AT&T Wireless Provisioning & Routing Guidelines

The Wireless Provisioning & Routing Guidelines is designed to help Wireless Service Providers (WSP) in planning, ordering, and maintaining their services with AT&T. The AT&T Network Planning organization is responsible for the planning of the AT&T Network Architecture. This organization monitors Tandem and switch capacity and is concerned with network integrity as outlined in the Telecommunications ACT.

1. Document Scope

This document covers the following:

- Wireless Service Types
- Routing and Provisioning
- Hierarchical Routing Network
- SHA Routing Plan
- ILEC Routing Plans
- Diversity at the Facility Level and Not Trunk Level
- AT&T Switch Limitations
- AT&T Code Administration
- Maintenance Window
- Industry Blocking Probabilities (Telcordia Notes on the Network)
- References

The Telcordia document SR2275 outlines industry guidelines, network design and configurations, however, the individual LEC will determine their network designs in order to insure network integrity. AT&T will notify the industry in reference to its expectations of the AT&T Network and provisioning expectations via an accessible letter.

1.1 Wireless Services Types:

- **TYPE 1** Provides a one-way trunk side connection between an end office and WSP(s) Switching Center ("MSC"). When a trunk group is ordered as one-way, it should be provisioned as one way and not as a 2-way. Type 1 trunks can be used for Ancillary Services which provides the transmission and routing of various types of traffic, such as 800/8YY traffic, 911 traffic, Operator Services traffic, and Directory Assistance traffic.

Note: The TYPE 1 Wireless product is still being offered by AT&T and did not go away with Wireless Local Number Portability.

- **Ancillary Connection** – (TYPE 1) is an option that may be used to connect a WSC to a LEC end office. This connection provides access to LEC operator services, Phase 0 (911) emergency services (see below), Service Access Codes such as 800 or 888 and calls to Inter-exchange Carriers using a trunk group that is presubscribed to a specific IC. The Ancillary Connection is provided by an end office that utilizes the Trunk-with-Line-Treatment (TWLT), or equivalent and is used only for **one-way mobile-to-land connections**, SS7 signaling is not available with Ancillary Connection.

- **Ancillary Connection** – (TYPE 1) does not meet the Phase I requirements as stated in FCC Docket 94-102 for Emergency Services.

- Traditional 911 – considered an ancillary service from the perspective of a wireline service.
  - Phase 0 – The description of the Type I network interconnection to provide 911 services through an end office interconnection from a MSC to an EO is termed Phase 0 and does not meet the Phase I requirements as stated in FCC Docket 94-102 for Emergency Services.

- Enhanced 911 for Wireless entails the delivery of the callers ANI (or call back number) and location information (ALI in wireline architecture) to a PSAP using selective routing to route the call to a PSAP designated to handle an emergency call based on the location of the caller.
  - Phase I Enhanced 911 – Phase I entails selective routing to the appropriate Selective Routing Tandem (SR) with a Type 2C interconnection and the delivery of the call back number of the calling party.
  - Phase II Enhanced 911 – Phase II delivers the location information of the calling party as well as the call back number, and also uses selective routing to the appropriate Selective Routing Tandem (SR) with a Type 2C interconnection to deliver the call.

TYPE 2A A TYPE 2A Interconnection is an interface at the POI of a trunk between a WSP and a AT&T Tandem. This trunk group can be 1-way incoming (Mobile to Land), 1-way outgoing (Land to Mobile) or two-way (Land to Mobile and Mobile to Land). See directionality limitations referenced in the accessible letter references below in this section.

The TYPE 2A trunk can handle the following traffic types:
- Incoming FGD Equal Access (carrier must provide OZZ/CIC)
- Local
- IntraLATA
- 800 Traffic (OZZ/CIC 0110)

Note 1: The following are AT&T regional switch limitations for Type 2A trunks.
Note 2: Incoming traffic is traffic AT&T receives from the WSP (Mobile to Land).
Note 3: Outgoing traffic is traffic AT&T sends to the WSP (Land to Mobile)

An AT&T Access Tandem performs the functions necessary to select the appropriate IEC for incoming interexchange calls (FGD Equal Access) equipped for FGD switched access signaling transmitting the proper OZZ/CIC code.

The OZZ tells the access tandem that translation of the CIC is necessary to identify the IC and the trunk group used to connect to the interexchange carrier.

Reference the following accessible letters for TYPE 2A 800, Equal Access, Directionality and AT&T regional switch limitations.

- **CEL03-024** AT&T 2State Mobile to Land Equal Access and 8XX Traffic Over TYPE 2A Trunks
- **CEL03-025** AT&T Southwest Region Mobile to Land Equal Access and 8XX Traffic Over TYPE 2A Trunks
- **CEL03-032** AT&T Midwest Mobile to Land Equal Access and 8XX Traffic Over TYPE 2A Trunks

Note: When the WSP orders a land to mobile or mobile to land 2A, it should not be ordered as a two-way and translated as a one-way trunk group.

- **TYPE 2B** A Type 2B provides a trunk side connection between the WSP(s) MSC and an AT&T End Office switch providing the capability to access only subscribers with NPA-NXXs served by that AT&T End Office. Type 2B can either be a 2way or 1way interconnection. The 2B 2-WAY product is not offered in AT&T East.

  Note: When the WSP orders a land to mobile or mobile to land 2B, it should not be ordered as a two-way and translated as a one-way trunk group.

The Two-way TYPE 2B Direct End Office connection may be ordered as the Primary High with overflow to a (AF) Tandem trunk group TYPE 2A. If, the service provider orders a TYPE 2B as a direct final (DF) trunk group this means that there will be no overflow to the TYPE 2A Tandem. In the instance where there is no access tandem TYPE 2A Trunk Group for the Wireless provider to also interconnect, then the TYPE 2B should be ordered as a Direct Final Trunk group.

Two-way TYPE 2B will not be available in the following technologies deployed by AT&T:

- NORTEL DMS 10
- Lucent 1AESS
- Ericsson AXE

It is recommended that the service provider check the LERG for AT&T Switch technology before submitting an ASR through the Access Service Center.

2B Signaling

2-WAY TYPE 2B may be ordered with (SS7) or (MF) signaling where available. SS7 is the preferred method (where available) and will be negotiated as such in interconnection agreements.

- **TYPE 2C** interconnection of WSP wireless subscriber originated 911 calls through a LEC network to emergency services provider(s).

- **TYPE 2D** provides a direct path between a LEC Operator Services (OSS) Switch. A LEC OSS Switch is a tandem switch with operator services call processing capabilities. LEC OSS(s) provides alternate billing services (e.g. calling card processing), directory assistance services (including Directory Assistance Call Completion) and general assistance services.

2. Routing and Provisioning

2.1 Service Providers should deliver traffic to the Tandem that serves the end office where the terminating NPA NXX resides or directly to the End Office. Service providers should utilize the Industry LERG (Local Exchange Routing Guide) which defines AT&T homing arrangement requirements for both incoming and outgoing traffic.

AT&T establishes switch translations and routes calls originated by AT&T customers according to assignments in the (LERG). Incorrect homing arrangements in the LERG will prevent proper delivery of calls to the correct (intended) switching entity for call completion.

Homing arrangements reflected in the LERG must be valid and must indicate connectivity between the two switching entities for the function (s) indicated. When LERG assignments indicate a switching entity subtends or homes on a given tandem, it suggests that there is a direct interconnection between the two entities.

The service provider is responsible for LERG assignments that indicate correct homing arrangements with actual network connections between the originating switching entity and the terminating switching entity.

2.2 Wireless Routing

Growth of the wireless industry has created tremendous demand for trunk terminations particularly in the tandem switches. As wireless carriers turn up new networks there appears to be little control or consistency over the manner in which trunking is established to AT&T Class 4 Tandem switches. Similarly, traffic routing for new wireless networks in some instances varies greatly for each wireless carrier. This is especially evident in large metropolitan LATAs with multiple tandems, some of which are at or near capacity exhaust (e.g. Chicago, Dallas, Houston, Los Angeles).

While it is recognized that many differences exist between the various regions, states, and markets in AT&T, the goal is to establish common engineering and operational objectives in managing wireless service providers.

To better align the network and ensure reliability, AT&T is transitioning to a hierarchical network design. This design is Industry Standard as defined in the Telcordia Notes on the Network, Document SR-2275. A Hierarchical network design utilizes alternating routing, which provides a more economical use of the network for all carriers.

The advantages to Hierarchical routing are:

- Provides the opportunity to minimize the cost per unit of carried traffic.
- With alternate routing, the load is allocated to high-usage and final routes in the most economical manner. In general, the direct or high-usage route is shorter and less expensive than the alternate-route path.
- Alternate routing also permits the meshing of traffic streams that have differing busy hours or seasons. Because each leg of the alternate route is used by other calls, a number of traffic items can be combined for improved efficiency on that route.

Transitioning to a hierarchical network AT&T has found it necessary to revisit standard network policy, and to request Carriers correct the embedded base on a next order basis. As AT&T Switch Conversions or Service Providers initiate Network architecture changes these will be the opportunities for converting AT&T routing to hierarchical (land-to-mobile). One must remember this conversion is AT&T traffic from the land-to-mobile direction and not the mobile to land direction.

2.2.1 Wireless Routing Network Regulatory Policy – See Exhibit 1

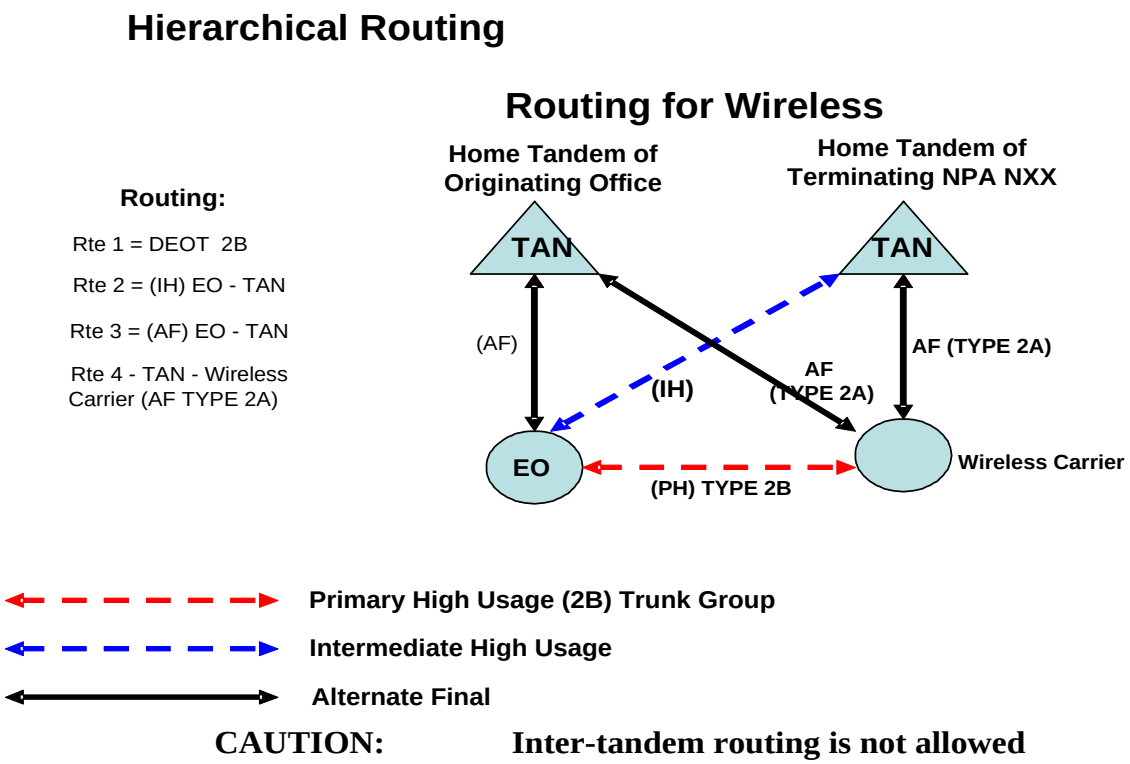
Any hierarchical routing schemes associated with WSP traffic should not include any inter-tandem routes.

Reciprocal Compensation is designed to cover the Tandem switching, transport and termination (End Office switching) within AT&T's network on calls that another carrier sends to us. It does not allow AT&T to recover the cost for more than one Tandem switching charge or for transport between Tandems; only the transport from the Tandem the End Office subtends.

2.3 HIERARCHICAL ROUTING EXHIBITS

The following diagram is a routing scenario that depicts hierarchical routing. Calls are first-routed over a direct primary high usage (2B) trunk group if, such a group exists. If, a direct trunk group (2B) does not exist, or if, no trunks are available, the call next routes over an IH trunk group to the home tandem of the terminating NPA-NXX code as determined by the Switch Homing Arrangement (SHA) indicator in the LERG. From this point the call attempts to complete over the alternate final trunk group to the wireless carrier. If, an IH trunk group from the originating end office to the home tandem of the terminating NPA-NXX code does not exist, or if, no trunks are available, the call is next routed to the home tandem of the originating office. From this point the call attempts to complete over the alternate final trunk group to the wireless carrier. If, no trunk is available at this point, the call is blocked.

EXHIBIT 1 - HIERARCHICAL ROUTING – Land to Mobile



CAUTION: Inter-tandem routing is not allowed

Granted there are embedded network configurations that exist and AT&T is continually working toward correcting these types of situations. On the originating end AT&T converting to Hierarchical routing will bring consistency through-out our networks. Consistency brings Network Integrity and better service for end users in the Public Switched Network.

2.4 SHA Homing Arrangements

(Reference Accessible Letter CEL03-042, AT&T 13 State), "SHA Routing Plan"

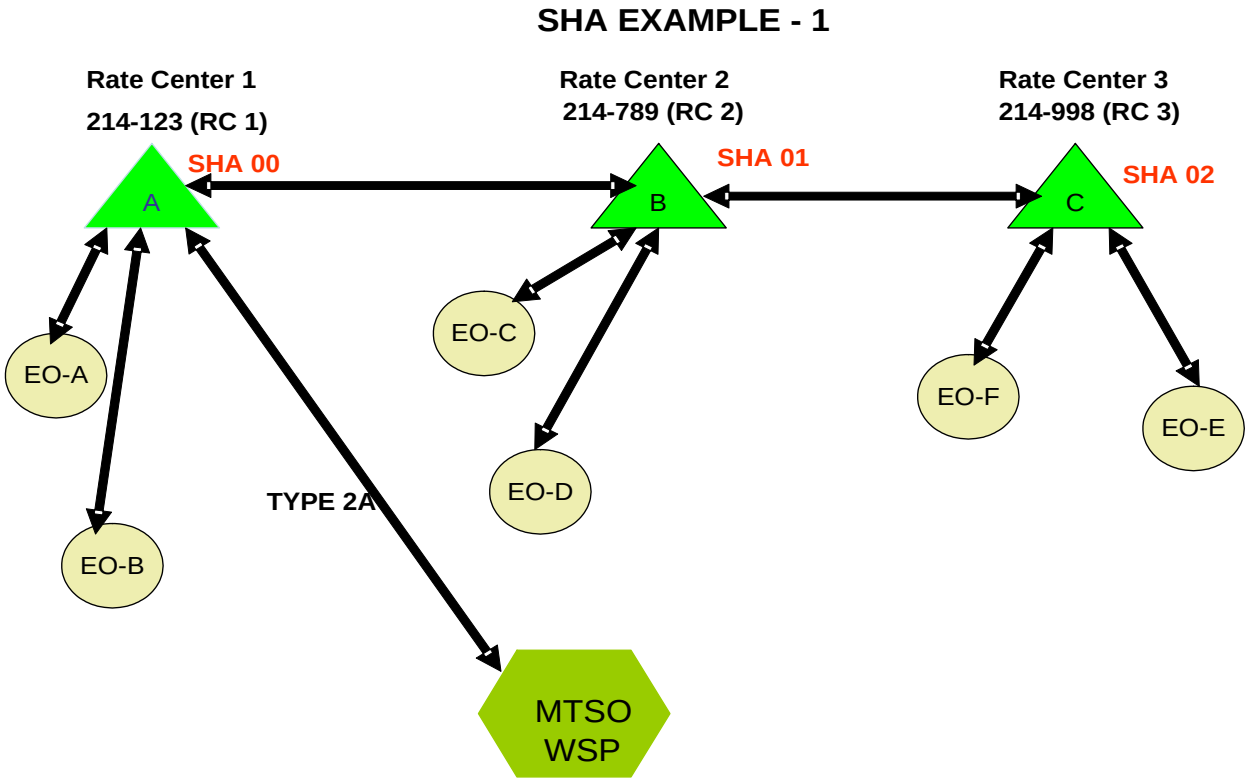
SHA (Switch Homing Arrangement) when associated with a SHA Indicator allows a Wireless Service Provider to have a single switch with multiple homing arrangements. A SHA Indicator delineates the rate exchange and associated NPA NXX for each homing arrangement.

When a Wireless Service Providers contract stipulates that they can select one presence in a single LATA and there are multiple tandems in that LATA all of that WSP's NPA NXX(s) in the LERG will be associated with the one tandem that was chosen. Even though many of that WSP's NPA NXX(s) are rated behind the other tandems in that LATA.

Once the service provider begins to establish trunking to other tandems in that LATA, they should make LERG changes to reroute their NPA NXX(s) to the correct tandem. This will eliminate the need to inter-tandem traffic (NPA NXX(s)) which decreases the inter-tandem traffic loads.

NOTE: The following SHA examples do not depict Hierarchical Routing but the effect SHA Arrangements have on the network and how they are configured in the LERG.

BEFORE - SHA Arrangement

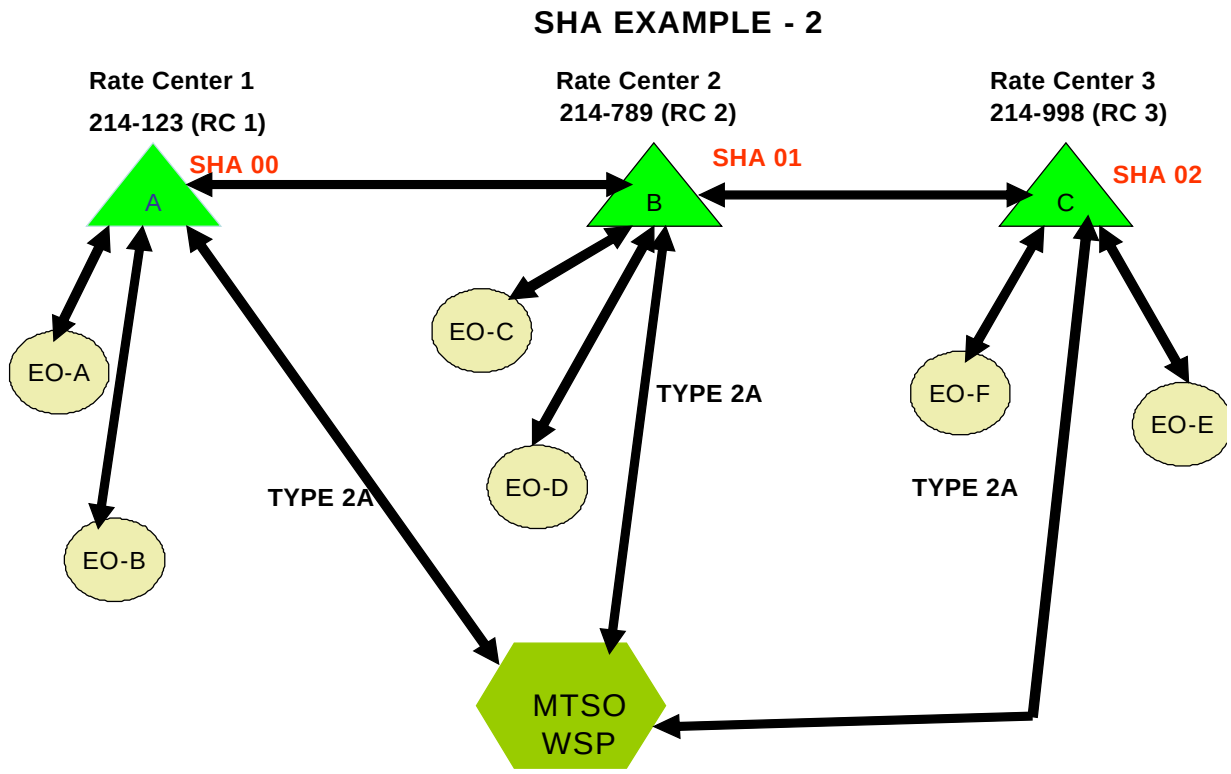


Service provider has interconnected at a single tandem (A) (SHA 00), SHA 01 and 02 do not exist. All codes would be shown in the LERG against Tandem A. The service provider has no connectivity to Tandems B or C.

EXHIBIT 1 (BEFORE)

LEGEND
EO = End Office
RC = Rate Center
A, B , C = Tandems

AFTER - SHA Arrangement



Service provider has interconnected at each tandem and
Rehomed their codes in the LERG to the appropriate tandems.

EXHIBIT 2
(AFTER)

LEGEND
EO = End Office
RC = Rate Center
A, B , C = Tandems

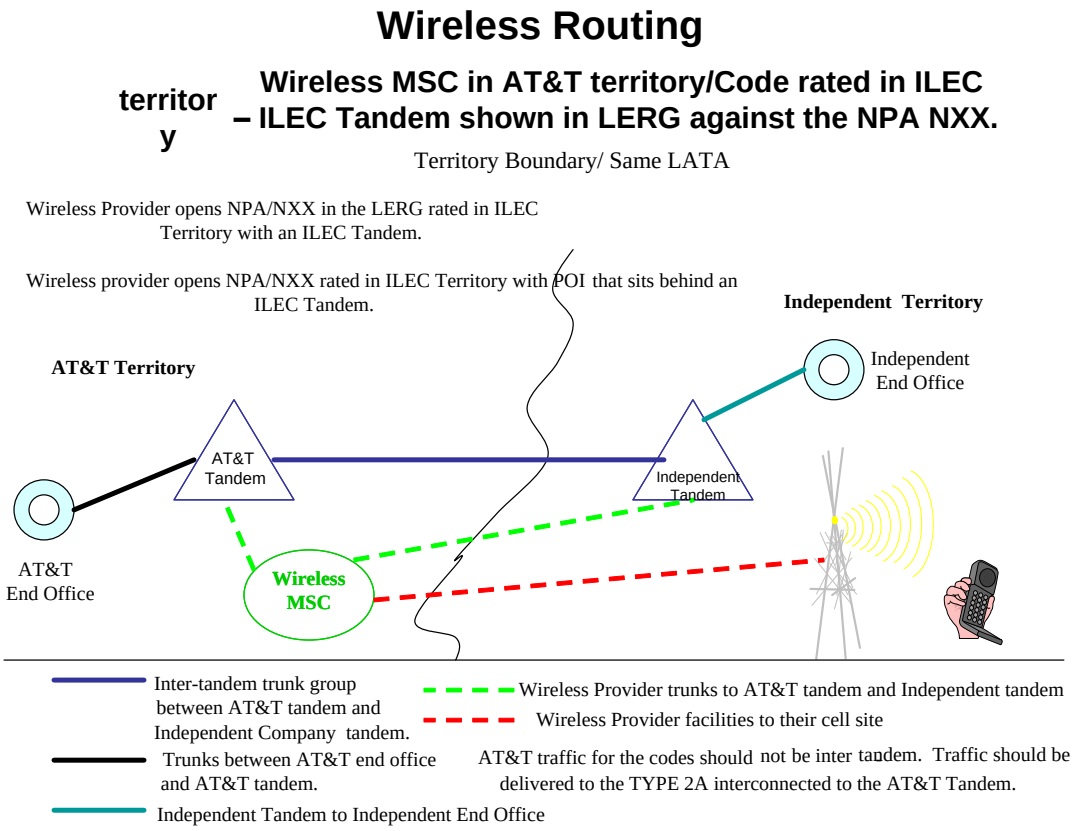
2.5 ILEC Routing Plans

The following drawing (Exhibit 3 and 4) depicts Wireless Routing when a code opening sits behind an ILEC Tandem and the routing associated with those territories involved.

Granted there are embedded network configurations that exist and AT&T is continually working toward correcting these types of situations. On the originating end AT&T converting to Hierarchical routing will bring consistency through-out our networks. Consistency brings Network Integrity and better service for end users in the Public Switched Network.

There may be exceptions to Hierarchical Routing when ILEC Routing Plans are involved that cause AT&T to route "Access Like" by delivering traffic to a central point to circumvent inter-tandem routing. The Wireless Service Provider will need to be prepared to receive the traffic when this routing plan occurs.

EXHIBIT 3 – Wireless ILEC Routing



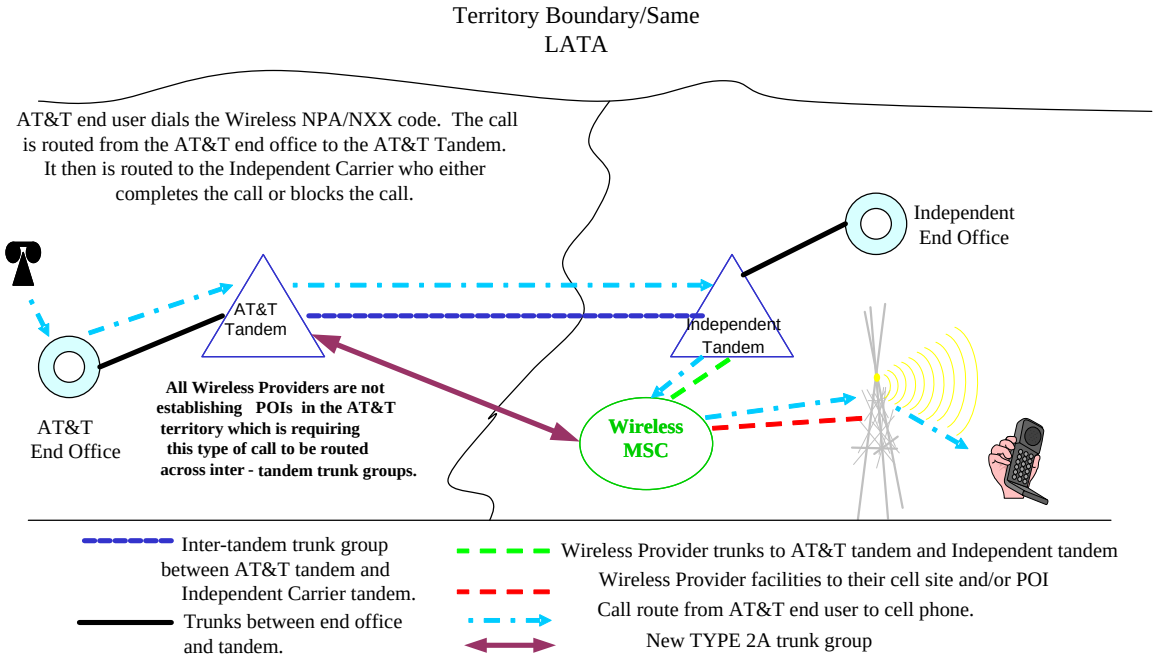
Note: Inter-Tandem Routing between AT&T tandems is not allowed.

AT&T Traffic for the NPA-NXX(s) should not inter-tandem. Traffic will be delivered to the Wireless MSC TYPE 2A trunk group to the AT&T Access Tandem.

EXHIBIT 4 – Wireless ILEC Routing

Wireless Routing

Wireless MSC in ICO territory/Code rated in ICO territory/ No Wireless POI in AT&T territory



Note: Inter-Tandem Routing between AT&T tandems is not allowed.

The Wireless Service Provider will be required to establish a TYPE 2A trunk group in AT&T Territory for AT&T to deliver the ILEC Territory traffic.

2.6 Wireless Routing Rules

AT&T Network Translations shall utilize Industry Telcordia Documentation BR 795-400-100 as routing guidelines:

Industry Routing Definitions:

- **PRIMARY HIGH USAGE**. A trunk group that is offered first route traffic only and is designed to overflow to an alternate route. (Traffic Class Code =PH)
- **ONLY ROUTE**. A trunk group that is the only route for particular traffic items. It receives only first route traffic, does not receive overflow traffic, and has no alternate route. (Traffic Class Code =DF)
- **INTERMEDIATE HIGH USAGE**. A trunk group that receives route advanced overflow traffic, and may receive first route and/or switched overflow traffic. (Traffic Class Code =IH)
- **ALTERNATE FINAL**. A trunk group that handles first route and overflow traffic and does not overflow to an alternate route. (Traffic Class Code =AF)

Routing Rules

- A primary high will not overflow to another primary high trunk group.
- A direct final shall provide no overflow routing.
- An IH shall not overflow to a Primary High
- An Alternate Final shall not overflow to a Direct Final, Primary High or Intermediate High.
- An Alternate Final (AF) overflowing to another Alternate Final (AF) is not allowed

Special Notes:

- **Note 1**: An Alternate Final should never be ordered as an End Office (Class 5) to End Office (Class 5) DEOT. The only, **exception** is where E911 trunk diversity is required.
- **Note 2**: Wireless providers should never have TYPE 2A PH (Primary High) trunking at the Tandem Level (Embedded base will change any order activity; .i.e. projects, switch conversions, augments)
- **Note 3:** TYPE 2A Service providers can order at the Tandem Level as AF. An IH trunk group is allowed whenever switch limitations exist.

3.0 Diversity

Diversity is the effective utilization of multiple facilities for a single trunk group to promote network reliability and protect against service disruptions. Diversity is not accomplished by the utilization of multiple trunk groups riding over a single facility.

1. For example, even where equipment has redundant transmission cards, diversity is not ensured where the transmission facilities used to connect the equipment follows the same geographical path. A break in that common path will disrupt the service. This is true even in ring architectures where the transmission facilities are "folded" or "collapsed" back into the same path. A "folded" or "collapsed" ring is one in which the transmission facilities are in the same sheath, trench, conduit, duct run, or even running along the same street in such a way that one catastrophic failure can disrupt both facilities. Therefore, diversity involves multiple transmission facilities following different paths. Multiple trunks riding over a single facility does not create this diversity.

2. An originating switch may not recognize trunk group failure and may send traffic over the defective trunk group anyway. In such an instance, diversity of transmission facilities provides assurance against total trunk group failure and a continued communications path to protect against service disruptions that might otherwise occur.

4.0 AT&T Switch Limitations

The following (CHART A) defines AT&T switch limitations based on the number of trunks that can reside on a single trunk group number (TGN).

CHART A

Number of Trunks that can be on one TGN

TYPE	MAX #
AXE	10000
DMS	2047
5ESS	1952
1A ESS	1024 (one-way)
1A ESS	512 (two-way)
DMS-10	256
Seimens	4095
4ESS	1008

4.1 AT&T Data Switch Limitations

- AXE Switch TYPE:
  - 64 CCC is not allowed in AXE switches. The AXE switches do not have the software to terminate a 64 CCC call.
- 1AESS Switch Type:
  - 56, 64 or B8ZS is not supported in the 1AESS switches.
- 4ESS (Combined Trunk Group) (KE modifier) will not work for this switch type. Must be two separate trunk groups one for voice and the second for data. (AT&T WEST Region).

5.0 AT&T Code Administration

The following will result when Service providers initiate NPA NXX(s) with incorrect LERG Homing, Rating Information, etc:

- The NPA NXX will not be opened. It will be placed on a "Pending List" by our AT&T Code Administration organization for resolution. The ASC will contact the customer to correct the LERG information. The code will not be released until the information is rectified in the LERG.

- When the NPA NXX is associated with an ASR both the dates on the ASR and the LERG must coincide. Therefore, incorrect LERG information may cause the customer not to meet the order activity they may be requesting.

- **AT&T Translations shall not occur until the LERG is corrected by the customer**. Routing and Rating Information, etc. in the LERG and the AT&T Switch must agree.

Consequences of Disregarding the LERG (Reference the Industry NIIF guidelines at **www.atis.org**)**:**

- Credit cards may not be able to go through for processing.
- Call failure.
- Difficulty completing calls to some locations.
- Network blockage.
- Misrouted traffic

6.0 Maintenance Window

This section addresses the Network Reliability concerns when sensitive translations should occur in order to maintain the Network Integrity in the Public Switched Telephone Network.

AT&T's policy on Maintenance Window is defined as the time period between the hours of 2200 (10:00PM) and 0600 (6:00AM).

There are critical types of Translation processes requiring an ASR /TQ and or LERG Activity that are sensitive in nature and must be performed in the maintenance window as follows:

Switch Conversions
Tandem Rehomes
Rerouting of Traffic
Calling Scope Changes
Rate Center Changes
Digits Changes and
SHA Indicator Changes

Exceptions to the maintenance window hours stated above may be reviewed and discussed through the AT&T Account Manager who will coordinate internally with AT&T Translation Centers. Exceptions will be evaluated based on the customer business needs and AT&T's commitment to end user network reliability.

7.0 Industry Blocking Probabilities (SR2275 Telcordia Notes on the Network) Section 4: Network Design and Configurations

AT&T utilizes industry standards in maintaining, monitoring and studying the network.

The following information is per the SR2275 Telcordia Notes on the Network, Section 4.4, page 4-23 "Blocking Probabilities":

Trunking service objectives are expressed in terms of the percent of calls blocked on final and only-route groups in the average time consistent busy hour of the busy season. With a given load, the degree of blocking is a function of the amount of trunk idle time available. When the idle time is low, there is little capacity available to handle new calls and the blocking rate is high. When the idle time is high, there is capacity available to handle new calls and the blocking rate is low. For example, with a random offered load of 406 CCS, the different trunk capacities and idle times required to achieve B.01 and B.02 blocking (according to the Neal-Wilkinson theory) are shown in Table 4-1.

TABLE 4-1 Comparison of Typical Blocking Probabilities

Blocking	Offered Load (CCS)	Peakedness of Offered Load	Trunks Required	Percent Occupancy	Percent Idle
B.01	406	1.0	20	56	44
B.02	406	1.0	18	63	37

It should be noted that there is more idle time with B.01 service than with B.02 service. Trunk groups engineered on a B.01 basis, therefore, do not react as severely to overloads as when higher blocking probabilities are used. This applies to all levels of offered load.

A B.01 objective for engineering a trunk group does not necessarily mean 1-percent overall (or point-to-point) blocking. If, the group is an only-route, B.01 blocking can be expected in the average time consistent busy hour of the busy season. At other periods of the year or during other hours of the day, probability of blocking is substantially lower.

8.0 References:

Accessible Letters:

CEL-04-003, AT&T 13 State, Protecting Network Integrity/Trunk Sizing/Blocking
CEL-04-042, AT&T 13 States, SHA Routing Plan

TYPE 2A 800, Equal Access and AT&T regional switch limitations:

CEL03-024 AT&T 2State Mobile to Land Equal Access and 8XX Traffic Over TYPE 2A Trunks
CEL03-025 AT&T Southwest Region Mobile to Land Equal Access and 8XX Traffic Over TYPE 2A Trunks
CEL03-032 AT&T Midwest Mobile to Land Equal Access and 8XX Traffic Over TYPE 2A Trunks

GR-145-CORE (Telcordia), "Compatibility Information for Interconnection of Wireless Services"
LERG (Local Exchange Routing Guide)
NIIF (Network Interconnection Interoperability Form) Reference Document,
www.atis.org
NIIF Educational Document,
www.atis.org
Telcordia Common Language CLCI – MSG Code Set (795-400-100)
Telcordia Notes on the Network (SR2275)
TIKI Reports (Accessible Letter CEL04-003, Protecting Network Integrity/Trunk Sizing/Blocking)
Wireless Interconnection Agreements
Wireless Interconnection Trunk Requirements (ITR)