



## APPLICATION EXHIBIT – FORM 442

### **Introduction**

By this application, Ford Motor Company seeks experimental authority to operate certain modular Cellular-V2X (C-V2X) prototype at specified locations for purposes of testing, development, and evaluation.

The Commission has established the Dedicated Short Range Communications (DSRC) service in the 5.850- 5.925 GHz band for enabling vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications. See 47 CFR §§90.371-90.377; Amendment of Parts 2 and 90 of the Commission's Rules to Allocate the 5.850-5925 GHz Band to the Mobile Service for Dedicated Short Range Communications of Intelligent Transportation Services, ET Docket No. 98-95, Report and Order, 14 FCC Rcd 18221 (1999). Recently, cellular specifications have emerged that support vehicle-to-everything (V2X) communications – V2V, V2I, vehicle-to-pedestrian (V2P), and vehicle-to-network (V2N). In recognition of the emerging C-V2X platforms, Ford Motor Company wishes to test modular technologies that would employ C-V2X functionality as an add-on module in a manner that allows for developmental flexibility. As several of Ford Motor Company's testing & development activities with C-V2X have occurred in association/ collaboration with the Michigan Department of Transportation (MDOT), it is also highly probable that they will be a municipality invested and dependent on Ford's ability to conduct development & testing along this stretch of Michigan Avenue in the heart of Michigan and Ford's home territory. In addition, Ford Motor Company has engaged with local universities for similar activities surrounding V2X systems, such as has occurred in Ann Arbor, MI, whom may also come to be dependent upon Ford Motor Company's licensed ability to operate C-V2X hardware in this environment.

### **Proposed Testing and Objectives**

The proposed testing would support equipment research and development, field testing, and proof of concept. Ford Motor Company is integrating the C-V2X functionality into the Telematics Control Units (TCU) by using an add-on module that would attach to the TCU. The devices to be tested would operate on frequencies allocated to DSRC service.

The proposed testing will be done in two stages: (1) Indoor Laboratory; and (2) Outdoor Vehicular.

#### **(1) Indoor Laboratory Testing**

The C-V2X module would be tested using a "bench" setup. Various parameters of basic operational states would be evaluated, including message transmission and reception statistics; latency; error rate; effects of fading and congestion; and effects of variations in transmit power.

Transmitter operating parameters:

| Type  | Frequency (MHz) | Bandwidth (MHz) | Power (dBm EIRP) | Power (mW EIRP) | Antenna Height (m) |
|-------|-----------------|-----------------|------------------|-----------------|--------------------|
| Fixed | 5850-5925       | 10              | 23 dBm (max)     | 200 (max)       | 3 (max)            |
| Fixed | 5850-5925       | 20              | 23 dBm (max)     | 200 (max)       | 3 (max)            |

## (2) Outdoor Vehicular Testing

The C-V2X module would be installed in test vehicles, and communication between the vehicles would be evaluated while engaged in controlled maneuvers emulating real world driving paths and configurations. Coordinated testing would occur along the public roads and properties identified below. Transmission and reception would be tested using up to ten vehicles simultaneously. In addition to the same parameters tested in the indoor laboratory, various use cases would be evaluated, including collision avoidance messaging; intersection messaging; vehicle-to-infrastructure (V2I) messaging; blind-spot warnings; and emergency braking warnings. The increased antenna height for outdoor testing is because of testing with C-V2X Road Side Unit installations that may be installed. The 20 MHz bandwidth transmissions would be for testing & evaluating C-V2X operations in channels that can utilize 20 MHz of bandwidth, such as channel 183. Modifications requests will be submitted to the license granted to this request to add the appropriate fixed locations of RSU transmitters, or use of 20 MHz, once they are determined.

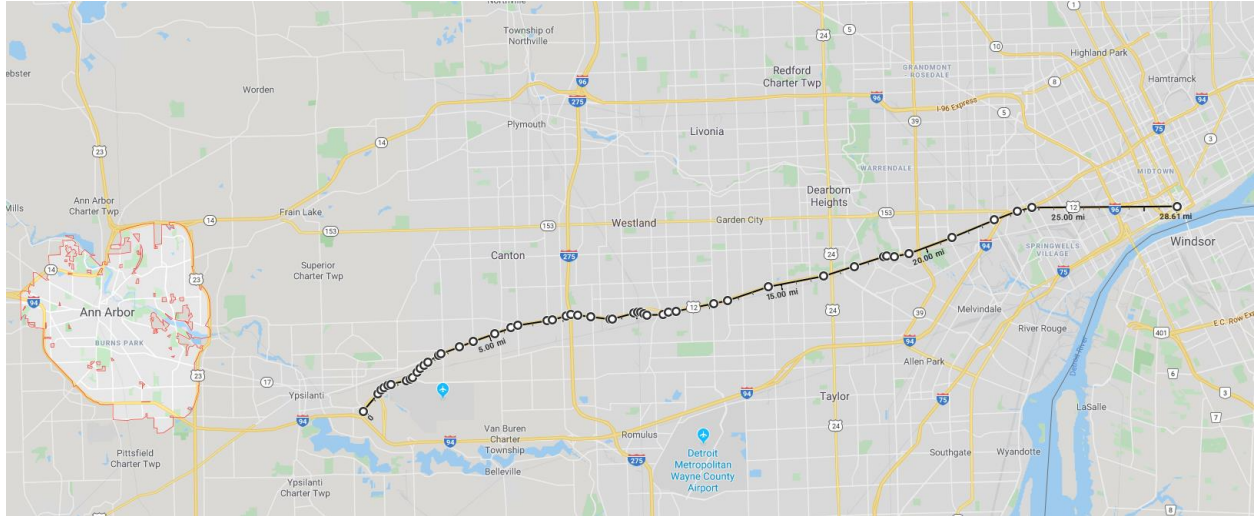
Transmitter operating parameters:

| Type   | Frequency (MHz) | Bandwidth (MHz) | Power (dBm EIRP) | Power (mW EIRP) | Antenna Height (m) |
|--------|-----------------|-----------------|------------------|-----------------|--------------------|
| Mobile | 5850-5925       | 10              | 23 dBm (max)     | 200 (max)       | 7.62 (max)         |
| Mobile | 5850-5925       | 20              | 23 dBm (max)     | 200 (max)       | 7.62 (max)         |

## Test Locations

Testing will be restricted to the following locations:

1. The ~ 30 Mile stretch of US 12 (Michigan Avenue) that runs between downtown Detroit, MI and Ann Arbor, MI ( US 12 & Woodward Ave to US 12 & Gates Ave, respectively). Testing would be restricted to within a 1 Kilometer circle around any point along the defined route:



### **Minimizing Interference**

Ford understands that the proposed experiment under Part 5 of the Commission's rules must avoid causing interference to co-channel licensed operations. As noted, the devices to be tested would operate on frequencies allocated to DSRC service. Ford is aware of DSRC test equipment installations at Mcity in Ann Arbor, and Ford Dearborn testing locations which is only for test-on-demands. Given the maximum transmitting antenna height of 3 meters, the low power operation, and the sporadic and non-continuous nature of the testing, it is highly unlikely that the proposed experiment would result in harmful interference.