plished by means of an alternating pattern of opaque patches over the last two pixel-column positions of each filter strip: for example, nonzero illumination at both of these column positions could signify the presence of the red filter strip, zero illumination at one of these column positions could signify the presence of the green filter strip, and zero illumination at both of these column positions could signify the presence of the blue filter strip.

*This work was done by Frank Hartley and Anthony Hull of Caltech for NASA's Jet Propulsion Laboratory.*

*This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to the Patent Counsel, NASA Management Office–JPL. Refer to NPO-20896.*

# Commercial Product Activation Using RFID

## Products would be tracked to points of sale and there activated automatically.

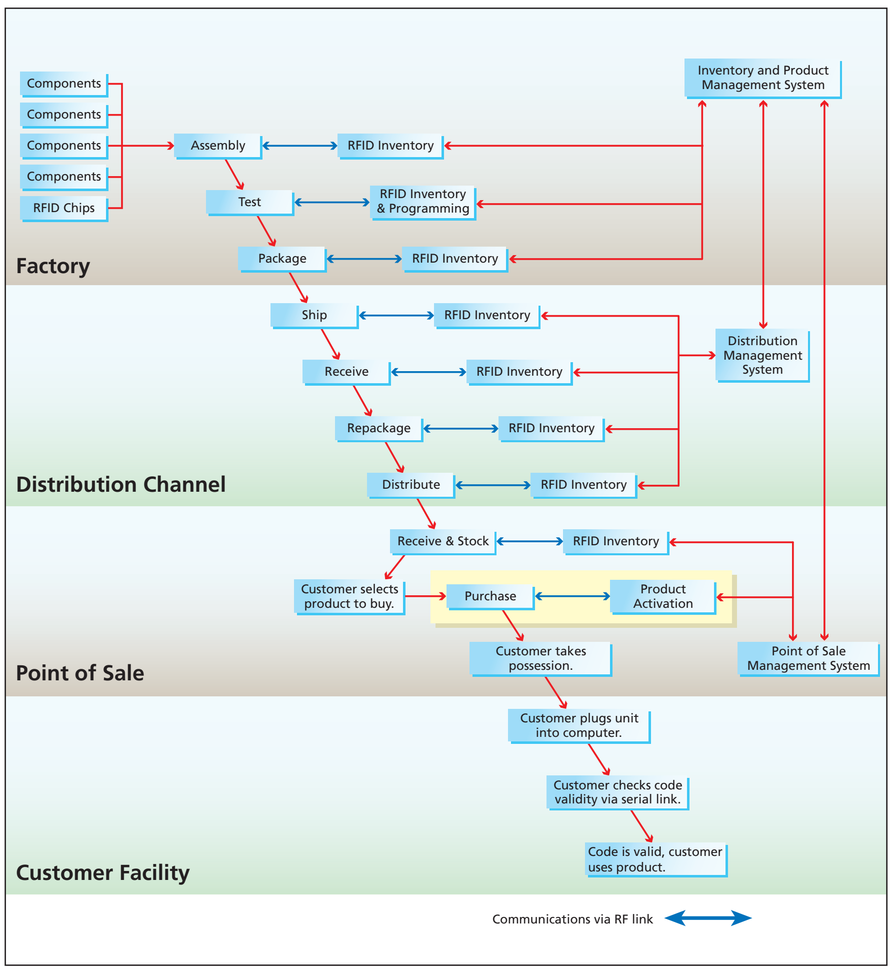
*NASA's Jet Propulsion Laboratory, Pasadena, California*

Radio-frequency identification (RFID) would be used for commercial product activation, according to a proposal. The concept of RFID is not new: RFID systems are widely used in commerce for tracking such diverse assets as animals, credit cards, and retail products. Also not new is the concept of manufacturing commercial products to be nonfunctional or unusable until activated at points of sale or in response to electronic submission of proof of purchase. What is new here is the concept of combining RFID with activation — more specifically, using RFID for activating commercial products (principally, electronic ones) and for performing such ancillary functions as tracking individual product units on production lines, tracking shipments, and updating inventories (see figure).

According to the proposal, an RFID chip would be embedded in each product. The information encoded in the chip would include a unique number for identifying the product. An RFID reader at the point of sale would record the number of the product and would write digital information to the RFID chip for either immediate activation of the product or for later interrogation and processing.

To be practical, an RFID product-activation system should satisfy a number of key requirements:

- The system should be designed to be integrable into the inventory-tracking and the data-processing and -communication infrastructures of businesses along the entire supply chain from manufacture to retail.
- The system should be resistant to sophisticated hacking.
- Activation codes should be made sufficiently complex to minimize the probability of activating stolen products.
- RFID activation equipment at points of sale must be capable of two-way RF communication for the purposes of reading information from, and writing information to, embedded RFID chips.
- The equipment at points of sale should be easily operable by sales clerks with little or no training.
- The point-of-sale equipment should verify activation and provide visible and/or audible signals indicating verification or the lack thereof.
- The system should be able to handle millions of products per year with minimal human intervention.
- The system should support non-simultaneous dual data-communication interfaces: (1) the RF link between the product-activation infrastructure and the RFID chip in each product and (2) a serial link, within each product, between the RFID chip and a control circuit.
- To the extent possible, the system should be constructed using relatively inexpensive off-the-shelf RFID equipment and methods that conform to in-




An **RFID Chip** embedded in each product at manufacture would be used to track the product through the entire supply chain and would be used to activate the product at the point of sale.

ternational standards and that involve minimal additions to pre-existing manufacturing processes and facilities.
- RFID chips should not contain batteries: instead, they should derive power from interrogating RF fields.

*This work was done by Thomas Jedrey and Eric Archer of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

*In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:*

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*Refer to NPO-42633, volume and number of this* NASA Tech Briefs *issue, and the page number.*

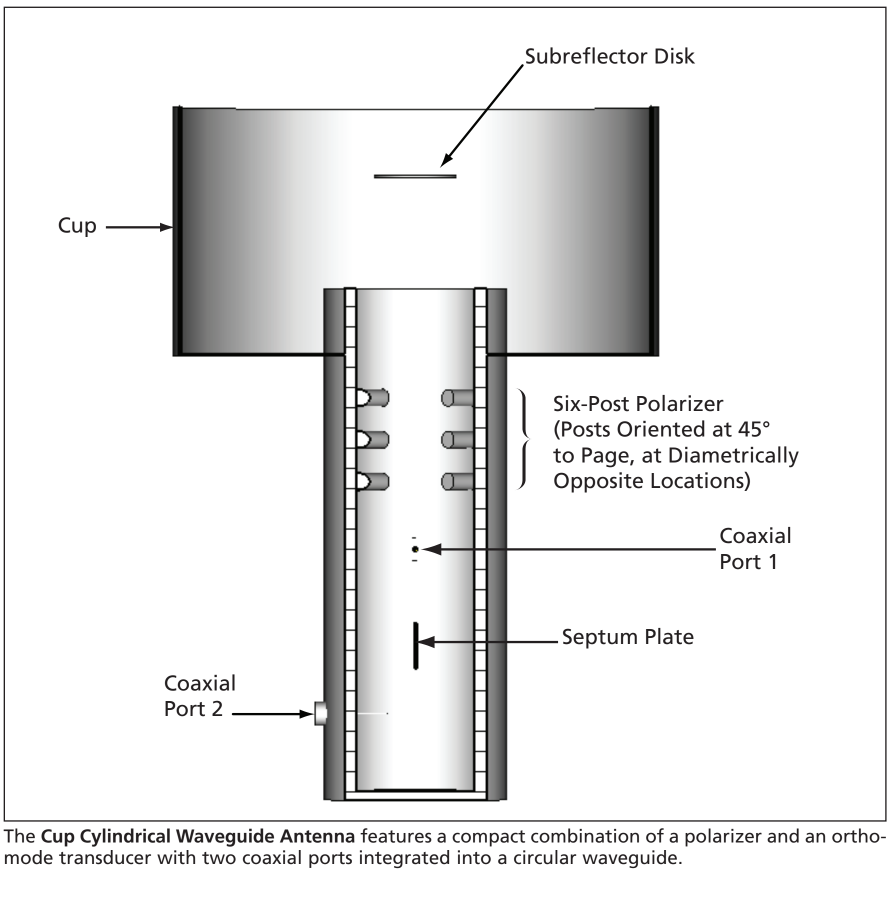
# Cup Cylindrical Waveguide Antenna

## This antenna is used in wireless networks and telemetry.

*John H. Glenn Research Center, Cleveland, Ohio*

The cup cylindrical waveguide antenna (CCWA) is a short backfire microwave antenna capable of simultaneously supporting the transmission or reception of two distinct signals having opposite circular polarizations. Short backfire antennas are widely used in mobile/satellite communications, tracking, telemetry, and wireless local area networks because of their compactness and excellent radiation characteristics.

A typical prior short backfire antenna contains a half-wavelength dipole excitation element for linear polarization or crossed half-wavelength dipole elements for circular polarization. In order to achieve simultaneous dual circular polarization, it would be necessary to integrate, into the antenna feed structure, a network of hybrid components, which would introduce significant losses. The CCWA embodies an alternate approach that entails relatively low losses and affords the additional advantage of compactness.




The **Cup Cylindrical Waveguide Antenna** features a compact combination of a polarizer and an orthomode transducer with two coaxial ports integrated into a circular waveguide.

The CCWA (see figure) includes a circular cylindrical cup, a circular disk subreflector, and a circular waveguide that serves as the excitation element. The components that make it possible to obtain simultaneous dual circular polarization are integrated into the circular waveguide. These components are a six-post polarizer and an orthomode transducer (OMT) with two orthogonal coaxial ports. The overall length of the OMT and polarizer (for the nominal middle design frequency of 2.25 GHz) is about 11 in. (≈28 cm), whereas the length of a commercially available OMT and polarizer for the same frequency is about 32 in. (≈81 cm).

*This work was done by Roberto J. Acosta and William G. Darby of Glenn Research Center and Carol L. Kory, Kevin M. Lambert, and Daniel P. Breen of Analex Corp. Further information is contained in a TSP (see page 1).*

*Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18089-1.*