



BROADMAPSM
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South Dakota Broadband Mapping Project: Product Release White Paper

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OVERVIEW

This white paper highlights the **Submission Summary** for this deliverable, as well as describes the **Data Gathering**, **Data Integration**, **Data Validation and Verification** and **Quality Control** processes used to create the Broadband Mapping Project's October 1st, 2014 data submission. To support varying levels of technical and program knowledge, both a **high-level summary** and a **detailed process review** are supplied.

SUBMISSION SUMMARY

PROVIDER DETAILS

PROVIDER PARTICIPATION

- Provider Participation Statistics Summary

Summary	Count
Total Valid Broadband Providers	63
Non-Responsive Providers	22
Non-Cooperative Providers	1
Number of Providers - Initial Response Only	0
Number of Providers – Represented in Data Submission	57
Number of Providers - Supplied Updates for this Submission	22
Number of Providers - Confirmed No Updates	19
Number of Providers – Waiting for Data	0

- Still no data response for Evertex, NatesNet, RDC Professional Services, Timber Lake Broadband, & Wirefree USA
- Removed Native American Telecom

- Providers – Non-Cooperative

- Zayo Group LLC

- Providers – Supplied Updates

1. AT&T Mobility LLC
2. Celerity Networks
3. CenturyLink
4. Fibercomm L.C.
5. Fort Randall Telephone Company
6. Frontier Citizens Communications
7. Golden West Telecommunications
8. Interstate Telecommunications Cooperative
9. Kennebec Telephone Company



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10. Mediacom LLC
11. Midcontinent Communications
12. Midstate Communications
13. Mitchell Telecom (Sancom, Inc.)
14. Santel Communications Cooperative
15. SDN Communications
16. Sioux Valley Energy
17. TrioTel Communications
18. Valley Telecommunications
19. Venture Communications Coop. (Venture)
20. ViaSat
21. West River Cooperative Telephone Company
22. WOW! Internet, Cable, and Phone

- Providers – Confirmed No Updates
 1. Alliance Communications (Alliance)
 2. Beresford Municipal Telephone
 3. Cheyenne River Sioux Tribe Telephone Authority
 4. City of Faith Telephone Company
 5. Consolidated Telecom
 6. Dryad Communications
 7. Golden West Cablevision, Inc.
 8. Interlakes Wireless
 9. Northern Wireless Communications
 10. NVC (Northern Valley Communications)
 11. RC Communications
 12. RC Technologies, Inc.
 13. Roberts County Telephone
 14. Skycasters
 15. Splitrock
 16. Sprint
 17. Valley Telephone Company (Park Region)
 18. Venture Communications Coop. (Western)
 19. West River Telecommunications
- Providers – Waiting for data
 - There were no providers we were waiting for data from
- Provider Initial Response
 - There were no providers that only initially responded
- Non-Responsive Providers
 1. Cable One
 2. Data Truck LLC
 3. Echelon Internet Services
 4. Evertex
 5. HughesNet
 6. James Valley Telecommunications
 7. Long Lines (Jefferson)
 8. Long Lines (Long Lines Metro)



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9. MNWireless, LLC
10. Nates Net
11. Native American Telecom
12. Prairie INet (KeyOn Communications)
13. RDC Professional Services
14. SpeedConnect
15. StarBand Communications
16. Swiftel Communications
17. Three River Telco
18. Timber Lake Broadband
19. Verizon Wireless
20. Wescomm Wireless
21. Wirefree USA
22. Zayo Group LLC

- Providers researched and identified as non-broadband providers can be viewed within the table at the end of this document.

COMMUNITY ANCHOR INSTITUTION (CAI) DETAILS

OVERALL STATISTICS

Community Anchor Institution - Categories	Overall Count	CAIID Counts	Broadband Subscriber (Yes)	Trans Tech	Advertised Speed Down	Advertised Speed Up
Category 1 - School K through 12	693	683	609	669	576	576
Category 2 - Library	157	156	65	59	58	58
Category 3 - Medical/Healthcare	219	0	142	59	53	53
Category 4 - Public Safety	471	0	83	70	43	43
Category 5 - Universities/Colleges	30	0	30	29	29	29
Category 6 - Other: Government	454	0	453	450	446	446
Category 7 - Other: Non-Government	44	0	31	22	22	22
Total	2068	839	1413	1358	1227	1227



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HIGH-LEVEL SUMMARY

DATA GATHERING

BROADBAND SERVICE AREAS, MIDDLE MILE AGGREGATION POINTS AND BROADBAND SERVICE OVERVIEW

The collection of Broadband Service Areas, Middle Mile Aggregation Points and Broadband Service Overview information is handled through the following Provider Outreach Process:

- Build and maintain an inventory of Broadband providers through currently known providers and research.
- The inventory and everyday interaction with providers is tracked using the Provider Catalog (PCat). Below are some examples of the web application, which has a shared access between our team and mapping partner (BroadMap).

Company Information		Edit	Clone	History	AAD
Provider Name	acmetech (All)	Source Name	acmetech		
Company Address		Source Description			
Company PO Box		Layer Name	TBD		
Company House Number	12345	Source Usage Type	Tracking		
Company Street Name	Acme Avenue	Source Provider Type	BroadMap		
Company City Name	Portland	Source Content Type			
Company Suite		Source Restrictions	<input type="checkbox"/>		
Company Postal Boundary		Source Restriction Description			
Company State		TT Types	--None-- Asymmetric xDSL Symmetric xDSL Other Copper Wireline Cable Modem-DOCSIS 3.0 Cable Modem-Other Optical Carrier/Fiber to the End User Satellite		
Company Website	http://www.acmebroadband.com	Addr Level Data Provided	<input type="checkbox"/>		
Source ID	4999	Preferred Contact Method			
Child Source	<input type="checkbox"/>				
Parent URL					
Parent Source ID	0				
User Name					
Password					
Form 477 Interest	<input type="checkbox"/>				
Provider Portal Trained	<input checked="" type="checkbox"/>				

Contacts							New
Type	Name	Preferred	Phone 1	Phone 2	Email	Position	
P	Sourcing						

FRN Info	
Provider Name	DBA
	FRN Number



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Confidence		New	
TT Type	Confidence	Last Modified	Comment
Status Tracking			
Non Facilities Based Provider	<input type="checkbox"/>		
Business Only Provider	<input type="checkbox"/>		
Reseller	<input type="checkbox"/>		
NDA Review - Internal	<input type="checkbox"/>		Non Responsive Provider <input type="checkbox"/>
NDA Review - External	<input type="checkbox"/>		Non Cooperative Provider <input type="checkbox"/>
			Source Closed <input type="checkbox"/>
Service Provider Details			
BroadMapper	--None--	BroadMap Status	Unassigned
Initial State Outreach Date		Initial Contact Vehicle	
Provider Origin		Member Association	
		Initial State Outreach	<input type="checkbox"/>
		NDA Status	--None--
Provider Packet Exchanged	<input type="checkbox"/>	NDA Not Required	<input type="checkbox"/>
Provider Packet Info Sent		NDA Requested	<input type="checkbox"/>
Provider Meeting Status	--None--	NDA Exchanged	<input type="checkbox"/>
Technical Meeting Requested	<input type="checkbox"/>	NDA Exchange Date	
Technical Meeting Scheduled	<input type="checkbox"/>	NDA Signed	<input type="checkbox"/>
Number of Subscribers		NDA Signed Date	
		Date Loaded	
		Source Closed Date	

BDIA Delivery 0412		Edit	
Status	--None--	Provider Data Reviewed	<input type="checkbox"/>
Outreach Date		Provider Data Reviewed Date	
Initial Response		FootPrint	
Meeting Date		MiddleMile	
No Update Date		Subscriber	
Waiting For Data Date		Provider Login	<input type="checkbox"/>
Data Received Date		Provider Login Date	
Data Accepted Date			
Source Ingested		Source Ingested Date	
Additional Data			
Notes			
Next Steps			
Inactive	<input type="checkbox"/>	Owner	brJordan
Created By	brJordan 2011-06-13 12:06:35	Last Modified By	krousseau 2012-03-16 13:41:58

- Update provider material that describes the data requirements and logistics for data transfer.
- Update Non-Disclosure Agreement (NDA) for use in the project, where applicable.
- Maintain multiple protocols for the provider to submit data, including Secure File Transfer Protocol (SFTP) technology when desired.
- Conduct one-on-one informational discussions with each provider to communicate the following:
 - Requirements of this project;
 - Broadband data required to support the product data model;
 - Submission protocols available;
 - Capability to validate how the supplied data is aggregated.
- Download/receive provider data.
- Establish a repeatable process with provider. Maintain provider communication, transaction and data handling records throughout the project (dates contacted, data received, etc.).



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COMMUNITY ANCHOR INSTITUTION (CAI)

The collection of CAI information is handled through the following CAI Collection Process:

- Collect and maintain inventory of CAIs through currently known CAIs, data mining, and research.
- Upload web-based data to Core Database for standardization.
- Perform internal cleansing, such as removing duplicate records, identifying gaps in broadband attribution and verifying category.
- Geocode CAI locations.
- Translate Core Database data to deliverable-ready format.
- Continue engagement with non-responsive institutions.

DATA INTEGRATION PROCESS

The data integration and processing mechanisms currently used allows for multiple types of inputs and result in a standardized output that meets the NTIA deliverable requirements. This flexible process supports data model changes and project-requested enhancements.

- Receive inputs from providers via submission protocols; upload into Sourcing Database and catalog with provider information.
- Review provider-supplied data for completeness and for potential discrepancies that require resolution prior to processing and flag as necessary.
- Categorize input into data-type category (addresses, block lists, paper maps, etc.).
- Standardize input based on data type within Staging Database.
- Create Compact Polygons (CP)—(internal methodology for generating area-based feature for coverage in Staging Database).
- Apply broadband attribution to CP; apply metadata to CP.
- Perform quality analysis of the CP against the source supplied to identify any completeness or accuracy issues.
- Request additional information from the provider if elements of coverage are missing or contain discrepancies. This is a second manual quality check to ensure data is complete.
 - Process coverage area to build the required NTIA data model layers.

With the deployment of the Provider Portal last round, the data collection and later validation process was streamlined allowing both activities to occur within a secure web application. The majority of the providers used this methodology as it supplies them with more visibility into how their data is being represented and gives them knowledge and ownership of their coverage representation. Below are some bullet points and supporting screen shots on how the portal is used.

- Each provider is assigned credentials with a strong password to ensure security measures are taken into consideration

A screenshot of a web-based login form titled "Login". It contains two input fields: "Username" and "Password". Below the "Password" field is a "Login" button.



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- Collection and confirmation our contact, as well as the company's DBA Name and FRN accuracy

Contact and Provider Information

Please enter contact information and change provider information if incorrect:

Contact name: * Kristin Rousseau

Contact E-mail: * kris.rousseau@broadmap.com

Contact Phone: * 603-448-4475

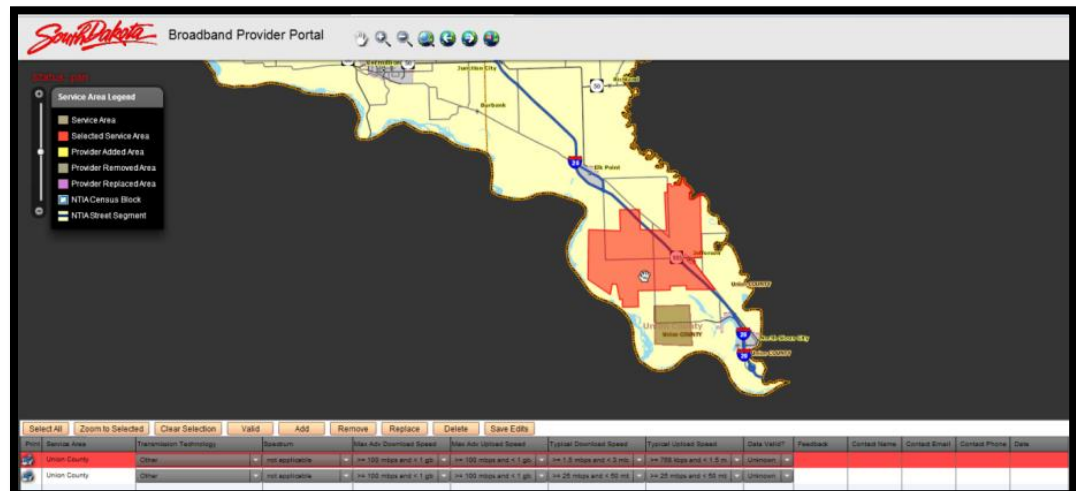
Doing Business As (DBA) Name: * acmetech

FCC Registration Number (FRN): * 22222222

Please note the following:

- Contact info will only be stored when a record is saved
- Provider info will be applied to all service areas

- Capability to review and request changes to the coverage footprint



- The provider can Add/Remove portions, or all, of the footprint requesting that their footprint be increased or refined.





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- File upload functionality to support providers that would prefer a shapefile, spreadsheet, PDF, KMZ/KML file be used to reflect changes for the data round



- Once the provider has reviewed completed changes to their coverage, they can then validate them by signing off that everything is accurate.

RF PROPAGATION – PREDICTIVE MODELING

For this data submission, we have used EDX to perform RF propagation analysis and create predictive modeling of wireless coverage based on available tower data. The analysis performed thus far has not required us to make significant adjustments to the provider submitted shapefiles; however we are working with providers to collect further tower information, as well as potential extra signal strength that may be gained from repeaters.



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DATA VALIDATION AND VERIFICATION

To ensure the data collected and processed is as accurate and as comprehensive as possible, South Dakota broadband verification encompasses many efforts. The methodologies employed are documented below:

BROADBAND PROVIDER VALIDATION—PROVIDER PORTAL APPLICATION

First and foremost, all providers are given access to, and are trained in the use of, a web application we call the “provider portal”. After each data collection and ingestion of provider data, representatives from the provider are able to review the polygons, segments, speeds, technologies, and other attribution that our GIS teams have developed based on the submitted data. Providers are given the opportunity to make changes to the data’s attributes (speeds, technology, spectrum, etc...) as well as add/change/move/delete coverage areas. The requested changes are delivered to the GIS teams for full ingestion in our broadband database. This process is repeated until the provider representatives confirm that all aspects of the coverage areas are accurate and complete.

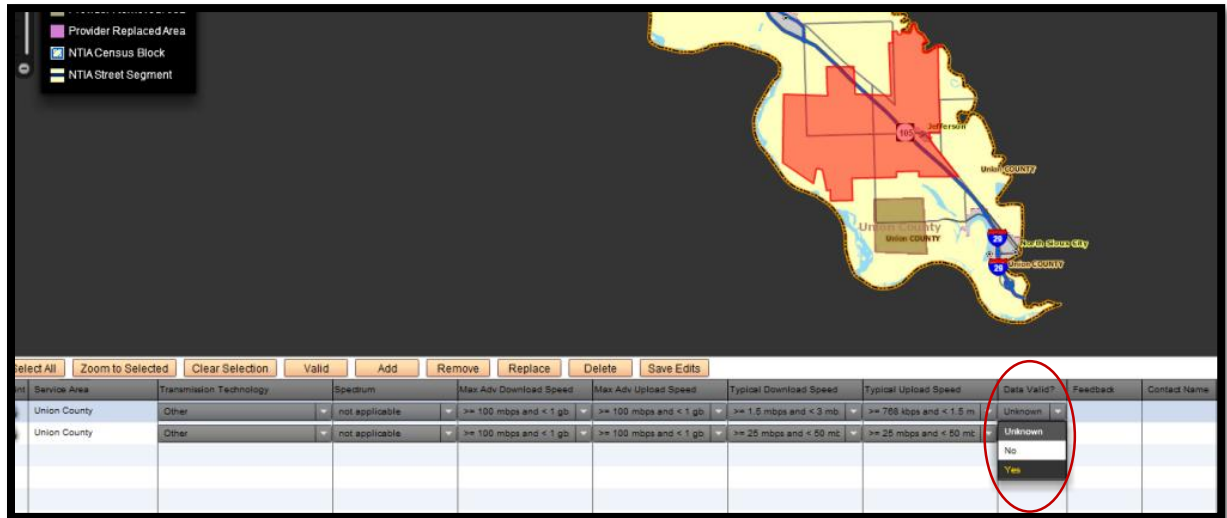
This portal is available 24/7/365 for providers to utilize, allowing those companies without GIS or mapping staff access to those technologies and benefits for review, presentations, and other business opportunities. This process has proven both successful and popular in the provider community.

- Coverage validation can be done on one record/footprint at a time or by selecting footprints and selecting the ‘Valid’ button. The provider could also print off or download their coverage for their own tracking purposes.

Select All	Zoom to Selected	Clear Selection	Valid	Add	Remove	Replace	Delete	Save Edits									
id	Service Area	Transmission Technology	Spectrum	Max Adv Download Speed	Max Adv Upload Speed	Typical Download Speed	Typical Upload Speed	Data Valid?	Feedback	Contact Name							
10	Union County	Other	not applicable	>= 100 mbps and < 1 gb	>= 100 mbps and < 1 gb	>= 1.5 mbps and < 3 mb	>= 768 kbps and < 1.5 m	Unknown									
	Union County	Other	not applicable	>= 100 mbps and < 1 gb	>= 100 mbps and < 1 gb	>= 25 mbps and < 50 mb	>= 25 mbps and < 50 mb	Unknown									



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All validation results are tracked internally through our Validation Table, which also improves the overall **Confidence Value** as mentioned below.

FURTHER BROADBAND PROVIDER VALIDATION

Following the completion of each data submission, maps are supplied to each provider in PDF format for them to perform further validation and review with their staff. These maps are also utilized as marketing material for their websites, internal communications, etc., which further fosters participation.

Any feedback or changes received following the delivery of these maps are incorporated into the overall broadband map and reviewed again with the provider.

PEER REVIEW

The BroadMap and South Dakota teams take the time to sit down and visually inspect the data for any abnormalities that need to be discussed.

INDUSTRY KNOWLEDGE – SUBJECT MATTER EXPERTS

South Dakota's technology and telecommunications businesses are highly consolidated, with the State of South Dakota often being the largest consumer of services in the state. Given that, relationships and partnerships often already exist between the State of South Dakota and the broadband providers, giving a first-hand look at the services offered and where they are offered. In addition, the South Dakota broadband team has ready access to industry experts within the SD Public Utilities Commission, telecommunications association's boards, and technology industry experts in the fields of telecommunications and data networking.

Our office has met and consulted with these experts regarding provider data as issues were found. Examples of these consultations are the review of provider coverage areas against telecommunications exchange areas with the Public Utilities Commission and against known technological capabilities. Any anomalies or questioned material is relayed to the providers for review.



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FIELD VERIFICATION

A number of field verification efforts have taken place during the last six months.

For mobile wireless providers, broadband staff and other team members have completed over 80,000 miles of drive testing utilizing mobile wireless phones collecting information on coverage and broadband performance. This drive testing has collected nearly 2 million data points across the state that confirm the availability of wireless broadband signal at a geographic location by coordinates, with the data collected every 10 seconds during the drive testing. Tower location information and wireless speed test results were also collected during this drive testing, with over 104,000 mobile test results collected. Combined with our wireline speed test, this gives us a total of 664,726 speed test results, either crowd sourced or field collected.

An important point to note is that with the development of an automated toolset that allows team members to start data collection upon entering the vehicle and not need any further intervention, a number of staff members have been volunteering time to drive untested roads and territories of the state during vacations, other state business, or leisure time at no cost to the program.

Due to the nature of our organization being a centralized IT group for government and education, we are uniquely positioned to request field verification by our remote office staff. As technicians travel the state, they have performed speed tests at businesses, homes, and government offices, as well as surveyed remote office staff on availability of coverage areas at their homes.

THIRD-PARTY DATA VERIFICATION

The South Dakota broadband team has collected data from the FCC CBT and Mobile tests, the FCC dead zone reporting tool, FCC ASR datasets, our own hosted speed test application, provider speed test results, census data, provider exchange boundaries and commercially available datasets from Ookla to confirm the availability of broadband service. Of particular interest to our program were datasets that tied a specific address to the broadband data, as we have found other location-based services (IP geolocation) to be woefully inaccurate in our state.

Collected third-party data is overlaid against provider coverage areas for comparison. Most valuable has been our hosted speed test server (speedtest.sd.gov). This test collects specific address location information and provider details, while providing consumers the ability to directly provide more accurate location information via a clickable map in the event that their address is not geocoded correctly. This provides benefits to our verification effort as well as our Improved Address Files grant program.

Recently added to our verification efforts have been more accurate provider exchange boundaries and 2010 Census information on population density. Provider coverage areas are compared against known exchange boundaries, and census population density information is used to explain any possibly gaps in coverage.



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CROWD SOURCING

In addition to our Crowd sourced speed test system, our state broadband website offers consumers the ability to report broadband dead zones, take surveys on available broadband and related topics, report inaccuracies in our online static/interactive maps, as well as any other relevant feedback about the broadband environment of South Dakota. This feedback is compared against provider coverage areas, with relevant information reported to the providers for comments and/or correction.

Website Hyperlink: <http://broadband.sd.gov/>

South Dakota citizens also have the opportunity to assist with field data collection from their smartphones and tablets by taking speed tests either with Ookla's free Speedtest.net application, or with MobilePulse's application. Our office receives both sets of data, and ingests those into our verification database to compare against stated coverages.

CURRENCY OF OVERALL PROCESS

This is a review of providers who sent updated coverage area data to BroadMap, or were at least cooperative, reporting no updates or changes for this round of submission.

SOURCING QC GEOMETRY AND ATTRIBUTION

This is a review that providers whose coverage areas submitted through the portal or via shapefile, met standards for the following:

- Format correctness;
- Table and field structure;
- Valid values, including default values, where applicable;
- Geographic extent and topology errors.

INTERNAL QC SCRIPTS

Internal QC scripts were run to check that data input into the attribution of the coverage areas matched the data in the internal Provider Catalog. This included attributes such as FRN number, source id # and Provider Name.

NTIA SUBMISSION CHECK

Prior to data submission, another quality control script supplied by NTIA is run. This script, SBDD_CheckSubmission.py, creates an output in text form that is required to be submitted along with the final deliverable. All errors must come up clean, unless otherwise specified by NTIA.

CONFIDENCE VALUES

All verification, validation and manual quality review results are tracked by provider/technology type and stored and maintained within a Validation spreadsheet. A confidence value is assigned, based on internal assessments of the collected information, to highlight the provider coverage areas and/or attributions that would benefit from further investigation and/or enhancements.



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The confidence value is calculated from the provider meeting the Quality Control checks listed below (and outlined in detail above):

- Provider Validation
- Peer Review
- State Review / Subject Matter Expert Review
- Third Party Data Verification
- Crowd Sourcing
- Currency of Overall Process
- Sourcing QC Geometry and Attribution
- Internal QC Scripts
- NTIA Submission Check

With the continued efforts on provider validation, 3rd party verification and the release of the public interactive map with feedback collection functionality, the confidence values will be utilized further to identify specific areas in need of attention.

QUALITY CONTROL

Following collection, processing and analysis of the provider and CAI data, the product is checked manually and algorithmically against the NTIA data model. These items are outlined above in the [Sourcing QC Geometry and Attribution](#) and [Internal QC Scripts](#) and [NTIA Submission Check](#) under [Data Validation and Verification](#).



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PROVIDERS RESEARCHED

Below is a list of providers that were researched and contacted, but identified as non-broadband providers and didn't require inclusion within the data submission. Some may be due to different naming conventions or inaccurate FRN/DBA names and were therefore considered a closed source.

5LINX Enterprises, Inc.	Megapath, Inc.
Airespring, Inc.	Metropolitan Telecommunications Holding Company
Apptix, Inc.	Millicorp
Aptela, Inc.	Minnesota Valley Television Improvement Corporation
Bandwidth.com, Inc.	Mitel Netsolutions Inc.
Birch Communications Inc.	MobilePro Corp.
Broadvox Go!, LLC	New Edge Network, Inc.
BullsEye Telecom, Inc.	NextWave Wireless Inc.
Cause Based Commerce Inc.	nexVortex, Inc.
CommPartners Holding Corporation	NNTC
Dickey Rural Telephone Cooperative	NOS Communications, Inc.
DigitalBridge Communications Corp.	OrbitCom, Inc
Evertex, Inc.	PaeTec Corporation
Farmers Mutual Telephone Company (MN & SD)	Phone.com, LLC
Fionda VoIP, LLC	Proximiti Technologies, Inc.
Granite Telecommunications, LLC	Siouxland WISP
Great Plains Communications, Inc.	Trans National Communications International, Inc.
GreatCall, Inc.	tw telecom inc.
Hickory Tech Corporation	VoIP360, Inc.
iCore Networks, Inc.	VoIPStreet, Inc.
InPhonex.com, LLC	Vonage Holdings Corp.
Kosmaz Technologies, LLC	Wave2Wave Communications, Inc.
Level 3 Communications, LLC	
Local Link	
LY Holdings, LLC	
Matrix Telecom, inc.	

DETAILED PROCESS REVIEW

To review the detailed process, please review the document BMap_ProcessDetails_2014_10_01.pdf that was sent with this submission.