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NORTEL

Service Scope of Work (SoW)

Service	**Design and Deploy Services for WiMAX 16e**
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Availability	Global
Purpose	This document details the Scope of Work for **Design and Deploy Services for WiMAX 16e**.

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1 Detailed Service Description

Faced with the increasing complexities of technology convergence and multi-vendor networking, network owners – both service providers and enterprises – require a turnkey implementation solution to help ensure optimal network design, minimize deployment risks and meet business goals. The Nortel Global Services portfolio of Design and Deploy offers an end-to-end solution that can help at all stages of the Massachusetts Broadband Institute network life cycle, whether you are planning a new network deployment or undertaking a significant network transformation or capacity expansion.

By leveraging Nortel's extensive deployment experience in all wireless technologies around the world, Massachusetts Broadband Institute can minimize business risk through smooth WiMAX network deployment and benefit from rapid time to market.

The proposed services are grouped into the following categories:

- **Design Services:** A set of services designed to help Massachusetts Broadband Institute to plan overall WiMAX network design including Access Network Design, Backhaul Traffic Design and Core Network Design based on network coverage and capacity requirements.
- **Deploy Services:** A broad range of deployment-related services to help Massachusetts Broadband Institute dimension, site acquire, install and commission, integrate and manage deployment of the WiMAX network.

Availability

This service is available globally.

1.1 Design Services

Design services provide the preparation and design work necessary to configure and plan a WiMAX network, whether you are initiating a new deployment or overlaying other technology. The following Design Services are offered by Nortel.

1.1.1 Overlay Planning

Overlay Planning represents the definition phase of an overlay and includes functional and logistical requirements, such as an engineering design and a project plan. It is intended for customers that require WiMAX to be overlaid on an in-service network.

Deliverables

Overlay Planning may include:

- Overlay plan
- Schedule
- Method of Procedure (MOP)
- Execution reports
- Network acceptance report

Prerequisites

- Massachusetts Broadband Institute will need to provide configuration details and information about its existing network architecture.

Note: *Because the requirements for Overlay Planning can vary widely among Nortel customers, this service is quoted on a specific-job basis (custom quote).*

1.1.2 System Validation

During the network design phase, System Validation provides evaluation and validation of WiMAX network elements in a multi-vendor environment. Nortel conducts the tests in dedicated interoperability and solution labs or in Massachusetts Broadband Institute's lab as appropriate. System Validation offers three testing levels to accommodate project requirements, technology and budget.

- Level 1: Baseline interworking and functionality within known solution architecture
- Level 2: Rigorous testing of features, capacity and outage behaviors
- Custom: Testing within highly specialized or highly complex architectures

Deliverables

System Validation may include:

- A validation test plan containing detailed test cases based on explicit test requirements and network complexity
- A test analysis and observation report containing test-case results, follow-up recommendations and configuration parameters required for successful interworking with the various platforms that compose the solution

Prerequisites

Massachusetts Broadband Institute needs to complete a validation testing event questionnaire that specifies test scope and requirements. For Level 2 and custom testing, Massachusetts Broadband Institute needs to provide detailed solution architecture information needed to develop the test plan.

Note: *Because the requirements for System Validation can vary widely among Nortel customers, this service is quoted on a specific-job basis (custom quote).*

1.1.3 Technical Governance (Optional)

Managing a cross-functional, multi-vendor technical team, Technical Governance identifies and manages issues that arise during deployment. The Nortel chief engineer works with Massachusetts Broadband Institute as well as with Nortel and third-party services suppliers to verify that all technical aspects and implications of the design for the network are understood and the technical deliverables within the contracts are met.

Deliverables

Technical Governance may include:

- A chief engineer who acts as a single point of contact for technical matters. This prime will provide timely and regular reporting of progress and issues to Massachusetts Broadband Institute
- Establishing and managing a cross functional, multi-vendor technical team based on responsibility matrix for deployment activities supplied by the project manager
- Defining and coordinating specific technical information requirements between multiple suppliers and/or Massachusetts Broadband Institute operations groups

- Managing the change control process for the network design document during the deployment phase. The chief engineer will also provide a modified network design document to all stakeholders with change summary and authorization log.
- Maintaining a technical deployment document with information provided by Massachusetts Broadband Institute operations and delivery subject-matter experts. This includes a matrix of product and services suppliers, deployment information and notes from engineering, installation, commissioning and integration activities that impact the overall acceptance testing strategy.
- Identifying and escalating deployment issues and facilitating technical mitigation plans with Massachusetts Broadband Institute and delivery subject-matter experts.

Prerequisites

Massachusetts Broadband Institute needs to provide:

- Contacts and telephone numbers for all responsible personnel in the key areas of the business involved with the new deployment
- Accurate network documentation including topology diagrams, configuration information and network specification booklets relevant to the project
- Access for Nortel's chief engineer to relevant deployment planning meetings and needs to advise of any design-affecting changes in a timely manner
- Up-to-date information about the design, product and service supplier matrix, integration and acceptance or migration strategy for inclusion in the network status document
- Access to Massachusetts Broadband Institute's facilities.

Note: *Because the requirements for Technical Governance can vary widely among Nortel customers, this service is quoted on a specific-job basis (custom quote).*

1.1.4 Network Design

High-level architecture planning and detailed element engineering is provided, including provisioning, configuration and material estimates for all network subsystems (i.e., core, access, radio frequency and backhaul/transport).

The Network Design function is principally the development of a precise definition of the network architecture and its associated elements.

Radio Frequency (RF) Design (RF Engineering)

Nortel RF Design services for WiMAX network provide detailed RF coverage and capacity design, interference analysis, site selection support and frequency planning required for WiMAX network deployment.

As WiMAX is a QoS-built-in system, Nortel will start with an intensive study of Massachusetts Broadband Institute Quality of Service offering, translating this critical information into an RF plan for the associated QoS.

Major challenges for this activity will be the availability and collocation of sites with existing systems, propagation issues as well as interference within this newly allocated frequency band.

The RF planning tool used is built on one of the marketplace-leader engines (Atoll from Forsk), enabling seamless transfer of information to either technical or marketing Massachusetts Broadband Institute teams.

Network Engineering

Nortel will provide a detailed WiMAX network design, including Access and Core domains – based on Massachusetts Broadband Institute network engineering and dimensioning requirements (i.e., capacity, services, quality and coverage), and through the application of Nortel's advanced engineering rules, Massachusetts Broadband Institute requirements will be translated into an efficient and scalable network. Network Engineering provides design and configuration requirements to verify that (1) network elements are connected to each other based on WiMAX defined standards, and (2) they can interface with each other based on WiMAX defined standard-based messaging to be able to complete the WiMAX data connections.

Backhaul design can also be included, with Nortel creating a flexible backhaul solution tailored to Massachusetts Broadband Institute network needs after looking into existing network reference architecture, current traffic model, future traffic growth and new service offering and other overheads as part of network subscriber call model.

Upon completion of the Network Design phase for each major phase of the network, the network architecture and configuration will be defined.

After the hardware architecture and configuration is finalized, Network Engineering service provides software configuration details required to integrate the node into the network.

Deliverables

RF Engineering

- Preliminary RF design identifying WiMAX BTS locations and antenna specification, i.e., height, orientation. The design report will be accompanied by the necessary coverage plots. Up to three candidate site locations will be identified for each intended BTS location.
- Perform Continuous Wave (CW) drive testing up to 15 percent of the total sites for propagation model tuning, assuming flat terrain and a single RF morphology.
- Search-area maps for all the selected site locations identified in the preliminary design report. Preliminary design report will be provided in Excel format listing candidate site locations.
- RF site visits will be performed on up to two candidates in each search area identified.
- Site candidate evaluation and ranking report in Excel format
- Final RF design report containing system-wide coverage and interference plots
- Coverage map includes the minimum Receive (RX) thresholds for each available burst profile so that an estimation of end user performance can be made as a result
- RF reuse plan map to help ensure that all sites are broadcasting on the designed channels.
- RF datafill parameters as required for deploying WiMAX network.
- Site database with final site specifications, including but not limited to site ID, site name, site coordinates, antenna height, antenna orientation, antenna tilt if applicable, Nortel WiMAX BTS types, number of antennas, carriers or radios provided in Excel format.

Network Engineering

Nortel provides the following deliverables as part of the service:

- Hardware Customer Information Questionnaire
    - Hardware requirement verification to meet required capacity to meet Massachusetts Broadband Institute network requirements and forecast
    - Required hardware configuration (seismic zone requirements, redundancy scheme, clocking source, shelf layout, network topology at physical layer network design, etc.)
    - Physical connectivity requirements to provide shelf and port level details to be able to provide clear demarcation information for deployment team

- Network Design Document and Dimensioning
    - Capacity evaluation for required hardware elements
    - Detailed list of software required
    - Detailed list of hardware required
    - Network diagrams reflecting the physical location of hardware and card and shelf layouts, where necessary
- Network Software Configuration Customer Information Questionnaire (BTS, Access Service Network [ASN] and Connectivity Service Network [CSN])
    - IP addressing scheme (IP planning and design)
    - Logical layer network design
    - Hardware and Software Parameter settings
    - Network Configuration scripts
    - Limited remote phone support to Massachusetts Broadband Institute's Questionnaires

Prerequisites

RF Engineering

- Massachusetts Broadband Institute will need to provide necessary RF design requirements, including Quality of Service (QoS), and any preferred cell site locations for Green-field or Overlay network deployment using the Nortel WiMax RF Design Questionnaire.

Network Engineering

- Massachusetts Broadband Institute will need to work with Nortel to complete a Customer Information Questionnaire (CIQ), which specifies network design requirements and operating parameters, and also provide traffic projections, existing network configuration (logical and physical) and network performance objectives. For detailed information please refer to the Roles and Responsibilities section (section 3).

1.1.5 Spectrum Clearing and Testing

It is essential in today's shared spectrum environment to verify a clear spectrum before introducing or overlaying a new wireless access technology such as WiMAX, and Spectrum Clearing and Testing provides that confirmation through analysis and field testing.

Deliverables

Spectrum Clearing and Testing may include:

- Conducting a preliminary spectrum sharing study
- Providing inference analysis
- Performing RF field measurement
- Making recommendations about frequency/carrier band allocation
- Conducting RF drive testing

Prerequisites

Massachusetts Broadband Institute needs to provide Nortel with information about its licensed spectrum, including any frequency band in use for existing live network and neighboring operators' networks. In

addition, for existing cell sites Massachusetts Broadband Institute needs to provide market-specific information such as site latitude, longitude, antenna height, antenna type and orientation.

1.2 Deploy Services

The following Deploy Services are offered by Nortel.

1.2.1 Site Acquisition

Identification of candidate sites for a designated search area is provided by Site Acquisition. Pending a Notice to Proceed, Nortel will assist with the closing of the purchase or lease agreement with the site owner.

The Nortel Site Acquisition service consists all of the activities necessary to search for suitable site candidates, negotiate a lease and fulfill all necessary legal obligations (e.g., zoning, filing). Site identification is driven by search rings provided by Massachusetts Broadband Institute. The Site Acquisition service will include the following tasks:

- Collocation Site Search and initial approach to site owners and legal authorities:
    - Carrying out an analysis of the market place to ensure full comprehension of national and local regulations to target the most suitable candidates
    - Identifying suitable sites, making contact with site owners and administration and establishing potential interest
    - Understanding the owner's and administration concerns and discussing methods of accommodating reasonable requirements and requests
    - Organizing a site survey with all relevant disciplines
    - Collecting building structural drawings or other relevant documents
    - Photographing the sites for future reference and to support permitting applications
    - Establishing the site candidate folder
- Site Survey
- Lease Negotiation:
    - Working with Massachusetts Broadband Institute to agree realistic lease rates
    - Selling the potential site to the land owner with regard to price and lease
    - Working with residents groups to gain confidence and get support for site objectives
    - Liaising with the Massachusetts Broadband Institute legal team and site provider to develop heads of terms
    - Agreeing heads of terms with site provider
    - Working with Massachusetts Broadband Institute legal team and site provider to finalize lease
    - Getting site providers signature on lease
    - Delivering legal package to Massachusetts Broadband Institute
- Preparation, submission and management of permit applications (Zoning and Regulatory Filings):
    - Working with local authority to gain confidence and get support at macro level for rollout objectives
    - Working with the design team to collate the submissions for permits

  - Managing the permit application through the local authority until permit accepted. If this involves revisions to application, managing these revisions through the design team and Massachusetts Broadband Institute.

- Site Provider Liaison
- Reporting schedule and site status to Massachusetts Broadband Institute on no less than a weekly basis

Deliverables

Site Acquisition may include:

- Identifying the candidate sites followed by the acquisition of the final site
- Providing applicable reports related to zoning and acquisition
- Providing a copy of the final purchase or lease agreement

Prerequisites

Unless Massachusetts Broadband Institute purchases Network Design, Massachusetts Broadband Institute will need to provide necessary search areas to Nortel for locating candidate sites before Site Acquisition begins. In addition, owner name and contact information for any preferred site will need to be provided to Nortel to facilitate the service. Massachusetts Broadband Institute is also responsible for final site selection, payment amount and terms and any applicable bindings.

1.2.2 Site Construction

Architectural and Engineering (A&E) and construction-related activities are included in this service. A&E activities support architectural and engineering requirements in accordance with a purchase or lease agreement. The service also prepares for the physical site construction and may include initial site design, tower loading and structural analysis, land survey, geotechnical services, site restoration, zoning drawings and testimony, environmental services as required by jurisdiction, regulatory filings and building permits

Construction services include physical construction-related activities from initial site build through site acceptance by Massachusetts Broadband Institute. These services may include permitting, construction stakeout, site access, fencing and gating, foundations, site grounding, equipment shelters, commercial electricity, tower construction, crane and boom truck services, geotechnical analysis, waste disposal, antennas and coaxial installation.

Site Construction consists of preparing the site to host power, antennae and transmission. Site Construction is performed by Nortel according to the technical specifications contained in the site engineering documents compliant with international and local standards.

Site construction scope of work includes:

- Site fitting out
- Civil works
- Power
- Aerial (tower mounting, microwave mounting, antenna mounting, etc)
- Earthing system
- Safety plant
- Site acceptance

Prior to any activities commencing on site, all necessary planning and management will be carried out and the site engineering folder will be finalized. The following tasks are examples of the tasks that will be completed:

- Liaison with local authority and site provider regarding commencement of works
- Arrange any special access/lifting requirements
- Pre-order of materials
- Confirm that legal requirements are met
- Final review of site construction deliverables and plan prior to commencement
- Completion of the site construction acceptance dossier and Defect Report (Punch List)

Deliverables

Site Construction may include:

- Physical construction of the site in compliance with A&E specifications and any regulatory or jurisdictional requirements
- Applicable as-built drawings, copies of analyses/reports, zoning, permitting and regulatory filings

Prerequisites

Unless Massachusetts Broadband Institute purchases Site Acquisition, Massachusetts Broadband Institute will need to provide to Nortel a signed purchase or lease agreement between the site owner and Massachusetts Broadband Institute, including applicable site-related documentation (e.g., reports and filings) before Site Construction begins.

1.2.3 Building Studies Engineering (BSE)/Site Engineering

This service includes site design, rack layouts and cabling specification of end-to-end WiMAX network elements (WiMAX BTS, ASN Gateway and CSN Networks)

Deliverables

The Nortel Building Studies/Site Engineering Service is primarily focused on pre-installation planning. Audits and Drawings service is available to Massachusetts Broadband Institute to maximize its facility space availability when Nortel WiMAX-related products (e.g., WiMAX Base Transceiver Station) are installed. Equipment location planning can retain vital space for future equipment while providing existing equipment with proper maintenance and operational clearances. It can also minimize last-minute installation problems that could delay testing and jeopardize in-service schedules. In its most basic form, this service consists of on-site data collection to support creation of AutoCAD floor plan drawings. As a basic service, the BSE Team will perform the following activities generic to both Core and BTS equipment sites.

- Conduct a Site Survey – BSE will physically visit each site and perform the following:
    - Evaluate the site/space for installability and future growth; integrate equipment into given space; perform space planning
    - Capture/document site-specific detail (physical dimensions/construction/existing equipment/etc.)
    - Determine/document applicable demarcation points (i.e., power/ground/transport/Ethernet/RF)
    - Document cable conveyance systems (cable rack and fiber duct)
    - Document grounding system applicable to Nortel equipment
    - Document power system applicable to Nortel equipment

  - Consider access routes and storage capabilities
  - Consider all specific Installation-Related Material (IRM) related to the Nortel standard Installation service

- Customer Drawing Package – BSE will create and present a drawing package to Massachusetts Broadband Institute for approval and use in the installation process.
  - Facility Floor Plan – Documents the typical “halls and walls” and all the equipment in the facility relating to the Nortel equipment network. Nortel equipment will be shown physical orientation and dimensional placement. All applicable demarcation points are identified.
  - Cable Rack Plan – Reflects the cable rack conveyance system in the areas applicable to the Nortel equipment and its application demarcation points. Information about appropriate cable lengths may be either contained in this drawing or forwarded to Engineering via an alternate method.
  - Fiber Duct Plan – Reflects the fiber conveyance system in the areas applicable to the Nortel equipment and its application demarcation points.
  - Grounding Plan – Reflects the grounding system/topology related to the Nortel equipment network.
  - For BTS networks, a digital photographic package is forwarded to Massachusetts Broadband Institute for reference.
- Customer Interface – BSE engages Massachusetts Broadband Institute in terms of preparedness for installation activity
  - Provides Massachusetts Broadband Institute with information related to the equipment’s physical, power, ground and interface characteristics
  - Provide Massachusetts Broadband Institute with information related to demarcation points applicable to the equipment installation
  - Provides Massachusetts Broadband Institute with both general and specific Site Ready criteria: what specific activities and/or information must be complete/available in order to consider the site ready for installation start.

- Installation-Related Material (IRM) Engineering – BSE will engineer a list of material necessary for the successful installation of the Nortel equipment.
  - Provisioning of applicable anchoring systems to secure Nortel equipment
  - Engineering and provisioning of appropriate power conductors/lugs between the Nortel equipment and the Massachusetts Broadband Institute-provided power source terminations (Massachusetts Broadband Institute provides the protection device specific to power system)
  - Engineering and provisioning of appropriate ground conductors/lugs between the Nortel equipment and the Massachusetts Broadband Institute-provided ground reference point (Massachusetts Broadband Institute provides the ground bar and system that references earth)
  - Identifying GPS antenna cable length and mounting hardware
  - Provisioning all other IRM hardware within the mutual scope
  - BTS-specific: Engineering and provisioning RF jumper cables between hatch plate or polyphaser bar to BTS
- Additional services are also available including the following drawing details and services:
  - Complete Site Plan Detail (Drawing)
  - Customer equipment audit and Miscellaneous Relay Rack Detail
  - Cable Rack/Fiber Duct Design and Provisioning
  - Antenna Sector ID and Tower Detail

- Coaxial Cable Entry Port Detail
- Master Ground Bar Detail
- Power and grounding system audit/consultation
- HVAC system evaluation and air distribution consultation

Prerequisites

For successful completion of this service, Massachusetts Broadband Institute needs to provide:

- All current Architectural and Engineering (A&E)-related drawings and floor plan layouts of an existing site
- Massachusetts Broadband Institute space must be available and accessible to perform the site survey
- Cable conveyance systems must either be in place or designed and documented
- Location of demarcation points must be either existing or planned

1.2.4 Warehousing

In addition to offering Massachusetts Broadband Institute a temporary warehouse facility, Warehousing also may include activities such as receiving, put-away, picking or pulling, staging, loading and storage of telecom equipment and ancillary products.

Deliverables

Warehousing may include:

- Collaborating with Massachusetts Broadband Institute to choose a practical, cost-effective warehouse facility for the applicable project markets
- Estimating project warehouse services, including length of stay, space requirements, average handling (in and out), inventory management and dumpster costs
- Providing copies of bill of lading, waybills, transfer of title and appropriate shipping and storage documentation, as required
- Confirming equipment delivery to the warehouse, storage details, order numbers and inventory

Prerequisites

Massachusetts Broadband Institute will need to provide a list of market locations and project details such as the amount of equipment to be stored, equipment ship dates, size of equipment (floor space required), estimated length of time for storage and any special requirements.

1.2.5 Project Logistics

Shipping of equipment and ancillary hardware from the warehouse to Massachusetts Broadband Institute's site is provided by Project Logistics. This service includes delivery of equipment, transportation, labor, dunnage and trash removal and provision of specialized equipment such as a lift gate, boom truck or crane.

Deliverables

In addition to equipment transport and delivery, Massachusetts Broadband Institutewill be provided:

- Copies of bill of lading, waybills and appropriate shipping documentation
- Confirmation of equipment delivery

Prerequisites

Unless Massachusetts Broadband Institute purchases Installation and Commissioning, Massachusetts Broadband Institute needs to provide:

- Complete installation site list, including addresses
- Deployment schedule by site
- Site detail and requirements for successful delivery to final site location

In addition, Massachusetts Broadband Institute needs to provide a single point of contact who will coordinate all activities with Nortel, provide Nortel with a safe working environment, and ensure access to the site, the equipment and the necessary information.

1.2.6 Installation and Commissioning

This service provides Installation and Commissioning of WiMAX BTS, ASN Gateway, Element Management System/Network Management System (EMS/NMS) CSN Networks and Customer Premise Equipment (CPE) terminals.

Deliverables

Nortel will provide Installation and Commissioning services for the supplied elements in the Access, Core and EMS/NMS domains following the relevant installation standards and methods.

Typical activities included in the Installation phase are:

- Unpacking and inventorying the shipped equipment
- Anchoring and mounting into position equipment, racks and cabinets
- Performing system assembly and connecting its peripheral equipment
- Connecting intra- and inter-rack cabinet and equipment cabling
- Connecting to the power supply
- Connecting to the power distribution frame
- Energizing power to the installed equipment
- Performing prescribed procedures to test and verify the hardware in compliance with Nortel or Other Equipment Manufacturer (OEM) installation methodologies and documented procedures
- Completion of Services Completion Notice (SCN) and as-built documentation.

With respect to WiMAX BTS, Nortel offers three levels of BTS Installation and Commissioning (I&C) service:

- **Base:** Available to customers who want only the most basic level of BTS I&C service required to successfully install and commission the BTS. No optional services included, i.e., RF jumpers, GPS antenna.
- **Essential:** In addition to the deliverables provided for Base level, the Essential package provides the following:
    - RF jumper installation for all sectors
    - GPS antenna and cable Installation
- **Comprehensive:** In addition to the deliverables provided for Essential level, the Comprehensive package provides the following,
    - Cable Rack Installation – single tier, up to 50 feet

- o Power Installation (AC or DC system) – AC Electrician for Outdoor BTS configurations

Prior to the commencement of the Installation process, Nortel will schedule delivery of equipment to site in accordance with the project plan milestones, to help ensure that the network elements and all associated hardware required for installation are ready for the turn-up of network equipment.

Prerequisites

Unless Massachusetts Broadband Institute purchases Site Preparation, Massachusetts Broadband Institute needs to complete all agreed-upon site preconditioning activities and provide a site-readiness report. In addition, Massachusetts Broadband Institute needs to provide a single point of contact, who will coordinate all activities with Nortel, provide Nortel with a safe working environment, and ensure access to the site, the equipment and the necessary information.

1.2.7 Initial System Testing and Acceptance

Initial System Testing and Acceptance (lab environment or pilot network): Before the mass network deployment, the WiMAX system is usually tested to verify that all contractual features and functionalities are properly implemented in Massachusetts Broadband Institute's environment, whether in a lab or on a pilot network. Testing will reduce risks of failures in a live network environment to a minimum. By combining system tests from Nortel and Massachusetts Broadband Institute's best practices, the quality will be improved and a time-consuming acceptance phase in the rollout can be avoided.

Initial System Testing and Acceptance activities in this early phase provide the possibility of identifying and resolving potential problems before the commercial rollout. The goal of the test execution is to verify the system's quality and to provide confidence that the system fulfills the requirements for live network introduction.

This service is required for the following scenarios:

- New network implementation
- New software version and/or hardware version (depending on the change) on existing network equipment
- New equipment or system not already existing in the wireless customer's network (Backbone, etc.)

This service does not apply for Network Extension, e.g., addition of new equipment in an already existing network at the same software level. The acceptance testing is a joint activity and involves both Nortel and Massachusetts Broadband Institute personnel.

After the Initial System Testing and Acceptance has satisfactorily passed, the system is ready for rollout and the next phase; Network Integration and Acceptance can start.

Deliverables

This service provides all required tasks to check that all the contractual relevant features and services supported by the system are working properly. Nortel will

- Develop and get Massachusetts Broadband Institute agreement on an acceptance strategy (how to perform the system acceptance in terms of requirements, time schedule, resources, technical aspects)
- Develop and get Massachusetts Broadband Institute agreement on an Acceptance Test plan (ATP)
- Execute the system acceptance tests with Massachusetts Broadband Institute witnesses (this is typically performed in a customer lab environment and/or a representative subset of the network such as a pilot network)

- Monitor a stability period (agreed contractually or during acceptance strategy validation)

Prerequisites

Any relevant Interoperability Testing for third-party-provided systems must be completed before the Initial System Testing and Acceptance can start.

Note: *Because the requirements for Initial System Testing and Acceptance can vary widely among Nortel customers, this service is quoted on specific-job basis (custom quote).*

1.2.8 Network Integration and Acceptance

This service validates that all network elements within the WiMAX network can interwork with each other efficiently. It encompasses seamless integration of various equipment, such as WiMAX nodes, microwave, Optical terminals and OAM platforms. The first step is configuring and integrating hardware and/or software components into an existing or new network. The second step is executing a Network Integration Test Plan to verify that the new components are performing as expected. As a default, Nortel will use its standard test plan (test cases), which it has developed from extensive market deployment knowledge. However, as an optional service, Nortel can follow any mutually agreed customer ATP (custom) to validate the system functionality.

During this Network Integration and Acceptance phase, all WiMAX Network elements are introduced into the network, configured onto and verified through the OAM system. This will help ensure that they are interacting with the rest of the network according to the product and engineering specifications. This phase also helps ensure that all required subsystems, interfaces and configurations are established between the Access and Core network to ensure all traffic flows and call functionality is functioning properly.

Nortel will prepare a Network Integration Strategy document describing the scope, the different steps and time frames before the activity starts on site; will complete a Network Integration Test Plan detailing all the procedures and tests required to complete the activity on site; and subsequent to the completion of the Integration activity will provide a Network Integration Test Report summarizing all tests performed over the course of the activity. This document will be reviewed with Massachusetts Broadband Institute.

Nortel has developed a robust and comprehensive set of criteria for assessing the performance of the WiMAX Network. Nortel will determine, in collaboration with Massachusetts Broadband Institute, what the most appropriate criteria are for Massachusetts Broadband Institute needs and will adapt the acceptance processes to meet Massachusetts Broadband Institute requirements.

The standard criteria to consider Network Integration and Acceptance as completed are the following:

- No critical Customer Service Request (CSR) opened
- No major CSR opened without a temporary satisfactory workaround in place and a committed plan for definitive resolution
- Existing Minor CSRs: These CSRs will not prevent Network Integration from being signed off by Massachusetts Broadband Institute

Any deviation from these criteria is subject to specific agreement between Nortel and Massachusetts Broadband Institute.

Deliverables

Network Integration and Acceptance may include:

- Implementing the integration plan and component configuration that Nortel has created for the network hardware and/or software components
- Collecting additional configuration data and updating the detailed logical design, as necessary

- Verifying that all components are interworking properly
- Executing the Nortel standard Network Integration Test Plan (NITP) or developing and executing a customized ATP
- Reporting test results from the NITP/ATP and providing recommendations

Prerequisites

The following must be completed for service to begin:

- Initial System Testing and Acceptance has been passed successfully.
- Massachusetts Broadband Institute needs to complete all mutually agreed-upon activities and provide a site-readiness report prior to Nortel arriving on site. Massachusetts Broadband Institute needs to designate a dedicated site contact, provide Nortel with a safe working environment, and ensure access to the site, the equipment and the necessary information.

The service excludes any Interoperability Testing (IOT) required between Nortel-supplied equipment and third-party elements, which is usually performed in a lab environment and field tested prior to the market deployment.

WiMAX BTS

Network Integration Service for WiMAX Base Transceiver Station (BTS) integrates the BTS within the WiMAX network. As part of this service, the WiMAX BTS will be configured according to the specification from network engineering and the interworking of the BTS within the WiMAX solution is verified according to the Nortel product specification. The BTS will be integrated at the associated OAM platform Element Management System (EMS) and towards the Nortel Access Service Network Gateway (ASN-GW).

The service will help to ensure that the BTS functions properly as part of the end-to-end network system. Therefore, after successful network integration, a functional testing according Nortel test specification is performed. When these tests are successfully performed, the network integration service is considered as complete, acceptance is achieved and the BTS will be handed over to the operating team. The sequence of events followed to deliver this service will vary depending on the actual equipment and specific needs of Massachusetts Broadband Institute.

Deliverables

Deliverables for this service include:

- The specific documentation required to perform this service
- Configuration of the WiMAX BTS with the appropriate datafill
- Integration of the WiMAX BTS into the ASN-GW
- Performing functional testing
- Handover to the operating team

Prerequisites

The following must be completed for service to begin:

- Installation and commissioning of the BTS has been performed. The BTS is ready for integration.
- Applicable datafill and engineering documents are available.
- All third-party or Massachusetts Broadband Institute equipment and software that are needed to perform the network integration of the WiMAX BTS are ready (microwave links, routing entries in the core, etc.)

- The WiMAX core network is updated and is ready to be connected to the ASN-GW

ASN Gateway

Network Integration Service for ASN Gateway integrates the ASN-GW within the WiMAX network.

Deliverables

Deliverables for this service include:

- The specific documentation required to perform this service
- Configuration of the ASN-GW with the appropriate datafill
- Integration of the ASN-GW at the OAM platform EMS/NMS
- Integration of the ASN-GW into the core network
- Performing functional testing according Nortel Standard Test Plan
- Handover to the operating team

Prerequisites

The following must be completed for service to begin:

- Installation and basic commissioning of the ASN-GW has been performed. The ASN-GW is remotely reachable and ready for integration.
- Applicable datafill and engineering documents are available.
- All third-party or Massachusetts Broadband Institute equipment and software that are needed to perform the network integration of the ASN-GW are ready (appropriate links, routing updates in the core network, etc.).
- One WiMAX BTS is ready for integration and available for connection to the ASN-GW.
- The WiMAX core network is updated and is ready to be connected to the ASN-GW.

1.2.9 RF Optimization

Nortel will provide the required RF optimization and validation for Massachusetts Broadband Institute's deployed WiMAX base stations. Testing will involve field measurements, with the aim of benchmarking and validating the RF coverage design provided by Massachusetts Broadband Institute. Nortel RF Optimization services maximize the network performance of Massachusetts Broadband Institute's WiMAX network where possible by minimizing coverage holes and RF Co-channel interference. Prior to beginning RF optimization, Nortel will reach agreement with Massachusetts Broadband Institute on the entry and exit criteria for successful completion of the testing. As a general practice, Nortel recommends commencing RF optimization testing when 85 percent of the network BTSs are successfully installed and integrated with the WiMAX network.

Deliverables

- Performing RF optimization/coverage verification drive testing of the new BTS, carrier and radio as necessary. Nortel will perform two rounds of optimization. Testing will verify the designed coverage of the network and average user throughput.
- Performing RF static location testing for a number of test locations not to exceed 20 percent of the total BTS site count. Tests to include golden value (maximum value obtainable under Line of Sight [LOS] condition) throughput measurements.

- Performing necessary Call Path or Call Trace analysis along with analysis of logged system protocol data as necessary for network optimization.
- Performing data analysis and recommending software (i.e., datafill) and hardware (i.e., antenna system) modification
- Implementing any network modification by working with Massachusetts Broadband Institute on approved changes.
- Providing all necessary Geographic Information System (GIS) data such as terrain, cluster and vector databases for roads, major highways, digital elevation, and land-use classification at necessary surface pixel resolution.
- Providing all final collected optimization data.

Prerequisites

If RF Design service is not purchased from Nortel, Massachusetts Broadband Institute needs to provide the RF cell site database containing site latitude, longitude, antenna height, antenna type, antenna orientation and any other pertinent information, including available tuned propagation models, market CW drive test data, design assumptions and optimization requirements for the wireless network being deployed prior to commencing this service. Massachusetts Broadband Institute is also responsible for providing test terminals, any necessary IP addresses and antenna crews to implement approved antenna modifications, e.g., azimuth, elevation or tilt.

1.2.10 Project Management

For this service, Nortel will design, coordinate and manage delivery of complete network solution within a pre-agreed timeline and financial targets. Nortel will provide a Project Manager to plan, coordinate and manage Massachusetts Broadband Institute-specified deployment activities to help ensure the overall achievement of scheduling, financial and quality objectives.

The Project Manager will use ISO 9001:2000 and TL 9000 certified processes and will be located at the Massachusetts Broadband Institute site or a Nortel location based on Massachusetts Broadband Institute preference and project needs. If on-site project management is required, Nortel can place a Project Manager on-site for an additional cost to Massachusetts Broadband Institute.

Deliverables

A Nortel Project Manager's responsibilities will vary from project to project and are dependent upon project size and complexity. In general, the Project Manager will be responsible to both Massachusetts Broadband Institute and Nortel to help ensure successful implementation of the project SoW, achieving schedule, cost and quality objectives. Typically, a Project Manager will:

- Act as a single point of contact for the project team, facilitating effective resource management, escalation, approvals process, scheduling, communication and reporting. If multiple project managers are required, Nortel will assign a Lead Project Manager who will be responsible for the overall project, providing direction to the team and for handling the higher-level contact with Massachusetts Broadband Institute.
- Manage the project scope through implementation of the change management plan. This includes confirming Massachusetts Broadband Institute understanding of the process and working closely with Massachusetts Broadband Institute to manage any scope changes through the term of the project and understanding their impact on the project performance from a cost, quality, and schedule perspective.
- Understand, define, review, analyze and provide project coordination from ordering a solution through installation and turnover of the solution.
- Identify project milestones for supporting vendors, incorporate into project plan, monitor and provide escalation as required.

- Develop and maintain the project schedule, which will include a Work Breakdown Structure (WBS). The WBS is a matrix of all project activities and deliverables, including estimated timetables, task prerequisites and interdependencies plus identification of critical path items and status.
- Establish a Responsibility Assignment Matrix identifying primes for all key project deliverables (Massachusetts Broadband Institute and Nortel). The matrix structure relates the project's organizational structure to the WBS, helping to ensure that each element of the project's scope of work is assigned to a responsible party.
- Establish a communications plan that facilitates regular and managed exchange of information both within and between Massachusetts Broadband Institute, Nortel and vendor staff. The plan will include the identification of critical project documentation and information and how this information will be maintained, accessed and distributed, including the method and timing of regular project status updates and meetings.
- Generate periodic reports concerning project issues and progress status as specified in the agreed-upon communications plan.
- Manage project risk through risk identification, quantification and mitigation.
- Organize and chair meetings and conference calls to assign tasks, evaluate progress and address issues, as appropriate.
- Establish and manage a Nortel Project Team that will provide timely and effective execution of project requirements.

Prerequisites

For successful completion of this service, Massachusetts Broadband Institute will need to:

- Provide a single point of contact who will interact directly with the Nortel Project Manager and who will be accountable for any Massachusetts Broadband Institute actions agreed to by Massachusetts Broadband Institute's project team.
- Act in concert with the Nortel Project Manager in a partnering relationship to address project deliverables in the overall project plan for Massachusetts Broadband Institute.
- Track Massachusetts Broadband Institute internal (and Massachusetts Broadband Institute's contractor) milestones. The overall project plan generated by the Nortel Project Manager will show Massachusetts Broadband Institute's major deliverable milestones, but not internal milestones of Massachusetts Broadband Institute or Massachusetts Broadband Institute's contractors. Tracking of Massachusetts Broadband Institute's and Massachusetts Broadband Institute's contractor internal milestones will remain the responsibility of Massachusetts Broadband Institute's project manager.
- Have appropriate staff available for regular consultation and meetings with the Nortel Project Manager.
- Provide contact names and related information for project-related operations.
- Provide detailed status of project efforts currently underway (or proposed), including contact and vendor information, project status and any relevant technical and business information that will have an impact on the progress of the project.

1.3 Optional Deployment Services

Nortel can also provide the following optional services to Massachusetts Broadband Institute to facilitate WiMAX network deployment.

- Installation of WiMAX CPE for 802.16d
- Installation of WiMAX BTS Antenna, Remote Radio Head (RRH)/Outdoor Unit (ODU) and Cable System
- Microwave Installation, Commissioning and Integration

- Installation and Commissioning Services for Three Sector to Six Sector BTS Conversion
- Installation and Commissioning of new D.C. Power Plant
- Hut Installation Services

2 Key Performance and Service Levels

This section defines the Key Performance Indicators (KPIs) and Service-Level Agreements (SLAs) against which the project scope will be measured.

2.1 Key Performance Indicators (KPIs)

Product KPIs include:

- Call Setup Time
- Round Trip Delay

Network KPIs include:

- Accessibility rate
- Latency/jitter
- Network throughput

2.2 Service-Level Agreements (SLAs)

No SLAs apply to this service.

3 Roles and Responsibilities

This section defines the detailed Nortel and Massachusetts Broadband Institute responsibilities needed to successfully complete the project. The responsible party is accountable for delivering the specific activity defined in section 1.

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
Design Services				
Overlay Planning (ref. section 1.1.1)				
Custom	Custom			
System Validation (ref. section 1.1.2)				
Custom	Custom			
Technical Governance (ref. section 1.1.3)				
Custom	Custom			
Network Design (ref. section 1.1.4)				
RF Design (RF Engineering)				
1. Perform Continuous Wave (CW) drive testing for up to 15% of the total anticipated BTS count for propagation model tuning	X			
2. Perform propagation model tuning for the new network	X			
3. Define applicable link budgets	X			
4. Analyze the traffic distribution/ capacity and interference for the design	X			
5. Determine search areas for new Base Transceiver Stations	X			
6. Issue search rings for candidate site validation	X			
7. Provide a preliminary design list to Massachusetts Broadband Institute indicating the candidate site locations for new sites	X			
8. Conduct RF site visits of the candidate site list to validate RF viability. Only two locations will be visited for each candidate search area.	X			
9. Conduct final candidate site analysis and produce an evaluation list defining	X			

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
recommended new network site locations for Massachusetts Broadband Institute				
10. Conduct appropriate frequency planning and interference analysis	X			
11. Provide necessary coverage design for each added BTS, carrier or radio	X			
12. Datafill RF parameters and neighbor list as per the design	X			
13. Provide a single point-of-contact for the Nortel team leader		X		
14. Provide all necessary design requirements for the network		X		
15. Provide information on any special requirements such as service in high-volume areas, i.e., hot spots		X		
16. Provide information on preferred sites, including any zoning restrictions		X		
17. Provide written approval of Nortel design prior to implementation and any testing		X		
18. Provide cranes at the testing sites		X		
19. Perform and provide antenna sweep test results for review				
20. Provide information on sites or service areas with security concerns where special arrangements may be necessary to conduct tests		X		
21. Provide Nortel engineers with a sufficient number of activated and non-billable test terminals		X		
Network Engineering (WiMAX BTS, ASN, NMS and Core Networks, i.e., AAA, HA, DHCP, DNS, PF)				
1. Provide to Nortel all requested inputs to complete of the Hardware and Configuration CIQ in a timely manner Provide S6 tab information for end to end connectivity information to complete Physical layer design Provide IP address required by Nortel. If Nortel is doing IP planning, please provide IP range requested by Nortel Provide network-specific parameters, which require specific		X		

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
detail inputs such as QoS etc.				
2. Approve Nortel Design document in writing prior to implementation and delivery phases of this service		X		
3. Provide sufficient and qualified engineering support during the planning, analysis and implementation phases, as required by Nortel		X		
4. Provide access by Nortel to Massachusetts Broadband Institute's single point of contact during the scope of the project, as well as during the planning and implementation phases		X		
5. Provide all required personnel resources identified in the contract and project plan to support the deployment and implementation		X		
6. Provide equipment access, documentation, and other required support if Nortel WiMAX products are to interface with any other third-party equipment		X		
7. Capture network design inputs based on Massachusetts Broadband Institute's required capacity and hardware configuration (i.e. seismic zone requirements, redundancy scheme, clocking source, etc.) and connectivity requirements	X			
8. Initiate meeting with internal project management team to make sure all inputs are captured from Massachusetts Broadband Institute to initiate the Network Design and Engineering	X			
9. Provide Network Design Document and Dimensioning based on: Capacity evaluation for required hardware elements Detailed list of software required Detailed list of hardware required Network diagrams reflecting the physical location of hardware and card and shelf layouts, where necessary	X			
10. Network Software Configuration CIQ (for ASN and NMS network)	X			

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
IP addressing scheme Hardware Parameter settings				
Provide Network Design status report as necessary according to the SoW	X			
Spectrum Clearing and Testing (ref. section 1.1.5)				
1. Clearance of the spectrum		X		
2. Define drive route for spectrum testing		X		
3. Conduct field drive testing and data measurement	X			
4. Analyze test data and provide the result	X			
5. Coordination with the neighboring operators etc.		X		
Deploy Services				
Site Acquisition (ref. section 1.2.1)				
1. Provide database containing preferred co-location cell sites and owner details.		X		
2. Release search rings for site acquisition		X		
3. Site Selection Procedure	X			
4. Site Search and initial approach to site owners, and legal administrative authorities	X			
5. Lease Negotiation	x			
6. Preparation, submission and management of permit applications (zoning and regulatory filings)	X			
7. Site Provider Liaison and reporting to Massachusetts Broadband Institute	X			
8. Final approval of the site, including payment terms		X		
Site Construction (ref. section 1.2.2)				
1. Physical construction of the site in compliance with A&E specifications and any regulatory or jurisdictional requirements as per SoW	X			
2. Applicable as-built drawings, copies of analyses/reports, zoning, permitting and regulatory filings as	X			

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
per SoW				
BSE/Site Engineering (ref. section 1.2.3)				
1. Conduct site visit	X			
2. Provide floor layout plan	X			
3. Identify cable rack/fiber raceway layout, demarcation point	X			
4. Power consumption analysis	X			
5. Provide Installation Related Materials (IRM)	X			
6. Provide access to the cell site location		X		
7. Preferences on BTS orientation or location		X		
8. Clearance/Future space requirements for the site		X		
Warehousing (ref. section 1.2.4)				
Custom	Custom			
Project Logistics (ref. section 1.2.5)				
Custom	Custom			
1. Provide complete installation site list including addresses and contact information		X		
2. Provide deployment schedule by site		X		
3. Provide access into facilities for delivery of product		X		
4. Provide unique site specific delivery requirements		X		
5. By-road transportation for inside and/or outdoor delivery	X			
6. Provide resources for the last mile delivery	X			
7. Responsible for dunnage removal	X			
Installation and Commissioning (ref. section 1.2.6)				
Unless Massachusetts Broadband Institute purchases Site Preparation, Massachusetts Broadband Institute must complete all agreed-upon site preconditioning activities and provide a site-readiness report prior to Nortel Field Technician being on site.		X		

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
WiMAX BTS – Base Level				
1. Provide environmentally controlled warehousing for all hardware, including warehouse management personnel and movement of the BTS hardware within the warehouse		X		
2. Provide all permits necessary for installation site construction, installation, electrical and communication connections and service activation		X		
3. Provide unobstructed access to install BTS with space for maneuvering the BTS		X		
4. Unless Massachusetts Broadband Institute purchases Nortel WiMAX backhaul deployment services, Massachusetts Broadband Institute must install WiMAX BTS site backhaul, test and provide test results provided to Nortel, and backhaul left in a loopback condition		X		
5. Unless Massachusetts Broadband Institute purchases Nortel Antenna and Cable installation services, Massachusetts Broadband Institute is responsible for installing the antennas, cables systems, RRH/ODU and/or tower/pole facilities		X		
6. Provide installation and commissioning tools	X			
7. Receive delivery of equipment at cell site, inventory, verify hardware configuration against site specifications	X			
8. Mount, level and secure the BTS equipment frames	X			
9. Power up BTS and perform commissioning	X			
10. Provide and install hatch plate and any lighting protection suppressor hardware.		X		
11. Provide, install, and label the cables required for the communication links, i.e. microwave or fiber backhaul interconnect, and alarms in sufficient length to be terminated to BTS		X		
12. Crane, boom truck, helicopter, forklift or any special-delivery system		X		

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
13. Power applications: Indoor DC plant application: Massachusetts Broadband Institute provides DC power plant and open breakers/fuse positions, including installation of power cable to the BTS. Massachusetts Broadband Institute provides to the BTS the DC power including all cable work, all tests, DC Breaker, etc. Nortel will only connect the DC power cable to the BTS. Indoor AC application: Massachusetts Broadband Institute is responsible to install and terminate AC from feeder box to BTS in accordance with governmental and/or local electrical/telecommunications regulatory codes (installation of AC cable) Outdoor AC application: Massachusetts Broadband Institute is responsible to install AC from commercial AC feeder to the BTS and terminate the AC to the BTS in accordance with governmental and/or local electrical/telecommunications regulatory codes (installation of AC cable)		X		
14. Provide grounding bar with connection to earth ground with open ground bar positions allowing frame grounding of BTS. Provide labels or color-code scheme identifying transmit and receive antenna cables at the hatch plate (i.e., sector and main and diversity identifiers).		X		
15. Provide and install any required cable ladder to support RF cables with unobstructed access between antenna hatch plate and BTS. Provide and install any required cable ladder to support power and ground cables with unobstructed access between power plant and BTS.		X		
16. Provide access to the installation sites 24 hours a day, seven days a week, except if such sites are otherwise restricted beyond control		X		

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
of < Customer>. Nortel personnel will provide Massachusetts Broadband Institute with 24 hours' advance notice of the need for access in cases where restrictions exist beyond control of Massachusetts Broadband Institute.				
17. AC feeder amperage capacity sizing is not provided as part of BTS I&C Services. Nortel Site Engineering will inform Massachusetts Broadband Institute about the Nortel BTS power and amperage (Amps) requirements. Massachusetts Broadband Institute is responsible for working with its local power company to determine the AC feed capacity.		X		
18. Provide and install all required commercial AC power and associated fixtures including, but not limited to, AC panels, AC circuit breakers, AC fuses, building wiring, convenience outlets, lighting, and AC grounds. All electrical facilities must conform to governmental and local codes to ensure a safe work environment.		X		
19. A grounding system, including am MGB and all subsequent connections to the ground field, needs to be provided by Massachusetts Broadband Institute to the Nortel-provided hardware at each installation site. The ground fields must measure 5 ohms or less, unless otherwise specified. An antenna sweep is successfully completed and all test results are performed in accordance with Nortel requirement and are accepted by Nortel. Successful testing of ground systems is completed in accordance with applicable governing standards. Massachusetts Broadband Institute-labeled circuits, alarms, RF coax/cables, power and grounding is completed at the time of installation.		X		
20. Provide, install, and label the cables required for the communication links i.e., T1/Microwave/Ethernet, and alarms in sufficient length to be terminated to BTS		X		

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
21. Provide Network Interface Unit at cell site for Nortel to terminate T1/Micro-wave/Ethernet communication cable between BTS		X		
22. Provide an unobstructed location to mount the GPS Antenna with a clear view of the sky down to 10 degrees above the horizon		X		
23. Install lightning rod within 6 feet of and with the tip at least 6 feet above the top of the GPS antenna		X		
24. Install any required indoor lightning protection surge suppressors		X		
25. Install any required line amplifiers		X		
26. Install cable ladder racking infrastructure required to support BTS system or power cabling		X		
27. Refuse station to discard packaging material originating from BTS installation		X		
28. Sign the Customer Services Completion Notice (SCN) provided by Nortel to confirm completion of Nortel BTS I&C Services		X		
29. Notify Nortel in writing of any defects with Nortel BTS I&C Services within 30 days of the date on which Nortel provided its signed SCN to Massachusetts Broadband Institute if making a warranty claim		X		
30. Nortel will install, secure and terminate DC power and ground cable at the BTS in accordance with governmental and/or local electrical/telecommunications regulatory codes, provided the DC power outlet is in the BTS room	X			
31. Terminate Massachusetts Broadband Institute-provided alarm cable to agreed-upon demarcation alarm points	X			
WiMAX BTS – Essential Level (additional activities beyond Base Level): • RF coax jumpers custom-measured to site configuration, cut to length, and RF connectors installed. • RF coax installed between antenna main line demarcation (hatch plate) to BTS termination points. Please note that solder-type RF coax connector jumper installation is excluded from this	X			

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
scope, but can be provided at an additional cost. • GPS Antenna and Cable Installation. Installation of the GPS antenna mount and antenna (not more than 10 feet in height above the surrounding surface area), cable, and lighting protection surge suppressors (placed inside for the Outdoor cabinet if cable is beyond 10 feet). Mounting options for the GPS antenna include weather-bridge, tripod, pipe-to-pipe, or wall mount.				
WiMAX BTS – Comprehensive Level (additional activities beyond Essential Level): • Indoor AC BTS Configuration – AC Power Installation: • AC power installation from AC feed breaker panel and terminated to Indoor BTS in accordance with governmental and/or local electrical/telecommunications regulatory codes • Outdoor AC BTS Configuration – AC Power Installation: AC power installation from AC feed breaker panel and terminated to Outdoor BTS in accordance with governmental and/or local electrical/telecommunications regulatory codes	X			
WiMAX ASN Gateway (applicable to 16e)				
1. Physical installation of WiMAX ASN Gateway and any associated peripherals (e.g., cables, power supply)	X			
2. Power up WiMAX ASN Gateway, load and configure applicable Software	X			
WiMAX EMS/NMS				
1. Physical installation of WiMAX EMS/NMS server and any peripherals	X			
2. Power up WiMAX EMS/NMS server, load and configure applicable software	X			
WiMAX CSN Networks (AAA, HA, DHCP, DNS, PF)				

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
1. Physical installation of WiMAX CSN network and any associated peripherals e.g. cables, power supply.	X			
2. Powering up and testing of the CSN network element as per the Nortel approved Installation Method	X			
Initial System Testing and Acceptance (ref. section 1.2.7)				
1. Develop and agree on an acceptance strategy (how to perform the system acceptance in terms of requirements, time schedule, resources, technical aspects, etc.)	X			
2. Develop and agree on an Acceptance Test Plan (ATP)	X	X		
3. Execute the system acceptance tests with Massachusetts Broadband Institute witnesses (This is typically performed in a customer lab environment and/or a representative subset of the network such as a pilot network)	X			
4. Monitor a stability period (agreed contractually or during acceptance strategy validation)	X			
Network Integration and Acceptance (ref. section 1.2.8)				
WiMAX BTS				
1. Develop a test plan that will address BTS feature functionality and reporting.	X			
2. Assign an on-site Nortel technician to perform the tests and record the results. As part of this service, the BTS will be configured according to the specification from network engineering and the inter-working of the BTS within the WiMAX solution is verified accordingly to the Nortel product specification. The BTS will be integrated at the associated OAM platform (Element Management System) and towards the Nortel ASN-GW (Access Service Network Gateway).	X			
3. Test the system to baseline system functionality throughout the various stages of the project.	X			
4. Perform BTS functional testing. Integrates the BTS within the WiMAX network.	X			

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
5. Provide a contact to handle transport or backhaul issues throughout the test phase.		X		
6. Review and return the database Customer Input Questionnaire (CIQ) prior to network integration work being scheduled.		X		
7. Assign one technical representative to witness functional testing as testing is performed, and sign off upon completion.		X		
8. Any testing and integration with micro-wave and optical fiber elements, unless purchased separately.		X		
9. Provide equipment access, documentation, and other required support if Nortel WiMAX products are to interface with any other third party equipment		X		
WiMAX ASN Gateway (applicable to 16e)				
1. Providing the specific documentation required to perform this service.	X			
2. Configuration of the ASN Gateway with the appropriate datafill	X			
3. Integration of the ASN Gateway at the OAM platform EM / NMS	X			
4. Integration of the ASN Gateway into the core network	X			
5. Perform functional testing according Nortel Standard Test Plan	X			
6. Handover to the operating team	X			
WiMAX EMS/NMS				
1. Provide all applicable third-party equipment and licensed software, e.g., Oracle Database		X		
2. Provide the specific documentation required to perform this service	X			
3. Configuration of the EMS/NMS with the appropriate datafill	X			
4. Integration of the EMS/NMS into the core network	X			
5. Perform functional testing according Nortel Standard Test Plan	X			

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
6. Handover to the operating team	X			
RF Optimization (ref. section 1.2.9)				
1. Provide RF design of the WiMAX network if purchased from Nortel. Otherwise, Massachusetts Broadband Institute is responsible for providing RF design, including RF Database information prior to RF Optimization service	X			
2. Develop drive routes for RF coverage validation and optimization	X			
3. Perform necessary drive testing and static field measurements	X			
4. Analyze field data and provide recommendation	X			
5. Approve hardware (antenna modification) or software changes		X		
6. Provide tower crew to perform approved antenna adjustment		X		
7. Provide Nortel engineers with a sufficient number of activated and non-billable end-user test terminals, along with test IP addresses, where applicable		X		
Project Management (ref. section 1.2.10)				
1. Provide Remote Project Management. Nortel Project Management service includes travel and living (T&L) expenses for a reasonable number of on-site visits Typically, this would involve one or two on-site visits to Massachusetts Broadband Institute in a month	X			
2. Provide the focus of team communications between Nortel, Massachusetts Broadband Institute, and other vendors to achieve the desired outcome for the project.	X			
3. Review and accept purchase order as provided in the applicable agreement	X			
4. Manage the vendor contractual paperwork and projects requirements as outlined in the applicable contract	X			
5. Coordinate and manage those products and services specified in the statement of work, including schedule, financial and quality	X			

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
objectives, as agreed with Massachusetts Broadband Institute				
6. Use proven project and resource management processes and tools, such as risk identification, response development and control, to manage project activities and to drive appropriate actions throughout the life of the project.	X			
7. Understand, review, and analyze the project requirements by providing overall project management through engineering, installation, turnover, and acceptance of the solution	X			
8. Implement a comprehensive Project Plan, approved by Massachusetts Broadband Institute and communicated to all key stakeholders	X			
9. Provide accountability to both Massachusetts Broadband Institute and Nortel for the successful delivery of all elements of the Project Plan, including the statement of work, schedule, cost, and quality targets	X			
10. Act as a single point of contact for Massachusetts Broadband Institute and Project Team by providing overall project direction and effective resource management, scheduling and communication	X			
11. Facilitate timely issue resolution using established escalation and approvals processes	X			
12. Manage project risk using the project Risk Management Plan	X			
13. Help ensure periodic operational and financial reporting is delivered as specified in the Communications Plan	X			
14. Provide project management support for the duration of the project, or as agreed with Massachusetts Broadband Institute	X			
15. Establish and manage a Nortel Project Team, helping to ensure effective resource allocation necessary to deliver the project requirements to the required quality and schedule objectives	X			

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
16. Develop a Project Plan that is based on the contractual terms and approved Statement of Work. The project will be managed according to this Project Plan, which will be used to track and report the progress of individual tasks.	X			
17. Project Schedule will include key milestones, activity durations, dependencies, responsibilities, and progress. It will include the major customer's and supporting vendors' activities and deliverables, as applicable.	X			
18. Communications Plan will facilitate a regular and managed exchange of information between Nortel, Massachusetts Broadband Institute, and Massachusetts Broadband Institute's vendors, as appropriate.	X			
19. Responsibility Assignment Matrix will be based on the approved statement of work, which identifies the primes for all major project deliverables (Massachusetts Broadband Institute's, Massachusetts Broadband Institute's vendors and Nortel)	X			
20. Change Management Plan will include the means by which Nortel and Massachusetts Broadband Institute will manage the project scope during the project's life cycle	X			
21. Quality Plan will be in accordance with the Nortel Quality Plan to help ensure the compliance of project activities	X			
22. Provide recommended training plan as outlined contractually for resources associated with post launch maintenance	X			
23. Ensure the smooth functioning of Nortel furnished network elements until the Acceptance Form has been signed	X			
24. Initiate any operation and maintenance services purchased from Nortel	X			
25. Develop Project Schedule, Communication Plan, Responsibility matrix, Risk and Quality management plans agreed by all parties	X	X		
26. Analyze and determine equipment list and services required to carry	X	X		

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
out the implementation				
27. Provide Project Management tools, software and other materials to perform the management of responsibilities	X	X		
28. Establish problem resolution through documented and agreed upon escalation process for Nortel, third-party vendor and Massachusetts Broadband Institute	X	X		
29. Facilitate problem resolution through documented and agreed upon escalation process for Nortel, third-party vendor and Massachusetts Broadband Institute	X	X		
30. Have appropriate staff available for regular consultation and meetings	X	X		
31. Reports status, track progress on a per market basis	X	X		
32. Provide detailed status of project efforts currently underway (or proposed), including any relevant technical and business information that would have an impact on the progress of the project	X	X		
33. Manage the progress of individual tasks within the third-party contractors statement of work	X	X		
34. Resource management for third-party build vendor statement of work	X	X		
35. Provide a single point of contact to interact with the Nortel Project Manager and to be accountable for any actions or agreements between Nortel, Massachusetts Broadband Institute and Massachusetts Broadband Institute's vendors		X		
36. Provide and maintain a detailed customer and customer's vendors contact list		X		
37. Maintain a partnering relationship with the Nortel Project Manager to achieve project objectives and complete deliverables within the framework of the overall Project Plan		X		
38. Allocate resources to be available for regular consultation and meetings with the Nortel Project Manager		X		
39. Track all Massachusetts		X		

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
Broadband Institute milestones, including those of the customer's vendors. The overall project schedule generated by the Nortel Project Manager will include only the major deliverables and milestones assigned to the customer or its vendors. The p				
40. Maintain an up-to-date status report detailing proposed or ongoing activities. The status will include any relevant technical and business information that may affect the progress or the cost of the project.		X		
41. Act as a single point contact for the project management Massachusetts Broadband Institute-provided third-party vendors		X		
42. Massachusetts Broadband Institute will manage and complete its deliverables, and ensure that its vendors complete the deliverables undertaken on behalf of Massachusetts Broadband Institute, in accordance with the agreed Project Plan.		X		
43. Any issues the Nortel Project Manager identifies as being issues related to the customer or its vendors, will be escalated to the Massachusetts Broadband Institute prime for resolution.		X		
44. Additional costs incurred by Nortel to deliver this Project Management service because Massachusetts Broadband Institute or its vendors have been unable to meet commitments that are agreed and included in the Project Plan, e.g., site not ready for installation start		X		
45. Provide at no charge test phones in the quantities identified by Nortel I&C, and Network Integration teams necessary to perform testing activities		X		
46. Provide Site Access including directions, Keys and/or Key Codes. Nortel will sign for keys and return upon completion of project.		X		
47. Provide contact names and related information for operations		X		
48. Provide contacts for existing power/Telco/fiber-optic companies		X		
49. Act in concert with the Nortel Project Managers in a partnering		X		

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
relationship to address deployment deliverables in the overall project plan				
50. Provide resource management for Massachusetts Broadband Institute deliverables		X		
51. Manage spare parts as soon as the network acceptance has passed		X		
52. Authorize and approve any billable job change orders (JCO) in a timely fashion so as not to impact the project schedule.		X		
53. Facilitate the approval process for invoicing between Massachusetts Broadband Institute and Nortel		X		
Optional Services (ref. section 1.3)				
Installation of Outdoor WiMAX CPE				
1. Install Outdoor CPE	X			
2. Install indoor Subscriber Data Adapter (SDA) as applicable	X			
3. Installation of CAT 5 cable between CPE and SDA as applicable	X			
4. Install CAT 5 cable between SDA and end user as applicable		X		
WiMAX BTS Antenna, RRH/ODU, and Cable System				
Antenna and Cable System				
1. Provide full access to all locations included in this project for the duration of the project during regular hours and after hours as necessary		X		
2. Provide site permits including lease, NEPA, Architecture and Engineering requirements		X		
3. Provide necessary hardware materials at the site prior to Nortel personnel on site		X		
4. Installation of all antenna, cable, grounding, cable raceway and antenna mounting hardware. Services do not include civil work, i.e., concrete, frames, demark, trenching or NEMA box placement.	X			
RRH/ODU				
1. Provide full access to all locations included in this project for the		X		

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
duration of the project during regular hours and after hours as necessary				
2. Provide site permits including lease, NEPA, Architecture and Engineering requirements		X		
3. Provide necessary hardware materials at the site prior to Nortel personnel on site		X		
4. Installation of RRH/ODU including cable/power system connecting to RRH/ODU. Services do not include civil work, i.e., concrete, frames, demark, trenching or NEMA box placement, or Antenna, or Antenna cable system installation.	X			
Microwave Installation, Commissioning and Integration				
1. Installation of radio rack and radio terminal equipment	X			
2. Installation of standard transmission line per site	X			
3. Sweep of transmission system for configurations with and without antenna	X			
4. Installation of a face-mounted antenna bracket	X			
5. Mounting of a 6 ft directional dish antenna. Larger antennas will attract a cost premium.	X			
6. Path alignment of both radio end sites	X			
7. 24 Hour BER Rate test based on a loopback test	X			
8. Provide all materials required for a microwave system including but not limited to radio equipment, radio cabling, transmission lines, dish antenna, antenna tower mounts and appropriate brackets		X		
9. Perform path surveys or equivalent path analysis to ensure path has radio line of sight, and free of obstructions		X		
10. Provide radio system configuration and frequency assignments		X		
11. Ensure DS1s are tested at the same time of loopback testing		X		
12. Delivery of all material to site		X		
13. Site access for installation crews		X		

Activity	Nortel	Massachusetts Broadband Institute	Other Vendor	Notes
Installation and Commissioning Services for Three-Sector to Six-Sector BTS Conversion				
1. Order appropriate antennas and make it available at timely manners	X			
2. Warehousing BTS and Antenna systems	X			
3. Acceptance of BTS equipment delivery at the cell site	X			
4. Install incremental BTS hardware equipment	X			
5. Re-orient, relocate or replace the existing antennas		X		
6. Install additional antenna systems		X		
7. Power up BTS and perform commissioning	X			
8. Dunnage removal	X			
Installation and Commissioning of new DC Power Plant				
Install and test new and complete power plant, including batteries, battery strapping, Power Plant racks, rectifiers (and float), breakers/fuses	X			
Hut Installation Services				
1. Storing Hut at customer's market warehouse		X		
2. Site Preparation – Concrete foundation and grounding	X			
3. Shipping Hut to Massachusetts Broadband Institute's Market Warehouse	X			
4. Last Mile Delivery of Hut	X			
5. Mounting of the Hut on the concrete foundation	X			

4 Assumptions and Acceptance

This section clearly defines the criteria that Nortel must fulfill to successfully achieve the critical project acceptance milestones. These acceptance milestones will be directly linked to the payment milestones as defined in the contract/purchase order.

Any acceptance milestones not directly linked to payment milestones are considered internal milestones and will not be captured as acceptance criteria.

4.1 Assumptions

The following assumptions govern the delivery of **Design and Deploy Services for WiMAX 16e**:

- Network Engineering
  - A single iteration of the Network Design CIQ and high-level data network architecture design is included in this service.
- RF Design
  - Nortel will perform Continuous Wave (CW) drive testing for up to 15 percent of the total anticipated BTS count for propagation model tuning, assuming flat terrain and one RF morphology.
  - Nortel assumes in its standard timeline that the necessary geographic data needed for a design is either readily available for purchase off the shelf or is already owned by Nortel.
  - Nortel will conduct site visits and surveys of the candidate site list. Only two locations will be visited for each candidate search area issued.
- RF Optimization
  - Any performance requirements necessary for the successful completion of the service will be mutually agreed upon between Nortel and Massachusetts Broadband Institute before service commences.
  - Prior to commencing RF optimization and testing activities, Nortel assumes that all network integration activities have been completed successfully. This includes verifying end-to-end IP connectivity of the network at the user terminal level (CSN to ASN to BTS connectivity).
  - An audit of any RF datafill is not included as part of this scope.
  - For cluster optimization drive testing, Nortel will perform up to two rounds of testing.
  - Sites for static data test (20 percent of the total number of sites) will be determined during Network Optimization (RF) process, one test per site.
- RF Design and Optimization
  - All RF reports are to include only necessary plots and Excel documents listing pertinent site information as required by the design process and optimization data collected and documented in Excel format.
- Site Readiness
  - All site preparation activities are completed prior to Nortel being notified to start Installation and Commissioning activities. Nortel will be notified within 10 working days that all site preparation work is complete before Installation and Commissioning teams are dispatched.
- Installation and Commissioning
  - All work can be completed during the daytime shift between 07:00 and 18:00.

- Installation of RRH/ODU and cable system
    - Labor only for the installation of antenna mounts, antennas, ODUs and the associated coax cabling from antennas to ODUs, and from ODUs to the bottom of the tower or to the rooftop BTS.
- Site Engineering and Installation and Commissioning
    - All deliverables are completed in one site visit. Delays or incremental site visits will incur additional costs.
- Project Management
    - Nortel will not be responsible for the resolution of Massachusetts Broadband Institute/vendor issues affecting the completion of the project but will assist in resolving interoperability issues as appropriate.
    - Although face-to-face communication and on-site meetings with Massachusetts Broadband Institute are an essential element of the service, much of the activity will be completed from the Project Manager's Nortel office, in order to reduce travel and living costs.
- Massachusetts Broadband Institute is responsible for managing their deliverables and milestones. However, Nortel can provide additional services to take up on these activities at an additional cost to Massachusetts Broadband Institute.
- Massachusetts Broadband Institute and Nortel will agree the Final Project Acceptance criteria as defined in the Responsibilities and Deliverables sections in this Service Scope of Work (SoW) document.
- Any and all outstanding tasks to be performed or defects to be corrected with respect to Nortel's contracted obligations will be captured via a defect report (punch list). The punch list will include a list of all outstanding issues known to Massachusetts Broadband Institute and/or Nortel.

  Note: *It may be appropriate to classify the punch list items into Critical, Major and Minor. Massachusetts Broadband Institute and Nortel project management team will review progress against the punch list.*

- Following punch-list completion and resultant achievement of Final Project Acceptance criteria, Massachusetts Broadband Institute and Nortel will be required to sign a Nortel Project Acceptance Certificate. This will formally recognize achieving the Final Project Acceptance milestone and Nortel's completion of its contractual obligations to deliver the project.

4.2 Acceptance Criteria

No acceptance criteria apply to this service.

5 Exclusions and Timelines

This section lists exclusions to the scope as defined in this SoW and the timelines associated with service delivery.

5.1 Exclusions

The following activities are completely out of the scope of this project and are not performed by Nortel and/or Massachusetts Broadband Institute as part of this project:

Installation and Commissioning excludes the following:

- More than one site visit. Additional site visits are priced incrementally.
- Unless Site Engineering is purchased, Massachusetts Broadband Institute is responsible for providing site survey, floor plans of frame location or cable routes, red lines of as-completed drawings, or the provisioning of ancillary installation materials.
- RF coax cable and connector (jumpers) material. This material must be either provided by Massachusetts Broadband Institute or engineered and ordered by Nortel at an additional price.
- Drilling entry holes and running conduits to the Massachusetts Broadband Institute building
- Cable ladder rack or ancillary material. This material must be either provided by Massachusetts Broadband Institute or engineered and ordered by Nortel at an additional price.
- GPS antenna and cable hardware. This hardware must be either provided by Massachusetts Broadband Institute or engineered and ordered by Nortel at an additional price.
- Site visit prior to delivery to verify site or Massachusetts Broadband Institutereadiness. Massachusetts Broadband Institute is responsible for ensuring site readiness prior to arrival of the Nortel technician on site.
- Second or third shift work and weekend (Saturday or Sunday) and Nortel-observed holiday work is excluded unless otherwise negotiated.
- Warehousing of BTS or ancillary material.
- Last-mile BTS delivery.
- RF cable and antenna sweep of main lines and antenna.
- Backhaul link validation (i.e., Ethernet/optical fiber cable), testing or troubleshooting (i.e., Bit Error Rate [BER]). Massachusetts Broadband Institute is responsible for ensuring backhaul is functional prior to arrival of the Nortel technician on site.
- Cable lacing of system, RF, power or ground cables.
- GPS antenna and cable installation, unless BTS Essential Level service is purchased.
    - Under Essential Level service, Nortel will Install GPS antenna *not more than 10 feet in height* above the surrounding surface area
- RF jumper cable installation, unless BTS Essential Level service is purchased.
    - Under Essential Level service, Nortel will install RF coax between antenna main line demarcation point (hatch plate) to BTS termination points
    - Solder-type RF coax connector jumper installation is excluded from this scope, but can be provided at an additional cost
- Direct connection of AC wiring, unless BTS Comprehensive Level service is purchased.

- Any upgrade or extension of previously installed equipment.
- Hot slide or deinstallation of existing equipment.
- Repair of existing hardware by Nortel installation personnel, whether or not the hardware that requires repair is under warranty. Such repairs will be performed according to Nortel Standard Repair and Return procedures.
- Crane, boom truck, helicopter, forklift or any special-delivery system. Massachusetts Broadband Institute must obtain any special-delivery systems and special personnel (e.g., personnel to direct traffic around crane) and pay for them directly to Massachusetts Broadband Institute's vendor if site access restrictions require special equipment (e.g., crane, helicopter, etc.).
- Installation of Power Plant, unless Comprehensive Level is purchased.
    - Massachusetts Broadband Institute will provide and install all required commercial AC power and associated fixtures including, but not limited to, AC panels, AC circuit breakers, AC fuses, building wiring, convenience outlets, lighting and AC grounds. All electrical facilities must conform to governmental and local regulatory codes to ensure a safe work environment
    - DC power plant breakers, fuses and lugs are not provided by Nortel as part of this service and must be provisioned by Massachusetts Broadband Institute or engineered and ordered by Nortel at an additional price.
- A grounding system, including an MGB and all subsequent connections to the ground field, must be provided by Massachusetts Broadband Institute the Nortel-provided hardware at each installation site. The ground fields must measure 5 ohms or less, unless otherwise specified in the most currently accepted industry standards.
- Installation of RRH/ODU and Cable System, unless this service is purchased separately. The service excludes the following:
    - Installation of coax supports, such as cable ladder, cable tray, T-brackets, sleepers, ice bridge, etc. However, the service does cover installation of hangers, hoisting grips, connectors, weatherproofing and ground kits as needed.
    - Any union-based labor resources. If required by Massachusetts Broadband Institute, this needs to be custom quoted.
    - Taxes, bond or permit costs/fees.
    - Night work. It is assumed that the field crews will have unrestricted access to the work site during daylight.
    - Modifications to existing structures (towers and/or buildings). It is assumed that all added parts can be bolted on or into the existing structure without requiring modification to the structure itself.
    - Stealthing or any type of covering of antennas and/or coax.
    - Repairs to structures, including roofing repairs.
    - Work in confined spaces.
    - Painting of antennas, lines or any parts added to the tower or rooftop.
    - Handling of hazardous materials including Freon, asbestos abatement and lead abatement.

    Also, please note:

    - FCC and FAA approvals to be arranged by Massachusetts Broadband Institute.
    - All AM/FM transmitters to be turned OFF while the field crews are on tower.
    - Azimuth control drawings to be provided by others.
    - Downtime resulting from situations beyond the control of Nortel including, but not limited to, lack of customer-supplied materials or unsafe working conditions, will be billed separately.

Network Integration and Acceptance service excludes the following:

- Procurement of any third-party product or software (example: Oracle Database Software). It is Massachusetts Broadband Institute's responsibility to acquire a licensed copy of the software.

RF Optimization service excludes the following:

- Spectrum-clearing activities with third parties, including border coordination with other operators.
- FAA or corresponding regulatory agency requirements and filings for sites close to flight paths.
- FCC or corresponding regulatory agency requirements and filings for operating licenses.
- Electromagnetic exposure safety-compliance requirements.
- Frequency sweep testing of antennas, connectors and feeders.
- Integration of any new sites after Massachusetts Broadband Institute has accepted the original BTS, carriers or radios.
- Any formal golden route testing after RF optimization testing is completed. The formal acceptance can be offered as an optional service if required by Massachusetts Broadband Institute.
- Massachusetts Broadband Institute training.
- Hardware installation.
- Provision of proprietary information regarding exact methods and procedures to perform this service.

5.2 Timelines

The timelines that govern the delivery of this service are dependent on the complexity of the network.

<END OF DOCUMENT>

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