TB9100 base station

P25 Transmit Steering Gateway Operation Manual

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Contact Information

Tait Radio Communications
Corporate Head Office

Tait Electronics Limited
P.O. Box 1645
Christchurch
New Zealand

For the address and telephone number of regional offices, refer to our website: www.taitradio.com

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Preface

Scope of Manual

This manual provides information about the configuration and operation of the P25 Transmit Steering Gateway.

Software and hardware versions

- TB9100 conventional firmware V3.60 or later.
- Transmit Steering Gateway V5.10 or later.

Document Conventions

Within this manual four types of alerts may be given to the reader: Warning Caution Important and Note. The following paragraphs illustrate each type of alert and its associated symbol.

Warning! **This alert is used when there is a potential risk of death or serious injury.**

Caution **This alert is used when there is a risk of minor or moderate injury to people.**

Important This alert is used to warn about the risk of equipment damage or malfunction.

Note This alert is used to highlight information that is required to ensure procedures are performed correctly.

Associated Documentation

The following documents provide useful information about other Tait equipment associated with this product. The -xx represents the issue number of the manual.

- TaitNet P25 conventional network system manual (MBA-00032-07)
- TB9100/P25 CG Service Manual (MBA-00039-xx)
- TB9100 and P25 CG Installation and Operation Manual (MBA-00002-xx)
- TB9100 and P25 Customer Service Software (CSS) User's Manual (MBA-00003-xx)

Always get the latest issue of a manual from the Tait Support website www.taitworld.com/technical. In addition to software release notes and the latest issue of a manual, useful downloads from the Support website include Technical notes (TN) which provide technical details not yet in the manuals or solve any problems that may have arisen.

Publication Record

Issue	Publication Date	Description
01	April 2011	First release.

Abbreviations

Abbreviation	Description
CSS	Customer Service Software (CSS) is the Tait PC-based software for monitoring, configuring, and diagnosing a Tait TB9100 base station.
DFSI	Digital Fixed Station Interface - allows direct digital connection between devices, using the FSI TIA open-standard interface.
FSI	Fixed Station Interface - TIA open-standard interface between a fixed device and a P25 sub-system.
GPIO	General Purpose Input/Output.
RS-232	Recommended Standard 232. A protocol for serial communications between DTE (data terminal equipment) and DCE (data communications equipment).
SSH	Secure shell.

1 Introduction

TB9100 base stations and gateways form a TaitNet P25 system and are interconnected over an IP-based linking infrastructure, where together they operate as a single logical channel. Third-party dispatch console systems can also be integrated with TaitNet P25 networks.

The transmit steering Gateway is a modified TB9100 and provides transmit steering functionality to non-simulcast P25 conventional systems. The gateway allows transmit steering and receiver voting behaviour to be configured from a third-party dispatcher console, via the TB9100 Ethernet interface. The receiver voting state is also made available to the dispatcher console via the digital interface.

When the signal from a mobile radio is received at multiple sites, receiver voting ensures that the best signal is sent to the console. Transmit steering is a form of transmit voting, based on dispatcher inputs and the previous receiver voting results. Commonly, the last base station to win the vote is used to transmit audio to the dispatcher.

The purpose of the Transmit Steering Gateway is to steer console audio to the appropriate transmitter, based on receiver voting information and its configuration, and display the receiver voting information on the console. This is a feature not supported by standard P25 equipment.

The gateway operates three steering modes:

- manual - the gateway provides static or fixed transmit steering,
- continuous - transmit steering is provided and is updated every second,
- first site - the transmit channel is steered just once at the start of a call.

1.1 Gateway interface

The transmit steering Gateway communicates with the TB9100 base station it controls via function codes, carried over the channel group multicast voice tree protocol. It monitors the base station by listening to the channel group stream information packets.

Each channel group is a single logical channel consisting of a set of base stations, of which the gateway is also a passive member. The members of a channel group are linked by an IP network and share a common multicast IP address.

The Transmit Steering Gateway can be configured in real-time using digital I/O, supporting connections to a wide range of console equipment. For convenience, receiver voting behaviour and status is available and configurable via GPIO.

Although the gateway only talks digital I/O to the console, a customer can supplement this with a DFSI or console gateway connection to the Taitnet P25 system

1.2 Equipment

Transmit Steering Gateway

The gateway hardware is physically the same as a Tait TB9100 base station, with transmit steering software added to the network board. The network board acts as the link between the I/O module and the TaitNet P25 Network, and gives the base station an identity as a network element. It also provides the physical connections for the Ethernet, and provides analogue and RS-232 serial interfaces although these are not used.

For detailed information about the TB9100 base station other than specific Transmit Steering Gateway operation, refer to the TB9100 base station service manual.

Advantech Digital I/O module

A digital I/O device is required to sit between the gateway Ethernet port and the third-party console, connected via a switch or hub. Tait recommends the ADAM-5000/TCP-BE 8-slot Ethernet-enabled SoftLogic controller for discrete digital I/O communications. This controller accepts 8 x 16 channel modules for up to 128 combined inputs and outputs.

The ADAM-5000 requires discrete I/O modules such as the ADAM-5051D-AE 16-channel digital input module or the ADAM-5056D-AE 16-channel digital output module. The number of each module needed depends on the system configuration.

Third-party DFSI P25 interface

The Tait TB9100 base station equipment supports third-party DFSI (digital fixed station interface) connectivity. DFSI is a Project 25 TIA Ethernet standard interface for communication between base stations and dispatcher equipment. The DFSI interface allows receive voting information and preferences to be viewed and configured via the console. It also provides several additional features such as caller ID, status queries and short messages.

The ADAM I/O modules can be connected to existing third-party DFSI consoles. When DFSI is used the digital I/O requirement is reduced.

2 Installation

The chapter describes:

- installing the Transmit Steering Gateway software into a TB9100 reciter,
- configuring the syslog configuration script,
- setting up the I/O connections,
- Adam 5000/TCP software install and setup.

2.1 Transmit Steering Gateway software installation

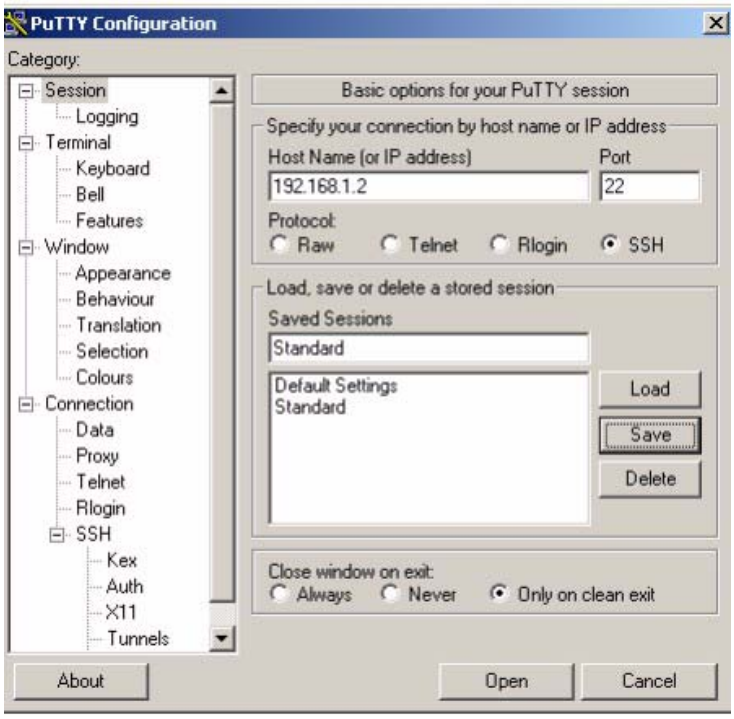
Equipment

- Steering software binary - provided by Tait Design Services.
- Steering configuration file - customised for a specific system.
- TFTP server - select a suitable one, for example http://www.solarwinds.com/products/freetools/free_tftp_server.aspx.
  Install the server on your PC.
- SSH client software - for example PuTTY (see http://www.putty.nl/download.html).

Procedure

1. Extract the transmitter steering binary and configuration file to the TFTP server's root directory.
2. Customize the configuration file to suit the target system. Refer to "Transmit Steering Gateway text file configuration" on page 23
3. Run the TFTP server program.
4. Set the server's security configuration to 'receive and transmit' so that files can be transferred. If using the Solar Winds server, select File > Configure and then the Security tab.
5. Specify the server's root directory. This is the directory containing the files that the server will transfer. If using the Solar Winds server, select File > Configure.
6. Make sure that there is a network connection between your PC and the base station.

7. Set up a remote connection to the base station as follows:
   a. Run PuTTY.
   b. Enter the base station's IP address or hostname.
   c. Select the SSH protocol.
   d. Save your settings for future use.
   e. Click Open.



   f. At the login screen, enter the user name (root) and then the password (default is k1w1). You should then have a Linux prompt.

Stopping an old version (if it exists)

1. From the Linux prompt, back up the inittab initialization script:

   ```
   cp /etc/inittab /etc/inittab.old
   ```

2. Use the 'vi' text editor to open '/etc/inittab'.

   ```
   vi /etc/inittab
   ```

3. Repeatedly press page down until you reach the bottom of the file. Look for a line similar to "null::respawn:/usr/bin/tait/2897A5".
   a. If this line exists, press 'i' once to enable insert mode and move the cursor to the start of the line. Press '#' to insert a hash character at the start of the line which should now read "#null::respawn:/usr/bin/tait/2897A5".
   b. If this line does not exist, continue as below.
4. Press the escape key to exit insert mode and type ":wq" followed by [enter] to save and exit vi.
5. Reboot the reciter by typing "reboot" at the Linux prompt. Your SSH connection should be automatically closed.

6. Wait 30 seconds and then reconnect as above.

Note You can exit vi at any time without saving by typing [esc] ":q!"

Adding a new version

1. From the linux prompt, navigate to the Tait bin directory:

   ```
   cd /usr/bin/tait
   ```

2. Copy the transmitter steering binary to the reciter using tftp.

   ```
   tftp -l 3038A5 -r 3038A5xx -g <TFTP server IP address>
   ```

   - Replace 3038A5xx with the latest binary name (eg 3038A511).
   - The Solar Winds TFTP server displays its IP address in the status bar. If you are using another server program, you can find the IP address by running ipconfig from a command prompt.

3. Copy the transmitter steering configuration file to the reciter using tftp.

   ```
   tftp -l 3038A5.cfg -r 3038A5xx.cfg -g <TFTP server IP address>
   ```

   - Note that -1 is the letter "l" not the number "1".
   - Replace 3038A5xx with the latest binary name (eg 3038A511).

4. Add execute permission to the transmitter steering binary:

   ```
   chmod +x 3038A5
   ```

Starting the new version

If the steering gateway is being installed for the first time you will need to update the innitab initialization script.

1. From the Linux prompt, use the 'vi' text editor to open '/etc/inittab'.

   ```
   vi /etc/inittab
   ```

2. Repeatedly press page down until you reach the bottom of the file. Look for a line similar to "#null::respawn:/usr/bin/tait/2897A5".

   a. If this line exists, press 'i' once to enable insert mode and move the cursor to the 'n' character after the '#' and press backspace once to remove the '#'. The line should now read "null::respawn:/usr/bin/tait/2897A5".

   b. If the line does not exist, press 'i' once to enable insert mode and move the cursor to the end of the last line in the file. Press enter to create a new line then type "null::respawn:/usr/bin/tait/2897A5".

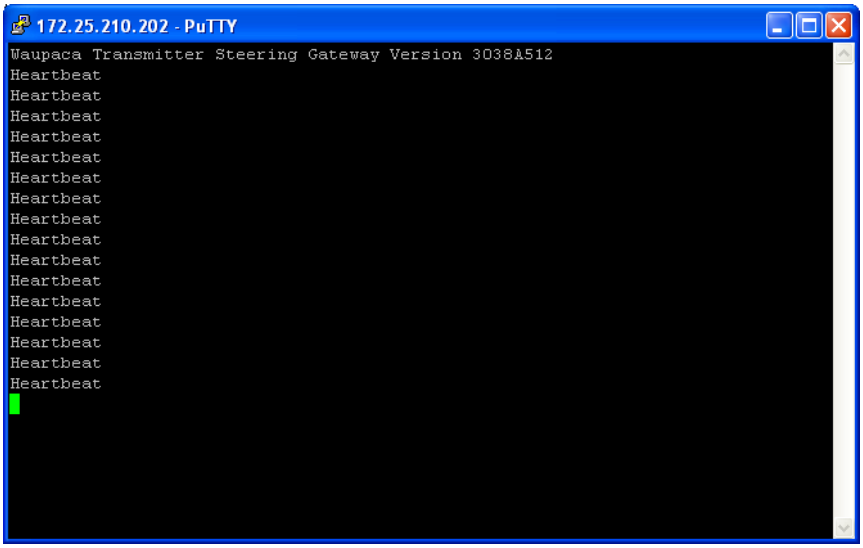
3. Press the escape key to exit insert mode and type ":wq" followed by [enter] to save and exit vi.

4. Reboot the reciter by typing "reboot" at the Linux prompt. Your SSH connection should be automatically closed.

Note You can exit vi at any time without saving by typing [esc] ":q!"

Confirming operation (connecting to monitor server)

1. Run PuTTY.
2. Enter the steering gateways IP address and port 9010.
3. Select "Raw" mode.
4. Click Open. Confirm that the connection is formed and version number is displayed as below.



2.1 Configuring syslog

1. From the Linux prompt, back up the syslog configuration script:

   ```
   cp /etc/syslog.conf /etc/syslog.conf.old
   ```

2. From the Linux prompt, use the 'vi' text editor to open '/etc/syslog.conf'.

   ```
   vi /etc/syslog.conf
   ```

3. Look for the line: "local7.* /var/log/txgw.log"

   a. If this line exists, no change is required.

   b. If the line does not exist, press 'i' once to enable insert mode and move the cursor to the end of the last line in the file. Press enter to create a new line then type

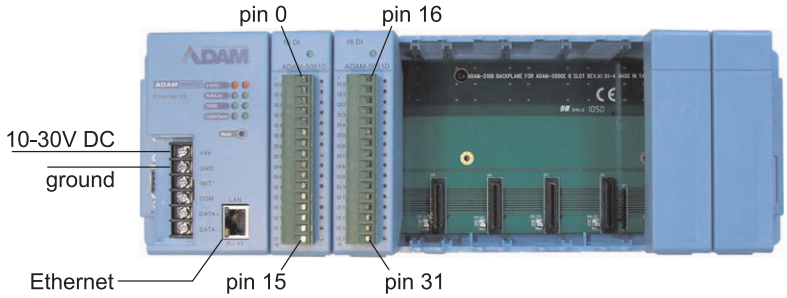
   ```
   local7.*       /var/log/txgw.log".
   ```

4. Press the escape key to exit insert mode and type ":wq" followed by [enter] to save and exit vi.

5. Reboot the reciter by typing "reboot" at the Linux prompt. Your SSH connection should be automatically closed.

Note You can exit vi at any time without saving by typing [esc] ":q!"

2.1 I/O connections



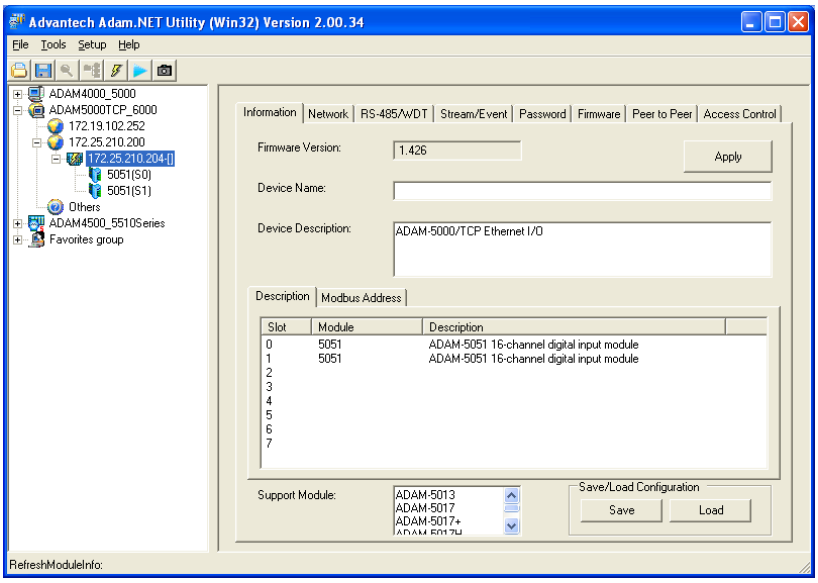
1. Connect Ethernet from the TB9100 to the ADAM-5000 RJ45 connector.
2. Connect DC power to the ADAM-5000.
3. The ADAM-5000 controller modules have banks of 16 channels. Make console connections to match the gateway configuration. Refer to "Transmit Steering Gateway text file configuration" on page 23
   The following table shows the maximum I/O requirement, using digital I/O only, no P25 DFSI interface and all available features.
   - N = total number of transmit and receive enabled base stations
   - R = total number of receive enabled base stations
   - T = total number of transmit enabled base stations

		Console I/P	Console O/P
General state	Base Station failed	N	
General preferences	PTT		1
	RF Repeat		1
	Continuous/First site		1
Receive preferences	Forced		R
	Disabled		R
Transmit preferences	Forced		T
	Disabled		T
Receive state	Receiving	R	
	Voted	R	
	Disabled	R	
	Failed	R	
Transmit state	Transmitting	T	
	Steered	T	
	Disabled	T	
Total		**N+4R+3T**	**3+2R+2T**

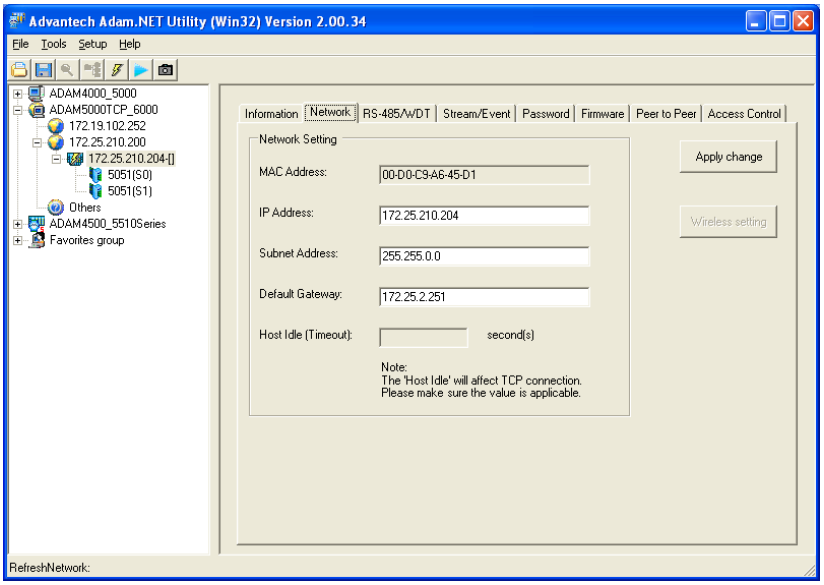
For electrical specifications, refer to the 5051D and 5056D manuals.

2.1 Adam 5000/TCP installation

1. Install ADAM-5051D and 5056D modules into ADAM5000/TCP.
2. Install Adam configuration software.
3. Confirm that modules have been detected.

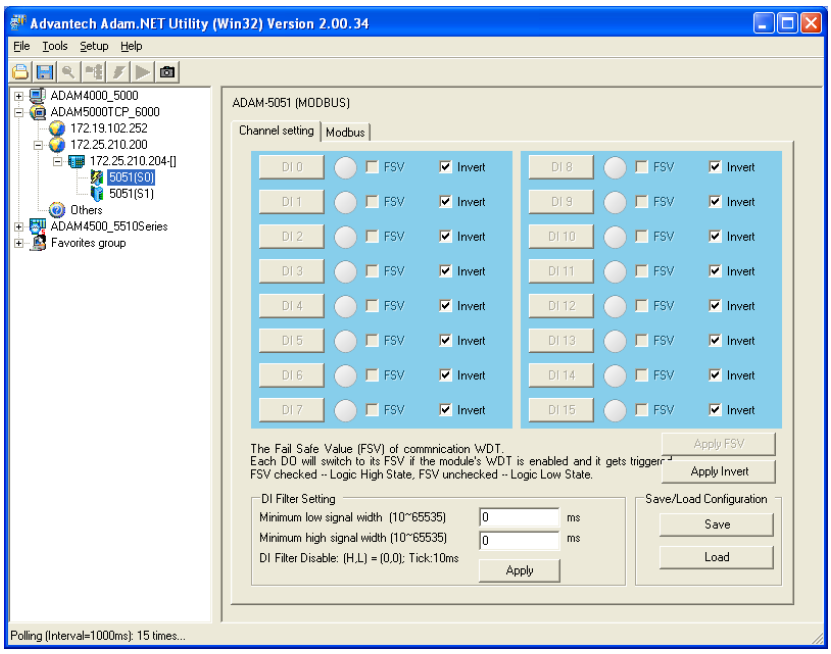


4. Configure ADAM5000/TCP IP address.



5. Configure modules (invert if required).
6. Test input modules by bringing inputs high/low and confirming via the channel settings interface.

7. Test output modules by manually forcing outputs high/low and confirming at the output.



3 Operation

The functions of the gateway are to:

- monitor the P25 system to determine the voting state of each receiver,
- report the voting state of each receiver to the console,
- capture the transmit steering preferences set at the console,
- intelligently select a suitable transmitter based on the receiver voter input and the console preferences,
- enable and disable the base station transmitters/receivers as appropriate,
- configure the receiver voting behaviour.

When the console user presses PTT, voice is broadcast to the channel group. The transmit steering process must allow only one group member to transmit and this is achieved by selectively locking (disabling) and unlocking (enabling) transmit on each base station.

The Transmit Steering Gateway enables and disables individual base station transmitters by sending function codes over Ethernet. These function codes are mapped to task manager tasks which lock and unlock the base station transmitters. The task mapping is configured in the TB9100 CSS, refer to "Transmit and receive site CSS configuration" on page 35.

3.1 Receiver voting status

The gateway monitors the messages from the TB9100 reciters to determine the current voting state of the receivers. This information is reported to the console and factored into the transmit steering preferences.

The receive state is output from the Transmit Steering Gateway to the console interface, using the pin mapping defined in the gateway configuration file.

The gateway reports on the voting state of the connected receivers to the console. The report can be displayed on the console, with the following messages:

- Voted - the receiver has currently won the vote.
- Receiving - the receiver is currently receiving a valid signal.
- Disabled - the receiver has been removed from voting consideration.
- Failed - the receiver has failed. An alarm is active or the reciter has stopped responding to the network.

3.2 Transmitter status

The transmit state of each reciter is output from the Transmit Steering Gateway to the console with its current status.

- Transmitting - the reciter is currently transmitting. Only one can transmit at a time.
- Steered - the reciter has been selected or 'steered'. This base station will be used for transmitting dispatcher audio and repeating vote-winning received signals. Only one base station is steered at a time.
- Disabled - the reciter has been disabled for transmit.

3.3 Console settings

The console can control the following Transmit Steering Gateway inputs:

- PTT indicates that the console operator has pressed the PTT.
- RF repeat
  - If enabled, received signals are re-transmitted from the currently selected transmitter.
- Tx steering Continuous/First site
  - If set to continuous, the current Rx vote winner is used for each subsequent PTT.
  - If set to first site, the first Rx vote winner detected is used to transmit, until the call timeout expires.
- Receive preferences - configured for each receive-enabled base station
  - If forced, the specified base station is the only one permitted to receive RF signals.
  - If disabled, the specified base station can not receive.
- Transmit preferences - configured for each transmit-enabled base station
  - If forced, the specified base station is used exclusively for all transmissions.
  - If disabled, the specified base station can not transmit.

3.4 Transmit steering algorithm

When the console transmits, the gateway selects the transmit channel using a combination of the following factors:

- the PTT line from the console being active,
- the Rx voter state, and
- console preferences.

There are three steering modes:

Manual mode

When any channel has been transmit-forced, the system is said to be in manual mode. In this mode the forced channel will always be used to transmit the vote-winning signal and dispatcher audio.

The Rx vote state and transmit-disable configuration is ignored in manual mode.

Continuous mode

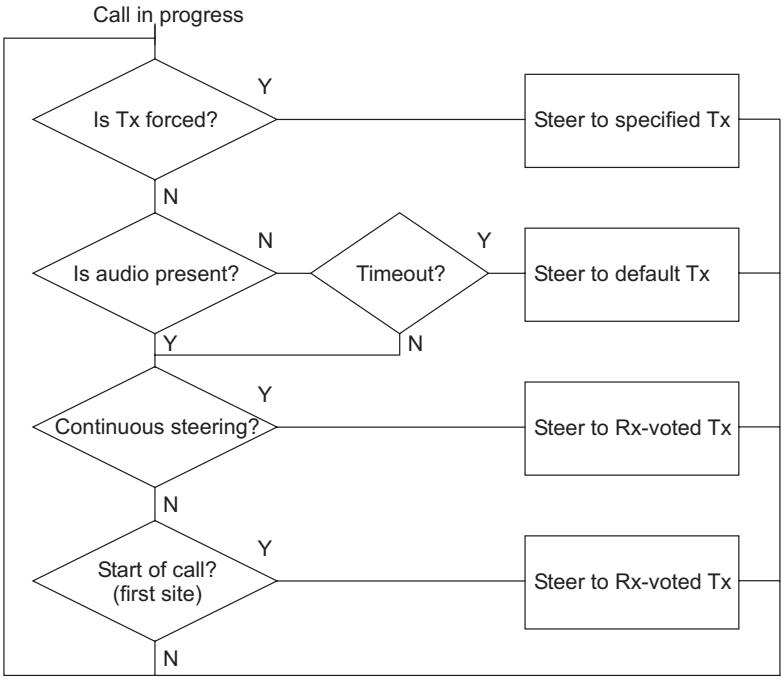
When the continuous steering mode input is high and no channel is transmit-forced, the system enters continuous steering mode. In this mode the 'steered' transmit channel is updated once every second based on the current Rx vote winner.

The steered channel resets to the default channel after a predetermined period of inactivity.

First site mode

When the continuous steering mode input is low and no channel is transmit-forced, the system enters first site steering mode. In this mode the transmit channel is updated once at the start of a call. For the remainder of the call, any change in Rx vote state does not affect the selected transmit channel.

The steered channel resets to the default channel after a predetermined period of inactivity.



3.5 Monitor port

The transmitter steering gateway provides a monitor port for remote monitoring. The gateway listens for TCP/IP connections on the monitor port 9000 and send the application description and version when a connection is established.

The log levels are configurable on a per-connection basis by sending single numeric character. This allows the user to view a particular aspect of the gateway in more detail. Only one connection is currently supported.

- 0=fatal
- 1=severe
- 2=error
- 3=alarm
- 4=warning
- 5=information
- 6=trace
- 7=debug

Any level selected includes the lower levels.

4 System configuration

This chapter describes:

- Configuring the Transmit Steering Gateway using the ASCII text file, including inputs and outputs.
- Set up the gateway via the Customer Service Software (CSS).,
- Set up other reciters in the channel group using the CSS

Note Reciters are referred to as receivers in the CSS.

Configuration of the gateway system is required using both the TB9100 Tait Customer Service Software (CSS) and an ASCII text file.

The CSS is a PC-based software for monitoring, configuring, and diagnosing TB9100 base station equipment. To install the CSS, you need a registration key. You can obtain a key from Tait. Please contact your Tait sales office. If you have previously installed a CSS, you can use the same key.

You also need to set up the PC so that it can handle network communications with base stations. The PC must use an IP address and subnet mask that is compatible with the base station.

Refer to the following manuals for detailed CSS information:

- TB9100 and P25 Customer Service Software (CSS) User's Manual for operation information.
- TB9100 base station installation and operation manual for installation information.

4.1 Transmit Steering Gateway text file configuration

The Transmit Steering Gateway is configured using an ASCII text file. The configuration file is read by the gateway on power-up so the gateway needs to be restarted for changes to take affect. The order of parameters in the configuration text file is not important.

Up to 16 reciters (numbers 1-16) are supported. Reciter numbers must match those configured with the CSS.

Note In the context of the Transmit Steering Gateway, the reciter number is the same as the receiver number defined in the CSS channel group of each TB9100 base station.

Misc parameters

The following address and timing parameters are configured:

- I/O device IP address (Modbus/TCP compliant eg Adam 5000/TCP)
- Multicast channel group IP address and port

- Reciter refresh
- Stream refresh
- Call timeout
- Revote interval
- Alarm timeout
- Retry count
- Default transmitter
- Reciter definition

Input parameters

Pin mapping is defined for the following inputs:

- PTT
- RF repeat
- Tx steering continuous
- Receive preferences
- Transmit preferences

Output parameters

Pin mapping is defined for the following outputs:

- Receive state
- Transmit state

4.2 Miscellaneous parameters

The Transmit Steering Gateway requires the following parameters configured using the ASCII text file.

I/O device IP address (eg Adam 5000/TCP)

The Modbus/TCP I/O device provides the ethernet-to-digital I/O bridge between the Transmit Steering Gateway and the dispatcher console.

Format IO_MODULE_ADDRESS = [DOT-DECIMAL_IP]:[PORT]

Example IO_MODULE_ADDRESS = 172.19.102.252:502

Multicast channel group IP address and port

The channel group address used by all transmit/receive sites in the system. Note that the multicast IP address for the system reciters is set up for each reciter in the CSS. Refer to "Transmit and receive site CSS configuration" on page 35.

Format CHANNEL_GROUP_IP = [DOT-DECIMAL_IP]:[PORT_NUMBER]

Example CHANNEL_GROUP_ADDRESS = 224.0.28.10:27260

Reciter refresh

Period after which the reciter configuration is updated. Reciter configuration is normally event based. This refresh period provides a time-based backup to ensure that the reciter state is correct. For example, if the power is cycled to a reciter, within 'n' seconds of coming back online, its configuration will be updated.

Format RECITER_REFRESH = [TIME_IN_MILLISECONDS]

Example RECITER_REFRESH = 15000

Stream timeout

The period of channel group inactivity required to clear receiving, voted and transmitting output status flags (available via GPIO).

Format STREAM_TIMEOUT = [TIME_IN_MILLISECONDS]

Example STREAM_TIMEOUT = 500

Call timeout

The idle time after the end of a stream before the call end is triggered. Defines the period of inactivity with no Rx, Tx or PTT.

Format CALL_TIMEOUT = [TIME_IN_MILLISECONDS]

Example CALL_TIMEOUT = 10000

Revote interval

The period in which transmit steering selection is updated.

Format VOTE_TIMEOUT = [TIME_IN_MILLISECONDS]

Example VOTE_TIMEOUT = 1000

Alarm timeout

Period of error free operation required to clear alarm flag for a reciter

Format VOTE_TIMEOUT = [TIME_IN_MILLISECONDS]

Example ALARM_TIMEOUT = 45000

Retry count

The number of times to resend a function code packet when no acknowledgement is received.

Format RETRY_COUNT = [COUNT]

Example RETRY_COUNT = 5

Default transmitter

The reciter to use for transmission when no reciter has received recently or transmitter steering is inconclusive.

Format DEFAULT_TRANSMITTER = [TX_NUMBER]

Example DEFAULT_TRANSMITTER = 2

Reciter configuration

Define the reciter number, IP address and associated Tx reciter, for each reciter in the system. This configuration allows mapping of receive-only reciters to transmit reciters. Transmit/receive enabled reciters normally have both Tx/Rx reciter numbers of the same value.

The Tx and Rx reciter number is referenced in other configuration parameters; Default transmitter, Transmit Steering Gateway inputs and Transmit Steering Gateway outputs.

Format

RECITER = [RX_NUMBER], [TX_NUMBER], [DOT-DECIMAL_IP]:[PORT]

- Rx Number is the reciter corresponding to the specified IP address.
- Tx Number is the reciter which will be steered when audio is received from the given reciter.
- IP:PORT

Example

RECITER = 2, 2, 172.25.210.107:27260

RECITER = 3, 3, 172.25.210.211:27260

4.3 Transmit Steering Gateway inputs

The Transmit Steering Gateway requires the following inputs to be configured using the ASCII text file. Inputs are mapped to a pin on the I/O device in the range 0 to 127.

PTT state

- High: Dispatcher PTT pressed.
- Low: Dispatcher PTT not pressed.

Format INPUT_PTT_PRESSED = [I/O_PIN_NUMBER]

Example INPUT_PTT_PRESSED = 0

RF repeat

- High: Enable RF repeat for channel group.
- Low: Disable RF repeat for channel group.

Format INPUT_RF_REPEAT_ENABLED = [I/O_PIN_NUMBER]

Example INPUT_RF_REPEAT_ENABLED = 1

Continuous/First site

- High: Enable continuous Tx steering (most recent Rx vote winner is used to transmit).
- Low: Enable First site Tx steering (first site to receive is used to transmit; reset on call timeout).

Format INPUT_TX_STEERING_CONTINUOUS = [I/O_PIN_NUMBER]

Example INPUT_TX_STEERING_CONTINUOUS = 2

Input receive preferences

Format INPUT_RECEIVE_MODE = [RECITER_NUMBER], [RX_FORCED_PIN_NUMBER], [RX_DISABLED_PIN_NUMBER]

- Reciter number: Reciter number as defined by the Reciter configuration parameters, for which the pin mapping relates.
- Forced: If pin is high, disable receive on all reciters but this one, forcing it to win the vote if it receives the RF.
- Disabled: If pin is high, disable receive on this reciter is it will not be used for Rx voting.

Examples INPUT_RECEIVE_MODE = 2, 8, 9

INPUT_RECEIVE_MODE = 3, 10, 11

Input transmit preferences

Format

INPUT_TRANSMIT_MODE = [RECITER_NUMBER], [TX_FORCED_PIN_NUMBER], [TX_DISABLED_PIN_NUMBER]

- Reciter number: Reciter number as defined by the Reciter configuration parameters, for which the pin mapping relates.
- Tx Forced: If pin is high, use this reciter to transmit irrespective of the current Rx vote winner or transmit steering mode.
- Tx Disabled: If pin is high, do not use this reciter to transmit.

If a disabled reciter wins the Rx vote, the default reciter will be used in its place.

If the default reciter is disabled, no reciters will be unlocked and nothing will be transmitted.

Example

INPUT_TRANSMIT_MODE = 2, 12, 13

INPUT_TRANSMIT_MODE = 3, 14, 15

4.4 Transmit Steering Gateway outputs

The Transmit Steering Gateway requires the following outputs to be configured using the ASCII text file. Outputs are mapped to a pin on the I/O device in the range 0 to 127.

Output receive state

Format OUTPUT_RECEIVE_STATE = [RECITER_NUMBER], [RX_PIN_NUMBER], [VOTED_PIN_NUMBER], [DISABLED_PIN_NUMBER], [FAILED_PIN_NUMBER]

- Reciter number: Reciter number as defined by the Reciter configuration parameters, for which the pin mapping relates.
- Receiving: Pin is high if reciter is receiving.
- Voted: Pin is high if reciter has won the Rx vote.
- Disabled: Pin is high if the reciter has Rx disabled.
- Failed: Pin is high if the reciter has a fault (active alarm or failed packet response).

Example OUTPUT_RECEIVE_STATE = 2, 16, 17, 18, 19

OUTPUT_RECEIVE_STATE = 3, 20, 21, 22, 23

Output transmit state

Format OUTPUT_TRANSMIT_STATE = [RECITER_NUMBER], [TX_PIN_NUMBER], [STEER_PIN_NUMBER], [DISABLED_PIN_NUMBER]

- Reciter number: Reciter number as defined by the Reciter configuration parameters, for which the pin mapping relates.
- Transmitting: Pin is high if reciter is transmitting.
- Steered: Pin is high if reciter has been 'steered'.
- Disabled: Pin is high if reciter has been disabled for transmit.

Example OUTPUT_TRANSMIT_STATE = 2, 24, 25, 26

OUTPUT_TRANSMIT_STATE = 3, 27, 28, 29

4.5 Example configuration file

```
#
# 3038A5xx - Transmitter steering gateway config file
#
# This file helps define system specific configuration parameters
for
# transmitter steering operation. White space is ignored, '#'
characters
# are used for comments.
#
# Valid input/output values:
#
#    * [0-127] a number representing the physical address of an input
pin on the IO module
#    * [T]     the character 'T' indicates a constant true value, no
pin mapping is configured
#    * [F]     the character 'F' indicates a constant false value, no
pin mapping is configured
#
# Up to 16 reciters (numbers 1-16) are supported. Reciter numbers
used here must match those
# configured in the reciter network identitys (using the CSS.)


# Address of Modbus/TCP enabled I/O module (IP:PORT)
# This device provides the ethernet <-> digital IO bridge.
IO_MODULE_ADDRESS            = 172.19.102.252:502


# Channel group multicast address (IP:PORT)
# This should be the channel group address used by all transmit/
receive sites in the system.
CHANNEL_GROUP_ADDRESS        = 224.0.28.10:27260


# Period at which reciter configuration is updated
# Reciter configuration is normally event based.
# This refresh period provides a time based backup to ensure that the
reciter state is correct.
# An example of where it may be useful would be if the power is
cycled to a reciter - within N
# seconds of coming back online, its configuration will be updated.
RECITER_REFRESH = 15000


# Time after after channelgroup goes quiet to when stream end is
triggered
# Rx voted, receiving and transmitting state flags for all reciters
will be cleared after no
```

```
# voice packets are seen on the channel group for the given period.
STREAM_TIMEOUT  = 500

# Idle time before call end is triggered
# Defines the period of inactivity (no rx, tx or PTT.)
CALL_TIMEOUT    = 10000

# Interval at which tx steering selection is updated
REVOTE_INTERVAL    = 1000

# Period of error free operation required to clear alarm flag for a
reciter
ALARM_TIMEOUT   = 45000

# Number of times to resend a fncode packet when no ack is received
RETRY_COUNT                  = 5

# Reciter to use for transmission when no reciter has received
recently (or transmitter steering is inconclusive)
DEFAULT_TRANSMITTER          = 2

# Define channel group reciters (rx reciter number, tx reciter
number, IP:PORT)
# 'Rx reciter' is the reciter corresponding to the given IP (the one
being configured
# 'Tx reciter' is the reciter which will be steered when audio is
received from the given reciter
# This allows for mapping of receive only reciters to sensible
transmit reciters. Transmit/receive
# enabled reciters would normally have both tx/rx reciter numbers
the same value.
RECITER = 2, 2, 172.25.210.107:27260
RECITER = 3, 3, 172.25.210.211:27260

#
# Items below set up modbus pin mappings
#

# PTT state pin number
# High: Dispatcher PTT pressed
# Low:  Dispatcher PTT not pressed
INPUT_PTT_PRESSED            = 0

# RF repeat pin number
# High: Enable RF repeat for channel group
```

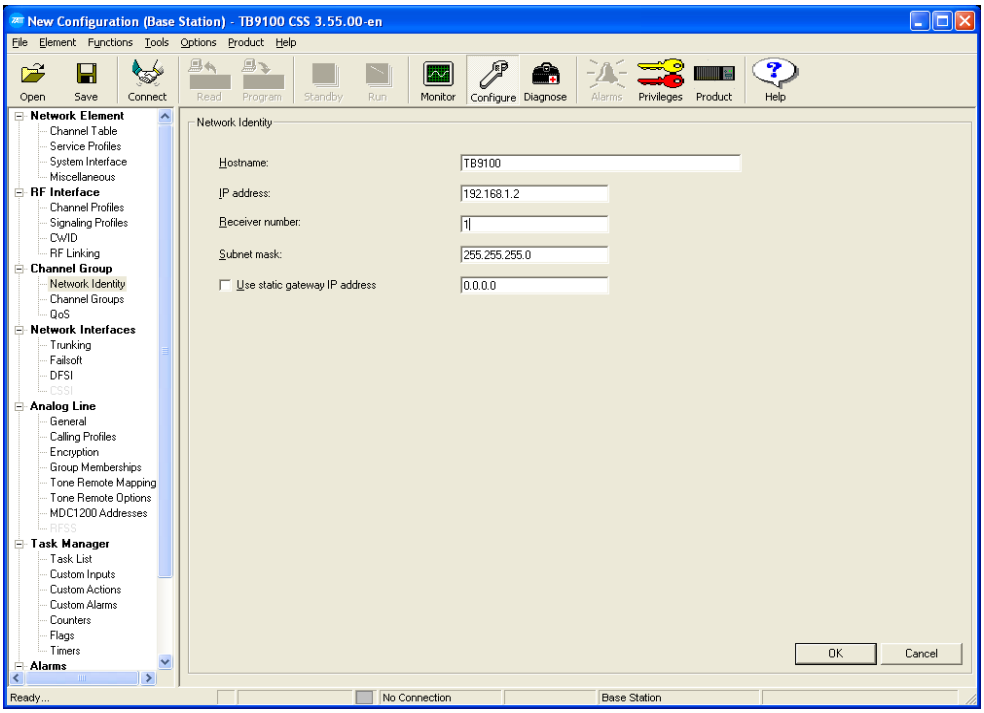
```
# Low:  Disable RF repeat for channel group

INPUT_RF_REPEAT_ENABLED      = 1


# Continuous/first-site pin number

# High: Enable continuous tx steering (most recent rx vote winner
used to tx)

# Low:  Enable first site tx steering (first site to rx used to tx,
reset on call timeout)

INPUT_TX_STEERING_CONTINUOUS = 2


# Input receive preference pin mappings (reciter number, forced,
disabled)

# Reciter number: Reciter number for which the following pin
mappings relate

# Forced:         High, Disable receive on all reciters but this one
(forcing it to win the vote - if it receives the RF!)

# Disabled:       High, Disable receive on this reciter (will not be
used for rx voting)

INPUT_RECEIVE_MODE   = 2, 8,  9

INPUT_RECEIVE_MODE   = 3, 10, 11


# Input transmit preference pin mappings (reciter number, forced,
disabled)

# Reciter number: Reciter number for which the following pins relate

# Forced:         High, Use this reciter to transmit irrespective of
the current rx vote winner (or tx steering mode)

# Disabled:       High, Do not use this reciter to transmit

#                If a disabled reciter wins the rx vote, the default
reciter will be used in it's palce

#               If the default reciter is disabled, no reciters will
be unlocked and nothing will be transmitted

INPUT_TRANSMIT_MODE  = 2, 12, 13

INPUT_TRANSMIT_MODE  = 3, 14, 15


# Output receive state pin mappings (reciter number, receiving,
voted, disabled, failed)

# Reciter number: Reciter number for which the following pins relate

# Receiving: High if reciter is receiving, low otherwise

# Voted:     High if reciter has won the rx vote, low otherwise

# Disabled:  High if the reciter has rx disabled, low otherwise

# Failed:    High if the reciter has a fault (active alarm or failed
packet response)

OUTPUT_RECEIVE_STATE = 2, 16, 17, 18, 19

OUTPUT_RECEIVE_STATE = 3, 20, 21, 22, 23


# Output transmit state pin mappings (reciter number, transmitting,
steered, disabled)
```

```
# Reciter number: Reciter number for which the following pins relate
# Transmitting: High if reciter is transmitting
# Steered:      High if reciter has been 'steered'
# Disabled:     High if reciter has been disabled for tx
OUTPUT_TRANSMIT_STATE = 2, 24, 25, 26
OUTPUT_TRANSMIT_STATE = 3, 27, 28, 29
```

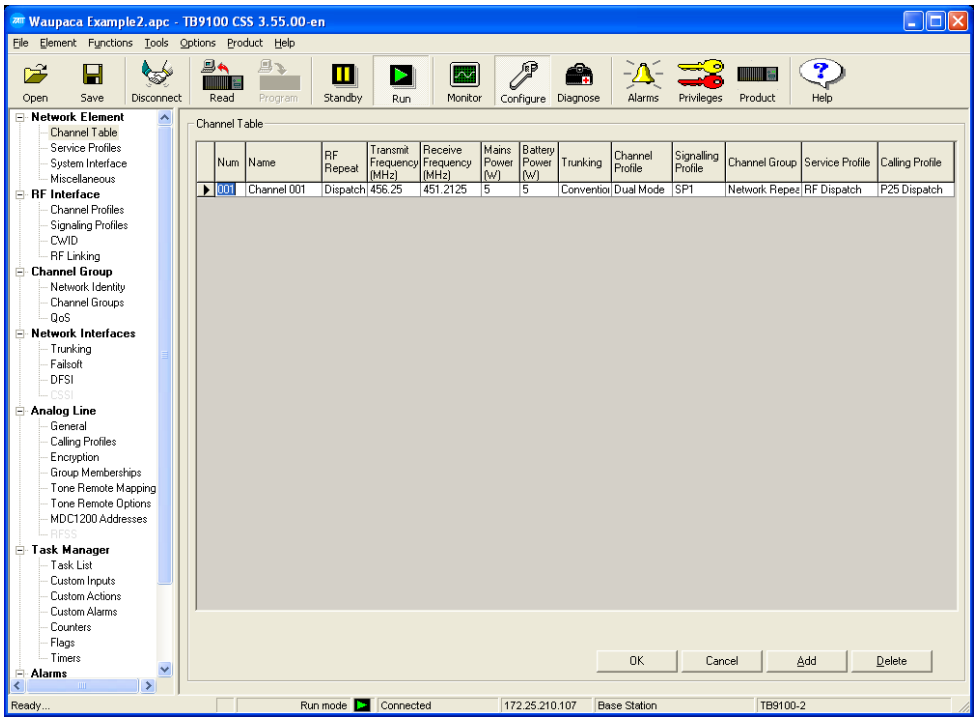
4.6 Transmit and receive site CSS configuration

To enable equipment to work with the Transmit Steering Gateway, the following parameter sets need to be configured in the transmit and receive sites, using the Tait Customer Service Software (CSS).

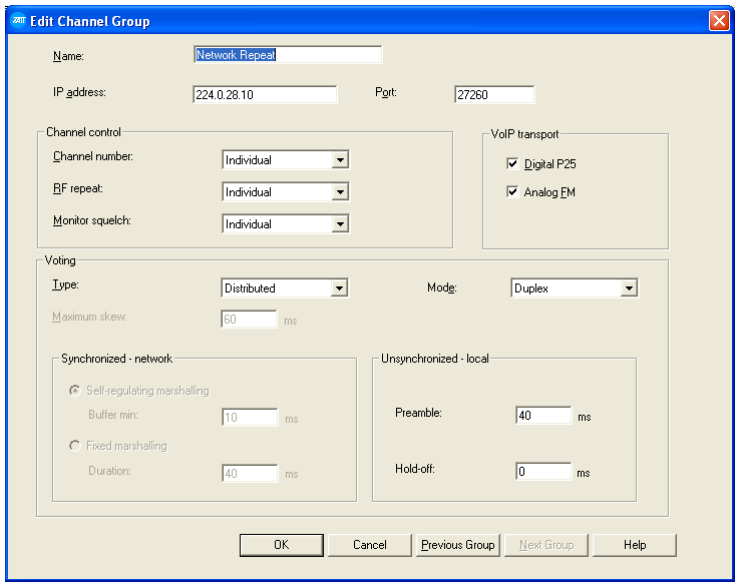
- Channel Group > Network Identity > receiver number (set for each reciter in the system)
- Network Element > Channel Table
- Channel Group > Channel Groups
- Task Manager > Custom Actions
- Task Manager > Custom Inputs
- Task Manager > Flags
- Task Manager > Timer
- Task Manager > Task List



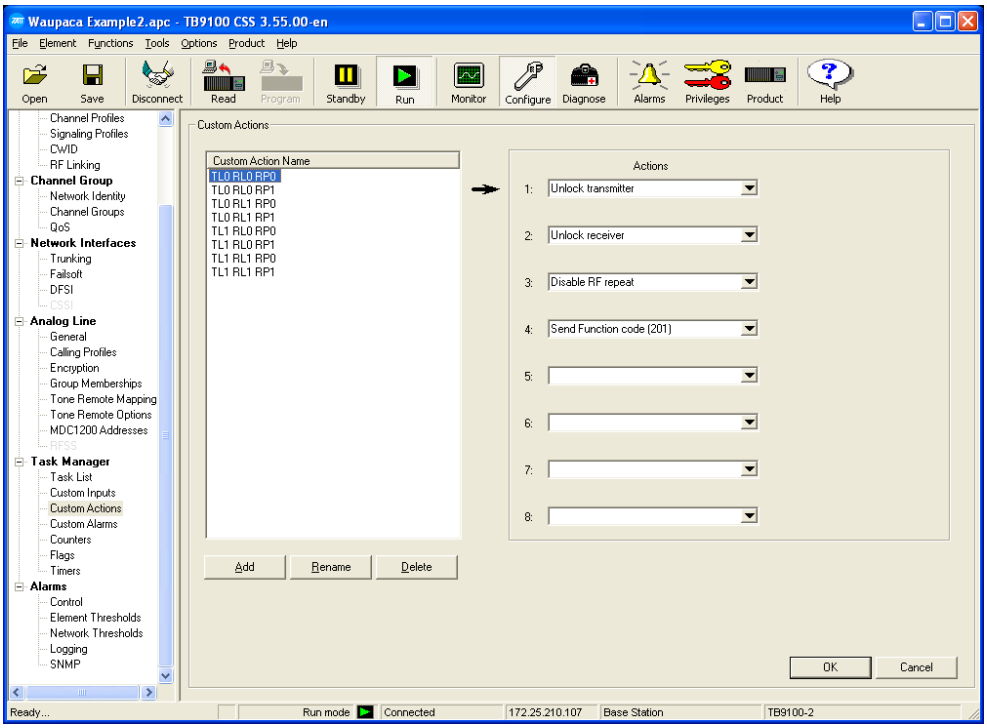
1. Select Configure > Channel Group > Network Identity.
   a. Assign each receiver a unique number. The number must be between 1 and 255..



2. Select Configure > Network Element > Channel Table.
   a. Set RF Repeat to Dispatch Controlled. This allows the gateway to control RF Repeat.
   b. Set Channel Group to Network Repeat. This means that voice is repeated to other channel group members.



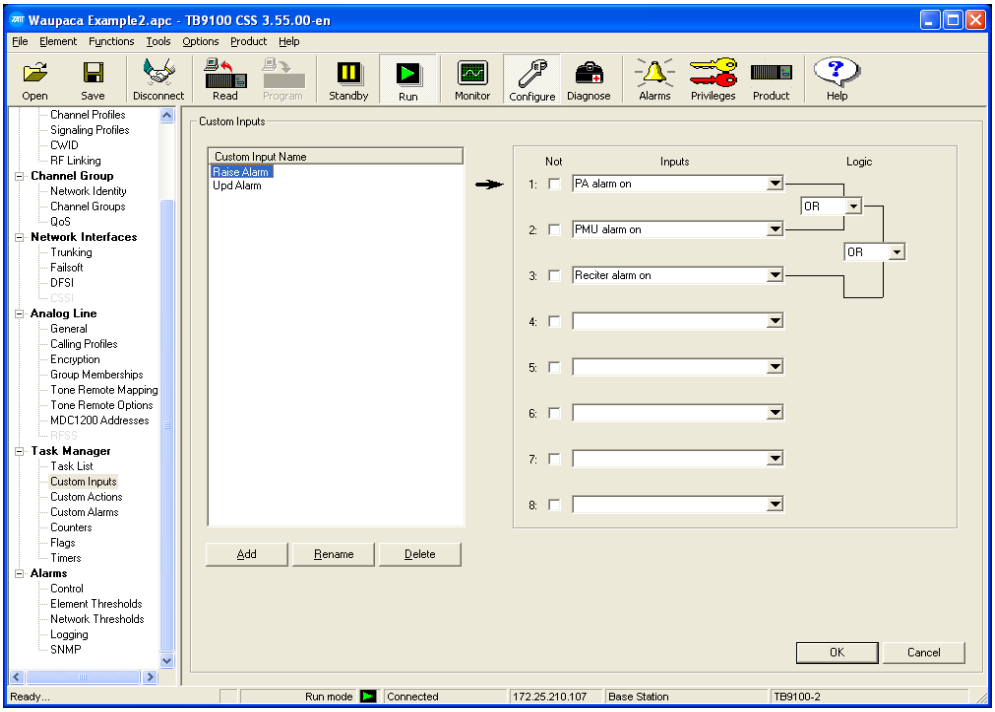
3. Select Configure > Channel Group > Channel Groups.
   a. Enter “Network Repeat” as the channel group name.
   b. Enter a valid multicast group address as the IP address. This should be common to all channel group members. Note that the gateway’s multicast IP address is configured in its ASCII configuration file. Refer to “Multicast channel group IP address and port” on page 25.
   c. Set the Port to 27260.
   d. Set the Channel control fields to individual so that the steering gateway can control them independently.
   e. Set the Voting Type to Distributed. This allows the steering gateway to see the vote winning traffic.
   f. Set the Mode to Duplex.



4. Select Configure > Task Manager > Custom Actions. The custom actions allow the steering gateway to configure multiple site attributes in response to a single input packet.
5. Set up the following custom actions using the naming convention:
   - TL = transmitter lock (suffix 0 = unlock, 1 = lock)
   - RL = receiver lock (suffix 0 = unlock, 1 = lock)
   - RP = repeat enabled (suffix 0 = disabled, 1 = enabled)

   For example, TL1 RL0 RP1 = Lock transmitter, unlock receiver, enable RF repeat, send acknowledge function code 211.
   Note that each action sends a unique acknowledgement function code to indicate to the steering gateway that the configuration has been updated.

Custom Action Name	Action 1	Action 2	Action 3	Action 4 Send Function Code
TL0RL0RP0	Unlock Tx	Unlock Rx	Disable RF Repeat	201
TL0RL0RP1	Unlock Tx	Unlock Rx	Enable RF Repeat	203
TL0RL1RP0	Unlock Tx	Lock Rx	Disable RF Repeat	205
TL0RL1RP1	Unlock Tx	Lock Rx	Enable RF Repeat	207
TL1RL0RP0	Lock Tx	Unlock Rx	Disable RF Repeat	209
TL1RL0RP1	Lock Tx	Unlock Rx	Enable RF Repeat	211
TL1RL1RP0	Lock Tx	Lock Rx	Disable RF Repeat	213
TL1RL1RP1	Lock Tx	Lock Rx	Enable RF Repeat	215

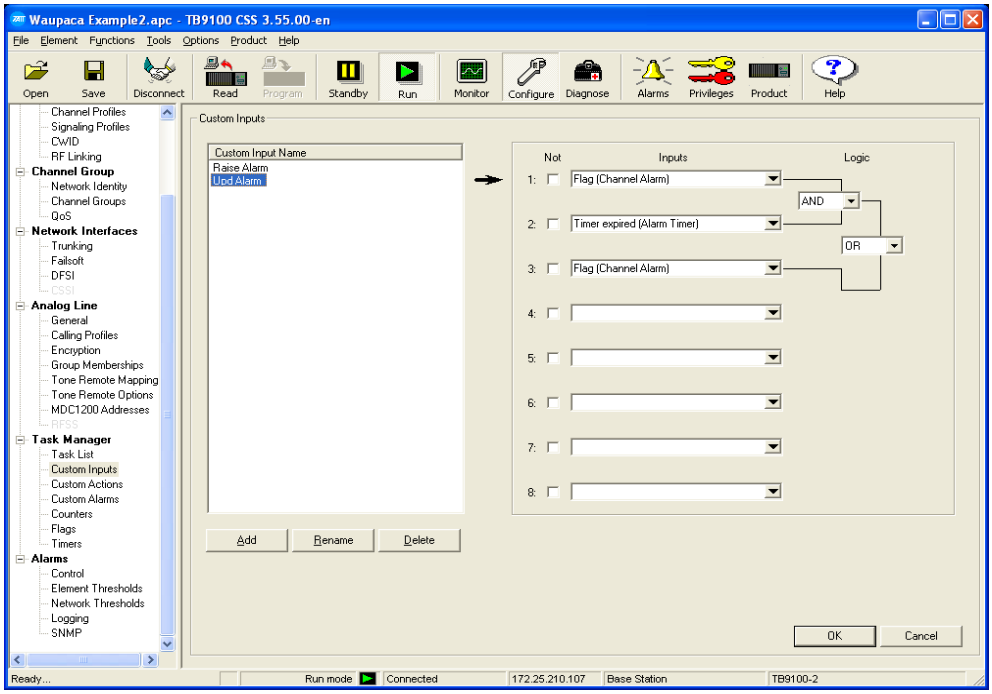


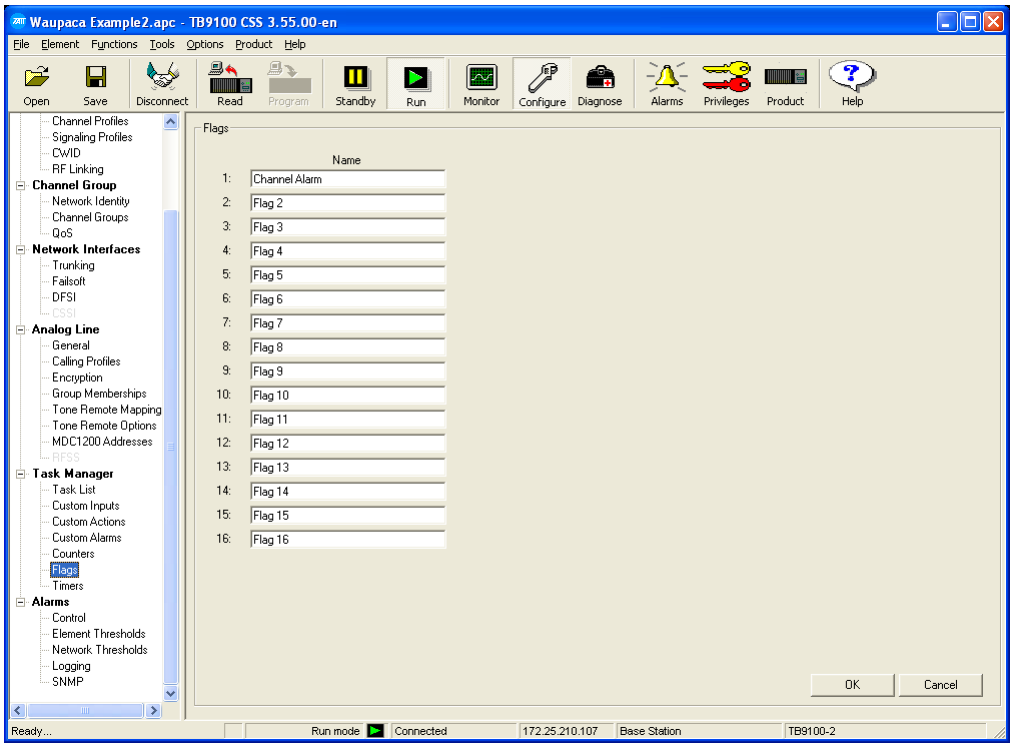
6. Select Configure > Task Manager > Custom Inputs.

   a. Set the input for alarm/channel fail state to be displayed on the console. This input can be customised to respond to up to eight alarms.

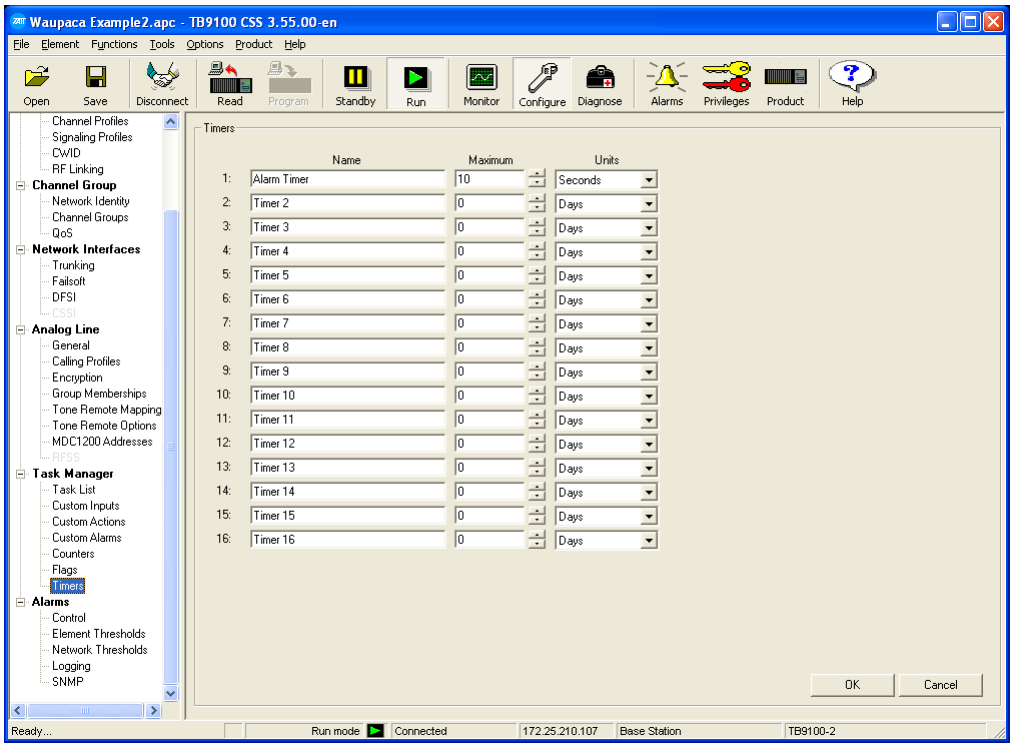
7. Set the input triggers (click 'Add'):

   - On initial alarm flag set
   - Periodically (interval = alarm timer) while alarm flag set.

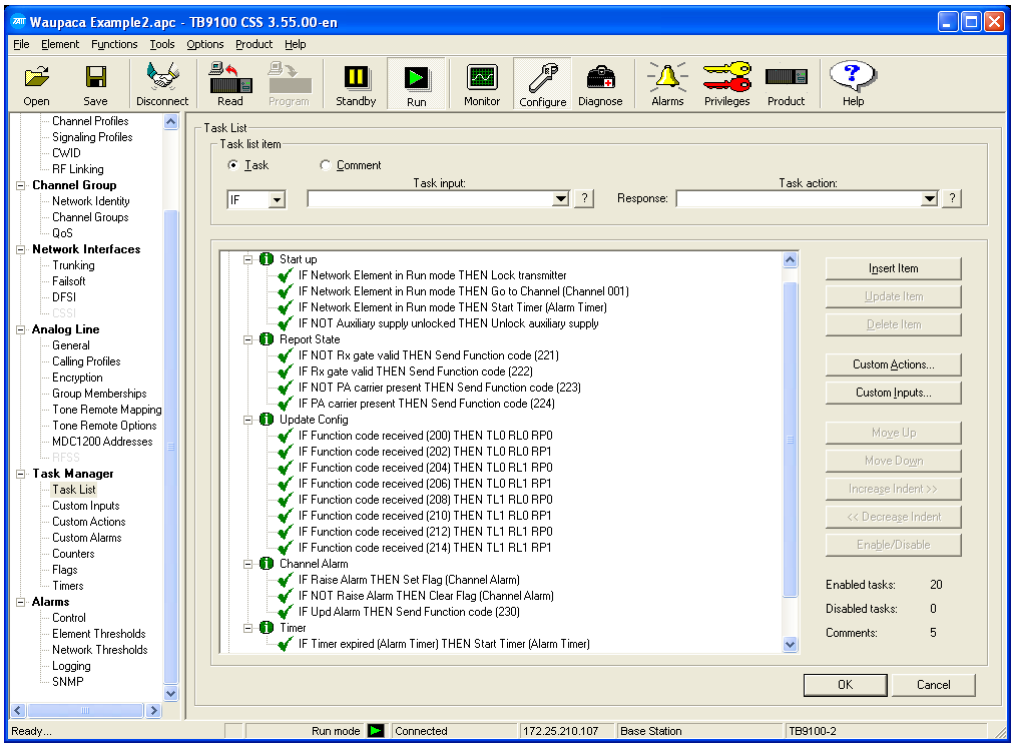




8. Select Configure > Task Manager > Flags. The Channel Alarm flag indicates the current site alarm/failure state.



9. Select Configure > Task Manager > Timer. Set the timer for periodic alarm updates, typically 10 to 20 seconds (times out after 30 seconds). Set less than the Alarm timeout - refer to "Alarm timeout" on page 26.

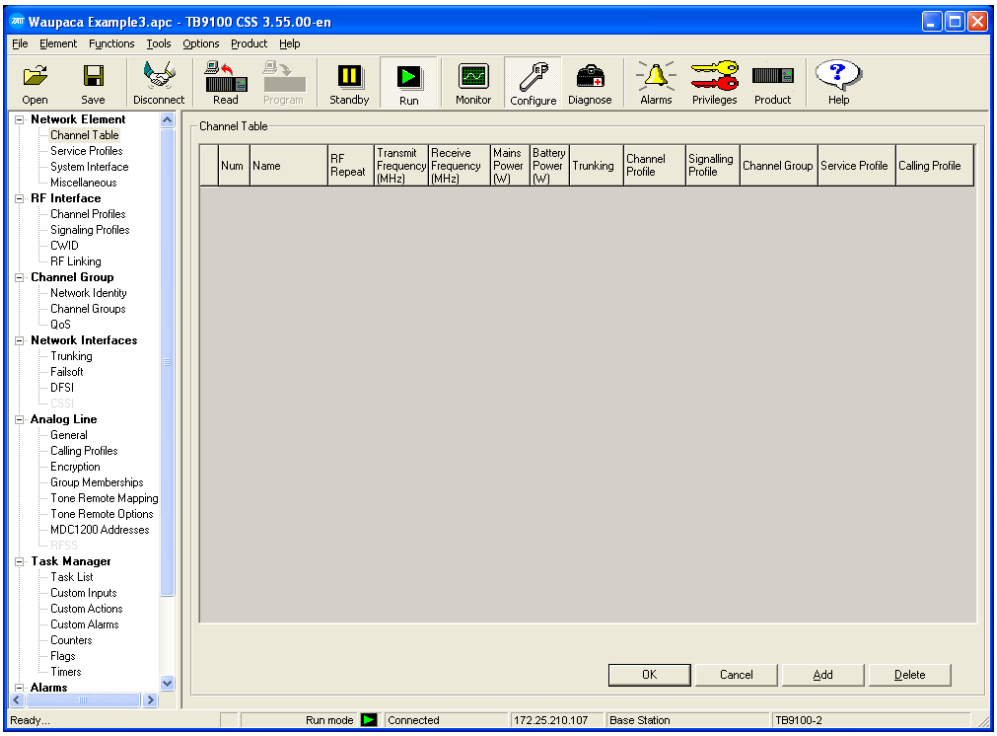


10. Select Configure > Task Manager > Task List. Note that function codes 200-255 are reserved for the steering gateway.

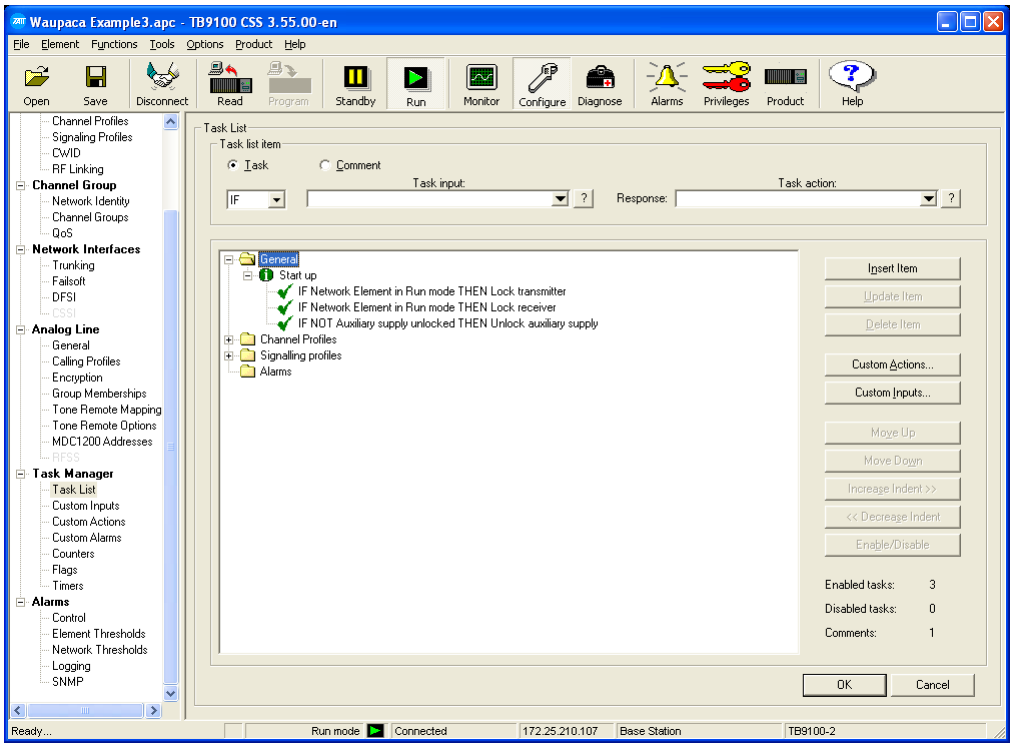
11. Using Comments to define the task groups, set up the following tasks:

Comment	IF/IF NOT	Task input	Task action
Start up	IF	Network Element in Run mode	Lock Transmitter
	IF	Network Element in Run mode	Go to Channel 001
	IF	Network Element in Run mode	Start Alarm Timer
	IF NOT	Auxiliary supply unlocked	Unlock aux supply
Report State	IF NOT	Rx gate valid	Send function code 221
	IF	Rx gate valid	Send function code 222
	IF NOT	PA carrier present	Send function code 223
	IF	PA carrier present	Send function code 224
Update config	IF	Function code received 200	TL0 RL0 RP0
	IF	Function code received 202	TL0 RL0 RP1
	IF	Function code received 204	TL0 RL1 RP0
	IF	Function code received 206	TL0 RL1 RP1
	IF	Function code received 208	TL1 RL0 RP0
	IF	Function code received 210	TL1 RL0 RP1
	IF	Function code received 212	TL1 RL1 RP0
	IF	Function code received 214	TL1 RL1 RP1
Timer	IF	Timer expired (Alarm Timer)	Start Alarm Timer

4.1 Transmit Steering Gateway CSS configuration



1. Select Configure > Network Element > Channel Table. No channels should be defined.
2. Disable the invalid channel alarms.



3. Select Configure > Task Manager > Task List.
4. Using Comments to define the task groups, set up the following tasks:

Comment	IF/IF NOT	Task input	Task action
General	IF	Network Element in Run mode	Lock Transmitter
	IF	Network Element in Run mode	Lock receiver
	IF NOT	Auxiliary supply unlocked	Unlock aux supply

5. Select Run. In Run mode, the transmitter and receiver should be disabled as this reciter should not be an active channel group member.

5 System testing

Use the Adam.NET utility to confirm I/O connectivity.

5.1 Equipment

Item	Qty	Description
TB9100 Reciter running conventional firmware version 3.6x+	1	Tx steering gateway
TB9100 Reciter running conventional firmware version 3.6x+ with PA and load	9	P25 conventional voice channels 1-9
Receiver multicoupler	1	Used to connect test set to all voice channels
Test set	1	Used to provide test P25 signal
6dB attenuator	8	
12dB attenuator	1	
20dB attenuator	1	
Windows PC	1	Must have .NET 4.0
Modbus/TCP simulator software	1	
CSS software v3.6x	1	

5.2 Procedure

Continuous steering mode

Test Setup

Place the Transmit Steering Gateway into Continuous steering mode (refer to Continuous/First site gateway input configuration).

Test Procedure

Inject a valid P25 signal into the receiver of the TB9100.

Expected Outcome

Verify the correct TB9100 is voted and the associated transmitter is keyed.

First site (call) steering mode

Test Setup

Place the steering gateway into First site steering mode (refer to Continuous/First site gateway input configuration).

Test Procedure

6. Inject a valid P25 signal into the receiver of the TB9100.
7. Remove the signal and connect it to a second TB9100.

8. Disconnect the RF for sufficient time to allow the call timer to expire.
9. Reapply the signal to the same TB9100.

Expected Outcome

1. Verify the correct TB9100 is voted and the associated transmitter is keyed.
2. After moving the RF Signal, verify the new receiver has been selected as the voted receiver and the previous transmitter is still keyed.
3. When reapplying the RF signal after the call timer has expired the selected transmitter should be selected based on the configuration file.

Console Select

Test Setup Tx Force select the TB9100 under test using the I/O control (refer to Input transmit preferences gateway input configuration). This enables Manual steering mode.

Test Procedure Inject a valid P25 signal into the receiver of a different TB9100.

Expected Outcome Verify the forced TB9100 becomes the selected transmitter.

Console Disable

Test Setup Tx Disable the TB9100 under test using the I/O control (refer to Input transmit preferences gateway input configuration).

Test Procedure Inject a valid P25 signal into the receiver of the TB9100.

Expected Outcome Verify the associated the channel is not selected as the voted source.

Voted Indication

Test Setup Place the steering gateway into Continuous steering mode (refer to Continuous/ First site gateway input configuration).

Test Procedure Inject a valid P25 signal into the receiver of the TB9100 under test.

Expected Outcome Verify the correct "Voted" indication is displayed at the console, or measured at the I/O interface. Refer to Output receive state for gateway output configuration details.

Receiving Indication

Test Setup

Place the steering gateway into Continuous steering mode (refer to Continuous/First site gateway input configuration).

Test Procedure

Inject a valid P25 signal into the receiver of the TB9100 under test at a level of -100dBm.

Inject a valid P25 signal into the receiver of a second TB9100 at a level of -90dBm.

Expected Outcome

Verify the correct "Receiving" indication is displayed at the console, or measured at the I/O interface for the TB9100 under test. Refer to Output receive state for gateway output configuration details.

Failed Indication

Test Setup

1. Using the CSS software lower the transmit output power to 10 Watts.
2. Place the steering gateway into Continuous steering mode (refer to Continuous/First site gateway input configuration).

Test Procedure

Key the TB9100 under test.

Expected Outcome

1. Verify the Alarm LED on the TB9100 control panel becomes active.
2. Verify the correct "Failed" indication is displayed at the console, or measured at the I/O interface for the TB9100 under test. Refer to Output receive state for gateway output configuration details.

Disabled Indication

Test Setup

Place the steering gateway into Continuous steering mode (refer to Continuous/First site gateway input configuration).

Test Procedure

Disable the TB9100 under test using the I/O control. Refer to Output receive state for gateway output configuration details.

Expected Outcome

Verify the correct "Disabled" indication is displayed at the console, or measured at the I/O interface for the TB9100 under test.

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4.2. Licensee will not, and will not directly or indirectly allow or enable any third party to: (i) reverse engineer, disassemble, extract components, decompile, reprogram, or otherwise reduce the Software or any portion thereof to a human perceptible form or otherwise attempt to recreate the source code; (ii) modify, adapt, create derivative works of, or merge the Software; (iii) copy, reproduce, distribute, lend, or lease the Software or Documentation to any third party; (iv) grant any sublicense or other rights in the Software or Documentation to any third party; (v) take any action that would cause the Software or Documentation to be placed in the public domain; (vi) remove, or in any way alter or obscure any copyright notice or other notice of Tait proprietary rights; (vii) provide, copy, transmit, disclose, divulge or make the Software or Documentation available to, or permit the use of the Software by, any third party or on any machine except as expressly authorized by this Agreement; or (viii) use, or permit the use of, the Software in a manner that would result in the production of a copy of the Software by any means whatsoever other than what is permitted in this Agreement. Licensee may make one copy of the Software to be used solely for archival, back-up, or disaster recovery purposes; provided that Licensee may not operate that copy of the Software at the same time as the original Software is being operated. Licensee may make as many copies of the Documentation as it may reasonably require for the internal use of the Software.

4.3. Unless otherwise authorized by Tait in writing, Licensee will not, and will not enable or allow any third party to: (i) install a copy of the Software on more than one unit of a Designated Product; or (ii) copy or transfer Software installed on one unit of a Designated Product to any other device. Licensee may temporarily transfer Software installed on a Designated Product to another device if the Designated Product is inoperable or malfunctioning. Temporary transfer of the Software to another device must be discontinued when the original Designated Product is returned to operation and the Software must be removed from the other device.

4.4. Licensee will maintain, during the term of this Agreement and for a period of two years thereafter, accurate records relating to this license grant to verify compliance with this Agreement. Tait, or a third party nominated by Tait, may inspect Licensee's premises, books and records, upon reasonable prior notice to Licensee, during Licensee's normal business hours and subject to Licensee's facility and security regulations. Tait is responsible for the payment of all expenses and costs of the inspection, provided that Licensee shall indemnify Tait for all costs (including audit costs and legal costs on a solicitor client basis) if Licensee has breached the terms of this Agreement. Any information obtained by Tait during the course of the inspection will be kept in strict confidence by Tait and used solely for the purpose of verifying Licensee's compliance with the terms of this Agreement.

Section 5 OWNERSHIP AND TITLE

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Section 6 LIMITED WARRANTY; DISCLAIMER OF WARRANTY

6.1. The commencement date and the term of the Software warranty will be a period of one (1) year from Tait shipment of the Software. If Licensee is not in breach of any obligations under this Agreement, Tait warrants that the unmodified Software, when used properly and in accordance with the Documentation and this Agreement, will be free from a reproducible defect that eliminates the functionality or successful operation of a feature critical to the primary functionality or successful operation of the Software. Whether a defect has occurred will be determined solely by Tait. Tait does not warrant that Licensee's use of the Software or the Designated Products will be uninterrupted, error-free, completely free of Security Vulnerabilities, or that the Software or the Designated Products will meet Licensee's particular requirements. Tait makes no representations or warranties with respect to any third-party software included in the Software.

6.2 Tait sole obligation to Licensee, and Licensee's exclusive remedy under this warranty, is to use reasonable efforts to remedy any material Software defect covered by this warranty. These efforts will involve either replacing the media or attempting to correct significant, demonstrable program or documentation errors or Security Vulnerabilities. If Tait cannot correct the defect within a reasonable time, then at Tait option, Tait will replace the defective Software with functionally equivalent Software, license to Licensee substitute Software which will accomplish the same objective, or terminate the license and refund Licensee's paid license fee. If Tait investigation of the perceived defect reveals that no such defect in fact exists, Tait may recover its costs in respect of such investigation from Licensee.

6.3. Tait disclaims any and all other warranties relating to the Software or Documentation other than the express warranties set forth in this Section 6. Warranties in Section 6 are in lieu of all other warranties whether express or implied, oral or written, and including without limitation any and all implied warranties of condition, title, non-infringement, merchantability, or fitness for a particular purpose or use by Licensee (whether Tait knows, has reason to know, has been advised of, or is otherwise aware of any such purpose or use), whether arising by law, by reason of custom or usage of trade, or by course of dealing. In addition, Tait disclaims any warranty to any person other than Licensee with respect to the Software or Documentation.

Section 7 TRANSFERS

7.1. Licensee will not transfer the Software or Documentation to any third party without specific prior written consent from Tait. Tait may withhold such consent or at its own discretion make the consent conditional upon the transferee paying applicable license fees and agreeing to be bound by this Agreement.

7.2. In the case of a value-added reseller or distributor of Tait Designated Products, the consent referred to in Section 7.1 may be contained in a Tait Reseller or Tait Distributor Agreement.

7.3. If the Designated Products are Tait vehicle-mounted mobile products or hand-carried portable radio products and Licensee transfers ownership of the Tait mobile or portable radio products to a third party, Licensee may assign its right to use the Software which is embedded in or furnished for use with the radio products and the related Documentation; provided that Licensee transfers all copies of the Software and Documentation to the transferee.

7.4. For the avoidance of any doubt, Section 7.3 excludes TaitNet Infrastructure, or the products listed at any time under network products at: http://www.taitradio.com.

7.5. If Licensee, as a contractor or subcontractor (integrator), is purchasing Tait Designated Products and licensing Software not for its own internal use but for end use only by a Customer, the Licensee may transfer such Software, but only if a) Licensee transfers all copies of such Software and the related Documentation to the transferee and b) Licensee has first obtained from its Customer (and, if Licensee is acting as a subcontractor, from the interim transferee(s) and from the ultimate end user sub license) an enforceable sublicense agreement that prohibits any other transfer and that contains restrictions substantially identical to the terms set forth in this Software License Agreement. Except as stated in the foregoing, Licensee and any transferee(s) authorised by this Section may not otherwise transfer or make available any Tait Software to any third party nor permit any party to do so. Licensee will, on request, make available evidence reasonably satisfactory to Tait demonstrating compliance with all the foregoing.

Section 8 TERM AND TERMINATION

8.1. Licensee's right to use the Software and Documentation will commence when the Designated Products are supplied by Tait to Licensee and will continue for the life of the Designated Products with which or for which the Software and Documentation are supplied, unless Licensee breaches this Agreement, in which case this Agreement and Licensee's right to use the Software and Documentation may be terminated immediately upon notice by Tait.

8.2. Within thirty (30) days after termination of this Agreement, Licensee must certify in writing to Tait that all copies of the Software have been removed or deleted from the Designated Products and that all copies of the Software and Documentation have been returned to Tait or destroyed by Licensee and are no longer in use by Licensee.

8.3. Licensee acknowledges that Tait made a considerable investment of resources in the development, marketing, and distribution of the Software and Documentation and that Licensee's breach of this Agreement will result in irreparable harm to Tait for which monetary damages would be inadequate. If Licensee breaches this Agreement, Tait may terminate this Agreement and be entitled to all available remedies at law or in equity including immediate injunctive relief and repossession of all non-embedded Software and associated Documentation. Licensee shall pay all Tait costs (on an indemnity basis) for the enforcement of the terms of this Agreement.

Section 9 CONFIDENTIALITY

Licensee acknowledges that the Software and Documentation contain proprietary and Confidential Information valuable to Tait and are Tait trade secrets, and Licensee agrees to respect the confidentiality of the information contained in the Software and Documentation.

Section 10 LIMITATION OF LIABILITY

10.1. In no circumstances shall Tait be under any liability to Licensee, or any other person whatsoever, whether in Tort (including negligence), Contract (except as expressly provided in this Agreement), Equity, under any Statute, or otherwise at law for any losses or damages whether general, special, exemplary, punitive, direct, indirect, or consequential arising out of or in connection with any use or inability of using the Software.

10.2. Licensee's sole remedy against Tait will be limited to breach of contract and Tait sole and total liability for any such claim shall be limited at the option of Tait to the repair or replacement of the Software or the refund of the purchase price of the Software.

Section 11 GENERAL

11.1. COPYRIGHT NOTICES. The existence of a copyright notice on the Software will not be construed as an admission or presumption of publication of the Software or public disclosure of any trade secrets associated with the Software.

11.2. COMPLIANCE WITH LAWS. Licensee acknowledges that the Software may be subject to the laws and regulations of the jurisdiction covering the supply of the Designated Products and will comply with all applicable laws and regulations, including export laws and regulations, of that country.

11.3. ASSIGNMENTS AND SUBCONTRACTING. Tait may assign its rights or subcontract its obligations under this Agreement, or encumber or sell its rights in any Software, without prior notice to, or consent of, Licensee.

11.4. GOVERNING LAW. This Agreement shall be subject to and construed in accordance with New Zealand law and disputes between the parties concerning the provisions hereof shall be determined by the New Zealand Courts of Law. Provided however Tait may at its election bring proceedings for breach of the terms hereof or for the enforcement of any judgment in relation to a breach of the terms hereof in any jurisdiction Tait considers fit for the purpose of ensuring compliance with the terms hereof or obtaining relief for breach of the terms hereof.

11.5. THIRD-PARTY BENEFICIARIES. This Agreement is entered into solely for the benefit of Tait and Licensee. No third party has the right to make any claim or assert any right under this Agreement, and no third party is deemed a beneficiary of this Agreement. Notwithstanding the foregoing, any licensor or supplier of third-party software included in the Software will be a direct and intended third-party beneficiary of this Agreement.

11.6. SURVIVAL. Sections 4, 5, 6.3, 7, 8, 9, 10, and 11 survive the termination of this Agreement.

11.7. ORDER OF PRECEDENCE. In the event of inconsistencies between this Agreement and any other Agreement between the parties, the parties agree that, with respect to the specific subject matter of this Agreement, this Agreement prevails.

11.8. SECURITY. Tait uses reasonable means in the design and writing of its own Software and the acquisition of third-party Software in order to limit Security Vulnerabilities. While no software can be guaranteed to be free from Security Vulnerabilities, if a Security Vulnerability is discovered, Tait will take the steps specified in Section 6 of this Agreement.

11.9. SEVERABILITY. In the event that any part or parts of this Agreement shall be held illegal or null and void by any court or administrative body of competent jurisdiction, such determination shall not affect the remaining terms which shall remain in full force and effect as if such part or parts held to be illegal or void had not been included in this Agreement. Tait may replace the invalid or unenforceable provision with a valid and enforceable provision that achieves the original intent and economic effect of this Agreement.

11.10. CONSUMER GUARANTEES. Licensee acknowledges that the licenses supplied in terms of this agreement are supplied to Licensee in business, and that the guarantees and other provisions of prevailing consumer protection legislation shall not apply.

11.11. WHOLE AGREEMENT. Licensee acknowledges that it has read this Agreement, understands it and agrees to be bound by its terms and conditions. Licensee also agrees that, subject only to the express terms of any other agreement between Tait and Licensee to the contrary, this is the complete and exclusive statement of the Agreement between it and Tait in relation to the Software. This Agreement supersedes any proposal or prior agreement, oral or written, and any other communications between Licensee and Tait relating to the Software and the Designated Products.