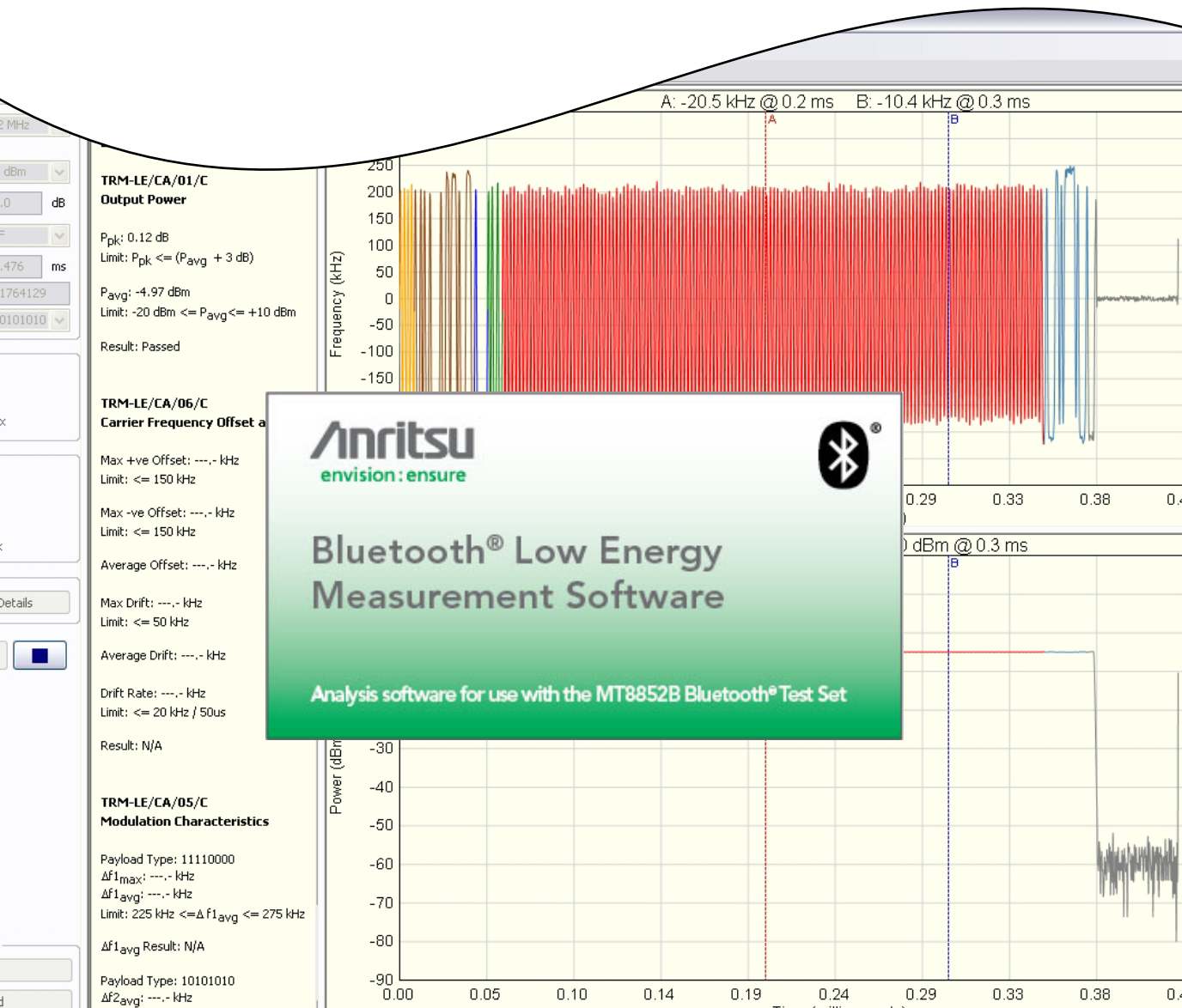
Operation Manual

Anritsu

MX885203A

Bluetooth® Low Energy Measurement Software for the MT8852B



Operation Manual

MX885203A

Bluetooth Low Energy Measurement Software for the MT8852B

Anritsu

P/N: 13000-00278
Revision: E
Created: February 2015

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Table of Contents

Chapter 1 — General Information

1-1 About this Manual

This manual details the MX885203A PC software.

The MX885203A software is available on MT8852B units fitted with option 27. It is provided as standard on the MT8852B-043 low energy only model.

Data length extension is available with units fitted with option 34.

Explanations in this manual apply equally to all MT8852B model types unless otherwise stated.

Comments on this Manual

Every effort has been made to ensure that this manual is thorough, easy to use, and free from errors. However, to ensure continued improvement, we would welcome your comments on this, or any other Anritsu document.

Please contact us at the address below if you have any comments, good or bad, find any errors or omissions, or have any suggestions on how our documentation could be improved further.

bluetooth.support@anritsu.com

Your comments will be logged and reviewed, and whenever possible, will be reflected in a subsequent release of the document.

Software Versions

This document provides information on the following software versions:

MX885203A software: 1.16

MT8852B firmware: 4.20

Some of the features documented in this manual may not be available to users of earlier software releases. Check the software versions by following the procedures below.

To check the version of the MX885203A software:

1. Start the low energy measurement software.
2. Click [Help] > [About Bluetooth low energy measurement software...].

To check the MT8852B firmware version:

1. Turn on the MT8852B and press **Config**.
2. Use the arrow keys to position the cursor at "MT8852B" and press **Sel**.
3. Use the arrow keys to position the cursor at "Identity" and press **Sel**.
4. Check the number that displays to the right of "Version".

Associated Documentation

The documentation for the MT8852B *Bluetooth* Test Set is supplied on the product CD shipped with the unit. Document part numbers are listed in the table below.

Table 1-1. Associated Documentation

Part number	Document
13000-00205 Rev. L	MT8852B *Bluetooth* Test Set Operation Manual
13000-00110 Rev. T	MT8852B *Bluetooth* Test Set Remote Programming Manual

The pdf files of the above documents can be viewed using Adobe Reader™ , a freeware program that can be downloaded from http://www.adobe.com/.

Conventions

The following conventions have been adopted in this manual.

Table 1-2. Notation Conventions

Item	Convention
MT8852B	Unless otherwise stated, the name “MT8852B” is used generically throughout this manual to refer to all models of the MT8852B *Bluetooth* Test Set.
EUT	The *Bluetooth* enabled device being tested is referred to as the EUT (Equipment Under Test).
Config	The five hard keys on the MT8852B (Run, Loop/Stop, Script, Config, and Preset) are depicted using an image of the key in question.
Sel	The keys on the MT8852B numeric keypad are depicted using an image of the key in question.
[Setup]	The names of soft keys appearing on the front panel of the MT8852B are enclosed in square brackets.
“Output Power”	Test appearing on the display of the MT8852B is enclosed in quotation marks when used in a body of text. Items with quotation marks are selected by pressing Sel.
Config > “MT8852B”	A chevron (>) is used to indicate that the user should select the keys or commands in sequential order.
[Packet Contents]	The names of software windows, dialogs, and tabbed pages are enclosed in square brackets.

1-2 *Bluetooth* Low Energy

Bluetooth low energy wireless technology (formerly known as ultra low power *Bluetooth* technology) was added to the *Bluetooth* specification in December 2009. It is designed specifically for small, predominantly button-cell battery powered devices for which low power-consumption and low cost are the primary concerns.

Bluetooth low energy is designed to work side-by-side with existing *Bluetooth* devices. It operates in the 2.4 GHz ISM band and offers data rates of 1 Mbit/sec over a range of 10 metres or more.

1-3 Product Description

Bluetooth RF testing of low energy devices can be performed on the MT8852B by upgrading to firmware version 4.16 and installing option 27 (*Bluetooth* low energy), or by purchasing an MT8852B-043.

Option 27 enables users to perform low energy measurements on the MT8852B or by using the MX885203A PC software described in this manual.

The MX885203A software is used to view low energy packets, make transmitter and receiver measurements, and execute automated low energy test scripts. It provides the ideal environment for detailed graphical analysis of low energy packets and allows the user to configure and run a low energy test script from the PC.

Features

- Graphical display of traces and numerical display of results.
- Create and execute low energy test scripts in a familiar Windows environment.
- Provides a colour-coded display of data packets.
- Transmit low energy packets to the EUT using a standard Windows interface.
- Import script and measurement settings directly from the MT8852B.

Supported Tests

The MX885203A software enables users to perform three transmitter and three receiver tests in full compliance the *Bluetooth* low energy specification.

Transmitter Tests

- TRM-LE/CA/01(02)/C (Output Power)

  Verifies the average power and peak to average power emitted from the EUT.
- TRM-LE/CA/05/C (Modulation characteristics)

  Verifies that the modulation characteristics of the transmitted signal are correct.
- TRM-LE/CA/06(07)/C (Carrier frequency offset and drift)

  Verifies that the carrier frequency offset and carrier drift of the transmitted signal is within specified limits

Receiver Tests

- RCV-LE/CA/01(02)/C (Receiver sensitivity)

  Verifies the receiver sensitivity of the EUT.

- RCV-LE/CA/06/C (Maximum input signal level)

  Verifies that the receiver is able to demodulate a wanted signal at high signal input levels.

- RCV-LE/CA/07/C (PER Report Integrity)

  Verifies that the DUT PER report mechanism reports the correct number of received packets to the tester.

Chapter 2 — Preparation for Use

2-1 Required Operating Environment

The following environment is required to install and run the MX885203A software successfully.

- Intel-based PC with Pentium processor or equivalent.
- Microsoft Windows XP or Windows 7 (32-bit or 64-bit) operating system.
- English, Chinese, or Japanese language environment.
- CD-ROM drive (if installing from the supplied CD).
- 16 MB RAM minimum.
- PC display settings of 1024 x 768 or greater.
- National Instruments GPIB interface card (recommended) or GPIB card that is VISA compatible or has NI-488.2 support.

2-2 Installing the MX885203A Software

Double-click the “Setup.exe” file and follow the instructions that display on screen.

Note	The low energy software can be installed on the same PC as the EUT control software or on a separate PC.

2-3 Configuring the MT8852B for Low Energy Testing

Single Mode Device

As single mode devices (those supporting low energy measurement only) are unlikely to have an HCI interface, the EUT must be initialized using the silicon vendor’s control software running on a remote PC, or using the 2-Wire interface and controlling from the MT8852B.

Note	Test scripts (as detailed in chapter 6) cannot be run for low energy single mode devices that do not have an HCI or 2-Wire interface.

Using the Silicon Vendor’s Control Software

1. Connect an RF cable between the antenna connector on the EUT and the “RF Port” on the front of the MT8852B.
2. Connect the GPIB cable from the rear of the MT8852B to the PC.
3. Connect the EUT control interface lead from the PC running the silicon vendor's control software to the EUT.
4. Ensure the MT8852B is connected to the mains power supply.

5. Press the [On/Standby] key on the front panel of the MT8852B.

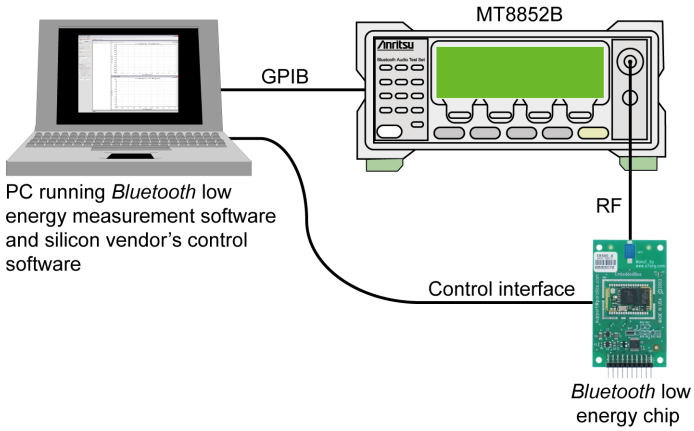

Figure 2-1. Configuration for Single Mode Device using Silicon Vendor's Control Software

Using a 2-Wire Connection

1. Connect an RF cable between the antenna connector on the EUT and the "RF Port" on the front of the MT8852B.

2. Connect the GPIB cable from the rear of the MT8852B to the PC.

3. Connect the 2-Wire lead from the "EUT Control" port on the front of the MT8852B to the interface on the EUT.

4. Ensure the MT8852B is connected to the mains power supply.

5. Press the [On/Standby] key on the front panel of the MT8852B.

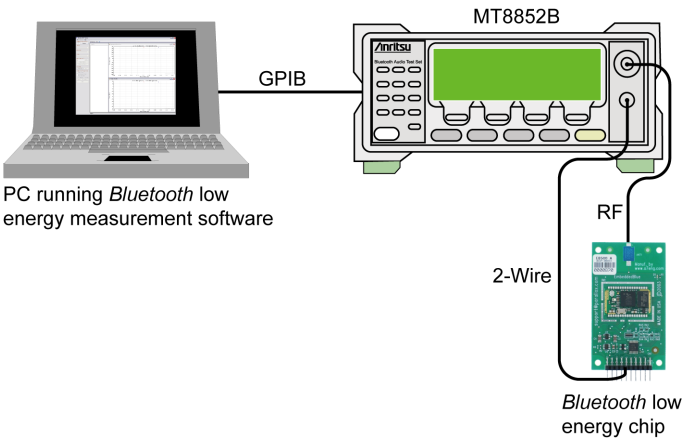

Figure 2-2. Configuration for Single Mode Device using a 2-Wire Connection

Dual Mode Device

Dual mode device (those supporting Basic Rate and/or EDR, and low energy transmission) can be initiated from the MT8852B as detailed below, or, if an HCI interface is not available, from a remote PC as described in the previous section on single mode device.

1. Connect an RF cable between the antenna connector on the EUT and the "RF Port" on the front of the MT8852B.
2. Connect the GPIB cable from the rear of the MT8852B to the PC.
3. Connect the control interface lead (RS232, USB, 2-Wire or USB Adaptor) from the "EUT Control" port on the front of the MT8852B to the HCI interface on the EUT.
4. Ensure the MT8852B is connected to the mains power supply.
5. Press the [On/Standby] key on the front panel of the MT8852B.

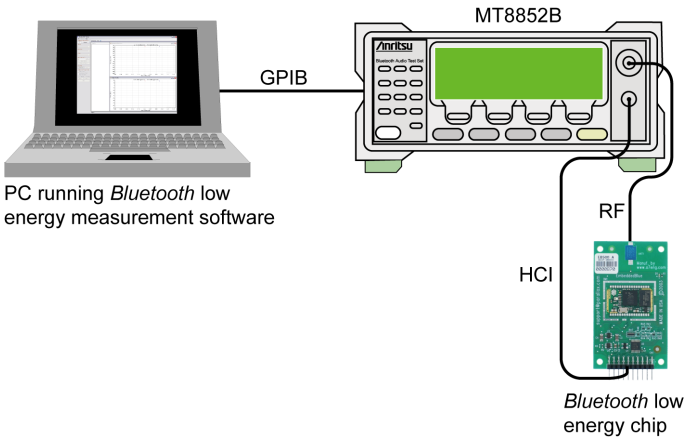

Figure 2-3. Configuration for Dual Mode Device with HCI Interface

Chapter 3 — Remote Connection

3-1 Establishing a Remote Connection

1. Configure the PC, MT8852B, and EUT as defined earlier in chapter 2.
2. Launch the *Bluetooth* low energy measurement software from the Windows Start menu to display the main program window as shown below.

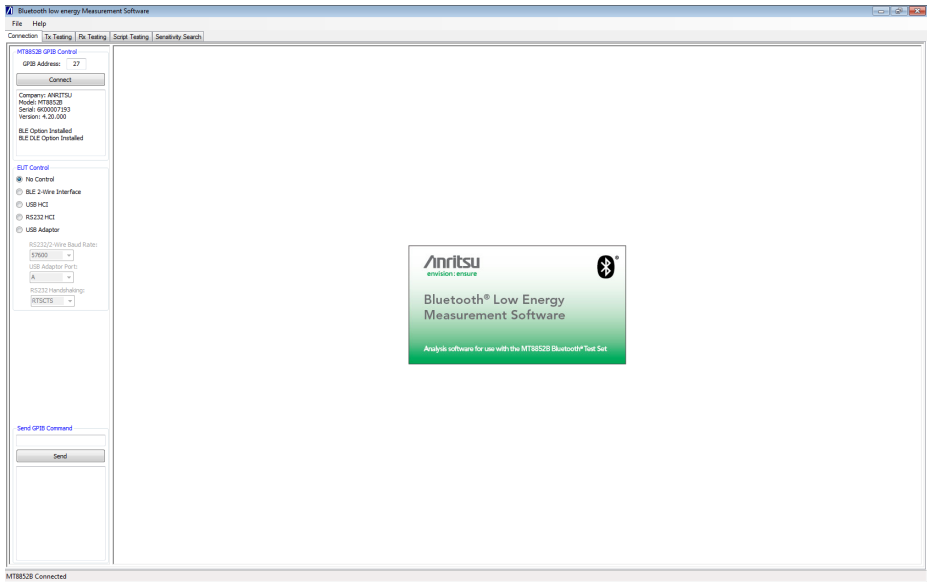

Figure 3-1. Main Window

3. The program opens displaying the [Connection] tab for GPIB connection. Check that the default GPIB address (27) matches that of the instrument and click [Connect] to establish a remote connection. When a connection is established, the serial number of the MT8852B and the firmware version display in the field beneath the button.

4. Use the buttons in the "EUT Control" field to select the method of HCI communication between the EUT and the MT8852B.

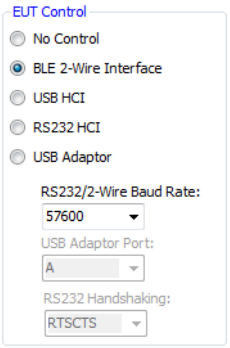

Figure 3-2. EUT Control Setting

Selecting "No Control" informs the software that, as an HCI or 2-Wire interface is unavailable, the EUT is being controlled using the vendor's own control software. Script testing (as detailed in chapter 6) is unavailable at this setting.

Chapter 4 — Transmitter Testing

4-1 Testing the EUT Transmitter

1. With a GPIB connection established as detailed in chapter 3, click the [Tx Testing] tab to display the tabbed page shown below. The [Tx Testing] tab allows the user to make power, frequency, and modulation measurements on low energy packets transmitted from the EUT.

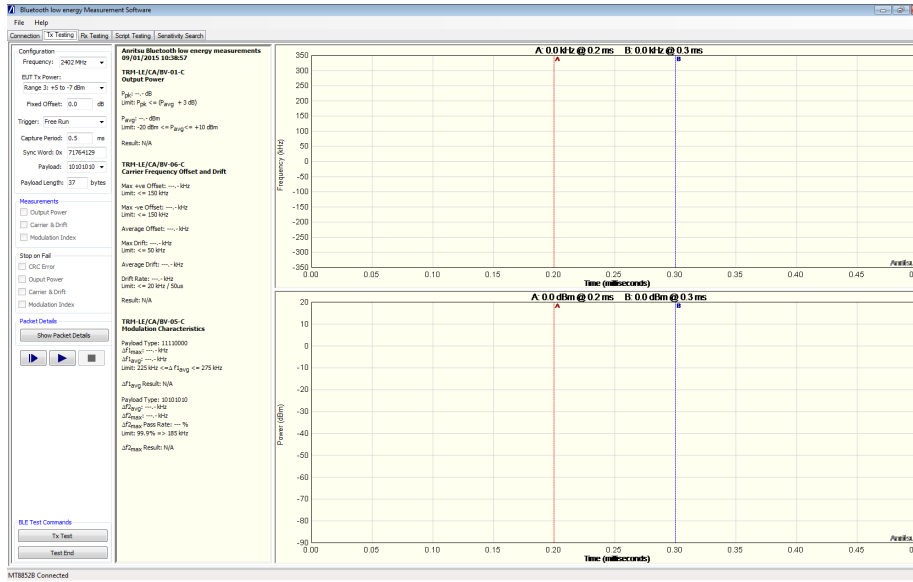

Figure 4-1. [Tx Testing] Tab

2. At the "Frequency" drop-down field, select the frequency at which data will be transmitted from the EUT.

3. At the "EUT Tx Power" drop-down field, select the power level range at which data will be transmitted from the EUT.

4. At the "Trigger" drop-down entry field, select the trigger mechanism.

Note

"Internal RF" triggers on the EUT power burst rising edge. "Trigger" should be set to "Internal RF" to enable stable packet capture and obtain a numeric display of measurement results.

If "External BNC Input" or "Free Run" is selected the frequency deviation and power profile traces are generated but numerical results are not available.

5. If viewing a graphical display of Tx packets without selecting measurements, set the capture time by entering a value in the "Capture Period" field of between 0.1 and 3.0 ms. A *Bluetooth* low energy reference packet is 376 µs in length.

Note	If measurements are selected, the capture period is set by default to 0.476 ms.

6. Set the Sync word to match the sync word of the packet under test. The defined sync word for a reference packet is 71764129. If the sync word is not set to match that of the packet being analysed, the software will not be able to decode the packet and display traces or measurement results.

7. Select the appropriate payload.

Note	The payload must be set to 10101010 to perform the Carrier & Drift measurement. The Modulation Index measurement is unavailable if the payload is set to PRBS9.

8. Select the Tx measurements to be performed by selecting the required check boxes.

9. If required, set a “Stop on Fail” for all or any of the selected measurements. “Stop on Fail” enables the user to capture failed packets for analysis when the failure is intermittent.

10. Configure the EUT to transmit low energy packets to the MT8852B in line with the settings made above.

- For EUTs without an HCI or 2-Wire interface, use the silicon vendor's control software.
- For EUTs with an HCI or 2-Wire interface, use the "BLE Test Commands" on the [Tx Testing] tab. Click [Tx Test] to commence transmission from the EUT to the MT8852B under the frequency and payload conditions defined above.

11. If required, click [Show Packet Details] to display the [Packet Contents] dialog. The fields within this dialog display a hexadecimal breakdown of the packet upon execution of the measurement.

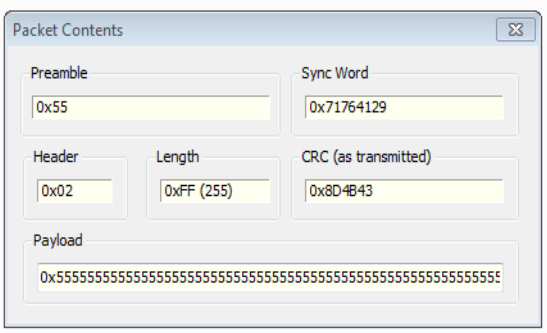

Figure 4-2. Packet Contents

12. Click  (run once) or  (run continuously) to capture the incoming data. A summary of the measurement results is provided in the frame to the right, and the [Frequency Deviation] and [Power Profile] traces are generated.

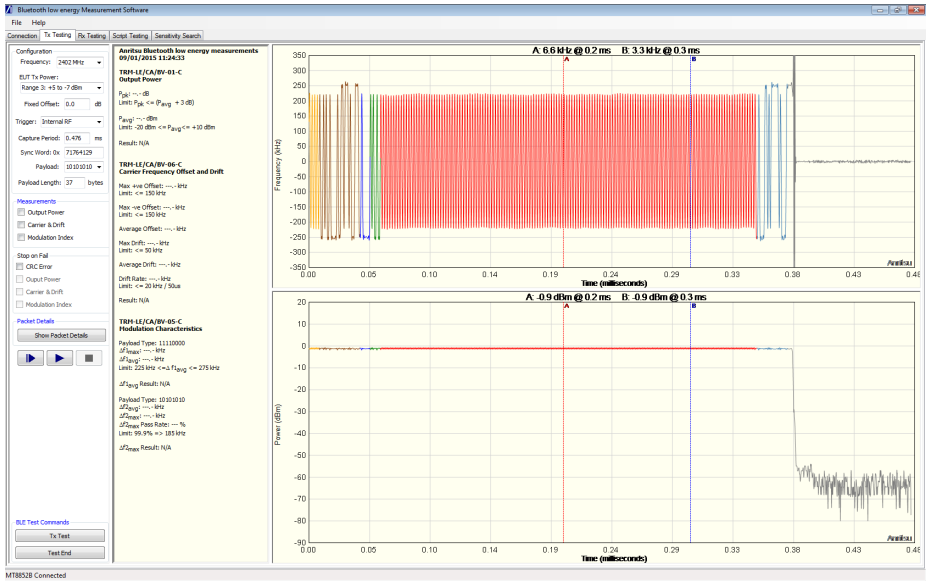

Figure 4-3. [Tx Testing] Tab with Traces

13. The trace can be zoomed by simply dragging the pointer over the required area. When the mouse button is released, the selected area is enlarged to fill the trace. Right-click the trace and select [Original Scale] to set the display back to the original scale. The right-click pop-up menu also allows the user to print and save the image, or to display the sample points on the trace.

Chapter 5 — Receiver Testing

5-1 Using the Silicon Vendor's Control Software

Receiver testing can be facilitated on single mode devices (or those devices without an available HCI or 2-Wire connection) by using the silicon vendor's test control software.

1. Establish a GPIB connection as detailed in chapter 3.
2. Set "EUT Control" on the [Connection] tab to "No Control".
3. Click the [Rx Testing] tab.

   The [Rx Testing] tab allows the user to generate and transmit *Bluetooth* low energy packets to the EUT.

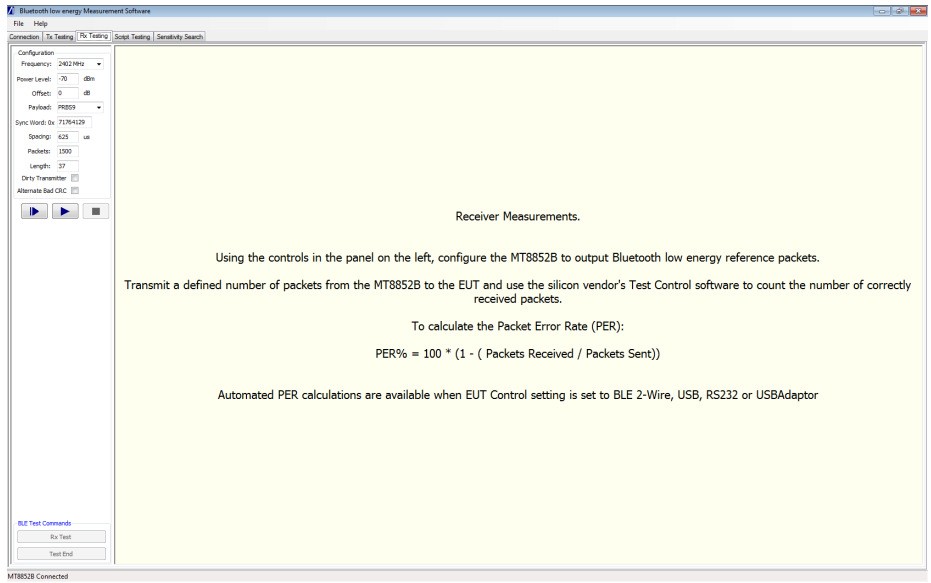

Figure 5-1. [Rx Testing] Tab for "No Control" Setting

4. At the "Frequency" drop-down field, select the frequency at which data will be transmitted to the EUT.
5. At the "Power Level" drop-down field, select the power level range at which data will be transmitted to the EUT.
6. Select the appropriate payload.
7. Set the Sync word. The defined sync word for a reference packet is 71764129. The sync word should be set to match the requirements of the EUT.
8. Set the spacing. The spacing setting defines the number of microseconds between the start of consecutive packets.

9. Specify the number of packets to be transmitted to the EUT.
10. Use the silicon vendor's control software to configure the EUT for receipt of low energy packets from the MT8852B.
11. Click (run once) or (run continuously) to transmit data.
12. Read the number of received packets using the silicon vendor's control software and calculate receiver sensitivity by making the calculation below.

    PER % = 100 x (1 - (packets received / packets sent))

5-2 Using an HCI or 2-Wire Control Interface

Receiver testing can be performed automatically on devices with an available HCI or 2-Wire connection.

1. Establish a GPIB connection as detailed in chapter 3.
2. Select the appropriate "EUT Control" setting on the [Connection] tab.

Note	Receiver sensitivity cannot be calculated automatically if "EUT Control" is set to "No Control". Refer to section 5-1 above if an HCI or 2-Wire connection is not available on the EUT.

3. Click the [Rx Testing] tab.

   The [Rx Testing] tab allows the user to generate and transmit *Bluetooth* low energy packets to the EUT.

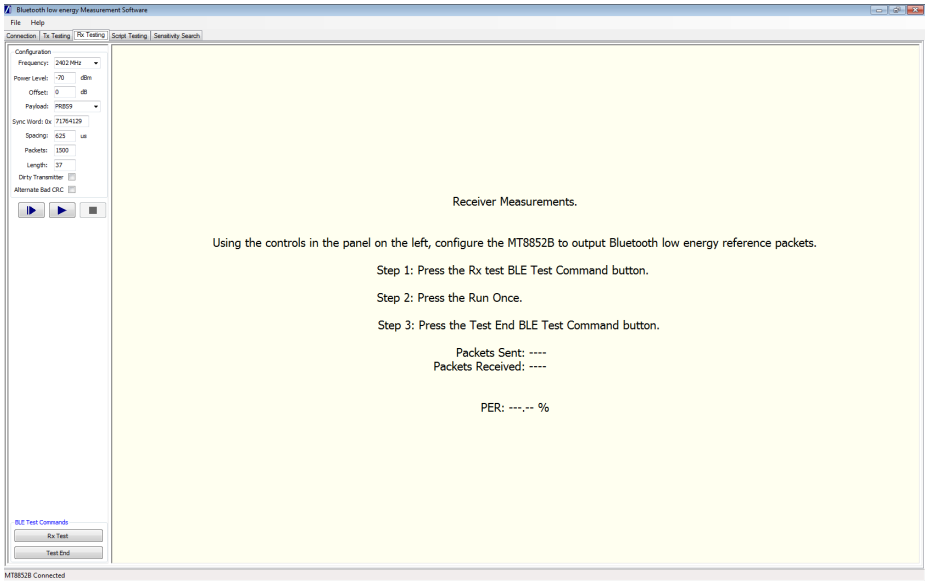

Figure 5-2. [Rx Testing] Tab for EUT with HCI Control

4. At the "Frequency" drop-down field, select the frequency at which data will be transmitted to the EUT.
5. At the "Power Level" drop-down field, select the power level range at which data will be transmitted to the EUT.
6. Select the appropriate payload.
7. Set the Sync word. The defined sync word for a reference packet is 71764129. The sync word should be set to match the requirements of the EUT.
8. Set the spacing. The spacing setting defines the number of microseconds between the start of consecutive packets.
9. Specify the number of packets to be transmitted to the EUT.
10. Click [Rx Test] to configure the EUT for receipt of low energy packets from the MT8852B.
11. Click  (run once) or  (run continuously) to transmit data.
12. Click [Test End]. The PC application reads the number of correctly received packets from the EUT.
13. The PER is calculated automatically and displays on screen.

Chapter 6 — Script Testing

6-1 Running a Low Energy Test Script

Note	Test scripts cannot be run from the *Bluetooth* low energy measurement software if the EUT does not have an available HCI or 2-Wire connection. The “EUT Control” setting on the [Connection] tab must be set to “No Control” if an HCI or 2-Wire connection is not available.

1. With a GPIB connection established as detailed in chapter 3, click the [Script Testing] tab to display the tabbed page shown below. The [Script Testing] tab allows the user to configure and execute an automated test script of *Bluetooth* low energy Tx and Rx test cases.

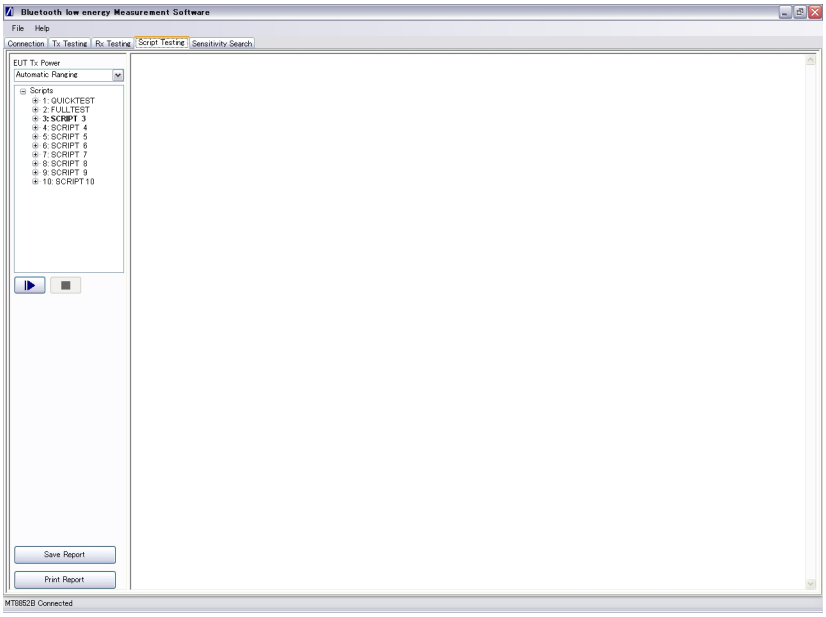

Figure 6-1. [Script Testing] Tab

2. Set the power used for the Tx test cases in the script at "EUT Tx Power". This setting is normally left at "Automatic Ranging".

3. Double click the required script within the test tree to open a [Script Setup] dialog such as that below.

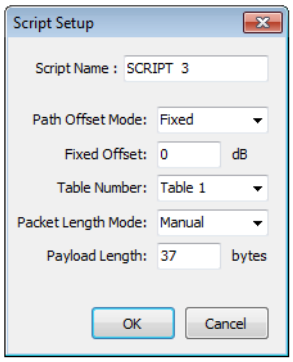

Figure 6-2. [Script Setup] Dialog

4. Enter a name for the script, set up a path loss if required, and click [OK] to save the settings.
5. Follow any of the three procedures outlined below to configure the test cases within the script.
   - Right-click the script name and select [Read Settings] to read all the selected script and test settings from the MT8852B.

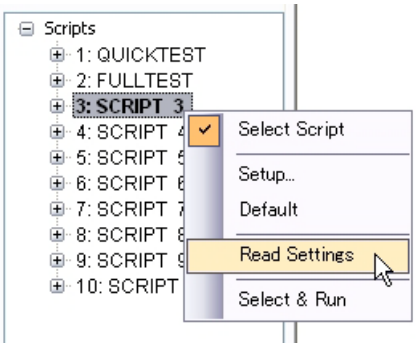

Figure 6-3. Read Settings for Script

- Right-click any of required test cases within the script and select [Read Settings] to read all the settings for that test from the MT8852B. Repeat this process as required for each of the test cases in the script.

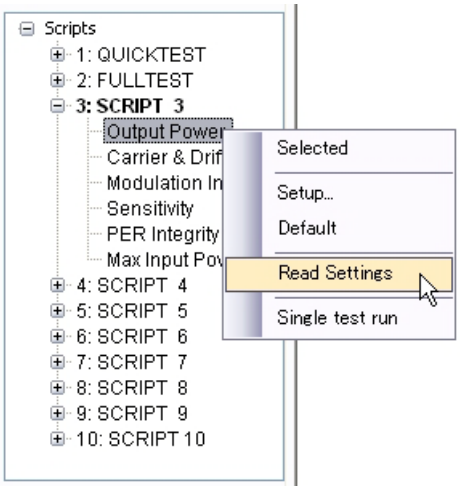

Figure 6-4. Read Settings for Test Case

- Double click any of the required test cases within the script. Set the test conditions and limits in the dialog that displays and click [OK] when complete. Repeat this process as required for each of the tests in the script.

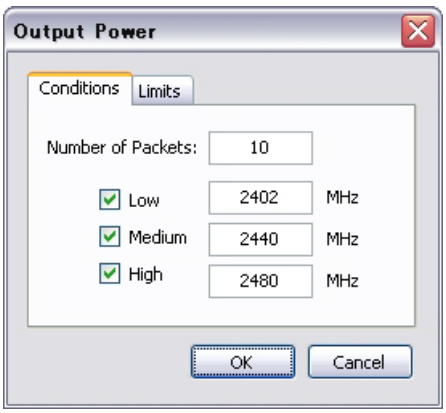

Figure 6-5. Output Power Test Conditions and Limits

6. Right-click each of the test cases to be run and click [Selected] from the pop-up menu. The test cases display in bold to indicate selection for execution when the script is run.

Note	Only test cases displaying in bold are executed when the script is run.

7. Right-click the script to be executed and select [Select Script] from the pop-up menu. The script name displays in bold to indicate that it is selected for execution.
8. Click  (run once) to execute the test script.
9. When the script is complete, a test report such as that shown below displays in the frame to the right. The report can be saved and printed as required using the buttons on the [Script Testing] tab.

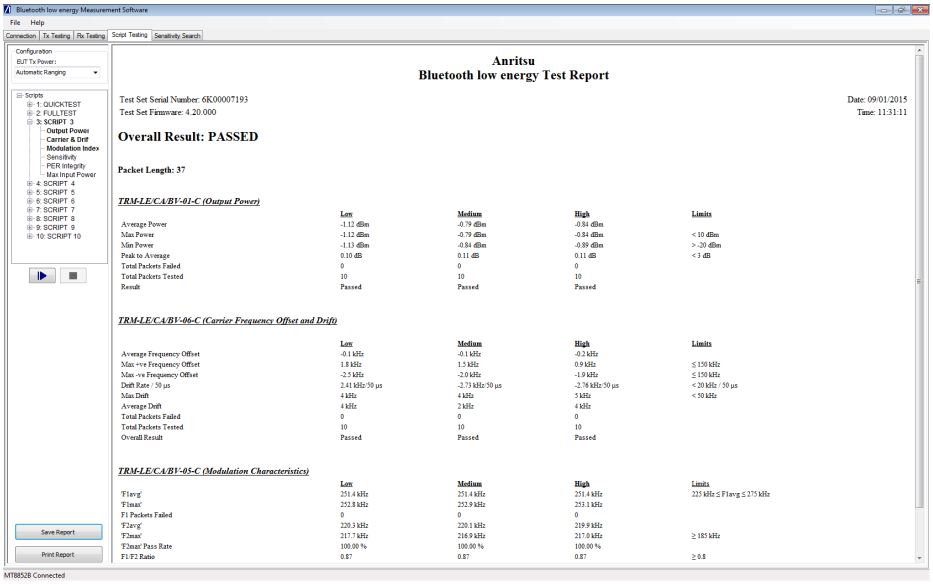

Figure 6-6. Test Report

Chapter 7 — Running a Sensitivity Search

7-1 Running a Sensitivity Search

The [Sensitivity] tab allows the user to configure and run sensitivity sweeps on any of the 40 channels.

Note	A sensitivity search cannot be performed if the “EUT Control” setting on the [Connection] tab is set to “No Control”.

1. Click the [Sensitivity Search] tab.

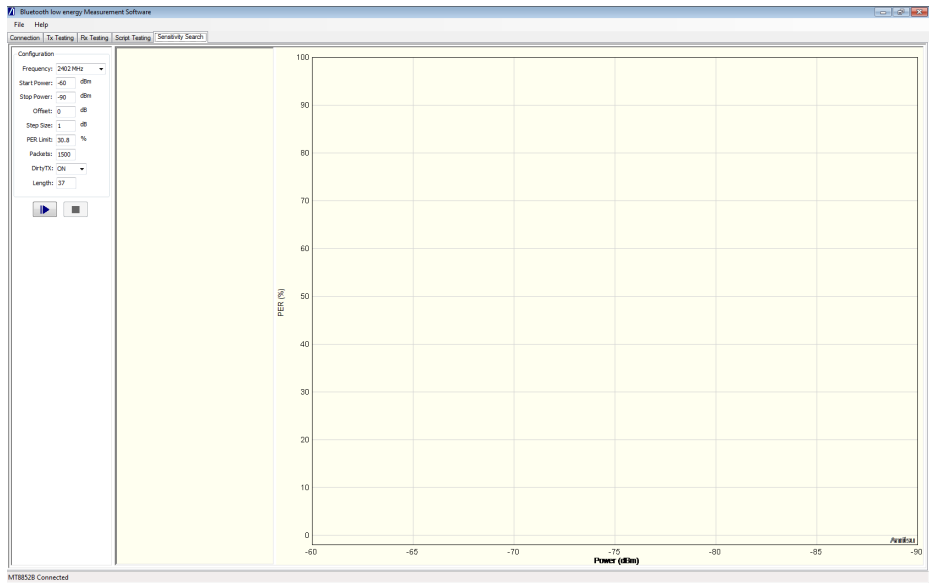

Figure 7-1. [Sensitivity Search] Tab

2. At the "Frequency" drop-down field, select the frequency at which data will be transmitted to the EUT.

3. Enter the “Start” and “Stop” RF level values within which the sensitivity sweep will be performed.

4. If required, enter an “Offset” in dB. Specifying an offset allows the user to compensate for path loss from the MT8852B RF port and EUT test port.

5. Enter a “Step Size” in dB. The step size determines the number of measurements that will be made within the specified power range.

6. At “PER Limit”, specify the maximum permissible error rate percentage. The test is stopped when the specified limit is reached.
7. At “Packets”, specify the number of packets to be analyzed at each iteration of the sensitivity sweep.
8. At “Dirty TX”, set use of the dirty transmitter to “ON” or “OFF” as required.
9. Click (run once) to start the sensitivity sweep. The PER recorded at each power step is displayed numerically and graphically as shown below.

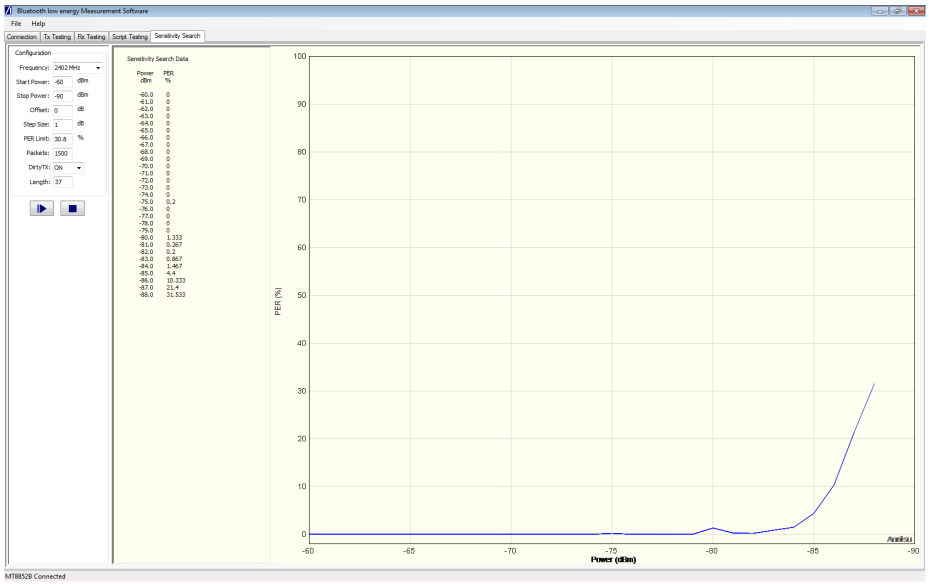

Figure 7-2. Sensitivity Sweep

Appendix A — GPIB PC Card Set-up

The following GPIB driver configuration setup is recommended for reliable GPIB communication with the MT8852B. The setup is expressed in the terms used by the National Instruments GPIB ISA and PCI cards and drivers for Windows and DOS.

A-1 GPIB Card Settings

The recommended GPIB board settings are as follows:

Table A-1. Recommended GPIB Settings

Terminate read on EOS	NO
Set EOI with EOS on write	YES
Type of compare on EOS	8 bit
Send EOI at end of write	YES
EOS byte	10 (0x0A hexadecimal)
System controller	YES
Assert REN when SC	YES
Enable Auto serial polling	NO
NI card. Cable length for HS488	OFF

A-2 GPIB Device Template

The MT8852B GPIB Default Primary Address is 27. Device templates for the primary address of each device can usually be set up separately. The settings for the device template for the MT8852B are detailed in the table below.

Table A-2. GPIB Device Configuration

Terminate Read on EOS	NO
Set EOI with EOS on Write	YES
Type of Compare on EOS	8-bit
EOS Byte	10 (0x0A hexadecimal)
Send EOI at end of write	YES
Readdressing	YES
Secondary address	NONE

Anritsu

AUSTRALIA ANRITSU PTY. LTD. Unit 3, 170 Foster Road Mt Waverley, VIC 3149 Australia Telephone: +61-3-9558-8177 Fax: +61-3-9558--8255	**BRAZIL** ANRITSU ELETRONICA LTDA. Praca Amadeu Amaral, 27 - 1 Andar 01327-010-Paraiso-São Paulo- Brazil Telephone: +55-11-3283-2511 Fax: +55-11-3288-6940	**CANADA** 700 Silver Seven Road, Suite 120, Kanata, ON K2V 1C3, Canada Telephone: +1-613-591-2003 Fax: +1-613-591-1006
CHINA ANRITSU BEIJING SERVICE CENTER Room 1515, Beijing Fortune Building, No. 5, Dong-San-Huan Bei Road, Chao-Yang District, Beijing 10004, P.R. China Telephone: +86-10-6590-9230 Fax: +86-10-6590-9235	**FINLAND** Teknobulevardi 3-5, FI-01530 VANTAA, Finland Telephone: +358-20-741-8100 Fax: +358-20-741-8111	**FRANCE** 9, Avenue du Québec Z.A. de Courtabœuf 91951 Les Ulis Cedex, France Telephone: +33-1-60-92-15-50 Fax: +33-1-64-46-10-65
GERMANY Anritsu GmbH Nemetschek Haus Konrad-Zuse-Platz 1 81829 München Germany Telephone: +49 (0) 89 442308-0 Fax : +49 (0) 89 442308-55	**HONG KONG** ANRITSU LIMITED LTD. Units 4 & 5, 28th Floor, Greenfield Tower, Concordia Plaza, No. 1 Science Museum Road, Tsim Sha Tsui East, Kowloon, Hong Kong Telephone: +852-2301-4980 Fax: +852-2301-3545	**ITALY** ANRITSU Sp.A Via Elio Vittorini 129, 00144 Roma EUR, Italy Telephone: +39-06-509-9711 Fax: +39-06-502-24-25
JAPAN 5-1-1 Onna, Atsugi-shi, Kanagawa 243-8555 Japan Telephone: +81-46-223-1111 Fax: +81-46-296-1264	**KOREA** ANRITSU CORPORATION LTD. 8F Hyunjuk Building, 832-41, Yeoksam Dong, Kangnam-ku, Seoul, 135-080, Korea Telephone: +82-2-553-6603 Fax: +82-2-553-6604	**SINGAPORE** 60 Alexandra Terrace, # 02-08 The Comtech (Lobby A) Singapore 118502 Telephone: +65-6282 2400 Fax : +65-6282 2533
SWEDEN Anritsu AB Borgafjordsgatan 13, 164 40 KISTA, Sweden Telephone: +46-8-534-707-00 Fax: +46-8-534-707-30	**TAIWAN** ANRITSU CO., LTD. 7F, NO.316, Sec.1 NeiHu Rd., Taipei, Taiwan, R.O.C Telephone: +886-2-8751-1816 Fax: +886-2-8751-1817	**UNITED KINGDOM** Anritsu LTD 200 Capability Green, Luton, Bedfordshire, LU1 3LU U.K. Telephone: +44-1582-433200 Fax: +44-1582-731303
UNITED STATES 1155 East Collins Blvd., Richardson, TX 75081, U.S.A. Toll Free: 1-800-ANRITSU (267-4878) Telephone: +1-972-644-1777 Fax: +1-972-671-1877		