

Ablaze Systems LLC / Ben Franklin

Antenna Modeling and Indoor Signal Fading Simulations for the Radiotronix Chip Central Unit in Restaurant Applications

Activities:

1. Signal Processing Track

Propagation Channel Model and Fading Characteristics:

Perform indoor propagation study using the EDX Software to assess the wireless communication link between the central unit (CU) and other transmitters and receivers in the overall wireless system. The EDX software allows a study of possible signal fading due to multipaths emanating from reflectors inside the Restaurant. The fading might be responsible for reduction in communication range and for the loss of signal at specific locations where the Central Unit is mounted. The input parameters and variables to the EDX software include the position of the transmitters, the restaurant layout, ceiling, ground, and wall properties. At any given receiver location, the EDX calculates all rays that reach this location through first as well as higher order reflections from surrounding objects, including , ground, ceiling, or sidewalls. The software will help in:

1. Defining CU location areas that will have least possible fading.
2. Sensitivity of the signal strength of the different locations of CU to antenna and unit displacements as well as the carrier frequency.
3. Power analysis at various locations in the restaurant.
4. Effect of antenna gain and directivity pattern on the short range wireless connectivities.
5. Restaurant size constraints for elimination of intersymbol interference.

The study will recommend whether there is a value in using 1) Spatial diversity scheme, 2) Beamforming and array processing scheme.

2. Antenna Track

Perform a detailed radiation analysis of the existing ANT-916-CW-QW antenna in the presence of the corresponding trans-receiving central unit (CU) in order to determine the pattern coverage in both the azimuth and elevation planes. In particular we will use a method of moment (MOM) electromagnetic analysis tool to study the pattern, directivity, and gain performances of the antenna mounted on the central unit (CU). The specifications provided by the manufacturer of ANT-916-CW-QW do not include any measured pattern or gain coverage data. Even though such data might be helpful, we will, however, approximately model and analyze the radiation characteristics of the ANT-916-CW-QW in the presence the central unit. We will also study effects of using more than one CU antenna on increasing the range and/or pattern coverage of the system. If time and resources permit, we will also study the performances of some other alternative antenna elements for the central unit.

In conclusion, we will perform a parametric study of the number and locations of the ANT-916-CW-QW antenna under consideration in the presence of the central unit

and recommend whether the antennas satisfy the required gain and pattern coverage. The study will also recommend (if time permits) whether there is a value in pursuing other alternative antenna types. The proposed investigation will include the following tasks:

- Radiation analysis of the antenna in free space in the absence of the CU housing; the resulting data will serve as the baseline for the tasks listed below.
- Development of an electromagnetic model for the CU prototype (Ablaze Systems will provide the prototype).
- Radiation analysis of the antenna in the presence of the CU housing.
- Investigation of the use of 2, 3 or 4 antenna elements in various locations in the presence of the CU housing for improving the pattern/gain coverage.
- Analysis of an alternative low-profile antenna, such as microstrip patch, for the central unit, if allocated time and resources permit.