

1 General Information

This Section introduces the T3000 Series II handportable radio, describing models and features available and their performance. A description of technical terms that may be used in this Manual is also provided in the Glossary.

The following topics are covered in this Section:

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1.1 Introduction

T3000 Series II is a versatile range of high performance, microprocessor controlled, handportable radios, designed and built to meet most mobile radio specifications. The T3010 9 channel and the T3020 100 channel handportables are used for conventional PMR applications, while the T3040 is a fully featured trunked radio, with conventional capabilities. The T3030 and T3035 trunked handportables are reduced-feature variants of the T3040, with conventional mode also available.

The T3000 Series II covers the following frequency ranges:

T3000-3000	136 to 174MHz
T3000-4000	175 to 208MHz
	250 to 270MHz
T3000-5000	400 to 530MHz
T3000-7000	336 to 400MHz
T3000-8000	806 to 870MHz (transmit)
	851 to 870MHz (receive)

Designed to meet international specifications, including Factory Mutual Intrinsic Safety approval, the T3000 uses SMD technology and multilayer PCBs mounted on a solid die-cast chassis, to provide strength and enhanced RF shielding. Intrinsically Safe (IS) models are available in most frequency bands (refer to Section 8).

A large backlit LCD screen and keys provide simple error-free operation, day or night. Key operations are supported by a range of different confidence tones, giving audible indications of functions and conditions. In noisy environments or when privacy is required, the T3000 may be operated like a telephone handset.

Most functions of the T3000 are microprocessor controlled, with no mechanical trimming or tuning required. The T3000 can be fully programmed and aligned under PC control, with no need to open or dismantle the radio.

A slimline battery pack is available in 1.2Ah (standard) and 1.5Ah (high capacity) versions. Battery pack capacities are subject to change, due to improvements in cell chemistry. The T3000 is supported by a range of battery charger options, including trickle, fast and rapid. An accessories connector is available for attaching T3000 external accessories, including speaker/microphones and headsets.

Standard T3010 and T3020 features include busy channel lockout, CTCSS, DCS and scanning, with optional multi-sequence Selcall. In addition, the T3020 menu system allows the user to customise many operational features, such as handset control or display back-lighting. The T3030, T3035 and T3040 radios offer full MPT1327 compatibility as well as a wide range of special features. The T3040 has full dialling capability and provides keypad initiation of calls to its own fleet, other fleets, PABX and PSTN.

If further information is required about the T3000 or this Manual, it may be obtained from Tait Electronics Ltd or accredited agents. When requesting this information, please quote the equipment product code (e.g. T3010-5122-M10) and serial number (found on a label under the battery pack). In the case of the Service Manual, quote the product code (e.g. M3000-00-202), and for circuit diagrams quote the 'Title', 'Internal Part Number' (IPN) and 'Issue'.

1.2 Specifications

1.2.1 Introduction

The performance figures given are typical figures, unless otherwise indicated, for equipment operating at standard room temperature. Where applicable, the test methods used to obtain the following performance figures are those described in the European specification ETS 300-086.

Details of test methods and the conditions which apply for type approval testing in all countries can be obtained from Tait Electronics Ltd.

1.2.2 General

Modulation Type	.. FM	
Frequency Ranges:		
T3000-3000	.. 136 to 174MHz	
T3000-4000	.. 175 to 208MHz	
	.. 250 to 270MHz	
T3000-5000	.. 400 to 530MHz	
T3000-7000	.. 336 to 400MHz	
T3000-8000	.. 806 to 870MHz (transmit)	
	.. 851 to 870MHz (receive)	
Frequency Increment:		
T3000-3000, -4000, -5000, -7000	.. 5 or 6.25kHz	
T3000-8000	.. 12.5kHz	
Number Of Channels:		
T3010	.. 9 (simplex or semi-duplex)	
T3020	.. 100 (simplex or semi-duplex)	
T3030	.. 1023 (2 in non-trunked mode)	
T3035, T3040	.. 1023 (9 in non-trunked mode)	
Bandwidth	.. 7.5, 12 or 15kHz	
Battery Pack:		
Supply Voltage	.. 7.5V DC	
Standard Test Voltage	.. 7.5V DC	
Battery Life:		
(for 5:5:90 duty cycle, Rx:Tx:Stby)		
Standard (1.2Ah)	.. 9¼ hours (1W Tx) or 7½ hours (5/4W Tx)	
High Capacity Pack (1.5Ah)	.. 12 hours (1W Tx) or 9 hours (5/4W Tx)	

Supply Current:

Standby (T3010 only)	.. 17mA
Receiver Squelched:	
T3010	.. 65mA
T3020, T3030, T3035, T3040	.. 75mA
T3035-8000, T3040-8000	.. 115mA
Receiver Full Audio	.. 300mA
T3035-8000, T3040-8000	.. 400mA
Transmit	.. 2A

Tx/Rx Changeover Switching .. solid state

Normal Operating Temperature Range .. -10°C to +60°C ambient

Programming .. PC programmable

Antenna:

Type:	
T3000-3000, -4000, -5000, -7000	.. MX-Stud (¼ UNEF)
T3000-8000	.. quarter wave with SMA connector
Impedance	.. 50Ω (nominal)

Handportable Dimensions:

Depth	.. 35mm
Width	.. 65mm
Height	.. 162mm

Weight .. 490g (with battery)

1.2.3 Receiver Performance

Type .. dual conversion superheterodyne

Sensitivity:

T3000-3000, -4000, -5000, -7000:	
12dB Sinad	.. better than -117dBm
20dB Sinad (psophometric)	.. better than -114dBm
T3000-8000 12dB sinad (unweighted)	.. better than -114dBm

IF Amplifiers:

Frequencies:	
T3000-3000, -4000	.. 21.4MHz and 455kHz
T3000-5000, -7000, -8000	.. 45MHz and 455kHz
First Local Oscillator Injection	.. low side (with respect to signal)
Second Local Oscillator Injection	.. low side (with respect to signal)
Bandwidth:	
Narrow Band	.. 7.5kHz
Medium Band	.. 12kHz
Wide Band	.. 15kHz

Signal-to-Noise Ratio (with respect to 100% deviation, at RF level of -47dBm):

T3000-3000, -4000, -5000, -7000:		
Narrow Band	..	40dB
Medium Band	..	43dB
Wide Band	..	45dB
T3000-8000:		
Wide Band	..	40dB

Audio:

Speaker Impedance (nominal)	..	8 Ω
Rated Power (into 8 Ω)	..	500mW (at 1kHz, 60% deviation, 10% maximum THD)
Distortion @ 250mW Response	..	<5% (1kHz, 60% deviation) within +1, -3dB of 6dB/octave de-emphasis
Bandwidth	..	300Hz to 3kHz

Selectivity:

T3000-3000, -4000:		
Narrow Band	..	70dB
Medium Band	..	75dB
Wide Band	..	78dB
T3000-5000, -7000:		
Narrow Band	..	65dB
Medium Band	..	70dB
Wide Band	..	75dB
T3000-8000:		
Wide Band	..	65dB (60dB minimum)

Spurious Response Attenuation:

T3000-3000, -4000, -5000, -7000	..	70dB
T3000-8000	..	60dB

Intermodulation Response Attenuation:

T3000-3000, -4000, -5000, -7000	..	65dB
T3000-8000	..	60dB

Spurious Emissions:

T3000-3000, -4000, -5000, -7000:		
Conducted & radiated to 1GHz	..	better than -57dBm
Conducted & radiated 1 to 4GHz	..	better than -47dBm
T3000-8000:		
Conducted & radiated to 1GHz	..	better than -50dBm
Conducted & radiated 1 to 4GHz	..	better than -40dBm

Blocking:

T3000-3000, -4000, -5000, -7000	..	better than -13dBm
T3000-8000	..	better than -23dBm

Co-channel Rejection:

Narrow Band	..	10dB
Medium Band	..	8dB
Wide Band	..	6dB

Fixed Squelch Sensitivity:

T3010 & T3020 'City Squelch' Setting	..	16dB sinad
T3010 & T3020 'Country Squelch', T3030, T3035 & T3040	..	10dB sinad

1.2.4 Transmitter Performance

Power Output:

Maximum:		
T3000-3000	..	5W
T3000-4000, -5000, -7000	..	4W
T3000-8000	..	2.5W
Low Setting	..	1W

Lock Up Time .. 20ms
(from PTT to 90% output power within 2kHz)

Spurious Emissions:

T3000-3000, -4000, -5000, -7000:		
Conducted & radiated to 1GHz	..	better than -36dBm
Conducted & radiated 1 to 4GHz	..	better than -30dBm
T3000-8000:		
Conducted & radiated to 1GHz	..	-70dBm (-36dBm minimum)
Conducted & radiated 1 to 2GHz	..	-64dBm (-30dBm minimum)
Conducted & radiated 2 to 9GHz	..	-52dBm (-18dBm minimum)

Adjacent Channel Power:

T3000-3000, -4000, -5000, -7000:		
Narrow Band	..	better than -60dBc
Medium Band	..	-70dBc
Wide Band	..	-70dBc
T3000-8000:		
Wide Band	..	better than -60dBc

Modulation System:

Type	..	direct FM
Deviation Limiting	..	adjustable up to ± 5 kHz
Bandwidth	..	300Hz to 2.55kHz below limiting or 450Hz to 2.55kHz in limiting

Responses:

In Limiting	.. within +0dB, -4dB of maximum system deviation
Below Limiting	.. within +1, -3dB of 6dB/octave pre-emphasis
Above 3kHz	.. greater than 25dB/octave roll-off

Audio:

Microphone Type	.. Electret
Input For 60% Deviation	.. 2.7mVrms (at 1kHz)

Distortion	.. 5% (1kHz, 60% deviation)
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Hum & Noise:

T3000-3000, -4000, -5000, -7000:	
Narrow Band	.. 40dB
Medium Band	.. 45dB
Wide Band	.. 45dB
T3000-8000:	
Wide Band	.. 40dB

Mismatch Capability:

Ruggedness	.. 2 minutes transmission into infinite VSWR
Stability	.. VSWR 5:1 (all phase angles)

Transmit Timer	.. programmable up to 240 seconds or disabled
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1.2.5 Frequency Reference

Oscillator Frequency	.. 12.8MHz
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Frequency Stability:

T3000-3000, -4000, -7000	.. ± 5 ppm -10 to +60°C
T3000-5000	.. ± 3 ppm -10 to +50°C
T3000-3000 FCC & T3000-5000 FCC ¹	.. ± 2.5 ppm -30 to +60°C
T3000-8000	.. ± 2.5 ppm -10 to +60°C

1.2.6 Trunking

Data Modulation	.. as per MPT1317
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Data Deviation (Tx):

Narrow Band	.. 1.5kHz
Medium Band	.. 2.4kHz
Wide Band	.. 3kHz

1. Refer to Section 6.

1.3 Product Codes

The 3 groups of digits in a T3000 product code provide information about the radio's model, RF type and options fitted, according to the conventions described below.

The following explanation of the T3000 product codes is not intended to suggest that any combination of features is necessarily available in any one radio. For details regarding availability of specific T3000 radios, consult your nearest Tait dealer or subsidiary.

Model

The Model group indicates the basic features of the radio, as follows:

T30XX -XXXX-XXX	T3010	9 channel PMR handportable
	T3020	100 channel PMR handportable
	T3030	trunked handportable (2 conventional channels)
	T3035	trunked handportable (9 conventional channels)
	T3040	enhanced trunked handportable

RF Type

RF Type group uses 4 digits to indicate the basic RF configuration of the radio.

The first digit in the RF Type group designates frequency band.

T30XX- <u>X</u> XXX-XXX	'3' for 136 to 174MHz
	'4' for 175 to 208MHz 250 to 270MHz
	'5' for 400 to 520MHz
	'7' for 330 to 400MHz
	'8' for 806 to 870MHz transmit 851 to 870MHz receive

The second digit in the RF Type group designates frequency sub-band.

T30XX- <u>XX</u> XX-XXX	'1' for 136 to 154MHz (T3000-3000)
	'2' for 146 to 174MHz (T3000-3000)
	'1' for 174 to 195MHz (T3000-4000)
	'2' for 184 to 208MHz (T3000-4000)
	'4' for 250 to 270MHz (T3000-4000)
	'1' for 400 to 440MHz transmit 400 to 450MHz receive } (T3000-5000)
	'2' for 440 to 470MHz (T3000-5000)
	'3' for 470 to 520MHz (T3000-5000)
	'4' for 410 to 430MHz (T3000-5000)
	'5' for 450 to 470MHz (T3000-5000)
	'6' for 470 to 490MHz (T3000-5000)
	'7' for 500 to 530MHz (T3000-5000)
	'0' for 336 to 360MHz (T3000-7000)
	'1' for 360 to 400MHz (T3000-7000)
	'1' for 806 to 870MHz transmit 851 to 870MHz receive } (T3000-8000)

call

A complete exchange of information between two or more parties. In trunked mode, this may occur on the control channel or on a traffic channel.

CCTM

Computer Controlled Test Mode. The operating mode of the radio whereby computer equipment can control various radio functions by sending commands down a serial link to the radio.

channel

A receive/transmit frequency pair.

configuration

The determination and set-up of the configuration data for a given frequency from the programmed calibration data (i.e. electronic tuning).

configuration data

The data set corresponding to the value of the electronic tuning variables on a given channel. This is calculated for each frequency from the calibration data.

control channel

The channel used by a trunking system to control the radio.

conventional mode

The mode of operation whereby the radio behaves as a conventional two way radio (i.e. non-trunked operation).

CSN

Chassis Serial Number.

CTCSS

Continuous Tone Controlled Sub-audible Signalling. Continuous, sub-audible coding on the channel for the purpose of segregating user groups.

DAC

Digital to Analog Converter. An electronic device that outputs a voltage dependant upon the value of binary data input.

database

The set of programmable data points which allow the product to be customised for a particular application or mode of operation.

DC

Direct Current.

DCS

Digitally Coded Squelch. Continuous, sub-audible coding (repeating digital code sequence) on the channel for the purpose of segregating user groups.

delayed

Key action. The input is not actioned until it has been stable for the duration of the debounce interval.

dialled string

A sequence of characters which is entered via the keypad. May contain numbers, labels, '*' or '#'. Used to initiate calls or invoke special functions.

dialling

The act of entering a number or label by typing in successive characters on the keyboard.

DTMF

Dual Tone Multiple Frequency. Method of encoding digits (0 to 9) and characters (A to F), each as a pair of eight standard tones.

economy mode

This is when the radio is cycling between the receive mode and standby state.

ECR

External Call Request.

EPROM

Erasable Programmable Read Only Memory.

EPTT

External Press To Talk.

ESN

The MPT1343 defined Electronic Serial Number of the radio.

FFSK

Fast Frequency Shift Keying. The signalling method employed in trunked radios. Data is represented by 1 cycle of 1200Hz (logic 1) or 1.5 cycles of 1800Hz (logic 0) and is transmitted at 1200 baud.

fixed (indicators)

Do not time out of their own accord. Generally indicate mode of operation or state.

FM

Factory Mutual Corporation.

idle

The state of the radio in **trunked mode** when it is not engaged in a call or call set-up, or in **conventional mode** when the radio is not transmitting.

IF

Intermediate Frequency.

inactive (indicator)

The 'off' (unasserted) state of a signal or indicator.

IS

Intrinsically Safe. Electrical equipment that is incapable of releasing sufficient electrical or thermal energy under normal or abnormal operating conditions to cause ignition of a specific hazardous mixture and air.

label

A plain language word (1 to 8 characters long) which is defined to represent a valid dialled **string** at radio programming time.

LCCC

Leadless Ceramic Chip Carrier.

LCD

Liquid Crystal Display.

LED

Light Emitting Diode.

LPF

Low Pass Filter.

MCU

Micro Control Unit.

MELF

Metal Electrode Face Bonded.

MTM

Manual Test Mode. The operating mode of the radio where test commands are requested via the keypad of the radio and results are returned to the front panel display (T3040 only).

mute

The receive audio gating element. When active, receive audio is passed to the speaker. The decision to activate/deactivate the audio signal path is based on an evaluation of signalling codes (CTCSS, DCS, Selcall) contained in the audio information (contrast with **sqelch**).

number

A simple **string** which corresponds to an MPT1343 defined called party identifier.

PA

Power Amplifier.

PABX

Private Automatic Branch Exchange.

PCB

Printed Circuit Board.

PLL

Phase Locked Loop.

PLCC

Plastic Leaded Chip Carrier.

PMR

Private Mobile Radio.

programming mode

The mode of operation of the radio in which computer equipment can read from and write to the radio **database**.

QFP

Quad Flat Pack.

PSTN

Public Service Telephone Network.

RAM

Random Access Memory.

receive mode

This is the state wherein the radio is producing a valid busy output, irrespective of whether any audio output is produced at the speaker terminals. The +5V-ECON supply is on, and sufficient time has elapsed for various circuit blocks to settle.

RF

Radio Frequency.

RSSI

Received Signal Strength Indicator.

SCI

Serial Communications Interface. This is the serial interface from the radio to an external device, normally utilising transmit and receive data, signal and ground lines.

Selcall

Selective calling. Sequential tone burst coding on the channel for the purpose of selecting an individual or group with which to communicate.

selecting

The act of picking a **label** from a displayed list using the arrow keys.

signalling

Non-voice coding on the channel for the purpose of identifying parties and/or segregating user groups e.g. **CTCSS**, **DCS**, **Selcall**.

SMD

Surface Mount Device.

SOIC

Small Outline Integrated Circuit.

SOT

Small Outline Transistor.

squelch

The channel busy detection circuitry. The decision to activate/deactivate the audio signal path is based on a signal to noise measurement on the received RF signal (the squelch circuitry precedes the mute circuitry).

stand-by state

This is essentially when the +5V-ECON line is off. That is, when the radio is drawing the minimum current, while still being switched on.

string (simple)

A sequence of the characters, '0..9', '*', '#', which instructs the radio to initiate a call or perform some other function.

successful (call)

A **call** for which a **traffic channel** is assigned.

system restart

The action taken by the radio (e.g. in response to the “^” character received on the **SCI**) where it immediately ceases current operation, then behaves as though it has just been switched on.

TCXO

Temperature Compensated Crystal Oscillator (voltage controlled). The frequency reference for the **RF** part of the radio.

test link (manual)

A physical connection which must be linked on the control PCB in order to put the radio into manual test mode.

test link (sticky)

A programmable item which, when set, causes the radio to always power-on in **manual test mode** (i.e. a ‘virtual’ link).

test mode (computer controlled)

The operating mode of the radio whereby computer equipment can control various radio functions by sending commands down a serial link to the radio.

test mode (manual)

The operating mode of the radio where test commands are requested via the keypad of the radio and results are returned to the front panel display (T3040 only).

traffic channel

The channel used by the radio for the duration of a **call**.

transmit mode

The radio has validated a request and commenced or completed the sequence of switching out of **receive mode**. This does not necessarily imply that **RF** is being generated.

trunked mode

The mode of operation of the radio whereby the radio obeys commands on the **control channel** and generally operates as proscribed in MPT1343.

trunking system

The infrastructure comprising repeaters and radios required to support a number of **control channels** and **traffic channels**.

VCO

Voltage Controlled Oscillator. The oscillator that generates either the on-channel signal to drive the transmitter, or the local oscillator signal to mix incoming **RF** signals to the **IF** of the radio. The instantaneous frequency of the VCO is determined by a combination of the synthesiser (**PLL**) and the modulation signals **TCXO-MOD** and **VCO-MOD**.

VOX

Voice Operated Transmit.