

TOPFLIGHT INNOVATIONS

RFID Label Performance in Liquid Nitrogen

Abstract: Topflight Corporation has completed the testing of various RFID label frequencies in liquid nitrogen with successful read results to temperatures below -196°C . Cryogenic freezing has long been used to preserve organic materials, and has also proven a difficult environment for radio frequency transmission. In all studies, both the chip and chip mounting sustained complete immersion in LN₂ (liquid nitrogen), operated effectively just above the LN₂ bath, and performed accurately just out of the LN₂ tank. A complex adhesive configuration also ensured the label itself endured such extreme temperatures and still remained affixed to the container. The test involved the preservation of biologicals for medical research which are individually tagged and read in separate vials. With the survival of both the construction and the electronics in LN₂, a system should shortly be completed which will read an entire case of vials simultaneously with no reliance on human or print readables.

Repositories have long relied on freezers to store and maintain collections of all types. Whether cells, tissue, or any number of samples, cryostorage has played a critical role in preserving a viable collection. Recent advancements show that RFID (Radio Frequency Identification) is ready to greatly increase the efficiency of labeling, securing, maintaining and even tracking the movement of such collections in 2006.

In addition to those interested in the safety and security of priceless samples in freezers, the byproduct of RFID implementation may mean exponentially greater efficiencies in counting inventories of specimens.

Since cryopreservation is required for many collections, the question was once how to label and easily identify individual samples. From its inception, barcodes have played a role in identifying a specimen, whether while in freezers or during transit. Once cutting edge technology, linear barcodes allowed scanners to reduce errors by "reading" the identification of the sample. More recently, 2D barcodes have been used where a larger amount of data was desired to fit onto a small label. Using a printed barcode works best when you can simply link it to a database. Privacy and blind studies are protected when sensitive information is not kept on a labeled vial. There is also typically very limited space. Adding an RFID component to freezer labels will enhance the security of repositories.

However, for the past 12 to 18 months, several different frequencies of RFID transponders have been frozen and read. Very low temperatures have not compromised the integrity of these RFID transponders at all. Enhanced by the integration into a proven freezer label that both protects the antenna and also sticks to vials in freezers, RFID technology is poised to become the next breakthrough in repository management.

Tom Hartmann of Topflight Corporation has converted these RFID labels and tested them with Partnered Print Solutions. Hartmann notes, "We have shown that freezers do not affect RFID labels that have been applied to full vials and even when not allowed time to thaw." Hartmann adds, "Multi-frequency testing shows us that we can offer the RFID technology to clients who must put the RFID labels to the test in severe environments, and they won't be hurt by freezing."

2005 saw the completion of Partnered Print Solutions' testing of RFID labels in room temperature, 4°C cooler, both -20° and -80°C

mechanical freezers and even in -196° liquid Nitrogen freezers. In every instance, the transponders embedded in freezer labels read successfully. To further test the resistance of the transponder to cold environments, they were submerged into liquid Nitrogen without the surrounding label and still read successfully. Many physical demands were placed on them including stepping, crushing, folding and wrapping and only with the exception of physically cutting the antenna, they read in every trail.

The next step promises to be the most exciting. With traditional barcodes, line of sight is required to read freezer labels. This can be a tedious, time-consuming and costly operation if each labeled vial is frost covered and thawing is not an option. However, when transponders have been embedded into a freezer label, we can read the transponder even if the barcode is not visible! This marriage offers protection for the chip and a reliable, proven adhesive for even LN₂ storage. All this is achieved with an easy encoding and printing process-all in one pass through an RFID thermal transfer printer that includes a traditional printed barcode as well!

Time saved in counting inventories of labeled frozen samples that do not require line of sight barcode scanning may more than pay for costs to add RFID technology to present barcode printing operations. Secure shipping and tracking is yet another benefit for those concerned with security.

Partnered Print Solutions is now marketing proven freezer labels which will be able to have both a visible barcode printed on them and an invisible readable code encoded inside them. The transition to this cutting edge technology is easier than ever-with conversion at your own pace.

John McGee of Partnered Print Solutions will gladly supply detail about adding an RFID component to freezer labels and for your application.

Acknowledgements:

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