12d. ASTRO 25 Integrated Voice and Data Network Coverage Acceptance Test Plan

12d.1 ASTRO 25 Integrated Voice and data Network Coverage Acceptance Test Plan

12d.2 Scope, Overview, & Test Philosophy

This section provides the Coverage Acceptance Test Plan (CATP) for the ASTRO 25 Integrated Voice and Data Network portion of the STARS Program. Motorola describes the CATP methodology on which is based the stated coverage performance guarantees found in Section 4 "ASTRO 25 Integrated Voice and Data Network Coverage and Traffic (IVDNC&T)." The CATP defines the coverage testing method and procedure, the coverage acceptance criteria, the test documentation, and the responsibilities of both Motorola and the Commonwealth of Virginia. Motorola will use the CATP to verify that coverage meets or exceeds Motorola's stated coverage guarantees.

The coverage maps contained in the IVDNC&T, along with the data files associated with those maps show the areas within which Motorola predicts coverage. These are based on parameters contained in the coverage summary reports which are part of the IVDNC&T. If the Commonwealth agrees that the implemented system varies from the design parameters, then a revised coverage map will be prepared for the Commonwealth. New maps will reflect the revised coverage areas. The ASTRO 25 IV&D Network CATP consists of five coverage tests that are separately conducted, evaluated, documented, and accepted. The purpose of the first test is to verify that the voice communication portion of the ASTRO 25 IV&D system meets or exceeds Motorola's voice coverage guarantees. The second test will verify that the data communication portion of the ASTRO 25 IV&D system meets or exceeds Motorola's data coverage guarantees. The third test will verify that the In-Tunnel system meets or exceeds Motorola's In-Tunnel voice coverage guarantee. The fourth test will verify that the In-Tunnel system meets or exceeds Motorola's In-Tunnel data coverage guarantee. The fifth test will verify system access. The ASTRO 25 IV&D Network CATP is deemed passed and will be accepted if each of the five coverage tests separately and independently passes.

Motorola and the Commonwealth will use the test philosophy presented in the Telecommunications Industry Association's (TIA) Technical Service Bulletin TSB-88A, Section 7 "Performance Confirmation". This bulletin is titled "Wireless Communications Systems, Performance in Noise- and Interference-Limited Situations, Recommended Methods for Technology-Independent Modeling, Simulation, and Verification," as the common technical reference for which testing will be conducted, thus providing a baseline for terminology, definitions, and methodology.

12d.3 CATP Definitions

12d.3.1. Service Area / Communication Zone

A "communication zone" is the same as the term "Service Area" used by TSB-88A to define a service area. Each communication zone will include all the area contained within its boundaries as shown on the coverage maps in Appendix 13.

12d.3.2. Coverage Area

The coverage area is the geographical region within the communications zone where Motorola will provide communications that meets or exceeds the specified **C**hannel **P**erformance **C**riterion (CPC) at the coverage reliability for the specified equipment configuration(s).

12d.3.3. Channel Performance Criterion (CPC)

The CPC is the specified minimum design performance level in a faded channel. For this system's voice communication, the CPC is a 2.0 BER, which under standard faded performance conditions provides a Delivered Audio Quality of DAQ-3.4 (the DAQ definitions are provided in the table below). For this system's data communication, the CPC provides a Message Success Rate (MSR) of 95%.

DAQ Delivered Audio Quality	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.

Table 12d-1 – DAQ Definitions

12d.3.4. Service Area Reliability

The Service Area reliability is the percent of locations within the communications zone, which are predicted to meet or exceed the specified CPC.

12d.3.5. Coverage Area Reliability

The Coverage Area reliability is the percent of locations within the coverage area, which are predicted to meet or exceed the specified CPC.

12d.3.6. Coverage Guarantee

Motorola guarantees that the system will provide the Service Area Reliability within each communications zone as described in the table below, and as shown for Communications Zones 1-13 and Waterways as indicated on maps in Appendix 13.

Service Area Description	Service Area Coverage Guarantee
Communication Zone 1	95%
Communication Zone 2	94%
Communication Zone 3	95%
Communication Zone 4	88%
Communication Zone 5	95%
Communication Zone 6	94%
Communication Zone 7	93%
Communication Zone 8	92%
Communication Zone 9	91%
Communication Zone 10	95%
Communication Zone 11	94%
Communication Zone 12	93%
Communication Zone 13	91%
Major Waterway Communication Zone (Waterways as indicated on the Waterway Map contained in Appendix 13)	88%

Table 12d-2 – Service Area Reliability Guarantees

Meeting the coverage guarantee is based on measured values of BER and/or DAQ, demonstration of PTT access, and measured MSR for data.

12d.3.7. Bit Error Rate (BER)

"BER" is defined as a mean measurement of received bit error rate taken over a distance exceeding 40 wavelengths.

12d.3.8. Message Success Rate (MSR)

The Message Success Rate is the percent of data test messages successfully delivered within the maximum number of protocol tries for a given predicted coverage area. A successful delivery is defined as transmitting a test message and receiving its corresponding acknowledgement within four (4) automated attempts accomplished within 20 seconds within the same test tile.

12d.3.9. CATP Test Tiles

To verify that the radio coverage reliability is met, the entire area within the Commonwealth, including major waterways and ten miles offshore, will be uniformly divided into equally sized tiles starting from one reference point. All accessible tiles will be tested. The presence of a road (either improved or unimproved) determines accessibility with the exception of waterways. The CATP Test Tiles are defined as:

1. All tiles within the Commonwealth, whole or in part, will be tested. Only tiles where the majority of the tile falls within the boundaries of the communication zones would be considered test tiles, with the exception of tiles that border other states.

2. Those test tiles within the CATP boundaries which are actually tested;

3. Inaccessible test tiles are not counted and will be categorized as simply "untested" and will not be factored into the results as a "CATP test tile."

12d.3.10. Problem Coverage Areas

A problem coverage area is a failure of the Coverage Acceptance Test Plan in a communication zone due to factors that are within Motorola's scope of work within this Contract. In the event that a problem coverage area is found during or after the coverage acceptance test, but still within the implementation stage, Motorola will address and correct the problem coverage area at Motorola's expense.

12d.3.11. Randomly Selected

"Randomly selected" is defined as evenly spaced across the service area.

12d.4 CATP Method

The method used to test coverage is a statistical sampling of each communication zone. This method will verify the CPC is met or exceeded at the required reliability for each of the defined equipment configurations and associated service area coverage guarantees. This will be done by sampling a statistically significant number of randomly selected locations, quasi-uniformly distributed throughout the communication zone. Prior to ATP, Motorola will provide the "Minimum Grid" calculations verifying the estimate of proportions calculations in accordance with TSB-88A, Section 7.2.

Service Area Description	Required Minimum Number of CATP Test Tiles
Communication Zone 1	3,184
Communication Zone 2	4,030
Communication Zone 3	3,184
Communication Zone 4	2,132
Communication Zone 5	5,263
Communication Zone 6	4,030
Communication Zone 7	2,579
Communication Zone 8	3,184
Communication Zone 9	1,147
Communication Zone 10	4,030
Communication Zone 11	5,263
Communication Zone 12	2,132
Communication Zone 13	1,147
Major Waterway Communication Zone (Waterways as indicated on the Waterway Map contained in Appendix 13)	5,263

Table 12d-3 – Communications Zones 1-13 and Waterways as indicated on maps contained in Appendix 13.

12d.4.1. Defining CATP Test Tiles

Motorola will use the uniformly sized tiles as defined in Section 12d.3.9 ("CATP Test Tiles"). The test tiles will be approximately 0.707 mile by 0.707 mile square. Motorola and the Commonwealth will then identify and agree upon any test tiles deemed not accessible for the coverage test. Those test tiles deemed inaccessible prior to testing will be eliminated from the acceptance test calculation.

If a test tile is identified as accessible but only with the use of a non-standard vehicle (aircraft, four-wheel drive, watercraft or by foot), Motorola will request the Commonwealth to provide the access and specialized transportation. The request will contain the dates and locations of the areas where such access is required. The Commonwealth will provide the means for the CATP test team to access the areas including providing specialized vehicles and watercraft, and/or personnel for walk-in testing.

12d.4.1.1. CATP Test Tiles for Tunnels

For VHF mobile radio voice and data testing in the tunnels, Motorola will conduct a test every 100 feet as the vehicle travels down the center of each traffic lane. For 700/800 MHz portable radio voice testing, Motorola will conduct a test every 100 feet in each traffic lane, and every 100 feet on the tunnel walkways in vehicular tunnels. Testing for one traffic lane will be initiated 50 feet outside the entrance of each tunnel, Testing for any adjacent traffic lanes and the walkway will be initiated 100 feet outside the tunnel entrance. For VHF mobile testing, only tests made after entering into the tunnel will count for purposes of acceptance. For 700/800 MHz portable radio testing, all tests will count for purposes of acceptance.

Motorola will not test coverage for walkways exterior to the vehicular tunnels, including bore cross connections, air ventilation shafts, or other areas accessible by tunnel maintenance personnel, except as requested by the Commonwealth as an "information only" test.

12d.4.2. Verification of CATP Test Equipment

Just prior to each day's test, Motorola personnel will verify that:

1. All test radio(s) installed in the test vehicle(s) supplied by the Commonwealth of Virginia are the same device type and configuration as used to predict coverage, including the antenna type and mounting location.

2. All test radio(s) are operating satisfactorily

3. All mobile test receiver(s) used with Motorola's automated coverage testing hardware and software coverage testing package are calibrated.

4. Additionally just prior to the test, Motorola personnel will verify that all GPS navigation, computers, and CATP software application is functioning properly and set up for the day's test.

5. Set up the trunked system sites to rotate through all available working channels at each site, except for control channel and BER test channel for the day of test.

6. Change the control channel at each site at the beginning of each day to a different control channel from the previous day's test.

7. Move the BER test to a different working channel at each site at the beginning of each day.

8. Reset test receivers to monitor correct BER test channels assigned for the day's test.

12d.4.3. Preparing Vehicles/Boats and Test Teams

In order to expedite testing, Motorola will use three (3) fully equipped VSP patrol vehicles, two (2) fully equipped DGIF watercraft, two (2) fully equipped VMRC watercraft, and two (2) 4WD vehicles provided by the Commonwealth to complete the CATP. Motorola will equip each vehicle and boat with the appropriate testing equipment for measuring voice BER, SSI (signal strength indication), PTT access and MSR measurements. Motorola will also equip each vehicle and boats with a 110-Watt VHF ASTRO 25 mobile radio (configured as delivered) for voice delivered audio quality (DAQ) testing. Motorola will equally alternate between the two agencies watercraft during the testing.

For each vehicle and boat the Commonwealth will provide one representative to drive (or pilot the boat) and another to witness the CATP. Motorola will provide one technical representative to operate the automatic test package. Commonwealth personnel will operate vehicles and watercraft.

Additionally, for DAQ testing the Commonwealth and Motorola will provide representatives at a dispatch console that is associated with the communication zone under test. Prior to performing a statistically valid subjective DAQ test, all personnel who will evaluate DAQ will be "calibrated" by listening to examples of static and faded audio of various CPC levels from the type of system being tested. Additionally, at the beginning of each test day all personnel that will evaluate DAQ will repeat the "calibration" process. Motorola and the Commonwealth will agree on the listening examples prior to beginning this test.

12d.4.3.1. Boat Antenna

The boat(s) will be equipped with the VHF marine style antenna for the test radios that will be used in the delivered system.

12d.4.3.2. In-Tunnel Portable

Motorola will use three new 700/800 MHz portables from the Commonwealth's purchased inventory for In-Tunnel portable voice DAQ testing.

12d.4.4. CATP Testing

This CATP includes testing of all tiles as defined in section 12d.3.9 Testing will be performed in the following manner.

1. For Communication Zones 1 and 2, DAQ testing will be performed in every accessible tile for information purposes

2. Excluded from testing are the following locations:

   - underground parking lots

   - above ground parking garages

After preliminary preparations, all Test Teams will attempt to test all CATP test tiles deemed accessible within their assigned test region. If tiles previously not identified as "inaccessible and excluded from testing" are found physically impossible to access then such tiles will be treated as follows:

- If the inaccessible tile(s) involves obtaining access via a means other than a standard vehicle (four-wheel drive or water boat), Motorola and the Commonwealth test teams will use every reasonable and safe means possible to test coverage in the tile(s). Motorola will request the Commonwealth to provide access to the inaccessible tile(s) and reschedule the tile for testing within 30 days. The request will contain the dates and locations of the areas where such access is required. The Commonwealth will provide the means for the CATP test team to access the test tile(s) including providing specialized vehicles and watercraft, and/or personnel for walk-in testing.

- If the inaccessible tile involves obtaining access to private property, restricted lands, or other areas not normally open to public access the Commonwealth will request and if possible obtain permission for the coverage test teams to access the test tile.

    - If after all reasonable means to access difficult to reach test tiles are exhausted, any remaining untested inaccessible test tiles (not previously identified and approved in advance as exempt from testing) will be removed from the coverage calculations and not be counted as either pass or failed.

After testing of a block of tiles or a Communication Zone, tiles with a BER greater than 2% but less than or equal to 5% will be identified for DAQ testing to verify that it is not below 3.4. The teams will conduct DAQ testing in all CATP test tiles deemed requiring DAQ testing.

12d.4.4.1. Random Selection of a Test Location within Each Test Tile

Using Motorola's fully automated coverage test hardware and software documented in Appendix 17 ("Automated Coverage Test Equipment Description"), the actual test location within each test tile will be randomly selected by the test vehicle crossing into the test tile at an arbitrary point, with an arbitrary speed and direction at the discretion of the vehicle's operator.

12d.4.5. CATP Test Results

Motorola will record coverage data in each tile and will compare the collected data to the guarantees in Table 12d-2. Motorola will use its proprietary coverage prediction and analysis tool called Hydra to analyze all CATP data and prepare CATP maps and reports. Motorola will correlate and analyze the coverage data, and will provide the results to the Commonwealth in a final Coverage Acceptance Test Plan report per Communication Zone for review and approval. Motorola will also provide the Commonwealth with each day's raw test data in electronic CSV file format no later than the next working day after the test data is taken. The Commonwealth will have unrestricted use of this data.

Each final CATP report will include a form to be signed by both the Commonwealth and Motorola upon successful completion of the testing, review, and approval of the results by the Commonwealth. This form will indicate the test was performed in accordance with this CATP and the results of the test indicate the acceptance of the coverage portion of the system. The Commonwealth will have the option to accept the coverage at any time prior to completion of the coverage test or documentation process.

12d.4.5.1. CATP Data Analysis and Reports

In the CATP final reports, Motorola will include a detailed description of the analytical manipulation of data and a summary of the Commonwealth approved deviations from the original design processes or models used for determining the coverage guarantees. To the extent reasonable, Motorola will use the same design processes and propagation models throughout the project, and will notify the STARS PD and obtain approval prior to modifying or improving the modeling process in anyway. Motorola will tabulate the test results as shown in the following example:

VHF Mobile Voice BER/DAQ Test Results Format

Tile Ref. No.	Mean Latitude	Mean Longitude	Mean BER	Talk-In DAQ 3.4 Test	Talk-Out DAQ 3.4 Test	Grid Pass / Fail
346	37.245	-77.342	2 %	n/a	n/a	Pass
347	37.453	-77.563	3 %	”Pass”	”Pass”	Pass
348	37.635	-77.273	4%	”Fail”	”Pass”	Fail
349	37.532	-77.621	5 %	”Pass”	“Fail”	Fail
350	37.367	-77.545	7 %	n/a	n/a	Fail

Push-to-Talk (PTT) Test Result Format

Tile Ref. No.	Mean Latitude	Mean Longitude	PTT Access Grant Attempt 1	PTT Access Grant Attempt 2	Grid Pass/ Fail
346	37.245	-77.342	Yes	N/A	Pass
347	37.350	-77.520	No	Yes	Pass
348	37.453	-77.563	No	No	Fail

Inbound Data Message Test Results Format

Tile Ref. No.	Mean Latitude	Mean Longitude	Inbound Test Data Message Acknowledged Yes/ No	Grid Pass/ Fail
346	37.245	-77.342	Yes	Pass
347	37.453	-77.563	No	Fail

Outbound Data Message Test Results Format

Tile Ref. No.	Mean Latitude	Mean Longitude	Outbound Test Data Message Acknowledged Yes/ No	Grid Pass/ Fail
346	37.245	-77.342	Yes	Pass
347	37.453	-77.563	No	Fail

12d.4.5.2. Coverage Test Results and Report Format

Motorola will reduce the test results to provide a tabulation showing:

- The number of test tiles where the CPC does not meet or exceed the performance objectives stated in this document or the tile fails PTT access testing, the total number of test tiles actually tested, and the total number of untested tiles in the coverage area under test.

- The mean Latitude and Longitude of each test point expressed in decimal degrees to at least DD.ddd precision.

- A listing of raw data in mean BER and associated median SSI, in electronic CSV file format.

- The percentage of test tile failures. This statistic will be computed by dividing the total number of test tile failures by the total number of valid CATP test tiles tested.

Motorola will provide the formatted results test data to the STARS PD in a digital format, complete with an explanation of the file structure. Motorola will also provide and present the acceptance test results in an Excel data file.

Motorola will provide test results displayed on a map with roads, communications zones, and service area boundaries, to show locations where the tested BER and/or system access locations do not meet the objective.

Motorola will not alter or modify measured coverage acceptance test data. In addition, Motorola will not substitute subjective tests of DAQ for any condition for any test location, either passed or failed except for the defined situation where the Commonwealth agrees that the measured mean bit error rate is greater than 2.0% (BER) but less than or equal to 5% (BER).

12d.4.6. CATP Equipment Failures

In the event there is a failure of either the test equipment or the tested system during a particular test run, and if the Commonwealth or Motorola determines that the data already collected is potentially corrupted or that the test results may not be valid, Motorola will retest affected coverage test tiles, at no cost to the Commonwealth, after the failure is repaired.

Motorola has applied VHF RF and environmental noise levels values to the VHF ASTRO 25 mobile radio using categorized noise figures as recommended in TSB-88A section 5 and as further revised in accordance with this Contract. These levels were used to calculate estimated mobile receiver sensitivity degradation of 5 dB. If during CATP outbound testing a test tile(s) fails due to suspected localized interference, and the corresponding CATP fails, Motorola will measure the mean mobile receiver sensitivity degradation within the failed test tile(s). Motorola will then compare the measured mean value with the estimated value to determine if the failure is the result of localized interference. Motorola will work with the Commonwealth to identify potential solutions to the interference issue(s).

12d.5 Responsibilities, Equipment, and Schedule

The Commonwealth of Virginia will provide the following for the duration of the coverage test:

- Three fully equipped VSP patrol vehicles for use as test sedans and if required two fully equipped VMRC and DGIF patrol watercraft which are exact models of the vehicles and boats to be installed with mobile radios, including antenna locations.

- At least one Commonwealth of Virginia representative and no more than one Commonwealth consultant, to drive each test vehicle (or boat) and/or to be the Commonwealth representative(s) for the test team(s).

- Additional personnel as the Commonwealth deems necessary for the test team(s), both at the control point and in the field.

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

- At least one Motorola representative per test team, to navigate and to operate Motorola's automatic coverage test hardware and software. No more than one Motorola representative will participate in the DAQ test

- At least one calibrated hardware and software coverage testing package for each vehicle and boat in use for the test.

- At least one laptop computer equipped with Motorola's automated coverage testing software for each vehicle and boat in use for the test.

- Additional personnel as needed both at the control point and in the field, to

operate the test equipment, but not as part of the DAQ test team.

- Test log forms as required for subjective DAQ testing.
- Equip the test vehicle or watercraft with the exact Motorola equipment, configuration, and location as the delivered system.

12d.5.1. Test Equipment

Motorola will provide the test equipment, software, and technical personnel necessary to test the system. As part of the CATP, Motorola will provide the Commonwealth a list of test equipment, model numbers, serial numbers, the latest calibration dates, and a description of how the equipment is planned to be used as defined in Appendix 17.

The automated test equipment required for Coverage Testing will be a receiver capable of monitoring frequencies in the VHF band, a GPS receiver, appropriate antennas, and a PC with data collection and coverage correlation software installed. The test equipment will derive its input power from the test automobile's 12VDC. All proprietary software and hardware remain the property of Motorola and will be returned to Motorola upon successful completion of the CATP.

During the coverage test, the laptop computer with the automatic test equipment application will display the vehicle location on a map of the coverage test area overlaid with the test tiles. Motorola's automated coverage testing hardware and software will automatically initiate BER, SSI, and MSR measurements when the GPS receiver indicates that a test tile has been entered. The computer will provide a visual indication that a measurement has been completed in a tile. Motorola's automated coverage testing hardware and software will manage the coverage test data collection, and will store for later analysis the mobile outbound reference signal level, BER measured in each tested grid, manual notations of DAQ, and MSR test results.

12d.5.2. Test Schedule

Motorola will conduct all tests in accordance with the STARS program schedule. If a specific device or subsystem fails to meet specifications during the testing period, Motorola will, with the agreement of the Commonwealth, elect one of the following procedures:

A. Motorola will repair or realign the equipment and then retest that device or subsystem later in that test sequence. If the Commonwealth believes that the repaired or realigned equipment will affect the previous collected test data, Motorola will retest all areas affected by the change.

B. Motorola and the Commonwealth will retest the device or subsystem at a later date and submit the results to the Commonwealth for approval.

Motorola will notify the STARS PD of any utilized equipment-failures throughout the coverage test period.

12d.6 CATP Measurements

This CATP includes measuring BER, DAQ, PTT Access, and MSR. The following details the specific procedures for each measurement:

12d.6.1. BER

In each test tile, a series of sequential measurements (subsamples) will be made. This test location measurement, containing a number of subsamples, constitutes the test sample for this location. The test sample will establish the local mean BER within the test grid. A mean of multiple subsamples 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. BER testing will be performed in the talk-out direction, to a mobile test receiver in a vehicle. Motorola will ensure that all channels will be utilized in the BER test protocol. Refer to BER CATP Test Plan Process Map in Appendix 17b.

12d.6.2. DAQ

In test tiles where DAQ tests are required, the test team (two Commonwealth and one Motorola representatives) will listen to an audio transmission, and each person will record their evaluation of the Delivered Audio Quality (DAQ) for the test tile. DAQ evaluations will be based on the DAQ descriptions in Table 12d-1. For the evaluated test tile, a simple majority DAQ evaluation from all test team personnel will be used to determine whether the grid passes or fails. DAQ testing will be performed in the talk-out and talk-in direction, between a VSP dispatch console and a mobile test receiver in a vehicle. Motorola will ensure that all channels will be utilized in the DAQ test protocol. Prior to testing, the Commonwealth of Virginia and Motorola will agree upon the specific spoken messages to be transmitted during the test calls so that they will last approximately five seconds each – about the length of a typical public-safety radio transmission. Refer to DAQ CATP Test Plan Process Map in Appendix 17c.

12d.6.3. MSR

Each MSR test transmission will consist of one 200-byte inbound message and one 200-byte outbound message, both of which define the "CATP Message Size" used to predict coverage. When its GPS receiver determines an unsampled test tile has been entered, Motorola's automated coverage testing hardware and software package will initiate an inbound test message transmission by the IV&D radio. Motorola's automated coverage testing hardware and software package will monitor the IV&D radio for an ACK that confirms success of the inbound test message, or for a NAK which will initiate another try (unless all protocol tries are exhausted). The software will be adjusted such that all four protocol tries are accomplished within twenty seconds.

When a test message is transmitted, the automated coverage testing hardware and software package's display will indicate "Testing", along with the number of seconds since transmission and the try number, until an acknowledgment (ACK) is received from the fixed network equipment, or all tries are exhausted.

- If an ACK is received by the IV&D radio, Motorola's automated coverage testing hardware and software package will conclude that test location and will record the test tile as passed.

- If an ACK is not received after four tries, Motorola's automated coverage testing hardware and software package will record the test tile as failed.

The reception of an acknowledgment (ACK) will indicate a successful inbound link communication. No acknowledgment of the test transmission after all protocol tries are exhausted will constitute an inbound link failure of the test point.

The inbound and outbound test messages each will be 200 bytes character in length. This is the message length used to predict coverage.

12d.6.4. Subscriber Access Tests

Push to Talk (PTT) Access Test – Motorola will provide a PTT test to demonstrate the establishment of two-way communications within each grid in a communications zone. The test team will use the PTT button on the non-fixed unit in accordance with product default specifications and wait for the tone indicating establishment or failure of communications. If the first attempt fails, a second attempt will be made. If both attempts fail, the grid fails for this test. If either attempt succeeds, the grid passes for this test. The radios used in the test will be set at factory default specifications. The test will be designed to utilize equally all available frequencies according to the channel plan.

If two attempts to establish access were needed in grids representing 50% or more of the difference between the guaranteed coverage in the zone and 100% (see example below), then Motorola will investigate and provide a report to the Commonwealth on the cause and potential resolution of any problems represented by the need to repeat access attempts. The Commonwealth may have its independent consultant review the report and provide additional information, if it chooses. If one or more remedies are possible, the parties will agree on the remedy to be implemented and determine whether the cause of the failure was within Motorola's scope of work under this or any associated contract. If so, then Motorola will be responsible for the implementation and reasonable cost of any such remedy. If not, the Commonwealth will either accept the system as is, implement the remedy with its own resources with Motorola's reasonable concurrence, or contract with Motorola to implement the remedy.

Example: Zone A has a coverage guarantee of 90%. The difference between 100% and 90% is 10%. Half of 10% is 5%. If 5% or more of the PTT tests required two attempts, then Motorola would investigate the reasons for the multiple attempts.

12d.7 Acceptance Sheet

BER/DAQ and Data Coverage test results will be provided on a Communications Zone and tunnel basis. The following data collection sheets will include fields for such information as location, communications zone number, tunnel name, date, etc.

BER/DAQ Coverage Acceptance

The BER/DAQ coverage acceptance is deemed passed if the number of passed valid CATP test tiles is greater than or equal to the percentage in Table 12d-2.

Communication Zone Number	Number of Valid Test Tiles	Number of Passed Valid Test Tiles	% of Passed Valid Test Tiles	BER/DAQ CATP Pass / Fail

12d.7.1. Data Coverage

A Data test tile is deemed passed if both parts of the data coverage test (inbound link part and outbound link part) pass. The communications zone is deemed passed if the number of test tiles passed is greater than or equal to the percentage in Table 12d-2.

Communication Zone Number	Number of Valid Test Tiles	Number of Passed Valid Test Tiles	% of Passed Valid Test Tiles	Data CATP sub-Part Pass / Fail
CZ# Data Inbound Link				
CZ# Data Outbound Link				

12d.7.2. In-Tunnel Voice Coverage

The In-Tunnel voice coverage test is deemed passed and will be accepted if the number of passed, valid CATP test tiles is greater than or equal to 95%.

Tunnel Name and Tube	Number of Valid Test Tiles	Number of Passed Valid Test Tiles	% of Passed Valid Test Tiles	BER/DAQ CATP Pass / Fail

12d.7.3. In-Tunnel Data Coverage

An in-tunnel data test tile is deemed passed if both parts of the data coverage test (inbound link part and outbound link part) pass. The tunnel is deemed passed if the number of test tiles passed is greater than or equal to 95%.

Tunnel Name and Tube	Number of Valid Test Tiles	Number of Passed Valid Test Tiles	% of Passed Valid Test Tiles	Data CATP sub-Part Pass / Fail
Tunnel Name and Tube Data Inbound Link				
Tunnel Name and Tube Data Outbound Link				

12d.7.4. PTT Access Acceptance

The PTT access acceptance is deemed passed if the number of passed valid CATP test tiles is greater than or equal to the percentage in Table 12d-2.

Communication Zone Number	Number of Valid Test Tiles	Number of Passed Valid Test Tiles	% of Passed Valid Test Tiles	PTT Access Pass / Fail

12d.7.5. In-Tunnel PTT Access Acceptance

The In-Tunnel PTT access acceptance is deemed passed if the number of passed valid CATP test tiles is greater than or equal to 95% for each tunnel.

Tunnel Name	Number of Valid Test Tiles	Number of Passed Valid Test Tiles	% of Passed Valid Test Tiles	PTT Access Pass / Fail