Applications for Bidirectional Electronically Steerable Phased Array (BESPA™) Antenna Systems with Passive UHF RFID Tags

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RF Controls’ Intelligent Tracking and Control System (ITCS®) is a standards-based, real-time location system which accurately locates & tracks passive UHF tags.

We have adapted rigorously proven technology utilized in military tracking / target acquisition applications.

ITCS is unlike any technology currently used within the auto-ID industry and takes passive UHF RFID to new heights.

Footnote: visit http://www.rf-controls.com / About Us to understand how...
Topical Questions

- Type approved by the FCC, and certified compliant with ETSI RF emissions regulations\(^1\)
- Compliant with applicable ISO and EPCglobal standards
- For the DoD, ITCS is ordnance friendly (HERO) yet offers superior operational capabilities
- ITCS can be applied across a range of product classes and assets; simply apply inexpensive “Gen2” passive tags
- Supports multiple business processes using a common AIT infrastructure

Note: 1) FCC CFR 47 Part 15.247; ETSI EN 302 208
ITCS Architecture

- Unique Bidirectional Electronically Steerable Phased Array (BESPA™) antenna technology
- ITCS employs distributed “smart antennas” – Signal Acquisition and Source Location (SASL®) modules
- One or more SASLs are managed by the ITCS Location Processor (LP)
- ITCS LP exposes collated, qualified data via a platform neutral API that is compliant with ISO/IEC 24730–1
- SASLs: software controlled antennas – superior intelligence at the edge
Distributed SASLs quickly scan volumes of interest
Define multiple, variable size, non-contiguous scanning “zones”
SASLs provide accurate locations of tags in 3D
The ITCS Location Processor collates data from SASLs and presents qualified data via a platform neutral API
3D Location Video
# UHF: Conventional vs. ITCS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Conventional</th>
<th>ITCS</th>
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<tbody>
<tr>
<td>Energy focus</td>
<td>Spread over a wide “cone”</td>
<td>Place tag excitation energy only where it’s needed</td>
</tr>
<tr>
<td>Weak tag signals</td>
<td>Prone to interference, worsening SNR with increasing range; Rx antenna sees many unwanted signals</td>
<td>High gain directional antenna coupled to high performance reader</td>
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<tr>
<td>Multi-pathing</td>
<td>Severe problems with extraneous reads (e.g. at adjacent dock door portals)</td>
<td>Sophisticated multi-path ambiguity resolution algorithms eliminate spurious reads</td>
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<tr>
<td>Operating range</td>
<td>Forward link limited to ≈ 30’</td>
<td>Maximum operating range of 120–130’ with “−3” tags</td>
</tr>
<tr>
<td>Practicality in use</td>
<td>Antennas mounted close to where tagged objects move so damage is likely; sometimes there’s no room for a portal</td>
<td>Antennas mounted away from normal traffic and item movement – distance is our friend, not an impediment</td>
</tr>
<tr>
<td>Tag sensitivity</td>
<td>Increases the likelihood of extraneous or spurious reads and “dirty data”</td>
<td>The more sensitive the tag, the more valuable ITCS becomes</td>
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ITCS Performance

- ITCS can excite, read and accurately locate Higgs-3 and Monza3 based tags at 120–130’(2)
- A single SASL provides 3D tag location data
- ITCS can locate each tag in three dimensions with an accuracy of \(\approx \pm 1.5’\) (<1’ range accuracy)
- Proven statistical signal processing methods resolve ghost images caused by multi-pathing effects and negate spurious (extraneous) reads
- Tracking is accomplished by time-stamping tag location data in the ITCS LP’s database

Note: 2) Operating range is critically dependent on tag characteristics
Locating Inventory

The conventional approach requires numerous, fixed reader components plus hand-held readers, is difficult to adapt to variable plan-o-grams and does not support discovery of the locations of arbitrarily placed inventory.

With ITCS, simply “light up” the store or stock room to achieve automated, real-time inventory monitoring; tagged goods may be positioned arbitrarily.
Food services distribution center, products in high bay metal racks
Ceiling 23', rack spacing 15', 2 SASLs 100' apart
Aisle coverage is end to end, floor to top of pallets on the upper rack
Location accuracy ~ ± 1.5' in 3D, consistent throughout the aisle
The Familiar Portal

Image Courtesy of USTRANSCOM
An Approach Using ITCS

ITCS SASLs are mounted high, off the floor, out of harm’s way, and “illuminate” the doors and adjacent areas.

Cover multiple dock doors and the staging area.
Selected ITCS Applications

✓ Efficient goods receiving; pallet, carton/case, item
✓ Inventory location, leading to efficient directed workflow for associates
✓ Automated real-time monitoring of staging operations
✓ Confirmation of dispatch: right product, right door
✓ Capital asset management
✓ For perishable goods, proactively managing inventory on a first-to-expire, first-out (FEFO) basis to minimize spoilage
ITCS Applications

Nature of the Business Environment

Manufacturing

Distribution and Warehousing

Retail Store or “Office”

Complementary RFID Technologies

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