TEXAS INSTRUMENTS

Tag-it™ Environmental Effects on Transponder Inlays

Application Report

TIRIS Technology by Texas Instruments™

MARCH 1999

SCBA018

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Literature Number: SCBA018
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About This Application Report

This application note describes the performance of TIRIS transponder inlays under environmental influences, describes and gives the results of a series of tests carried out in the Texas Instruments laboratories.

Chapter 1:

Gives a general description of the transponder inlay types tested and the tests performed.

Chapter 2:

Describes the test setup used.

Chapter 3:

Test results.

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Chapter 1
SCBA018–MARCH 1999

Introduction

Topic **Page**

1.1 General

Tests described in this application note were performed with Tag-it transponder inlays of the type:

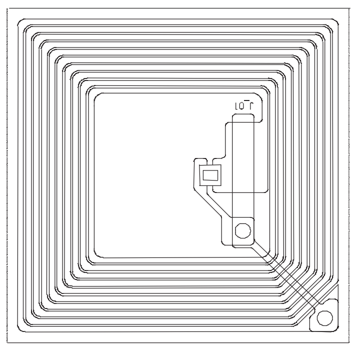
RI-I01-0110A-00 (square antenna)

RI-I02-0110A-00 (rectangular antenna)

Note: Detailed information on how to handle transponder inlays for label manufacturing and other purposes is available in the application note Tag-it Transponder Inlays (No. 11-09-22-078) available as an Adobe Acrobat document (PDF file) via the Texas Instruments internet home page: http://www.tiris.com

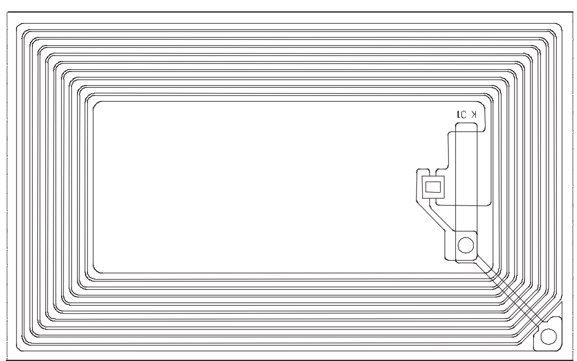
1.2 Transponder Types

The following transponder types were used for testing purposes:



A Transponder size: 45 x 45 mm, antenna J_01

Figure 1-1. Transponder RI-I01-0110A-00



A Transponder size: 45 x 76 mm, antenna K_01

Figure 1-2. Transponder RI-I02-0110A-00

Test Set-up for Measurements

Topic **Page**

2.1 General

These tests have been carried out in the Texas Instruments laboratories to provide information concerning performance of the TIRIS transponder inlays in conditions approximating those to be found in user environments, with results which are applicable to a real-world situation. The set-up described here was used to measure the performance of the transponder inlays after carrying out the series of tests described in Chapter 3.

The criterion used to determine the definition of good transponder inlay performance was the maintenance of readability without errors during the testing processes.

2.2 Test Set-up

The test configuration, a Reader/Antenna set (RI-K02-320A), was connected to the host PC via an RS 232 Interface. For control of the Tag-it Reader/Antenna Set, Tag-it Navigator software, a utility and demonstration program which may be downloaded from the TIRIS web site, was installed.

Note: The Tag-it Navigator is a Windows™ program capable of communicating with the Tag-it reader via a standard serial interface. It supports the Host Protocol implemented in the reader, allowing the execution of commands such as the writing and reading of data to and from Tag-it transponders. Tag-it Navigator, which runs within the Windows™ environment, is menu-driven and can be employed to assist in reader set-up, tuning, and diagnosis. It can additionally log transponder responses for initial experimentation and testing with the Tag-it system. It also provides data and time information and can display the acquired data in a number of formats.

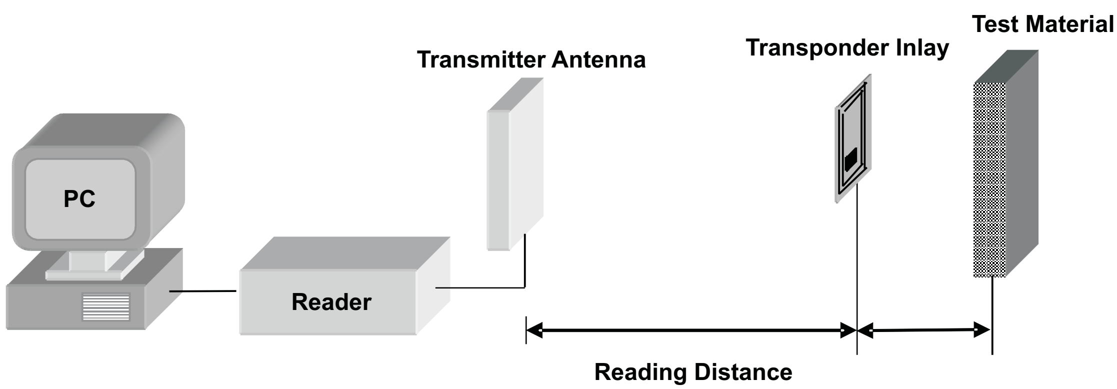


Figure 2-1. Test Set-up

2.3 Test Conditions

Environmental

Laboratory room temperature: 23°C

Laboratory humidity: 42% relative

Electrical

Transponder type:	RI-I01-0110A-00	RI-I02-0110A-00
Field strength:	153 dB/uVm	156 dB/uVm
Max. read range:	220 mm	190 mm
Transmitter power:	800 mW	
Transponder inlay operating frequency:	13.56 MHz	

Test Results

Topic **Page**

3.1 General

The graphs shown in the following chapters show the results for both of the transponder types tested. The maximum reading performance was achieved with the transponder inlay type RI-I02-0110A-00 (rectangular antenna).

3.2 Effects of Metal

The effect of different test materials was evaluated by successively moving the test material towards to the Tag-it transponder inlay, the measurements being carried out statically, i.e., with the material at rest.

Test Set-up

Configuration as described in chapter 2.2, Figure 2-1.

Test Material

Aluminum plate 100 x 100 x 10 mm

Steel plate 100 x 100 x 10 mm

Test Results

The performance of a transponder facing a metal background depends primarily on the distance between the transponder inlay and the metal background as well as the transponder size and type. Both types of metal tested gave similar results, these being shown in Figure 3-1. The X-axis of this graph shows the test distance between the transponder and the metal object, while the Y-axis shows in percent terms the relative read range, i.e., the percentage reduction of the read range within the user's environment. (This form of reporting allows a direct transfer of results to a real-world environment.)

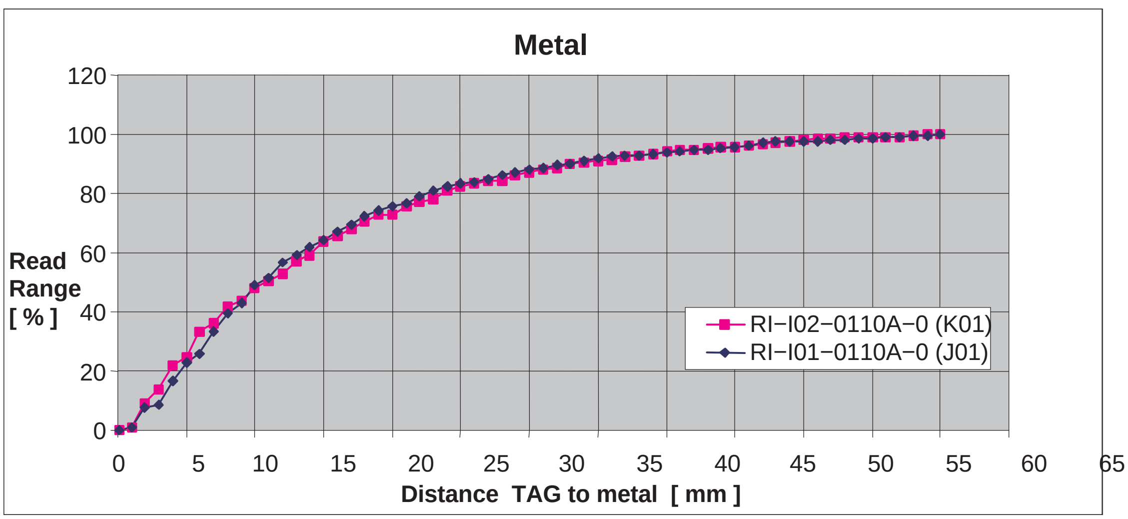


Figure 3-1. Effects of Metal Objects

3.3 Effects of Contact With Various Materials

Since the transponder inlay is often in direct contact with other materials, for example for mechanical support purposes, this test has been carried out to gather data relating to this condition.

The distances used between the test materials and the transponder inlay differ according to the type of material used, with in some cases the test material being attached directly to the transponder inlay.

Test Set-up

Configuration as described in chapter 2.2, Figure 2-1.

Test Conditions

Test materials were either bonded or laminated to the transponder inlay, these materials being PVC, PET, normal paper and silicon-coated paper.

Test Results

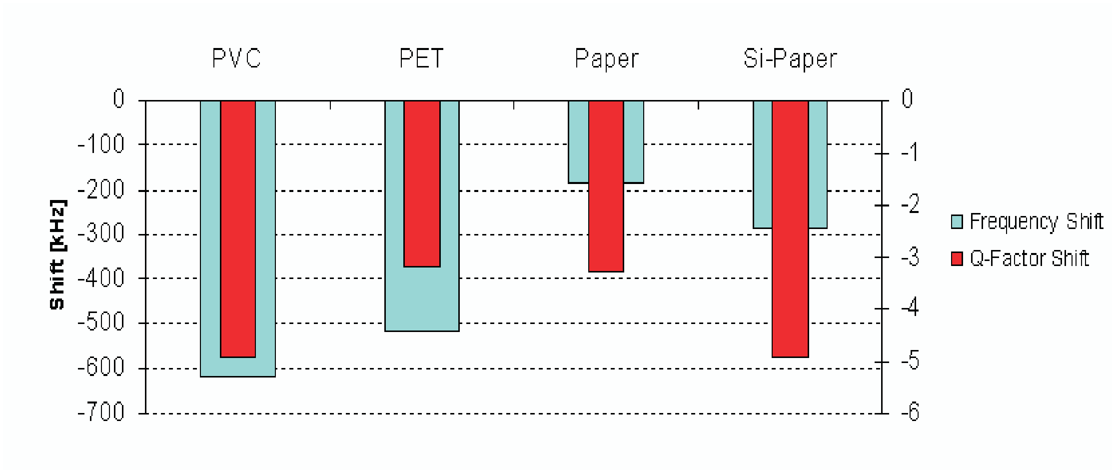


Figure 3-2. Effects of Various Materials

3.4 Effects of a Second Transponder Inlay

This test simulates a situation which can occur in a production environment, namely that two transponders are found in close proximity to each other.

Test Set-up

Configuration as described in chapter 2.2; Figure 2-1.

Test Conditions

The test material shown in Figure 1-2 was replaced by a second transponder inlay.

Test Parameters

Two similar transponder types were used to measure the influence of a second transponder inlay.

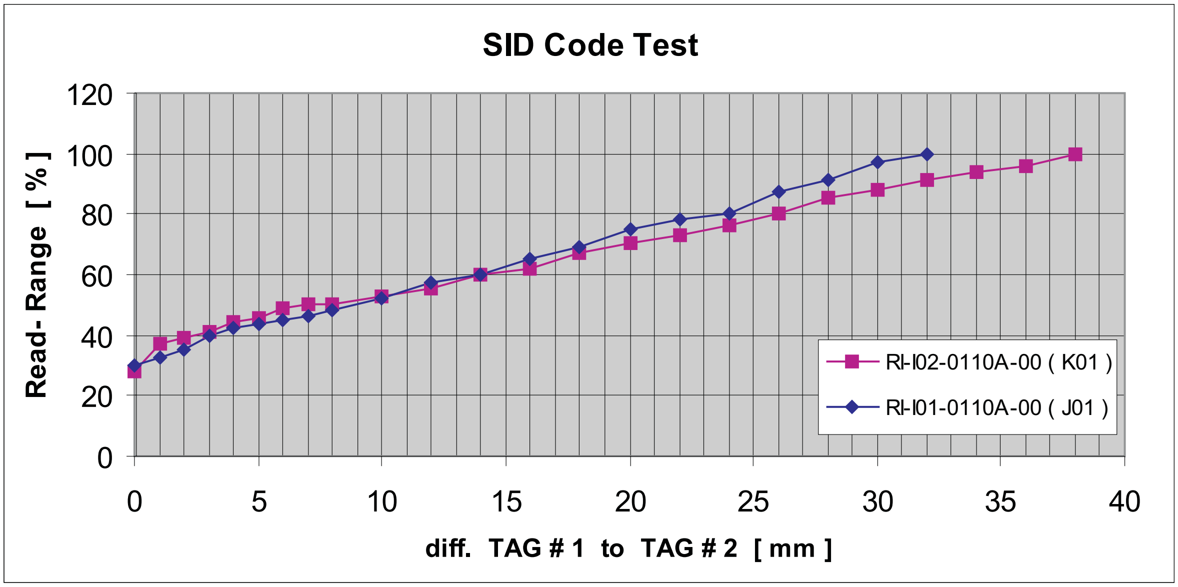


Figure 3-3. Effects of a Second Transponder Inlay

3.5 Ultra-Violet Sensitivity Test

This test was carried out to approximate, under laboratory conditions, the effects of exposure of the transponder inlays to ultra-violet light. The transponder chips were placed in open ceramic housings and then exposed to a strong ultra-violet light source, a UV EPROM eraser (Spectroline Model PR 125 T/F) being used for this purpose. Similarly, the transponder inlays themselves were placed in open ceramic housings and irradiated first from the top, then turned through 180° and irradiated again.

Test Conditions

All blocks programmed with 5555555hex

Check of user block contents

Check of SID number Check of lock bit function

Test Parameters

UV Wavelength: 254 nm

Intensity: 17000 µW/cm2

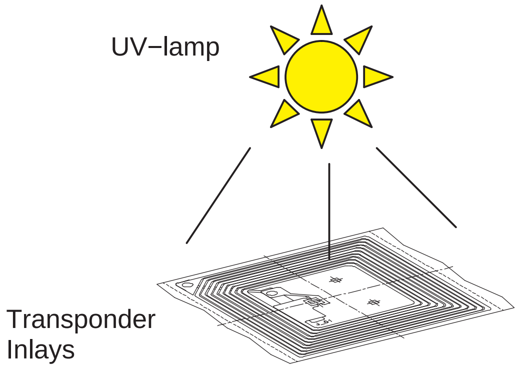


Figure 3-4. UV-Sensitivity Test Set-up

Table 3-1. UV Exposure Test Results

Item	No. of Samples	Duration of Irradiation		
		Start	**10 minutes**	**2 hours**
Chip in open ceramic housing	4	No failures	Erased	-
Inlay RI-I01-0110A-00 (top side)	10	No failures	No failures	No failures
Inlay RI-I01-0110A-00 (bottom side)	10	No failures	No failures	No failures

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