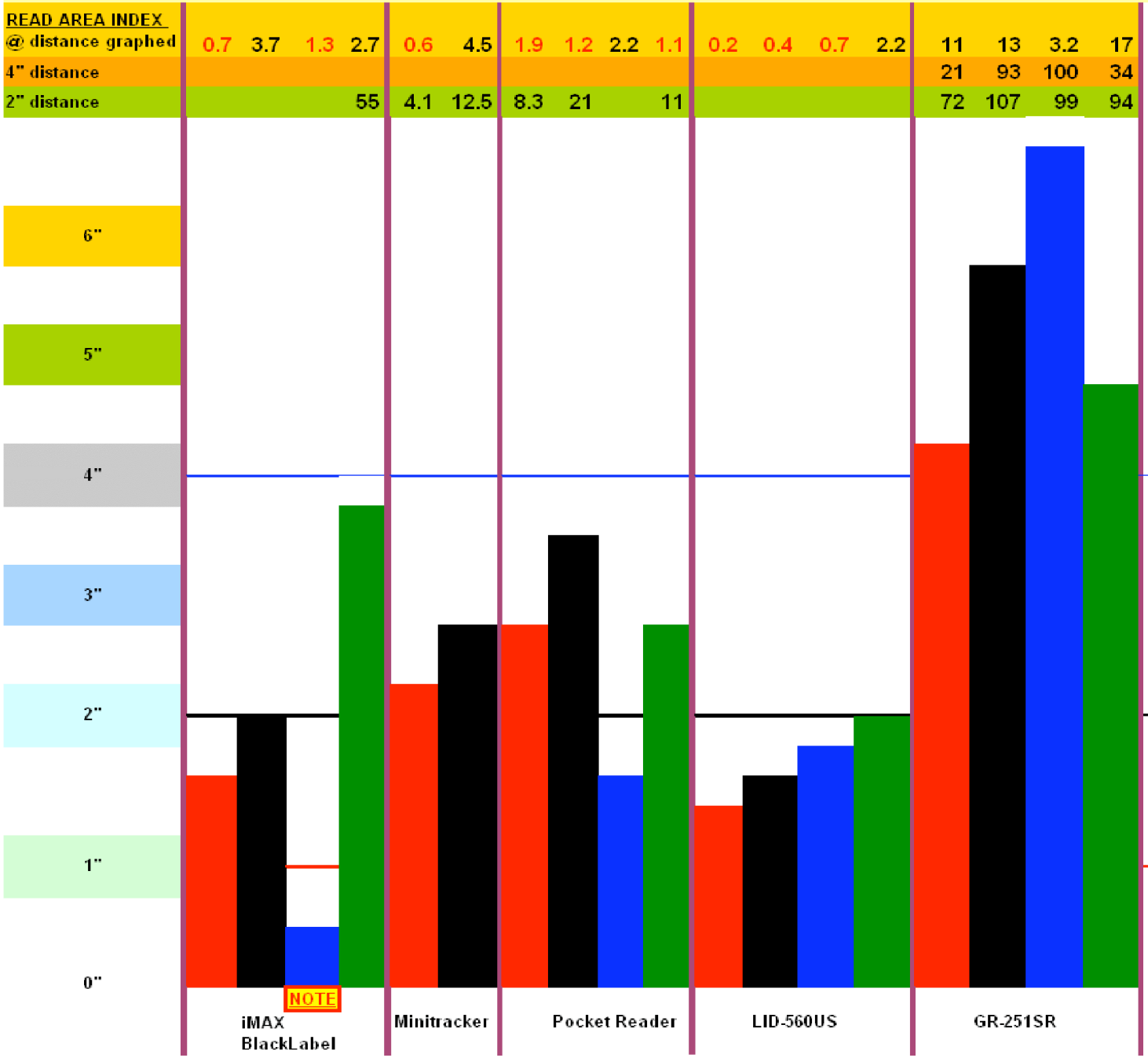
Evaluation of
U.S. Pet Microchip Scanning Network
Microchip Readers
December 2007

US PET SCANNERS - PERFORMANCE EVALUATION

READ AREA INDEX @ distance graphed	0.7	3.7	1.3	2.7	0.6	4.5	1.9	1.2	2.2	1.1	0.2	0.4	0.7	2.2	11	13	3.2	17
4" distance															21	93	100	34
2" distance				55	4.1	12.5	8.3	21		11					72	107	99	94



Read area Index below 2.0 will likely result in missed microchips when scanner is moved @ 1 foot per second. The larger this index, the more reliably the microchip can be located and read.

*READ AREA INDEX is a "figure of merit" consisting of the sum of the products of the height and width of the read areas at the specified read distance.

AIM Required Minimum Read Distance

**AIM Companion Animal Electronic ID User Requirements -- approved by consensus of participating organizations in December 1994.

Minimum Read Distance below 2" will regularly miss microchips due to implant depth, imperfect implant procedure, migration, etc.

Implanted Microchip assumed to be at least 1" below fur/skin

NOTE: The iMAX Black Label scanner did not read certain Trovan brand microchips at any distance. This is considered a serious deficiency.

Type Microchips
AVID FriendChip
HomeAgain
Trovan
Bayer

Performance Evaluation Tests on 5 Microchip Scanners Available to the U.S. Pet Market

November 2007

General Notes:

1. The first four scanners (iMAX Black Label, MiniTracKer I, Pocket Reader, and the LID-560US) are all powered with alkaline non-rechargeable batteries. These batteries reduce their voltage as the scanners are used and deplete their stored charge. The performance of these scanners reduces significantly as the battery voltage is reduced. The tests included herein are run with fresh Energizer type batteries. Therefore, the results are better than can be relied on in normal use, depending on the depletion level of the battery charge.

2. The fifth scanner, the GR-251SR, is powered with an NiMH rechargeable battery. As these batteries are used and the charge is depleted, the voltage reduction is comparatively small, resulting in negligible scanner performance change as the battery charge is depleted.

3. The performance of the first and fifth scanners (iMAX Black Label and the GR-251SR) is not dependent on microchip rotational orientation with respect to the scanner. This is not the case with the other three scanners in which the read distance/area drops to zero, or near zero, if the microchip is oriented orthogonal to the preferred orientation. Since it is unknown what the implanted microchip's position and orientation is, or even if there is a microchip present, this presents an additional challenge to locating and reading a microchip implanted in an animal.

4. The iMAX Black Label scanner did not read certain Trovan brand microchips at any distance. This is considered a serious deficiency.

5. The graphical plots on the following pages depict the area over which the implanted transponder (subcutaneous and parallel to skin surface) can be successfully read at the distance from the scanner face noted on each plot. The scale is 1:1 except as noted (graphical plots reduced in scale to fit on the page for the GR-251SR plots).

iMAX Black Label

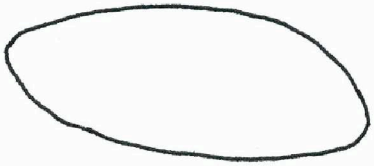
- Single antenna
- 134.2 kHz excite frequency
- Reads the three U.S. implanted base microchips (except as noted above) and the ISO FDX-B microchips
- Omni directional microchip orientation allowed without performance degradation
- The iMAX Black Label scanner did not read certain Trovan brand microchips at any distance. This is considered a serious deficiency.
- Manufacturer: Datamars SA
- Distributor in U.S.: Bayer AG

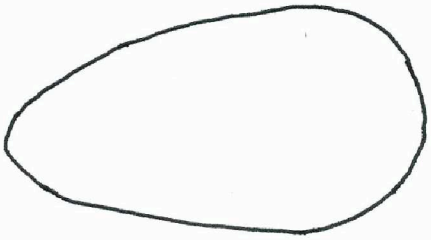
AVID FriendChip Microchip

1 ½" Distance. Does Not Read at 1 ¾".

HomeAgain Microchip

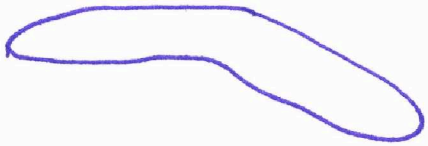
2" Distance. Does Not Read at 2 ¼''.





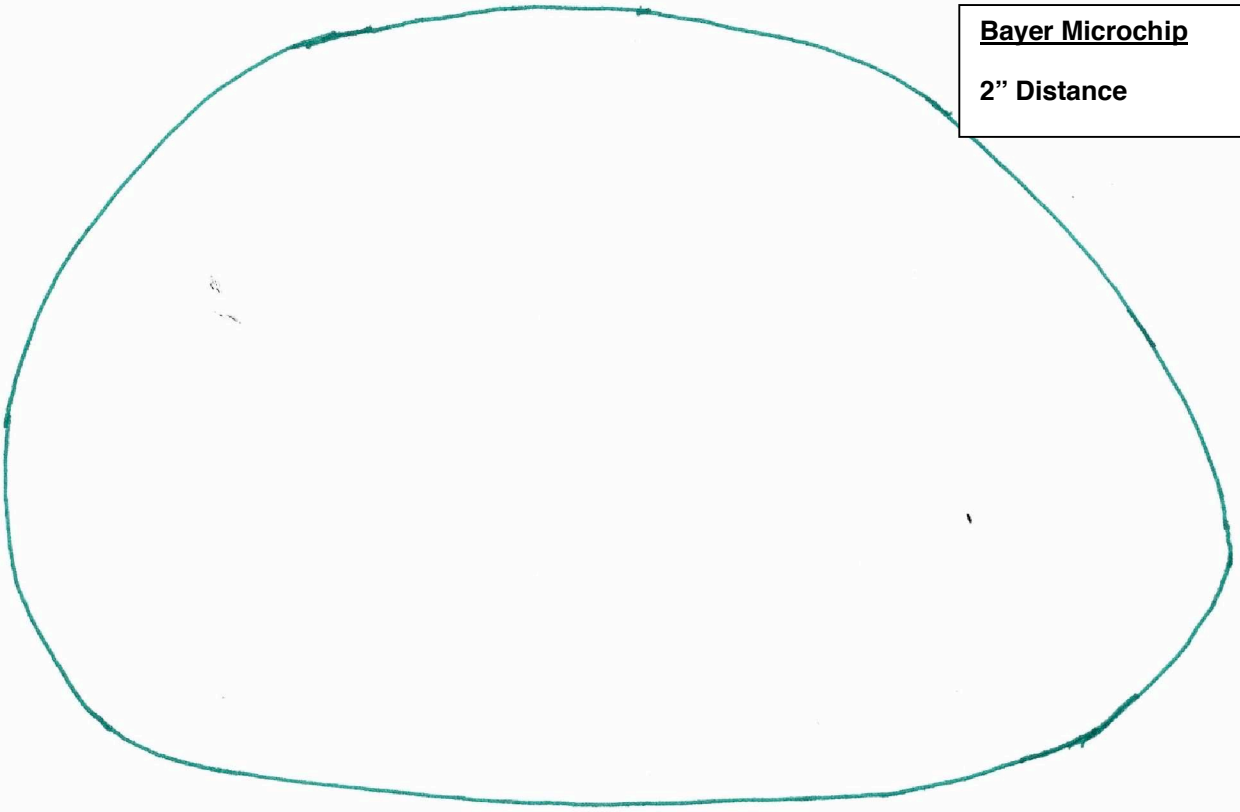
Trovan Microchip

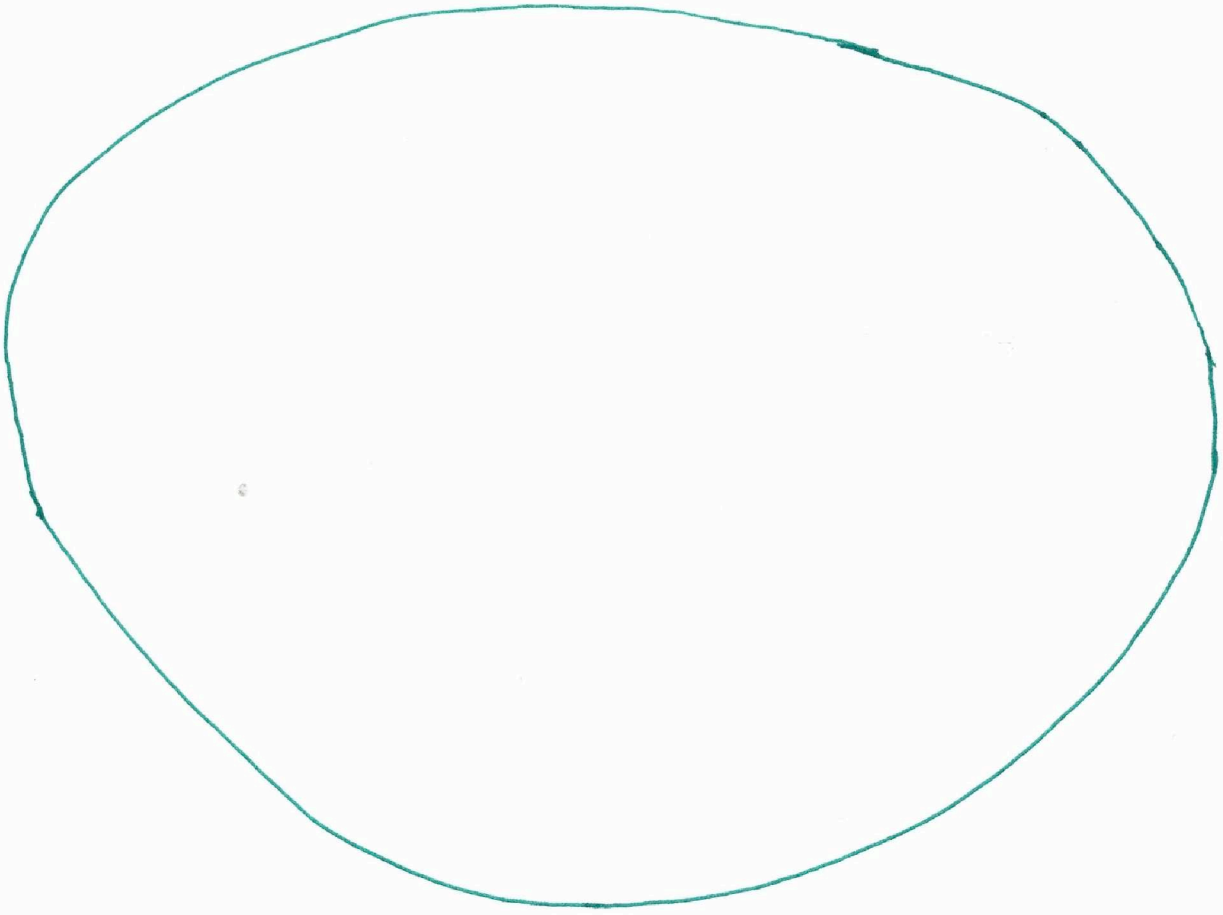
½" Distance. Does Not Read at ¾".



Bayer Microchip

2” Distance



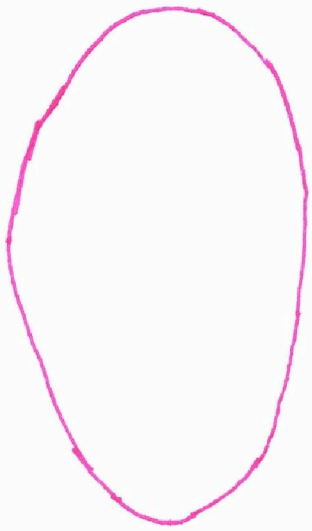


MiniTracKer I

- **Single antenna (uses ferrite bar)**
- **125 kHz excite frequency**
- **Reads two of the three U.S. implanted base microchips**
- **Microchip orientation severely restricted for reading**
- **Manufacturer: American Veterinary Identification Devices (AVID)**
- **Distributor in U.S.: AVID**

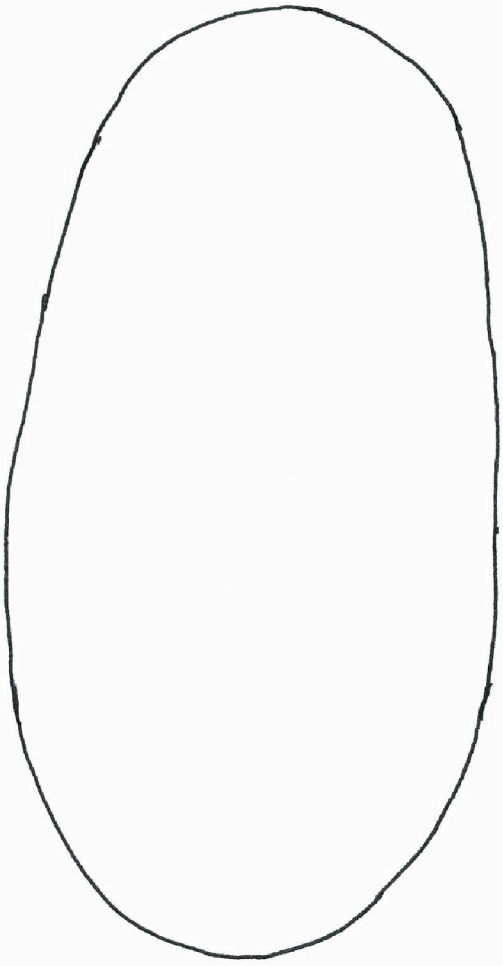
AVID FriendChip Microchip

2" Distance. Does not read at 2 ½"



HomeAgain Microchip

2" Distance. Does Not Read at 3".

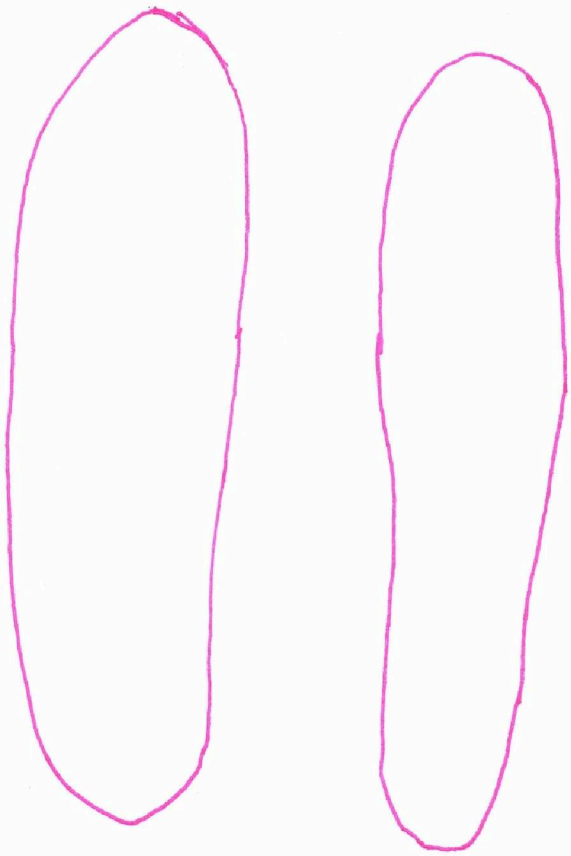


Pocket Reader

- Triple coil antenna (uses a ferrite bar)
- 125 kHz excite frequency
- Reads the three U.S. implanted base microchips & ISO FDX-B microchips (currently does not display ISO ID #)
- Microchip orientation restricted for reading
- Manufacturer: Destron (Digital Angel)
- Distributor in U.S.: Schering Plough (HomeAgain)

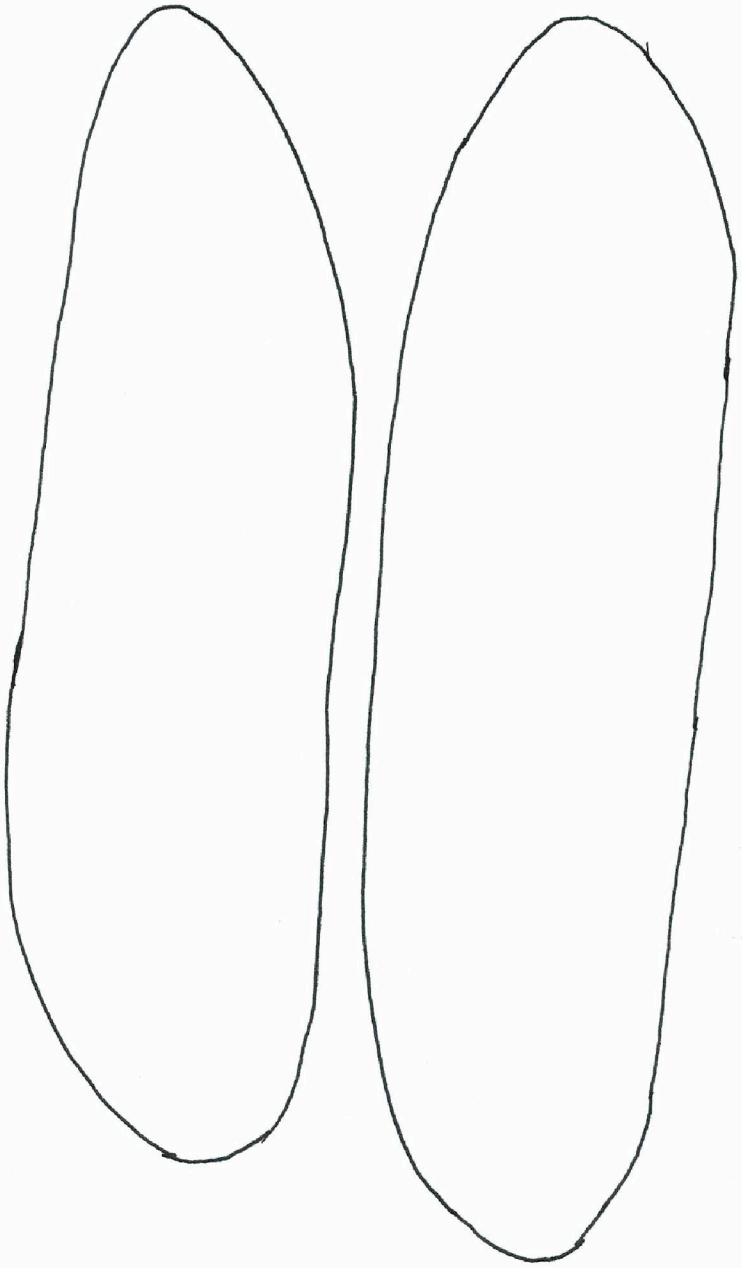
AVID FriendChip Microchip

2” Distance.



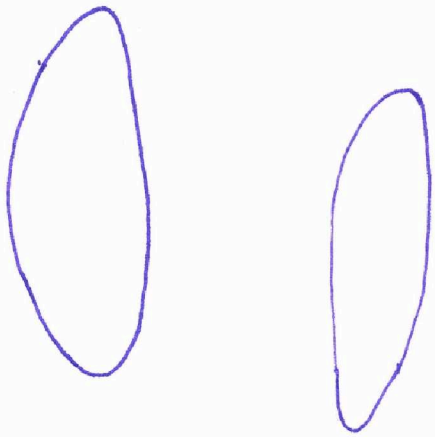
HomeAgain Microchip

2” Distance.



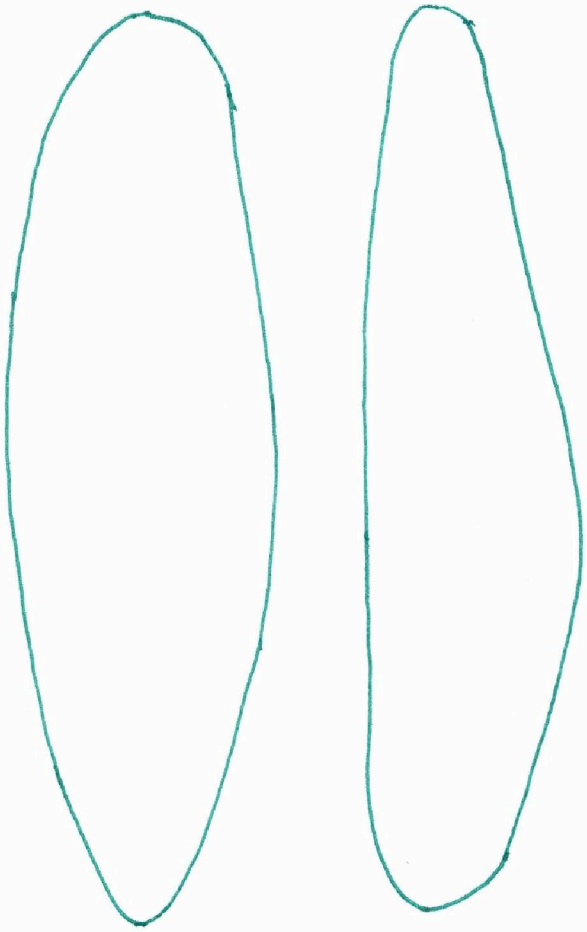
Trovan Microchip

1 ½" Distance. Does Not Read at 1 ¾".



Bayer Microchip

2” Distance.



LID-560US

- **Single antenna (uses ferrite rod)**
- **128 kHz excite frequency**
- **Reads the three U.S. implanted base microchips & ISO FDX-B microchips (currently does not display ISO ID # due to legal issues impacting sale of FDX-B Transponders in the US)**
- **Microchip orientation severely restricted for reading**
- **Manufacturer: EID Aalten NV**
- **Distributor in U.S.: AKC CAR**

AVID FriendChip Microchip

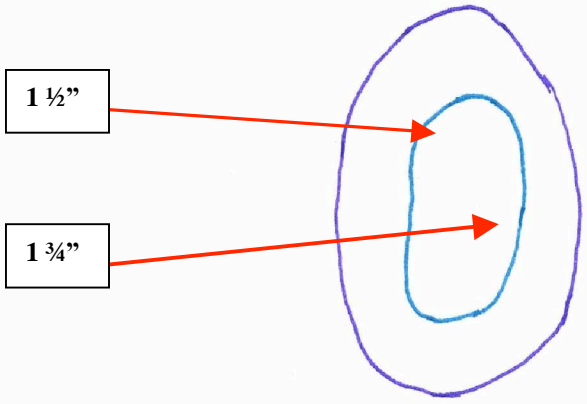
1 ¼" Distance. Does Not Read at 1 ½".

HomeAgain Microchip

1 ½" Distance. Does Not Read at 2".

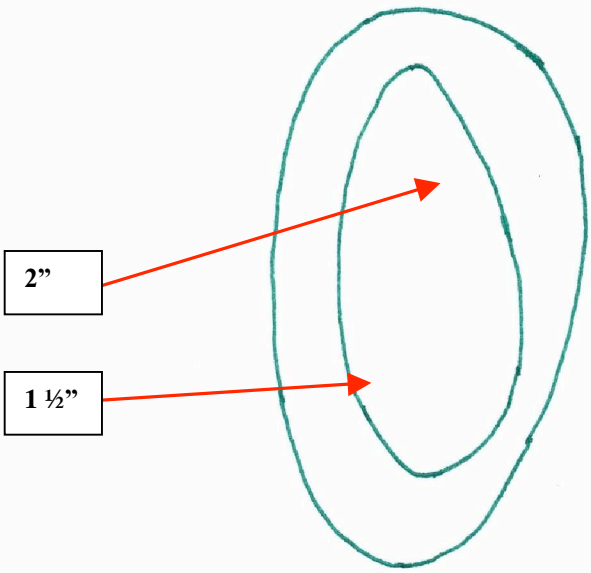
Trovan Microchip

1 ½" & 1 ¾"Distance. Does Not Read at 2".



Bayer Microchip

1 ½" & 2" Distance. Does Not Read at 2 ¼".



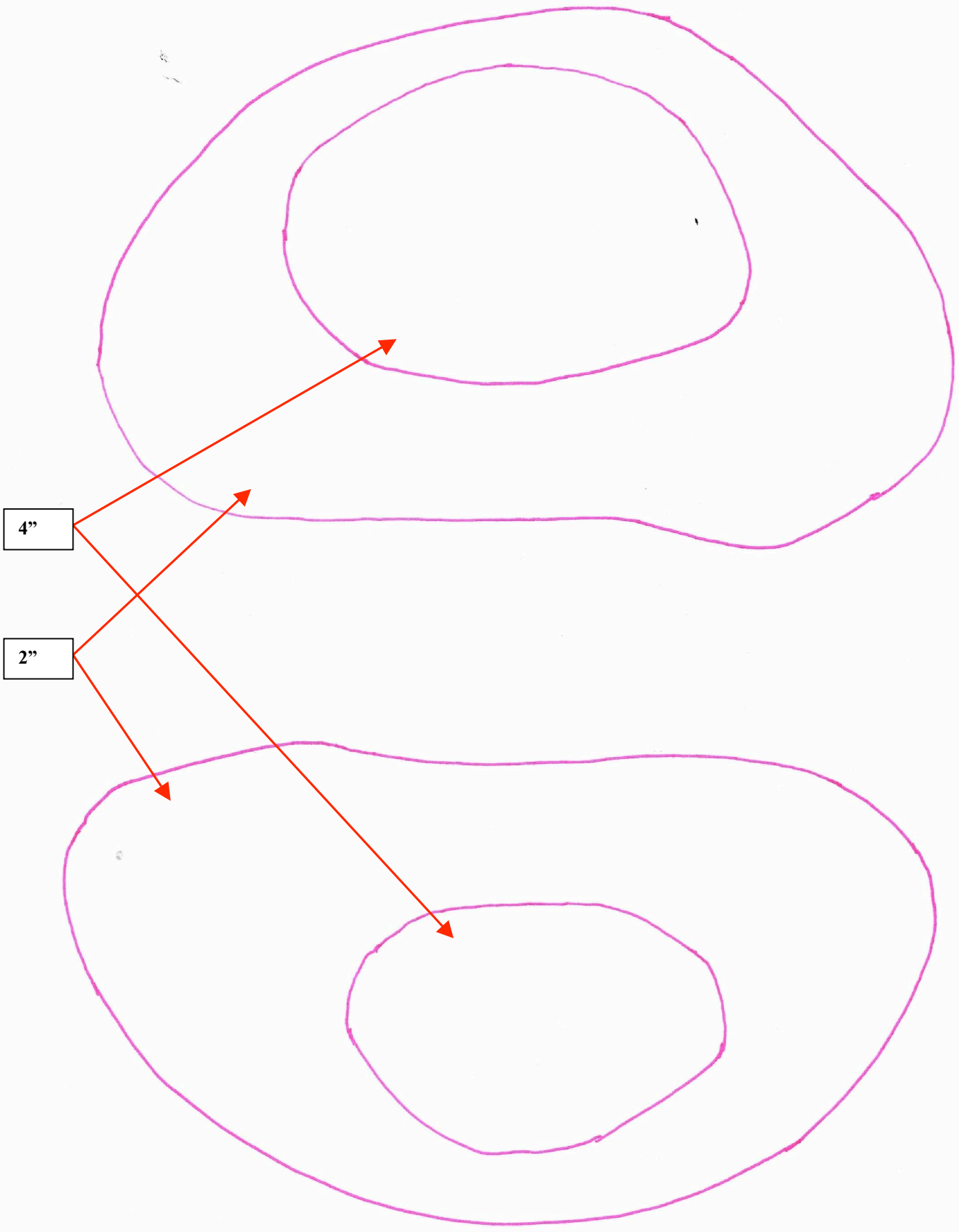
GR-251SR

- **Triple coil antenna**
- **128 kHz excite frequency**
- **Reads the three U.S. implanted base microchips & ISO FDX-B microchips (currently programmed to not display ISO ID # due to legal issues impacting sale of FDX-B Transponders in the US)**
- **Rugged design for shelter use**
- **Omni directional microchip orientation allowed**
- **Manufacturer: Vantro Systems**

SCALE
1”=1.2”

AVID FriendChip Microchip

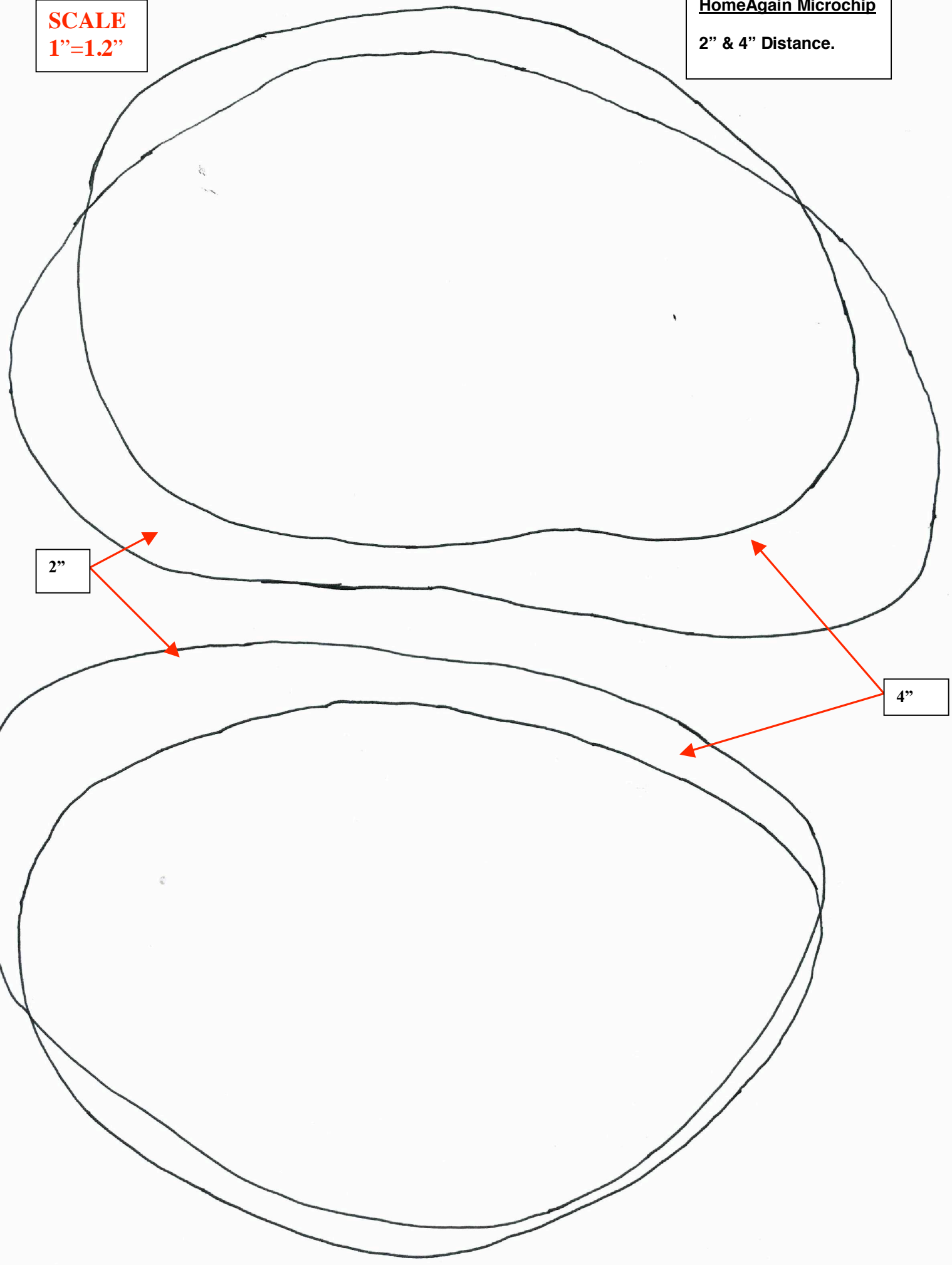
2” & 4” Distance.



SCALE
1”=1.2”

HomeAgain Microchip

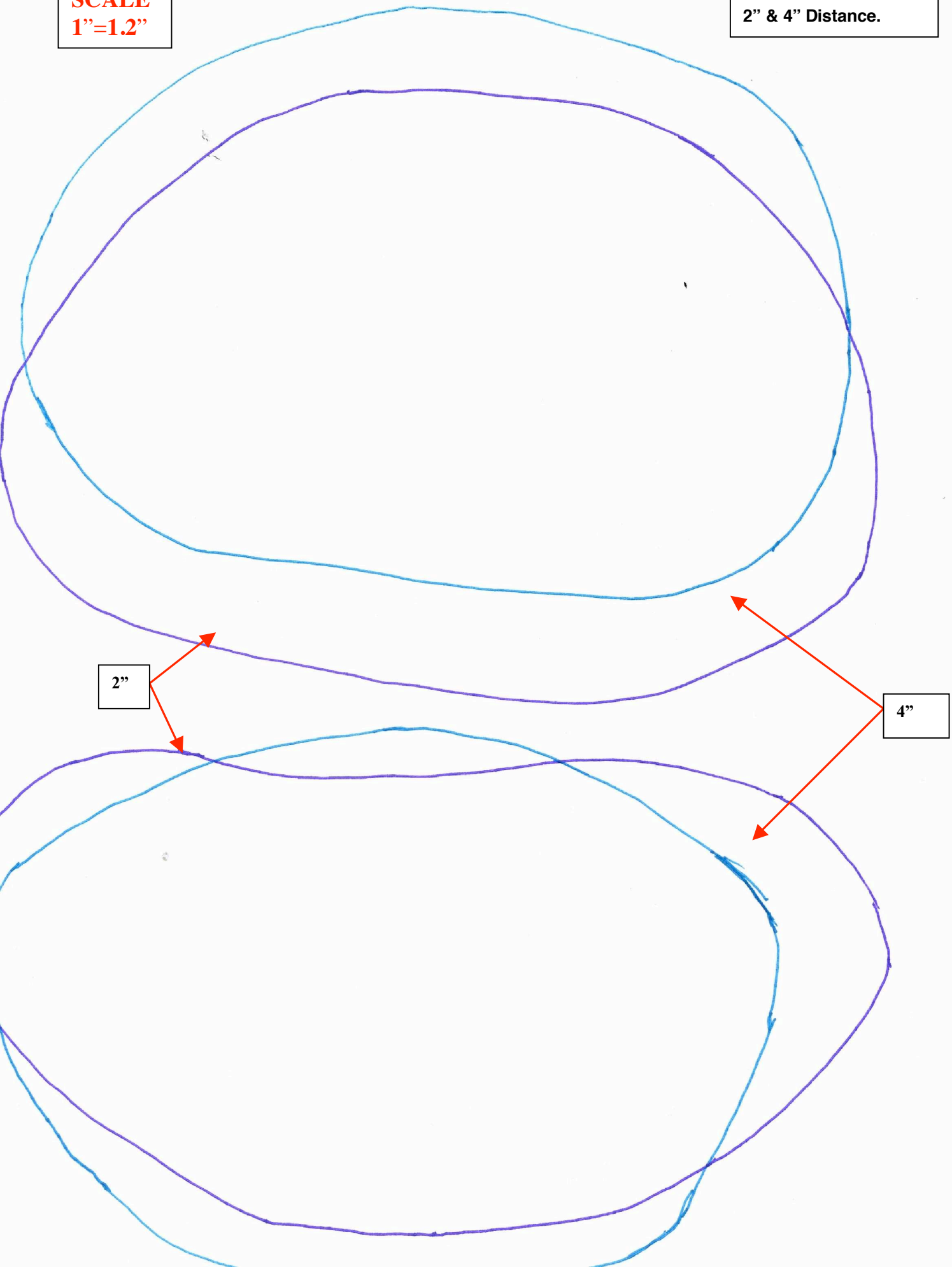
2” & 4” Distance.



SCALE
1”=1.2”

Trovan Microchip

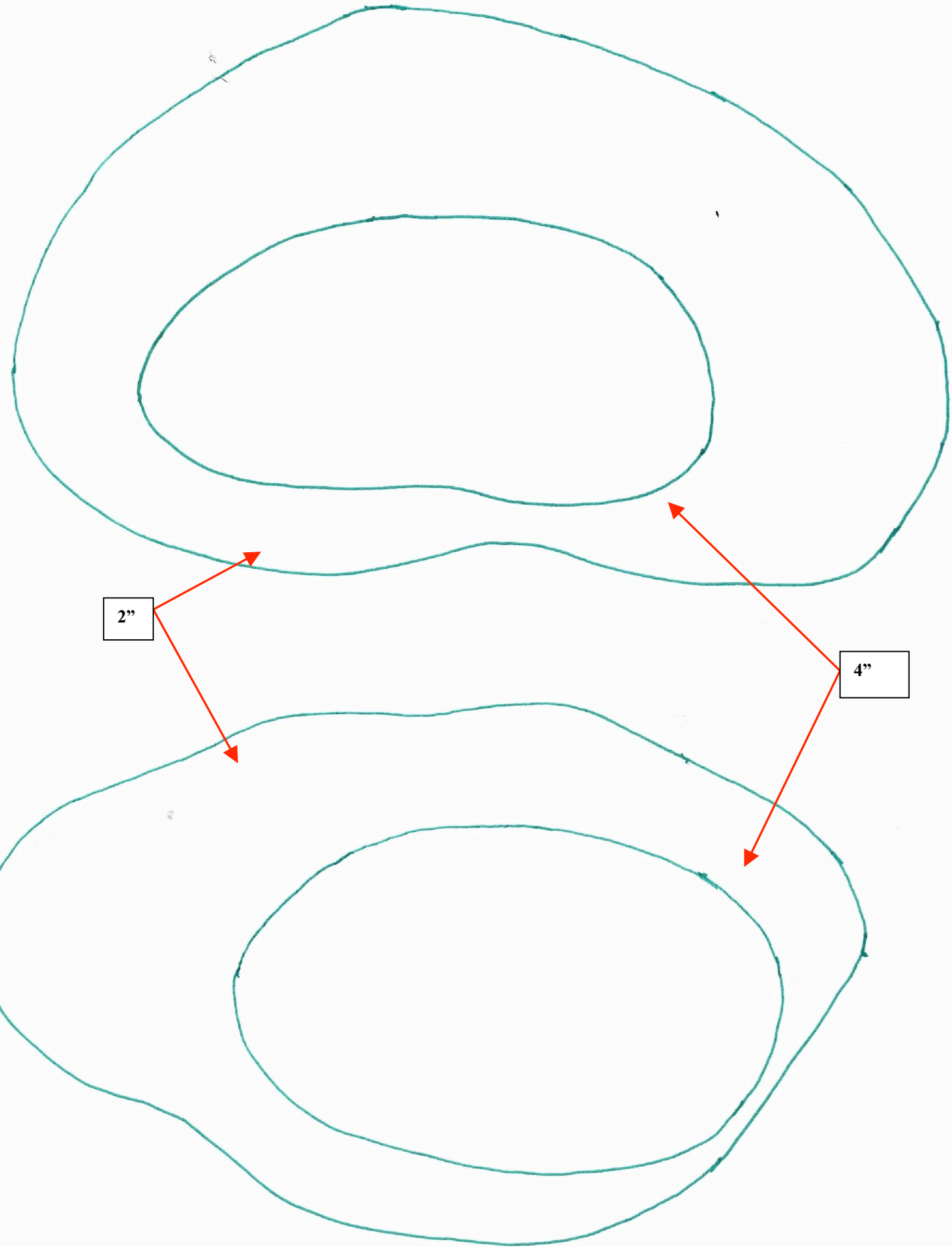
2” & 4” Distance.



SCALE
1”=1.2”

Bayer Microchip

2” & 4” Distance.



AIM USA

AIM USA
Companion Animal
Electronic ID User Requirements

TABLE OF CONTENTS

This document was developed and published by AIM USA, an affiliate of AIM International, the world-wide trade association for manufacturers and providers of Automatic data collection and identification products, services and supplies.

A rigorous review process is followed for each document in which all member companies were offered the opportunity to review the document prior to publication. Liaison with other affiliates was also maintained.

This document is intended as a guide to aid the manufacturer, the consumer, and the general public. Its use is entirely voluntary.

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Published by:
AIM USA
634 Alpha Drive
Pittsburgh, PA 15238-2802
USA
Phone: (412) 963-8588
Fax: (412) 963-8753
BBS: (412) 963-9047
email: tech@aimusa.org

October 1994

1 Introduction

The task of identifying companion animals (pets) and reuniting them with their owners is the charter of the approximately 3,000 animal shelters across the United States. The overwhelming majority of these stray pets have no visible form of identification. Electronic identification using RFID transponders provides permanent, unalterable, and unique identification of companion animals, thereby creating a better chance to return them to their owners, rather than being placed with new owners or unnecessarily euthanized.

The efficacy of an electronic identification system used to identify companion animals is determined by how well the system satisfies the following three basic requirements:

A) Be Safe and Humane - The injection or attachment of the transponder must be as painless as possible, cause minimal trauma to tissue, be non-toxic/non-carcinogenic, and have a low propensity to move (i.e., migrate).

B) Be Reliably Read - The transponder should be unaffected by body tissue and fluids, be expected to operate properly over the life of the animal, and be reliably read by the scanner under expected animal shelter conditions of electrical noise, temperature, and other environmental conditions. The scanner must operate properly under field use conditions.

C) Have Minimal Impact on operations - The animal scanner should require minimal time for personnel to operate and reliably acquire the transponder's identification number from each animal. The reading operation should minimize risk of personnel injuries due to handling of the animal (i.e., bitten/scratched). The animal scanner should meet compatibility requirements to eliminate the need to scan the animal more than once.

To assure these basic requirements are adequately satisfied, this document defines minimum performance requirements for companion animal electronic identification systems and their component parts: transponder, scanner, and delivery system.

This document shall be complemented by veterinary practices and procedures guidelines. Changes and amendments to this document shall follow current AIM$_{USA}$ practices for technical documents. As a minimum this document shall be reviewed and revised, reaffirmed, or withdrawn every 5 years.

2 Scope

This document shall apply to the electronic identification of companion animals.

3 Purpose

The purpose of this document is to establish minimum performance requirements for electronic identification of companion animals.

4 References

4.1 *Companion Animal Electronic Identification Veterinary Practices and Procedures Guidelines* - available from the American Veterinary Medical Association, 1931 Meacham Road, Suite 100, Schaumberg, IL 60173-4360

5 Definitions

5.1 AIM_{USA}: The trade association of the Automatic Data Collection (ADC) industry.

5.2 Companion Animal: An animal kept predominately for pleasure.

5.3 RFID: Radio frequency identification.

5.4 Scanner: An electronic device (sometimes called a reader) which creates a magnetic field to power a transponder and receives, decodes, and displays the unique identification number from the transponder. The scanner may provide various other functions and features to the user.

5.5 Transponder: An electronic device which receives power via a magnetic field from a scanner and transmits its unique identification number via a magnetic field back to the scanner.

5.6 Injectable Transponder: A hermetically sealed biocompatible transponder suitable for injecting into animals.

5.7 Passive: Externally powered.

6 Requirements

The purpose of this section is to define performance criteria that will assist in developing a comprehensive standard for companion animal RFID.

6.1 Transponder

6.1.1 Size

The transponder electronics employed shall be capable of meeting the size requirements of injectable transponders as defined in Section 7.1.

6.1.2 Materials

The transponder materials shall be non-harmful to the companion animal.

6.1.3 Operating Life

The transponder shall be passive. The transponder shall operate properly when interrogated with a compatible reader over the expected life of the animal.

6.1.4 Reliability

The transponder shall have a read reliability >99.9% immediately after injection and greater than 98% after 5 years.

6.1.5 Identification Number

The transponder design shall provide a minimum of 238 unique identification numbers and the transponder identification number encoding process shall prevent duplicate numbers from being produced. There will be a manufacturers code. The transponder design shall be such that the identification number cannot be modified once the transponder fabrication is complete.

6.1.6 Operating and Storage Temperature

The transponder shall operate to required performance standards over the temperature range of -20°C to +50°C (-4°F to +122°F). The transponder shall be capable of surviving a storage temperature of -40°C to +90°C (-40°F to +194°F).

6.1.7 Read Compatibility

The transponder shall be excited and correctly read by the scanner identified in Section 6.2.

6.2 Scanner

The scanner shall provide the functions and performance levels required for use in a veterinary hospital, in an animal shelter, and by animal control personnel in outdoor field conditions. The embodiment of the scanner shall be capable of reading any transponder meeting the requirements of the TBD AIM$_{USA}$ Technical Specifications.

6.2.1 Hand-Held Scanner

The hand-held scanner shall be capable of exciting the transponder at distances, areas, and transponder orientations specified below. once the transponder is excited, the scanner shall receive, process, and display the transponder identification number within 1 second.

6.2.1.1 Read Performance

The scanner shall be capable of powering and reading the transponder at a minimum distance of 4 inches over an area of one foot square within 10 seconds at a velocity of one foot per second. The transponder may be at any arbitrary orientation with respect to the scanner antenna.

6.2.1.2 Read Accuracy

The scanner shall employ error checking techniques to prevent false identification number readings. The probability that the identification number read and displayed is inaccurate shall be less than 10^{-6}.

6.2.1.3 Displays, Controls, and Indicators

The transponder identification number shall be displayed by an alpha and/or numeric display with a character size suitable for easy reading by the operator. The scanner operation shall require the use of only one hand. In addition to the display of the transponder identification number, the scanner shall provide an indication that a transponder has been read.

6.2.1.4 Operating Temperature

The scanner shall provide performance in accordance with the minimum standards while operating in an ambient temperature between 0°C and +65 C (+32°F and +149°F)

6.2.1.5 Storage Temperature

The scanner shall provide performance in accordance with the minimum standards after indefinite storage at any temperature between -20°C and +70°C (-4°F and +158°F) after being returned to the operating temperature range.

6.2.1.6 Humidity

The reader shall be capable of storage and operation at relative humidity levels to 95% (non-condensing).

6.2.2 Hands Free Scanner

The hands free scanner shall be capable of exciting the transponder at distances, areas, and transponder orientations specified below.

6.2.2.1 Read Performance

The scanner shall be capable of reading the transponder without the use of the operator's hands at any arbitrary orientation of the transponder with reference to the scanner antenna as a companion animal is walked or carried by the face of the antenna.

6.2.2.2 Read Accuracy

Same as Section 6.2.1.2.

6.2.2.3 Displays, Controls, and Indicators

The transponder identification number shall be displayed by an alpha and/or numeric display with a character size suitable for easy reading by the operator. In addition to the display of the transponder identification number, the scanner shall provide an indication that a transponder has been read.

6.2.2.4 Operating Temperature

Same as Section 6.2.1.4

6.2.2.5 Storage Temperature

Same as Section 6.2.1.5

6.2.2.6 Humidity

Same as Section 6.2.1.6

6.2.3 Backward Compatibility

Backward compatible scanners may be either hand-held or hands free. The backward compatible scanner shall have the capability to reliably read the three transponder types being injected into companion animals in the United States as of October 1, 1993: the Trovan ID-100, the Destron TX1400L, and the AVID ITI-125S, as well as any new transponder meeting the requirements of the TBD AIM$_{USA}$ technical standard.

6.3 Veterinary Practices and Procedures Guidelines

Guidelines for the implantation of a transponder are contained in Companion Animal Electronic Identification Veterinary Practices and Guidelines (Reference 4.1).

7 Requirements Specific to Injectable Transponders

7.1 Size

The transponder shall have a maximum length of 12 millimeters and be easily implanted using a 12 gauge or smaller diameter needle.

7.2 Encapsulation

The transponder circuit components shall be hermetically sealed in biocompatible glass or materials having the hermetic properties of glass.

7.3 Materials

The transponder materials shall cause no harm to the companion animal in the event of failure of the transponder capsules hermetic seal.

AIM USA

THE TRADE ASSOCIATION OF THE AUTOMATIC DATA COLLECTION INDUSTRY

634 Alpha Drive
Pittsburgh, PA
15238-2802

Phone
(412) 963-8588

Fax
(412) 963-8753

BBS
(412) 963-9047

Internet
adc@aimusa.org

Mr. Larry Kuechle	Advanced Telemetry Systems, Inc	(612) 444-9384
Mr. Glen Barone	AEG	(908)204-8945
Dr. Schenk		
Mr. James Seiler	ALLFLEX SA	(303) 449-9665
Mr. Bob Stewart		
Mr. Brett Hinsch, DVM	American Animal Hospital Assoc.	(602) 885-2462
Dr. Patricia Olson	American Humane Association	(303) 792-5333
Mr. Robert Keely	American Kennel Club	(919) 233-3618
Dr. Richard Grambow, DVM	American Veterinarian Med. Assoc.	(847) 925-1329
Dr. Karen Wernette, DVM		
Mr. Tony Kosarew	AT&T Global Information Solutions	(513) 439-8517
Mr. Jim Albertson	Atlanta Humane Society	
Mr. Douglas Hull	AVID	(909) 737-8967
Dr. Hannis Stoddard, III DVM		
Mr. Peter Troesch		
Ms. Vickie Cameron	City of Henderson Police Department	(702) 565-8933
Mr. James S. Bianco	Control Module, Inc.	(203) 741-6064
Mr. James Mason	Datacode Systems, Inc.	(216) 498-3410
Mr. Kenneth A. Quinn		
Mr. Zeke Mejia	Destron Fearing Corp.	(612) 455-0413
Mr. David Clemons	Destron Fearing Corp.	(800) 362-1429
Ms. Barbara Masin	Electronic Identification Devices,(EID)	(805) 969-1542
Mr. Darrin Drollinger	EMI/AEA	(312) 321-1480
Mr. Kevin Owen	Equine ID	(817) 624-1686
Ms. Amelita Donald		
Mr. Michael Sloe	Identatronics, Inc.	(216) 461-8222
Mr. Keith Myhre	Infopet ID Systems	(612) 890-2054
Mr. Robert E. Cooper	Livestock Monitoring Systems, Inc.	(815) 633-6089
Ms. Lyng Wong	Metanetics Corporation	(206) 806-7560
Mr. Norm Weiland	Monarch Marking Systems	(513) 865-2380
Mr. Coy Willis	NACA	(915) 686-1603
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Mr. Ron Vingerling	NEDAP Agri	011-61-31 5753 3725
Ms. Donna Keller	PSC Inc.	(716) 265-6400
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Mr. Thomas Wettach	Titus & McConomy	(412) 642-2950
Mr. Jimm Grimm	Transilwrap Company, Inc.	(317) 935-4924
Mr. Joe Masin	Trovan, Ltd.	(805) 969-1542
Mr. Clive P. Hohberger	Zebra Technologies Corp.	(847) 913-2274
Mr. Roger Lall	Zebra Technologies Corporation	(847) 913-8766