



APPLICATION NOTE

Tetra Base Station Test and
Monitoring

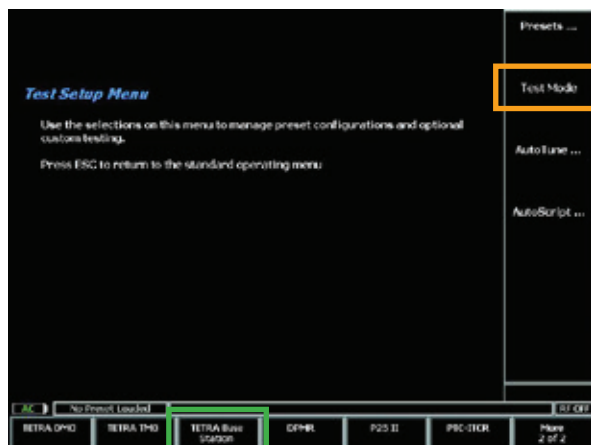
Introduction to Tetra Base Station Test and Monitoring

- The two options TETRA Base Station Monitoring (R8-TETRA_BSM) and TETRA Base Station T1 Test (R8-TETRA_BST1) share the same operating interface
- Whilst TETRA Base Station Monitoring Option may be purchased and operated as a standalone application, TETRA Base Station T1 Test requires that TETRA Base Station Monitoring is enabled
- The user may select between these options on the fly if enabled
- The purchase of TETRA Base Station T1 Test application includes the TETRA Base Station Monitoring application
- There is an upgrade path from TETRA Base Station Monitoring to TETRA Base Station T1 Test
- Mobile Country Code(MCC), Mobile Network Code(MNC), Base Station Colour Code(BCC) and Local Area Code(Larea) are only decoded and displayed in the TETRA Base Station T1 Test application
- Both options conduct full transmitter parametric measurements, either by direct connect or OTA antenna connection
- The TETRA Base Station T1 Test option has additional transmitter and receiver T1 measurements for BER/MER

Initial Power On

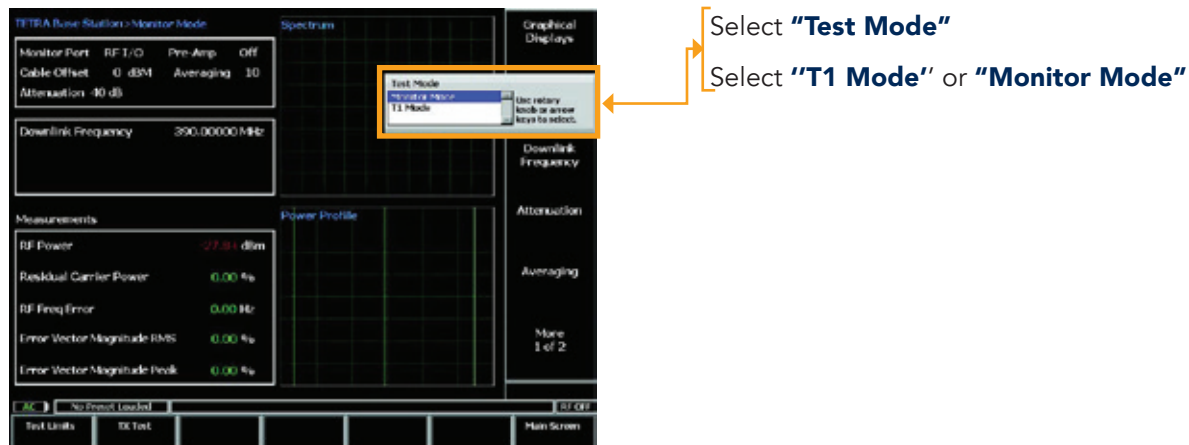


1. Initial Power On
2. Press Green Power Button
3. Wait for configuration to load around 30 Seconds
4. Press Blue **"TEST"** Button



Select **"Test Mode"**

On Page 2, Select **"TETRA Base Station"**



RX Tones and Voice Loopback

This feature works in any Duplex call type.

Example:

- Set up a Group Call
- Select **"Call Type"** and **"Group"** from the dropdown menu
- Select **"Select Group"** the radio will have sent Group Allocations during Registration.
- Select the Group to make the call to
- Select **"Call Mobile"**

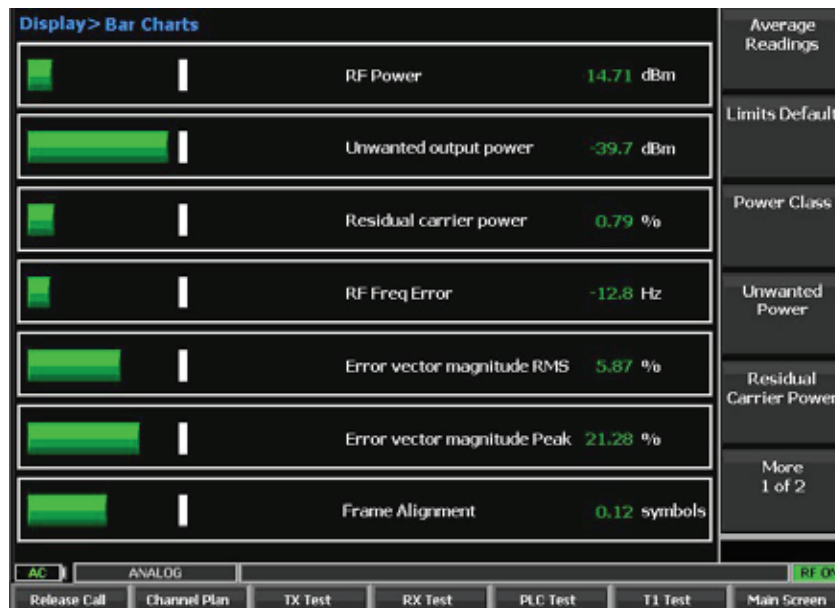
The Mobile will indicate Group Call ID 777 on its display.

- Press PTT to observe TX measurements
- Release PTT
- **"Select Voice Loopback"**
- Scroll to each tone in the menu to hear them on the mobiles speaker Select **"Voice"**
- Press PTT and speak into the microphone to record a message
- Release PTT. Recorded message will play back repeatedly until **"OFF"** is selected

*Note: A manual test of the RX sensitivity can be made by: Selecting **"RF Level"** then adjust negatively until the speech becomes broken up. <-116 to -120 is a typical level for breakup of voice.*

Full Screen Graphical Display

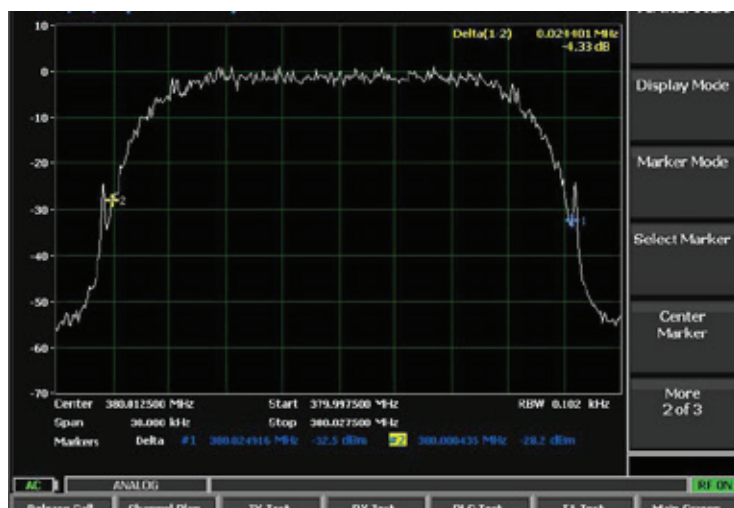
Bar charts provide a graphical representation of measured parameters.



- Colour coded pass/fail as in the main screen.
- The White markers indicate the limit of each parameter.
Individual Limits may be adjusted by the operator
- Power Class selection loads the limits for that class of radio.

Spectrum Analyser

Bar charts provide a graphical representation of measured parameters.



The Spectrum Analyser will be familiar as it is a copy on of the main Spectrum Analyser from the standard R8100. Only the functions applicable to TMO have been copied across,

Page through all the menu pages to see the features included.

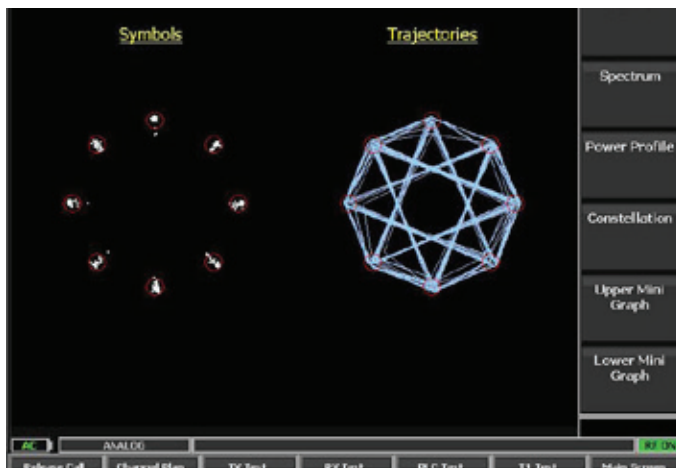
- Start/Stop Frequency Display Mode
 - » Max Hold is useful for capturing the TDMA Bursts.
- Markers Marker Modes
 - » Delta Mode is useful to measure channel bandwidth
- Adjustable Span

Power Profile



- TDMA slot view
- 2 Markers for timing analysis
- Markers toggle for Mkr1 or Mkr2 adjustment.

Constellation Display



Industry standard QPSK Constellations Graphical representation of:

- Phase errors
- Amplitude Errors
- I/Q Imbalance

Test Limits

Test Limits	Lower	Upper
RF Power Level	28 dB	32 dB
Unwanted Power		-35 dB
Residual Carrier Power	0 %	5 %
Frequency Error	-100 Hz	100 Hz
RMS Vector Error	0 %	10 %
Peak Vector Error	0 %	30 %
Frame Alignment Symbols	-0.250 sym	0.250 sym
RX Sensitivity	-114 dBm	
MS T1 BER		3.000 %
MS T1 MER		3.000 %

- This menu allows the operator to set his own limits for each TMO parameter being measured
- These limits are mirrored in the Bar Charts display.
- The setting of each parameter is used to calculate pass/fail results automatically.

The default key returns all limits the ETSI standard

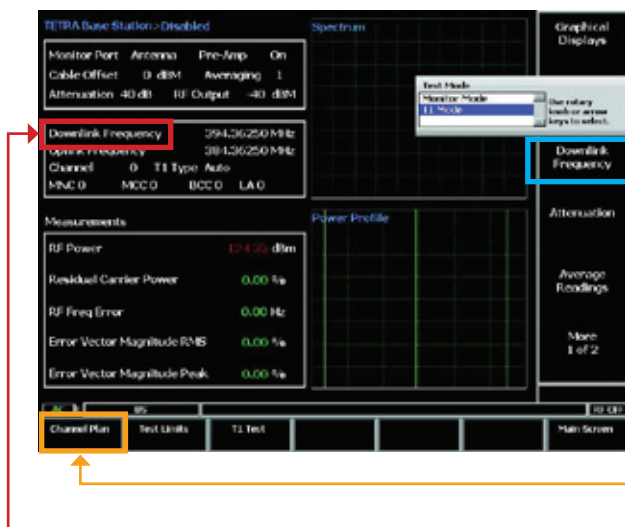
Call Types

Each type of call can be made individually to and from the mobile.

- Ind Duplex Simultaneous TX and RX Ind Simplex PTT to TX.
- Group PTT to TX
- Phone Simultaneous TX and RX
- SDS & DGNA Send and Receive short message, Assign and Unassign Dynamic Groups OTA..
- Emergency
- Ambient Listening. Covert operation... Radio speaker is inhibited, Microphone is live.

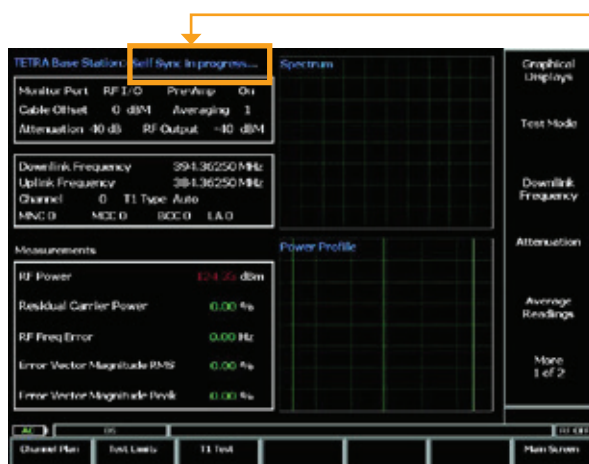
All of these can be activated or turned off by the Radio's Programming software. Call initiation and connections can be made by the MS Radio or the BS R8100.

BST T1 Mode Operation



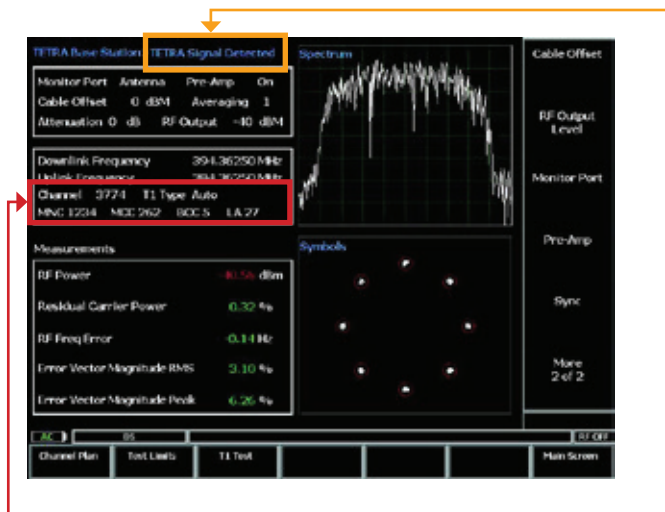
1. Connect the Base Station RF to the units RF I/O port
2. On Page 2 of 2 select **"Monitor Port"** and set to RF I/O
3. Depending on the BS Output Power the Attenuation may require adjustment
4. Enter the BS **Downlink Frequency**
5. Or select from the **channel plan**

Note: The **Uplink channel parameters** are set in the channel plan. Entry of a Frequency directly will use this plan to define the Uplink Parameters automatically



The unit will display :

Self Sync in Progress and synchronise to the BS Signal



- When synchronisation is achieved the **TETRA Signal Detected** will be displayed
- If the BS is transmitting a T1 signal this will be displayed as **TETRA Signal Detected**
- **Channel**, T1 Type, MNC, MCC, BCC and LA are decoded and displayed
- All Transmitter measurements are now live in both digital and graphical displays

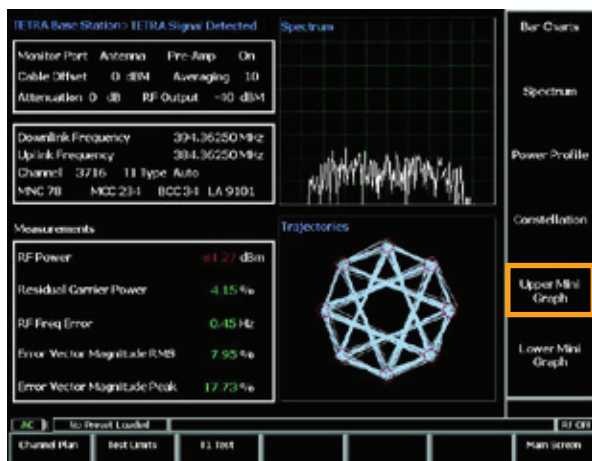
Graphical Display



The **Graphical Displays** key provides access to full screen displays for:

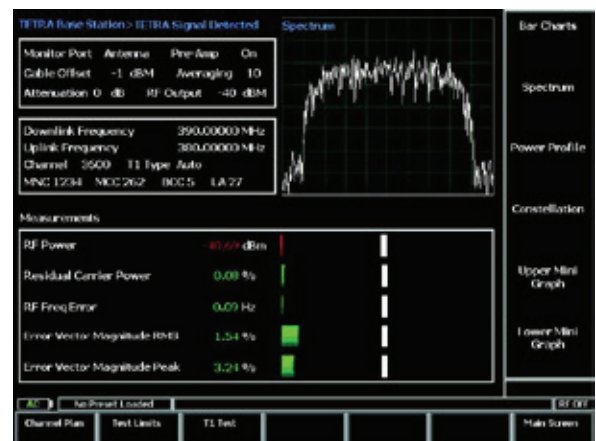
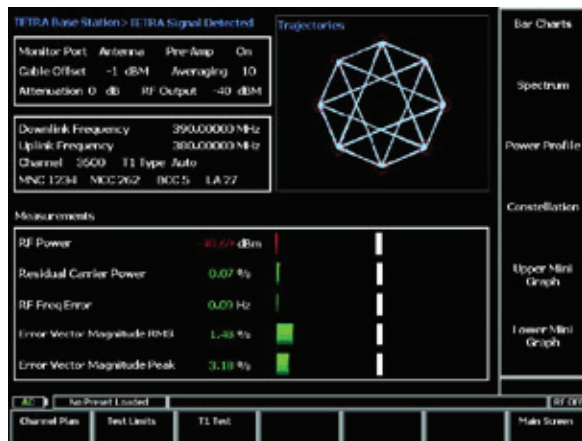
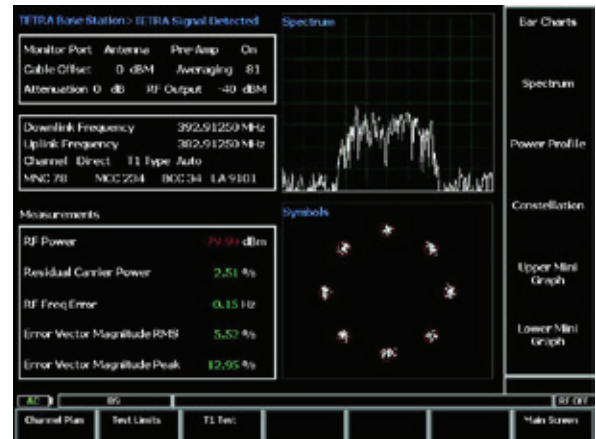
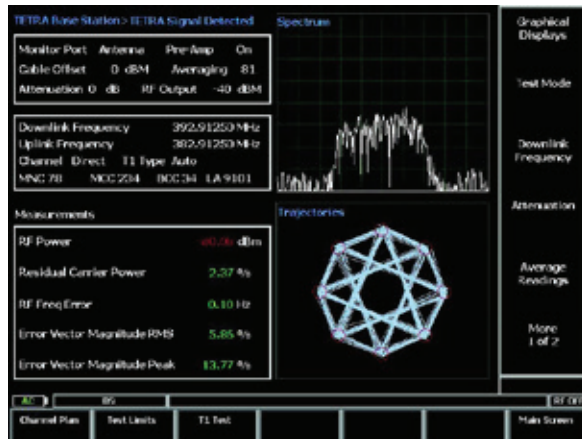
- Bar Charts
- Spectrum
- Power Profile
- Constellations

Upper and Lower Mini Graphs

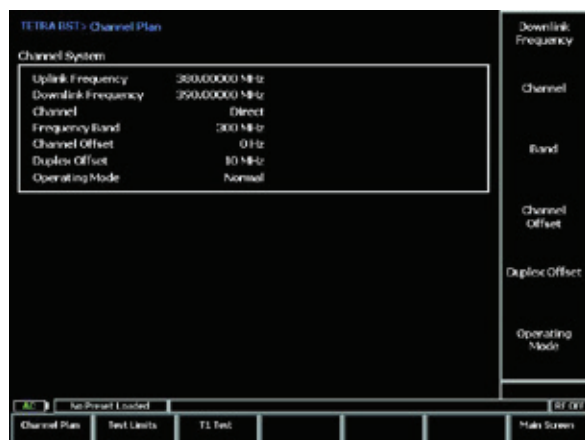


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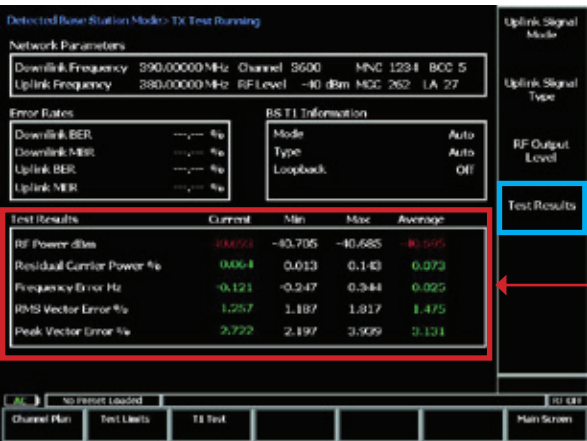
Channel Plan Settings



Test Limit Settings



Automatic Transmitter Test



If a valid TETRA signal is present live **Test Results** will be calculated and displayed

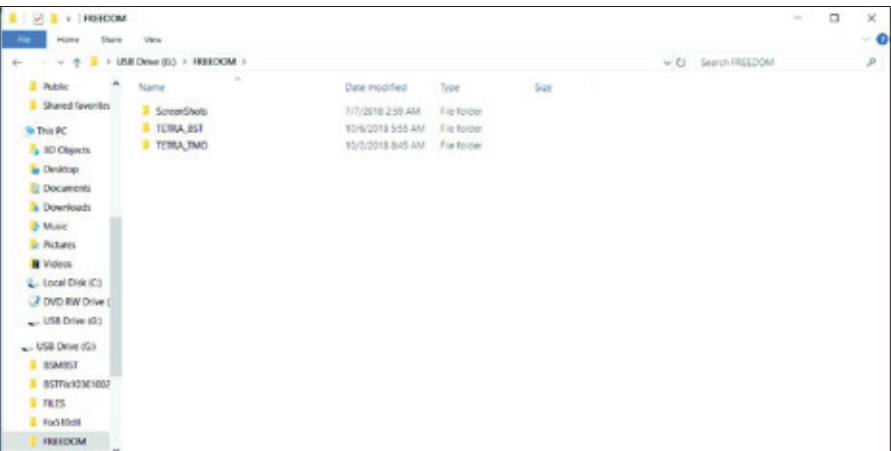
To save these results select:

- **Test Results**

Test Results and Save to File



- When a USB flash drive is inserted into the unit the button **Export to CSV** becomes active
- A folder named **"Freedom"** will be Created on the drive with a sub folder named **"TETRA BST"** and a sub-folder named **"Results"**
- The same folder will have a sub-folder named **"Screen Shots"**
- Full screen jpg format screen shots
- May be saved at any time by selecting Shift +0 at any time



TETRA T1 Testing



There are two Modes of Operation:

User Defined and Base Station Specific In User Defined the operator may select:

1. Uplink Signal Type

- Auto responds to a valid T1 Downlink and sets the appropriate Uplink response
- Selectable:
 - » TCH 7.2
 - » SCH/F
 - » STCH+STCH
 - » SCH/HU+SCH+HU
 - » TCH/S
 - » TCH/2.4 N=1
 - » TCH/4.8 N=1

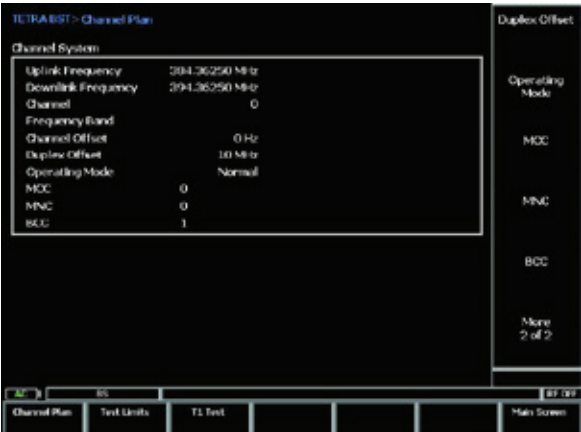
2. Uplink Signal Mode

- » Auto TX ON
- » Transmit
- » Receive
- » Loopback
- » Manual Transmit

Note: The user of this mode must have intimate knowledge of the BS and its T1 test procedures

MNC, MCC and BCC are set in the Channel Plan to support the above selections for valid scrambling encode/decode.

Channel Plan Screen



Valid T1 Signal Flow>Searching>Found>Proving>Connected

Select T1 Test Key to make and see measurements



Test Results Screen



T1 Measurements Display Screen Motorola MTS1 or Dimetra Selected



RF Adjust for Uplink RX Test of BER/MER

- **Motorola MTS & Dimetra Pre-set Test Conditions**
- **Downlink TX Measurements**
- **Uplink Measurements are displayed on the OEM BS Control software screen**

TETRA T1 Testing

