WHITE PAPER
CONSTRUCTION OF SIMPLE MOBILE DTV DRIVE TEST RECEPTION SYSTEM

Summary

For DTV broadcast stations equipped with the M/H mobile service, a simple system was assembled to evaluate Mobile DTV reception using off-the-shelf USB type DTV receivers. The equipment used to implement the system includes a USB type of DTV receiver, a GPS receiver and an analog-to-digital converter; all interfaced together with a laptop. The system works by sampling the audio output of the Mobile DTV receiver at each measurement location defined by GPS geographic coordinates. If audio is present, then DTV reception is flagged as available and vice-versa. The results can then be geographically mapped to show where mobile DTV reception is available within the measured station's coverage area. Different types of Mobile DTV receivers and/or receiving antennas can be used with this system to evaluate the reception characteristics.

This system was designed for simplicity, so other television transmission engineers could build such a system for their own station(s). For a more complete coverage analysis, other signal metrics should be obtained such as received signal strengths and signal-to-noise ratios – but this would require specialized test equipment.

Construction of System

In summary, the system simply samples for the presence the Mobile DTV receiver's audio output and flags the associated GPS location on the audio availability. The audio availability is directly correlated to availability of the Mobile DTV program stream.

The following equipment is used for the measurement device:

- Mobile DTV Channel with continuously transmitted audio tone
- USB Mobile DTV Tuner
  - In this example, a *DTV Interactive Storm* USB Receiver was used
- GPS Receiver
- Analog-to-Digital Converter
  - A supplemental audio amplifier may be needed to drive A/D converter
- Laptop Computer with Software Interface to the above devices.

Below is a block diagram of the layout of the Mobile DTV system.

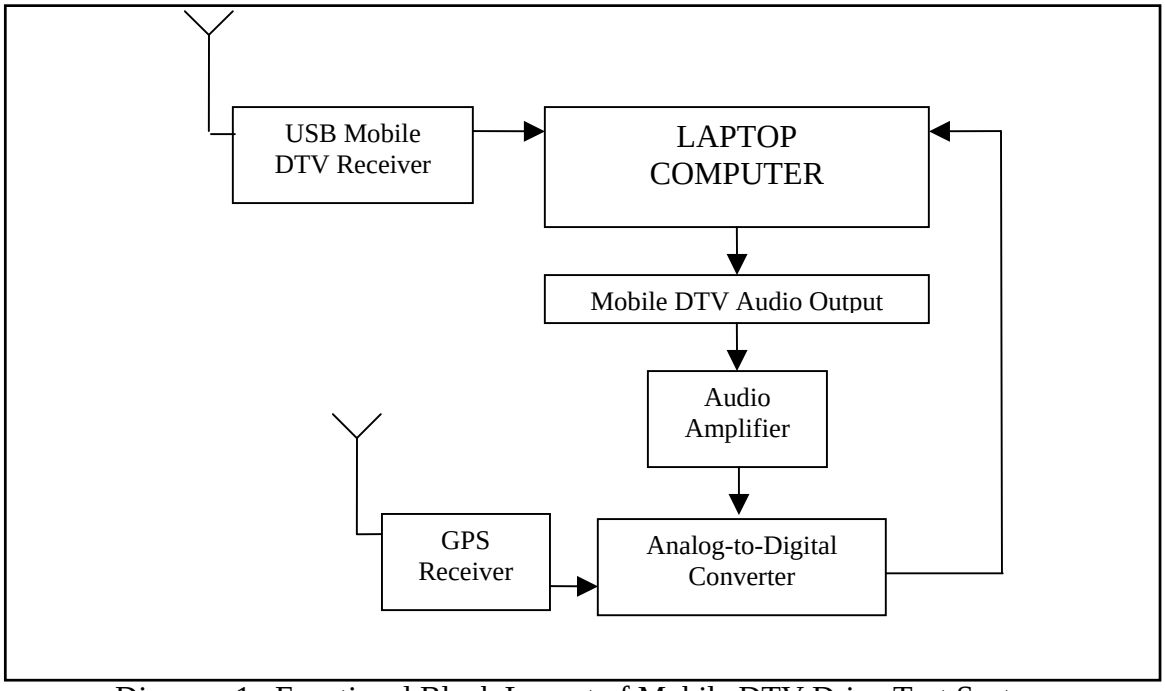


Diagram 1. Functional Block Layout of Mobile DTV Drive Test System

Photographs showing implementation of the system is provided below:

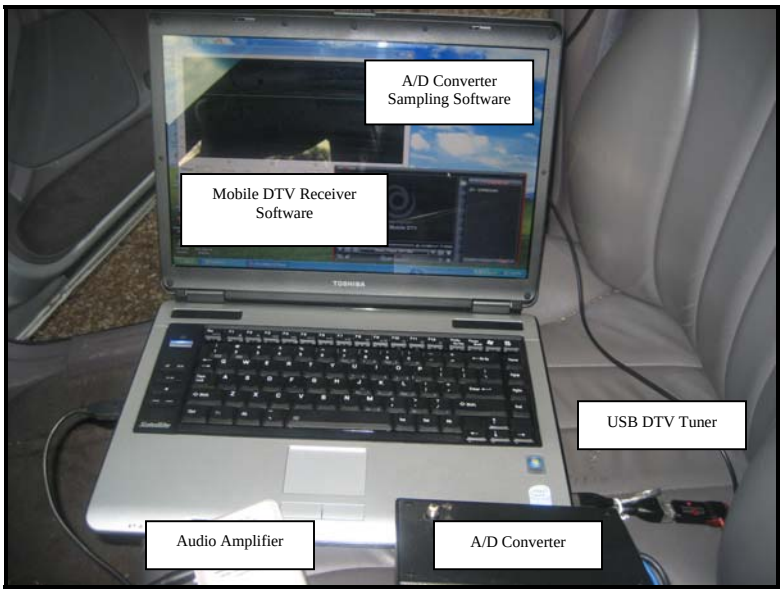


Photo 1. Mobile DTV Drive Test System.

Photo 2. Mobile DTV Receiver & GPS Antennas Atop Test Vehicle.

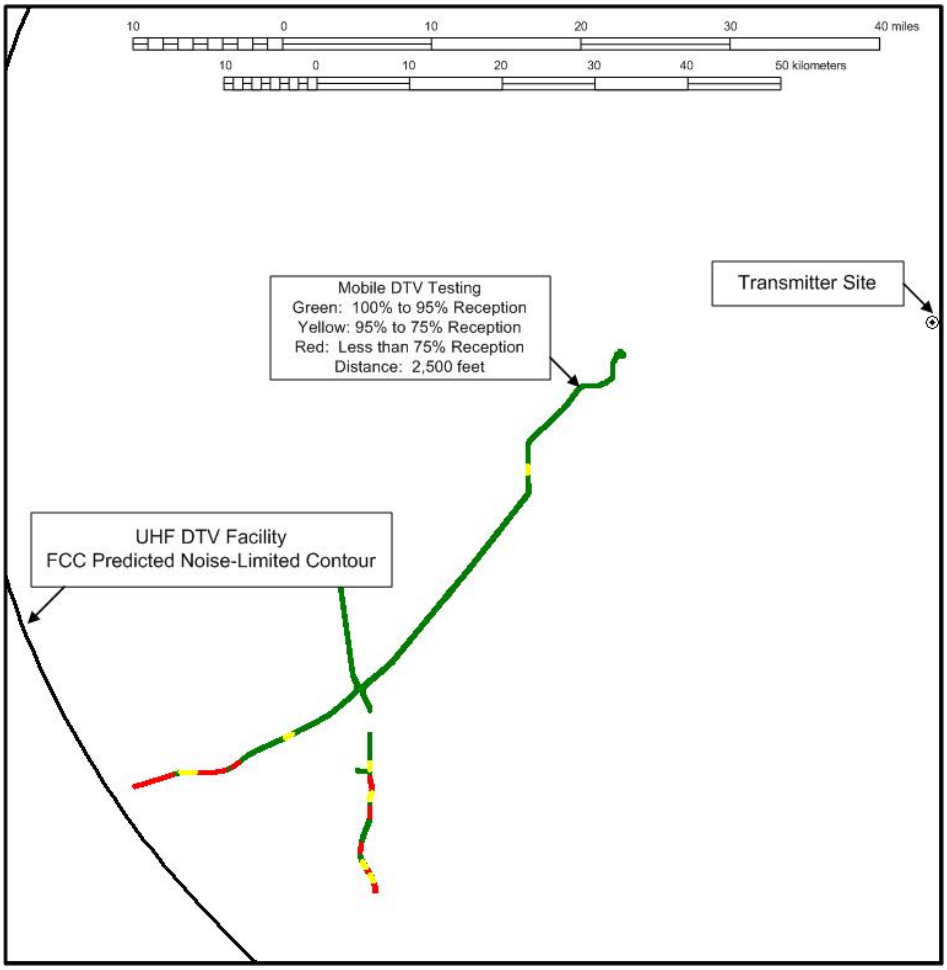
The following procedure was used to implement the system:

- Install USB DTV Mobile Tuner on Laptop
- Install GPS Receiver and Analog-to-Digital Converter on Laptop
- Availability of continuous audio tone of Mobile DTV channel to be tested
- Sample the mobile DTV audio channel during a drive test
    - If audio is present, then indicate that location has Mobile DTV service.
    - If no audio is present, then flag that location as no Mobile DTV service.
- After drive test is completed, import data into geographic mapping program

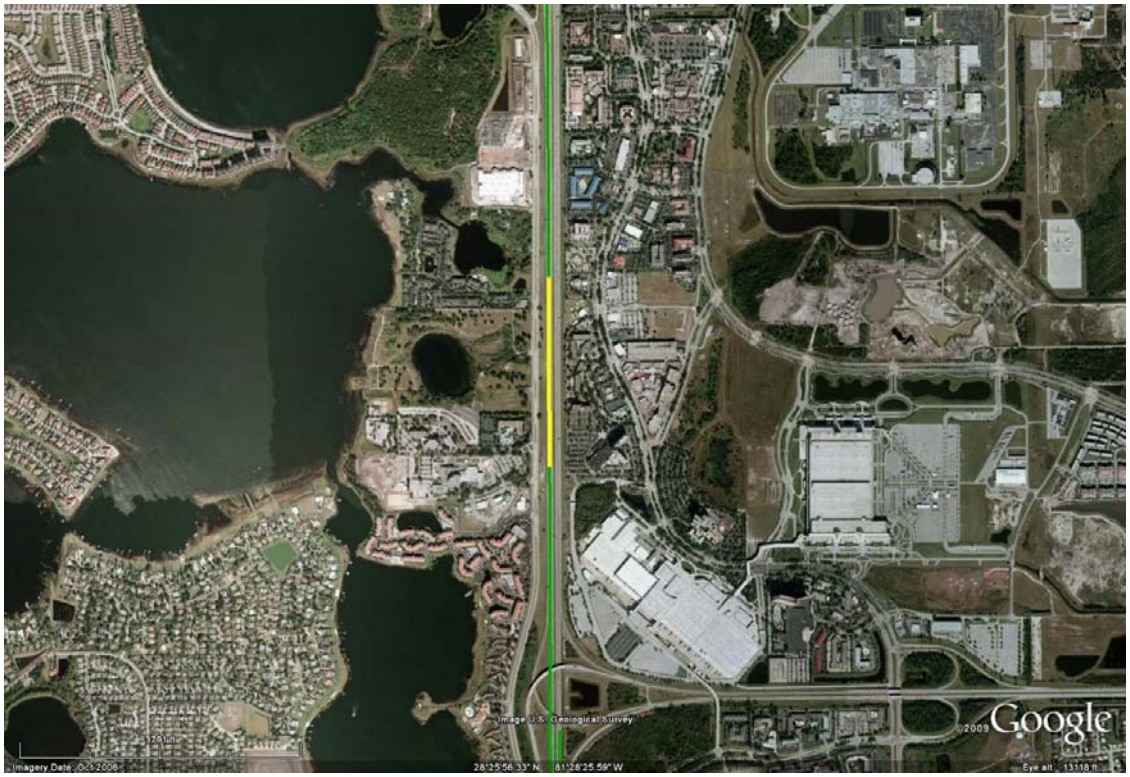
Results

Below are maps showing the results of M/H system with ¼ rate coding with a full-service station within the UHF band. The acquired data was post-processed into line segments to illustrate areas of excellent, marginal and poor service.

In this specific case, the line segments are defined in 2,500 foot increments. If 95% of the measurements had successful reception, then that line segment is classified as excellent with a green color; if between 75% to 95% of the measurements had successful reception, then that line segment is classified as marginal with a yellow color; if fewer than 75% of the measurements had successful reception, then that line segment is classified as poor with a red color. The data is defined by one-second time internals, with culling of the measurements having the same location (for example, if stopped at a traffic light).



Map 1. Mobile DTV Automobile Reception with USB Storm Receiver and External Magnetic Mounted Antenna.



Map 2. Zoomed In Area Showing Areas of Intermittent Reception Failure.

Map 3. Zoomed In Area Showing Areas of Reception Failure at Service Area Edge.

Conclusion

Using a simple Mobile DTV drive test reception system, a broadcast station could quickly evaluate the actual coverage of its mobile DTV channel with the capability of testing a variety of USB tuners, receiving antenna configurations and different coding rates. Further investigation of areas with reception failure could then be done to determine if the failures are caused by low signal strength, multipath and/or external signal interference.

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