



RF Absorber Options for low Electromagnetic Radiation Phone

By
Millimeter Wave Technology



Available Options

to reduce RF signal intensity to the phone user

- RF Absorbing Injection Molded keyboard pad
- RF Absorbing MAS-310 applied to circuit board
- RF Absorbing Injection Molded Circuit Case
- RF Absorbing Injection Molded Circuit Case with conductive overlay
- EMI Design Process to determine optimum combination of above options



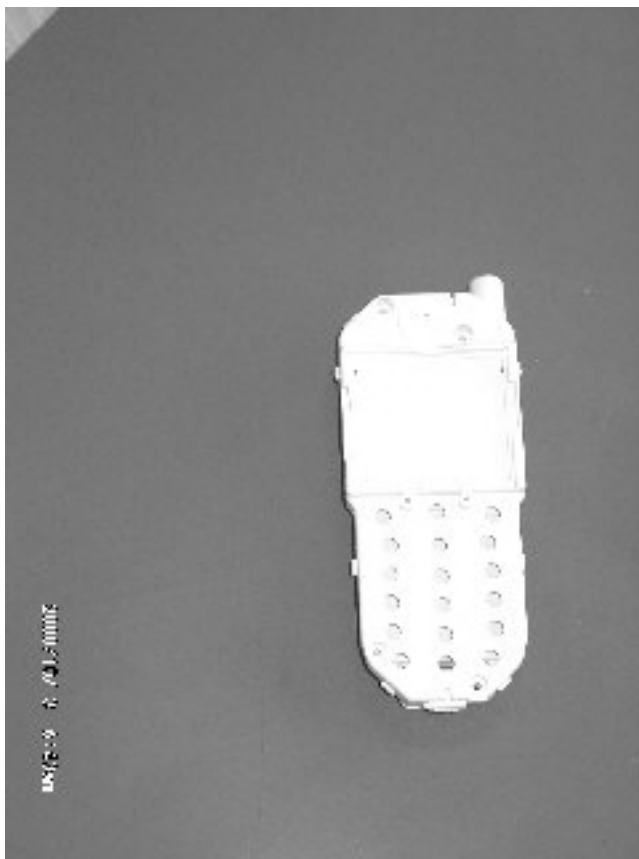
RF Absorbing Injection Molded keyboard pad



- Loaded keyboard pad will allow for isolation of RF energy leaking through lower part of phone case



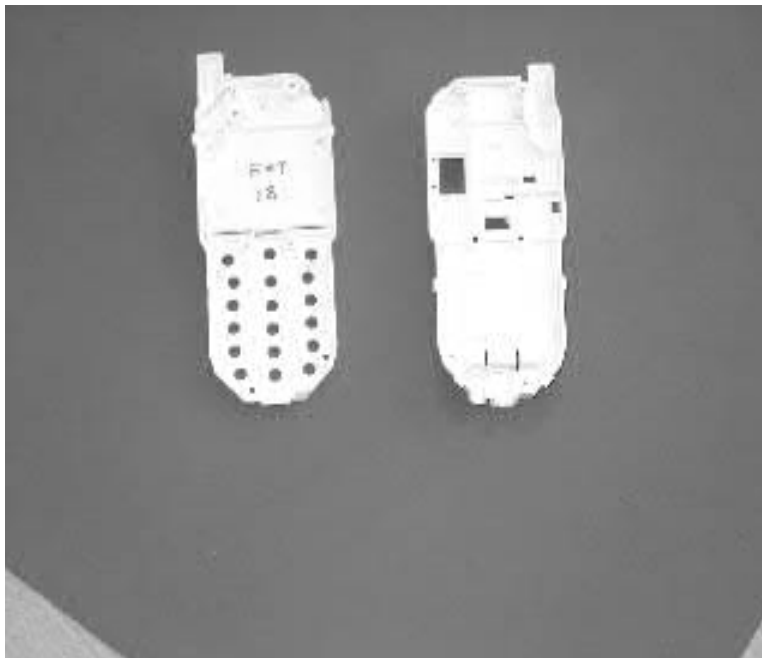
RF Absorbing MAS-310 applied to circuit board



- Inserting MAS 310 behind the front Molded Circuit Case will isolate the RF energy from the IC from the user



RF Absorbing Injection Molded Circuit Case



This unit can be either loaded with RF Absorber material or Loaded with RF Absorber material and then overlaid with a conductive layer



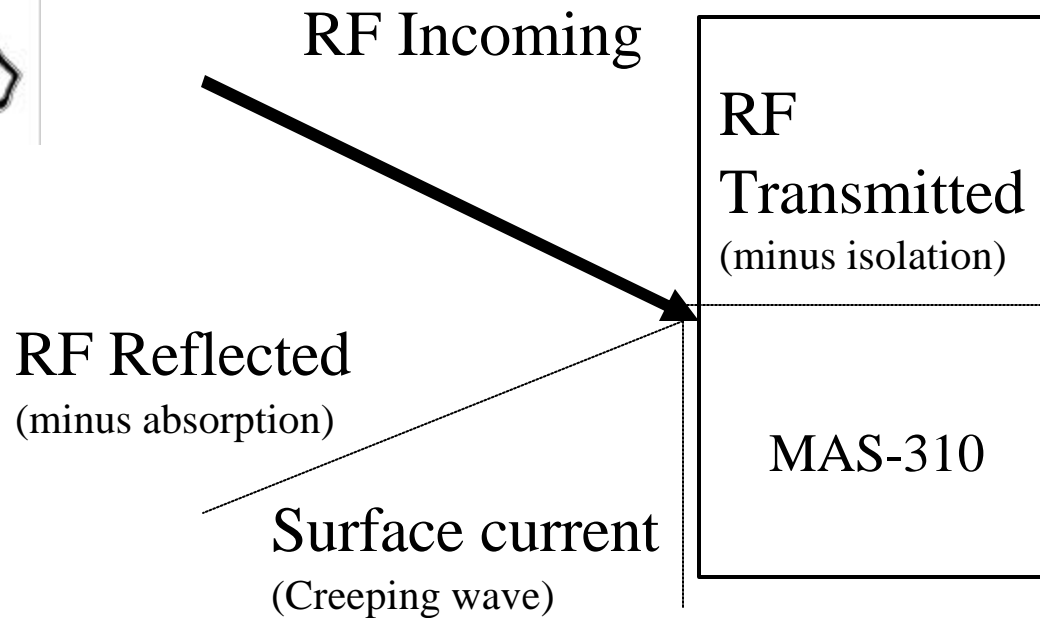
Different Options operate Differently

- RF Absorbing keyboard pad provides Traveling Wave Attenuation and Isolation between user and circuit board.
- RF Absorbing MAS-310 applied to circuit board provides RF Absorption and Isolation isolating the user from RF
- RF Absorber loaded circuit case provides RF Absorption between user and circuit board as well as the forward facing part of the antenna.
- By providing a conductive overlay on this circuit case, isolation is enhanced by reflecting back the RF. It is believed that this will enhance antenna operation while minimizing radiation to the user



Absorption Mechanisms

- Traveling Wave Suppression is accomplished by preventing RF energy from passing along the surface of the absorber
- Isolation is accomplished by thoroughly shielding one material from the other
- RF Absorption is accomplished by absorption of RF energy passing both along the surface and through the absorber
- RF Absorption with conductive overlay enhances isolation



Surface Current and Traveling Waves

- An incident wave will excite surface currents (creeping waves) on a conductive surface.
- Due to non-specular behavior, a surface current can propagate along the surface.
- When the surface current encounters a discontinuity on the surface (break or gap) it can radiate.
- Important to absorb the surface currents as they propagate.
- MWT's MAS-310 series products are magnetic absorbers which attract and dissipate the magnetic portion of the surface wave.
- Surface wave absorbers act as a wave guide or conduit to guide and attenuate waves as they propagate.



Comparison of Advantages

Thin Film Traveling Wave Absorber (MF-500) for Keyboard pad

- Light Weight
- Low Cost
- Stops Traveling Waves

Loaded Circuit Board Case

- No additional parts required
- Moderate weight
- Stops Traveling Waves and minimizes RF emissions
- Conductive overlay enhances isolation and antenna performance

Circuit Board insert (MAS-310)

- Stops Traveling Waves and Minimizes RF Emissions



Comparison of Disadvantages

Thin Film Traveling Wave Absorber (MF-500)

- Minimal RF energy Absorption
- **Loaded Circuit Board Case**
- Moderate RF energy Absorption
- Reduction of active antenna area

Circuit Board insert (MAS-310)

- Extra weight
- Extra Part/Installation



Weight and Cost Comparison

Option	Cost \$/piece	Weight Gr./piece <i>(estimate)</i>
Loaded Keypad	0.06 (increase over current part)	<0.5
Loaded Circuit Board Case	0.16 (increase over current part)	8 (an increase of 6 grams)
Loaded Circuit Board Case with Conductive Overlay	0.19 (increase over current part)	8 (an increase of 6 grams)
Circuit Board Insert MAS-310	0.24 (assuming 15 cm ²)	<5 (assuming 15 cm ²)

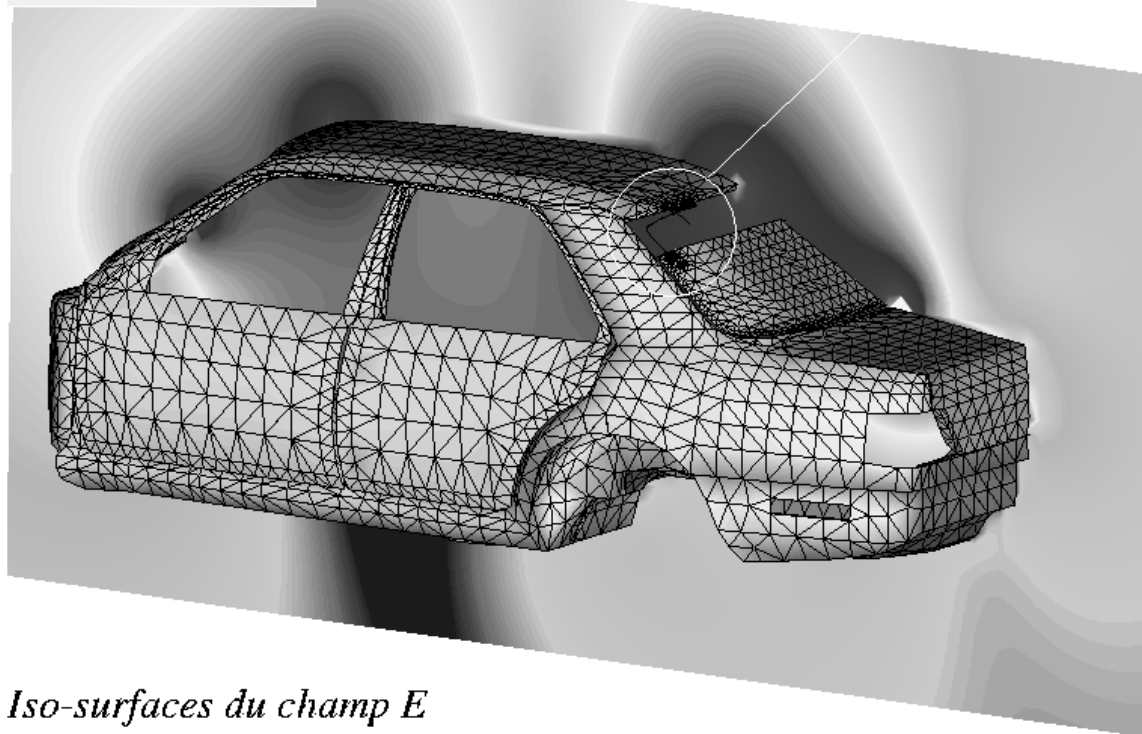


EMI Analysis can optimize performance...

Use of a proper software (such as ASERIS or similar) will help optimize performances for a given combination of absorbers.

AEROSPATIALE
ASERIS-BE

Mercedes-Benz
Calcul d'antenne



Iso-surfaces du champ E



... while minimizing costs

Item	Unit Cost	Cumulative Cost
Keypad Cover	.06	.06
Loaded Circuit Case	.16	.22
Loaded Circuit Case with Conductive Overlay	.19	.25
MAS 310 Insert	.24	.49

Cost can vary from .06 to .49 per unit