

Michelin Guidelines for Deployment of Licensed RFID Tag

1.0 Description of the RFID Tire Transponder:

1.1 Transponder Overview:

The transponder consists of a UHF/SHF RFID chip, circuit board and two antennas. The antenna leads must be tuned to resonate at 868MHz and 960MHz when cured into the tire. **The current design (patent pending) has a nominal recommended tuned length of around 61mm end to end (effective August 2005 and beyond).** The versions provided up to August of 2005 had a nominal recommended tuned length of around 73mm. Exact tuned length will always depend on tire type. The distinction is that the current design has a slightly larger diameter for the antenna coils. read distances with the current version should meet or exceed past read distances (fig 1). The mechanical performance similarly meets or exceeds past performance.

The assembly is coated with an adhesive which will bond it to rubber during curing.
See photo:



Fig 1 Older version (top) New Version(bottom)

1.2 Tire installation:

The transponder may be added to the tire during tire build by itself or encased in a sandwich of green rubber of a low carbon composition (fig 2.0). The thickness of the sandwich correlates directly to the final read distance since the carbon in the tire rubber detunes the transponder.

Tires come in a variety of sizes, spanning several orders of magnitude in size, weight, and load-carrying capacity. Most of the Requirements which follow are common to all tires, but every specific application must be examined carefully to assure optimum performance.

For purposes of this document, the term “rubber” may refer to either natural or synthetic compounds commonly used in tire construction. Exact formulation is left to the discretion of the tire manufacturer or patch manufacturer.

Insulation and Laminator

Typically, provision of the insulating layer of rubber will be the responsibility of the tire maker or patch maker who buys the RFID assemblies, and not the RFID manufacturer. An adequate insulation layer is critical to the performance of the unit, and the tire or patch maker must understand that the RFID manufacturer is not responsible for poor results caused by inadequate insulation. Although specific compounds may vary, in general insulating rubbers can be defined as rubbers with resistivity $> 10^5$ ohm-cm. However, the best way to evaluate candidate rubber compounds is to measure the dielectric permittivity (ϵ') and dielectric loss (ϵ''). Successful RFID transponders have been made using materials characterized at 915MHz to have $\epsilon' < 5$ and $\epsilon'' < 0.2$, although higher values might work.

A semiautomated laminator useful to create the sandwich is shown below



Fig 2.0 Tag in Uncured Rubber Sandwich



Fig 3 Sandwich Placed During Tire Build

1.2 Environmental and Operating Conditions

1.2.1 Definitions

Operational – The transponder is fully functional. It is readable and programmable.

Survival – The transponder may not be readable or programmable under these conditions.

However, the transponder will return to being fully functional after the conditions return to the operational norm. Note: survival also means that the data that has been programmed into the chip has remained unaltered.

1.2.2 Tire Manufacturing Conditions:

The transponders must **survive** these conditions:

175 deg C for 20 minutes or
160 deg C for 45 minutes

Max molding pressure > 50 bar

1.2.3 Tire Operational Conditions:

- Transponder must be **operational** at a temperature between –40C & 85C.
- Transponder must **survive** indefinitely between –40 deg C & 110 deg C.
- Transponder must **survive** up to 8 hours between 110 deg C & 125 deg C.
- Transponder must be **operational** under max tire inflation pressures:
 - Passenger/Light Truck up to 60 psi

1.3 Handling, Packaging, and Storage (Tag)

1.3.1 Storage of components – Boards, chips, and antenna wire must be stored in an environmentally controlled condition:

Temperature range 40 to 90 deg F and humidity < 75%..

1.3.2 Handling –Coated transponders may not be handled with bare hands (use gloves).

1.3.3 Packaging – To be defined

However, the following will be some key elements

- UV protection – UV light degrades the quality of the adhesive
- ESD protection
- Desiccant
- Ability to feed an automated applicator and a manual applicator

1.3.4 Storage –

Transponders must be stored in an environmentally controlled condition:
Temperature range 40 to 80 deg F and humidity < 75%.
UV protected.

1.3.5 RFID Tag Sandwich in Uncured Rubber

Use typical uncured rubber procedures for handling , preparation and storage.

1.4. Tag Quality Assurance

Licensee's are held to the conditions and normative standards listed in AIM Global TOR 5Q for manufacturing reliability.