



Avaya Solution & Interoperability Test Lab

Application Notes for the Vocera Communications System with Avaya Communication Manager using the T1 and E1 Interface - Issue 1.0

Abstract

These Application Notes describe the configuration steps required to integrate the Vocera Communications System – Vocera Server, Telephony Server and badges, with Avaya Communication Manager, and Avaya Wireless AP-8.

Emphasis of the testing was placed on verifying reliable integration between the Vocera Telephony Server and Avaya Communication Manager, using the T1 and E1 interface.

Information in these Application Notes has been obtained through compliance testing and additional technical discussions. Testing was conducted via the *DeveloperConnection* Program at the Avaya Solution and Interoperability Test Lab.

1. Introduction

These Application Notes describe a compliance-tested configuration comprised of the wireless communication features of Vocera Communications System with Avaya Communication Manager and Avaya Wireless AP-8s.

Vocera Communications System is comprised of three main components:

- Vocera Badges
- Vocera Server
- Vocera Telephony Server

The Vocera Badges are wireless 802.11b devices that serve as communicators in a wireless environment. By pressing the call button on a badge, a user can interface with the Vocera Server to start the call process.

The Vocera Server acts as a communication server to service calls between the badges. The Vocera Server stores the user and badge information, and has the speech access interface that allows users to place and receive calls.

The Vocera Telephony Server provides connectivity to a PBX system. The Vocera Telephony Server was tested using an ISDN-PRI trunk, robbed-bit trunk, and a set of analog stations, between the Vocera Telephony Server and Avaya Communication Manager. The trunk interfaces used between the Vocera Telephony Server and PBX were T1 and E1. The Vocera Telephony Server allows the Vocera Server to connect Badges to PBX users, as well as route calls to the public network through the PBX. The two server applications, the Vocera Server and Vocera Telephony Server, can reside in the same physical server platform.

For additional information on Vocera Communication System, please refer to Vocera documentation [3] and [4].

Figure 1 illustrates the network configuration used to verify the Vocera Communications System solution. The configuration details provided in these Application Notes focus on the interface between Avaya Communication Manager and the Vocera Telephony Server as well as the wireless configuration between the Vocera Badges, and Avaya Wireless AP-8. Site A is comprised of an Avaya S8700 Media Server and an Avaya G650 Media Gateway, and has connections to Avaya 4600 Series IP Telephones, an Avaya 9630 IP Telephone, an Avaya 6402 Digital Telephone, and an ISDN-PRI trunk to the PSTN. Vocera Site is comprised of a PC with Microsoft Windows 2003 Server and a Netgear ProSafe Switch with Power Over Ethernet (POE). The Vocera Server, Vocera Telephony Server, and DHCP Server applications were installed on the PC prior to the compliance test. Avaya Wireless AP-8s are utilized to provide the wireless network for the Vocera badges.

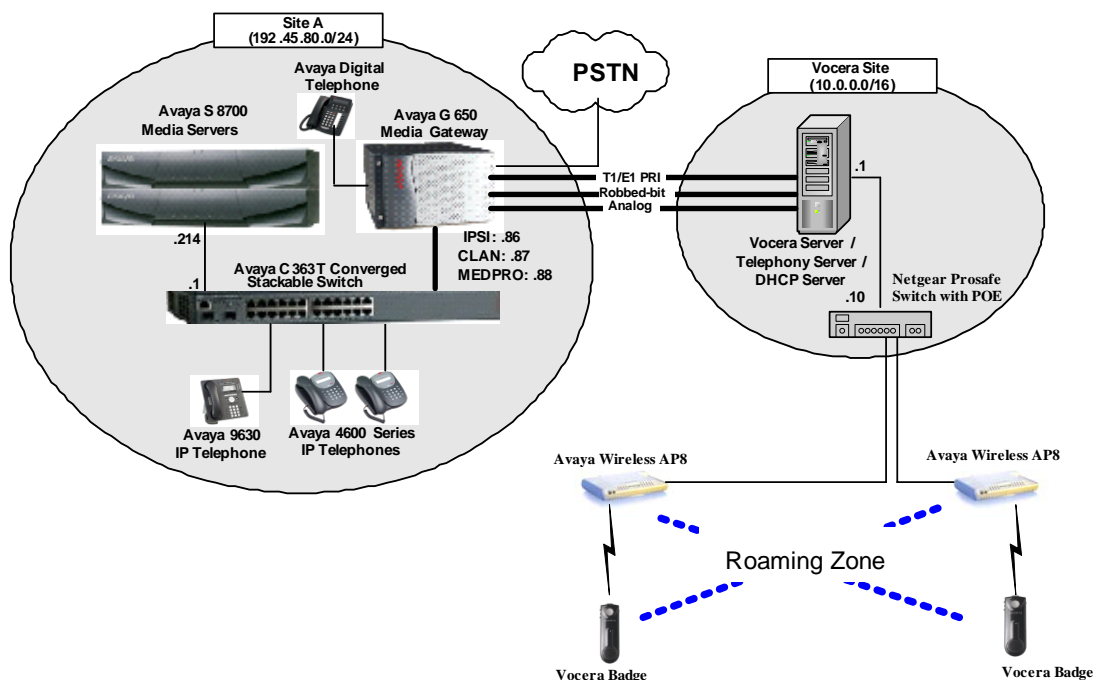


Figure 1: Test Configuration of Vocera with Avaya Communication Manager

2. Equipment and Software Validated

The following equipment and software were used for the sample configuration provided:

Equipment		Software
Avaya S8700 Media Server		Avaya Communication Manager 3.1.2 (R013x.01.2.632.1)
Avaya G650 Media Gateway		
	TN2312BP IP Server Interface	HW11 FW030
	TN799DP C-LAN Interface	HW20 FW017
	TN2302AP IP Media Processor	HW01 FW108
	TN2602AP IP Media Processor	HW02 FW007
Avaya 4600 Series IP Telephones		
	4620 SW	2.6
	4625 SW	2.5
Avaya 9630 Series IP Telephones		1.1 (H.323)
Avaya 6402 Digital Telephone		-
Avaya C363T-PWR Converged Stackable Switch		4.5.14
Avaya Wireless AP-8		3.1
Vocera Server and Telephony Server running on Windows 2003 Server		4.0 build 1273
Vocera Badges		4.0 build 1273
Netgear ProSafe with POE		FS108P

3. Configure Avaya Communication Manager

During the compliance test, the connectivity between Avaya Communication Manager and the Vocera Telephony Server were performed with T1 ISDN-PRI and E1 QSIG protocol. Before configuring Avaya Communication Manager, the DS1 board must be physically configured for an appropriate mode (T1 or E1). The DS1 board has 24 channels in T1 mode or 32 channels in E1 mode. The default is set to the T1 mode. To modify the DS1 board to use it in E1 mode, the dipswitch in the DS1 board must be switched to the 32 channels side.

When integrating with trunks, it is important to allow trunk-to-trunk transfer for the Badges to be able to transfer/conference calls, as well as place outbound calls. Trunk to trunk transfer is a global parameter that is enabled in the “system-parameters features” form.

Enter the **display system-parameters features** command. On Page 1 of the “system-parameters feature” form, verify that the Trunk-to-Trunk Transfer field is set to **all**.

```
display system-parameters features                               Page 1 of 18
      FEATURE-RELATED SYSTEM PARAMETERS
      Self Station Display Enabled? y
      Trunk-to-Trunk Transfer: all
Automatic Callback - No Answer Timeout Interval (rings): 3
      Call Park Timeout Interval (minutes): 10
      Off-Premises Tone Detect Timeout Interval (seconds): 20
      AAR/ARS Dial Tone Required? y
      Music/Tone on Hold: none
      Music (or Silence) on Transferred Trunk Calls? no
      DID/Tie/ISDN/SIP Intercept Treatment: attd
Internal Auto-Answer of Attd-Extended/Transferred Calls: transferred
      Automatic Circuit Assurance (ACA) Enabled? n

      Abbreviated Dial Programming by Assigned Lists? n
      Auto Abbreviated/Delayed Transition Interval (rings): 2
      Protocol for Caller ID Analog Terminals: Bellcore
Display Calling Number for Room to Room Caller ID Calls? N
```

Enter the **display system-parameters customer-options** command. On Page 4 of the “system-parameters customer-options” form, verify that the ISDN-PRI field is enabled. If not, contact an authorized Avaya account representative to enable these features.

display system-parameters customer-options		Page 4 of 11
OPTIONAL FEATURES		
Emergency Access to Attendant? y		IP Stations? y
Enable 'dadmin' Login? y		Internet Protocol (IP) PNC? n
Enhanced Conferencing? y		ISDN Feature Plus? n
Enhanced EC500? y		ISDN Network Call Redirection? n
Enterprise Survivable Server? n		ISDN-BRI Trunks? n
Enterprise Wide Licensing? n		ISDN-PRI? y
ESS Administration? n		Local Survivable Processor? n
Extended Cvg/Fwd Admin? y		Malicious Call Trace? n
External Device Alarm Admin? n		Media Encryption Over IP? y
Five Port Networks Max Per MCC? n		Mode Code for Centralized Voice Mail? n
Flexible Billing? n		
Forced Entry of Account Codes? n		Multifrequency Signaling? y
Global Call Classification? n		Multimedia Appl. Server Interface (MASI)? n
Hospitality (Basic)? y		Multimedia Call Handling (Basic)? n
Hospitality (G3V3 Enhancements)? n		Multimedia Call Handling (Enhanced)? n
IP Trunks? y		
IP Attendant Consoles? n		
(NOTE: You must logoff & login to effect the permission changes.)		

Enter the **display system-parameters customer-options** command. On Page 8 of the “system-parameters customer-options” form, verify that the following fields are enabled. If not, contact an authorized Avaya account representative to enable these features.

display system-parameters customer-options		Page 8 of 11
QSIG OPTIONAL FEATURES		
		Basic Call Setup? y
		Basic Supplementary Services? y
		Centralized Attendant? n
		Interworking with DCS? n
		Supplementary Services with Rerouting? n
		Transfer into QSIG Voice Mail? n
		Value-Added (VALU)? N

It is important that stations that have access to the Vocera Server are not outward restricted. All stations and trunks have a Class of Restriction (COR) assigned to them. From the System Access Terminal interface, enter **change cor C**, where **C** is the COR number. Set the Calling Party Restriction and Called Party Restriction fields to **none** in the COR form for the appropriate COR that is assigned to the stations and trunks. During the compliance test, stations under test were assigned **1** as the COR number.

change cor 1		Page 1 of 22
CLASS OF RESTRICTION		
COR Number: 1		
COR Description:		
FRL: 2	APLT? y	
Can Be Service Observed? y	Calling Party Restriction: none	
Can Be A Service Observer? y	Called Party Restriction: none	
Partitioned Group Number: 1	Forced Entry of Account Codes? n	
Priority Queuing? n	Direct Agent Calling? n	
Restriction Override: none	Facility Access Trunk Test? n	
Restricted Call List? n	Can Change Coverage? n	
Access to MCT? y	Fully Restricted Service? n	
Group II Category For MFC: 7	Add/Remove Agent Skills? n	
Send ANI for MFE? n	Automatic Charge Display? n	
MF ANI Prefix:	PASTE (Display PBX Data on Phone)? n	
Hear System Music on Hold? y	Can Be Picked Up By Directed Call Pickup? n	
	Can Use Directed Call Pickup? n	
	Group Controlled Restriction: inactive	

3.1. Configuring T1 ISDN-PRI Trunk

The configuration verified for T1 trunks used the **229xx** extension range for the Vocera Server and Badges. Add the DS1 for the T1 trunks by using the command **add ds1 xxxx**, where **xxxx** is the DS1 board location. In this case the location was **1a12**, where “**1**” is the cabinet number, “**a**” is the carrier number, and “**12**” is the slot number of the DS1 board.

The next screen shows the DS1 CIRCUIT PACK form for the ISDN-PRI protocol. Avaya Communication Manager acted as the **network**, and the Vocera Server was the **user**. The following information is provided for configuring the DS1 board.

- Line Coding: **b8zs**
- Framing Mode: **esf**
- Signaling Mode: **isdn-pri**
- Connect: **pbx**
- Interface: **network**

Default values may be used in the remaining fields.

```

add ds1 1a12                                     Page 1 of 2
                                         DS1 CIRCUIT PACK

      Location: 01A12                               Name: Vocera
      Bit Rate: 1.544                               Line Coding: b8zs
      Line Compensation: 1                           Framing Mode: esf
      Signaling Mode: isdn-pri
      Connect: pbx                                   Interface: network
      TN-C7 Long Timers? n                           Country Protocol: 1
      Interworking Message: PROGress                 Protocol Version: a
      Interface Companding: mulaw                     CRC? n
      Idle Code: 11111111
                                         DCP/Analog Bearer Capability: 3.1kHz

                                         T303 Timer(sec): 4

      Slip Detection? n                             Near-end CSU Type: other

```

Enter the **add signaling-group S** command, where **S** is the signaling-group number, to define new signaling group for the trunk between the Vocera Telephony Server and Avaya Communication Manager. Configuring the signaling-group is a two step procedure:

1. Create a signaling-group and specify the **Group Type** and **Primary D-Channel**.
2. After the trunk-group is created, specify the **Trunk Group for Channel Selection** field in the signaling group.

The following screen shows the first step. The important signaling-group related parameters that were different from the default values are highlighted here.

```

add signaling-group 73                           Page 1 of 5
                                         SIGNALING GROUP

      Group Number: 73                               Group Type: isdn-pri
                                         Associated Signaling? y
                                         Primary D-Channel: 01A1224
                                         Max number of NCA TSC: 0
                                         Max number of CA TSC: 0
                                         Trunk Group for NCA TSC:
      Trunk Group for Channel Selection:
      Supplementary Service Protocol: a

```

Enter the **add trunk-group T** command, where **T** is the trunk-group number, to create a trunk group. The important trunk-group related parameters that were different from the default values are highlighted below.

```

add trunk-group 73                               Page 1 of 21
                                         TRUNK GROUP

      Group Number: 73                               Group Type: isdn
      Group Name: 2Vocera                            COR: 1
      Direction: two-way                             TN: 1
      Dial Access? n                                TAC: 118
      Queue Length: 0                               Carrier Medium: PRI/BRI
      Service Type: tie                              Night Service:
                                         Auth Code? n
                                         TestCall ITC: rest
      TestCall BCC: 4                               Far End Test Line No:

```

On Page 5 of the TRUNK GROUP form, add trunk group members. To add members the following information should be specified.

- **Port**
- **Sig Grp**

The following screen shows the first five entries of the GROUP MEMBER ASSIGNMENTS page in the TRUNK GROUP form.

```

add trunk-group 73                                     Page 5 of 21
                                     TRUNK GROUP
                                     Administered Members (min/max): 1/4
GROUP MEMBER ASSIGNMENTS                               Total Administered Members: 23

Port      Code Sfx Name      Night      Sig Grp
1: 01A1201  TN464  F                               73
2: 01A1202  TN464  F                               73
3: 01A1203  TN464  F                               73
4: 01A1204  TN464  F                               73
5: 01A1205  TN464  F                               73

```

Enter the **change signaling-group S** command, where **S** is the signaling-group added earlier, to finish the signal group configuration. The following screen shows the signaling-group configuration. The important parameter in the screen is assigning the **Trunk Group for Channel Selection** field.

```

change signaling-group 73                               Page 1 of 5
                                     SIGNALING GROUP

Group Number: 73      Group Type: isdn-pri
Associated Signaling? y      Max number of NCA TSC: 0
Primary D-Channel: 01A1224    Max number of CA TSC: 0
Trunk Group for NCA TSC:
Trunk Group for Channel Selection: 73
Supplementary Service Protocol: a

```

Enter **change uniform-dialplan U**, where **U** is the uniform-dialplan number. The following screen shows the Uniform Dial Plan configuration. The 5-digit extension range starting with **229** was used for the Vocera Server and Badges, and utilized Automatic Alternate Routing (AAR).

```

change uniform-dialplan 229                             Page 1 of 2
                                     UNIFORM DIAL PLAN TABLE
                                     Percent Full: 0

Matching      Insert      Node      Matching      Insert      Node
Pattern Len Del Digits Net Conv Num  Pattern Len Del Digits Net Conv Num
229      5  0      aar  n
4        5  0      aar  n
                                     n

```


Enter **change aar analysis A**, where **A** is the AAR number. Automatic Alternate Routing (AAR) was used to route calls to the appropriate route pattern.

change aar analysis 229							Page 1 of 2
AAR DIGIT ANALYSIS TABLE							Percent Full: 1
Dialed String	Total Min	Total Max	Route Pattern	Call Type	Node Num	ANI Req'd	
229	5	5	73	aar		n	n

Enter **change route-pattern R**, where **R** is the route-pattern number. The route pattern 73 routes calls to trunk group 73. Before any call is sent to the trunk-group 73, 5 digits (21285) were inserted to make a 10 digit call.

change route-pattern 73														Page 1 of 3	
Pattern Number: 73 Pattern Name: 2Vocera															
SCCAN? n Secure SIP? n															
Grp	FRL	NPA	Pfx	Hop	Toll	No.	Inserted							DCS/ IXC	
No			Mrk	Lmt	List	Del	Digits							QSIG	
Dgts														Intw	
1:	73	0						73285							n user
2:														n user	
3:														n user	
BCC VALUE TSC CA-TSC ITC BCIE Service/Feature PARM No. Numbering LAR															
0	1	2	3	4	W	Request								Dgts Format	
														Subaddress	
1:	y	y	y	y	y	n	n	rest						none	
2:	y	y	y	y	y	n	n	rest						none	
3:	y	y	y	y	y	n	n	rest						none	

3.2. Configuring T1 Robbed Bit Trunks

The configuration verified for T1 trunks used the **229xx** extension range for the Vocera Server and Badges. Add the DS1 for the T1 trunks by using the command **add ds1 xxxx**, where **xxxx** is the T1 board location. The DS1 form for the Robbed Bit T1 board is shown here.

add ds1 1a12		Page 1 of 2
DS1 CIRCUIT PACK		
Location: 01A12	Name: Vocera	
Bit Rate: 1.544	Line Coding: b8zs	
Line Compensation: 1	Framing Mode: esf	
Signaling Mode: robbed-bit		
Interface Companding: mulaw		
Idle Code: 11111111		
Slip Detection? n	Near-end CSU Type: other	

Enter the **add trunk-group T** command, where **T** is the trunk-group number, to create a trunk group. The important trunk-group related parameters that were different from the default values are highlighted below.

add trunk-group 73		Page 1 of 20
TRUNK GROUP		
Group Number: 73	Group Type: tie	CDR Reports: y
Group Name: Vocera RBS	COR: 1	TN: 1 TAC: 107
Direction: two-way	Outgoing Display? n	Trunk Signaling Type:
Dial Access? y	Busy Threshold: 255	Night Service:
Queue Length: 0	Incoming Destination:	
Comm Type: voice	Auth Code? n	
	Trunk Flash? n	
TRUNK PARAMETERS		
Trunk Type (in/out): wink/immed	Incoming Rotary Timeout(sec): 5	
Outgoing Dial Type: tone	Incoming Dial Type: tone	
	Disconnect Timing(msec): 500	
Digit Treatment:	Digits:	
	Sig Bit Inversion: none	
Analog Loss Group: 9	Digital Loss Group: 13	
Incoming Dial Tone? y		
Disconnect Supervision - In? y Out? y		
Answer Supervision Timeout: 0	Receive Answer Supervision? y	

On Page 4 of the TRUNK GROUP form, add trunk group members. To add members the following information should be specified.

- **Port**
- **Sig Grp**

The following two screens show the results of the Group Member assignments page in the TRUNK GROUP form.

display trunk-group 73		Page 4 of 20	
		TRUNK GROUP	
		Administered Members (min/max): 1/24	
GROUP MEMBER ASSIGNMENTS		Total Administered Members: 24	
	Port	Code Sfx	Name Night Mode Type Ans Delay
1:	01A0701	TN464 F	
2:	01A0702	TN464 F	
3:	01A0703	TN464 F	
4:	01A0704	TN464 F	
5:	01A0705	TN464 F	
6:	01A0706	TN464 F	
7:	01A0707	TN464 F	
8:	01A0708	TN464 F	
9:	01A0709	TN464 F	
10:	01A0710	TN464 F	
11:	01A0711	TN464 F	
12:	01A0712	TN464 F	
13:	01A0713	TN464 F	
14:	01A0714	TN464 F	
15:	01A0715	TN464 F	

display trunk-group 73		Page 5 of 20	
		TRUNK GROUP	
		Administered Members (min/max): 1/24	
GROUP MEMBER ASSIGNMENTS		Total Administered Members: 24	
	Port	Code Sfx	Name Night Mode Type Ans Delay
16:	01A0716	TN464 F	
17:	01A0717	TN464 F	
18:	01A0718	TN464 F	
19:	01A0719	TN464 F	
20:	01A0720	TN464 F	
21:	01A0721	TN464 F	
22:	01A0722	TN464 F	
23:	01A0723	TN464 F	
24:	01A0724	TN464 F	
25:			
26:			

3.3. Configuring Analog Ports

Integration with analog ports requires administering the appropriate number of analog stations in Avaya Communication Manager, and assigning them to a hunt group. Users dialed the Hunt Group extension, **22023**, to reach the Vocera Server. In this configuration, 2 stations were used. The following screen shows a sample “STATION” form.

```
display station 22024                                     Page 1 of 3

                                STATION

Extension: 22024                                         Lock Messages? n      BCC: 0
Type: 2500                                              Security Code:         TN: 1
Port: 01A0601                                           Coverage Path 1:      COR: 1
Name: Vocera Port 1                                     Coverage Path 2:      COS: 1
                                                         Hunt-to Station:      Tests? y

STATION OPTIONS
    Loss Group: 1                                     Message Waiting Indicator: none
Off Premises Station? n
```

Enter the **add hunt-group H** command, where H is a hunt group number. On Page 1 of the “HUNT GROUP” form, the hunt group is assigned to extension **22023**.

```
add hunt-group 2                                         Page 1 of 60

                                HUNT GROUP

Group Number: 2                                         ACD? n
Group Name: Vocera                                     Queue? n
Group Extension: 22023                                 Vector? n
Group Type: ucd-mia                                    Coverage Path:
TN: 1                                                   Night Service Destination:
COR: 1                                                  MM Early Answer? n
Security Code:
ISDN Caller Display
```

On Page 3 of the “HUNT GROUP” form, stations were assigned to the hunt group.

```
add hunt-group 2                                         Page 3 of 60

                                HUNT GROUP

Group Number: 2      Group Extension: 55555      Group Type: ucd-mia
Member Range Allowed: 1 - 1500      Administered Members (min/max): 1 /2
Total Administered Members: 2

GROUP MEMBER ASSIGNMENTS
Ext      Name (24 characters)      Ext      Name (24 characters)
1: 22024      Vocera Port 1      14:
2: 22025      Vocera Port 2      15:
3:           16:
4:           17:
5:           18:
6:           19:
7:           20:
8:           21:
9:           22:
```

3.4. Configuring E1 QSIG Trunk

The steps for configuring E1 are similar to the T1 configuration. The only section that is different than T1 is the DS1 configuration. Hence, the DS1 configuration steps are the only ones that will be discussed in this section.

Enter **display system-parameters customer-options**. On Page 3, check the **DS1 MSP** field is enabled to create an E1 interface. If not, contact an authorized Avaya account representative to enable this feature.

display system-parameters customer-options		Page 3 of 11
OPTIONAL FEATURES		
Abbreviated Dialing Enhanced List? n	Audible Message Waiting? n	
Access Security Gateway (ASG)? n	Authorization Codes? n	
Analog Trunk Incoming Call ID? n	Backup Cluster Automatic Takeover? n	
A/D Grp/Sys List Dialing Start at 01? n	CAS Branch? n	
Answer Supervision by Call Classifier? n	CAS Main? n	
ARS? y	Change COR by FAC? n	
ARS/AAR Partitioning? y	Computer Telephony Adjunct Links? n	
ARS/AAR Dialing without FAC? y	Cvg Of Calls Redirected Off-net? n	
ASAI Link Core Capabilities? n	DCS (Basic)? n	
ASAI Link Plus Capabilities? n	DCS Call Coverage? n	
Async. Transfer Mode (ATM) PNC? n	DCS with Rerouting? n	
Async. Transfer Mode (ATM) Trunking? n	Digital Loss Plan Modification? n	
ATM WAN Spare Processor? n	DS1 MSP? y	
ATMS? n	DS1 Echo Cancellation? Y	
Attendant Vectoring? n		

On Page 5, check that the **Station and Trunk MSP** field is enabled to create an E1 interface. If not, contact an authorized Avaya account representative to enable this feature.

display system-parameters customer-options		Page 5 of 11
OPTIONAL FEATURES		
Multinational Locations? n	Station and Trunk MSP? y	
Multiple Level Precedence & Preemption? n	Station as Virtual Extension? n	
Multiple Locations? n	System Management Data Transfer? n	
Personal Station Access (PSA)? n	Tenant Partitioning? n	
Posted Messages? n	Terminal Trans. Init. (TTI)? n	
PNC Duplication? n	Time of Day Routing? n	
Port Network Support? y	Uniform Dialing Plan? y	
Processor and System MSP? n	Usage Allocation Enhancements? y	
Private Networking? y	TN2501 VAL Maximum Capacity? y	
Processor Ethernet? n	Wideband Switching? n	
Remote Office? n	Wireless? y	
Restrict Call Forward Off Net? y		
Secondary Data Module? y		

The next screen shows the configuration of the DS1 CIRCUIT PACK form for the QSIG protocol. Avaya Communication Manager acted as the **peer-master**, and the Vocera Server was the **QTE**, which is the same as **peer-slave** in Avaya Communication Manager. The following information is provided for configuring the DS1 board:

- Bit Rate: **2.048**
- Line Coding: **hdb3**
- Signaling Mode: **isdn-pri**
- Connect: **pbx**
- Interface: **peer-master**
- CRC?: **y**

Default values may be used in the remaining fields.

```
change ds1 1a13                                     Page 1 of 1
DS1 CIRCUIT PACK

Location: 01A13                                     Name: Vocera-E1
Bit Rate: 2.048                                     Line Coding: hdb3
Signaling Mode: isdn-pri
Connect: pbx                                         Interface: peer-master
TN-C7 Long Timers? n                               Peer Protocol: Q-SIG
Interworking Message: PROgress                      Side: a
Interface Companding: alaw                          CRC?: y
Idle Code: 11111111                               Channel Numbering: timeslot
DCP/Analog Bearer Capability: 3.1kHz

T303 Timer(sec): 4

Slip Detection? n                                  Near-end CSU Type: other
```

To turn on QSIG, the Supplementary Service Protocol should be set to **b** in the trunk-group and signaling-group forms. The following shows a sample trunk-group page to turn on QSIG.

```
change trunk-group 51                               Page 2 of 21
Group Type: isdn

TRUNK PARAMETERS
Codeset to Send Display: 6                         Codeset to Send National IEs: 6
Max Message Size to Send: 260                     Charge Advice: none
Supplementary Service Protocol: b                   Digit Handling (in/out): enbloc/enbloc

Trunk Hunt: cyclical

Digital Loss Group: 13
Incoming Calling Number - Delete:                  Insert:                      Format:
Bit Rate: 1200                                     Synchronization: async          Duplex: full
Disconnect Supervision - In? y Out? n
Answer Supervision Timeout: 0
```

The following shows a sample signaling-group page to turn on QSIG.

```
display signaling-group 51                           Page 1 of 5
SIGNALING GROUP

Group Number: 51                                   Group Type: isdn-pri
Associated Signaling? y                             Max number of NCA TSC: 0
Primary D-Channel: 01A1024                         Max number of CA TSC: 0
Trunk Group for NCA TSC:
Trunk Group for Channel Selection: 51
Supplementary Service Protocol: b
```

4. Configure Avaya Wireless AP-8

Avaya Wireless AP-8s were utilized for providing the wireless network for the Vocera badges to register to the Vocera server. The initial configuration for the Avaya Wireless AP-8 is accomplished through the ScanTool software, which comes with the Avaya Wireless AP-8 software. After the initial configuration, the web interface was utilized to do the configuration modifications. The configuration screens included here show how to configure the **Network**, **Interfaces**, and **Service Set Identifier (SSID)**.

Use a web browser to access the Management IP address of the Avaya Wireless AP-8. Provide proper credentials to login. Click on the **Configure** button from the main menu on the left. Click the **Network** tab from the right menu and select **DHCP RA** (DHCP Relay Agent) tab from the submenu (**Configure** → **Network** → **DHCP RA**). The following screen appears. Enable the DHCP Relay Agent by checking the box. Add the DHCP server by clicking the **Add** button and provide the IP address of the DHCP server.

After completion of adding DHCP server, click **OK** button.

The screenshot displays the Avaya Wireless AP-8 web interface. The left sidebar contains buttons for Status, Configure, Monitor, Commands, Help, and Exit. The main navigation area has tabs for Alarms, Bridge, QoS, RADIUS Profiles, SSID/VLAN/Security, System, Network, Interfaces, Management, and Filtering. The Network tab is selected, and the DHCP RA sub-tab is active. The DHCP RA configuration page includes a checkbox for 'Enable DHCP Relay Agent' which is checked. Below this are 'OK' and 'Cancel' buttons. A section titled 'DHCP Server IP Address Table' contains an 'Add' button and an 'Edit' button. Below the buttons is a table with columns for 'DHCP Server IP Address', 'Comment', and 'Status'. The table shows one entry with IP '10.0.0.1' and Status 'Enable'.

DHCP Server IP Address	Comment	Status
10.0.0.1		Enable

Navigate to the **Configure → Interfaces → Operational Mode** page. Select the **802.11 B only** for the Operational Mode field as shown in the following screen.

AVAYA

Alarms Bridge QoS RADIUS Profiles SSID/VLAN/Security

System Network **Interfaces** Management Filtering

Operational Mode Wireless Ethernet

The operational mode of the wireless interface determines the mode of communication between wireless clients and the access point

Note: Changes to these parameters require access point reboot in order to take effect.

Note: Select the desired operational mode prior to configuring other wireless interface parameters.

Note: 802.11d needs to be enabled before enabling IBSS Power Control.

Wireless - A

Operational Mode 802.11b only

Enable Super Mode ☐

Enable Turbo Mode ☐

Navigate to the **Configure → Interfaces → Wireless** page. The following screen appears. Configure the SSID and “Frequency Channel” fields and enter the value as shown below. For the roaming test, the “Frequency Channel” field for Avaya Wireless AP-8 was set to Channel 1. The Avaya Wireless AP-8 device used channel 11 for the “Frequency Channel” field.

AVAYA

Alarms Bridge QoS RADIUS Profiles SSID/VLAN/Security

System Network **Interfaces** Management Filtering

Operational Mode **Wireless** Ethernet

Wireless interface properties determine the characteristics of the wireless medium as well as how wireless clients will communicate with the access point.

Verify configuration of the desired operational mode prior to configuring the wireless interface properties below.

Note: This page allows configuration of a single SSID (Wireless Network Name); in order to configure more than one SSID, please visit the [SSID/VLAN/Security](#) page.

Note: Changes to these parameters except Wireless Service Status require access point reboot in order to take effect.

Physical Interface Type 802.11b (DSSS 2.4 GHz)

MAC Address 00:20:A6:5B:1F:1F

Regulatory Domain USA (FCC)

Network Name (SSID) vocera

Enable Auto Channel Select ☐

Frequency Channel 1 - 2.412 GHz

Transmit Rate Auto Fallback

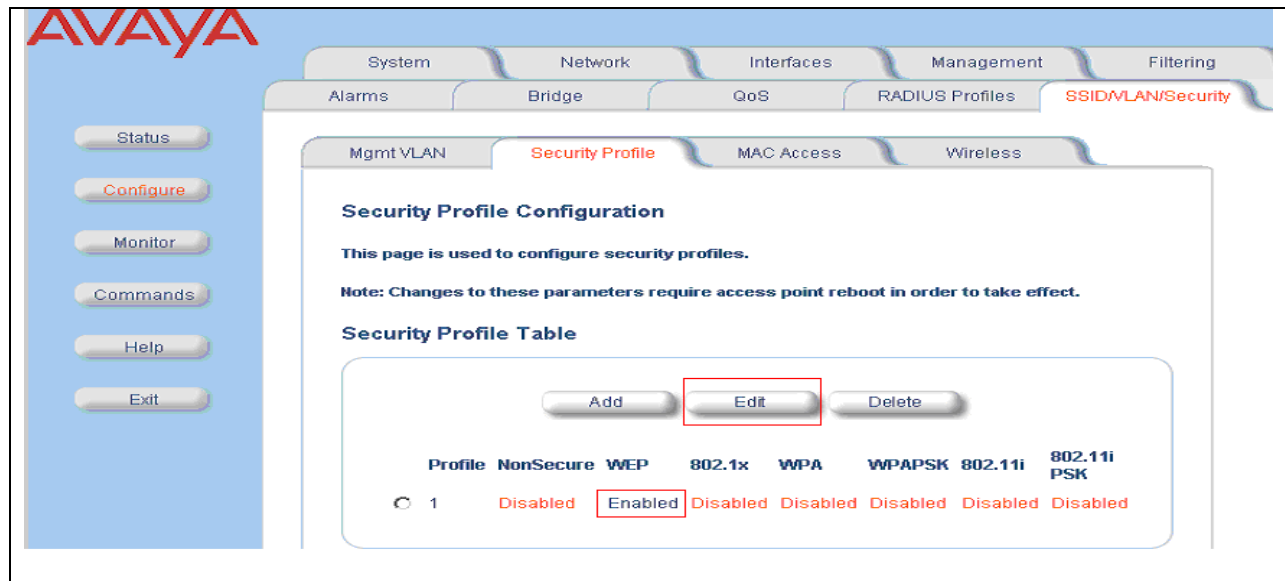
DTIM Period (1-255) 1

RTS/CTS Medium Reservation (2347=off) 2347

Enable Closed System ☐

Wireless Service Status Resume

Navigate to the **Configure → SSID/VLAN/Security → Security Profile** page. The following screen appears. Enable the WEP encryption by clicking the **Edit** button.



To Add or Edit the WEP encryption, click on the **WEP Station** box, and enter 13 characters to be used for the WEP 128 encryption key on the Encryption Key 0 field.

Note that the same WEP encryption key needs to be used by all wireless devices to be able to communicate.



For the new configuration to take effect, the Avaya Wireless AP-8 must now be rebooted. Click the **Commands** tab from the main menu, and then select the **Reboot** tab to reboot.

5. Configure the Vocera Communications System

The Vocera Communications System is configured using a web based console interface. Use a web browser to access the IP address of the Vocera Communication System. Log in with appropriate credentials. The following screen shows the telephony configuration used when the Vocera Telephony Server places outbound calls through the PBX.

Select **Telephony** from the left pane. Select the **Access Codes** tab in the right pane to configure Local and Long Distance Access Code. The Local Area Code field should match the local PBX area code. The Default Long-Distance Access Code field is typically the same as the Local Access Code, followed by a **1**.

After completion, click the **Save Changes** button.

The screenshot displays the Vocera Communications System Administrator interface. The left sidebar contains a navigation menu with options: Status Monitor, Sites, Users, Groups, Departments, System, Defaults, Locations, Email, Telephony (highlighted), Reports, Maintenance, Address Book, and Documentation. The main content area is titled 'Telephony' and features several tabs: Basic Info, Access Codes (highlighted with a red box), Toll Info, DID Info, PIN, Dynamic Extensions, and Sharing. Below the tabs, there is a 'Select Site' dropdown menu set to 'Global'. The 'Access Codes' section includes the following fields: 'Local Area Code*' with the value '732' (highlighted with a red box), 'Default Local Access Code' with the value '9' (highlighted with a red box), 'Default Long-Distance Access Code' with the value '91' (highlighted with a red box), and 'Company Voicemail Access Code' which is empty. A checkbox labeled 'Omit Area Code when Dialing Locally' is checked. Below these fields is a section titled 'Access Code Exceptions' with a descriptive paragraph: 'By default, numbers in the local area code use the Default Local Access Code and all others use the Default Long-Distance Access Code. Enter exceptions in the table below:'. This section contains a table with three columns: 'Area Code', 'Range of Numbers', and 'Access Code'. The table is currently empty. To the right of the table are three buttons: 'Add', 'Edit', and 'Delete'. At the bottom of the page, there are 'Save Changes' and 'Reset' buttons. The footer text reads 'Vocera Server 4.0 [Build 1273] Console [Build 1273]'.

Area Code	Range of Numbers	Access Code
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5.1. Configuring the Vocera Telephony Server for T1 ISDN-PRI

The next screen shows the configuration used when the Vocera Telephony server was connected to Avaya Communication Manager using an ISDN-PRI T1 trunk. For inbound, there are two ways that a call can reach an individual badge.

- A caller calls the Vocera Hunt Group Number. In this case, the user is greeted by the voice interface, and prompted for a badge user to contact.
- A user calls a Direct Inward Dialing (DID) number for a badge user. In this case, the call will be directly connected to the badge user without a greeting.

Select **Telephony** from the left pane, and select the **Basic Info** tab in the right pane. Edit the values as indicated below:

- Vocera Hunt Group Number: **22941**
- Number of Lines: **23**
- Integration Type: **Digital**
- Signaling Protocol: **ISDN PRI**
- Framing: **ESF**
- Line Code: **B8ZS**
- ISDN Protocol: **5ESS**

After completion, click the **Save Changes** button.

The screenshot displays the Vocera Telephony Administrator web interface. The left sidebar contains a navigation menu with options: Status Monitor, Sites, Users, Groups, Departments, System, Defaults, Locations, Email, Telephony (highlighted), Reports, Maintenance, Address Book, and Documentation. The main content area is titled 'Telephony' and features a tabbed interface with 'Basic Info' selected. Other tabs include Access Codes, Toll Info, DID Info, PIN, Dynamic Extensions, and Sharing. A 'Select Site' dropdown is set to 'Global'. The configuration fields are as follows:

- Enable Telephony Integration:** Checked.
- Vocera Hunt Group Number:** 22941
- Number of Lines*:** 23
- Integration Type:** Digital (selected over Analog).
- Digital Settings:**
 - Signaling Protocol: ISDN PRI
 - Framing: ESF
 - Line Code: B8ZS
- ISDN Settings:**
 - ISDN Protocol: 5ESS
 - Calling Party Number: (empty field)
 - Debug ISDN?: (unchecked checkbox)

A note at the bottom states: 'Note: Saving any changes to digital parameters will cause the telephony server to restart.' At the bottom of the page, there are 'Save Changes' and 'Reset' buttons. The footer indicates 'Vocera Server 4.0 [Build 1273] Console [Build 1273]'.

Click the **DID Info** tab to start configuring Direct Inward Dialing (DID) for an individual badge. Click the **Add** button to add DID range. After completion of the Add screen, shown later, click **Save Changes** button.

The screenshot displays the Vocera Communications Administrator web interface. The top navigation bar includes the Vocera logo, the word "ADMINISTRATOR", and a "Log Out" button. Below this is a "Telephony" section with tabs for "Basic Info", "Access Codes", "Toll Info", "DID Info" (highlighted with a red box), "PIN", "Dynamic Extensions", and "Sharing". A "Select Site" dropdown menu is set to "Global". The main content area is titled "Direct Inward Dialing (DID)" and contains a descriptive paragraph: "Allocate ranges of phone numbers for use as DID numbers. When an outside caller dials a number within a specified DID range, the call goes directly to the associated badge. Otherwise, the Genie prompts the caller to say the full name of the person or group, or enter an extension." Below this text is a table with two columns: "Prefix" and "Range of Numbers". The table is currently empty. To the right of the table are three buttons: "Add" (highlighted with a red box), "Edit", and "Delete". At the bottom of the interface are "Save Changes" and "Reset" buttons. The footer text reads "Vocera Server 4.0 [Build 1273] Console [Build 1273]".

From the “Edit DID Range” screen, provide a 5 digit **Prefix** to make a 10 digit DID number. This Prefix should match with the **Inserted Digit** in route-pattern 73 in Section 3.1. During the compliance test, the DID number (732-852-2942) was allocated. Click the **Add** button to finish the DID configuration.

The screenshot shows a web-based dialog box titled "Add DID Range Entry -- Web Page Dialog". Inside, there is a section titled "Edit DID Range" with a "DID Range" tab. The "Prefix" field is set to "732-85". Under the "Match" section, three radio buttons are present: "All Desk Extensions with Prefix", "Desk Extensions Starting With" (with an empty field and "(732-85-XX...)"), and "Desk Extensions In Range" (which is selected). Below the selected option, two fields are set to "22942", with "To" between them, resulting in "(732-85-22942 To 22942)". At the bottom, there are "Add" and "Cancel" buttons.

5.2. Configuring the Vocera Telephony Server for Wink Start

The following screen shows the configuration used when Vocera was connected to Avaya Communication Manager using T1 robbed-bit Signaling Mode.

- Vocera Hunt Group Number: **22941**
- Number of Lines: **24**
- Integration Type: **Digital**
- Signaling Protocol: **Wink Start**
- Framing: **ESF**
- Line Code: **B8ZS**

After completion, click the **Save Changes** button.

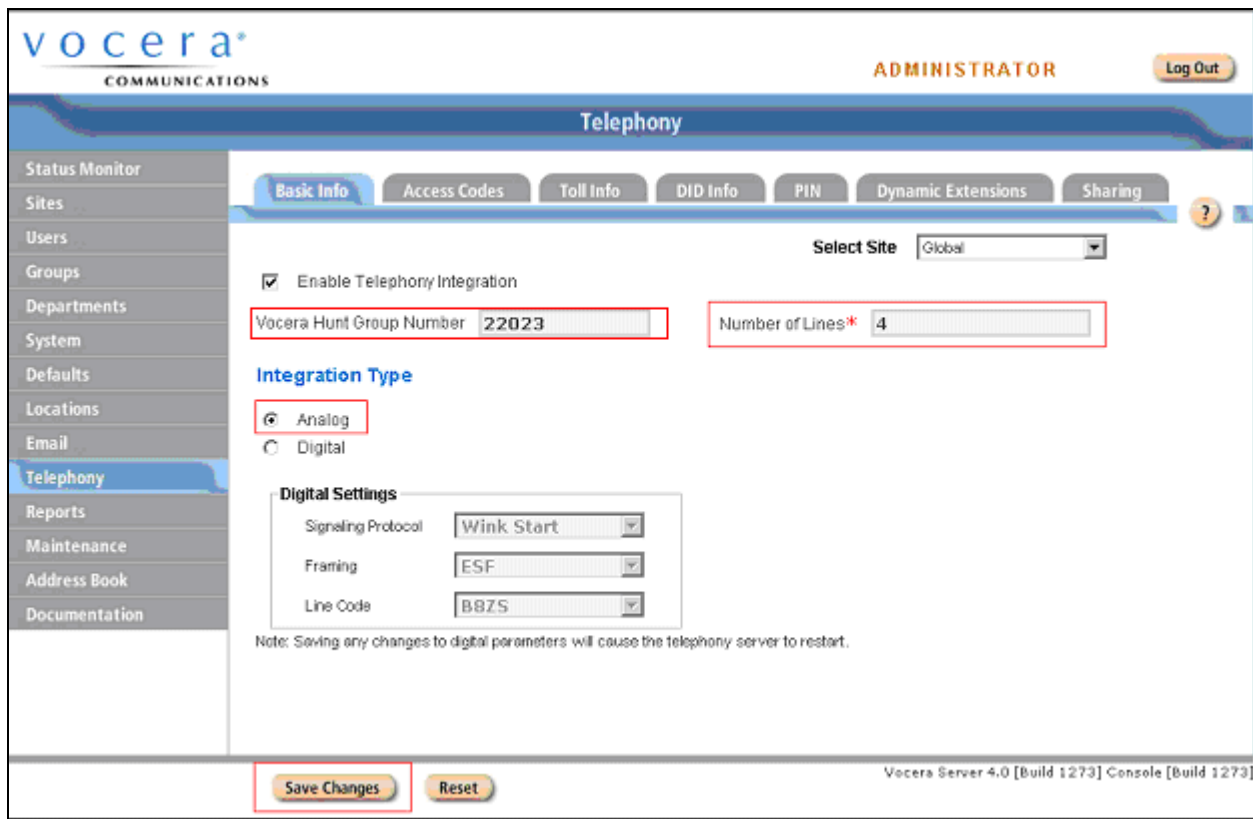
The screenshot displays the Vocera Communications Administrator web interface. The top header shows the Vocera logo, the word "ADMINISTRATOR", and a "Log Out" button. The main navigation sidebar on the left includes links for Status Monitor, Sites, Users, Groups, Departments, System, Defaults, Locations, Email, Telephony (highlighted), Reports, Maintenance, Address Book, and Documentation. The main content area is titled "Telephony" and features several tabs: Basic Info, Access Codes, Toll Info, DID Info, PIN, Dynamic Extensions, and Sharing. The "Basic Info" tab is selected, showing a "Select Site" dropdown set to "Global". Below this, there is a checkbox for "Enable Telephony Integration" which is checked. Two input fields are present: "Vocera Hunt Group Number" with the value "22941" and "Number of Lines*" with the value "24". Under the "Integration Type" section, there are radio buttons for "Analog" and "Digital", with "Digital" being selected. A "Digital Settings" box contains three dropdown menus: "Signaling Protocol" set to "Wink Start", "Framing" set to "ESF", and "Line Code" set to "B8ZS". A note at the bottom states: "Note: Saving any changes to digital parameters will cause the telephony server to restart." At the bottom of the page, there are two buttons: "Save Changes" and "Reset". The footer indicates "Vocera Server 4.0 [Build 1273] Console [Build 1273]".

5.3. Configuring the Vocera Telephony Server for Analog Ports

The following screen shows the configuration used when Vocera was connected to Avaya Communication Manager using 4 analog Ports.

- Voice Hunt Group Number: **22023**
- Number of Lines: **4**
- Integration Type: **Analog**

After completion, click the **Save Changes** button.



The screenshot displays the Vocera Telephony configuration interface. The left sidebar contains a navigation menu with options: Status Monitor, Sites, Users, Groups, Departments, System, Defaults, Locations, Email, **Telephony**, Reports, Maintenance, Address Book, and Documentation. The main content area is titled 'Telephony' and includes a 'Select Site' dropdown set to 'Global'. Under the 'Basic Info' tab, the 'Enable Telephony Integration' checkbox is checked. The 'Vocera Hunt Group Number' is set to '22023' and the 'Number of Lines*' is set to '4'. The 'Integration Type' section shows 'Analog' selected with a radio button, while 'Digital' is unselected. Below this, the 'Digital Settings' section includes dropdowns for 'Signaling Protocol' (Wink Start), 'Framing' (ESF), and 'Line Code' (B8ZS). A note states: 'Note: Saving any changes to digital parameters will cause the telephony server to restart.' At the bottom, there are 'Save Changes' and 'Reset' buttons. The footer indicates 'Vocera Server 4.0 [Build 1273] Console [Build 1273]'.

5.4. Configuring the Vocera Telephony Server for E1 ISDN-PRI

The following screen shows the configuration used when Vocera was connected to Avaya Communication Manager using an E1 trunk.

- Vocera Hunt Group Number: **22941**
- Number of Lines: **30** (For an E1 trunk, the 16th channel is reserved for signaling and 32nd channel is reserved for Controlling. This leaves 30 channels for voice.)
- Integration Type: **Digital**
- Signaling Protocol: **EURO ISDN PRI**

- Framing: **CEPT1**
- Line Code: **HDB3**
- ISDN Protocol: **QTE** (Indicates that the Vocera Telephony Server was set to **peer-slave**)

After completion, click the **Save Changes** button.

vocera
COMMUNICATIONS

ADMINISTRATOR Log Out

Telephony

Basic Info | Access Codes | Toll Info | DID Info | PIN | Dynamic Extensions | Sharing

Select Site: Global

☒ Enable Telephony Integration

Vocera Hunt Group Number: **22941** | Number of Lines*: **30**

Integration Type

☐ Analog
☒ Digital

Digital Settings

Signaling Protocol: **EURO ISDN PRI**
Framing: **CEPT1**
Line Code: **HDB3**

ISDN Settings

ISDN Protocol: **QTE**
Calling Party Number:
☐ Debug ISDN?

Note: Saving any changes to digital parameters will cause the telephony server to restart.

Save Changes Reset

Vocera Server 4.0 [Build 1273] Console [Build 1273]

5.5. Configuring the Vocera Badges

A Vocera provided script is used to easily download configuration information to the Vocera Badges. The following screen shows the applicable fields that were changed for the Vocera Badges to communicate with the Avaya Wireless AP-8.

AuthenticationType	Open
EncryptionType	WEP128
SSID	vocera
ServerIPAddr	10.0.0.1
ShortPreamble	FALSE
UpdaterIPAddr	10.0.0.1
WEPKey1	31323334353637383930313233
WEPKeySlot	1

6. Interoperability Compliance Testing

Interoperability compliance testing covered connectivity, error recovery, and feature functionality. Feature tests verified the ability of the Vocera Server to communicate with Avaya Communication Manager to make and receive calls, transfer calls, and conference calls.

Connectivity tests verified that the Vocera Server was able to connect to Avaya Communication Manager over the T1 and E1 trunks, and as a set of analog stations. The test also verified that the Vocera Badges were able to connect to Avaya Wireless AP-8s, and roam between access points. Error recovery testing verified that the Vocera Server was able to recover connectivity to Avaya Communication Manager under a link failure scenario.

6.1. General Test Approach

All test cases were performed manually. The following features and functionality were verified:

- T1 connectivity between Vocera Telephony Server and Avaya Communication Manager, using the ISDN-PRI protocol
- T1 connectivity between Vocera Telephony Server and Avaya Communication Manager, using a Robbed-bit Wink Start trunk.
- E1 connectivity between Vocera Telephony Server and Avaya Communication Manager, using the QSIG protocol.
- Analog Integration
- Layer 2 Roaming
- Transfer and Conference calls between the Vocera badges and Avaya IP Telephones
- Link failure scenario

6.2. Test Results

All test cases passed. The Vocera Communications System provided connectivity to Vocera Badge users over an Avaya wireless infrastructure, and connected to Avaya Communication Manager over the T1 and E1 interfaces, and a set of analog stations.

7. Verification Steps

To verify the solution is properly configured, the following steps can be utilized.

- Place calls between the Vocera Badges to verify proper connectivity through the wireless infrastructure. If the Vocera Badge is not able to reach the Vocera Server, verify that the proper WEP encryption key and SSID was configured for the badge and Avaya Wireless AP-8s.
- Place calls in both directions between Vocera Telephony Server and Avaya Communication Manager. If the calls are not successful, verify the proper configuration for the trunk port between Avaya Communication Manager and the Vocera Telephony Server. To check the trunk between Avaya Communication Manager and the Vocera Telephony Server, the following commands were utilized.
 - **test board** (to check the physical connection between Avaya Communication Manager and the Vocera Telephony Server)
 - **status trunk** (to check the trunk between Avaya Communication Manager and the Vocera Telephony Server)

8. Support

For technical support on the Vocera Communications System, call Vocera Support at (800) 473-3971 or send email to Support@Vocera.com.

9. Conclusion

These Application Notes describe the configuration steps required for integrating the Vocera Communications System with Avaya Communication Manager. The systems interoperated successfully, providing a suitable solution for wireless access and connectivity between Vocera Badge users and Avaya Communication Manager users.

10. References

This section references the Avaya and Vocera Communications documentation that are relevant to these Application Notes.

The following Avaya product documentation can be found at <http://support.avaya.com>.

- [1] *Feature Description and Implementation For Avaya Communication Manager*, Release 3.1, Issue 4, February 2006, Document Number 555-245-205.
- [2] *Administrator Guide for Avaya Communication Manager*, Release 3.1, Issue 2, February 2006, Document Number 03-300509.

The following Vocera Communications system product documentation is provided. For additional product and company information, visit <http://www.vocera.com>.

- [3] *Vocera Administration Guide*, Version 4.0 build 1273
- [4] *Vocera Installation Guide*, Version 4.0 build 1273

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