

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...

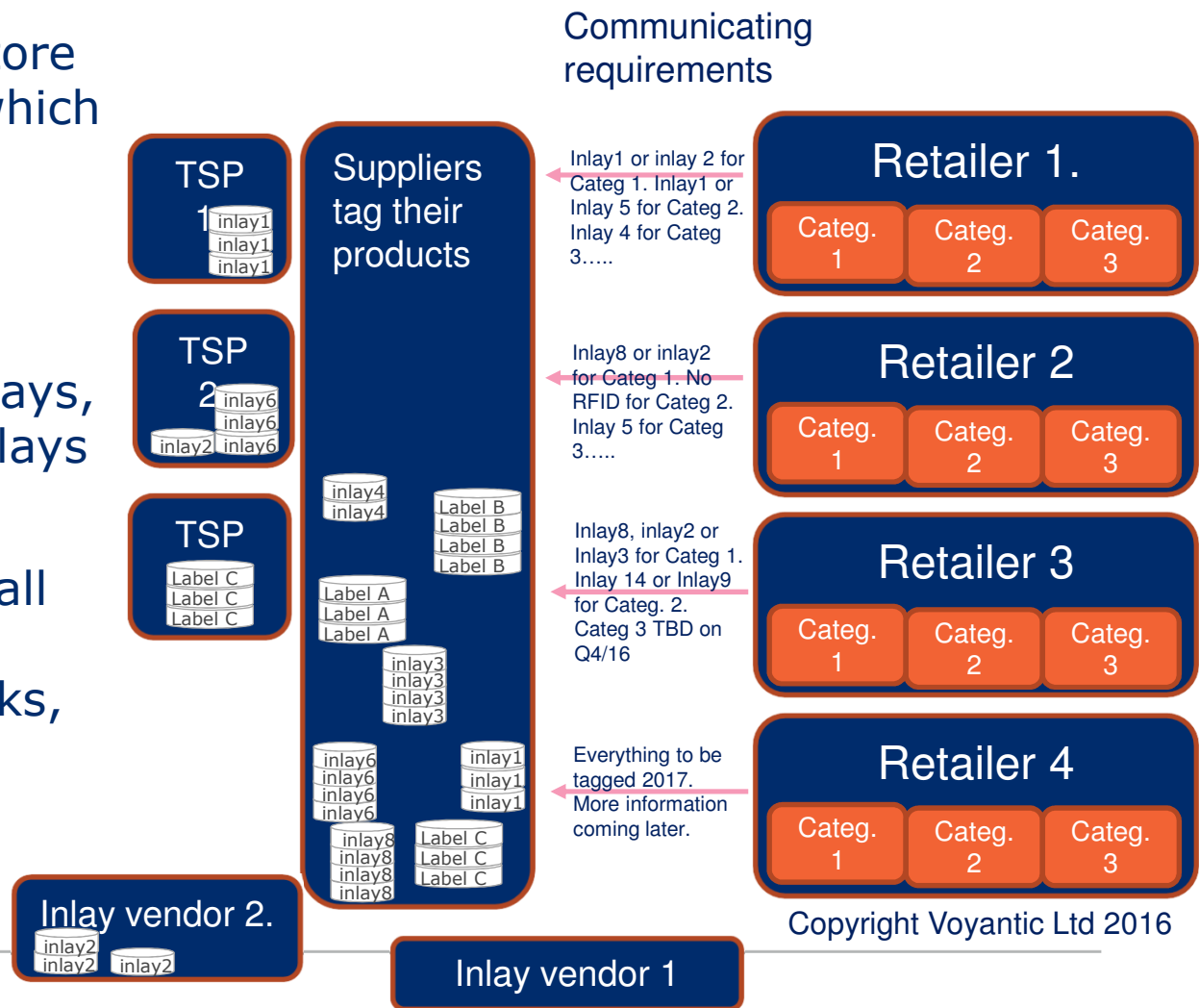


10w-40
5w-30
20w-50
5w-20
15w-40



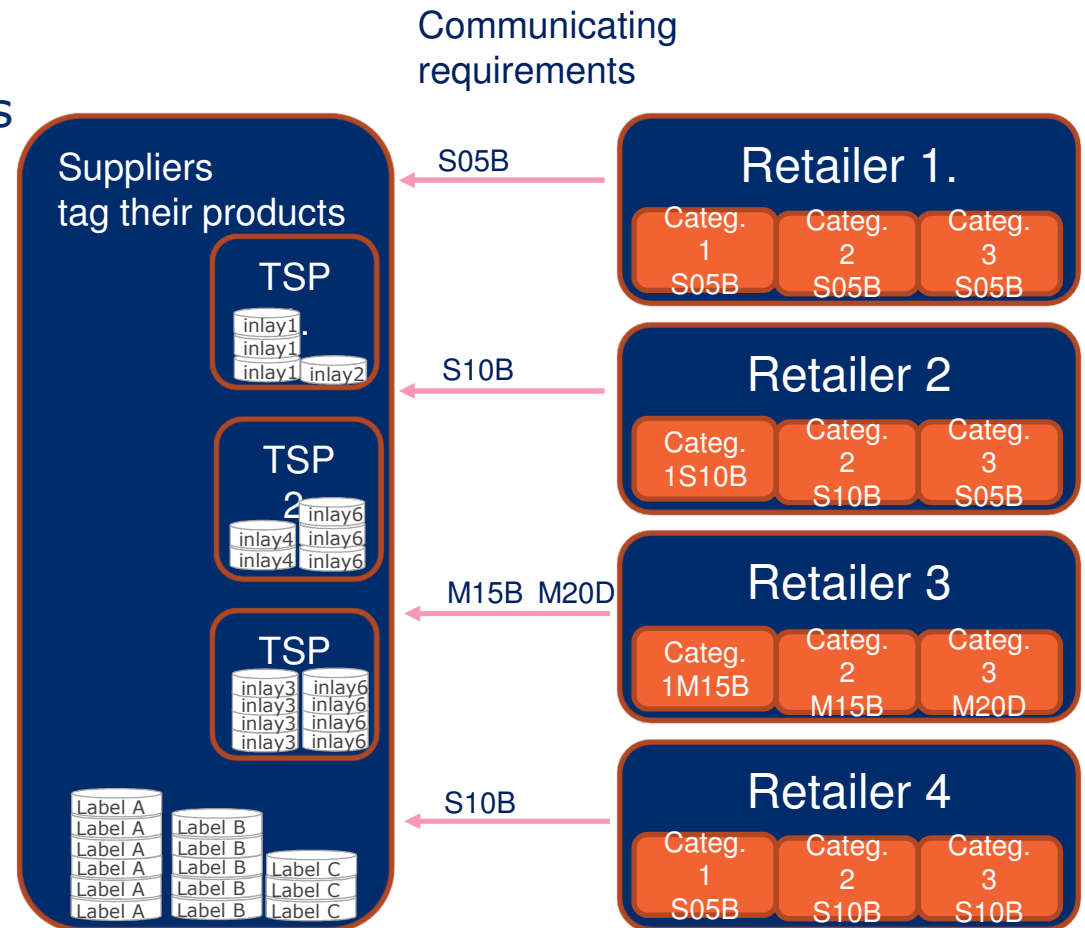
Inlay Lists *Seemed* Easy at First

- 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



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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
-

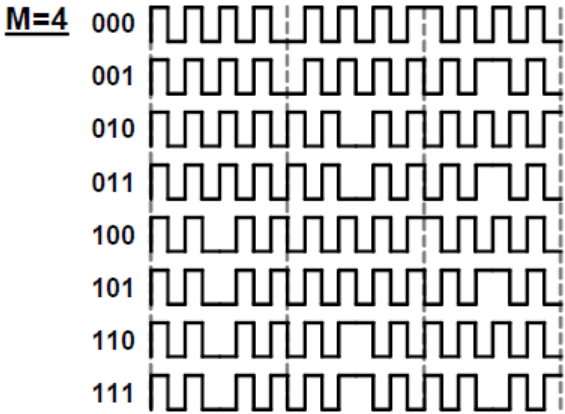


TIPP Measurement Gen2 Protocol Settings

TIPP Testing Methodology Guideline

Gen2 physical layer parameters

- Modulation = DSB-ASK
- Tari = 12.5 μ s - 25 μ s
- BLF = 250 - 320 kHz
- M = 4 (Miller)
- Truncate = disabled
- TRext = 0



	Command	DR	M	TRext	Sel	Session	Target	Q	CRC
# of bits	4	1	2	1	2	2	1	4	5
description	1000	0: DR=8 1: DR=64/3	00: M=1 01: M=2 10: M=4 11: M=8	0: No pilot tone 1: Use pilot tone	00: All 01: All 10: ~SL 11: SL	00: S0 01: S1 10: S2 11: S3	0: A 1: B	0-15	CRC-5



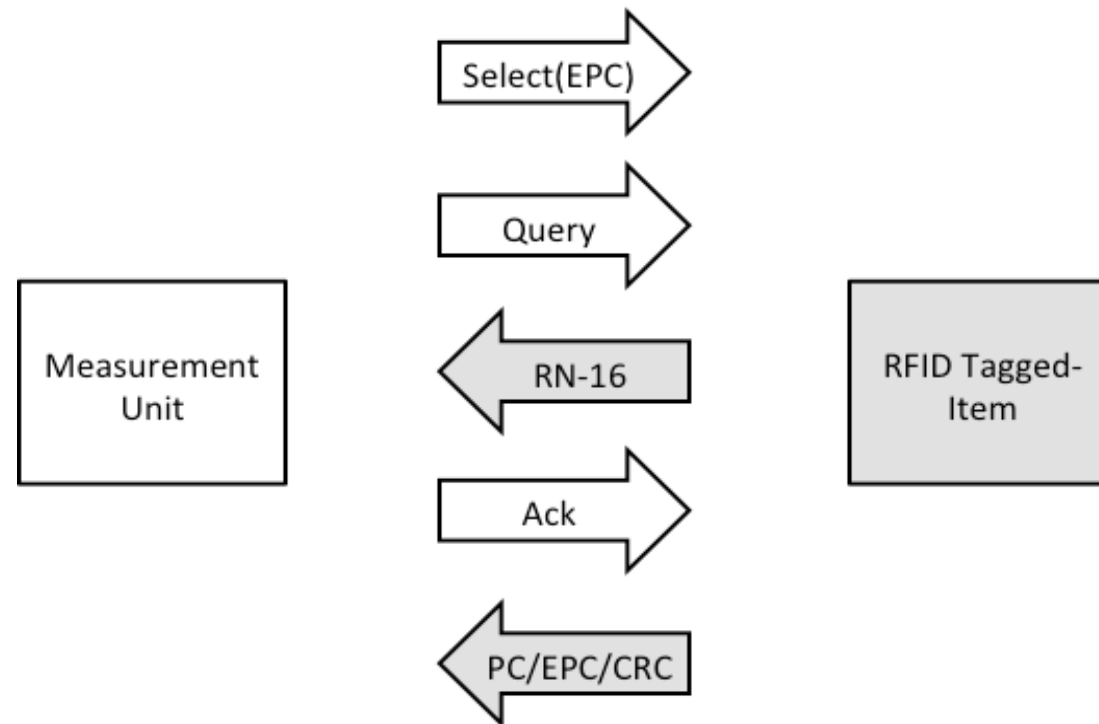
TIPP Measurement Command Sequence

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

Sensitivity				
	Antenna			
	1	2	3	4
0	-6.5	-6.5	-5.5	-5.5
30	-2	-1	1	-1
60				
120				
150	-2	-1	1	-1
180	-6.5	-6.5	-5.5	-5.5

Orientation

GS1 TIPP Excerpt:
Sensitivity for
Performance Grade
S15B



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

Backscatter				
	Antenna			
	1	2	3	4
0	-31	-32	-32	-31
30				
60				
120				
150				
180	-31	-32	-32	-31

Orientation

GS1 TIPP Excerpt:
Backscatter for
Performance Grade
S15B



TIPP Test Variables

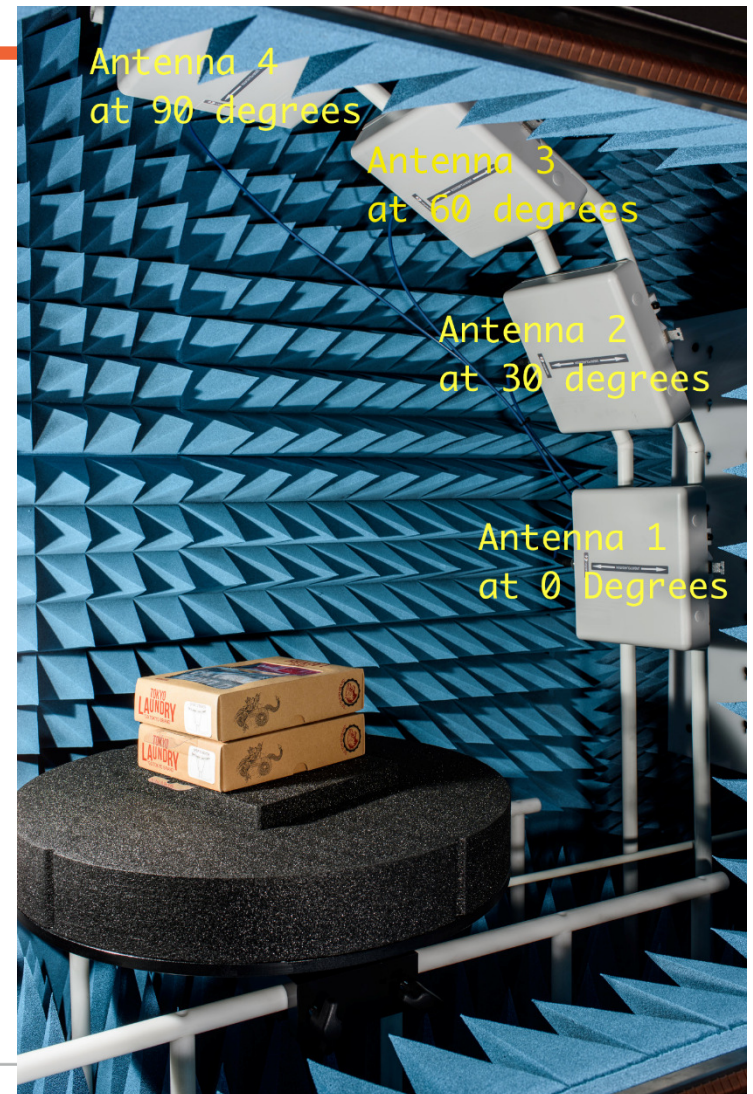
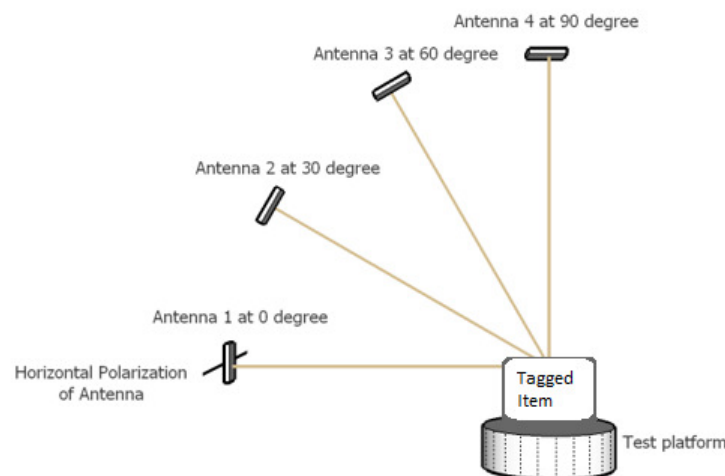
TIPP Testing Methodology Guideline

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

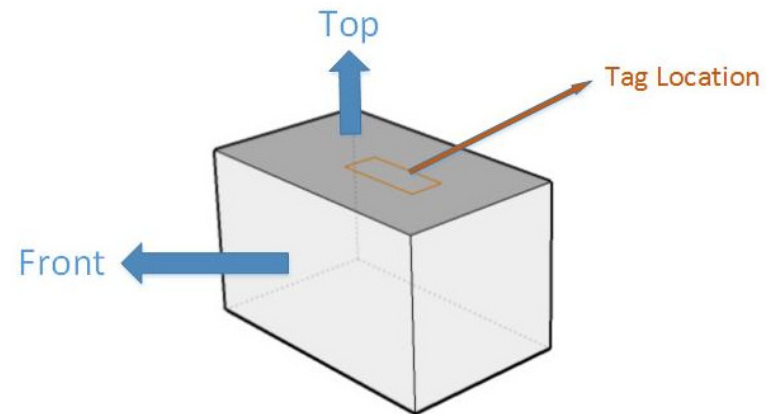
Test variables from TIPP Testing Methodology

Orientation and placement relative to:

- Measurement Antenna
- Test Platform Position

Tagged item variables

- Front of item
- Top of item
- Tag location

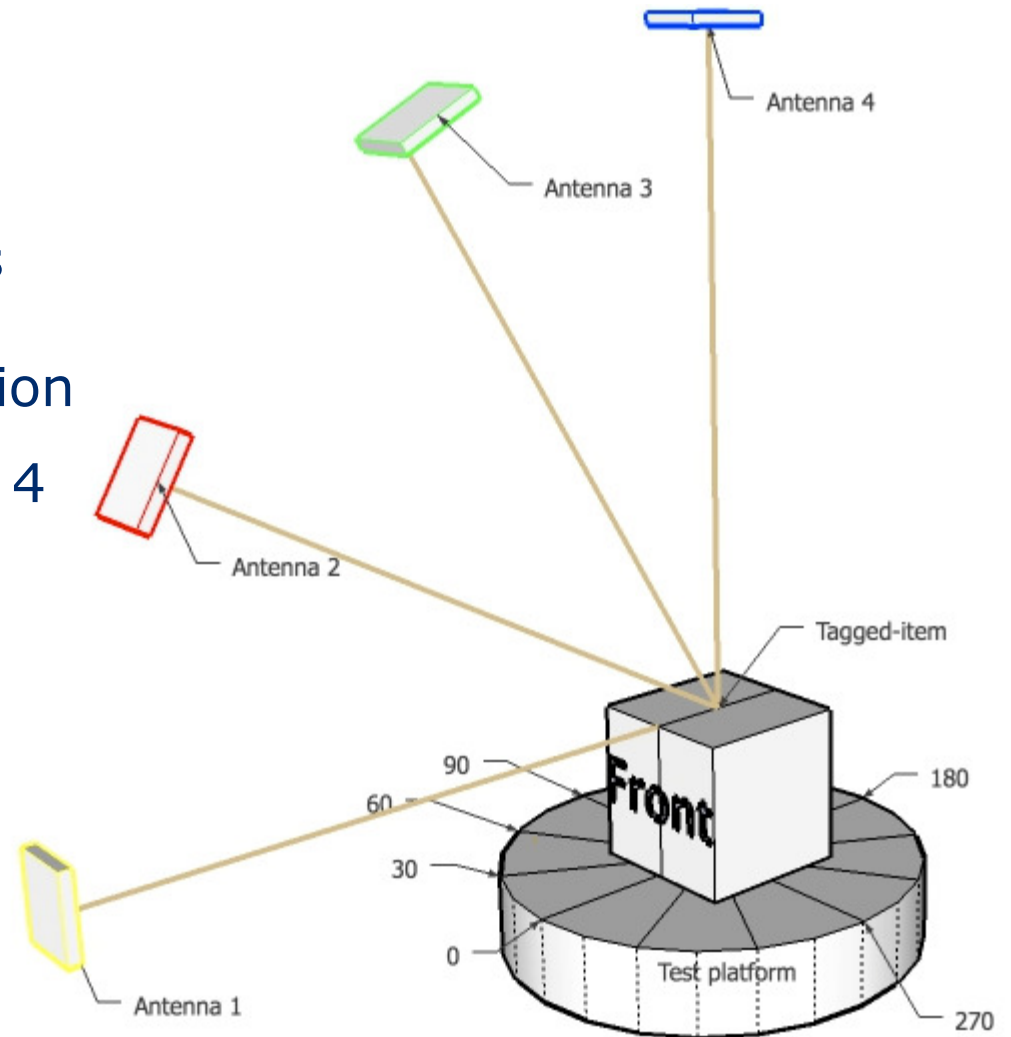


TIPP Orientation & Placement of Tagged Item

TIPP Test Configuration Guideline

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

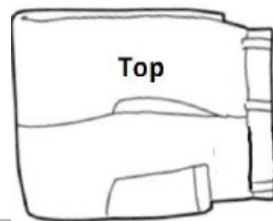
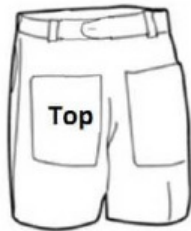
- Front of tagged item faces Antenna 1 when the test platform is at the 0° position
- Top of item faces Antenna 4



TIPP Tag Orientation

TIPP Test Configuration Guideline

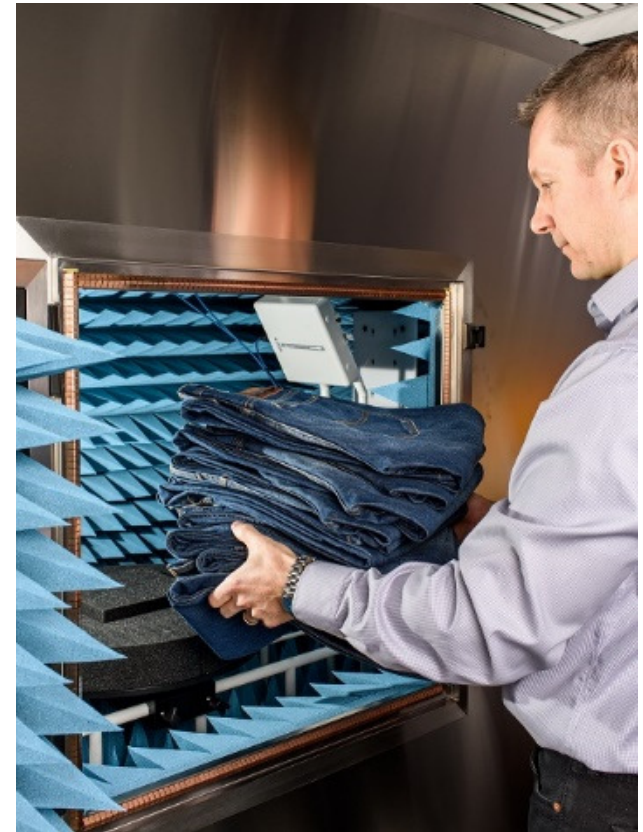
- Tag must be positioned at incidence point of all 4 antennas
- Incidence point must be tag location regardless of mounting
- Incidence point is also center of rotation of test platform
- For non-fixed tags...
 - Hang-tag should be placed parallel or perpendicular to Antenna 1 when platform is in the 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

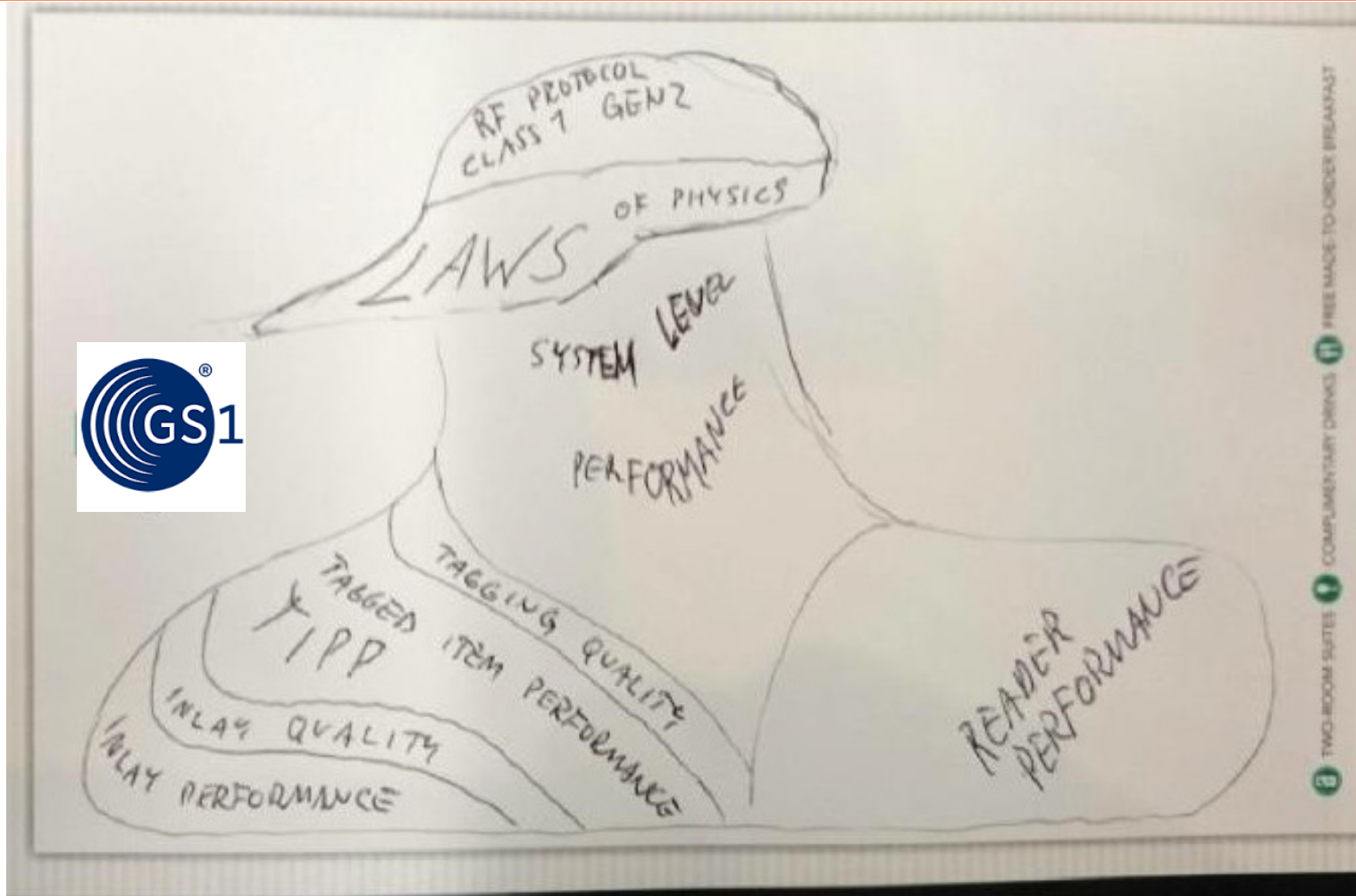
TIPP Test Configuration Guideline

- 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**



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GS1 encourages adoption of TIPP and supports the Big Picture to drive adoption



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