# Radio Frequency Analysis Report

Site MA-4388

196 West Street
Paxton, MA 01612

May 9, 2014

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# List of Attachments

# 1. Overview

Previously, C Squared Systems, at the request of AT&T, performed and independent review of all the data and materials, as well as the results of baseline and continuous wave ("cw") drive tests. C Squared's findings were set forth in a report dated March 26, 2014. By letter dated April 3, 2014, the Town's consultant, Mr. Graiff, provided comments concerning the information provided in C Squared's March 26, 2014 report (the "March Report"). On behalf of AT&T, C Squared provides the following responses and exhibits to address Mr. Graiff's comments.

# 2. Further Explanation of Coverage Plots

Mr. Graiff's report raises certain questions concerning the coverage plots provided as exhibits to the March Report. C Squared responds as follows:

- *Exhibit 2* – The prior Exhibit 2 was provided to depict AT&T's existing network coverage in a format consistent with the other exhibits included with C Squared's March Report. As noted in Mr. Graiff's comments, the coverage plot provided depicted the coverage for UMTS services but was labeled with the LTE coverage thresholds. C Squared has confirmed that the coverage plot presented was prepared using the correct coverage threshold for AT&T's UMTS coverage, but was mislabeled with the LTE coverage thresholds. In order to avoid any confusion, C Squared has revised Exhibit 2 to depict the existing UMTS coverage with correct UMTS coverage threshold (-82 dBm).

- *Differences in Coverage Between 850 MHz and 700 Mhz Predictions* – Mr. Graiff raises a general question concerning the difference between the coverage plots that depict AT&T's network using the 850 MHz spectrum versus that depicting the 700 MHz spectrum. Mr. Graiff questions the difference in the predictions of the 850 MHz UMTS network coverage versus the 700 MHz network coverage. Mr. Graiff states that "[r]adio frequency energy, being independent to the modulation method that places the call or data on the radio frequency, it matters not whether it is UMTS or LTE" and that "the coverage at any given frequency power level should be the same, or very nearly so." He then opines that for this reason, the depicted coverage of AT&T's network at 850 MHz should closely align with its 700 MHz coverage.

  Mr. Graiff is only partially correct. It is true that all things being equal, the differences between the propagation characteristics of coverage at 700 MHz and 850 MHz, although similar, would not be exactly the same. However, as I described to Mr. Graiff in a telephone conversation prior to his written comments, there are two differences that account for the differences in the coverage plots (i) the signal strength thresholds required for UMTS are different than those required for LTE and (ii) there are power differences between the UMTS and LTE services. As explained above, the LTE coverage thresholds allow for a lower signal strength (which would generally show a larger coverage footprint), but the power output for the LTE system is also significantly lower than the UMTS power output. As a result of these two factors, the LTE coverage plots vary more than Mr. Graiff expects, because the frequency band (850 MHz vs. 700 MHz) is not the only variable.

- *Frequencies and Labeling of Exhibits* – Mr. Graiff raises a question concerning the accuracy of the coverage plots provided as Exhibits 3 and 4 versus Exhibits 5 through 11 because the label under "Plot Information" states "725 MHz" on Exhibits 3 and 4, while it states "750 MHz" on Exhibits 5 through 11. It is important to note that the references throughout the March Report and this report refer generally to 700 MHz, 850 MHz and 1900 MHz bands. However, these are general references to the specific blocks of spectrum for which AT&T holds licenses from the FCC. This is a generally accepted form of "shorthand" within the industry to easily identify the block of spectrum involved and generally differentiate between the different types of bands

(cellular, PCS, AWS, among others) that are being discussed. The actual coverage plots were run using the same prediction model, and correct frequencies for AT&T's network, antenna model, power levels, assumptions and other site specific factors used by the propagation tool. Therefore, while C Squared apologizes for any confusion the differing labels caused, the information presented in the underlying coverage plots is accurate and consistent across all of Exhibit 3 through Exhibit 11.

- *Drive Test Maps* – Mr. Graiff again questions the labels for the coverage maps provided at Exhibits 12, 13, and 14. The purpose of Exhibits 12 through 14 is to demonstrate (i) the results of the drive tests performed at the different heights, (ii) the accuracy of the underlying model, and (iii) the anticipated LTE coverage from the proposed Facility at the stated heights. Similar to the above explanation, the coverage depicted demonstrates the anticipated coverage from the Facility for LTE services. Therefore, in order to avoid any confusion, C Squared has revised the labels on these exhibits to correct them. As with the coverage plots mentioned above, it is important to note that it is only the label that was incorrect, and C Squared has verified that the proper inputs were used to generate the coverage depicted.

## 3. Additional Coverage Maps Requested

Mr. Graiff and the Board also requested certain additional coverage maps. Therefore, I have provided the following additional maps. To avoid any confusion, the exhibits attached hereto are the next consecutive number from those previously provided (beginning Exhibit 18).

- Exhibit 16 titled: "Normalized CW Drive Test @ 134' and Predicted Coverage" was requested by Mr. Graiff. The original drive test data maps provided at Exhibits 13, 14, and 15 are unaltered data from the CW drive test and show the measured received signal strengths. However, because by necessity a CW test does not use the exact antenna model that will be installed, there can be slight differences between the coverage from the CW test and the coverage provided from the actual antenna to be used. Therefore, the data can be "normalized" or corrected by the prediction tool to depict coverage based on the actual antenna model to be used by AT&T.
- Exhibit 17 titled: "AT&T Wireless 4G 700 MHz LTE Coverage with Alternate MAL0H4388T (Town Property)" is an analysis of an additional of alternate candidate AT&T was requested to evaluate that is Town-owned property near Widlewood Road. As demonstrated by the coverage map, a facility at this location provides almost no coverage to the Targeted Coverage Area at all and does not add any new coverage along Route 31. Therefore, it is not a feasible alternative to the proposed site.

## 4. Technology

Mr. Graiff's comments state that "the antenna used to model the calculated coverage from this site was one of the most recent technology ones where all 4 systems (700, 850, 1900 and 2300 MHz) are combined into ONE antenna. Therefore, AT&T would not require the 4 antennas per sector." Mr. Graiff's assertion that AT&T does not require the number of antennas proposed is incorrect. The use of the antenna model in connection with the propagation model is not a new development. The proposed antenna model to be used has been part of AT&T's facility throughout the design and planning phases. Therefore, AT&T designed its proposed Facility with this model as part of the design and still requires the four antennas per sector.

AT&T requires multiple antennas per sector for a number of reasons. Although Mr. Graiff is correct that this particular model of antenna can be used in connection with various different frequencies, it cannot be used for all of AT&T's licensed frequencies at the same time. Therefore, in order for AT&T's facility to use all of the licensed frequencies and accommodate all of AT&T's technologies, multiple antennas are required. For example, AT&T's 700 MHz licenses include 2 channels (B/C channel and D/E channel). Due to hardware and system limitations these channels cannot be combined into one antenna and must be split into two separate antennas. Similarly, where AT&T is currently using certain licensed frequencies to provide UMTS and LTE services, the two services must use separate antennas.

Therefore, although the same antenna model can be used to accommodate the multiple frequencies and services that AT&T provides, AT&T cannot combine those frequencies and services into a single antenna per sector. In order to meet AT&T's network requirements and needs for this facility AT&T requires the four antennas per sector as proposed.

## 5. Conclusion

C Squared has addressed the concerns raised by Mr. Graiff in his April 3, 2014 comments and, where appropriate, provided revised coverage plots. As Mr. Graiff's report confirms, AT&T has a "dearth of coverage in the area of Paxton, especially the proposed site."

As stated in C Squared's March Report, no existing structures were identified and available that would be able to satisfy the coverage requirements needed for this area. The location and the minimum height selected were chosen to achieve an optimal balance between meeting coverage objectives, overcoming the tree line for signal propagation, minimizing the aesthetic impact to the community, and future collocation.

Without a site in this area, at the height requested, significant gaps in service will exist within the Town of Paxton, and the identified public need for reliable wireless services in this area will not be met.

## 6. Statement of Certification

I certify to the best of my knowledge that the statements in this report are true and accurate.

Dan Goulet
C Squared Systems, LLC

May 9, 2014
Date

# 7. Attachments

**Exhibit 2: AT&T Existing 3G Coverage (850 and 1900 MHz UMTS Overlay)**

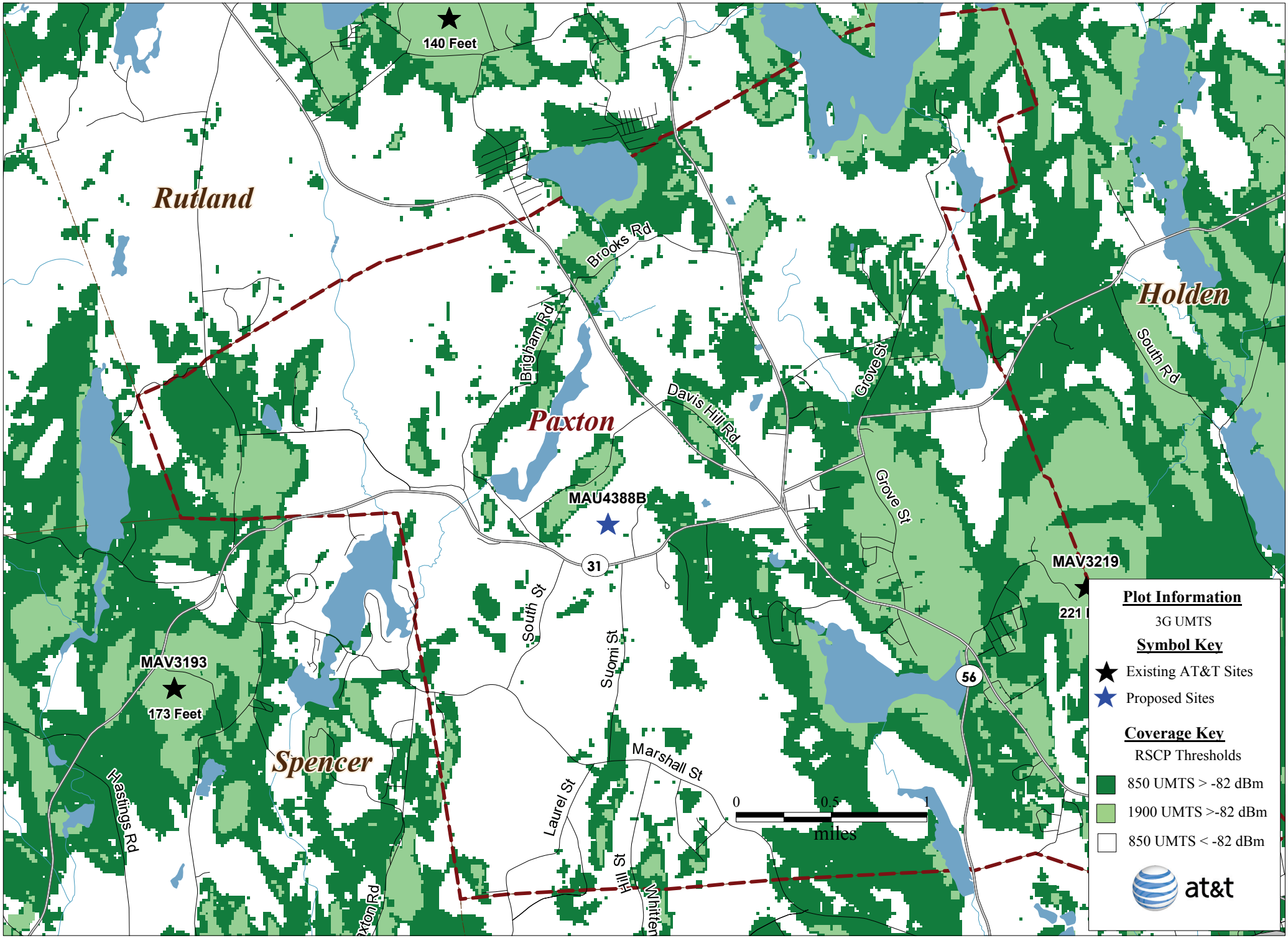

**Exhibit 12: CW Drive Test Data @ 134 Ft. and Tuned 850 MHz Model**

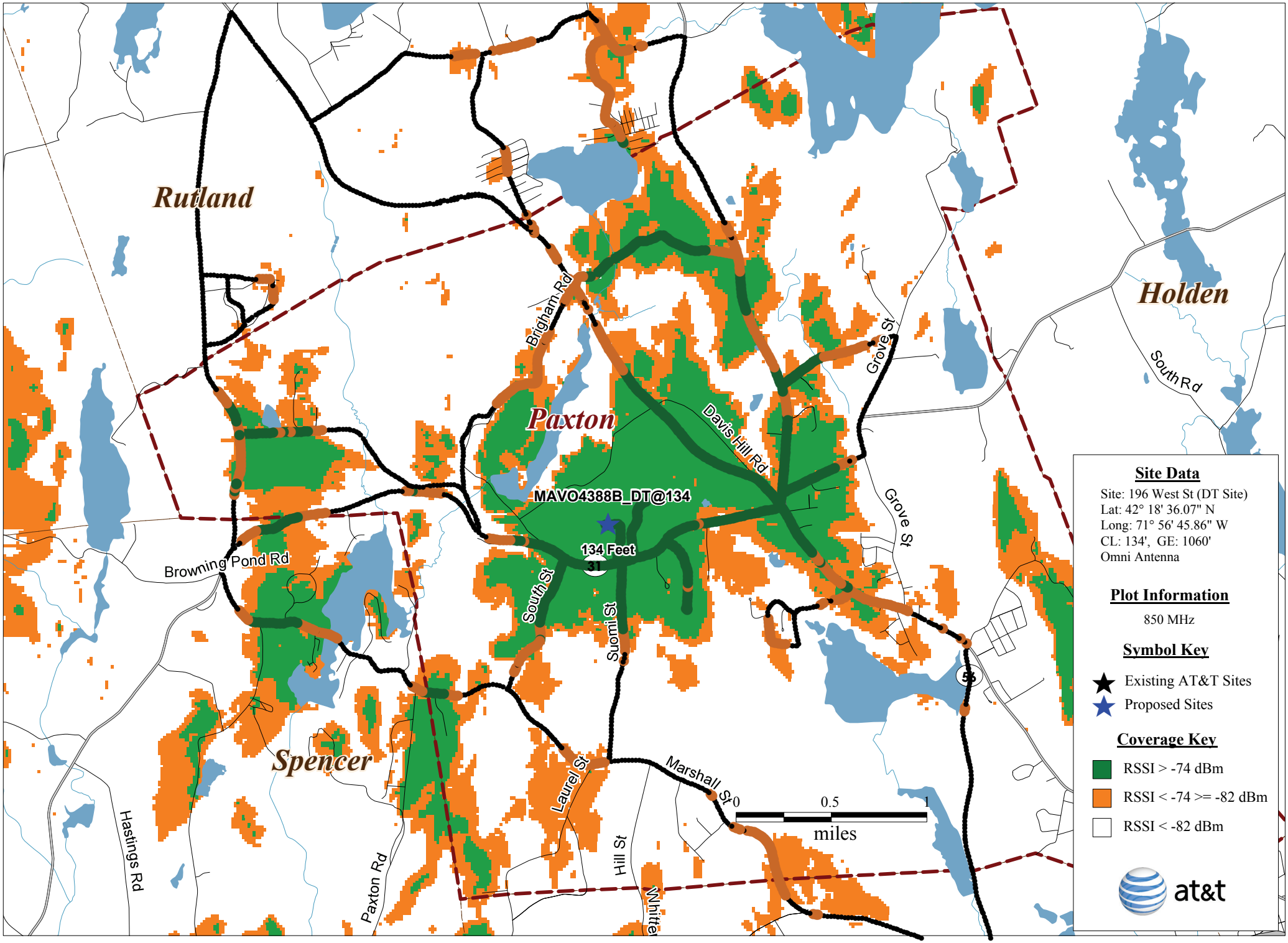

**Exhibit 13: CW Drive Test Data @ 114 Ft. and Tuned 850 MHz Model**

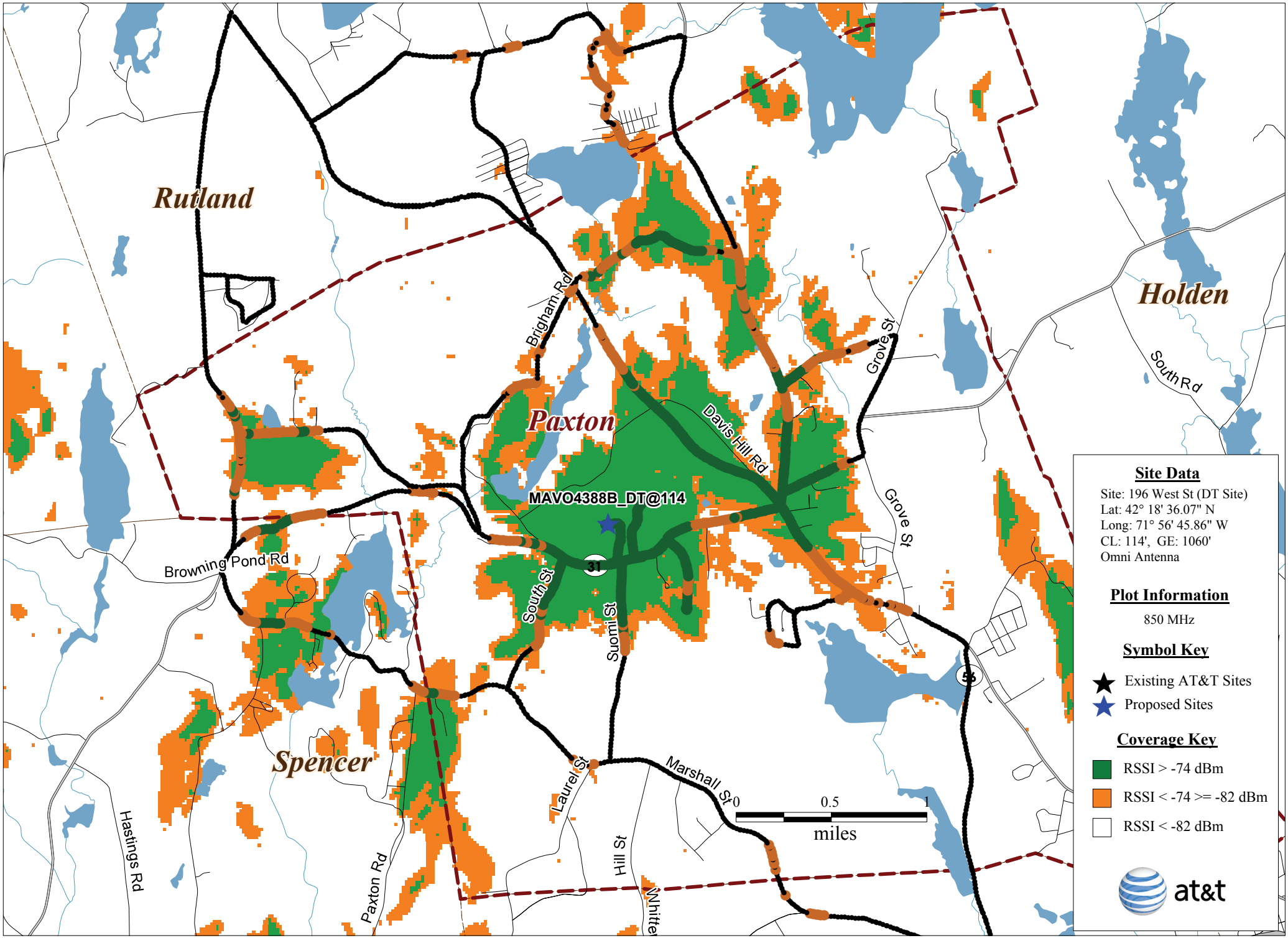

**Exhibit 14: CW Drive Test Data @ 80 Ft. and Tuned 850 MHz Model**

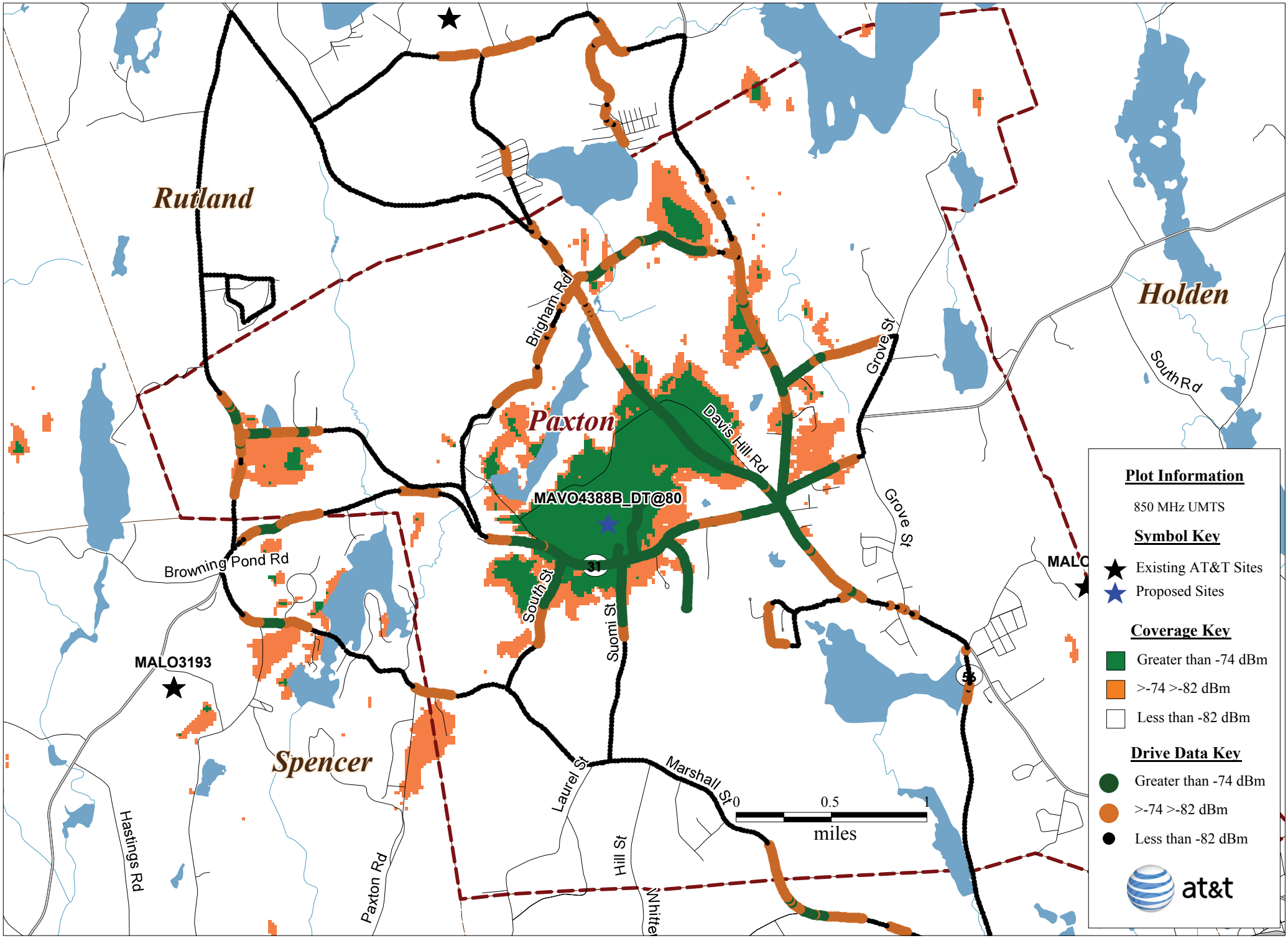

**Exhibit 16: Normalized CW Drive Test @ 134' and Predicted Coverage**

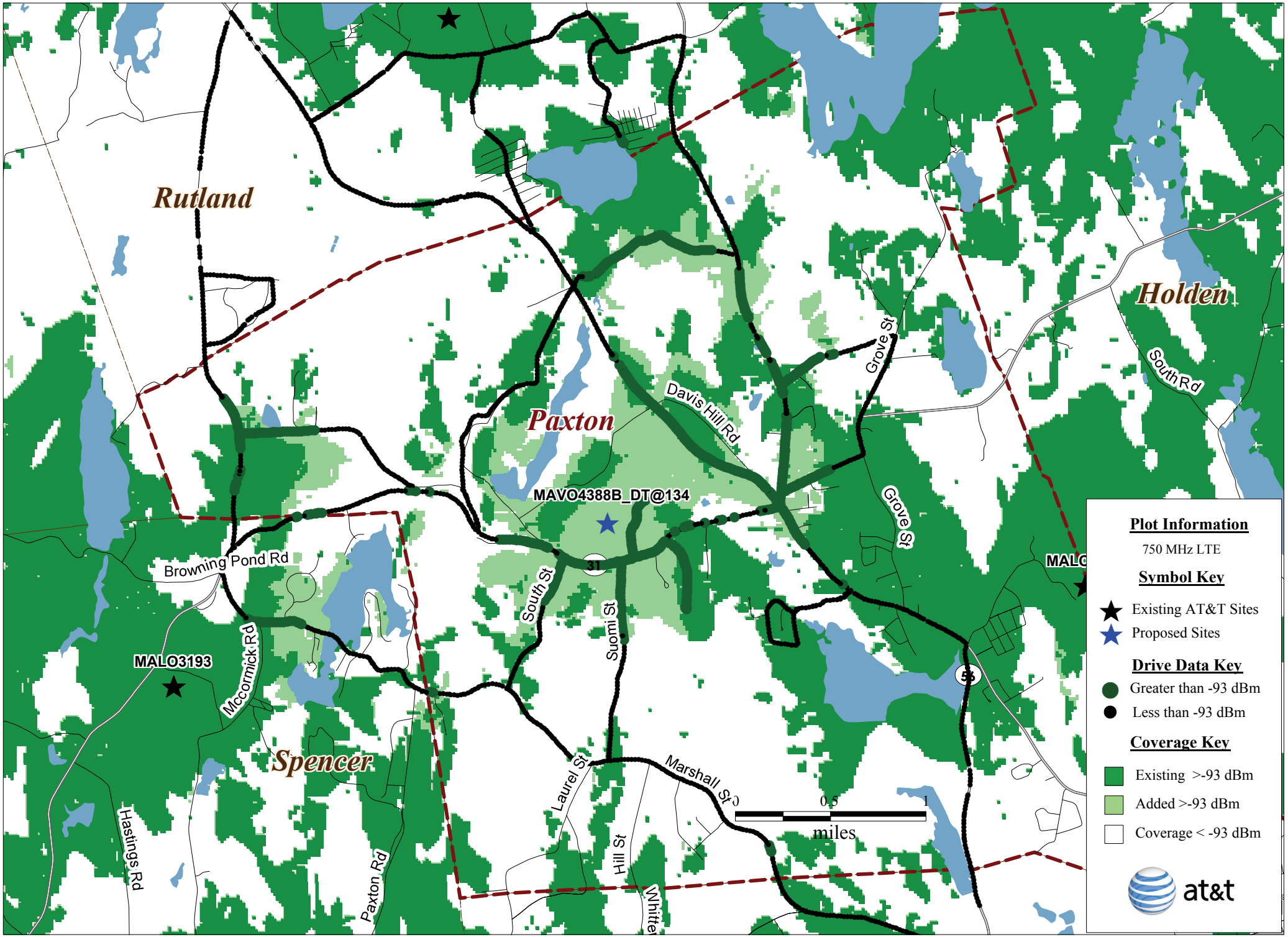

**Exhibit 17: AT&T Wireless 4G 700 MHz LTE Coverage with Alternate MAL0H4388T (Town Property)**