5.1.9.3 User Configuration Manager (UCM) Reports

1. DESCRIPTION

The User Configuration Manager report window allows the user to generate data summaries to view information from the database in a Web browser or to export the information as a file. The User Configuration Manager report window shows the users all of the fields that can be included in the report. By selecting which fields are wanted in the report and entering selection criteria for each field, the user can restrict the data that is retrieved.

SETUP

No prior setup is required for this test.

VERSION #1.070

2. TEST

Step 1. From the PC Application Launcher, select User Configuration Manager.

Step 2. Click on the appropriate folder to list its contents if it is not already open.

Step 3. Select the object for which a report is to be generated.

Step 4. Under the toolbar FILE pulldown menu, select Reports.

Step 5. Observe a window opens allowing a user to create a report.

Step 6. Enter all sorting data for the report and click Generate Report.

Step 7. Observe a window appears showing the requested report.

Step 8. Close the report window.

Step 9. Reports available to an operator under the UCM User Configuration Reports section are arranged in three categories: Subscribers, Security and System Configuration. Run the following reports : Under Subscribers folder, select Radio User; Under Security, select User; Under System Configuration , select System.

Pass____ Fail____

5.1.10 Site Trunking - FDMA Only Sites

5.1.10.1 Busy Queuing and Callback

1. DESCRIPTION

If no voice channel resources are available, radios requesting channels for new conversations are placed in the busy queue. Users of the same priority will move through the queue in a FIFO (first in, first out) sequence; however, users of higher priority will be inserted ahead of lower priority users in the queue. When a voice channel becomes available, the radio at the top of the busy queue gets a channel assignment and generates a callback tone. The callback alerts the user that a channel assignment was made and transmitting is now possible on the selected talkgroup.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 2
RADIO-2 - SITE - Simulcast
RADIO-3 - TALKGROUP 3
RADIO-3 - SITE - Simulcast
RADIO-4 - TALKGROUP 1
RADIO-4 - SITE - Simulcast

Note: All radios are "Site Locked."

VERSION #1.100

2. TEST

Step 1. Simulate a busy system by disabling all channels at Simulcast with the exception of the control channel and one voice channel.

Step 2. Initiate a Talkgroup Call with RADIO-1 and observe that RADIO-4 receives the call. Keep this call in progress until instructed to end the call.

Step 3. Key RADIO-2 and observe that the radio receives a busy.

Step 4. Key RADIO-3 and observe that the radio receives a busy.

Step 5. End the Talkgroup Call established in Step 2.

Step 6. Observe that RADIO-2 receives a callback prior to RADIO-3 receiving a callback.

Step 7. Return the site to Wide Area Trunking unless the next test requires Site Trunking.

Pass____ Fail____

5.1.10.2 Emergency Call and Alarm

1. DESCRIPTION

Emergency Alarms and Calls can be initiated by subscribers when the registered site is in Site Trunking. With all subscribers registered on a Site Trunking site, a subscriber will initiate an Emergency Alarm by pressing the Emergency button. By pressing the PTT, an Emergency Call will be issued and the ID of the initiator will be displayed with an Emergency indication by the other subscribers on the same talkgroup. Note that for site trunking, Emergency Call operation is always Top of Queue.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - Simulcast
RADIO-3 - TALKGROUP 2
RADIO-3 - SITE - Simulcast
RADIO-4 - TALKGROUP 3
RADIO-4 - SITE - Simulcast

Note: All Radios should be "Site Locked"

VERSION #1.050

2. TEST

Step 1. Place Simulcast into the Site Trunking mode.

Step 2. Simulate a busy system by disabling all channels at Simulcast with the exception of the control channel and one voice channel.

Step 3. Press the PTT on RADIO-3 and hold the PTT switch until instructed to release.

Step 4. Key RADIO-4 and observe that the radio receives a busy.

Step 5. Using RADIO-1, initiate an emergency alarm followed by an emergency call.

Step 6. Observe that RADIO-1 cannot transmit due to the voice channel being busy.

Step 7. Release the PTT switch on RADIO-3.

Step 8. Observe that RADIO-1 can now proceed with the call and RADIO-2 receives the call. Also observe that the display on RADIO-2 denotes an emergency and the ID of the unit sending the emergency.

Step 9. End the emergency call and verify that RADIO-4 gets a callback.

Step 10. Restore all channels to service and return the site to Wide Area Trunking unless the next test requires Site Trunking.

Pass____ Fail____

5.1.11 Site Trunking Features

5.1.11.1 Call Alert

1. DESCRIPTION

Call Alert is a tone page that allows a user to selectively alert another radio unit. When a site is in Site Trunking, Radios at the site will only be able to Call Alert other radios at the same site. The initiating radio will receive notification from the trunked system as to whether or not the page was received by the target radio.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 2
RADIO-2 - SITE - Simulcast

Note: All Radios should be "Site Locked"

VERSION #1.050

2. TEST

Step 1. Place Simulcast into the Site Trunking mode.

Step 2. Using RADIO-1, press the page button.

Step 3. Enter the Unit ID of RADIO-2 with the keypad, or scroll to the location where this ID is stored.

Step 4. Press the PTT to initiate the Call Alert.

Step 5. Verify that RADIO-2 received the Call Alert.

Step 6. Exit the Call Alert mode and return to normal talkgroup mode.

Step 7. Return the site to Wide Area Trunking unless the next test requires Site Trunking.

Pass____ Fail____

5.1.11.2 Continuous Assignment Updating

1. DESCRIPTION

When a talkgroup is assigned a voice channel, the site controller continues to transmit the channel assignment on the control channel for the duration of the Talkgroup Call. Radios coming into use on the system are automatically sent to voice channels with conversations in progress involving their selected talkgroups.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - Simulcast
RADIO-3 - TALKGROUP 1
RADIO-3 - SITE - Simulcast

Note: All Radios should be "Site Locked"

VERSION #1.040

2. TEST

Step 1. Place Simulcast into the Site Trunking mode.

Step 2. Turn OFF RADIO-1.

Step 3. Initiate a Talkgroup Call using RADIO-2.

Step 4. While the Talkgroup Call is in progress, turn on RADIO-1.

Step 5. Observe that RADIO-1, which was just brought back into service, joins the Talkgroup Call already in progress.

Step 6. Release the PTT of RADIO-2. Switch RADIO-1 to TALKGROUP 2.

Step 7. Initiate a Talkgroup Call using RADIO-2.

Step 8. While the Talkgroup Call is in progress, turn RADIO-1 back to TALKGROUP 1.

Step 9. Observe that RADIO-1, which was just set back to TALKGROUP 1, joins the Talkgroup Call already in progress.

Step 10. Return the site to Wide Area Trunking unless the next test requires Site Trunking.

Pass____ Fail____

5.1.11.3 Private Call

1. DESCRIPTION

Private Call is a selective calling feature that allows a dispatcher or radio user to carry on one-to-one conversation that is only heard by the 2 parties involved. When a site is in Site Trunking, Radios at the site will only be able to Private Call other radios at the same site.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - Simulcast
RADIO-3 - TALKGROUP 1
RADIO-3 - SITE - Simulcast

Note: All Radios should be "Site Locked"

VERSION #1.050

2. TEST

Step 1. Place Simulcast into the Site Trunking mode.

Step 2. Using RADIO-1, press the Private Call button.

Step 3. Enter the Unit ID of RADIO-2 with the keypad, or scroll to the location where this ID is stored.

Step 4. Press the PTT to initiate the call.

Step 5. Verify that at RADIO-2 only tones are heard and the display indicates that a call has been received.

Step 6. Answer the call at RADIO-2 by pressing the Private Call button. Verify its display shows the ID number or alias of the calling unit.

Step 7. Press the PTT switch on RADIO-2 and respond to the call. Note that if you do not press the Private Call button before pressing PTT, your audio will be heard by all members of the talkgroup, and not by the radio initiating the Private Call.

Step 8. Verify only RADIO-1 hears the audio from RADIO-2.

Step 9. End the Private Call. Return the site to Wide Area Trunking unless the next test requires Site Trunking.

Pass____ Fail____

5.1.11.4 Site Trunking Indication

1. DESCRIPTION

When a remote site loses its link or does not have a link to the Zone Controller, the affected site will enter "Site Trunking" mode of operation. Radios locked onto this site will be serviced locally within this site's coverage area.

NOTE: If the subscriber does not have the Display option, the "Site Trunking" indication will not be displayed.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 2
RADIO-2 - SITE - Simulcast
Lock the subscribers to Simulcast if more than one site exists on the system.

VERSION #1.050

2. TEST

Step 1. Place Simulcast into the Site Trunking mode.

Step 2. Verify that RADIO-1 and RADIO-2 are displaying the "Site Trunking" indication.

Step 3. Return the site to Wide Area Trunking unless the next test requires Site Trunking.

Pass____ Fail____

5.1.11.5 Talkgroup Call

1. DESCRIPTION

When a site goes into Site Trunking, radios with Talkgroup Call capability will be able to communicate with other members of the same talkgroup at that same site. Members of the same talkgroup at other sites will not be able to monitor those conversations.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - Simulcast
RADIO-3 - TALKGROUP 1
RADIO-3 - SITE - SITE 2
RADIO-4 - TALKGROUP 1
RADIO-4 - SITE - SITE 2

Note: All Radios should be "Site Locked"

VERSION #1.050

2. TEST

Step 1. Place Simulcast into the Site Trunking mode.

Step 2. Initiate a Talkgroup Call with RADIO-1 on TALKGROUP 1 at Simulcast.

Step 3. Observe that only RADIO-2 will be able to monitor and respond to the call. Note that RADIO-3 and RADIO-4 are not able this monitor the call since the site is not in wide area operation.

Step 4. Initiate a Talkgroup Call with RADIO-3 on TALKGROUP 1 at SITE 2.

Step 5. Observe that only RADIO-4 will be able to monitor and respond to the call.

Pass____ Fail____

5.1.11.6 Wide Area Recovery

1. DESCRIPTION

A site in Site Trunking will transition to Wide Area Trunking when all failures have been cleared. All subscribers should transition from Site Trunking to Wide Area Trunking and continue to process calls.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - Simulcast

Note: All Radios should be "Site Locked"

VERSION #1.050

2. TEST

Step 1. Set the status of SITE 1 to Wide Area and clear any system errors that may have placed SITE 1 into Site Trunking.

Step 2. Verify that the status of SITE 1 has transitioned into Wide Area Trunking.

Step 3. Verify that RADIO-1 and RADIO-2 no longer display Site Trunking.

Step 4. Verify Wide Area communications between RADIO-1 and RADIO-2.

Pass____ Fail____

5.1.12 System Management Tests

5.1.12.1 Affiliation Display

1. DESCRIPTION

Affiliation Display is a Private Radio Network Management (PRNM) application that monitors the mobility of radios for a particular zone. Mobility describes how radio users travel between different sites in a zone and how they communicate with other members of their assigned talkgroup or even with members outside of their talkgroup. A radio can be viewed in more than one zone. As a radio roams from one site to another or changes talkgroups, Affiliation Display updates and displays the affiliation and de-affiliation information for a monitored radio. This information can be useful for the troubleshooting and tracking of radios in the system and for monitoring the movement of traffic within a zone.

The Affiliation Display is divided into three sections: Site Viewer, Talkgroup Viewer, and Radio Viewer.

- The Site Viewer displays the number of talkgroups and number of radios affiliated to that site.
- The Talkgroup Viewer displays how many radios are affiliated to that talkgroup and the number of sites at which the talkgroup has radios affiliated.
- The Radio Viewer window displays affiliation information for a custom list of radios.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - Simulcast
RADIO-3 - TALKGROUP 2
RADIO-3 - SITE - SITE 2
RADIO-4 - TALKGROUP 2
RADIO-4 - SITE - SITE 2

VERSION #1.040

2. TEST

Step 1. Add RADIO-1,RADIO-2,RADIO-3, and RADIO-4 to the Affiliation Display.

Step 2. Verify that RADIO-1 and RADIO-2 show they are affiliated to Simulcast and TALKGROUP 1.

Step 3. Verify that RADIO-3 and RADIO-4 show they are affiliated to SITE 2 and TALKGROUP 2.

Step 4. Change the talkgroup of RADIO-1 and RADIO-2 to TALKGROUP 2.

Step 5. Verify that RADIO-1 and RADIO-2's affiliated talkgroup changes to TALKGROUP 2 on the Affiliation Display.

Step 6. Change the site of RADIO-3 and RADIO-4 to Simulcast.

Step 7. Verify that RADIO-3 and RADIO-4's affiliated site changes to Simulcast on the Affiliation Display.

Pass____ Fail____

5.1.12.2 Configuration Management - Access Permissions

1. DESCRIPTION

Prior to the ASTRO 7.8 release the Radio System Infrastructure Configuration Management section of the Zone Configuration Manager (ZCM) application set the parameters for each of the system devices in the SmartZone system. In ASTRO releases 7.8 and later the Radio System Infrastructure management is done in the Unified Network Configurator (UNC) application. The Unified Network Configurator Wizard (UNCW) also helps to configure the system by having a User interface into the system configuration.

Configuration parameters such as Individual and Talkgroup Default Access Permission, and Site Access Denial Type can be manipulated from these applications.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - Simulcast

VERSION #1.120

2. TEST

Step 1. Delete the database record for RADIO-1 in both the Radio and Radio User Configuration Windows so that the system does not have any knowledge of RADIO-1.

Step 2. Verify the "Individual Default Access Permission" flag is set to "NO" using the correct management application. If changes are made, approve the job in Voyence, then Publish Infrastructure Data from the UNCW. (Prior to 7.8 release the application will be the ZCM, 7.8 and later releases will use the Unified Network Configurator Wizard.)

Step 3. Initiate a call from RADIO-1 on TALKGROUP 1. Verify that the Radio System rejects the RADIO-1 call request because RADIO-1 has not been defined in the Radio User database.

Step 4. Change the Individual Default Access Permission flag to YES. After approving the job in Voyence, Publish Infrastructure Data from the UNCW.

Step 5. Initiate a call from RADIO-1. Verify that the system permits the RADIO-1 call request because the system grants radio access using default settings.

Step 6. Configure the RADIO-1 records that were automatically created in the Radio and Radio User Configuration Windows as a result of the radio's PTT.

Step 7. Reset the "Individual Default Access Permission" flag to NO. After approving the job in Voyence, Publish Infrastructure Data from the UNCW.

Step 8. Initiate a call from RADIO-1. Verify that the Radio System permits the RADIO-1 call request because RADIO-1 is now a valid user.

Pass____ Fail____

5.1.12.3 Configuration Management - Subscriber Capabilities

1. DESCRIPTION

The User Configuration Manager (UCM) controls the parameters for all radio users and dispatchers on the system. Within the Subscriber section, the Radio User Configuration Window enables the network manager to tailor SmartZone subscribers' capabilities. Multigroup, Secure, Call Alert, Private Call, and Telephone Interconnect are some of the features that can be enabled or disabled. The features that could be unique to the particular user are configured directly in the Radio User Configuration Window. The features that could be configured the same for a group of users are placed into records called profiles. The network manager references the profile which contains the desired setup for these features from the Radio User Configuration Window.

Note - A profile must already exist to be referenced through the Radio Configuration Window but can be modified later if needed.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - SITE 2

* Flag both radios to be capable of Call Alert, Private Call, and Dispatch Calls.

* Set the "User Enabled" flag to YES for both RADIO-1 and RADIO-2.

VERSION #1.050

2. TEST

Step 1. Initiate a Call Alert (PAGE) from RADIO-1 to RADIO-2. Verify that RADIO-2 receives the Call Alert (PAGE).

Step 2. Change the Call Alert Enabled flag to NO for RADIO-1 via the UCM.

Step 3. Initiate a Call Alert (PAGE) from RADIO-2 to RADIO-1. Verify that RADIO-2 receives a reject when attempting to Call Alert (PAGE) RADIO-1.

Step 4. Change the Call Alert Enabled flag back to YES for RADIO-1 via the UCM.

Step 5. Initiate a Call Alert (PAGE) from RADIO-2 to RADIO-1. Verify that RADIO-1 now receives the Call Alert (PAGE).

Step 6. Initiate a Private Call (CALL) from RADIO-1 to RADIO-2. Verify that RADIO-2 receives the Private Call (CALL).

Step 7. Change the Private Call Enabled flag to NO for RADIO-1 via the UCM.

Step 8. Initiate a Private Call (CALL) from RADIO-2 to RADIO-1. Verify that RADIO-2 receives a reject when attempting to Private Call (CALL) RADIO-1.

Step 9. Change the Private Call Enabled flag back to YES for RADIO-1 via the UCM.

Step 10. Initiate a Private Call (CALL) from RADIO-2 to RADIO-1. Verify that RADIO-1 now receives the Private Call (CALL).

Pass____ Fail____

5.1.12.4 Configuration Management - Talkgroup Capabilities

1. DESCRIPTION

The User Configuration Manager (UCM) controls the parameters for all radio users and dispatchers on the system.

Within the Subscriber section, the Talkgroup Configuration Window enables the network manager to tailor SmartZone Talkgroup Capabilities. Emergency, Secure and Priority Monitor are some of the features that can be enabled or disabled. The features that could be unique to the particular user are configured directly in the Talkgroup Configuration Window. The features that could be configured the same for a group of users are placed into records called profiles. The network manager references the profile which contains the desired setup for these features from the Talkgroup Configuration Window.

NOTE: A profile must already exist to be referenced through the Talkgroup Configuration Window but can be modified later if needed.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - SITE 2

* Set the "Talkgroup Enabled" flag to YES for TALKGROUP 1 in the UCM.

VERSION #1.070

2. TEST

Step 1. Initiate a call from RADIO-1 on TALKGROUP 1. Verify that RADIO-2 hears the RADIO-1 audio.

Step 2. Change the Talkgroup Enabled flag to NO for TALKGROUP 1 via the UCM.

Step 3. Initiate a call from RADIO-1 or RADIO-2 on TALKGROUP 1. Verify that neither radio can initiate a call because of the change in status of the Group Enabled Flag of TALKGROUP 1.

Step 4. Initiate an Emergency call from RADIO-1. Verify that both the console (if present) and RADIO-2 can hear the transmission.

Step 5. Dekey RADIO-1.

Step 6. Change the Talkgroup Enabled flag back to YES for TALKGROUP 1 via the UCM.

Step 7. Initiate a call from RADIO-1 on TALKGROUP 1. Verify that both the console (if present) and RADIO-2 hear RADIO-1.

Pass____ Fail____

5.1.12.5 Site Wide Area Trunking to Site Trunking State using the Unified Event Manager (UEM)

1. DESCRIPTION

Through the Unified Event Manager (UEM), the system user can run diagnostics that change the "Trunking State" of a site. The effect of the diagnostic is displayed on the UEM.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast (Site Locked)
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - SITE 2
NMclient01 - UEM session up and running in the alarms view.

VERSION #1.100

2. TEST

Step 1. Initiate a Wide Area Call with RADIO-1 in TALKGROUP 1. Verify RADIO-2 will be able to monitor and respond to the call.

Step 2. Select Simulcast in the Network Devices tab. Right click and select SNMP Node then Issue Command. Select "Site Trunking" and apply to put the site in Site Trunking mode.

Step 3. Observe that the UEM alarms view shows that the site is now in Site Trunking and is User Requested.

Step 4. Verify ZoneWatch (if applicable) no longer shows the Simulcast trunking activity. Also verify that RADIO-1 can no longer communicate with RADIO-2.

Step 5. Place the site back into Wide Area Trunking using the "Issue command" feature from UEM. Verify that the site returns to Wide Area mode using the UEM.

Step 6. Verify communications between RADIO-1 and RADIO-2.

Pass____ Fail____

5.1.12.6 UEM - Diagnostics - RF Site

1. DESCRIPTION

The purpose of this test is to confirm diagnostic commands are sent to an RF site and the proper status is reported at the Unified Event Manager (UEM).

All commands are initiated from the UEM.

Standalone and MultiSite configurations are tested.

SETUP

NMclient01 - UEM session up and running in the Network Database view.

VERSION #1.070

2. TEST

Step 1. From the UEM, right click on an ASTRO Repeater Site managed resource and select the Command option.

Step 2. The command window opens for the ASTRO repeater Site managed resource with the following commands available: Site Trunking, Site Off, Wide Trunking, and Site Failsoft.

Step 3. Select Site Trunking and click the Apply button.

Step 4. The command execution status is displayed in the command window. After the command is executed, the site enters site trunking mode. The event is displayed in the Network Events Browser. An alarm is displayed in the Alarms Browser.

Step 5. Select Site Off and click the Apply button.

Step 6. The command execution status is displayed in the command window. After the command is executed, the site enters site off mode. The event is displayed in the Network Events Browser. An alarm is displayed in the Alarms Browser.

Step 7. Select Wide Trunking and click the Apply button.

Step 8. The command execution status is displayed in the command window. After the command is executed, the site enters wide trunking mode. The event is displayed in the Network Events Browser.

Step 9. For a MultiSite Site, repeat step 1 except right click on a MultiSite Site managed resource.

Step 10. Repeat steps 2-8. Verify the same results occur.

Pass____ Fail____

5.1.12.7 Unified Event Manager (UEM) - Diagnostics - CCGW

1. DESCRIPTION

The purpose of this test is to confirm diagnostic commands are sent to a Conventional Channel GateWay (CCGW) and the proper status is reported at the Unified Event Manager (UEM).

All commands are initiated from the UEM.

SETUP

RADIO-1 CCH1
RADIO-2 CCH1
CONSOLE-1 CCH1

NMclient01 - UEM session up and running in the Network View.

VERSION #1.070

2. TEST

Step 1. From the UEM, right click on a CCGW managed resource and select SNMP-Node then the Issue Command option.

Step 2. The command window opens for the CCGW managed resource with the following commands available: Disable and Enable.

Step 3. Verify the conventional channel is operational using the two radios programmed to the channel.

Step 4. Select Disable and click the Apply button.

Step 5. The command execution status is displayed in the command window. After the command is executed, the CCGW is disabled. The event is displayed in the Network Event Browser. An alarm is displayed in the Alarm Browser.

Step 6. Attempt to place a conventional call using the two radios. The call audio will not be heard at the console. The resource at Console-1 will show that the resource is unavailable.

Step 7. Select Enabled and click the Apply button.

Step 8. The command execution status is displayed in the command window. After the command is executed, the CCGW is enabled. The event is displayed in the Network Event Browser.

Step 9. Attempt to place a conventional call using RADIO-1. The call should now be heard by CONSOLE-1 as well as RADIO-2.

Pass____ Fail____

5.1.12.8 ZoneWatch

1. DESCRIPTION

ZoneWatch is an administration tool for monitoring radio traffic on a system. A system manager can use ZoneWatch to analyze traffic patterns for load distribution and troubleshoot radio and site problems. ZoneWatch is used to view current radio traffic activity for the system. This activity is displayed in graphical format, color-coded for easy identification of the type of activity occurring on the system.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - SITE 2
RADIO-3 - TALKGROUP 1
RADIO-3 - SITE - SITE 3
RADIO-4 - TALKGROUP 1
RADIO-4 - SITE - SITE 4

VERSION #1.080

2. TEST

Step 1. Verify that ZoneWatch has been configured for the Grid and Multi Site Scroll windows to display system activity.

Step 2. From the PC Application Launcher, select a zone folder.

Step 3. From within that zone, select ZoneWatch.

Step 4. Select the appropriate profile to be able to view the channel usage on the system.

Step 5. Initiate several calls with the radios and observe that the appropriate channel usage information is displayed.

Pass____ Fail____

5.1.13 System Reliability Features

5.1.13.1 Link Failure between CCGW and Zone Controller (MCC 7500 System Only)

1. DESCRIPTION

This test verifies that the two communication paths between the CCGW and Zone Controller (ZC) are redundant and the system will continue uninterrupted if the main path fails. To accomplish this, a NIC connection is removed at the ZC.

SETUP

RADIO-1 - CCH1
RADIO-2 - CCH2
This test requires an operational system with a CCGW with CCH1 and CCH2 and MCC 7500 Console Site with CONSOLE-1 and CONSOLE-2. CONSOLE-1 and CONSOLE-2 are affiliated to CCH1 and CCH2.

2. TEST

Step 1. Initiate a analog conventional Call with RADIO-1 on CCH1.

Step 2. Observe that only CONSOLE-1 and CONSOLE-2 will be able to monitor and respond to the call.

Step 3. Initiate an analog conventional call with RADIO-2 on CCH2.

Step 4. Observe that only CONSOLE-1and CONSOLE-2 will be able to monitor and respond to the call.

Step 5. Remove one ENET cable to Link1 from the NIC on the ZC, this will simulate a Zone Controller to Console Site Link failure.

Step 6. Observe that the calls on CCH1 and CCH2 continue.

Step 7. Repeat steps 1-6 for the other Zone Controller.

Step 8. Connect the ENET cables to normalize the system.

VERSION #1.020

Pass____ Fail____

5.1.13.2 Link Failure between MCC 7500 Site and Zone Controller

1. DESCRIPTION

This test verifies that the two communication paths between the MCC 7500 Console Site and Zone Controller are redundant and the system will continue uninterrupted if the main path fails. To accomplish this test one of the two NIC connections is removed at the ZC.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - Simulcast
RADIO-3 - TALKGROUP 2
RADIO-3 - SITE - Simulcast
RADIO-4 - TALKGROUP 2
RADIO-4 - SITE - SITE 2
CONSOLE-1 and CONSOLE-2 at the MCC 7500 Console site are affiliated to the TALKGROUP 1 and TALKGROUP 2 talkgroups.

VERSION #1.040

2. TEST

Step 1. Initiate a Talkgroup Call with RADIO-1 in TALKGROUP 1.

Step 2. Observe that only RADIO-2, CONSOLE-1 and CONSOLE-2 are able to monitor and respond to the call.

Step 3. Initiate a Talkgroup call with RADIO-3 in TALKGROUP 2.

Step 4. Observe that only RADIO-4, CONSOLE-1 and CONSOLE-2 are able to monitor and respond to the call.

Step 5. Remove the ENET cable to Link 1 from the NIC on the ZC, this will simulate a Zone Controller to Console Site Link failure.

Step 6. Observe that the calls on TALKGROUP 1 and TALKGROUP 2 can continue.

Step 7. Repeat steps 1-6 for the other Zone Controller.

Step 8. Connect the ENET cables to normalize the system.

Pass____ Fail____

5.1.13.3 Multiple Control Channels

1. DESCRIPTION

A maximum of four channels are eligible for assignment as control channel at each site. In the event that the assigned control channel fails at any remote site, the Zone Controller automatically selects one of the other control capable channels as the active control channel for that site. A Control Channel Preference Level can be used to rank the control capable channels where 1 is the highest ranking and 4 the lowest.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 1
RADIO-3 - TALKGROUP 2
RADIO-4 - TALKGROUP 2

Note: All radios should be affiliated to the site under test.

VERSION #1.100

2. TEST

Step 1. Initiate a Talkgroup Call with RADIO-1 on TALKGROUP 1.

Step 2. Observe that only RADIO-2 will be able to monitor and respond to the call.

Step 3. Initiate a Talkgroup Call with RADIO-3 on TALKGROUP 2.

Step 4. Observe that only RADIO-4 will be able to monitor and respond to the call.

Step 5. Power off the control channel at the site under test.

Step 6. Observe that the control channel rotates to the next available channel capable of acting as a control channel.

Step 7. Initiate a Talkgroup Call with RADIO-1 on TALKGROUP 1.

Step 8. Observe that only RADIO-2 will be able to monitor and respond to the call.

Step 9. Initiate a Talkgroup Call with RADIO-3 on TALKGROUP 2.

Step 10. Observe that only RADIO-4 will be able to monitor and respond to the call. Power up the channel previously powered off to return the system to normal operation.

Pass____ Fail____

5.1.13.4 Receiver Interference Shutdown

1. DESCRIPTION

Receiver interference occurs when a repeater receives an unauthorized signal. In order to prevent a disruption of communications, the affected channel will be disabled and removed from the system's pool of available channel resources when the undesired carrier is detected for longer than the time-out period. Once the interfering carrier disappears, the channel is returned to service within approximately 5 minutes. The channel is then enabled.

Note: The default Carrier Malfunction Timeout is 50 seconds. If the default value is to be modified, the change will need to be made in the Unified Network Configurator (UNC) for the channel(s) to be modified.

SETUP

A Service Monitor is needed to transmit a signal at the receive frequency of a chosen channel.

VERSION #1.100

2. TEST

Step 1. Using a service monitor, transmit a 1 kHz tone at the receive frequency of any repeater.

Step 2. Continue to transmit the 1 kHz tone until the controller removes the channel from service. (The Carrier Malfunction Time parameter timer is configurable, default is 50 seconds).

Step 3. Initiate a Talkgroup Call with RADIO-1 on TALKGROUP 1.

Step 4. Dekey (allow the channel to end the call) and initiate another Talkgroup Call with RADIO-1. Verify the affected channel is removed from the selection/assignment process by repeating talkgroup calls until the available channels have all been used.

Step 5. From the Unified Event Manager (UEM), verify channel malfunction due to interfering carrier is indicated.

Step 6. Remove the interfering signal. Verify the test Channel is returned to service within five minutes and that UEM indicates that the channel is now enabled.

Step 7. Initiate a Talkgroup Call with RADIO-1 on TALKGROUP 1. Dekey (allow the channel to end the call) and initiate another Talkgroup Call with RADIO-1. Repeat the calls until the test channel has been used.

Step 8. Verify that RADIO-2 can monitor and respond to the TALKGROUP 1 call on the channel that has returned to service.

Pass____ Fail____

5.1.13.5 Redundant Site Controller Switching - Automatic Switchover

1. DESCRIPTION

This test verifies the essential subsite operation within a simulcast system. An essential simulcast remote subsite is one that must have at least one control channel and one traffic channel for the simulcast subsystem to remain trunking mode. If all control channels or all traffic channels have experienced faults at an essential simulcast remote subsite, then the entire simulcast subsystem is put into failsoft mode to ensure communication can continue in the area covered by the essential simulcast remote site. When all of the failsoft channels at an essential simulcast remote subsite have experienced faults, the essential simulcast remote subsite is malfunctioned.

SETUP

Three radios are required to perform this test (radios 1, 2 and 3). All Radios should be selected to Talkgroup A and "Site Locked."

VERSION #1.050

2. TEST

Step 1. Verify both Site Controller are available and in the Normal state.

Step 2. Power off the active Site Controller and verify the backup becomes the new active Site Controller (note events in the event viewer).

Step 3. Key Radio 1 and verifying that the other 2 radios hear the audio.

Step 4. End the call from Radio 1.

Step 5. Power up the Site Controller and verify it returns to the normal state.

Pass____ Fail____

5.1.13.6 Redundant Site Link Failure

1. DESCRIPTION

Communication between the Master Site and the Remote Site can take place over dedicated redundant links. The two links between the Master Site and the Remote Site operate in a hot/standby mode. The system will switch to the backup link if the main LAN or WAN link fails.

Note that the Primary Site Router, if functional, will always be the active router. The Secondary Site Router will only take over when the Primary Site Router is malfunctioning.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 1

* The site being tested should have redundant links to the Master Site.

VERSION #1.050

2. TEST

Step 1. Initiate a Talkgroup Call with RADIO-1 on TALKGROUP 1.

Step 2. Observe that RADIO-2 is able to monitor and respond to the call.

Step 3. Remove the WAN link from the active router at the Remote Site.

Step 4. Initiate a Talkgroup Call with RADIO-1 on TALKGROUP 1.

Step 5. Observe that RADIO-2 is able to monitor and respond to the call.

Step 6. Replace the WAN link connection that was removed in Step 3.

Pass____ Fail____

5.1.13.7 Redundant Zone Controller Switching/Automatic Switchover

1. DESCRIPTION

In a non-DSR configuration the Zone Controller subsystem uses two Zone Controllers in a redundant configuration. The backup Zone Controller is made active either upon the loss of the active ZC or upon a user command from the Unified Network Configurator (UNC). In a DSR configuration there are 4 Zone Controllers in a redundant configuration. Any one of the 4 could be active to keep the Zone Sites in Wide Area Trunking. If using the Dynamic Resilience Zone configuration the Unified Event Manager will report the Zone Controller switchover in both Unified Event Managers (UEM).

SETUP

RADIO 1 - TG 1
RADIO 1 - SITE - SITE 1
RADIO 2 - TG 1
RADIO 2 - SITE - SITE 2
RADIO 3 - TG 1
RADIO 3 - SITE - Site 3 (Site 3 should be in another Zone if applicable.)

* The Zone Controllers should be successfully synchronized before performing this procedure.

VERSION #1.050

2. TEST

Step 1. Verify the state of the current Zone Controllers is Active or Standby in the Unified Network Configurator (UNC). (There will be 2 Zone Controllers in single Zone or 4 in the case of DSR zones.)

Step 2. Reset the active Zone Controller via the Unified Event Manager (UEM) diagnostic.

Step 3. Verify using UNC, UEM and ZoneWatch (if applicable) that the standby Zone Controller becomes active and brings all sites back wide. Wait for the Radios to settle out the site affiliations.

Step 4. Key RADIO 1 and verify that RADIO 2 and RADIO 3 hear the audio.

Step 5. End the call from RADIO 1.

Step 6. Verify that Zone Controller that was reset comes back up to an “Enabled” and “Standby” state.

Pass____ Fail____

5.1.13.8 Site Failsoft

1. DESCRIPTION

Failure of all control channels, failure of all voice channels, or failure of the site controller will cause a site (RF Subsystem) to enter failsoft operation. Subscribers can be programmed to operate in failsoft by talkgroup; to search its list of control channel frequencies in failsoft; or to disable failsoft altogether. When a site enters failsoft, a radio programmed for failsoft by talkgroup will first look for a specific failsoft channel dictated by the selected talkgroup. Since many systems have different frequencies across sites, if the radio is unable to find the talkgroup's failsoft channel the radio will instead operate in the control channel search failsoft mode. A radio programmed or needing to search control channels for failsoft frequencies will lock onto the first control channel in its control channel list.

Note: Radios should not be site locked when in failsoft mode. The radio will not check the full list of 64 control channels programmed into the radio's code plug. All radios should be programmed to have the same sequence of control channel frequencies.

Note: The subscribers MUST be SmartZone capable.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - Simulcast
RADIO-3 - TALKGROUP 2
RADIO-3 - SITE - Simulcast
RADIO-4 - TALKGROUP 2
RADIO-4 - SITE - Simulcast
* Program the Radios for failsoft operation by talkgroup. TALKGROUP 1 should use a different channel for failsoft than TALKGROUP 2 and neither should be a control channel.

* In order to prevent roaming turn off all sites except the site under test.

VERSION #1.060

2. TEST

Step 1. Using the Zone Configuration Manager (ZCM)or Unified Event Manager (UEM), place the subsystem into failsoft mode.

Step 2. Verify that the Radios emits a failsoft tone approximately once every ten seconds.

Step 3. Initiate a Talkgroup Call from RADIO-1 while in failsoft mode.

Step 4. Verify that only RADIO-2 can hear RADIO-1.

Step 5. Dekey RADIO-1 and power down the failsoft channel associated with TALKGROUP 1.

Step 6. Key RADIO-1 and verify RADIO-2 can still monitor the call but the other radios cannot. *

Step 7. Dekey RADIO-1 and initiate a Talkgroup Call from RADIO-3.

Step 8. Verify that only RADIO-4 can hear RADIO-3.*

Pass____ Fail____

5.1.13.9 Station Failure

1. DESCRIPTION

When a base station repeater at one site fails due to hardware problems, the pending call is lost and the trunking controller removes the channel from service system wide. This failure can be created by powering down one base station repeater.

SETUP

No set up required.

VERSION #1.030

2. TEST

Step 1. Power down a voice repeater for any voice channel at one remote site.

Step 2. Press PTT on a radio several times to step through all available voice channels.

Step 3. Verify that the disabled channel is not used.

Pass____ Fail____

5.1.13.10 Transmitter Power Failure Shutdown

1. DESCRIPTION

The repeaters can detect a loss or decrease in transmitter output power of all trunked repeaters connected to it. Each trunked repeater contains an internal wattmeter element. Once the forward power has decreased past the threshold set, the repeater instructs the Zone Controller to take the channel out of service. If reflected power increases past the threshold set, the repeater will also instruct the Zone Controller to take the channel out of service.

Once the station threshold has been exceeded and the station taken out of service a 5 minute timer will start. At the timer expiration a transmitter test will start to perform a self check on the station. This self check lasts for 20 seconds. If the station passes the self check it will be placed back into service.

Note: This test should be done on a site with more than 2 channels. Failsoft will occur if the test is done on a 2 channel site.

SETUP

RADIO-1 - TALKGROUP 1

VERSION #1.110

2. TEST

Step 1. Select a channel to disconnect the transmit antenna connection to the trunked repeater. (This will cause a high VSWR condition.)

Step 2. Key RADIO-1 so that the selected channel is assigned, and verify that the channel disables due to an alarm condition. Verify that this alarm is reported at the Unified Event Manager (UEM).

Step 3. Wait 30 seconds after the failure then restore the transmit antenna connection to the trunked repeater.

Step 4. Using the station LEDs, verify that the time it takes from the corrected connection to the station being placed back in service is within 5 minutes.

Step 5. Verify the Unified Event Manager (UEM) also reports the station being back in service.

Pass____ Fail____

5.1.13.11 Verify Continued Operation Upon Loss of RDM or XHUB

1. DESCRIPTION

Dual LAN subsites are equipped with new hardware that enable all of the Multisite Base Radios (MsBRs) to communicate over an active or redundant LAN, thus lessening the impacts of a single point of failure. Two modules ("GPB 8000 Reference Distribution Modules (RDM)") are added to the primary GTR8000 Expandable Site Subsystem (ESS) to facilitate the switching and time reference distribution functions at the remote sites. In addition, the expansion cabinets are equipped with two Expansion HUBs (XHUBs). A failure of an RDM or XHUB will result in the MsBRs automatically reverting to the LAN served by the other active RDM/XHUB thus allowing continued wide area operation by all MsBRs.

This test case verifies continued wide area operation upon a single point of failure associated with an RDM failure or XHUB failure.

SETUP

Three radios are required. All three are set to the same talkgroup.
- RADIO-1 TALKGROUP 1
- RADIO-2 TALKGROUP 1
- RADIO-3 TALKGROUP 1

Ensure Zone Watch is setup to monitor the sites and the Unified Event Manager (UEM) is available for viewing faults.

Note: An RDM/XHUB failure can be simulated by pulling the RDM/XHUB out of the ESS.

VERSION #1.000

2. TEST

Step 1. Using RADIO-1, key-up on a channel residing on the primary ESS. While RADIO-1 is keyed, fail RDM_1.

Step 2. Verify RADIO-1 operation on Zone Watch. RADIO-1 stays on the same channel and the Site remains in wide area trunking.

Step 3. Verify that RADIO-2 and RADIO-3 receive RADIO-1 audio.

Step 4. Verify that the UEM reports the failure of RDM_1.

Step 5. Dekey RADIO-1, key-up RADIO-3 on a channel residing on the primary ESS. While RADIO-3 is keyed, restore RDM_1.

Step 6. Verify RADIO-3 operation on Zone Watch. RADIO-3 stays on the same channel and the Site remains in wide area trunking.

Step 7. Verify that RADIO-1 and RADIO-2 receive RADIO-3 audio.

Step 8. Verify that the UEM reports the recovery of RDM_1.

Step 9. For customers with expansion cabinets, repeat the test on channels served by the expansion ESS by failing XHUB_1 instead of RDM_1.

Pass____ Fail____

5.1.14 Wide Area Trunking Features

5.1.14.1 Audio Interrupt/Interrupt Never Mode

1. DESCRIPTION

A radio PTT request may be received for a group already active and currently being sourced by another radio unit. The talkgroup can be flagged to either allow or disallow the new PTT. If allowed, the latest PTT request will be granted and become the source of the call.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 1
RADIO-3 - TALKGROUP 1

VERSION #1.070

2. TEST

Step 1. Verify TALKGROUP 1's template is set up as Audio Interrupt Never.

Step 2. Using RADIO-1, initiate a call on TALKGROUP 1.

Step 3. Verify both RADIO-2 and RADIO-3 monitor the audio.

Step 4. Using RADIO-3, initiate a call on TALKGROUP 1.

Step 5. Verify that RADIO-3 receives a reject and that RADIO-2 continues to listen to RADIO-1.

Step 6. Dekey both Radios.

Pass____ Fail____

5.1.14.2 Call Alert

1. DESCRIPTION

Call Alert is a tone page that allows a user to selectively alert another radio unit. The initiating radio will receive notification from the trunked system as to whether or not the page was received by the target radio. Units receiving a Call Alert will sound an alert tone. As with other types of calls, Call Alerts can take place from anywhere in the system.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 2
RADIO-3 - TALKGROUP 3

VERSION #1.130

2. TEST

Step 1. Using RADIO-1, press the page button.

Step 2. Enter the unit ID of RADIO-2 with the keypad, or scroll to the location where this ID is stored.

Step 3. Press the PTT to initiate the call alert. Verify that the RADIO-1 user receives audible indication that the Call Alert was sent.

Step 4. Verify that RADIO-2 user receives an audible indication of an incoming Call Alert was sent but RADIO-3 does not.

Step 5. Verify RADIO-1 gets an audible indication that the Call Alert was successfully received at the target radio.

Step 6. Turn off RADIO-2. Send a Call Alert from RADIO-1 to RADIO-2.

Step 7. Verify that the RADIO-1 user receives audible indication that the Call Alert was sent.

Step 8. Verify RADIO-1 receives a "No Acknowledgement" indication that the Call Alert was not received at the target radio.

Pass____ Fail____

5.1.14.3 Continuous Assignment Updating

1. DESCRIPTION

When a talkgroup is assigned a voice channel, the site controller continues to transmit the channel assignment on the control channel for the duration of the talkgroup call. Radios coming into use on the system are automatically sent to voice channels with conversations in progress involving their selected talkgroups.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 1
RADIO-3 - TALKGROUP 1

VERSION #1.080

2. TEST

Step 1. Turn OFF RADIO-1.

Step 2. Initiate a Talkgroup Call using RADIO-2 and verify RADIO-3 hears the audio.

Step 3. While the Talkgroup Call is in progress, turn ON RADIO-1.

Step 4. Observe RADIO-1, which was just brought back into service, joins the Talkgroup Call already in progress.

Step 5. End the talkgroup call.

Step 6. Switch RADIO-1 to another talkgroup.

Step 7. Initiate a Talkgroup Call from RADIO-2 to RADIO-3.

Step 8. While the Talkgroup Call is in progress, set RADIO-1 back to TALKGROUP 1.

Step 9. Observe that RADIO-1 joins the Talkgroup Call already in progress.

Pass____ Fail____

5.1.14.4 Emergency Alarm and Call with Hot Mic

1. DESCRIPTION

Users in life threatening situations can use the Emergency button on the radio to immediately send a signal to the dispatcher and be assigned the next available voice channel. An Emergency Call can be set to either Top of Queue or Ruthless Preemption operation. During an emergency call the Emergency ID will appear on the display of the subscribers. To demonstrate this, an Emergency Alarm and Call will be initiated from a portable which will be received by a portable, on the same talkgroup, affiliated at any site of any zone in the system.

This test will demonstrate when the Hot Mic option is configured, the subscriber will send an emergency and after a voice channel is assigned, the subscriber will automatically transmit for a programmable period of time.

Emergency Alarm with Voice to Follow (Hot Mic) is an option in the portable and must be enabled via software. This test case works for all portable radios. For mobile radios, specific mobile microphone models are required.

NOTE: If the subscriber does not have a display, the Emergency ID will not be displayed.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 1
RADIO-3 - TALKGROUP 1

Emergency Alarm w/ Voice Following must be enabled in the subscriber.

VERSION #1.180

2. TEST

Step 1. Using RADIO-1 send an Emergency Alarm by pressing the emergency button.

Step 2. Observe the display on RADIO-2 and RADIO-3 denotes an emergency and the unit ID or alias of RADIO-1.

Step 3. Observe that RADIO-2 and RADIO-3 can hear any audio from RADIO-1 even though RADIO-1 does not have its PTT switch pressed.

Step 4. Observe that RADIO-1 PTT times out and the radio dekeys.

Step 5. End the Emergency Call by holding down the Emergency button.

Pass____ Fail____

5.1.14.5 Private Call

1. DESCRIPTION

Private Call is a selective calling feature that allows a radio user to carry on one-to-one conversation that is only heard by the 2 parties involved. Subscriber units receiving a private call will sound an alert tone. As with other types of calls, Private Calls can take place from anywhere in the system.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 1
RADIO-3 - TALKGROUP 1

VERSION #1.080

2. TEST

Step 1. Using RADIO-1, press the Private Call (Call) button.

Step 2. Enter the unit ID of RADIO-2 with the keypad, or scroll to the location where this ID is stored.

Step 3. Press the PTT to initiate the Private Call.

Step 4. Verify that RADIO-2 hears tones and the display indicates that a Private Call has been received, but RADIO-3 receives no indications.

Step 5. Answer the call at RADIO-2 by pressing the Private Call (Call) button. If RADIO-2 has a display, verify it shows the ID number or Alias of the calling unit.

Step 6. Press the PTT switch on RADIO-2 and respond to the Private Call. Note that if you do not press the Private Call button before pressing PTT, your audio will be heard by all members of the talkgroup, and not just by the radio initiating the Private Call.

Step 7. Verify that RADIO-2 can communicate with RADIO-1.

Step 8. Verify that RADIO-3 does not monitor the Private Call.

Step 9. End the Private Call by pressing the "home" key and return to normal talkgroup operation.

Pass____ Fail____

5.1.14.6 Site Access Control/"Both" Site Access Denial

1. DESCRIPTION

The system can be configured to limit radio or talkgroup access to selected valid sites. Control can be exercised to restrict radio users or talkgroups to certain sites, or to steer radio activity away from smaller sites in an effort to avoid busies. System flags establish which sites are valid for each individual radio user, talkgroup and multigroup. An overall Site Access Denial flag for the system governs how these radio and talkgroup settings affect the affiliation or rejection of radios to individual sites. Once a subscriber unit has been denied at a site, it will not attempt to access that site unless power is cycled or the user changes talkgroups. Four possible values for the Site Access Denial flag exist: Individual Only, Talkgroup Only, Either, or Both.

"Both" Site Access Denial indicates that a radio will not be allowed to affiliate to a site only if both the radio user and affiliated talkgroup do not have access to the site.

NOTE: Site Denial flags are not cleared from the subscriber until the power is cycled or the talkgroup is changed.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - SITE 2

VERSION #1.060

2. TEST

Step 1. Verify/Set the Site Access Denial Flag to Both.

Step 2. Cycle power to RADIO-1 and RADIO-2 to force them to affiliate, this will clear any site denials they may hold in memory.

Step 3. Initiate a TALKGROUP 1 call from RADIO-2. Verify that RADIO-2 is allowed to make the TALKGROUP 1 call.

Step 4. Set SITE 2 to be a non-valid site for RADIO-2.

Step 5. Initiate a TALKGROUP 1 call from RADIO-2. Verify that RADIO-2 is allowed to make the TALKGROUP 1 call.

Step 6. Set SITE 2 to be a non-valid site for TALKGROUP 1.

Step 7. Verify the updates complete.

Step 8. Initiate a TALKGROUP 1 call from RADIO-2. Verify that RADIO-2 receives a reject, and roams to a valid site. RADIO-2 is not allowed to make the TALKGROUP 1 call from SITE 2 since TALKGROUP 1 nor RADIO-2 is valid at SITE 2.

Step 9. Reset all Talkgroup and Radio User flags. Verify the updates complete.

Step 10. Recycle power to the radios to clear the affiliation flags.

Pass____ Fail____

5.1.14.7 Site Access Control/"Either" Site Access Denial

1. DESCRIPTION

The system can be configured to limit radio or talkgroup access to selected valid sites. Control can be exercised to restrict radio users or talkgroups to certain sites, or to steer radio activity away from smaller sites in an effort to avoid busies. System flags establish which sites are valid for each individual radio user, talkgroup and multigroup. An overall Site Access Denial flag for the system governs how these radio and talkgroup settings affect the affiliation or rejection of radios to individual sites. Once a subscriber unit has been denied at a site, it will not attempt to access that site unless power is cycled or the user changes talkgroups. Four possible values for the Site Access Denial flag exist: Individual Only, Talkgroup Only, Either, or Both.

"Either" Site Access Denial indicates that a radio will not be allowed to affiliate to a site if either the radio user or affiliated talkgroup does not have access to that site.

NOTE: Site Denial flags are not cleared from the subscriber until the power is cycled or the talkgroup is changed.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - SITE 2
RADIO-3 - TALKGROUP 2
RADIO-3 - SITE - SITE 2

VERSION #1.020

2. TEST

Step 1. Set the Site Access Denial Flag to "Either".

Step 2. Verify that the change has completed.

Step 3. Cycle power to the radios to force them to affiliate, this will clear any site denials they may hold in memory.

Step 4. Initiate a TALKGROUP 1 call from RADIO-2. Verify that RADIO-2 is allowed to make the TALKGROUP 1 call.

Step 5. Set SITE 2 to be a non-valid site for RADIO-2.

Step 6. Initiate a TALKGROUP 1 call from RADIO-2. Verify that RADIO-2 receives a reject, and roams to a valid site. RADIO-2 is not allowed to make the TALKGROUP 1 call from SITE 2 since RADIO-2 is no longer valid at SITE 2.

Step 7. Switch RADIO-1 to TALKGROUP 2 and initiate a TALKGROUP 2 call from RADIO-3. Verify that RADIO-3 is allowed to make the TALKGROUP 2 call.

Step 8. Set SITE 2 to be a non-valid site for TALKGROUP 2.

Step 9. Initiate a TALKGROUP 2 call from RADIO-3. Verify that RADIO-3 receives a reject, and roams to a valid site. RADIO-3 is not allowed to make the TALKGROUP 2 call from SITE 2 since TALKGROUP 2 is no longer valid at SITE 2.

Step 10. Return all settings to the original state.

Pass____ Fail____

5.1.14.8 Site Access Control/"Individual Only" Site Access Denial

1. DESCRIPTION

The system can be used to limit radio or talkgroup access to selected valid sites. Control can be exercised to restrict radio users or talkgroups to certain sites, or to steer radio activity away from smaller sites in an effort to avoid busies. System flags establish which sites are valid for each individual radio user, talkgroup and multigroup. An overall Site Access Denial flag for the system governs how these radio and talkgroup settings affect the affiliation or rejection of radios to individual sites. Once a subscriber unit has been denied at a site it will not attempt to access that site unless power is cycled or the user changes talkgroups. Four possible values for the Site Access Denial flag exist: Individual Only, Talkgroup Only, Either, or Both.

"Individual Only" Site Access Denial dictates that a radio will not be allowed to affiliate to a particular site if the radio user does not have access to that site. If the Site Access Denial flag is set to "Individual Only", the talkgroup record for valid sites is not used in the determination of actual site affiliation permissions.

NOTE: Site Denial flags are not cleared from the subscriber until the power is cycled or the talkgroup is changed.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - SITE 2

VERSION #1.020

2. TEST

Step 1. Set the Site Access Denial Flag to Individual Only. Verify that the change has completed.

Step 2. Cycle power to RADIO-1 and RADIO-2 to force them to affiliate, this will clear any site denials they may hold in memory.

Step 3. Initiate a Private Call from RADIO-2 to RADIO-1. Verify that the Private Call occurs since RADIO-2 is valid at SITE 2. End the Private Call.

Step 4. Set SITE 2 to be a non-valid site for RADIO-2. Verify that the change has completed.

Step 5. Initiate a Private Call from RADIO-2 to RADIO-1. Verify that RADIO-2 receives a reject, (Note: this may happen quickly and not be noticeable if the radio is not site locked. If site locked, the radio will not roam until the site lock is removed.) and roams to a valid site. RADIO-2 is not allowed to make the Private Call from SITE 2 since it is no longer valid at SITE 2.

Step 6. Set SITE 2 to be a valid site for RADIO-2. Verify that the change has completed.

Step 7. Cycle power to RADIO-1 and RADIO-2 to force them to affiliate, this will clear any site denials they may hold in memory.

Step 8. Return the system to the original settings.

Pass____ Fail____

5.1.14.9 Site Access Control/"Talkgroup Only" Site Access Denial

1. DESCRIPTION

The system can be configured to limit radio or talkgroup access to selected valid sites. Control can be exercised to restrict radio users or talkgroups to certain sites, or to steer radio activity away from smaller sites in an effort to avoid busies. System flags establish which sites are valid for each individual radio user, talkgroup and multigroup. An overall Site Access Denial flag for the system governs how these radio and talkgroup settings affect the affiliation or rejection of radios to individual sites. Four possible values for the Site Access Denial flag exist: Individual Only, Talkgroup Only, Either, or Both.

"Talkgroup (TG) Only" Site Access Denial dictates that a radio will not be allowed to affiliate to a particular site if its affiliated talkgroup does not have access to that site. In this case, the individual radio user setting for valid sites is not used in the determination of actual site affiliation permissions.

NOTE: Site Denial flags are not cleared from the subscriber until the power is cycled or the talkgroup is changed.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - Simulcast

VERSION #1.060

2. TEST

Step 1. Set the Site Access Denial Flag to Talkgroup Only.

Step 2. Verify that the change completed.

Step 3. Set SITE 2 to be a valid site for RADIO-2. Set SITE 2 to be a non-valid site for TALKGROUP 1.

Step 4. Attempt to force RADIO-2 to scan to SITE 2. Verify that RADIO-2 cannot affiliate to SITE 2 since TALKGROUP 1 is a non-valid talkgroup for SITE 2.

Step 5. Set SITE 2 to be a valid site for TALKGROUP 1. Set SITE 2 to be a non-valid site for RADIO-2.

Step 6. Cycle power to RADIO-2 then attempt to force RADIO-2 to scan to SITE 2. Verify that RADIO-2 is now allowed to affiliate to SITE 2 since the talkgroup record determines site access.

Step 7. Initiate a call from RADIO-2. Verify that RADIO-2 is allowed to make the call from SITE 2 since TALKGROUP 1 is valid at SITE 2. Also verify that RADIO-1 hears the audio.

Step 8. Set SITE 2 to be a valid site for RADIO-2. Return the Site Access Denial Flag to "Both".

Pass____ Fail____

5.1.14.10 Talkgroup Call

1. DESCRIPTION

The Talkgroup is the primary level of organization for communications on a trunked radio system. Radios with Talkgroup call capability will be able to communicate with other members of the same Talkgroup. This provides the effect of a private channel down to the Talkgroup level. This test will demonstrate that a Talkgroup transmission initiated by a radio user will only be heard by system users, which have, the same Talkgroup selected. As with other types of calls, Talkgroup calls can take place from anywhere in the system.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 1
RADIO-3 - TALKGROUP 2
RADIO-4 - TALKGROUP 2

VERSION #1.150

2. TEST

Step 1. Initiate a Wide Area Call with RADIO-1 in TALKGROUP 1.

Step 2. Observe that only RADIO-2 will be able to monitor and respond to the call.

Step 3. Initiate a Wide Area Call with RADIO-3 in TALKGROUP 2.

Step 4. Observe that only RADIO-4 will be able to monitor and respond the call.

Pass____ Fail____

5.1.15 Punch-list

Brief Description	Owner (Required)	Target Date

_____ Check here if there are additional punch-list items attached.

5.1.16 Signoff Certificate

By their signatures below, the following witnesses certify they have observed the In-Field System Acceptance Test Procedures.

Signatures

WITNESS: _____Date: _____

Please Print Name: _____ _____

Initials:

Please Print Title: _____

WITNESS: _____Date: _____

Please Print Name: _____ _____

Initials:

Please Print Title: _____

WITNESS: _____Date: _____

Please Print Name: _____ _____

Initials:

Please Print Title: _____

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5.2 Microwave Factory/Field Acceptance Test

5.2.1 Functional Test Pass/Fail Matrix

Configuration Verification / Functional Tests		PASS/ ACCEPT	FAIL/ REJECT
I	System Configuration		
II	Cable & Equipment Labeling		
III	Equipment Inventory		
IV	Antenna System Configuration		
V	Microwave Terminal Configuration (SP & RF)		
1.1	Field Path Loss		
1.2	TX: RF Power Test		
1.3	TX: RF Frequency Test		
1.4	TX: RF Fade Test		
1.5	TX: ATPC Test		
2	RX: RSL / AGC Test		
3.1	Proteus MX Switching Test - Automatic		
3.2	Proteus MX Switching Test - Manual		
3.3	Proteus MX Switching Test - Power Interruption		
4	DS1 Traffic Routing Test – Main T1 Routing		
5.1	SHARP Protection Test - Automatic		
5.2	SHARP Protection Test – Manual		
6	Microwave Terminal Alarms Test – Minor, Major, Normal		
7	Orderwire Functionality Test		
8	Microwave Terminal – MOSCAD Interface Test		
9	Network Loop 24 Hour BER Test (Loop 1,2,3)		
10	Ethernet Test		
11	Network Management System (NMS) Test		

Exceptions/Comments:

_____

_____

_____

_____ _____

Customer Representative – (PM) Date

_____ _____

Microwave Networks, Inc. Representative – (PM) Date

5.2.2 System Configuration

A. Description

The system is physically staged for the Factory Acceptance Test (FAT) as it will be installed in the system.

All the equipment is powered using the DC power system supporting our Systems Integration test area.

Note: All DS1s are configured for B8ZS.

Note: All terminals are connected back-to-back through fixed attenuation. Receive Signal Levels (RSL) will be between -30/-50dBm. **Note: MNI does not simulate the calculated RSL for each terminal hop.**

B. Instructions

Verify each site is physically present and interconnected per the System Map.

C. Result

The system configuration is consistent with the System Map. Each site is accounted for and is connected to its coordinating sites.

5.2.3 Cable & Equipment Labeling

A. Description

Demonstrate all wiring in the system is clearly labeled and dressed into the equipment racks. Each cable is labeled at both ends with the cable function, destination and rack profile identifier. All wiring is documented on the Wiring List (WL).

Note: Specific customer labeling requirements are required at least 30 days prior the scheduled FAT.

B. Instructions

On a sample basis verify wiring and labeling is consistent with system documentation (Wiring List and Block & Level Drawing).

C. Result

Audited cables are routed per the Wiring List and labeled at both ends with the cable function, destination and rack profile identifier.

5.2.4 Equipment Inventory

A. Description

Demonstrate all equipment ordered through Microwave Networks Incorporated is present.

Note: At the FAT only integrated equipment and spares are present. “Drop Ship” items such as the antennas and transmission lines are shipped directly to the field from our supplier.

This step is accomplished by comparing the equipment list with the actual equipment on-site.

B. Instructions

Verify each line item on the Equipment List is present.

C. Result

All equipment specified on the Equipment List (EL) is accounted for. For the FAT this excludes all “drop ship” equipment.

5.2.5 Antenna System Configuration

A. Description

Note: This Section is not applicable for the FAT.

Each antenna will be verified for antenna type, azimuth, polarization, centerline, waveguide length, and waveguide type following antenna alignment.

This information will be documented on the Terminal Acceptance form in Section 1.

B. Instructions

Record the antenna type, azimuth, polarization, actual centerline, actual waveguide length and waveguide type used in Section 1 of the Terminal Acceptance form.

Compare the recorded data with the FCC Supplemental Showing for the hop being installed.

Take Digital photographs of the antenna installation showing antenna mount, polarization, side struts, and waveguide routing / grounding.

C. Result

Antenna type, azimuth, polarization, centerline, waveguide length, and waveguide type match what is stated on the FCC Supplemental Showing.

Note: Measured Antenna Centerline must be +/- 3 feet of Centerline specified on Supplemental Showing.

5.2.6 Microwave Terminal Configuration (SP & RF)

A. Description

Demonstrate each terminal's SP and RF Part #, Serial #, Software Version, TLI A type and TLI B type match what is recorded on the System Test data sheet.

B. Instructions

1. Record the Proteus MX SP part number and serial number shown on the sticker located on the SP Shelf in Section 2 of the Terminal Acceptance form.

2. Record the Proteus MX RF part number and serial number shown on the sticker located on the RF Shelf in Section 2 of the Terminal Acceptance form.

3. Record the TLI type in Section 2 of the Terminal Acceptance data form.

4. Record the Software version for the Channel Units and RF in Section 2 of the Terminal Acceptance form.

    a. "Log-In" to the respective terminal using the following procedure:

        i. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled "COMPUTER".
        ii. Open the EM2 software and on the initial log-in screen select "Serial" from the pull down and choose the appropriate "COM PORT" that the PC is using.
        iii. Enter the username: "Admin" (note this cannot be changed) enter the password. The default password is "password" which can be changed). Once the correct "Admin" and "User Password" is entered you will be "logged on" and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.

    b. Go to "Terminal Info" in the menu and select "Inventory …" this will bring up a screen that includes the software versions.

    c. Go to "View Full table (System Test data sheet)/Save Info" button at the bottom of this window and it will bring up a detailed inventory of the terminal with all of its active parts. Save the information on this screen to a "text" file and print.

C. Result

5. Recorded data: SP and RF Part #, Serial #, Software Version, TLI type matches that recorded on the System Test Data Sheet.

5.2.7 Field Path Loss (TX Flange to RX Flange Loss)

A. Description

To establish a reference “Field Path Loss” which is equal to the “Far End” TX Reference Power Out minus the “Near End“ Receive signal Level (RSL)

B. Instructions

1. Note: Perform this in conjunction with 1.2 TX: RF Power Test so that Power Meter is only connected once.

2. Log on to the Terminal under test if you have not already logged on.
   a. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled “COMPUTER”
   b. Open the EM2 software and on the initial log-in screen select “Serial” from the pull down and choose the appropriate “COM PORT” that the PC is using.
   c. Enter the username: “Admin” (note this cannot be changed) enter the password. The default password is “password” which can be changed). Once the correct “Admin” and “User Password” is entered you will be “logged on” and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.

3. If the Terminal under test is a Hot-Standby or Space-Diversity terminal, position the “On Line” switch on the front of the Switching Shelf to “Primary” on both the Near End and Far End terminals.

4. Adjust the ‘Far End” ATPC MAX TX PWR out to achieve a “Near End” AGC voltage equal to a recorded point In the AGC Voltage - RSL table in the Systems Test Data Sheet. Record both the RSL from the AGC curve (measured) and the Indicated RSL in Section 10 of the Terminal Acceptance form.

5. If the Terminal under test is a Hot-Standby or Space-Diversity terminal, position the “On Line” switch on the front of the Switching Shelf to “Secondary” on both the Near End and Far End terminals and repeat Step 4.

6. In the EM2 software go to the “Test” and “RFU Mute” selection and MUTE all the RF portions of the terminal (Factory location only). Set the time to be “0” so it does not UN-Mute.

   Warning – In the field DO NOT Mute the Far End terminal without setting a time out. You will lose communication to that terminal which can only be un-muted by logging on locally.

7. Remove the mating flange to the RF unit under test and connect an RF transition. Connect the Power Meter to the transition.

   Warning: Do not to exceed the power rating of the Power Sensor. Use a “high power” sensor capable of + 33 DBm or use a calibrated attenuator.

8. If the Terminal under test is a Hot-Standby or Space-Diversity terminal, position the “On Line” switch on the front of the Switching Shelf to “Primary” on both the Near End and Far End terminals.

9. In the EM2 software, go back to the “Test” and “RFU Mute” screen and set the transmitter connected to the power meter to “On Line”. Measure the power and record in Section 13 of the Terminal Acceptance form. Also record the indicated TX PWR OUT.

10. If the Terminal under test is a Hot-Standby or Space-Diversity terminal, position the “On Line” switch on the front of the Switching Shelf to “Secondary” on both the Near End and Far End terminals.

11. Repeat Step 9.

12. In the EM2 software go to the “Test” and “RFU Mute” selection and MUTE all the RF portions of the terminal (Factory location only). Set the time to be “0” so it does not UN-Mute.

    Warning – In the field DO NOT Mute the Far End terminal without setting a time out. You will lose communication to that terminal which can only be un-muted by logging on locally.

13. Re-Set for the Primary and Secondary ATPC MAX TX PWR Outs to the specified FCC MAX Power level.

14. Re-connect Flange disconnected in Step 7 unless you will perform Step 1.2 next.

15. Calculate the Field Path Loss TX PWR (dBm) minus RSL (dBm) and enter into Section 13 Terminal Acceptance form for both the ”measured” values and the ”indicated” values.

5.2.8 TX: RF Power Test

A. Description

Measurement of TX RF Power

Note: For Proteus MX terminal the power output is software configurable not hardware set. There is no “fine tune” adjustment. You set the desired output power using the EM2 software. The Terminal output power is set per the PCN requirements.

B. Instructions

1. Log on to the Terminal under test if you have not already logged on.
   a. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled “COMPUTER”
   b. Open the EM2 software and on the initial log-in screen select “Serial” from the pull down and choose the appropriate “COM PORT” that the PC is using.
   c. Enter the username: “Admin” (note this cannot be changed) enter the password. The default password is “password” which can be changed). Once the correct “Admin” and “User Password” is entered you will be “logged on” and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.
2. If the Terminal under test is a Hot-Standby or Space-Diversity terminal, position the “On Line” switch on the front of the Switching Shelf to “Primary” on both the Near End and Far End terminals.
3. In the EM2 software go to the “Test” and “RFU Mute” selection and MUTE all the RF portions of the terminal (Factory location only). Set the time to be “0” so it does not UN-Mute.

   Warning – In the field DO NOT Mute the Far End terminal unless you set a time out. You will lose communication to that terminal which can only be un-muted by logging on locally.

4. Remove the mating flange to the RF unit under test and connect an RF transition. Connect the Power Meter to the transition.

   Warning: Do not to exceed the power rating of the Power Sensor. Use a “high power” sensor capable of + 33 DBm or use a calibrated attenuator.
5. In the EM2 software, go back to the “Test” and “RFU Mute” screen and set the transmitter connected to the power meter to “On Line”. Measure the power and record in Section 3 of the Terminal Acceptance form.
6. Mute the transmitter for the Secondary terminal if applicable and repeat steps 2 – 5. Repeat steps 2 – 6 on the Far End terminal.
7. Re-connect flange disconnected in step 4.
8. Un-Mute all RF units.
9. Ensure that the “On Line” switch is set to “Auto” on the Switching Shelf for protected terminals.

C. Result

10. Indicated Power (EM2 Screen) =’s measured power +/- 1 dB.

5.2.9 TX: RF Frequency Test

A. Description

Measurement of TX frequency

B. Instructions

1. Exit out of the EM2 software if logged on and log on to terminal using HyperTerminal.
   a. Open the HyperTerminal program and set the following parameters:
      i. Data Bits: 8
      ii. Parity: None
      iii. Stop Bits: 1
      iv. No Flow Control
      v. Baud Rate: 9600
   b. Connect the computer to the terminal using the “COMPUTER” port on the front panel.

2. If the Terminal under test is a Hot-Standby or Space-Diversity terminal, position the “On Line” switch on the front of the Switching Shelf to “Primary” on both the Near End and Far End terminals.

   CAUTION: The Power Output Level at the “On Line” Monitor Port is +5 dBm. If this value is greater than the maximum RF level allowed by the Frequency Counter, use a +20dB 2W Attenuator to attenuate the signal so no damage occurs.

3. Connect a Frequency Counter to the “TX Monitor” port of the terminal under test and follow the steps below to configure the terminal to measure the transmitter frequency:

   a. In the Command Line Interface (CLI) go to menu item 3 “Test”.

   b. Under the test menu select menu item 6 “Modem RF Test”.

   c. Under Modem RF Test, select option 1 (toggle): Continuous Wave (CW) Test.
   Note: CW mode removes the modulation from the carrier to allow accurate frequency measurement.

   d. Measure the frequency of the terminal and record it under Section 3 of the Terminal Acceptance sheet.

   e. Under Modem RF Test, select option 1 (Toggle):”On Line” to return the terminal back to normal operation.

4. Switch to the Secondary terminal if applicable and repeat step 3.

5. Repeat steps 1 – 4 for the Far End terminal.

6. Ensure that all of the terminals are returned to “Normal” operation and the Frequency Counter is disconnected.

C. Result

Measured frequency is ±10 ppm of the indicated frequency on the Supplemental Showing.

5.2.10 TX Fade Test

A. Description

Measure Receive Signal Level for threshold of 10E-6 by fading the TX RF.

A variable attenuator is inserted between the Terminal RF Out and the Transmission Line in order to simulate a fade, i.e. reducing the Receive Signal Level (RSL) at the coordinating receiver.

Note: Due to the sophisticated Forward Error Correction Algorithm, there is a very minimal difference between RSL's for10E-6 and 10E-3. There is no specification for 10E-3.

B. Instructions

1. Log on to the Terminal under test if you have not already logged on.
   a. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled "COMPUTER"
   b. Open the EM2 software and on the initial log-in screen select "Serial" from the pull down and choose the appropriate "COM PORT" that the PC is using.
   c. Enter the username: "Admin" (note this cannot be changed) enter the password. The default password is "password" which can be changed). Once the correct "Admin" and "User Password" is entered you will be "logged on" and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.

2. Connect a DS1 test set to the Near End and Far End terminals and ensure it is running error free before starting the test.

3. In the EM2 software go to the "Test" and "RFU Mute" selection and MUTE all the RF portions of the terminal. Set the time to be "0" so it does not UN-Mute.

   Warning – In the field DO NOT Mute the Far End terminal unless you set a time out. You will lose communication to that terminal which can only be un-muted by logging on locally.

4. Disconnect the RF connection at the waveguide flange of the terminal and insert a variable attenuator in line with the coordinating terminal.

5. Set the variable attenuator to "0dB" and connect a Power Meter to the "output" of the RF cable that connects to the Receiver under test.

6. In the EM2 software Go back to the "Test" then "RFU Mute" screen and set the terminal to "On Line".

7. In the EM2 software Go back to "Configuration" then "RFU" and click on "ATPC Enable" (toggle). "ATPC Off" will be displayed.

8. Connect a Digital Voltmeter to the AGC port on the coordinating receiver.

9. For the Factory Test determine the "Fixed" Losses. Measure the TX PWR OUT at the flange and note. Measure the Power at the end of the cable which includes the fixed attenuators, splitter for space diversity plus the Variable Attenuator set to 0 dB. Fixed loss = TX PWR out – PWR Out at the end of the cable. Required for step 15.

Example:

TX PWR OUT (Measured)	+29 dBm
Variable Attenuator (Set)	0 dB
PWR at End of cable(Measured)	-36 dBm
Fixed Losses	65 dB

10. For the Field Test Measure and record the power to establish a reference RSL with "0dB" attenuation for the variable attenuator. Required for step 16.

11. In the EM2 software go to the "Test" and "RFU Mute" selection and MUTE all the RF portions of the terminal. Set the time to be "0" so it does not UN-Mute.

    Warning – In the field DO NOT Mute the Far End terminal unless you set a time out. You will lose communication to that terminal which can only be un-muted by logging on locally.

12. Re-connect the cable from transmitting terminal to the receiver under test.

13. In the EM2 software Go back to the "Test" then "RFU Mute" screen and set the terminal to "On Line".

14. Fade the TX by adjusting the variable attenuator (adding attenuation). Add attenuation in 5 dB increments to an RSL of -65 dBm, then continue to slowly increase attenuation until the coordinating receiver has a BER of 10E-6. Note: This is a continuously variable attenuator, not a step attenuator.

15. For the Factory Test Determine the RSL which is equal to the TX PWR OUT plus the Fixed Losses (determined in step 9) + Variable Loss (Variable Attenuator for BER of 10E-6).

    Example

TX PWR OUT (Measured)	+29 dBm
FIXED Losses (Determined in step 9)	-65 dBm
Variable Attenuator (Attenuation for BER 10E-6)	-34 dBm
Threshold	-70 dBm

16. For the Field Test, Compare the attenuator reading and AGC voltage at each 5 dB step to the AGC table recorded on the System Form. Record the AGC voltage for a BER of 10E-6 on the Terminal Acceptance form and determine the RSL from the AGC table on the System Test Data sheet and record in Section 4 of the Terminal Acceptance form.(Field Test only)

17. In the EM2 software goes to "Configuration" then "RFU" and click on "ATPC Enable" (toggle). "ATPC On" will be displayed.

18. Leave the attenuator in the path. It is required for following ATPC test.

C. Result

19. Measured AGC voltage is +/- .05 of voltage indicated on AGC table (System Test data sheet).

20. RSL at 10E-6 is less than -69.0 dBm.

21. Indicated RSL (EM2 Screen) +/- 2 dB of actual.

5.2.11 TX ATPC Test

A. Description

Verification of ATPC (Automatic TX Power Control)

B. Instructions

1. Confirm you are still logged on the hop you are testing.
2. Go to the EM2 Screen “Terminal Info” with “Link View” checked.
   This will provide a pictorial representation of the Proteus MX terminal.
3. If the Terminal under test is a Hot-Standby or Space-Diversity terminal then switch the “On Line” switch on the front of the Switching Shelf to “Primary” on both the Near End and Far End terminals.
4. Set the “path” attenuator to 0 dB.
5. Note the Power Out.
6. Note the RSL (coordinating receiver) = the ATPC set point
7. Record the RSL Set Point in Section 3 of the Terminal Acceptance data sheet.
8. Slowly increase the attenuation while monitoring the power level and the RSL.
9. Slowly reduce the attenuation to 0 dB.
10. Repeat steps 3-9 for Secondary transmitter if present.
11. Mute the RF, remove the attenuator and restore the connection.
12. Un-Mute the RF and set the “On Line” switch to auto.
13. Confirm Terminal is in ‘normal” operation.

C. Result

14. As attenuation is increased the power will increase and the RSL will remain constant.
15. When the TX is at maximum allowed power the terminal will display a minor alarm.
16. As the attenuation is reduced the power will decrease, the minor alarm is extinguished.
17. Power Output is equal to that observed in Step 5 above.

5.2.12 RX: RSL / AGC Test

A. Description

Verify RSL-AGC Table (System Test data sheet) correlation.
Verify Field RSL equals expected RSL.

B. Instructions

1. Log on to the Terminal under test if you have not already logged on.

    a. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled “COMPUTER”
    b. Open the EM2 software and on the initial log-in screen select “Serial” from the pull down and choose the appropriate “COM PORT” that the PC is using.
    c. Enter the username: “Admin” (note this cannot be changed) enter the password. The default password is “password” which can be changed). Once the correct “Admin” and “User Password” is entered you will be “logged on” and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.

2. If the Terminal under test is a Hot-Standby or Space-Diversity terminal then position the “On Line” switch located on the front of the Switching Shelf to “Primary” on both the Near End and Far End terminals.

3. From the Supplemental Showing find the Calculated RSL reading and record it in the appropriate box of Section 4 of the Terminal Acceptance sheet.

4. Record the RF unit’s RX frequency in the appropriate location of Section 4 of the Terminal Acceptance sheet. The frequency can be found on the RF unit’s label.

5. Using a Digital Volt Meter measure the AGC voltage for RF unit under test (AGC test point is on front of RF unit). Record the AGC voltage in the appropriate box in Section 4 of the Terminal Acceptance test form.

6. Repeat steps 2 – 5 for the Secondary terminal if it is a protected terminal and then repeat steps 1 – 6 on the Far End terminal.

7. Ensure that all of the terminals are returned to Normal operation and the “On Line” switch located on the Switching Shelf is set back to “AUTO”.

C. Result

8. Factory Measurement - the Indicated RSL on the EM2 screen =’s the actual RSL +/- 2dB.

9. Factory Measurement – the Indicated RSL on the EM2 screen =’s the interpolated RSL from the AGC table (System Test data sheet) +/- 2 dB.

10. Field Measurement – the interpolated RSL from the AGC table (System Test data sheet) =’s the expected RSL from the Supplemental Showing +/- 2 dB.
11. Field Measurement – the indicated RSL on the EM2 screen =’s the interpolated RSL from the AGC table (System Test data sheet).

5.2.13 Proteus MX Switching Test – Automatic

A. Description

Demonstrate a forced switch occurs when an “on-line” Section of the terminal fails resulting in a successful switch to the redundant device.

Note: This test only applies to Monitored Hot and Space Diversity configured terminals.

B. Instructions

1. Connect a DS1 level test set to the Near End and Far End terminals and ensure it is running error free before starting the test.
2. Verify the connection by injecting an error to each test set.
3. Position the “On Line” switch located on the Switching Shelf to “Primary” on both the Near End and Far End terminals. Once both terminals are locked on the Primary Terminal, position the “On Line“ Switch back in the ”Auto” position. This is to insure traffic is on the Primary terminal.
4. Simulate a failure by Unscrewing and removing the TLI module from the Primary terminal.
5. Once the DS1 test set has cleared, allow it to run for 10-15 seconds to verify error free operations.
6. Re-install the TLI module into the Primary terminal.
7. Once all alarms have cleared from the terminal, unscrew and remove the TLI Module from the Secondary terminal and the terminal will switch the necessary hardware to re-route the traffic.
8. Once the DS1 test set has cleared, allow it to run for 10-15 seconds to verify error free operations.
9. Repeat steps 4 – 8 on the Far End terminal.

C. Result

10. Data carried by the Primary terminal switches to the Secondary terminal upon removal of the TLI from the Primary terminal.
11. Data carried by the Secondary terminal switches back to the Primary terminal after the Primary terminal TLI is replaced and the TLI in the secondary terminal is removed.

NOTE
A successful switch is defined as, a switch which reverts data to the redundant component and resumes traffic error free. Typically, switching will not cause a resynchronization of termination equipment, this however, cannot be guaranteed.

5.2.14 Proteus MX Switching Test – Manual

A. Description

Demonstrate a forced switch occurs when the on-line terminal is instructed to switch (via the EM2 software), resulting in a successful switch to the redundant device.

Note: This test only applies to Monitored Hot and Space Diversity configured terminals.

B. Instructions

1. Connect a DS1 level test set to the Near End and Far End terminals and ensure it is running error free before starting the test.

2. Verify the connection by injecting an error to each test set.

3. Position the “On Line” switch located on the Switching Shelf to “Primary Terminal” on both the Near End and Far End terminals. Once both terminals are locked on the Primary Terminal, position the “On Line “switch back into the ”Auto” position. This is to insure traffic is on the Primary terminal.

4. Log on to the Terminal under test if you have not already logged on.

    a. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled “COMPUTER”
    b. Open the EM2 software and on the initial log-in screen select “Serial” from the pull down and choose the appropriate “COM PORT” that the PC is using.
    c. Enter the username: “Admin” (note this cannot be changed) enter the password. The default password is “password” which can be changed). Once the correct “Admin” and “User Password” is entered you will be “logged on” and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.

5. Go to the “TEST” menu and choose “TEST PROTECTION STATUS/SWITCHING”

    a. This screen allows you to call for Online Requests (OLR). At this point the Primary terminal on both sides of the hop should show “IS” and the secondary should show “OOS”.
    b. On the Near End Secondary and Far End Secondary terminals click on the “OLR OFF” button and it will change to “OLR ON” and the color Section will begin to flash indicating a pending change.
    c. Once all 8 locations are set to “OLR ON” and flashing select “APPLY” and the terminal will start the switching process.
    d. The LED on the front of the terminal will begin to flash indicating a manual condition is set in the terminal.
    e. While this is set to “OLR ON” the terminal WILL NOT switch back to the Primary terminal until it is taken out of the “OLR ON” condition.
    f. Go back and click on all 8 of the buttons to change them to “OLR OFF” and then click “APPLY”.
    g. The terminal will stay on the secondary terminal but will now go back to a normal operating state and now the “IS” will be on the Secondary terminals and the “OOS” will be on the Primary terminals.

6. Repeat steps 3-5 for the Secondary terminal.

C. Result

7. Data carried by the Primary terminal switches to the Secondary terminal following the Manual Switch command “Apply” in step 5c.

8. Data carried by the Secondary terminal does not switch back to the Primary terminal following the Manual Switch command “Apply” in step 5f.

Note: A RXU/DEMOD switch will result in a hitless switch (no errors). A TXU/MOD switch will result in a momentary error burst.

5.2.15 Proteus MX Switching Test - Power Interruption

A. Description

Demonstrate the redundancy of the power supplies provided with the MX platform.

Note: This test only applies to Monitored Hot and Space Diversity configured terminals.

B. Instructions

1. Connect a DS1 level test set to the Near End and Far End terminals and ensure it is running error free before starting the test.
2. Verify the connection by injecting an error to each test set.
3. Position the “On Line” switch located on the Switching Shelf to “Primary Terminal” on both the Near End and Far End terminals. Once both terminals are locked on the Primary Terminal, position the “On Line“ switch back in the ”Auto” position. This is to insure traffic is on the Primary terminal.
4. Disconnect the power to the Primary terminal to simulate power interruption.
5. The data will be switched to the Secondary terminal and the DS1 test set will clear.
6. Allow the terminal to run on the Secondary for 10-15 seconds to show error free operations and then replace the power to the primary.
7. Once the alarms have cleared on the Primary terminal, disconnect the power to the Secondary terminal. Traffic will switch back to the Primary terminal and resume error free operations.
8. Re-connect Power to the Secondary terminal and verify all alarms have cleared.
9. Repeat steps 3-8 on the Far End terminal.

C. Result

10. Data carried by the Primary terminal switches to the Secondary terminal following the removal of power from the Primary terminal.
11. Data carried by the Secondary terminal switches back to the Primary terminal following the restoration of Power to the Primary terminal and subsequent removal of power from the Secondary terminal.

5.2.16 DS1 Traffic Routing Test – T1 Routing

A. Description

Demonstrate all DS1 circuits in the network under the T1 Routing are wired and routed in accordance with the System Channel Plan.

Each circuit is routed from its point of origin to its point of destination. The demarcation point at each site provides entry and exit access. The demarcation point is the RJ48 DSX panel(s) at each site.

B. Instructions

1. Start with the first DS1 on the Channel Plan.
    a. Identify from the Channel Plan each DS1's point of origin and point of destination.
    b. Identify the DSX port the DS1 is connected to at each site.
2. Connect a DS1 test set to the local (point of origin) RJ48 Port and connect a DS1 test set to the Far End (point of destination) RJ48 Port for the DS1 being tested.
3. At the SHARP MUX at the point of origin pull the connection going East to ensure the DS1s are all routing correctly through the system in the "West" direction
4. Demonstrate connectivity by injecting an error on the near end terminal's test set and ensure the Far End site sees the error. Then have the Far End site send and error and ensure it shows up on the near end site.
5. Allow each DS1 to run for 10-15 seconds error free.
6. Re-insert the East connection and wait for the alarms to clear.
7. Pull the connection going "West". This will insure the DS1's are routed correctly through the system in the "East" direction
8. Demonstrate connectivity by injecting an error on the near end terminal's test set and ensure the Far End site sees the error. Then have the Far End site send an error and ensure it shows up on the near end site.
9. Allow each DS1 to run for 10-15 seconds error free.
10. Re-insert the "West" connection and wait for the alarms to clear.
11. Repeat steps 2 – 10 for each DS1 on the channel plan.

C. Result

12. Connectivity of each DS1 (both "East" and "West" directions) is verified by one DS1 test set communicating with the other over the DS1 being tested and running error free for 10-15 seconds.
13. All DS1's within the network are properly routed and fully functional.

5.2.17 SHARP Switching Test - Automatic

A. Description

Demonstrate a forced switch occurs when an “on-line” Tributary within SHARP fails resulting in a successful switch to the redundant side.

B. Instructions

1. Connect a DS1 level test set to the Near End and Far End terminals and ensure it is running error free before starting the test.

2. Verify the connection by injecting an error to each test set.

2.1 Log on to radio terminal under test if you have not already logged on.

   a. Go to “Configuration” Menu and click on “SPU TLI B SHARP”

   b. Identify the DS1 under test and make sure Master and Slave show “NoErr” for error free operations. On the “Active” column, find out which side is on-line (M) for Master and (S) for Slave

   c. Highlight the DS1 under test
   - If Master (M) is on-line, unplug the 32DS1 SHARP TLI from the Master radio terminal. By losing DS1 signal from Master direction SHARP automatically switches to receive directly from Slave(S) radio terminal.
   - If Slave(S) is on-line, unplug the 32DS1 SHARP TLI from the Slave(S) radio terminal. By losing DS1 signal from Slave direction SHARP automatically switches to receive directly from Master (M) radio terminal.

2.2 Verify that DS1 traffic has switched from the on-line side to the redundancy without losing traffic.

C. Result

3. Connectivity of DS1 is verified by one DS1 test set communicating with the other over the DS1 being tested and running error free for 10-15 seconds.

NOTE

Switching will not cause a resynchronization of termination equipment.

5.2.18 SHARP Switching Test - Manual

A. Description

Demonstrate a forced switch occurs when an “on-line” Tributary within SHARP fails resulting in a successful switch to the redundant side.

B. Instructions

1. Connect a DS1 level test set to the Near End and Far End terminals and ensure it is running error free before starting the test.

   a. Verify the connection by injecting an error to each test set.

   a. Log on to radio terminal under test if you have not already logged on.

      i. Go to “Configuration” Menu and click on “SPU TLI B SHARP”.

      ii. Identify the DS1 under test and make sure Master and Slave show “NoErr” for error free operations. On the “Active” column, find out which side is on-line (M) for Master and (S) for Slave.

      iii. Highlight the DS1 under test and click on “Edit” button.
      - If Master (M) is on-line, under “Manual Switching” drop down menu select “Force Slave” and click on “Apply”.

      - If Slaver(S) is on-line, under “Manual Switching” drop down menu select “Force Master” and click on “Apply”.

   b. Verify that DS1 traffic has switched from the on-line side to the redundancy without losing traffic.

C. Result

2. Connectivity of DS1 is verified by one DS1 test set communicating with the other over the DS1 being tested and running error free for 10-15 seconds.

NOTE

Switching will not cause a resynchronization of termination equipment.

5.2.19 Microwave Terminal Alarms Test – Minor, Major

A. Description

Demonstrate that both the EM2 software and the external LED's display Minor and Major alarms

B. Instructions

Begin by ensuring that no alarms exist on the terminal to be tested. If any alarms are present troubleshoot those alarms and then continue with the test.

1. Log on to the Terminal under test if you have not already logged on.
   a. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled "COMPUTER"
   b. Open the EM2 software and on the initial log-in screen select "Serial" from the pull down and choose the appropriate "COM PORT" that the PC is using.
   c. Enter the username: "Admin" (note this cannot be changed) enter the password. The default password is "password" which can be changed). Once the correct "Admin" and "User Password" is entered you will be "logged on" and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.

2. Go to the "Status" and then "Link Alarms" screen. This will show the presence of alarms for all terminals on the hop being tested.

3. On protected terminals pull the NMS interconnect cable and a MINOR alarm LED will show. With Non-protected terminals a MINOR alarm can be caused by pulling an equipped DS1 connection from the TLI card.

4. Return the cables to the normal operating position and all alarms should clear except the Severity Section of the Link Alarm screen. It holds the color of the highest alarm until reset. Also the "Latched" alarms will show on the main screen as a blue indicator until latched alarms are reset.

5. Once all the alarms have cleared click on the "RESET" button to get back to a green indicator.

6. Now a Major alarm is to be tested by pulling the TLI card from the chassis and monitor both the external LED and the internal Link Alarm screen.

7. Return the TLI to the normal operating position and watch to ensure that all alarms clear.

8. Reset the Latched alarms once all alarms are clear.

9. Repeat steps 2-8 for the Far End terminal.

C. Result

1. When a minor alarm is caused it is visible on the ”Link” screen and the “Minor” alarm LED illuminates.

2. When a major alarm is caused it is visible on the ”Link” screen and the “Major” alarm LED illuminates.

3. Latched alarms remain until manually reset.

4. “Latched Alarm” reset clears latched alarms.

Note: All alarm indications come on as explained and clear up after everything is replaced and normal operations are resumed. Latched alarms have to be manually reset as they are an indication feature on this system.

5.2.20 Orderwire Functionality Test

A. Description

Demonstrate the functionality of the Orderwire. Each site is equipped with an Orderwire which has unique three digit ring address assigned to it.

An “All Call” function is used to alert all sites.

The Orderwire channel is a full duplex party line circuit.

B. Instructions

1. Identify a Local and Remote site.
2. Identify which terminal at each site is equipped with the Orderwire.
3. From the provided Orderwire Address list identify the address for the remote site to be called.
4. Dial the 3 digit code plus the # key.
5. The technician at the Far End site will answer the ringing handset (go off hook) and the two technicians can communicate over the Orderwire system.
6. After both technicians hang up (go on hook) the technician at the Far End site dials the three digit code plus the # key of the Near End site.
7. The technician at the near end will answer the ringing handset (go off hook) and the two technicians can communicate over the Orderwire.
8. Both technicians will then hang up again (go on hook).
9. The technician at the Near End site will go off hook and perform and “ALL CALL” by pressing the * key.
10. All of the other handsets on the network will ring and any Far End site handset can be answered and communication verified.
11. Repeat steps 1-10 for each site in the network in the system.

C. Result

12. Each site can call every other site in the network by dialing the 3 digit code plus the # key.
13. The Speech from any site will be heard at every other site.
14. Pressing the * key on any handset will cause every site to ring.

5.2.21 Microwave Terminal - MOSCAD Interface Test

A. Description

Demonstrate the terminal communicates with the MOSCAD RTU test fixture via MNI supplied cables.

B. Test Instructions

1. Randomly select a terminal link to test the data channel and the modem port.
2. Connect the MOSCAD RTU test fixture to each terminal of the hop under test.
3. Send a TX signal from the Near End terminal MOSCAD RTU.
4. Send a TX signal from the Far End terminal MOSCAD RTU.

C. Test Result

Receiving MOSCAD RTU acknowledges transmitted signal by reporting 3 data bursts.

5.2.22 Network Loop 24 Hour BER Test

A. Description

Demonstrate that the loop's operates error free for 12 hours in the "clockwise" direction for twelve (12) hours and then the "counter-clockwise" direction for twelve (12) hours.

B. Instructions

1. Select a DS1 that goes the loop.
2. Connect a DS1 test set at Prime site and the remote site and verify continuity.
3. Configure the SHARP to transport traffic in the "clockwise" direction" by using the manual-forced switching capability under the SPU SHARP TLI B menu.
4. Verify the DS1 test set is "Green" and commence the BER test.
5. Record BER Result after the 12 hour test.
6. Re-configure the SHARP to transport traffic in the "counter-clockwise direction" by using the manual-forced switching capability under the SPU SHARP TLI B menu.
7. Verify the DS1 test set is "Green" and commence the BER test.
8. Record BER Result after the 12 hour test.
9. Record BER Result after the 12 hour test.
10. Normalize all the connections.

C. Result

Each 12 hour BER test is error free.

5.2.23 Ethernet Test

A. Description

Demonstrates Ethernet connectivity around the system.

Note:
All the Ethernet ports of the radio will be bridged; the interconnection can be verified along any of the network radio terminals.

B. Instructions

1. Connect an Ethernet test set into the hub at Prime site and remote site.
2. Verify connectivity to all sites.

C. Result

The Ethernet connectivity is verified for all sites.

5.2.24 Network Management System (NMS) Test

A. Description

Demonstrate the functionality of the Network Management System (NMS) with regard to the microwave terminal.

B. Instructions

1. Open the NMS software and view the main site map.

2. Double click on a network element icon on the right hand side of the screen which will open the site and show the terminal icons.

3. Double click on a selected terminal icon which will launch the EM2 software so that individual terminal manipulation can be done.

4. Exit the EM2 software and browse the NMS sites and select another terminal and log in by double clicking on the icon.

5. Alarm reporting
   a. While viewing the Icon and alarm log location of the NMS remove a cable or TLI from a terminal and observe the “alarm” screen for the reported alarm, icon changes color.
   b. Re-install the removed cable or TLI and view the “alarm” screen to see that the alarm clears and the icon returns to a green color.
   c. Note: the “Current” logs are shown on the main screen of the NMS.
   d. Note: Alarms are also recorded in History, open the “History” tab to view.
   e. Clear all alarms.
   f. Once all alarms are clear the “Current” alarms should be clear also and normal operations can resume.

C. Result

6. NMS displays icons for each site in the network.

7. Each site can be accessed by double clicking the site icon.

8. The NMS accesses the EM2 software; thus, allowing the user to perform the required function that can be done via the EM2 software.

9. The “Active” alarm screen displays the correct alarm at the correct site only when present.

10. The “History” alarm screen will display all alarms that have occurred until reset.

Section 6. Coverage Acceptance Test Plan

6.1 Overview

This Coverage Acceptance Test Plan (CATP) is designed to verify that the voice radio system implemented by Motorola meets or exceeds the required coverage reliability within the County service area as defined by the RFP. The CATP defines the coverage testing method and procedure, the coverage acceptance criterion, the test documentation, and the responsibilities of both Motorola and the County.

Coverage Acceptance Testing is based upon a coverage prediction that accurately represents the implemented infrastructure and parameters consistent with the contract agreements. If the implemented system varies from the design parameters, a revised coverage map will be prepared. New test maps will reflect the measured losses and gains associated with the implemented infrastructure and subscribers. These will be used to define the test configuration and potential areas from which test locations may be included in the evaluation process.

The defined service area as outlined in this CATP is the Sumter County service area.

To verify that the radio service area reliability is met as presented, the Sumter County service area + 3 miles (~1000 square miles) will be divided into approximately 2040 equally sized test tiles and the County area only (~500 square miles) will be divided into approximately 1220 equally sized test tiles at minimum. The test tiles for both grid maps are approximately 3600 feet by 3700 feet and thus meet the maximum tile size for the countywide test of no greater than 4000 feet.

Table 6-1 details the service area reliabilities for each of the different configurations. The service area reliability is the percentage of test tiles that will pass within the service area with a specified CPC or DAQ.

Table 6-1: Predicted System Coverage

Equipment Configuration	% Service Area Reliability of Sumter County
Mobile w/unity gain ant.	≥95% County +3 mi
Portable (½ wave in Swivel Case) Outside	≥95% County +3 mi
Portable (½ wave in Swivel Case) in 6 dB Residence	≥95% County

Motorola has defined the countywide in-building/in-residence loss factor to be 6 dB. The following coverage maps are included for the configurations listed in Table 6-1:

6-site Simulcast System (Talk-out and Talk-In)

- Mobile with unity gain antenna.
- Portable (½ wave in Swivel Case) outside.
- Portable (½ wave in Swivel Case) 6 dB loss.

Motorola is additionally including several other coverage maps for various building losses for informational purposes and to ensure all coverage criteria in the RFP is appropriately addressed.

6.1.1 CATP Definitions

Several definitions are needed to accurately describe the coverage test method.

6.1.1.1 Coverage Area

The coverage area is the geographical region in which communications will be provided that meets or exceeds the specified CPC at the specified reliability for the specified equipment configurations.

For mobile and portable outside testing, the entire County plus 3 miles will be tested. The County + 3mi grid map is shown in Figure 6-1.

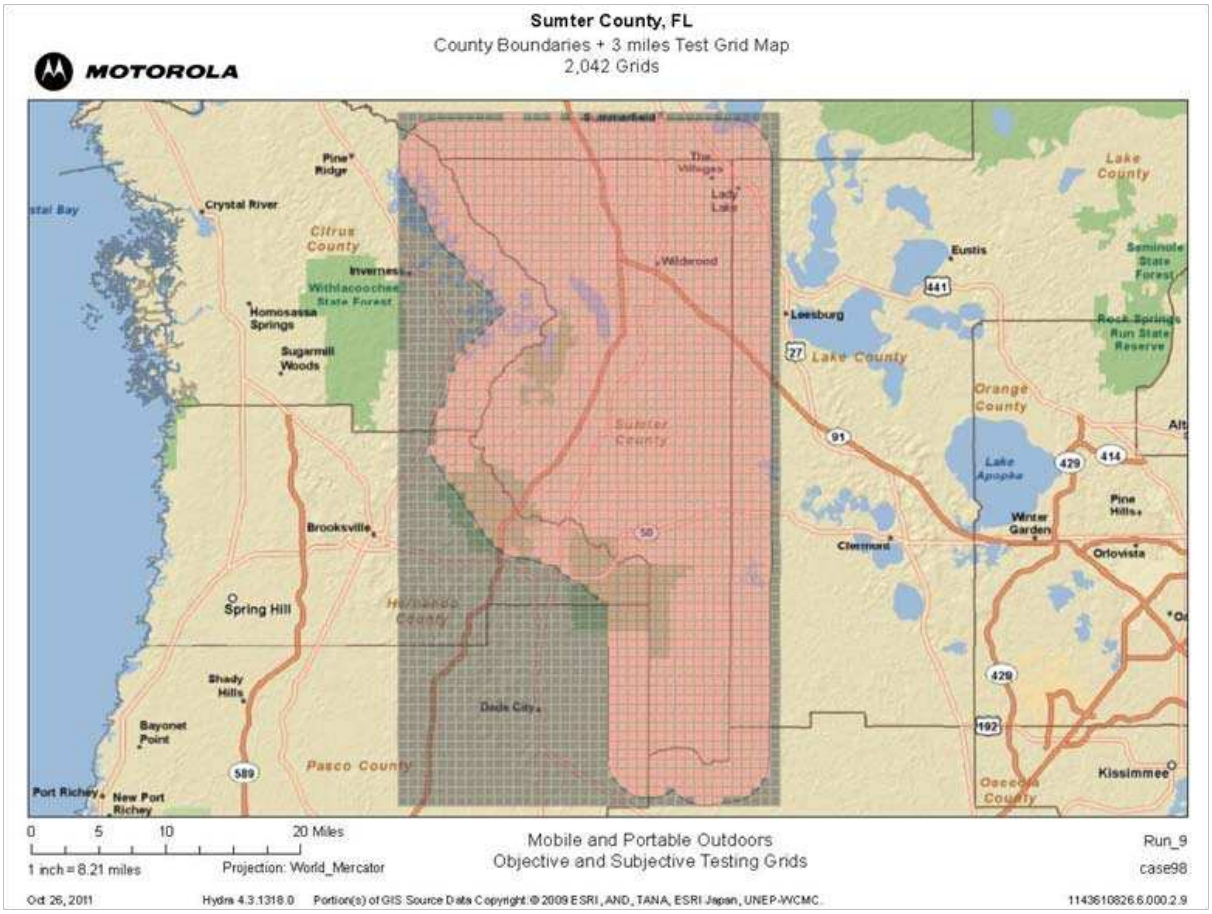

Figure 6-1: Mobile and portable outside testing

For portable in-residence testing, the County will be tested. This County-only grid map is shown in Figure 6-2.

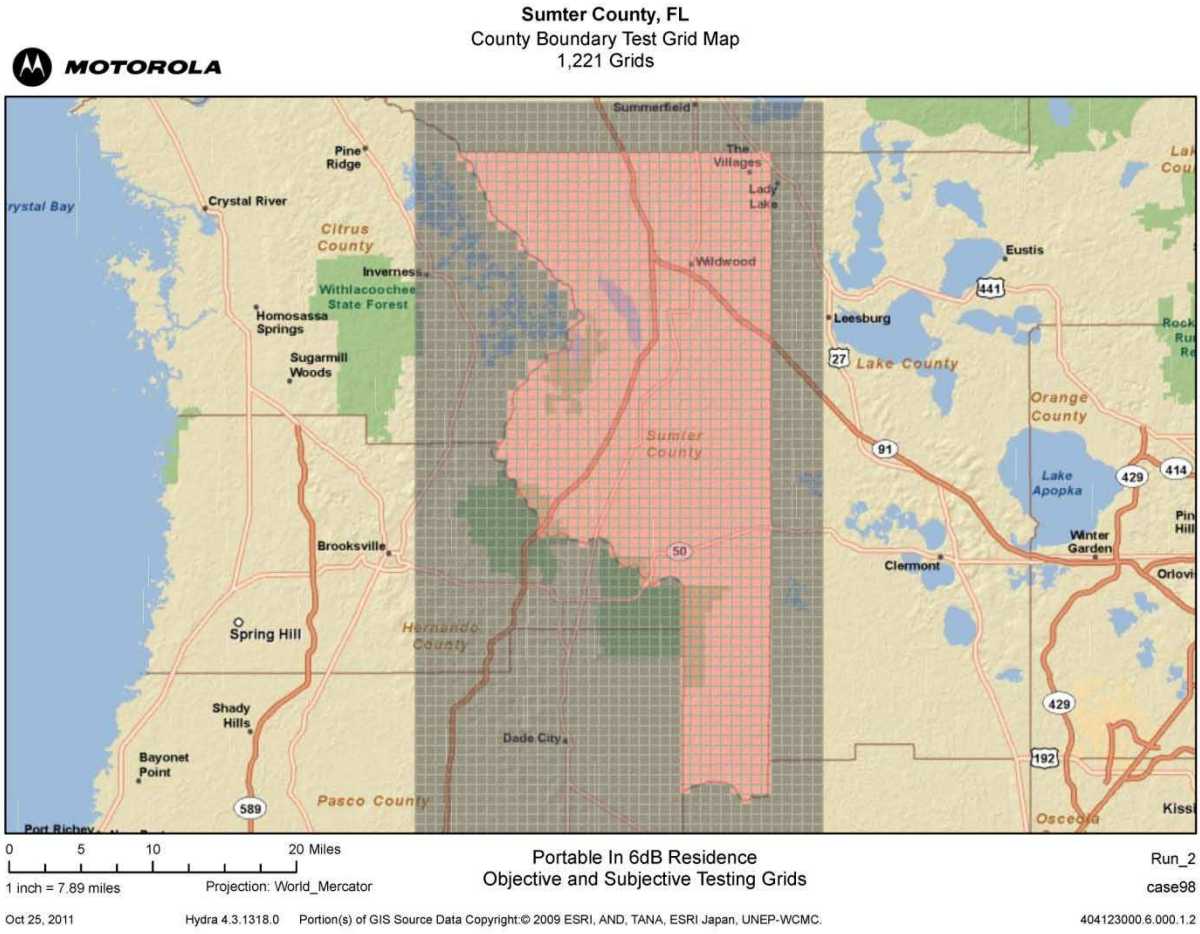

Figure 6-2: Portable in-residence testing

6.1.1.2 Reliability

Reliability is the percentage of locations within the coverage area that meet or exceed the specified CPC. Motorola's coverage maps indicate the area within which this system is predicted to provide at least 95% reliability of meeting or exceeding the CPC.

6.1.1.3 Channel Performance Criterion

CPC is the specified minimum design performance level in a faded channel. For this system, the CPC is DAQ-3.4 for portables and DAQ-4.0 for mobiles. The DAQ definitions are provided in Table 6-2.

Table 6-2: Delivered Audio Quality Definitions

DAQ	Faded Subjective Performance Description
1	Unusable, speech present but unreadable.
2	Understandable with considerable effort. Frequent repetition due to noise/distortion.
3	Speech understandable with slight effort. Occasional repetition required due to noise/distortion.
3.4	Speech understandable with repetition only rarely required. Some noise/distortion.
4	Speech easily understood. Occasional noise/distortion.
4.5	Speech easily understood. Infrequent noise/distortion.
5	Speech easily understood.

6.1.1.4 Service Area Reliability

The service area reliability is the percentage of test tiles that will pass within the service area with a specified CPC or DAQ. The service area reliability is noted in the header of Table 6-1 and meets the requirements of the RFP.

The defined service area is outlined in this CATP as Sumter County. The outline of this service area is depicted on each coverage map. Motorola has indicated the CPC Service Area Reliability of this area in Table 6-1 of this document for the losses detailed in the RFP. Although the coverage maps do not guarantee coverage within a specific location, they do indicate the ability of the system to overcome the expected losses of these buildings.

6.1.1.5 Equipment Configurations

There are two configurations for the field unit equipment or subscriber upon which coverage acceptance is based. Motorola's coverage maps for this system indicate the coverage area for the following equipment configurations:

3-watt Portable:

- Remote Speaker Microphone and ½ wave flex-whip antenna.
- In swivel case at hip level (3 feet) for Transmit and Receive.
- 15-watt mobile with unity gain antenna center roof mounted.

The 6-site simulcast proposed design supports this configuration:

- The 6-site system transmitting simulcast and receiver voting sites utilize P25 compliant ASTRO 25 Linear Simulcast Modulation (LSM).

In-Building Coverage

Motorola's coverage maps for portable in-building equipment configurations are predictions of coverage inside 4 dB, 6 dB, 15 dB, 20 dB, and 25 dB loss buildings. Since building loss varies significantly depending on the construction of buildings, Motorola's coverage maps do not predict coverage within any specific building. Rather, the in-building coverage maps indicate the area within which this system is predicted to provide the percentage reliability of meeting or exceeding the CPC of DAQ-3.4. The named buildings in Attachment C of the RFP will be tested per the requirements of the RFP. Motorola will provide 95% reliability coverage within these buildings as required.

6.1.2 CATP Method

The method used to test coverage is statistical sampling of the predicted coverage area to verify that the CPC is met or exceeded at the required reliability for the defined equipment configuration. It is impossible to verify every point within a coverage area, because there are infinite points; therefore, coverage reliability will be verified by sampling a statistically significant number of randomly selected locations, quasi-uniformly distributed throughout the predicted coverage area.

This CATP provides an objective, quantitative method of measurement using Motorola's Voyager software in conjunction with an APX portable radio for location reference, signal strength measurements, and recording.

The CATP also provides a subjective audio quality test by using actual equipment configured as it will be used in the system.

If a coverage test, or a portion thereof, is suspected by Motorola to have failed due to external interference, those tiles suspected of being affected by an interferer may be retested. If the tiles (or test points) retested are confirmed to have failed due to interference, those tiles (or test points) will be excluded from all acceptance

calculations and Motorola will work with the County to identify potential solutions to the interference issues.

If a coverage test, or a portion thereof, is suspected by Motorola to have failed due to the system malfunctioning and being in need of repair, those tiles (or test points) suspected of being affected by this may be retested. The coverage testing will be stopped until the repairs are made. After the repairs are made, Motorola will retest only the tiles (or test points) that failed due to the system malfunctioning and being in need of repair.

Determine the Required Number of Test Tiles in the Coverage Area

The predicted coverage area shown on Motorola's coverage maps and service area will be divided into a tile pattern to produce at least the number of uniformly sized test locations (or tiles) required by the Estimate of Proportions formula {TSB-88B, sub clause 8.2.1, equation 64}. The minimum number of test tiles required varies for different systems, from a hundred to many thousands, depending on the size of the service area, desired confidence in results, type of coverage test, and the predicted versus required reliability. Motorola's Hydra coverage modeling tool calculates the required test tiles as described.

Constraints on Test Tile Sizes

The minimum tile size is 100 by 100 wavelengths; however, the minimum practical test tile size is typically about 400 by 400 meters (about 0.25 by 0.25 miles). The minimum practical tile size for any system is determined by the distance traveled at the speed of the test vehicle while sampling, GPS error margin, and availability of road access within very small test tiles. A related consideration is the time, resources, and cost involved in testing very large numbers of very small tiles. The maximum test tile size is 2 by 2 km (1.25 by 1.25 miles). In some wide-area systems, this constraint on maximum tile size may dictate a greater number of test tiles than the minimum number required by the Estimate of Proportions formula. Motorola has complied with the maximum tile sizes as recommended by the RFP.

Accessibility to Test Tiles

Prior to testing (if possible) or during the test, Motorola and the County will determine whether any test tiles are inaccessible for the coverage test (due to lack of roads, restricted land, etc.). Motorola expects to test all test tiles within the service area and expects Sumter County to provide access to all test tiles that require other than a standard 4-wheel drive vehicle. If Sumter County cannot provide access, inaccessible tiles with predicted coverage will be counted as a pass for the acceptance test calculation.

Randomly Select a Test Location within Each Tile

Using Voyager, the actual test location within each test tile will be randomly selected by the test vehicle crossing into the tile at an arbitrary point, with an arbitrary speed and direction. This will be the queue for the objective sampling test to begin.

Perform Measurements in Each Tile

In each test tile, a series of 200 or more sequential SSI measurements (sub-samples) will be made. This test location measurement, containing a number of sub-samples, constitutes the test sample for this location. The test sample will establish the local mean and median SSI within the test tile. With this measurement, the required target SSI can be extrapolated for each configuration and loss required. The distance over which the sub-samples are measured will be 40 wavelengths. A mean or median of multiple SSI sub-samples is used rather than a single measurement to ensure that the measurement is not biased by taking a single sample that might be at a peak or null point on the radio wave.

6.1.2.1 Determine If Each Test Tile Passes or Fails the CPC Requirement

For each test tile, the pass/fail criterion is the objective target signal strength test that indicates the specified DAQ-3.4 (DAQ-4.0 for mobile). To simulate losses of buildings, the loss is simply extrapolated from the measured faded SSI. The target faded SSI is the actual signal level as measured by the test radio at the input connector.

Table 6-3: Net Target Signal Strength Indication – Mobile

Objective Test	Mobile Faded Sensitivity (dBm) DAQ-4.0	Measured Faded Target SSI (dBm) DAQ-4.0	Adjustments for Mobile Antenna Loss/Gain & Delta for talk-in/talk-out (dB)
Outside	-105.5	-105.5	0

Table 6-4: Net Target Signal Strength Indication – Portable in Swivel Case at Hip

Objective Test	Portable Faded Sensitivity (dBm) DAQ-3.4	Portable Faded Target SSI (dBm) DAQ-3.4	Adjustments for Mobile Antenna Loss/Gain, Portable Antenna & Building Loss (dB)
Outside	-108.5	-102.7	-5.8 (-8.6+2.8)
4 dB bldg	-108.5	-98.7	-9.8 (-8.6-4.0+2.8)
6 dB bldg	-108.5	-96.7	-11.8 (-8.6-6.0+2.8)
15 dB bldg	-108.5	-87.7	-20.8 (-8.6-15.0+2.8)
20 dB bldg	-108.5	-82.7	-25.8 (-8.6-20.0+2.8)
25 dB bldg	-108.5	-77.7	-30.8 (-8.6-25.0+2.8)

* The -8.6 dB is the antenna loss figure for the ½-wave flex-whip antenna on an APX portable in a swivel case with remote speaker microphone and standard battery.

** The +2.8 dB is the mobile antenna and transmission line that a portable does not have and thus must be added back to get the signal at the input to the test radio.

6.1.2.2 Determine the Coverage Area Reliability for Acceptance

After all accessible tiles in the coverage area have been tested; the coverage area reliability (percentage) will be determined by dividing the number of tiles that pass by the total number of tiles tested. The total number of tiles is defined as the summation of the tiles tested in the Sumter County service area (+3 mi or County only). The coverage test acceptance criterion for each equipment configuration is that the tested coverage area reliability must be equal to or greater than the required reliability as shown in Table 6-1.

6.1.2.3 Responsibilities and Preparation

This information will help set the expectations of Sumter County and Motorola regarding requirements for equipment, personnel, and time during the coverage test.

The County will provide the following for the duration of the coverage test:

- **Marked Public Safety Escort Vehicles for the duration of the test.** A minimum of two test teams would be recommended: one team for the county area and a second team to test the mandatory buildings. Whichever team finishes first can then assist the other teams with their areas.
- **Two County representatives** (one can be a Tusa Consulting Services representative) for each test vehicle to be the customer representatives for each of the field test teams.
- **Two County representatives** (one can be a Tusa Consulting representative) for the fixed location (likely the dispatch center) to be the customer representatives for the fixed end.

Motorola will provide the following for the duration of the coverage test:

- Rental off road type vehicles for the duration of the test.
- At least one Motorola representative to operate Voyager for each team (this would assume that the customer representative would drive the vehicle).
- At least one calibrated Motorola Voyager coverage testing package per team.
- Test radios for each field team (will use calibrated subscribers).

Coverage acceptance testing will be performed within the borders of the County. Motorola has determined the minimum number of test tiles required, as described in Section 6.1 of this CATP. Motorola and the County will plan the route for the test vehicles through the coverage test area, to ensure that at least the minimum required number of tiles is tested. If possible, any tiles not accessible to the test vehicles will be identified while planning the route.

Motorola will calibrate the test radios (standard APX portables) used with the Voyager coverage-testing package. This can be done at an independent testing lab or facility using their calibrated signal generating equipment. Depending on the system, either Motorola or the County may provide the test radios.

Motorola will conduct this test only once. If any portion of the test is determined to be unreliable because of proven equipment malfunctions or failures, Motorola will repeat the portion of the test affected by the equipment malfunction or failure. The County will have the option to accept the coverage at any time prior to completion of the coverage test.

Before starting the test, the County and Motorola will agree upon the time frame for Motorola's submission of a report containing the coverage test results.

6.1.2.4 CATP Procedures

Objective Signal Strength Testing Measurements

The Motorola Voyager coverage test setup consists of the following:

- A calibrated digital voice test radio, connected to an antenna installed in a representative location on the test vehicle. The test radio will monitor sequential transmissions within each grid from the fixed network radio site(s).
- A laptop computer with Voyager software and a mapping database, which includes highways and local streets, political boundaries, rivers, and railroads.
- A Global Positioning System (GPS) receiver, which will provide the computer with the location and speed of the test vehicle.

Subjective Voice Quality Testing

A subjective listening test will be performed for coverage acceptance testing to verify talk-out and talk-in DAQ performance of the system. Since the DAQ-3.4 portable threshold is more stringent than the DAQ-4.0 mobile threshold, the test will be conducted using the DAQ-3.4 portable.

The procedure for the subjective DAQ coverage test will be as follows:

- To perform a statistically valid subjective DAQ test, a large group of people is required to ensure high confidence in the results. However, obtaining a large group of people for a subjective listening test is usually impractical; therefore, several (3 to 4) people in a car or van must be used for the test. Since a group this small cannot provide statistically significant results, it is very important that the personnel participating in the subjective test be familiar with the sound of radio conversations. Before subjectively testing, all personnel who will evaluate audio quality must be "calibrated" by listening to examples of static and faded audio of various CPC levels from the type of system being tested.
- A fixed control point location will be established. Prior to testing, the County and Motorola will agree upon a procedure to allow each audio transmission to be evaluated for approximately 5 seconds.
- The test participants will be divided into teams, each consisting of personnel from the County, Tusa Consulting Services, and Motorola. Each team will have members that operate a portable unit inside the test vehicle and members that are stationed at the fixed control point location. An odd number of team members is required to avoid ties for the pass/fail consensus.

- As the field test team(s) drive through the coverage area, test locations within each tile will be selected randomly by Voyager that will be conducting the objective SSI testing. The voice subjective test may begin after the sampling is complete. This is to prevent any degradation to the receiver sampling the SSI.
- The field test unit will make a call, identify the test tile by the current x-y tile location, and repeat 1 of the 10 phonetically balanced phrases (approximately 5 seconds in length). The fixed location unit (console or control station) test team will then determine if the voice passes or fails the DAQ criteria as defined by the Table 6-2. The fixed location will then read one of the ten phonetically balanced phrases (approximately 5 seconds in length) and the field team will in turn determine if the voice passes or fails the DAQ criteria shown in in Table 6-2.

Table 6-2: Delivered Audio Quality Definitions

- The tile pass/fail evaluations will be used to determine the coverage area reliability of the defined coverage areas in Table 6-1. If any test point should fail, the test team will move 3 feet and perform another test in the same manner. Either passed test will render that test point a PASS. If the portable transmission is still a considered a FAIL, a DAQ-4.0 test will be conducted using a mobile radio for purposes of evaluating mobile coverage.
- Coverage acceptance will be based on demonstrating that the percentage of the tile locations, as described in Table 6-1 for each equipment configuration will provide an audio quality of DAQ-3.4 or better (DAQ-4.0 for mobiles). The system coverage acceptance criterion will be the successful passing of each of the equipment configurations.
- Motorola reserves the right to review any test tiles that fail the subjective DAQ tests.

Objective SSI Testing and Subjective Voice Quality Testing

Both the subjective and objective testing as described will be performed at the same time but will be evaluated independently of each other. A failed tile for the objective test does not constitute a failure for the subjective testing. The reason for this is that the points are taken at different times (thus at different locations). The modeling does not predict the probability of one location against the other but predicts area reliability of all test points for each test.

Critical Buildings Subjective Voice Quality Testing

An independent subjective listening test will be performed for each of the 31 critical buildings identified in Attachment C of the RFP. Testing will verify talk-out and talk-in DAQ performance of the system. It will be the responsibility of Sumter County to provide access to each building in a manner that does not delay the testing effort.

The procedure for the critical building subjective DAQ coverage test will be as follows:

- To perform a statistically valid subjective DAQ test, a large group of people is required to ensure high confidence in the results. However, obtaining a large group of people for a subjective listening test is usually impractical; therefore, several (3 to 7) people must be used for the test. Since a group this small cannot provide statistically significant results, it is very important that the personnel participating in the subjective test be familiar with the sound of radio conversations. Before subjectively testing, all personnel who will evaluate audio quality must be "calibrated" by listening to examples of static and faded audio of various CPC levels from the type of system being tested.
- A fixed control point location will be established. Prior to testing, the County and Motorola will agree upon a procedure to allow each audio transmission to be evaluated for approximately 5 seconds.
- The test participants will be divided into teams, each consisting of personnel from the County, Tusa Consulting Services, and Motorola. Each team will have members that operate a portable unit inside the building and members that are stationed at the fixed control point location. An odd number of team members is required for the pass/fail consensus.
- Each critical building must be divided into test points:
  - 40,000 square feet per floor or less – The building's lowest floor that is completely above ground level will be tested. This lowest floor test will include 20 test points, evenly distributed throughout the floor. The 20 test points will include at least one test point at each of the furthermost accessible locations in the northern, southern, western, eastern, and one in the center of the floor, as well as one point in each stairwell entrance. All test locations will be above ground level. If no more than 5% of the test points on this floor have been shown to have failed, then this particular building is considered to have passed. If more than 5% of the test points on this floor have been shown to have failed, then a full building test will need to be performed. If necessary, the full building CATP will include 20 points, evenly distributed throughout each of the remaining upper floors. The 20 points will include at least one test point at each of the furthermost accessible locations in the northern, southern, western, eastern, and one in the center of the floor, as well as one point in each stairwell entrance on each floor. All test locations will be above ground level. There will be a minimum of 100 test points per building.
  - Greater than 40,000 square feet per floor – The building's lowest floor that is completely above ground level will be tested. All test points will be evenly distributed throughout the floor. The total number of test points required to achieve a maximum of 50-foot sample spacing will be employed. The total points will include at least one test point at each of the furthermost accessible locations in the northern, southern, western, eastern, and one in the center of the floor, as well as one point in each stairwell entrance. All test locations will be above ground level. If no more than 5% of the test points on this floor have

been shown to have failed, then this particular building is considered to have passed. If more than 5% of the test points on this floor have been shown to have failed, then a full building test will need to be performed. If necessary, the full building CATP will include evenly distributed points throughout each of the remaining upper floors. The total number of test points required to achieve a maximum of 50-foot sample spacing will be employed. The total points will include at least one test point at each of the furthermost accessible locations in the northern, southern, western, eastern, and one in the center of the floor as well as one point in each stairwell entrance on each floor. All test locations will be above ground level. There will be a minimum of 20 test points per floor and a minimum of 100 test points per building.

- Specialty Buildings – Any critical buildings that are constructed with metal roofs, bay doors, or stairwells, will be tested with the exterior doors open, this includes bay doors at fire/EMS stations, manufacturing/shipping facilities, and airport hangars, or exterior stairwell access doors for multiple story buildings.

- In order to make the testing as easy and time efficient as possible, the talkout and talkback field tests for all test points will initially be performed utilizing a portable in hand without the use a remote speaker microphone. The field test unit will make a call, identify the test number and the building, and repeat one of the ten phonetically balanced phrases (approximately 5 seconds in length).
- The fixed location unit (console or control station) test team will then determine if the voice passes or fails the DAQ criteria as defined by Table 6-2 of this document. The fixed location will then repeat 1 of the 10 phonetically balanced phrases (approximately 5 seconds in length) and the field team will in turn determine if the voice passes or fails the DAQ criteria.
- If any test point should fail, the test team will move three feet and perform another test in the same manner. Either passed test will render that test point a PASS. Based on the TSB-88B definition of DAQ 3.4 which allows for repetition no more than 15% of the test points within a given service area may be deemed to have passed due to a successful retry. If a test point also fails the retry then measurements will be made from that test point to determine if in-building loss exceeds 25 dB for that specific test point. If penetration loss exceeds 25 dB, that specific test point will be omitted from reliability calculations.
- Each critical buildings coverage acceptance will be based on demonstrating that 95 percent of the test point locations provide an audio quality of DAQ-3.4 or better. Motorola reserves the right to review any test tiles that fail the subjective DAQ tests. Each critical building will be evaluated independently of each other. A failed test for one critical building does not constitute a failure of another building.
- If a building is determined to have failed after the entire critical building testing procedure is completed as described in this CATP then the system may be modified to achieve the required reliability within the failed building. If it is determined that a BDA system is required, then a BDA system may be installed as described in the SOW of this proposal.

6.1.2.5 CATP Documentation and Coverage Acceptance

During the coverage acceptance test, Voyager generates computer files that include the mean and median SSI for each test tile. It also generates a raw file that has the multiple samples for each test point taken. A copy of this raw data will be provided to the County or Tusa Consulting Services at any time per the RFP requirements.

Motorola will process this data to determine whether the coverage test was passed for the equipment configurations and to produce a map that graphically displays the statistical coverage test results along with the analyzed numbers of the passes and failures.

Motorola will submit to the County a report detailing the coverage test results. This report will include a document, which is to be signed by both the County and Motorola, indicating the test was performed in accordance with this CATP and the results of the test indicate the acceptance or non-acceptance of the coverage portion of the system. The County will have the option to accept the coverage at any time prior to completion of the coverage test or documentation process.

Section 7. Coverage Methodology

7.1 Coverage Overview

Coverage Design

Motorola has proposed a 6-site simulcast-only system, which meets the requirements of the RFP. The site-specific data has been used in our design and is shown in Table 7-1.

Table 7-1: RF site transmission line and antenna data

Site Name	GTR8000 Power (dBm)	Transmit Line Losses TX/RX (dB)	Antenna Gain TX/RX (dB)	Antenna Height TX/RX	Antenna Type TX/RX	Effective Radiated Power (dBm)	Effective Receive Sensitivity (dBm)
Villages Water Tank	50	2.5/4.0	13.3/13.3	179	BMR12-O/BLR12-O	55.1	-126.47
Sumterville Tower	50	4.0/6.0	15.4/15.4	400	BMR12-H/BLR12-H	55.7	-127.79
Rutland Tower	50	3.6/5.5	13.4/15.4	328	BMR10-H/BLR12-H	54.1	-128.00
Bushnell Water Tank	50	3.5/5.0	13.3/13.3	152	BMR12-O/BLR12-O	54.1	-126.11
Wilson's Corner	50	3.5/5.5	13.4/15.4	328	BMR10-H/BLR12-H	54.2	-128.00
Linden Tower	50	3.0/4.6	15.4/15.4	270	BMR12-H/BLR12-H	56.7	-128.36

Motorola has included the following coverage maps, Section 7.3, for the configurations used for the coverage guarantee:

6-site Phase 1 (FDMA) Simulcast System (Talk-Out and Talk-In)

- Mobile w/unity gain antenna.
- Portable (½ wave in Swivel Case) Outside.
- Portable (½ wave in Swivel Case) 6 dB loss, Residences.

6-site Phase 2 (TDMA) Simulcast System (Talk-Out and Talk-In)

- Mobile w/unity gain antenna.
- Portable (½ wave in Swivel Case) Outside.
- Portable (½ wave in Swivel Case) 6 dB loss, Residences.

Per the RFP, additional coverage maps for various building losses have also been included, in Section 7.3, for informational purposes. Table 7-2 shows these additional maps.

Table 7-2: Additional coverage maps for information purposes

Talk-Out MAP #	Talk-In MAP #	System Configuration	Subscriber Configuration	Subscriber Location
1A	1B	6 Site Simulcast (FDMA)	Mobile with Unity Gain Antenna	On-Street
2A	2B	6 Site Simulcast (FDMA)	Portable with half-wave in Swivel Case	Outside
3A	3B	6 Site Simulcast (FDMA)	Portable with half-wave in Swivel Case	in 4dB building
4A	4B	6 Site Simulcast (FDMA)	Portable with half-wave in Swivel Case	in 6dB residence
5A	5B	6 Site Simulcast (FDMA)	Portable with half-wave in Swivel Case	in 10dB building
6A	6B	6 Site Simulcast (FDMA)	Portable with half-wave in Swivel Case	in 15dB building
7A	7B	6 Site Simulcast (FDMA)	Portable with half-wave in Swivel Case	in 20dB building
8A	8B	6 Site Simulcast (FDMA)	Portable with half-wave in Swivel Case	in 25dB building
1C	1D	6 Site Simulcast (TDMA)	Mobile with Unity Gain Antenna	On-Street
2C	2D	6 Site Simulcast (TDMA)	Portable with half-wave in Swivel Case	Outside
3C	3D	6 Site Simulcast (TDMA)	Portable with half-wave in Swivel Case	in 4dB building
4C	4D	6 Site Simulcast (TDMA)	Portable with half-wave in Swivel Case	in 6dB residence
5C	5D	6 Site Simulcast (TDMA)	Portable with half-wave in Swivel Case	in 10dB building
6C	6D	6 Site Simulcast (TDMA)	Portable with half-wave in Swivel Case	in 15dB building
7C	7D	6 Site Simulcast (TDMA)	Portable with half-wave in Swivel Case	in 20dB building
8C	8D	6 Site Simulcast (TDMA)	Portable with half-wave in Swivel Case	in 25dB building

Talk-Out MAP #	Talk-In MAP #	System Configuration	Subscriber Configuration	Subscriber Location
9A	9B	Villages Tank Individual Site Coverage	Portable with half-wave in Swivel Case	Outside
10A	10B	Sumterville Individual Site Coverage	Portable with half-wave in Swivel Case	Outside
11A	11B	Rutland Individual Site Coverage	Portable with half-wave in Swivel Case	Outside
12A	12B	Bushnell Tank Individual Site Coverage	Portable with half-wave in Swivel Case	Outside
13A	13B	Wilson's Corner Individual Site Coverage	Portable with half-wave in Swivel Case	Outside
14A	14B	Linden Individual Site Coverage	Portable with half-wave in Swivel Case	Outside
15A		5 Site 8TAC Coverage Talk-out -106dBm	Signal Strength Map	Outside
	15B	5 Site 8TAC Coverage Talk-in	Mobile with Unity Gain Antenna	Outside
	16B	5 Site 8TAC Coverage Talk-in	Portable with half-wave in Swivel Case	Outside

**Talk-In and Talk-Out Painted Areas are based on 95% Covered Area Reliability*

7.2 Coverage Prediction Method

7.2.1 Hydra[SM] Overview

Hydra is an innovative software tool developed by Motorola Solutions ("Motorola") to accurately predict coverage, model traffic (voice and data), analyze interference, plan channel re-use, and perform other design tasks for our diverse portfolio of radio networks. This description concentrates on Hydra coverage planning aspects.

Our solution presents typical Hydra coverage analysis for Sumter County.

7.2.2 Hydra Development

Motorola's Hydra coverage prediction tool was developed to provide accurate coverage simulations by applying proven models to detailed system and environmental data across large geographical areas.

To create an accurate picture of the predicted radio coverage, many elements must be considered. Some of these elements, called system factors, are related to the system design parameters. System factors affecting coverage performance include frequency, distance, transmitter power, receiver sensitivity, antenna height, and antenna gain. Other factors, called environmental factors, vary according to the path taken by the radio signal and the environment surrounding the receiver. Environmental factors include terrain variations, obstructions, vegetation, buildings, ambient noise, and interference.

All coverage prediction methods try to account for both types of factors and incorporate them into a computational model. In general, the currently accepted models, such as Okumura, Longley-Rice, and TIA provide excellent portrayals of radio coverage when used within their respective ranges of applicability.

In the past, this level of analysis was adequate for the type of basic systems that were available. However, today's complex technologies, such as digital voice radios, packet data systems, or simulcast, require a much more in-depth analysis of the expected coverage performance to create a cost-effective design. This makes it necessary to select the appropriate coverage model, provide accurate representation of the environmental factors throughout the service area, and apply the coverage analysis method to every location within the service area.

Recognizing these facts, Motorola has developed Hydra, a multi-purpose network design tool that includes a coverage analysis program. Taking advantage of the knowledge gained from Motorola's many years of practical experience and coverage testing, Hydra provides a superior means for analyzing system coverage. This program, unique to Motorola, employs a technique of computing coverage on every tile in a service area rather than along a finite number of radials. Hydra computes "layers" of these tiles, with each layer containing the values of propagation model

losses, coverage simulation results, or datasets. Layers can be displayed separately or in any combination as maps of the service area.

7.2.3 Hydra Detailed Description

Inputs and Outputs

Inputs to Hydra simulations include system architecture, equipment characteristics, service area boundaries, areas of various building losses, subscriber unit distribution density for traffic analysis, etc.

Hydra coverage map outputs are created and displayed using ESRI's shapefiles, an industry-standard GIS file format. Shapefiles from many sources (GIS vendors, the Internet, your own GIS department, etc.) can be loaded, displayed, and used in Hydra to enhance mapping, and to define service area polygons. Hydra coverage analyses can be limited to specified service area polygons (e.g., a county, a city, or a dispatch territory), so coverage reliability can be analyzed exclusively within the boundaries of your operating area.

In addition to showing coverage reliability, Hydra maps can display terrain, land cover, roads and boundaries, signal strength and field strength, interference predictions, etc.

Hydra provides closed-loop integration between predicting coverage and verifying coverage using Motorola's Voyager^{SM} coverage acceptance testing tool. Field survey measurements—signal strength, Bit Error Rate (BER), and Message Success for data—can be loaded into Hydra for analysis, display, and printing.

Tile Method

Hydra uniformly divides the entire geographical area to be analyzed into small, distinct areas called tiles. The resolution (size) of the tiles can be as fine as one arc-second (approximately 100 feet at U.S. latitudes). At each tile, Hydra models propagation from each site in the system.

The tile method is of particular importance in the calculation of simulcast coverage and interference analysis. Radial methods determine performance only at the locations where radials from all sites cross, leaving many areas where coverage performance is not calculated. With the tile method, the information from every site and all datasets is available in every tile; this provides the most accurate results for multi-site analyses (simulcast, voting, interference, best server, etc.).

Datasets

For propagation prediction, Hydra uses two types of geophysical datasets:

1. Hypsographic (terrain elevations) to determine shadow loss and elevation
2. Morphological (land use) for environmental clutter loss

With the proper datasets, Hydra produces accurate results. Because propagation prediction accuracy is directly dependent on the quality of the digitized datasets, Motorola uses high-quality datasets for its analyses. These datasets generally originate from official government agencies such as the U.S. Geological Survey in the United States, and equivalent governmental organizations worldwide. When datasets are not available from these sources, Motorola can work with commercial GIS vendors to produce Hydra-compatible datasets.

Even the best datasets contain a certain amount of errors, caused by a number of factors that are difficult to completely overcome due to the massive amount of data involved. Some examples follow:

- Source information – Older hypsographic and morphologic datasets were derived from existing map information, so any errors in the existing maps were carried over to the datasets. Newer datasets such as the U.S. National Land Cover Dataset (NLCD) are derived from satellite imagery, and are affected by digitization error.
- Dataset development process – Potential error sources include limitations in the digitizing algorithms, computer hardware problems, and judgment calls by the dataset developer.
- Dataset currency – Since the physical world is constantly changing, datasets can never be completely up-to-date. Over time, forests and shrub land are turned into farmland, hills are leveled, roads are built, communities are developed, and large buildings are constructed. Natural phenomena such as earthquakes, volcanoes, fires, storms, etc., change both the topography and environmental factors.

Hydra, like all terrain-based propagation tools, provides coverage predictions that are only as accurate as the available datasets permit. In the U.S., Motorola uses high-quality terrain and land cover data derived from USGS 30-meter DEM and NLCD sources.

Other datasets, which Hydra can use, include the following:

- Planimetric (mapping) – Roads, water features, political boundaries, feature names, etc.
- U.S. radio site locations – Coordinates of existing radio sites, including FCC wireless licenses, FCC antenna site registry, and some commercial site providers
- U.S. frequencies – Potentially available channels in geographic areas, per FCC wireless licenses

Propagation Model

For each tile, Hydra predicts signal strength using an improved algorithm based on the industry-accepted Okumura model.[1]

Coverage Reliability

Hydra coverage maps indicate the probability (usually referred to as reliability) of the radio system providing a minimum acceptable criterion, such as a voice Delivered Audio Quality (DAQ) or a data Message Success Rate (MSR). Since system coverage can never be 100% reliable, there will always be particular times and locations where the signal strength or Bit Error Rate (BER) does not meet that needed to reach the performance criterion. These locations of unsatisfactory performance are often predictable in a coverage study. However, there are also areas of unsatisfactory coverage that cannot be predicted due to unknown circumstances such as unusual structures, tree density, ambient noise, atmospheric conditions, dataset errors, and interference from co-channel or adjacent channel units operating outside their normal service area. *Because these conditions exist and signals fade due to these environmental and terrain factors, coverage must be described statistically in terms of a percentage of locations that exhibit the minimum acceptable criterion.*

Hydra predicts Area reliability, defined as the probability of achieving a specified performance criterion within a geographical area of interest. The area of interest is either the Covered Area (the painted area on a Hydra coverage map), or the entire Service Area.

To provide radio systems with acceptably few communications failures throughout the Covered Area, Motorola designs coverage at high Area reliabilities. The performance criterion is usually DAQ for voice or MSR for data. It is also important to note that locations outside of a Hydra map coverage area may still provide useable communications, even though such locations do not achieve the minimum acceptable performance.

7.2.4 Hydra Capabilities

Hydra provides detailed performance simulation of the following Motorola wireless network architectures:

- Voice coverage and traffic (Analog FM, ASTRO®, SECURENET™, etc.)
- ASTRO 25 Integrated Voice & Data (IV&D) coverage and traffic
- Dimetra® coverage and voice traffic
- High Performance Data (HPD)
- Long Term Evolution (LTE) data coverage

If co-channel and/or adjacent-channel sites are known to exist, Hydra can model both Interfered and non-Interfered coverage.

[1] Okumura, Yoshihisa *et al*, "Field Strength and Its Variability in VHF and UHF Land-Mobile Radio Service", *Review of the Electrical Communication Laboratory*, 16(9-10), Sept-Oct 1968, pp 825-873.

Hydra Frequency Re-Use Planning analysis takes into account both co-channel and adjacent channel frequencies.

Voice Systems

Hydra coverage models use proven Okumura-based prediction methods and Monte Carlo simulation techniques to provide coverage reliability maps. Voice coverage models (Voice, Dimetra, ASTRO 25) provide system-wide coverage maps, as well as subsystem maps (when applicable, e.g., for simulcast cells and receiver voting), and individual site maps.

Simulcast Coverage Performance

For a simulcast system, merely providing coverage maps of individual sites (separately or on the same map) does not accurately represent the total system performance, which depends upon differential delays and aggregate signal levels. Therefore, Motorola has developed the Hydra simulcast model that uses the delay spread methodology to simulate aggregate signal strength and audio phase angle (delay) throughout the entire predicted coverage area. All locations within the predicted coverage area are analyzed for the combined effect of signal strengths and differential delays from the simulcast transmitters in the system. Hydra simulcast coverage maps will show any areas predicted to have coverage problems caused by out-of-phase signals and/or inadequate signal strengths. Hydra allows modeling with varied transmitter launch delays to predict optimized simulcast coverage within the area being evaluated.

Data Systems (ASTRO 25 IV&D, HPD, and LTE)

Wireless data network performance is highly dependent on RF coverage reliability, network protocol, and network traffic load. Hydra accurately predicts the coverage and traffic performance of Motorola data systems by modeling the automatic protocol retry mechanisms of data protocols. Hydra integrates RF coverage prediction, network protocol modeling, and traffic engineering into a single simulation, and utilizes Monte Carlo simulations as well as discrete event simulation techniques to provide a tool that accurately predicts wireless network system performance.

Hydra uses the Okumura model for terrain-based propagation prediction, and adds the modeling of the protocol behavior (try-based coverage) via a detailed protocol simulation. Hydra models the relevant layers of the OSI protocol stack, from the physical layer of the air interface to the application layer of the host and subscriber entities.

Using this modeling approach, Hydra can account for all the elements that impede network performance, from packet loss on the wireless link due to co-channel interference, to packet latencies in the fixed end equipment introduced by protocol behavior. Hydra's modeling architecture allows true end-to-end system modeling.

Data Coverage

Hydra's data coverage model, through multiple iterations, displays the area that meets the MSR performance criterion requested by the user. The system-wide maps show the composite coverage from multiple sites, at the specified area reliability criterion and for the specified number of protocol tries.

Data Traffic

Hydra integrates coverage prediction into the traffic simulation, so the terrain and subscriber distribution effects on packet collisions and interference are modeled in the simulation. Traffic simulation results provide performance statistics for the RF station, radio channel, controller, and application(s). Hydra allows predicting the performance of the actual network topology as designed by the engineer.

7.2.5 Summary

Hydra is continually updated for the latest technologies by Motorola's Resource Development Engineering team, to create the most accurate and up-to-date coverage and traffic prediction tool. It is used extensively in the design and testing phases of Motorola's radio networks. Hydra provides accurate, easy-to-read maps of the predicted coverage for your radio system.

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7.2.6 Coverage Parameters

Table 7-3 details the coverage parameters that were used to generate the coverage map predictions. This table provides all of the parameters required by the RFP.

Table 7-3: Parameters used for coverage map predictions

SITE NAME	LOCATION COORDINATES	GROUND ELEV. (feet)	ANTENNA AGL (base) (feet)	ANTENNA HAAT (base) (feet)	ANTENNA HAAT (Centerline) (feet)	TX ERP (dBm) RX ERS (dBm)*	ANTENNA LENGTH (feet)	ANTENNA MODEL MAX GAIN (dB)	ANTENNA DOWN TILT ° AZIMUTH	TX POWER OUTPUT (dBm)	TX COMBINER & JUMPER LOSS (dB)	TRANSMISSION LINE LOSS (dB)
Site 1 - Villages Water Tank	28° 52' 10.60" N 81° 59' 34.74" W	26	Tx: 179 Rx: 179	Tx: 192.66 Rx: 192.66	Tx: 202.66 Rx: 202.66	Tx: 55.10 Rx: -126.47	20 20	BMR12-O/13.3 BLR12-O/13.3	0.75° / 290 ° 0.75° / 290 °	50	4.9	Tx: 2.5 Rx: 4.0
Site 2 - Sumterville Tower	28° 45' 50.84" N 82° 3' 36.26" W	17	Tx: 400 Rx: 400	Tx: 389.64 Rx: 389.64	Tx: 399.63 Rx: 399.64	Tx: 55.70 Rx: -127.79	20 20	BMR12-H/15.4 BLR12-H/15.4	0.75° / 90 ° 0.75° / 90 °	50	4.9	Tx: 4.0 Rx: 6.0
Site 3 - Rutland Tower	29° 54' 35.00" N 82° 10' 52.87" W	14	Tx: 328 Rx: 328	Tx: 322.91 Rx: 322.91	Tx: 329.91 Rx: 332.91	Tx: 54.10 Rx: -128	13 20	BMR10-H/13.4 BLR12-H/15.4	0.75° / 45 ° 0.75° / 45 °	50	4.9	Tx: 3.6 Rx: 5.5
Site 4 - Bushnell Water Tank	28° 40' 26.82" N 82° 8' 52.80" W	18	Tx: 152 Rx: 152	Tx: 147.50 Rx: 147.50	Tx: 157.50 Rx: 157.50	Tx: 54.10 Rx: -126.11	20 20	BMR12-O/13.3 BLR12-O/13.3	0.75° / 0 ° 0.75° / 0 °	50	4.9	Tx: 3.5 Rx: 5.0
Site 5 - Wilsons Corner Tower	28° 32' 23.55" N 82° 4' 47.92" W	24	Tx: 328 Rx: 328	Tx: 326.97 Rx: 326.97	Tx: 333.97 Rx: 336.97	Tx: 54.20 Rx: -128	13 20	BMR10-H/13.4 BLR12-H/15.4	0.75° / 45 ° 0.75° / 45 °	50	4.9	Tx: 3.5 Rx: 5.5
Site 6 - Linden American Tower	28° 33' 49.30" N 82° 1' 27.20" W	32	Tx: 270 Rx: 270	Tx: 289.11 Rx: 289.11	Tx: 299.11 Rx: 299.11	Tx: 56.70 Rx: -128.36	20 20	BMR12-H/15.4 BLR12-H/15.4	0.75° / 90 ° 0.75° / 90 °	50	4.9	Tx: 3.0 Rx: 4.6

Table 7-4: System Parameters

PARAMETER	VALUE
Propagation Model	Okumura
Reliability	95% Area Outside County / 95% Area 6 dB Building Loss
Mode of Operation	ASTRO25 IMBE Linear Simulcast and C4FM
In Building Scenarios	<=25 dB loss of Attachment C of RFP
Scenario	Simulcast (Talk Out) or Voting (Talk In)

Table 7-5: Repeater Parameters

PARAMETER	VALUE
Model	GTR8000
RF Power	100 W
TX ERP	Varies Per Site (see Table 7-3)
Effective Faded Receiver Sensitivity	Varies Per Site (Table 7-3*

Table 7-6: Portable Parameters – RSM with 1/2 Wave Flex Antenna

PARAMETER	VALUE
Model	APX Portable
RF Power	3 W
TX ERP	26.2 dBm
Effective Faded Receiver Sensitivity	99.9 dBm*
Antenna Type	½ Wave Flex Antenna
Tx Antenna Height	3.0’
Tx Antenna Placement	hip
Rx Antenna Height	3.0’
Rx Antenna Placement	hip

Table 7-7: Mobile Voice Parameters

PARAMETER	VALUE
Model	APX Mobile
RF Power	35 W
TX ERP	42.7 dBm
Effective Faded Receiver Sensitivity	105.75 dBm*
Antenna Height	4.9’
Antenna Type	¼ Wave
Antenna Placement	Center of the Roof

** Effective receiver sensitivity in faded environment including antenna losses/gains*