

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington D.C. 20554**

In the Matter of)	
Revision of the Commission's Rules)	
To Ensure Compatibility with Enhanced)	
911 Emergency Calling Systems)	CC Docket No. 94-102
)	
Minnesota Southern Wireless Company)	
dba HickoryTech)	
Petition For Waiver of Section 20.18(g))	
of the Commission's Rules)	

To: The Wireless Telecommunications Bureau

**SUPPLEMENT TO
PETITION OF MINNESOTA SOUTHERN WIRELESS COMPANY DBA
HICKORYTECH
FOR WAIVER OF SECTION 20.18 OF THE COMMISSION'S RULES**

Minnesota Southern Wireless Company dba HickoryTech ("HickoryTech"), by its attorney and pursuant to Sections 1.3 and 1.925 of the Commission's Rules, 47 C.F.R. §§1.3, 1.925, hereby supplements its August 25, 2003 petition for waiver of section 20.18 of the rules.

HickoryTech has made a substantial investment in the deployment of a network-based E911 Phase II solution.^{1/} On October 10, 2003, the Commission granted HickoryTech interim relief

^{1/} As set forth in its waiver, the HickoryTech network-based solution employs a TDOA-only network-based technology. This deployment, which was limited by HickoryTech to its existing cell sites and antenna configurations used to provide CMRS, falls short of achieving the Commission's accuracy requirements. To date, HickoryTech has spent approximately \$1 million dollars on this deployment.

pending action on its waiver and the pending *Petition for Forbearance* filed by the Tier III Coalition, on November 19, 2002.^{2/3/}

In its *Order To Stay*, the Commission required carriers seeking a waiver of the accuracy requirements to submit test data demonstrating the inability to meet those requirements.^{4/} On July 24, 2002, HickoryTech's E911 network solution vendor provide a report memorializing the results of the accuracy test it had conducted on the 20 cell site cluster.^{5/} Appended hereto as Appendix A is a copy of that test report. Appended hereto as Appendix B is an engineering statement analyzing the test results and confirming that they indicate that this network solution does not provide sufficient accuracy to meet the Commission's accuracy requirements.

HickoryTech has been involved in ongoing discussions with Andrew Corporation (formerly known as Grayson Electronics) ("Andrew") its E911 network vendor. Andrew has agreed to perform an analysis of the HickoryTech E911 network and formally advise HickoryTech whether, and if so, at what cost, the HickoryTech E911 network solution can be modified to achieve the Commission's E911 Phase II accuracy requirements throughout the HickoryTech market. That report is expected within the next several weeks. While HickoryTech and Andrew agree that the report will contain

^{2/} Revision of the Commission's Rules To Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, FCC 03-241, released October 10, 2003; *caption amended to add E911 Compliance Deadlines for Non-Nationwide Tier III CMRS Carriers*, WT Docket No. 02-377, *Errata* DA 03-3600, released November 7, 2003. ("*Order To Stay*").

^{3/} As the Commission is aware, HickoryTech is a member of the Tier III Coalition.

^{4/} *Order To Stay* at ¶ 26.

^{5/} While HickoryTech demonstrates in its waiver that it has added the network-based technology to numerous additional cell sites it has deployed since that test was conducted, those additional cell sites are not within the core of the tested cluster and do not materially affect the test results.

Andrew-proprietary information, Andrew has agreed to work with HickoryTech to allow for the disclosure of sufficient information to the Commission to enable it to have a full understanding as to the ability of the HickoryTech network to ultimately achieve the level of accuracy required by the Commission's rules and whether doing so is economically feasible.

HickoryTech has also sought waiver of the handset sale rules to preserve the option of migrating to a handset-based solution should handsets become available for an alternate technology once HickoryTech migrates away from TDMA; a technology for which the record is absolute that there are no ALI-compatible handsets available or envisioned. Since no ALI-capable handset will presently work with its existing TDMA/AMPS network, HickoryTech has been unable to begin selling any such handsets by the established deadlines.

In light of the foregoing, HickoryTech respectfully submits that its substantial deployment of a network-based solution at all of its clustered cell sites shows a good-faith effort to comply with the Commission's rules. HickoryTech's network-solution vendor is applying its expertise to ascertain what, if any, upgrades can be economically made to the HickoryTech network-based solution to bring it into compliance with the Commission's accuracy requirements^{6/}. The results of that effort should be available within the next several weeks. HickoryTech has also sought to preserve the option of migrating to a handset-based solution (if and when one becomes available) should that prove to be the only economically feasible way of meeting the Commission's accuracy requirements in this rural area. Accordingly, HickoryTech respectfully submits that it has met the requirements to justify the limited waiver it has sought by showing not only a good faith effort to comply but by

^{6/} As set forth in HickoryTech's waiver, there are substantial portions of the HickoryTech network where service is being provided by isolated, non-clustered cell sites. HickoryTech expects that this fact will impact the ability of a network-based solution to uniformly achieve the Commission's accuracy requirements throughout its network.

DECLARATION

I, Mark S. Dundas, hereby declare and state as follows:

1. I am a Network and Switch Engineering Manager in the field of wireless telecommunications with Minnesota Southern Wireless Company d/b/a HickoryTech Wireless, a "Tier III" CMRS carrier as defined by the Federal Communications Commission ("FCC");
2. I am familiar with the facts as set forth in the foregoing Supplement to the Petition of Minnesota Southern Wireless Company dba HickoryTech for Waiver of Section 20.18 of the Commission's Rules. The statements set forth in the attached Supplement are true and correct of my own knowledge, except such statements herein made on information and belief, and as to such statements, I believe them to be true; and,
3. Appended hereto is a copy of the "*PSAP Location Accuracy Test Report, v. 1.0,*" dated July 24, 2002, which was supplied by Grayson.

I declare under penalty of perjury that the foregoing is true and correct.

11/7/03
Date


Mark S. Dundas

PSAP Location Accuracy Test Report

v. 1.0

Prepared by:

Grayson Wireless

July 24, 2002



Geometrix®
Wireless Location System

Hickory Tech Cellular Mankato, Minnesota E-911 Phase II Deployment

PSAP Location Accuracy
Test Report

v. 1.0

Prepared by:

Grayson Wireless

July 24, 2002

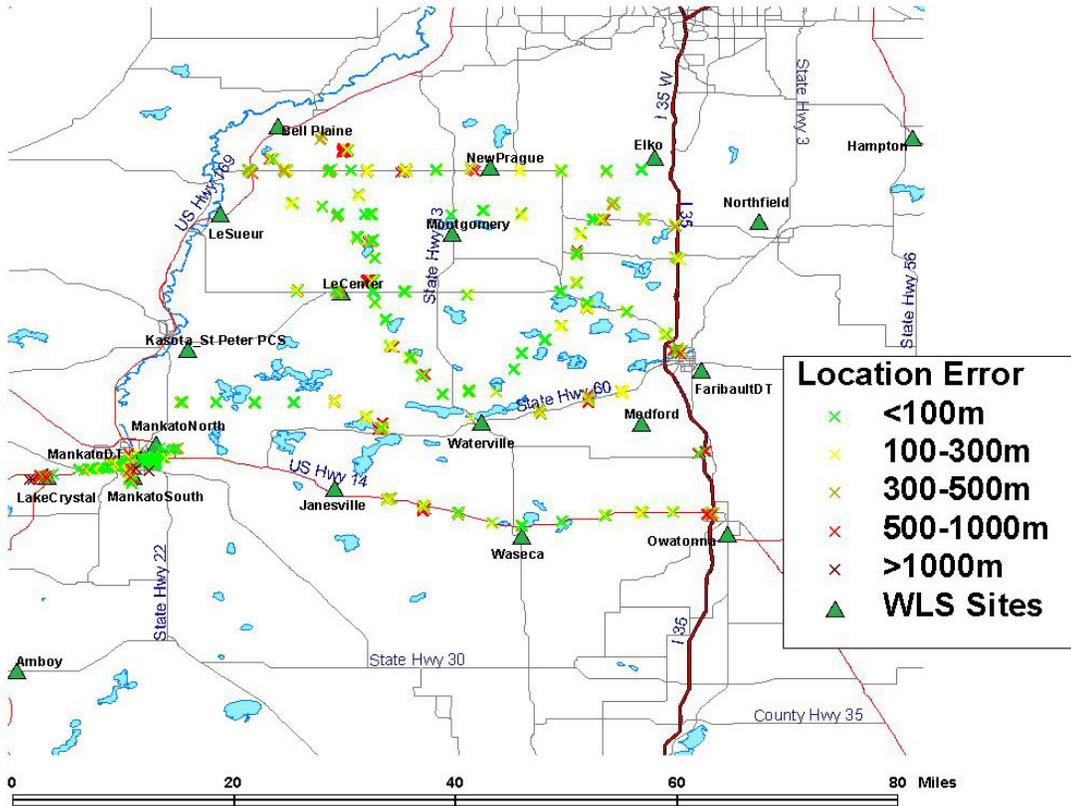
This report summarizes the data collected during the Hickory Tech Cellular Mankato Minnesota deployment E911 phase II Geometrix® system accuracy testing. Test Plan specifics include:

- Use of a standard cellular band IS-136 TDMA handset
- Test calls placed throughout the coverage region as defined in the Hickory Tech Market Plan (3/25/02)
- Testing was completed in accordance with the Hickory Tech Market Plan (3/25/02)
- Ground truth location measurements computed using differential GPS reference data.
- The requirement of this deployment was to produce geolocations in the coverage area using all 2-channel TDOA WLS units, which would not necessarily produce FCC Phase II compliant results.

Over 4000 geolocations were computed from stationary test points and drive routes. Test environments included suburban and rural areas. Test conditions included outdoor stationary, in-car stationary, low-speed driving, and high speed driving. In the absence of any call statistical data (e.g. traffic statistics, 911 dialing statistics), the collected data was not weighted to any geographic region. Composite statistics for the collected data are shown in the following table.

67th Percentile Statistic	95th Percentile Statistic	Locations Computed
129.9 m	332.9 m	4096

The figure below depicts a map of the test area and all of the collected geolocation data. Hickory Tech Cellular base station sites equipped with Grayson Wireless Geometrix® sensors are shown as labeled green triangles. The collected geolocation data is shown as colored "X's". This accuracy verification test used a standalone PDE system (i.e., call tipping provided by Grayson Drive Test Platform).



Qualifications of James C. Egyud

I, James C. Egyud, hereby declare and state as follows:

1. I am a Senior Consulting Engineer in the field of wireless telecommunications with the firm of Kurtis & Associates, P.C.;
2. I graduated from Grove City College, Grove City, Pennsylvania, with a degree of Bachelor of Science in Electrical Engineering in 1990;
3. I am familiar with the Federal Communications Commission's Rules and Regulations, including Part 22 and Section 20.18 regarding the provision of Enhanced 911 services;
4. I have designed cellular and PCS systems throughout the United States since 1990, and am familiar with the technical, operational, and propagation characteristics associated therewith;
5. I am familiar with the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102;
6. I am familiar with the technical options available to CMRS carriers for the provision of Enhanced 911 services, and the current technological limitations inherent to those options;
7. Based on my professional judgment and the experience referenced herein, I am technically qualified and responsible for the attached Engineering Declaration regarding Enhanced 911 test results; and,
8. The foregoing statements are true and correct of my own knowledge except such statements therein made on information and belief, and as to such statements, I believe them to be true.

I declare under penalty of perjury that the foregoing is true and correct.

November 10, 2003
Date

/S/ James C. Egyud
James C. Egyud

APPENDIX B

Engineering Declaration of James C. Egyud

1. Introduction. In my capacity of Senior Consulting Engineer to Hickory Tech Cellular (“HickoryTech”), I have reviewed a document entitled “PSAP Location Accuracy Test Report,” as prepared by Grayson Wireless (“Grayson”) on July 24, 2002 (hereinafter referred to as “Test Report”).^{1/} The report provides the results of field testing conducted by Grayson of the network-based Phase II system that it installed at a cluster of 20 HickoryTech cell site locations. As stated in the Test Report, the system did not meet the FCC’s E911 Phase II location accuracy requirements. Moreover, as will be discussed herein, it appears that the test was conducted almost entirely within the perimeter of equipped sites; accuracy outside of that perimeter can be expected to be lower.

2. Technology Background. Grayson’s E911 Phase II solution, as tested, uses a technology called Time Difference of Arrival (TDOA) as its core algorithm to calculate a handset’s position. TDOA relies on triangulation: the ability of not less than three (3) distinct measurement locations to receive and measure uplink signals from a handset in order to calculate its location. Grayson also offers a supplemental technology called Angle of Arrival (“AOA”), which Grayson advises only requires two (2) distinct measurement locations to calculate a handset’s position based on phase differences detected in the signal arriving at specialized antennas. Those antennas impose significant additional loading on their supporting towers. The HickoryTech network does not utilize AOA technology or equipment. The TDOA deployment was limited to existing cell site locations and antenna configurations.

3. Technology Limitations. The achievable accuracy of TDOA technology is entirely dependent upon the ability of the handset’s emitted signal to reach three distinct measurement locations, usually comprised of cell sites where the TDOA measurement equipment shares the cells’ antenna system. The ability of the cellular signal to reach each equipped site is naturally dependent upon all factors normally associated with cellular coverage and performance: distance, morphology, intervening terrain, antenna height, coverage pattern, etc. Therefore, the ability of TDOA to perform accurate measurements is predicated upon a handset’s location with respect to nearby cell sites, and, by extension, the distance between those sites. Greater spacing between comparable sites will naturally reduce the overlap between them; as the distance increases, the TDOA receiver’s ability to detect the handset’s signal will eventually be exhausted. From a geometric standpoint, the greatest chance for sufficient overlap occurs in the midst of a cluster, or, at a minimum, a triangle of equipped sites that are all close enough to the handset. As the handset moves to the edge of that cluster or to the side of that triangle, it may only have sufficient overlap from two of the sites. As the handset moves outside the perimeter of that cluster, it begins to move away from all of the sites, and triangulation capability quickly disappears.

¹ The PSAP Location Accuracy Test Report prepared by Grayson Wireless on July 24, 2002 is attached hereto as Attachment A.

4. The Test Report. The test report is comprised of a cover sheet, a brief description of the test plan, a small table summarizing the accuracy of the results, and a map showing the equipped site locations and test points.^{2/} According to Grayson, the test included measurements at over 4,000 discreet locations throughout the test area, spread among various environments and scenarios, including both stationary and mobile conditions.^{3/} In the subject test, Grayson tested a contiguous cluster of 20 of HickoryTech's cell sites which had been equipped with TDOA-only equipment, as identified on the Test Report's map.^{4/} The Grayson system utilized HickoryTech's existing antenna system at each equipped site. The map also displays each location at which test location measurements were performed. Section 20.18(h)(1) of the FCC's rules require, for network-based Phase II technologies, accuracy to 100 meters for 67% of the calls, and 300 meters for 95% of the calls. By contrast, the results stated in the Test Report are as follows: 129.9 meters for 67% of the test locations, and 332.9 meters for 95% of the test locations.^{5/} These results do not satisfy the FCC's requirements.

5. Projected extension of the test results to HickoryTech's entire service area. As discussed in (3) herein, TDOA accuracy depends heavily upon sufficient proximity of the handset to at least three (3) measurement points. A cursory review of this map shows that almost all of the test measurements were taken from within the cluster/perimeter of equipped sites.^{6/} The few test points taken outside of the cluster appear to be just to the west of HickoryTech's Lake Crystal facility, where visual inspection shows most, if not all, of the test measurements having a location error of over 500 meters.^{7/} Similarly, test locations along the perimeter, such as near the New Prague, Fairbault DT, and Owatonna sites, also generally demonstrate lower accuracy than the measurements taken in central areas of the cluster and in the Mankato area. HickoryTech's actual coverage area extends beyond the perimeter of equipped sites. Therefore, it can be expected from the Test Report map and from the discussion at (3) herein, that location measurement accuracy of calls made outside the equipped perimeter will be lower than the test results presented in the report from within the equipped cluster.

6. Summary. Even within the cluster of cell sites equipped with TDOA Phase II technology, the test calls, as reported by Grayson, did not meet the FCC's accuracy's requirements. By extension, it can be reasonably deduced that the addition of calls made outside of the cluster of equipped cell sites will serve to further reduce overall system accuracy.

² See Test Report at Attachment A.

³ *Id* at p. 1.

⁴ *Id* at p. 2.

⁵ *Id.*

⁶ *Id.* The report did not include a written list of the test points, but only the graphical depiction seen in the Test Report. Because of the resolution of the graphic, we are unable to accurately count the exact number of test points that occurred outside of the perimeter of equipped sites.

⁷ *Id.*