



# Technical Support

TECHNICAL NOTE

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## Technical Note TN-884 Increasing TB8100 Maximum Deviation

21 June 2004

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### Applicability

This application note applies to TB8100's and will affect TB8100's configured for either Wide Band or Narrow Band

The TB8100 as sent out from the factory is setup to never exceed the maximum compliance deviation limit

In some circumstances there may be a need to be able to achieve a higher deviation than is available from the standard TB8100 setup.

This Technical Note explains how to achieve a greater maximum deviation from the TB8100 transmitter than can be gained from calibrating and configuring the TB8100 using the approved standard method. However, this may result in levels that are over the 5kHz maximum compliance limit. As with any radio device setting up the radio equipment to go over the regulatory authority's maximum compliance levels is done at your own risk.

Currently (with V2.00 software and firmware), the standard setup of the TB8100 limits the maximum deviation that can be transmitted with no CTCSS encode to approximately 3.7kHz for wide band channels and 1.85kHz for narrow band channels. If CTCSS tone is encoded then the maximum deviation that can be transmitted is approximately 4.2kHz for wide band channels and 2.1kHz for narrow band channels (ie. 3.7kHz +500Hz of CTCSS would result in a total maximum deviation of 4.2kHz).

Some users require that the limiting be closer to or greater than maximum allowed deviation when used as either a talk through repeater or when transmitting line audio from the Tx Line In from the SIF connector.

# 1. Preliminary Requirements

## Software/Firmware Requirements

Ensure the PMU, Reciter & PA firmware has been upgraded to version 2.00.

Ensure that V2.00 or greater Service Kit and Calibration Kit software is available.

## Configuration Parameters

V2.00 Service Kit includes the field 'Max Tx deviation has sub-audible signalling' on the 'Signal Path' page which allows the base to:

- **Superimpose** CTCSS to the speech audio (ie. -10dBm of 1kHz tone into the 'Tx line in' and 10% of encode CTCSS 'superimposed'. Eg for wide band there would be 3.5kHz total deviation or 3kHz of tone + 500Hz of CTCSS)

or

- **Include** CTCSS and speech audio (ie. -10dBm of 1kHz tone into the 'Tx line in' and 10% of encode CTCSS 'included'. eg for wide band there would be 3kHz total deviation or 2.5kHz of 1kHz tone and 500Hz of CTCSS).

## Test Equipment Required

TB8100 Calibration Test Unit Kit (CTU)  
TB8100 V2.00+ Service Kit (SK) & Calibration Kit (CK)  
Communications Test Set  
BNC & N type coax cables

# 2. Procedure

## Calibration

1. Before using the Calibration Kit ensure that there are **NO** CTCSS tones programmed into the TB8100. Using the Service Kit remove any CTCSS tones from the 'Signalling Profile' or 'Channel Table'. Having CTCSS tones programmed into the TB8100 while using the Calibration Kit will result in lower maximum deviation levels. After using the Calibration Kit it is OK to put the CTCSS tones back into the TB8100 'Signalling Profile' or

'Channel Table' using the Service Kit.

2. Remove the reciter from the rack and place the reciter on the top of the TB8100 rack frame with the SMA and DC connector plugged into the reciter and placed in such a way that there is access to the Rx and Tx VCO adjustment points.
3. Connect the reciter SIF connector to the Calibration Test Unit SIF connector using the 15 or 25 way D range cable supplied with the Calibration Test Unit and also connect the computer to the TB8100 via the RS232 cable.
4. 'Connect' the Calibration Kit to the TB8100 in the standard method.
5. The sections of the TB8100 Calibration Kit that are relevant to setting up the deviation are the first 3 steps of the 'Reciter Calibration' menu:
  - FCL Auto Tuning
  - FCL Calibration
  - VCO Calibration
6. Do 'FCL Auto-Tuning'.
7. Do the 'FCL Calibration' as follows:
  - Select the Reciter Calibration tab, and double-click FCL Calibration. The FCL Calibration Wizard appears.
  - Attach an appropriate Load and Modulation meter to the PA or exciter output, set the meter to measure the **peak** deviation, and then click Next. (If you are using a PA, it will now transmit.)
  - Insert the tuning tool into the exciter VCO tuning hole and adjust the trimmer to roughly centre the exciter VCO on the band specified. Click Next.
  - Use the slider to adjust the deviation at 30Hz until it is **3.8kHz peak**.
  - Select the 1kHz Modulation Test and adjust the deviation at 1kHz until it is **3.8kHz peak**.
  - Repeat the adjustments at both 30Hz and 1kHz until the modulation is **3.8kHz peak** at both frequencies.
  - Click Finish. (If you are using a PA, it will now stop transmitting.)

*Note: The 'standard' way to calibrate the FCL is to use 3.0 kHz peak, in order to achieve a higher maximum deviation we are calibrating the FCL to **3.8kHz peak**. Calibrating to levels much greater than **3.8kHz** may cause issues with the internal DSP numerical limits.*

8. Do the 'VCO Calibration' as follows:

- Select the Reciter Calibration tab, and double-click VCO Calibration.
- Attach an appropriate Load and Modulation meter to the PA or exciter output, set the meter to measure the **peak** deviation, and then click Next. (If you are using a PA, it will now transmit.)
- Using the scale in the dialog box to help you, adjust the exciter lock band trimmer to centre the exciter VCO on the sub-band indicated and then click Next.
- For each of the seven frequencies shown, adjust the slider until the deviation shown on the modulation meter is **3.8kHz peak**. When you have finished, click Next Band.
- For each sub-band repeat the above adjustments.
- Click Finish. (If you are using a PA, it will now stop transmitting.)

*Note: The 'standard' way to calibrate the VCO is to use 3.0 kHz peak, in order to achieve a higher maximum deviation we are calibrating the VCO to **3.8kHz peak**. Calibrating to levels much greater than **3.8kHz** may cause issues with the internal DSP numerical limits.*

9. You may now want to complete the rest of the reciter or PA calibration. When you have finished 'Disconnect' from the Calibration Kit.
10. Open the TB8100 Service Kit and 'Connect' to the TB8100.
11. You may want to put CTCSS back into the configuration if you had to remove it previously (see step 1).
12. The 2 sections of the Service Kit that are relevant to the maximum deviation are:  
**Configure/Channel Profiles/General** (see Fig. 1) and  
**Configure/Channel Profiles/Signal Path** (Fig. 2).

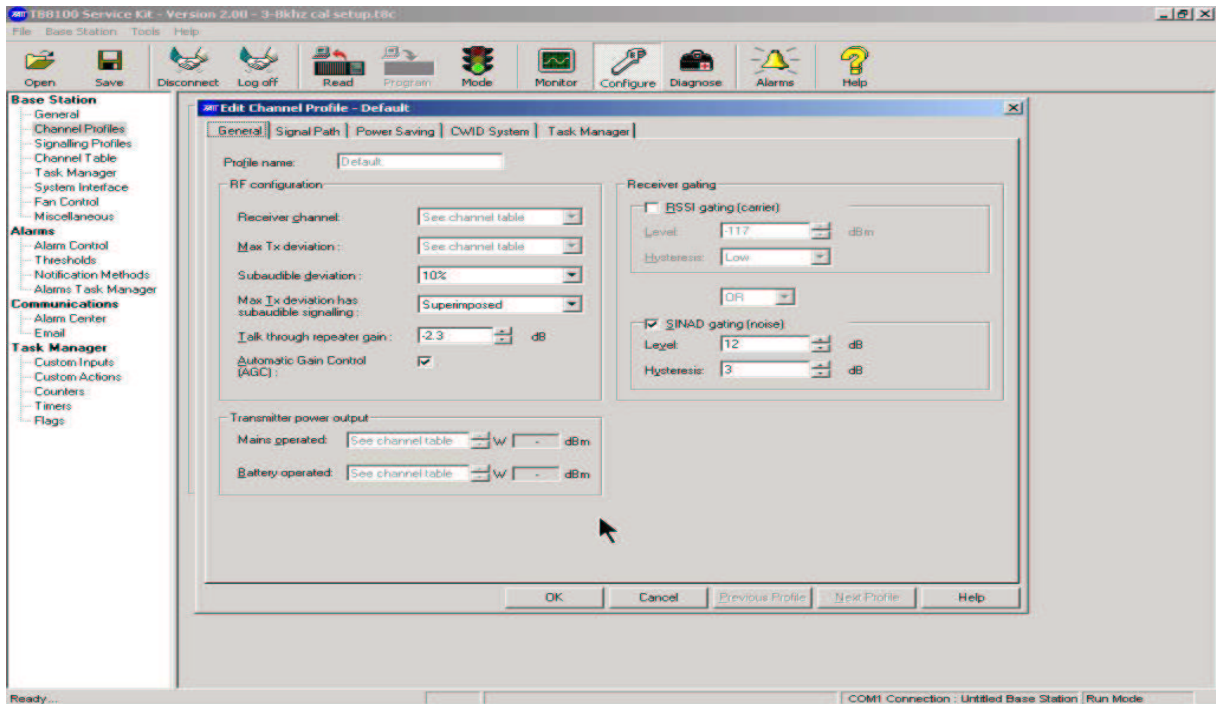


Fig. 1 - Configure/Channel Profiles/General page

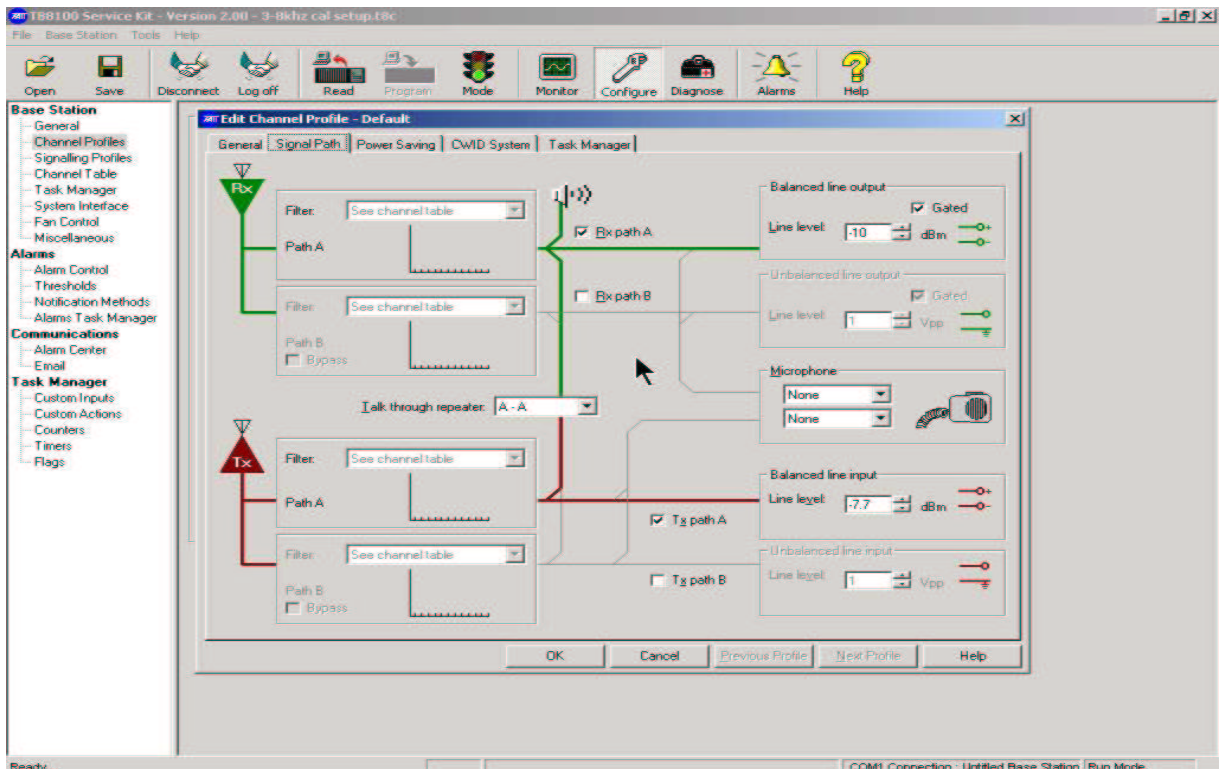


Fig. 2 - Configure/Channel Profiles/Signal Path page

13. The following steps assume that the TB8100 is configured as either a Talk Through Repeater with unity gain (ie. 3kHz in = 3kHz out) and/or Line Controlled using -10dBm of signal into the Tx Line In resulting in 3kHz deviation out. These steps will reduce the Talk Through Repeater and Line Controlled Base gains by 2.3dB, compensating for the additional gain introduced during calibration.
14. Go to the **Configure/Channel Profiles/General** page and change the 'Talk through repeater gain' field to **-2.3dBm**.
15. Set the field 'Sub-audible deviation' to '10%'.
16. Set the field 'Max Tx deviation has subaudible signalling' to 'Superimposed'
17. Go to the **Configure/Channel Profiles/Signal Path** page and change the 'Balanced line input' line level field to **-7.7dBm**.
18. Make any other configuration changes that are required on the TB8100, then program them into the base and then put the base back into 'Run' mode.

## Testing

1. After the TB8100 has been calibrated as per the above procedure it is recommended that the maximum deviation of the TB8100 be measured to ensure the required maximum deviation has been achieved.
2. The maximum deviation should be checked in both the Talk Through Repeater mode (from receiver in to transmitter out) and in the Line Controlled Base mode (from line in to transmitter out)
3. If the required maximum deviation has not been achieved then the calibration procedure can be repeated. However it will be necessary to slightly adjust the deviation level used for calibrating the FCL and VCO.

### 3. General Information

Future firmware and software upgrades to the TB8100 may make this Technical Note redundant and may require the procedure documented in this Technical Note to be reversed.

**Compliance Issues** Recalibrating the TB8100 as per this Tech Note may under some conditions allow the TB8100 to exceed the maximum allowable deviation.

**CSO Instruction** This Tech Note is for distribution within Tait. However it may be issued to Dealers who report that they have found the TB8100 max deviation is low and they wish to increase it.

### 4. Issuing Authority

**Name and Position of Issuing Officer** Rob Ottaway  
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