TIPP Grading
Tagged Item Performance Protocol

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What is TIPP
Tagged Item Performance Protocol

- Performance grades for tagged items (not tags or inlays)
- Grades indicate predictable performance in-field
- Test procedures to determine if tagged item meets a grade
- Procedures that can be repeated by all stakeholders
- Means for retailers to communicate tagging requirements

Grading is an effective means of communicating performance...
Inlay Lists Seemed Easy at First

- Retailers perform in-store testing to determine which inlays work
- Retailers send lists to suppliers
- Supplier source the inlays, or labels, or receive inlays from retailers
- Exception tagging, small volumes, plenty of management and stocks, misunderstandings, mistakes, uncertainty
- Difficult to optimize
TIPP simplifies communication of tagging performance requirements in retail

- Retailer specifies TIPP grades for different product categories
- Retailer communicates requirements as TIPP grades to supplier
- Supplier works together with their tagging solutions providers (TSP) to optimize tagging
- Less complexity, less management
- More flexibility, high volume tagging, thus efficient tagging process
Scope of TIPP
Tagged Item Performance Protocol

GS1’s TIPP Guideline specifies:

- Grade Definitions (specific performance grades)
- Testing Methodology (testing procedures)
- Test Configurations (tagged item placement)

The guideline does not specify:

- Who, when, where to test
- How to choose a grade for an application or use case
- Retailer validation/audit process
TIPP Test Process
TIPP Testing Methodology Guideline

Tagged items for testing
• Sample of 30 tagged items
• Each tagged item uniquely encoded with an EPC

Pass/Fail criteria
• Sensitivity
• Backscatter power
• Orientation
• including optional minimum success rate
TIPP Test Equipment
TIPP Testing Methodology Guideline

- **Anechoic chamber**
  - eliminate EMI for outside sources, ensure repeatable results

- **Rotating test platform**
  - 360° in 1° increments, height-adjustable

- **Antennas (4)**
  - mounted at 0°, 30°, 60°, 90° to floor
  - horizontal linear polarization plane parallel to floor
  - directed at single incidence point in far field, min distance 0.4 m

- **Measurement unit**
  - Network analyser optimized for RFID @ 800-980 MHz, DSB-ASK
  - Implements EPC Gen2 air interface protocol
  - Output power range at incidence point -25 dBm to 5 dBm
  - Output power dynamically controllable in 0.1 dBm increments
TIPP Measurement Gen2 Protocol Settings
TIPP Testing Methodology Guideline

Gen2 physical layer parameters

- Modulation = DSB-ASK
- Tari = 12.5 μs - 25 μs
- BLF = 250 – 320 kHz
- M = 4 (Miller)
- Truncate = disabled
- TRext = 0
TIPP Measurement Command Sequence
TIPP Testing Methodology Guideline

Gen2 commands are used to measure performance
(Tested tag’s unique EPC is specified for all measurements)

- Select
- Query
- ACK
TIPP Measurement Parameters
TIPP Testing Methodology Guideline

Tagged item’s read sensitivity & backscatter signal are measured

Frequency Range
• each antenna measures tagged item in grade’s specified range
• increments of 1 MHz inclusive of specified range

Power Range
• tagged items measured for response from -25 dBm sensitivity
• increments of 0.1 dB, until response for each frequency
TIPP Read Sensitivity
TIPP Testing Methodology Guideline

- Minimum amount of power, in dBm, tagged item requires to complete a successful Gen2 Select/Query/ACK sequence
- Established by repeating sequence while adjusting power sent from measurement unit until there is a response from the tag
- Can be calculated from this power level by subtracting measurement unit antenna gain, cable loss, free space loss...
- Read sensitivity at a given orientation is the worst (highest) read sensitivity across the measured frequency range

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GS1 TIPP Excerpt: Sensitivity for Performance Grade S15B

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TIPP Backscatter Power
TIPP Testing Methodology Guideline

- Amount of power backscattered following successful Gen2 Select/Query/ACK sequence at a specific sensitivity level
- Backscatter measurement must be performed at sensitivity level contained in specification of grade to be validated
- Calculated by calibrating the power measured at the receiver of the measurement unit with loss/gain during transmission
- Backscatter power at a given orientation is the worst (lowest) backscatter power across the measured frequency range

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*GS1 TIPP Excerpt: Backscatter for Performance Grade S15B*
TIPP Test Variables
TIPP Testing Methodology Guideline

Test Platform Position
• rotated 0° - 270° in 30° increments

Measurement Antenna
• at each position, tagged item is measured with 4 antennas
• mounted at 0°, 30°, 60°, 90° with respect to test platform
TIPP Definition of Variables
TIPP Test Configuration Guideline

Test variables from TIPP Testing Methodology
Orientation and placement relative to:
• Measurement Antenna
• Test Platform Position

Tagged item variables
• Front of item
• Top of item
• Tag location
TIPP Orientation & Placement of Tagged Item
TIPP Test Configuration Guideline

During measurements, the tagged item is oriented and placed in such a way that...

- Front of tagged item faces Antenna 1 when the test platform is at the 0° position
- Top of item faces Antenna 4
TIPP Tag Orientation
TIPP Test Configuration Guideline

- Tag must be positioned at incidence point of all 4 antennas
- Incidence point must be tag location regardless of mounting
- Incidence point is also center of rotation of test platform
- For non-fixed tags...
  - Hang-tag should be placed parallel or perpendicular to Antenna 1 when platform is in the 0° position
  - Limited motion tag should be placed in most natural position relative to item when oriented as described
TIPP Tag Stacking
TIPP Test Configuration Guideline

• Some TIPP Grades require item stacking
• Stacked items are aligned vertically
• Tag of item is placed at incidence point
• Most stacked testing requires only 2-stack
• 11-stack testing required for 7 of 35 categories
• 11-stack results sensitive to tag positions
• Tags should be carefully aligned for repeatability
TIPP Position by Merchandise Category (35)
TIPP Test Configuration Guideline

- **Shorts and skirts**
  - Overalls, shorts and rompers
  - Vests, sport coats, blazers, suits, tuxedos, outerwear coats, jackets, ponchos, robes & parkas

- **Pants, slacks and jeans**
  - Dresses

- **Tops**
  - Tops – Folded

- **Bras**

- **Camisoles, teddies, crop tops, slips, swimwear, bodywear and dancewear**

- **Panties and control garments**

- **Banded apparel**
- **Boxed apparel**
- **Carded apparel (flap), gloves and mittens**

- **Flat packed apparel**
  - Plastic packaged apparel
  - Backpacks
  - Belts
  - Bibs
  - Caps, visors and hats
  - Neckwear
  - Cummerbunds
  - Dickies and collars
  - Footwear

- **Glasses**
- **Handbags, Purses and Wallets**
- **Luggage and briefcases**
- **Loose watches**
- **Watches displayed in a box or case**
- **Jewellery - carded**
- **Jewellery - Loose**
- **Key chains**
- **Scarves and shawls**
- **Sweatbands**
- **Suspenders and braces**
- **Umbrellas**

*Categories in bold require 11-stack performance thresholds for M-Grade testing*
TIPP Grade Identifiers
TIPP Test Configuration Guideline

A TIPP Grade has 4 components:

- **Test Configuration**: a letter (S or M)
  - S for single item
  - M for multiple items (stacks of 2 or 11, as specified)

- **Performance Level**: a 2-digit number
  - in multiples of five to allow for additional grades in future
  - higher numbers correspond to higher performing tagged items

- **Grade Family**: a letter (B, V, or D)
  - Groups together grades with common performance characteristics
  - Within a family, higher grades automatically satisfy lower grades
  - Determined by similarity across 4 data dimensions:
    - Azimuth, Elevation, Sensitivity & Backscatter

- **Test Frequency Range**: (optional to specify FCC or ETSI)
TIPP Grade Definitions
TIPP Test Configuration Guideline

- Each grade includes a set of tables that specify tagged item sensitivity and backscatter (dBm) at various orientations
- Current performance grades (as of October 2016):
  - S05V
  - S05B
  - S15B
  - S15D
  - S20B
  - M05B
  - M10B
  - M15B
  - M20D
GS1 encourages adoption of TIPP and supports the Big Picture to drive adoption
For further information please contact:

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