WS Technologies Inc.

Beacon Tester
Operator's Manual

BT200

Version 5.20

Information contained in this manual is subject to change without notice. Please consult the website at www.wst.ca for new Operator's Manual updates. Complying with all applicable copyright laws is the responsibility of the user. Without limiting the rights under copyright, no part of this document may be reproduced, stored in a retrieval system, or transmitted in any form or by any means including but not limited to electronic, mechanical, photocopying, recording, or otherwise, or for any purpose, without the written permission of WS Technologies Inc. (WST). WST may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from WST, the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

The purchaser shall not, in any event, be entitled to, and WST shall not be liable for indirect, special, incidental or consequential damages of any nature including, without limitation, business interruption costs, loss of profit or revenue, loss of data, promotional or manufacturing expenses, overhead, injury to reputation or loss of customers, even if WST has been advised of the possibility of such damages. In any event, purchaser's recovery from WST for any claim shall not exceed purchaser's purchase price for the product giving rise to such claim irrespective of the nature of the claim, whether in contract, tort, warranty, or otherwise. WST shall not be liable for and purchaser shall indemnify, defend and hold WST, its agents, distributors, dealers, successors and assigns harmless from any and all claims, damages or losses, including injury or death, arising from or relating to the use or failure of the products.

Printed in Canada
January 2024

CONTENTS

WARNING!

DO NOT ACTIVATE ANY BEACON IN ITS NORMAL ACTIVATE MODE UNLESS THE BEACON IS IN A SCREEN BOX (TSE100B) OR A SCREEN ROOM. DOING SO COULD RESULT IN A FALSE DISTRESS ALERT.

INTRODUCTION

Thank you for choosing the BT200 series of 406 Beacon Testers. This Operator's Manual explains the operation of all available models.

SUMMARY OF MODELS AND OPTIONS

BT200 Base Model: Measures and decodes all First Generation Cospas-Sarsat EPIRBs and PLBs. It decodes the 406 MHz message, measures the 406 MHz transmitter and the 121.5 MHz transmitter.

ELT Option: Adds the capability to measure and decode all First Generation Cospas-Sarsat ELTs. It decodes the 406 MHz message, measures the 406 MHz transmitter and the 243 MHz transmitter.

SGB Option: Adds the capability to measure and decode Second Generation Beacons (ELT option required for SGB ELTs).

AIS (Rx) Option: Adds the capability to decode and measure the AIS channel in AIS-EPIRBs.

AIS (Rx & Tx) Option: Adds the capability to measure AIS transceivers in accordance with IMO MSC.1Circ.1252. This option will measure AIS-EPIRBs also.

Limit Tester Option: This option will indicate pass or fail based on selected user-defined measurement parameters.

UNPACKING

Please verify the contents of your package. It should contain:

- Rugged Smartphone with integrated Beacon Receiver
- Operator's Manual
- Certificate of Calibration with Calibration data
- RF Interface cable
- USB interface cable
- Booster Antenna
- AC Adapter with International Plug kit
- OTG/USB cable (for connecting a USB drive)
- Screen cleaning cloth
- Pen with stylus
- Waterproof yellow hard case

BEFORE YOU START

Charging the Battery:
Charge the BT200 using the AC adapter and USB cable for 4 hours.

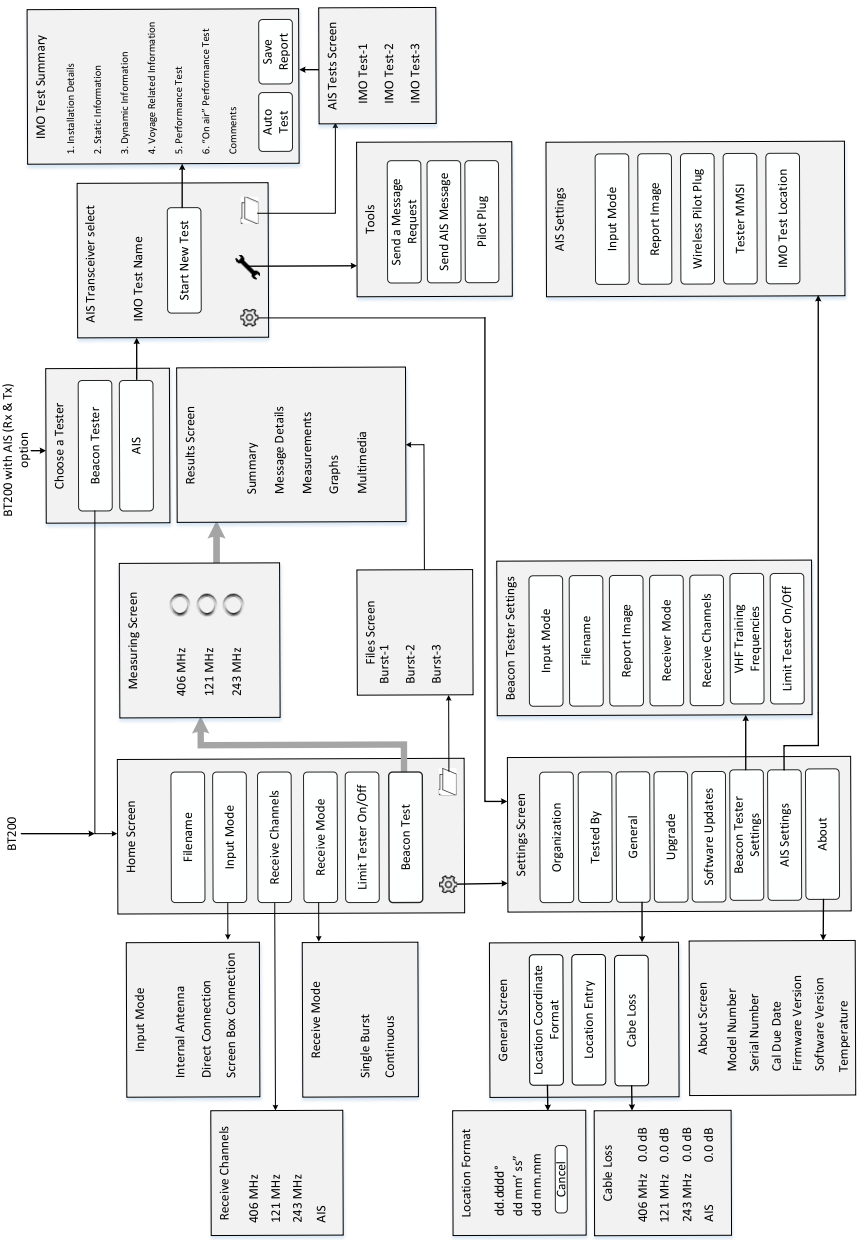
TIP: To ensure a full charge, when the device power is low, always charge the device for a minimum of 2 hours, regardless of the power level showing on the device.

TIP: If the device has been off for a while, the battery may be in deep discharge. Plug in the charger and leave for 10 hours. The device will recover, and the battery will charge fully.

GETTING STARTED

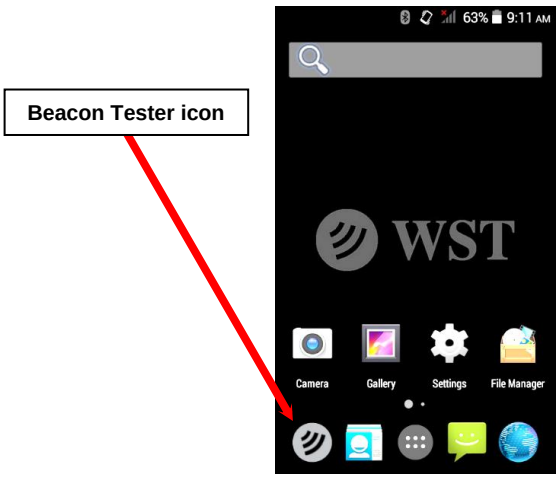
Please read this Operator's Manual to become familiar with the operation of the Beacon Tester.

Flowchart:

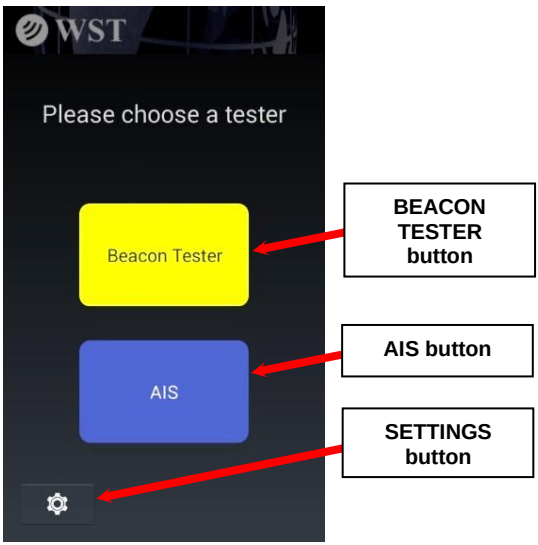

BT200
BT200 with AIS (Rx & Tx) option
Choose a Tester
Beacon Tester
AIS
AIS Transceiver select
IMO Test Name
Start New Test
IMO Test Summary
1. Installation Details
2. Static Information
3. Dynamic Information
4. Voyage Related Information
5. Performance Test
6. "On air" Performance Test
Comments
Auto Test
Save Report
AIS Tests Screen
IMO Test-1
IMO Test-2
IMO Test-3
Tools
Send a Message Request
Send AIS Message
Pilot Plug
AIS Settings
Input Mode
Report Image
Wireless Pilot Plug
Tester MMSI
IMO Test Location
Results Screen
Summary
Message Details
Measurements
Graphs
Multimedia
Measuring Screen
406 MHz
121 MHz
243 MHz
Files Screen
Burst-1
Burst-2
Burst-3
Beacon Tester Settings
Input Mode
Filename
Report Image
Receiver Mode
Receive Channels
VHF Training Frequencies
Limit Tester On/Off
Home Screen
Filename
Input Mode
Receive Channels
Receive Mode
Limit Tester On/Off
Beacon Test
Settings Screen
Organization
Tested By
General
Upgrade
Software Updates
Beacon Tester Settings
AIS Settings
About
Input Mode
Internal Antenna
Direct Connection
Screen Box Connection
Receive Mode
Single Burst
Continuous
General Screen
Location Coordinate Format
Location Entry
Cabe Loss
About Screen
Model Number
Serial Number
Cal Due Date
Firmware Version
Software Version
Temperature
Receive Channels
406 MHz
121 MHz
243 MHz
AIS
Location Format
dd.dddd°
dd mm' ss"
dd mm.mm
Cancel
Cable Loss
406 MHz 0.0 dB
121 MHz 0.0 dB
243 MHz 0.0 dB
AIS 0.0 dB

Running the Beacon Tester Application:
Turn on the device by pressing and holding the Power button for 5 seconds, then releasing. The device will boot up.

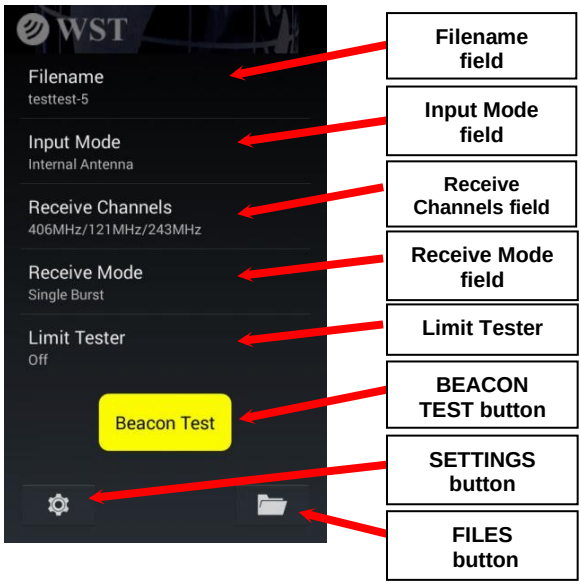
Launch the Beacon Tester application by tapping the Beacon Tester icon on the device:



The 406 Beacon Tester title screen will show for a few seconds, followed by either the Beacon Tester home screen or the BT200 +AIS (Rx & Tx) home screen:



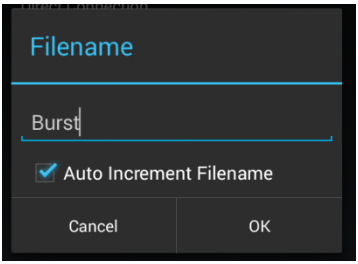
To test beacons (including AIS-EPIRBs), tap the ***Beacon Tester button***.



Selecting the Desired Measurement Filename:

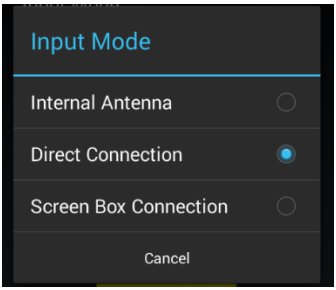
- tap the ***Filename*** field.
- enter the desired measurement file name.
- select the Auto Increment Filename box if you wish to have the filename number ***Auto Increment*** after each measurement.
- tap ***OK.***

NOTE: Do not use forbidden file name characters: / \ : * ? “ < > |



Selecting the Input Mode:

• tap the ***Input Mode*** field. The following screen will appear.



• select ***Internal Antenna*** to use the internal antenna when receiving the beacon signal through the air. If signal levels are too low using the **Internal Antenna**, then insert the **Booster Antenna** in the appropriate port of the device to help boost the signal.

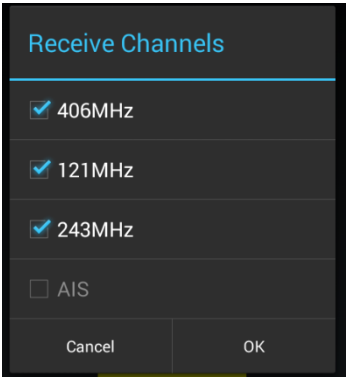
• select ***Direct Connection*** to use the 50Ω input port along with the RF Interface cable connected directly to the beacon. Also, use this mode when using the WST RF Screen Box (model TSE100B) with the beacon and tester connected directly and both located in the RF Screen Box, or if a beacon is connected directly through the BNC port.

• select ***Screen Box Connection*** when measuring a beacon while it is inside a screen box, with the output of the screen box connected to the tester. The tester will show relative power measurements in %.

NOTE: Using Direct Connection will result in absolute power measurement units (dBm). Using the Internal Antenna or Screen Box Connection will result in relative power measurement units (%).

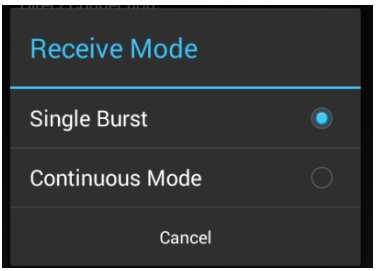
WARNING!
DO NOT EXCEED A CONTINUOUS PEAK SIGNAL LEVEL OF 3 WATTS, OR A PEAK SIGNAL LEVEL OF 10 WATTS, MAXIMUM DURATION 1 SECOND, WITH A 20% DUTY CYCLE (406, 121.5, AND 243), OR A PEAK SIGNAL LEVEL OF 20 WATTS, MAXIMUM DURATION 27 MILLISECONDS WITH A 2% DUTY CYCLE (AIS). DAMAGE WILL RESULT.

Selecting the Desired Receive Channels:
• tap the ***Receive Channels*** field. The following screen will appear.



• select the desired channels you wish to receive.
• tap ***OK***.
• having the **BT200 + AIS (Rx)** or **BT200 + AIS (Rx & Tx)** option enabled will enable the AIS receive channel option.

Selecting the Desired Receive Mode:
• tap the ***Receive Mode*** field. The following screen will appear.



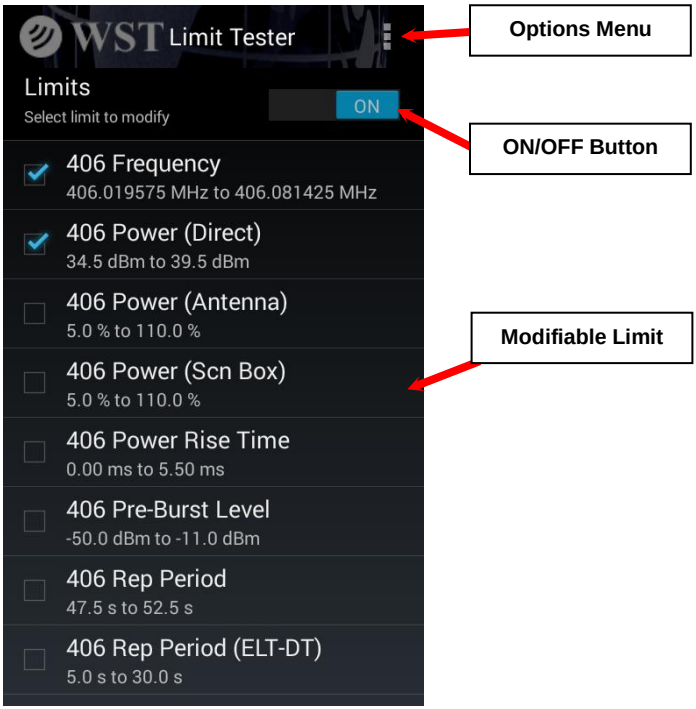
• select the desired mode.
• tap ***OK***.

In ***Single Burst*** mode, the receiver will capture one set of measurements and terminate the test.

In ***Continuous*** mode, the receiver will continue to capture sets of measurements until Cancel is tapped.

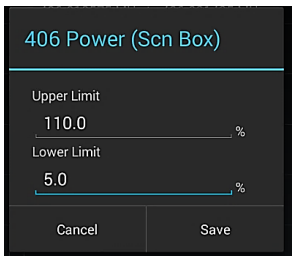
Activating Limit Tester (Limit Tester option required):

• tap the ***Limit Tester*** field. The following screen will appear.

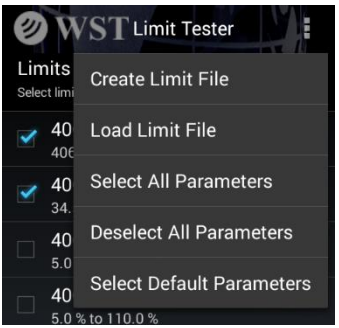


• tap the ***On/Off Button*** to activate or deactivate the **Limit Tester** function in the Beacon Tester.

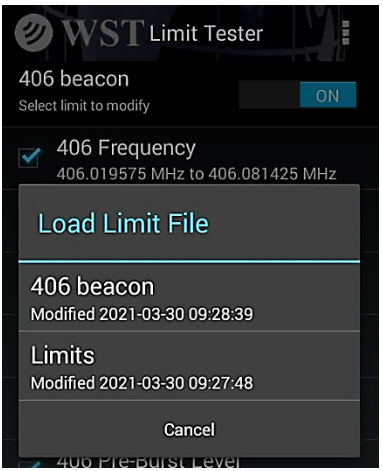
• tap on any parameter to display that parameter's Upper and Lower Limits. Modify as required and ***Save***.



- tap the ***Options Menu*** to display **Limit Tester** options.



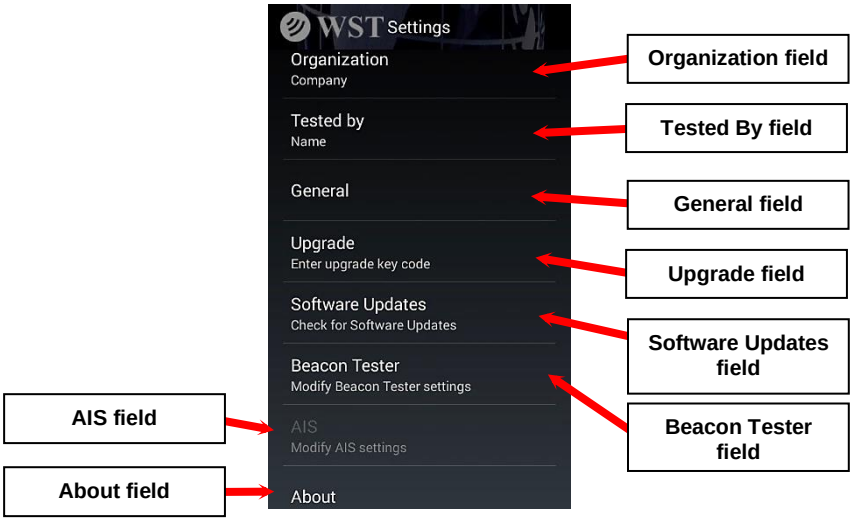
- tap ***Create Limit File*** to save a Limit Tester file.
- tap ***Load Limit File*** to select a previously created Limit Tester file.



- tap ***Select All Parameters*** to enable all Test Limit parameters.
- tap ***Deselect All Parameters*** to disable all Test Limit parameters.
- tap ***Select Default Parameters*** to reset all Test Limits values.

SETTING THE CONFIGURATION SETTINGS

• tap the ***Settings*** button (the icon at the bottom left of the screen).



Setting the Organization and Tested By Names:

• tap the ***Organization*** field.
• enter the desired Organization name.
• tap ***OK***.

• tap the ***Tested By*** field.
• enter the desired name.
• tap ***OK***.

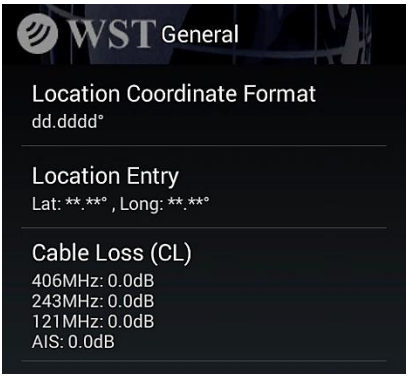
NOTE: The entered *Organization* and *Tested By* names will appear on each Test Report and in the data file.

NOTE: The AIS field is enabled with the AIS (Rx & Tx) option.

General:

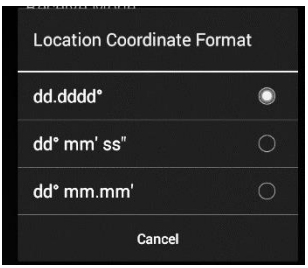
- tap on the ***General*** field.

The ***General*** screen will allow changing Location Coordinate formats, Location, and entering Cable Loss factors.



Location Coordinates Setting:

- tap on the ***Location Coordinate Format*** field
- select the box relating to your desired location coordinate display.



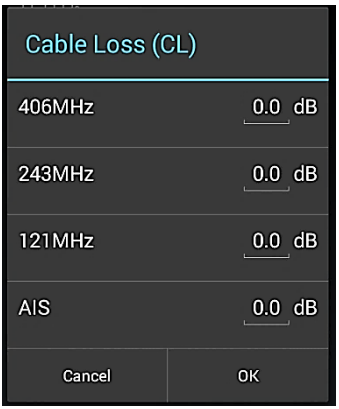
NOTE: dd.dddd° is decimal degrees; dd° mm' ss" is degrees/minutes/seconds; dd° mm.mm' is degrees/decimal minutes.

Entering the BT200 Location:
When the Location data of the BT200 is entered, the delta distance between the BT200 and the decoded location from the location-protocol beacon is provided.

- tap on the ***Location Entry*** field.
- enter the latitude and longitude data in decimal degrees (dd.dddd).
- tap OK.

Entering Cable Loss Factors:

- tap on the ***Cable Loss (CL)*** field.

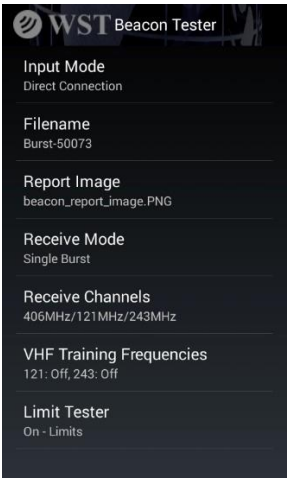


- enter the desired cable loss factor for each frequency.
- tap ***OK.***

When the ***Input Mode*** is set to ***Direct Connection***, the cable loss factor will be included in the power measurements for each frequency.

Beacon Tester:

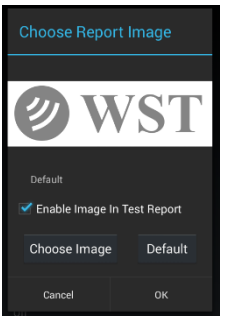
- tap on the ***Beacon Tester*** field.



- tap the ***Input Mode*** field to bring up the ***Input Mode*** screen.
- tap the ***Filename*** field to bring up the ***Filename*** screen.
- tap the ***Receive Mode*** field to bring up the ***Receive Mode*** screen.
- tap the ***Receive Channels*** field to bring up the ***Receive Channels*** screen.
- tap the ***Limit Tester*** field to bring up the ***Limit Tester*** page.

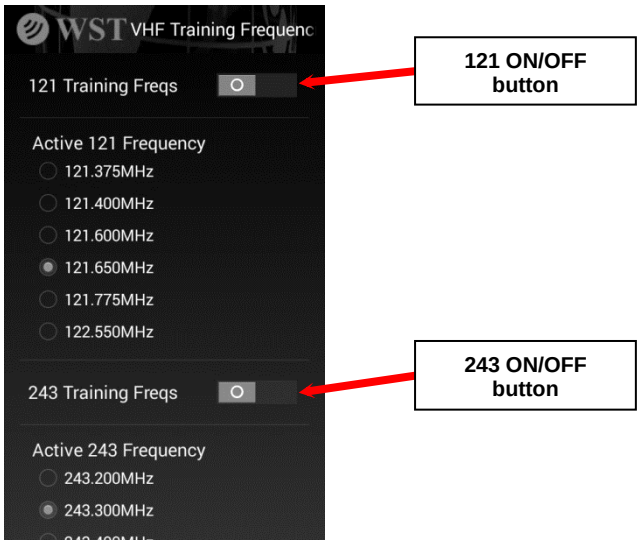
Selecting the Report Image:

- tap the ***Report Image*** field. The following screen will appear.



• click the ***Enable Image In Test Report*** checkbox to enable or disable showing the selected image in the Beacon Test Report.
• click the ***Choose Image*** button to select a new image. Place your desired image into any folder on the phone.
• click the ***Default*** button to select the default image.

Selecting VHF Training Frequencies:
• tap on the ***VHF Training Frequencies*** field. The following screen will appear.



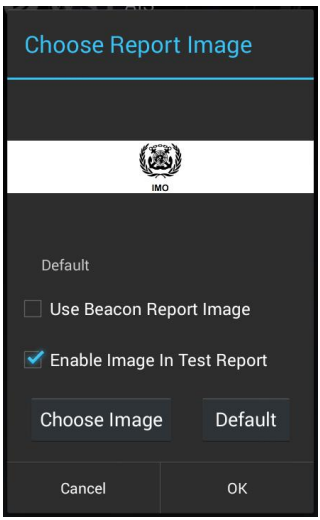
• activate the 121 Training Frequency or the 243 Training Frequency, or both.
• select the desired Training Frequency for each channel selected.

AIS:

• tap on the ***AIS*** field.

NOTE: The AIS field is enabled with the AIS (Rx & Tx) option.

• tap the ***Input Mode*** field to bring up the ***Input Mode*** screen.
• tap the ***Report Image*** field to bring up the ***Choose Report Image*** dialog.

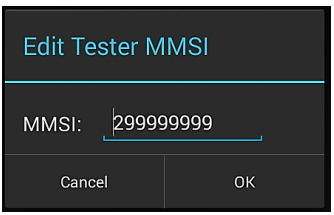


• click the ***Use Beacon Report Image*** checkbox to enable or disable selecting the Beacon Tester's selected image as the IMO Test Report image.
• click the ***Enable Image In Test Report*** checkbox to enable or disable showing the selected image in the IMO Test Report.
• click the ***Choose Image*** button to select a new image.
• click the ***Default*** button to select the default image.

• tap the ***Wireless Pilot Plug*** field to bring up the ***Wireless Pilot Plug*** configuration screen.

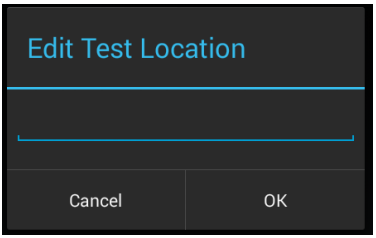
• reference the **PPA100 User Manual** for information on how to properly configure the above settings.

• tap the ***Tester MMSI*** field to bring up the ***Edit Tester MMSI*** configuration screen.



• the MMSI entered here will be the MMSI number used by the BT200 to send AIS message requests to the Class A or Class B AIS transceiver under test.
• the default MMSI number is 299999999

• tap the ***IMO Test Location*** field to bring up the ***Edit Test Location*** configuration screen.



• information entered here will be filled out in the ***Date and Place*** section of the generated **IMO Test Report**.

Upgrade:
When upgrading to add new features, such as the ELT option or Limit Tester option, you may purchase an upgrade code.

• tap on the ***Upgrade*** field.
• enter the upgrade code (supplied by WS Technologies Inc. when you purchase an upgrade).
• restart the Beacon Tester application for changes to take effect.

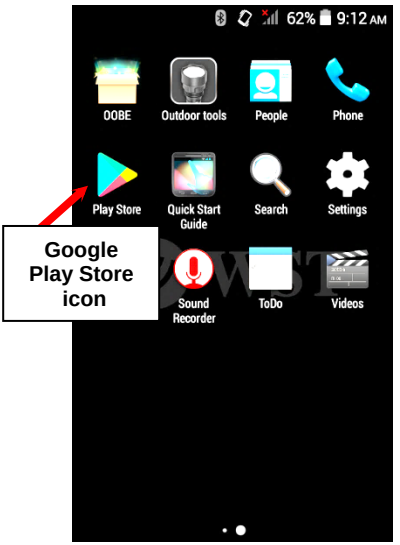
Software Updates:
Software updates are available free of charge to all users.

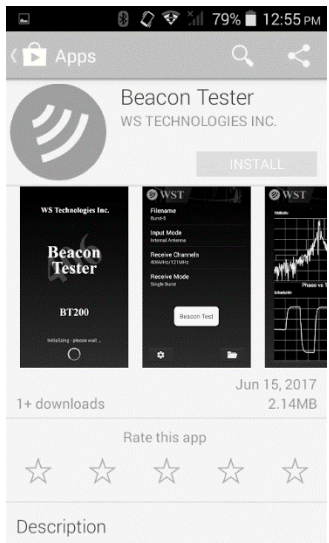
Three methods of downloading and installing new Beacon Tester software are available from: the Google Play Store; the BT200 via WST website; or via a connected PC.

Software Update Instructions:

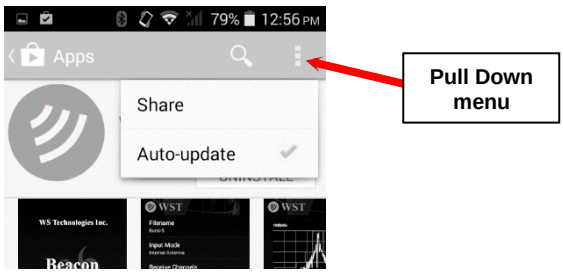
From the Google Play Store:

On the device, tap on the ***Google Play Store*** **icon** to go to the Google Play Store and search for the Beacon Tester app.



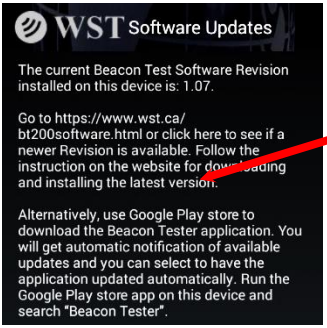


Tap ***Install*** to install the WS Technologies Inc. Beacon Tester app.
If you wish to have the Google Play Store automatically update the app when updates are available, then check the ***Auto-update*** box from the Pull-Down menu.



From the BT200 Handheld Device:

- make sure the BT200 device has a network connection capable of accessing the internet.
- from the **Settings > Software Updates** screen, tap on the hyperlink or use a browser to navigate to ***wst.ca/BT200***

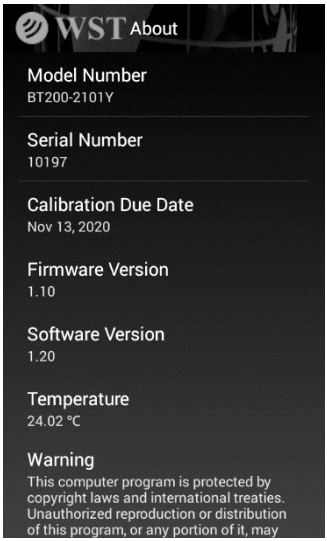


- if a newer software version is available, then click the **Download** link.
- save the file to the BT200 device.
- once downloaded, use **File Manager** on the BT200 device to navigate to the downloaded .apk file and tap to install.
- once the installation is complete, run the Beacon Tester application and go to **Settings > About** to verify the new Software Version was installed.

From a PC:

- from your network-connected PC, navigate to wst.ca/bt200
- if a newer software version is available, then click Download and save to Desktop.
- connect the BT200 device to the PC using the USB cable.
- on the BT200 device, tap ***Turn on USB storage***.
- on the PC, locate the connected drive representing the BT200 device.
- copy the .apk file downloaded to the Desktop to the BT200 device.
- once downloaded, tap ***Turn Off USB storage*** on the BT200 device.
- disconnect the USB cable.
- on the BT200 device, use **File Manager** to navigate to the downloaded .apk file and tap to install.
- once the installation is complete, run the Beacon Tester application and go to **Settings > About** to verify the new Software Version was installed.

About:
Tapping on the ***About*** field will display the following screen:



The ***About*** screen provides information relating to the BT200. The information provided includes the Model Number, Serial Number, Calibration Due Date, Firmware Version, Software Version, and internal temperature of the BT200.

MAKING MEASUREMENTS

NOTE: Interpreting the results provided by the Beacon Tester requires some knowledge of beacon requirements. Using the self-test mode of the beacon may result in some measurements being outside the required limits due to the lack of a warm-up period.

WARNING! DO NOT ACTIVATE ANY BEACON IN ITS NORMAL ACTIVATE MODE UNLESS THE BEACON IS IN A SCREEN BOX (TSE100B) OR A SCREEN ROOM. DOING SO COULD RESULT IN A FALSE DISTRESS ALERT.

General:

All measurements will produce a Test Report in a PDF format and a data file in comma-separated values (.csv) format for easy importing into a spreadsheet for data parsing and data saving.

Measurement results are stored in the BT200 device. Each measurement will be saved in a folder with the same name as the measurement filename. For example, a measurement with the filename "Burst-1" is made on a beacon. When the measurement is completed, the following is created:

<Burst-1>		folder name
	<images>	folder of graphic images
	Burst-1.csv	measurement data file
	Burst-1.pdf	PDF Test Report

When the ***Auto-Increment*** feature is enabled in the ***Filename*** field, the next measurement will be named ***Burst-2***.

When the ***Receive Mode*** settings are set to ***Continuous Receive***, then each subsequent burst measurement data will be appended to the stored data file (.csv file).

Connecting the Beacon:

There are 3 methods for receiving a signal from a beacon – using the Internal Antenna, the Direct Connection mode, or the Screen Box Connection mode.

Internal Antenna:

- select ***Internal Antenna*** from the ***Input Mode*** on the ***Home*** screen.

When a measurement is completed, the power level units will be shown in %, with 100% being displayed when the tester is very close to the antenna of the transmitting beacon.

Direct Connection:

- select ***Direct Connection*** from the ***Input Mode*** on the ***Home*** screen.
- attach the RF Interface Cable (p/n 130-024) to the ***RF IN*** connector located on the rear of the BT200 device. Attach the beacon.

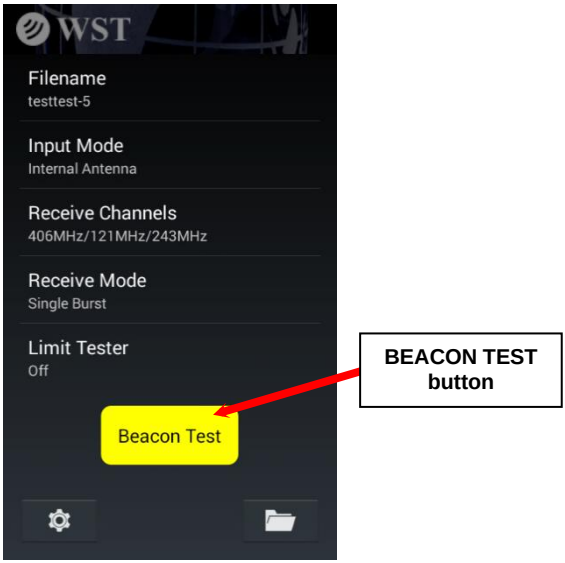
When a measurement is completed, the power level units will be shown in dBm. This measurement is very accurate. If cable loss factors are set up in the **Settings > General > Cable Loss** section, then these factors are included in the power level measurements.

Screen Box Connection:

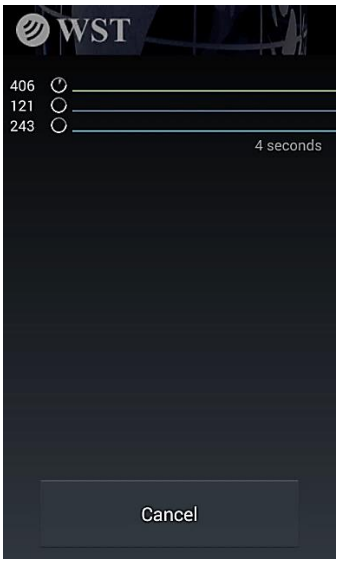
- select ***Screen Box Connection*** from the ***Input Mode*** on the ***Home*** screen.
- attach a cable from the output of a Screen Box to the RF Interface Cable which is connected to the ***RF IN*** connector located on the rear of the BT200 device.

Single Burst Measurement:

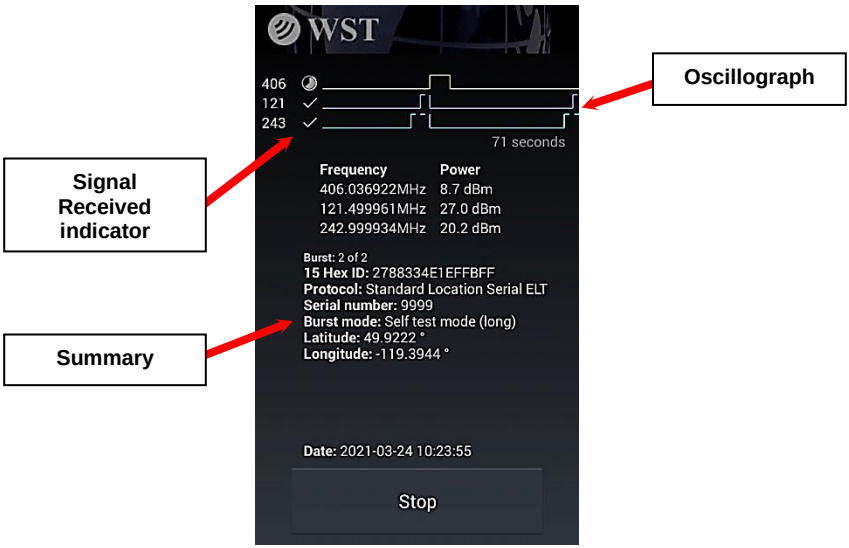
- activate the beacon under test.
- tap the ***Beacon Test*** button.



The following screen will appear, and the timer will start.



• if the beacon is transmitting a 121.5 and/or 243 MHz homing signal, the tester will produce the characteristic swept audio tone and indicate on the display that the channel has been received. These signals must be received prior to the 406 MHz burst in order to be measured.



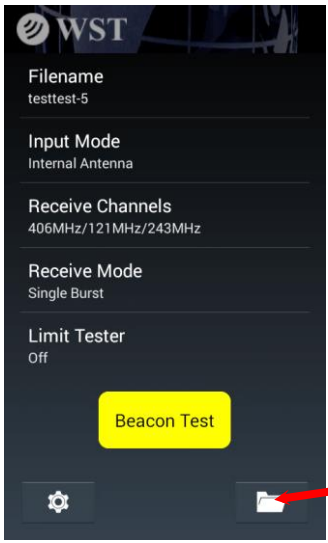
• once a 406 MHz burst is received, the measurement is complete, and the results are displayed.

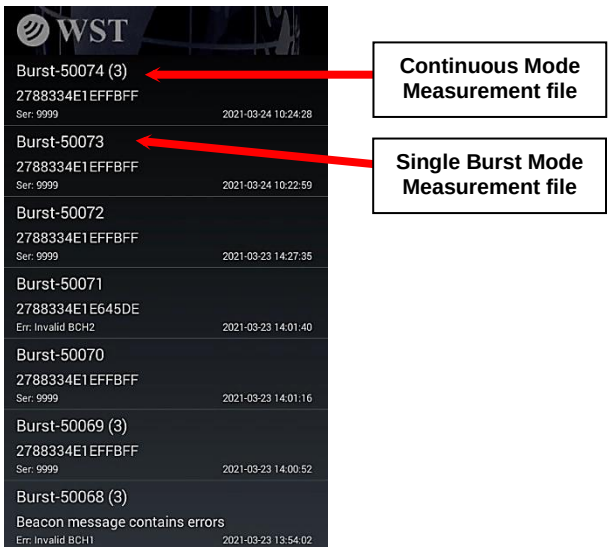
Continuous Measurement:

• when making a measurement in ***Continuous*** mode, once a measurement is complete, the device will return to the ***Measuring*** screen and continue waiting for another measurement. This will continue until the user taps ***Cancel,*** at which time the measurement will end.

• the ***Continuous*** mode measurement file will show the number of measurements contained in the file in brackets after the measurement name: ***Burst-4(11)***

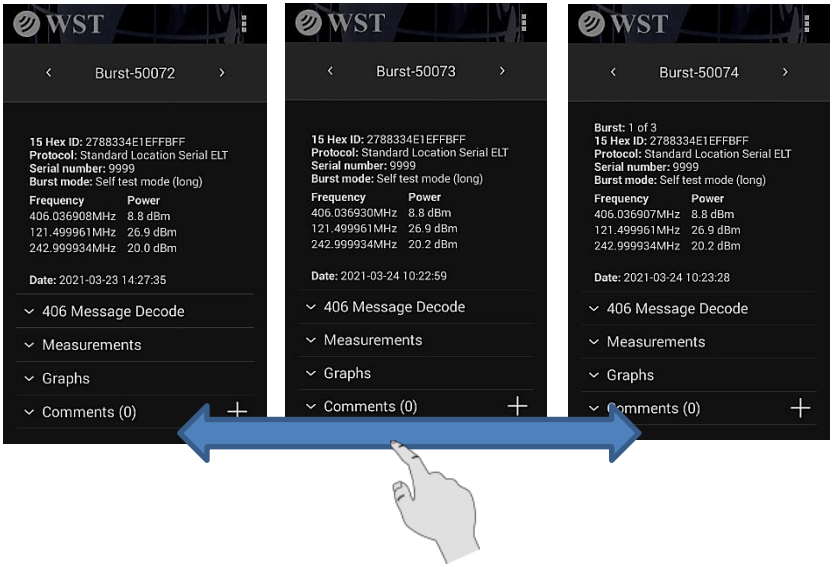
Viewing Measurements for Single Burst Mode:





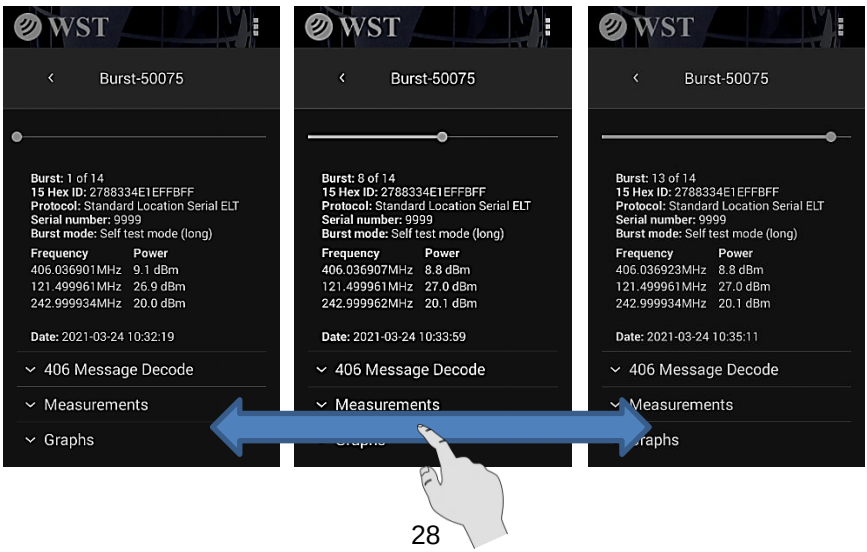
• go to the ***Files*** screen and tap the desired Measurement file. Example ***Burst-50073***

A very useful feature of the BT200 is the ability to view adjacent measurements easily with the swipe of a finger.



Viewing Measurements for Continuous Mode:

• go to the ***Files*** screen and tap the desired Measurement file. Example ***Burst-50075(14)***



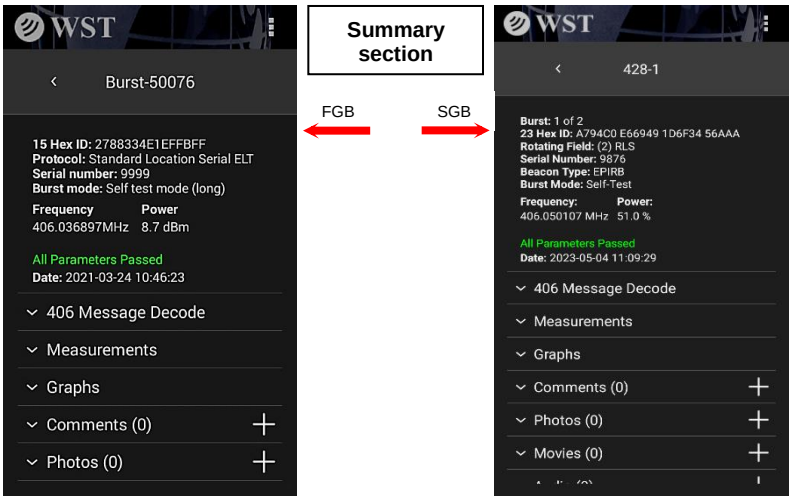
- you can now view the first burst and scroll horizontally through the remaining bursts within the same filename.
- the slider at the top of the screen shows which burst you are viewing.

Note: In Continuous mode, all beacons within range of the tester will be captured. The Hex IDs may not necessarily be the same.

MEASUREMENT RESULTS

The below screenshots show both First Generation Beacons (FGB) and Second Generation Beacons (SGB).

Results Screen:



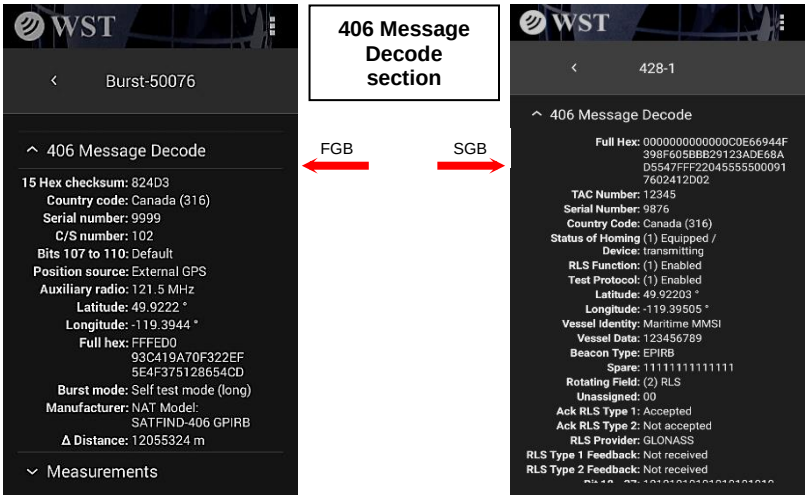
The ***Results*** screen consists of a summary section, along with collapsible sections for ***406 Message Decode***, ***Measurements***, and ***Graphs***.

Sections can be expanded or collapsed by tapping on the section headings. The screen can be scrolled up and down using your finger.

Summary Section:
The Summary section includes:

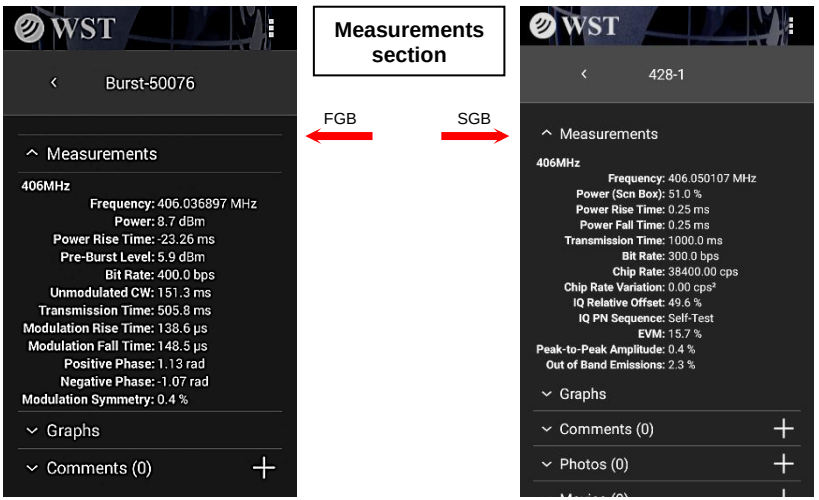
- Filename
- Hex ID
- Beacon information (protocol-dependent) plus location
- Burst mode (Normal or Self Test mode)
- Channel frequency and power level
- Limit Test pass or fail indicator (requires Limit Tester option)
- Date and time of receiving burst

406 Message Decode:



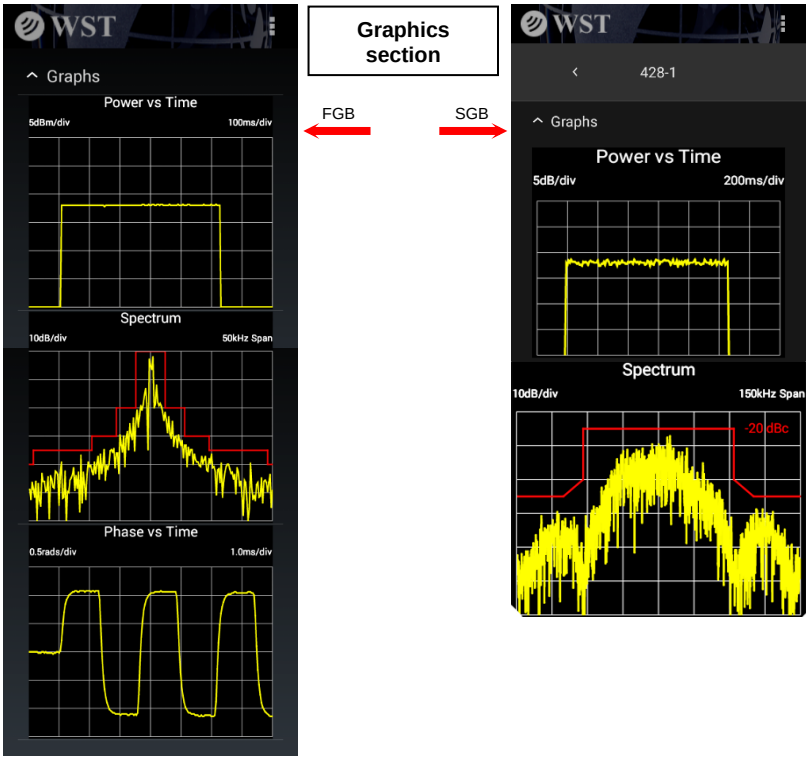
The ***406 Message Decode*** section shows the details from the decoded message of the beacon transmission.

Measurements:



The ***Measurements*** section shows the detailed measurements for all received channels.

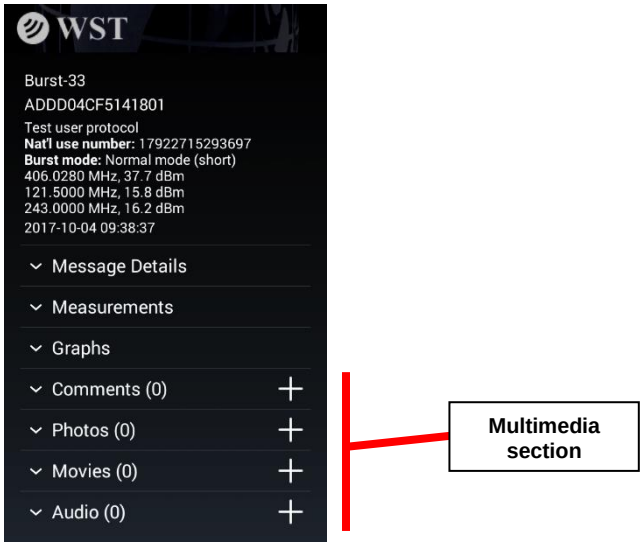
Graphics:



The ***Graphics*** section displays the Power vs. Time for the 406 MHz burst, the 406 MHz frequency Spectrum, and the demodulated Phase vs. Time waveform.

Multi-Media Data:

The ***Results*** screen allows the addition of one or more Comments, Photos, Movies, and Audio clips to each measurement. This feature is very useful for recording various conditions relating to measuring beacons. Each additional file is also saved in the measurement folder.



Comments:

- tap the + symbol adjacent to the ***Comments*** field.
- type the desired comment and tap ***OK***.

Photos:

- tap the + symbol adjacent to the ***Photos*** field.
- take the photo and tap ✓.

Movies:

- tap the + symbol adjacent to the ***Movies*** field.
- record the movie and tap ✓.

Audio:

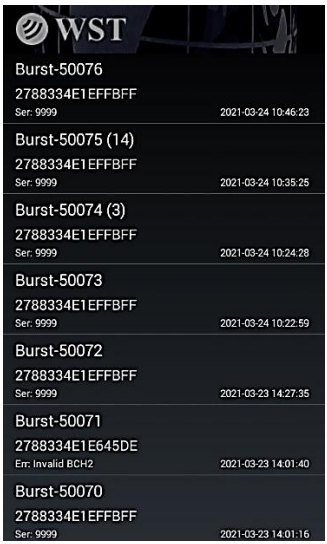
- tap the + symbol adjacent to the ***Audio*** field.
- record the audio and tap ✓.

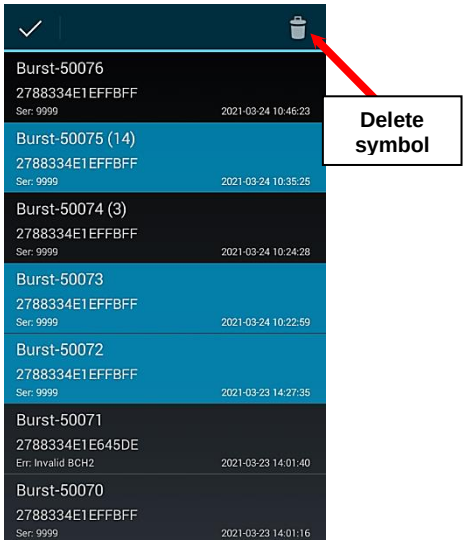
More than one multimedia file can be recorded. The number of files is shown in brackets beside each section.

FILES

Getting to the Files Screen:

- tap ***Files*** from the Home screen.





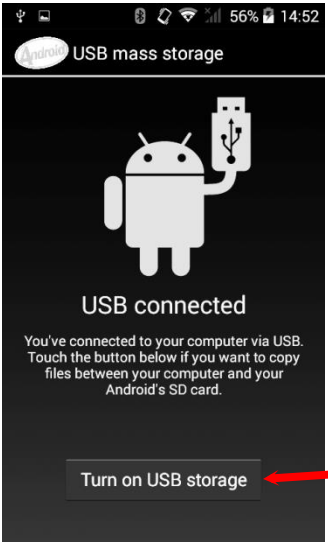
- tapping on a file name will select and display that measurement.

Deleting Files:

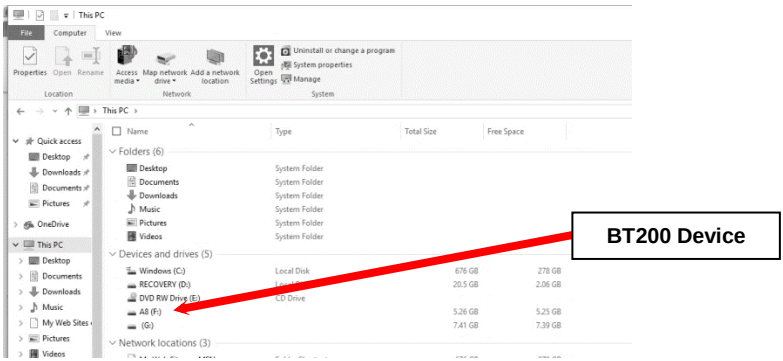
- tap and hold the file to be deleted.
- tap on any other files you also wish to delete.
- tap the ***Delete*** symbol.

Deleting Files Using the PC:

- connect the BT200 device to the PC using the USB cable.
- tap on the ***Turn on USB storage*** button



- on the PC, go to File Explorer and navigate to the connected device



- navigate to **BT200 > Measurements** and select the measurements to be deleted.
- click delete.
- Tap ***Turn off USB storage*** button on the device.
- disconnect the BT200 from the PC.

TEST REPORTS AND DATA FILES

Each measurement generates a folder containing the measurement data. The measurement data includes a Test Report in a PDF format and a data file in CSV format for easy importing into a spreadsheet for data parsing and saving.

Measurement results are stored in the BT200 device. Each measurement will be saved in a folder with the same name as the measurement filename. For example, a measurement with the filename "Burst-1" is made on a beacon. When the measurement is completed, the following is created:

<Burst-1>	folder name
<images>	folder contain graphic images
Burst-1_comments.csv	comments data
Burst-1_phase.csv	phase graphics data
Burst-1_power.csv	power graphics data
Burst-1_spectrum.csv	spectrum graphics data
Burst-1.csv	delimited measurement data file
Burst-1.pdf	PDF Test Report

NOTE: The BT200 device can store many measurements. It is strongly advised to transfer your measurements to a USB drive or a PC. The BT200 is an Android-based device and is subject to periodic situations where data may be lost.

Moving Measurement Folders:
Measurement folders can be moved to a USB drive or a PC.

Move to USB Drive (via OTG/USB Cable):

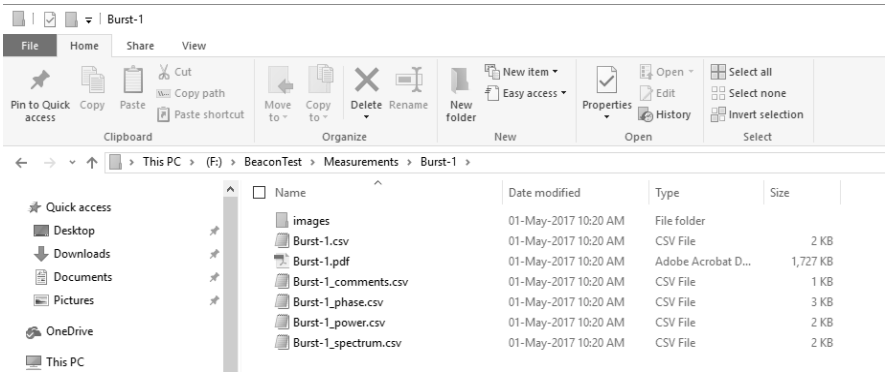
- connect the OTG/USB cable supplied to the USB connector on the BT200. Plug in a USB drive.
- using File Manager on the BT200 device, navigate to the **BT200 > Measurements** folder and select the measurement folders that you wish to move by tapping and holding on the first folder, then tapping on any additional folders.
- tap the Copy/Move icon  at the bottom.
- use the Back button to navigate back to the Android home page and select ***External USB storage***.
- tap the Clipboard icon  at the bottom to paste the selected folders into the new location.

Move to PC:

- connect the BT200 to the PC using the USB cable supplied.
- go to ***File Explorer*** on the PC and double-click on the BT200 device.
- navigate to **BT200 > Measurements** and select the measurement folders you wish to move.
- using standard Windows techniques, Copy and Paste the selected measurement folders to the desired location on the PC.

Measurement Files:

A folder will exist for each successfully completed measurement. Each measurement folder will contain the following files:



PDF Test Report:

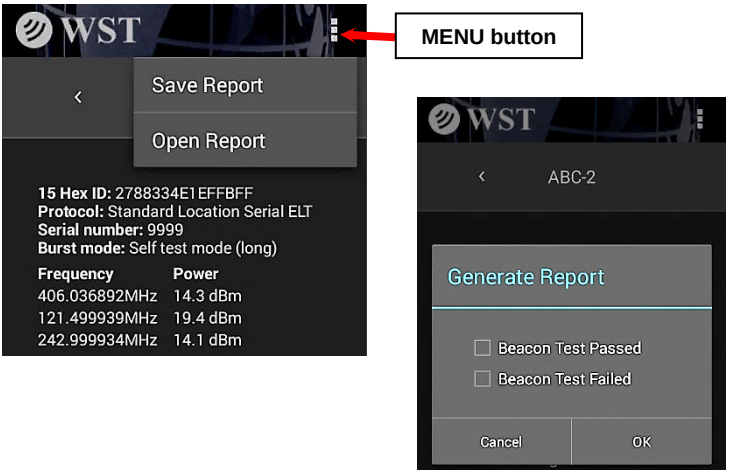
The PDF Test Report contains all of the measurement data along with 406 graphics showing the Power vs Time, 406 Spectrum, and 406 Phase Modulation. The Test Report can be viewed and printed from a PC. The Test Report can also be viewed directly on the BT200 by using File Manager and navigating to **BT200 > Measurements** > **filename,** and tapping on the filename.pdf file.

Manually Adding a Pass or Fail Indication to the PDF Test Report

If Limit Tester is installed and turned ON, the Pass or Fail indication will automatically be selected in the PDF Test Report.

If Limit Tester is not installed or turned off, the user can manually select Pass or Fail on the PDF Test Report.

- tap the ***Menu*** button on the upper right of the Measurement screen
- tap on the ***Save Report*** button
- select the appropriate Pass or Fail item
- tap ***OK.*** A message will indicate when the report has been successfully saved.



- tap the ***Open Report*** option to view the report in the phone's selected PDF viewer.

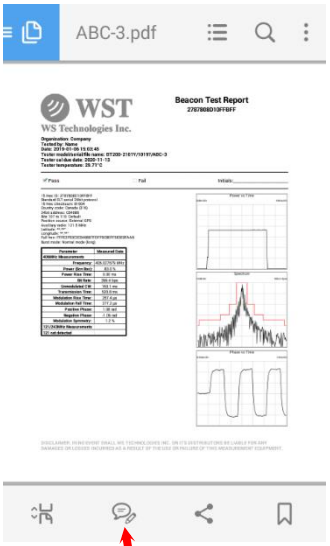
PDF Test Reports when in Continuous Mode

When the BT200 is in Continuous mode, users need to generate a test report manually. You can easily generate a PDF Test Report for any measurement by navigating to any burst number from the Measurement screen and tapping ***Save Report*** from the Menu button (see above).

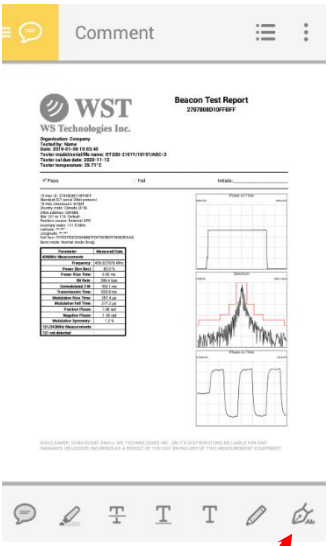
Adding a Signature to the PDF Test Report

- from the BT200 device home screen, tap on ***File Manager*** and navigate to ***Beacon Tester > Measurements***.
- select the desired measurement folder and tap on the associated pdf file.

The PDF Test Report will open in Adobe Acrobat™:



ADD COMMENT button



ADD SIGNATURE button

- tap the ***Add Comment*** button
- tap the ***Add Signature*** button
- follow the instructions on the screen.

Measurement Data File:

The Measurement Data file is a delimited text file (csv format) suitable for importing into a spreadsheet or database.

The header section of the file contains the Filename, Tester Model, Serial Number, Tester Cal Due Date, Tester Temperature, Input Mode, Cable Loss factors, Organization Name, Tested By name, and Receive Channels.

The body for FGB measurements contains the Date/Time, Burst #, 15 Hex ID, Full HEX, Latitude, Longitude, 406 Freq (MHz), 406 Power (dBm or %), 406 Power Rise Time (ms), 406 Pre-Burst Level (dBm), 406 Rep Period (s), 406 Bit Rate (bps), 406 Unmodulated CW Time (ms), 406 Transmission Time (ms), 406 Mod Rise Time (µs), 406 Mod Fall Time (µs), 406 Positive Phase (rad), 406 Negative Phase (rad), 406 Phase Symmetry (%), 121 Freq (MHz), 121 Peak Power (dBm or %), 121 Sweep Direction, 121 Audio Freq Upper (Hz), 121 Audio Freq Lower (Hz), 121 Audio Sweep Range (Hz), 121 Mod Index (%), 121 Sweep Rep Rate (Hz), 121 Duty Cycle (%), 243 Freq (MHz), 243 Peak Power (dBm or %), 243 Sweep Direction, 243 Audio Freq Upper (Hz), 243 Audio Freq Lower (Hz), 243 Audio Sweep Range (Hz), 243 Mod Index (%), 243 Sweep Rep Rate (Hz), 243 Duty Cycle (%), Full Binary, and Decoded Message Details.

The body for SGB measurements contains the Date, Burst#, 23 Hex ID, Full HEX, Latitude, Longitude, 406 Freq (MHz), 406 Power (%), 406 Bit Rate (bps), 406 Chip Rate (cps), 406 Chip Rate Variation (cps^2), 406 IQ Relative Offset (%), 406 Repetition Period, 406 Pre-Burst Level (dBm), 406 Transmission Time (ms), 406 Power Rise Time (ms), 406 Power Fall Time (ms), 406 EVM (%), 406 Peak-to-Peak Amplitude (%), 406 Out of Band Emissions (%), 406 IQ PN Sequence, 406 Post-Burst Level (dBm), 121 Freq (MHz), 121 Peak Power (%), 121 Sweep Direction, 121 Audio Freq Upper (Hz), 121 Audio Freq Lower (Hz), 121 Audio Sweep Range (Hz), 121 Mod Index (%), 121 Sweep Rep Rate (Hz), 121 Duty Cycle (%), 243 Freq (MHz), 243 Peak Power (%), 243 Sweep Direction, 243 Audio Freq Upper (Hz), 243 Audio Freq Lower (Hz), 243 Audio Sweep Range (Hz), 243 Mod Index (%), 243 Sweep Rep Rate (Hz), 243 Duty Cycle (%), Full Binary, Description

AIS data will be saved to a separate csv file appended with '_ais'

The AIS body contains the Date/Time, Burst #, AIS Freq (MHz), Full HEX, AIS Power (dBm or %), Transmission Time, Delta Time, and Decoded Message Details.

When the Tester is in ***Continuous Mode***, each set of measurement data will be appended to the measurement data file.

Graphics Files:

The Measurement folder contains the data used for the graphics files. This data represents the Graphic plot with 200 data points in a CSV format.

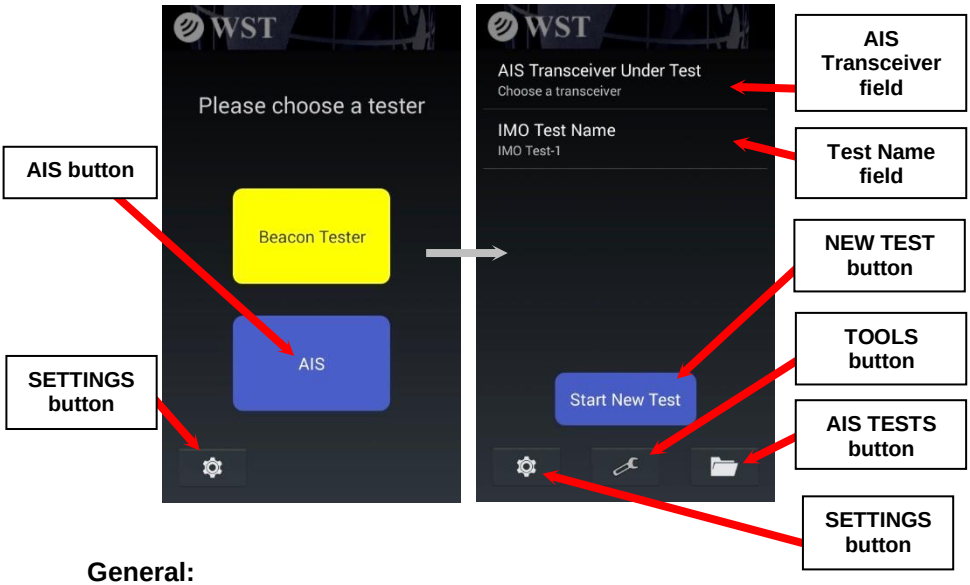
The sub-folder ***Images*** contains the graphic images created for each measurement.

Multimedia Files:

The Measurement folder also contains the multimedia files, including Comments, Photos, Movies, and Audio Clips.

AIS TRANSCEIVER MEASUREMENTS

AIS Transceiver Measurement functionality is only available with the AIS (Rx & Tx) option. Both Class A and Class B AIS transceivers can be measured. No attenuator is required between the AIS transceiver and the BT200.



General:

The user must add the AIS transceiver information before making measurements. The BT200 software will keep a list of previously added transceivers, which can easily be recalled.

The measurements can be made via the Start New Test Button, or alternatively, the user can manually select each individual test. The results from each test will be automatically inserted into the appropriate section of the IMO AIS Test Report in accordance with IMO MSC.1/Circ.1252.

Measurements are made with the AIS transceiver connected directly to the BT200 via a 50Ω coaxial cable.

All associated AIS Transceivers, IMO Tests, AIS Tools data is saved to a database located in the file system at **BT200** > **AIS Database** > **AISMeasurements.db**

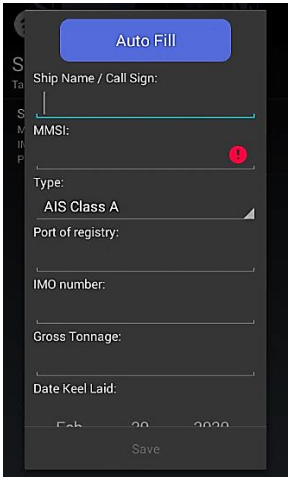
AIS Transceiver Selection:

• select the ***AIS Transceiver Under Test*** field to open up the ***Select a Transceiver*** screen.

• a selectable list of previously created AIS transceivers is presented for selection, editing, or deletion.

NOTE: Deleting an AIS transceiver will also delete all associated tests.

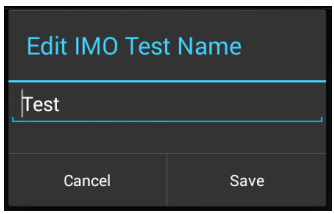
• press the ***Add Transceiver*** button to open the ***Create New AIS Transceiver*** dialog.



• the ***Auto Fill*** button will automatically receive and parse a connected transceivers MMSI number, IMO number, and Ship Name where applicable. Auto fill functionality only works in **Direct Connection** mode.
• the MMSI number field is the only required field to make a new transceiver.
• all data filled out in this section will be populated in the **IMO Test Report.**
• once a transceiver has been created, select it from the list of transceivers to use for testing.

IMO Test Name:

• select the ***IMO Test Name*** field to open up the ***Edit IMO Test Name*** dialog.

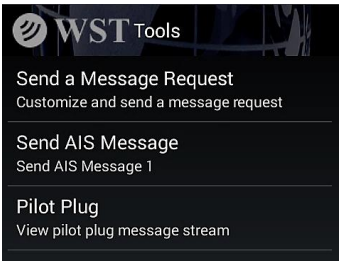


• type in the requested name of the **IMO Test Report**
• a dash # will be applied to the name to indicate the next available test name.

AIS Tools:

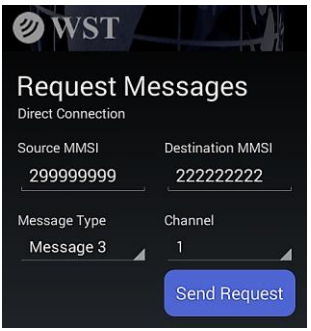
The ***TOOLS*** section allows users to run individual tests associated with AIS transceivers. This section has 3 parts: Send a Message Request; Send AIS Message; and Pilot Plug.

• select the ***TOOLS*** button to open up the ***Tools*** screen.



Send a Message Request:

• select the ***Send a Message Request*** field to open up the ***Request Messages*** page.



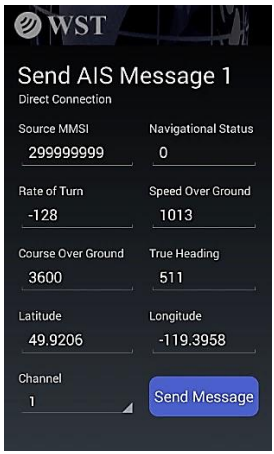
• the *Source MMSI* field is editable and is also auto filled based on the Tester MMSI number in the **AIS settings**.
• the *Destination MMSI* field is editable and is also auto filled based on the selected AIS transceiver in the ***AIS Transceiver Under Test*** section.

• the ***Message Type*** dropdown list auto-updates based on the class of transceiver selected. Class A transceivers have Message 3, 5, and 11 available, and class B transceivers have Message 18 and 24 available.
• if no AIS transceiver is selected, the *Destination MMSI* field will be empty, and all message types will be available.
• changing the input mode can be done in the **AIS settings**.

NOTE: The Destination MMSI must match the transceiver under test to see requested results.

Send AIS Message:

• select the ***Send AIS Message*** field to open up the ***Send AIS Message 1*** page.



• the *Source MMSI* field is editable and is also auto filled based on the Tester MMSI number in the **AIS settings**.
• see Rec. ITU-R M.1371-5 Table 48 for information on filling out remaining fields.
• changing the input mode can be done in the **AIS settings**.

Pilot Plug:

• select the ***Pilot Plug*** field to open up the ***Pilot Plug*** page.

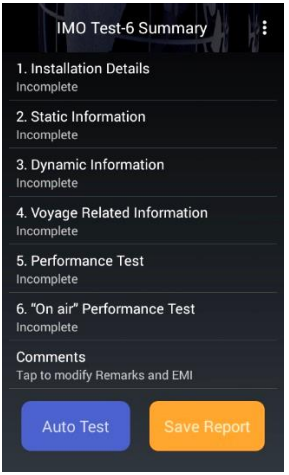
• verify that the ***Wireless Pilot Plug*** settings in the ***AIS Settings*** page are configured properly before attempting to connect.
• select the menu item ***Save Data*** in the top right corner to save the collected Pilot Plug output data.

AIS IMO Tests:

• click the ***Start New Test*** button to create a new IMO Test under the selected AIS transceiver
• click the ***AIS Tests button*** to view a list of previously created IMO tests under the selected AIS transceiver

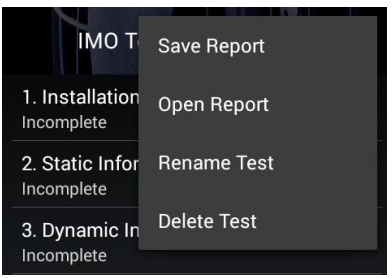
NOTE: An AIS transceiver must be selected to create and view IMO tests.

• after clicking the ***Start New Test*** button or selecting a previously created test, a test summary page will be displayed.

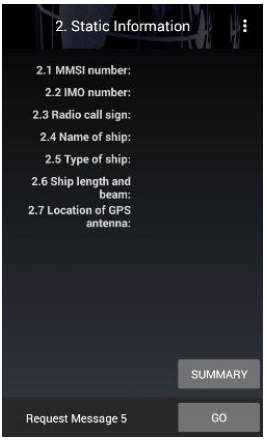


- click the ***Auto Test*** button to begin an IMO Auto Test.
- all measurement tests run in ***Direct Connection mode***.
- Note: section 4.5 requires Message 14 to be manually sent from the AIS transceiver. Please reference the selected AIS transceiver on how to send Message 14.
- Note: section 6 requires contact with Vessel Traffic Services (VTS).
- click the ***Save Report*** button to save a test report. Reports will save in the file system as **BT200** > **AIS Reports** > **Transceiver Name** > **Test Name.pdf**

- select the menu in the top right corner for options to ***Save Report***, ***Open Report***, ***Rename Test***, and ***Delete Test***.



• you can select each individual test step to view the collected data or run and re-run an individual test.



SOFTWARE UPDATES

Software updates are available free of charge on the Google Play Store or WS Technologies Inc. website: **wst.ca/bt200**

You are encouraged to keep your Beacon Tester software up to date by downloading and installing the most current software revision.

BEACON TESTER MODEL UPGRADING

All models can be remotely upgraded as desired. Please contact WS Technologies Inc. at **sales@wst.ca** for upgrade costs and procedures.

USING THE TSE100B SCREEN BOX

The TSE100B Screen Box will allow testing of the beacon in normal activate mode without the risk of being detected by a satellite (causing a false alert). If the beacon being tested has an internal GPS receiver, the TSE100B will allow you to verify the GPS reception and ensure proper encoding of location data onto the 406 MHz transmission.

Both the beacon and the BT200 are placed into the TSE100 Screen Box. The viewing window and the screened gloves allow you to control both the beacon and the Beacon Tester. If connecting the beacon and tester directly, use ***Direct Connection*** mode. Use ***Internal Antenna*** mode if the beacon is transmitting through its antenna.

The TSE100B Screen Box also has a sniffer antenna and an RF out connector. Use the ***Screen Box Connection*** mode when the BT200 is connected to the RF Out Connector.

If a beacon is connected directly using the BNC through port, then use the **Direct Connection** mode.

FREQUENTLY ASKED QUESTIONS

The signal levels are too low to measure using the Internal Antenna. What can I do?
The supplied Booster Antenna will help increase the levels by approximately 10 dB. Insert into the port on the top of the device and extend the antenna fully.

Can I convert Internal Antenna percentages into power values?
Due to the many uncontrollable and dynamic environmental variables that affect the path loss of radio waves, it is nearly impossible to calculate the transmitter power from just the received power. Therefore, BT200 only gives a relative indication of signal strength in percent.

If absolute power values are necessary, connect the BT200 directly to the beacon's transmission output and use the Direct Connection mode.

Why is my battery depleting so quickly?
In order to save battery power, turn off WiFi and keep the screen brightness to a minimum whenever possible. Do not turn off Bluetooth as this is used internally to the BT200.

I exceeded the input signal level allowed, and now the power levels are measuring wrong. Is my unit damaged?
A sudden change in typical measurement levels for any given channel is a sign of input damage. The unit may have to be returned for repair.

Why can't I measure AIS and 243 frequencies at the same time?
Currently, no such beacons exist on the market.

Why does my tester say "Measurements aren't available while the storage memory is in use"?
When the BT200 is connected to the computer and in USB mode, its internal memory control is handed over the PC disallowing the app read/write permissions. Disconnect from the PC and restart the app to resolve this.

Why is my AIS Transceiver not responding to the BT200?
The most common cause of the AIS transceiver being unresponsive to the BT200 is due to the incorrect MSSI number entered. Double check the BT200's MSSI setting matches the transceiver.

How can I find out my AIS Transceiver's MSSI (User ID) number?
When setting up a transceiver, select the "Auto Fill" button next to the MSSI number to have it automatically filled in. To check it manually, go into the Beacon Tester side, select AIS only, and wait for a burst. It will be displayed as the User ID number.

My Beacon Tester won't receive either 406 MHz or 121.5 MHz.
Ensure that the proper Input mode is selected. If you are receiving a beacon self-test transmission through its antenna, then select ***Internal Antenna***. If you are connected directly to the beacon, then select ***Direct Connection***.

The Bluetooth on my device is not functioning.
The Bluetooth function is dedicated to the operation of the Beacon Tester. The NFC is also not functional.

When I launch the Beacon Tester app, after it is Initialized, the spinning timer goes for a long time.
The length of time the timer continues depends on the number of measurement files in the Measurements folder. If you reduce the number of files, the app will launch quicker.

When I activate the beacon in self-test mode, the measurements produce questionable results. Is there a problem with the beacon?
In order to meet all of the Cospas-Sarsat requirements, a beacon is allowed a 15 minute warm-up period. When testing a beacon in self-test, there is no warm-up period; hence some measurements may be somewhat skewed. Also, in self-test, the 121.5 homing transmission may be different depending on the particular beacon. Some beacons transmit a short modulated signal, some beacons transmit a shorter unmodulated signal, and some beacons transmit no signal. The Beacon Tester may indicate "unable to measure details" or "unmodulated carrier" depending on the beacon characteristics.

I am testing an ELT with separate 121.5 and 406 output connectors. How do I get the results printed on one Test Report?
WST has a 121/406 high power, low loss combiner (p/n CMB102) that can be used to combine both channels into one output.

Is the characteristic swept tone audio that I hear when the Beacon Tester receives a 121.5 MHz signal the actual demodulated audio from the beacon?
No, the swept tone audio is just an audio file played when the tester has received a 121 MHz or 243 MHz signal.

SPECIFICATIONS

Description	BT200	add ELT	add AIS (Rx)	add AIS (Rx&Tx)	add SGB	Uncertainty
406 MHz First Generation Beacon (FGB)						
Measure all Cospas-Sarsat Frequency Channels	●					-
15 HEX ID and Full HEX ID	●					-
Decode Message – EPIRB & PLB	●					-
Decode Message – ELT		●				-
Frequency Leaving Factory Long Term	●					 ± 50 Hz ± 1.0 ppm/yr
Power Output	●					± 0.25 dB*
Power Rise Time	●					± 0.5 ms
Pre-Burst Level	●					± 1 dB
Pulse Repetition Period	●					± 10 ms
Bit Rate	●					± 0.1 bps
CW Preamble Time	●					± 0.8 ms
Total Transmission Time	●					± 0.8 ms
Rise Time	●					± 10 µs
Fall Time	●					± 10 µs
Phase Deviation: Positive	●					± 0.02 rad
Phase Deviation: Negative	●					± 0.02 rad
Modulation Phase Symmetry	●					± 0.005
406 MHz Second Generation Beacon (SGB)						
Decode Message SGB EPIRB & PLB					●	-
Decode Message SGB ELT (ELT & SGB Options Required)		●			●	-
23 HEX ID and Full HEX ID					●	-
Power Output					●	± 0.25 dB*
Power Rise/Fall Time					●	± 0.1 ms
Pre-Burst and Post-Burst Level					●	± 1.0 dB
Total Transmission Time					●	± 0.25 ms
Frequency Leaving Factory Long Term					●	 ± 50 Hz ± 1.0 ppm/yr
Chip Rate Average					●	± 0.05 cps
Chip Rate Variation					●	± 0.05 cps²
I, Q Relative Offset					●	± 0.5 %
I, Q Peak to Peak Amplitude					●	± 0.5 %
Out-of-Band Emissions					●	± 0.1 %
Error Vector Magnitude (EVM)					●	± 1.0 %
Graphic Measurements						
-406 Spectrum Mask Graphics Data	●				●	-
-406 Output Power During Burst Graphic Data	●				●	-
-406 Phase Modulation Graphics Data	●					-
121.5 MHz Measurements						
Frequency Leaving factory Long Term	●					 ± 60 Hz ± 1.0 ppm/yr
Peak Power	●					± 1.0 dB
Sweep Direction	●					-
Audio Frequency – Upper and Lower	●					± 30 Hz
Audio Sweep Range	●					± 60 Hz
Modulation Index	●					± 5%
Sweep Rep Rate	●					± 0.1 Hz
Duty Cycle	●					± 2%
243 MHz Measurements						
Frequency Leaving factory Long Term		●				 ± 60 Hz ± 1.0 ppm/yr
Peak Power		●				± 1.0 dB
Sweep Direction		●				-
Audio Frequency – Upper and Lower		●				± 30 Hz
Sweep Range		●				± 60 Hz
Modulation Index		●				± 5%
Sweep Rep Rate		●				± 0.1 Hz
Duty Cycle		●				± 2%

***Between 35-39 dBm**

SPECIFICATIONS (cont'd)

Description	BT200	add ELT	add AIS (Rx)	add AIS (Rx&Tx)	add SGB	Uncertainty
AIS Measurements						
Frequency (AIS1 & AIS2) Leaving Factory Long Term			•	•		± 60 Hz ± 1.0 ppm/yr
Power			•	•		± 1.0 dB
AIS Messages Decode			•	•		-
Tx AIS Transceiver (Class A & B)				•		-

Miscellaneous Parameters		
RF Range (Antenna mode)		
406 MHz 121.5 MHz/243 MHz AIS		>5 m >1 m >5 m
RF Input VSWR		1.20:1
Dynamic Range		
Direct Mode	121.5 MHz	+5 dBm to +35 dBm
	243 MHz	+5 dBm to +35 dBm
	406 MHz	+20 dBm to +40 dBm
	AIS	+20 dBm to +43 dBm
Screen Box Mode	121.5 MHz	-16 dBm to +20 dBm
	243 MHz	-17 dBm to +24 dBm
	406 MHz	-4 dBm to +30 dBm
	AIS	+10 dBm to +30 dBm
Maximum Input Power (Continuous RF)		+34.8 dBm
Maximum Input Power (406, 121.5, 243)		+40 dBm, ≤ 20% Duty Cycle
Maximum Input Power (AIS)		+43 dBm, ≤ 2% Duty Cycle
Operating Temperature Range		+5°C to +50°C
Storage Temperature Range		-20°C to +60°C
Ingress Rating		IP67
RF Input Cable Termination		BNC-female
Dimensions and Weight BT200: w x l x h mm (inches) Weight		 135 (5.31) x 70 (2.76) x 20.0 (0.79) 222 g (0.49 lbs)
Hard Case: w x l x h mm (inches) Weight		363 (14.29) x 284 (11.18) x 124 (4.88) 1.90 kg (4.2 lbs)

REGULATORY INFORMATION

CANADA

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:
(1) This device may not cause interference; and
(2) This device must accept any interference, including interference that may cause undesired operation of the device.

USA

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

EUROPEAN UNION

DECLARATION OF CONFORMITY

Supplier Name:	WS Technologies Inc.
Supplier Address:	#2 – 215 Neave Road Kelowna, B.C. Canada V1V 2L9

Declares under our sole responsibility that the following product

Product Name:	Beacon Tester Model BT200

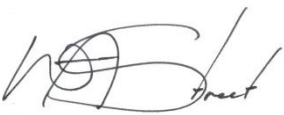
Conforms to the following normative European and International Standards

Normative Standards:	ANSI/ISO 17025:2005 EN 61000-4-2 EN 61000-4-3 EN 61000-6-1

Following the provisions of the normative European Council 1999/5/EC R&TTE Directive.

Product conformance to cited product specifications is based on sample (type) testing, evaluation, or assessment at Celltech Labs Inc. located in Kelowna, Canada.

Supplementary Information: This product was tested and complies with all the requirements for the CE Mark.



W. Street
President
WS Technologies Inc.
#2 – 215 Neave Road
Kelowna, BC
Canada V1Y 5L9
Phone: (250) 765-7583
FAX: (250) 765-1652

WARRANTY INFORMATION

WS Technologies Inc. (WST) warrants the products manufactured by WST to be free from defects in material and workmanship for one year from the date of shipment. Liability of WST under the foregoing warranty is limited to the replacement or repair, at the option of WST, of any products which show defective workmanship or materials within one year from the date of shipment, which replacement shall be made Exworks (EXW) WST's facility in Kelowna, BC, CANADA, upon proof satisfactory to WST of the defect claimed. Except for the foregoing warranty, WST makes no other warranty, express or implied, as to the merchantability or fitness for a particular purpose of products shipped or the performance thereof, and does not make any warranty to the purchaser's customers or agents.

CALIBRATION

The BT200 series of Beacon Testers has been designed to have a standard 1 year calibration cycle or a 2 year calibration cycle for the High Stability version. The calibration date appears on the Calibration Certificate supplied with the Beacon Tester, and the Cal Due date appears on the back of the BT200 device.

Before returning a unit for calibration, email **returns@wst.ca** to obtain an RMA (Return Materials Authorization) number and shipping instructions. Once calibrated, a new Cal Due date label will be placed on the back of the unit, and a new Calibration Certificate will be issued.

RETURNS

An RMA (Return Materials Authorization) number must be obtained by emailing **returns@wst.ca** . If the unit being returned is not covered under warranty, a minimum repair charge will apply. If damage is severe or the products have been tampered with, there may be additional charges.

POWER CONVERSION CHART - dBm to Watts

dBm	Watts	dBm	Watts	dBm	Watts
-12	0.06 mW	8	6 mW	28	630 mW
-11	0.08 mW	9	8 mW	29	800 mW
-10	0.10 mW	10	10 mW	30	1.0 W
-9	0.13 mW	11	13 mW	31	1.3 W
-8	0.16 mW	12	16 mW	32	1.6 W
-7	0.20 mW	13	20 mW	33	2.0 W
-6	0.25 mW	14	25 mW	34	2.5 W
-5	0.32 mW	15	32 mW	35	3.2 W
-4	0.40 mW	16	40 mW	36	4.0 W
-3	0.50 mW	17	50 mW	37	5.0 W
-2	0.63 mW	18	63 mW	38	6.3 W
-1	0.8 mW	19	79 mW	39	8.0 W
0	1.0 mW	20	100 mW	40	10 W
1	1.3 mW	21	126 mW	41	13 W
2	1.6 mW	22	158 mW	42	16 W
3	2.0 mW	23	200 mW	43	20 W
4	2.5 mW	24	250 mW	44	25 W
5	3.2 mW	25	316 mW	45	32 W
6	4 mW	26	398 mW	46	40 W
7	5 mW	27	500 mW	47	50 W

NOTES