

A **Paxar Americas, Inc.** White Paper

PAXAR

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Practical Guide To RFID Label Quality

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Introduction

You can do a quick analysis or comparison of quality without expensive equipment.

Matching RFID Labels with Printer/Encoder

Ensure that the RFID labels match with the capabilities of the printer/encoder.

Read Range

Checking or comparing the read range of different labels.

Flexure

Another measure of RFID label quality is its durability when flexed.

Adhesion to Fiberboard

Testing the label's ability to adhere to the carton.

ESD (Electrostatic Discharge)

Checking the label's resistance to static electricity.

Defects in Delivered Rolls of Labels

Reputable label manufacturers will test inlays before inserting them into labels.

Practical Guide to RFID Label Quality

Introduction

Detailed analysis of the quality of RFID labels requires expensive equipment and some experimental skill, but with access to an RFID reader and other common equipment, almost anyone can get some indication of the quality of their RFID labels. The tests described here give you the most basic of information-if more authoritative results are required, you should consult a professional RFID testing lab.

Matching RFID Labels with the Printer/Encoder

It's important that the RFID labels used with the printer/encoder match in protocol. The protocol of an RFID label refers to how a tag and reader talk to each other. For optimal performance, the internal RF antenna system in the printer/encoder and the supply running through the printer needs to be matched. For example, if you tried to use Gen 2 supplies in a printer/encoder configured to support Class 1, Gen 1 protocol, you might experience errors such as partial recording of the RFID information, which can render your RFID labels unreadable or

incorrectly readable. Many of the latest RFID printer/encoders are "multi-protocol", but "multi" does not mean "all".

In addition to matching protocol, the position of the inlay within the label must meet the particular printer manufacturer's specification. Many printer brands require different inlay locations. If the labels you have are not a perfect match, some may encode properly but errors can result.

The best way to avoid this problem is to check the RFID label box and packaging for an indication that the labels are intended for the printer/encoder model involved. If the labeling isn't clear, contact the label manufacturer for documented assurance.

Read Range

Read range is the distance from which a reader can communicate with a tag. The longer the read range, the better the performance of the RFID label.

A simple test of read range can be conducted by setting up an RFID reader in a large open area. Place an RFID label on an empty carton and place the carton on an RF friendly platform (wood, plastic, etc.) with the label facing the center of the reader antenna.

Stand behind the reader antenna holding it facing the tag, but far enough away so that no reading occurs. Then slowly move the reader antenna toward the empty carton and record the

distance at which good reads start to occur.

If the reader being used reads continuously, record the distance at which good reads occur on about 50% of the read cycles.

Repeat this test with about 15 individual RFID labels chosen from a batch at random. Find the average of the recorded range measurements. Also find the standard deviation of this list. (Many small calculators have a simple way of finding the average, usually called "X" and standard deviation, usually called "S". Microsoft Excel also has an easy way to find "X" and "S".)

A comparative measure of the quality is the average value of the range (larger is better) and the spread of the range readings represented by the standard deviation (smaller is better). While no minimum standard has yet been established, a range average of 12 to 15 feet is usual and a standard deviation of range of less than 5% of the average range is desirable.

Flexure

Another measure of RFID label quality is its durability when bent around small radius corners. Sharp bending can happen when an RFID label is applied to a soft or irregular surface, causing failure in poor quality labels.

A test for flexure durability is to attach a one-pound weight to one end of an RFID label, with the long direction of the RFID antenna pointing towards the weight. Repeatedly pull the label over a ½" diameter rod with about 90 degrees of the rod in contact with the label. High quality labels will tolerate 20 or more repetitions before failure.

Adhesion to Fiberboard

An important function of most RFID labels is to stay affixed to a fiberboard carton, throughout the life of the carton.

To get an indication of this feature, apply several RFID labels to several cartons, wait about one hour and then try to pull them off. If they are difficult to remove and the adhesive side of the labels shows lots of fiber torn away from the cartons, the labels will likely adhere satisfactorily, indicating high quality adhesion.

If the cartons are to have an end use that involves unusual environmental conditions (e.g. freezer temperatures, extremely high humidity, etc.) this test should be performed under those environments. Reputable label manufacturers will direct you to special adhesives that perform best under these special conditions.

ESD (Electrostatic Discharge)

RFID labels can be ruined by discharges of static electricity that can result from printer/encoder or operator effects,

particularly in low relative humidity environments. Low humidity is common in winter, at high altitudes or in desert areas.

To test if the RFID labels are unusually susceptible to ESD damage, choose about ten labels and cut them apart with the release liner still attached. Measure the range capability of each with the procedure as described above. Next, with a rapid motion, strip the release liner from each label. Again check the range capability. Any labels with partial or total loss of range, indicate some ESD damage. Quality labels will not show significant difference in range capability.

Defects in Delivered Rolls of Labels

Reputable label manufacturers will test inlays before inserting them into labels, and some will test the finished label again, discarding those that are "bad" or exhibit low power at each testing station. Of course, if defective labels are found in the "as delivered" roll, this is a major indication of poor quality. At this stage of technology development, good quality rolls of labels should have, at most, no more than one or two defective labels per hundred labels.