Cover Design

S512 Operators Manual

(Draft Version)

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INTRODUCTION

The Model S512 Scanner and Dura-label developed by SCS is a state-of-the-art data gathering and inspection system that combines sophisticated Interactive Identification (i^2) technology in a compact form factor. This unique synergy allows the S512 and Dura-label system to integrate seamlessly into — and significantly increase productivity for — a wide range of applications and environments.

The S512 and Dura-label system consists of the following components:

- An S512 that writes information to and reads information from Dura-labels using a read/write head (antenna). The S512 conforms to FCC part 15 specifications and can operate with 1 or 2 externally connected transmit and receive antenna pairs. For more information, see "InstaScan Model S512 Scanner" on page 3.

- Dura-labels that contain information programmed by the S512. These reusable tags are designed to store information under extremely harsh environments without requiring a battery, and can store a permanent record of multiple events and transactions.

Data stored in SCS Dura-labels can be write-protected by enabling the SCS Dura-label's write-protect bit.

Communications between the S512 and Dura-labels are conducted using a revolutionary, two-way technology called i^2, which provides superior advantages over conventional communication methods. The specific data being communicated,

and the amount of interaction you have with the S512 and Dura-labels, is determined by your application.

For more information on i² technology, refer to "i² Advantages," below.

i² Advantages

Conventional data-gathering systems such as bar code readers and Radio Frequency Identification products use one-way communication: A sensor reads information from a device, without any interaction between the two devices.

Moreover, bar code systems are subject to line-of-sight limitations. As a result, airborne contaminants such as dust, dirt, oil, and mist, as well as label damage and objects outside the line of sight, result in inefficient and erroneous results.

The SCS S512 and Dura-label system overcomes these restrictions by using state-of-the-art i² technology. i² technology allows the S512 and Dura-label to conduct ongoing two-way communications that are not restricted by line-of-sight constraints.

Figure 1. i² Technology

This unique capability allows:

- Collective or selective data to be read from a single Dura-label.
- Collective or selective data to be read from multiple Dura-labels without requiring sorting or unpacking.
- Data to be written into a Dura-label.
- Classes of Dura-labels to be filtered according to user-defined criteria.

i^2 technology employs a superior interrogation feature that enables applications to uniquely identify all Dura-labels in the scan field, without misidentification or identifying the same Dura-label multiple times.

i^2 technology also uses a robust protocol that maintains a uniform per-Dura-label scan time, regardless of the number of Dura-labels in the scan field. The protocol provides a flexible software application interface that can be customized to the specific needs of particular industries and markets.

These unparalleled capabilities make the S512 and Dura-label system the ideal solution for asset and document management, inventory control, ticketing, and other high-volume applications and environments.

For examples of applications that can benefit from using the S512 and Dura-label system, refer to "Applications" on page 9.

InstaScan Model S512 Scanner

The Model S512 Scanner supports up to 2 external transmit and receive antenna pairs. Each antenna connects to its own coaxial connector on the front panel of the S512.

The two-antenna S512 is ideal for applications where Dura-labels

are placed in various orientations. Figure 2 shows the two-antenna S512.

Figure 2. Model S512 Scanner

Package Contents

The following items are included in your package:

- One Model S512 Scanner
- One or more external antenna(s) and matching number of RF cable(s)
- Wall mount Power Supple
- RS-232 serial cable
- A Diagnostic Label
- A diskette containing the S512 configuration program
- This Operations Manual

Please verify that you have received all of these items. If any item is missing or damaged, contact SCS as soon as possible.

What Else You Need

To complete your system, you need an IBM or compatible personal computer with the following *minimum* system requirements:

- 486 processor
- Compatible screen and keyboard
- MS-DOS version 3.3
- Windows 3.1
- DOS users: 8 MB of RAM
  Windows users: 8 MB of RAM (12 MB recommended)
- 9-pin RS-232 port and cable

The applications you use to interface with your S512 and Dura-label system may have additional hardware and software requirements. For more information, consult the manual that came with your applications.

Conventions in This Manual

This Operations Manual uses the following conventions:

- Steps you are to perform are numbered. Any result that occurs after performing a step appears below the step.
- Text you are to type appears in a `Courier` typeface.
- The carriage return key (designated as ↵ on some keyboards) is referred to as the Enter key.

- Notes that require special attention are prefaced with an open hand (✋).

Summary of Chapters and Appendixes

Besides Chapter 1, this Operations Manual contains the following additional chapters and appendixes:

- *Chapter 2, Applications* — describes various applications suited for the S512 and Dura-label system.
- *Chapter 3, Installation* — describes how to install the S512 and Dura-label.
- *Chapter 4, RF Tips*— provides information on radio-frequency (RF) communications.
- *Chapter 5, Troubleshooting* — describes how to identify, resolve, and avoid problems when using the S512 and Dura-label. This chapter also contains Customer Service information and merchandise return instructions.
- *Appendix A, Specifications* — lists S512 and Dura-label specifications.

NOTES

APPLICATIONS

The S512 and Dura-label system's sophisticated data gathering and inspection capabilities, combined with its flexible design, make it a powerful solution for improved productivity and quality control.

The ability to program data into and retrieve data from SCS Dura-labels makes the S512 and Dura-label system ideal for portable database applications. SCS Dura-label technology prevents data from being accessed, modified, or deleted by unauthorized individuals. It also provides fast read times and places less overhead on the Host computer.

The following sections describe a few of the applications that can benefit from the S512 and Dura-label system.

Intelligent Object Sensing

The S512 and Dura-label system is ideally suited for portable database applications, where information needs to be retrieved from a large quantity of items, or from selective items that meet user-defined criteria, quickly and efficiently.

For example, an industrial laundry, health-care facility, or other institution that processes large numbers of textiles may need to obtain a quick count of all soiled laundry lying on a floor or all laundered clothing hanging neatly on hangers.

Alternatively, an institution may need to obtain information from only certain articles of clothing, such as:

- Individual serial numbers.
- The number of all size 12 shirts that have been laundered.
- The number of times a shirt has been washed.
- The name of the shirt manufacturer.
- The name of the person who wears the shirt.
- A department budget number assigned to the shirt.

As Figure 3 shows, the characterizing of objects can be accomplished by attaching a Dura-label to each clothing item that is to be processed or detected. The size of the Dura-label and the system's non-line-of-sight capabilities allow flexible placement of the Dura-label. The system can then be designed to return information about all textiles within a particular area, or only the items that meet specific requirements.

Figure 3. Intelligent Object Sensing Application

Inventory Assessment

The SCS S512 and Dura-labels are ideal for portable database applications involving inventory assessment.

For example, a company shipping products to various distributors across the country may want an inventory of all items leaving the factory. Information such as model number, serial number, distributor name and location, and shipping date may need to be obtained before each product is loaded onto a truck for delivery to distributors.

Using an S512 and Dura-label system, the appropriate information can be programmed into Dura-labels, which are mounted on the boxes containing the product. The S512 can then retrieve the information from the Dura-label before the products load onto delivery trucks. Figure 4 illustrates this application using an S512 equipped with two antennas.

Figure 4. Inventory Assessment Application

Manufacturing Applications

Manufacturing environments frequently require information at various steps in a product's production cycle. For example, one step in the manufacturing process may require product assembly, serial number, and diagnostic information. A later step may require test results after an object has gone through various diagnostics, or a count of the number of times an operation has been performed.

These environments typically use expensive mainframe computers and costly data communication networks to transfer this information between locations in the manufacturing process.

Using an S512 and Dura-label system, an efficient, cost-effective portable database solution can be designed to obtain the necessary information from individual products as they pass each manufacturing cycle.

In Figure 5, for example, unique production information is obtained from plastic-framed fax machines at each critical point in the manufacturing process, without requiring expensive mainframe computers and data communication networks. Because the S512 and Dura-label system allows non-line-of-sight detection, the system can be positioned to accommodate today's complicated fixturing.

As a result, expenses are reduced significantly and inaccuracies resulting from human or system errors are completely eliminated. The manual paperwork that typically accompanies the manufacturing process is also eliminated, streamlining production.

Figure 5. Manufacturing Application

INSTALLATION

This chapter provides instructions for installing the S512 and Dura-label.

S512 LEDs and Connectors

The S512 provides the connectors and LEDs described in the following sections and shown in Figure 6.

Figure 6. Two Antenna S512
(Front and Back Views)

Front Panel

The S512 front panel has three LEDs and 4 coaxial RF connectors. The LEDs are used to indicate power, activity, and RF transmission. Table 1 describes the meanings of the S512 LEDs.

Table 1. S512 LED Meanings

LED	Color	Status
Power ON	Red	ON = S512 is turned on and receiving power from an AC outlet.
Activity/ Error	Yellow	Flicker = S512 detects Dura-label information. Constant Flickering with no Dura-label in the scanning field = Noisy environment or possible interference, resulting in diminished Dura-label reading.
RF On	Green	ON = S512 is transmitting RF power.

The S512 front panel has four coaxial connectors for connecting external antennas. Two connectors (left side) are for transmitting the RF signal to the Dura-label and two connectors (right side) are for receiving signals from the Dura-label. Note that the S512 can operate with either one or two pairs of transmit and receive antennas connected.

Installation

For instructions on connecting antennas to the S512, refer to page 21.

Rear Panel

The S512 rear panel has an On/Off switch, a DC power connector, an RS-232 connector and a test connector. The On/Off switch controls power from the power supply to the scanner.

- In the ON (up) position, the S512 is turned on. The red Power ON LED should go ON, indicating that the S512 is receiving power.

- In the OFF (down) position, the S512 is turned off and not receiving power, even if connected to a power outlet.

The power supply, provided with the S512, should be plugged into a wall outlet and into the DC power connector. For more information, refer to "Connecting to an AC Outlet" on page 24.

The 9-pin connector is the RS-232 port. The RS-232 serial port connector allows the S512 to communicate with a personal computer through the PC's serial port. For more information on making this connection, refer to page 22.

The 25-pin connector is a test port and should not be used.

S512 Installation Steps

The S512 installation consists of the following steps:

1. Position the S512 — locate near desired antenna locations.
2. Connect external antennas — see page 21.
3. Place the antenna for optimum read/write operation — see page 22.
4. Connect the S512 to a computer serial port — see page 23.
5. Power-up the S512 — see page 24.
6. Configure the S512 — see page 25.
7. Align the S512 — see page 27.

Connecting External Antennas

The front panel of S512 has four coaxial antenna connectors. Each connector accommodates a single external antenna. Figure 7 shows the external antenna connections to the S512.

The four-antenna S512 can be used with either 2 or 4 antennas.

Figure 7. S512 Antenna Connections

Placing the Antenna

Antenna placement is critical to ensuring that information is written to and read from Dura-labels accurately. Observe the following guidelines when placing the antenna:

- Locate the antenna away from metal objects, microwave ovens, and other devices that may induce radio frequency interference. In addition, make sure there are no metallic surfaces between, or in relative proximity to, the S512 antenna and Dura-label. For additional placement considerations, refer to "RF Communications".

- The S512 antennas should be placed no more than 5 inches from the objects bearing the Dura-labels.

- The front of the antenna must be free of obstructions. Otherwise, information may not be written to and read from Dura-labels accurately.

Dura-labels must reside within the scan field for at least 10 milliseconds for information to be written to or retrieved from them.

Connecting to a PC Serial Port

The S512 has a 9-pin female (DB-9F) RS-232 connector that connects to a serial port connector on an IBM or compatible personal computer. The serial port can operate up to 19,200 baud.

To make this connection, you need:

- An appropriately configured serial cable.
- One of the following adapters, if your computer's serial port does not have a 9-pin connector:
  - A 15-pin to 9-pin adapter, if your computer has a 15-pin serial port connector.
  - A 25-pin to 9-pin adapter, if your computer has a 25-pin serial port connector.

  These adapters are available from most computer and electronics stores.

Use the following procedure to connect the S512 to your computer's serial port.

1. Attach the male connector on the serial cable to the 9-pin serial connector on the S512 rear panel (see Figure 6).
2. Connect the other end of the cable to your computer's serial port. Use an adapter, if appropriate, to make this connection.

Figure 8 shows this connection with a S512.

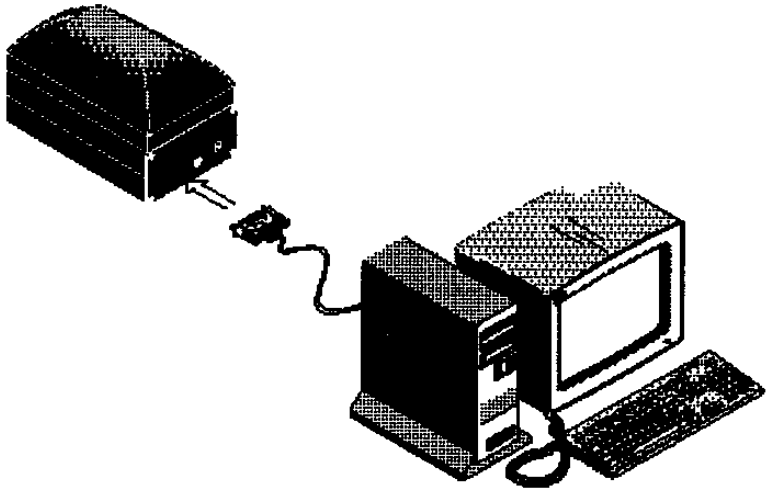


Figure 8. Connecting to a Computer Serial Port

Connecting to an AC Outlet

The following procedure describes how to connect the S512 to an AC outlet.

1. Verify that the On/Off switch on the S512 rear panel is in the OFF (down) position (see Figure 6).

2. Connect the power supply to the DC receptacle in the S512 rear panel.

3. Connect the other end of the power supply to the wall outlet.

4. Set the On/Off switch to the ON (up) position. The Power ON LED lights.

5. Type the following command and press Enter:

   ```
   CHKREAD
   ```

   A running series of zeros appear on your computer screen:

   ```
   0
   0
   0
   ```

6. Place the supplied Diagnostic Label in front of the antenna. Do not place your finger over the Dura-label. The Activity/Error LED on the S512 flickers and the display changes to a running series of zeros and ones:

   ```
   1
   1
   1
   ```

   This indicates that the S512 is identifying Dura-labels correctly and is ready for operation.

If the Activity/Error LED flickers, but a running series of zeros and ones do not appear, it indicates a communication problem between the S512 and computer. Refer to page 33 for troubleshooting procedures.

7. To exit CHKREAD, press the Esc key.

Aligning the S512

After verifying that the S512 is operating properly, use the following procedure to align the S512. Aligning the S512 ensures optimal read and write performance.

1. At the DOS prompt, type the following command and press Enter:

   ```
   CHKREAD
   ```

   A running series of zeros appear on your computer screen.

2. Hold the supplied Diagnostic Label within the scanning area, at the point where you intend to scan.

3. Adjust the position and orientation of the antenna mounting until the display on your computer screen changes to:

   ```
   01
   01
   01
   ```

4. Remove the configuration utility diskette from the floppy disk drive.

5. To exit CHKREAD, press the Esc key.

This completes the S512 installation procedure.

Installing Dura-labels

Dura-labels have a diminutive form factor that allows them to be installed in areas that cannot accommodate conventional read/write tags. In addition, Dura-labels can communicate with the S512 without having to be in the line-of-sight. This unique combination provides tremendous flexibility when determining a location for placing Dura-labels.

In textile applications, for example, Dura-labels can be inserted into the front tail of a shirt or the waistline of pants using a heat seal patch and a heat press. Because the S512 and Dura-label system does not require line-of-sight scanning, the Dura-label does not have to be visible to the S512.

When considering locations for installing Dura-labels, make sure they are within 18 inches of the S512 antenna for at least 10 milliseconds, so data can write to or be read from the Dura-label. Avoid locations where metal or water is present, because radio-frequency communication does not penetrate metal and is absorbed by water.

Loading Your Application

After you install the S512 and Dura-labels according to the instructions in this chapter, you can load your application and begin writing information to and reading it from the Dura-labels. Your application will determine the amount of interaction you have with the S512 and Dura-labels.

If you will be developing applications designed to interface to the S512 and Dura-label system, refer to the Application Programming Interface Manual for programming information.

RF COMMUNICATIONS

In general, devices that communicate using radio frequencies, such as your S512 and Dura-label system, can be sensitive to signal interference and signal attenuation. This chapter provides tips for optimizing radio-frequency (RF) communications with your S512 and Dura-labels.

Topics in this chapter include:

Signal Interference

Signal interference is RF signals that interfere with the information being exchanged between the Dura-label and the S512. Signal interference can severely diminish the S512's ability to write information to and read it from Dura-labels. The Activity/Error LED on the S512 flickers constantly if the S512 detects signal interference.

The source of the interfering signals may be:

- An RF system, such as an RF local-area network or another S512 and Dura-label system, located close to your S512 and Dura-label system.
- Security gates, garage doors, or similar devices that emit RF signals.
- Appliances such as microwave ovens.
- Multiple Dura-labels that reside close enough so that both are located within the scan field at the same time. In this case, rearrange the antenna to read each Dura-label individually.

Dura-labels with similar orientations, placed within two inches of each other, will have their read distance diminished by 40%.

The effects of the first three noise sources are localized and can be eliminated by relocating the S512 or its antennas. The effects of the fourth noise source can be resolved by placing Dura-labels a sufficient distance from each other.

The S512 and Dura-label system's communication capabilities are significantly reduced when the noise level perceived by the system exceeds the strength of signals received.

Signal Attenuation/Reflections

Signal attenuation is the loss of signal strength that occurs naturally over distances, but which can also be caused by RF barriers in the signal path.

Examples of such barriers include:

- Enclosed locations that have concrete walls, floors, and ceilings.
- Metal surfaces surrounding the antenna or Dura-label.
- Water or other fluids surrounding the antenna or Dura-label.

Almost every object (furniture, partitions, and people) in the path of a signal causes some degree of attenuation. What effects there are can be minimized by careful antenna placement.

The reflection from metal or metallic surfaces behind the Dura-label can also affect signal attenuation. In some cases, this may increase the read distance slightly, while inducing intermittent "dead" spots within the read field that permit little or no communication between the S512 and Dura-label.

Optimizing Performance

While it is not possible to predict how the S512 and Dura-label system will perform in any given environment, observing the following guidelines will help optimize performance in your environments and applications:

- Carefully plan the placement of the S512 antenna. The antenna can be extended approximately five feet from the S512. If your applications require longer distances, move the S512 to an appropriate location.

The S512 antenna should never be removed, altered, or modified except by an authorized technician. Any unauthorized antenna modifications can void your warranty.

- Consider the environment's RF characteristics, including construction materials, office plan (closed or open), and the presence of windows and ducting. The RF field pattern, and the reading distance, may be influenced by nearby metal objects, such as appliances, equipment, metal wall framing, and wire coat hangers.

- Ensure that the S512 antennas are not pointed directly at fluorescent lighting.

- Ensure that objects containing Dura-labels are no more than 18 inches from the antenna and remain in the scan field for at least 10 milliseconds.

- To avoid mutual interference when installing more than one Dura-label in the same object, allow a sufficient distance between the Dura-labels. The maximum interference occurs when Dura-labels within the same object are within 2 inches of each other and nearly equidistant from the S512 antenna.

- Never apply chemicals to the antenna. Certain chemicals, such as alcohol, may have little or no effect at room temperature, but may become corrosive at higher temperatures.

TROUBLESHOOTING

This chapter provides troubleshooting information you can use in the unlikely event you have a problem with your S512 and Dura-label system. Customer Service information and merchandise return instructions are included in this chapter.

Solving Problems

The following table identifies S512 and Dura-label problems and provides suggestions for resolving the problem.

Table 2. Problem Solving

Problem	Probable Cause	Solution
The Power ON LED does not light when you turn on the S512.	The AC outlet may not be working.	Plug another electrical appliance, such as a lamp, into the outlet and turn it on. If the appliance does not work, plug the S512 into a different outlet.
	The AC outlet may be controlled by a wall switch.	Set the wall switch to provide AC power to the outlet, or use an outlet not controlled by a switch.
The Activity / Error LED does not light when you configure the S512.	You may have a faulty Dura-label.	Use a Dura-label you are certain is working.
	The S512 may be faulty.	Use the CHKLINK and CHKREAD utilities to verify S512 operation (see "Configuring the S512" on page 25).
	The antenna cable may be faulty.	Contact SCS Customer Service (see page 34).

Problem	Probable Cause	Solution
You receive an error message when configuring the S512.	The S512 may not be turned on.	Verify that the Power ON LED is lit. If it is, proceed to the next row. Otherwise, make sure the S512 is turned on; if it is, perform the steps in the first row of this table to make sure the AC outlet is working.
	The S512's serial port connection to your computer may not be secure.	Verify the S512-to-serial port connection. If you are using a serial port adapter, make sure the adapter connections are secure.
Information cannot be written to or read from the Dura-label.	The Dura-label may be outside of the scanning area.	Make sure the Dura-label is no more than 18 inches from the S512.
	The Dura-label may have passed too quickly past the S512.	Make sure the Dura-label is in the scanning area for at least 10 milliseconds.
Same as above, but the Activity/ Error LED flickers constantly.	RF interference is disrupting S512-to-Dura-label communications.	See "RF Communications" section for suggestions on improving communications.

Contacting Customer Service

If you encounter a problem using your S512 and Dura-label system that you cannot resolve, contact Customer Service:

- Voice number: (619) 485-9196, ext. 225
- Fax number: (619) 485-0561
- E-mail address: info@scs-corp.com

Customer Service Representatives are available from 8:00 am to 5:30 pm, Pacific Standard Time, Monday through Friday. Please have the following information ready *before* you call Customer Service.

S512 Information:	System serial number, located on the back of the S512.
	Modifications made to the S512 and Dura-label system.
	Location where the S512 and Dura-labels are installed.
Computer Information:	Computer brand and model.
	Processor speed and available RAM.
	COM Port.
	Number and type of disk drives and other attached peripherals.
	Any extension boards in your computer.
	MS-DOS and Windows versions installed.
	Memory-resident or background programs installed.
Application Software:	Name and version of the application software installed.

Returning Your System

If SCS Customer Service determines you need to return your S512 and Dura-label system for service, the Service Representative will give you a Return Merchandise Authorization (RMA). Write this number on the outside of the box containing the returned system, and on a slip of paper inside

the box, so your return can be processed quickly.

Return only your S512, antenna, cable, and adapter. Do not return accessories, such as the Diagnostic Label or the diskette containing the S512 configuration program.

Follow these steps to return your S512 and accessories for service:

1. Carefully pack your S512 and accessories in the original static-protected bubble wrap and container. If you no longer have the original container, use a protected box.
2. Use filler material to cover the items in the box.
3. Add a note with the RMA number inside the package.
4. Write the RMA number and the word FRAGILE on the outside of the package in large, legible writing.
5. Address the package to:
   SCS
   10905 Technology Place
   San Diego, CA 92127

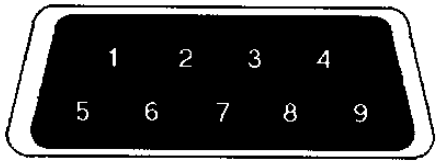
   ATTN: RMA # _____ (indicate your RMA number here)

SPECIFICATIONS

This appendix lists the specifications for the S512 and Dura-label system.

S512 Specifications

LEDs:	One Power ON LED, one Read LED, and one Activity/Error LED
Communication Method:	RS-232
Serial transmission rate:	Up to 19,200 baud
Connector:	One female DB-9 for RS-232 communications
Pin assignments:	Pin 1 - Not used Pin 2 - Transmit Data (Input) Pin 3 - Receive Data (Output) Pin 4 - Not used Pin 5 - Protective Ground Pin 6 - Not used Pin 7 - Not used Pin 8 - Not used Pin 9 - Not used



Limited Warranty

SCS warrants its Dura-labels to be free from defects in workmanship and materials, under normal use and service, for a period of ninety (90) days from receipt of products.

SCS warrants its S512 to be free from defects in workmanship and materials, under normal use and service, for a period of ninety (90) days from date of receipt.

If a product does not operate as warranted during its applicable warranty period, SCS shall, at its option, repair the defective product or deliver to Customer an equivalent product to replace the defective item. All products that are replaced shall become the property of SCS. Replacement products may be new or reconditioned. The warranty for replacement or reconditioned product is the same as the equivalent newly purchased product.

SCS reserves the right to refuse to warranty repair any product that has been subjected to any abnormal electrical, mechanical, or environmental abuse.

Disclaimer

The intensity of the energy field of the S512 is well below the maximum permissible human exposure guidelines established by ANSI C95.1 - 1992 and all other published exposure standards. As is the case with any radio-frequency transmitter, it is inadvisable to touch the antenna, or to stare directly from close proximity (less than a foot) at the face of the antenna.

Operation of any radio transmitting equipment, including the S512, may interfere with the functionality of inadequately protected medical devices. Consult a physician or the manufacturer of the medical device if you have any questions. Other electronic equipment may also be subject to interference.