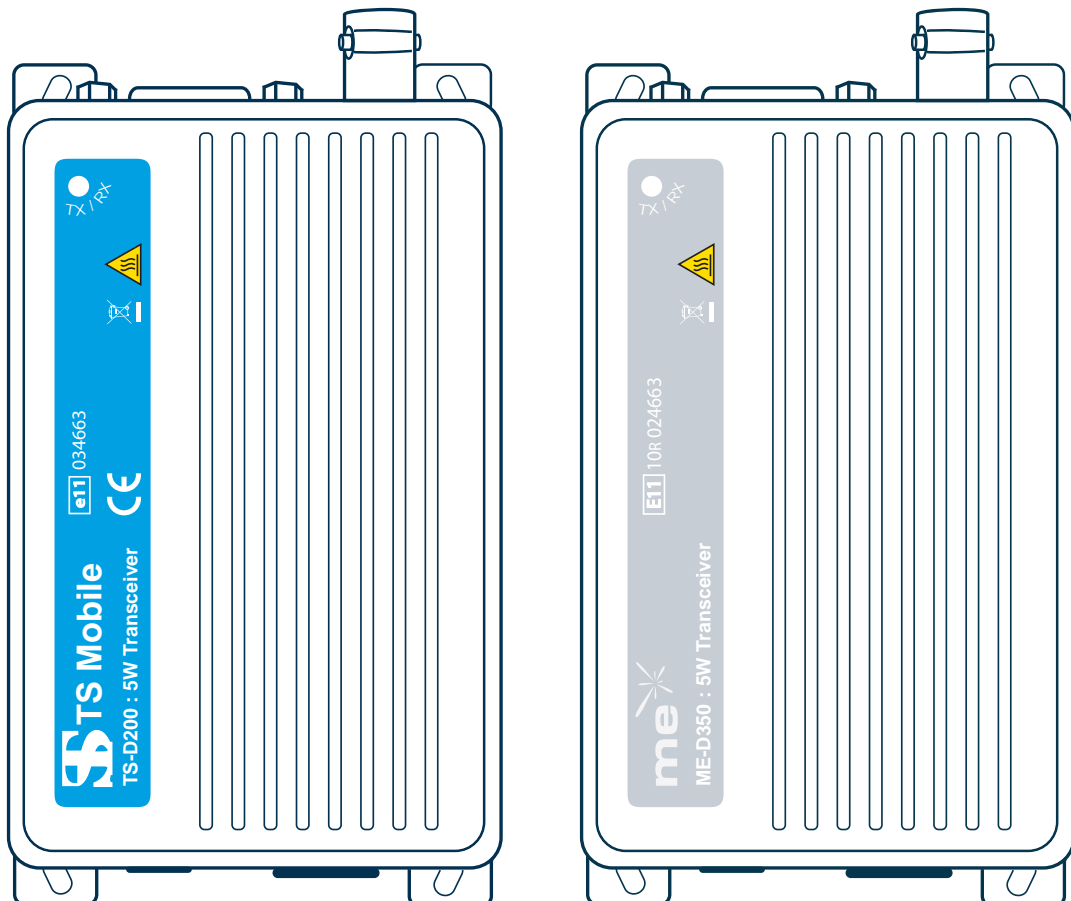


**me**   
**mobile expertise**  
**TS-D200 / me-D350 range**

# User Guide



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# Introduction

The TS-D200/me-D350 range is a 1 to 5 Watt radio data modem, which can be used for data up to 9600 baud rate (using GMSK module) in stand alone conditions.

The TS-D200/me-D350 is housed in a rugged cast-aluminium box sealed to IEC 529 (IP54) making it suitable for a wide range of mobile and fixed applications.

All TS-D200 modem units meet the essential requirements of the relevant European directives (RED2014/53/EU) and all me-D350 modems meet relevant US FCC and Canadian regulations. In order to maintain this compliance the installation and safety information must be adhered to at all times.

- The TS-D200/me-D350 modem must only be installed where unintentional contact cannot be made. The surface of the device may be hot to touch under certain transmit conditions. A warning label is permanently displayed as part of the equipment rating label affixed to the lid. The TS-D200/me-D350 is not designed for permanent transmission. If prolonged transmission periods are used, the unit will become hot and will require an additional heatsink to be fitted.
- When fitting the TS-D200/me-D350 into a fixed installation, care must be taken in the routing of all cabling such that the insulation cannot become damaged.
- The recommended supply sources for use with the TS-D200/me-D350 are a standard 12V supply, but is capable of operating in the range 9V ~ 18V.

## Preparing for use

### Description of modem

The TS-D200/me-D350 is a network free, point to point data radio that offers great flexibility in varied applications where wireless data or voice communication is needed.

It can be used as a “dumb” radio, with no internal module fitted, to allow users to facilitate the use of their own modem and protocol. Internal link changes enable the input to be set for TTL levels so allowing POCSAG for example. In this scenario, the radio is completely transparent and simply needs the correct signal level inputs (see pin out details), and use of separate control lines (PTT etc) or serial commands.

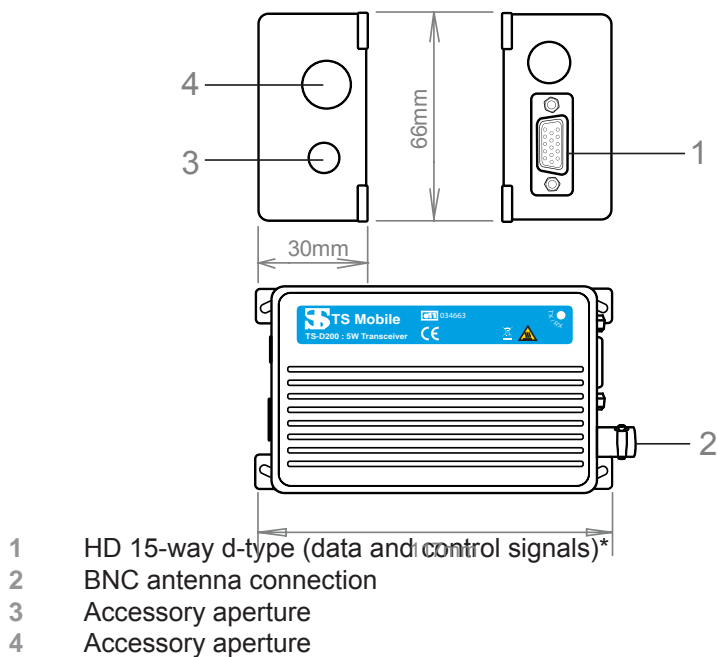
The TS-D200/me-D350 can also be fitted with either a Bell 202 / V.23 module, a FFSK module (up to 4800 baud rate) or a GMSK module (up to 9600 baud rate). These allow communication with a pc via hyper terminal and other emulation packages. For further information on these options, including pin outs, please refer to the separate Module Manual available on the Mobile Expertise Global web site.

The TS-D200/me-D350 also operates as a standard radio with microphone input and speaker output, in this mode the radio has the following associated features, these include CTCSS/DCS, busy channel lockout and scan.

## Features

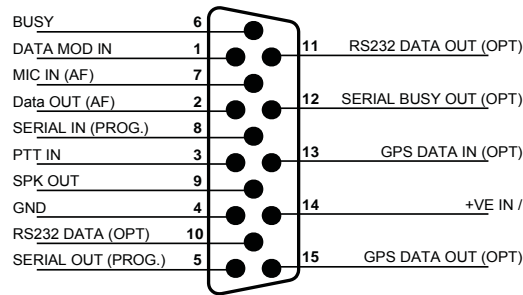
- Frequency Bands
  - VHF2: 146 - 174MHz
  - UHF1: 400 - 440MHz
  - UHF2: 440 - 480MHz
- Compact and rugged die cast box
- Resistant to dirt, dust and water ingress (IP54 rated)
- Network free, point to point communication
- 1/5 watt programmable output power
- Synthesised operation with 16 channel capability
- CTCSS & DCS encode and decode
- programmable 12.5 / 25kHz channel spacing
- External modem / Direct FM / TTL (pocsag)
- Internal (RS232) module options available:
  - GMSK up to 9600 or
  - FFSK up to 4800 or
  - Bell 202 FSK and V23 1200bps
- RSSI level indication
- Busy' output
- 9 – 18 volt supply input
- Enhanced Power Save Mode (sleep)
- Serial commands available to control radio
- Busy Channel lockout
- Time out timer
- Scanning
- TX only feature
- Programmable squelch levels

## External connections



\*The power supply is connected via pin14 (+ve) and pin 4 (GND) of the 15 way D-type.

# DB-15 Pin Interface Connector



The table on the following pages indicates the DB-15 Pin descriptions with input and output levels.

Pin No.	Function	Description	Signal Type	I/O
1 Link option default	Data modulation IN. (used with an external modem)	AC coupled signal directly injected to MOD through data low pass filter without pre-emphasis.	Analogue Input signal 1KHz audio at 60% peak dev. input level = 100 to 120mVrms	I/P
1 Link option	DC data modulation In	DC coupled direct FM signal without filtering (POCSAG)	Analogue Input signal 1.9V dc offset 450~550mV @60% dev	I/P
1 Program option	TTL input (POCSAG)	DC coupled direct signal designed to work with TTL signals. Frequency and Deviation adjustable to application	TTL Levels	I/P
1 Program Opt & H/W changes	AC coupled direct FM modulation	AC coupled direct FM signal, without filtering. Program to TTL	Analogue Input signal 350mV @ 60% dev adjustable	I/P
1 Link option	DC data modulation Input	DC coupled direct FM signal, without filtering	1.9V dc offset 450~550mV @60% dev	I/P
2	Unfiltered Data OUT (RX disc)	Discriminator Audio, unprocessed AF signal(prior to tone filtering and de-emphasis	Output signal 1KHz audio at 60% peak dev. produces 200 to 300mVrms	OP
3	PTT In (Tx Key)	Signal, which keys the transmitter, when operating as a dumb radio. Note: If the option module is installed, RS232 levels must be selected on CON407. See Module manual.	TTL level 0V = TX, open cct = RX  RS232 level (option) +12V = Tx, -12V = Rx	I/P
4	Ground	Ground connection	0V (Chassis)	
5	Program Data Out/ Serial Data Output	Programming data output / Serial data output.	TTL level (programming cable has RS232 converter)	OP
6	Busy (CD)	Logic level output to indicate presence of a carrier. Note: If the option modem is installed, RS232 levels should be selected on CON407. See Module manual.	TTL level 0V = carrier, 5V = no carrier RS232 level (option) +12V = carrier -12V = no carrier	OP
7 default	Audio IN (Mic) / Monitor	Audio signal that is filtered (high pass and pre- emph) then follows same route as data mod through LPF. Mic activated by being at 0V (also 0V activates monitor). 5V default (pull up resistor), assumes data input when PTT is active.	1KHz audio at 60% peak system deviation input level = 6 to 8mV rms(AC coupled)	I/P

Pin No	Function	Description	Signal Type	I/O
7 Link option	RSSI	RSSI Level	1.0 to 3.5 V	OP
8	Program data IN / Serial command	Used for serial command for radio control or is used for inputting programming data	TTL level (RS232 converter in programming cable)	I/P
9	Audio OUT (Speaker)	Audio output from the audio amplifier. Filtered by tone-filter and de-emphasis circuit.	1KHz audio at 60% peak dev. Produces nominal 1Vrms @ 8Ω	OP
10	RS232 Data IN for option module	Data input when the option module board is installed.	RS232 level	I/P
11 default	RS232 Data Out for option module	Recovered data output when the option module is installed..	RS-232 level	OP
12 default	Buffer status( busy) for option module (reserved)	Indicates buffer status to prevent data loss according to buffer overrun	RS-232 level	OP
12 Link option	TTL channel change	16 Channel change at TTL level. 0V activates 4 bit word (bit2)	TTL level	IP
12 Link option	Lock Detect signal	PLL lock detect signal	>3V out of lock <0.5V in lock	OP
13	GPS data input	Data input for initial setting of GPS module. (NMEA 0183 format)	TTL level	I/P
13 Link option	TTL channel change	0V activates 4bit word(bit1)		IP
14 (default)	VCC in +12 Volts nominal	Power supply input, operation outside the stated range will be subject to degraded performance	+12 Volts nominal 9v~18v extreme	I/P
14 Link option	DGPS data input	Data input for DGPS Correction of GPS module. (NMEA 0183 format)	TTL level	I/P
15	GPS data output	Position data output from the GPS module. (NMEA0183)	TTL level	OP
15 Link option	TTL channel change	16 channel change at TTL level. Ground to activate. LSB(bit0)	TTL level	I/P

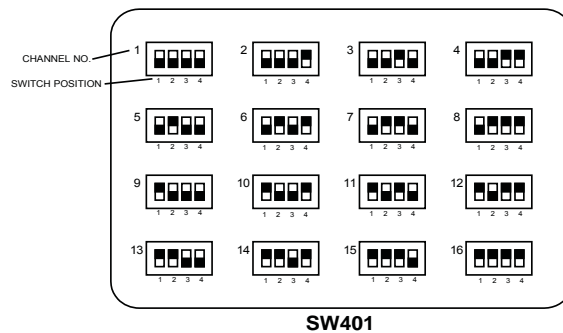
\*This input can be used as direct FM and can be used for FSK if the signal level is within the limits.

**Link options :** To be carried out with reference to the layout and must be carried without any damage to the pcb. Any damage will invalidate the warranty.

Refer to Application Notes for details of link changes. Application Notes can be found on the Mobile Expertise Global web site.

## Channel selection

Channels are selected by the use of internal switches and can be set as shown below. The bottom 4 screws will need to be removed to gain access to the switches, care must be taken to avoid any damage which could invalidate the warranty. The channel can also be changed by a serial command inputted from the external control system.



**Figure:** Setting of channel selector switch for each channel.

By altering link options, channel change can also be implemented using TTL levels on pins 11,12,13 & 15 of DB15 way assuming these pins are not in use and default conditions are met. Refer to Application Notes on the Mobile Expertise Global web site.

## Operation

### Transmit/receive operation

The TS-D200/me-D350 can be put into transmit by different methods. When used as a “dumb” radio, the PTT line is pulled low (pin 3 of DB15). The TX serial command will also put the radio into transmit (pin 8 of DB15), until the RX serial command is received. If the Mic line is low (grounded via resistor) then audio on the Mic line is transmitted and if line is left disconnected DATA is transmitted. If one of the internal modem board is installed, the radio can be put into transmit by receiving input serial data (pin 10 of DB15). When the data is no longer present at pin 10, the TS-D200 will return to receive mode. See the module manual for details.

### Serial commands

The modem can be controlled by using the serial command (pin 8) data in, sending commands to the radio such as PTT or change channel

The format for these commands (asynchronous) is:

- Baud rate: 4800 bit/sec
- Data: 8 bit,
- Parity: Non parity
- Stop Bit (SP): 1 bit
- MSB first transmission

Each serial command consists of 3 bytes. The first byte is the command (CMD), the second is data required by the command(DATA) and the third is the check sum (CS) to validate contents

**TX Command format:**

CMD	DATA	CS
1st byte	2nd byte	3rd byte

N.B. Check Sum = 1st byte + 2nd byte. CS = CMD + DATA

## Response format:

CMD	DATA1	DATA2	...	DATAn
-----	-------	-------	-----	-------

The response CMD is in the form of:

ACK, acknowledge, Hex: 0xAA; (then data if any)

NACK, no acknowledge (error in command) Hex: 0x55

NOK, not okay (cannot carry out command) Hex: 0x65

If command is not recognised, if it is repeated, or already in requested or wrong state (e.g. channel change in TX) then there is no response from the radio.

## Commands and data

Mode	Transmit command (CMD)	Transmit Data (DATA)	Response (CMD)	Response Data	Remark
Channel Change	0x64	0x00 : chn 1 0x01 : chn 2	0xAA (ACK) 0x55 (NACK)		No response if in transmit mode
Request current Channel	0x53	0x66	ACK / NACK	1st byte: Chn no. 2nd byte: option board status	Chn 1 = 01 Chn 2 = 02 A0: No option board A1: GMSK A2: FFSK/AFSK
Activate prog mode / main loop	0x87	0x00	ACK / NACK No response on earlier models		Cannot receive in this mode, but clears previous serial commands. Use 0x53 to rx mode
Request current channel number, when in prog mode	0x53	0x66	ACK / NACK	1st byte: chn no. 2nd byte: software version 3rd byte: option board status	Chn 1 = 01 Chn 2 = 02 Software version 1.2 = 12 A0: No option board A1: GMSK A2: FFSK/AFSK
*Software version number	0x59	0x00	ACK / NACK	1st byte main ver 2nd byte update ver	2 bytes in Hex represent version e.g. 1.10 becomes 01,0A
Enter TX mode	0x61	0x74	ACK / NACK		No response if already TX
Enter RX mode	0x61	0x72	ACK / NACK		No response if already RX
*Enter Sleep mode	0x57	0x4f	ACK / NACK		Firmware 5.0 or later
*Exit Sleep mode	0x57	0x58	ACK / NACK		Firmware 5.0 or later
Check radio awake	0x6a	0x00	ACK / NACK		
Scan start	0x62	0x73	ACK / NACK		No response if already scanning



Mode	Transmit command (CMD)	Transmit Data (DATA)	Response (CMD)	Response Data	Remark
Scan start, whist stopped on 'correct call' channel	0x62	0x73	0X66	Chn no., CMD+DATA	Respond once if stopped on a channel. e.g.If on channel 1 : 66,00,66 (00=chn1,01-chn2)
Scan Stop	0x62	0x46	ACK / NACK		
Scan stop, whist stopped on 'correct call' channel	0x62	0x46	0X66 / data / ACK	Chn no., CMD+DATA	Respond once if stopped on a channel. e.g.If on channel 1 : 66,00,66 (00=chn1,01-chn2)
Scan delete	0x62	0x4f	ACK / NACK 0X65 (NOK)		NOK : e.g when stopped not on a channel
Module Test Message Enable	0x75	0x78	ACK / NACK		
Module Test Meesage Disable	0x75	0x79	ACK / NACK		

\*Software version 5.0 and above.

A comprehensive list of serial commands is available on our web site [www.mobile-expertise.co.uk/support](http://www.mobile-expertise.co.uk/support)

## Standard radio commands

### Scanning

A scan function is available whereby any or all 16 channels can be monitored for activity. Scanning parameters such as scan speed and delay are programmable (refer to programming guide)

Control of the scan channels is by serial commands.

Note The priority channel (the transmit channel during scanning) is the channel selected via the dip switch.

### Timings

Radio timings parameters are available for alteration via the programmer.

These include:

- Time-out timer,
- Hang timer -transmit after dis-asserting PTT
- Tx delay - prevents squelch noise when using CTCSS/DCS

### Busy Channel Lockout

Prevents TX when while the radio is receiving. Refer to programming guide more detail.

N.B. Where the module option board is fitted alternative programmable functions apply.

### Internal Module Timings

Tx delay and Rx delay timings are available for alteration when the internal module is fitted only. Please refer to the programming guide and module manual for details.

### Power Save Mode

The modem will go into power save mode for short periods of time to minimise power consumption when a battery supply is being used. Parameters are programmable.

### Enhanced Power Save Mode (sleep)

The modem in this mode deactivates all circuitry with the exception of the micro controller. It is activated and deactivated using serial commands (see Command List).

Current consumption is significantly reduced to approximately 7mA and represents an 85% saving on normal standby consumption.

### Squelch

The modem offers 2 forms of squelch, which are programmable as RSSI level check or busy port .

- RSSI level uses the RSSI level from the FM detector chip and the point of squelch is programmable.
- Noise saquelch uses the 'on board' circuitry to detect noise and is manually adjusted.

## Status indicators and Audible alerts

The LED indicates the current status of the radio and if an external speaker is connected to pin 9 of the DB-15, audible tones can be heard under certain fault conditions. The details are shown in the table opposite.

Status	Description	LED colour	Audible tone (if speaker fitted)
Normal	Power ON	Green-Orange-red	
	Busy channel	Orange	
	Correct Call (with SAT)	Green	
	Transmit	Red	
Warning	Busy channel lockout	Green flashes	beep tone
	Time out time	Green flashes (ptt active) Red LED extinguishes (serial cmd)	
	5 secs before TOT	1 Green flash	beep tone
Errors	EEPROM error	1 Orange flash	
	Out of lock	Continuous Orange flashes	
	Comms error with module	Green LED flash	
	Transmit hang on time		Single beep tone
	Wrong model programmed	After "Power ON sequence -two extra Orange flashes.	
Program	Read Mode	Red LED flashes	
	Write mode	Green LED flashes	
Squelch program mode	Initial data load	Green-Orange-Red	
	Open squelch mode	Three Green flashes	
	Close squelch mode	Two Green flashes	
	Save squelch mode	One Green flash	

## Programming

The data modem is pc programmable. The parameters available for programming include:

- Frequency, channel spacing and sub-audible tones on a per channel basis
- Radio settings such as power save mode, TX lockout, TX timeout, Squelch
- Module options when A FSK, FFSK or GMSK module is fitted, such as setting baud rate, dumb or auto mode, Hyper Terminal mode and data settings (flow control, block size etc)

The pc program also allows for squelch adjustments and calibration Refer to programming manual and PC software.

## Installation

### Antennas

It is important that any antennas are installed in a suitable location with an adequate ground plane. Ideally, multiple antennas should be separated by a minimum of a wavelength (at the lowest frequency), whilst still retaining a good ground plane for each antenna. Therefore, for a 400MHz system, the ideal separation should be a minimum of 0.75m (~30in), and for 150MHz system the minimum should be 2.5m (~98in).

Warning: If installing an antenna near people it is necessary to ensure the minimum separation is maintained. This particularly important where prolonged exposure is likely.

For a full range of antenna options and other accessories visit the Mobile Expertise Global web site.

### Power sources

It is important that a “clean” source of power is used for the supply to the modem

### Fuse replacement

We recommend an inline “quick blow” fuse rating of 4 amps be fitted to the +ve supply.

### Cabling

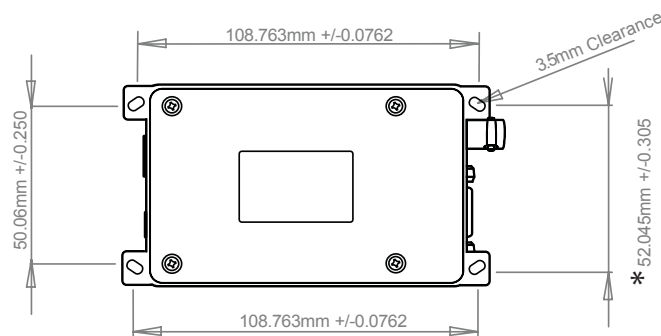
If possible, run RF cables separately from other cables and keep RF cables apart from one another to avoid interference / coupling.

When fitting the modem into a fixed installation care must be taken in the routing of all cabling such that the insulation cannot become damaged.

### Fixing

We recommend that the TS-D200/me-D350 is securely fixed to a surface, either directly, or with a suitable bracket. The fixing hole centre dimensions are as shown.

The modem can be attached to any surface by using suitable size screws through the M3.5 holes in the mounting flanges.



**N.B.** Mounting hole positions are different on each side.

# Safety and general information

Important information on safe and efficient use of your Radio device

## Exposure to radio frequency energy

Your modem is a high power radio transceiver. When it is on, it receives and also sends out radio frequency (RF) signals. To help minimise human exposure to RF electromagnetic energy, keep transmission time to 50% or less.

As with all radio devices, holding the antenna affects transmission quality and may cause the radio to operate at a higher power level than required. Do not hold the antenna when the radio is in use.

Do not use radios with damaged or modified antenna, this may violate compliance with relevant international standards.

Where prolonged human exposure is likely, the minimum separation from the antenna should be 0.8m.

## Electromagnetic interference/compatibility

Most modern electronic equipment is shielded from RF energy. However certain electronic equipment may not be shielded against RF signals. The modem needs to be switched off in any facility where posted notices instruct you to do so to avoid electromagnetic interference or compatibility conflicts. Special care should be taken near facilities such as hospitals or health care centres may be using equipment that is sensitive to external RF energy.

## Medical devices (Pacemakers)

If you use any personal medical device, consult the manufacturer of your device to determine it is adequately shielded from RF energy. Your physician may be able to assist you in obtaining this information.

## Vehicles with airbags

Air bags inflate with great force. Do not place a radio in the area over an airbag or in the airbag deployment area, any radio may be propelled with great force and cause serious injury to the occupant of the vehicle.

## Potentially explosive atmospheres

Turn off your modem prior to entering any area with a potentially explosive atmosphere, unless it is a radio type especially qualified for use in such areas. Do not remove install or charge batteries in such areas. Sparks in potentially explosive atmospheres can cause an explosion or fire resulting in bodily injury or death.

Potentially explosive atmospheres include fuelling areas such as petrol stations, below decks on boats, fuel or chemical transfer or storage facilities, vehicles using liquidpetroleum gas (such as propane or butane); areas where the air contains chemicals or particles such as grain, dust or metal powders, and any other area where you would normally be advised to turn off your vehicle engine. Areas with potentially explosive atmospheres are often but not always posted.

## Warranty and repairs

The TS-D200/me-D350 is a low maintenance device. Once installed it requires no ongoing maintenance.

In the event that your Mobile Expertise Global TS-D200/me-D350 modem needs repair, return your radio to an authorised Mobile Expertise Global supplier. Do not disassemble, modify or repair the unit unless the work is carried out by a Mobile Expertise Global approved supplier. Incorrect assembly, modification or repair may cause irreparable damage to your unit and will invalidate any warranty.

## Care of the equipment

- Do not immerse the TS-D200/me-D350 modem in water or other fluids.
- Do not use solvents or spirits for cleaning as this may cause damage to the case materials.
- Do not over tighten connection to the modem.

## Disposal / Recycling

The TS-D200/me-D350 is a Class 3 product in accordance with the Waste of Electrical and Electronic Equipment (WEEE) Directive. Disposal of this class of equipment must be carried out through an authorised recycling centre.

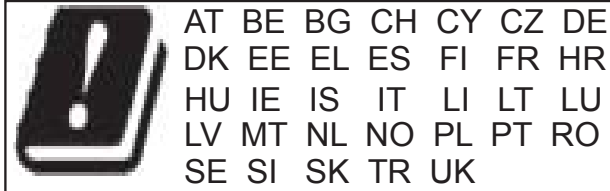


# Declaration of conformity\*

The TS-D200/me-D350 range is a 1 to 5 Watt radio data modem, in V2 (146-173MHz), U1(400-440MHz) or U2 (440-480MHz) frequency ranges,

These frequencies are licensed, restriction of use may apply in some countries.  
This equipment is intended for use in:-

## Model TS-D200:



## Model me-D350:

United States of America & Canada.

This equipment can also be used worldwide, where the equipment is approved for use.

## FCC / Canadian Specifications

FCC	Part 15*, 90
Canada	RSS-119 issue 9 2007

\*This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- 1) This device may not cause harmful interference, and
- 2) This device must accept any interference received, including interference that may cause undesired operation.

Any change or modification to the product not expressly approved by Mobile Expertise Global Ltd. could void the user's authority to operate the device.

This equipment complies with FCC radiation exposure limits set forth for an occupational/controlled environment. This equipment should be operated with a minimum distance of 20cm between the radiator and your body. A maximum antenna gain of 0dB at 1W (low power) and -7dB at 5W (high power) should be used with the equipment in order to maintain the 25cm distance.

## RED2014/53/EU Specifications

Art. 3.1 (a)	Health & Safety	EN60950-1:2006+A2:2013 EN62368-1:2014
	SAR	EN62311:2008
Art. 3.1(b)	EMC	EN301 489-1 V2.2.0 Draft EN301 489-5 V2.2.0 Draft
Art. 3.2	Radio	EN300 113 V2.2.1(2016-12)  EN300 113-2 V1.4.2(2009-11) EN300 113-1 V1.6.2(2009-11) EN300 220 V2.1.2(2007-06)

We hereby declare that the above named product is in conformity to all the essential requirements of the Radio Equipment Directive (RED2014/53/EU).

Identification mark : **0168**

Type Examination  
Certificate No: **RED000221**

\*A signed and dated Declaration of Conformity is available on request.

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Any queries regarding information in this manual, please contact the Technical Services Group Leader at the above address.

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Mobile Expertise Global Limited  
Version 7.0.0

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