Caterpillar Inc.

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Purpose

This document supports Caterpillar's supplemental request for Special Temporary Authority and an amendment to its underlying request for an experimental authorization to conduct electromagnetic compatiability testing on the television channel edge of specified frequencies in the television band. It illustrates that proposed transmissions by Caterpillar on the television channel edges for electromagnetic compatibility testing are not expected to cause harmful interference to licensed stations.

Caterpillar Station Parameters

Power Output: .5 kW ERP maximum. Actual power output is less in most cases
Modulation: Unmodulated Carrier and 1 kHz 80% AM (2 kHz bandwidth)
Antenna Height Above Ground: 2 meters or less (typical)
Antenna Radiation Pattern: Omnidirectional below 200 MHz (biconical antenna), directional above 200 MHz (log periodic antenna)

Test Transmission Procedure

Starting at the lowest frequency of interest, the signal generator is stepped through the frequencies of interest by computer control, normally dwelling on any particular frequency for duration of less than 10 seconds. The transmitted signal is either an unmodulated carrier or 80 percent AM modulated at 1 kHz.

Proposed Test Signal Frequency

The proposed test signal would be centered at the edge of the television channel, and have a maximum bandwidth of 2 kHz. This location was chosen to minimize potential interference to both analog and digital television stations. For analog NTSC stations, this frequency is well below the visual carrier frequency where there is very little energy being transmitted due to the vestigial sideband modulation scheme. For digital ATSC stations, this frequency is well within the roll-off of the channel mask where there is little energy, which should minimize any impact on a receiver's signal to noise ratio.

Figure 1 shows the spectrum of an analog NTSC television channel, along with the location of the proposed test signal. Figure 2 shows the spectrum of a digital ATSC television channel, along with the location of the proposed test signal.

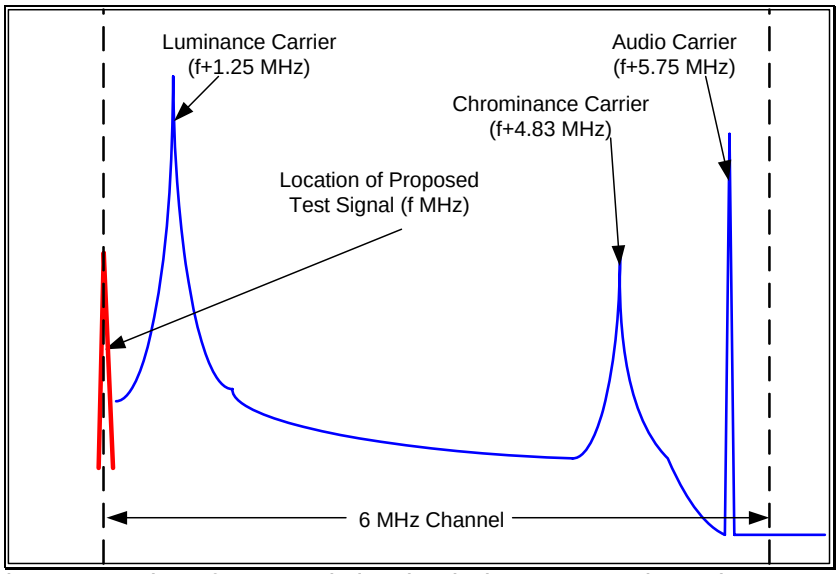

Fig. 1 – Location of Proposed Signal Relative to NTSC Channel Spectrum

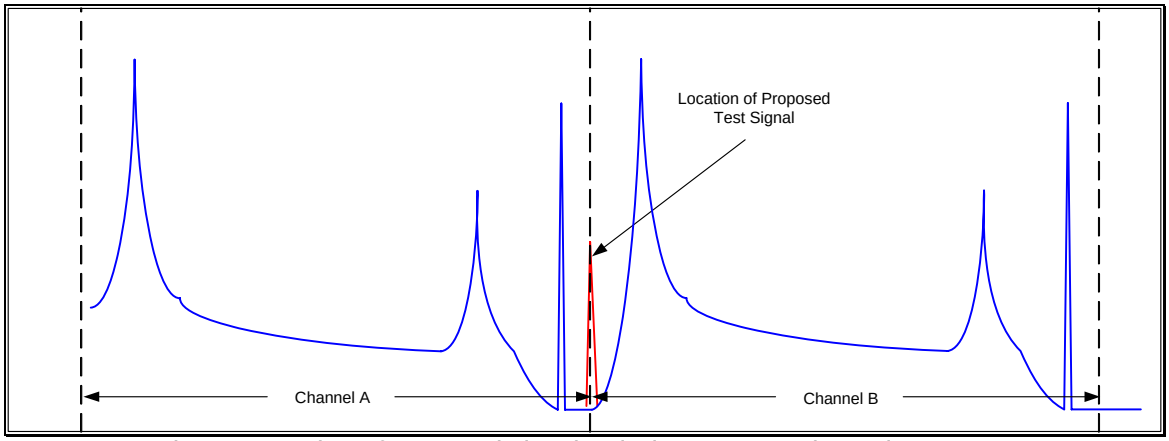

Fig. 2 – Location of Proposed Signal Relative to NTSC Channel Spectrum

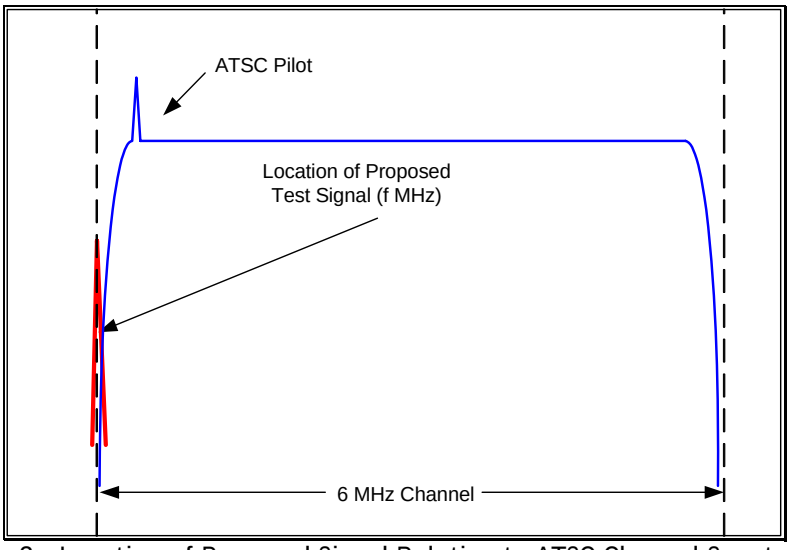

Fig. 3 – Location of Proposed Signal Relative to ATSC Channel Spectrum

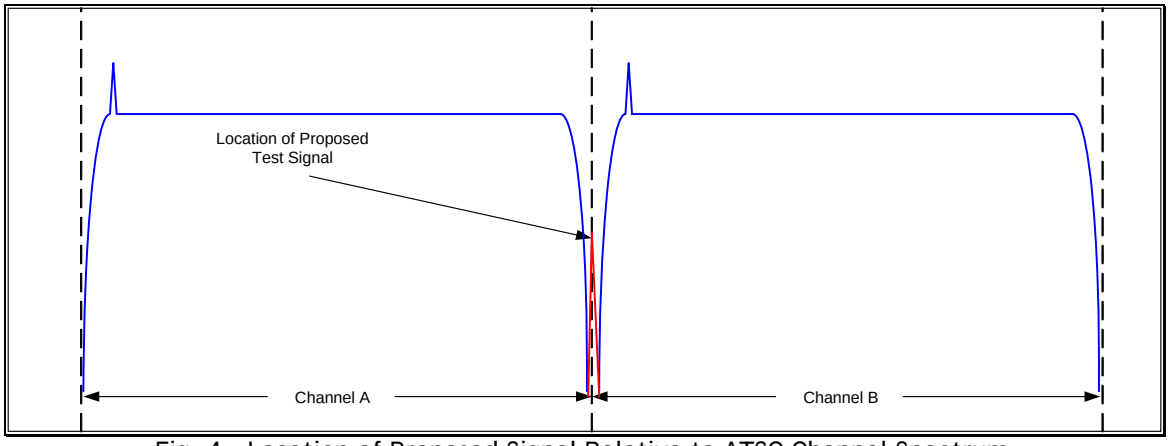

Fig. 4 – Location of Proposed Signal Relative to ATSC Channel Spectrum

Interference Protection Criteria

The normal interference protection criteria (IPC) for two co-channel analog stations is 45 dB D/U. Since the proposed test signal would not be co-channel, but would be at the extreme channel edge, the offset IPC value of 28 dB D/U could reasonably be used. However, even this is a fairly conservative value, since the proposed test signal would be offset from the visual carrier frequency by 1.25 MHz, which is much greater than the 20 kHz offset that the 28 dB criteria is based on. Lab tests have shown that a D/U ratio of up to –25 dBu or more (the test signal could be 25 dB stronger than the TV station signal without interference) may be acceptable with this frequency spacing.

For digital stations, the analog into digital IPC of 2 dB could reasonably be used. Again, however, this is an overly conservative value because the 2 dB IPC criterion assumes a truly co-channel analog station as the interfering signal.

The proposed signal would not only have less bandwidth than an analog TV station, but would also be located outside of the ATSC channel mask, resulting in greatly reduce interference potential relative to a co-channel analog television station.

The images below show the results of several sample interference prediction simulations. These simulations use a –20 dB D/U criteria for both analog and digital TV stations. While this value is much less severe than normal IPC criteria, it is believed to be a reasonably conservative value for the situation in question based on lab testing.

The yellow shaded areas of the images are where the simulated television station's signal is predicted to have coverage. Areas shaded red are where the signal from the proposed testing is predicted to be 20 dB stronger than the television signal when using worst-case parameters (.5kW ERP from an omnidirectional test antenna).

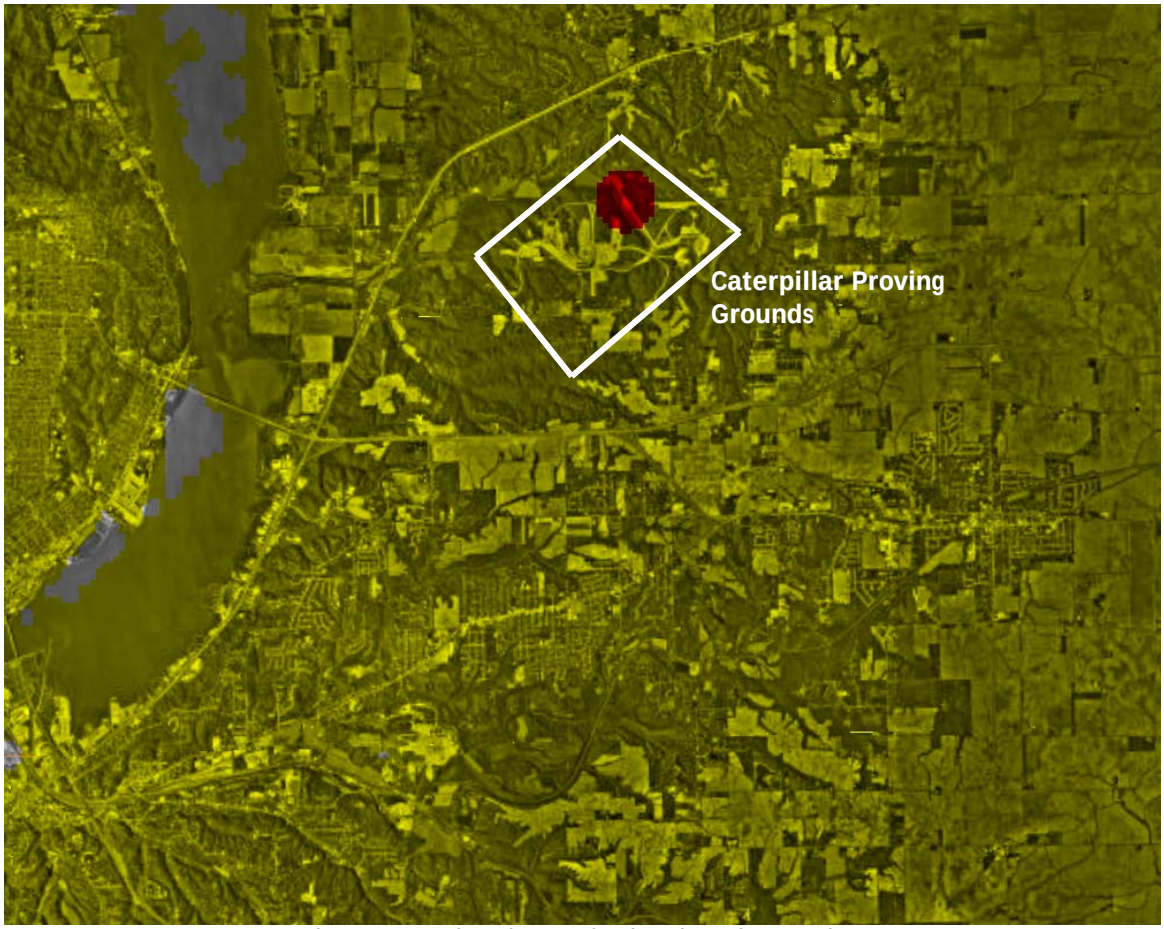

Fig. 5 – -20 dB D/U IPC for local analog station

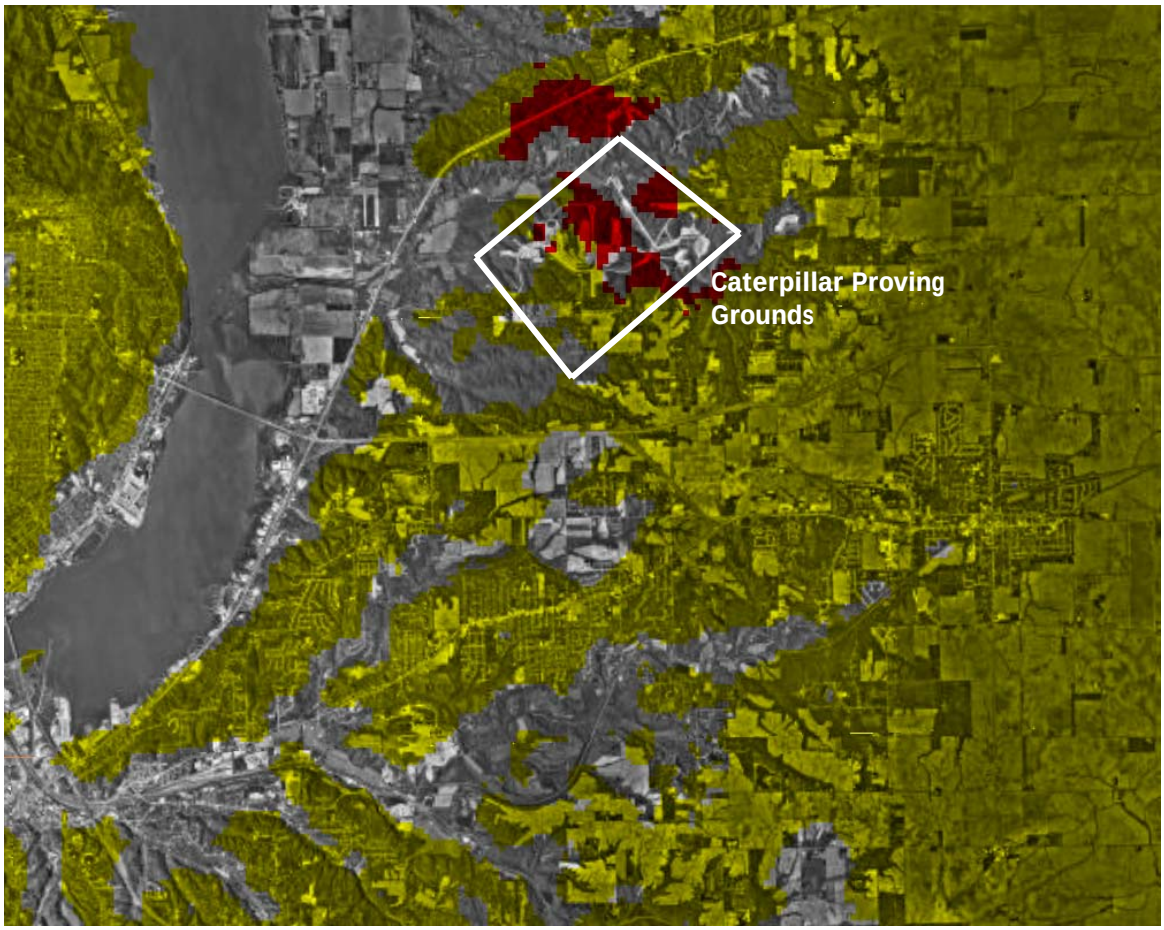

Fig. 6 – -20 dB D/U IPC for distant digital station

Figure 5 shows simulation results for a local analog TV station. In this case, predicted areas of potential interference are limited entirely to Caterpillar property. Figure 6 shows simulation results for a distant digital TV station whose primary market is the Urbana-Champaign area of Illinois. In this case, almost all predicted areas of potential interference are limited to Caterpillar property. It should also be noted that all areas of potential interference are outside of the station's protected 41 dBu contour (based on FCC database data).

Conclusion

Caterpillar's proposed test transmissions would occur on frequencies within the television broadcast bands that are specifically chosen to reduce interference potential to licensed stations. This, coupled with the fact that transmissions would be infrequent and brief, suggests that the probability of harmful interference to licensed stations from the proposed testing is very low.