

Multitone RPT500 Series

Installation Guide



Issue Control

Issue	Date	Remarks
01	19.02.07	First Issue.
02	13.03.07	Software update.
03	26.03.07	Line Synchronisation Added (Section 6).
04	16.04.07	Para. 4.3 Aerial inserted.
05	28.06.07	Para. 4.3 modified.
06	28.09.07	North American info. added to Para. 2.3 & Section 3. Para's. 4.3, 4.11 & Section 5.1 modified.
07	14.04.08	Reference to earthing of enclosure amended, Section 4.1.
08	26.01.09	Issue created to include RPT501 and revise document template.
09	10.02.09	Wire colour information in para. 4.12 Table, corrected to reflect cable 7761-8245.
10	09.06.09	Line Sync changes - 4. 8 reference to line sync added. 4.12 modified to add Tx keyed o/p. 6. Switch setup added.
11	20.07.11	Illustrations modified to reflect the moving of the VCO adjustment trimmer and the subsequent change to the end-panel layouts.

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1. Introduction

This Installation Guide describes the installation and operation of the RPT500 Series Paging Transmitter. Unless stated otherwise, information given applies to both the RPT501 and RPT503 equipment variants.

Note: There are no user serviceable parts in this equipment, all faulty units should be returned to Multitone or their agent, for repair.



WEEE DIRECTIVE & PRODUCT DISPOSAL

At the end of its serviceable life, this product should not be treated as household or general waste. It should be handed over to the applicable collection point for the recycling of electrical and electronic equipment, or returned to Multitone or their agent, for disposal.



2. Safety Warning

2.1 Company Liability

The information in this manual has been carefully compiled and checked for technical accuracy. Multitone Electronics plc will accept no liability for inaccuracies or errors. In line with the company policy of technical advancement, the information within this document may be changed. The user should ensure that the correct issue of the document is used. Comments or correspondence regarding this manual should be addressed to:

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2.2 Safety Summary

The following information applies to both operating and servicing personnel. General Warnings and Cautions will be found throughout the manual where they apply.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in equipment damage.

2.3 Important Safety Information



The Multitone RPT500 Series Radio Paging Transmitter equipments, contain a low power (5 Watts) transmitter and are intended for use with either an externally mounted dipole antenna, or a "local" unity gain (or less) "desk-top" whip antenna.

The equipment's performance may be characterized in accordance with the recommended MPE requirements of the European Council Directive 1999/519/EC on the limitation of exposure of the general public to electromagnetic fields (0Hz - 300GHz), as given in Annex III, Table 2; the requirements of FCC 47CFR and Industry Canada Standard RSS102.

Where an installation is to be fitted with a "local" whip style antenna, the following criteria must be adhered to, in order to reduce and comply with the Electro-magnetic radiation absorption regulations.

Any equipment and antenna that is installed within an area normally populated whilst it is in use, must be located in a position where people may not approach, or be located within 1m of the radiating antenna, for periods in excess of 5 mins. in any 1 hour. This distance is calculated to provide an additional safety margin for the product.

3. Compliance Information

- 3.1 EU Territories** - This product complies with the requirements of the EU Radio & Telecommunications Terminal Equipment Directive 99/5/EC. A complete copy of the associated Declaration of Conformity for this and other Multitone products, may be found at the Multitone Internet address www.multitone.com.

This is a Class 2 type equipment under the terms of the R & TTE Directive and is therefore subject to restrictions in its use. Before installation and use, consult your local radio communications spectrum authority, for licensing and frequency regulations.

- 3.2 United States** - This product has been tested and certified for use in the US. Any modifications to this equipment not expressly authorised by Multitone, could void the user's authority to operate the equipment.

3.3 Installation Notes



WARNING

Do not install / use this equipment near sources of water, moisture, or in areas where explosive gases may be present! Do not expose to strong magnetic fields, extreme temperatures or strong sunlight.



The equipment should be positioned so that there is no interference to the flow of air around the unit and away from sources of heat. It should only be mounted to a wall, as recommended in the installation instructions.

All installation wiring should be carried out in accordance with recognised Codes of Wiring Practice, applicable to the equipment and circuits involved, e.g. Mains power, telephone and/or radio. Power supply cords and other leads should be routed so that they are not likely to be walked on, or pinched by items placed upon or against them. Particular attention should be paid to cord entrance and exit points.

Where installation involves an external radio aerial/antenna, the antenna should be located away from power lines. Ensure that where applicable the antenna system is grounded, to provide some protection against voltage surges and the build-up of static charges.

This equipment has been designed to conform to the relevant Radio and EMC performance standards, but it may be necessary to take additional precautions during installation, to ensure continued compliance.

Use only cables supplied, or suitably rated power cables and screened signaling cable. Where quoted, do not exceed specified cable lengths and keep cable runs to a minimum, especially on the outside of buildings.

Do not unnecessarily route wiring alongside cables from or through areas that are a source of interference e.g. heavy plant and switch rooms, RF transmitter housings, without taking suitable precautions to reduce EM interference coupling.

Where necessary, use additional protection e.g. armoured trunking, surge arrestors, especially on the outside of buildings.

Where any interference problems are observed, it may be required to fit additional filtering components such as ferrite absorbers, or in-line filters. If such action proves to be necessary, contact either Multitone or their authorised agents.

3.4 Connection of Power Supplies

Use only power sources specified, or supplied by Multitone. The use of another device will invalidate any declared conformity for this equipment, if as a result it ceases to conform to those standards on which conformity is based.

The equipment should only be connected to a power supply as described in the operating instructions, as marked on the equipment, or supplied by Multitone. Do not overload outlets and extension cords, as this can result in fire, or electrical shock.

Where equipment has been provided with a three-wire grounding type plug, this plug will only fit a grounding type power outlet. This is a safety feature and should not be defeated. If you are unable to use a grounding outlet, contact your electrician.

Where equipment has been provided with a polarised line plug (one blade wider than the other - US/Canada), this plug will only fit a power outlet one way. This is a safety feature and should not be defeated. If you are unable to insert the plug fully, try reversing the plug. If the plug still does not fit, contact your electrician to replace the obsolete outlet.

3.5 Servicing

This equipment contains non user-serviceable parts. All repairs to be undertaken by qualified service personnel. In the case of a problem, please contact your service representative/agent.

All the safety and operating instructions should be read before the equipment is connected and operated and retained for future reference. All warnings marked on the equipment should be strictly adhered to. No attempt should be made to remove any designated safety covers, as these areas contain voltages of a sufficient magnitude to constitute a risk of electric shock to personnel.

4. Installation & Fitting

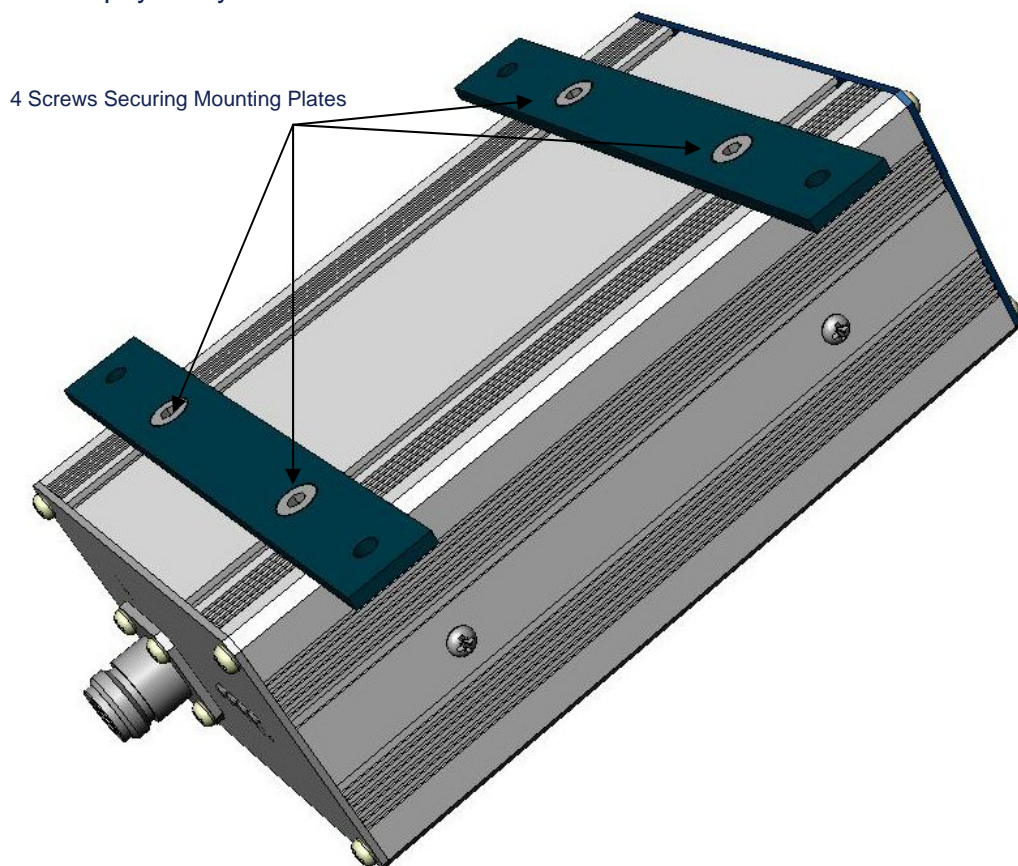
The installation and servicing of this product must only be carried out by suitably qualified personnel.

The procedures outlined, apply to both the RPT501 and RPT 503 equipment variants, unless otherwise stated.

4.1 Fitting

The RPT500 can be wall or shelf mounted. For wall mounting there are two mounting brackets affixed to the base of the transmitter. Attach the unit to the wall through the four mounting holes provided, using suitable fixings.

For shelf mounting, remove the four screws affixing the wall mounting brackets and substitute the four rubber feet supplied. Where this method of installation is used, ensure that the unit is physically stable once all the leads have been connected.



An earth wire **MUST** be fitted to the 4mm earth screw terminal on the back of the transmitter, using the earthing lead supplied, or suitable equivalent.

4.2 Power Supply

The power supply can be wall mounted, using the two holes in the mounting bracket supplied and suitable fixings. Once the bracket is attached to the wall, fit the power supply to the bracket by feeding the DC output lead through the square hole in the bracket, from the inside. With the power supply sitting centrally between the two lugs of the bracket, insert the mains connector into the power supply through the oval hole, ensuring that it is fully pushed in. This locks the power supply into the bracket.



The transmitter requires 13.8VDC at about 2.1A. The DC input to the transmitter is via a 2.1mm connector. To fit the locking type connector to the transmitter, push the connector in and turn it until the two locking lugs enter the socket and none of the connector barrel is visible. Then turn the connector a quarter turn clockwise.

To disconnect, first turn the connector a quarter turn anti-clockwise and then pull.

4.3 Aerial (see also 2.3)

The impedance of the aerial should be 50 Ohms. It is recommended that the aerial be connected to the transmitter by coaxial cable and be sited at least 1.5 metres from the transmitter.



Care must be taken during installation to keep the power supply away from excessive RF fields.

Where the transmitter power is to be greater than 2.5W, the antenna must be sited a **minimum** of 1.5 metres away from the RPT500 housing and power supply.

In cases where a close-coupled antenna must be used, the transmitter power must be reduced to a **maximum** of 2.5W and care must be taken to position the antenna at least 0.5m from the power supply unit.

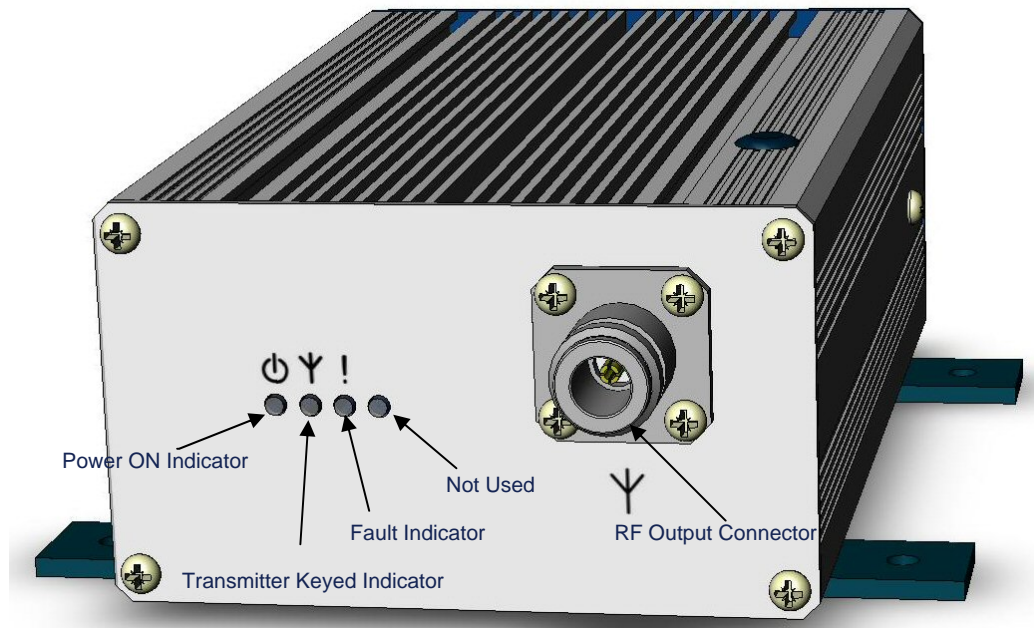
4.4 Transmitter Adjustment

Whilst adjusting the transmitter, an aerial or dummy load MUST be connected to the RF Output socket.

To adjust the transmitter, a PC with the RPT500 field programming software installed is required, with the RS232 serial port connected to the 15 way hi-density D Auxiliary Connector on the RPT500 using lead part number 7761-8251. To adjust the VCO, a long thin non-metallic (preferably ceramic) adjustment tool is required (part no. 8902-0004.)

There are no selectable links or diodes within the transmitter. All adjustments and settings, apart from the VCO frequency, are made from the connected PC.

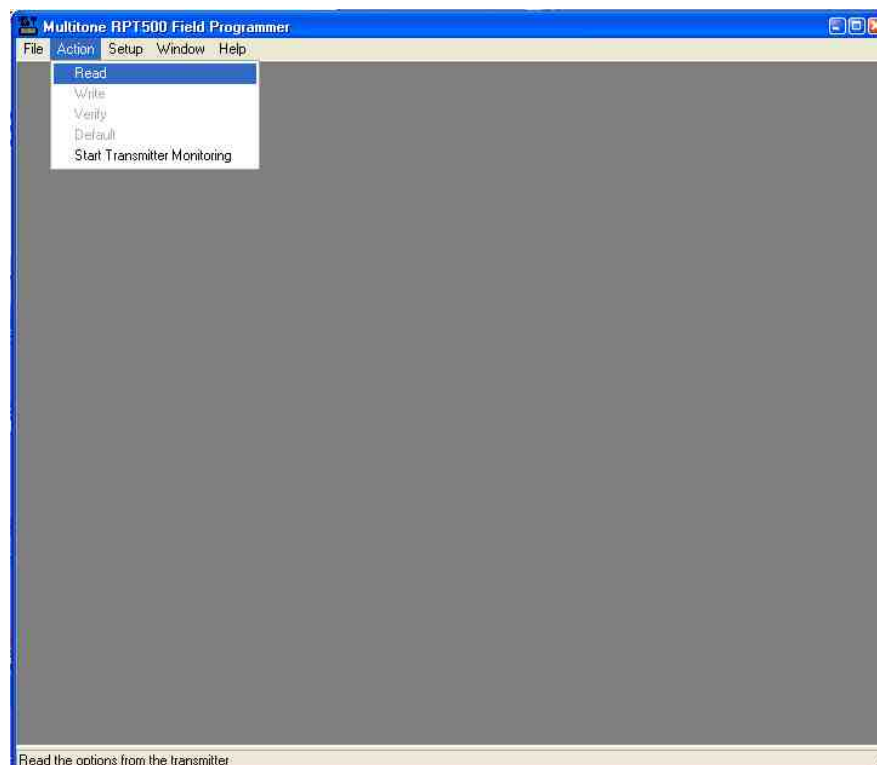
The transmitter **MUST NOT** be keyed, if it is removed from the case for any reason. The RF power amplifier utilises the case as a heat-sink, therefore it is likely to destroy the amplifier very quickly if this provision is removed.



4.5 PC Programming

If a particular setup is used often, a setup file can be saved and recalled via the *File* menu. A transmitter monitoring bar is available from the *Action* menu. This monitors the transmitter status.

Open the field programmer on the PC and select *Action-Read*:



This will then display the current transmitter parameters:

The screenshot shows the 'Multitone RPT500 Field Programmer' window. Inside, there's a sub-window titled 'TX2*'. At the top, it shows 'Serial Number: Mask ID: 5030000008 : RPT500 V010L'. Below this, the 'Channel' section has 'Frequency MHz' set to 450 and 'Reference Frequency Hz' set to 12500. The 'Options' section includes checkboxes for 'DTMF Control' (checked), 'DTMF Channel A' (checked), 'Direct Line Control' (checked), and 'DTMF Channel B' (unchecked). Other options include 'VOX Keying' (unchecked), 'Continue on Line Sync Fail' (unchecked), 'Key Line Polarity' (Active Low), 'Mode Line Polarity' (Digital / Analogue), 'VCO Control' (On Demand), 'Data Polarity' (Normal), 'Fail Safe Timeout' (255 Seconds), 'VOX Hold Time' (8 Seconds), 'Line Sync' (None), and 'Alarm Set Power' (5.0W). At the bottom, there are 'Fault Overrides' for 'Main Synth Out of Lock', 'Line Sync Out of Lock', 'Low Forward Power', and 'High Reverse Power', all of which are unchecked. On the right side of the window, there are buttons for 'Read', 'Write', 'Verify', 'Hex Dump', and 'Alignment'. Below these buttons is a 'Faults' section with 'Main Synth Out of Lock', 'Line Sync Out of Lock', 'Low Forward Power', and 'High Reverse Power', each with a '0' value.

(RPT503 shown for illustration purposes, window for RPT501 identical except for Frequency information, see below).

4.6 Frequency Adjustment

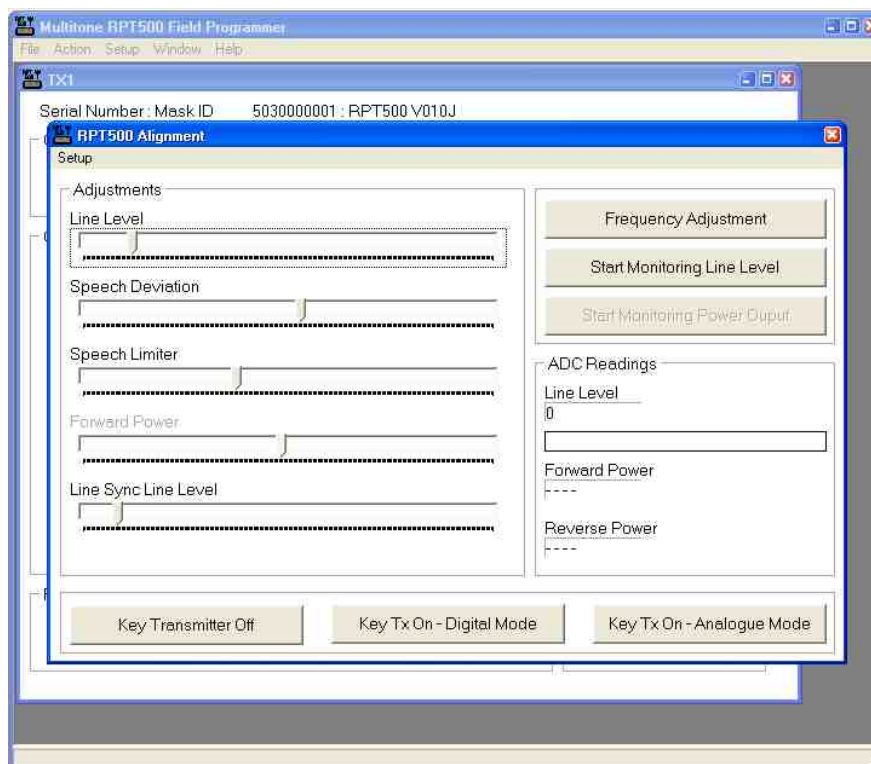
If changing the frequency, enter the new frequency in the frequency box. If necessary the reference frequency can be changed to 10000Hz. The new frequency must be a multiple of 10000 or 12500Hz and in the range 430.000 to 470.000MHz for the RPT503, or within the banded frequencies given in the following table for the RPT501:-

Band	1	2	3	4	5	6
Frequency	25-26.999	27-29.999	30-33.999	34-39.999	40-43.999	44-54

The screenshot shows the 'Multitone RPT501 Field Programmer' window. Inside, there's a sub-window titled 'TX1*'. At the top, it shows 'Serial Number: Mask ID: 5015000006 : RPT500 V0103'. Below this, the 'Channel' section has 'Frequency MHz' set to 41.000000 and 'Reference Frequency Hz' set to 12500. The 'Options' section includes checkboxes for 'DTMF Control' (checked), 'DTMF Channel A' (checked), 'Direct Line Control' (checked), and 'DTMF Channel B' (unchecked). Other options include 'VOX Keying' (unchecked), 'Continue on Line Sync Fail' (unchecked), 'Key Line Polarity' (Active Low), 'Mode Line Polarity' (Digital / Analogue), 'VCO Control' (On Demand), 'Data Polarity' (Normal), 'Fail Safe Timeout' (255 Seconds), 'VOX Hold Time' (8 Seconds), 'Line Sync' (None), and 'Alarm Set Power' (5.0W). At the bottom, there are 'Fault Overrides' for 'Main Synth Out of Lock', 'Line Sync Out of Lock', 'Low Forward Power', and 'High Reverse Power', all of which are unchecked. On the right side of the window, there are buttons for 'Read', 'Write', and 'Verify'. Below these buttons is a 'Faults' section with 'Main Synth Out of Lock', 'Line Sync Out of Lock', 'Low Forward Power', and 'High Reverse Power', each with a '0' value.

Set *Alarm Set Power* to the required level. Re-select any other parameters which need to be changed, then click *Write*. The new parameters are now stored in the transmitter.

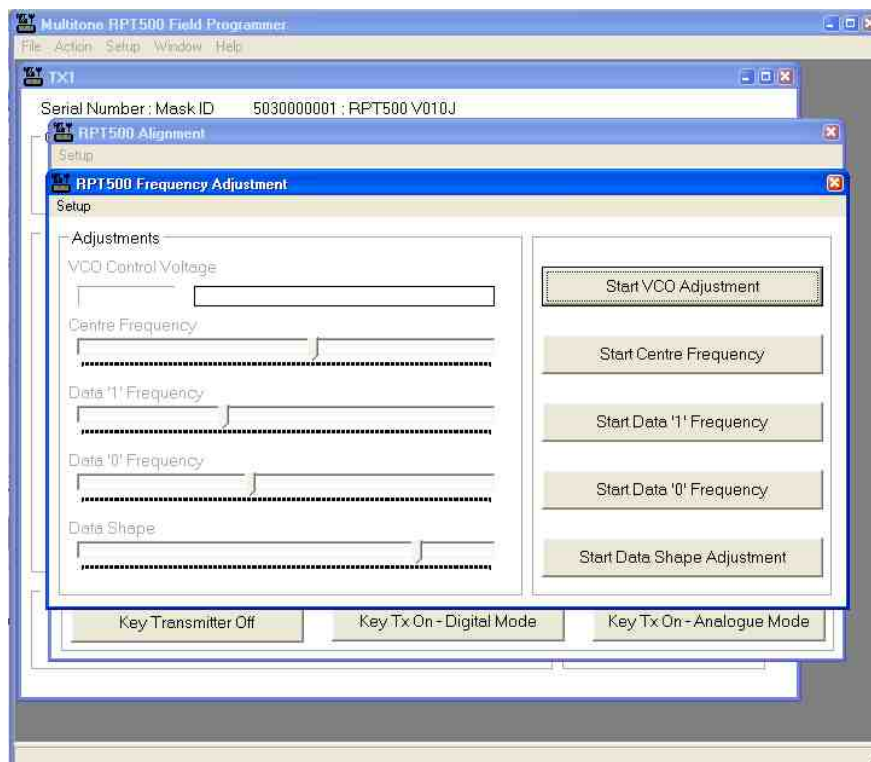
Click *Alignment*.

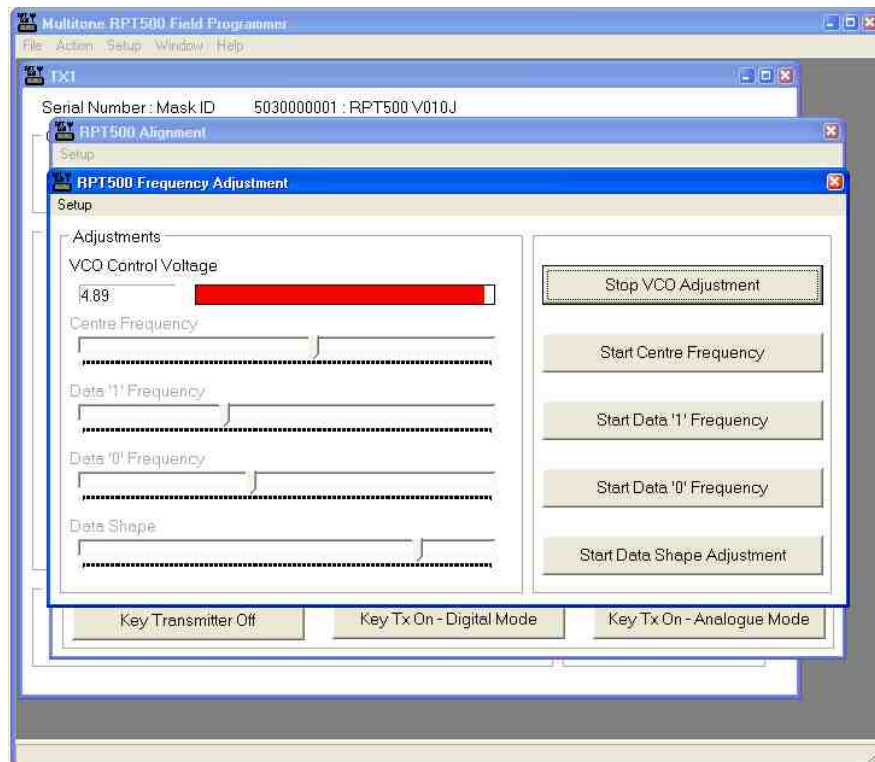


If the frequency has been altered, select *Frequency Adjustment*.

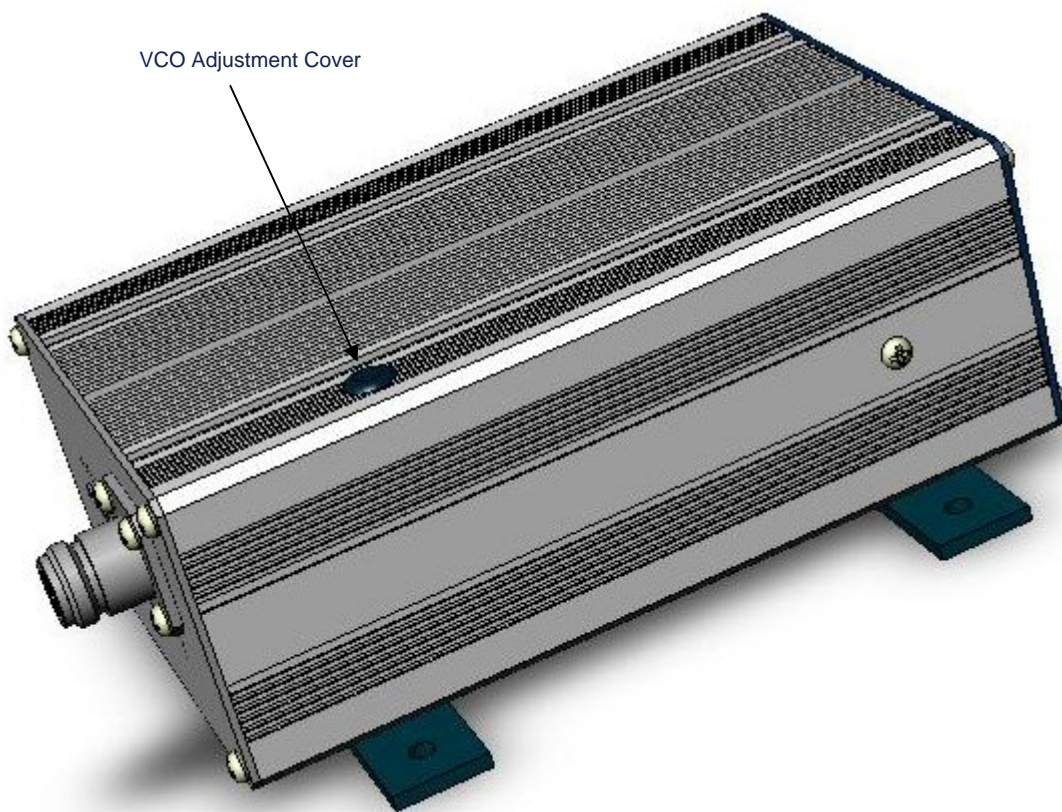
4.7 VCO Adjustment - RPT503 Only

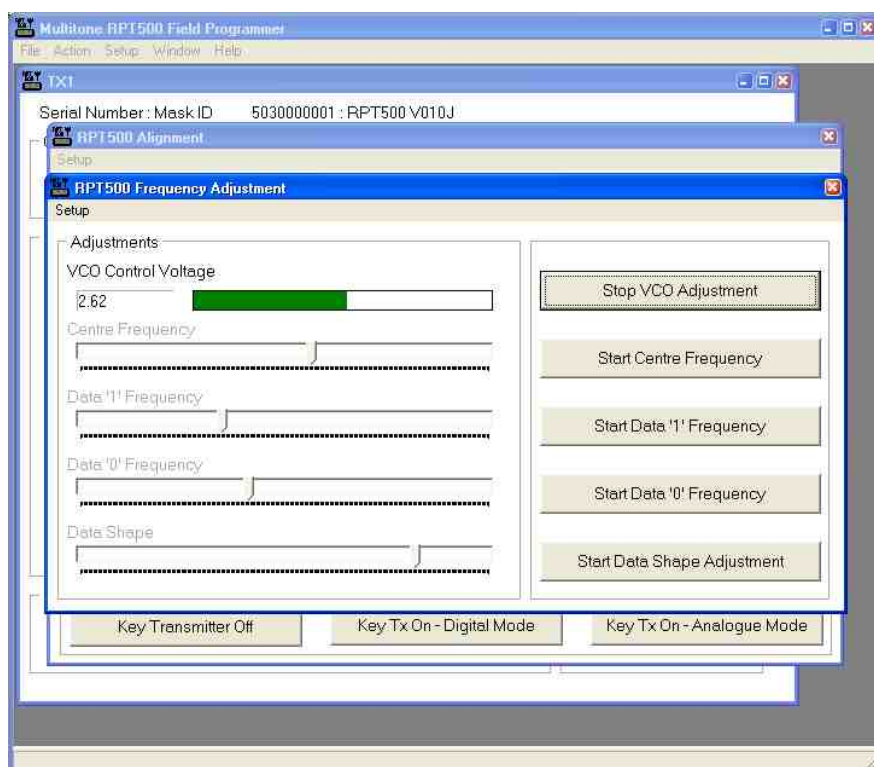
Select *Start VCO Adjustment*.



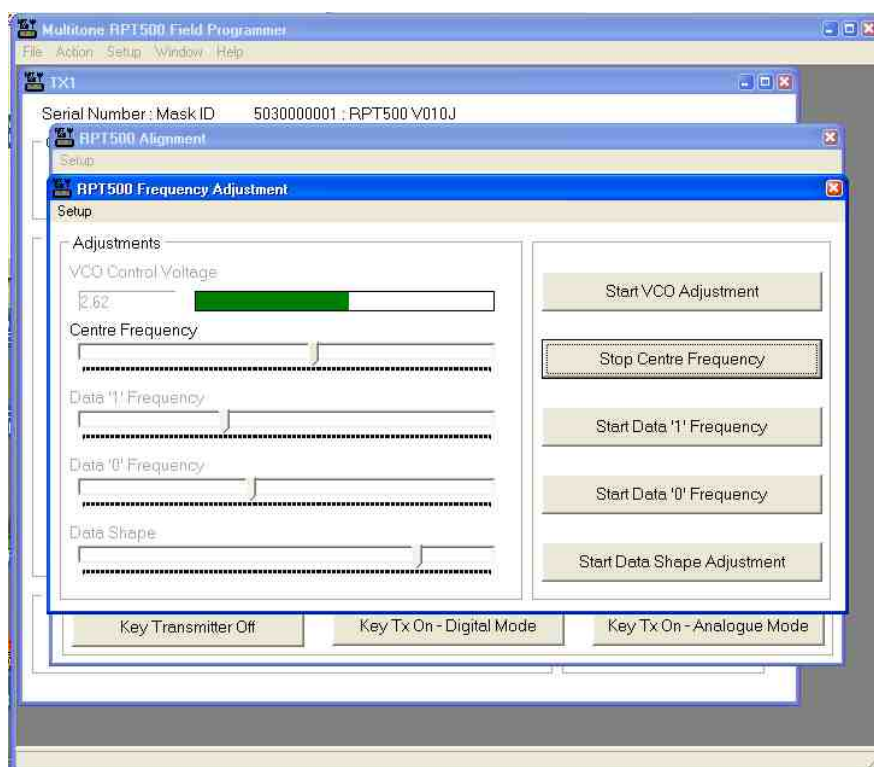


If the VCO control voltage bar is not green, remove the VCO Adjustment Cover from top of transmitter and using a thin *non-metallic* adjusting tool, adjust CV1 until the control voltage bar is green.





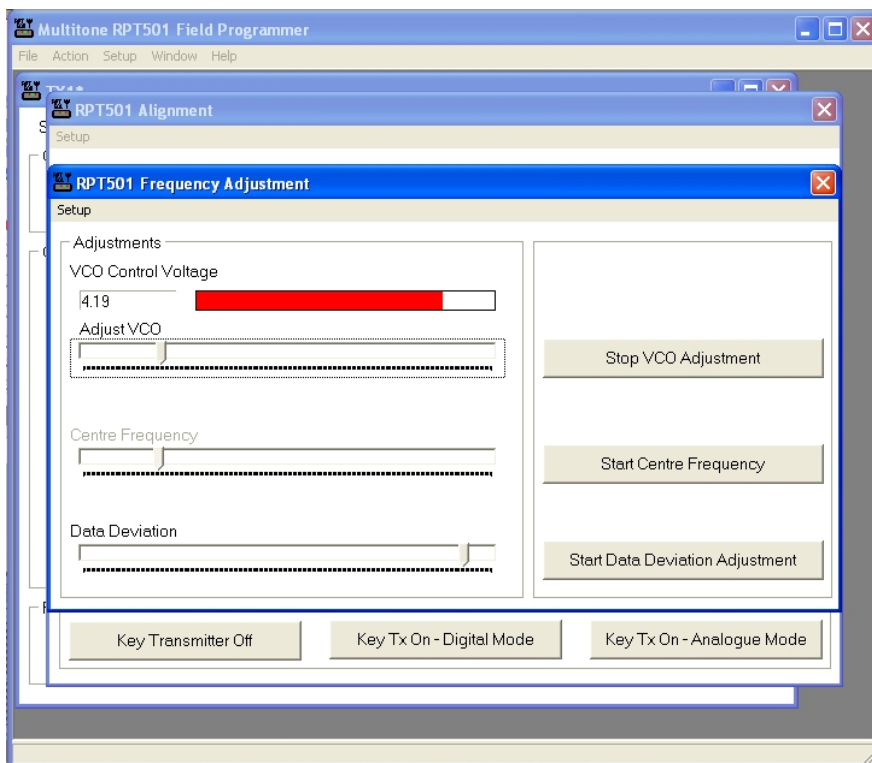
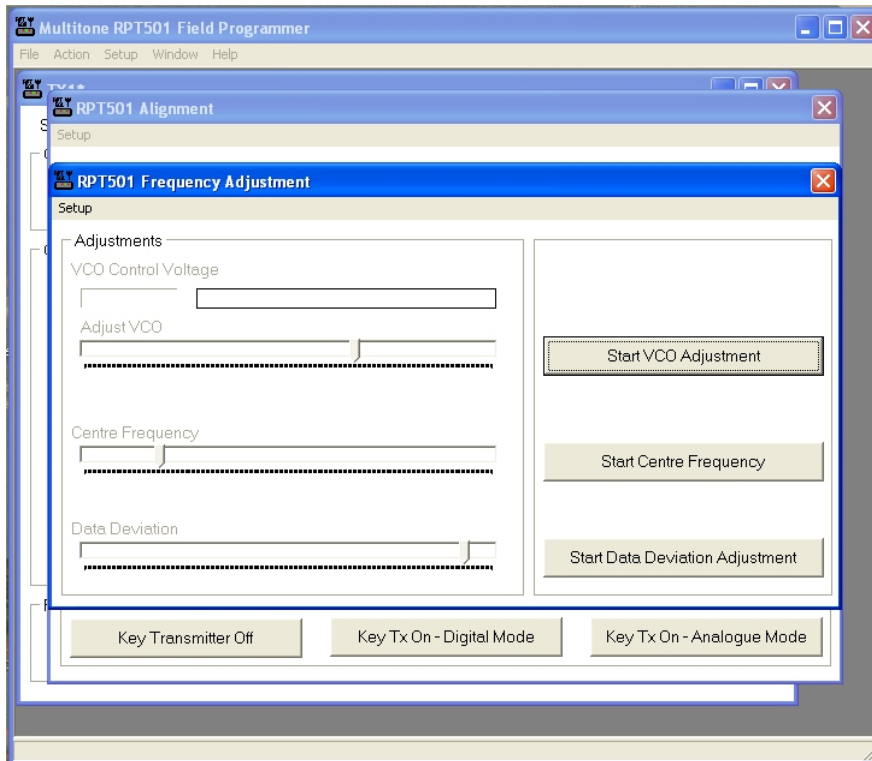
Replace the VCO Adjustment Cover. Click *Start Centre Frequency* and using a frequency counter (via an attenuator!), check that the transmitter carrier is on the correct frequency (within 150Hz). If not, adjust the frequency using the *Centre Frequency* slider (left mouse button click and hold). Fine adjustment can be better achieved by using the left and right arrow cursor keys on the PC keyboard, once the slider has been selected with a left mouse button click:



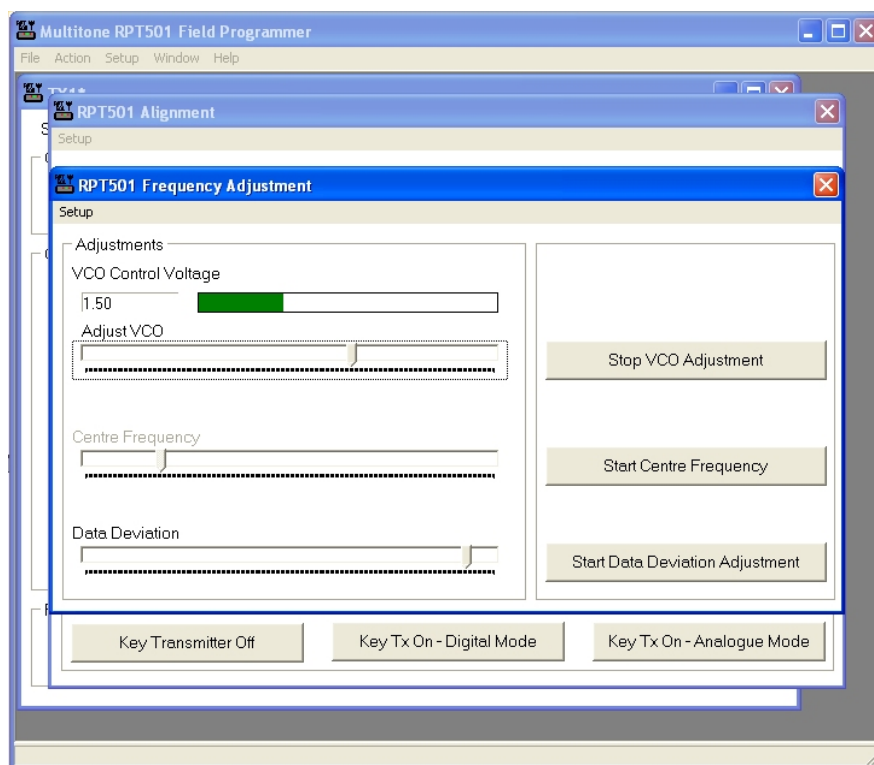
4.7.1 VCO Adjustment - RPT501 Only

It is not necessary to remove the VCO adjustment cover.

Select *Start VCO Adjustment*.



If the VCO voltage bar is not green, move the Adjust VCO slider until the bar is green and the value is as close as possible to 1.5.



Click on *Stop VCO Adjustment*.

Click *Start Centre Frequency* and using a frequency counter (via an attenuator!), check that the transmitter carrier is on the correct frequency (within about 20Hz). If not, adjust the frequency using the *Centre Frequency* slider (left mouse button click and hold). Fine adjustment can be better achieved by using the left and right arrow cursor keys on the PC keyboard, once the slider has been selected with a left mouse button click.

4.8 Data Modulation Adjustment - RPT503 only

If the transmitter is set for line synchronisation (master or slave) the Data 1 and Data 0 adjustments must be skipped. Data Shape must be set in all cases. (See para 6. for line sync switch settings)

Select and repeat this adjustment for *Data '1' Frequency* and *Data '0' Frequency modes*, which should be set to:

Slider	25 KHz Bandwidth	12.5 KHz Bandwidth
Data 1 Frequency	Carrier minus 4.5 KHz	Carrier minus 2.25 KHz
Data 0 Frequency	Carrier plus 4.5 KHz	Carrier plus 2.25 KHz
Data Shape (Deviation)	4.5KHz	2.25KHz

Data '1' frequency **MUST** be set before data '0' frequency.

Once the frequencies have been set, the *Data Shape Adjustment* must be set. The easiest way to do this is to connect a modulation meter to the output (via an attenuator!) and adjust the *Data Shape* slider for the correct deviation. The required data is generated by the software. Once deviation is set, click on *Stop Data Shape Adjustment* and close the *Frequency Adjustment* window.

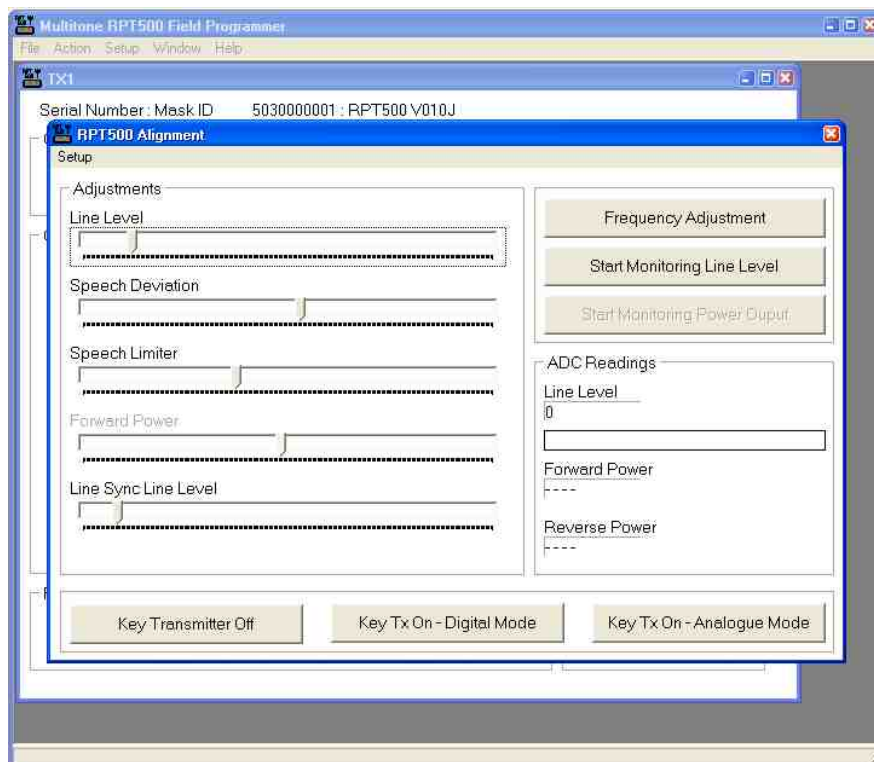
4.8.1 Data Modulation Adjustment - RPT501 only

Connect a modulation meter to the output (via an attenuator!) Click on *Start Data Deviation Adjustment*. Adjust the *Data Deviation* slider to give the correct deviation:

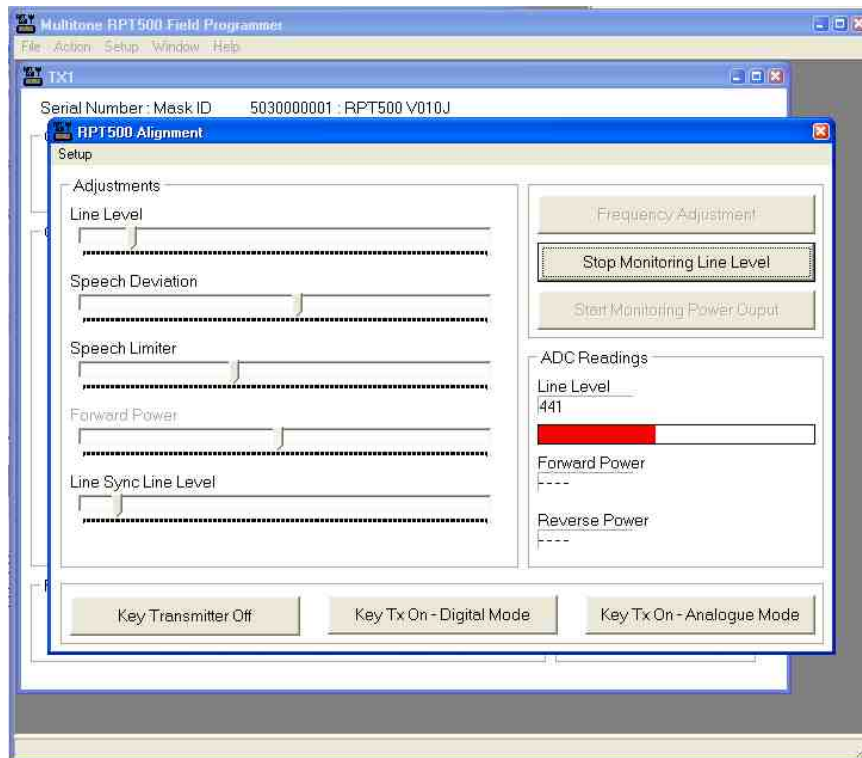
Channel Spacing	Deviation
20/25 kHz	4.5kHz
10/12.5 kHz	2.5kHz

Click on *Stop Data Deviation Adjustment*.

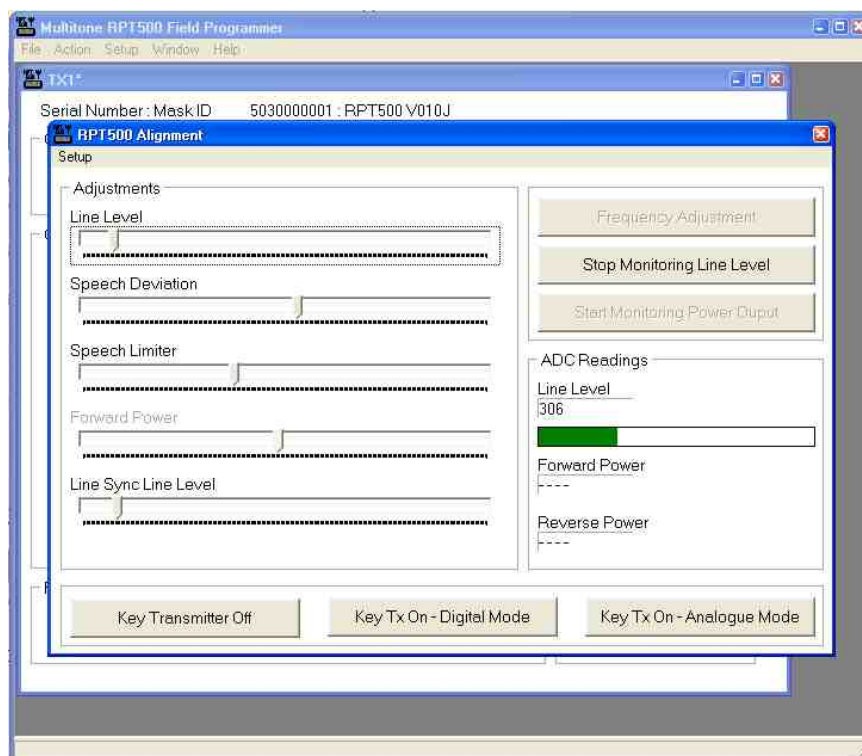
4.9 Line Level Adjustment



Feed a 1209Hz tone into the RPT500 600 Ohm line input (e.g. C+5 on P391) at -13dBm level. Click *Start Monitoring Line Level*:



Adjust the *Line Level* slider, until the *Line Level* bar is green:



Click *Stop Monitoring Line Level* button.

Next, using a modulation meter and with transmitter keyed on in Analogue Mode, adjust the *Speech Deviation* and *Speech Limiter* sliders as follows:

Slider	Line Level	25 KHz Bandwidth	12.5 KHz Bandwidth
Speech Deviation	-13dBm	3.5KHz	2.0KHz
Speech Limiter	7dBm	4.5KHz	2.5KHz

It may be necessary to iteratively adjust these two sliders, as they are interactive.

4.10 RF Power Adjustment

Click *Start Monitoring Power Output* and then *Key Tx On – Analogue Mode*. Using a power meter on the transmitter output, adjust the *Forward Power* slider for the required output. This power must agree with the *Set Alarm Power* level, or false fault conditions may be generated. DO NOT SET TO MORE THAN 5 WATTS!

If the transmitter frequency has not been changed by more than about 5MHz, then further adjustment of the frequency, deviation and power level MAY not be necessary, once the VCO has been adjusted onto frequency.

The alignment window must be closed, in order to close the field programmer program.

4.11 Connections

RF output is via the N-type connector on the front of the transmitter.

The line connector is an 8-pin RJ45 socket. This connector carries both the Audio Line and the Line Synchronisation circuits. The Audio/Data Line connections are compatible with the P251 Series. Input is 600 Ohms impedance and should be at –13dBm level.

Pins 2 and 4 are Audio/Data Line, Pins 6 and 8 are Line Synchronisation line (also –13dBm 600 Ohms.)

Direct inputs (Data, Key and Mode) are on the Auxiliary Connector. Cable 7761-8245 is available, which has the connector on one end and open wires at the other, for connection in a junction box.

4.12 Auxiliary Connections

Pin	Wire colour	Function
1		Flash Input – Do not connect
2	Black	Ground
3	Yellow	Ground
4	Green	Ground
5	Orange	Tx keyed (O/C output)
6	Pink	Data Input
7		Flash Input – Do not connect
8	Grey	Mode Line Input
9		Flash Input – Do not connect
10	Blue	Key Line Input
11	Red	Fault Output (open collector)
12	Violet	12V 10mA Output
13	Brown	Serial RS232 Transmit Data
14	White	Serial RS232 Receive Data
15		Flash Input – Do not connect
	Turquoise	Cut Short

Tx keyed on pin 5 is available on all RPT501 and RPT503 build 9 and above.

The polarity for the mode, key and data lines is software selectable from the field programmer.

The Serial RS232 circuits on this socket are for connection to the field programmer.

The Flash Inputs are for re-flashing the RPT500 firmware. **These must not be connected!**

5. RPT500 Dis-Assembly & Re-Assembly

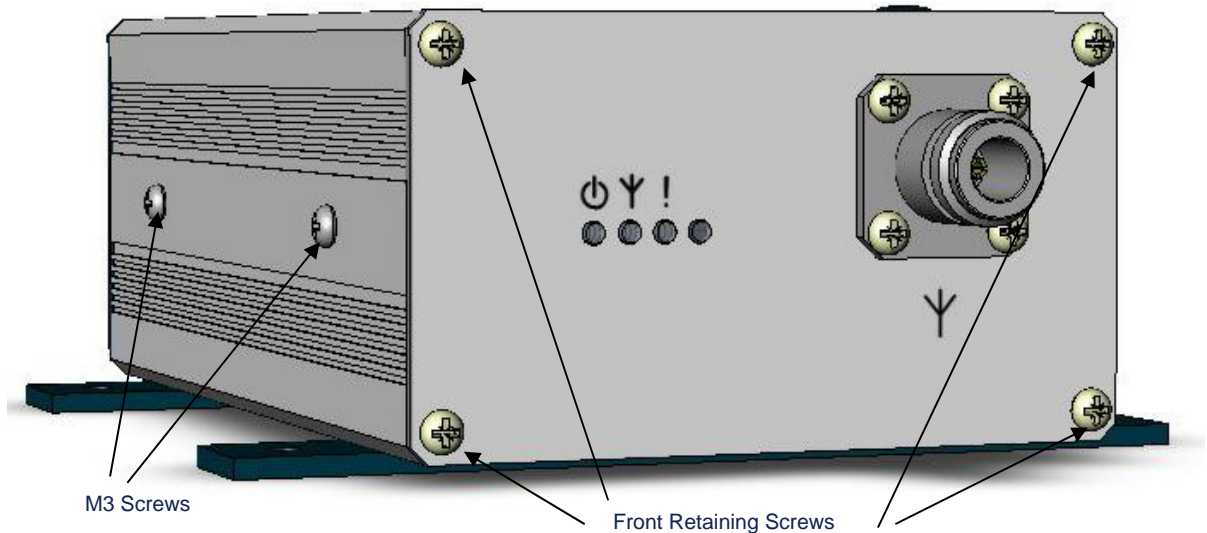
5.1 Dis-Assembly

Ensure that the transmitter is unplugged.

Remove the 3 x M3 screws from either side of the transmitter.

Remove the four front retaining screws.

Pull the transmitter circuit board out of the case from the front, with the front panel attached.



5.2 Re-Assembly

Slide the transmitter into the correct runners, so that the front panel aligns with the case. Ensure that the rear connectors align with their cut-outs. This does not require undue force!

Loosely fit the M3 screws in the side of the transmitter.

Fit the four front retaining screws and tighten

Tighten the M3 screws fully to pull the power amplifier heat-sink into close contact with the case.

6. RPT500 Line Synchronisation Adjustment

In stand alone mode all formats (Pocsag MK6 and MK7) are supported.

In line synchronization mode only MK6 and MK7 are supported.

To convert the mode it is necessary to open the transmitter and set the switch (SW1) as follows.

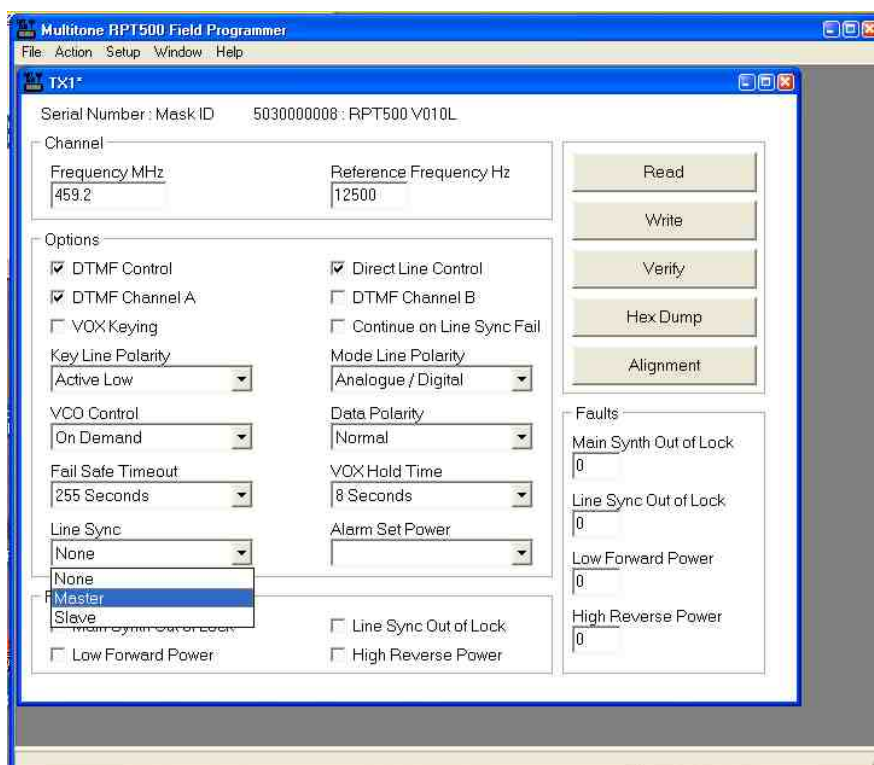
Mode	Switch S1	Switch S2
Stand Alone, Pocsag,MK6,MK7	ON	ON
Line Sync MK6,MK7	OFF	OFF

Ensure that both the line synchronisation and audio lines are connected correctly. The polarity of the audio line is important, but the polarity of the synchronisation line makes no difference.

The line synchronisation signal level is -13dBm into 600 Ohms, at a frequency of 20,000Hz. It must therefore be connected by a continuous twisted copper pair, from the Master through to the Slave equipment(s).

6.1 Master Transmitter

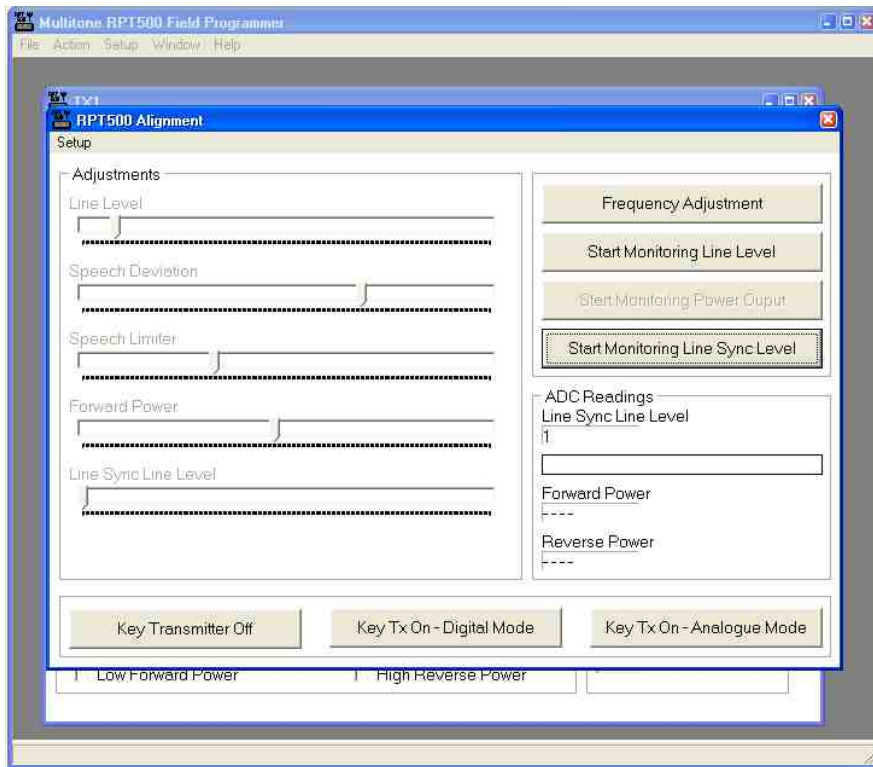
Connect the Field Programmer to the RPT500 and read from the transmitter. Select Master from the Line Sync pull-down menu.



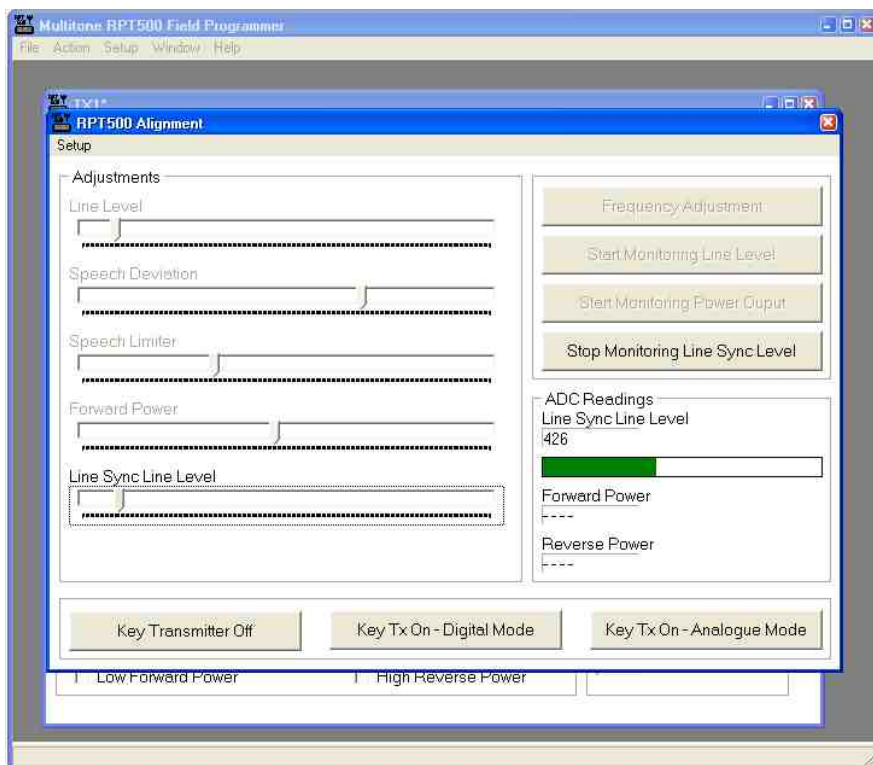
Write to the transmitter.

Click the *Alignment* button.

Click the *Start Monitoring Line Sync Level* button.



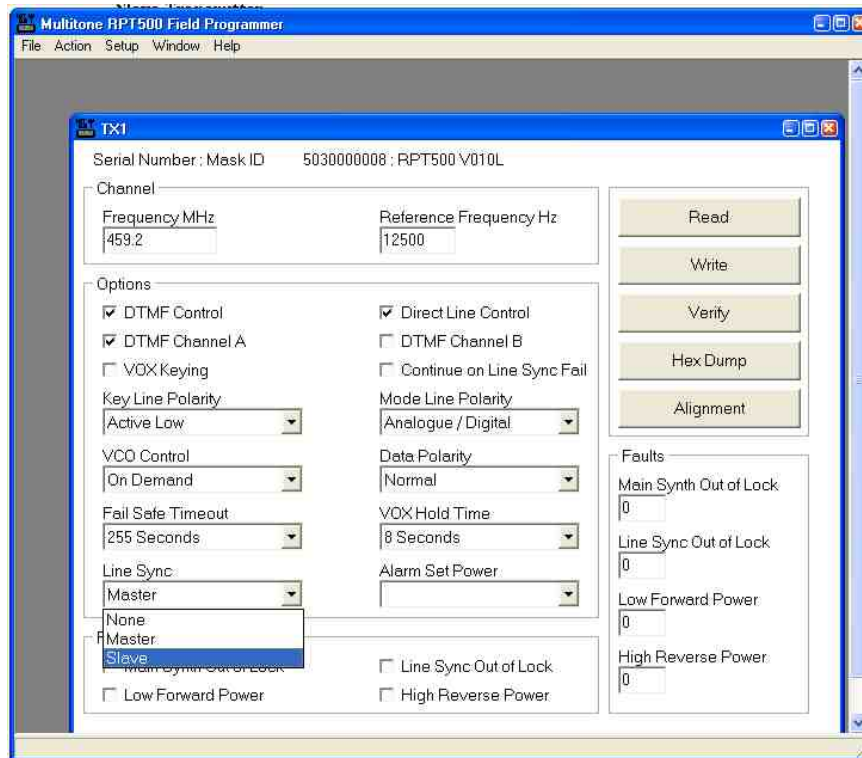
Start with the *Line Sync Level Slider* at minimum (to the left) and pull the slider across to the right, until the *Line Sync Line Level* bar changes to red and then green. Stop before the bar changes back to red.



Click *Stop Monitoring Line Sync Level*.
Close the *Alignment* Window. Setup is complete.

6.2 Slave Transmitter

Connect the Field Programmer to RPT500 and read from the transmitter. Select Slave from the Line Sync pull-down menu.



Write to the transmitter.

Click the *Alignment* button.

Click the *Start Monitoring Line Sync Level* button.

Check that the *Line Sync Line Level* bar shows a level of 300 or more. Preferably the bar should be green, but this may not always be possible. If the level is below 300, return to the Master transmitter and increase its output a little.

Click *Stop Monitoring Line Sync Level*.

Close the *Alignment* Window.

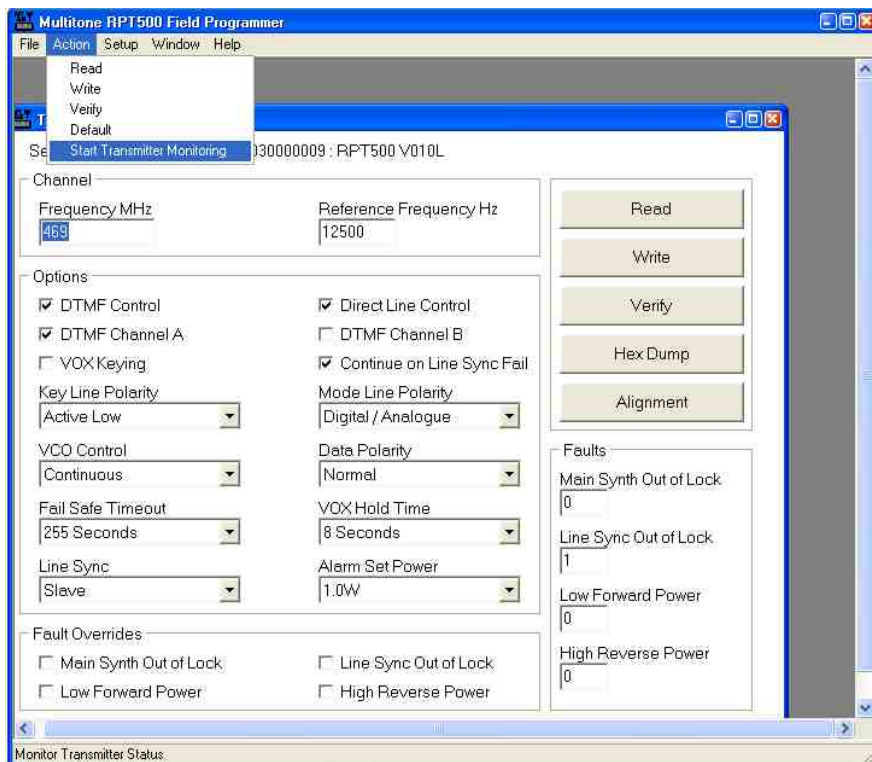
Setup is complete.

Synchronisation can take up to about 30 seconds to complete.

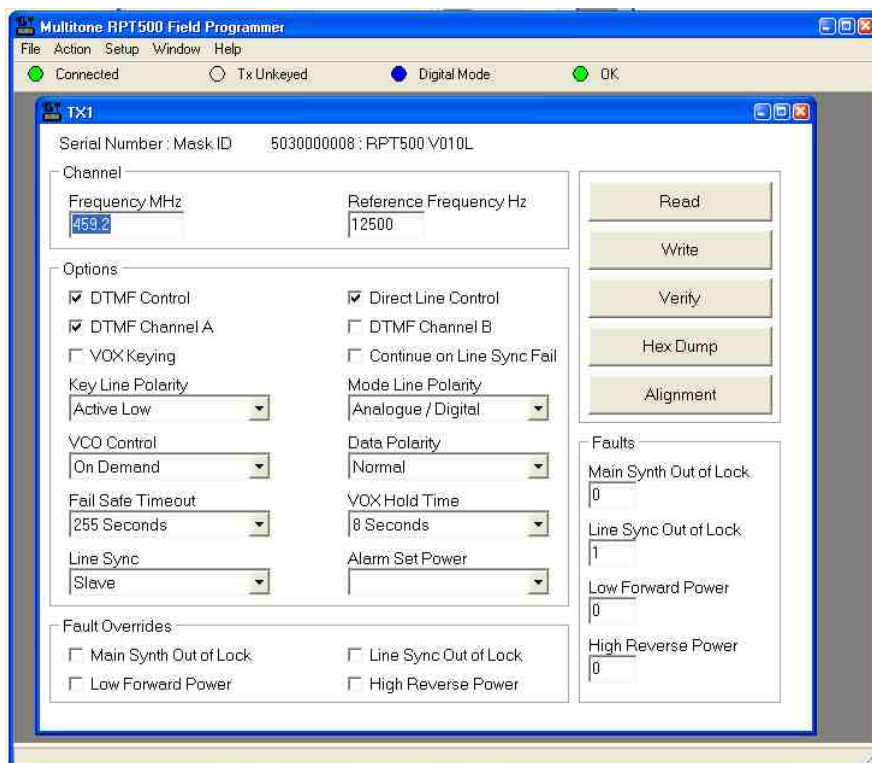
It is possible to check the status of the transmitter.

Click on the *Action* menu.

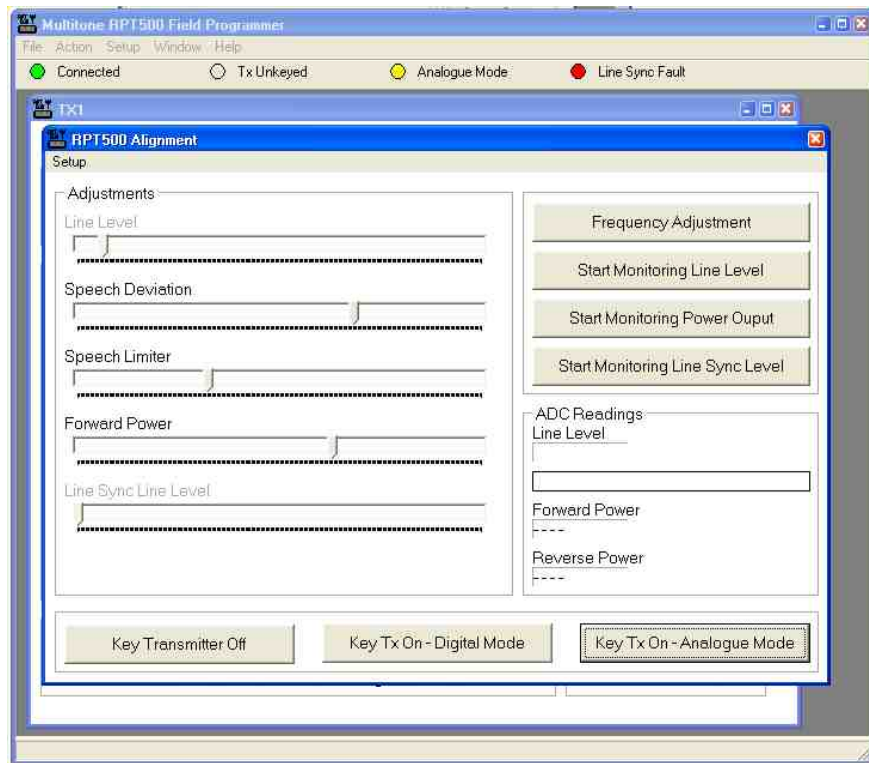
Select *Start Transmitter Monitoring*.



This gives a bar showing transmitter status:



Key the transmitter from the *Alignment* screen. If all is well, the transmitter will key and the *OK* indicator will remain green. If the line sync. has failed, the *OK* indicator will change to red and the message *Line Sync Fault* will be shown:



The transmitter status bar registers faults only when the transmitter is keyed. The exception is *Connected*, which indicates communication between the PC and the transmitter.

The *Faults* section of the main screen shows the number of times each fault has occurred, whilst the transmitter has been keyed. It is updated only when the transmitter is read and therefore will not indicate a fault in “real time”. The fault counts can be edited (back to zero) and then written back to the transmitter.



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9261 – 8252 Iss. 11



Cert No.
FM20122