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Application Brief: **Proximity Wireless Inc. - One Page Application Briefs**
Title: **Special mounting of RFID tags on large metal objects**
Number: **AB081006-01**

Placing an RFID tag onto any large metal object requires some special attention be paid to the exact type, location, and mounting method to assure optimum results. Some tag types will work poorly or not at all depending upon the surface type, size, mounting method, as well as the frequency the tag operates at.

One application involves placing a small RFID tag into a semi-permanent mounting location by placing the tag into a drilled hole and then covering the tag with an epoxy or plug to hold it in place. When the tag is ready for replacement the hole can be re-drilled and a new tag installed. Mounting such a tag, possibly a small round tag into a drilled hole requires that a few rules be followed to assure optimum performance.

The picture below is of a circular radio waveguide. Placing an RFID tag into a drilled hole essentially must follow the rules of building a waveguide antenna. Unless these rules are observed the RFID tag will perform poorly or not at all. Below is a partial but certainly not an exhaustive list of important guidelines.

- The waveguide dimensions must adhere to the basic waveguide dimension restrictions shown for TE Mode.
- The RFID tag must be held “d” distance from the bottom of the hole by use of a “dielectric spacer” like a plastic disk. This dimension is approximately ¼ wavelengths at the frequency of operation of the tag.
- “d” is calculated based upon several factors including frequency, hole dimensions, tag dimensions, and dielectric constant of the spacer, tag, and epoxy.
- Basic dimensions can be calculated but several experiments will be necessary to determine the final optimum dimensions and spacing. This is due to the fact that the frequency the tag operates at is fixed, so the dimensions of the waveguide must be found such that it works with the tag, spacer, and epoxy simultaneously.

Circular Waveguide

TE (Transverse Electric) Mode

The lower cutoff frequency (or wavelength) for a particular TE mode in circular waveguide is determined by the following equation:

$$\lambda_{c,mn} = \frac{2\pi r}{p'_{mn}} \text{ (m)},$$

where p'_{mn} is

m	p'_{m1}	p'_{m2}	p'_{m3}
0	3.832	7.016	10.174
1	1.841	5.331	8.536
2	3.054	6.706	9.970

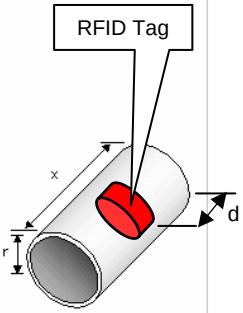
TM (Transverse Magnetic) Mode

The lower cutoff frequency (or wavelength) for a particular TM mode in circular waveguide is determined by the following equation:

$$\lambda_{c,mn} = \frac{2\pi r}{p_{mn}} \text{ (m)},$$

where p_{mn} is

m	p_{m1}	p_{m2}	p_{m3}
0	2.405	5.520	8.654
1	3.832	7.016	10.174
2	5.135	8.417	11.620



Use of such RFID techniques can greatly enhance tracking and maintenance of many types of equipment and machine tools but placement and installation of such tags can be tricky. Proximity Wireless can help you determine the best tag, reader, and mounting method for your application. Please contact Proximity Wireless sales at (913) 438-1321 x102, or on the web at http://www.proximitywireless.com/contact.htm to find your best RFID solution.