ONRAMP WIRELESS

TOTAL REACH NETWORK

System Acceptance Test Specification

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Revision History

Revision	Release Date	Change Description
A	TBD	Initial release.

1 System Acceptance Test Plan Overview

1.1 Purpose of System Acceptance Testing

There are several goals of formal System Acceptance Testing activities for On-Ramp Wireless (On-Ramp) networks:

- Clarifies system performance expectations between customer and ORW
- Demonstrates delivered system meets specifications and acceptance criteria
- Clearly defines a milestone for transition from network deployment phase to network maintenance phase
- Supports business execution milestones

SAT activities are focused on demonstrating that the On-Ramp network performs the functions as outlined during the system design phase.

1.2 Typical Deployment Milestones and Timeline

Figure 1 illustrates a high level schedule of the key activities and milestones in the deployment and system acceptance process:

A. System Level Activities – Planning and design of the end-to-end solution culminates in the Design Acceptance of system specifications and overall acceptance criteria. Initial deployment of the back office, field network, and endpoints have independent milestones, but once initial solution capability is live, the System Acceptance Test (SAT) demonstrates the end-to-end solution satisfies agreed-to specifications and acceptance criteria. Should the network and endpoint deployment continue in phases, a Final Solution Review (FSR) is sometimes conducted to update the SAT review with final site and endpoint deployment results.

B. Appliance or Hosted Environment Activities – The back office environment is established ahead of bringing the field network sites live, and an informal back office verification is typically conducted ahead of initial site verification to ensure proper configuration and connectivity.

C. Base Station Deployment Activities – Survey, preparation, and installation of each Access Point (AP) site is followed by Site Verification Test (SVT) to ensure the AP and base station deployment satisfies specifications and the site is ready to support endpoint deployments.

D. Endpoint Deployment Activities – The endpoint deployment is the responsibility of the OEM and the customer. In rare cases, On-Ramp is the OEM of a deployed device, but in most cases, Connected By On-Ramp partners provide the endpoints to the customer. The OEM is responsible for conducting First Article Acceptance (FAT) to demonstrate that the customer specified configuration of an endpoint has been delivered. Once FAT

is completed and endpoints are deployed in the field, deployment checkpoints are conducted in waves to isolate and rectify any deployment issues.

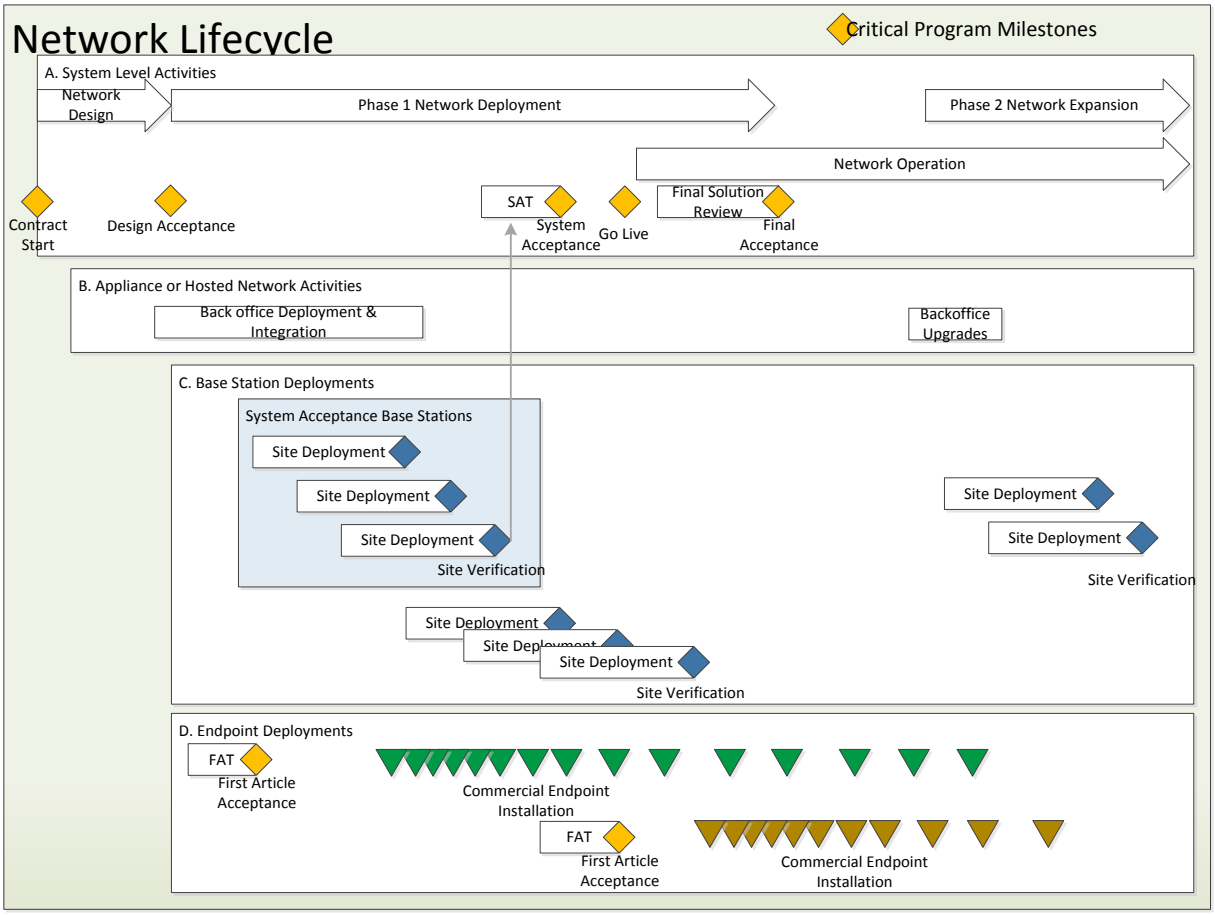

Figure 1. System Acceptance Milestones and Timeline

2 System Acceptance Milestones

2.1 Design Acceptance

As the customer and On-Ramp finalize the baseline IT network, RF network, and endpoint reporting requirements and design, the customer will be asked for confirmation of Design Acceptance. If a customer makes a change to any of the requirements or design elements after the baseline is accepted, the parties will work to accommodate the changes through the change management process. All site, system and final acceptance activities will be conducted against the current baseline requirements and design.

2.2 Site Verification Test (SVT)

Once the On-Ramp back office applications and site backhaul to the data center are fully enabled, the AP sites can be deployed. The Site Verification Test (SVT) is conducted for each AP site once all preparation, installation, and connectivity activities are complete.

Using a customer and ORW-agreed SVT plan, equipment installation and site services (e.g., power, backhaul, RF connectivity) are verified and results recorded. Successful completion of the SVT for a given site indicates that the site is ready for installation of production endpoints that will rely on the site for network communications.

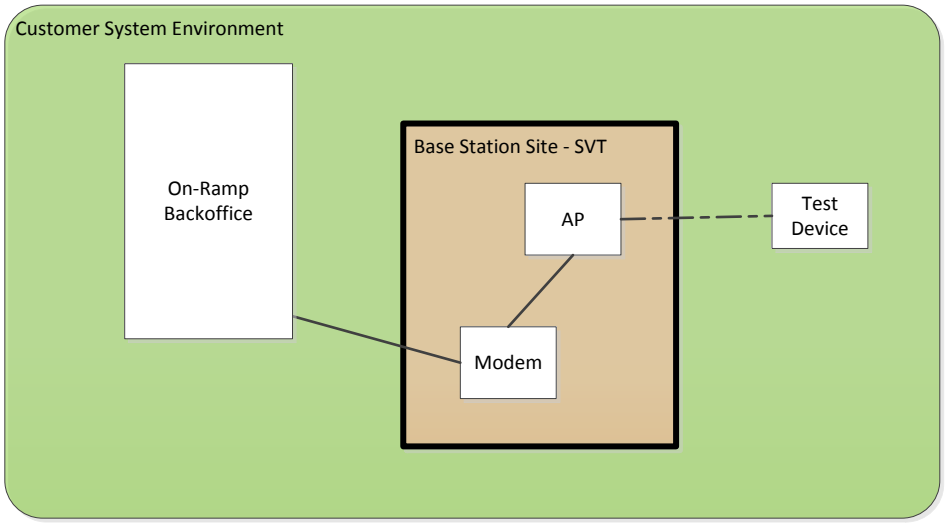

Figure 2. Site Verification Test Scope

The result of the SVT can be:

- Passed – requirements for Site Verification have been met for the given site.
- Passed with Contingency – Site Verification is approved contingent on the completion of one or more activities by agreed to due dates
- Failed – requirements of Site Verification have not been met

Who performs test, generates report: Installation contractors using On-Ramp test plan/report format plus network operations team (back office); On-Ramp or On-Ramp system integrator verifies a sample of reports.

Site Verification Date: Date a given site passes Site Verification with no remaining contingency items to resolve.

Entry Criteria:

- IT Infrastructure stable and in steady-state
- AP Physically Installed by contractors

Activities:

- Verify Base Station Physical Site Installation
- Verify AP RF Parameter Configuration
- Verify AP Network Parameter Configuration
- Verify AP Online Status through EMS
- Verify Base Station Physical Site Security
- Verify Backhaul

Exit Criteria:

- Test cases executed and results archived.
- Customer Signoff on Site
- AP Site As-built document

2.3 First Article Acceptance Test (FAT)

If an endpoint requires configuration for a given customer, an OEM will typically configure a small lot of devices to customer specification and conduct the First Article Acceptance Test (FAT) in the factory ahead of shipping the initial lot of production endpoints. The FAT plan and procedures are unique for each OEM and endpoint type, and will be negotiated directly with the endpoint supplier at time of purchase.

2.4 System Acceptance Test (SAT)

Once the back office and site backhaul are operational and stable, a minimum number of AP sites (e.g., 3 to 5 sites) have passed SVT, and a suitable endpoint sample has been deployed (e.g., production endpoints post FAT if available, prototype endpoints or test devices if no production units available), On-Ramp works with the customer to perform the System Acceptance Test (SAT). Using a customer and ORW-agreed SAT plan, the end-to-end On-Ramp solution is verified and results documented, including in-scope integration with customer 3rd party software applications, On-Ramp back office applications, On-Ramp TotalView Appliance or On-Ramp hosting services, a specified number of AP sites, and a specified number of test or production endpoint(s).

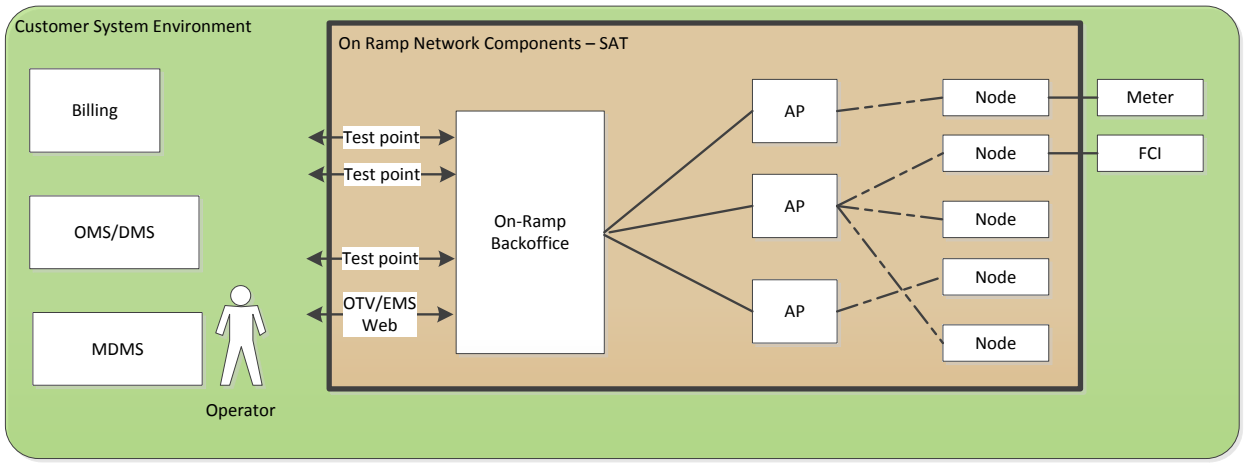

Figure 3. System Acceptance Test Scope

The System Acceptance Tests cover six (6) main test categories that cover many network operational scenarios. Additional categories specific to the endpoint applications may be defined and added to the test plan, but those remain the responsibility of the endpoint OEM. The SAT plan will be reviewed and accepted by the customer during the project planning phase. The core test categories include:

- Verify Basic Tools and Login Capabilities
- Verify End-to-End AP Network Management
- Verify End-to-End Device Management
- Verify End-to-End IT Backoffice Management
- General Device Management

Successful completion of the SAT indicates that the On-Ramp Wireless Network communications link has been demonstrated in the field end-to-end, and required information is provided via in-scope visualization platform(s) or data interfaces. The result of the SAT can be:

- Passed – requirements for System Acceptance have been met.
- Passed with Contingency – System Acceptance is granted contingent on the completion of one or more activities by agreed to due dates
- Failed – requirements of System Acceptance have not been met

Who performs test, generates report: Engagement Prime (VAR or OnRamp) executes the tests remote or on-site. Test reports produced and archived with the Prime and with the customer.

System Acceptance Date: Date ORW receives customer System Acceptance with no remaining contingency items to resolve.

Entry Criteria:

- IT Infrastructure and back office applications stable and in steady state
- 1-N APs online and communicating with On-Ramp back office (N agreed to by On-Ramp and customer during planning phase)
- 1-N Commercial Endpoints deployed (N agreed to by On-Ramp, customer and endpoint OEM during planning phase)

Activities:

- Verify Basic Tools and Login Capabilities
- Verify End-to-End AP Network Management
- Verify End-to-End Device Management
- Verify End-to-End Back office Management

Exit Criteria:

- Test cases executed and results archived with ORW and customer.
- Customer Signoff
- Network Back office As-built document and any AP as-built document(s)

2.5 Go Live

Once SAT is complete and ahead of any large deployment of commercial endpoints, a 30-90 day period will be designated by customer and On-Ramp to allow for ramp up and stabilization of network operations activities. Customer and On-Ramp will jointly determine when the operational processes and network operations are stable and network is considered in commercial operation.

Go Live Date: Date ORW and customer agree Production Stabilization Period is complete and commercial endpoints are deployed on the network. Go Live Date is likely after SAT, but could be before or after Final Acceptance Date. Go Live Date will determine the initiation of the maintenance phase of the network.

2.6 Final Acceptance

If a customer is deploying their On-Ramp network in a single phase, Final Acceptance is typically granted by the customer once the SAT and Go Live milestones are reached and all critical issues are resolved.

If a customer is deploying their On-Ramp network in phases, there may be an additional milestone beyond SAT and Go Live where the Final Solution Review (FSR) is conducted with key stakeholders to gain Final Acceptance of the project. Once the FSR is complete and any critical actions noted at the FSR are resolved, customer will issue Final Acceptance for the On-Ramp project. A typical FSR will summarize:

- SAT results
- SVT results for all in-scope sites
- Training sessions delivered
- Operational process status
- Future operational roles across the teams
- Potential expansion projects (if any identified)

Final Acceptance Date: Date ORW receives customer Final Acceptance with no remaining critical contingency items to resolve.

3 System Requirements Traceability

As noted above in Section 2.4, System Acceptance Test, the acceptance of the On-Ramp network is based on verification of agreed to requirements. The following table illustrates a typical set of On-Ramp network requirements mapped to the baseline SAT test categories.

Requirement	Verify basic tools and login capabilities	Verify End to End AP Network Management	Verify End to End Device Management	Verify End to End IT Backoffice Management
OTR Network shall support both periodic and aysnchronous data reporting from OTR enabled applications.			X	
OTR Network shall support adding additional application types to the network dynamically			X	
OTR Networks shall support integration of 3rd party tools to any OTR enabled device through a standard XML interface.			X	
OTR Networks shall provide universal timing synchronization through GPS, with support for GUIs to provide information in local time.	X			
OTR Networks shall support NIST approved secure network preventing clones or fraudulent endpoints and providing data confidentiality, endpoint anonymity, and message integrity.			X	
OTR Networks enabled with the OTV application shall support google maps view of devices deployed on the network, assuming with proper location information provided.			X	

OTR Networks enabled with the OTV application shall support visualization of device data and alarms with custom attributes to match customer specific needs.			X	
OTR Networks shall support authenticated login systems.	X			
OTR Network shall support seamless network expansion and updates with no system downtime.		**X**	X	
OTR Network shall support configurable event notification and alarm services via email and SNMP.		**X**	X	
OTR Network shall continuously monitor network connectivity and send notifications if any network connection goes offline.		**X**	X	
OTR Networks shall buffer application data for up to an hour of AP backhaul outage.		**X**		
OTR Networks shall support DNP3 integration of WSO-11 applications.			X	
OTR Network shall support automatic software failure recovery.				X
OTR Networks shall support automatic logging of network activities.				X
OTR Networks shall support software upgrade of any software component with minimal and managed downtime.			X	
OTR Networks shall support automatic AP failover, network coverage permitting.				
OTR Networks shall provide data reliability through backoffice network software upgrades.				X

4 Reference Documentation

Additional On-Ramp Wireless Network technical documentation that may be of interest includes:

- **System Documentation**
  - ORW Network Functional Specification (014-0044-00)
- **Node Documentation:**
  - Node Comparison Product Brochure (006-0014-00)
  - microNode Integration Specification (014-0033-00)
  - dNode Integration Specification (014-0038-00)
- **Access Point Documentation:**
  - Access Point Product Specification (014-0030-00)
  - Access Point Deployment Guide (010-0042-00)
- **On-Ramp Wireless Network Appliance Documentation**
  - Appliance Deployment Guide (010-0109-00)
  - EMS Operator Guide (010-0107-00)
  - OTV Operator Guide (010-0106-00)

Appendix A Abbreviations and Terms

Abbreviation/Term	Definition
AP	Access Point. The On-Ramp Wireless network component that is geographically deployed over a territory.
dNode	A third generation, small form factor, wireless network module developed by On-Ramp Wireless that works in combination with various devices and sensors and communicates data to an Access Point. Also referred to as Node.
EMS	Element Management System. The network component that provides a concise view of the Total Reach Network for controls and alarms.
FAT	First Article Test
FSR	Final Solution Review
GPS	Global Positioning System
GW	Gateway
microNode	A second generation, small form factor, wireless network module developed by On-Ramp Wireless that works in combination with various devices and sensors and communicates data to an Access Point. Also referred to as Node.
NIST	National Institute of Standards and Technology
Node	The wireless module developed by On-Ramp Wireless that integrates with OEM sensors and communicates sensor data to an Access Point. Also, the generic term used interchangeably with endpoint device.
OEM	Original Equipment Manufacturer
OTA	Over-the-Air
OTV	On-Ramp Total View
PDU	Protocol Data Unit
RPMA	Random Phase Multiple Access™. A highly efficient multiple access scheme, developed by On-Ramp Wireless and deployed in its wireless communication systems.
SAT	System Acceptance Test
SDU	Service Data Unit
SMS	Short Message Service
SNMP	Simple Network Management Protocol
SSL	Secure Socket Layer
SVT	Site Verification Test