interconnections

RF signal routing - Distributed structures

a. Microstrip – x-section and trace impedance

b. Stripline – x-section and trace impedance

c. Grounded co-planar – x-section and trace impedance

d. Selecting substrate height, max operating frequency

e. Skin effect and surface roughness

RF performance and limitations of passive SMT Components

a. RF Parasitic modelling of R, L, C, Via

b. RF Footprint modelling

RF through board Via transitions

Passive RF distributed components: Series L, Shunt L, Shunt C

RF sub-circuit design example: Impact of components on a practical RF filter

Session #4:

7) PCB Technology

. PCB substrates: FR4, Rogers, Arlon, Taconic, Isola, Park etc.

i. Production tolerances: track widths, gaps, min hole diam

ii. Component Assembly: peel strength, copper balance, test panels, controlled impedance lines

iii. PCB finishes

iv. PCB multilayer board processing

v. Resist & legends

vi. PCB manufacturers

vii. Practical examples

Session #5:

8) PCB Layout

a. Ground plane

- Analog / Digital Ground plane
- Impedance of ground plane
- Ground stitching vias
- Routing of digital ground planes – unintended slot antennas
- Directing ground return currents

b. Power planes

c. RF bends

d. Labelling of circuit schematics

e. Floor planning and partitioning

f. Layout check list

g. Practical examples