FUJITSU

RTR

RADIO TEST ROBOT

RT-5060

DUAL PROCESSOR

1RU, 19" RACK MOUNT VERSION SERIAL/ITEM 533/nnn

OPERATOR HANDBOOK

Version 1.2 - MARCH, 2006

DESIGNED AND MANUFACTURED IN AUSTRALIA

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DESIGN TWO THOUSAND PTY LTD

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RADIO TEST ROBOT RT-5060

USER HANDBOOK

N468

DESIGNED AND MADE IN AUSTRALIA

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DESIGN TWO THOUSAND PTY LTD

FOR

FUJITSU

OSS Technologies

1. SERVICE INFORMATION

If problems are experienced with the installation or operation of the Radio Test Robot please call the Help Desk Number listed below before returning units to the factory for repair.

In many cases, problems can be diagnosed and rectified over the phone, avoiding unnecessary transportation and service costs.

HELP DESK NUMBER:

+61 3 9758 5933 (All hours)

2. INTRODUCTION

The Radio Test Robot –Trunked/PMR (RTR-T/P) is a custom hardware development for the State Mobile Radio Network Service Performance Monitoring (SMR-SPM) project. It connects to the SMR MAP27 Gateway & Digital Audio Switch (DAS) for performing Control and Traffic Channel Availability Tests on the Trunked Radio Network, & to Voter Nodes for performing Conventional Channel Service Tests on the VicPol, CFA & Melbourne Water PMR Networks.

2.1 OVERVIEW

The SMR-SPM test arrangement incorporates the RTR-T and RTR-P as the interfaces between the Test & Diagnosis (T&D) server and the Trunked & PMR networks. Please note that the Trunked & PMR Interface Testers are physically housed in the same enclosure.

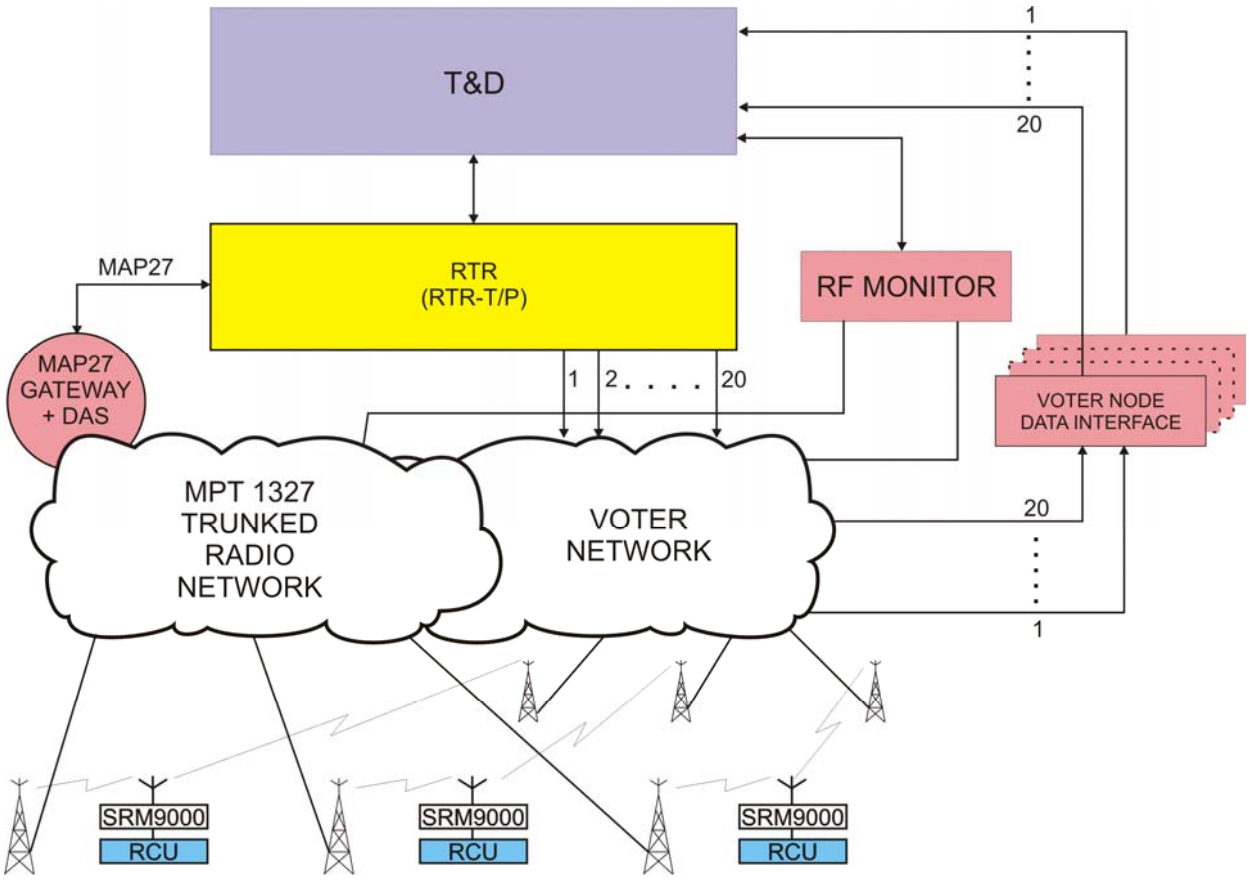


Figure 1: SMR-SPM Test Arrangement

The RTR-T/P is housed in a single 1RU 19” rack-mount enclosure. To more easily describe the test functions, both the Logical Representations & Test Descriptions have been separated into two discrete parts:

1. **Trunked (T)**

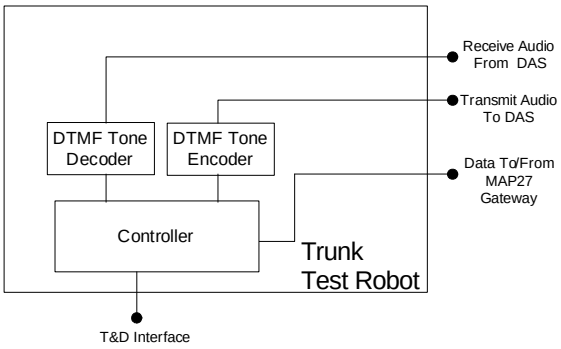


Figure 2: RTR-T Logical Representation

2. **Private Mobile Radio (PMR) (P)**

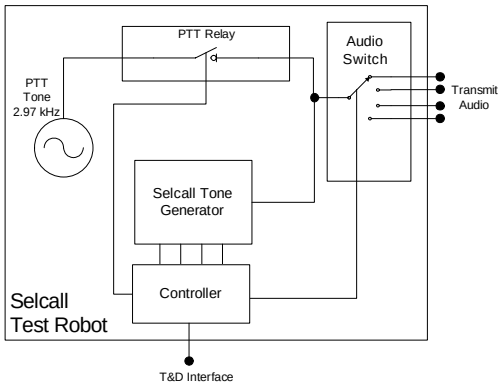


Figure 3: RTR-P Logical Representation

3. DESCRIPTION

3.1 Radio Test Robot – Trunked (RTR-T)

The RTR-T is used for performing Control and Traffic Channel Availability Tests on the Trunked Radio Network. Its logical representation is shown in Figure 2.

The RTR-T is a custom development and performs the Control and Traffic Channel Availability Tests on the SMR by initiating a Voice Call over the Traffic Channel assigned to it by the Trunking System Controller (TSC). Test Tones are then sent for the Test Transmitter Receiver (TTR) to receive and respond with Acknowledgment Tones. This requires the RTR-T to make the call, send, receive and correlate the DTMF Test Tones to and from the TTR. The TTR also requires additional hardware (the Radio Control Unit (RCU)) to answer the incoming call, and receive the test tone and send an acknowledgement to the DTMF Test Tones.

The RTR-T is responsible for receiving a request from T&D to initiate a Voice Call to a given Trunked RCU/TTR. The RTR-T makes a MAP27 Voice Call into the Trunked Radio Network via the Map27 Gateway Node. Once the RTR-T detects that the RCU/TTR has answered the call and the TSC allocates a traffic channel, the RTR-T will transmit the DTMF Test Tones over the traffic channel. The RTR-T will then wait for the RCU/TTR to respond with the Acknowledgment DTMF Tones. T&D will then be notified of the test result.

In addition to performing Control and Traffic channel tests, the RTR-T is used to change the mode of the remote TTR from Trunked to PMR mode. T&D will instruct the RTR-T to send a message to the RCU/TTR over the control channel instructing it to change its mode and acknowledge T&D that the mode change message has been received by the RCU/TTR.

3.2 Radio Test Robot – PMR (RTR-P)

The RTR-P uses 5 Tone Selcall signaling for performing a Conventional Channel Service Test on the VicPol, CFA & Melbourne Water PMR Networks. Its logical representation is shown in Figure 3.

The RTR-P is a custom development and will perform the following:

- Address a multi-channel Audio Switch to switch the audio path to the required Voter Node
- Issue a PTT Tone to key the required Voter Node
- Issue the Selcall Tones to address the required TTR

The logical representation of the RTR-P is shown in Figure 3. Here the T&D interface is used to control the functionality of the RTR-P. The Controller is used to select the required transmit audio path to the Voter Node. A command is the issued to the relay carrying the PTT tone to activate, at which point the PTT Tone is sent to the Voter Node. The Controller is then issued a command to send the required set of Selcall tones in order to address the required TTR. An automatic Selcall acknowledgement is correlated by T&D analysing the data received from the RF Monitor and Voter Node Data Interface shown in Figure 1.

3.3 RTR-T/P FEATURES

FEATURE	(RTR-T/RTR-P)
Single Enclosure Design	√ (1RU)
12V dc Working	√
dc Supply Indicator	√
Serial Interfaces: T&D MAP27 Gateway	 √ √
DAS 4w 600 Ohm analogue audio Interface	√
DTMF Receiver	√
DTMF Transmitter	√
5 Tone Selcall encode	√
5 Tone Selcall decode	X
Control Channel Integrity Test	√
Traffic Channel Integrity Test	√
End to End Testing (with RCU/TTR units at remote sites)	√
2970 Hz Key Tone	√
20 Port Tx Audio Switch	√
20 Port Rx Audio Switch (in tandem with Tx)	X
Firmware upgradeable via USB	√

Figure 4: Table of RTR Features

4. RTR-T/P CONTROLS

The RTR-T/P has a Reset button and an Update button for both the Trunked Processor and the PMR Processor. The function of these buttons is described in the 'Update Procedure' (separate document).

4.1 RTR-T/P DISPLAY PANEL

The RTR-T/P has 2 x 8 character LCD display that indicates testing variables such as Control Channel test, Traffic Channel test, TTR Identity (IDENT.) under test, Voter Node under test, Selcall ID, and test result Pass/Fail:

System Ready:	SYSTEM READY.	The system is idle with no errors detected.
MAP27 Fail:	MAP27 FAIL!	The MAP27 communication link has been lost.
Control Channel Test:	CCT -> ID NNNN,	where nnnn is the TTR IDENT
Traffic Channel Test:	TCT -> ID NNNN,	where nnnn is the TTR IDENT
Swap to PMR mode:	SWAP MODE	
Selcall Test:	SCT VNXX ID PPPPP,	where xx is the Voter Node & ppppp is the TTR Selcall ID (paging number).

Figure 5: RTR Front Panel

4.2 DISPLAY PANEL LEDs

In addition to the LCD display, visual indication of operating progress is provided by five LEDs on the front panel marked PMR 'TEST', PMR 'ACT', TRUNKED 'TEST', TRUNKED 'ACT' and 'POWER'.

PMR TEST	RTR-P is busy testing the PMR network
PMR ACT	RTR-P is swapping modes or in the PMR mode
TRUNKED TEST	RTR-T is busy testing the Trunked network
TRUNKED ACT	RTR-T has MAP27 link Activity with the MAP27 Gateway/RCU
POWER	12Vdc power is connected and the internal fuse is intact.

4.3 RTR-T/P CONNECTORS

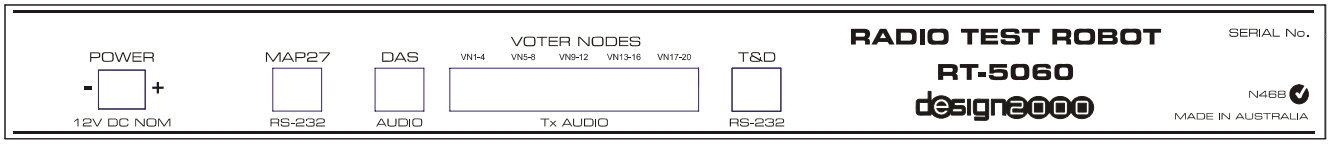


Figure 6: RTR Rear Panel

12Vdc power input	BL-2	Voter Nodes (Tx Audio)	5 x RJ45
MAP27 Gateway (RS-232)	RJ45	Test & Diagnosis (RS-232)	RJ45
DAS 4w Audio	RJ45	USB (front Panel)	2 x 2.0 Type B

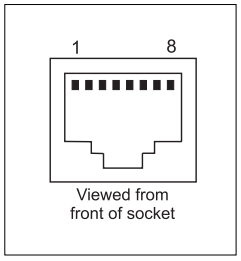
5. INSTALLATION

The RTR-T/P is supplied in a 1RU, 19" rack mount enclosure with the operating LCD & LEDs and USB upgrade ports on the front. The Power, Com ports & Audio ports are at the back. The RTR-T/P is therefore ideally suited to be mounted in a standard 19" rack, but can be placed on a desk or in a shelf.

Installation is essentially 'plug and play' as described here.

5.1 CONNECTING TO THE T&D

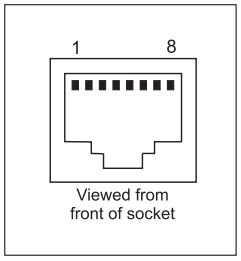
The RTR-T/P is connected to the Fujitsu Test & Diagnosis Server via a standard RS-232 serial link. RJ45 Pin assignments for the T&D RS-232 port are:



PIN	ASSIGNMENT
1	NC
2	NC
3	TxD (Data OUT from RTR to T&D)
4	NC
5	RxD (Data IN to RTR from T&D)
6	GND
7	NC
8	NC

5.2 CONNECTING TO THE PMR VOTER NODES

The RTR-P Tx audio is connected to the Voter Nodes via pairs on 5 x RJ45 jacks. Viewed from left to right, the first jack connects to Voter Nodes 1-4, the second connects to Voter Nodes 5-8, the third connects to Voter Nodes 9-12, the fourth to Voter Nodes 13-16 and the fifth to Voter Nodes 17-20. Pin assignments for the Voter Node Tx audio jacks are:

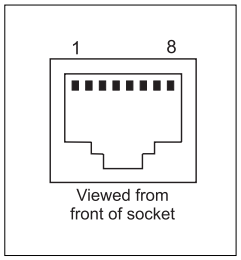


PAIR	PINS	ASSIGNMENT
1	4 & 5	Tx out from RTR-P to VN 1
2	3 & 6	Tx out from RTR-P to VN 2
3	1 & 2	Tx out from RTR-P to VN 3
4	7 & 8	Tx out from RTR-P to VN 4

Please note that the same pin-outs apply to all five RTR-P Voter Node RJ45 jacks, with the second and subsequent jacks providing the Tx audio for Voter Nodes 5–20, eg. pair 1 on the second jack is connected to Voter Node 5, pair 2 on the third jack is connected to Voter Node 10, pair 3 on the fifth jack connects to Voter Node 19. **See also Section 9 for the 'Voter Node Cable Assembly' diagram**.

5.3 CONNECTING TO THE TAIT T1561 DIGITAL AUDIO SWITCH (DAS)

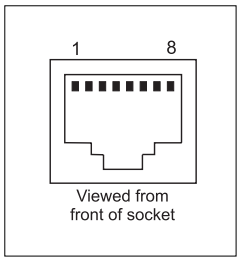
The RTR-T Tx/Rx audio is connected to the DAS via an RJ45 jack. Pin assignments for the DAS Audio port are :



PAIR	PINS	ASSIGNMENT
1	4 & 5	Tx Audio OUT from RTR-T to DAS
2	3 & 6	Rx Audio IN to RTR-T from DAS
3	1 & 2	NC
4	7 & 8	NC

5.4 CONNERCTING TO THE TAIT T1410 MAP27 GATEWAY

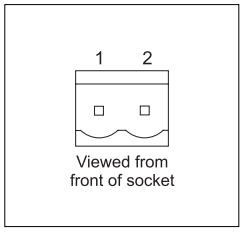
The RTR-T/P is connected to the TAIT MAP27 Gateway via a standard RS-232 serial link. RJ45 Pin assignments for the MAP27 RS-232 port are:



PIN	ASSIGNMENT
1	NC
2	NC
3	TxD (Data OUT from RTR to MAP27 Gateway)
4	NC
5	RxD (Data IN to RTR from MAP27 Gateway)
6	GND
7	NC
8	NC

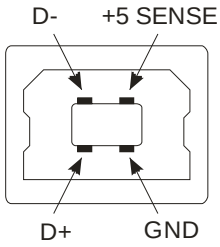
5.5 CONNECTING POWER TO THE RTR-T/P

The RTR-TP is powered from a nominal 12V dc supply, with the polarity as indicated. The nominal operating current is 150 mA @ 12V with a maximum current of 300 mA. The power connector supplied is a BL-2 screw/clamp plug.



PIN	ASSIGNMENT
1	12V -ve
2	12V +ve

5.6 USB CONNECTION



Viewed from
front of socket
USB type B

The RTR-T and P's firmware can be upgraded using a standard USB patch lead with a Type A male plug (PC) to a Type B male (RCU) plug

5.7 INSTALLATION BLOCK DIAGRAM

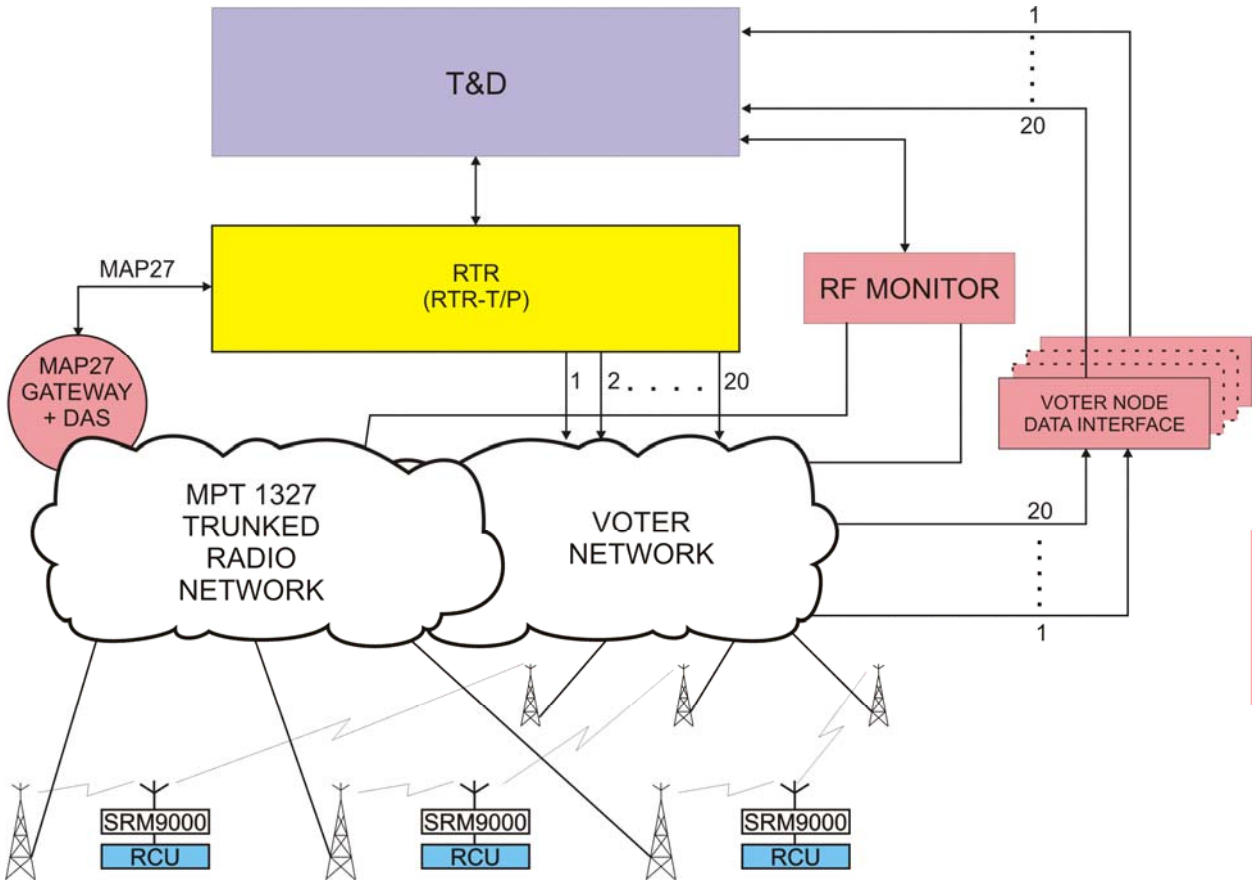


Figure 7: SMR-SPM Test Arrangement

6. FUNCTIONAL DESCRIPTION

6.1 Radio Test Robot – Trunked (RTR-T)

The Trunked Radio Network uses a TaitNet MPT1327 backbone for the coverage of 97 sites with a total traffic channel count of 330. There are two tests that are performed on the Trunked Radio Network:

- Control Channel Availability Test
- Traffic Channel Availability Test

6.1.1 Control Channel Test

- T&D issues a command for the RTR-T to perform a Trunk Control Channel Test
- T&D specifies the IDENT of the TTR to be tested when the requesting the test from the RTR-T
- T&D specifies the number of retries to be performed by the RTR-T should the remote RCU/TTR not acknowledge the message.
- The RTR-T issues a MAP27 "Send Status Message 1" command (Status Message 1 signifying a Control Channel Test) to the MAP27 Gateway Node to reach the remote RCU/TTR with the specified IDENT.
- The RTR-T waits for the specified time for the RCU/TTR to respond with Status Message 1.
- The RTR-T responds to T&D with the result of the test (Passed/Failed) and the number of retries performed.

6.1.2 Traffic Channel Test

- T&D issues a command for the RTR-T to perform a Trunk Traffic Channel Test.
- T&D specifies the IDENT of the TTR to be tested when the requesting the test from the RTR-T
- T&D specifies the number of retries to be performed by the RTR-T should the remote RCU/TTR not acknowledge the message.
- If either the IDENT or number of retries is not specified or invalid, the RTR-T notifies T&D that the message has been rejected.
- The RTR-T establishes a Voice Call to the RCU/TTR as specified in the IDENT over the MAP27 Gateway Node.
- If the RTR-T does not receive a MAP27 'Go-To-Channel' message to indicate that the RCU/TTR has answered the call within the specified period of time from the call being initiated, the RTR-T terminates the call and attempts to re-establish the call to the RCU/TTR until the number of retries has been exhausted.
- If the numbers of call retries has been exhausted, the RTR-T will return the result of the test to T&D as failed including the number call retries performed while setting the test tone retries to zero as no tones were sent.
- Once the RTR-T detects that the call has been answered by the remote RCU/TTR, the RTR-T issues DTMF test tones A and D (within the specified period of time of detecting the call has been answered) to the RCU/TTR under test over the established audio path on the traffic channel. The A & D test tones have been chosen because they are not easily replicated by Customer Terminal Equipment.
- The RTR-T waits for the RCU/TTR to respond with the DTMF A and D acknowledgement tones from the RCU/TTR under test for a specified period of time.
- The test tones will be resent if the RTR-T detects that the received acknowledgement tones are not the Acknowledgement DTMF digits or are not received within the specified time period.

- If the RCU/TTR does not acknowledge the Test Tone, the RTR-T re-sends the Test Tones to the RCU/TTR until the number of retries has been exhausted.
- If the RTR-T detects that the call has been terminated by the RCU/TTR or by the Network, the RTR-T will treat this as a failed call attempt, increment the call retry counter and attempt to call the RCU/TTR if the number of call retries has not been exhausted.
- The RTR-T responds to T&D with the result of the test (Passed/Failed) including the number of call retries and test tone retries that were performed.
- Once the status of the test has been determined as either Pass or Fail, the RTR-T terminates the call to the RCU/TTR if the call is still active.

6.2 Radio Test Robot – PMR (RTR-P)

The RTR-P tests the Conventional PMR Voting Radio Network. There are currently three customers that operate on the RMR Voting Radio Network:

- Victoria Police
- Country Fire Authority (CFA)
- Melbourne Water

The Victoria Police network is structured around 6 regions across Victoria each having two PMR voting networks to provide working coverage. Transmit and receive audio from each site is brought back to one of 6 regional sites (including the NOCC) for connection to a voter node. There are currently 116 sites and 131 channels in operation.
The CFA have four PMR Voting networks covering outer metro regions. Transmit and receive audio from each site is brought back to the NOCC for connection to a voter node. Each network has a receiver voting configuration coupled to a conventional transmitter configuration. There are currently 19 sites in operation.
Melbourne Water has a single PMR voting network covering Melbourne and adjacent areas. Transmit and receive audio from each site is brought back to the NOCC for connection to a voter node. The network has a receiver voting configuration and simulcast transmitter configuration.

6.2.1 RTR Mode Change

T&D issues the Mode Change command to the RTR-T in preparation for a Selcall Test where a site has a dual mode (Trunk & PMR) TTR. The following procedure defines the behaviour for changing a dual mode TTR from Trunk to PMR mode.

- T&D issues a command for the RTR-T to change the mode of the RCU/TTR from Trunked to PMR.
- T&D specifies the period for which the radio is to remain in PMR mode.
- T&D specifies the number of retries to be performed by the RTR-T should the remote RCU/TTR not acknowledge the message.
- The RTR-Ts sends a MAP27 "Send Status Message 10" command (Status Message 10 signifying the mode change to PMR) for the RTR-T to instruct the RCU/TTR to swap modes from Trunked to PMR.
- The RTR-Ts sends a MAP27 "Send Status Message (11 – 18)" which defines the period of time that the TTR should remain in the PMR mode of operation.
- The RTR-T waits for the RCU/TTR to acknowledge that it has received the "Mode Change" message (Status Message 10) and is about to change modes to PMR.
- If the RTR-T does not get an acknowledgement from the RCU/TTR within the specified period of time of sending the mode change message, the RTR-T will re-send the mode change message to the RCU/TTR.
- The RTR-T responds to T&D with the status of the mode change (successful /unsuccessful) and the number of retries performed.
- If successful:
    - For diagnostic purposes, the RTR-P indicates the state of the RCU/TTR by blinking the PMR "ACT" LED for the duration of time that the remote unit is in PMR mode.
    - The RTR-T continues to accept commands from T&D and can perform other tasks such as Trunk Tests to other RCU/TTR units.

6.2.2 Selcall Test

- T&D issues a command for the RTR-P to perform a Sellcall Test.
- T&D specifies the Selcall-ID of the TTR to be tested when the requesting the test from the RTR-P.
- T&D specifies the Voter Node ID to which the TTR is associated with when requesting the test from the RTR-P.
- The RTR-P notifies T&D if the Selcall ID or Voter Node ID is invalid or missing.
- The RTR-P selects the Tx Audio interface for the specified Voter Node.
- The RTR-P transmits the 2.97kHz PTT tone at the default level of -23.5dBm for 2000 ms over the Tx Audio interface for the specified Voter Node.
- The RTR-P transmits the Sellcall tones for the specified Selcall-ID at the default level of -14dBm over the Tx Audio interface for the specified Voter Node.
- The RTR-P de-selects the Tx Audio interface for the specified Voter Node and mutes the 2.97kHz PTT tone.
- The RTR-P responds to T&D that it has completed the test once the RTR-P has deselected the audio interface to the Voter Node.

7. T&D – RTR INTERFACE SPECIFICATION

The complete T&D – RTR Interface specification is detailed in Document ID FAL-OSSTech-01026IS02. It defines the both the serial data command and physical interface of the RTR.

7.1 T&D – RTR-T/P – TTR/RCU SEQUENCE DIAGRAMS

7.1.1 Control Channel Test (CCT)

The sequence of messages from T&D through to the RCU for the Trunk Control Channel Test is shown in figure 8.

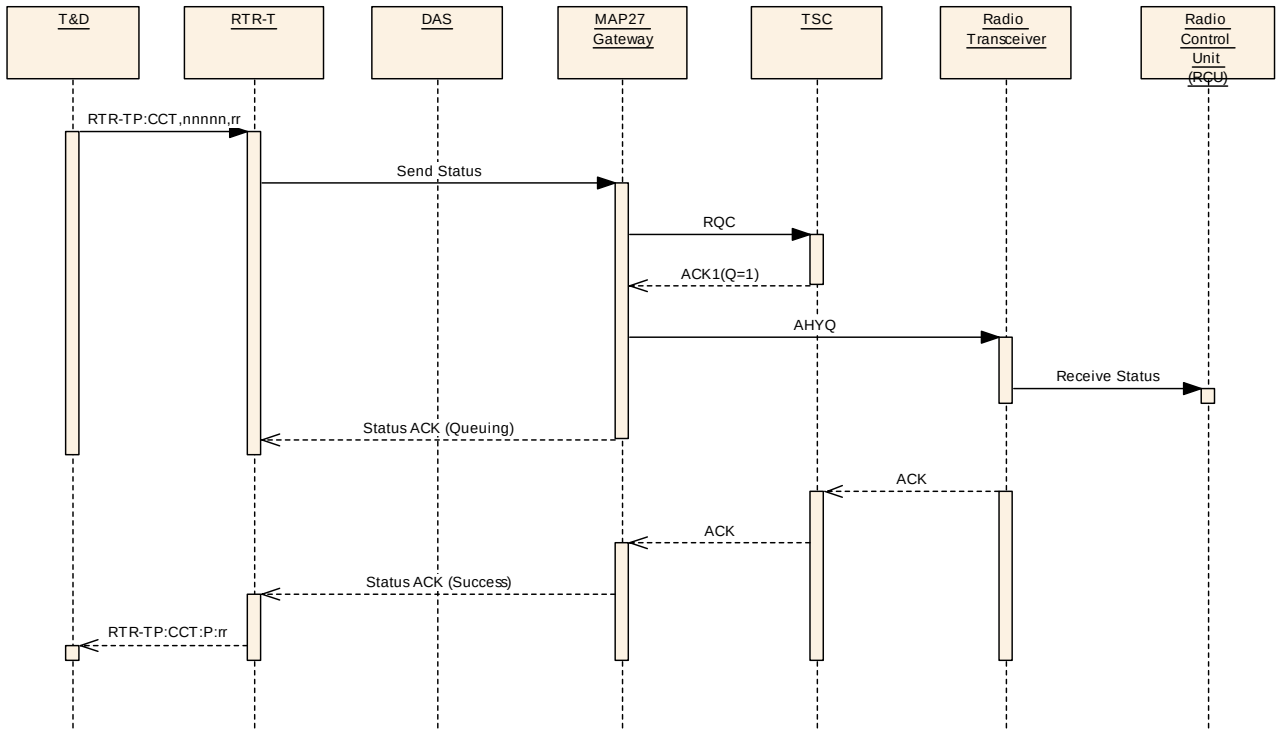


Figure 8: Control Channel Test Sequence Diagram

Here, T&D issues the CCT command specifying the IDENT of the Transceiver to be tested and the number of retries. The RTR-T/P translates this to a Status message which is sent to the Transceiver. After the RTR-T/P issues the Status message, it waits for the MAP27 gateway to issue a StatusACK (Success) and Status message reply which indicates that the TTR/RCU received and responded to the Status message. The RTR-T/P then responds to T&D with CCT with a Pass (P) clause.

Note: The Status Message for CCT is Status Message 1.

7.1.2 Traffic Channel Test (TCT)

The sequence of messages from T&D through to the RCU for the Trunk Control Channel Test is shown in Figure 9.

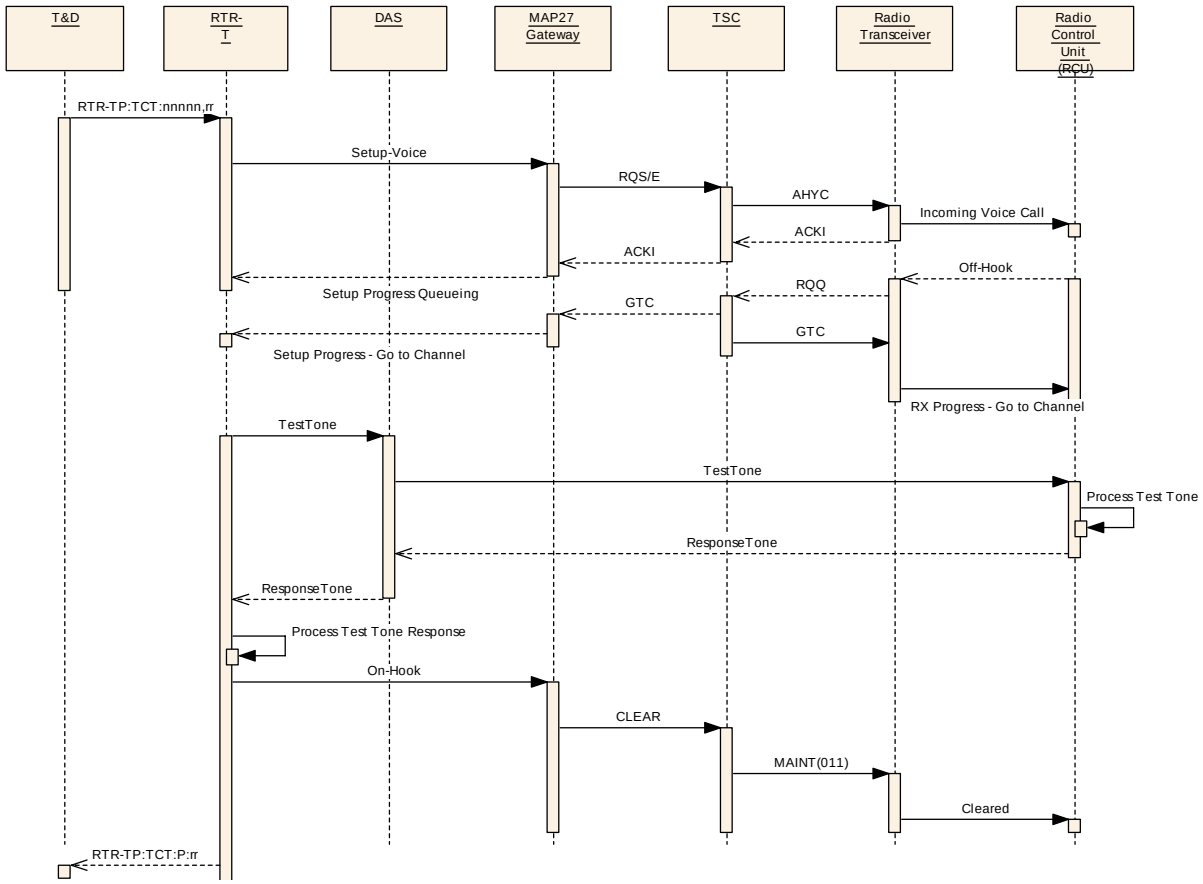


Figure 9: Traffic Channel Test Sequence Diagram

Here, T&D issues the TCT command specifying the IDENT of the Transceiver to be tested and the number of retries. The RTR-T/P translates this to a "Setup Voice" message which is sent to the Transceiver. After the RTR-T/P issues the "Setup Voice" message it waits for the MAP27 gateway to issues a "Go-To-Channel" message which indicates that the RCU has answered the Voice Call.
On receipt of the "Go-To-Channel" message, the RTR-T/P issues two DTMF Test Digits each for 1500 ms. The RTR-T/P then waits for the RCU to respond with exactly the same DTMF Test Digits that it received and verified. If the correct DTMF digits are received and verified by the RTR-T/P, the Trunk Call is cleared down and the TCT response messages is sent to T&D with a response clause of Pass (P)

7.1.3 Mode Change

The sequence of messages from T&D through to the RCU for changing the mode of the Transceiver from Trunk to PMR mode is shown in Figure 10.

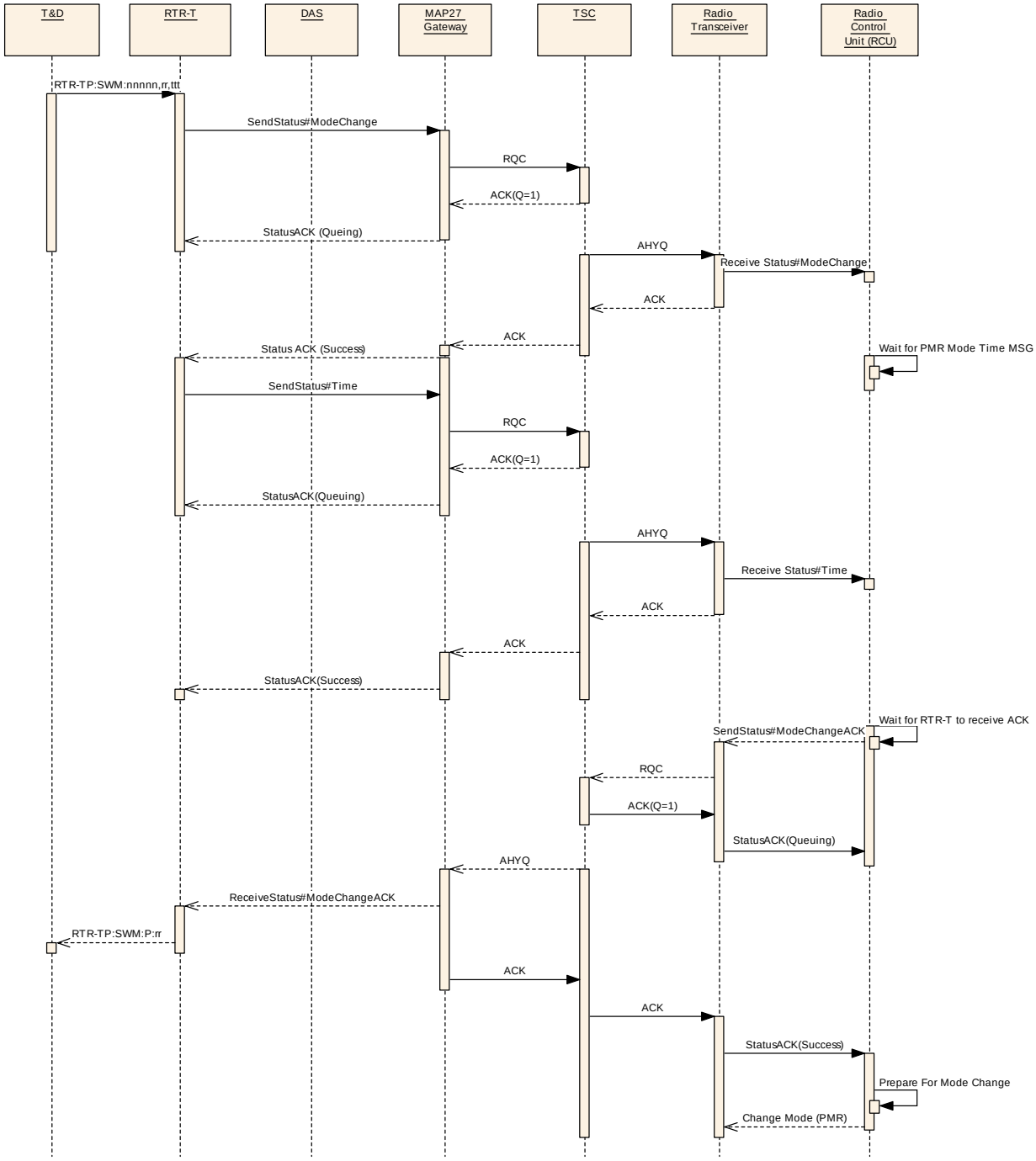


Figure 10: Transceiver Mode Change Sequence Diagram

Here, T&D issues the SWM command specifying the IDENT of the Transceiver to be Mode Switched, the number of retries and a final parameter which specifies the time that the Transceiver will remain in the PMR Mode.

The RTR-T/P translates the SWM to a Status message, sends it to the Transceiver and waits for the MAP27 gateway to issue a StatusACK (Success). When the Status message is received, the RCU replies with the same Status message and waits for the next Status message from the RTR-T/P that provides the timing information (Timer value T1 … T8). When this is received, the RCU replies with the same Status message and RTR-T/P has full confirmation that the Mode Change message and the time period for which the Transceiver is to remain in PMR Mode have been received by the RCU. The RCU prepares for Mode Change and issues a command to the Transceiver to change to PMR mode.

Note: The Status Message for SWM is Status Message 10
The Status Messages for T1 → T8 are Status Messages 11 → 18.
Timer values are in 30 second increments starting at T1 = 30 seconds to T8 = 240 seconds.

7.1.4 Selcall Test (SCT)

The sequence of messages from T&D through to the RCU for the Selcall Test is shown in Figure 11.

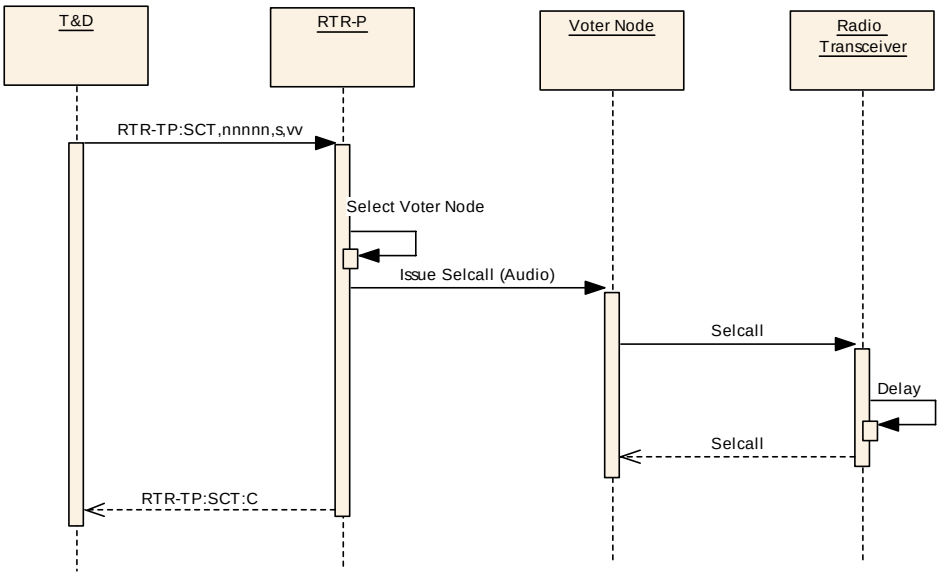


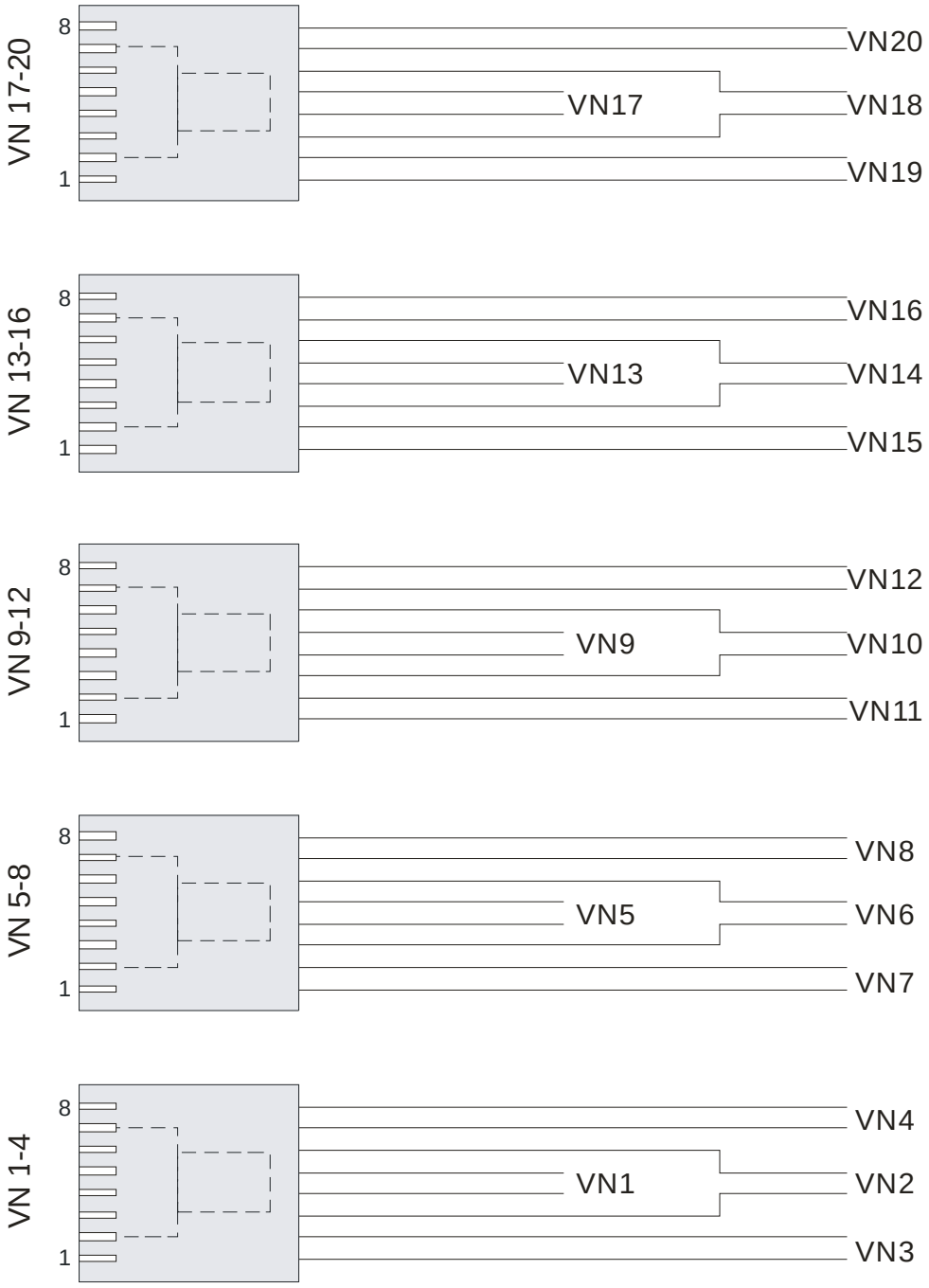
Figure 11: Selcall Test Sequence Diagram

Here, T&D issues the SCT command specifying the IDENT of the Transceiver to be tested and the Voter Node to be selected by the RTR-T/P when issuing the Selcall. Once the RTR-T/P selects the appropriate Voter Node, the RTR-T/P issues the Selcall over the Voter Node Audio interface. The RTR-T/P then issues a STC response with a clause of Complete [C] back to T&D.

8. RTR RT-5060 FIRMWARE

The RTR-T/P RT-5060 Firmware Source Code Reference Number is SW-5062
The RCU-5056 Firmware Source Code Reference Number is SW-5058

9. VOTER NODE CABLE ASSEMBLY DIAGRAM



RJ45's SHOWN
WITH TAB UNDERNEATH

10. SPECIFICATIONS

Enclosure	1U high, 19” rack mount, 250mm deep.
Finish	Dulux Black Onyx Pearl powder coat.
Power Requirement	12 Vdc nominal (10.8→16Vdc), polarity sensitive.
Power Consumption	300 mA max. @ 12 V 3.6 W
Operating Temperature Range	-10 → +70 ° C.
Storage Temperature Range	-20 → 80 ° C ambient.
Humidity, Storage and Operating	To 98% non-condensing.
Mean Time Between Failure:	> 20 years.
Dual Processors	2 x PIC18F4550
Processors Speed	20 MHz XTAL, internally multiplied to 48MHz
On Board RAM2	2KB per processor
On Board FLASH	32KB per processor
On Board EEPROM	256B per processor
In-band Signaling	Dual Tone Multi Frequency (DTMF) and 5 Tone Sellcall.
DTMF Dialer	1500 ms on / 260 ms off, -6dBm.
DTMF Receiver	-26 → 0 dBm sensitivity.
5 Tone Paging Protocol	CCIR 40 ms, -14dBm.
PTT Tone	2970 Hz @ -23.5dBm, on for 20000 ms prior to Selcall Tx
Status Messages	1: Control Channel Test (CCT) 10: Swap to PMR mode (SWM) 11 – 18: Timer Values T1 – T8 (30 – 240 s).
Controls	Reset, Update for Trunked & PMR
Displays	2 x 8 character backlit LCD, 5 x status LEDs.
T & D Interface	9600 baud, 8N1 format, RS-232 levels (± 12V).
MAP27 Gateway RS232 Port	9600 baud, 8N1 format, RS-232 levels (± 12V).
Voter Node Interfaces Impedance	Tx only, 600 Ohms balanced.
DAS Interface Impedance	Tx & Rx, 600 Ohms balanced.
ACMA Supplier’s Code Number	N468.
Warranty	Two years

Note: Specifications are subject to change without notice.

N468

RADIO TEST ROBOT

RT-5060

DUAL MODE TRUNKED/PMR RADIO NETWORK CENTRAL TEST TRANSMITTER RECEIVER INTERFACE

MADE IN AUSTRALIA BY

design2000

Est.1968 www.design2000.com.au

FOR

FUJITSU

OSS Technologies

RTR RT-5060

PACKING LIST

1 x RTR UNIT Model RT-5060

1 x G/06166 OPERATOR MANUAL

8 x RJ45 PLUGS

1 x BL-2 PLUG

2 x MOUNTING BRACKETS & SCREWS

1 x WARRANTY CARD

RTR RT-5060

SELF-TEST MODE

It is possible to enter the RTR into a Self-Test mode to exercise the internal circuitry, operating LEDs and LCD.

The RTR-T/P is placed into test mode by applying power to the unit, then holding the PMR "Update" button for three seconds. The unit will then indicate that it is in test mode by cycling the status LEDs on the front panel from left to right and displaying an appropriate message on the LCD.

While the test mode is active the unit's two processors constantly stress-test themselves and all auxiliary components including the two RS-232 line driver chips, DTMF transceiver chip, and three operational amplifier chips. Intra-processor communications are maximised and the LCD controller's internal RAM is written to and read back.

Both 16-channel IO expander interface chips are instructed to sequentially activate all 20 voter node mechanical relays, and the custom Selcall audio processor continually cycles through its 12 tones while utilising the on-chip Pulse Width Modulation (PWM) system to generate a 2.97kHz radio PTT sine wave.

The unit's two Microchip 18F4550 microcontrollers are made to exercise all of their instruction set commands and ten I/O ports. All on-chip timers are started and trigger regular processor interrupt routines which reset the timers to perform another cycle.

The test mode should be cancelled by removing power from the unit, rather than by pressing the "Reset" button, to ensure no components are left in an unstable state by the exhaustive test process.

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