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Tagged-Item Performance Protocol (TIPP) Tagged-Item Grading: Test Configuration Guideline

Provides the placement for tagged-item when the item is measured using the Tagged-Item Test Methodology

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Log of Changes

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0.9	26 Feb 2015	D.Buckley	Created with kind permission of GS1 US from the document *Tagged-Item Performance Protocol (TIPP) Tagged Item Grading: Testing Methodology 9/16/2014 R1.0 Dec 18 2014*
1.0	Sep 2016	P Dietrich	Multiple revisions from internal comment review. Initial release following Work Request 14-219
1.1	Jul 2017	J Partanen, G.Rowe	Work Request 17-000009 Incorporate changes for Close Coupling test Protocol. Changed the backscatter signal strength definition in section 3.1.3. Added pictures and frequency parameters related to the J-grade test protocol. Corrected the 2-stack test to focus only on the lower tagged item.
1.2	April 2024	Claude Tételin	WR 23-260 Add new family and associated grades for smart enclosures and smart cabinets based applications.

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Table of Contents

1 Introduction

This document specifies the orientation and placement of tagged items when validating their grade. It is critical for repeatable testing that the tagged items are oriented and positioned the same way when they are measured. This document is an evolving catalogue of test configurations that will accommodate tagged item orientations for future/new or existing product categories.

A tagged item is an item that has RFID functionality. Often the functionality is implemented by inserting a RFID tag on the item, but also embedded tagging solutions are utilized. The Tagged-Item Performance Protocol (TIPP) Workgroup developed a tagged-item grading system to facilitate the specification of tagged-item performance between users and suppliers. Tagged-item grades were developed to specify the RFID performance of a tagged item. The tagged-item test procedure defines a method and criteria for establishing that a tagged item meets a specified grade level. To support test quality, testing configurations were specified in a product catalogue that defines the orientation and layout of common items.

2 Definition of variables

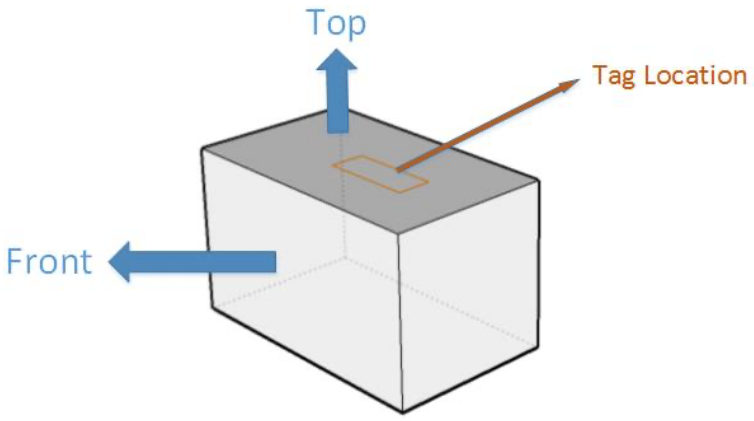
2.1 Test variables from the tagged-item test methodology

The orientation and placement of the tagged item is defined relative to the two test variables specified in TIPP Tagged-Item Grading: Testing Methodology Guideline: Measurement Antenna and Test Platform Position.

2.2 Tagged-item variables

There are three variables identified for the tagged item to define the orientation of the item for testing. The three variables are the front of the item, the top of the item and the location of the tag as shown in the figure below. The location of the tag on the tagged item is where the RFID tag is attached to or embedded in the item.

Figure 2-1 Test variables from the tagged-item test methodology

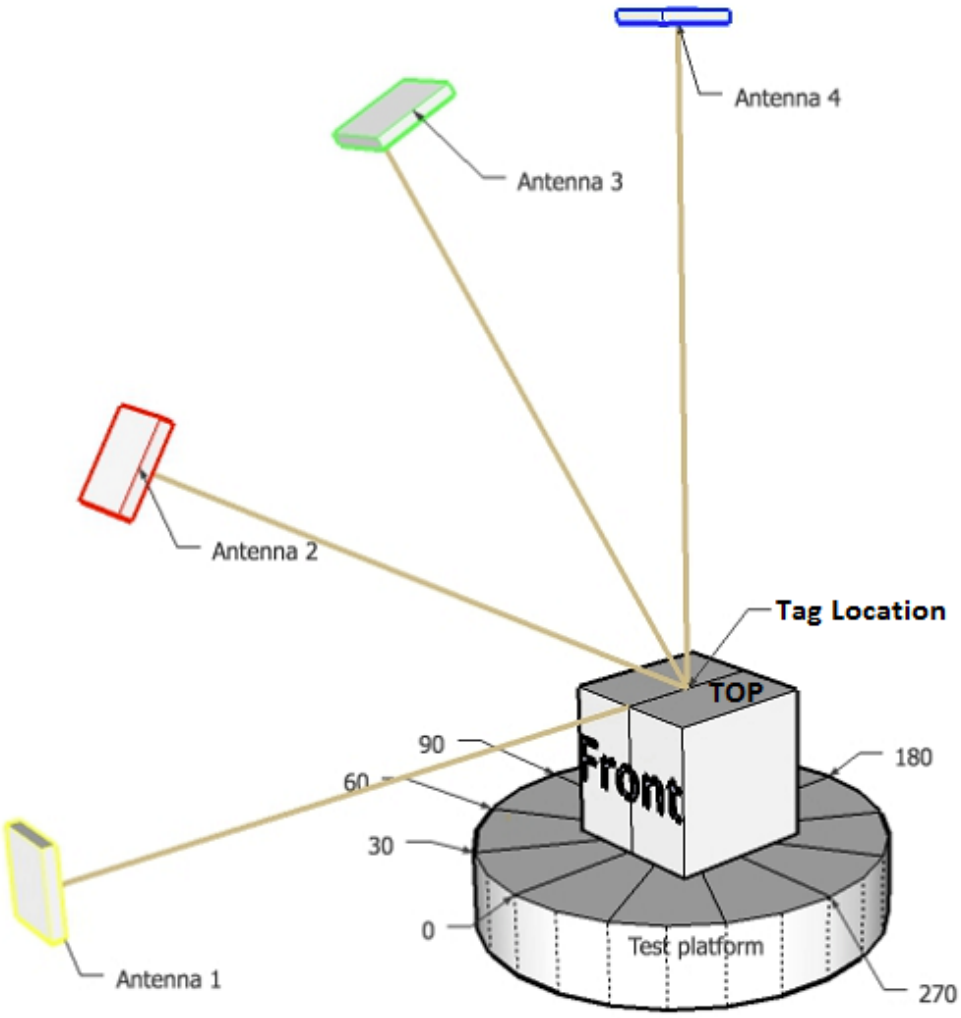


General test orientation of a tagged item is defined in Section 3. For cases where tags are not rigidly fixed to the item (like hangtags), the default resting place of the tag during testing is defined in Section 3.1. For cases with stacking, stacked orientation is defined in Section 3.2. The front and the top variables for different categories of merchandise are defined in Section 4.

3 Orientation and Placement of the Tagged-Item

During measurements, the tagged item is oriented and placed in such a way that the front of the tagged item faces Antenna 1 when the test platform is at 0-degree position. The top of the item faces Antenna 4. The orientation and placement of the tagged item when the platform is at the 0-degree position is shown in the figure below.

Figure 3-1 Orientation of the tagged-item



The top of the tagged item should face Antenna 4 in all of the test platform positions as shown above.

For relatively large items and/or items where the tag placement is significantly offset from the centre (e.g., dresses or overalls, with the tag positioned almost towards the bottom), special care is needed to ensure the validity of the test while carrying out the measurements in practice. Large items must be wholly placed on top of the test platform whenever possible. Any adjustments made must not affect the RF performance of the tagged item, as these would invalidate the test results.

3.1 Tag Orientation

The tag location on/in the item MUST be positioned at the incident point of all four antennas as shown in Figure 3-1. In stacked item tests typically the center item within a stack acts as the reference location, but please refer to the test protocol for more details. In Figure 3-1, this is shown on the top of the item, but the incident point MUST be the tag location regardless of the mounting of the tag on or in the item. This incident point is also the centre of rotation of the test platform.

The following additional rules apply for tag orientation:

- If tag is fixed to the item, there are no additional orientation requirements.
- If the tag is loose (e.g., a hangtag) and can vary freely in position with respect to the item when oriented according to Section 4, the tag should be placed either parallel or perpendicular to

Antenna 1 when the platform is in the 0-degree rotation settings and parallel to the turntable and Antenna 4.

- The parallel or perpendicular position with respect to Antenna 1 should be determined by whichever orientation leads to the worse (higher) sensitivity at Antenna 1 in the zero-degree position.

- If the tag is partially affixed to the item and has limited motion, the tag should be placed in the most natural position relative to item when oriented according to Section 4.
  - Where ambiguity exists, the orientation should be determined by whichever orientation leads to the worse (higher) sensitivity at Antenna 1 in the zero-degree position.
- For certain items, the product catalogue may offer more explicit requirements for the loose tag orientation during testing.

3.2 M-Grade Stacking

M-grades within TIPP Tagged-Item Grading: Grade Definitions Guideline require item stacking for testing. When items are stacked for testing, items are stacked top to bottom with vertical alignment between the stacked items. In the M-grade stacking only one item within the stack is tested against the grade threshold levels, and that particular tagged-item under test is placed such that its RFID component is located at the incident point.

Unless otherwise noted in Section 4 of this document, stacked M-grade testing for a tagged item requires only the 2-stack performance thresholds. If the 11-stack test component of the M-grades is required it is especially mentioned, as it is for example in 4.1. The 11-stack test results are sensitive to the stack orientation and relative tag positions. Care should be taken to align tags for repeatability. It is recognized that the middle tag (as defined by the test procedure) does not represent the comprehensive performance of the stack, but a correlation to the overall stack performance.

3.3 J-Grade Stacking

J-grades within TIPP Tagged-Item Grading: Grade Definitions Guideline require item stacking for testing, and all the tagged items in the stack are tested against the grade threshold performance levels. Place the item stack on the rotating table horizontally with fronts towards antenna 1 and the top of the item facing antenna 4. The sequence of the items is randomized. The center item in the stack should be centered on the incident point of the antennas. Take care to adjust the height of the test table so that the RFID labels are on the same level as the test antenna main beam.

4 Tagged-Item Position by Category of Merchandise

4.1 Shorts and skirts

This category includes items such as shorts, swim trunks, bike shorts, boxer shorts, denim skirts, twill skirts, woven skirts, fleece skirts and knit skirts with either a constructed, elastic or drawstring waistband.

When performing M-grade testing, items in this category require 2-stack and 11-stack testing. When performing J-grade testing, items in this category require 7-stack testing, unless the grade specifies other item count for the stack.

Figure 4-1 Shorts – top view

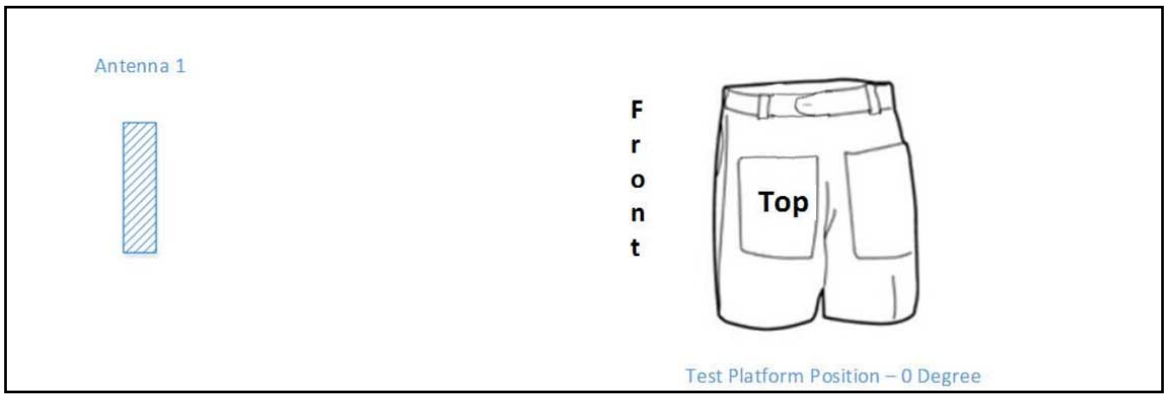
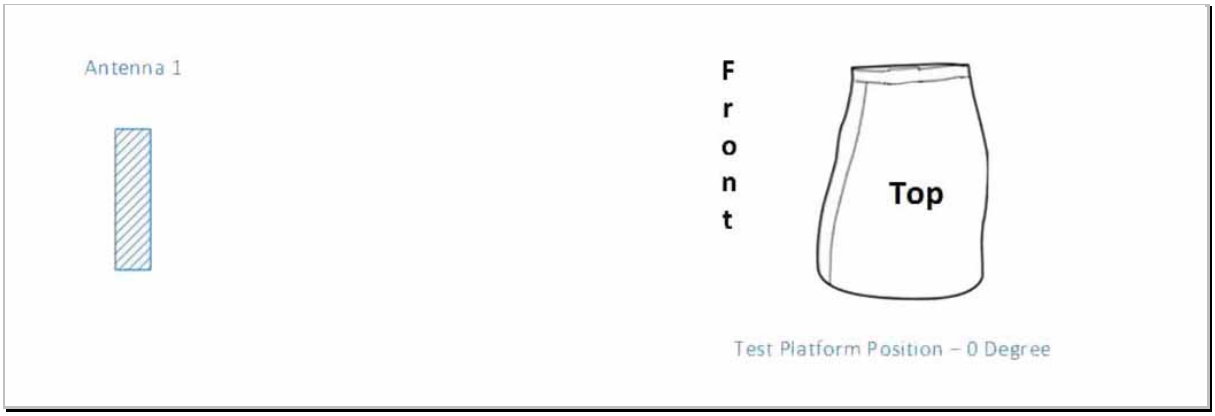


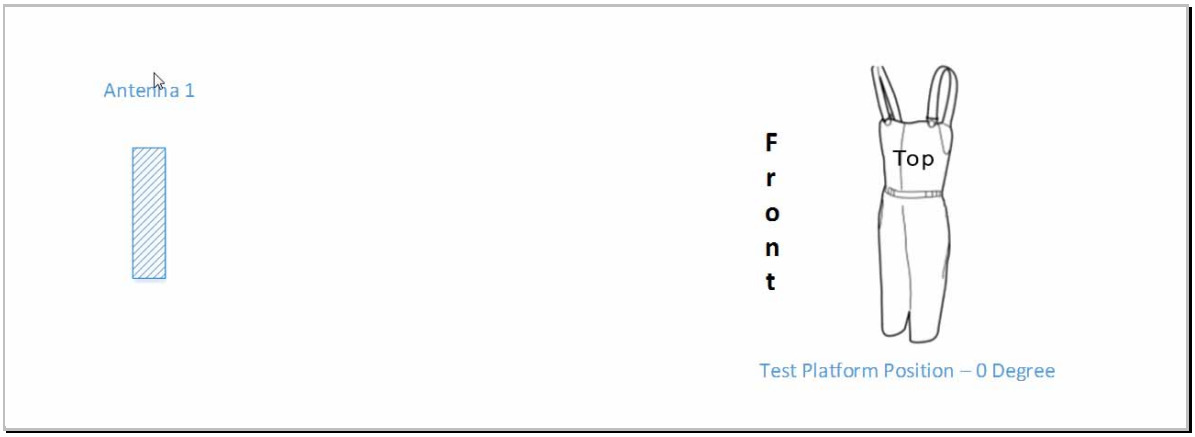
Figure 4-2 Skirts – top view



4.2 Overalls, shorts and rompers

This category includes items such as fabrications of bib and sku overalls, shortalls and rompers.

Figure 4-3 Overalls, shorts and rompers – top view



4.3 Vests, sport coats, blazers, suits, tuxedos, outerwear coats, jackets, ponchos, robes & parkas

This category includes items such as vests, sport coats, blazers, two-piece and three-piece suits, tuxedos, trench coats, overcoats, raincoats, ski jackets, leather jackets, bombers, quilted flannel shirts, wind breakers, ponchos and parkas.

Figure 4-4 Vests – top view

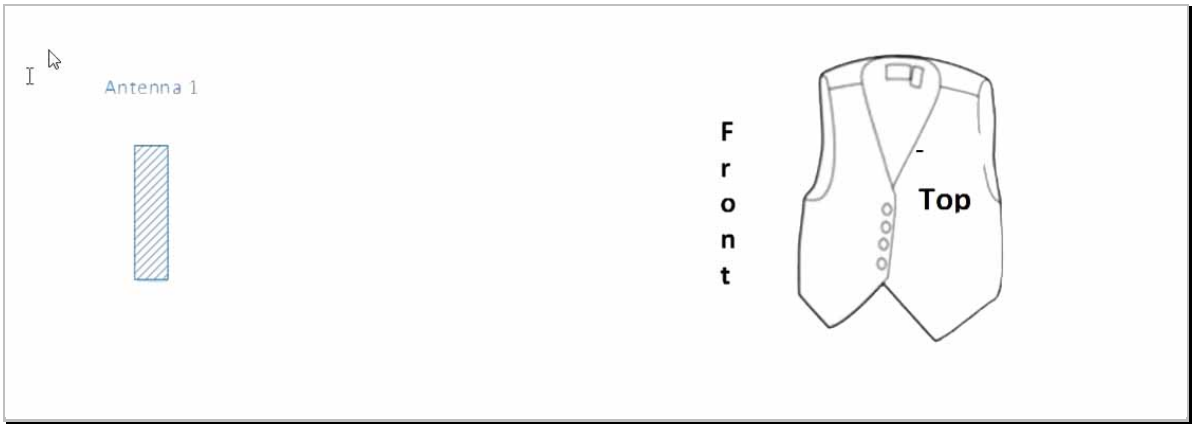


Figure 4-5 sport coats, blazers, suits, tuxedos, outerwear coats, robes and jackets – top view

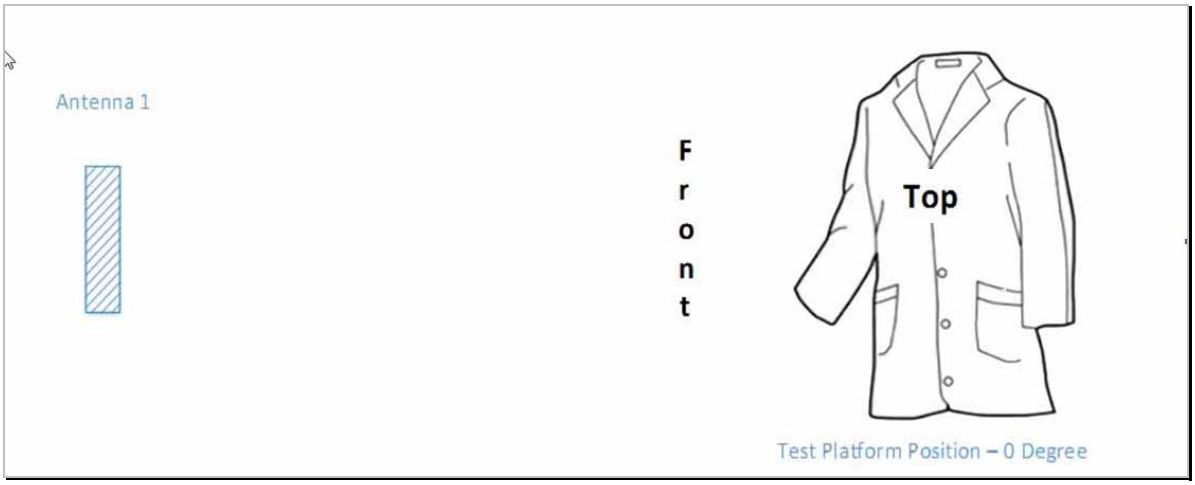
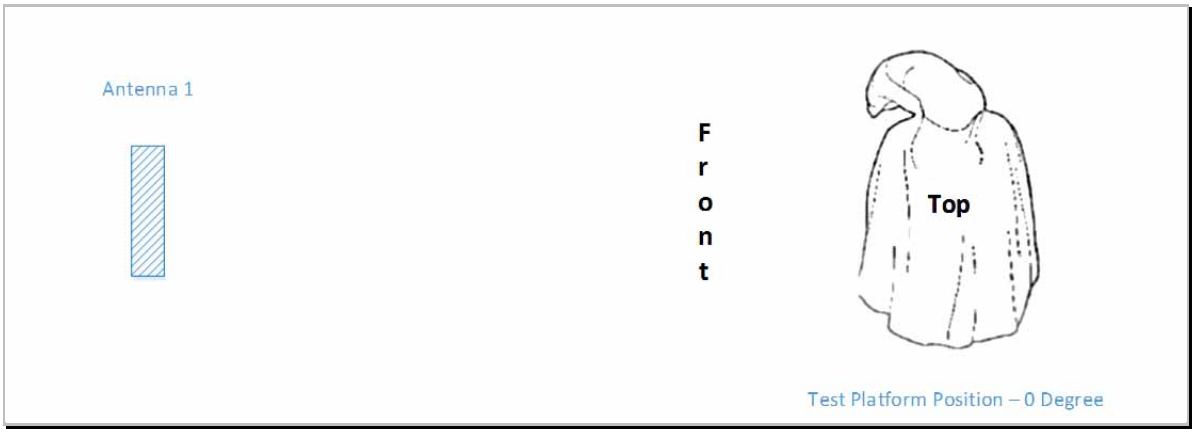


Figure 4-6 Ponchos and parkas – top view

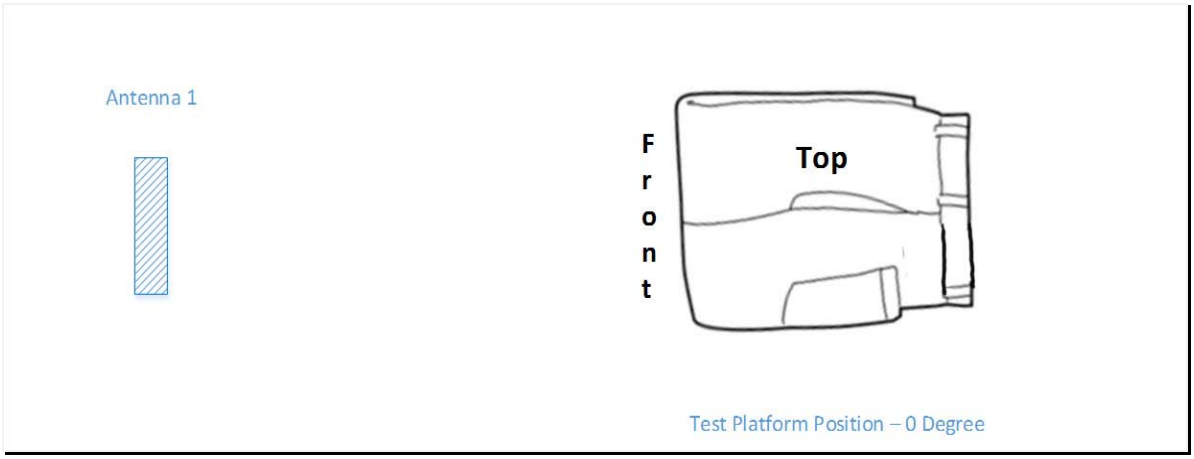


4.4 Pants, slacks and jeans

This category includes items such as denim pants, twill pants, woven pants, fleece pants, knit pants, slacks and jeans with either a constructed, elastic or drawstring waistband. The item is folded using the tri-fold method with the tag on the top of the item.

When performing M-grade testing, items in this category require 2-stack and 11-stack testing. When performing J-grade testing, items in this category require 7-stack testing, unless the grade specifies other item count for the stack.

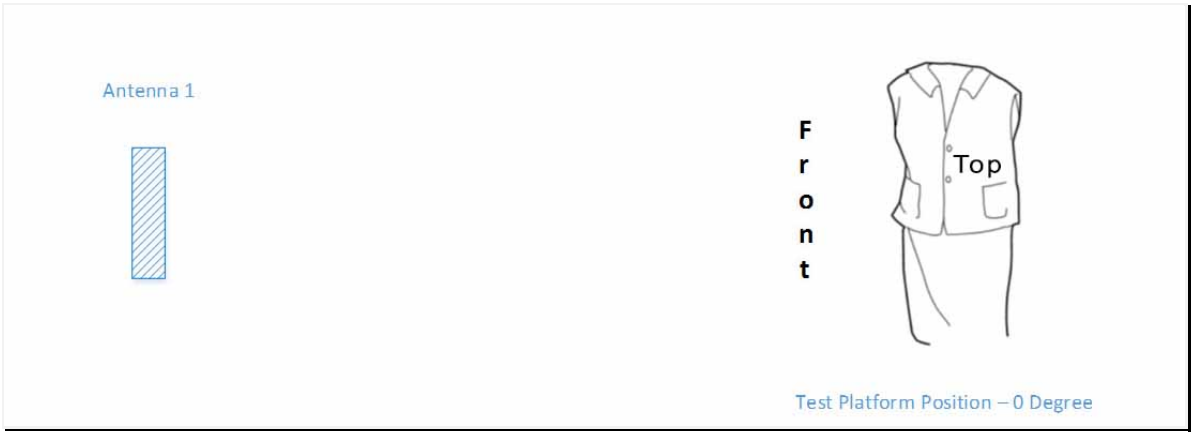
Figure 4-7 Pants, slacks and jeans – top view



4.5 Dresses

This category includes dresses of all lengths. If the dress has an outer jacket, the sleeve of the jacket is considered part of the dress.

Figure 4-8 Dresses – top view

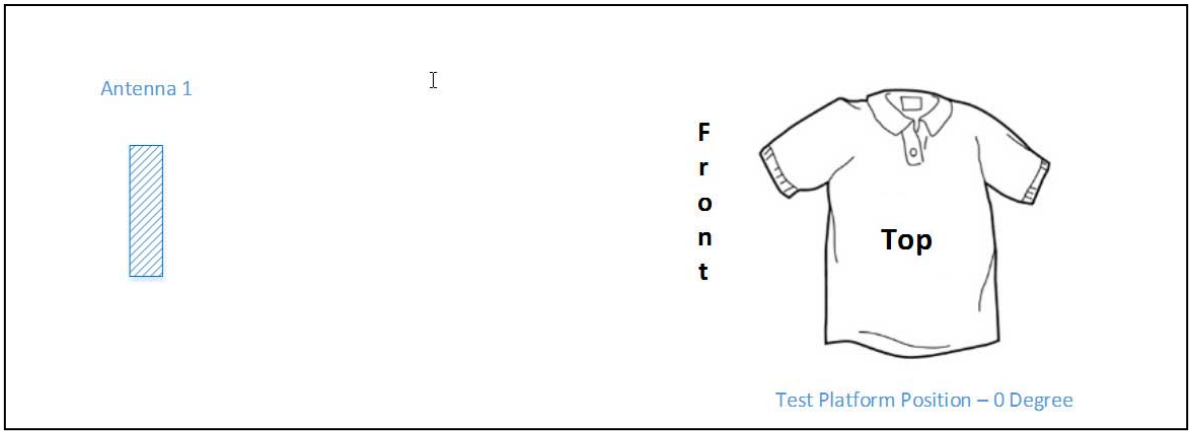


4.6 Tops

This category includes items such as woven and knit shirts, sweaters, turtlenecks, polos, blouses, tank tops, sweater vests and halter-tops.

When performing M-grade testing, items in this category require 2-stack and 11-stack testing. When performing J-grade testing, items in this category require 7-stack testing, unless the grade specifies other item count for the stack.

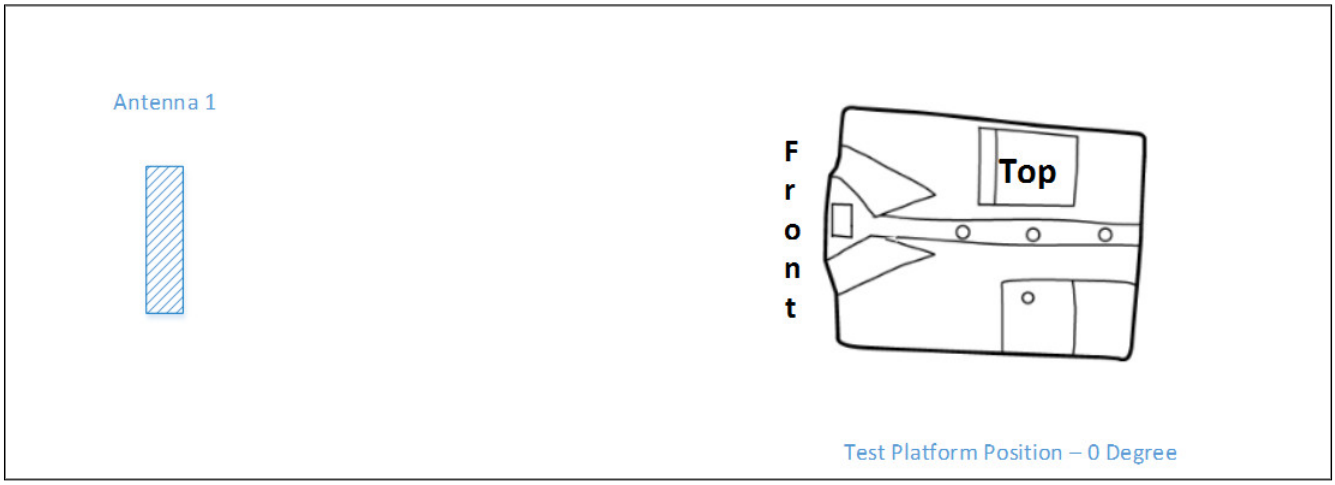
Figure 4-9 Tops – top view



4.7 Tops - Folded

This category includes items such as woven and knit shirts, sweaters, turtlenecks, polos, blouses, tank tops, sweater vests and halter-tops.

Figure 4-10 Tops folded – top view



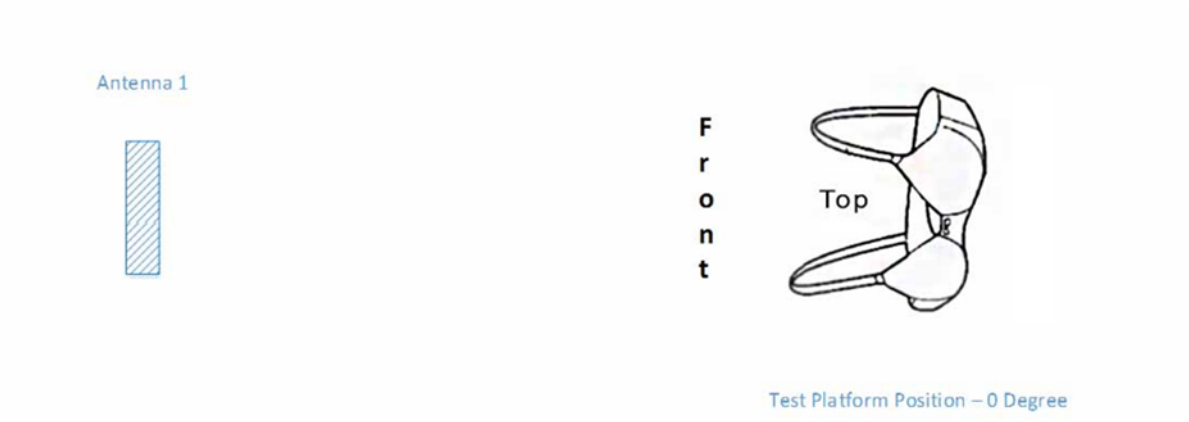
4.8 Bras

This category includes items such as bras.

The bra straps are positioned towards antenna 1, whilst the bra cups face upwards towards antenna 4.

When performing M-grade testing, items in this category require 2-stack and 11-stack testing. When performing J-grade testing, items in this category require 7-stack testing, unless the grade specifies other item count for the stack.

Figure 4-11 Bras



4.9 Camisoles, teddies, crop tops, slips, swimwear, bodywear and dancewear

This category includes items such as camisoles, teddies, crop tops, slips, swimwear, bodywear and dancewear.

When performing M-grade testing, items in this category require 2-stack and 11-stack testing. When performing J-grade testing, items in this category require 7-stack testing, unless the grade specifies other item count for the stack.

Figure 4-12 Camisoles, teddies, crop tops, slips, swimwear, bodywear and dancewear

4.10 Panties and control garments

This category includes items such as panties, briefs and girdles.

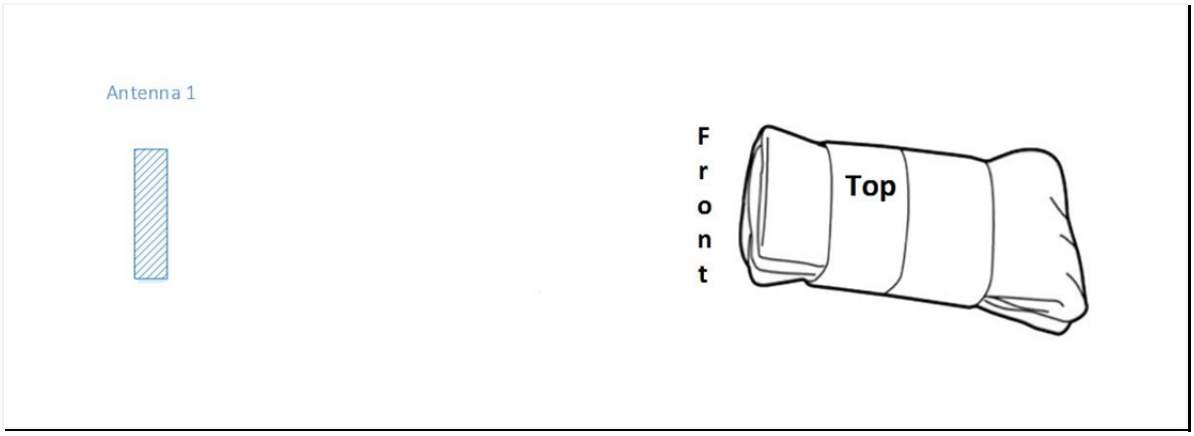
When performing M-grade testing, items in this category require 2-stack and 11-stack testing. When performing J-grade testing, items in this category require 7-stack testing, unless the grade specifies other item count for the stack.

Figure 4-13 Panties and control garments

4.11 Banded apparel

This category includes items such as packaged socks.

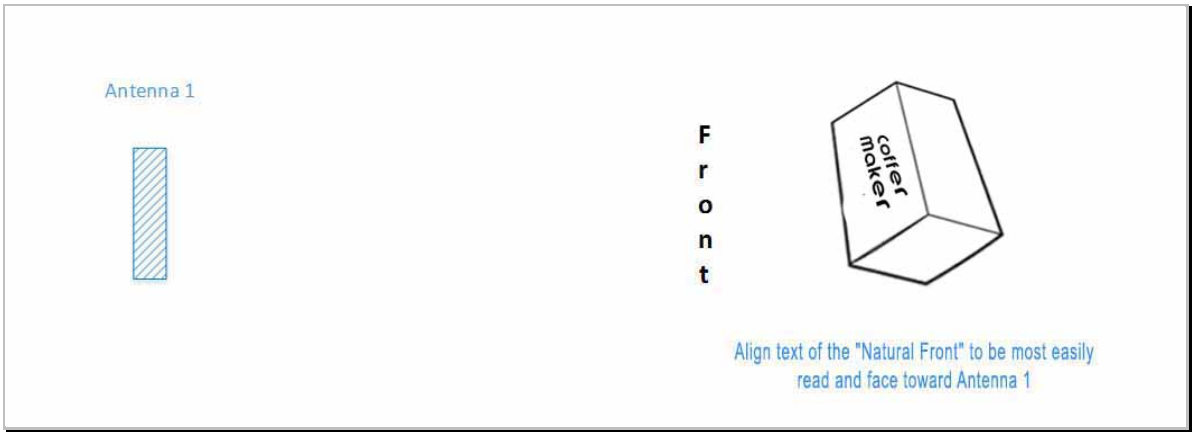
Figure 4-14 Banded apparel



4.12 Boxed apparel

This category includes apparel packaged in boxes with a flap lid that are to be merchandised with the product, such as shoes, men's underwear and slippers.

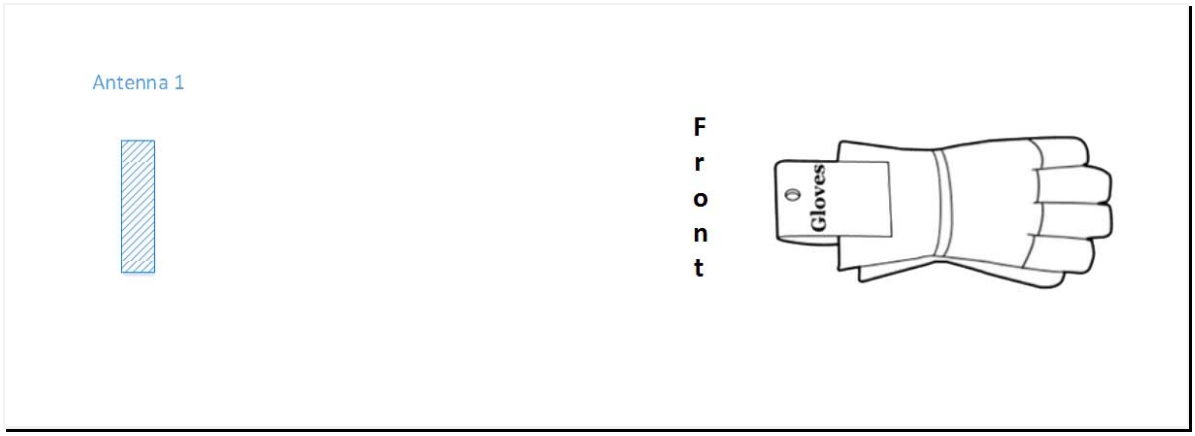
Figure 4-15 Boxed apparel



4.13 Carded apparel (flap), gloves and mittens

This category includes merchandise that is affixed to a cardboard for display purposes, such as gloves and mittens.

Figure 4-16 Carded apparel (flap), gloves and mittens

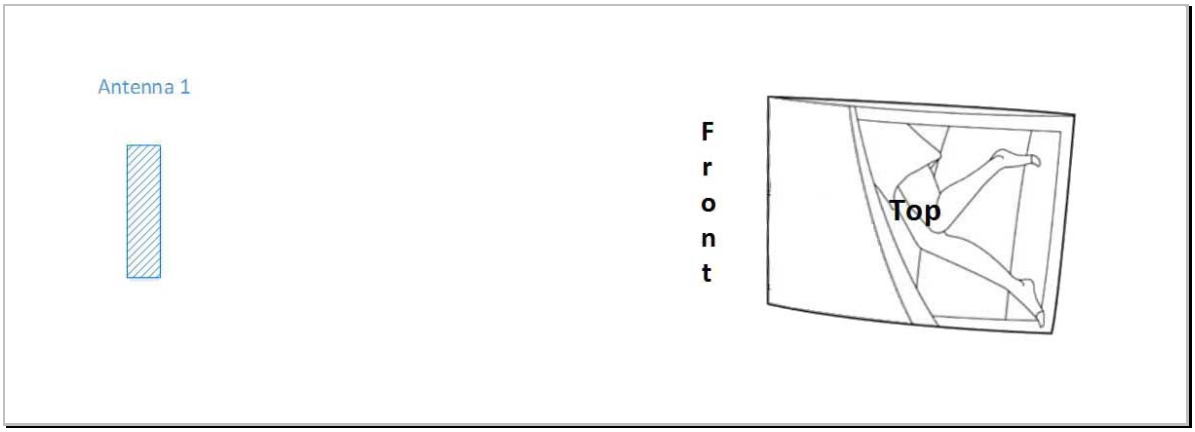


4.14 Flat packed apparel

This category includes items such as hosiery.

When performing M-grade testing, items in this category require 2-stack and 11-stack testing. When performing J-grade testing, items in this category require 7-stack testing, unless the grade specifies other item count for the stack.

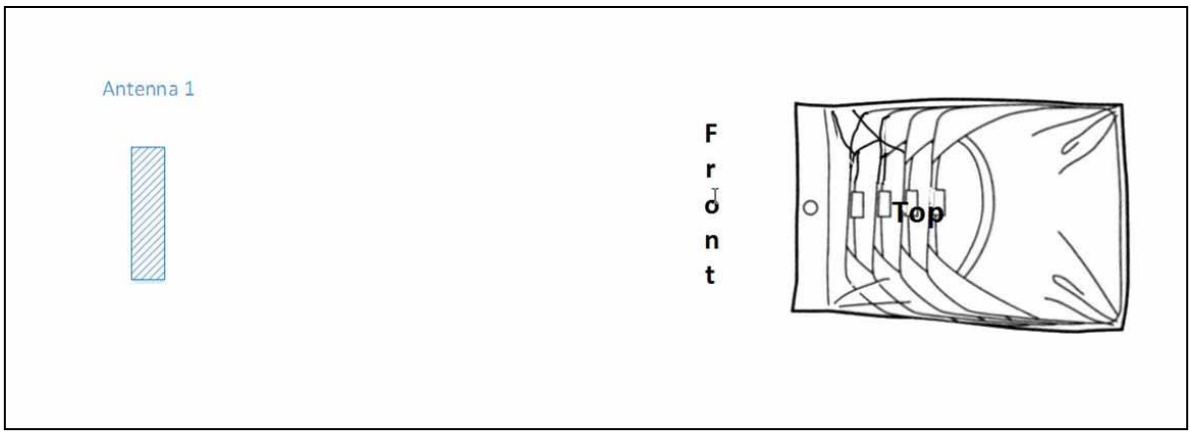
Figure 4-17 Flat packed apparel



4.15 Plastic packaged apparel

This category includes merchandise wrapped in plastic that may or may not include cardboard inserts, such as packages of underwear or socks

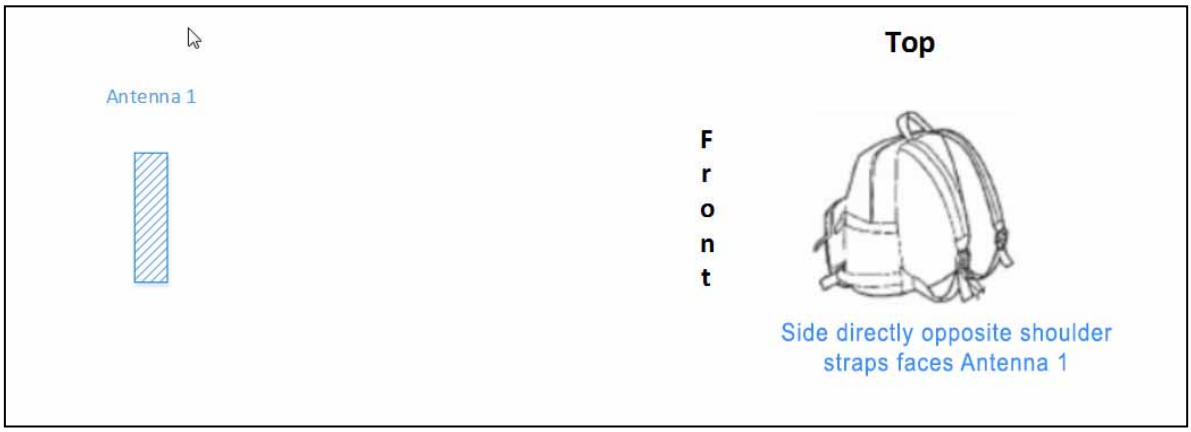
Figure 4-18 Plastic packaged apparel



4.16 Backpacks

This category includes items such as backpacks, knapsacks and fanny packs.

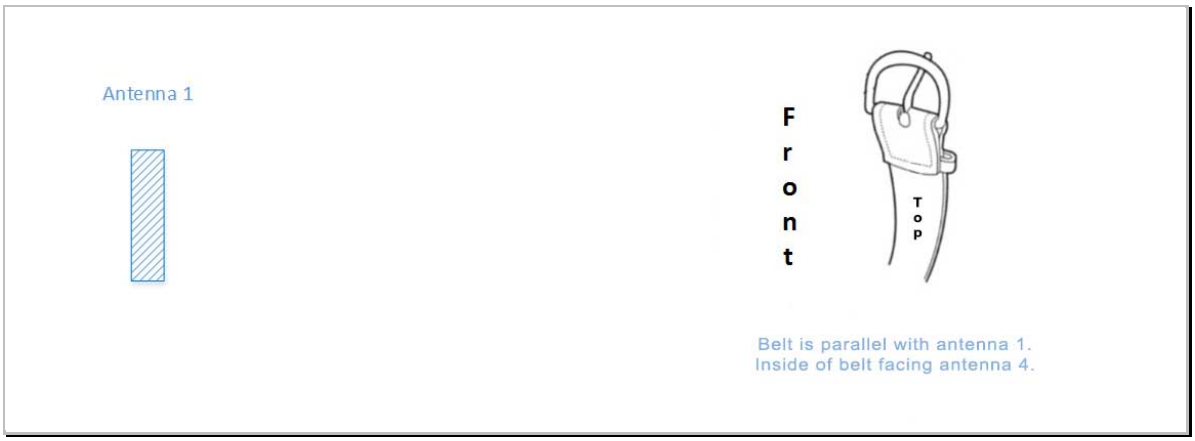
Figure 4-19 Backpacks



4.17 Belts

This category includes items such as belts

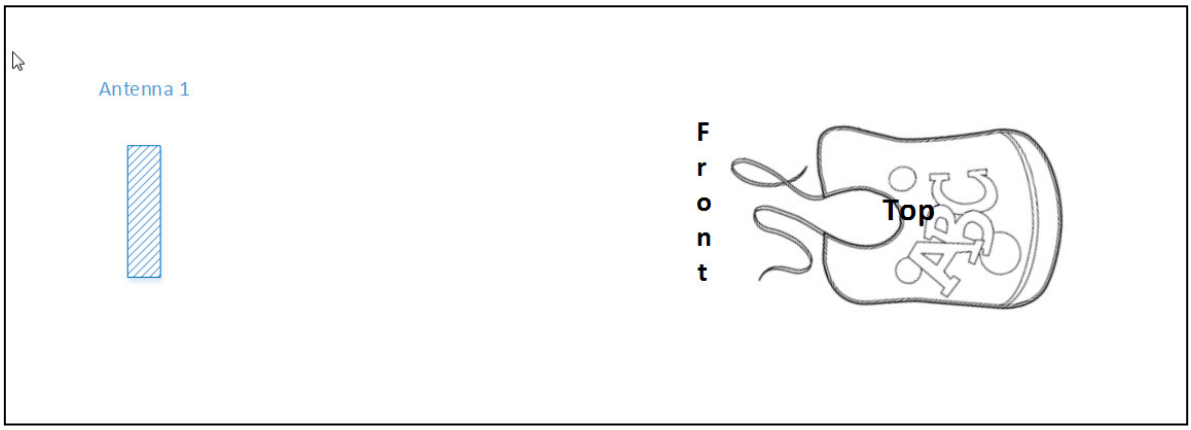
Figure 4-20 Belts



4.18 Bibs

This category includes items such as infant bibs.

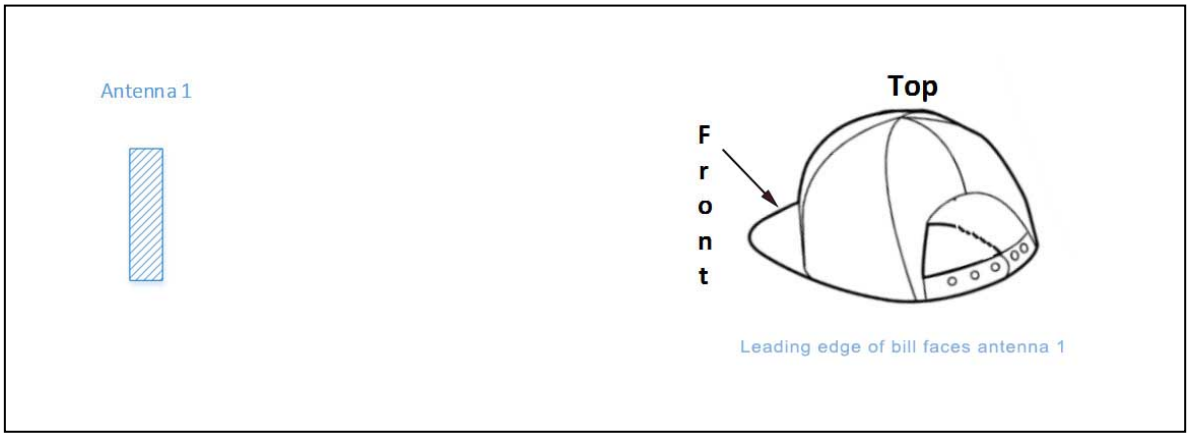
Figure 4-21 Bibs



4.19 Caps, visors and hats

This category includes items such as baseball caps, berets, visors, knit hats, ski masks, beanies, cowboy hats, straw hats, fedoras, pillbox hats, felt hats and dressy hats.

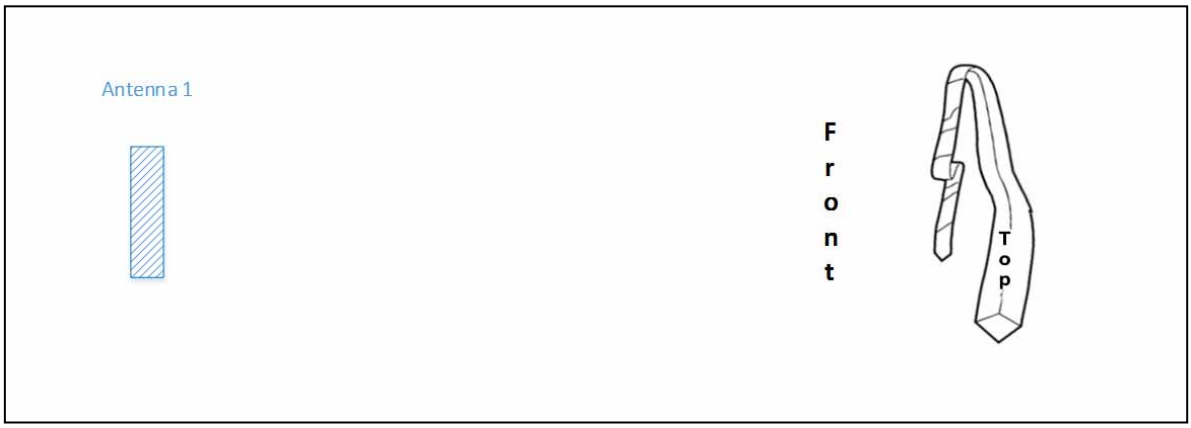
Figure 4-22 Caps, visors and hats



4.20 Neckwear

This category includes items such as unknotted ties, clip-on ties and bow ties of all fabrication.

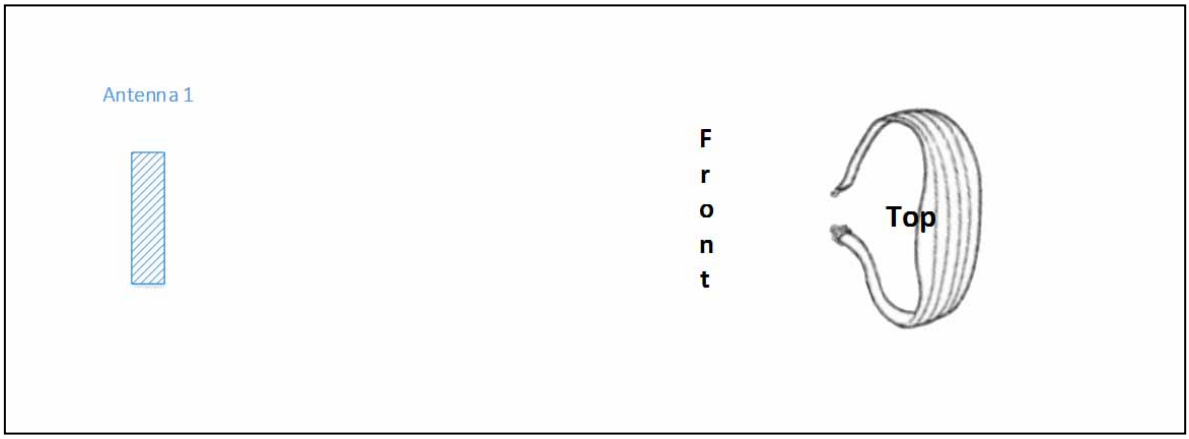
Figure 4-23 Neckwear



4.21 Cummerbunds

This category includes items such as cummerbunds.

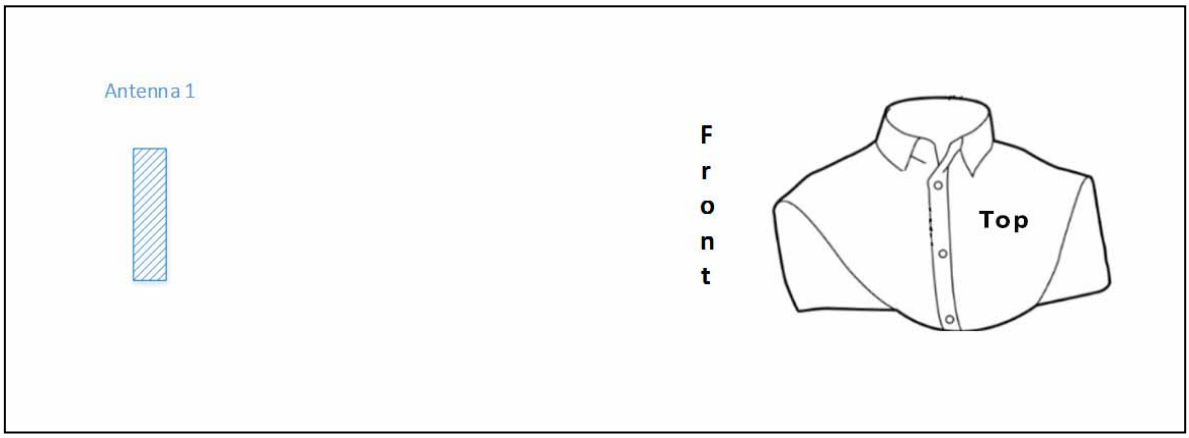
Figure 4-24 Cummerbunds



4.22 Dickies and collars

This category includes items such as dickies and collars.

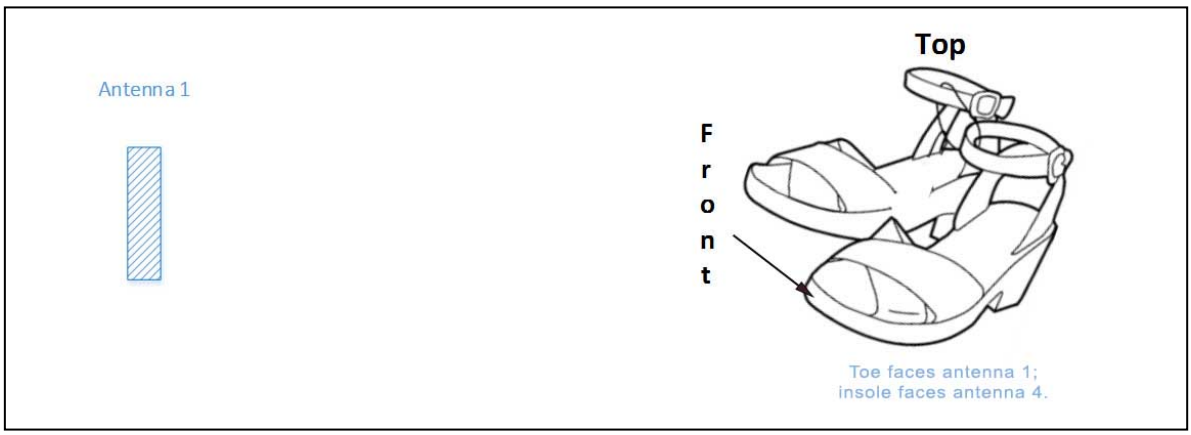
Figure 4-25 Dickies and collars



4.23 Footwear

This category includes items such as sandals, slippers, athletic shoes, or other footwear.

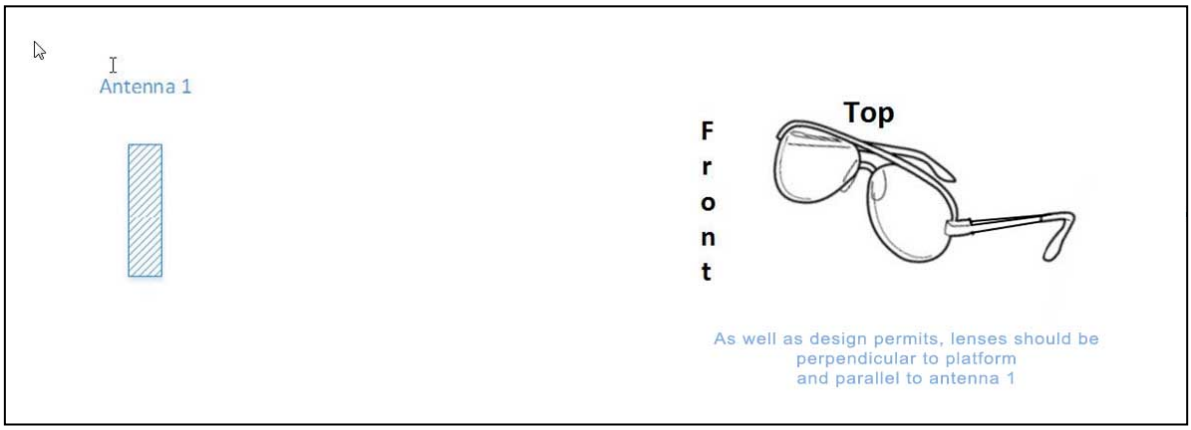
Figure 4-26 Footwear



4.24 Glasses

This category includes items such as sunglasses and pre-made readers.

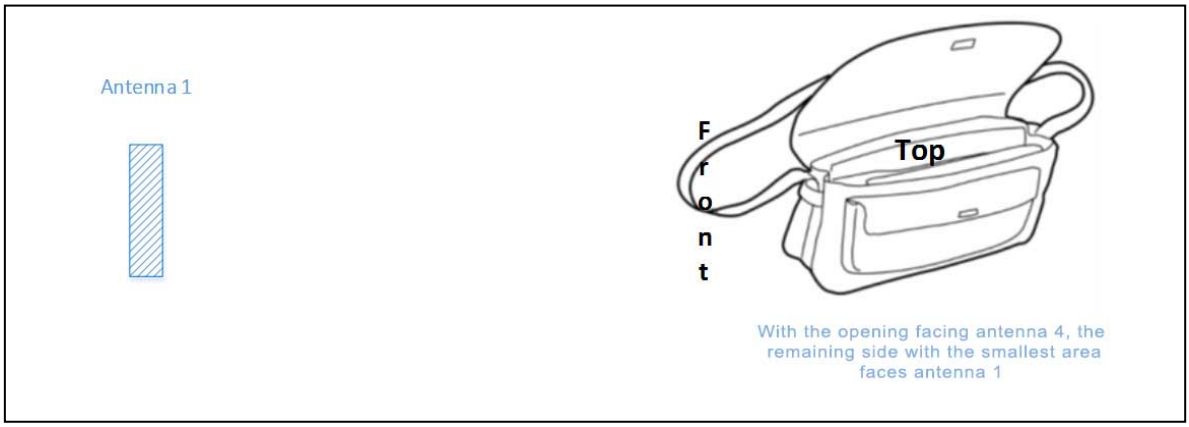
Figure 4-27 Glasses



4.25 Handbags, Purses and Wallets

This category includes items such as clutches, coin purses, dop kits, purses, cinch sacks, wallets, billfolds and tri-folds.

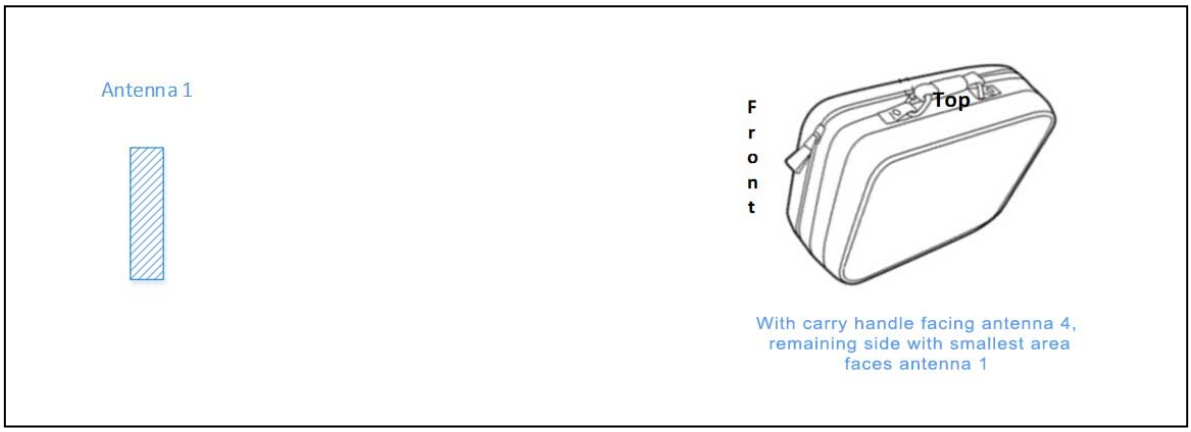
Figure 4-28 Handbags, purses and wallets



4.26 Luggage and briefcases

This category includes items such as briefcases, suitcases, garment bags and duffle bags.

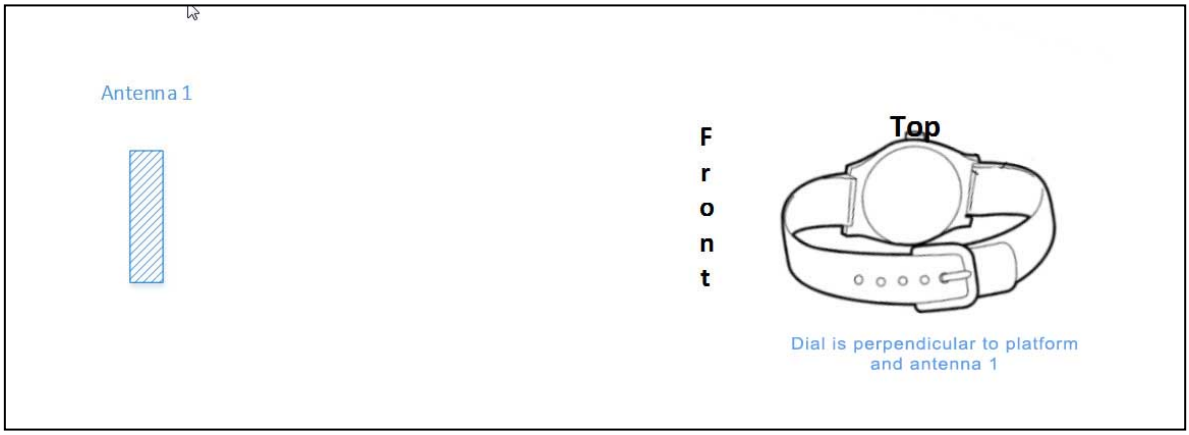
Figure 4-29 Luggage and briefcases



4.27 Loose watches

This category includes items such as watches and pocket watches.

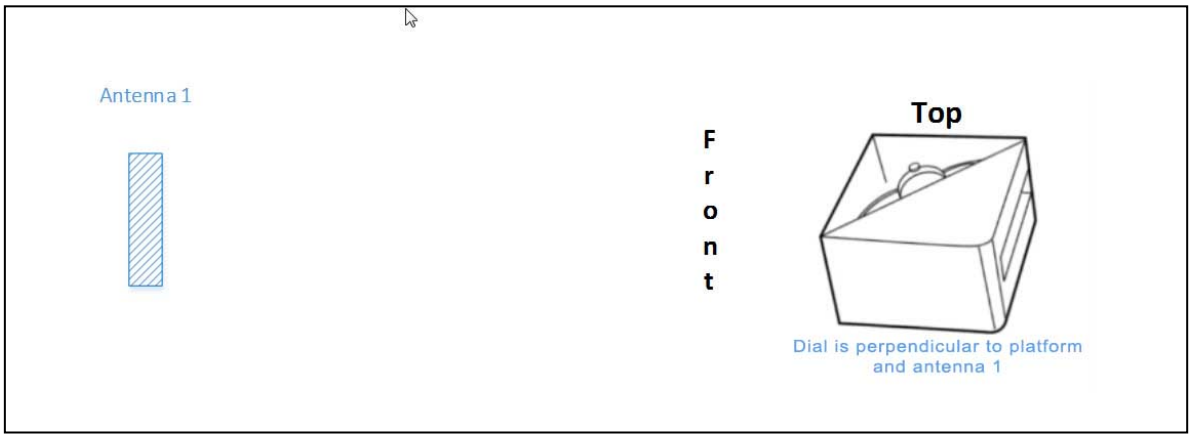
Figure 4-30 Loose watches



4.28 Watches displayed in a box or case

This category includes items such as watches and pocket watches.

Figure 4-31 Watches displayed in a box or case

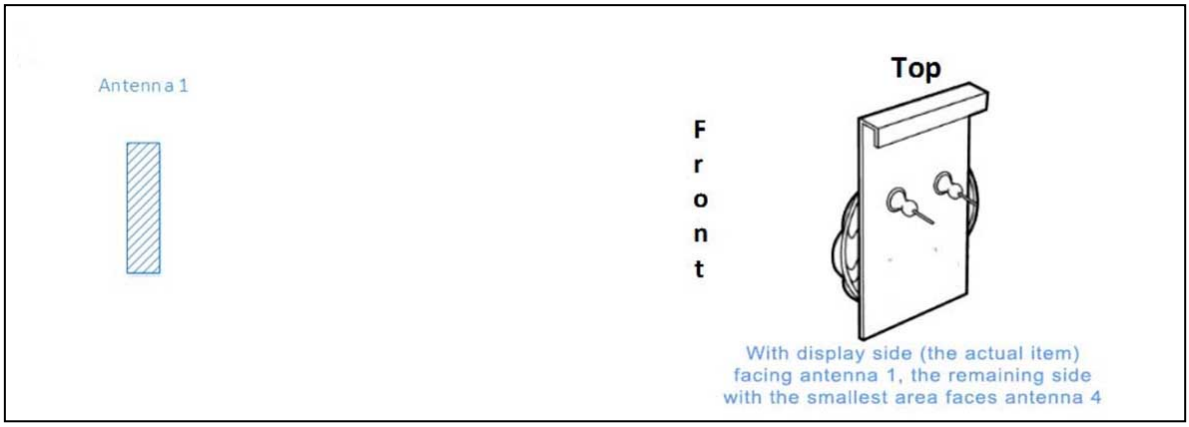


4.29 Jewellery - carded

This category includes items such as earrings, pins, broaches, charms, hair clips, tie tacks, cuff links and studs.

When performing J-grade testing, items in this category require 7-stack testing, unless the grade specifies other item count for the stack.

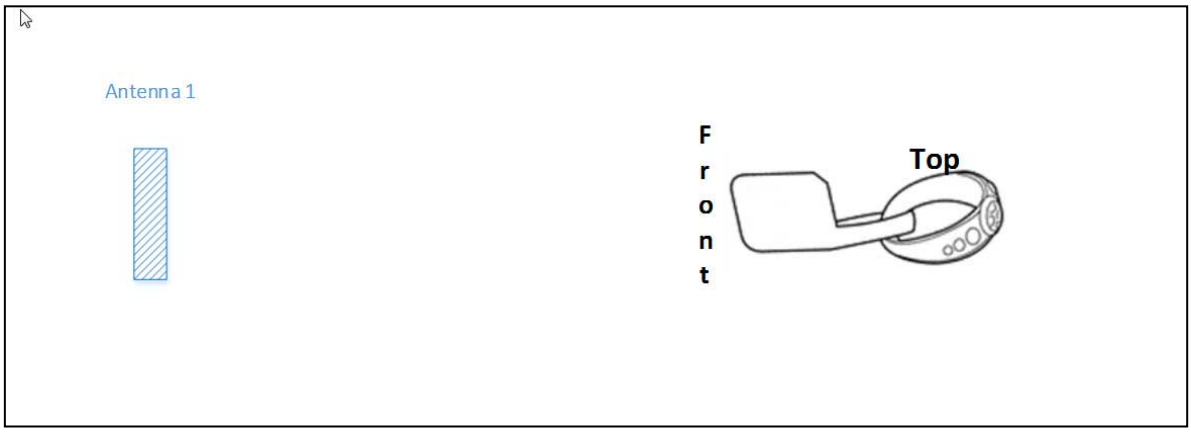
Figure 4-32 Jewellery carded



4.30 Jewellery - Loose

This category includes items such as necklaces, chains, bracelets, bangles and rings.

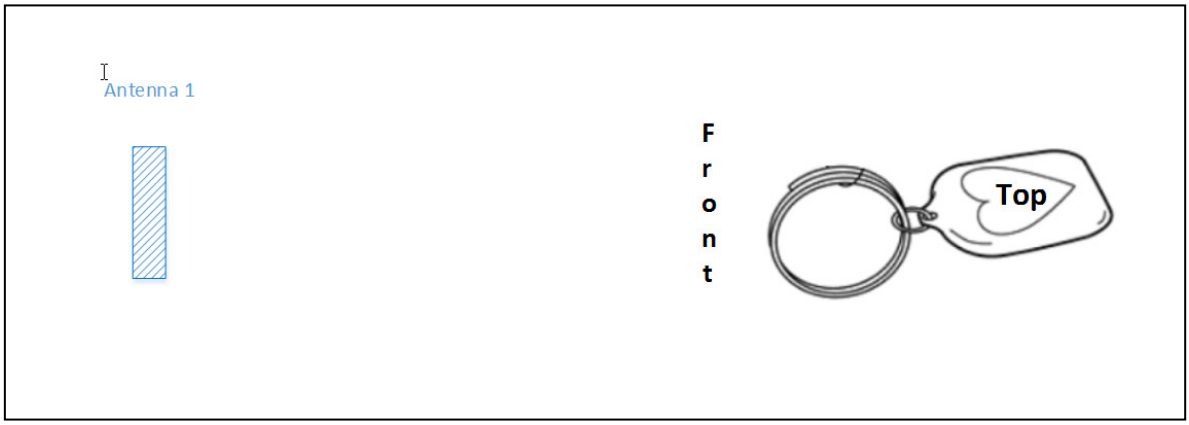
Figure 4-33 Jewellery-loose



4.31 Key chains

This category includes items such as key chains.

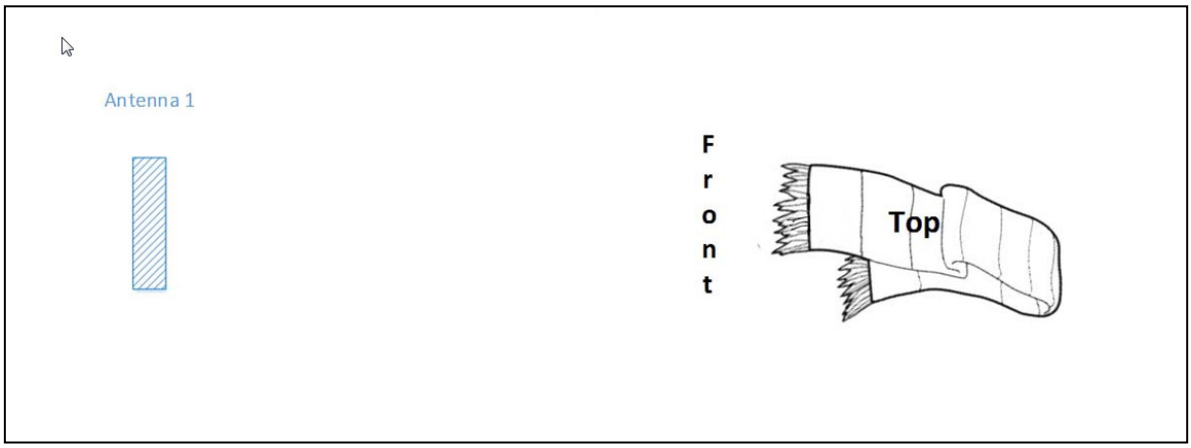
Figure 4-34 Key chains



4.32 Scarves and shawls

This category includes items such as winter scarves, silk scarves and shawls.

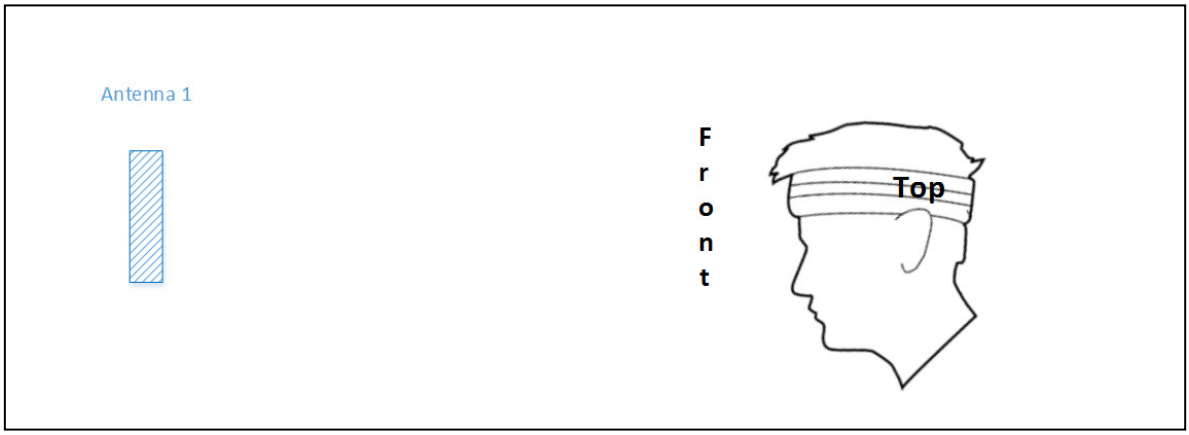
Figure 4-35 Scarves and shawls



4.33 Sweatbands

This category includes items such as headbands, wrist bands and ankle bands.

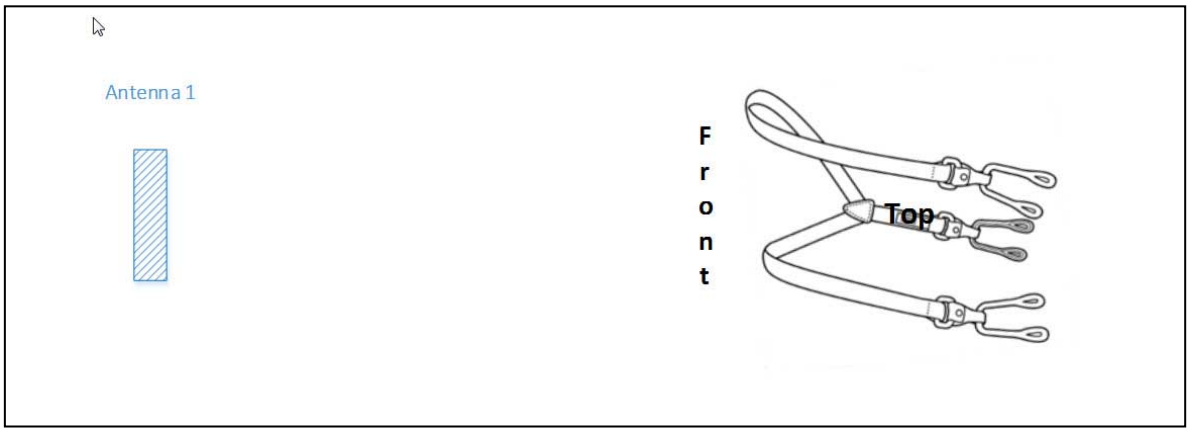
Figure 4-36 Sweatbands



4.34 Suspenders and braces

This category includes items such as suspenders and braces.

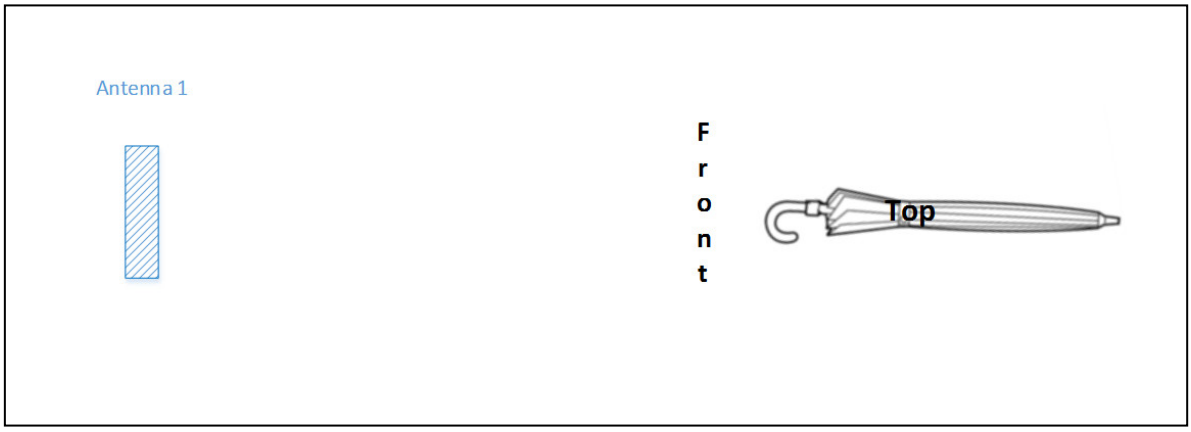
Figure 4-37 Suspenders and braces



4.35 Umbrellas

This category includes items such as umbrellas.

Figure 4-38 Umbrella

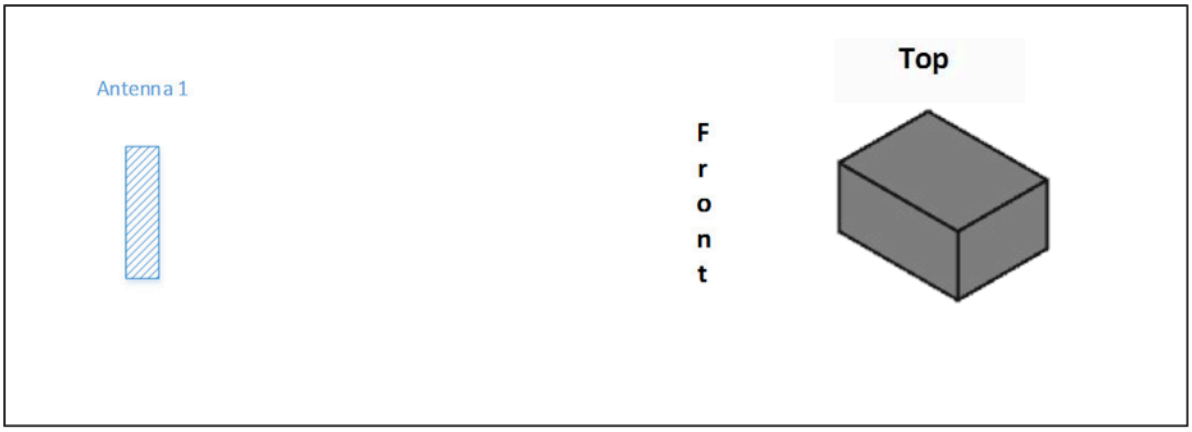


4.36 Small boxed items

These items include small electronics, packaged cosmetics and other products typically displayed in a horizontal stack or array configuration.

When used in stack testing, these items should be placed so their faces are touching. When performing J-grade testing, items in this category require 7-stack testing, unless the grade specifies other item count for the stack.

Figure 4-39 Small Boxed Item

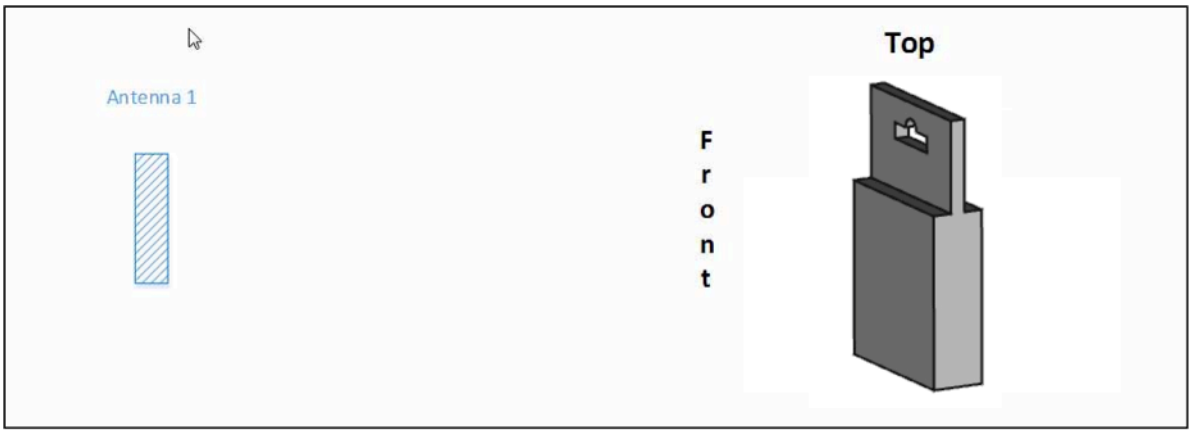


4.37 Small hanging items

These items include small items that hang from rods or pegs typically hanging perpendicular to a wall or fixture.

When using in stack testing, these items should be placed so that their faces are touching without any outside force required to maintain their spacing (i.e. don't pack them in a box or compress them). When performing J-grade testing, items in this category require 7-stack testing, unless the grade specifies other item count for the stack.

Figure 4-40 Small Hanging Item



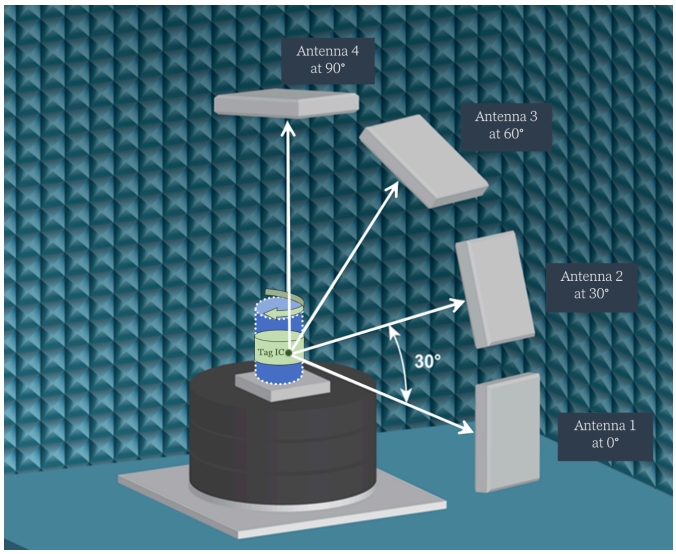
4.38 Healthcare vial and syringe items

These items include glass or plastic vials and syringes that are to be used in smart enclosures or smart RFID cabinets.

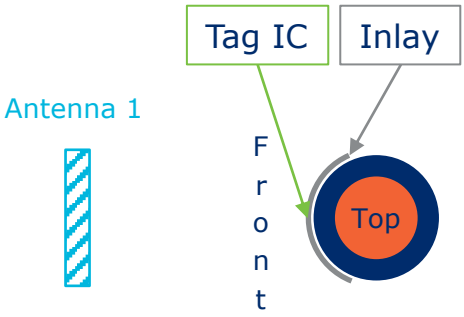
The Tagged item is to be placed on the rotating test platform so that the integrated circuit (IC) or front face of the tag will be parallel to linear polarized antenna 1 when the test platform is at the 0° position. The top of item faces Antenna 4. The tag location on/in the item MUST be positioned at the

incident point (center of test platform) of all four antennas. Optionally, the supplier can specify the location and orientation of the tag on/in tagged item.

Figure 4-41 Healthcare vials and syringes



Front view



Top view