3900 Series

Digital Radio Test Set

NXDN Option Manual

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PUBLISHED BY
VIAVI Solutions, Inc.

Re-Issued Jan 2020

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Preface

SCOPE

This manual contains operational descriptions of the features contained in the 3900 Series NXDN Test System Option. Refer to the 3900 Series Operation Manual for information regarding general Test Set operation.

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 personnel familiar with the use of the 3900. Refer to the 3900 Series Operation Manual for information pertaining to Test Set operation.

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 - General Description

1.1 NXDN OPTION OVERVIEW

The 3900 NXDN Test System (390XOPT440) is an optional test system developed by VIAVI to support the testing of digital two-way radio systems. The NXDN Test System has been developed according to technical specifications outlined in the NXDN Technical Specifications Part 1, Sub-Part A, B, C and D, V1.2.

The 3900 NXDN Test System Option provides the user with the following capabilities:

- Ability to lock/unlock paired generator and receiver frequencies;
- Ability to receive, demodulate and analyze NXDN modulated signals;
- Ability to perform RF and modulation parametric tests on the Unit Under Test (UUT).
- Distribution, Constellation and Eye Diagram graph plots;
- Variety of UUT measurements including Bit Error Rate, Signal Power, Frequency Error, Symbol Clock Error, Symbol Deviation and Modulation Fidelity;
- Power Profile Over Time Display Tile;
- Spectrum Analyzer, Channel Analyzer and Oscilloscope are available within the NXDN Test System.

1.2 SCOPE OF MANUAL

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

- Test Set Instruments
- Tone Encoding
- Tone Decoding
- Frequency List

1.3 NXDN OPTION STATUS

1.3.1 Factory Installed Option

When NXDN is purchased as a factory installed option the NXDN Software Option is ready to use upon receipt.

1.3.2 Post Production Option

If the NXDN Software Option 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.

1.3.3 Verifying NXDN Option Installation

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

STEP	PROCEDURE

1. Push the UTILS Key twice to access the Utils floating menu.
2. Select Software Settings, License from the floating menu.

The License Tile displays a list of installed options (refer to Fig. 1-1). NXDN is 390XOPT440. The option list varies according to the features installed on the Test Set. "Try before you buy" options have an expiration date.

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

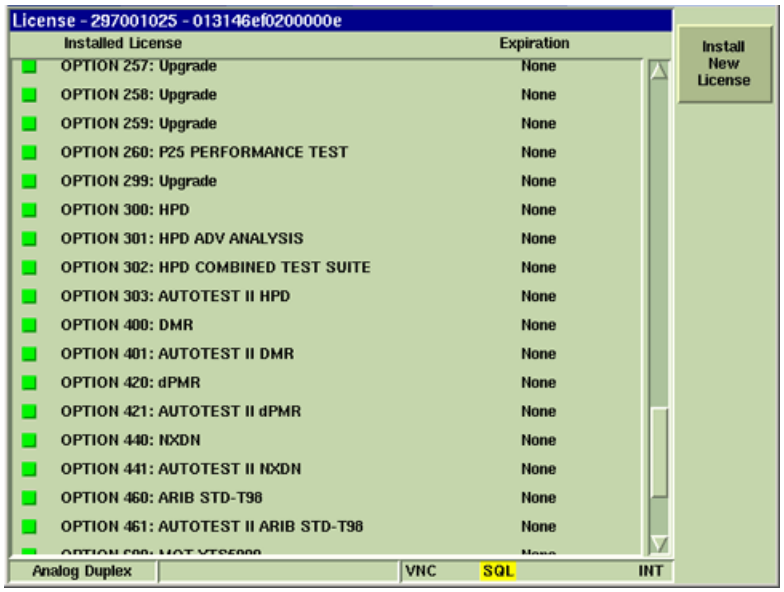

Fig. 1-1 3900 License Tile

Chapter 2 - NXDN System Tiles

2.1 INTRODUCTION

This chapter describes NXDN Tile layout and provides an operational description of NXDN System Tile components.

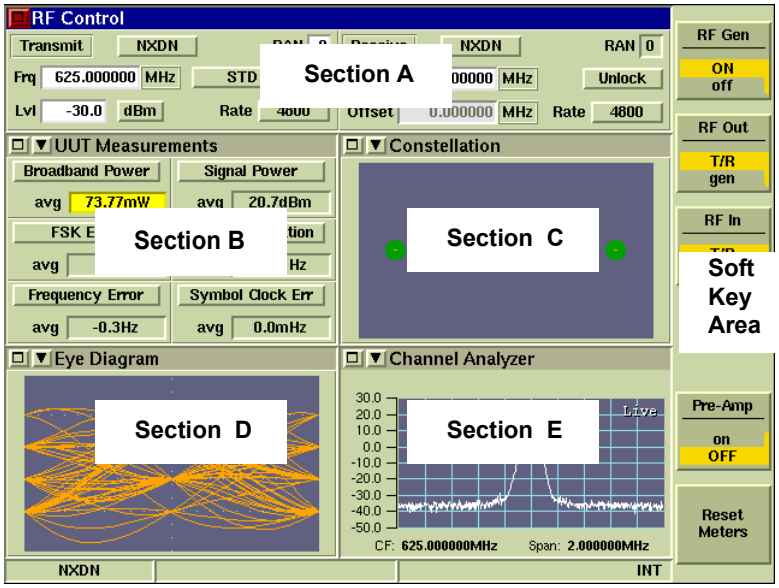

Fig. 2-1 NXDN Tile Layout

2.2 NXDN SYSTEM TILE LAYOUT

The NXDN Display Tiles can be configured according to 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 NXDN User Screen always displays the RF Control Tile when the Tiles are minimized.
- NXDN Test functions are selected from the drop-down menu located on the Tile menus on Sections B through E.
- NXDN includes access to the Channel Analyzer, Spectrum Analyzer and Oscilloscope. Use of the Channel Analyzer, Spectrum Analyzer and Oscilloscope are described in the 3900 Series Operation Manual.

2.3 AUDIO SIGNAL ROUTING

2.3.1 Audio/Demod Signal Routing

Audio/demod signal routing is configured by pressing the Assign Key on the Front Panel. Pressing the Assign Key displays a group of soft keys. The Speaker Toggle Soft Key selects the source and routing of the demod/audio signal applied to the Test Set's loudspeaker.

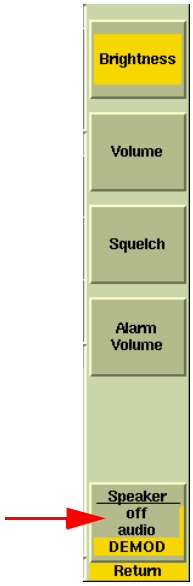

Fig. 2-2 Assign Key - Soft Key Sub-menu

2.3.1.A Field Definitions

2.3.1.A.1 Off

No audio input is being routed to the speaker.

2.3.1.A.2 Audio

Routes the incoming signal from the Audio Input connector to the speaker.

2.3.1.A.3 Demod

Routes the incoming signal from the FGEN Connector to the speaker.

2.4 CONFIGURATION TILES

2.4.1 Offsets Configuration Tile

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

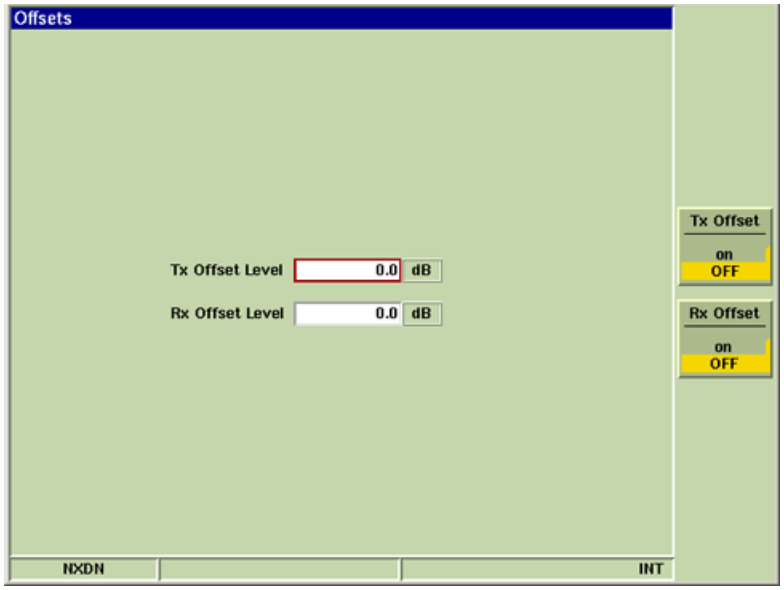

Fig. 2-3 Offsets Configuration Tile

2.4.1.A Field/Soft Key Definition

2.4.1.A.1 Tx Offset Level

Defines RF Generator Level Offset value.

2.4.1.A.2 Rx Offset Level

Defines Receiver Level Offset value.

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

Enables/Disables defined Tx and Rx offset values.

2.4.2 Offsets Cable Loss Measurements

The Cable Loss Measurements functionality provides users with the ability to use the Test Set's Tracking Generator to evaluate a test cable in order to compensate for any cable loss and to characterize attenuators and other devices which impart a gain or loss.

> **NOTE** Cable Loss Measurements are enabled when the 3900 Tracking Generator Option is installed in the Test Set.

2.4.2.A Field/Soft Key Definitions

2.4.2.A.1 Cable Loss File Menu

The Cable Loss File Menu is enabled when the Tracking Generator Option is installed in the Test Set. This menu loads a stored Cable Loss trace file which contains data that defines the RF Generator or RF Analyzer Level Offset by the offset value in the Cable Loss Trace.

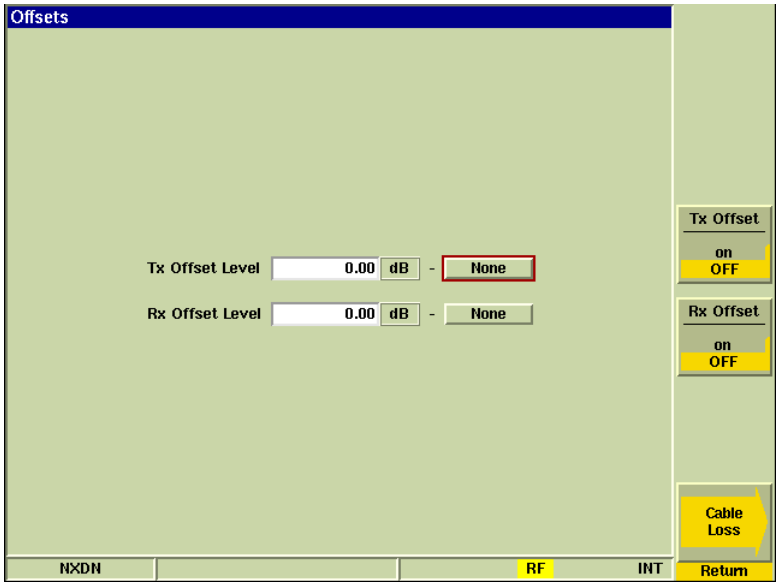

Fig. 2-4 Cable Loss Parameters Enabled

> **NOTE** The Cable Loss File Menu is only populated when one or more Cable Loss traces has been created.

2.4.2.A.2 Cable Loss Soft Key

The Cable Loss Soft Key is enabled when the Tracking Generator Option is installed in the Test Set. The Cable Loss Soft Key accesses soft keys which are used to create tables of amplitude loss for up to three test cables of different configurations.

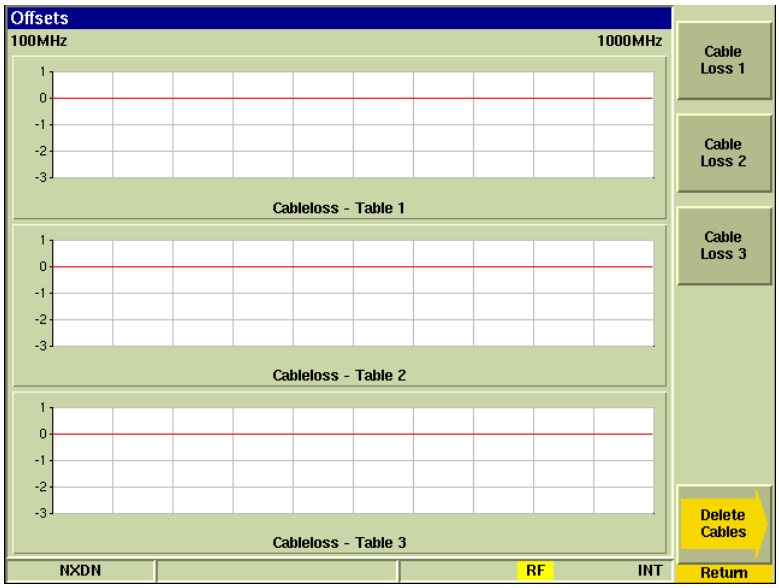

Fig. 2-5 Cable Loss Tables

Pressing the Cable Loss 1, 2 or 3 Soft Key initiates a guided procedure for defining a cable loss table. The Test Set provides a series of on-screen instructions that the user follows to create each table.

NOTE

Cable Loss files are stored in the Test Set's Cable Loss Files directory.

Stored Cable Loss Files can be transferred from one Test Set to another using the File Management Tile. The receiving Test Set must have the Tracking Generator Option installed in order to transfer the files.

Transferred files must be placed in the receiving Test Set's Cable Loss Files directory in order for the file to be accessible.

2.4.3 UUT Measurements Limits Configuration Tile

The UUT Measurements Configuration Tile defines limits for UUT meter readings.

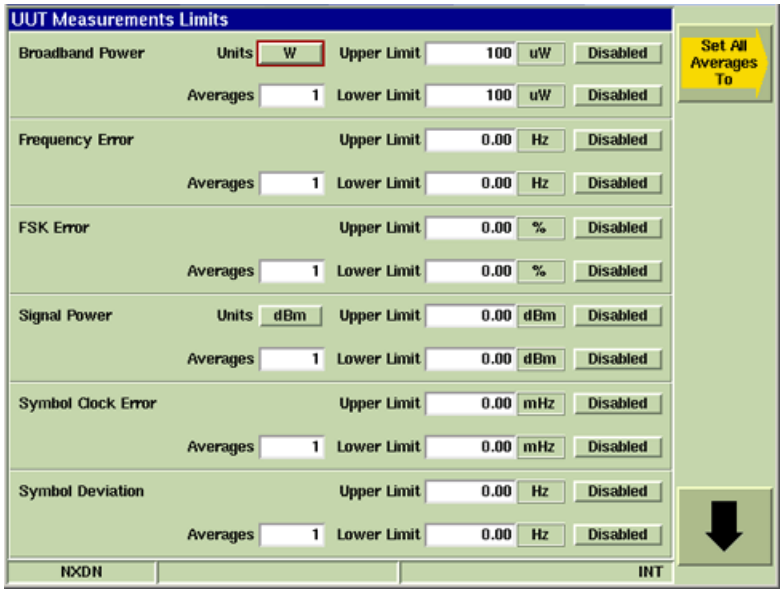

Fig. 2-6 UUT Measurements Limits Configuration Tile

2.4.3.A Field/Soft Key Definitions

2.4.3.A.1 Disabled/Enabled

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

2.4.3.A.2 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 are within enabled Upper and Lower limits the Meter Bar and reading background on the Measurement Tiles turns GREEN.

2.4.3.A.3 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 are within enabled Upper and Lower limits the Meter Bar and reading background on the Measurement Tiles turns GREEN.

2.4.3.A.4 Units

Selects the unit of measure for applicable measurement.

2.4.3.A.5 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.

2.4.3.A.6 Set All Averages To Soft Key

Specifies the number of bursts over which data is averaged for all measurements. Values can also be set independently for each meter.

2.4.4 AutoTune Setup Configuration Tile

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

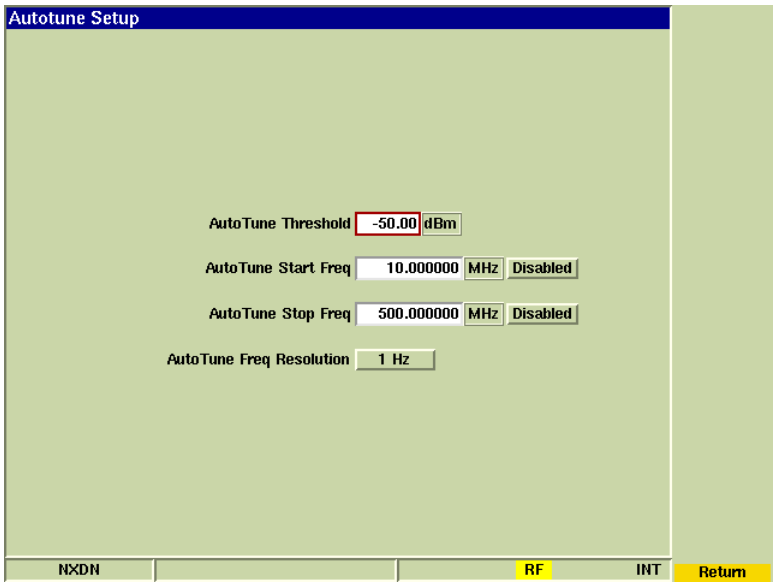

Fig. 2-7 AutoTune Setup Configuration Tile

2.4.4.A Field Definitions

2.4.4.A.1 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.

2.4.4.A.2 AutoTune Start Freq

Sets the lower frequency at which AutoTune sweeps start.

2.4.4.A.3 AutoTune Stop Freq

Sets the upper frequency at which AutoTune sweeps stop.

2.4.4.A.4 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.

2.5 TEST TILES

2.5.1 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 Generator Modulation Tile.

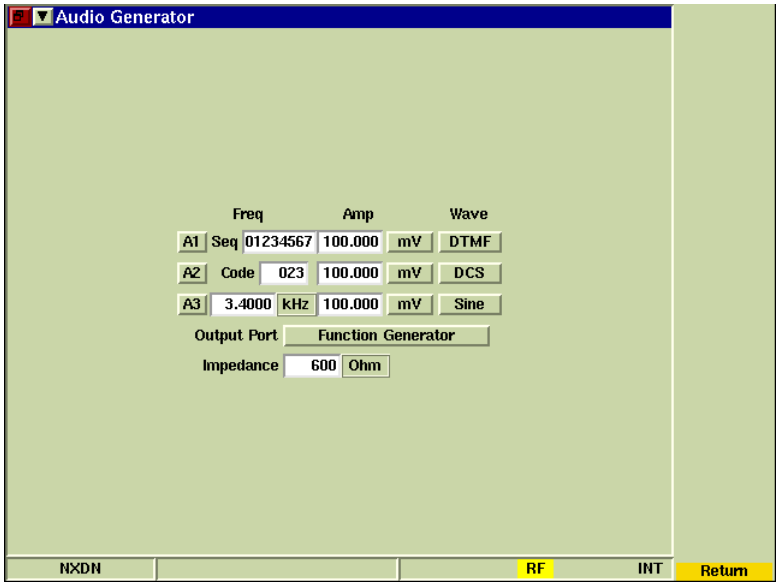

Fig. 2-8 Audio Generator Tile

2.5.1.A AF Generator Field Definitions

2.5.1.A.1 A1, A2, A3 Toggle Buttons

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

2.5.1.A.2 Frequency

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

2.5.1.A.3 Amplitude

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

2.5.1.A.4 Waveform

Defines the Waveform for each AF Generator.

2.5.1.A.5 Sequence

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

2.5.1.A.6 CODE

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

2.5.1.A.7 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.

2.5.1.A.8 Impedance

Defines the external termination value used to calculate the AF Generator power level.

2.5.2 Audio Input Tile

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

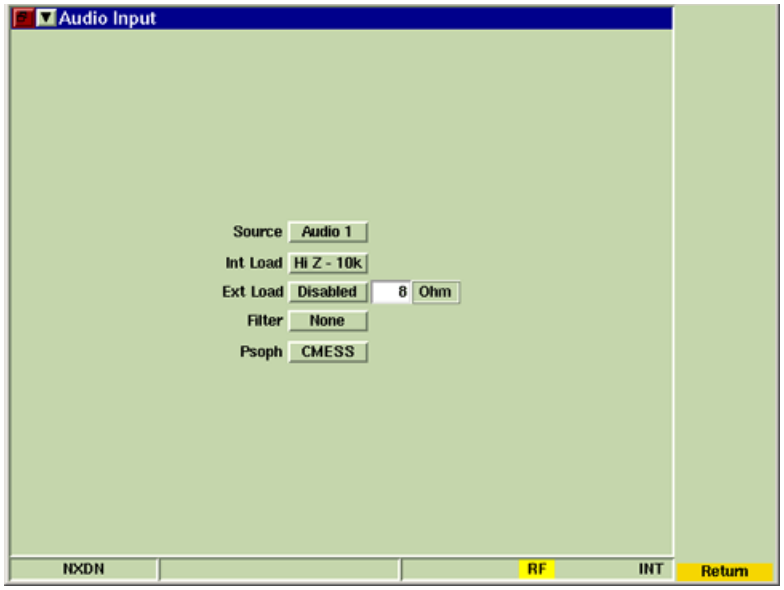

Fig. 2-9 Audio Input Tile

2.5.2.A Field Definitions

2.5.2.A.1 Source

Selects the Audio input source.

2.5.2.A.2 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.

2.5.2.A.3 External Load Value

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 tofcalculate dBm or Watts when Hi Z Impedance is selected.

2.5.2.A.4 External Load

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

2.5.2.A.5 Filter

Selects a measurement filter to include in the measurement path.

2.5.2.A.6 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.

2.5.3 Constellation Tile

The Constellation tile is used to determine proper operation of the transmitter. The four points represent the four deviation states (DIBIT Symbols) of the NXDN FSK modulation shown below. The green plot fields indicate the expected location of plot clusters.

Information Bits	Symbol	4FSK Deviation 4800 sps	4FSK Deviation 9600 sps
01	+3	+1.050 kHz	+2.400 kHz
00	+1	+0.350 kHz	+0.800 kHz
10	-1	-0.350 kHz	-0.800 Hz
11	-3	-1.050 kHz	-2.400 kHz

DIBIT Symbol Mapping to 4FSK Deviation

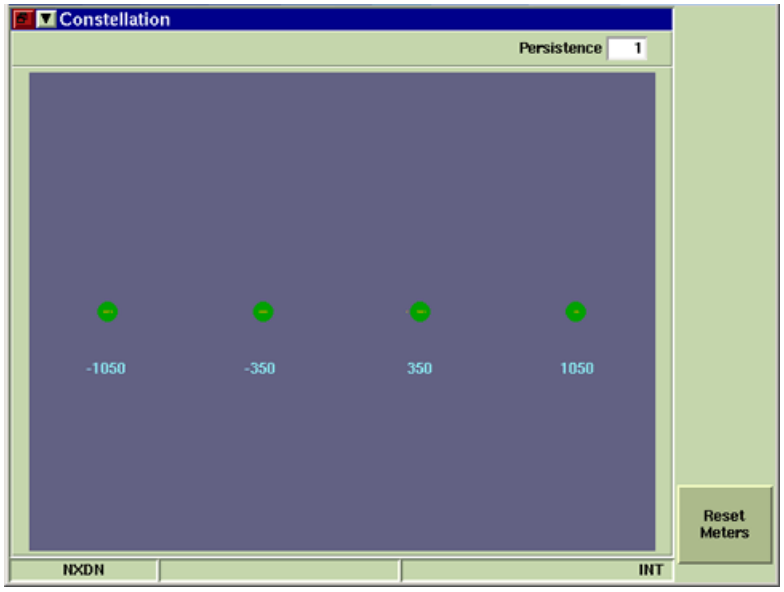

Fig. 2-10 Constellation Tile

2.5.3.A Field/Soft Key Definitions

2.5.3.A.1 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.

2.5.3.A.2 Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

2.5.4 Distribution Tile

The Distribution Tile shows the relative number of symbols in relation to each other. The plot shows the four deviation points and the level of symbols accumulated. For example, a higher level on the +1 (+350 Hz deviation point when rate is 4800 sps; +800 Hz deviation point when rate is 9600 sps) would indicate that more “00” information bits were received compared to the other deviation points.

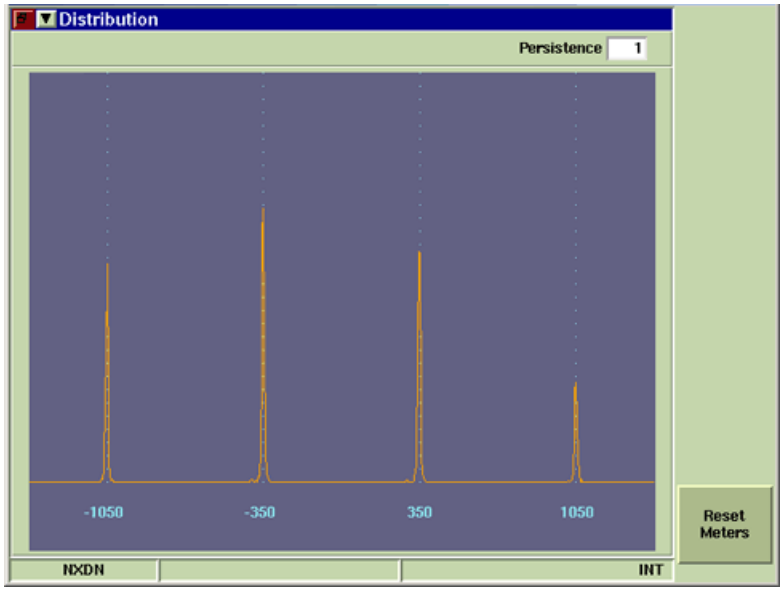

Fig. 2-11 Distribution Tile

2.5.4.A Field/Soft Key Definitions

2.5.4.A.1 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.

2.5.4.A.2 Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

2.5.5 Decode Tile

The Decode Tile displays digital data contained in the NXDN Voice Call Message received from the UUT. Fields appear blank when data is invalid and display --- when the content is not applicable to the received signal. RF Control Receive parameters should be configured according to UUT specifications in order for the Test Set to properly decode the NXDN Voice Call Message.

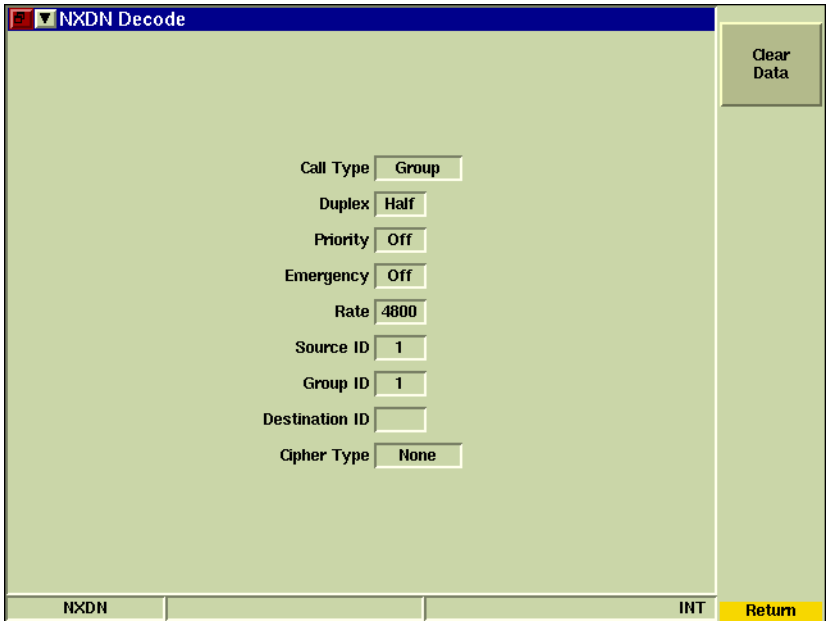

Fig. 2-12 Decode Tile

2.5.6 Encode Tile

The Encode Tile configures the digital data that is to be included in the NDXN Voice Call Message sent to the UUT. Encode parameters and RF Control Transmit parameters should be configured according to UUT specifications in order for the Test Set to send a valid encoded NDXN Voice Call Message.

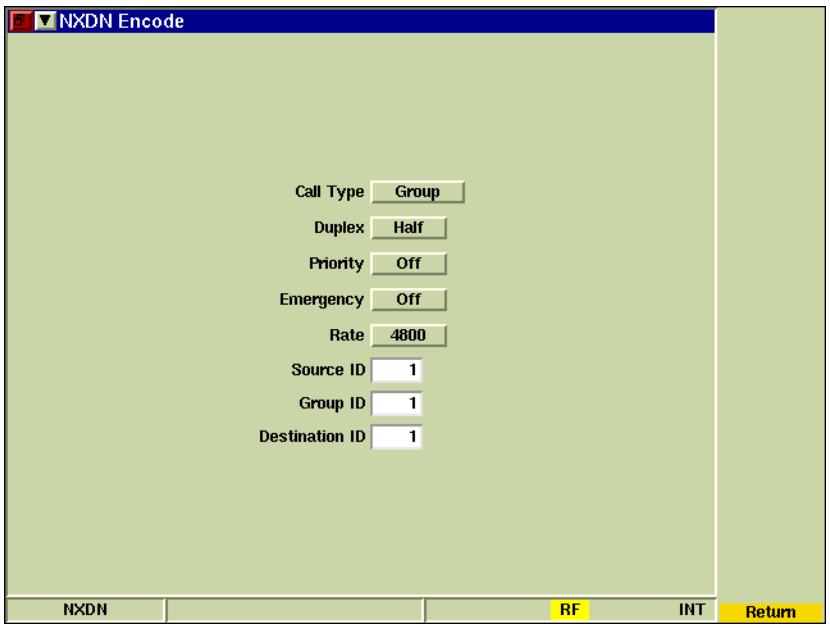

Fig. 2-13 Encode Tile

2.5.6.A Field/Soft Key Definition

2.5.6.A.1 Call Type

Field selects the type of call the Test Set is expecting to receive from the UUT.

2.5.6.A.2 Duplex Mode

Field selects the type of Duplex signal the Test Set expects to receive from the UUT.

2.5.6.A.3 Priority

Field displays the Priority value the Test Set receives from the UUT.

2.5.6.A.4 Emergency Priority

Field defines the Emergency Priority value encoded in the transmit channel.

2.5.6.A.5 Rate

Field displays the transmission rate value the Test Set receives from the UUT.

2.5.6.A.6 Source ID

Field displays the Source ID value the Test Set receives from the UUT.

2.5.6.A.7 Group ID

Field displays the Group ID value the Test Set receives from the UUT. Group ID is not applicable when an Individual Call is being performed.

2.5.6.A.8 Destination ID

Field displays the Destination ID value the Test Set receives from the UUT. Destination ID is not applicable when a Group Call is being performed.

2.5.7 Eye Diagram Tile

The Eye Diagram is used to plot the demodulated signal from one slot of the NXDN signal. The plot shows the demodulated signal periods from that slot which allows the user to observe the deviation accuracy of the demodulated signal at the symbol points. The point at which symbol deviation is measured is referenced to the symbol clock to determine the deviation of the waveform at the symbol time.

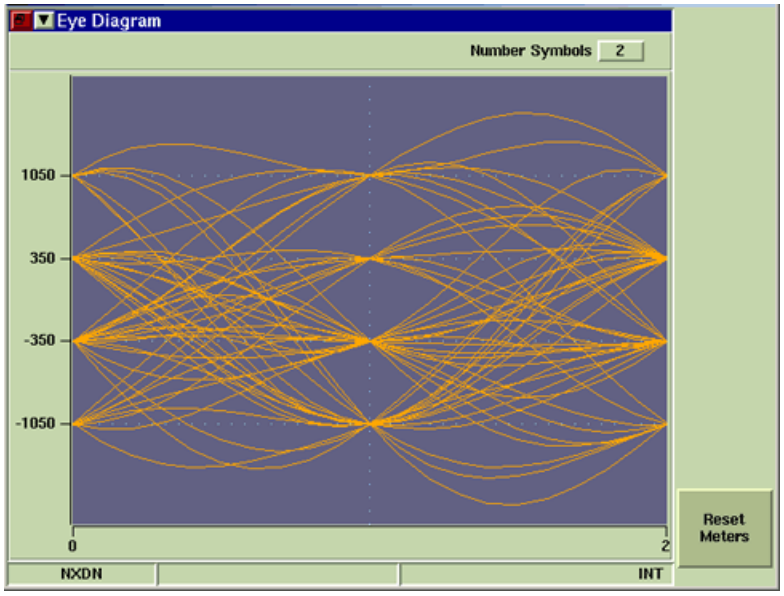

Fig. 2-14 Eye Diagram Tile - 2 Symbols

2.5.7.A Field/Soft Key Definitions

2.5.7.A.1 Number Symbols

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

2.5.7.A.2 Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

2.5.8 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.

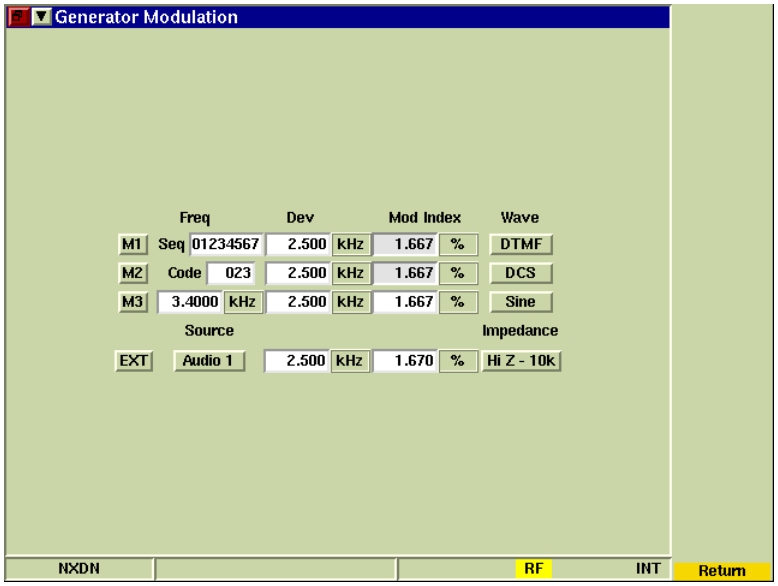

Fig. 2-15 Generator Modulation Tile

2.5.8.A Modulation Generator Field Definitions

2.5.8.A.1 M1, M2, M3 Buttons

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

2.5.8.A.2 Frequency

Sets the frequency for each Modulation generator.

2.5.8.A.3 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.

2.5.8.A.4 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.

2.5.8.A.5 Waveform

Selects Waveform for each modulator.

2.5.8.A.6 Sequence

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

2.5.8.A.7 CODE

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

2.5.8.A.8 EXT Toggle Button

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

2.5.8.A.9 Source

Selects the Audio input source.

2.5.8.A.10 Impedance

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

2.5.9 Power Over Time Tile

The Power Over Time Tile displays the power measurement of the received signal over a specified period of time. This measurement provides an indication of the transmitter's stability.

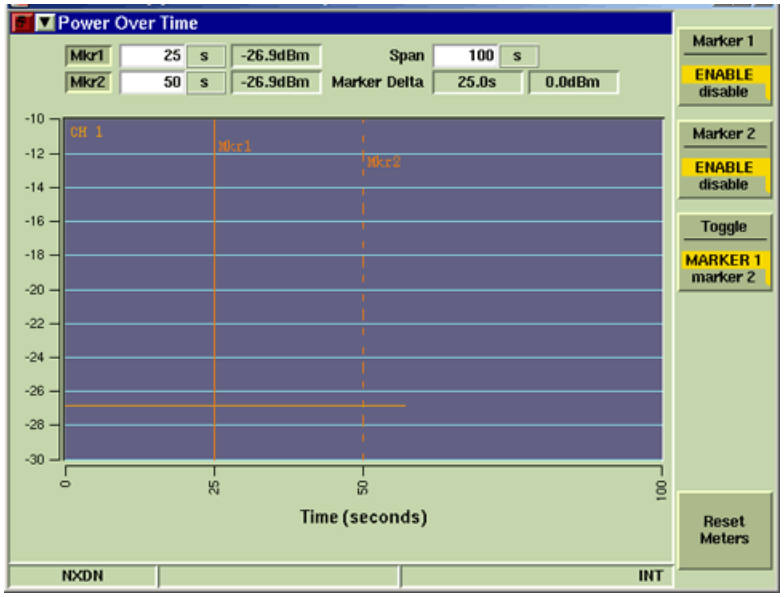

Fig. 2-16 Power Over Time Tile

2.5.9.A Field/Soft Key Definitions

2.5.9.A.1 Mkr1/Mkr2

The Mkr1 and Mkr2 toggle buttons enable Marker 1 and Marker 2. Markers must be enabled to edit the Marker position fields. Status and functionality of these toggle buttons is linked to the Marker 1 and Marker 2 Soft Keys.

2.5.9.A.2 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.

2.5.9.A.3 Power Measurement

The data fields beside each marker position field indicate the power reading at the signal point.

2.5.9.A.4 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.

2.5.9.A.5 Span

Span sets the length of time (horizontal scale) over which the power measurement is displayed. Maximum Span setting is 1800 seconds.

2.5.9.A.6 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.

2.5.9.A.7 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.

2.5.9.A.8 Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

2.5.10 RF Control Tile

The RF Control Tile configures the Test Set for testing the physical layer of NXDN 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.

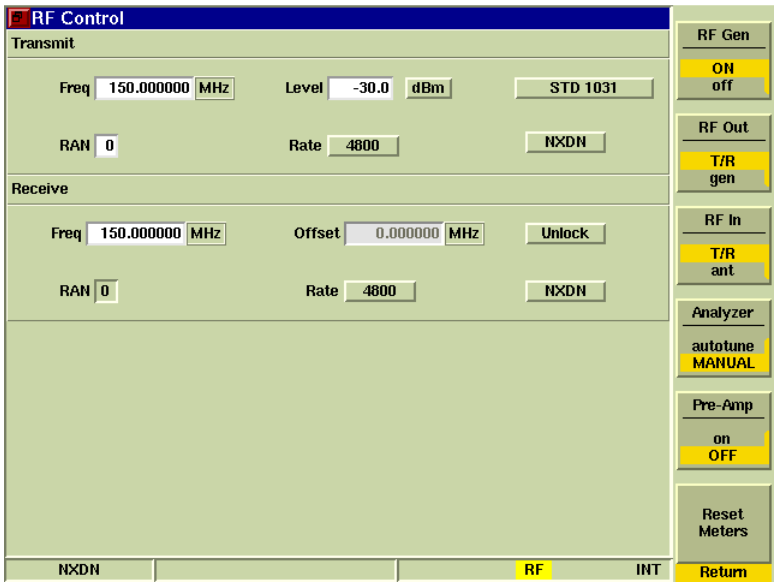

Fig. 2-17 RF Control Tile - NXDN Protocol

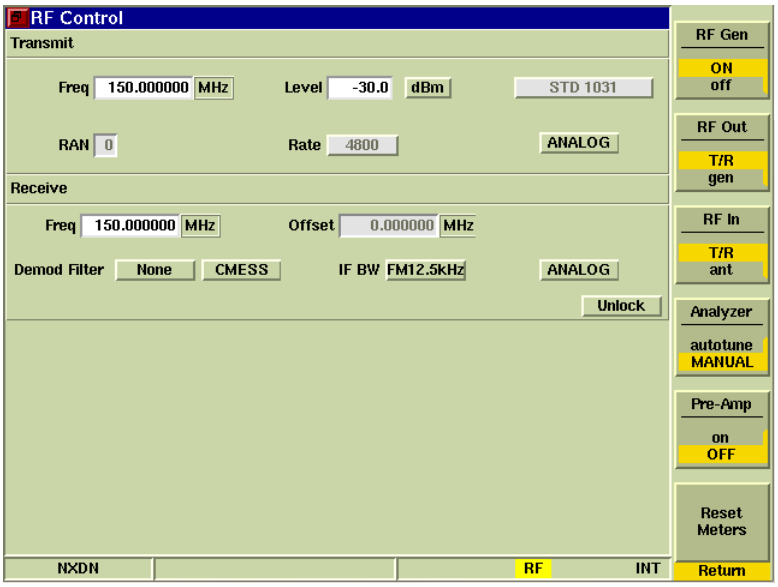

Fig. 2-18 RF Control Tile - Analog Protocol

2.5.10.A Transmit Field Definitions

2.5.10.A.1 Frq/Freq (Frequency)

The Transmit Frequency defines carrier frequency of the NXDN signal being generated by the Test Set and is used to determine proper receiver operation.

2.5.10.A.2 Level

Level defines the output power of the 3900 NXDN transmit signal from either the T/R or the GEN Connector.

2.5.10.A.3 PD / EMF

When the RF Output Level unit of measurement is Volts, the value can be displayed as EMF or PD.

2.5.10.A.4 Units (Level)

The units drop-down menu selects the output power level unit of measure.

2.5.10.A.5 RAN (Radio Access Number)

Field defines the Radio Access Number transmitted by the Test Set.

2.5.10.A.6 Rate

The Rate drop-down menu selects the rate at which data is transmitted. Rate is specified in Bits Per Second.

2.5.10.A.7 Protocol

Defines Protocol for Transmit Channel.

2.5.10.A.8 Pattern

The Pattern drop-down menu selects the type of pattern the Test Set sends to the UUT.

STD 1031

The STD 1031 Pattern is typically used to verify the audio performance of a radio. When a radio is programmed with a RAN (Radio Access Number) of 1, it should produce a 1031 Hz tone when it receives a STD 1031 Signal.

CAL STD

The CAL STD Pattern is a test pattern that introduces a 5% BER into the STD 1031 Pattern. This pattern is typically used to verify a radio's ability to detect and correct BER.

STD 511

The STD 511 Pattern is used to generate the standard modulation data stream which is used to perform BER testing. The standard modulation data stream is a 511-bit pseudo-random binary sequence defined by ITU-T.

STD INTFR

The STD INTFR Pattern is used to generate a standard interfering modulation data stream in a test environment where the Test Set RF Generator is used as an interferer. The standard interfering modulation data stream is a 32767-bit pseudo-random binary sequence defined by ITU-T.

2.5.10.B Receive Field Definitions

2.5.10.B.1 Frq/Freq (Frequency)

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

2.5.10.B.2 Offset

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.

2.5.10.B.3 Lock/Unlock

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

2.5.10.B.4 RAN (Radio Access Number)

Field displays the Radio Access Number received by the Test Set.

2.5.10.B.5 Rate

The Rate drop-down menu selects the rate at which data is received. Rate is specified in Symbols Per Second (BPS).

2.5.10.B.6 Demod Filter

Parameter is enabled when Analog Protocol is selected. Selects a measurement filter to include in the receive signal path.

2.5.10.B.7 Psoph

Parameter is enabled when Analog Protocol is selected. 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.

2.5.10.B.8 IF Bandwidth

Parameter is enabled when Analog Protocol is selected. The IF BW field selects the IF Bandwidth Filter included in the demodulation path.

2.5.10.B.9 Protocol

Defines Protocol for Receive Channel.

2.5.10.C Soft Key Definitions

2.5.10.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.

2.5.10.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.

2.5.10.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.

2.5.10.C.4 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.

2.5.10.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.

2.5.10.C.6 Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

2.5.11 UUT Measurements Tile

The UUT Measurements Configuration Tile displays UUT measurement readings.

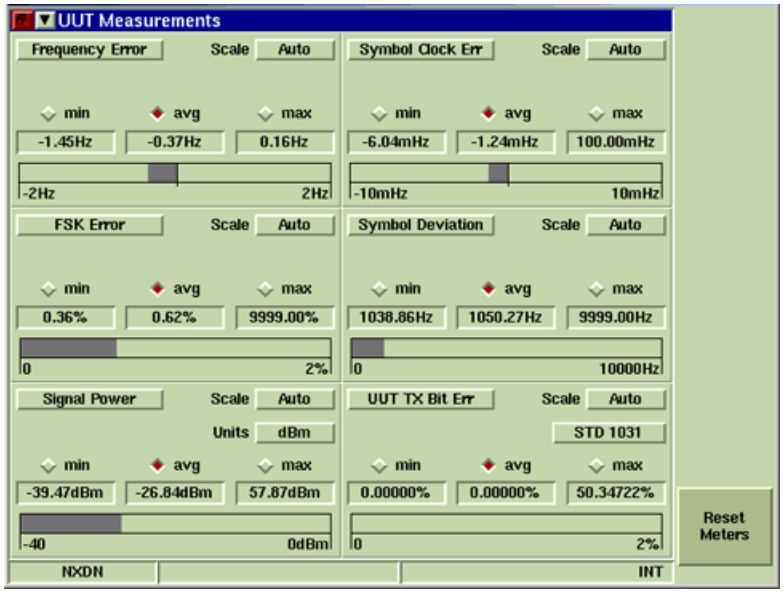

Fig. 2-19 UUT Measurements Tile

2.5.11.A Field/Soft Key Definitions

2.5.11.A.1 Meter Drop-down Menu

The drop-down menu on each section of the UUT Measurements Tile selects the type of meter to be displayed in that section.

2.5.11.A.2 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.

2.5.11.A.3 Bar Graph

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 Measurements Configuration Tile.

2.5.11.A.4 Scale

Defines the display of the Meter Bar. User selection is made from a drop-down box offering the choice of Auto (default value) or a fixed value.

2.5.11.A.5 Reset Meters Soft Key

The Reset Meters Soft Key clears and resets the meter readings.

2.5.11.B Measurement Meters

The drop-down menu on each section of the UUT Measurements Tile selects the type of meter to be displayed in that section. Audio and Demod Meters are enabled when Analog Protocol is selected.

2.5.11.B.1 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).

2.5.11.B.2 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).

2.5.11.B.3 Broadband Power

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.

2.5.11.B.4 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).

2.5.11.B.5 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.

2.5.11.B.6 FM Deviation Meter

The FM Deviation Meter measures the amount of deviation present on an FM Modulated RF Signal received by the 3900. When Analog Protocol is selected, the FM Deviation Meter does not include a filter in the signal path.

2.5.11.B.7 Frequency Error

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 on the RF Control Tile.

2.5.11.B.8 FSK Error

The FSK Error Meter measures rms deviation error at the symbol deviation points of the signal. FSK Error is measured over 60 ms and is expressed as the percentage of the deviation. FSK Error should not exceed 5%.

Outbound traffic (signal generated by BR) contains 144 symbols at 4800 symbols per second; inbound traffic (signal generated by mobile) contains 288 symbols at 9600 symbols per second.

2.5.11.B.9 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.

2.5.11.B.10 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.

2.5.11.B.11 RF Error Meter

The RF Error Meter indicates the difference (frequency error) between the received RF signal and the defined receive frequency. RF Error measurements are only valid when Analog Protocol is selected. The accuracy of the RF Error Meter is defined by the Resolution drop-down menu.

2.5.11.B.12 Signal Power

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 -100 to +10 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.

2.5.11.B.13 Sinad Meter (Audio/Demod)

The AF SINAD Meter measures the receive quality of a radio receiver. The Demod SINAD Meter measures the quality of the incoming RF Signal being demodulated by the Test Set. This meter also measures the quality of a radio transmitter when an audio signal is modulated. Meter is enabled when Analog protocol is selected on the Tx and Rx signals.

2.5.11.B.14 SNR Meter (Audio/Demod)

The Audio/Demod SNR Meters can be configured for Hum and Noise or Normal SNR measurements. Analog Protocol must be selected to enable these meters. Hum and Noise enables a Reference Lock button on the meter.

2.5.11.B.15 Symbol Clock Error

The Symbol Clock Error Meter measures the symbol clock of an incoming NXDN signal over 60 ms. Symbol Clock Error measurements should not exceed ±48 mHz.

Outbound traffic (signal generated by BR) contains 144 symbols at 4800 symbols per second; inbound traffic (signal generated by mobile) contains 288 symbols at 9600 symbols per second.

2.5.11.B.16 Symbol Deviation

The Symbol Deviation Meter measures the deviation of the NXDN signal at symbol time, normalized to the 1050 Hz symbol point when receive rate is 4800 symbols per second; 2400 Hz symbol point when receive rate is 9600 symbols per second. Symbol Deviation is measured over 60 ms.

Outbound traffic (signal generated by BR) contains 144 symbols at 4800 symbols per second; inbound traffic (signal generated by mobile) contains 288 symbols at 9600 symbols per second. Symbol deviation measurements should be >945 and <1155 for rate of 4800 symbols per second and >2160 and <2640 for rate of 9600 symbols per second.

2.5.11.B.17 UUT Tx Bit Error

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

Chapter 3 - NXDN Channel Logger

3.1 NXDN CHANNEL LOGGER INTRODUCTION

The NXDN Channel Logger (390XOPT442) 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 NXDN 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.

NOTE	Received XML files can be viewed by either a text editor or a customer developed Viewing Application. This is an **option enabled* feature.

3.2 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. Netcat is available at http://www.vulnwatch.org/netcat/.

3.3 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.

3.4 NXDN XML COMMAND STRUCTURE

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

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

3.4.1 <burst></burst>

The <burst> tag has the following attributes:

3.4.1.A 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).

3.4.1.B phys_channel

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

- 0 = Channel 1
- 1 = Channel 2

3.4.1.C direction

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

3.4.1.D detect

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

3.4.1.E type

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

3.4.1.F 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.

3.5 FILTER PARAMETERS

3.5.1 <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 the following sub-tags (all sub-tags MUST be present), each of which is a boolean value (0/1 on/off true/false):

3.5.1.A <Environment></Environment>

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

3.5.1.B <Raw></Raw>

Raw controls the logging of raw octets received.

3.5.1.C <Protocol_Raw></Protocol_Raw>

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

3.5.1.D <Protocol_Cooked></Protocol_Cooked>

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

3.5.1.E <Voice></Voice>

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

3.5.2 Example LogFilter:

```
<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>
```

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Chapter 4 - Sample Setup File

4.1 NXDN TEST SETUP SAMPLE CONFIGURATION FILE

The Test Set contains sample setup files which allow the user to easily configure the Test Set for NXDN testing.

To load the NXDN Loopback Setup file:

STEP	PROCEDURE

1. Open the UTILS Store/Recall Tile.

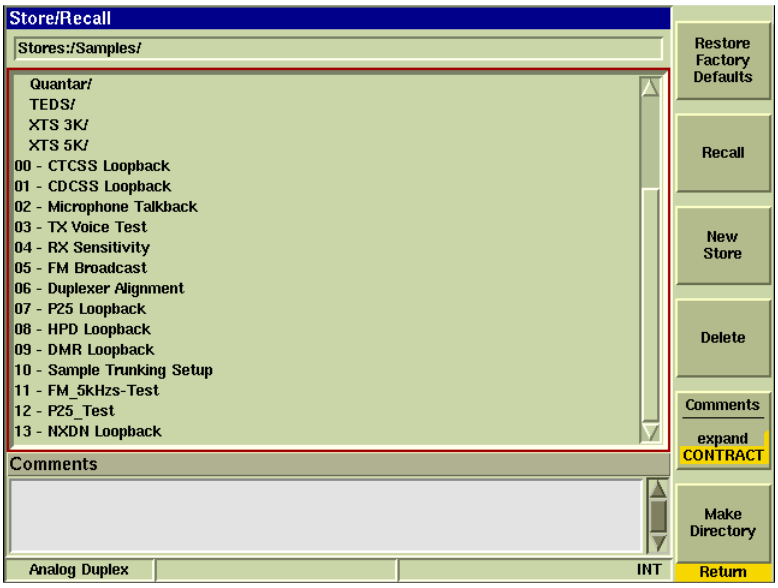

Fig. 4-1 UTILS Store/Recall Tile

2. Select the NXDN Loopback file.
3. Press the Recall Soft Key. Wait while the setup file is loaded.

STEP	PROCEDURE

4. After the NXDN Loopback Setup file is loaded a user can customize parameters to meet UUT specifications.

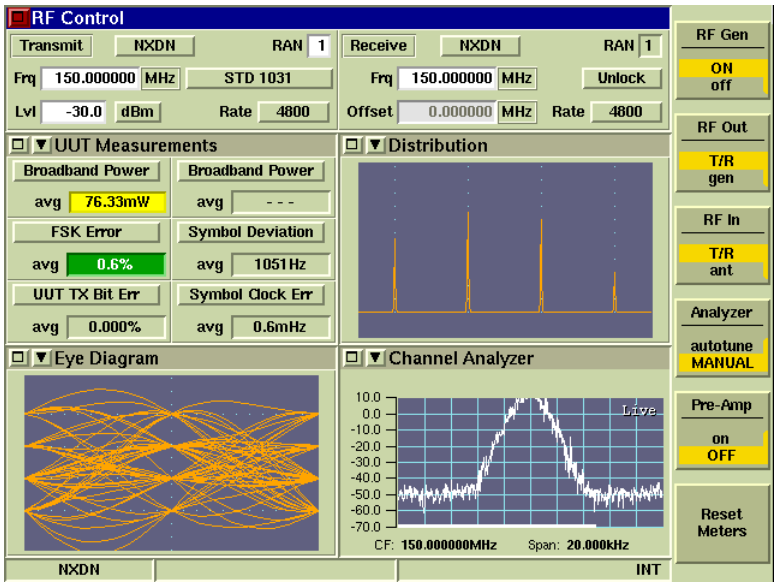

Fig. 4-2 NXDN Loopback Setup FIle

5. Refer to the 3900 Series Operation Manual for instructions about using the UTILS Store/Recall Tile to save the newly configured setup file.

Appendix A - NXDN Terms and Abbreviations

avg	Average reading
Bit Err	Bit Error Rate
CONFIG	Configuration
dB	decibel
dBm	decibel relative to 1 mW
dBV	decibel relative to 1 Volt
dBW	decibel relative to 1 Watt
frq/freq	Frequency
FSK	Frequency Shift Keying
GEN	Generate/Generator
GHz	Giga Hertz
Hz	Hertz
kHz	kilo Hertz
Lvl	Level
max	Maximum reading
MHz	Mega Hertz
min	Minimum reading
Mkr	Marker
Mod	Modulation
ms/msec	Millisecond
mW	milli-Watt
RF	Radio Frequency
Rx	Receive
sps	Symbols Per Second
TOS	Top of Scale
Tx	Transmit
UTILS	Utilities
UUT	Unit Under Test
VNC	Virtual Network Client/Virtual Network Computing
W	Watt

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Part of CD # 6047
Revision M0
Jan 2020

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