PierCon Solutions LLC
Specialists in Wireless Systems

# Supplemental Report Regarding the Philipstown Cell Solutions Group Report

## Site ID: "Nelsonville"

15 Rockledge Road
Village of Nelsonville, NY
Putnam County

Prepared for
New York SMSA Limited Partnership d/b/a Verizon Wireless

By

PierCon Solutions, LLC
December 18, 2017

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## 1 PURPOSE AND SCOPE

PierCon Solutions LLC, an engineering firm specializing in wireless communications, performed an independent analysis regarding the proposed Nelsonville Site located on Rockledge Road. This report is in response to the submission by Philipstown Cell Solutions Group dated November 28, 2017 (Cell Solutions Report) in regard to sections which include Verizon Wireless.

The following report provides detailed explanations to the LTE technology in regard to voice calls, a response to the hand held call test performed by residents, a response to the coverage maps generated by residents, a response to the coverage maps found on the Verizon Wireless website, and a response to the letter regarding computer propagation modeling programs (Exhibits E, F, G, and I of the Cell Solutions Report).

The report also provides supplemental information regarding the height of the facility and provides actual drive test data.

## 2 DETAILED EXPLANATION OF VOICE CALLS ON LTE

The Cell Solutions Report incorrectly argues that since LTE is a data service, personal wireless service could not be applied to LTE, because LTE would not be able to perform voice calls. It is understandable that laymen are not familiar with the current standards and the wireless technology generation that is supporting today's applications; including voice. Those arguments regarding LTE and voice calls are incorrect. Section 704 of the 1996 Telecommunication Act defines personal wireless services to include a broad range of spectrum-based services. All commercial mobile services fall within the definition of personal wireless services; which includes LTE.

The Cell Solutions Report's claims are inaccurate as LTE technology supports voice calls through Voice over LTE or VoLTE ("VOLTEE"). The current 4th generation personal wireless service mobile network technology in use today is LTE. While users still have access to the legacy 3rd generation technology, most network traffic and all newer devices operate on the 4G / LTE services. When engaging in a voice call over LTE (VOLTE) the user device will connect to the public switched telephone network (PSTN) through a gateway in order to complete a call to a non-LTE device. Therefore LTE (4G) is a personal wireless service, not only for the voice application it provides for but also for the range of additional mobile services offered. For example, a person making an emergency E911 call from a mobile device to a public safety operator on a landline, such emergency call will be routed through the PSTN. This is just one example.

PierCon's initial report discusses the frequency bands which Verizon Wireless is licensed for and the names which the FCC has assigned them (Cellular, PCS, AWS, 700). PierCon's initial report stated that "this application is to provide coverage for voice and data in the Cellular, PCS, and LTE services." This statement does not indicate that only the Cellular (850 MHz) or PCS (1900 MHz) bands handle voice. As already described above, the bands which deploy LTE also handle voice through VoLTE. The next paragraph in PierCon's initial report provides a description of the use of frequency bands by Verizon Wireless. The statement that the Cellular band handles mostly voice traffic does not indicate that the Cellular band is the only band which handles voice traffic. This simply means that since LTE is currently not deployed on that band, a device would likely attempt to utilize LTE on a different band for a faster data session. The statement that the PCS band serves 3G technology is no longer correct as that entire band has now been designated to provide LTE (see next paragraph for further details). The remaining statements that 700 MHz and the AWS (2100 MHz) bands provide 4G LTE service indicate that data and voice services through VoLTE technology are provided.

PierCon's initial report also provided propagation plots in the 700 MHz and 2100 MHz frequency bands. From a coverage perspective 700 MHz will cover the furthest. From a capacity perspective, 2100 MHz will provide the most capacity. All other Verizon licensed frequency bands fall between these two frequencies; 850 MHz and 1900 MHz.

Since the current personal wireless service technology is LTE, only LTE technology is represented. The other frequency bands, 850 and 1900 MHz, are currently migrating towards LTE only or are already LTE only. The 1900 MHz band previously supporting 3G (CDMA) has already been decommissioned and is only deployed with LTE. The 850 MHz band has a portion currently reserved to support legacy customers whose phones are not capable of LTE. Nevertheless, showing 850 or 1900 MHz propagation would show larger existing coverage gaps than 700 MHz since they are a higher frequency bands. Therefore, it is irrelevant to show propagation on those bands since it would also show a significant gap in wireless service.

## 3 THE HAND HELD CALL TEST PERFORMED BY RESIDENTS

This section provides a review of the hand held call test (Cell Solutions Report Exhibit E). A customer hand-held call test is not common practice or an industry standard approach to determining coverage. To the best of my knowledge none of Verizon Wireless' competitors utilize customer hand-held call tests to design wireless networks and customer call tests are not generally accepted within the field of radio frequency engineering. The reliability of a customer call test has never to my knowledge been scientifically tested, there is no estimation of the potential rate for error, and the customer call test has never to my knowledge been subject to peer review and publication. A customer call test does not represent accepted engineering practices, since any such customer call test would be based on unreliable principles and statistical methods and would thereby fail to produce sufficient facts or data to draw scientifically and statistically relevant conclusions. Rather, a customer call test will provide mere anecdotal evidence that may lead to misleading conclusions. Accordingly, a customer call test is not a methodology that is generally accepted within the field of radio frequency engineering.

Each wireless facility provides service to hundreds of Verizon Wireless users, utilizing many different wireless devices, including varying phone models which all have differing receiver, transmitter, and processing algorithm properties. The network must be designed to handle numerous variables including the wide variety of wireless devices on the market, and the times when and places where such devices are used. Therefore, vast amounts of information about call initiation and progress must be collected and processed. This can only be done scientifically with specialized calibrated equipment and computer programs designed for this purpose, not by simply placing a series of voice calls from an ordinary hand held wireless phone. A true and fair assessment of a network's needs requires data collected at literally thousands of data points throughout a given area, to provide a statistically significant analysis. The signal level at any location is also in constant flux in time because of reflections, refraction and diffraction from a mobile and changing environment, which causes fading and multi-path propagation (where multiple versions of the signal arrive at the mobile device's antenna with a statistically distributed power, phase and polarization). In addition, losses attributable to a vehicle and a person's head and body must be taken into account. Such losses may vary as a car travels and temporarily locates a person's head and body between a base station and the antenna on the mobile device. Thus, the signal is not constant in any of its properties at any time, wherever it exists. The properties of radio signals are therefore naturally complex and are not readily determined by simple means. In conclusion, it is my opinion that customer call testing and anecdotal customer claims are statistically flawed methodologies that can result in unreliable conclusions. Nevertheless, PierCon evaluated the call test.

According to Exhibit E in the Cell Solutions report, a total of 52 actions were performed at various locations with devices containing phone numbers of 917-275-1688, 845-742-7112, and 917-968-2687 (Verizon Wireless phone numbers) on November 24th and 25th. The actions performed appear to be calls or text messages. There is also a column to designate Interior/Exterior/Car which is assumed to indicate whether the device was located in a building, outside on the street, or in a vehicle respectively. The actions performed were approximately half calls and text messages. No measurements were performed, but a quantity of bars was recorded. Please note that based on the limited sensitivity and lack of calibration, measuring signal strength with a consumer mobile device does not provide reliable information or data. Moreover, the number of bars is not representative of reliable service. The devices used to obtain measurements are not specified so it is assumed that mobile phones were used. The technology or frequency bands which the devices were utilizing are also unclear. Out of the 52 actions performed on Verizon Wireless devices,

47 of the actions were performed outside on the street and 5 actions were performed in a building. It is difficult to come to any conclusion from this exhibit regarding any gaps in coverage.

The only conclusion that can be allegedly drawn is that actions were successfully performed at the specified locations in the address column. 47 of these actions were performed outside on the street which is consistent with the submitted plots from PierCon RF reports. The PierCon plots indicate that an outdoor coverage gap does not exist since the threshold for outdoor coverage is lower than in-vehicle or in-building. It is important to note that coverage at this time of year is expected to be better due to the foliage loss, especially when completely surrounded by tall trees. Based on the foregoing, the information provided by the hand-held call test is scientifically unreliable and nevertheless does not contradict my prior conclusions regarding Verizon Wireless' significant gap in service in the Village.

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## 4 COVERAGE MAPS GENERATED BY RESIDENTS

This section provides a review of the coverage maps generated by a local Nelsonville resident (Cell Solutions Report Exhibit F). Two of the coverage maps seem to represent AT&T call performance and AT&T Best technology found, which will not be discussed since they would not be applicable to Verizon Wireless. One coverage map (using a ROOT Metrics software called Coverage Map) seems to represent Verizon Wireless call performance. PierCon's review of this map identified the following issues.

1. The presence or lack of foliage, or partial presence of foliage, during testing will have a significant impact on the results. During the time of the testing, November 25th (as stated in Exhibit F), a reduction in the "foliage" loss is apparent and not considered in the analysis. The time of year (late November) that this testing was performed would demonstrate better than expected results as compared to testing performed during peak foliage between the months of May and August.
2. The report does not specify which technology is shown. Without this information, it is unclear to be able to determine what these coverage maps are showing. After downloading and reviewing the "Coverage Map" application by ROOT Metrics, a way to specify which technology to show signal strength measurements could not be found
3. The description of the legend indicated signal strength measurements in units of dBm but does not provide the reference nor the technology used to provide that signal strength. For LTE measurements, the correct parameter to be able to compare to the data presented in the past RF reports is reference signal received power (RSRP). This is a measurement standard for LTE technology which allows design standard thresholds to be utilized properly. The term signal strength could also be applied to RSSI (Received Signal Strength Indicator) which would not be correct for comparison as this measurement could differ from RSRP by more than 20 dB. After downloading and reviewing the "Coverage Map" application by ROOT Metrics, no further information could be found relating to the reference signal or the technology utilized.
4. It is assumed that the 3 different coverage maps which are shown are snap shots of a smartphone due to the symbols at the top of the snap shot, battery life, etc. It appears that the local Nelsonville resident who captured these snap shots has AT&T as his/her service provider. It was alarming think that an AT&T phone collected data on the Verizon Wireless network since that would be impossible. After downloading and reviewing the "Coverage Map" application by ROOT Metrics it became clear that the data shown was not recorded by the resident in Nelsonville. The measurements shown are collected by any user who installs the application and sends data to the company, specifically on the Verizon Wireless network.

A second coverage map (using Sensorly software) appears to show 4G coverage in terms of bars. The Sensorly map does not provide signal strength in terms of RSRP nor does it provide methodology on how the data is collected and therefore cannot be used for designing a wireless network.

Both Sensorly and ROOT Metrics data are collected by users who download the application on their mobile phones. In order to collect data that is relevant and accurate for RF engineering, the device recording measurements must be calibrated against a precision RF standard. There is no evidence that the mobile phones used were calibrated to ensure the accuracy.

In conclusion, the coverage maps shown in Exhibit F of the Cell Solutions Report do not provide enough information and/or have unclear methodology in order to be analyzed and compared to the measurement standard of RSRP for LTE networks. These maps do not provide any relevant or reliable data from an engineering perspective with respect to determining whether there is a need for the proposed facility.

## 5 COVERAGE MAPS FOUND ON THE VERIZON WIRELESS WEBSITE

This section provides a review of the coverage maps found of the Verizon Wireless website (Exhibit G of the Cell Solutions Report). The intent of this interactive coverage map is to assist a Verizon Wireless consumer in making choices about how to meet wireless service needs. The interactive map is not an engineering tool used to determine where gaps in service are located. Coverage maps (created using industry standard engineering tools), like the ones submitted in this application, are intended to demonstrate Verizon Wireless' existing and proposed reliable coverage. Therefore the two maps cannot be directly compared. The bottom right corner of the coverage map contains a disclaimer. If the disclaimer is opened, it reads the following in its entirety:

> *"**Coverage Disclaimer***
>
> These Coverage Locator depictions apply to the following calling plans:
> National Calling Plans, Mobile Broadband and Prepaid.
>
> International rates for voice and data will apply.
>
> These maps are not a guarantee of coverage and contain areas of no service, and are a general prediction of where rates apply based on our internal data. Wireless service is subject to network and transmission limitations, including cell site unavailability, particularly near boundaries and in remote areas. Customer equipment, weather, topography and other environmental considerations associated with radio technology also affect service and service may vary significantly within buildings. Some information on service outside the Verizon Wireless proprietary network, and we cannot vouch for its accuracy."

Notice that the disclaimer states that the map does not guarantee coverage to a specific area and it also states that it will contain areas of no service. It also states that service may vary significantly in buildings. The coverage map which is shown on the Verizon Wireless website and in Exhibit G of the Cell Solutions Report does not represent reliable in-building coverage. The coverage map on the Verizon Wireless website shows outdoor coverage. The threshold for outdoor coverage is a lower signal level than for in-vehicle or in-building coverage. This means that the area shown as outdoor coverage, like on the Verizon Wireless website, should be larger than both the in-building suburban and in-vehicle plots shown in the PierCon RF reports. A separate layer could not be located for in-building coverage on the Verizon Wireless website.

The coverage maps submitted in previous PierCon RF reports represent reliable suburban coverage and can be used for RF engineering. Therefore this interactive map (showing outdoor coverage) cannot be compared to the suburban (in-building) gaps presented in the previous PierCon RF reports.

## 6 LETTER REGARDING COMPUTER MODELING PROGRAMS

This section provides a review of the Dr. Chris Marrison letter regarding computer modeling programs (Exhibit I of the Cell Solutions Report). Dr. Marrison indicated in his letter that the data presented is a complex form of speculation. Providing no grounds for this conclusion, he determines that the reason for this is to due four possibilities. Each possibility will be responded to below.

Possibility 1. Dr Marrison states that the software could be inadequate. The software used is Forsk's coverage planning tool called Atoll. Forsk products are used in 140 countries and are used by Verizon Wireless, AT&T, Sprint, and many other service providers throughout the world. Atoll is the wireless coverage planning tool that Verizon Wireless uses for network planning. Atoll predicts the radio frequency ("RF") coverage maps and signal strengths that can be expected over a geographic area based on certain input parameters. These parameters include, without limitation, factors such as: the frequency of the RF signal; the height, gain and orientation of the antennas; and the strength of the RF signals. The terrain over which the RF signals are propagated are also pre-loaded as a database and taken into account. Thus, Coverage Maps accurately predict the RF signal strength over geographic areas on a map. The use of these coverage maps generated by industry standard software such as Atoll has not been disputed by the Village's RF consultant Mr. Graiff.

Possibility 2. Dr. Morrison states that the data fed into the model could be inadequate. The data fed into the model is input by, or provided by Verizon Wireless and has been reviewed by PierCon. I personally reviewed and verified that the data is correct and accurate and there is no specific suggestion that it is not other than the pure speculation by Dr. Morrison. In Dr. Morrison's letter, he indicates that "the results are **made** to show gaps in coverage around Nelsonville" (emphasis added). Again, this is purely unsupported speculation with any basis or specific grounds.

Possibility 3. Dr. Morrison states that the user of the software may have insufficient skills. PierCon RF engineers have been trained by Verizon Wireless RF engineers in order to use the coverage tool Atoll. PierCon RF engineers have been accepted as experts in the field of RF engineering for decades, so to make this statement would be preposterous. All of the work performed in the reports submitted by PierCon in this application have been prepared by myself and reviewed by Richard Conroy. Mr. Conroy is the president of PierCon and a copy of his CV is attached hereto.

Possibility 4. Dr. Morrison states that the results may have been manipulated by the assumptions that the user has chosen to make. The results have not been manipulated in any way with the intent of showing a coverage gap which does not exist. Please refer to the response to possibility 2 for more information on this baseless allegation.

Dr. Morrison appears to conclude that no evidence of a coverage gap exists based on one or more of the four possibilities above. Given that the four possibilities above are not applicable, and the Village RF expert has not raised any concerns regarding the use of the Atoll to produce coverage maps, the use of the industry standard coverage planning tool Atoll, is acceptable. More importantly, Dr. Morrison has not provided any data or evidence to support his unfounded and speculative allegations, and has failed to provide any data to show that there is not a gap in service.

In order to further confirm the accuracy of the submitted propagation maps, an independent drive test was performed on December 15th, 2017 by Senior RF Engineer Adam Feehan. The test consisted of collecting thousands of data points in the vicinity of Nelsonville and surrounding roadways. A W1314B-E19 multiband receiver was used to collect data points through the use of a magnetic mounted antenna and GPS device on the outside of the vehicle. Viavi drive

test software was used to collect the data on a laptop computer while the vehicle was moving. The receiver has a calibration certification from TRS RenTelco and this certificate is attached as Exhibit A.

Due to the fact that the drive test was performed after foliage loss has occurred (indicating measured signals will be stronger), a correction factor needed to be taken into account to compensate for the stronger measured signal. Typical correction factors for foliage loss vary based on the type of environment and could be anywhere between 5-20 dB. PierCon determined that a correction factor of 5 dB, which is the least conservative, is appropriate to correct the measured signal levels due to foliage loss in this environment. Please find attached in *Exhibit B* the *Drive Test Data from 12/15/17*.

As demonstrated by Exhibit B, a significant in-building suburban gap exists in the Village of Nelsonville. This is demonstrated by the colors of the data points which appear on the roads in Exhibit B. The color green indicates that the signal level is greater than or equal to -95 dBm or reliable coverage for suburban buildings. The colors yellow and red indicate that the signal level is less than -95 dBm or unreliable coverage for suburban buildings. The measured drive test data in Exhibit B closely matches the propagation maps which have submitted in the past PierCon RF reports. Therefore the propagation maps have been confirmed to be accurate based on measured data.

## 7 SUPPLEMENTAL INFORMATION FOR THE HEIGHT OF THE FACILITY

As stated in previous PierCon RF Reports, the need for this facility is to alleviate coverage gaps (not capacity gaps) in the area of the Village of Nelsonville. Three factors determine the height to which the proposed tower is designed: The local ordinance, coverage objective, and the tree heights.

The local ordinance specifies a maximum tower height of 110' and the proposed tower complies with that ordinance.

The coverage objective, which was described in previous PierCon RF Reports, is met within the Village of Nelsonville and mostly met with the proposed site at 110' outside of the Village particularly in Cold Spring. As noted by Mr. Graiff, there are areas which remain in the area identified as the coverage gap which are located in Cold Spring. Therefore, a taller tower would be preferred but the facility has been designed to meet the Village's height requirements.

The tree heights are the other factor that determines the designed height of a facility. The tree heights in the area can be 80' and greater, including the increasing topography in close relation to the facility. Locating antennas below the tree line provides attenuation to the signal and severely impedes the ability of the facility to provide coverage. Since there are areas that remain in the coverage gap, reducing the height of the antennas any further only increases the area to remain in the gap. Therefore the facility is proposed at a height of 110' which is permitted in the ordinance.

## 8 CONCLUSION

Long Term Evolution (LTE) is mobile wireless 4th generation technology. The wireless industry has gone through 4 generations and is soon to deploy 5th generation technology. All of these mobile technologies are personal wireless services. LTE, while a data technology, supports a multitude of applications including voice (VoLTE). The VoLTE application connects to the PSTN through gateways and meets the FCC and 1996 telecom act's definition.

PierCon reviewed the Cell Solutions Report and identified a number of issues in the data which is presented. Due to these issues, the hand held call tests, coverage maps using ROOT Metrics and Sensorly, and the coverage maps on the Verizon Wireless website were unable to be compared with the data presented in the past PierCon RF reports. Nevertheless the maps presented by the Cell Solutions report do not provide scientifically reliable evidence to refute the properly prepared engineering reports previously submitted by PierCon and confirmed by the Village's consultant, Mr. Graiff, as well as the drive test data in this report.

PierCon also reviewed the letter from Dr. Morrison and addressed the wholly unsubstantiated and speculative concerns he had regarding the accuracy of the industry standard coverage planning tool, Atoll. PierCon also confirmed the accuracy of the propagation tool Atoll with an independent drive test.

PierCon continues to demonstrate that a gap persists in the areas described in previous RF reports by PierCon and that the proposed location is necessary to remedy a significant gap in service provide reliable coverage to the Village of Nelsonville.

Report Prepared by:

Adam Feehan
Sr. RF Engineer
12/18/2017
PierCon Solutions, LLC

## 9 APPENDIX – EXHIBITS

- *A – W1314B-E19 Calibration Certificate*
- *B – 700 MHz LTE Drive Test Performed 12/15/17*
- *CV of Richard Conroy*

TRS RenTelco
1830 West Airfield Drive
DFW Airport, Texas 75261

Exhibit A

# Calibration Certificate Traceability Statement

| | |
|---|---|
| **Asset Number:** | 1180244 |
| **MFG/Model Number:** | JDSU/W1314B-E19 |
| **Serial Number:** | SG14280177 |
| **Description:** | MULTI-BAND RECEIVER |
| **Customer:** | PIERCON SOLUTIONS, LLC |
| **Address:** | 63 BEAVER BROOK RD. BLDG 1 STE 201<br>LINCOLN PARK NJ 07035 |
| **Customer P.O. No:** | 171212AF-1 |
| **Rental Agreement Number:** | 1713369-0 |
| **Certificate Number:** | 171336901180244171115 |

This certificate applies to the instrument identified above and shall not be reproduced, except in full, without written approval of TRS-RenTelco.

This certifies that the above instrument was calibrated to manufacturer's specifications using approved procedures and traceable measurement standards.

This calibration was performed by an approved vendor.

The Quality System of TRS-RenTelco is registered by UL DQS Certificate Number 10000112 to the Quality Management System Standard ISO 9001:2008. TRS-RenTelco's Laboratory is in compliance with MIL-STD-45662A, ANSI/NCSL Z540-1-1994, ISO/IEC 17025:2005 and ISO 10012-2003.

Measurement standards are calibrated at planned intervals. Traceability is to the International System of Units (SI) through the National Institute of Standards and Technology (NIST) or other recognized National Metrology Institute (NMI), natural physical constants, consensus standards, or by ratio type measurements using self calibrating techniques. Supporting documentation relative to traceability is available for review by appointment.

This instrument is initially being sent to the above customer calibrated and fully functional. Before being placed in service, the instrument was properly stored after being calibrated. Calibration interval time is started when the instrument is initially placed in service.

Although the calibration laboratory is in compliance with ANSI/NCSL Z540-1-1994 and MIL-STD-45662A this calibration certificate is issued only as a Traceability Statement and does not carry the requirement of recalibration at the end of rental and customer notification of Out of Tolerance conditions.

TRS-RenTelco's calibration interval for this instrument is 12 months.

**Processed By:** CURTIS DUVALL

| | |
|---|---|
| **Calibration Date:** | Nov 15, 2017 |
| **In Service Date:** | Dec 13, 2017 |
| **Calibration Due Date:** | Dec 13, 2018 |

**Quality Assurance:** Allen F Todd

*Peel Off Sticker Here --->*

**TRS-RenTelco** 800-621-6354
ID: 1180244 Cal: 11/15/17
AV Due: 12/13/18
In Service Date: 12/13/17

Certificate Print Date: December 13, 2017

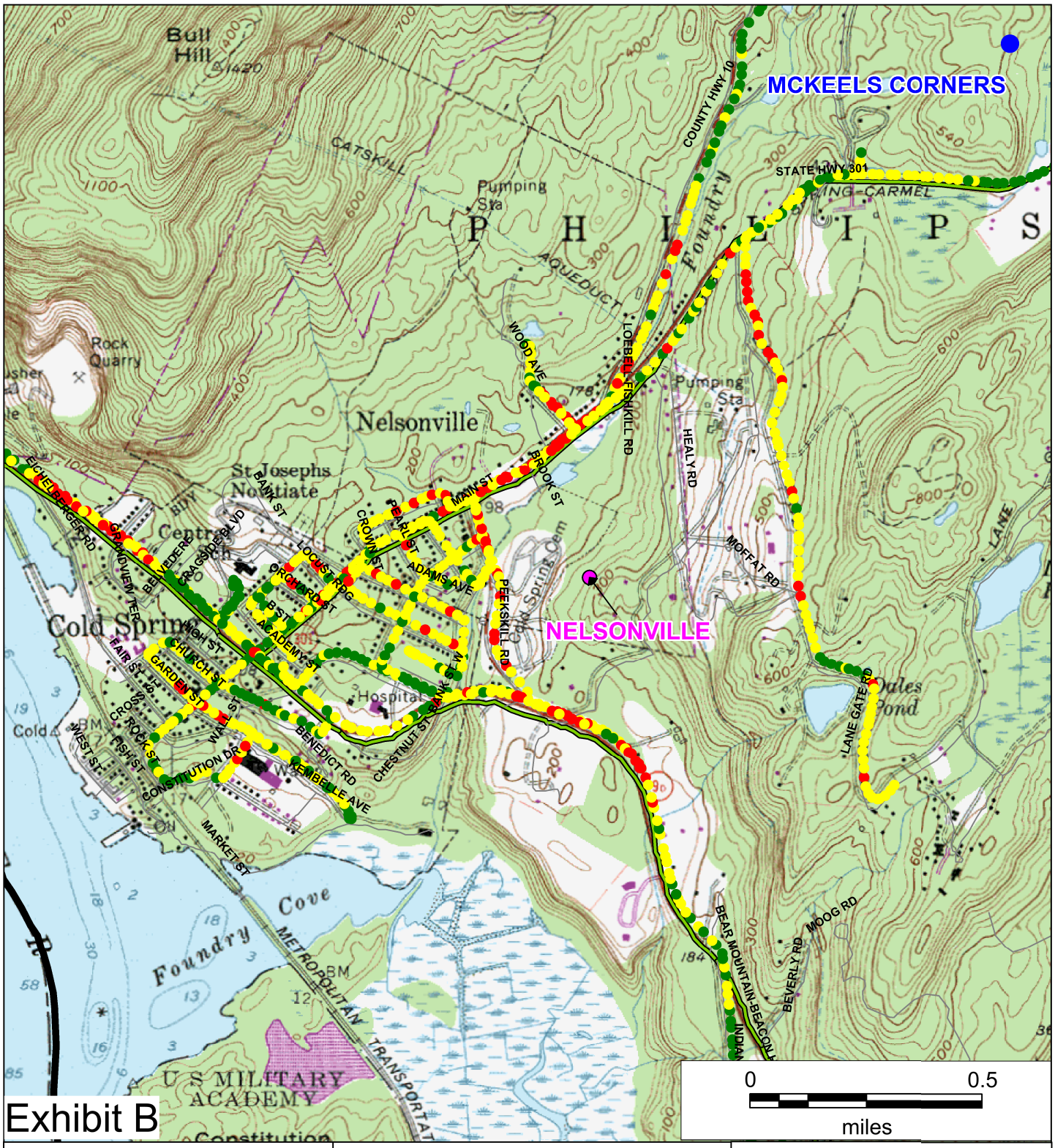


Exhibit B

# Nelsonville

700 MHz LTE
Drive Test
Performed 12/15/17

Village of Nelsonville, NY

- Verizon Wireless Existing Facility
- Verizon Wireless Proposed Facility
- Town of Philipstown Boundary

Drive Test Data (12/15/17)

- Reliable In-Building Suburban Coverage (>=-95 dBm RSRP)
- Reliable In-Vehicle Coverage (>=-105 dBm RSRP)
- Unreliable In-Vehicle Coverage (<-105 dBm RSRP)

verizon

PierCon Solutions LLC
Specialists in Wireless Systems

Prepared by A. Feehan
12/18/2017

PierCon Solutions L.L.C.
*Specialists in Wireless Systems*

**Richard A. Conroy, Jr.**

**SUMMARY**

Richard A. Conroy Jr. has over twenty-nine years of engineering and executive experience in the wireless communications industry.

Prior to co-founding PierCon Solutions LLC in 1998, Mr. Conroy was employed by Wireless Systems Consulting (WSC) as the Director of Engineering Operations. At WSC, Mr. Conroy was responsible for the design and implementation of New York's first all digital Personal Communications System (PCS). Mr. Conroy provided Engineering Management, design, process development, testing guidelines and expert testimony for Omnipoint Communications.

Prior to his roles at WSC and Omnipoint, Mr. Conroy was employed by Motorola Communications where he held positions of Account Manager, Senior Systems Engineer and Lead Engineer for Motorola Communications & Electronics, Inc.

Mr. Conroy holds a Bachelor of Science degree in electrical engineering from New Jersey Institute of Technology; as well as additional training from Motorola, Wireless Systems Consulting, Ericsson, Nortel, Omnipoint & T-Mobile including the following: System Integration Institute, Presenting Technical Information to Customers, Needs Analysis, Managing Technical People, SmartZone, Trunked Simulcast Systems, Secure Communications, Analog and Digital Microwave Design, Dispatch Center Design, ESMR / TDMA, GSM, and CDMA.

Mr. Conroy has been accepted as an expert in the field of RF Engineering and testified in federal court in New Jersey & California. As a technical consultant with a solid background in wireless theory and design, Mr. Conroy specializes in providing all aspects of wireless system design, implementation, and project management.

**STRENGTHS**

- Business Development
- Project Management
- Managing multiple cross-disciplined teams
- MS Project expert
- MS Access
- Implementation
- Cutover Plans
- Process Mapping
- Expert Testimony & Public Presentations
- Land Mobile Radio Systems
- Radio Coverage Standards
- Strategic Planning
- IP Networking / Subnetting
- LAN / WAN system planning
- WiFi / WiMAX
- Microwave Design
- GSM RF Design & Optimization
- Cell Site Testing & Planning
- Tools: RF Prediction - Excalibur, Odyssey, Comsite, Aircomm Asset;

**CORPORATE HEADQUARTERS**
63 Beaver Brook Rd., Suite 201
Lincoln Park, NJ 07035
973-628-9330 phone 973-628-9321 fax

- Optimization Network / Performance – OptPcs -Metrica KingFisher – AIMS – Nortel CPT analyzer - NERF
- TEMS
- MapInfo
- Technical Platforms: S18000-S12000-S8000-S2000 (Nortel) PCS Digital
- Cellular System GSM. RBS2102 (Ericsson)
- RF Zoning / FCC-FAA Compliance

**RELEVANT EXPERIENCE**

**PierCon Solutions** **(1998 – Present)**
**Senior RF Engineer, President/Co-Owner**

- Responsible for business development, growth and stability of PierCon Solutions.
- Responsible for providing technical consulting services to clients in the wireless industry.
- Provide all aspects of wireless System Design, Implementation and Project Management.
- Responsible for technical delivery on all major projects within PierCon Solutions.
- Expert Testimony provided for T-Mobile, Verizon Wireless, Sprint PCS, Nextel and AT&T Wireless before local zoning & planning boards for the approval of wireless sites. Testimony provided for hundreds of facilities.
- Testified in Federal Court of NJ and CA.
- Managed team of engineers performing unlicensed microwave system design for T-Mobile throughout NYC market.
- Responsible for the design of the Sprint PCS CDMA network for the NYMTA from search ring release to site commissioning. Defined link budget, issue search rings, evaluate candidates, perform design visits, develop antenna system designs, site prediction utilizing Planet, drive test evaluation and expert testimony. Solid background in CDMA theory and design.
- System needs analysis, design and specification document for numerous local police, fire public safety communication and computer networks.
- Design and facilitate temporary public safety dispatch facilities in anticipation of 9-1-1 and new system cutover.
- Design analog, digital, conventional and trunked public safety radio systems in all four public safety bands.
- Implementation project management and acceptance testing.
- FCC licensing, implementation & cutover plan.

**Wireless Systems Consulting, Inc.** **(1996 – 1998)**
**Consultant, Director of Engineering Operations**

Client - Omnipoint Communications

- RF Manager for Manhattan, Brooklyn and Queens.
- Team Leader responsible for the design and implementation of Northern New Jersey.
- Design and Implementation of Omnipoint's 1900 MHz GSM PCS system.
- Lead team of RF Engineers
- Perform RF Expert testimony in front of boards of adjustment and planning boards within New Jersey & New York.
- RF Team Leader for the Region 5, New Jersey RF Design.
- Developed standard operating practices, procedures and processes.
- Lead in development of Omnipoint's corporate wide site management database.
- Performed detailed in-building fiber optic distribution design proposals.

- Implemented in-building fiber optic PCS systems.
- Developed spread spectrum microwave designs
- Develop long and short term system RF design plan.
- Responsible for developing Grid and Frequency Plan.
- Develop Optimization Plans.

**Motorola, Inc. (1988 – 1996)**
**Lead Engineer / Project Engineering Manager (1992-1996) (Eastern Division, Glen Rock, NJ)**

- Responsible for managing an engineering team that designed and implemented the NYPD radio system enhancement and E9-1-1 project.
- Responsible for the overall project engineering effort of country's largest E9-1-1 system.
- Managed/ authored the test and troubleshooting process.
- Managing the field engineering implementation teams.
- Customer interface for engineering issues.
- Developed detailed schedules and plans for complex audio routing designs.
- Coordinated efforts between Engineering, Product Groups, Deliverables and Staging.
- Directed field engineering with regards to project priorities and goals.
- Awarded Motorola's Eastern Division Salesman of the Year (1995).

**Senior Systems Engineer (1994 – 1995) (Southern Division, Columbia, SC)**

- Provide engineering and technical support for the Southern Division.
- Responsible for the design of complex communication systems ranging from analog trunking systems to emerging digital technologies.
- Responsible for design and implementation of statewide SmartZone trunking System.
- Responsible for design of 6 site Astro Simulcast system for Charleston County FD
- Developed Corporate wide accepted MOSCAD technical proposal document.
- Designed 19.2 Mobile Data System.
- Performed Customer needs assessment training to division sales team.

**Systems Engineer (1992 – 1993) (Southern Division, Atlanta, GA)**

- Managed the presale design of a multi-state MIRS system.
- Responsible for developing the first private ESMR system using Motorola's MIRS (TDMA) technology. Interface between RF and Switch engineers during design phases.
- Managed radio TDMA coverage prediction based on high elevation / high ERP.
- Developed and assigned TDMA RF coverage parameters.
- Developed (TDMA) ESMR technical proposal.
- Designed Hybrid digital/analog 800 MHz (6 site) simulcast public safety trunking system.
- Awarded Peak Performer 1993 of Motorola's Southern Division.

**Systems Engineer (1988 – 1992) (Glen Rock, NJ)**

- System Engineer responsible for the design of wireless systems
- Experience in the following system designs and implementation: RF point to point links, Analog and Digital Microwave design and implementation, Data System design Coverage prediction, Two-way repeater systems and Trunked radio systems.

Richard A. Conroy Jr.

**INDUSTRY SKILLS**

- Technology expert – LTE, CDMA, GSM, WiMAX, P25, Public Safety
- Computer propagation and optimization tools: Planet EV, DB Planner, Odyssey and Asset, EDX Signal Pro, Excalibur, MOSAIC, PlotworX, Ericsson's TEMS & FICS,
- GIS mapping tools such as MapInfo, Terrain Navigator, Streets & Trips and Street Atlas.
- Drive testing tools: Agilent, Grayson & MLJ Drive Testing Tools
- FCC Office of Engineering Technology Bulletin 65.
- TSB88
- Microsoft Office: Excel, Word, Visio, Power Point, MS Project

**EDUCATION**

- BS – Electrical Engineering – New Jersey Institute of Technology, Newark, NJ

**TRAINING**

- Antenna Design Seminars – Georgia Technical Institute, Atlanta, GA
- Lucent CDMA training course material
- Management and Communication Seminars
- M/A-COM Public Safety Training
- R56 Bonding and Grounding – Motorola
- Consultant's Training – Motorola
- System Integration Institute
- Presenting Technical Information to Customers
- Secure, Astro Conventional & Astro Systems Training
- Sales Training program
- Dispatch Console Design
- Advanced Microwave Design
- Simulcast Design
- Trunked Systems Design