AEROFLEX

3900 Series Digital Radio Test Set

P25 Option Manual

Issue-5

3900 Series

Digital Radio Test Set

P25 Option Manual

PUBLISHED BY
Aeroflex

Original Release	Dec 2009
Issue-2	Mar 2010
Issue-3	Oct 2011
Issue-4	Mar 2013
Issue-5	Sep 2013

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Preface

SCOPE

This manual contains information on how to use 3900 P25 Options. This manual is provided as an addition to the 3900 Series Operation Manual. Refer to the 3900 Series Operation Manual for information regarding functions and basic operation of the 3900 Radio Test Set.

NOMENCLATURE STATEMENT

The 3901, 3902, 3920 and 3920B Digital Radio Test Set is the official nomenclature for the test sets currently included in the 3900 Digital Radio Test Set Series. In this manual, 3900, unit or Test Set, refers to the 3901, 3902, 3920 and 3920B Digital Radio Test Sets unless otherwise indicated.

INTENDED AUDIENCE

This manual is intended for users familiar with P25 Systems and with the operation of the 3900.

TEST SET REQUIREMENTS

Refer to the 3900 Series Operation Manual for information on the following:

- Safety Precautions
- Power Requirements
- Platform Performance Data Specifications
- Repacking/Shipping Test Set

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Chapter 1 - Introduction to P25 Options

1.1 FUNCTIONS AND CAPABILITIES OVERVIEW

The 3900 Series P25 Options provide various features for testing P25 radios systems. The 3900 Series currently supports the following P25 test capabilities:

1.1.1 P25 Option 390XOPT200

P25 Option provides the following test features:

- P25 Base Radio simulation;
- Ability to lock/unlock paired generator and receiver frequencies;
- Ability to configure independent generator and receiver protocol;
- Internal AF Generators for audio modulation;
- Data Link Tile displays data from inbound voice packets;
- Ability to transmit P25 C4FM modulation waveforms;
- Ability to receive, demodulate and analyze P25 modulated signals;
- Ability to select Phase 1 or Analog Protocols;
- Ability to perform RF and modulation parametric tests on the Unit Under Test (UUT).
- Provides features for use of DES encryption on Trunked P25 Voice Channels.

1.1.2 P25 Trunking Option 390XOPT201

The 3900 Series P25 Trunking Option provides all of the features found in option 390XOPT200 plus the following:

- P25 Trunked Base Radio simulation;
- System Plan configuration for defining system information and Channel Plan data;
- Two Channel selection capability;
- P25 700 MHz, 800 MHz, UHF and VHF frequency band support.

1.1.3 P25 LSM Option 390XOPT204

The 3900 Series P25 LSM Option provides all of the features found in option 390XOPT200 plus the following:

- Ability to transmit Motorola® LSM waveforms;
- Enables the EVM Meter and related remote commands;
- Enables CQPSK Transmit Modulation;
- Enables the Trajectory Tile;
- Enables Frequency and IQ Constellation Tile selection.

1.1.4 P25 Channel Logger Option 390XOPT206

The 3900 Series P25 XML Logger Option provides all of the features found in option 390XOPT200 plus the following:

- Allows XML formatted information to be relayed to and from a remote PC location and a Test Set.

1.1.5 SmartNet™/SmartZone™ Option 390XOPT207

The 3900 Series SmartNet™/SmartZone™ Option provides all of the features found in option 390XOPT200 plus the following:

- Ability to emulate a repeater station operation (not locked to a specific 'test sequence' for the radio);
- Ability to 'find' and monitor a SmartNet™/SmartZone™ control channel and then 'follow' the channel, the group or the individual unit;
- Full analog (FM) parametric tests and digital P25 mode tests;
- Various 800 and 900 MHz frequency band and VHF/UHF frequency band selection;
- Channel designation and frequency settings for 800 and 900 MHz band.
- Channel Logger which allows XML formatted information to be relayed to and from a remote PC location and a Test Set.
- Ability to log Symbol Layer XML data.
- Ability to log Raw XML data.
- Ability to log Protocol Layer XML data.

1.1.6 KVL Loader Option 390XOPT209

The KVL Keyloader Option adds the ability to enter encryption keys into the 3900 for DES and AES. Encryption keys may be loaded manually using either the front panel, external keypad, or the P25 Key Fill Device (KFD) interface protocol.

1.1.7 P25 Explicit Mode UHF/VHF Option 390XOPT212

The 3900 Series P25 Explicit Mode UHF/VHF Option provides all of the features found in option 390XOPT200 plus the following:

- Enables all bands for P25 Explicit Mode of operation.

1.1.8 P25 Unit to Unit Call Option 390XOPT213

The 3900 Series P25 Unit to Unit Call Option provides all of the features found in option 390XOPT200 plus the following:

- Enables ability to test Unit to Unit calls.

1.1.9 P25 Adjacent Status Broadcast Messages 390XOPT214

The 3900 Series P25 Adjacent Status Broadcast Messages Option provides all of the features found in option 390XOPT201 and 390XOPT212 plus the following:

- Provides the ability to configure repeater control channel messages.

1.1.10 P25 Secondary Control Channel Broadcast Messages 390XOPT215

The 3900 Series P25 Secondary Control Channel Broadcast Messages Option provides all of the features found in option 390XOPT201 and 390XOPT212 plus the following:

- Provides the ability to configure repeater messages (SCCB and SCCB_EXP) to define the parameters of two secondary control channels.

1.1.11 P25 AutoTest II Option 390XOPT218

The 3900 Series P25 AutoTest II Option provides an interface to the Test Set's Autotest System and remote command functionality.

1.1.12 P25 Phase 2 Option 390XOPT220

The 3900 Series P25 Phase 2 Option provides all of the features found in option 390XOPT200 plus the following:

- Ability to test P25 Phase 2 protocol radios.
- Ability to configure HCPM and HDQPSK Phase 2 Modulation.

1.1.13 P25 AES Encryption Option 390XOPT240

The P25 AES Encryption Option supports encoding and decoding of Advanced Encryption Standard data exchanged between P25 radios.

1.1.14 P25 Mobile Simulator Option 390XOPT245

The 3900 Series P25 Mobile Simulator Option is currently only supported for ASTRO® 25 X2-TDMA Protocol. The 3900 Series P25 Mobile Simulator Option provides all of the features found in option 390XOPT200 plus the following:

- The Mobile Simulator allows the Test Set to be configured to function as a mobile radio for testing the operation of Base Stations and other mobile radios.

1.1.15 P25 Occupied Power Meter Option 390XOPT250

The 3900 Series P25 Occupied Bandwidth Power Meter Option provides all of the features found in option 390XOPT200 plus the following:

- Enables the Occupied Bandwidth Power Meter and relevant remote commands.

1.1.16 P25 Performance Testing 390XOPT260

The 3900 Series P25 Performance Testing provides all of the features found in option 390XOPT200

option plus the following:

- Enables boundary triggers which can be used for evaluating the timing of the radio's receive path.

1.1.17 Motorola ASTRO® 25 X2-TDMA Testing Suite (R2122A)

The Motorola ASTRO® 25 X2-TDMA Testing Suite includes both the X2-TDMA Mobile Emulation Option and the X2-TDMA Base Station and Parametric Option. The X2-TDMA Testing Suite is the recommended X2-TDMA Test Option for evaluating Motorola ASTRO® 25 X2-TDMA Radio Systems.

1.1.17.A X2-TDMA Mobile Emulation (R2123A)

The X2-TDMA Mobile Emulation Option includes all of the features found in option R2124A plus the following:

- Enables functionality used to test X2-TDMA Base Station operational parameters and for testing mobile-to-mobile functionality.

1.1.17.B X2-TDMA Base Station and Parametric (R2124A)

The X2-TDMA Base Station and Parametric Option:

Enables X2-TDMA Base Station simulation which is used to test the performance of X2-TDMA Mobile Subscriber Units;

- Enables the Adjacent Channel Power Meters and relevant remote commands;
- Enables the Occupied Bandwidth Power Meter and relevant remote commands.

1.2 SCOPE OF MANUAL

The 3900 P25 Option Manual describes functions associated with the 3900 P25 Test System. Refer to the 3900 Operation Manual for use of the following inherent base functions:

- Test Set Instruments
- Tone Encoding
- Tone Decoding

1.3 VERIFYING P25 OPTION INSTALLATION

1.3.1 Factory Installed Option

When a P25 Option(s) is purchased as a factory installed option the P25 Software Option(s) is ready to use upon receipt.

1.3.2 Post Production Option

When a P25 Software Option(s) is purchased post production the option software and option license files must be installed in the Test Set. Refer to the 3900 Operation Manual for Option Installation and Software Upgrade Procedures.

To check the status of installed options while operating in Test Mode:

STEP	PROCEDURE

1. Push the UTILS Key twice to open Utility Menu.
2. Select Software Settings, License from the Utility menu.

The License Tile lists installed options (refer to example below). The option list varies according to the features installed on the Test Set (refer to the P25 Option List for option numbers). If the P25 option is not installed in the Test Set, refer to the 3900 Series Operation Manual for detailed information on installing a license file and performing software upgrades.

NOTE	The Software Upgrade Tile also contains a list of installed options as well as the software version.

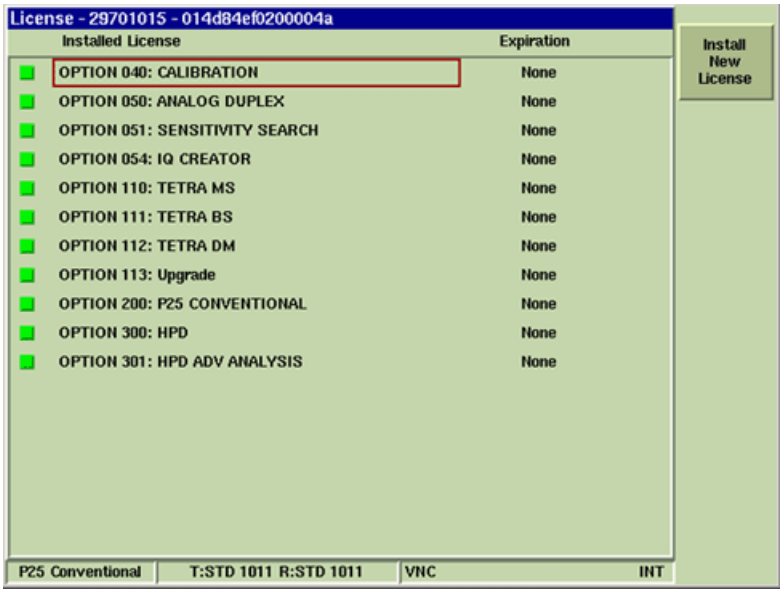

Fig. 1-1 3900 License Tile

1.4 P25 SYSTEM TILE LAYOUT

The P25 User Screens can be configured for customized test requirements. Each section of the display is configured using the drop-down menu on the title bar of each tile.

- Section A of the P25 User Screen displays the RF Control Tile.
- Sections B through E of the P25 User Screen are configured using the drop-down menu.
- P25 includes access to 3900 Test Instruments. Use of the 3900 Test Instruments is described in the 3900 Series Operation Manual.

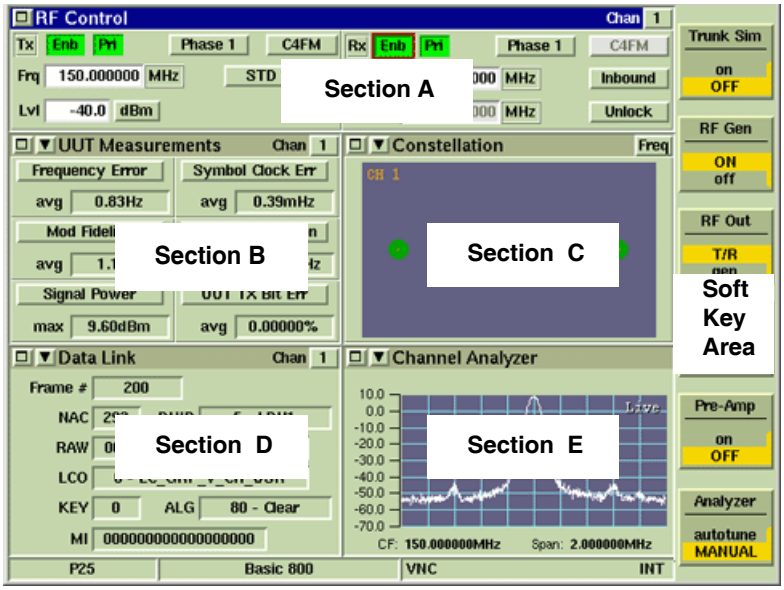

Fig. 1-2 P25 Tile Layout

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Chapter 2 - P25 Enhancement Options

2.1 INTRODUCTION

This chapter provides a functional description of P25 System Options which optimize the functionality of P25 Base Option (390XOPT200). Refer to Appendix A for information on option dependencies.

Refer to Chapter 3, P25 Test and Measurement Tiles, for a description of P25 Test and Measurement Tiles.

Refer to Chapter 4, P25 Configuration Tiles, for a description of P25 Configuration Tiles.

Refer to Chapter 5, P25 Protocol Tiles, for a description of P25 Protocol Tiles.

Refer to Chapter 6, Setting Up Calls, for information on configuring various types of calls.

2.2 P25 TRUNKING OPTION (390XOPT201)

This section provides a functional description of the P25 Trunking Option (390XOPT201). The P25 Trunking Option requires installation of P25 System Option, 390XOPT200.

The P25 Trunking Option provides the user with features necessary to test Trunked P25 radios and systems. P25 Trunking Option includes all of the features found in the P25 System Option plus the following:

- P25 Trunked Base Radio simulation;
- System Plan configuration for defining system information and Channel Plan data;
- Two Channel selection capability;
- P25 700 MHz, 800 MHz, UHF and VHF frequency band support.

When the P25 Trunking Option is installed, additional display tiles and fields are enabled to provide the user with the ability to configure the Test Set to test Trunked P25 radios and systems.

2.3 P25 LSM OPTION 390XOPT204

The P25 LSM Option provides features required to test Motorola® Linear Simulcast Modulation. P25 LSM Option includes all of the features found in the P25 System Option plus the following:

- Ability to transmit Motorola® LSM waveforms;
- Enables the EVM Meter and related remote commands;
- Enables CQPSK Transmit Modulation;
- Enables the Trajectory Tile;
- Enables Frequency and IQ Constellation Tile selection.

2.3.1 LSM Modulation Selection

LSM measurements are enabled by selecting LSM as the Transmit Modulation Type.

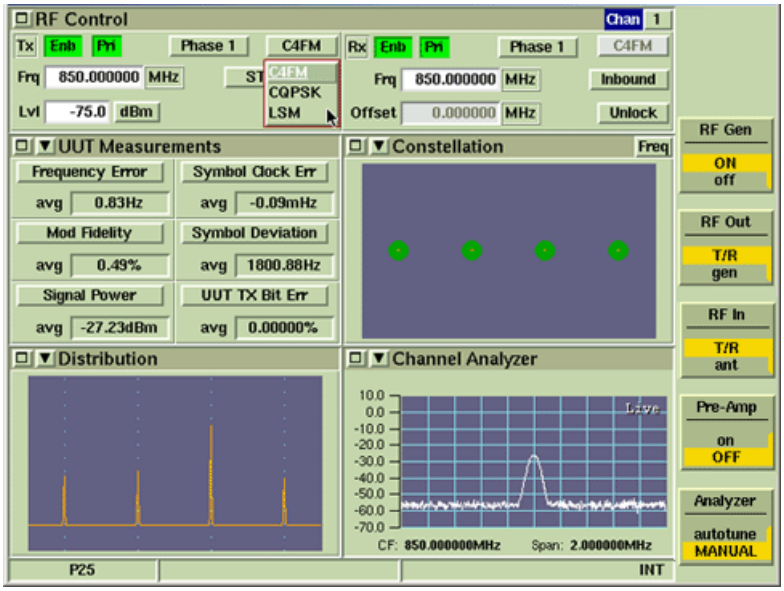

Fig. 2-1 Selecting LSM Modulation

2.4 P25 CHANNEL LOGGER OPTION 390XOPT206

2.4.1 Introduction

The P25 Channel Logger Option allows XML formatted information, referred to in this manual as XML files, to be relayed to and from a remote PC location and a Test Set. Each XML file contains processing instructions, a timestamp, and MAC header and MAC data blocks. When the PC and Test Set are connected, the Test Set sends any valid received P25 data to the PC in XML format. The PC receives the XML file, which can be saved to a file, edited and re-transmitted to the Test Set, or deleted.

Received XML files can be viewed by either a text editor or a customer developed Viewing Application.

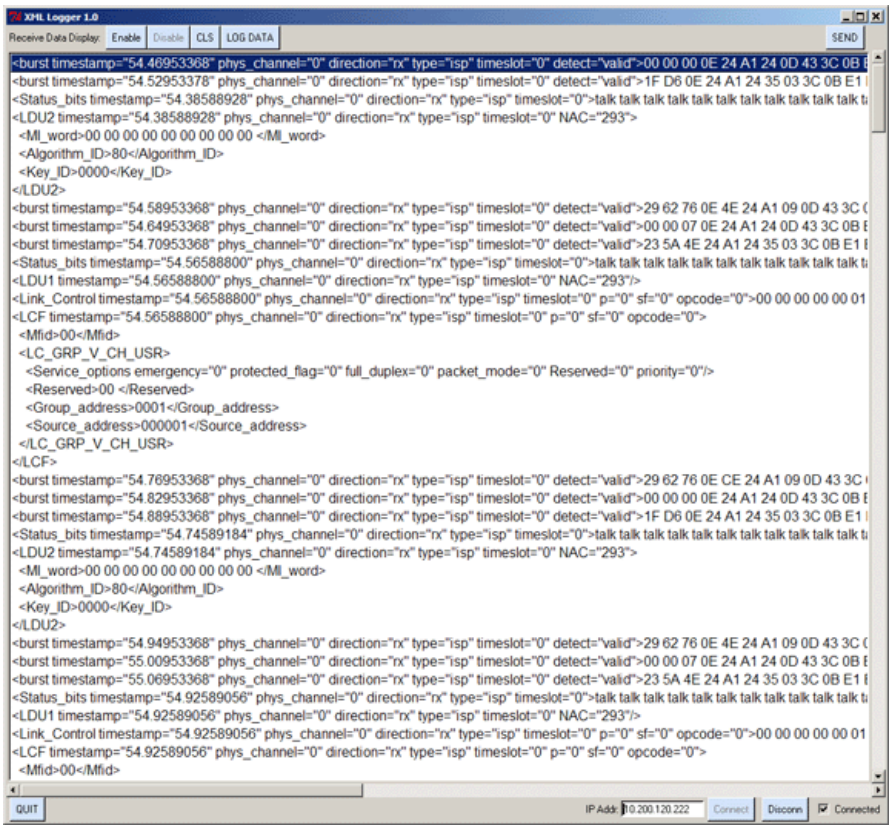

Fig. 2-2 XML Viewing Application - Logged Data

2.4.2 Viewing Application

The following information is necessary to develop an internal viewing application:

- The Test Set Raw Data Service is 'listening' on TCP socket number 2222.
- The Test Set's IP address can be configured and accessed from the Network Utility Tile. Refer to the 3900 Series Operation Manual for use of this feature.
- Netcat application for transferring XML commands to and from the Test Set.

2.4.3 Connecting Equipment

To use the User Data I/O Port, the PC and the Test Set must be operating on the same local network via an Ethernet cable. Once equipment is connected, XML files can be transmitted to and from the PC and the Test Set. In this configuration, the Test Set functions as a TCP socket "server" and the users PC application functions as a TCP "client." The port number used by the Test Set is 2222.

NOTE	The TCP socket on the PC should be opened in "blocking" mode so that XML data is not lost when it is sent to the Test Set. PC processing speed must be sufficient to allow it to accept the incoming data burst stream of XML lines.

2.4.4 P25 XML Command Structure

This section describes P25 XML commands and command formatting instructions. This section is intended for users familiar with XML and therefore only describes XML commands specific to the P25 Data I/O Port feature.

The P25 RF/Trunking Control Tile must be configured with the same settings defined in the XML command script prior to sending or receiving XML data.

2.4.4.A <burst></burst>

The <burst> tag has the following attributes:

2.4.4.A.1 timestamp

The timestamp command is an 8 digit hexadecimal number representing:

- On data sent to the Test Set: the time of transmission of the data in the burst.
- On data received from the Test Set: the time of reception of the burst.

The timestamp is optional on commands sent to the Test Set. It is present on data loads received from the Test Set

Times are all referenced from the first bit of the burst. They are relative to an arbitrary value, so timestamps should only be used is to compute the times between bursts in the same capture.

Timestamp resolution is 20 nsec, meaning a burst at 00000010 and a burst at 00000020 are 320 nsec apart (20 HEX - 10 HEX is 16 decimal, x 20 ns timestamp resolution is 320 nsec).

2.4.4.A.2 phys_channel

This command specifies the channel (0 or 1) being transmitted or received.

0 = Channel 1

1 = Channel 2

2.4.4.A.3 direction

This command specifies whether the signal is being transmitted (tx) or received (rx).

2.4.4.A.4 detect

The field is used with receive only signals. Command indicates if received signal is valid or invalid.

2.4.4.A.5 type

Indicates if data is an inbound service packet (isp) or outbound service packet (osp).

2.4.4.A.6 timeslot

Indicates which timeslots in a TDMA system a specific data element is sent or received. The command is skipped when it is received in a non-TDMA mode system or when command is not applicable to command usage.

2.4.5 Filter Parameters

2.4.5.A <LogFilter></LogFilter>

The user may specify what types of information are to be sent from the Test Set by using the <LogFilter> tag. This tag requires using the parameter “phys_channel”, which has the same meaning as the “phys_channel” of the <burst> tag.

The <LogFilter> tag requires using all of the following sub-tags, each of which is a boolean value (0/1 on/off true/false):

2.4.5.A.1 <Environment></Environment>

The Environment tag controls the logging of Test Set configuration changes, such as received frequency, transmit frequency, etc.

2.4.5.A.2 <Raw></Raw>

Raw controls the logging of raw octets received.

2.4.5.A.3 <Protocol_Raw></Protocol_Raw>

Protocol_Raw controls the logging of raw protocol data (after decoding from the raw data stream but without interpretation).

2.4.5.A.4 <Protocol_Cooked></Protocol_Cooked>

Protocol_Cooked controls the logging of protocol data with the data parsed into a more legible format.

2.4.5.A.5 <Voice></Voice>

Voice controls logging of the voice data as sent to the vocoder.

2.4.5.A.6 Example:

```
<LogFilter phys_channel=”1”>
        <Environment>0</Environment>
        <Raw>0</Raw>
        <Protocol_Raw>0</Protocol_Raw>
        <Protocol_Cooked>0</Protocol_Cooked>
        <Voice>0</Voice>
</LogFilter>
```

NOTE The following example DOES NOT WORK: it is missing some of the required subtags:

```
<LogFilter phys_channel=”1”>
        <Environment>0</Environment>
        <Raw>0</Raw>
</LogFilter>
```

2.4.6 Example XML File

The following is an example of a transmitted or received xml file:

<?xml version="1.0" encoding="UTF-8"?>

<!DOCTYPE P25_log_data PUBLIC "-//Aeroflex/P25_log_data/1.0/EN"

"http://ftp.ifrsys.com/wowbaggr/p25_log.dtd" >

<P25_log_data>

<LogFilter phys_channel="1">

<Environment>0</Environment>

<Raw>1</Raw>

<Protocol_Raw>0</Protocol_Raw>

<Protocol_Cooked>0</Protocol_Cooked>

<Voice>0</Voice>

</LogFilter>

<burst timestamp="FFFFFFFF" phys_channel="0" direction="tx" type="isp" timeslot="0">01 02 03 04 05 06 07 08 09 01 02 03 04 05 06 07 08 09 01 02 03 04 05 0607 08 09 01 02 03 04 05 06 07 08 09 01 02 03 04 05 06 07 08 09 01 02 03 04 05 06 07 08 09 01 02 03 04 05 06 07 08 09 01 02 03 04 05 06 07 08 09

</burst>

</P25_log_data>

2.4.7 Other P25 Logging Options

The 3900 supports the following additional P25 Logging functions:

P25 Remote Symbol I/O Option 390XOPT237

- Adds the ability to log Symbol Layer XML data.

P25 Remote Data I/O Option 390XOPT238

- Adds the ability to log Raw XML data.

P25 Remote Data I/O Option 390XOPT239

- Adds the ability to log Protocol Layer XML data.

2.5 P25 SMARTNET™/SMARTZONE™ OPTION 390XOPT207

The 3900 SmartNet™/SmartZone™ Option provides test features necessary to test SmartNet™/SmartZone™ radios and systems. The SmartNet™/SmartZone™ Option includes the following features:

- Two Channel selection capability;
- Ability to emulate a repeater station operation (not locked to a specific 'test sequence' for the radio);
- Ability to 'find' and monitor a SmartNet™/SmartZone™ control channel and then 'follow' the channel, the group or the individual unit;
- Full analog (FM) parametric tests and digital P25 mode tests;
- Various 800 and 900 MHz frequency band and VHF/UHF frequency band selection;
- Enables Deviation Meter and related remote commands;
- Channel designation and frequency settings for 800 and 900 MHz band.

2.5.1 Selecting SmartNet™/SmartZone™ Protocol

When the SmartNet™/SmartZone™ Option is installed, the feature is enabled by selecting SmartNet™/SmartZone™ Protocol on the RF Control Tile. When SmartNet™/SmartZone™ is selected as the Protocol the Modulation type updates to FMFSK (FM Frequency Shift Keying).

Refer to Chapter 3, P25 Test and Measurement Tiles, section titled SmartNet™/SmartZone™ Protocol Parameters for a description of the RF Control Tile.

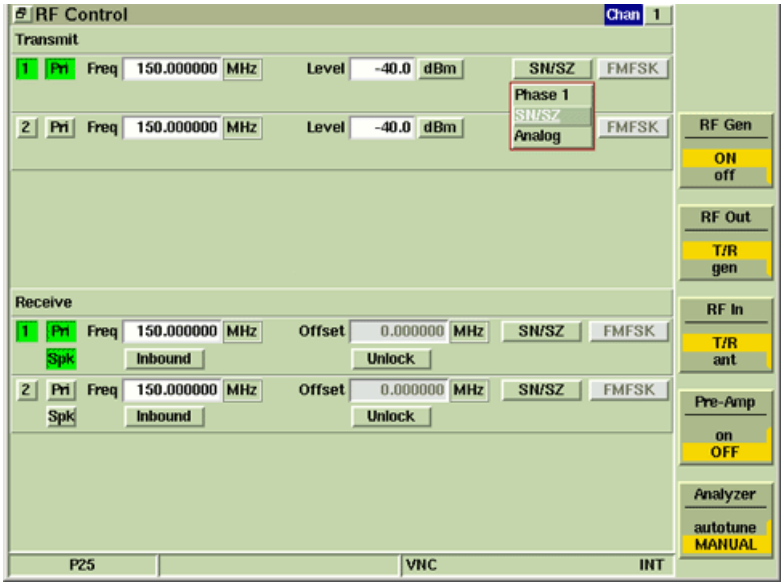

Fig. 2-3 Selecting SmartNet™/SmartZone™ Protocol

2.6 KVL LOADER OPTION (390XOPT209)

The KVL Keyloader Option adds the ability to enter encryption keys into the 3900 for DES and AES. Encryption keys may be loaded manually using either the front panel, external keypad, or the P25 Key Fill Device (KFD) interface protocol.

2.6.1 Automatic Loading

The KVL Keyloader option includes a cable for connecting the 3900 Test Connector to the KVL-3000 Plus™.

The KVL-3000 Plus™ may be set to load keys as is done for a radio, but instead the 3900 receives the key for checking the radio in secure mode. Refer to the KVL-3000 Plus™ User's Guide (68P81131E16-A) for more information about KVL device, and for details about how key loading is performed. Use the "ASTRO 25" mode of operation on the KVL device with the 3900. KVL ASN Mode is only supported with Option 20.

2.6.2 Manual Loading

Manual Key loading is configured using the Encryption Keys Configuration Tile.

2.7 P25 EXPLICIT MODE VHF/UHF (390XOPT212)

The P25 Explicit Mode UHF/VHF Option enables all bands for P25 Explicit message format mode of operation.

2.7.1 Selecting Explicit Message Format

Explicit Message Format is selected on the Trunking Control Tile. The message format indicator updates from and indicator field to a toggle button when the P25 Explicit Mode option is installed in the Test Set. Explicit Message Format is selected using this toggle button.

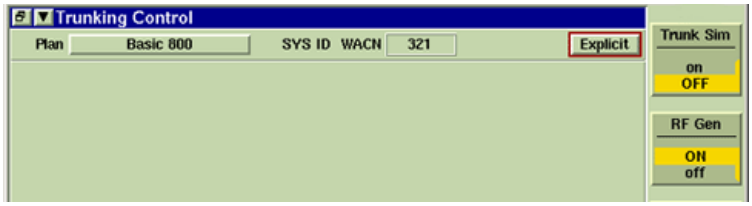

Fig. 2-4 Selecting Message Format Mode of Operation

2.7.1.A Implicit Message Format

Implicit message format is typically used in frequency bands that use fixed channel assignments such as the 800 MHz Band, therefore, when Implicit Mode is selected the Receive parameters are system defined based on channel assignments.

2.7.1.B Explicit Message Format

Explicit message format allows the user to configure Transmit and Receive parameters to test a radio operating on un-assigned channels. When Explicit Mode is selected, the user can manually configure Control Channel and Voice Channel Receive ID, Number and Frequency.

2.8 P25 UNIT TO UNIT CALL OPTION (390XOPT213)

The 3900 Series P25 Unit to Unit Call Option provides the following test features:

- P25 Base Radio simulation;
- Ability to lock/unlock paired generator and receiver frequencies;
- Ability to configure independent generator and receiver protocol;
- Internal AF Generators for audio modulation;
- Data Link Tile displays data from inbound voice packets;
- Ability to transmit P25 C4FM modulation waveforms;
- Ability to receive, demodulate and analyze P25 modulated signals;
- Ability to select Phase 1 or Analog Protocols;
- Ability to perform RF and modulation parametric tests on the Unit Under Test (UUT).
- Ability to test Unit to Unit calls.

Refer to section titled Call Setup for additional information.

2.9 ADJACENT STATUS BROADCAST MESSAGES (390XOPT214)

The Adjacent Status Broadcast Messaging (ASB) Option provides users with the ability to configure repeater control channel messages. The fields on the Adjacent Status Broadcast Message Tile are used to define the parameters of an adjacent repeater site.

Refer to Chapter 5, P25 Protocol Tiles, section titled Trunking Messages Tile for information about configuring messages.

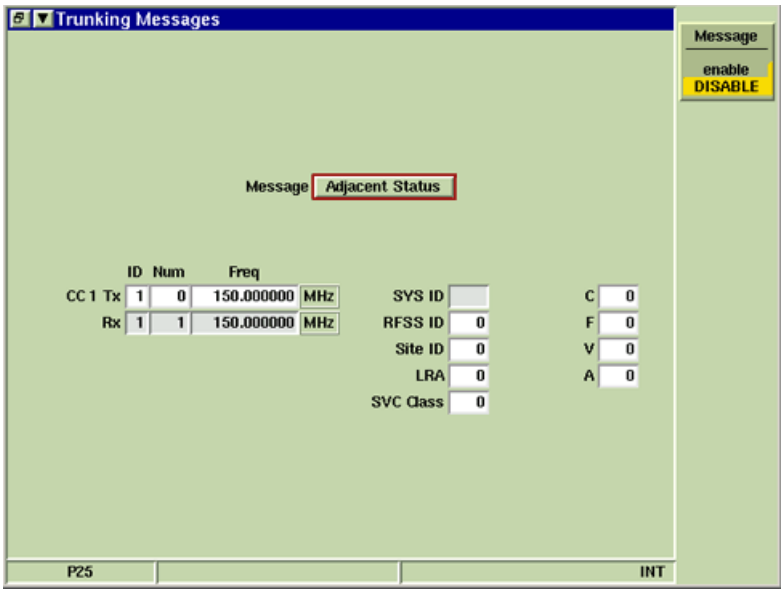

Fig. 2-5 Adjacent Status Broadcast Messages - Implicit Mode

2.10 SECONDARY CONTROL CHANNEL BROADCAST MESSAGES (390XOPT215)

The Secondary Control Channel Broadcast (SCCB) Messages Option allows users to configure repeater messages (SCCB and SCCB_EXP) to define the parameters of two secondary control channels. System Service Class fields for each channel can be used to control message transmission.

Implicit message format transmits all data to the repeater simulator as single block messages. This format is designed for simple networks operating on 700 Hz and 800 Hz bands where the repeater can provide a minimum amount of information.

The radio uses the provided information to imply what the remaining data should be. For example, since the 800 MHz band uses a standard -45 MHz transmit offset, the repeaters only need to inform the radio of the receive frequency when it assigns a voice channel. Because the receive channel has been identified, the radio can “imply” the transmit channel.

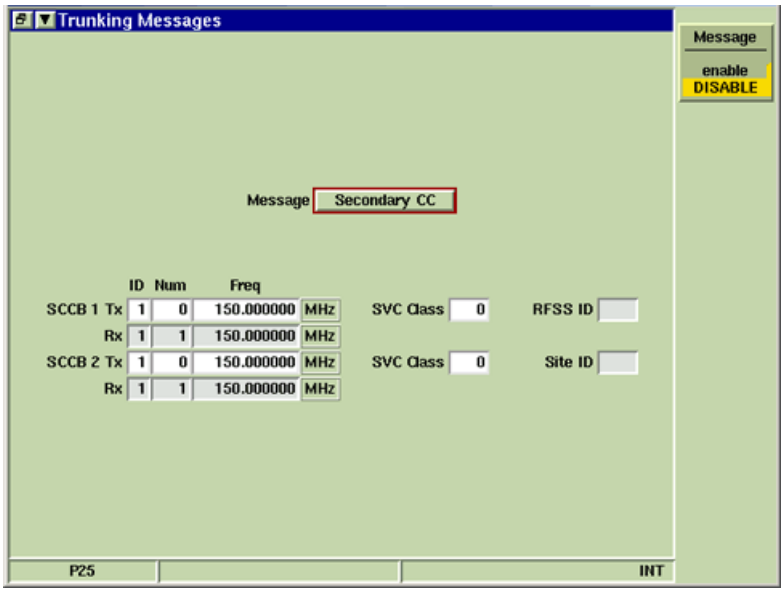

Fig. 2-6 Secondary Control Channel Broadcast Messages - Implicit Mode

Refer to Chapter 5, P25 Protocol Tiles, section titled Trunking Messages Tile for information about configuring messages.

2.11 P25 AUTOTEST II (390XOPT218)

The 3900 Series P25 AutoTest II Option provides an interface to the Test Set's Autotest System and remote command functionality.

Refer to the 3900 Series Operation Manual for information on using the AutoTest II System.

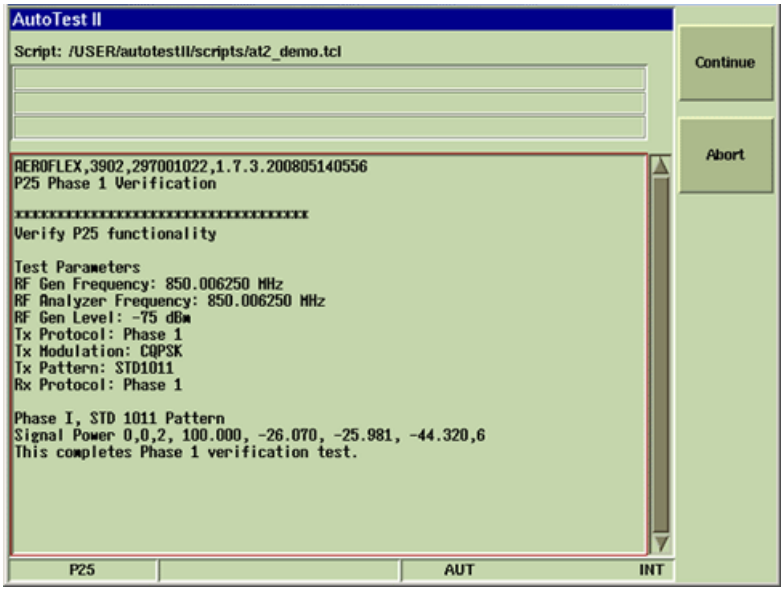

Fig. 2-7 P25 AutoTest II Example Script

2.12 MOTOROLA ASTRO® 25 X2-TDMA TEST OPTIONS

Motorola has developed ASTRO® 25 X2-TDMA Base and Mobile radio functionality as part of P25 development which adds TDMA functionality on a 12.5 kHz channel. The X2-TDMA Test Options were developed by Aeroflex to provide a test solution for verifying the functionality of Motorola ASTRO® 25 X2-TDMA Base and Mobile Radio systems. The X2-TDMA Test Options must be purchased from Motorola. Refer to Appendix B, Motorola Contact Information.

2.12.1 X2-TDMA Testing Suite (R2122A)

The X2-TDMA Testing Suite includes both the X2-TDMA Mobile Emulation Option and the X2-TDMA Base Station and Parametric Option.

2.12.1.A X2-TDMA Mobile Emulation (R2123A)

The X2-TDMA Mobile Emulation Option includes all of the functionality found in R2124A plus the following:

- Enables functionality used to test X2-TDMA® Base Station operational parameters and for testing mobile-to-mobile functionality.

2.12.1.B X2-TDMA Base Station and Parametric (R2124A)

The X2-TDMA Base Station and Parametric Option includes all of the features found in 390XOPT200 and 390XOPT201 plus the following:

- Enables X2-TDMA® Base Station simulation which is used to test the performance of X2-TDMA® Mobile Subscriber Units.
- Enables the Adjacent Channel Power Meters and relevant remote commands.
- Enables the Occupied Bandwidth Power Meter and relevant remote commands.

2.12.2 Selecting X2-TDMA Protocol

X2-TDMA test functions are enabled by selecting X2-TDMA Transmit and/or Receive Protocol.

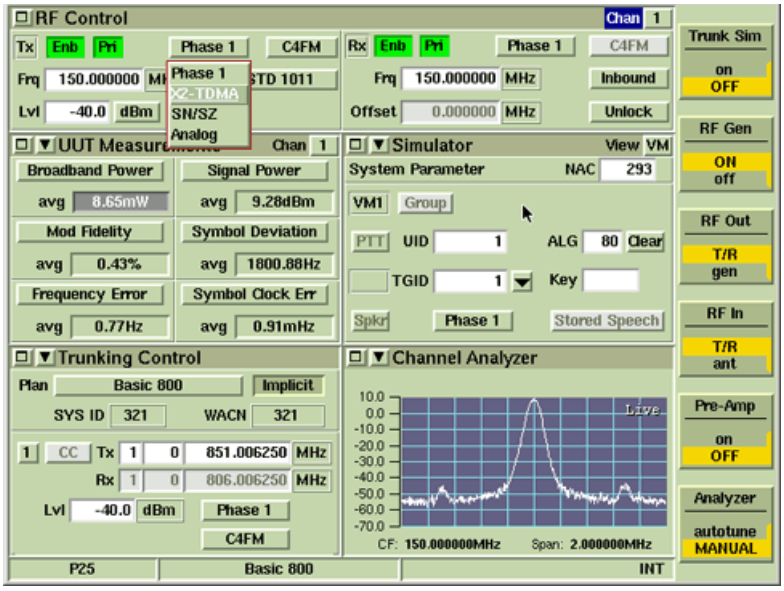

Fig. 2-8 Selecting X2-TDMA Protocol

2.13 P25 AES ENCRYPTION (390XOPT240)

The P25 AES Encryption Option supports encoding and decoding of Advanced Encryption Standard data exchanged between P25 radios.

NOTE	Due to export regulations the P25 AES Encryption Option can not be installed in a Test Set prior to shipment to the customer. The software option must be installed by the end user.

Refer to the 3900 Series Operation Manual for instructions on installing options in the 3900.

If the P25 AES Encryption Option has not been properly installed in the Test Set, the system generates the error message shown below. This error message means that the P25 AES Encryption Option **license file was** installed in the Test Set, but the P25 AES Encryption **software (.rpm file) was not** installed. Install the P25 AES Encryption Option .rpm file to complete option installation.

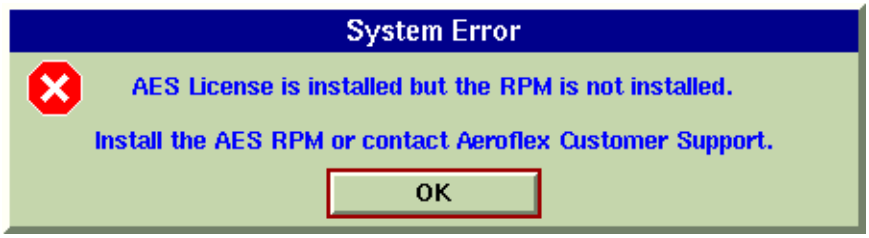

Fig. 2-9 P25 AES Encryption Option Error Message

2.13.1 AES Encryption Keys

AES encryption keys are defined on the Encryption Keys Configuration Tile. Refer to the section titled Encryption Keys Configuration Tile for information on configuring encryption keys.

2.13.2 Selecting AES Encryption

AES Encryption format is selected from the ALG drop-down menu on the Simulator Tile.

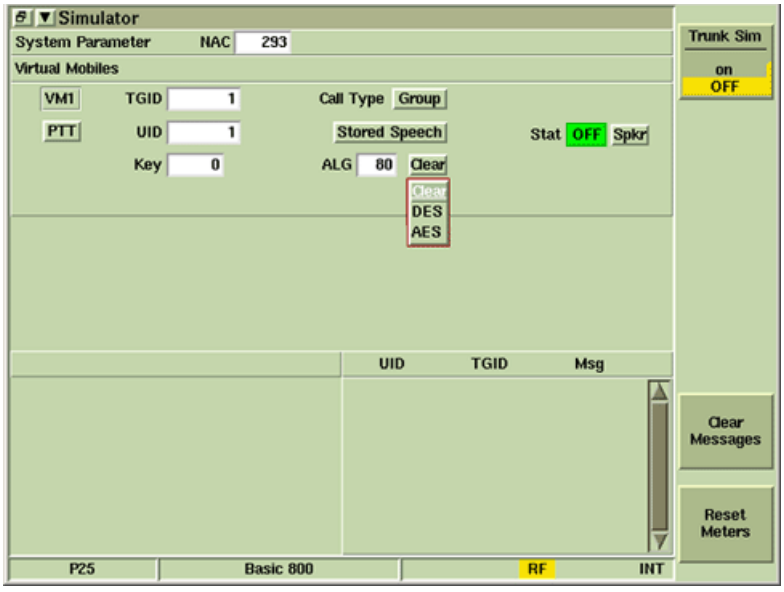

Fig. 2-10 AES Selection (Simulator Tile)

2.13.3 Valid AES Pattern Types

Standard patterns are not valid when AES or DES Encryption is selected. If a Standard pattern is selected when AES encryption is enabled an error message is displayed next to the Pattern drop-down menu.

Fig. 2-11 Invalid Pattern Indicator

2.14 P25 MOBILE SIMULATOR (390XOPT245)

The Mobile Simulator allows the Test Set to be configured to function as a mobile radio for testing the operation of Base Stations and other mobile radios.

During Mobile Simulation, the Test Set serves as a Base Station or secondary Mobile and transmits on a Phase 1 or SNSZ Control Channel. The Mobile Simulator is enabled by selecting Mobile on the Control Soft Key located on the Trunking Control Tile.

Refer to Chapter 5, P25 Protocol Tiles, section titled Trunking Control Tile and Chapter 6, Setting Up Calls, for use of the Mobile Simulator Option.

2.15 P25 OCCUPIED BANDWIDTH METER (390XOPT250)

The Occupied Bandwidth Meter indicates the Occupied Bandwidth measurement of the received signal. This option allows the user to evaluate transmit frequency accuracy.

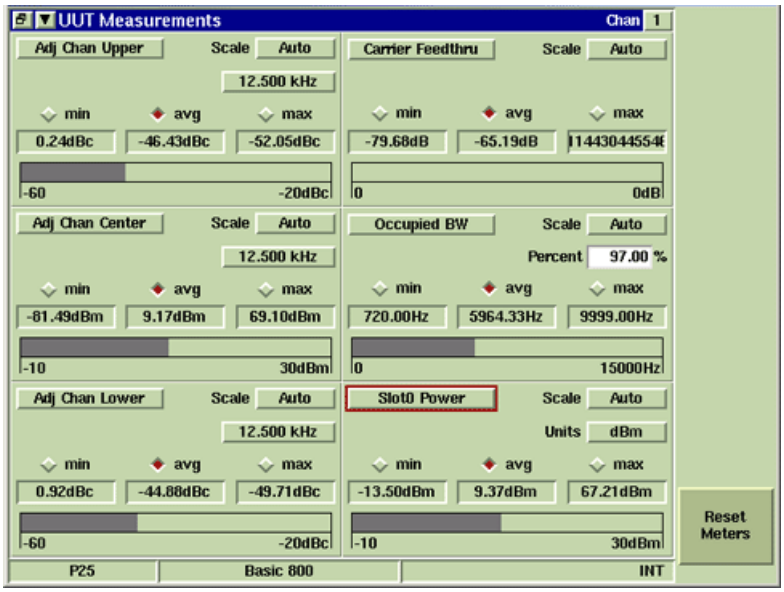

Fig. 2-12 Occupied Bandwidth Meter

2.16 P25 PERFORMANCE TEST TRIGGERS (390XOPT260)

The P25 Performance Test Triggers Option enables boundary triggers which can be used for evaluating the timing of the radio's receive path. The P25 Performance Test Triggers Option adds the capability of the following trigger scenarios:

- When changing from the Standard Silence Pattern to the Standard 1011 Hz Test Tone Pattern;
- When changing from the Standard Idle Pattern to the Standard Busy Pattern,
- At the start of LDU1 when Tx is Enabled with the LDU1 Pattern selected;
- At the start of LDU2 when Tx is Enabled with the LDU2 Pattern selected;
- At the slot boundaries during trunking simulation when slot boundaries is selected as the P25 Trunking Trigger;
- At the start of the TSBK containing a Channel Grant message when Channel Grant is selected as the P25 Trunking Trigger.

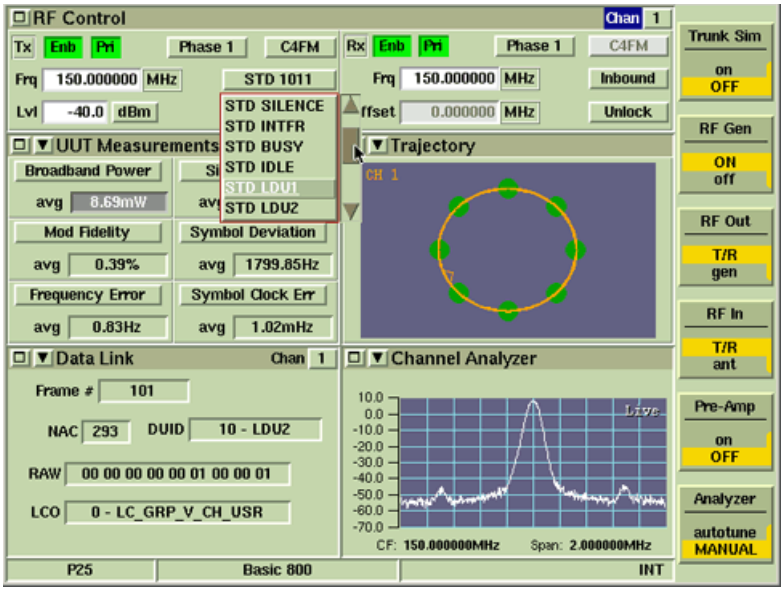

Fig. 2-13 Enabling P25 Performance Testing - Selecting Pattern

2.16.1 P25 Performance Test Trigger Modes

The P25 Trunking Trigger Mode is selected on the Ports Configuration Tile.

2.16.1.A STD SILENCE to STD 1011 Trigger

The Sync I/O Output is at a "low" state during the STD SILENCE pattern. Sync I/O Output changes to a "high" state when the pattern is changed to STD 1011. Trunking Simulation must be disabled for this state to occur.

2.16.1.B STD BUSY to STD IDLE Trigger

The Sync I/O Output is at a "low" state during the STD BUSY pattern. Sync I/O Output changes to a "high" state when the pattern is changed to STD IDLE. Trunking Simulation must be disabled for this state to occur.

2.16.1.C LDU1 Trigger

The Sync I/O Output is at a “low” state when the Tx is disabled on the RF Control Tile. Sync I/O Output changes to a “high” state at the start of LDU1 when Tx is enabled and the LDU1 pattern is selected. Trunking Simulation must be disabled for this state to occur.

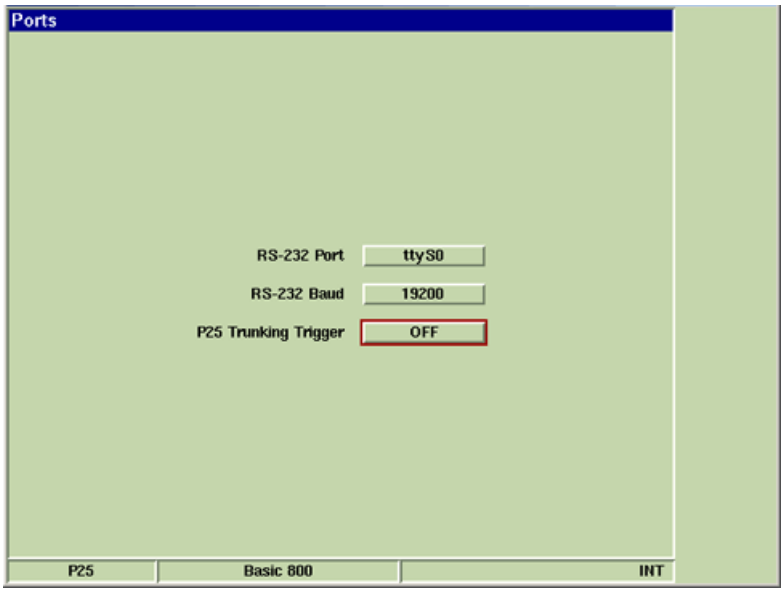

Fig. 2-14 Ports Configuration Tile - Trigger Mode

2.16.1.D LDU2 Trigger

The Sync I/O Output is at a “low” state when the Tx is disabled on the RF Control Tile. Sync I/O Output changes to a “high” state at the start of LDU2 when Tx is enabled and the LDU2 pattern is selected. Trunking Simulation must be disabled for this state to occur.

2.16.1.E Slot Boundaries Trigger

The Sync I/O Output triggers at the slot boundaries during Trunking Simulation when Slot Boundaries is selected as the P25 Trunking Trigger. The Slot Boundaries Trigger is a “high” pulse with a duration of one symbol (about 208 microseconds).

2.16.1.F Channel Grant Trigger

The Sync I/O Output triggers at the start of the Channel Grant Message during Trunking Simulation when Channel Grant is selected as the P25 Trunking Trigger. The Channel Grant Trigger is a "high" pulse with a duration of one symbol (about 208 microseconds).

2.17 P25 PHASE 2 PROTOCOL (390XOPT220)

The P25 Phase 2 Protocol Option provides features required to test P25 Phase 2 radio systems. P25 Phase 2 Option includes all of the features found in the P25 System Option plus the following:

- Ability to transmit and receive P25 Phase 2 signals;
- Ability to transmit and receive P25 Phase 2 HCPM and DDQPSK modulated signals.

2.17.1 Selecting Phase 2 Protocol

Phase 2 Protocol test functions are enabled by selecting Phase 2 Transmit and/or Receive Protocol.

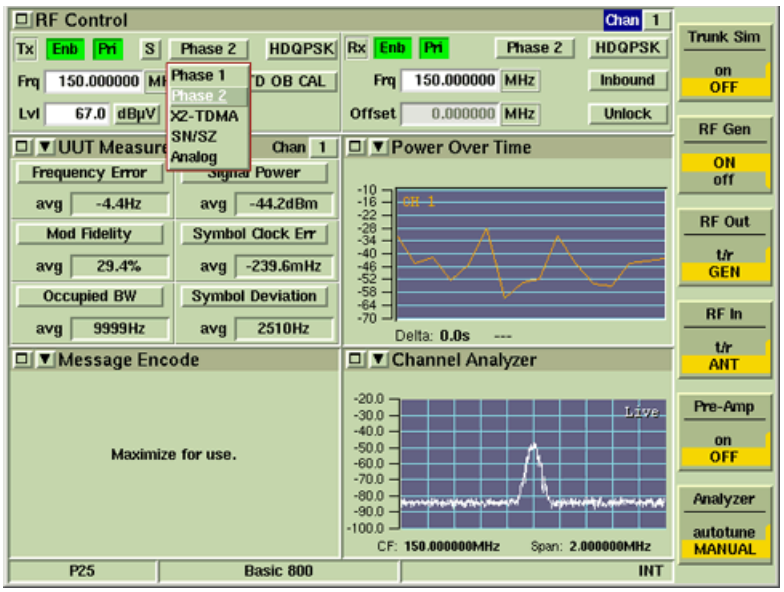

Fig. 2-15 Selecting Phase 2 Protocol

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Chapter 3 - P25 Test and Measurement Tiles

3.1 INTRODUCTION

The 3900 Series P25 Options provide users with the ability to test the operational capabilities of P25 Conventional and P25 Trunked radio systems. P25 Option 390XOPT200 is the basis from which all other P25 Test Options are developed and is referred to in this manual as the P25 Base Option. This option is required to operate all other P25 options.

The 3900 supports a variety of P25 testing options (i.e., P25 Trunking, SmartNet™/ SmartZone™ and Motorola® Linear Simulcast Modulation). Many of these options enable parameters that are specific to that option and are not visible on the Test Set unless that option is installed on the unit.

This chapter provides an operational description of the parameters found throughout the test and measurement tiles of the P25 options. Some of the screen images shown may contain parameters not found on all Test Sets. Optional fields and parameters are noted with ***option enabled** statement.

This chapter provides an operational description of P25 Test and Measurement Tiles

Refer to Chapter 4, P25 Configuration Tiles, for a description of P25 Configuration Tiles.

Refer to Chapter 5, P25 Protocol Tiles, for a description of P25 Protocol Tiles.

Refer to Chapter 6, Setting Up Calls, for information on configuring various types of calls.

3.2 AUDIO GENERATOR TILE

The Audio Generator Tile defines audio generator parameters for use in testing Analog radio systems. Parameters can be defined separately for each generator. The Test Set is configured to allow the user to simultaneously enable the audio generators on the Audio Generators Tile and the modulation generators on the Modulation Tile.

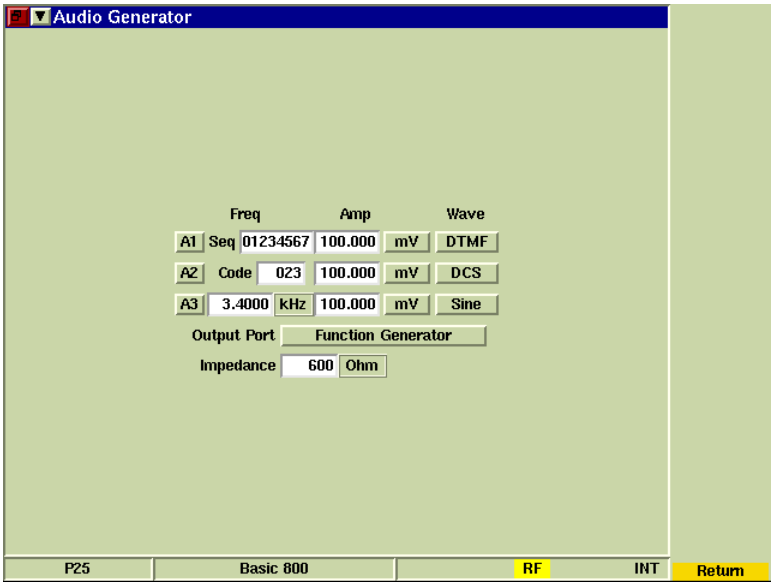

Fig. 3-1 Audio Generator Tile

3.2.1 AF Generator Field Definitions

3.2.1.A A1, 2, 3

The A1, A2 and A3 toggle buttons enable/disable corresponding audio generator. AF Generators can be enabled in combination or individually.

3.2.1.B Frequency

Sets the frequency for each AF generator. Frequency can be specified in kHz or Hz as defined by user.

3.2.1.C Amplitude

Defines the amplitude for each AF Generator. Amplitude can be specified in V or mV as defined by user.

3.2.1.D Waveform

Defines the Waveform for each AF Generator.

3.2.1.E Output Port

Setting the Output Port to AF Out routes the output from the AF Generators to the FCTN GEN/Demod Connector. Selecting Demod Out routes the demodulated audio signal to the FCTN/GEN Demod Out Connector.

3.2.1.F Impedance

This field defines the external termination value used to calculate the AF Generator power level.

3.3 AUDIO INPUT TILE

The Audio Input Tile contains parameters for configuring audio signal routing.

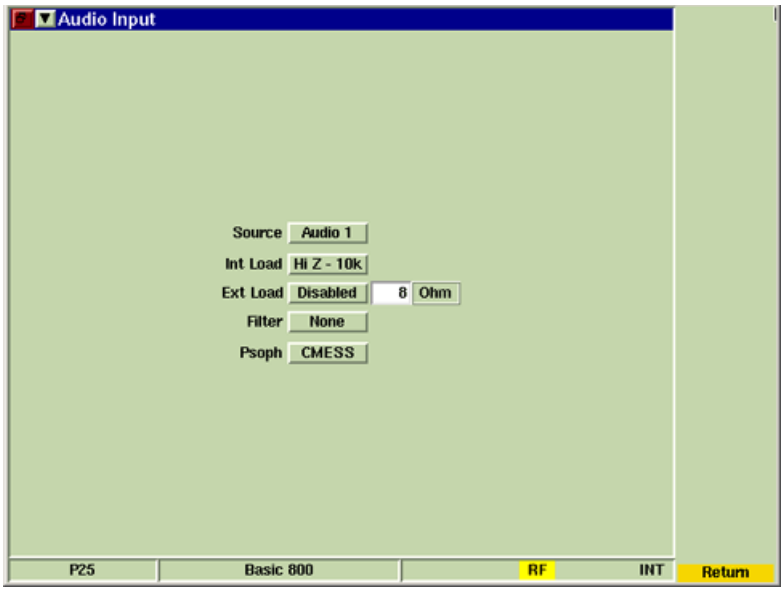

Fig. 3-2 Audio Input Tile

3.3.1 Field Definitions

3.3.1.A Source

Selects the Audio input source.

3.3.1.B Int Load

Selects either the 10 kOhm or 600 Ohm internal load to be applied at the Audio 1 or Audio 2 Input. Audio Balanced Input applies a fixed internal load of 600 Ohms.

3.3.1.C External Load

The 3900 allows the user to define an external load value which is applied at the Audio 1 or Audio 2 Input ports. The external load value is applied to AF Level dBm or Watt measurements when the External Load is enabled. External Load is used to calculate dBm or Watts when Hi Z Impedance is selected.

3.3.1.D Audio Analyzer - Enable External Load

The Ext Load toggle button enables/disables the use of an external load.

3.3.1.E Filter

Selects a measurement filter to include in the measurement path.

3.3.1.F Psoph

Selects CMESS or CCITT Psophometric weighting filter when the Psoph filter is selected from any of the Filter selection drop-down menus. Psoph filters are typically used for SINAD measurements, either Demod or Audio.

3.4 CONSTELLATION TILE

The Constellation plot displays the signal Constellation points of the received P25 signal which allows the user to evaluate the signal for distortion and noise. The green plot circles indicate the expected location of plot clusters.

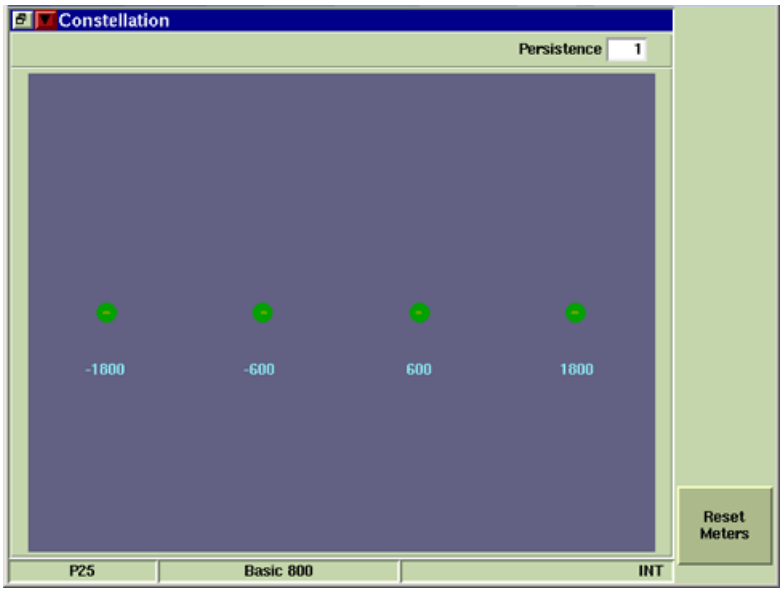

Fig. 3-3 Constellation Tile - CQPSK Modulation

3.4.1 Field/Soft Key Definitions

3.4.1.A Persistence

Specifies how many trace plots are shown simultaneously on the display field. Selectable range is 1 to 10. Selecting 1 means that only one burst or time slot is displayed on the display field. Selecting 10 means the last 10 bursts or time slots are displayed simultaneously on the display field.

3.4.1.B Reset Meters Soft Key

The Reset Meters Soft Key clears and resets meter readings.

3.4.1.C Freq/IQ Domain Mode

The Freq/IQ Domain Toggle Button is enabled when the LSM Option is installed in the Test Set. The LSM Option enables the ability to configure the Constellation Tile to display either the Frequency domain or the IQ domain of the P25 signal. The example below shows the display configured to show both the Frequency and IQ Constellation plots of the same signal.

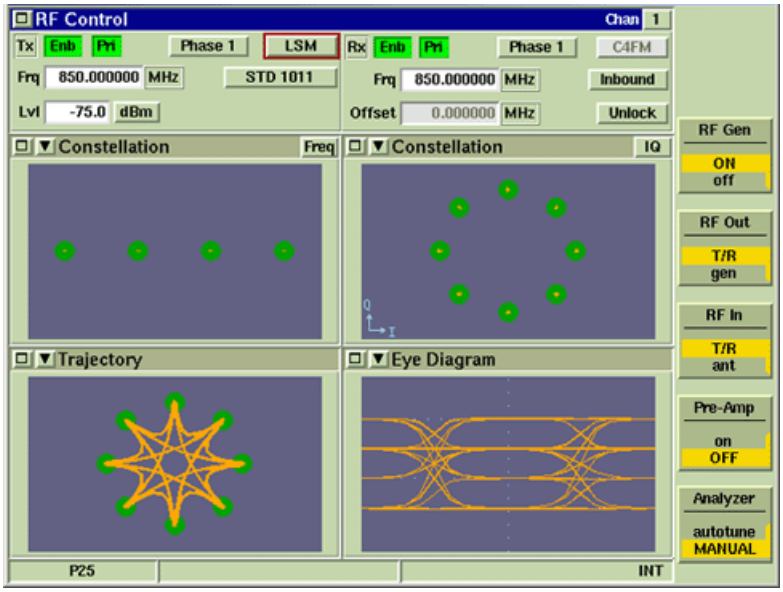

Fig. 3-4 Frequency and IQ Constellation Tiles

3.4.1.C.1 Frequency Constellation Plot

The Frequency Constellation plot represents the frequency domain of the P25 signal. The Frequency Constellation plot shows the demodulated frequency of the P25 signal following internal signal processing.

3.4.1.C.2 IQ Constellation Plot

The IQ Constellation plot represents the IQ domain of the P25 signal. The IQ Constellation plot shows the P25 signal before it is demodulated and processed.

3.5 DISTRIBUTION TILE

The Distribution Tile shows a histogram of the number of times a frequency occurs along the P25 signal at the symbol time.

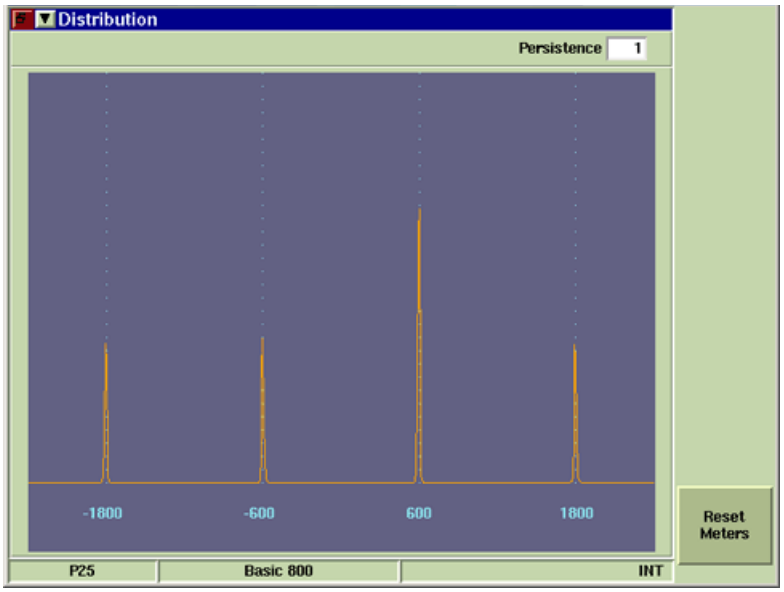

Fig. 3-5 Distribution Tile - Maximized View

3.5.1 Field Definitions

3.5.1.A Persistence

Specifies how many trace plots are shown simultaneously on the display field. Selectable range is 1 to 10. Selecting 1 means that only one burst or time slot is displayed on the display field. Selecting 10 means the last 10 bursts or time slots are displayed simultaneously on the display field.

3.5.1.B Reset Meters Soft Key

The Reset Meters Soft Key clears and resets meter readings.

3.6 EYE DIAGRAM TILE

The Eye Diagram Display Tile shows the eye diagram of the received P25 signal. The format of the signal displayed changes according to various P25 parameters such as Protocol and Modulation type.

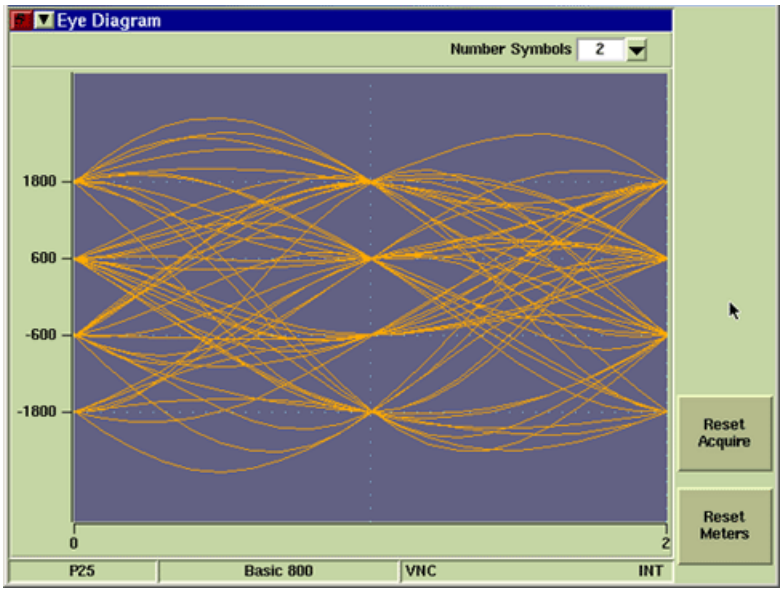

Fig. 3-6 Eye Diagram Tile - Maximized View - 4 Symbols

3.6.1 Field Definitions

3.6.1.A Number Symbols

Defines the horizontal scale of the display field. Lowering the number or symbols shows more detail of the signal pattern.

3.6.1.B Reset Meters Soft Key

The Reset Meters Soft Key clears and resets meter readings.

3.7 GENERATOR MODULATION TILE

The Generator Modulation Tile defines modulation generator parameters for use in testing Analog radio systems. Parameters can be defined separately for each modulator.

The Test Set is configured to allow the user to simultaneously enable the modulation generators on the Generator Modulation Tile and the AF generators on the Audio Generators Tile.

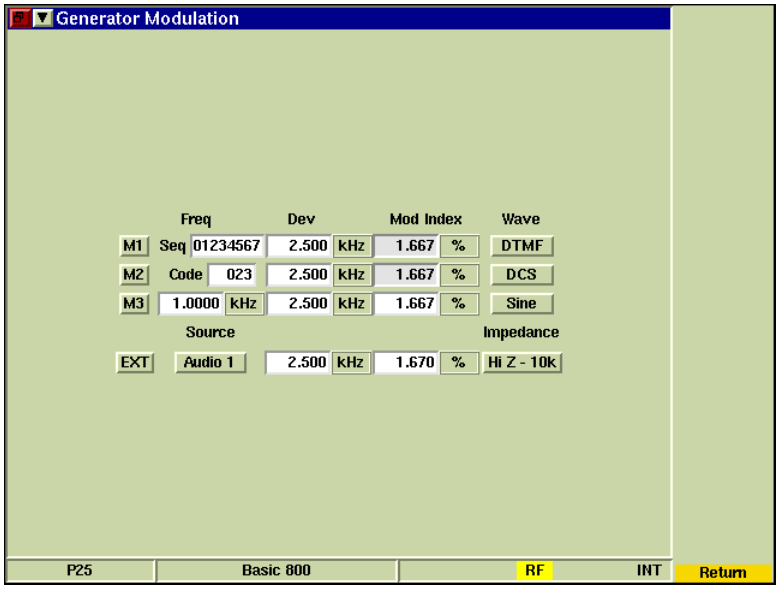

Fig. 3-7 Generator Modulation Tile

3.7.1 Modulation Generator Field Definitions

3.7.1.A M1, M2, M3 Buttons

The Modulator buttons enable/disable each modulator. Modulators can only be enabled one at a time.

3.7.1.B Frequency

Sets the frequency for each Modulation generator.

3.7.1.C Deviation

Defines the Deviation for each generator when FM modulation is selected. When this value is defined, the Modulation Index value updates to display the value as a percent.

3.7.1.D Mod (Modulation) Index

The Mod Index field defines the modulation level as a percent of the maximum deviation setting (150 kHz). When a Mod Index value is entered, the Deviation value updates to display the value in kHz. For example, when the Mod Index value is set to 100%, the Deviation value updates to 150 kHz, the maximum Deviation setting.

3.7.1.E Waveform

Selects Waveform for each modulator.

3.7.1.F Sequence

The Sequence field is enabled when DTMF Waveform is selected. The field defines/ indicates the DTMF Sequence of the DTMF Waveform.

3.7.1.G CODE

The Code field is enabled when DCS or DCSINV Waveform is selected. The field defines/ indicates the DCS codeword of the generated signal.

3.7.1.H EXT Toggle Button

The EXT Toggle Button enables/disables an external modulation source.

3.7.1.I Source

Selects the Audio input source.

3.7.1.J Impedance

External source can be set to un-terminated high impedance (Hi Z), or include a 600 Ohm termination (600 Ohms).

3.8 POWER OVER TIME TILE

Displays the power measurement of the received signal over a specified period of time.

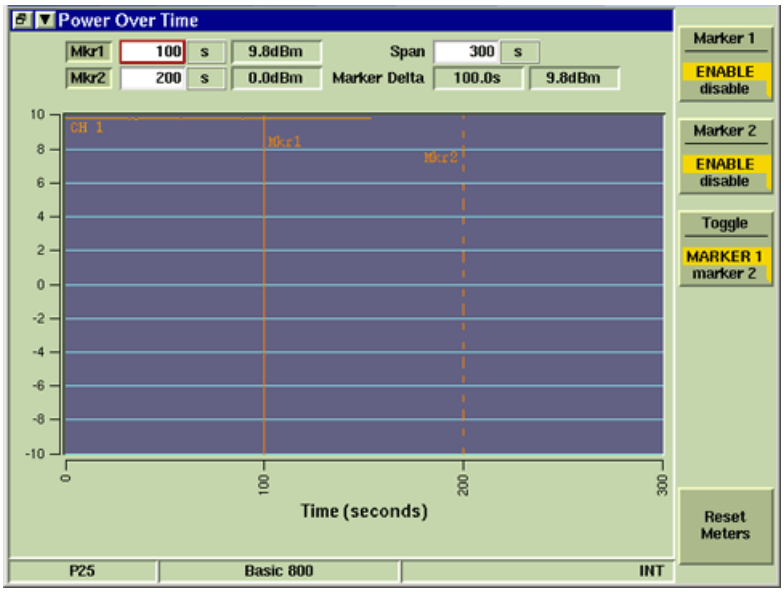

Fig. 3-8 Power Over Time Tile

3.8.1 Field/Soft Key Definitions

3.8.1.A Mkr 1/Mkr 2

The Mkr1 and Mkr2 toggle buttons enable Marker 1 and Marker 2. When Markers are enabled, marker data fields can be edited to define marker position.

3.8.1.B Marker Position

The Position Field allows the user to enter a value to specify Marker position on the graph field. A marker must be enabled and selected before this field can be edited.

3.8.1.C Marker Reading

The Marker Reading field displays the measurement at the specified marker position.

3.8.1.D Span

Sets the length of time (horizontal scale) over which a power measurement is displayed.

3.8.1.E Marker Delta

When both markers are defined and enabled the Delta field indicates the difference between the position and power measurement at each point on the signal.

3.8.1.F Marker 1/Marker 2 Soft Key

The Marker 1 and Marker 2 Soft Keys enables or disables the corresponding marker. Markers can also be enabled using the Marker On/Off toggle button.

3.8.1.G Toggle Marker Soft Key

The Toggle Marker Soft Key changes focus between Marker 1 and Marker 2 when both markers are enabled. The Toggle Marker Soft Key also controls the marker readings displayed at the top of the minimized tile. Each press of this Soft Key changes the source of the measurements through Mkr1, Mkr2 and Delta readouts.

3.8.1.H Reset Meters Soft Key

The Reset Meters Soft Key clears and resets meter readings.

3.9 POWER PROFILE FULL TILE

The Power Profile Full Tile displays the complete profile of the signal's power reading over a user defined period of time. This Tile is only applicable to X2 TDMA Protocol.

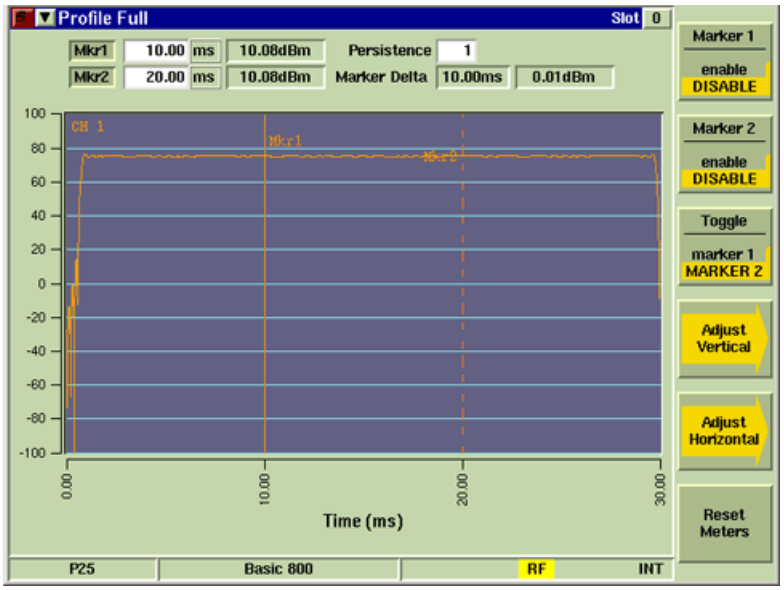

Fig. 3-9 Power Profile Full TIle - Maximized View

3.9.1 Field/Soft Key Definitions

3.9.1.A Slot Drop-Down Menu

The Slot drop-down menu selects the Slot for which data is being displayed on the plot and measurement fields.

3.9.1.B Mkr 1/Mkr 2

The Mkr1 and Mkr2 toggle buttons enable Marker 1 and Marker 2. When Markers are enabled, marker data fields can be edited to define marker position.

3.9.1.C Marker Position

The Position Field allows the user to enter a value to specify Marker position on the graph field. A marker must be enabled and selected before this field can be edited.

3.9.1.D Marker Reading

The Marker Reading field displays the measurement at the specified marker position.

3.9.1.E Persistence

Specifies how many trace plots are shown simultaneously on the display field. Selectable range is 1 to 10. Selecting 1 means that only one burst or time slot is displayed on the display field. Selecting 10 means the last 10 bursts or time slots are displayed simultaneously on the display field.

3.9.1.F Marker Delta

When both markers are defined and enabled the Delta field indicates the difference between the position and power measurement at each point on the signal.

3.9.1.G Marker 1/Marker 2 Soft Key

The Marker 1 and Marker 2 Soft Keys enables or disables the corresponding marker. Markers can also be enabled using the Marker On/Off toggle button.

3.9.1.H Toggle Marker Soft Key

The Toggle Marker Soft Key changes focus between Marker 1 and Marker 2 when both markers are enabled. The Toggle Marker Soft Key also controls the marker readings displayed at the top of the minimized tile. Each press of this Soft Key changes the source of the measurements through Mkr1, Mkr2 and Delta readouts.

3.9.1.I Reset Meters Soft Key

The Reset Meters Soft Key clears and resets meter readings.

3.10 POWER PROFILE RAMPS TILE

The Profile Ramps Tile is only applicable to X2 TDMA Protocol. The tile allows the user to observe and evaluate the ramp up and ramp down conditions of the signal's power reading over one slot. The left side of the field provides a detailed view of the first 2 ms (msec) of the slot. The right side of the field provides a detailed view of the last 2 ms (msec) of the slot.

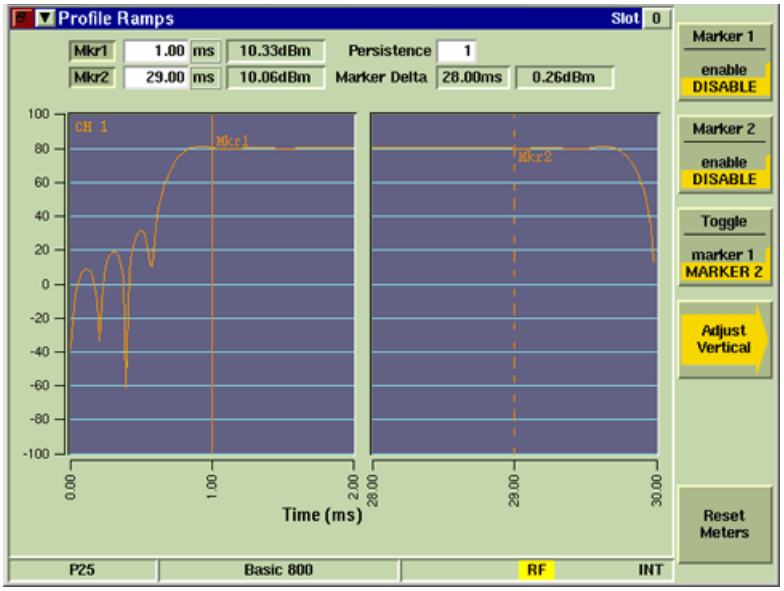

Fig. 3-10 Power Profile Ramps Tile - Maximized View

3.10.1 Field/Soft Key Definitions

3.10.1.A Slot Drop-Down Menu

The Slot drop-down menu selects the Slot for which data is being displayed on the plot and measurement fields.

3.10.1.B Mkr 1/Mkr 2

The Mkr1 and Mkr2 toggle buttons enable Marker 1 and Marker 2. When Markers are enabled, marker data fields can be edited to define marker position.

3.10.1.C Marker Position

The Position Field allows the user to enter a value to specify Marker position on the graph field. A marker must be enabled and selected before this field can be edited.

3.10.1.D Marker Reading

The Marker Reading field displays the measurement at the specified marker position.

3.10.1.E Persistence

Specifies how many trace plots are shown simultaneously on the display field. Selectable range is 1 to 10. Selecting 1 means that only one burst or time slot is displayed on the display field. Selecting 10 means the last 10 bursts or time slots are displayed simultaneously on the display field.

3.10.1.F Marker Delta

When both markers are defined and enabled the Delta field indicates the difference between the position and power measurement at each point on the signal.

3.10.1.G Marker 1/Marker 2 Soft Key

The Marker 1 and Marker 2 Soft Keys enables or disables the corresponding marker. Markers can also be enabled using the Marker On/Off toggle button.

3.10.1.H Toggle Marker Soft Key

The Toggle Marker Soft Key changes focus between Marker 1 and Marker 2 when both markers are enabled. The Toggle Marker Soft Key also controls the marker readings displayed at the top of the minimized tile. Each press of this Soft Key changes the source of the measurements through Mkr1, Mkr2 and Delta readouts.

3.10.1.I Reset Meters Soft Key

The Reset Meters Soft Key clears and resets meter readings.

3.11 RF CONTROL TILE

The RF Control Tile configures the Test Set for evaluating P25 mobile radios operating in Conventional Mode and for testing the physical layer of P25 radio systems. RF Control Tile fields must be configured according to the operating parameters of the Unit Under Test (UUT) to obtain valid test data.

The parameters that are available on the RF Control Tile depend on the options installed in the Test Set, the selected Protocol and/or Modulation Type. This section provides a description of the parameters found on the RF Control Tile for supported protocols.

NOTE	When two channels are available different protocols can be selected for Channel 1 and Channel 2.

3.11.1 Two Channel Capability

Some of the P25 Options enable two transmit and receive signals on the RF Control Tile. Each channel can be configured to different parameters such as frequency, modulation and protocol.

When both channels are enabled, the secondary channel must be within ±2.5 MHz of the primary channel (center frequency). The Pri toggle button indicates which channel is selected as the Primary Channel. The example below shows Channel 1 selected as the primary channel.

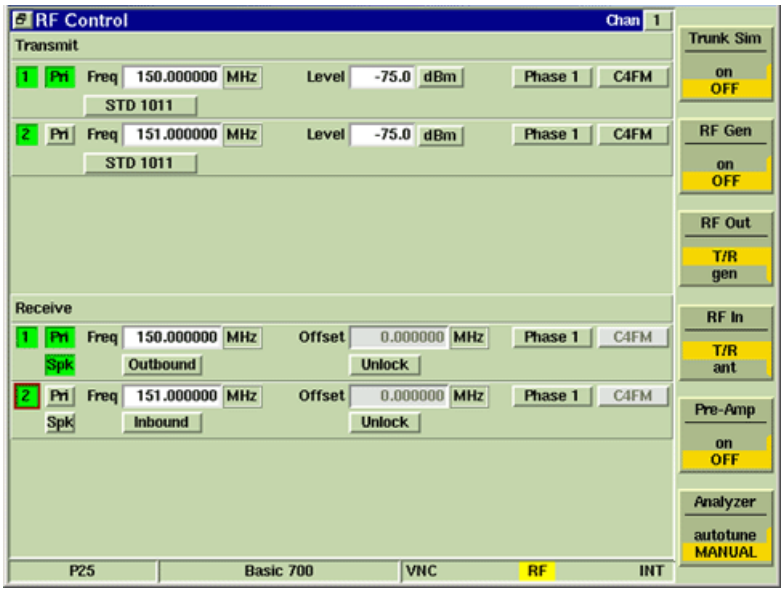

Fig. 3-11 Primary Channel Indication

When a user enables both channels and the secondary channel frequency is more than 2.5 MHz from the primary channel frequency, an invalid condition occurs and the system is unable to complete the function. When this condition occurs, the Channel Toggle Button of the inactive channel turns ORANGE to indicate the invalid condition.

Fig. 3-12 shows an example of this invalid condition. In the example, Channel 1 is enabled as the primary channel and is set to 851.00 MHz. The user has attempted to enable Channel 2 as the secondary channel, with the frequency set to 150.00 MHz. The following indicators have been triggered:

- ⚠ Indicates secondary channel frequency is more than 2.5 MHz from primary channel.
- Orange button indicates system can not enable the channel because it is more than 2.5 MHz from primary channel.

In this example, to enable Channel 2, the user must perform either of the following:

- Select Channel 2 as the primary channel (Channel 1 will be disabled).
- Change Channel 2 frequency to within ±2.5 MHz of Channel 1 frequency (Channel 1 will remain enabled).

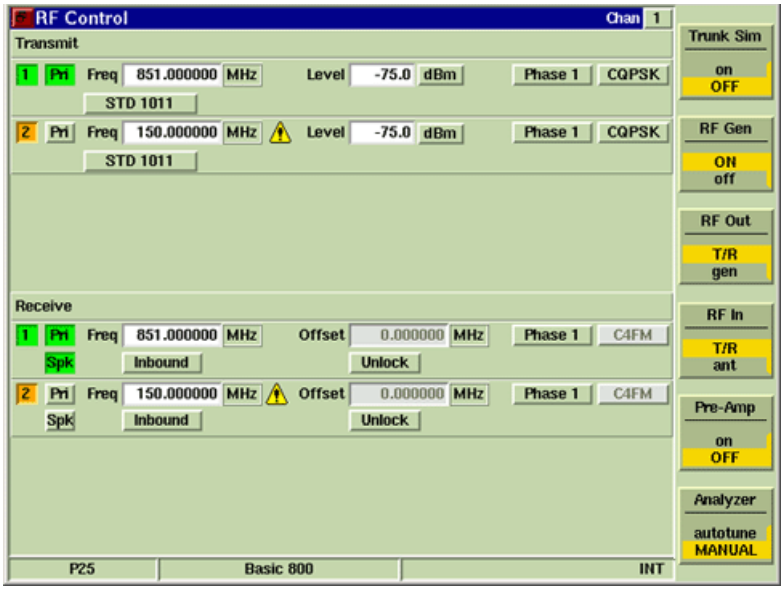

Fig. 3-12 Channel 2 - Invalid Parameter

3.11.2 Primary and Secondary Channel Indicators

The Pri toggle button selects the channel as the generator center frequency. When Channel 1 is selected as the primary channel, traces are displayed in ORANGE on all plot/graph fields and a CH 1 indicator is displayed when a valid signal is being displayed. When Channel 2 is selected as the primary channel, traces are displayed in YELLOW on all plot/graph fields and a CH 2 indicator is displayed when a valid signal is being displayed. The Primary Channel should be used for obtaining test measurements.

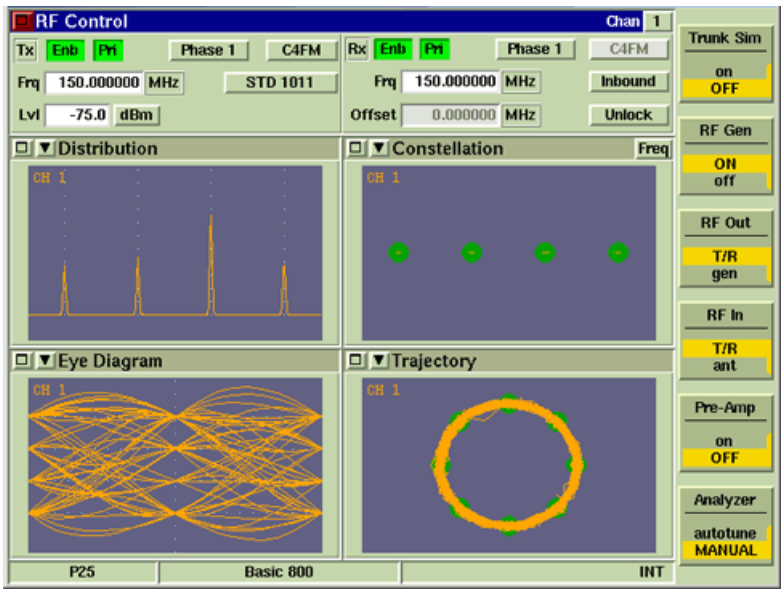

Fig. 3-13 Channel 1 Primary - Traces are ORANGE

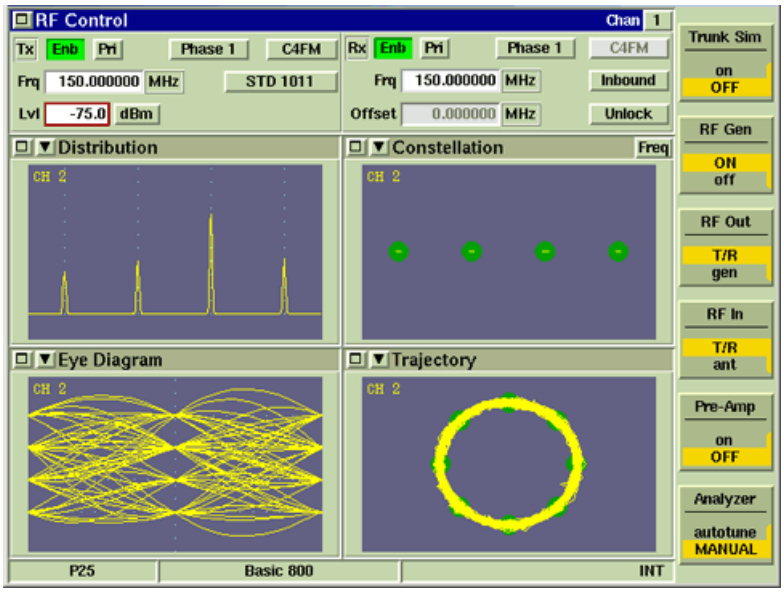

Fig. 3-14 Channel 2 Primary - Traces are YELLOW

3.11.3 Phase 1 Protocol Parameters

Fig. 3-15 shows an example of the RF Control Tile parameters that are displayed when Phase 1 Protocol is selected, with one channel operation supported on the Test Set.

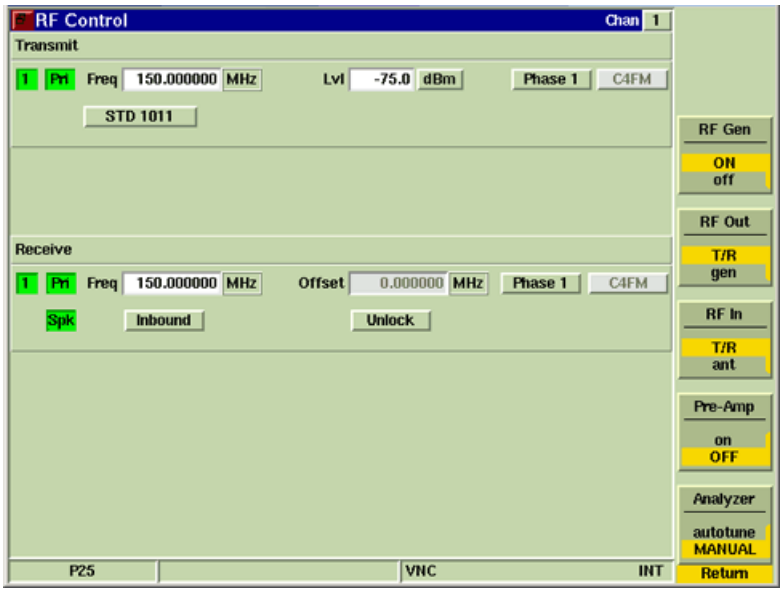

Fig. 3-15 RF Control Tile - Phase 1 Protocol Selected

3.11.3.A Transmit Parameters

3.11.3.A.1 Channel 1 Toggle Button

The 1 Toggle Buttons enables/disables the transmit or receive path for Channel 1.

3.11.3.A.2 Pri (Primary Channel)

Indicates the channel is operating as the primary frequency. This read-only field updates to a toggle button when Two Channel functionality is enabled.

3.11.3.A.3 Frq/Freq (Frequency)

Defines carrier frequency of signal generated by the Test Set.

3.11.3.A.4 Level

Defines the output power level of Transmit signal.

3.11.3.A.5 Units (Level)

The Units drop-down menu selects the unit of measurement for the Power Level.

3.11.3.A.6 PD / EMF

When the Level unit of measurement is Volts, the value can be displayed as EMF or PD. This field is enabled when Level is set to Volts.

3.11.3.A.7 Protocol

Selects the P25 Protocol of the signal generated by the Test Set. The P25 Base Option currently supports P25 Phase 1 (non-trunked) and Analog Protocols. Other protocols are *option enabled (i.e., SNSZ, Phase 2).

NOTE	When Two-channel operation is available, Analog Protocol is only supported on one channel at a time.

3.11.3.A.8 Modulation

The P25 Base Option supports C4FM Modulation. Additional Modulation types are *option enabled.

3.11.3.A.9 Pattern

The Pattern drop-down menu selects the data or voice pattern to be generated by the Test Set. P25 patterns are derived from TIA-102.CAAA Specification. Pattern types include standard and non-standard P25 patterns, stored speech files and voice modulation. Available pattern types are dependent on the type of Protocol selected and the options installed in the Test Set.

NOTE	Standard patterns are not valid when DES Encryption is selected. If a Standard pattern is selected when DES encryption is enabled an error message is displayed next to the Pattern drop-down menu.

3.11.3.B Receive Field Definitions

3.11.3.B.1 Channel 1 Toggle Button

The Channel 1 Toggle Button enables/disables the transmit or receive path for Channel 1.

3.11.3.B.2 Pri (Primary Channel)

Indicates the channel is operating as the primary frequency. This read-only field updates to a toggle button when Two Channel functionality is enabled.

3.11.3.B.3 Frq/Freq (Frequency)

This field defines the receiver frequency. For accurate readings, this frequency should be set to the UUT transmit frequency.

3.11.3.B.4 Offset

The Offset field displays or defines the offset between the Transmit and Receiver frequencies.

When set to LOCK, changing the Receive or Transmit Frequency offsets the other frequency by the value specified in the Offset field. For example, setting the Receiver frequency to 150 MHz, with an offset of 2.5 MHz, results in the Transmit frequency updating to 152.5 MHz. Or, if the Transmit frequency is set to 150.0 MHz, with an Offset of 2.5 MHz, the Receive frequency updates to 147.5 MHz.

When set to UNLOCK, a value can be entered independently for either the Transmit Frequency or the Receiver Frequency.

3.11.3.B.5 Protocol

Selects the expected P25 Protocol of the received signal.

3.11.3.B.6 Modulation

The P25 Base Option supports C4FM Modulation. Additional Modulation types are *option enabled.

3.11.3.B.7 Spk (Speaker)

Selects the channel that routes the incoming audio signal to Test Set demodulators.

3.11.3.B.8 Message Direction

The Inbound/Outbound menu defines how the system processes signal data. When set to Inbound, the Test Set processes the signal as a mobile originated signal. When set to Outbound, the Test Set processes the signal as a mobile terminated signal. This parameter affects Trunking Simulation and XML data log.

3.11.3.B.9 Offset Mode

Locks/Unlocks frequency offset in relation to the Transmit and Receive frequencies.

3.11.3.C Soft Key Definitions

3.11.3.C.1 RF Gen Soft Key

Selects and indicates the On/Off state of the RF Generator output from the Test Set. When the generator is disabled, an RF OFF indicator is shown on the Tile.

3.11.3.C.2 RF Out Soft Key

The RF Out Soft Key controls the RF Output signal routing. Select either the GEN (Generator) Connector or T/R Connector as RF Output port.

3.11.3.C.3 RF In Soft Key

The RF In Soft Key controls the RF Input signal routing. Select either the T/R Connector or ANT (Antenna) Connector as the RF Input port.

3.11.3.C.4 Pre-Amp Soft Key

The 3900 is equipped with an internal 15 dB broadband amplifier that affects the T/R Connector and ANT (Antenna) Connector. When Pre-Amp is turned ON, the 3900 has a typical noise figure of -9 dB leading to a noise floor level of approximately -140 dBm in the Spectrum Analyzer (RBW = 300 Hz) and approximately -126 dBm for the Inband Power Meter (IF = 6.25 kHz). Using the Pre-Amp feature increases the sensitivity of the 3900.

NOTE	When Pre-Amp is used, special attention is required; it is a broadband amplifier and could lead to saturation or compression problems in the receiver chain if the signal of interest is very low, but a strong out of band signal is present.

3.11.3.C.5 Analyzer Soft Key

The Analyzer Soft Key selects the method of setting the RF input frequency (Autotune or Manual). When Autotune is selected the Test Set locks on to the strongest signal. Once the Test Set locks on to a frequency, it monitors the Inband/Broadband Power Meter depending on the selected RF Input connector.

T/R Connector

When the T/R Connector is selected Autotune monitors the Inband and Broadband Power Meter. If Inband Power drops below the dB threshold defined on the AutoTune Setup Configuration Tile, and BroadBand Power exceeds 3 dBm, a search is triggered and the Test Set again searches for the strongest signal with a power level above the defined threshold.

ANT Connector

When the ANT Connector is selected Autotune monitors the Inband Power Meter. If Inband Power drops below the dB threshold defined on the AutoTune Setup Configuration Tile, a search is triggered and the Test Set again searches for the strongest signal with a power level above the defined threshold.

AutoTune parameters are configured on the Autotune Setup Configuration Tile.

3.11.4 Analog Protocol Parameters

Fig. 3-16 shows an example of the RF Control Tile when Analog Protocol is selected, with one channel operation supported on the Test Set.

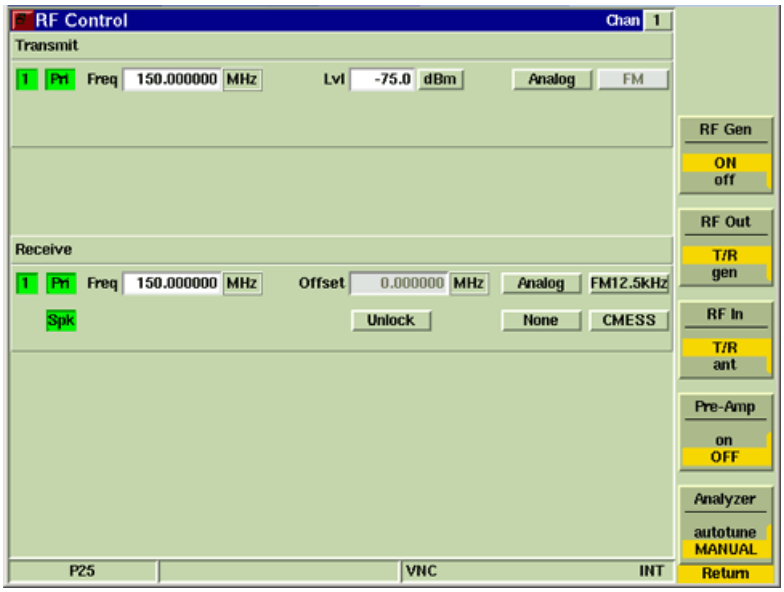

Fig. 3-16 RF Control Tile - Analog Protocol Selected

3.11.4.A Transmit Field Definitions

3.11.4.A.1 Channel 1 Toggle Button

The Channel 1 Toggle Button enables/disables the transmit or receive path for Channel 1.

3.11.4.A.2 Pri (Primary Channel)

Indicates the channel is operating as the primary frequency. This read-only field updates to a toggle button when Two Channel functionality is enabled.

3.11.4.A.3 Frq/Freq (Frequency)

Defines carrier frequency of signal generated by the Test Set.

3.11.4.A.4 Level

Defines the output power level of Transmit signal.

3.11.4.A.5 Units (Level)

The Units drop-down menu selects the unit of measurement for the Power Level.

3.11.4.A.6 PD / EMF

When the Level unit of measurement is Volts, the value can be displayed as EMF or PD. This field is enabled when Level is set to Volts.

3.11.4.A.7 Protocol

Selects the P25 Protocol of the signal generated by the Test Set. The P25 Base Option currently supports P25 Phase 1 (non-trunked) and Analog Protocols. Other protocols are *option enabled (i.e., SNSZ, Phase 2).

NOTE	When Two-channel operation is available, Analog Protocol is only supported on one channel.

3.11.4.A.8 Modulation

FM Modulation is the only available modulation type for Analog Protocol. This field updates to a read only field when Analog Protocol is selected.

3.11.4.B Receive Field Definitions

3.11.4.B.1 Channel 1 Toggle Button

The Channel 1 Toggle Button enables/disables the transmit or receive path for Channel 1. Channel 2 is *option enabled.

3.11.4.B.2 Pri (Primary Channel)

Indicates the channel is operating as the primary frequency. This read-only field updates to a toggle button when Two Channel functionality is enabled.

3.11.4.B.3 Frq/Freq (Frequency)

This field defines the receiver frequency. For accurate readings, this frequency should be set to the UUT transmit frequency.

3.11.4.B.4 Offset

The Offset field displays or defines the offset between the Transmit and Receiver frequencies.

When set to LOCK, changing the Receive or Transmit Frequency offsets the other frequency by the value specified in the Offset field. For example, setting the Receiver frequency to 150 MHz, with an offset of 2.5 MHz, results in the Transmit frequency updating to 152.5 MHz. Or, if the Transmit frequency is set to 150.0 MHz, with an Offset of 2.5 MHz, the Receive frequency updates to 147.5 MHz.

When set to UNLOCK, a value can be entered independently for either the Transmit Frequency or the Receiver Frequency.

3.11.4.B.5 Protocol

Selects the expected P25 Protocol of the received signal.

3.11.4.B.6 IF Bandwidth

The IF Bandwidth drop-down menu selects the receiver IF bandwidth. The typical bandwidth used for P25 systems is 12.5 kHz. Selecting a 25 kHz bandwidth is useful when a mobile radio is transmitting off frequency.

3.11.4.B.7 Spk (Speaker)

Selects the channel that routes the incoming audio signal to Test Set demodulators.

3.11.4.B.8 Offset Mode

Locks/Unlocks frequency offset in relation to the Transmit and Receive frequencies.

3.11.4.B.9 Audio Filter Type

Selects a measurement filter to include in the measurement path.

3.11.4.B.10 Psoph Filter

Selects the type of Psoph filter included in the measurement path. The Audio Filter type must be set to PSOPH for this parameter to be valid.

3.11.4.C Soft Key Definitions

3.11.4.C.1 RF Gen Soft Key

Selects and indicates the On/Off state of the RF Generator output from the Test Set. When the generator is disabled, an RF OFF indicator is shown on the Tile.

3.11.4.C.2 RF Out Soft Key

The RF Out Soft Key controls the RF Output signal routing. Select either the GEN (Generator) Connector or T/R Connector as RF Output port.

3.11.4.C.3 RF In Soft Key

The RF In Soft Key controls the RF Input signal routing. Select either the T/R Connector or ANT (Antenna) Connector as the RF Input port.

3.11.4.C.4 Pre-Amp Soft Key

The 3900 is equipped with an internal 15 dB broadband amplifier that affects the T/R Connector and ANT (Antenna) Connector. When Pre-Amp is turned ON, the 3900 has a typical noise figure of -9 dB leading to a noise floor level of approximately -140 dBm in the Spectrum Analyzer (RBW = 300 Hz) and approximately -126 dBm for the Inband Power Meter (IF = 6.25 kHz). Using the Pre-Amp feature increases the sensitivity of the 3900.

NOTE	When Pre-Amp is used, special attention is required; it is a broadband amplifier and could lead to saturation or compression problems in the receiver chain if the signal of interest is very low, but a strong out of band signal is present.

3.11.4.C.5 Analyzer Soft Key

The Analyzer Soft Key selects the method of setting the RF input frequency (Autotune or Manual). When Autotune is selected the Test Set locks on to the strongest signal. Once the Test Set locks on to a frequency, it monitors the Inband/Broadband Power Meter depending on the selected RF Input connector.

T/R Connector

When the T/R Connector is selected Autotune monitors the Inband and Broadband Power Meter. If Inband Power drops below the dB threshold defined on the AutoTune Setup Configuration Tile, and BroadBand Power exceeds 3 dBm, a search is triggered and the Test Set again searches for the strongest signal with a power level above the defined threshold.

ANT Connector

When the ANT Connector is selected Autotune monitors the Inband Power Meter. If Inband Power drops below the dB threshold defined on the AutoTune Setup Configuration Tile, a search is triggered and the Test Set again searches for the strongest signal with a power level above the defined threshold.

AutoTune parameters are configured on the Autotune Setup Configuration Tile.

3.11.5 Phase 2 Protocol Parameters

Fig. 3-17 shows an example of the RF Control Tile parameters that are displayed when Phase 2 Protocol is selected.

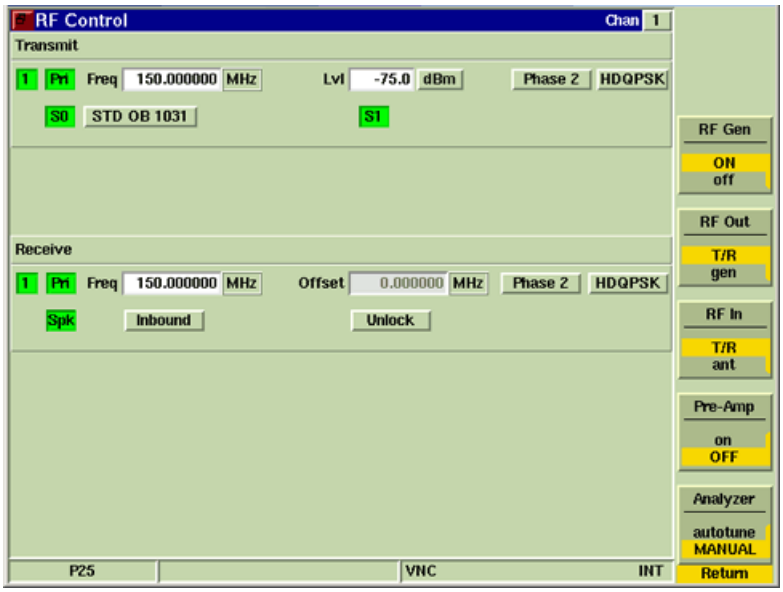

Fig. 3-17 RF Control Tile - Phase 2 Protocol, HDQPSK Modulation

3.11.5.A Transmit Parameters

3.11.5.A.1 Channel 1 Toggle Button

The Channel 1 Toggle Button enables/disables the transmit or receive path for Channel 1. Channel 2 is *option enabled. When Two Channel Functionality is enabled Channel 1 and 2 can be enabled at the same time, however, the secondary channel frequency must be within +/- 2.5 MHz of the primary channel frequency.

3.11.5.A.2 Pri (Primary Channel)

Indicates the channel is operating as the primary frequency. This read-only field updates to a toggle button when Two Channel functionality is enabled.

3.11.5.A.3 Frq/Freq (Frequency)

Defines carrier frequency of signal generated by the Test Set.

3.11.5.A.4 Level

Defines the output power level of Transmit signal.

3.11.5.A.5 Units (Level)

The Units drop-down menu selects the unit of measurement for the Power Level.

3.11.5.A.6 PD / EMF

When the Level unit of measurement is Volts, the value can be displayed as EMF or PD. This field is enabled when Level is set to Volts.

3.11.5.A.7 Protocol

Selects the P25 Protocol of the signal generated by the Test Set. Other protocols are *option enabled (i.e., SNSZ, Phase 2).

NOTE	When Two-channel operation is available, Analog Protocol is only supported on one channel.

3.11.5.A.8 Modulation

This drop-down menu selects the Modulation type of the signal generated by the Test Set.

HDQPSK (Harmonized Quadrature Phase Shift Keying) is defined per the TIA/EIA-102 Standard, HDQPSK is the modulation transmitted by the repeater to the subscriber.

HCPM (Harmonized Continuous Phase Modulation) is defined per the TIA/EIA-102 Standard, HCPM is the modulation transmitted by the subscriber unit to the repeater.

3.11.5.A.9 S0/S1 (Slot 0/Slot 1) Toggle Buttons

When Phase 2 Protocol is selected, Slot 0 and Slot 1 are system enabled and the fields appear as read-only status indicators.

3.11.5.A.10 Pattern

The Pattern drop-down menu selects the data or voice pattern to be generated by the Test Set. P25 patterns are derived from TIA-102.CAAA Specification. Pattern types include standard and non-standard P25 patterns, stored speech files and voice modulation. Available pattern types are dependent on the type of Protocol selected and the options installed in the Test Set.

3.11.5.A.11 Sync Mode

Sync Mode is enabled when Phase 2 Protocol is selected and the Modulation Type is set to HCPM. Sync Mode selects the type of synchronization applied to the Phase II, HCPM modulated signal, which defines how the Test Set references timing found in an incoming HCPM signal in order to generate an outgoing HCPM signal.

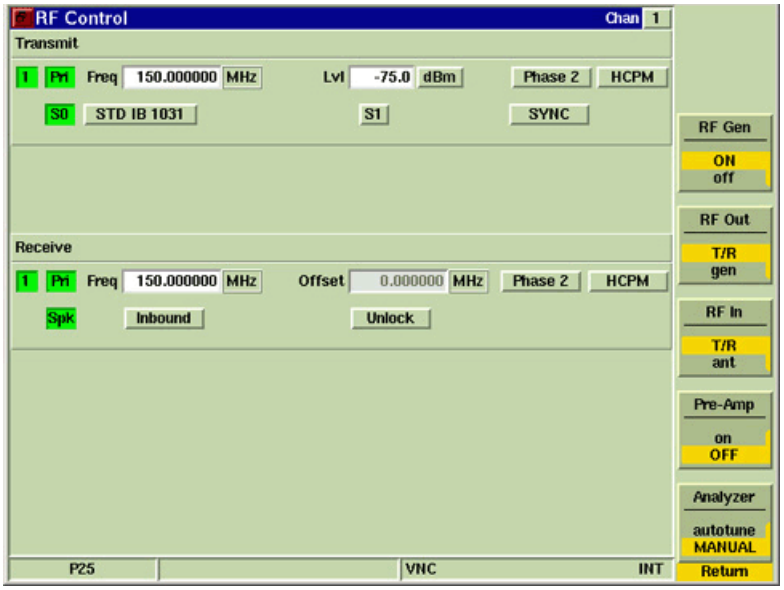

Fig. 3-18 RF Control Tile - Phase 2 Protocol, HCPM Modulation

Free Run

When Free Run is selected the Test Set generates it's own timing and the generated inbound channel runs independently.

NOTE	The UUT TX Bit Error Meter is not valid when Free Run Sync Mode is selected.

Sync

When Sync is selected the Test Set uses a received Outbound channel to calculate timing in order to align the generated Inbound channel with the received Outbound channel.

3.11.5.B Receive Field Definitions

3.11.5.B.1 Channel 1 Toggle Button

The Channel 1 Toggle Button enables/disables the transmit or receive path for Channel 1. Channel 2 is *option enabled.

3.11.5.B.2 Pri (Primary Channel)

Indicates the channel is operating as the primary frequency. This read-only field updates to a toggle button when Two Channel functionality is enabled.

3.11.5.B.3 Frq/Freq (Frequency)

This field defines the receiver frequency. For accurate readings, this frequency should be set to the UUT transmit frequency.

3.11.5.B.4 Offset

The Offset field displays or defines the offset between the Transmit and Receiver frequencies.

When set to LOCK, changing the Receive or Transmit Frequency offsets the other frequency by the value specified in the Offset field. For example, setting the Receiver frequency to 150 MHz, with an offset of 2.5 MHz, results in the Transmit frequency updating to 152.5 MHz. Or, if the Transmit frequency is set to 150.0 MHz, with an Offset of 2.5 MHz, the Receive frequency updates to 147.5 MHz.

When set to UNLOCK, a value can be entered independently for either the Transmit Frequency or the Receiver Frequency.

3.11.5.B.5 Protocol

Selects the expected P25 Protocol of the received signal.

3.11.5.B.6 Modulation

The 3900 Receiver Modulation type in the P25 Base Option is system defined as C4FM and can not be changed by the user.

3.11.5.B.7 Spk (Speaker)

Selects the channel that routes the incoming audio signal to Test Set demodulators.

3.11.5.B.8 Message Direction

The Message Direction drop-down menu defines how the system processes received protocol data. When set to Inbound, the Test Set processes the received data packets as a mobile originated signal. When set to Outbound, the Test Set processes the received data packet as a mobile terminated signal. This parameter affects Trunking Simulation and XML data log.

NOTE	When configuring the Test Set to simulate an ASTRO® 25 X2-TDMA Mobile radio, Message Direction must be set to Outbound for the Test Set's receiver to properly process protocol data received from the Base Station.

3.11.5.B.9 Offset Mode

Locks/Unlocks frequency offset in relation to the Transmit and Receive frequencies.

3.11.5.C Soft Key Definitions

3.11.5.C.1 RF Gen Soft Key

Selects and indicates the On/Off state of the RF Generator output from the Test Set. When the generator is disabled, an RF OFF indicator is shown on the Tile.

3.11.5.C.2 RF Out Soft Key

The RF Out Soft Key controls the RF Output signal routing. Select either the GEN (Generator) Connector or T/R Connector as RF Output port.

3.11.5.C.3 RF In Soft Key

The RF In Soft Key controls the RF Input signal routing. Select either the T/R Connector or ANT (Antenna) Connector as the RF Input port.

3.11.5.C.4 Pre-Amp Soft Key

The 3900 is equipped with an internal 15 dB broadband amplifier that affects the T/R Connector and ANT (Antenna) Connector. When Pre-Amp is turned ON, the 3900 has a typical noise figure of -9 dB leading to a noise floor level of approximately -140 dBm in the Spectrum Analyzer (RBW = 300 Hz) and approximately -126 dBm for the Inband Power Meter (IF = 6.25 kHz). Using the Pre-Amp feature increases the sensitivity of the 3900.

NOTE	When Pre-Amp is used, special attention is required; it is a broadband amplifier and could lead to saturation or compression problems in the receiver chain if the signal of interest is very low, but a strong out of band signal is present.

3.11.5.C.5 Analyzer Soft Key

The Analyzer Soft Key selects the method of setting the RF input frequency (Autotune or Manual). When Autotune is selected the Test Set locks on to the strongest signal. Once the Test Set locks on to a frequency, it monitors the Inband/Broadband Power Meter depending on the selected RF Input connector.

T/R Connector

When the T/R Connector is selected Autotune monitors the Inband and Broadband Power Meter. If Inband Power drops below the dB threshold defined on the AutoTune Setup Configuration Tile, and BroadBand Power exceeds 3 dBm, a search is triggered and the Test Set again searches for the strongest signal with a power level above the defined threshold.

ANT Connector

When the ANT Connector is selected Autotune monitors the Inband Power Meter. If Inband Power drops below the dB threshold defined on the AutoTune Setup Configuration Tile, a search is triggered and the Test Set again searches for the strongest signal with a power level above the defined threshold.

AutoTune parameters are configured on the Autotune Setup Configuration Tile.

3.11.6 SmartNet™/SmartZone™ Protocol Parameters

Fig. 3-19 shows an example of the RF Control Tile parameters that are displayed when SmartNet™/SmartZone™ (SNSZ) Protocol is selected. SmartNet™/SmartZone™ Option enables two transmit and receive signals on the RF Control Tile. Each channel can be configured to different parameters such as frequency, modulation and protocol.

When both channels are enabled, the secondary channel must be within ±2.5 MHz of the primary channel (center frequency). The Pri toggle button indicates which channel is selected as the Primary Channel. The example below shows Channel 1 selected as the primary channel.

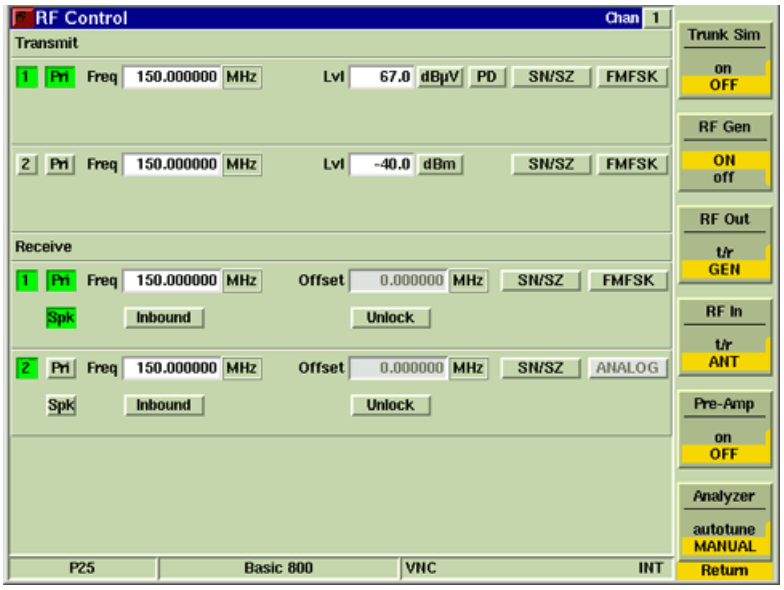

Fig. 3-19 RF Control TIle - SmartNet™/SmartZone™ Protocol Selected

3.11.6.A Transmit Parameters

3.11.6.A.1 1/2 Channel Toggle Buttons

The 1 / 2 Channel Toggle Buttons enable/disable a Channel to be used for the transmit or receive path. Channel 1 and 2 can be enabled at the same time, however, the secondary channel frequency must be within +/- 2.5 MHz of the primary channel frequency.

Channel 2 is *option enabled.

3.11.6.A.2 Pri (Primary Channel)

Selects the channel as the primary frequency.

3.11.6.A.3 Frq/Freq (Frequency)

Defines carrier frequency of signal generated by the Test Set.

3.11.6.A.4 Level

Defines the output power level of Transmit signal.

3.11.6.A.5 Units (Level)

The Units drop-down menu selects the unit of measurement for the Power Level.

3.11.6.A.6 PD / EMF

When the Level unit of measurement is Volts, the value can be displayed as EMF or PD. This field is enabled when Level is set to Volts.

3.11.6.A.7 Protocol

Selects the P25 Protocol of the signal generated by the Test Set. The P25 Base Option currently supports P25 Phase 1 (non-trunked) and Analog Protocols. Other protocols are *option enabled (i.e., SNSZ, Phase 2).

3.11.6.A.8 Modulation

This drop-down menu selects the Modulation type of the signal generated by the Test Set. Plot/graph traces vary based on the selected Modulation type.

The Modulation types available depend on the Protocol type selected and the options installed in the Test Set.

3.11.6.B Receive Field Definitions

3.11.6.B.1 1/2 Channel Toggle Buttons

The 1 / 2 Channel Toggle Buttons enable/disable a Channel to be used for the transmit or receive path. Channel 1 and 2 can be enabled at the same time, however, the secondary channel frequency must be within +/- 2.5 MHz of the primary channel frequency.

3.11.6.B.2 Pri (Primary Channel)

Selects the channel as the primary frequency.

3.11.6.B.3 Frq/Freq (Frequency)

This field defines the receiver frequency. For accurate readings, this frequency should be set to the UUT transmit frequency.

3.11.6.B.4 Offset

The Offset field displays or defines the offset between the Transmit and Receiver frequencies.

When set to LOCK, changing the Receive or Transmit Frequency offsets the other frequency by the value specified in the Offset field. For example, setting the Receiver frequency to 150 MHz, with an offset of 2.5 MHz, results in the Transmit frequency updating to 152.5 MHz. Or, if the Transmit frequency is set to 150.0 MHz, with an Offset of 2.5 MHz, the Receive frequency updates to 147.5 MHz.

When set to UNLOCK, a value can be entered independently for either the Transmit Frequency or the Receiver Frequency.

3.11.6.B.5 Protocol

Selects the expected P25 Protocol of the received signal.

3.11.6.B.6 Modulation

The 3900 Receiver Modulation type in the P25 Base Option is system defined as C4FM and can not be changed by the user.

FMSK is an *option enabled modulation type. When two channel capability is enabled on the Test Set, FMSK Modulation is only supported on Channel 1. Channel 2 Receive Modulation system defaults to Analog.

3.11.6.B.7 Spk (Speaker)

Selects the channel that routes the incoming audio signal to Test Set demodulators.

3.11.6.B.8 Message Direction

The Inbound/Outbound menu defines how the system processes signal data. When set to Inbound, the Test Set processes the signal as a mobile originated signal. When set to Outbound, the Test Set processes the signal as a mobile terminated signal. This parameter affects Trunking Simulation and XML data log.

NOTE	When configuring the Test Set to simulate an ASTRO® 25 X2-TDMA Mobile radio, Message Direction must be set to Outbound for the Test Set's receiver to properly process protocol data received from the Base Station.

3.11.6.B.9 Offset Mode

Locks/Unlocks frequency offset in relation to the Transmit and Receive frequencies.

3.11.6.C Soft Key Definitions

3.11.6.C.1 Trunk Sim Soft Key

Enables/disables Trunked Mode Simulator. When the Trunking Simulator is enabled, the Test Set reconfigures the transmit and receive parameters on the RF Control Tile based on the parameters defined on the Trunking Control Tile.

3.11.6.C.2 RF Gen Soft Key

Selects and indicates the On/Off state of the RF Generator output from the Test Set. When the generator is disabled, an RF OFF indicator is shown on the Tile.

3.11.6.C.3 RF Out Soft Key

The RF Out Soft Key controls the RF Output signal routing. Select either the GEN (Generator) Connector or T/R Connector as RF Output port.

3.11.6.C.4 RF In Soft Key

The RF In Soft Key controls the RF Input signal routing. Select either the T/R Connector or ANT (Antenna) Connector as the RF Input port.

3.11.6.C.5 Pre-Amp Soft Key

The 3900 is equipped with an internal 15 dB broadband amplifier that affects the T/R Connector and ANT (Antenna) Connector. When Pre-Amp is turned ON, the 3900 has a typical noise figure of -9 dB leading to a noise floor level of approximately -140 dBm in the Spectrum Analyzer (RBW = 300 Hz) and approximately -126 dBm for the Inband Power Meter (IF = 6.25 kHz). Using the Pre-Amp feature increases the sensitivity of the 3900.

NOTE	When Pre-Amp is used, special attention is required; it is a broadband amplifier and could lead to saturation or compression problems in the receiver chain if the signal of interest is very low, but a strong out of band signal is present.

3.11.6.C.6 Analyzer Soft Key

The Analyzer Soft Key selects the method of setting the RF input frequency (Autotune or Manual). When Autotune is selected the Test Set locks on to the strongest signal. Once the Test Set locks on to a frequency, it monitors the Inband/Broadband Power Meter depending on the selected RF Input connector.

T/R Connector

When the T/R Connector is selected Autotune monitors the Inband and Broadband Power Meter. If Inband Power drops below the dB threshold defined on the AutoTune Setup Configuration Tile, and BroadBand Power exceeds 3 dBm, a search is triggered and the Test Set again searches for the strongest signal with a power level above the defined threshold.

ANT Connector

When the ANT Connector is selected Autotune monitors the Inband Power Meter. If Inband Power drops below the dB threshold defined on the AutoTune Setup Configuration Tile, a search is triggered and the Test Set again searches for the strongest signal with a power level above the defined threshold. AutoTune parameters are configured on the Autotune Setup Configuration Tile.

3.11.7 X2-TDMA Protocol Parameters

Fig. 3-20 shows an example of the RF Control Tile parameters that are displayed when X2-TDMA Protocol is selected, with the P25 Trunking Option installed. The X2-TDMA Test Options enable two transmit and receive signals on the RF Control Tile. Each channel can be configured to different parameters such as frequency, modulation and protocol.

When both channels are enabled, the secondary channel must be within ±2.5 MHz of the primary channel (center frequency). The Pri toggle button indicates which channel is selected as the Primary Channel. The example below shows Channel 1 selected as the primary channel.

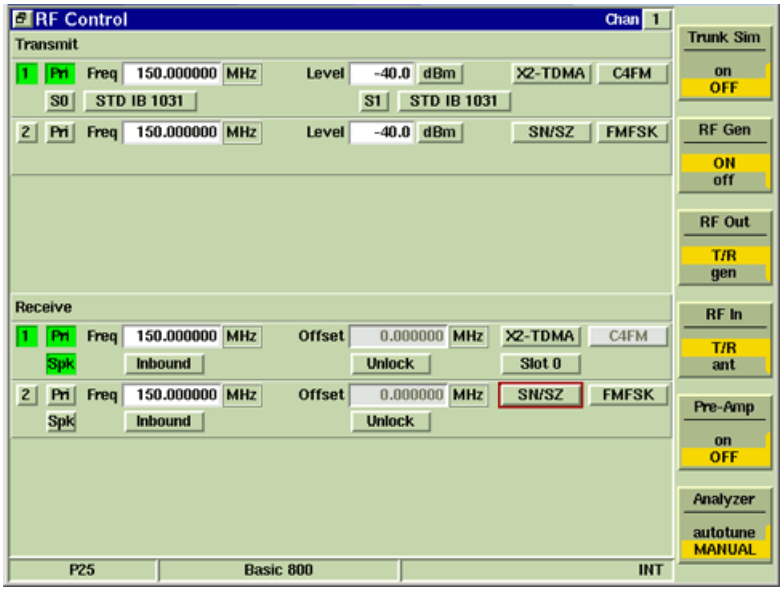

Fig. 3-20 RF Control Tile - X2-TDMA Protocol Selected

3.11.7.A Transmit Parameters

3.11.7.A.1 1/2 Channel Toggle Buttons

The 1 / 2 Channel Toggle Buttons enable/disable a Channel to be used for the transmit or receive path. Channel 1 and 2 can be enabled at the same time, however, the secondary channel frequency must be within +/- 2.5 MHz of the primary channel frequency.

3.11.7.A.2 Pri (Primary Channel)

Selects the channel as the primary frequency.

3.11.7.A.3 Frq/Freq (Frequency)

Defines carrier frequency of signal generated by the Test Set.

3.11.7.A.4 Level

Defines the output power level of Transmit signal.

3.11.7.A.5 Units (Level)

The Units drop-down menu selects the unit of measurement for the Power Level.

3.11.7.A.6 PD / EMF

When the Level unit of measurement is Volts, the value can be displayed as EMF or PD. This field is enabled when Level is set to Volts.

3.11.7.A.7 Protocol

Selects the P25 Protocol of the signal generated by the Test Set. The P25 Base Option currently supports P25 Phase 1 (non-trunked) and Analog Protocols. Other protocols are *option enabled (i.e., SNSZ, Phase 2).

3.11.7.A.8 Modulation

This drop-down menu selects the Modulation type of the signal generated by the Test Set. Plot/graph traces vary based on the selected Modulation type.

3.11.7.A.9 S0/S1 (Slot 0/Slot 1) Toggle Buttons

When X2-TDMA Protocol is selected, the Test Set allows the user to select the pattern transmitted on Slot 0 and Slot 1. The S0 and S1 buttons enable/disable these Slots. S0 and/or S1 must be enabled to generate an X2-TDMA signal.

3.11.7.A.10 Pattern

The Pattern drop-down menu selects the data or voice pattern to be generated by the Test Set. P25 patterns are derived from TIA-102.CAAA Specification. Pattern types include standard and non-standard P25 patterns, stored speech files and voice modulation. Available pattern types are dependent on the type of Protocol selected and the options installed in the Test Set.

3.11.7.B Receive Field Definitions

The 1 / 2 Channel Toggle Buttons enable/disable a Channel to be used for the transmit or receive path. Channel 1 and 2 can be enabled at the same time, however, the secondary channel frequency must be within +/- 2.5 MHz of the primary channel frequency.

3.11.7.B.1 Pri (Primary Channel)

Selects the channel as the primary frequency.

3.11.7.B.2 Frq/Freq (Frequency)

This field defines the receiver frequency. For accurate readings, this frequency should be set to the UUT transmit frequency.

3.11.7.B.3 Offset

The Offset field displays or defines the offset between the Transmit and Receiver frequencies.

When set to LOCK, changing the Receive or Transmit Frequency offsets the other frequency by the value specified in the Offset field. For example, setting the Receiver frequency to 150 MHz, with an offset of 2.5 MHz, results in the Transmit frequency updating to 152.5 MHz. Or, if the Transmit frequency is set to 150.0 MHz, with an Offset of 2.5 MHz, the Receive frequency updates to 147.5 MHz.

When set to UNLOCK, a value can be entered independently for either the Transmit Frequency or the Receiver Frequency.

3.11.7.B.4 Protocol

Selects the expected P25 Protocol of the received signal.

3.11.7.B.5 Modulation

The 3900 Receiver Modulation type in the P25 Base Option is system defined as C4FM and can not be changed by the user. Additional Modulation types are *option enabled.

3.11.7.B.6 Spk (Speaker)

Selects the channel that routes the incoming audio signal to Test Set demodulators.

3.11.7.B.7 Message Direction

The Message Direction drop-down menu defines how the system processes received protocol data. When set to Inbound, the Test Set processes the received data packets as a mobile originated signal. When set to Outbound, the Test Set processes the received data packet as a mobile terminated signal. This parameter affects Trunking Simulation and XML data log.

NOTE	When configuring the Test Set to simulate an ASTRO® 25 X2-TDMA Mobile radio, Message Direction must be set to Outbound for the Test Set's receiver to properly process protocol data received from the Base Station.

3.11.7.B.8 Offset Mode

Locks/Unlocks frequency offset in relation to the Transmit and Receive frequencies.

3.11.7.B.9 Slot 0/1 (Receive)

Selecting X2TDMA Protocol enables the Receiver Slot which routes the Audio for the selected Slot (0 or 1) to the speaker.

3.11.7.C Soft Key Definitions

3.11.7.C.1 Trunk Sim Soft Key

Enables/disables Trunked Mode Simulator. When the Trunking Simulator is enabled, the Test Set reconfigures the transmit and receive parameters on the RF Control Tile based on the parameters defined on the Trunking Control Tile.

3.11.7.C.2 RF Gen Soft Key

Selects and indicates the On/Off state of the RF Generator output from the Test Set. When the generator is disabled, an RF OFF indicator is shown on the Tile.

3.11.7.C.3 RF Out Soft Key

The RF Out Soft Key controls the RF Output signal routing. Select either the GEN (Generator) Connector or T/R Connector as RF Output port.

3.11.7.C.4 RF In Soft Key

The RF In Soft Key controls the RF Input signal routing. Select either the T/R Connector or ANT (Antenna) Connector as the RF Input port.

3.11.7.C.5 Pre-Amp Soft Key

The 3900 is equipped with an internal 15 dB broadband amplifier that affects the T/R Connector and ANT (Antenna) Connector. When Pre-Amp is turned ON, the 3900 has a typical noise figure of -9 dB leading to a noise floor level of approximately -140 dBm in the Spectrum Analyzer (RBW = 300 Hz) and approximately -126 dBm for the Inband Power Meter (IF = 6.25 kHz). Using the Pre-Amp feature increases the sensitivity of the 3900.

NOTE	When Pre-Amp is used, special attention is required; it is a broadband amplifier and could lead to saturation or compression problems in the receiver chain if the signal of interest is very low, but a strong out of band signal is present.

3.11.7.C.6 Analyzer Soft Key

The Analyzer Soft Key selects the method of setting the RF input frequency (Autotune or Manual). When Autotune is selected the Test Set locks on to the strongest signal. Once the Test Set locks on to a frequency, it monitors the Inband/Broadband Power Meter depending on the selected RF Input connector.

T/R Connector

When the T/R Connector is selected Autotune monitors the Inband and Broadband Power Meter. If Inband Power drops below the dB threshold defined on the AutoTune Setup Configuration Tile, and BroadBand Power exceeds 3 dBm, a search is triggered and the Test Set again searches for the strongest signal with a power level above the defined threshold.

ANT Connector

When the ANT Connector is selected Autotune monitors the Inband Power Meter. If Inband Power drops below the dB threshold defined on the AutoTune Setup Configuration Tile, a search is triggered and the Test Set again searches for the strongest signal with a power level above the defined threshold.

AutoTune parameters are configured on the Autotune Setup Configuration Tile.

3.12 TRAJECTORY TILE

The Trajectory Tile is enabled when the LSM Option is installed in the Test Set. The Trajectory Tile provides a visual representation of the received P25 signal. The Trajectory Tile can be used in combination with the Constellation Tile to evaluate modulation accuracy. The green markers on the plot field indicate the expected location of intersect points along the signal.

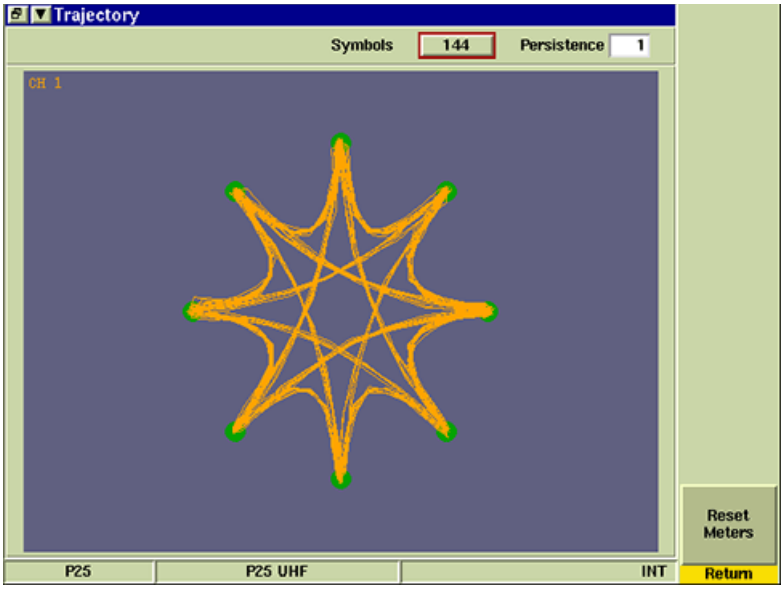

Fig. 3-21 Trajectory Tile

3.12.1 Field Definitions

3.12.1.A Number Symbols

Defines the number of symbols plotted on the Trajectory display field.

3.12.1.B Persistence

Specifies how many trace plots are shown simultaneously on the display field. Selectable range is 1 to 10. Selecting 1 means that only one burst or time slot is displayed on the display field. Selecting 10 means the last 10 bursts or time slots are displayed simultaneously on the display field.

3.12.1.C Reset Meters Soft Key

The Reset Meters Soft Key clears and resets meter readings.

3.13

3.14 UUT MEASUREMENTS TILE

The UUT Measurements Tile displays readings taken from the signal being transmitted by the UUT to the Test Set. The tile is divided into six sections, which display meters based on the P25 options installed in the Test Set. The drop-down menu in the upper left hand corner of each section allows the user to also select from the available list of meters. This tile can be selected on multiple sections of the P25 User Screen and each tile can be configured to display data from different channels and different meters.

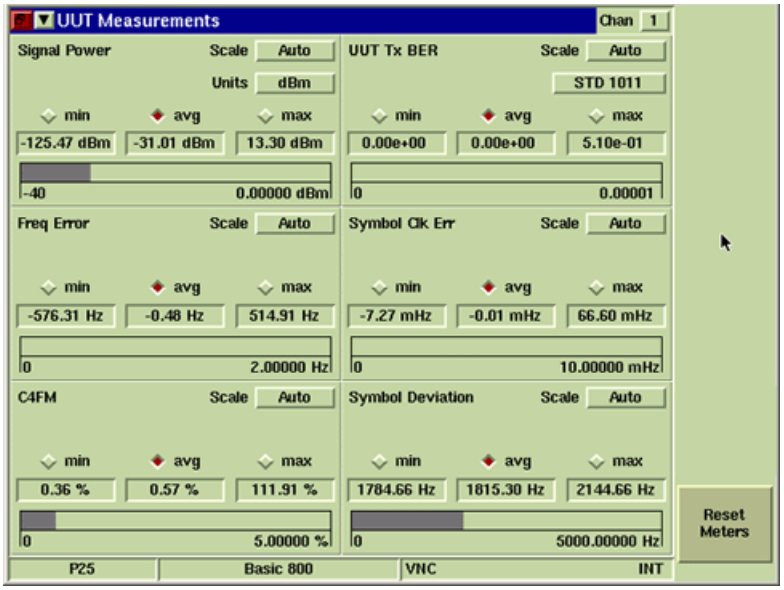

Fig. 3-22 UUT Measurements Tile

3.14.1 Measurement Meters

3.14.1.A Adjacent Channel Power Meter

The Adjacent Channel Power Meters are *option enabled when the X2-TDMA Base Station and Parametric Option is installed in the Test Set.

The Adjacent Channel Power Meters provide power measurements for Upper, Center and Lower Adjacent Channels. The Center Channel is the power level of the actual channel, which serves as the reference level for the Upper and Lower channel measurements. Upper and Lower Adjacent Channel Power measurements are relative to the Center Channel Power measurements.

3.14.1.A.1 Adjacent Channel Upper

The Adjacent Channel Power Upper meter indicates channel signal power one channel width above the desired channel.

3.14.1.A.2 Adjacent Channel Center

The Adjacent Channel Power Center meter indicates signal power of the desired channel.

3.14.1.A.3 Adjacent Channel Lower

The Adjacent Channel Power Lower meter indicates channel signal power one channel width below the desired channel.

3.14.1.A.4 Channel Width Drop-down Menu

The Channel Width drop-down menu selects the width over which Upper, Center and Lower Adjacent Channel power are measured. The drop-down menus are interconnected: changing the Channel Width on one meter updates the Channel Width on the other two Adjacent Channel meters.

3.14.1.B Audio Frequency Meter

The Audio Frequency Meter measures the frequency of the audio signal received at the Test Set's selected input connector (i.e., Audio 1 or MIC Connector). Meter is enabled when Analog protocol is selected on the Tx and Rx signals.

3.14.1.C Audio Level Meter

The Audio Level Meter measures the amplitude and audio signal received at the Test Set's selected input connector (i.e., Audio 1 or MIC Connector). Meter is enabled when Analog protocol is selected on the Tx and Rx signals.

3.14.1.D BER Meter (UUT Rx)

The UUT Rx BER Meter compares external data received at the RS-232 Connector to a signal being transmitted by the Test Set. For example, the Test Set is configured to generate a STD 1011 Pattern to a UUT. The UUT in turn sends the received signals back to the Test Set for comparison. The Test Set calculates the bit error between the two signals as the Rx BER of the UUT. This meter only applies to Phase 1 Protocol.

3.14.1.D.1 Performing Rx BER Measurements:

STEP	PROCEDURE
1.	Connect UUT Test Connector to Test Set RS-232 Connector using programming cable.
2.	Set Test Set RS-232 Port to ttyS0 (Ports Configuration Tile).
3.	Set Test Set RS-232 Baud Rate to 19200 (Ports Configuration Tile).
4.	Maximize UUT Measurements Tile. Select Rx BER Meter as a visible meter.
5.	Enable UUT BER Detector Output.
6.	Enable Rx BER Measurements on Test Set.

3.14.1.E BER Meter (UUT Tx)

The UUT Tx BER Meter compares an incoming P25 symbol data to a standard pattern to determine errors in signal processing.

The P25 Base Option currently supports STD 1011, STD CAL, STD SILENCE, STD INTFR, STD BUSY, STD IDLE, and STD 511 (.153) patterns as defined in TIA-CAAA Specification.

NOTE	BER is calculated over the entire data packet, not just the voice data. Use Standard P25 Patterns for accurate BER measurements.

3.14.1.F Broadband Power Meter

The Broadband Power Meter measures input power levels at the T/R Connector over a range of 100 mW to 125 W. The Broadband Power Meter is frequency independent which allows the user to measure and align transmitter power settings without adjusting the 3900's receiver frequency to match the transmitter frequency.

3.14.1.G Carrier Feedthrough Meter

The Carrier Feedthrough Meter is *option enabled when the Carrier Feedthrough Meter Option is installed in the Test Set.

The Carrier Feed Through Meter indicates leakage of the carrier frequency into the modulated signal.

3.14.1.H Demod Frequency Meter

The Demod Frequency Meter measures the frequency of the demodulated signal received at the Test Set's selected input connector (i.e., Audio 1 or MIC Connector). Meter is enabled when Analog protocol is selected on the Tx and Rx signals.

3.14.1.I Distortion Meters (Audio/Demod)

The Audio Distortion Meter measures the amount of audio distortion a radio receiver may add to an audio signal during the demodulation process. The Demod Distortion Meter measures the amount of audio distortion created by a radio transmitter when an audio signal is modulated. Meter is enabled when Analog protocol is selected on the Tx and Rx signals.

3.14.1.J EVM Meter

The EVM Meter is *option enabled when the P25 LSM Option is installed in the Test Set.

The EVM Meter indicates the Error Vector Magnitude measurement for CQPSK modulation. EVM measurements apply to transmitters that generate signals using CQPSK or LSM modulation.

3.14.1.K FM Deviation Meter

The FM Deviation Meter measures the amount of deviation present on an FM Modulated RF Signal received by the 3900. Meter is enabled when Analog protocol is selected on the Tx and Rx signals.

3.14.1.L FM Deviation Peak- Meter

The FM Deviation Pk- Meter displays the lowest FM Deviation measurement present on the FM Modulated RF Signal received by the 3900. Meter is enabled when Analog protocol is selected on the Tx and Rx signals.

3.14.1.M FM Peak+ Deviation Meter

The FM Deviation Pk+ Meter displays the highest FM Deviation measurement present on the FM Modulated RF Signal received by the 3900. Meter is enabled when Analog protocol is selected on the Tx and Rx signals.

3.14.1.N Frequency Error Meter

The Frequency Error Meter measures the frequency error of the incoming RF carrier signal. Frequency Error is calculated as the difference between the frequency of the received signal and the receive frequency defined for the 3900.

3.14.1.O HSD Deviation Meter

The HSD Deviation Meter is *option enabled with the P25 SmartNet™/SmartZone™ Option is installed in the Test Set.

SmartNet™/SmartZone™ signals use a High Speed Data Digital Control Channel. The HSD Deviation Meter measures the FM deviation on the SmartNet™/SmartZone™ High Speed Data Digital Control Channel. The HSD Deviation Meter is only available when SNSZ Protocol and FMFSK Modulation are selected on the Rx Channel.

3.14.1.P Hum & Noise Meters (Audio/Demod)

The Audio Hum & Noise Meter measures the amount of hum and noise a radio receiver may add to the audio signal during the demodulation process. The Demod Hum & Noise Meter measures the level of hum and noise created by a radio transmitter when an audio signal is modulated. Meter is enabled when Analog protocol is selected on the Tx and Rx signals.

3.14.1.Q Inband Power Meter

The Inband Power Meter indicates the total power measurement of the selected channel in the received RF Signal. Analog Protocol must be selected to enable this meter. Meter is enabled when Analog protocol is selected on the Tx and Rx signals.

3.14.1.R Modulation Fidelity Meter

The Mod Fidelity Meter measures P25 waveform Modulation Fidelity as indicated in the TIA-102.CAAA Specification. Desired measurement is equal to or less than 5% per TIA-102.CAAB Specification. Readings > 5% indicate the radio may require alignment or repair.

3.14.1.S Occupied Bandwidth Meter

The Occupied Bandwidth Meter is *option enabled when the Occupied Bandwidth Meter Option is installed in the Test Set. The Occupied Bandwidth Meter indicates the Occupied Bandwidth measurement of the received signal.

3.14.1.T RF Error Meter

The RF Error Meter indicates the difference (frequency error) between the received RF signal and the defined receive frequency. Meter is enabled when Analog protocol is selected on the Tx and Rx signals.

3.14.1.U Signal Power Meter

The Signal Power Meter is a tuned power meter that indicates the amount of RF Energy that is contained within the 3900's selected receiver bandwidth (i.e. 12.5 kHz). The Signal Power Meter is tuned to a specific frequency, giving the ability to selectively measure the power of one channel when other channels are present.

Signal Power can be measured at the T/R or ANT Connector. The T/R Connector provides measurements from -60 to +51 dBm. The ANT Connector provides the ability to measure levels from +10 to -100 dBm.

Drop-down menu selects unit of measurement as dBm or Watts. When Watts is selected and the reading falls below 100 mW, the meter background turns GRAY, indicating the reading may be inaccurate. If this occurs, switch the unit of measurement to dBm to obtain an accurate reading.

3.14.1.V SINAD Meter (Audio/Demod)

The AF Sinad Meter measures the receive quality of a radio receiver. The Modulation Sinad Meter measures the sinad of a transmitter. Meter is enabled when Analog protocol is selected on the Tx and Rx signals.

3.14.1.W Slot Power Meters

The Slot 0 and Slot 1 Power Meters are *option enabled when the X2-TDMA Base Station and Parametric Option is installed in the Test Set.

The Slot 0 / Slot 1 Power Meters indicate power measurements for Slot 0 and Slot 1 of X2-TDMA Protocol signal. This meter applies only to X2-TDMA Protocol. One application of the Slot 0 / Slot 1 Power Meters is to measure an Inbound signal when only one slot is occupied.

3.14.1.X Slot Power Ratio Meter (X2-TDMA)

Motorola ASTRO® 25 X2-TDMA is a registered trademark of Motorola.

The Slot Power Ratio Meter is *option enabled when the X2-TDMA Base Station and Parametric Option is installed in the Test Set. This meter applies to X2-TDMA Protocol.

The Slot Power Ratio Meter displays the Power On/Off ratio between the Slot 1 and Slot 2 Power meters.

3.14.1.Y Symbol Clock Error Meter

The Symbol Clock Error Meter measures the 4800 baud symbol clock of the incoming P25 signal. Symbol Clock Error measurements should not exceed +/-48 mHz per TIA-102.CAAA Specification.

3.14.1.Z Symbol Deviation Meter

The Symbol Deviation Meter measures the symbol deviation accuracy of a P25 signal per TIA-102.CAAA and TIA-CAAB Specifications. Symbol Deviation measurements should be >1620 and <1980 Hz per the above referenced specifications.

3.14.2 Field/Soft Key Definitions

3.14.2.A min/avg/max Reading Indicators

These radio buttons select the reading displayed on the bar graphs and the reading displayed when the UUT Measurements Display Tile is minimized.

Selecting min displays the lowest recorded reading.

Selecting avg displays the average of all recorded readings over the period of defined bursts (default setting).

Selecting max displays the highest recorded reading.

3.14.2.B Meter Bar

The METER BAR is a single, linear indicator that provides a visual measurement reading based on a user defined scale. Upper and lower limit indicators are set on the UUT Measurement Configuration Tile. Refer to the section titled UUT Measurements Limits Configuration Tile for more information on Upper and Lower Limits.

3.14.2.C Scale

The scale of the bar graph is selected from the Scale drop-down menu. Available settings are Auto-ranging (Auto) or a fixed value. The selected scale value is displayed below the bar graph.

3.14.2.D Reset Meters Soft Key

The Reset Meters Soft Key stops, clears, and re-starts the acquisition of data for the data display fields.

Chapter 4 - P25 Configuration Tiles

4.1 INTRODUCTION

This chapter provides an operational description of P25 Configuration Tiles

Refer to Chapter 3, P25 Test and Measurement Tiles, for a description of P25 Test and Measurement Tiles.

Refer to Chapter 5, P25 Protocol Tiles, for a description of P25 Protocol Tiles.

Refer to Chapter 6, Setting Up Calls, for information on configuring various types of calls.

4.2 AUTOTUNE SETUP CONFIGURATION TILE

The AutoTune Setup Tile allows the user to configure functional parameters for the RF Analyzer AutoTune feature.

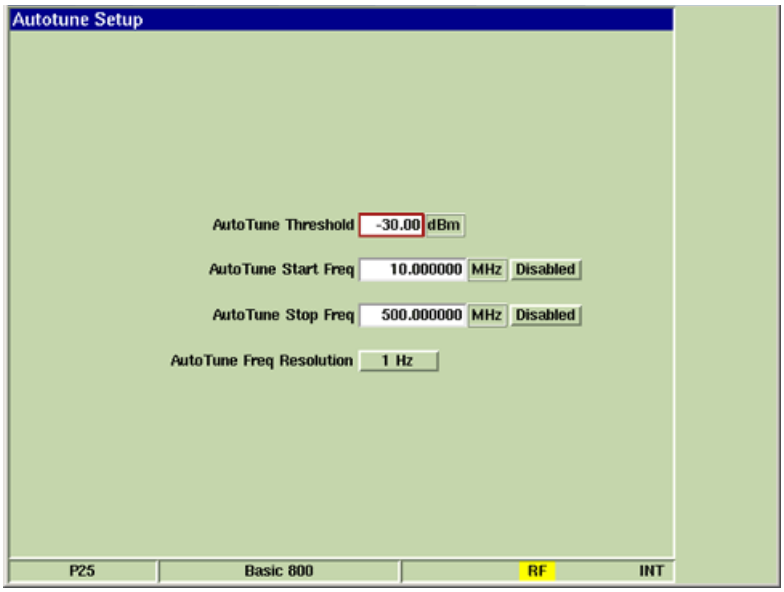

Fig. 4-1 AutoTune Setup Configuration Tile

4.2.1 Field Definitions

4.2.1.A AutoTune Threshold

When Autotune is selected the Test Set sets the RF Analyzer frequency to the strongest signal detected at the active RF Input connector. This reading defines an acceptable signal level in dBm's for successful detection on the ANT (Antenna) Connector. Default setting is -100 dBm on the ANT (Antenna) Connector which reflects -60 dBm on the T/R Connector.

4.2.1.B AutoTune Start Freq

Sets the lower frequency at which AutoTune sweeps start.

4.2.1.C AutoTune Stop Freq

Sets the upper frequency at which AutoTune sweeps stop.

4.2.1.D AutoTune Freq Resolution

AutoTune Frequency Resolution defines the unit of measure a frequency is rounded to when AutoTune is enabled.

For example, if AutoTune Frequency Resolution is set to 1000 Hz, and the 3900 identifies a frequency as 151.625020 MHz, the frequency would be rounded to 151.625000 MHz and Frequency Error meter would be 20 Hz.

4.3 ENCRYPTION KEYS CONFIGURATION TILE

The Encryption Keys Configuration Tile allows the user to configure encryption parameters. The Test Set is configured with AES and DES Default encryption keys for industry standard testing. DES Encryption is included in the 3900 P25 Base Option (390XOPT200). P25 AES Encryption is an *option enabled feature. Encryption Keys must be configured on this tile before they can be selected on the Simulator Tile.

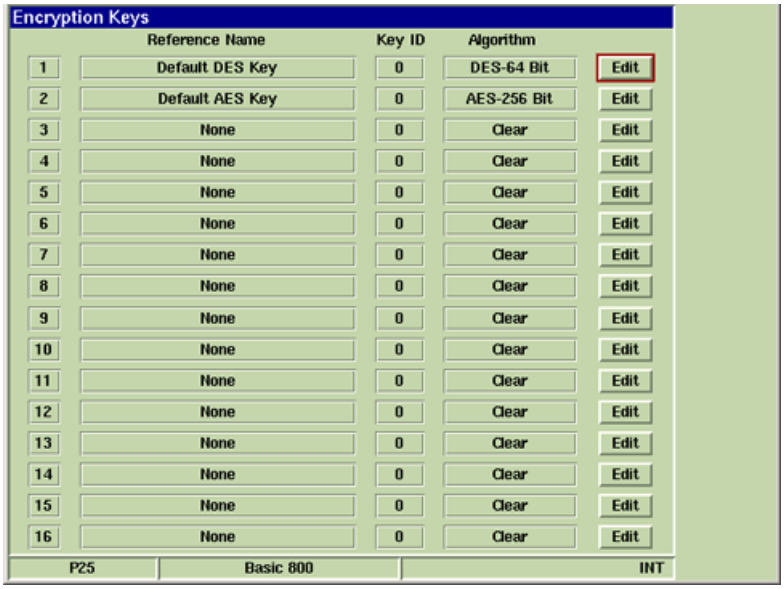

Fig. 4-2 P25 Encryption Keys Configuration Tile

Standard patterns are not valid when DES Encryption is selected. If a Standard pattern is selected when DES encryption is enabled an error indicator is displayed next to the Pattern drop-down menu.

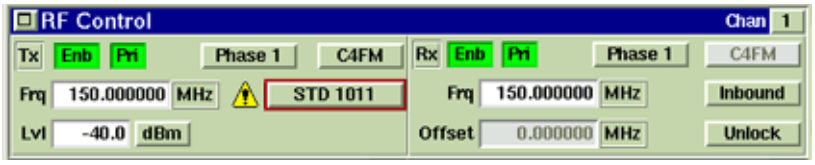

Fig. 4-3 Invalid Pattern Error Indicator

4.3.1 Field/Soft Key Definitions

4.3.1.A Reference Name

The Reference Name field is defined by the user to identify an encryption key. This field is not a required field, it has been provided to assist users in identifying specific encryption keys. The Test Set will still save encryption key data if this field is left blank.

4.3.1.B Key ID

The Key Identifier is a 4 hex digit value ranging from 0 to 0xFFFF (0 to 65535).

4.3.1.C Algorithm

Encryption Algorithm Identifier.

4.3.1.D Edit

Pressing the Edit button accesses a display tile where the user can define encryption key parameters.

4.3.1.E Key (Bytes 1-x)

Field defines the Encryption key value. The number of valid bytes depends on the selected Algorithm.

4.3.1.F Apply Soft Key

Pressing the Apply Soft Key saves the Key ID configuration to the available list of Encryption Keys.

4.3.1.G Clear Key Data Soft Key

The Clear Key Data Soft Key erases all key information for the selected encryption key. When Clear Key Data is pressed the Test Set opens a confirmation screen which requires that the user confirm the decision to delete the encryption key.

4.3.1.H Cancel Soft Key

Pressing the Cancel Soft Key terminates the current function, returning to main Encryption Key Tile.

4.3.2 Validation Error Messages

When a duplicate Key ID is entered a Duplicate error icon is displayed. This error indicator remains until a unique Key ID is entered.

When invalid Key values are entered, an Invalid error icon is displayed. This error indicator remains until valid Key values are entered.

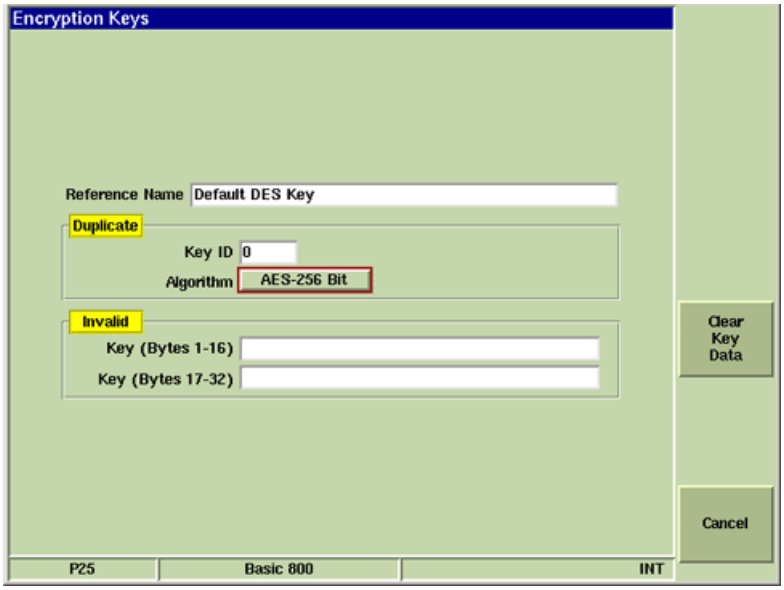

Fig. 4-4 Encryption Error Indicators

4.3.3 How to Create an Encryption Key

To create or edit an Encryption Key:

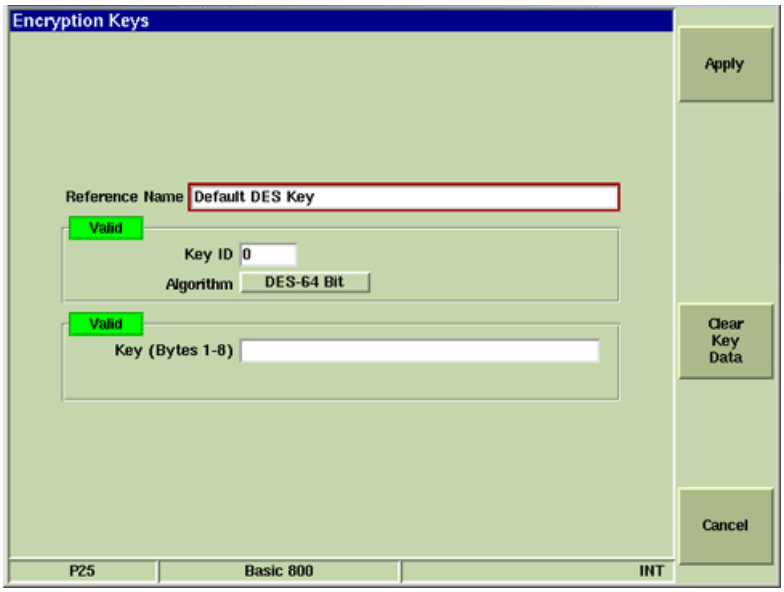

Fig. 4-5 Edit Encryption Key Parameters

STEP	PROCEDURE

1. Press one of the Edit buttons. Display changes as shown in example above.
2. Select Reference Name field and enter a name for the encryption key.
3. Enter Key ID value.
4. Select Encryption Algorithm Identifier.
5. Enter Key (Bytes 1-n) value. The Test Set was designed to display an “Invalid” indicator until a valid Key is entered.

Press Apply Soft Key when valid configuration is entered. When the Apply Soft Key is pressed, the display returns to the main Encryption Tile and the new Encryption Key ID appears in the list of encryption keys.

4.4 OFFSETS CONFIGURATION TILE

The Offsets Configuration Tile allows users to define Generator (Tx) and Receiver (Rx) Level offsets.

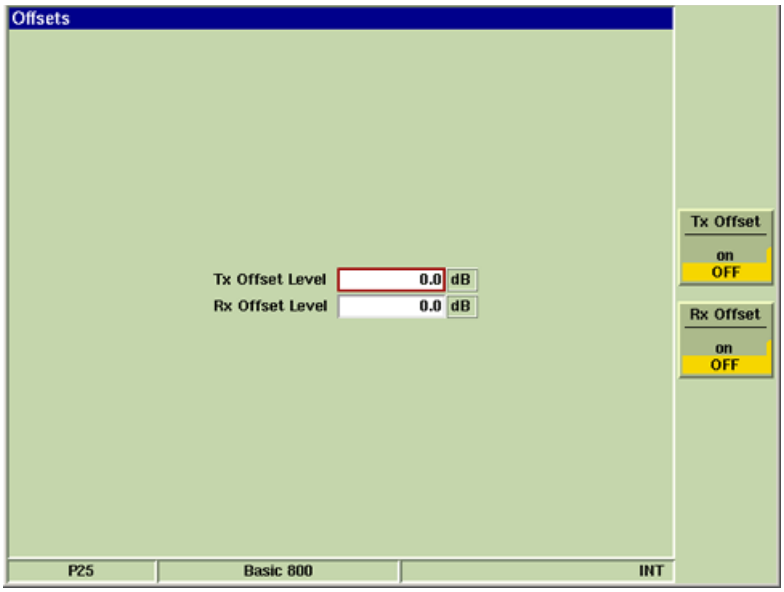

Fig. 4-6 Offsets Configuration Tile

4.4.0.A Field/Soft Key Definition

4.4.0.A.1 Tx Offset Level

Defines RF Generator Level Offset value.

4.4.0.A.2 Rx Offset Level

Defines Receiver Level Offset value.

4.4.0.A.3 TX Offset/Rx Offset Soft Keys

Enables/Disables defined Tx and Rx offset values.

4.5 PORTS CONFIGURATION TILE

The Ports Configuration Tile defines the Test Set's output parameters.

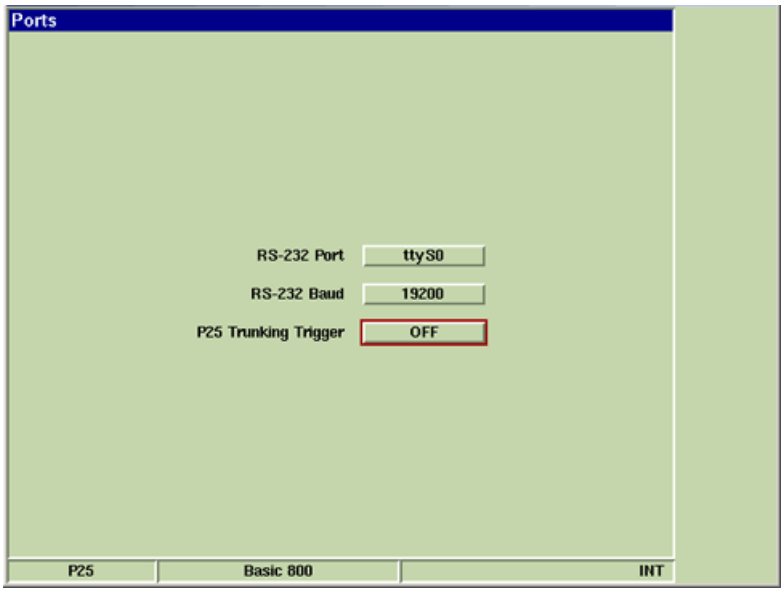

Fig. 4-7 Ports Configuration Tile

4.5.1 Field Definitions

4.5.1.A RS-232 Port

The RS-232 Port drop-down menu selects the port at which data is received for obtaining Rx BER measurements. This parameter should be set to ttyS0 to obtain valid Rx BER measurements.

4.5.1.B RS-232 Baud

The RS-232 Baud drop-down menu sets the Baud Rate at which data is received for Rx BER Measurements. This parameter should be set to 19200 to obtain valid Rx BER measurements.

4.5.1.C P25 Trunking Trigger

The P25 Trunking Trigger Mode allows the user to define the position of the Sync I/O output trigger. This function is option enabled when the P25 Performance Testing Option is installed in the Test Set.

4.5.1.C.1 Off

Disables Sync I/O Pulse Trigger.

4.5.1.C.2 Slot Boundaries

The Sync I/O Output triggers at the slot boundaries during Trunking Simulation when Slot Boundaries is selected as the P25 Trunking Trigger. The Slot Boundaries Trigger is a "high" pulse with a duration of one symbol (about 208 microseconds).

4.5.1.C.3 Channel Grant

The Sync I/O Output triggers at the start of the Channel Grant Message during Trunking Simulation when Channel Grant is selected as the P25 Trunking Trigger. The Channel Grant Trigger is a "high" pulse with a duration of one symbol (about 208 microseconds).

4.6 SYSTEM PLAN CONFIGURATION TILE

The System Plan Configuration Tile is *option enabled. This tile allows the user to define parameters for testing Trunked P25 systems. Once a plan has been defined and saved, all parameters associated with the plan are recalled when the plan is selected on the Trunking Control Tile. All System Plan parameters must be defined to perform tests and obtain valid test data.

The System Plan Configuration Tile also allows users to select one of the pre-defined system plans which can be customized to meet specific test scenarios, then saved as a new file for future testing. Saved files can be imported to and exported from the Test Set using the Utility Management Tile.

4.6.1 How to Configure a System Plan

The P25 System includes default System Plans that can be used as templates from which to create custom plans. All fields are display only until the Edit Soft Key is pressed. All System Plan parameters must be defined to perform tests and obtain valid test data.

To edit an existing System Plan:

STEP	PROCEDURE
1.	Select a plan from System Plan menu.
2.	Press Edit Soft Key. Screen updates to editable fields as shown in example below.
3.	Enter plan name in Name field.
4.	Make desired changes to various system parameters.
5.	Press Save Soft Key.

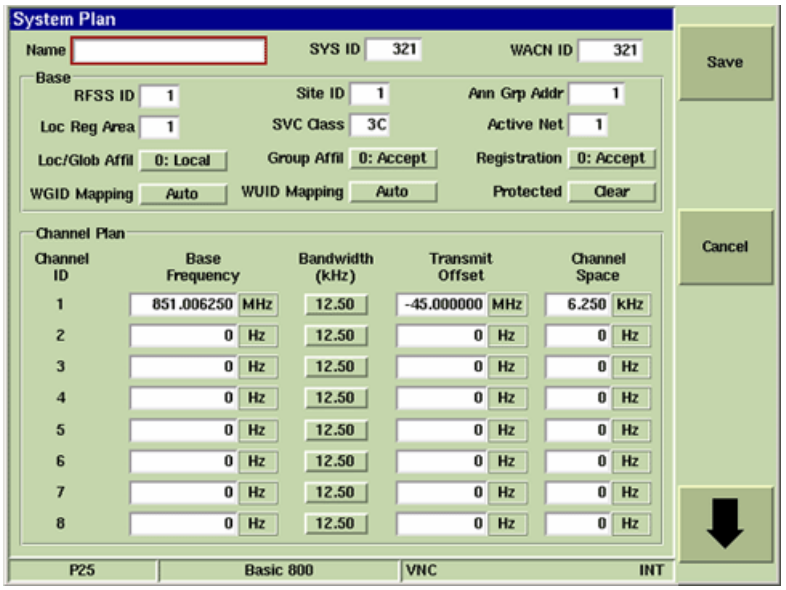

Fig. 4-8 Edit System Plan

When configuring plan parameters, pressing Cancel Soft Key aborts all unsaved changes. The Utilities File Management Tile allows saved plans to be imported to and exported from the Test Set.

4.6.2 P25 System Plan Configuration Parameters

System Plan parameters are enabled by the type of plan selected from the System Plan drop-down menu.

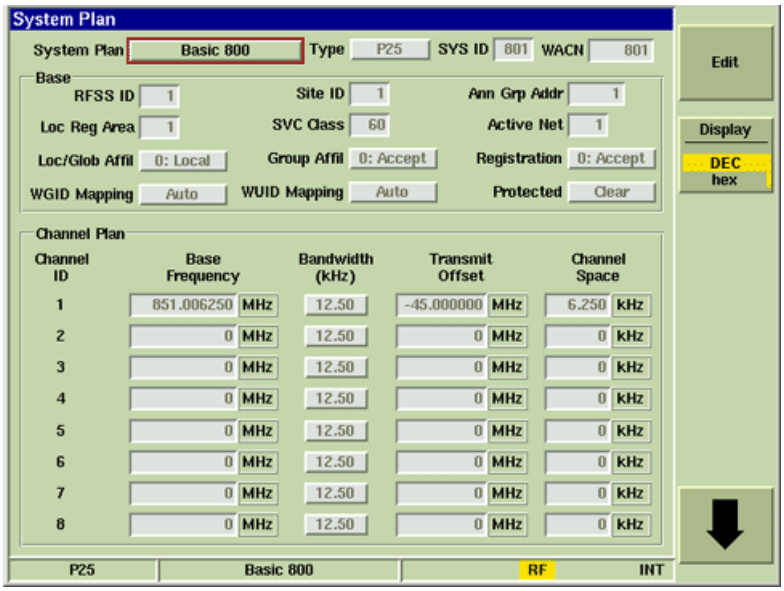

Fig. 4-9 P25 System Plan Configuration Tile - Decimal Format

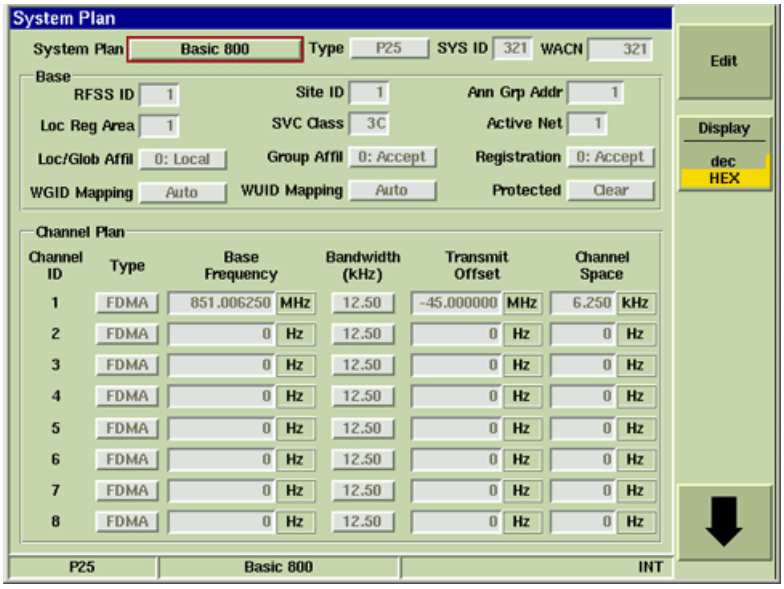

Fig. 4-10 P25 X2-TDMA System Plan Configuration Tile

4.6.2.A Field/Soft Key Definitions

4.6.2.A.1 System Plan

Allows user to select desired System Plan. Use the Edit Soft Key to customize pre-defined System Plans. Refer to How to Configure a System Plan for instructions on how to create a custom plan.

4.6.2.A.2 Type

Identifies/defines System Plan as a P25 System Plan or SmartZone Band Plan when the SmartZone Option is installed in the Test Set. This field is display only unless the user is editing the current system or band plan.

4.6.2.A.3 Sys ID

Defines the System Identifier per TIA-102.AABB Specification. The System ID is equivalent to the NAC.

4.6.2.A.4 WACN ID

Defines Wide Area Access Network Identifier.

4.6.2.B Base Parameters

Base Parameters must be configured for the Test Set to simulate a base station.

4.6.2.B.1 RFSS ID

Defines RF Subsystem Identifier for Outbound Channel.

4.6.2.B.2 Site ID

Defines Site Identifier.

4.6.2.B.3 Ann Grp Addr

Defines Announcement Group Address.

4.6.2.B.4 Local Reg Area

Defines Local Registration Area.

4.6.2.B.5 SVC Class

Defines Service Class.

4.6.2.B.6 Active Net

Defines Active Network value.

4.6.2.B.7 Loc/Glob Affil

Selects Local or Global Affiliation.

4.6.2.B.8 Group Affil

Defines the Group Affiliation status sent when a radio attempts to affiliate with the Test Set.

0 = Accept (Default)
1 = Fail
2 = Deny
3 = Refused

4.6.2.B.9 Registration

Defines the Registration Value sent when a radio attempts to register.

0 = Accept (Default)
1 = Fail
2 = Deny
3 = Refused

4.6.2.B.10 WGID Mapping

Selects method for obtaining Working Group Identifier. This value is currently automatically selected by Test Set.

4.6.2.B.11 WUID Mapping

Sets Bandwidth for each channel within the selected Channel ID.

4.6.2.B.12 Protected

Defines the Protected bit value for the encrypted control data.

0 = Clear (Default)

1 = Encrypted

4.6.2.C Channel Plan Parameters

Each physical channel in a system is identified by a unique Channel ID/Channel Number pair. The channel plan is the basis for calculating frequencies from ID/Number pairs. The channel plan is not related to the mobile radio scan lists which the mobile uses to find active control channels.

4.6.2.C.1 Channel ID

Lists Channel Identifier.

4.6.2.C.2 Channel Type

The Channel Type toggle button selects the type of channel (FDMA or TDMA) assigned to the channel. This field is enabled when either of the Motorola ASTRO® 25 X2-TDMA options are installed in the Test Set.

4.6.2.C.3 Base Frequency

Sets starting frequency for calculating channel numbers.

4.6.2.C.4 Bandwidth

Sets Bandwidth for each channel within the selected Channel ID.

4.6.2.C.5 Transmit Offset

Sets Offset value of the transmit frequency from the receiver frequency for each channel within the selected Channel ID.

4.6.2.C.6 Channel Space

Defines spacing between each channel within a given Channel ID.

4.6.2.D Soft Keys

4.6.2.D.1 Edit Soft Key

The Edit Soft Key allows the user to create and save custom System Plans. Pressing the Edit Soft Key changes System Plan data fields to an editable state and enables additional soft key functions.

4.6.2.D.2 Display Soft Key

The Display Soft Key selects Decimal (refer to Fig. 4-9) or Hexadecimal (refer to Fig. 4-10) format to display data field content.

4.6.2.D.3 Arrow Up/Down Soft Key

The Up and Down Arrow Soft Keys navigate the Channel Plan data fields.

4.6.2.D.4 Save Soft Key

Pressing the Save Soft Key saves current System Plan Configuration to the Test Set's internal database. A saved System Plan can later be recalled for future use. Pre-configured System Plans are reconfigured to factory default parameters when the Restore Factory Defaults procedure is performed.

4.6.2.D.5 Cancel Soft Key

When configuring plan parameters, pressing Cancel Soft Key aborts all unsaved changes.

4.6.3 SmartNet™/SmartZone™ Band Plan Configuration

The P25 SmartNet™/SmartZone™ System Option includes several pre-configured band plans which allow the user to quickly configure the Test Set to UUT system plan requirements. Users can select one of the pre-configured band plans to test a radio operating on one of the allocated SmartNet™/SmartZone™ band plans, or they can configure a customized plan to test a radio operating on non-allocated channel plans. All parameters must be defined to perform tests and obtain valid test data

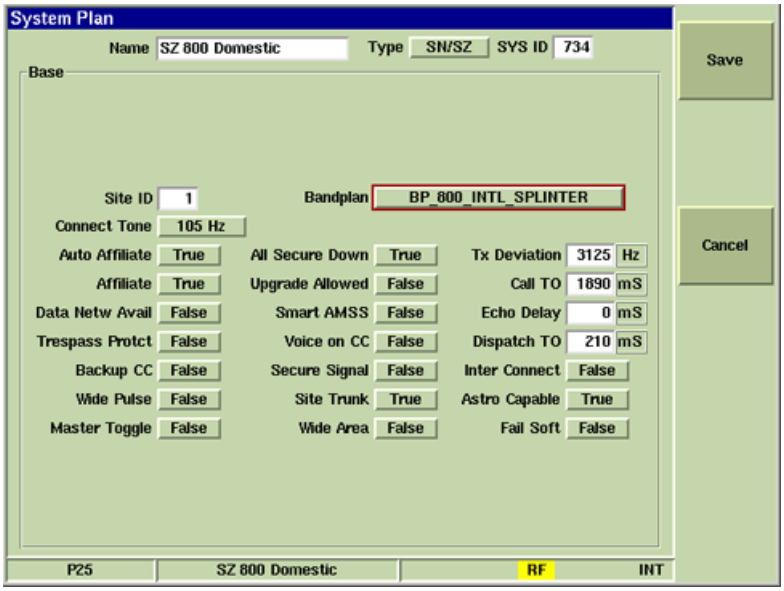

Fig. 4-11 SmartNet™/SmartZone™ System Plan Configuration Tile

4.6.3.A Field/Soft Key Definitions

4.6.3.A.1 System ID

The System Identifier is the identity of the System that the Test Set is simulating.

4.6.3.A.2 Bandplan

The Bandplan drop-down menu selects the type of bandplan.

4.6.3.A.3 Site ID

Site ID defines the identity of the specific site within a system that the unit is to simulate.

4.6.3.A.4 Connect Tone

The Connect Tone is the tone transmitted on the Inbound Traffic Channel from an Analog SmartNet/SmartZone radio. The Connect Tone is only valid when Analog Modulation is selected with SmartNet/SmartZone Protocol.

4.6.3.A.5 Auto Affiliate

Selects whether or not the Auto Affiliate flag is included in the Bandplan.

4.6.3.A.6 Affiliate

Selects whether or not the Affiliate Flag is included in the Bandplan.

4.6.3.A.7 All Secure Down

Selects whether or not the All Secure Down flag is included in the Bandplan.

4.6.3.A.8 Tx Deviation

Tx Deviation sets the deviation of the low speed data transmitted by the Base Radio Simulator on the Analog Traffic Channel.

4.6.3.A.9 Upgrade Allowed

Selects whether or not the Upgrade Allowed flag is included in the Bandplan.

4.6.3.A.10 Call TimeOut

Call TimeOut controls how long the radio transmits in a normal call before dropping the call.

4.6.3.A.11 Data Network Available

Selects whether or not the Data Network Available flag is included in the band plan.

4.6.3.A.12 Smart AMSS

Selects whether or not the Smart AMSS flag is included in the Bandplan.

4.6.3.A.13 Echo Delay

Sets Echo Delay in Bandplan in micro seconds.

4.6.3.A.14 Dispatch Time Out

Sets radio Dispatch Time Out value in micro seconds.

4.6.3.A.15 Trespass Protection

Selects whether or not the Trespass Protection flag is included in the band plan.

4.6.3.A.16 Voice on CC

Selects whether or not the Voice on Control Channel flag is included in the Bandplan.

4.6.3.A.17 Backup CC

Selects whether or not the Backup Control Channel Flag is included in the Bandplan.

4.6.3.A.18 Secure Signal

Selects whether or not the Secure Signal flag is included in the Bandplan.

4.6.3.A.19 Inter Connect

Selects whether or not the Inter Connect flag is included in the Bandplan.

4.6.3.A.20 Wide Pulse

Selects whether or not the Wide Pulse flag is included in the Bandplan.

4.6.3.A.21 Site Trunk

Selects whether or not the Site Trunking Flag is included in the Bandplan.

4.6.3.A.22 Astro Capable

Selects whether or not the Astro Capable flag is included in the Bandplan.

4.6.3.A.23 Master Toggle

Selects whether or not the Master Toggle flag is included in the Bandplan.

4.6.3.A.24 Wide Area

Selects whether or not the Wide Area flag is included in the Bandplan.

4.6.3.A.25 Fail Soft

Selects whether or not the Fail Soft flag is included in the Bandplan.

4.6.3.B Soft Keys

4.6.3.B.1 Save Soft Key

Pressing the Save Soft Key saves current System Plan Configuration to the Test Set's internal database. A saved System Plan can later be recalled for future use. Pre-configured System Plans are reconfigured to factory default parameters when the Restore Factory Defaults procedure is performed.

4.6.3.B.2 Cancel Soft Key

When configuring plan parameters, pressing Cancel Soft Key aborts all unsaved changes.

4.6.4 SmartNet™/SmartZone™ Otherband Channel Plan

The SmartNet™/SmartZone™ Otherband Channel Plan allows the user to create customized SmartNet™/SmartZone™ Band Plans. The SmartNet™/SmartZone™ Otherband Channel Plan supports a total of 380 Channels on three separate Channel Blocks (1, 2 and 3). The Channel Count, Channel Spacing, Start Frequency and Stop Frequency fields are inter-dependent and are automatically updated when any of these parameters are changed.

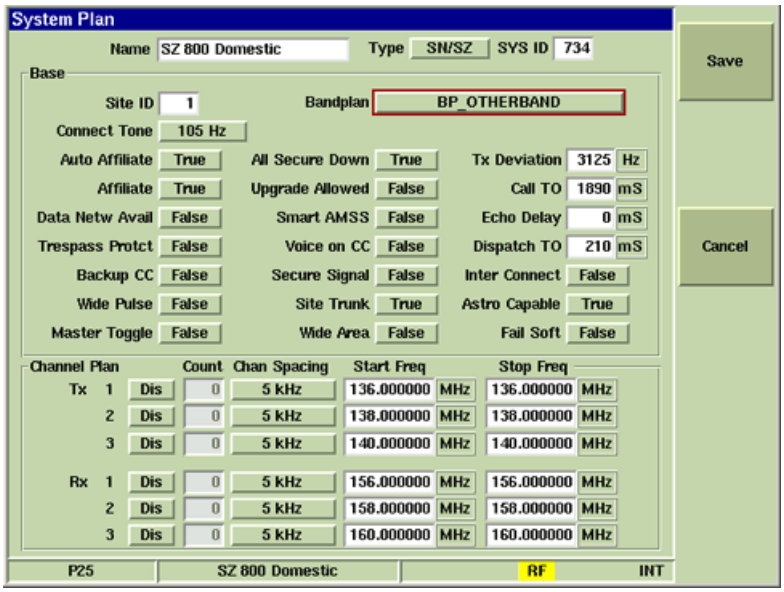

Fig. 4-12 SmartNet™/SmartZone™ Otherband Configuration

4.6.4.A Field Definitions

SmartNet™/SmartZone™ Otherband Channel Plans contain the same parameters found in pre-defined SmartNet™/SmartZone™ Band Plans as well as the following additional parameters.

4.6.4.A.1 Channel Block

Lists Channel Identifier for Channel Block information. SmartNet™/SmartZone™ Otherband Plan supports three Channel Blocks.

4.6.4.A.2 Channel Enabled/Disabled

The Channel Enabled/Disabled toggle button selects whether or not the Channel Block is to be included in the Bandplan. The Channel Count field is "0" when either the corresponding Rx or Tx Channel is disabled (OFF).

4.6.4.A.3 Channel Count

Displays the number of channels in each Channel Block. The number of channels is determined by the Channel Spacing value, Start Frequency, Stop Frequency and number of available channels (380).

4.6.4.A.4 Channel Spacing

Defines spacing between each channel within a given Channel ID.

4.6.4.A.5 Channel Start Frequency

The Start Frequency defines Start Frequency of the Rx and Tx Channel Block.

4.6.4.A.6 Channel Stop Frequency

The Stop Frequency indicates the ending frequency of Rx and Tx Channel Block.

4.7 UUT MEASUREMENTS LIMITS CONFIGURATION TILE

The UUT Measurement Configuration Tile allows the user to define limits for UUT Measurements meter readings. Available measurements depend on the options installed in the Test Set.

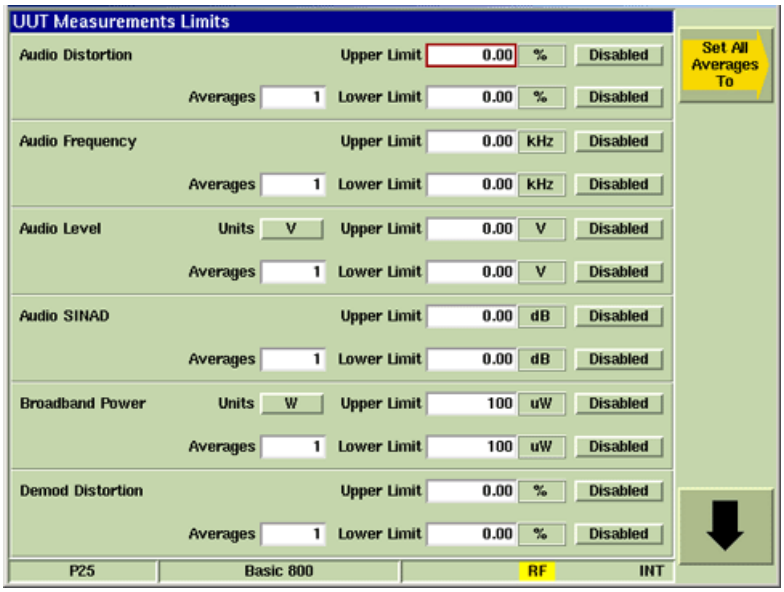

Fig. 4-13 UUT Measurements Limits Configuration Tile

4.7.1 Field/Soft Key Definitions

4.7.1.A Disabled/Enabled

The Enable/Disable Toggle button turns defined limits on and off. Default values are applied if values are not defined by user.

4.7.1.B Upper Limit

The UPPER LIMIT function sets a maximum acceptable reading for a specific measurement. When a measured level exceeds the enabled UPPER LIMIT, the Meter Bar and reading background on the Measurement Tiles turns RED.

When readings within enabled Upper and Lower limits the Meter Bar and reading background on the Measurement Tiles turns GREEN.

4.7.1.C Lower Limit

When a measured level drops below the enabled LOWER LIMIT, the Meter Bar and reading background of the Measurement Tiles turns BLUE.

When readings within enabled Upper and Lower limits the Meter Bar and reading background on the Measurement Tiles turns GREEN.

4.7.1.D Units

Units defines the unit of measurement for a specific measurement.

4.7.1.E Averages

Specifies the number of bursts over which data is averaged for each measurement. Values can be set independently for each meter. If the Averages field is set to 50, the Test Set averages data over 50 samples.

4.7.1.F Set All Averages To Soft Key

Specifies the number of bursts over which data is averaged for each measurement. Values can be set independently for each meter. If the Averages field is set to 50, the Test Set averages data over 50 samples.

4.7.1.G Up/Down Arrow Soft Key

There Up and Down Arrow Soft Keys navigate the measurements available on the UUT Measurements Limits Configuration Tile. The type of measurements available depends on the options installed in the Test Set.

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Chapter 5 - P25 Protocol Tiles

5.1 INTRODUCTION

This chapter provides an operational description of P25 Protocol Tiles

Refer to Chapter 3, P25 Test and Measurement Tiles, for a description of P25 Test and Measurement Tiles.

Refer to Chapter 4, P25 Configuration Tiles, for a description of P25 Configuration Tiles.

Refer to Chapter 6, Setting Up Calls, for information on configuring various types of calls.

5.2 DATA LINK (DECODE) TILE

The Data Link Measurement Tile displays digital data contained in the signal received from the UUT on a voice channel. This tile can be selected on multiple sections of the P25 User Screen and each tile configured to display data from different channels (*Channel 2 is option enabled).

The parameters displayed on the Data Link Measurements Tile are dependent on the type of call being received. Data Link parameters are defined per TIA-102.AABF-B Specification.

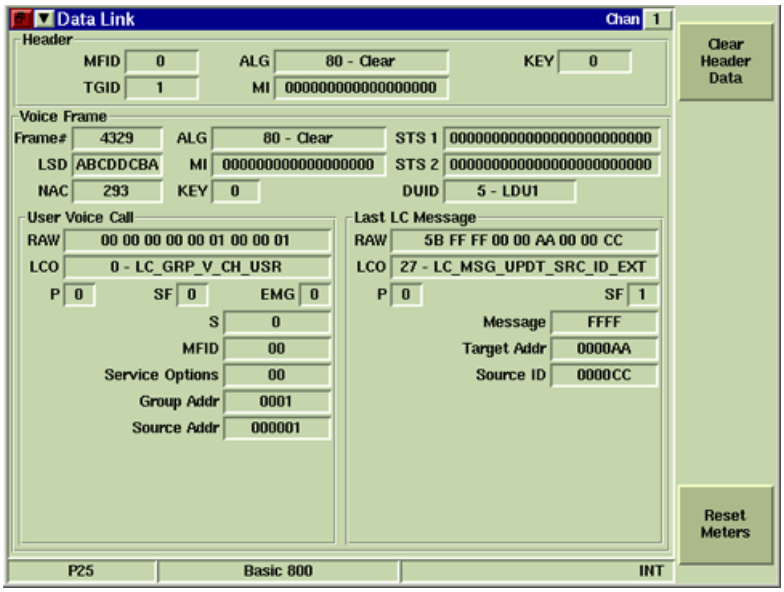

Fig. 5-1 Data Link Measurements Tile - LCO 27

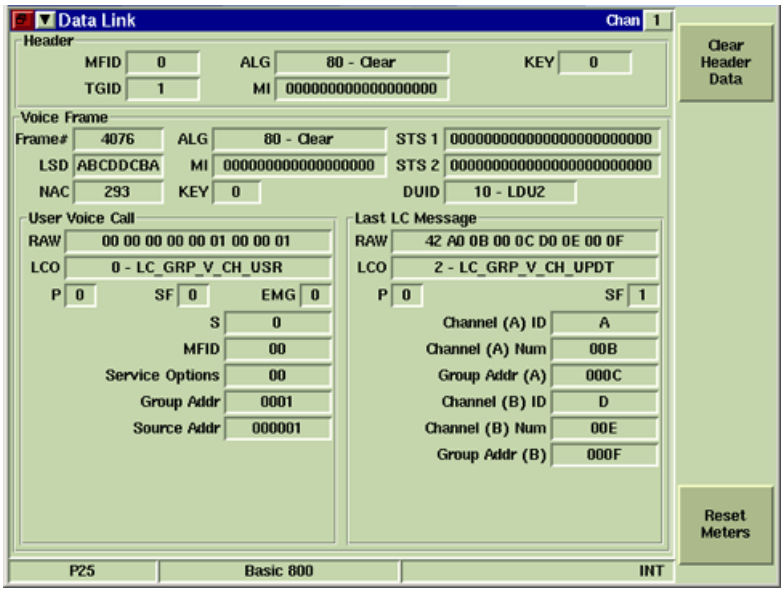

Fig. 5-2 Data Link Measurements Tile - LCO 2

5.2.1 Header Data Field Definitions

The Header Data section of the Data Link Measurement Tile displays header data received from the UUT. Field content can be cleared and reset by pressing the Clear Header Data Soft Key.

5.2.2 Voice Frame Data Field Definitions

The Voice Frame Data section of the Data Link Measurement Tile displays data received from the UUT voice channel.

5.2.3 User Voice Call Data Field Definitions

The User Voice Call section of the Data Link Measurement Tile displays Voice Frame data received by the Test Set from the UUT voice channel. The data fields displayed on this section of the Data Link Measurement Tile are based on the type of call being received from the UUT. User Voice Call Data fields are updated for Group, Unit-to-Unit and PSTN calls.

5.2.4 Last Link Control Data Field Definitions

The Last Link Control Message section of the Data Link Measurement Tile displays the last Link Control Message sent from the mobile or base station (applies to all messages except Group, Unit-to-Unit and PSTN interconnect calls). The data fields displayed on this section of the Data Link Measurement Tile are dependent upon the type of Link Control Message being received from the UUT. Refer to TIA-102.AABF-B Specification for a list of supported decode messages types.

5.2.5 Soft Key Definitions

5.2.5.A Clear Header Data Soft Key

The Clear Header Data Soft Key clears and updates Data Link Header fields.

5.2.5.B Reset Meters Soft Key

The Reset Meters Soft Key clears and resets meter readings.

5.3 MESSAGE ENCODE TILE

The Message Encode Tile allows users to define encoded Link Control Messages. Available parameters are determined by the Link Control Opcode (LCO) entered in the LCO field. Message Encode parameters are defined per TIA-102.AABF-B Specification.

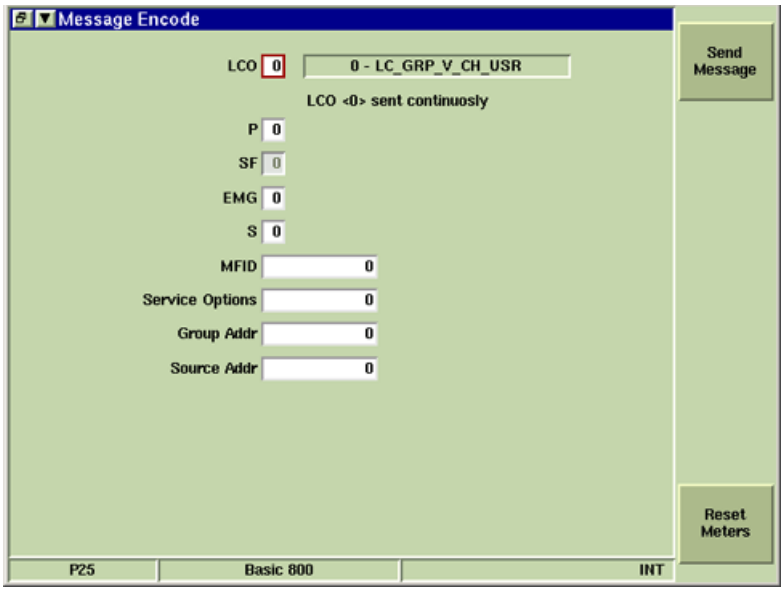

Fig. 5-3 Message Encode - LCO 0

5.3.1 Configure an LCO Message:

STEP	PROCEDURE
1.	Enter a valid LCO number in the LCO field. Wait while tile fields update.
2.	Configure LCO Message parameters according to UUT.
3.	Press Send Message Soft Key.

5.4 SIMULATOR TILE

The P25 Simulator Tile allows the user to simulate the effect of a radio by configuring the 3900 to serve as a Virtual Mobile (VM) to talk to the unit under test.

When the Test Set is operating in non-trunking mode, the fields on the Simulator Tile set basic call parameters. When the Test Set is operating in trunking mode* or SmartNet™/ SmartZone™ protocol* is selected (*option enabled), the fields on the Simulator Tile set additional call parameters.

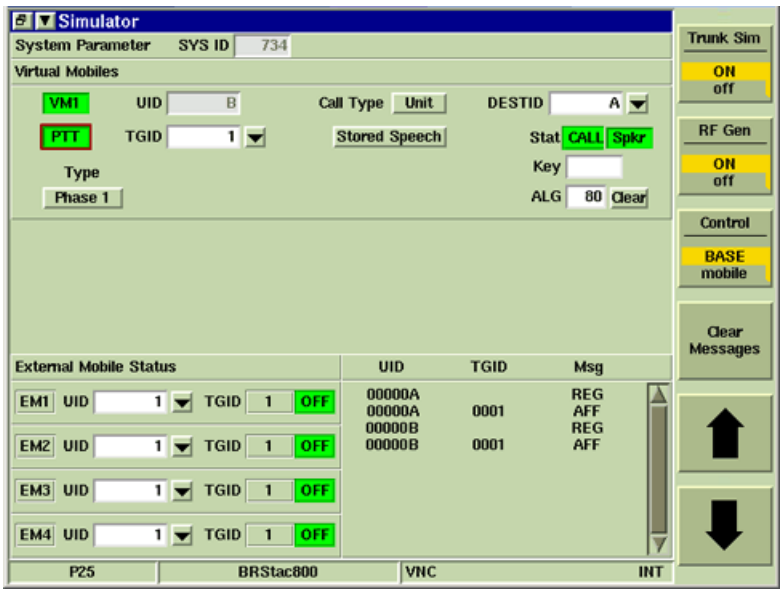

Fig. 5-4 P25 Simulator Tile - Unit to Unit Call Type (*option enabled)

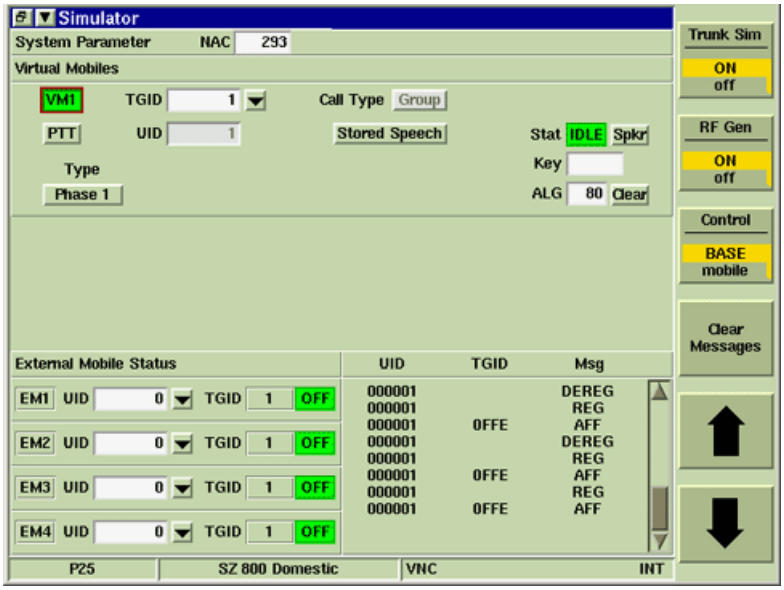

Fig. 5-5 P25 Trunking Simulator Tile - Group Call Type

5.4.1 System Parameters

5.4.1.A NAC

The NAC field applies to Group Calls. The NAC field defines the Network Access Code used by the Test Set Simulator.

5.4.1.B SYS ID

The SYS ID field applies to Unit to Unit Calls and is *option enabled. The SYS ID field defines the System Identifier used by the Test Set Simulator.

5.4.2 Virtual Mobile Field Definitions

5.4.2.A VM1

When the P25 Trunking Simulator is enabled (Trunking Sim Soft Key is in ON state), the VM1 indicator updates to a toggle button. Enabling the VM1 toggle button simulates powering on an external radio which initiates radio registration and affiliation with the Test Set. This functionality is enabled when the P25 Trunking Option is installed.

5.4.2.B PTT (Push to Talk)

5.4.2.B.1 Group Call

Enabling the Push to Talk toggle button keys the virtual radio and begins transmission for Group calls.

5.4.2.B.2 Unit to Unit Call

Enabling the Push to Talk toggle button initiates a call to the DEST ID mobile. The call request must be answered by the DEST ID mobile to establish the call.

5.4.2.C TGID

Defines the Virtual Mobile's Talk Group Identifier as a six hex digit value. Range is 0x0 to 0xFFFFFF.

5.4.2.D UID

Defines the Virtual Mobile's Encryption Key Identifier as a four hex digit value. Range is 0x0 to 0xFFFF.

5.4.2.E Call Type

The Test Set supports Group and Unit to Unit call types. Selecting Unit enables the Dest ID Field. Unit call type is only available when P25 Unit to Unit Call Option (390XOPT213) is installed in Test Set.

5.4.2.F DEST ID

Defines Destination ID of target unit in Unit to Unit calls.

5.4.2.G Pattern

The Pattern drop-down menu selects the audio source used by the Virtual Mobile.

5.4.2.H VM Call Status Indicator

The Call Status Indicator displays the virtual mobile's call status.

5.4.2.H.1 OFF

OFF indicates that the Virtual Mobile is not enabled.

5.4.2.H.2 IDLE

IDLE indicates the Virtual Mobile is attempting to locate a control channel and send a registration request.

5.4.2.H.3 REG

REG indicates that the Virtual Mobile has registered with the Test Set.

5.4.2.H.4 AFF

AFF indicates that the Virtual Mobile has affiliated with the Test Set.

5.4.2.H.5 CALL

CALL indicates that the Virtual Mobile is participating in a call.

5.4.2.H.6 HANG

HANG indicates that the active Unit to Unit call has entered a "Hang" state. This state occurs when the mobile transmitting the call is "unkeyed" and another mobile participating in the call can "key up" to acquire transmit control of the call.

5.4.2.H.7 WAIT

WAIT indicates that the Virtual Mobile has initiated a Unit to Unit (Private) call and the system is waiting for the destination mobile to answer ("key up") the call. When the call is answered status updates to CALL status.

5.4.2.H.8 RING

RING indicates that the Test Set is receiving a Unit to Unit call (ringing) from a mobile radio. During this state the PTT button updates status to ANS. Press the ANS button to answer the call.

5.4.2.I Key

Defines the Virtual Mobile's Encryption Key Identifier as a four hex digit value. Range is 0x0 to 0xFFFF. When an undefined Encryption Key is entered in the Key field, an Invalid indicator symbol is displayed next to the Key field as shown in Fig. 5-7.

5.4.2.J ALG

Defines the Virtual Mobile's Encryption Algorithm Identifier as a two hex digit value. Range is 0x0 to 0xFF.

5.4.2.K (Radio) Type

The Radio Type drop-down menu selects the type of radio participating in the call. This drop-down menu is only available when the SmartNet™/SmartZone™ Option is installed.

5.4.2.L Cap Flags (Capability Flags)

Capability Flags apply to X2-TDMA and SNSZ Radio Types.

5.4.2.L.1 X2-TDMA Capability Flags

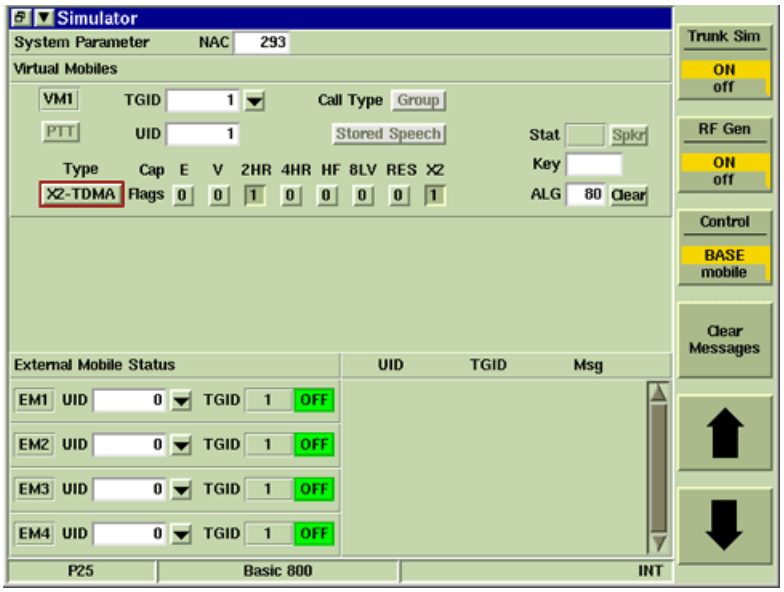

Fig. 5-6 X2-TDMA Simulator Capability Flags

E

E (Requesting Emergency Mode) reserved for future implementation.

V

V indicates that the capabilities field is valid. Motorola X2-TDMA sets this flag to 0. Refer to the APCO U_REG_REQ and LOC_REG_REQ message Specification for capability flag information.

2HR (Two-Slot, Half-Rate)

2HR indicates mobile is capable of half-rate vocoder on two-slot TDMA channel.

4HR (Four-Slot, Half-Rate)

4HR indicates mobile is capable of half-rate vocoder on two-slot TDMA channel. Reserved for future implementation.

HF (Half-Rate FDMA)

HF indicates mobile is capable of half-rate vocoder on FDMA channel. Reserved for future implementation.

8LV (Eight-Level)

8LV indicates mobile is capable of operating on Eight-Level Simulcast Modulation (H-D8PSK) TDMA channels. Reserved for future implementation.

RES

Reserved.

X2

X2 (Motorola X2-TDMA) indicates mobile is capable of operating on an X2-TDMA Network. Per TIA-102.BAAE Specification this bit is reserved if V bit is 0.

5.4.2.L.2 SNSZ Radio Flags

PCC (Phase 1 Control Channel)

When PCC is enabled, the Virtual Mobile searches for APCO-P25 Phase 1 Control Channels.

SCC (SmartNet™/SmartZone™ Control Channel)

When SCC is enabled, the Virtual Mobile searches for SmartNet™/SmartZone™ Control Channels.

DTC (Digital Traffic Channel)

When DTC is enabled, the Virtual Mobile is capable of operating on a Digital Traffic Channel.

ATC (Analog Traffic Channel)

When ATC is enabled, the Virtual Mobile is capable of operating on an Analog Traffic Channel (narrow-band, FM, with low-speed data). Implementation of this feature is planned for a future release.

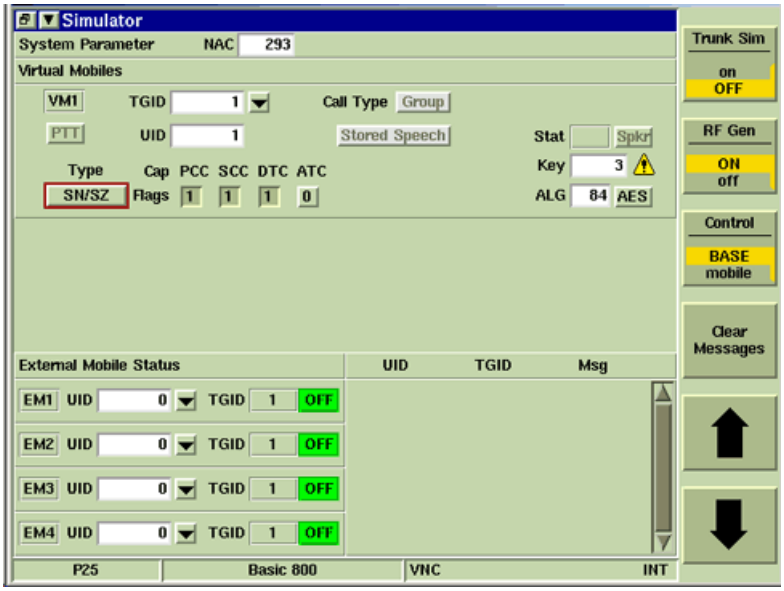

Fig. 5-7 SmartNet™/SmartZone™ Simulator Tile Capability Flags

5.4.3 External Mobile Field Definitions

The External Mobile parameters allow the user to configure the Test Set to monitor up to four external mobile radios. These fields are enabled when the P25 Trunking Option is installed.

5.4.3.A EM1

EM label indicates the External Mobile (1, 2, 3 or 4) for which the data applies.

5.4.3.B UID

Defines the External Mobile's User Identifier as a six hex digit value. Range is 0x0 to 0xFFFFFF.

5.4.3.C TGID

Displays the External Mobile's Talk Group Identifier in six hex digit format within range of 0x0 to 0xFFFFFF.

5.4.3.D Call Status Indicator

The Call Status Indicator displays the External Mobile's call status.

5.4.3.D.1 OFF

OFF indicates that the External Mobile is not enabled.

5.4.3.D.2 REG

REG indicates that the External Mobile has registered with the Test Set.

5.4.3.D.3 AFF

AFF indicates that the External Mobile has affiliated with the Test Set.

5.4.3.D.4 CALL

CALL indicates that the External Mobile is participating in a call.

5.4.4 Call Logging Field

The Call Logging field displays the registration, affiliation and deregistration of external mobile radios. These fields are *option enabled when the P25 Trunking Option is installed in the Test Set.

5.4.4.A UID

Unit Identification of the External Mobile.

5.4.4.B TGID

Talk Group Identifier of the External Mobile.

5.4.4.C MSG

The Logging messages are the registration and affiliation messages sent by the External Mobile.

5.4.4.C.1 REG

REG indicates that the External Mobile has sent registration message to the Test Set.

5.4.4.C.2 AFF

AFF indicates that the External Mobile has sent affiliation message to the Test Set.

5.4.4.C.3 DEREG

DEREG indicates that the External Mobile has sent a de-registration message to the Test Set.

5.4.5 Soft Key Definitions

5.4.5.A Trunk Sim Soft Key

Enables/disables Trunked Mode Simulator. When the Trunking Simulator is enabled, the Test Set reconfigures the transmit and receive parameters on the RF Control Tile based on the parameters defined on the Trunking Control Tile.

This soft key is *option enabled when the P25 Trunking or SmartNet™/SmartZone™ Option is installed in the Test Set.

5.4.5.B RF Gen Soft Key

Selects and indicates the On/Off state of the RF Generator output from the Test Set. When the generator is disabled, an RF OFF indicator is shown on the Tile.

5.4.5.C Control Soft Key

Selects between Base Simulation and Mobile Simulation (*option enabled).

5.4.5.D Clear Messages Soft Key

Clears message data in Call Logging Field.

5.4.5.E Reset Meters Soft Key

The Reset Meters Soft Key clears and resets meter readings.

5.5 TRUNKING CONTROL TILE

The Trunking Control Tile is *option enabled. The Trunking Control Tile configures the Test Set for testing the operational parameters of a P25 Trunked radio system. Channels are activated when the Trunking Simulator is enabled (Trunk Sim Soft Key is ON). When Trunking Simulation is activated, call parameters are copied from the Trunking Control Tile to the RF Control Tile.

5.5.1 Base Station Simulator

The Trunking Control Base Station Simulator is included with P25 Trunking functionality.

The Base Simulator allows the Test Set to be configured to function as a base station for testing the operation of mobile radios.

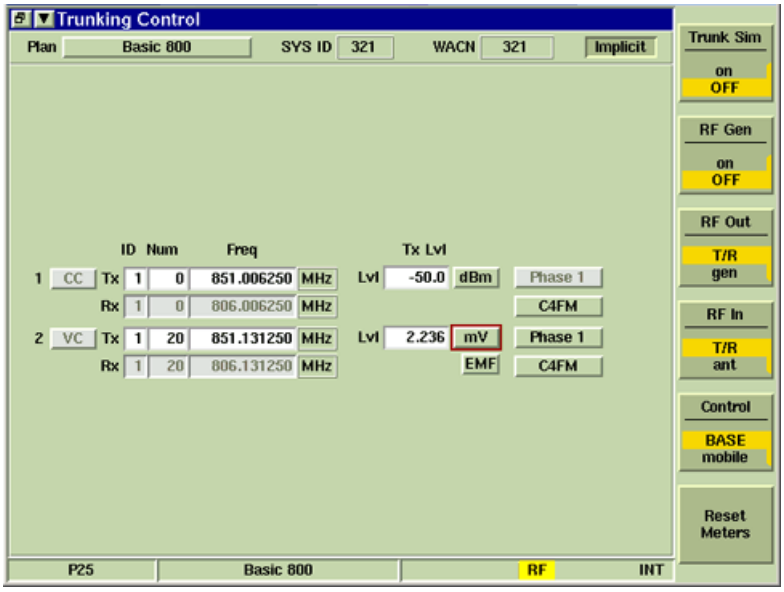

Fig. 5-8 Trunking Control Tile - Base Station Simulator

5.5.1.A Field/Soft Key Definitions

5.5.1.A.1 Plan

Selects the System Plan to be used when testing the UUT. Custom System Plans can be defined and saved using the System Plan Configuration Tile.

5.5.1.A.2 Sys ID

Indicates System ID associated with the selected System Plan. The Sys ID is currently equivalent to the NAC. This field is system specific and must match the UUT.

5.5.1.A.3 WACN

Indicates Wide Area Communications Network identifier of the selected System Plan. This field is system specific and must match the UUT.

5.5.1.A.4 Implicit Message Format

The Implicit/Explicit toggle button selects whether the simulator uses Implicit or Explicit message format data fields. Implicit message format is the standard format used within the P25 system. Explicit Message Format is *option enabled when the P25 Explicit Mode UHF/VHF Option is installed in the Test Set.

5.5.1.A.5 CC (Control Channel)

The CC Tx and Rx fields define the ID, Number and Frequency for the Tx and Rx Control Channels. Either the ID and Number or the ID and Frequency must be defined in order for the Test Set to populate data fields based on the System Plan selected on the System Plan Configuration Tile. CC Rx fields are display only when Implicit mode is selected.

5.5.1.A.6 VC (Voice Channel)

The VC Tx and Rx fields define the ID, Number and Frequency for the Tx and Rx Voice Channels. Either the ID and Number or the ID and Frequency must be defined in order for the Test Set to populate data fields based on the System Plan selected on the System Plan Configuration Tile. VC Rx fields are display only when Implicit mode is selected.

5.5.1.A.7 ID/NUM

ID and Num (Number) fields define the frequency according to the System Plan defined on the System Plan Configuration Tile. ID and Frequency fields define the Number according to the System Plan defined on the System Plan Configuration Tile.

5.5.1.A.8 Freq (Frequency)

Frequency fields are defined by selecting the ID/Num fields or be entering the values manually.

5.5.1.A.9 Lvl (Level)

Defines the default RF Power Level for the Control Channel and Voice Channel.

5.5.1.A.10 Protocol

Selects the P25 protocol to be used for each channel. P25 Phase 1 and Analog are the protocol types currently supported by the P25 Base Option. Other protocol types are *option enabled.

5.5.1.A.11 Trunk Sim Soft Key

Enables/disables Trunked Mode Simulator. When the Trunking Simulator is enabled, the Test Set reconfigures the transmit and receive parameters on the RF Control Tile based on the parameters defined on the Trunking Control Tile.

5.5.1.A.12 RF Gen Soft Key

Selects and indicates the On/Off state of the RF Generator output from the Test Set. When the generator is disabled, an RF OFF indicator is shown on the Tile.

5.5.1.A.13 RF Out Soft Key

The RF Out Soft Key controls the RF Output signal routing. Select either the GEN (Generator) Connector or T/R Connector as RF Output port.

5.5.1.A.14 RF In Soft Key

The RF In Soft Key controls the RF Input signal routing. Select either the T/R Connector or ANT (Antenna) Connector as the RF Input port.

5.5.1.A.15 Reset Meters Soft Key

The Reset Meters Soft Key clears and resets meter readings.

5.5.2 Mobile Simulator

The Trunking Control Mobile Simulator is *option enabled. The Mobile Simulator allows the Test Set to be configured to function as a mobile radio for testing the operation of Base Stations and other mobile radios.

During Mobile Simulation, the Test Set serves as a Base Station or secondary Mobile and transmits on a Phase 1 or SNSZ Control Channel. The Mobile Simulator is enabled by selecting Mobile on the Control Soft Key located on the Trunking Control Tile.

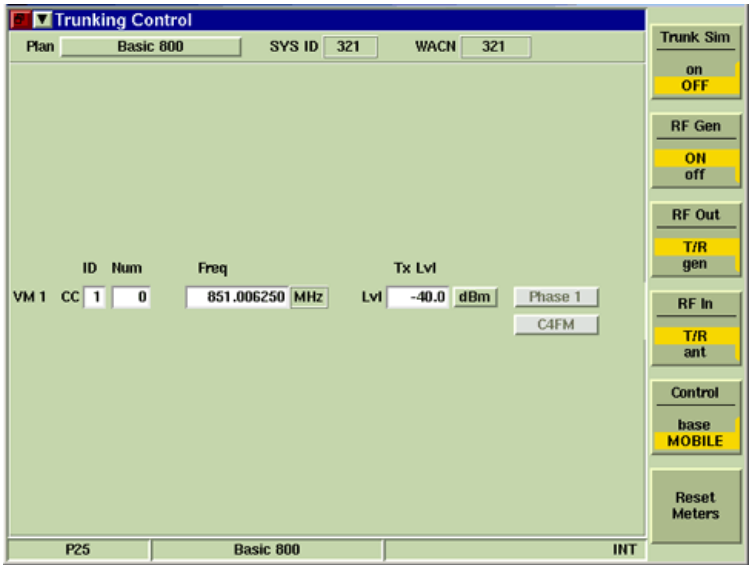

Fig. 5-9 Trunking Control Tile - Mobile Simulator

5.5.2.A Field/Soft Key Definitions

5.5.2.A.1 Plan

Selects the System Plan to be used when testing the UUT. Custom System Plans can be defined and saved using the System Plan Configuration Tile.

5.5.2.A.2 Sys ID

Indicates System ID associated with the selected System Plan. The Sys ID is currently equivalent to the NAC. This field is system specific and must match the UUT.

5.5.2.A.3 WACN

Indicates Wide Area Communications Network identifier of the selected System Plan. This field is system specific and must match the UUT.

5.5.2.A.4 CC (Control Channel)

The Mobile Control Channel (CC) fields define the ID, Number and Frequency for the VM1 Trunking Control Channel. Either the ID and Number or the ID and Frequency must be defined in order for the Test Set to populate data fields based on the System Plan selected on the System Plan Configuration Tile.

X2-TDMA Mobile Simulated Calls operate on a Phase 1 Protocol Control Channel.

5.5.2.A.5 ID/NUM

ID and Num (Number) fields define the frequency according to the System Plan defined on the System Plan Configuration Tile. ID and Frequency fields define the Number according to the System Plan defined on the System Plan Configuration Tile.

5.5.2.A.6 Freq (Frequency)

Frequency fields are defined by selecting the ID/Num fields or be entering the values manually.

5.5.2.A.7 Protocol

Selects the P25 protocol to be used for each channel. P25 Phase 1 and Analog are the protocol types currently supported by the P25 Base Option. Other protocol types are *option enabled.

5.5.2.A.8 Modulation

The Modulation drop-down menu selects the Modulation type to be used by the Mobile simulator.

5.5.2.A.9 Trunk Sim Soft Key

Enables/disables Trunked Mode Simulator. When the Trunking Simulator is enabled, the Test Set reconfigures the transmit and receive parameters on the RF Control Tile based on the parameters defined on the Trunking Control Tile.

5.5.2.A.10 RF Gen Soft Key

Selects and indicates the On/Off state of the RF Generator output from the Test Set. When the generator is disabled, an RF OFF indicator is shown on the Tile.

5.5.2.A.11 RF Out Soft Key

The RF Out Soft Key controls the RF Output signal routing. Select either the GEN (Generator) Connector or T/R Connector as RF Output port.

5.5.2.A.12 RF In Soft Key

The RF In Soft Key controls the RF Input signal routing. Select either the T/R Connector or ANT (Antenna) Connector as the RF Input port.

5.5.2.A.13 Control Base/Mobile Soft Key

The Control Base/Mobile Soft Key selects whether the Test Set is simulating a Base or Mobile Radio.

5.5.2.A.14 Reset Meters Soft Key

The Reset Meters Soft Key clears and resets meter readings.

5.6 TRUNKING MESSAGES TILE

5.6.1 Adjacent Status Broadcast Messages (390XOPT214)

The Adjacent Status Broadcast Messaging (ASB) Option provides users with the ability to configure repeater control channel messages. The fields on the Adjacent Status Broadcast Message Tile are used to define the parameters of an adjacent repeater site.

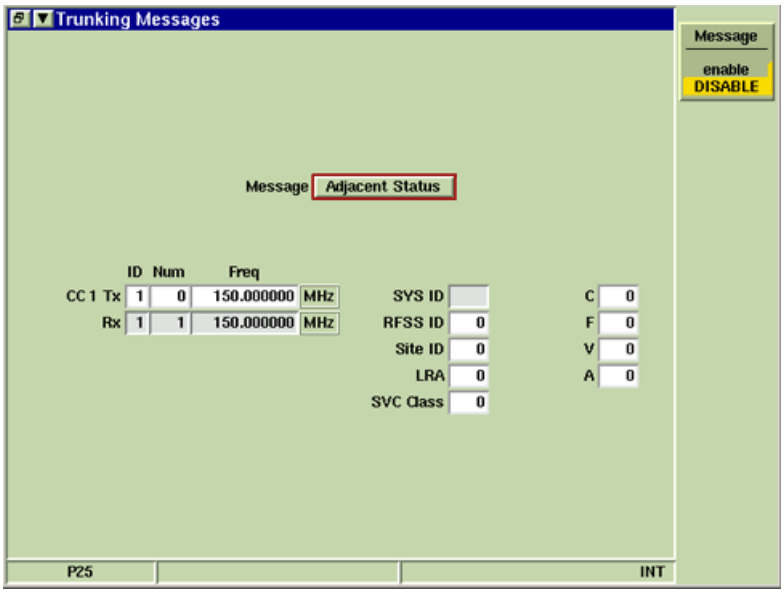

Fig. 5-10 Adjacent Status Broadcast Messages - Implicit Mode

5.6.1.A Field Definitions

Message Soft Key must be in DISABLE state to change Adjacent Status Broadcast Message parameters. Attempts to change parameters when ASB message is ENABLED results in system generated error message.

NOTE	Some parameters are only accessible when the P25 Explicit Message Option is installed in the Test Set.

5.6.1.A.1 Tx/Rx ID

The ID field displays value used for the Channel ID field of the Tx/Rx Channel in adjacent site packets. The ID value selects the channel configuration associated with the channel number to determine the Tx/Rx frequency.

5.6.1.A.2 Tx/Rx Number

The Number field displays the Channel Number field of the Tx/Rx Channel in adjacent site packets. The Number value sets the number of channel slots to offset the Channel ID from the selected base frequency to calculate the Tx/Rx Frequency.

5.6.1.A.3 Tx/Rx Frequency

The Frequency field displays the Tx/Rx Channel frequency of the adjacent site for information purposes only: this frequency is not transmitted. If the channel configuration settings of the adjacent channel is identical to those of the repeater simulator the user can enter a value in this field to set the adjacent site transmit frequency. The closest corresponding control channel number is displayed in the channel number field. Changing the Frequency field does not affect the Channel ID setting. If the channel configuration settings for the adjacent site and the repeater simulator are not identical, setting the frequency will not select a correct channel number because the channel computation is based upon the repeater simulator's configuration.

5.6.1.A.4 MFID

The MFID field displays the Manufacturer Identifier sent out on adjacent site packets.

5.6.1.A.5 RFSS ID

The RFSS ID field displays the RF Sub-system ID sent out on adjacent site packets.

5.6.1.A.6 SYS ID

The SYS ID field displays the System ID sent out on the adjacent site packets.

5.6.1.A.7 SITE ID

The Site ID field displays the Site ID sent out on the adjacent site packets.

5.6.1.A.8 LRA

The LRA field displays the Local Registration Area sent out on the adjacent site packets.

5.6.1.A.9 SVC CLASS

The SVC Class field displays the Service Class sent out on the adjacent site packets.

5.6.1.A.10 C Bit

The C Bit field displays the “C” bit sent out on the adjacent site packets. Set this field to 1 if the adjacent site is advertising a conventional channel.

5.6.1.A.11 F Bit

The F Bit field displays the “F” bit sent out on the adjacent site packets. Set this field to 1 to stimulate a site failure on the adjacent site.

5.6.1.A.12 V Bit

The V Bit field displays the “V” bit sent out on the adjacent site packets. Set this field to 1 if all adjacent site message data is valid.

5.6.1.A.13 A Bit

The A Bit field displays the “A” bit sent out on the adjacent site packets. Set this field to 1 if the adjacent site has a valid, active RFSS network connection.

5.6.2 Secondary Control Channel Broadcast Messages

The Secondary Control Channel Broadcast (SCCB) Messages Option allows users to configure repeater messages (SCCB and SCCB_EXP) to define the parameters of two secondary control channels. System Service Class fields for each channel can be used to control message transmission. Implicit message format transmits all data to the repeater simulator as single block messages. This format is designed for simple networks operating on 700 Hz and 800 Hz bands where the repeater can provide a minimum amount of information. The radio uses the provided information to imply what the remaining data should be. For example, since the 800 MHz band uses a standard -45 MHz transmit offset, the repeaters only need to inform the radio of the receive frequency when it assigns a voice channel. Because the receive channel has been identified, the radio can “imply” the transmit channel.

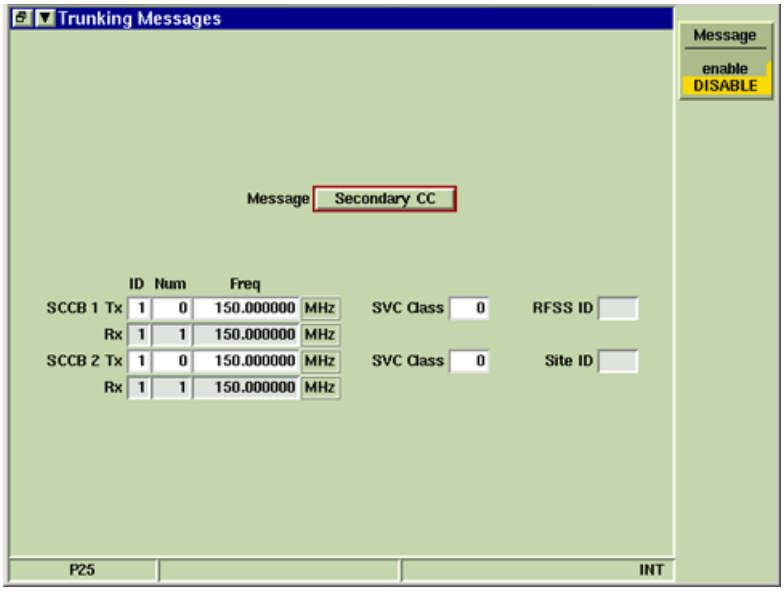

Fig. 5-11 Secondary Control Channel Broadcast Messages - Implicit Mode

5.6.2.A Field Definitions

Message Soft Key must be in DISABLE state to change Secondary Control Channel Broadcast Message parameters. Attempts to change parameters when SCCB message is ENABLED results in system generated error message.

> **NOTE** Some parameters are only accessible when the P25 Explicit Message Option is installed in the Test Set.

5.6.2.A.1 Tx/Rx ID

The ID field displays the Channel ID field of the Tx/Rx Channel in SCCB packets. The value selects the channel configuration associated with the channel number to determine the Tx and Rx frequencies.

5.6.2.A.2 Tx/Rx Number

The SCCB Channel Number field displays the Channel Number field of the Tx/Rx Channel in SCCB packets. The value sets the number of channel slots to offset the Channel ID from the selected base frequency to calculate the Tx/Rx Frequency.

5.6.2.A.3 Tx/Rx Frequency

The Frequency field displays the Tx/Rx Channel frequency: this frequency is not transmitted. Users set the SCCB Tx/Rx frequency by entering a value in this field. The closest corresponding channel number is displayed in the Tx/Rx Channel Number field. Changing this field does not affect the Channel ID setting.

5.6.2.A.4 RFSS ID

The RFSS ID field displays the RF Sub-system ID sent out on in SCCB packets.

5.6.2.A.5 Site ID

The Site ID field displays the Site ID sent out on the SCCB packets.

5.6.2.A.6 Service Class

The SVC CLASS field displays the System Service Class of an SCCB channel. Zero indicates that a Channel is invalid, therefore a user can enter “0” in this field to block the transmission of SCCB message(s).

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Chapter 6 - Setting Up Calls

6.1 INTRODUCTION

This chapter describes how to use the 3900 in the following test scenarios:

- Configure 3900 to Simulate Base Station - Conventional (Non-Trunked) System
- Configure 3900 to Simulate Base Station - Trunked System
- Place Group Call from Test Set to Mobile
- Place Group Call from Mobile to Test Set
- Place Unit to Unit Call from Test Set to Mobile
- Place Unit to Unit Call from Mobile to Test Set
- Configuring SmartNet™/SmartZone™ Base Simulation

Refer to Chapter 3, P25 Test and Measurement Tiles, for a description of P25 Test and Measurement Tiles.

Refer to Chapter 4, P25 Configuration Tiles, for a description of P25 Configuration Tiles.

Refer to Chapter 5, P25 Protocol Tiles, for a description of P25 Protocol Tiles.

NOTE	Some of the call configurations described in this chapter are option enabled.

6.2 CONFIGURE 3900 TO SIMULATE BASE STATION - CONVENTIONAL (NON-TRUNKED) SYSTEM

Option Requirements

- P25 Option 390XOPT200

To configure the Test Set for Base Station Simulation for evaluating a Conventional (Non-Trunked) P25 mobile radio:

STEP	PROCEDURE

1. Power on Test Set and select P25 System.
2. Restore Test Set to Factory Defaults, selecting Settings and GUI restore option.
3. Connect Antenna Port on UUT to Test Set T/R Connector with coaxial cable.
4. Configure Test Set Measurements Tiles to display Simulator Tile, UUT Measurements Tile, Data Link Tile and Channel Analyzer.

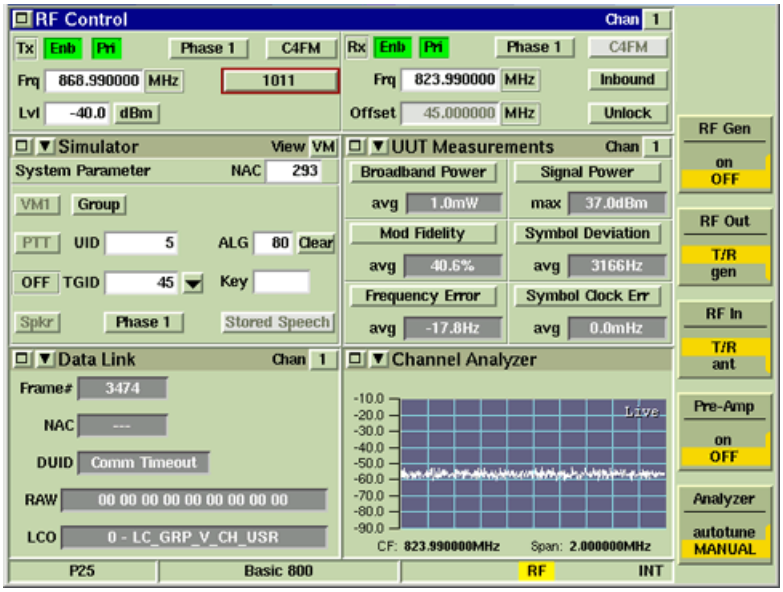

Fig. 6-1 Conventional Base Simulation Tile Layout

5. Select RF Control Tile. Set RF Out and RF In Soft Keys to TR.
6. Set Test Set Transmit frequency to match UUT Receive frequency. The example uses 868.99 MHz.
7. Set Test Set Receive frequency to match UUT Transmit frequency. The example uses 823.99 MHz.
8. Verify Gen Level is at default value of -40 dBm.
9. Verify Offset is in default state (Unlocked).
10. Set Test Set Transmit Pattern to a non-standard pattern (Voice, 1011, or Silence). The example uses 1011.
11. Select Simulator Tile. Set NAC value to match radio programming. The example uses 293.
12. Set UID to any valid non-zero value. The example uses 5.
13. Set TGID to any valid non-zero value. The example uses 45.
14. Select RF Control Tile. Enable Tx and Rx Channel. Set RF Gen Soft Key to ON.

STEP	PROCEDURE

15. Power on UUT. Verify selected tone (Pattern) is being transmitted on radio. Some radios display the UID of the received call. If UUT has this functionality, verify UID on radio matches UID defined on Test Set Simulator Tile.

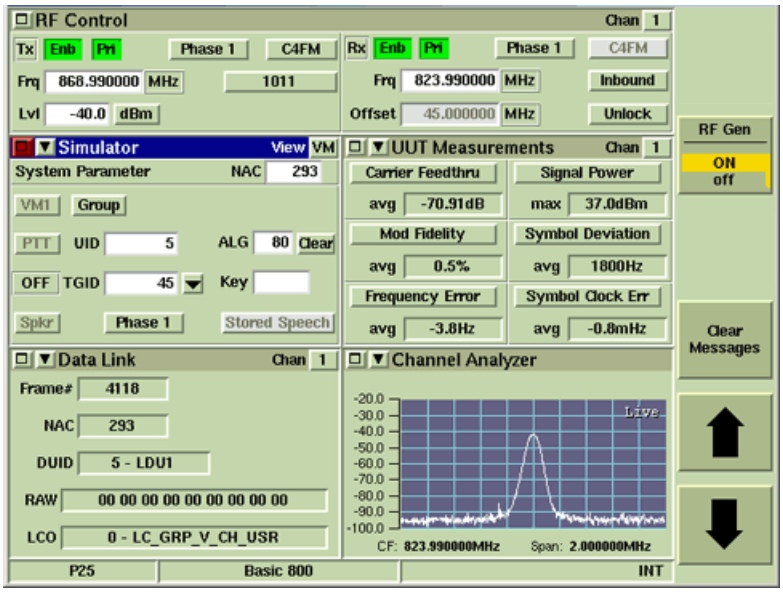

Fig. 6-2 Conventional Base Simulation Call Data

16. Key Radio to obtain readings on Test Set.

6.3 CONFIGURE 3900 TO SIMULATE BASE STATION - TRUNKED SYSTEM

Option Requirements

- P25 Option 390XOPT200
- P25 Trunking Option 390XOPT201

In this configuration the Test Set is configured to operate as a trunked base station. The following UUT parameters must be known when configuring Base Station Simulation:

- UUT System ID
- UUT WACN
- UUT Base Frequency
- First Control Channel Frequency in UUT scan list
- UUT Channel Spacing value
- UUT Tx Offset value

STEP PROCEDURE

To configure the Test Set for Base Station Simulation for evaluating a Trunked P25 mobile radio:

1. Power on Test Set and select P25 System.
2. Restore Test Set to Factory Defaults, selecting the Settings and GUI restore option.
3. Connect Antenna Port on UUT to Test Set T/R Connector with coaxial cable.
4. Select System Plan Configuration Tile. Select or configure a system plan appropriate to the network programming of the UUT.

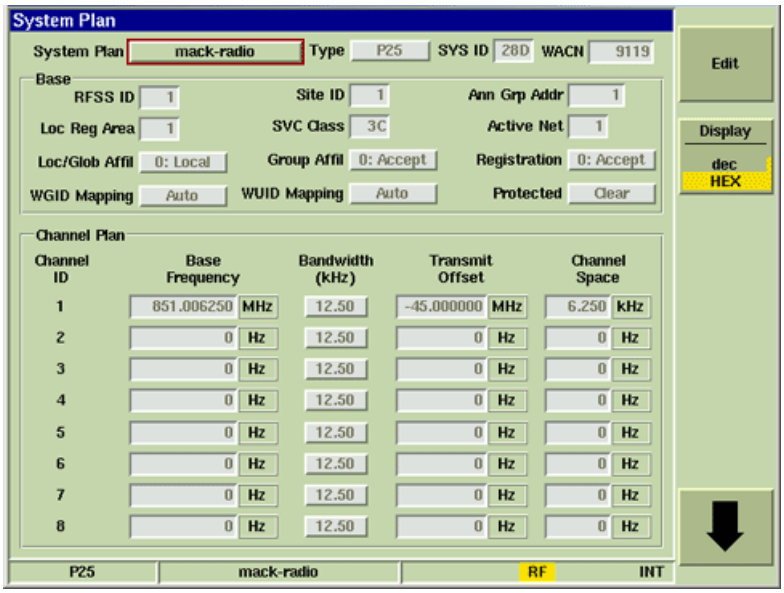

Fig. 6-3 Configure P25 System Plan

5. Select the Trunking Control Tile on one of the measurement tiles.

STEP	PROCEDURE

6. Configure other measurement tiles as desired. The example shows the Simulator Tile selected on two measurement tiles, with VM View on one of the Simulator Tiles and Log View on the other Simulator Tile.

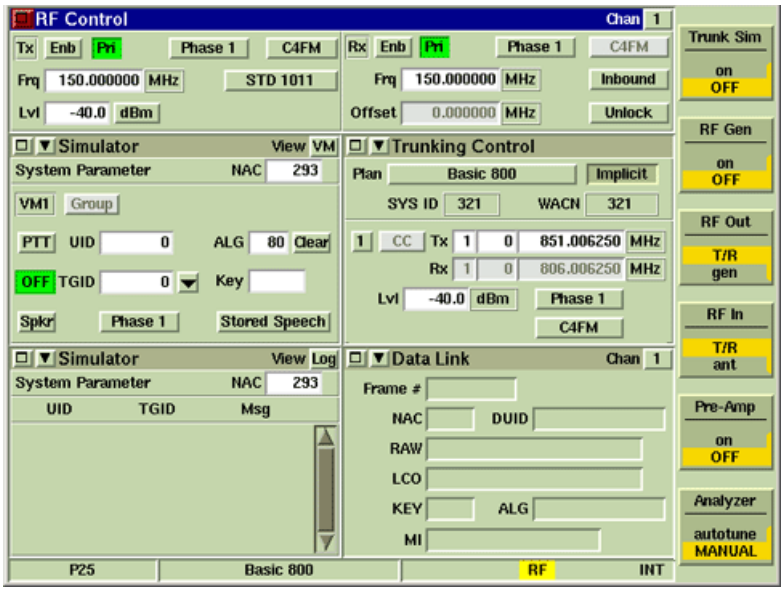

Fig. 6-4 Trunking Base Simulation Tile Configuration

7. Select and maximize Trunking Control Tile. Set Control Channel Frequency to match one of the UUT's programmed scan frequencies. The example uses 860.775 MHz. Control Channel Number updates when frequency is entered.

8. Set Control Channel and Voice Channel so that frequency spacing is a value between
100 kHz and 1 MHz. The example uses 200 kHz frequency spacing.

9. Minimize Trunking Control Tile.

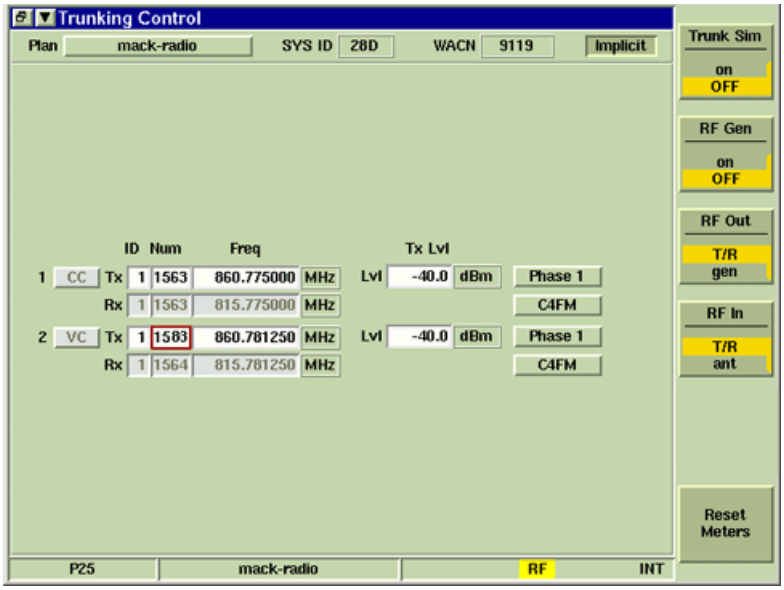

Fig. 6-5 Trunking Base Simulation Trunking Control Tile

STEP	PROCEDURE

10. Set Trunk Sim Soft Key to ON. RF Control Tile Tx and Rx Frequency fields update to Trunking Control Tile values and RF Gen Soft Key updates to ON.

11. Simulator Tile can be selected to view the call registration and affiliation process.

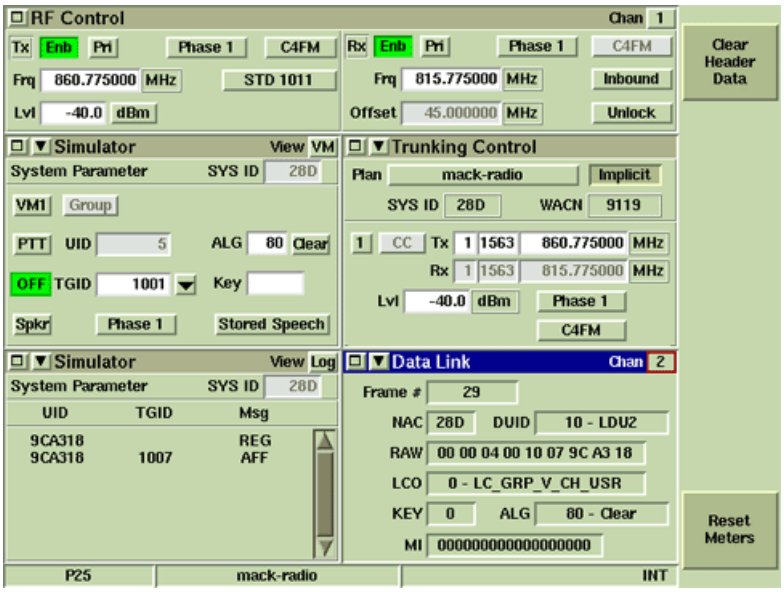

Fig. 6-6 Trunking Base Simulation - Mobile Call Registration

12. UUT (external mobile) is now registered and affiliated with the Test Set's simulated trunked network. UUT can now participate in call.

Refer to the following sections for configuring calls:

- Configure Groups Calls
- Configure Unit to Unit Calls
- Configuring SmartNet™/SmartZone™ Base Simulation

6.4 CONFIGURE GROUPS CALLS

6.4.1 Place Group Call from Test Set to Mobile

Option Requirements

- P25 Option 390XOPT200

In this type of call the Test Set's Virtual Mobile functions as the originator of the group call.

STEP	PROCEDURE

1. Power on Test Set and select P25 System.
2. Restore Test Set to Factory Defaults, selecting the Settings and GUI restore option.
3. Connect Antenna Port on UUT to Test Set T/R Connector with coaxial cable.
4. Configure Test Set Measurements Tiles to display Simulator Tile, UUT Measurements Tile, Data Link Tile and Channel Analyzer.

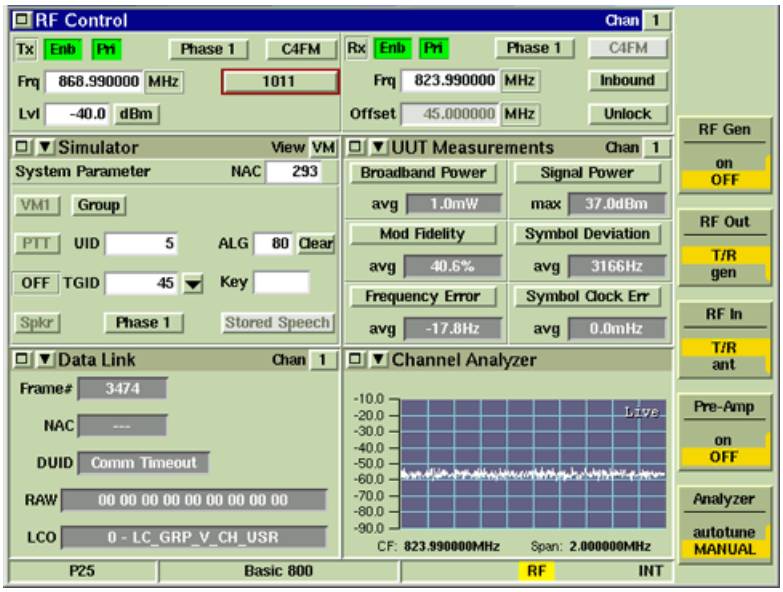

Fig. 6-7 Conventional Base Simulation Tile Layout

5. Select RF Control Tile. Set RF Out and RF In Soft Keys to TR.
6. Set Test Set Transmit frequency to match UUT Receive frequency. The example uses 868.99 MHz.
7. Set Test Set Receive frequency to match UUT Transmit frequency. The example uses 823.99 MHz.
8. Verify Gen Level is at default value of -40 dBm.
9. Verify Offset is in default state (Unlocked).
10. Set Test Set Transmit Pattern to a non-standard pattern (Voice, 1011, or Silence). The example uses 1011.
11. Select Simulator Tile. Set VM UID to an arbitrary value. The example uses 5.

STEP	PROCEDURE

12. Set TGID to match UUT network programming. The TGID value is reported in the Log view of the Simulator Tile after the external mobile affiliates with the Test Set. The example uses 1007.

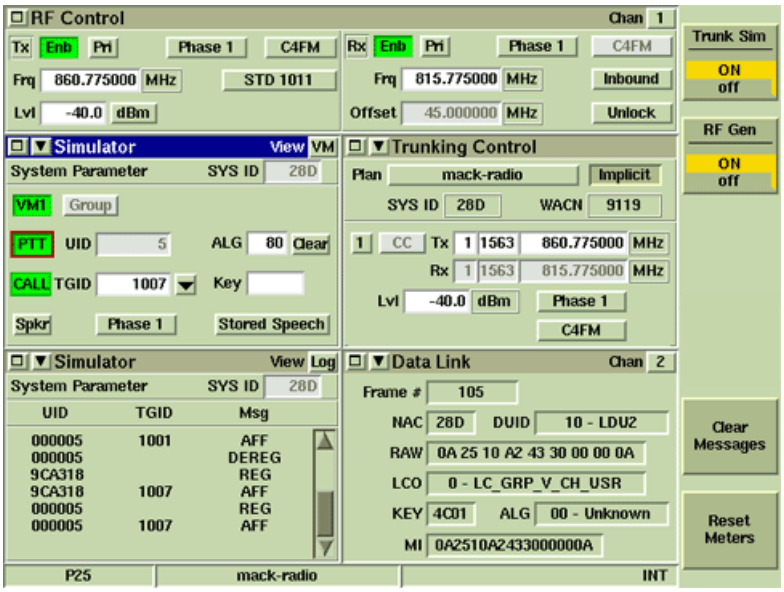

Fig. 6-8 Trunking Base Simulation - Call to Mobile

13. Enable the VM1 toggle button to “power on” the Virtual Mobile. Enable the PTT toggle button to “key” the Virtual Mobile and initiate the Group call. The UUT emits the Stored Speech or Voice Pattern being generated by the Test Set.

6.4.2 Place Group Call from Mobile to Test Set

Option Requirements

- P25 Option 390XOPT200

In this type of call the Test Set simulates the base station and the Test Set's Virtual Mobile is the destination of the group call.

STEP	PROCEDURE

1. Power on Test Set and select P25 System.
2. Restore Test Set to Factory Defaults, selecting the Settings and GUI restore option.
3. Connect Antenna Port on UUT to Test Set T/R Connector with coaxial cable.
4. Configure Test Set Measurements Tiles to display Simulator Tile, UUT Measurements Tile, Data Link Tile and Channel Analyzer.

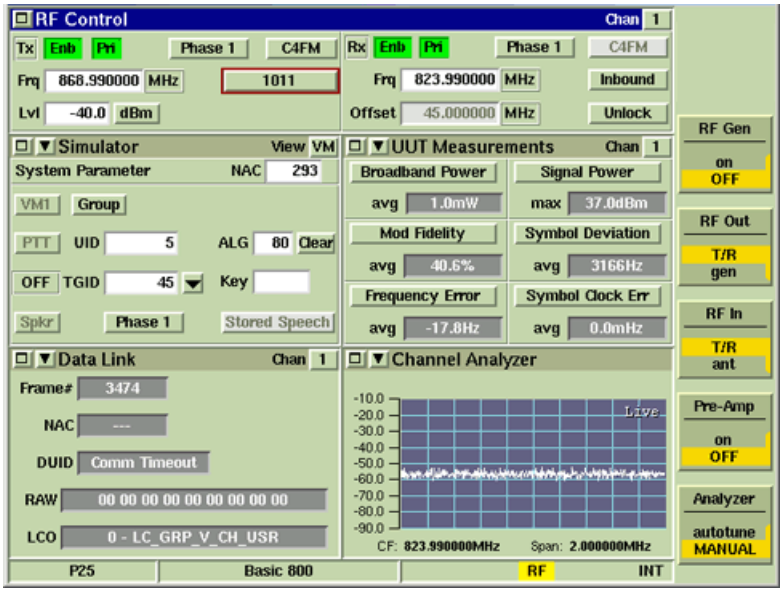

Fig. 6-9 Conventional Base Simulation Tile Layout

5. Select RF Control Tile. Set RF Out and RF In Soft Keys to TR.
6. Set Test Set Transmit frequency to match UUT Receive frequency. The example uses 868.99 MHz.
7. Set Test Set Receive frequency to match UUT Transmit frequency. The example uses 823.99 MHz.
8. Verify Gen Level is -40 dBm (default value).
9. Verify Offset is in Unlock state (default state).
10. Verify Control Soft Key is set to BASE (default state).
11. Set Test Set Transmit Pattern to a non-standard pattern (Voice, 1011, or Silence). The example uses 1011.
12. Select Simulator Tile. Set VM UID to an arbitrary value. The example uses 5.
13. Verify Call Type is Group (default setting).

STEP	PROCEDURE

14. Set TGID to match UUT network programming. The TGID value is reported in the Log view of the Simulator Tile after the external mobile affiliates with the Test Set. The example uses 1007.

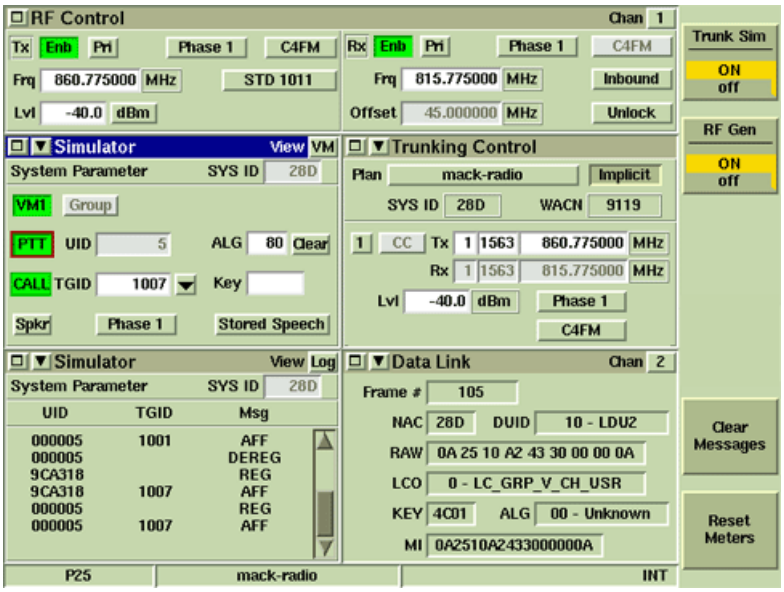

Fig. 6-10 Trunking Base Simulation - Call to Mobile

15. Enable the VM1 toggle button to “power on” the Virtual Mobile. Enable the PTT toggle button to “key” the Virtual Mobile and initiate the Group call. The UUT emits the Stored Speech or Voice Pattern being generated by the Test Set.

6.5 CONFIGURE UNIT TO UNIT CALLS

6.5.1 Place Unit to Unit Call from Test Set to Mobile

Option Requirements

- P25 Option 390XOPT200
- P25 Trunking Option 390XOPT201
- P25 Unit to Unit Call 390XOPT213

In this type of call the Test Set simulates a trunked base station and the Test Set's Virtual Mobile is the originator of the unit to unit call.

Refer to External Mobile documentation for instructions on configuring the External Mobile for unit to unit call.

STEP PROCEDURE

1. Power on Test Set and select P25 System.
2. Restore Test Set to Factory Defaults, select Settings and GUI restore option.
3. Connect Antenna Port on UUT to Test Set T/R Connector with coaxial cable.
4. Configure Test Set Measurements Tiles to display Simulator Tile, UUT Measurements Tile, Data Link Tile and Channel Analyzer.

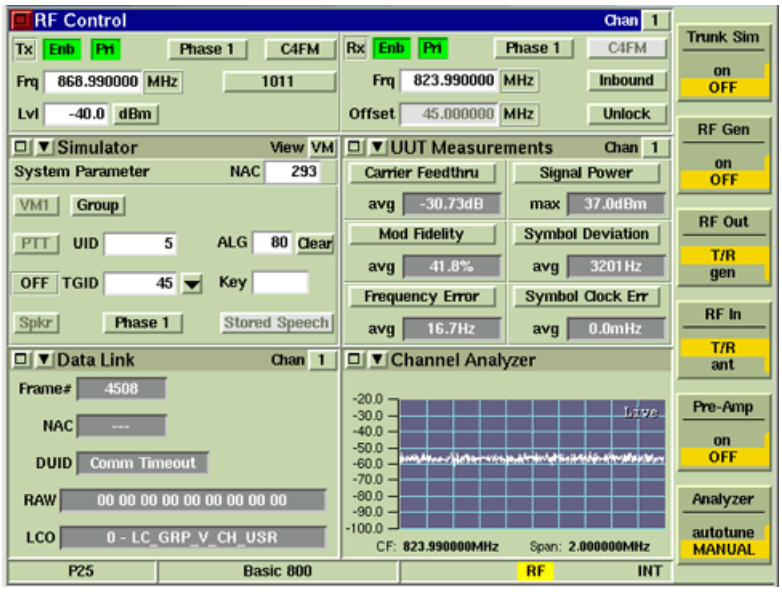

Fig. 6-11 Unit to Unit Call from Test Set - Tile Layout

5. Select RF Control Tile. Set RF Out and RF In Soft Keys to TR.
6. Set Test Set Transmit frequency to match UUT Receive frequency. The example uses 868.99 MHz.
7. Set Test Set Receive frequency to match UUT Transmit frequency. The example uses 823.99 MHz.
8. Verify Gen Level is -40 dBm (default value).
9. Verify Offset is in Unlock state (default state).
10. Set Test Set Transmit Pattern to a non-standard pattern (Voice, 1011, or Silence). The example uses 1011.
11. Select Simulator Tile. Set VM UID to an arbitrary value. The example uses 5.
12. Verify Control Soft Key is set to BASE (default setting).
13. Select Unit as Virtual Mobile Call Type.

STEP	PROCEDURE

14. Set DEST ID to match UUT Unit ID. The UID value is reported in the Log view of the Simulator Tile after the external mobile affiliates with the Test Set.

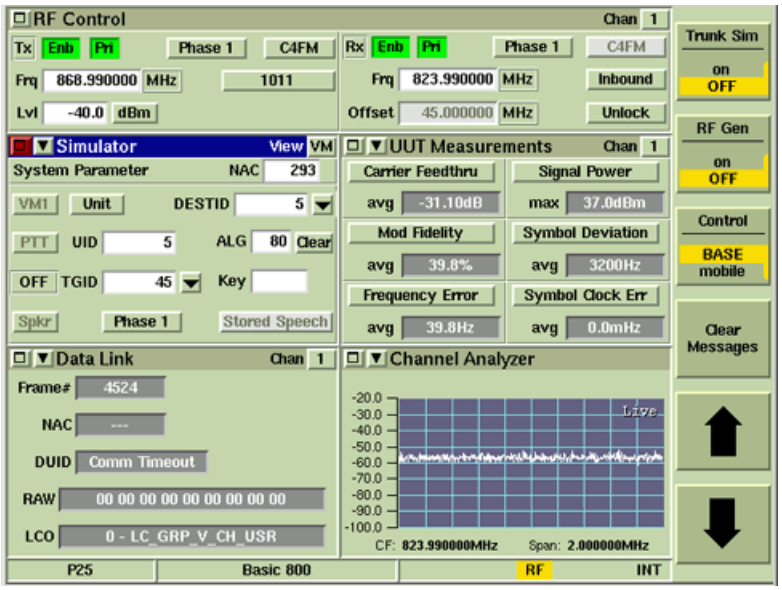

Fig. 6-12 Unit to Unit Call from Test Set - 3900 Parameter Setup

15. Place Trunk Sim Soft Key to ON position.
16. Enable the VM1 toggle button to “power on” the Virtual Mobile.
17. Enable the PTT toggle button to initiate Unit to Unit call to mobile radio.
18. When unit to unit call is initiated, the Test Set’s PTT button turns blue and the Call Status Indicator updates to WAIT. External Mobile should prompt user to answer the incoming call.
19. After call is answered on External Mobile the Call Status Indicator on the Test Set updates to CALL. Incoming signal can be heard on Test Set’s speaker.

6.5.2 Place Unit to Unit Call from Mobile to Test Set

Option Requirements

- P25 Option 390XOPT200
- P25 Unit to Unit Call 390XOPT213

In this type of call the Test Set simulates a trunked base station and via the Virtual Mobile the unit to unit call destination.

Refer to External Mobile documentation for instructions on configuring the External Mobile for unit to unit call.

STEP PROCEDURE

1. Power on Test Set and select P25 System.
2. Restore Test Set to Factory Defaults, select Settings and GUI restore option.
3. Connect Antenna Port on UUT to Test Set T/R Connector with coaxial cable.
4. Configure Test Set Measurements Tiles to display Simulator Tile, UUT Measurements Tile, Data Link Tile and Channel Analyzer.

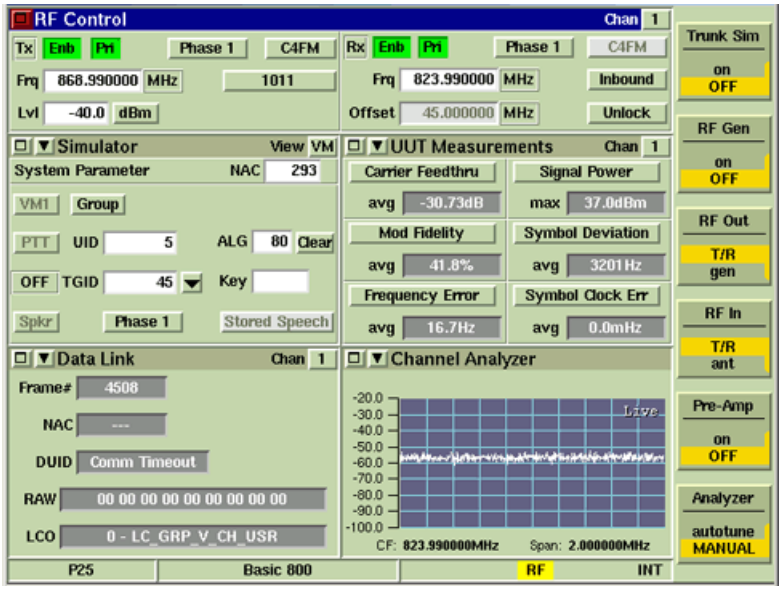

Fig. 6-13 Unit to Unit from Mobile - Tile Layout

5. Select RF Control Tile. Set RF Out and RF In Soft Keys to TR.
6. Set Test Set Transmit frequency to match UUT Receive frequency. The example uses 868.99 MHz.
7. Set Test Set Receive frequency to match UUT Transmit frequency. The example uses 823.99 MHz.
8. Verify Gen Level is at default value of -40 dBm.
9. Verify Offset is in default state (Unlocked).
10. Set Test Set Transmit Pattern to a non-standard pattern (Voice, 1011, or Silence). The example uses 1011.
11. Select Simulator Tile. Set VM UID to an arbitrary value. The example uses 5.
12. Select Unit as Virtual Mobile Call Type.
13. Configure external mobile with Virtual Mobile Unit ID to place private Unit to Unit call.
14. Place Trunk Sim Soft Key to ON position.

STEP	PROCEDURE

15. Enable the VM1 toggle button to “power on” the Virtual Mobile. Use Simulator Tile Log to verify that Virtual Mobile registers and affiliates with external mobile.

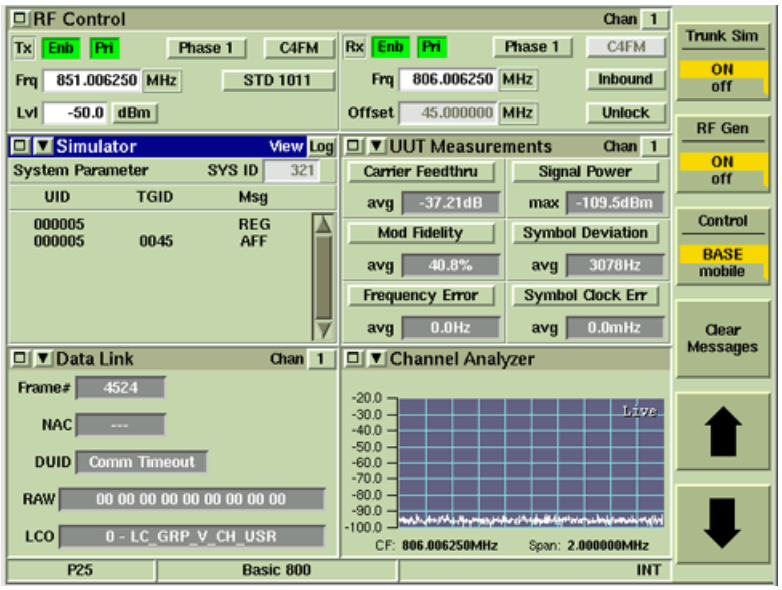

Fig. 6-14 Unit to Unit from Mobile - Call Affiliated

16. Initiate Unit to Unit call from external mobile to Test Set Virtual Mobile.
17. Verify Call Status Indicator on Simulator Tile updates to RING state. Verify PTT toggle button on Simulator Tile updates to ANS state.
18. Press ANS toggle button to establish Unit to Unit call. Stored Speech pattern or Voice should be heard on the external mobile speaker.

6.6 CONFIGURING SMARTNET™/SMARTZONE™ BASE SIMULATION

Option Requirements

- P25 Option 390XOPT200
- P25 SmartNet™/SmartZone™ Option 390XOPT207

To configure the Test Set for SmartNet™/SmartZone™ Base Simulation:

STEP	PROCEDURE

1. Power on Test Set and select P25 System.
2. Restore Test Set to Factory Defaults, Settings and GUI restore option.
3. Connect Antenna of UUT to Test Set T/R Connector with a coaxial cable.
4. Select System Plan Configuration Tile. Select SZ 800 Domestic from System Plan drop-down menu.
5. Use pre-configured BP 800 Domestic Bandplan or configure a custom System Plan according to UUT network capabilities and parameters. Refer to System Plan Configuration Tile for information on configuring system plans.
6. Return to Test Mode.
7. Configure Test Set measurement tiles to display Simulator Control Tile (Log View), Trunking Control Tile, Data Link Tile and Channel Analyzer. Select Channel 2 on the Data Link Tile.

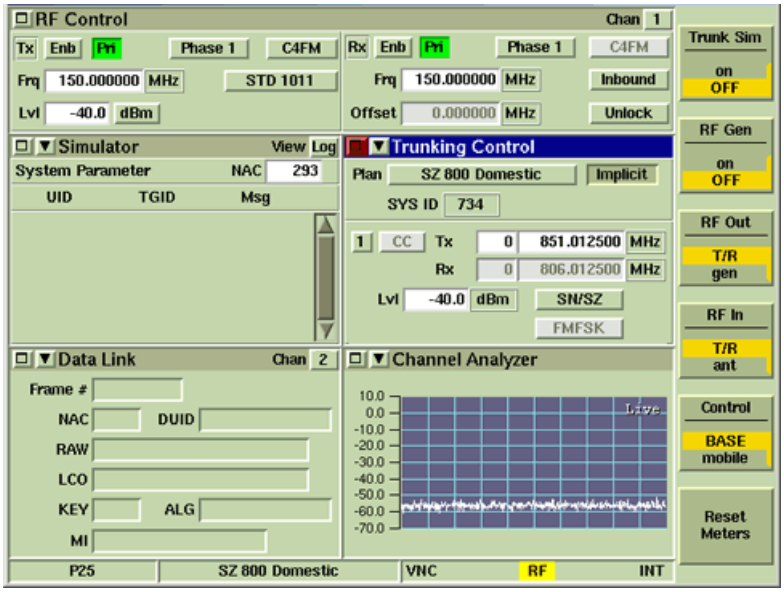

Fig. 6-15 Measurement Tile Configuration

8. Maximize Trunking Control Tile.
9. Set Control Channel Frequency according to UUT operating parameters. The example uses Channel ID 0, 851.0125 MHz. Verify frequency matches Channel ID.
10. Set Voice Channel Frequency according to UUT operating parameters. The example uses Channel ID 25, 851.6375 MHz. Verify frequency matches Channel ID.

STEP PROCEDURE

11. Set RF In and RF Out Soft Key to TR.

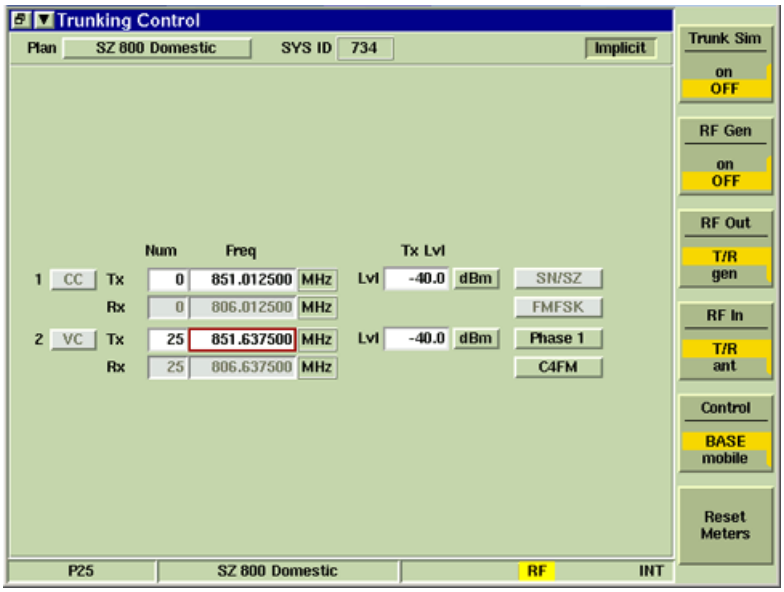

Fig. 6-16 Trunking Control Tile Configuration

12. Minimize Trunking Control Tile.
13. Set Trunk Sim Soft Key to ON. Power on UUT.
14. Verify radio display indicates that site trunking has been established.
15. Radio Registration and Affiliation can be verified on Simulator Tile.
16. Radio measurements can obtained on the UUT Measurements Tile by selecting Channel 2.

NOTE	When using the Base Simulator for obtaining SmartNet™/ SmartZone™ trunked radio measurements, set Measurements and Protocol Tiles to Channel 2.

Appendix A - Measurement Meter Dependencies

The UUT Measurement Meters available in the 3900 P25 Option depend on the options installed in the Test Set and the type of Protocol and Modulation selected on the RF Control Tile. The following table shows the option required (in addition to P25 Base Option) and the protocol and modulation type that must be selected to enable and/or obtain valid meter measurements.

	Selected Protocol							
Meter	**Analog**	**Phase 1**	**Phase 2 HCPM**	**Phase 2 HDQPSK**	**X-TDMA**	**SNSZ FMSFSK**	**SNSZ Analog**	**Requires Option #**
Adjacent Channel					x			R2122A / R2124A
AF/Mod Distortion	x						x	
AF/Mod Frequency	x						x	
Audio Level	x						x	
AF/Mod SINAD	x						x	
AF/Mod SNR/HN	x							
Broadband Power	x	x	x	x	x	x	x	
Carrier Feedthrough		x			x			
EVM		x			x			390XOPT204
Frequency Error		x	x	x	x	x		
FM Deviation	x						x	
FM Deviation Pk+	x						x	
FM Deviation Pk-	x						x	
HSD Deviation						x		390XOPT207
Inband Power	x						x	
Mod Fidelity		x	x	x	x			
Occupied Bandwidth		x		x	x	x		390XOPT250
RF Error	x						x	
Signal Power		x	x	x	x	x		
Slot 0/1 Power			x		x			R2122A / R2124A
Slot Power Ratio			x		x			R2122A / R2124A
Sub-Audible Deviation	x						x	390XOPT207
Symbol Clock Error		x		x	x			
Symbol Deviation		x	x	x	x			
UUT Rx BER		x						
UUT Tx BER		x	x	x	x			

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Appendix B - Motorola Contact Information

For information on purchasing X2-TDMA Software Option, contact Motorola:

CONTACT:	Motorola Parts Call Center	
	Telephone:	(800) 422-4210, ext 6883
	Hours of Operation:	Monday through Friday 7 am to 7 pm CST

HPD® Option Numbers	X2-TDMA Mobile Emulation Test Option	Motorola Part # R2123A
	X2-TDMA Base Station and Parametric Test Option	Motorola Part # R2124A
	X2-TDMA Testing Suite (R2123A and R2124A)	Motorola Part # R2122A

For technical support, contact Motorola:

CONTACT:	Motorola System Support Center	
	Telephone:	(800) 221-7144
	Hours of Operation	24 hours a day/7 days a week

For issues relating to use of the 3900, contact the Aeroflex Sales Support Department:

CONTACT:	Aeroflex	
	Sales Support Department	
	10200 West York Street	
	Wichita, KS 67215	
	Telephone:	(800) 835-2350 (Dial Option 4)
	FAX:	(316) 529-5330
	Email:	techsupport@aeroflex.com

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CHINA / Shanghai	Tel: [+86] (21) 5109 5128	Fax: [+86] (21) 6457 7668
FINLAND	Tel: [+358] (9) 2709 5541	Fax: [+358] (9) 804 2441
FRANCE	Tel: [+33] 1 60 79 96 00	Fax: [+33] 1 60 77 69 22
GERMANY	Tel: [+49] 8131 2926-0	Fax: [+49] 8131 2926-130
HONG KONG	Tel: [+852] 2832 7988	Fax: [+852] 2834 5364
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JAPAN	Tel: [+81] 3 3500 5591	Fax: [+81] 3 3500 5592
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SCANDINAVIA	Tel: [+45] 9614 0045	Fax: [+45] 9614 0047
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* Indicates Regional Sales/Service Center

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