FRN: 0005881040
File No 0236-EX-PL-2015
Applicant: 3M Company. Traffic Safety and Security Division (TSSD)

Technical Description

3M Company develops UHF RFID Systems (Transmitters and Passive Tags) for global ITS Transportation applications such as Open Road Tolling. Typically, UHF readers operate at FCC Part 90 (licensed) devices (902-904MHz & 910-921MHz) in North America. Other countries operate within 902-928 MHz band or 865-868 MHz band in ETSI (CE Mark) deployments. 3M has multiple indoor / outdoor locations in developing and testing RFID technology, conformance and its interoperability. Locations include 3M Austin (TX) Center, 3M Center & EMC Laboratory (St. Paul, MN), 3M Test Track (Cottage Grove, MN) and 3M North Carolina (Morrisville).

UHF Readers have been "equipment typed" approved typically FCC Part 90.353 and use remote attached directional antennas mounted downward on overhead roadway gantry (~17 feet high). Vehicle with windshield mounted tag passes under overhead gantry (antenna) and data is captured. Antenna is localized to each lane (~3-4m width) and minimize cross lane reads. 3M reader automatically adjusts the power output for antenna gain and cable loss to comply with each country's regulatory requirements. 3M offers model 6204 multiple protocol reader (FCC Identifier M4Z6204) for open road tolling. Tolling protocols used in United States are: 1) ASTMv6, 2) ISO 10374 (ATA), 3) ISO 18000-62 Type B (40k & 80k), 4) ISO 18000-63 Type C, 5) PS111 (IAG) and 6) Title 21 (T21). Experimental License is needed to test different RFID readers (3M and from other manufacturers), antennas, protocol combinations, power levels and parameter configurations for interference and compatibility in vehicle transportation environment for MAP-21 directive.

UHF RFID tolling reader supports multiple RFID protocols, with diverse modulation schemes where reader activates the tag and receives tag's data. These protocols may be operated individually or in a time-multiplexed combination. Readers have antenna ports are multiplexed, and only one port is transmitting at any given time and connected through cable to antenna mounted on overhead gantry. The RF field from the reader can produce a tag read zone ranging between 3-4m zone (0 degrees from horizontal / 3 degree vertical antenna angle) within the roadway lane depending on the antenna port power, antenna gain and antenna positioning. The RF field generated by the reader performs the following:

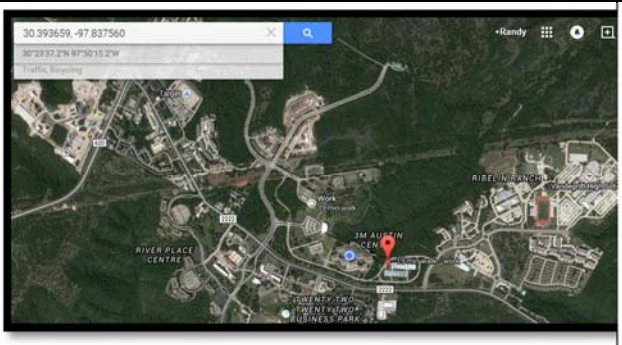
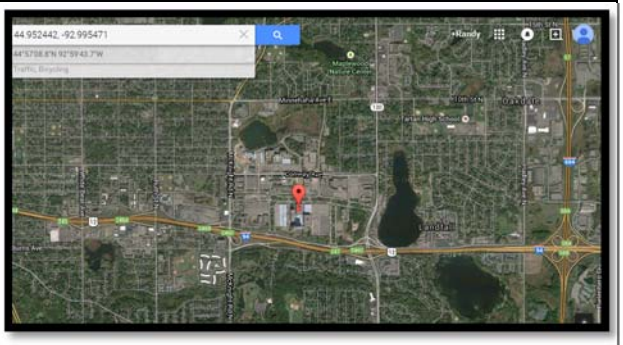
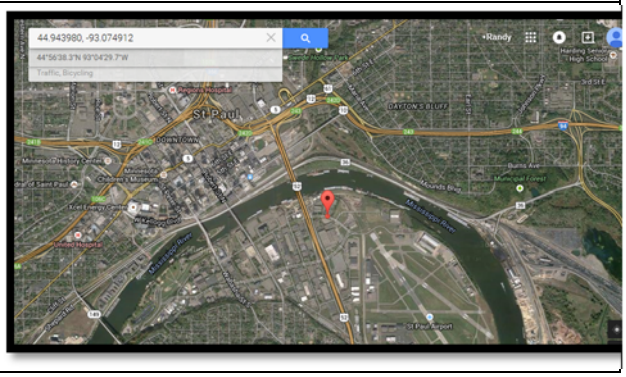
- Energize the tag antenna to provide power to the tag's integrated circuit
- Provide a synchronized clock source for the tag
- Communicates the commands from the reader to the tag via modulation
- Act as a carrier for returned tag data

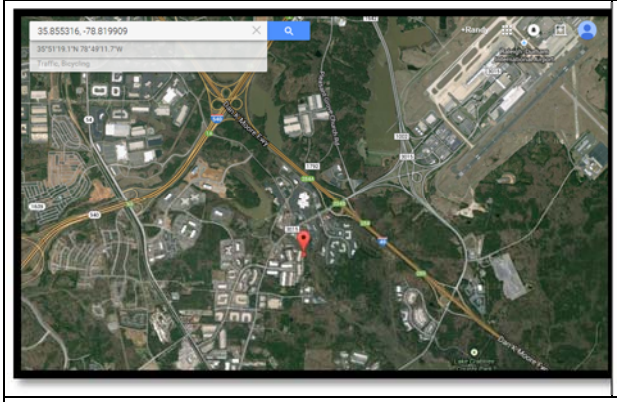
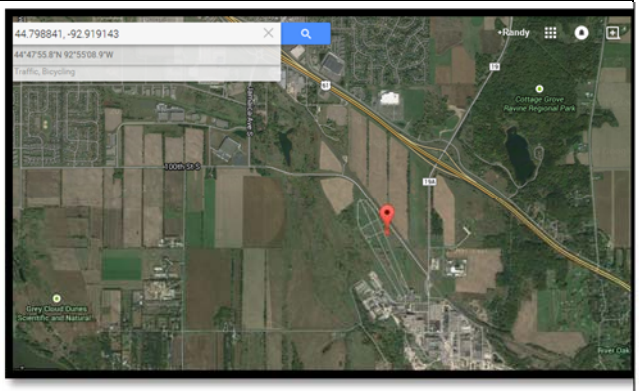
The reader is configured to selectable RF Channel assigned to each lane and transceiver is idle until an event triggers the reader to begin transmission. While the RF downlink (reader-to-tag) signal is transmitted, the reader monitors its receiver output for modulation indicating the presence of a tag.

When a tag enters the RF read zone, its antenna is energized and the tag starts to divide down the carrier, demodulate commands from the reader, and begins to clock data to its antenna modulator circuit. The modulator circuit shunts the antenna element, causing momentary fluctuations in the carrier amplitude reflected back to the reader. The reader detects this amplitude-modulated data and decodes the resulting bit stream into the actual tag data. The decoding scheme depends on the specific tag protocol.

In next generation transportation safety initiative with Connected – Automated Vehicles, 5.9 GHz DSRC (IEEE 802.11 based) two-way (bi-directional) communications is being developed and validated for low latency "Critical Safety of Life" transmissions. Vehicle's DSRC device (Part 95) has targeted 300m omnidirectional range and infrastructure's DSRC device (Part 90) has 500-700m range typically omnidirectional. DSRC device can be used for many safety communication applications in transmitting digital message giving vehicle-to-vehicle, vehicle-to-infrastructure and time/location information in ad-hoc network. Currently, industry is evaluating this communication technology in application pilots.

Testing includes UHF RFID Readers and their protocol used in regional tolling applications to insure multiple protocol performance and interoperability for FCC Part 90.353 Location & Monitoring Transmitter. Also, 3M request 5.850 – 5.925 GHz coverage in developing and testing DSRC (Dedicated Short Range Communications) devices per FCC Part 90 & 95 rules. Two year experimental license is being requested to operate these "Equipment Type Approved" readers within 5 kilometers radius of these locations and short term (less than two months) at existing U.S. tolling locations for technology evaluation / compatibility. 3M's locations coverage request are shown below:

3M Austin Center **6801 River Place Blvd, 141-4N-33** **Austin, TX 78726 USA** **(30.393659, -97.837560 or 30°23'37.2"N 97°50'15.2"W)**	**3M Center, Building 235** **St. Paul, MN 55144** **(44.952442, -92.995471 or 44°57'08.8"N 92°59'43.7"W)**
	
Reader / Antenna Setup at 3M Austin Center	**3M EMC Laboratory, Bldg. 76-1-01,** **410 E. Fillmore Ave.** **St. Paul, MN 55107-1208** **(44.943980, -93.074912 or 44°56'38.3"N 93°04'29.7"W)**
	

3M North Carolina 200 Perimeter Park Drive, Suite E Morrisville, NC 27560 USA (35.855316, -78.819909 or 35°51'19.1"N 78°49'11.7"W)	3M Test Track Cottage Grove, MN (44.798841, -92.919143 or 44°47'55.8"N 92°55'08.9"W)
	
Overhead Gantry at Test Track (Cottage Grove)	
	

Technical Data

Readers (UHF per FCC part 90.353 LMT and DSRC per Part 90 & 95L):

- 3M 6204 (M4Z6204), 902.75 – 920.45 MHz, 3.2 W Output, Frequency Tolerance 1.0 PM, Emission Designators (432KK1D, 1M06K1D, 422KK1D and 758KK1D)
- 3M 6100 (n/a), 911.2 – 920.45 MHz, 3.0 W Output, Same as 6204
- Kapsch Janus MPRv2 (JQU802295A), 902.5 – 921.5 MHz, 2.43 W Output, Frequency Tolerance 0.24 PM, Emission Designators (231KNON, 248KNON, 499KK1D, 465KK1D, 475KK1D, 679KK1D, 762KK1D and 1M66K1D)
- Kapsch Badger (JQU800495). 909.75-921.75 MHz, 4.0W, 6M50P0N
- Transcore MPI 6000A (FIHMPI6000A), 902.25 – 921.5 MHz, 2.0 W Output, 2.5 PM, Emission Designators (NON, 610KL1D, 815KL1D, 1M71L1D and 2M82L1D)
- DSRC MCTT (n/a), 5.850-5.925 GHz, 17 dBm output & 6 dBi Gain Antenna

UHF Antennas

- Overhead Gantry Antenna, Mounted ~5-6M high pointed downward and forward ~5 Degrees, 902-928 MHz, Linear 36 degrees beamwidth, 15 dBi gain.
- Overhead Gantry Antenna, Mounted ~5-6M high pointed downward and forward ~5 Degrees, 865-870 MHz and 902-928 MHz, Linear 30 degrees beamwidth, 15 dBi gain.
- Overhead Gantry Antenna, Mounted ~5-6M high pointed downward and forward ~5 Degrees, 865-870 MHz and 902-928 MHz, Linear 22 degrees beamwidth, 16 dBi gain.
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Locations and Coverage:

- 3M Austin Center, 6801 River Place Blvd, 141-4N-33, Austin, TX 78726 USA (30°23'37.2"N 97°50'15.2"W) fixed and mobile within 5km radius
- 3M North Carolina 200 Perimeter Park Drive, Suite E, Morrisville, NC 27560 USA (35°51'19.1"N 78°49'11.7"W), fixed and mobile within 5km radius
- 3M Test Track, Cottage Grove, MN (44°47'55.8"N 92°55'08.9"W) fixed and mobile within 5km radius
- 3M Center, Building 225, St. Paul, MN 55144
- (44°57'08.8"N 92°59'43.7"W) fixed within 5 km radius
- 3M EMC Laboratory, Bldg. 76-1-01, 410 E. Fillmore Ave., St. Paul, MN 55107-1208
- (44°56'38.3"N 93°04'29.7"W), fixed within 5 km radius