

### **Description of Program of Research**

Caterpillar of Delaware, In. (“CAT”) is a major manufacturer of diesel motors, heavy construction equipment as well as mining and specialty equipment. Testing of new products and product improvements is conducted at CAT’s Peoria, Illinois and Green Valley, Arizona proving grounds. CAT has developed heavy equipment that rely on computer modules as well as equipment that is designed to work autonomously on a Wi-MAX system in mining operations. Additionally, CAT has other equipment under development that can make use of Wi-MAX and other wireless technologies and frequency bands.

The purpose of using computer modules in its heavy equipment and motors is to ensure that these devices operate efficiently and properly. Additionally, for those devices that are radio controlled, the purpose is to protect personnel from injury or death by automating the operation of equipment in extremely hazardous environments, such as certain mining applications.

This Experimental Radio Service license modification application will support CAT’s ongoing electromagnetic (“EMC”) immunity testing of Caterpillar, Inc. products. This testing is necessary to ensure product safety and to comply with regulations in certain counties and the European Union<sup>1</sup> in which CAT offers machines for sale. The European Union has recently updated its EMC & Safety directives, which no require CAT to ensure that its products will operate correctly in the presence of electric fields. Test method ISO11451-2 specifies the testing for proper operation in the presence of electric fields, including which frequencies that CAT must use to test its machines. Further, CAT is required to develop a field strength of 30V/m at a distance of 1 meter from the machine at frequencies between 1 GHz and 2 GHz. At 1 GHz, this field strength will be developed and held for 2.5 seconds, at which time the field will be withdrawn and the frequency adjusted up by 2% and the field developed and held for 2.5 seconds again. The testing regimen requires that this rubric be repeated until all spectrum between 1 GHz and 2 GHz has been tested.

While it would be ideal for CAT to be able to test its devices in a shielded enclosure, this is not practical due to the size of some of CAT’s products. The license modification requested herein will permit CAT to make the necessary testing of its products that cannot be feasibly tested in a shielded environment in order to ensure product safety, quality and regulatory compliance.

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<sup>1</sup> See e.g., EU EMC Directive (2014/30/EU) and EU Safety Directive (2006/42/EC).

**Exhibit 1**  
**FCC Form 442**  
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The system will be a fixed EMC pad, consisting of an amplifier, signal generator, power meters and an antenna.

*Duration*

A license term of five (5) years is requested, since products are tested on an ongoing (although very intermittent) basis. Total operation time on any one frequency is expected to be less than 3 hours per month.

*Frequencies*

Although a large range of permitted frequencies have been requested between 1 GHz and 2 GHz, actual testing will be done on discrete frequencies between 1.0 and 2.0 GHz in 2% frequency increments in order to comply with the testing rubric imposed by the European Union and other countries under test standard ISO11451-1. The required frequencies are, as follows:

1000.0000 MHz, 1020.0000 MHz, 1040.4000 MHz, 1061.2080 MHz, 1082.4322 MHz, 1104.0808 MHz, 1126.1624 MHz, 1148.6875 MHz, 1171.6594 MHz, 1195.0926 MHz, 1218.9944 MHz, 1243.3743 MHz, 1268.2418 MHz, 1293.6066 MHz, 1319.4788 MHz, 1345.8683 MHz, 1372.7857 MHz, 1400.2414 MHz, 1428.2462 MHz, 1456.8112 MHz, 1485.9474 MHz, 1515.6663 MHz, 1545.9797 MHz, 1576.8993 MHz, 1608.4372 MHz, 1640.6060 MHz, 1673.4181 MHz, 1706.8865 MHz, 1741.0242 MHz, 1775.8447 MHz, 1811.3616 MHz, 1847.5888 MHz, 1884.5406 MHz, 1922.2314 MHz, 1960.6760 MHz, 2000.0000 MHz

*Emission Designator*

The emission designator is 2G00A3N.

*Power Levels*

EMC immunity testing requires uniform field strength to be generated across the frequency range of interest. This means, that in theory, the effective radiated power (ERP) across the frequency range should be the same even though the transmitter output power will vary – depending upon the efficiency of the antenna at any given frequency.

*Conclusion*

Grant of the instant application in support of CAT's experimentation will contribute to CAT's ability to develop safer heavy construction equipment and machines by ensuring that on-board computers and RF devices will not interfere or cause interference to other devices and machines or malfunction due to interference from other RF devices.