BTAG Internal Design Validation — Test Apparatus

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1 About This Document

1.1 Purpose

This document describes the test equipment and apparatus used in the internal design validation of the Intel BTAG radio frequency identification (RFID) tag. It also describes a number of standard apparatus configurations used in individual tests. The test procedures each refer to one of these standard configurations.

1.2 Document Owners

Any suggestions or corrections for this document should be referred to Justin Reina or Paul Hamlow.

1.3 Distribution Policy

This document is intended for internal use only.

1.4 Revision Control

All test documentation is located in a source repository found here on the Intel Network. You must be granted access to view:

\\VMSPFSFSEG01\BTag\Testing\TestCodeRepos\TestSpec

No revision history is listed in this document or any other, and instead is tracked in the source repositories' log. All test documentation is tracked under a single source and revision number for uniformity.

1.5 References

BTAG Internal Design Validation Test Plan

BTAG Internal Design Validation Test Procedures

1.6 Glossary

The terms, abbreviations and acronyms listed in Table 1 are used in this document.

Table 1: Terms, Abbreviations and Acronyms

Term	Description
OTA	Over-the-Air
RFID	Radio frequency identification

2 Test Apparatus

This chapter describes the various components of an apparatus configuration.

2.1 Test Instruments

A test may require the use of one or more of the test instruments listed in this section. As there may be several instances of each instrument model in the RF lab, check the serial number of the instrument(s) used so the test measurements are consistent.

2.1.1 Agilent MSO6104A Oscilloscope

Table 2: Agilent MSO6104A Oscilloscope Information

Datum	Description
Manufacturer	Agilent Technologies, Inc.
Model	MSO 6104A, Option 8MH
Description	4 Channel, 1GHz Oscilloscope + 16 logic channels
Serial Number	MY44001011
MAC	00:30:D3:0B:30:1F
Documentation/Manuals	*MSO6104A Manuals*

Figure 1: Agilent MSO6104A Oscilloscope, Front View

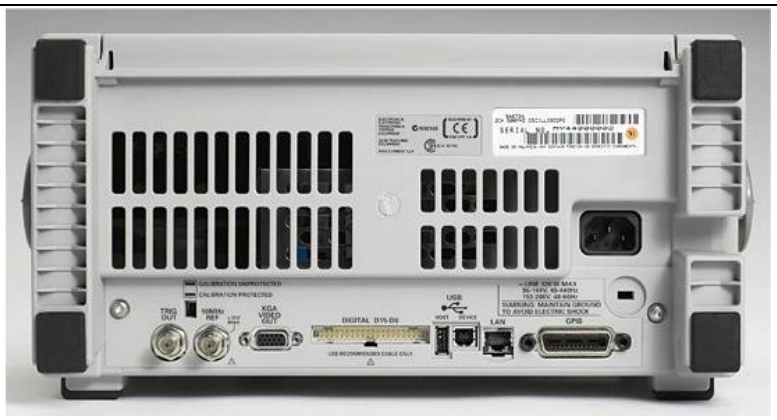


Figure 2: Agilent MSO6104A Oscilloscope, Back View

2.1.2 Agilent E4440A Spectrum Analyzer

Table 3: Agilent E4440A Spectrum Analyzer Information

Datum	Description
Manufacturer	Agilent Technologies, Inc.
Model	E4440A
Description	PSA Spectrum Analyzer, 3 Hz–26.5 GHz
Serial Number	MY44303365
MAC	00:30:D3:0B:30:1F
Documentation/Manuals	*E4440A Manuals*

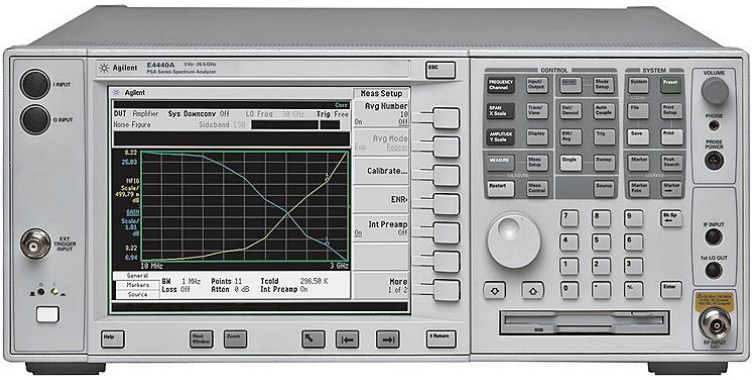


Figure 3: Agilent E4440A PSA Spectrum Analyzer, Front View

Figure 4: Agilent E4440A PSA Spectrum Analyzer, Back View

2.1.3 Agilent 33220A 20 MHz Function/Arbitrary Waveform Generator

Table 4: Agilent 33220A 20 MHz Function/Arbitrary Waveform Generator Information

Datum	Description
Manufacturer	Agilent Technologies, Inc.
Model	33220A
Description	20 MHz Function/Arbitrary Waveform Generator
Serial Number	44011557
MAC	00:30:D3:OC:39:19
Documentation/Manuals	*33220A Manuals*
Application Notes	33220A AppNotes

Figure 5: Agilent 33220A 20 MHz Function/Arbitrary Waveform Generator, Front and Back Views

2.1.4 Fluke 289 True RMS Multimeter

Table 5: Fluke 289 True RMS Multimeter Information

Datum	Description
Manufacturer	Fluke Corporation
Model	289
Description	True RMS Multimeter
Serial Number	16390264
Manuals	Fluke 289 Manuals

Figure 6: Fluke 289 True RMS Multimeter, Front View

2.1.5 Tektronix TX3 Multimeter

Table 6: Tektronix TX3 Multimeter Information

Datum	Description
Manufacturer	Tektronix, Inc.
Model	TX3
Description	Multimeter
Serial Numbers	B011272, B011251
Manuals	Tektronix TX3 Manuals

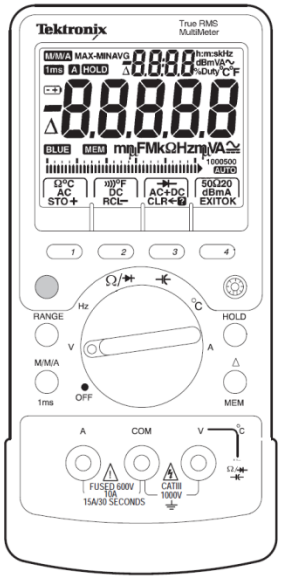


Figure 7: Tektronix TX3 Multimeter, Front View

2.1.6 Tenma Digital Power Supply #0

Table 7: Tenma DC Power Supply Information

Datum	Description
Manufacturer	Tenma
Model	72-7695
Description	36V, 10A Single Output DC Bench Power Supply
Serial Number	0001734
Manuals	Tenma 72-7695 Power Supply Specification

Figure 8: Tenma 72-7695 Power Supply, Front View

Figure 9: Tenma 72-7695 Power Supply, Back View

2.1.7 National Instruments USB-6009 DAQ #0

Table 8: National Instruments USB-6009 DAQ Information

Datum	Description
Manufacturer	National Instruments
Model	USB-6009 DAQ
Description	Bus-Powered Multifunction DAQ USB Device
Serial Number	
Manuals	NI USB-6009 DAQ User Guide & Specification

Figure 10: National Instruments USB-6009 DAQ

2.2 Annenuators

Attentuators are used to reduce the RF power to the RFID antenna. The RFID readers are typically designed to operate at a distance of 30 feet or more from the RFID tags. The use of attenuators allows tests to be done in the lab that would otherwise have to be performed in an open-field environment.

2.2.1 Agilent 8494B, 8496B RF Attenuators

Table 9: Agilent 8494B Step Attenuator

Datum	Description
Manufacturer	Agilent Technologies, Inc.
Model	8494B
Maximum Input Power	30 dBm
Insertion Loss	2.22 dB
Description	11 dB Step Attenuator
Serial Number	MY42144271
Manuals	Agilent 8494B Quick Spec Sheet Agilent 8494B Operating Manual

Figure 11: Agilent 8494B 11 dB Step Attenuator

Table 10: Agilent 8496B Step Attenuator

Datum	Description
Manufacturer	Agilent Technologies, Inc.
Model	8496B
Maximum Input Power	30 dBm
Insertion Loss	2.22 dB
Description	110 dB Step Attenuator
Serial Number	MY42142141
Manuals	Agilent 8496B Quick Spec Sheet Agilent 8496B Operating Manual

Figure 12: Agilent 8496B 110 dB Attenuator

These two step attenuators are used together and have been permanently connected in series as shown in Figure 13.

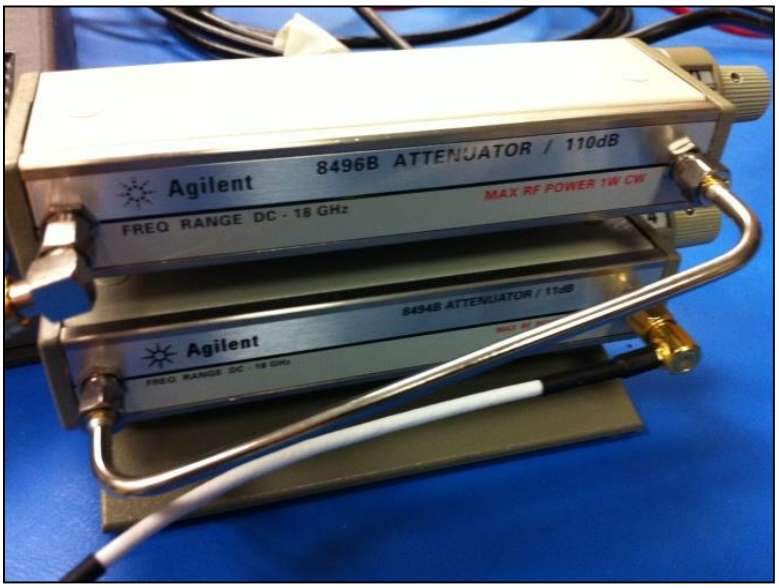


Figure 13: Combined Agilent Attenuators

2.2.2 CryStek Attenuators

Table 11: Crystek In-Line Attenuators

Model	Attenuation	Maximum Power (watts)	Datasheet
CATTEN-01R0	1.0 dB	1.0	CATTEN-01R0
CATTEN-01R5	1.5 dB	1.0	CATTEN-01R5
CATTEN-02R0	2.0 dB	1.0	CATTEN-02R0
CATTEN-03R0	3.0 dB	1.0	CATTEN-03R0
CATTEN-04R0	4.0 dB	1.0	CATTEN-04R0
CATTEN-05R0	5.0 dB	1.0	CATTEN-05R0
CATTEN-06R0	6.0 dB	1.0	CATTEN-06R0
CATTEN-07R0	7.0 dB	1.0	CATTEN-07R0
CATTEN-08R0	8.0 dB	1.0	CATTEN-08R0
CATTEN-09R0	9.0 dB	1.0	CATTEN-09R0
CATTEN-0100	10.0 dB	1.0	CATTEN-0100
CATTEN-0150	15.0 dB	0.5	CATTEN-0150
CATTEN-0200	20.0 dB	0.5	CATTEN-0200

Figure 14: ***Crystek Attenuator (CATTEN-01R0 shown)***

Table 12: Specifications Common to All Crystek Attenuators

Specification	Value
Frequency Range	DC-3GHz
VSWR	1 Typ, 1.3 Max
Impedance	50 Ω
Tolerance	±0.3 dB
Temperature Range	-40°C to +85°C

2.2.3 JFW 50P-1914 Solid State Programmable Attenuator

Table 13: JFW 50P-1914 Attenuator Information

Datum	Description
Manufacturer	JFW Industries, Inc.
Model	50P-1914
Description	Solid State Programmable Attenuator
Serial Number	580346 1111
Frequency Range	840-1000 MHz
Input Impendence	50Ω
Attenuation Range	0-63.5 dB, 0.5 dB steps
VSWR	1.5:1 maximum
RF Input Power (operating)	+20 dBm
RF Input Power (maximum)	+25 dBm
RF Connector	SMA female
Specification Sheet	50P-1914 Specifications
Drawing	50P-1914 Drawing

Figure 15: JFW 50P-1914 Programmable Attenuator

2.3 RFID Readers

Several different RFID readers are used in the BTAG validation tests; these are listed in Table 14.

Table 14: RFID Readers Used for BTAG Validation

ID Tag	Manufacturer	Model	Serial Number	MAC	User Name	Password
ATC#0	Alien Technology	ALR-9900+	JB1102495	00:1B:5F:00:51:D1	alien	password
E50#0	ACURA Global	Edge50	401850	N/A[1]	N/A[2]	N/A[2]
E50#1	ACURA Global	Edge50	403585	N/A[1]	N/A[2]	N/A[2]
R1K#0	Impinj, Inc.	R1000	37008080158	00:16:25:10:04:5C	root	impinj
IF2#0	Intermec, Inc.	IF2/1009FF01	31911163047	00:10:40:3B:CC:5A	intermec	intermec
IF2#1	Intermec, Inc.	IF2/1009FF01	21711163011	00:10:40:3B:E8:6D	intermec	intermec
IF2#2	Intermec, Inc.	IF2/1009FF01	30911163070	00:10:40:3B:E9:65	intermec	intermec
IF2#3	Intermec, Inc.	IF2/1009FF01	26811263107	00:10:40:3B:CE:FA	Intermec	intermec
MFX#0	Motorola	FX7400	1135500504723	00:23:68:C7:E3:E2	admin	change
TM6#0	ThingMagic	M6-NA	061255401039	00:12:A4:21:14:22	web	radio
S5X#0	Sirit, Inc.	INfinity 510	IN51008653	00:17:9E:00:43:B1	N/A[3]	N/A[3]
S5X#1	Sirit, Inc.	Infinity 510	IN51009714			
S5X#2	Sirit, Inc.	Infinity 510	IN51009715	00:17:9E:00:48:A5	N/A[4]	N/A[3]
S5C#0	Sirit, Inc.	IDentity 5100	ID5100 00070	00:17:9E:00:27:08	support	cfa050413f47dabd

The following sections describe each of these readers in more detail.

2.3.1 AcuraGlobal Edge50 Leitor UHF RFID Reader

Table 15: AcuraGlobal Edge50 Specifications

Datum	Description
Manufacturer	AcuraGlobal
Model	Edge50 Leitor UHF (100.141)
MAC	N/A (Serial/USB only)
Documentation	ACURA Global Edge 50 Documentation

[1] The Edge50 has no network interface.
[2] The Edge50 has no login username or password.
[3] The INfinity 510 does not have a login user name or password.
[4] The INfinity 510 does not have a login user name or password.

Table 16: AcuraGlobal Edge50 Instance Data

Datum	Tag ID "Edge50 #0"	Tag ID "Edge50 #1"
Serial Number	401850	403585
HW Version	v18.00.00.01	v18.00.00.01
SW Version	v1.13.02.00	v1.13.02.04
Label ID	400-0030-01-05/241130401850/-5.0/P+	400-0030-01-06/421130403585/-5.0/P+

Figure 16: ACURA Global Edge 50

2.3.2 Alien Technologies® ALR-9900+ RFID Reader

Table 17: Alien Technologies ALR-9900+ RFID Reader Information

Datum	Description
Manufacturer	Alien Technologies
Model	ALR-900+
Serial Number	JB220495
MAC	
Username	alien
Password	password
Documentation	Alien Technologies ALR-9900+ RFID Reader

Figure 17: Alien Technologies ALR-9900+ RFID Reader

2.3.3 Impinj® Speedway® R1000

Table 18: Impinj Speedway R1000 RFID Reader Information

Datum	Description
Manufacturer	Impinj, Inc.
Model	IPJ-R1000-USA 1M
Serial Number	37008080158
MAC	00:16:25:10:04:5C
Username	root
Password	impinj
Documentation	Impinj Speedway R1000 RFID Reader

Figure 18: Impinj Speedway R1000 RFID Reader

2.3.4 Intermec IF2

Table 19: Intermec IF2 Network Reader Information

Datum	Description
Manufacturer	Intermec
Model	IF2/1009FF01
Serial Number	31911163047
MAC	00:10:40:3B:CC:5A
Username	intermec
Password	intermec
Documentation	Intermec IF2 Network RFID Reader

Figure 19: Intermec IF2 RFID Reader

2.3.5 Motorola FX7400 #0

Table 20: Motorola FX7400 RFID Reader Information

Datum	Description
Manufacturer	Motorola, Inc.
Model	FX7400
Serial Number	1135500504723
MAC	00:23:68:C7:E3:E2
Username	
Password	
Documentation	Motorola FX7400_RFID Reader

Figure 20: Motorola FX7400 RFID Reader

2.3.6 Sirit INfinity 510

Table 21: Sirit INfinity 510 RFID Reader

Datum	Description
Manufacturer	Sirit Inc.
Model	INfinity 510
Dimensions (L x W x D)	22.0 x 30.0 x 5.6 cm (8.66 x 11.81 x 2.20 in.)
Weight	3.0 Kg (6.5 lbs)
RF Output Power	+30 dBm
Documentation	Sirit INfinity 510 Documentation

Figure 21: Sirit INfinity 510 RFID Reader

2.3.7 Sirit IDentity 5100 RFID Reader

Table 22: Sirit 5100 Information

Datum	Description
Manufacturer	Sirit Inc.
Model	IDentity 5100
Dimensions (L x W x D)	45.0 x 45.0 x 10.5 cm (17.7 x 17.7 x 4.1 in.)
Weight	~6.8 Kg (15 lbs)
RF Output Power	+33 dBm
Environmental Rating	IP67
Documentation	Sirit IDentiity 5100 Documentation

Figure 22: Sirit IDentity 5100 RFID Reader

2.3.8 ThingMagic Mercury M6 RFID Reader

Table 23: ThingMagic M6 Specifications

Datum	Description
Manufacturer	ThingMagic, A Division of Trimble
Model	M6-NA
Serial Number	061255401039
MAC	00:12:A4:21:14:22
Username	web
Password	radio
Documentation	ThingMagic Mercury M6 RFID Reader

Figure 23: ThingMagic Mercury M6 RFID Reader

2.4 RFID Antennas

Table 24: RFID Antennas

Antenna ID	Manufacturer	Model
	Laird Technologies	CushCraft S9028PCRJ
	Motorola	AN710
	Poynting Europe GmbH	PATCH-A0025
	Linx Technologies, Inc.	ANT-916-CW-RH-SMA-ND

2.4.1 CushCraft S9028PCRJ

Table 25: CushCraft S9028PCRJ Specifications [5]

Datum	Description
Manufacturer	Laird Technologies (www.lairdtech.com)
Model	CushCraft S9028PCRJ
Serial Number	none
Mounting	Threaded stud, (Flush mount, mast or wall bracket)
Frequency	902 to 928 MHz
Gain	9 dBic
Maximum VSWR	1.3:1
Polarization	Right-hand, circular polarization
Dimensions (L x W x H)	259 x 259 x 33.5 mm (10.2" x 10.2" x 1.32")
Horizontal Beamwidth	70°
Elevation Beamwidth	70° (3 dB Beamwidth – Azimuth)
Connector	Pigtail with reverse TNC Male
Weight	1.04 Kg (2.3 lb)
Operational Temperature	-25°C to +70°C
Environmental Rating	IP 54
Axial Ratio	1 dB Typical
Input Impedence	50 Ω
Maximum Input Power	10 W

Figure 24: CushCraft S9028PCRJ RFID Antenna [5]

[5] Taken from Laird Technologies datasheet, ANT-DS-S9028PCL S9028PCR 0411

2.4.2 Motorola AN710 RFID Antenna

Table 26: Motorola AN710 RFID Antenna Specifications [6]

Datum	Description
Manufacturer	Motorola, Inc.
Model	AN710
Serial Number	L61NF00WUS
Mounting	Includes articulating mount
Frequency Range	902-928 MHz, 867-870 MHz
Gain	3.0 dBi linear
Front to Back Ratio	> 10 dB
Maximum VSWR	2:1
Polarization	Left-hand, Circular Polarization
Dimensions (L x W x H)	146.05 x 146.05 x 17.53 mm (5.75 x 5.75 x 0.69 in.)
Horizontal Beamwidth (3dB)	80°
Elevation Beamwidth	not specified
Connector	Type 'N' female
Weight	0.5 Kg (1.1 lbs)
Operational Temperature	-30° to +80°C (-22° to +176°F)
Environmental Rating	IP65 Vented
Axial Ratio	< 3 dB
Input Impedence	50 Ω
Maximum Input Power	10 watts

Figure 25: Motorola AN701 RFID Antenna

[6] All specifications take from the Motorola Product Spec Sheet.

2.4.3 Poynting PATCH-A0025 RFID Antenna

Table 27: Poynting PATCH-A0025 Specifications [7]

Datum	Description
Manufacturer	Poynting Europe GmbH
Model	PATCH-A0025
Serial Number	4788-2010 [8]
Mounting	Four threaded inserts, M5-?
Frequency	860 to 960 MHz
Gain (max)	7 dBi (±1 dB)
Gain (min over the band)	6.5 dBi (±0.5dB)
VSWR	< 1.3:1
Polarization	Circular polarization
Axial ratio	< 1 dB
Dimensions (L x W x H)	245 x 235 x 40mm
Horizontal 3dB Beamwidth	67° (±5°)
Vertical 3 dB Beamwidth	69° (±5°)
Connector	0.3 m RG 58 with N(f) connector
Front to Back (F/B ratio)	20 dB (±3 dB)
Weight	470 g
Operational Temperature	-20°C to +70°C
Environmental Rating	IP 66 (NEMA 4X)
Input Impedence	50 Ω
Maximum Input Power	10 W
Wind Loading	160 km/h

Figure 26: Poynting PATCH-A0025 RFID Antenna

[7] Taken from Poynting Europe GmbH datasheet, PATCH-A0025_BROC V5.3

[8] This number was found on a label on the back of the reader next to the model number; it is assumed to be the serial number.

2.4.4 Linx Technologies ANT-916-CW-RH-SMA RFID Antenna

Table 28: Linx Technologies ANT-916-CW-RH-SMA Specifications

Datum	Description
Manufacturer	Linx Technologies
Model	
Serial Number	
Mounting	SMA Connector
Frequency	898.5 MHz to 933.5 MHz
VSWR	1.9
Polarization	Right Hand
Dimensions (L x D)	51 x 8 mm
Input Impedence	50 Ω
Documentation	ANT-916-CW-RH-SMA

Figure 27: Linx Technologies ANT-916-CW-RH-SMA RFID Antenna

2.5 Reference RFID Tags

Many of the tests are run on industry–standard RFID tags from other vendors to provide reference data against which the BTAG test data may be compared. Each of the reference tags has been trimmed to remove all but the actual RFID inlay, then applied to a small piece of cardboard. The cardboard backing is marked with the Tag ID and attached to an empty BTAG case to allow the tag to be used with the BTAG holding fixtures.

2.5.1 Intermec® ILS00154

Table 29: Intermec ILS00154 RFID Tag Specifications [9]

Datum	Description
Manufacturer	Intermec Technologies
Part Number	ILS00154
Dimensions	4 x 2 inches
Type	RFID Thermal Transfer
Material	Duratran™ II Label – RFID (PM4i)
Documentation	Intermec RFID Tag Documentation

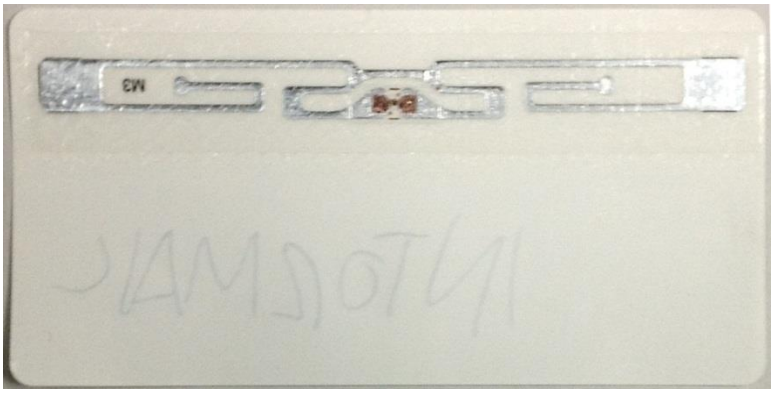


Figure 28: Intermec ILS00154 RFID Tag, Back View

Three instances of this tag are being used as reference tags, as listed in the table below.

Table 30: Intermec ILS00154 Reference Tags

Tag ID	EPC
Intermec0	3008 33b2 f000 06c0 0000 0000
Intermec1	3008 33b2 f001 06c0 0000 0000
Intermec2	3008 33b2 f002 06c0 0000 0000

2.5.2 Alien Technology® ALN-9640 Higgs™-3 Squiggle® EPC Gen 2 RFID Tag

While there is no indication on the roll of tags indicating the manufacturer, atlasRFIDstore.com lists this part number as a 4 x 6 inch RFID Label for the Zebra R110Xi RFID Printer which uses the Alien Technology Squiggle® Higgs 3 RFID inlay. Inspection of the RFID inlay on the label shows it to be the Alien Technology ALN-9640 inlay, based on the image shown in the ALN-9640 Datasheet.

Table 31: Alien Technology ALN-9640 Higgs-3 Squiggle EPC Gen 2 RFID Tag Specifications

Datum	Description
Manufacturer	Alien
Part Number	4057546
Dimensions	4 x 6 inches
RFID Inlay	Alien Technology ALN-9640
Documentation	ALN-9640 Documentation

[9] Taken from description at http://www.barcodesinc.com/intermec/part-ils00154.htm

Three instances of this tag are being used as reference tags, as listed in the table below.

Table 32: Alien Technology ALN-9640 Reference Tags

Tag ID	EPC
Alien0	0123 4567 f100 cdef 0001 7d79
Alien1	0123 4567 f101 cdef 0001 7d76
Alien2	0123 4567 f102 cdef 0001 7d77

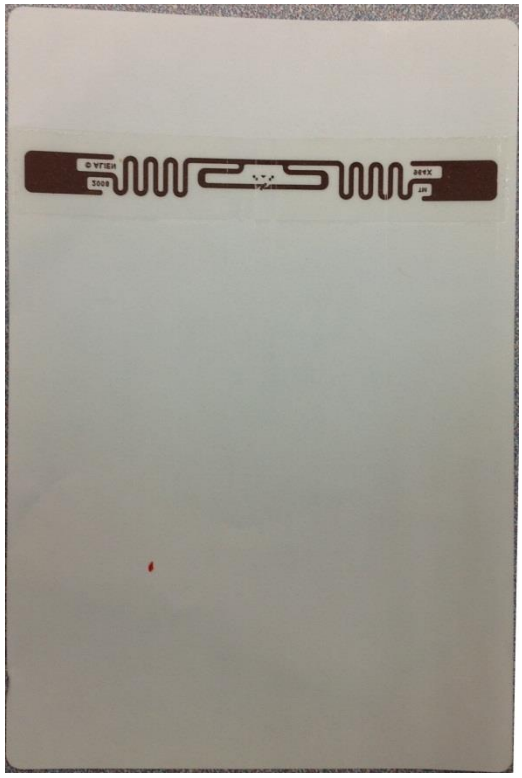


Figure 29: Alien ALN-9640 RFID Tag

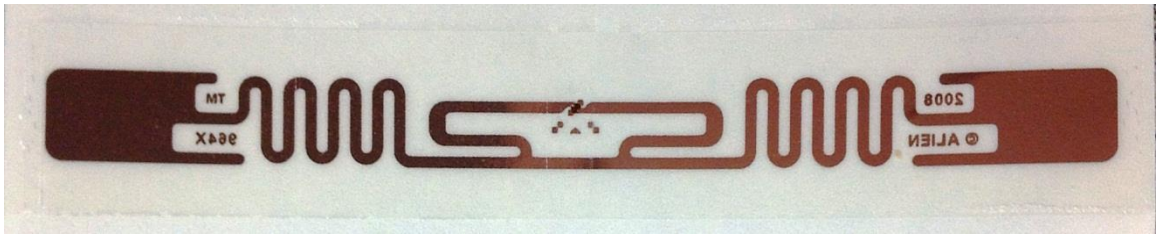


Figure 30: Alien ALN9640 Inlay Detail

2.5.3 Printronix 254387-003 (Avery AD-222 Inlay) RFID Tag

This RFID tag is marketed by Printronix but uses the AD-222 RFID inlay from Avery Dennison.

Table 33: Printronix Media 110 Gen 2 RFID Tag Specifications

Datum	Description
Manufacturer	Printronix
Part Number	254387-003
Dimensions	4 x 6 inches
RFID Inlay	Avery AD-222
Documentation	Avery AD-222 Inlay Documentation

Three instances of this tag are being used as reference tags, as listed in the table below.

Table 34: Avery AD-222 Reference Tags

Tag ID	EPC
Avery0	3005 fb63 f200 3841 ec88 0467
Avery1	3005 fb63 f201 3841 ec88 0467
Avery2	3005 fb63 f202 3841 ec88 0467

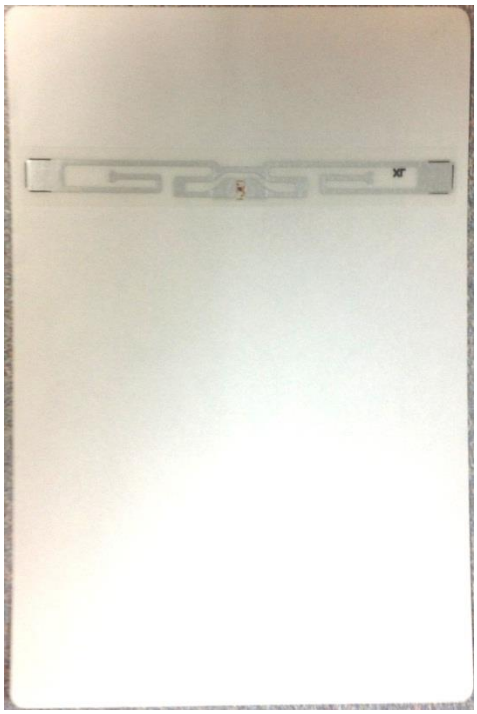


Figure 31: Printronix 254387-003 RFID Tag

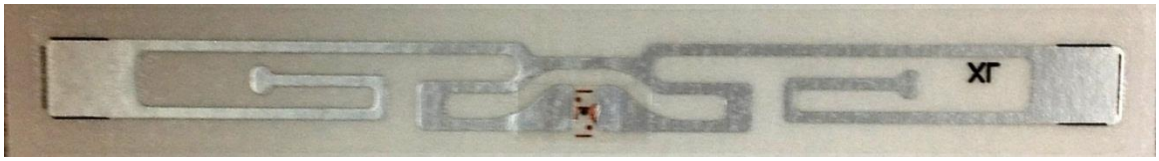


Figure 32: Avery AD-222 Inlay Detail

2.6 Fixtures

The fixtures described in this section have been purpose-built for the BTAG Internal Design Validation testing.

Many of these fixtures were designed in SolidWorks 2011 and printed in ABS plastic on a Dimension Stratasys SST 768 3D Printer (www.dimensionprinting.com). The Printer Controlling software was Catalyst EX 4.1. For these components, links are provided to the design files used to generate the parts.

2.6.1 Spherical Tag Holder

The Spherical Tag Holder is designed to mount on one of the pole stands and can hold either a BTAG in its case or the bare BTAG PCB [10]. The holder allows the tag to be rotated 360° in both the vertical and horizontal axes. Both axes include indexing scales molded into the plastic every 10°. Figure 33 shows the spherical tag holder and indicates the horizontal and vertical scales. Note that the holder has been designed such that the horizontal and vertical axes of rotation pass through the center of the tag case so that the distance from the tag to the reader antenna remains constant regardless of the orientation of the tag.

The horizontal scale has the angle marked at 0, 90, 180 and 270°, with the angle increasing as the tag is rotated counter-clockwise around its vertical axis. The 0° marking is opposite the stand pole attachment.

The vertical scale has similar markings with the 0° indicator at the top. As with the horizontal scale, the angle increases as the tag is rotated counter-clockwise with respect to its horizontal axis.

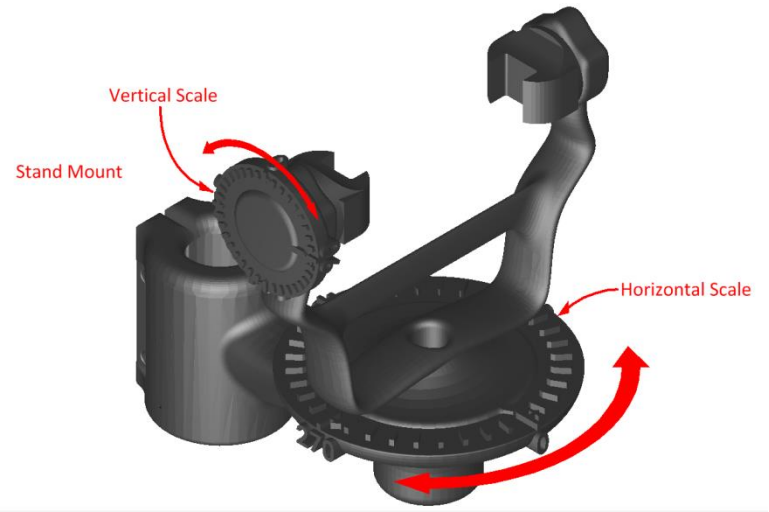


Figure 33: Spherical Tag Holder

The Spherical Tag Holder was designed using SolidWorks 2011 3D CAD software and printed in ABS plastic on a Dimension Stratasys SST 768 3D Printer. The Printer Controller software version was Catalyst EX 4.1. The design files for this fixture are located here. The holder comprises seven parts:

Base	The base attaches to a test stand with an integrated pole clamp. The base included the horizontal scale and a socket which holds the Yoke.
Yoke	The yoke rotates in the vertical axis in the base socket. The yoke includes the vertical scale and has two holes in the yoke arms for the case holders.
Case Holder	The two case holders fit into the holes mentioned above and have grooves sized to fit the BTAG case. The case is held between the two parts by friction.
Phi Arrow	This component indicates the rotation of the tag around the horizontal axis. It mates with the Case Holder in the vertical scale and should be fitted such that the arrow points to 0° when the BTAG case is in the normal vertical orientation.

[10] Reference tags from other vendors are mounted in the holder by being taped to the front exterior of an empty BTAG case.

Bare Tag Adapter	Two bare tag adapters are provided to allow BTAGs to be held without their cases. The adapters fit onto the Case Holders.

2.6.2 Small Multi-Tag Holder

The Small Multi-Tag Holder is used to hold up to nine BTAG cases equidistant from the reader antenna. The tag cases are held in a 3 x 3 matrix, as shown in Figure 34. The horizontal spacing between columns is 6 inches and the vertical spacing between rows is 4 inches. Note that the Small Multi-Tag Holder uses the same base as the Spherical Tag Holder.

Figure 34: Small Multi-Tag Holder

The Small Multi-Tag Holder was designed using SolidWorks 3D CAD software and printed in ABS plastic on a Dimension Stratasys SST 768 3D Printer. The design files for this fixture are located here. The fixture was printed in six segments which were then glued together.

2.6.3 Large Multi-Tag Holder

The large Multi-Tag Holder is a piece of ¼ inch thick foam-core board which is attached to one of the test stands. The board is marked with locations for up to nine BTAG cases which are simply taped to the board with blue painters masking tape. A drawing of the board layout is shown in Figure 35.

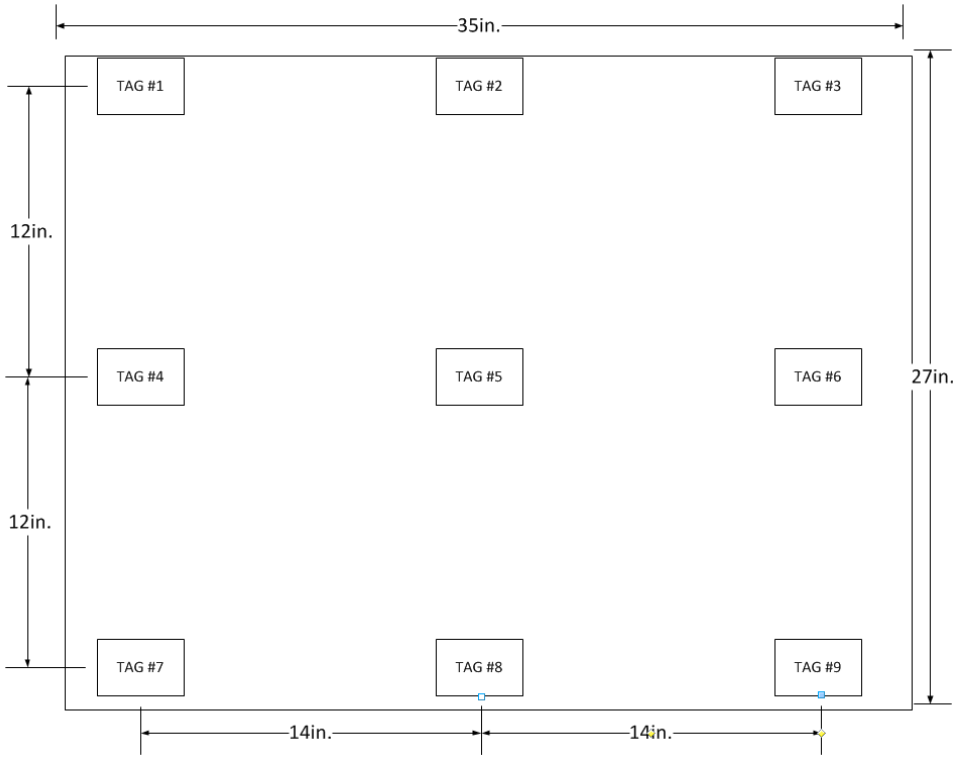


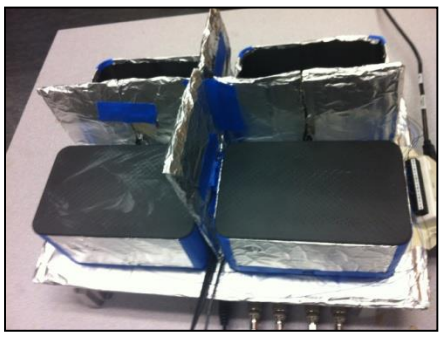
Figure 35: Large Multi-Tag Holder

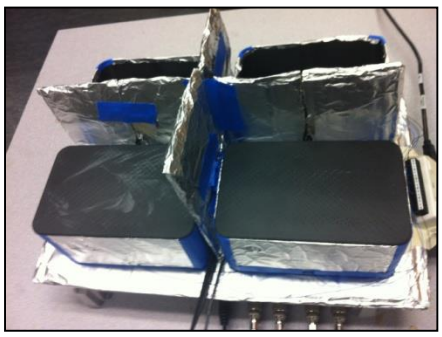
2.6.4 Tag Stand #0:

Uses the solidModel V0:

Images:

2.6.5 Mini-Chamber #0





2.7 Cables and Connectors

Table 35: Cables

Manufacturer	Mfr. P/N	Vendor	Vendor P/N	Description
Amphenol Connex	135110-02-24.00	Digikey	ACX1624	SMA Cable Assembly, Straight Plug to Bulkhead Jack, RG174/U, 24 inch. Documentation is here.

Figure 36: ACX1625 Cable Assembly

Table 36: Connector Descriptions

Manufacturer	Mfr. P/N	Vendor	Vendor P/N	Description
Amphenol Connex	202112	Digikey	ACX1240-ND	SMA Male Cap (Less Chain). Documentation is here.
Amphenol Connex	242105RP	Digikey	ACX1329-ND	SMA Jack to Reverse Polarity TNC Plug Adapter. Documentation is here.
Amphenol Connex	242107RP	Digikey	ACX1332-ND	SMA Jack to Reverse Polarity TNC Jack Adapter. Documentation is here.

Table 37: Connector Images

		
ACX1240-ND	ACX1239-ND	ACX1332-ND

List standard cable
List standard adapter
List standard attenuator
List lon Type-N Cable

3 Standard Apparatus Configurations

This chapter describes each of the standard test apparatus configurations.

3.1 Components of an Apparatus Configuration

A typical apparatus configuration consists of the following items:

- Computer running test program
- RFID Reader
- RFID Antenna
- Fixture to hold antenna
- Fixture to hold RFID tag under test
- Test equipment, as required
- Cabling, attenuators, etc., as required.

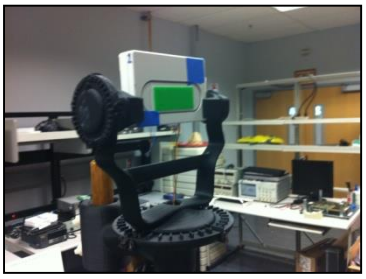
3.1.1 Standard Tag Orientation

Unless otherwise explicitly stated, in a test with a tag in the FOV of a reader antenna the Tag shall be oriented with the plane of the tag antenna parallel to the plane of the RFID Reader antenna. If the tag antenna is not located in the center of the tag, the tag shall be oriented in the tag holder such that the antenna is on top.

3.1.2 RFID Tag Orientation

The antenna shall be aligned horizontally with the floor in a vertical orientation. In the case of a label-type Gen2 tag, the label side shall be facing the reader antenna. In the case of a BTAG, the battery side shall face the antenna, with the BTAG antenna being oriented above the battery wrt to the floor. Alignment towards the antenna shall be directly in front of reader antenna with no offset.

Example Default Orientations:



3.2 Apparatus 1: OTA-Standard

Description:

This is the OTA Tag Stands, spaced d=39” apart with tag-antenna centerline set to d=39”, h=68.5” off the ground. Alignment is horizontal at 0° offset. Stands are towards the center of the room with as little obstruction as possible.

3.2.1 Revision 1.0

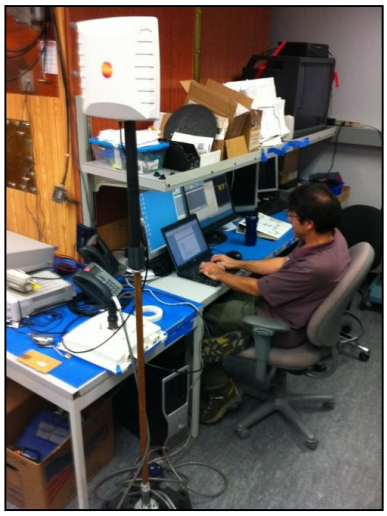
Location: PTL-RF Lab

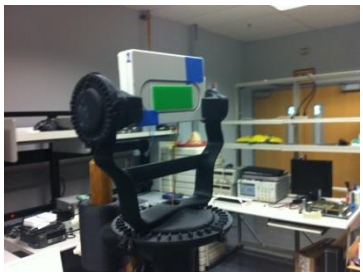
Equipment Used:

- Tag Stand #0
- Spherical Holder #0

- Poynting Antenna #0
- (1) listed RFID Reader

Images:





3.2.2 Revision 1.1

The same as 1.1, but with d=3m and h=1.5m. This is the similar configuration as used for ARTESP certification.

3.3 APPARATUS 2: OTA-STD + OSCOPE

This is the same as Test Apparatus 1, but with the oscilloscope, psu and black cart located behind the tag stand for measurement.

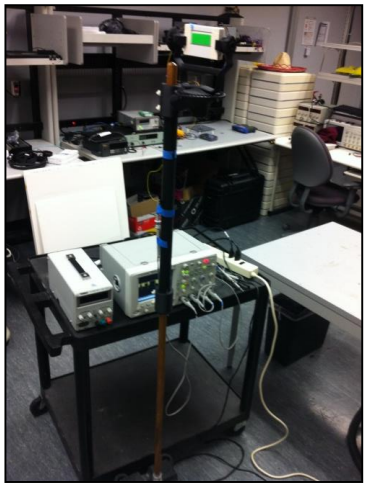
3.3.1 Revision 2.0

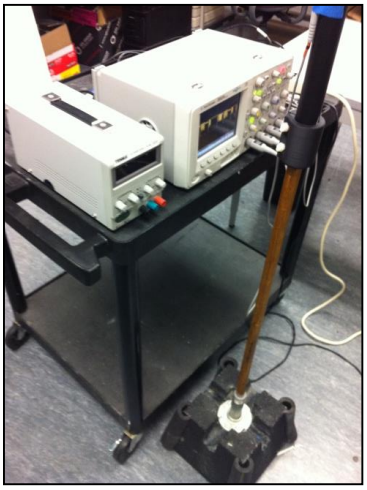
Location: PTL-RF Lab

Equipment Used:

- Test Apparatus 1.0 equipment plus:
- Agilent Oscope #0
- Tenma Digital Power Supply #0
- (1) Cart/Table of plastic to set components on top of directly behind the tag stand

Images:





3.3.2 Revision 2.1

Description: This is the same equipment as 2.0, but with the oscilloscope cart moved close to the operator station for faster measurement. Oscilloscope cables are run the to the tag stand for measurement. Test equipment in this configuration may interfere in the FOV of reader-tag.

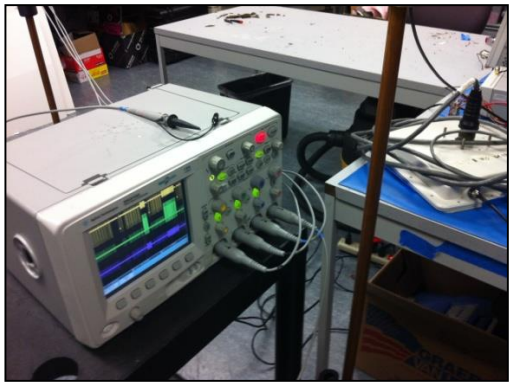
Location: PTL-RF Lab

Equipment Used:

- Test Apparatus 2.0 equipment

Images:





3.4 APPARATUS 3: OTA-STD + DIG ATTEN

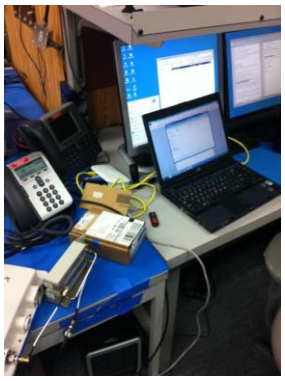
This is the same as Test Apparatus 1, but with a digital attenuator inline between the reader and the reader antenna.

3.4.1 Revision 3.0

Equipment Used:

- Test Apparatus 1.0 equipment plus:
- Digital Attenuator #0

Images:

3.5 APPARATUS 4: APP2 + DIG ATTEN

3.5.1 Revision 4.0

Location: PTL-RF Lab

Equipment Used:

- Test Apparatus 2.0 equipment plus:
- Digital Attenuator #0

Images:

<none>

3.6 Apparatus 4: Desktop Electrical Measurement

any configuration where just benchtop location is used

3.6.1 Revision 5.0

Location: PTL-RF Lab

3.7 Apparatus 6: Mini-Chamber Shielded OTA

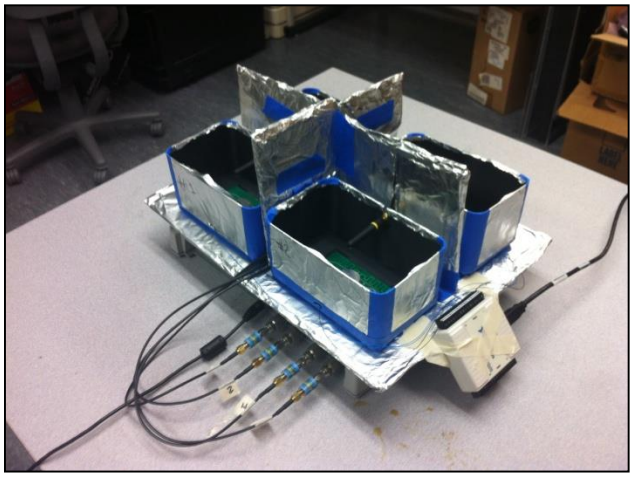
3.7.1 Revision 6.0

Equipment Used:

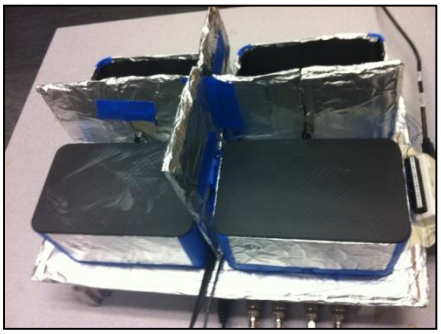
- (1)National Instruments USB-6009 DAQ #0
- (4) Crytek 10dB attenuators
- (4) mini-attenuators (todo: list)
- (4) Mini-Chamber #0

Location: PTL-RF Lab

Images:







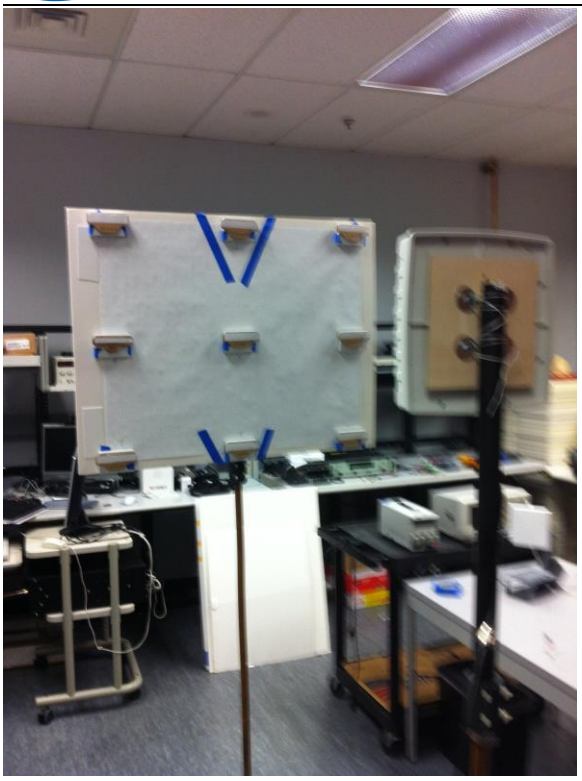
3.8 Apparatus 7: Large Multi-Tag OTA Fixture

3.8.1 Revision 7.0

- (1)National Instruments USB-6009 DAQ #0
- (4) Crytek 10dB attenuators
- (4) mini-attenuators (todo: list)
- (4) Mini-Chamber #0

Location: PTL-RF Lab

Images:



3.9 Apparatus 8: Small Multi-Tag OTA Fixture

3.9.1 Revision 8.0

Equipment Used:

- (1)National Instruments USB-6009 DAQ #0
- (4) Crytek 10dB attenuators
- (4) mini-attenuators (todo: list)
- (4) Mini-Chamber #0

Location: PTL-RF Lab

Images:

A Default Reader Configurations

Each RFID reader has a number of parameters that can be configured to control its operation via the reader's API. The exact parameters and configuration methods are unique to each model of reader. For each reader used in the BTAG validation, this appendix lists the configuration parameters available, the default power-up value for each parameter, and the standard configuration used in the BTAG tests. If a test requires a different value for any parameter than that used in the standard configuration, it will be explicitly described in the test requirements in the *BTAG Internal Design Validation Test Plan*.

A.1 Sirit510

Table 38: Sirit INfinity 510 Configuration Parameters

Parameter	Standard Configuration	Default Configuration
Group: setup		
tag_volume	1_4	1_4
operating_mode	standby	standby
protocols	isoc	isoc
Group: modem.protocol.isoc.control		
cmd_retries	0	3
crc_retries	0	1
display_tag_crc	true	false
enable_per_antenna	false	false
inventory_both_targets	false	true
max_incr_slots_q	0	15
mem_bank_for_selection	membank_epc	membank_epc
number_slots_q	0	4
query_sel	0	0
query_session	2	0
query_target	tgt_a	tgt_a
select_cmd_period	1	0
session_id	session_2	session_2
tx_atten	0	0
use_block_write	false	false
verify_write	false	true
Group: modem.protocol.isoc.physical		
data_1_length	d1_len_15	d1_len_20
interrogator_mode	single	single
modulation_depth	90	90
pilot_tone	true	true
return_link_freq	LF320	LF160
rt_modulation	rt_mod_dsb	rt_mod_dsb
tari	tari_06_25	tari_25_00
tr_encoding	tr_enc_fm0	tr_enc_fm0
truncated_epc_response	N/A	N/A
Group: modem.protocol.isoc.filtering		
enabled	false	false
truncated_epc_response	false	false
truncated_tag_epc_length	0	0
use_session	false	false
Group: antennas		
mux_sequence	1	1
conducted_power	300	0
Group: modem.control.inventory		
period	0	0
Group: radio		
idle_cw	false	false
lbt.enabled	false	false
Group: modem.protocol.isoc.filter.1		
action	ASSERT_DEASSERT	ASSERT_DEASSERT
enabled	false	false
offset	0	0
length	0	0
mask	0x00	0x00
mem_bank	not_used	not_used

A.2 Sirit5100

The same as Sirit510 except adding:

Field	Standard	Default Setup
setup.		
region	fcc	?
sub_region	fcc_part90_dense	?
setup.advanced		
preferred_frequencies	915750	?

Also you must login to this reader first before changing power levels!

```
reader.login(support, cfa050413f47dabd)
```

A.3 ThingMagic M6

Field	Standard *Default Setup*
/reader/tagop/protocol	TagProtocol.GEN2 *TagProtocol.GEN2*
/reader/antenna/checkPort	true *true*
/reader/tagop/antenna	1 *1*
/reader/commandTimeout	1000 *1000*
/reader/gen2/q	new Gen2.StaticQ(0) *new Gen2.StaticQ(0)*
/reader/gen2/tagEncoding	Gen2.TagEncoding.FM0 *Gen2.TagEncoding.FM0*
/reader/gen2/target	Gen2.Target.AB *Gen2.Target.AB*
/reader/gen2/session	Gen2.Session.S2 *Gen2.Session.S0*
/reader/gen2/tari	Gen2.Tari.TARI_6_25US *Gen2.Tari.TARI_6_25US*
/reader/gen2/BLF	Gen2.LinkFrequency.LINK320KHZ *Gen2.LinkFrequency.LINK320KHZ*
/reader/iso180006b/BLF	Iso180006b.LinkFrequency.LINK160KHZ *Iso180006b.LinkFrequency.LINK160KHZ*
/reader/iso180006b/delimiter	Iso180006b.Delimiter.DELIMITER4 *Iso180006b.Delimiter.DELIMITER4*
/reader/iso180006b/modulationDepth	Iso180006b.ModulationDepth.MODULATION99PERCENT *Iso180006b.ModulationDepth.MODULATION99PERCENT*
/reader/radio/portReadPowerList	{{1, 3000},{2,3000},{3, 3000},{4, 3000}} *?*
/reader/radio/portWritePowerList	{{1, 3000},{2,3000},{3, 3000},{4, 3000}} *?*
/reader/radio/readPower	3000 *2500*
/reader/radio/writePower	3000 *2500*
/reader/read/asyncOffTime	50 *0*
/reader/read/asyncOnTime	250 *250*
/reader/read/plan	new SimpleReadPlan() *SimpleReadPlan:[GEN2 auto, 1000]*
/reader/tagReadData/recordHighestRssi	true *true*
/reader/tagReadData/uniqueByAntenna	false *false*
/reader/tagReadData/uniqueByData	false *false*
/reader/transportTimeout	1000

1000

A.4 AcuraGlobal Edge 50

Field	Standard	Default Setup

A.5 Intermec IF2

Field	Standard	Default Setup

A.6 Impinj Speedway R1000

Field	Standard	Default Setup

B BTAG Memory Map Definitions

The test system shall support rigid definitions of each memory map configuration. These only apply to BTAG tests and this field is ignored during non-BTAG tests.

B.7 Memory Definition #0

This is the btag memory state essentially **after pre-cert** (May 2012) and reflected in as low as **FW 3.0.44**. The memory permissions are for the **initialization state**. This map is in support of **PA SJ5511 V1.0.0**.

B.7.1 Reserved Bank

- Length: 120 bytes
- Read Restrictions: none
- Write Restrictions: none
- Value:

```
0101010101010101010101010101010101000102030405060708090A0B0C0D0E0F101112131415161718191A1B1C1
D1E1FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFF
```

B.7.2 UII Bank (aka "EPC Bank")

- Length: 120 bytes
- Read Restrictions: none
- Write Restrictions: bits 0..31.
  bit 44..45 (BF/TF) can be written to in terms of protocol, but must remain 0.
- Value:

```
000018008010001234ADFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFF
```

B.7.3 TID Bank

- Length: 120 bytes
- Read Restrictions: none
- Write Restrictions: no bits may be written to the TID.
- Value:

```
E28194004000000001000A0B0C0D0E0F101112131415161718191A1B1C1D1E1F202122232425262728292A2B2C2
D2E2F303132333435363738393A3B3C3D3E3F404142434445464748494A4B4C4D4E4F505152535455565758595A
5B5C5D5E5F606162636465666768696A6B6C6D6E6F707172737475767778797A7B7C7D7E7F8081828384858687 8
8898A8B8C8D8E8F909192939495969798999A9B9C9D9E9FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFF
```

B.7.4 User Bank

- Length: 120 bytes
- Read Restrictions: none
- Write Restrictions: none
- Value:

```
000000111111111AAAAAAAAAAAAAAA253081860A80801212008080102039C2C7CCD1D6DBE0E5EAEFF4F9FE030
80D12171C21262B30353A3F44494E53585D62676C71767B80858A8F94999EA3A8ADB2B7BCC1C6CBD0D5DADFE4E9
EEF3F8FD02070C11161B20252A2F34393E43484D52575C61666B70757A7F84898E93989DA2A7ACB1B6BBC0C5CAC
FD4D9DEE3E8EDF2F7FC01060B10151A1F24292E33383D42FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFF
```

B.8 Memory Definition #1

This is the btag memory state essentially **after pre-cert** (May 2012) and reflected in as low as **FW 3.0.48**. The memory permissions are for the **initialization state**. This map is in support of **PA SJ5511 V1.0.0**.

B.8.5 Reserved Bank

- Length: 120 bytes
- Read Restrictions: none
- Write Restrictions: none
- Value:

```
0101010101010101010101010101010100010203040506070809 0A0B0C0D0E0F101112131415161718191A1B1C1
D1E1F202122232425262728292A2B2C2D2E2F303132333435363738393A3B3C3D3E3F404142434445464748494A
4B4C4D4E4F505152535455565758595A5B5C5D5E5F606162636465666768696A6B6C6D6E6F707172737475767778
797A7B7C7D7E7F808182838485868788898A8B8C8D8E8F909192939495969798999A9B9C9D9E9FA0A1A2A3A4A5
A6A7A8A9AAABACADAEAFB0B1B2B3B4B5B6B7B8B9BABBBCBDBEBFC0C1C2C3C4C5C6C7C8C9CACBCCCDCECFD0D1D2D
3D4D5D6D7D8D9DADBDCDDDEDF
```

B.8.6 UII Bank (aka "EPC Bank")

- Length: 120 bytes
- Read Restrictions: none
- Write Restrictions: bits 0..31.
  bit 44..45 (BF/TF) can be written to in terms of protocol, but must remain 0.
- Value:

```
000018008010001234ADFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFF
```

B.8.7 TID Bank

- Length: 120 bytes

- Read Restrictions: none
- Write Restrictions: no bits may be written to the TID.
- Value:

```
E28194004000000000100A0B0C0D0E0F10111213141516171819 1A1B1C1D1E1F202122232425262728292A2B2C2
D2E2F303132333435363738393A3B3C3D3E3F404142434445464748494A4B4C4D4E4F505152535455565758595A
5B5C5D5E5F606162636465666768696A6B6C6D6E6F707172737475767778797A7B7C7D7E7F80818283848586878
8898A8B8C8D8E8F909192939495969798999A9B9C9D9E9FA0A1A2A3A4A5A6A7A8A9AAABACADAEAFB0B1B2B3B4B5
B6B7B8B9BABBBCBDBEBFC0C1C2C3C4C5C6C7C8C9CACBCCCDCECFD0D1D2D3D4D5D6D7D8D9DADBDCDDDEDFE0E1E2E
3E4E5E6E7E8E9EAEBECEDEEEF
```

B.8.8 User Bank

- Length: 120 bytes
- Read Restrictions: none
- Write Restrictions: none
- Value:

```
00000011111111111AAAAAAAAAAAAAAAAA253081860A8080121200808010203 9C2C7CCD1D6DBE0E5EAEFF4F9FE030
80D12171C21262B30353A3F44494E53585D62676C71767B80858A8F94999EA3A8ADB2B7BCC1C6CBD0D5DADFE4E9
EEF3F8FD02070C11161B20252A2F34393E43484D52575C61666B70757A7F84898E93989DA2A7ACB1B6BBC0C5CAC
FD4D9DEE3E8EDF2F7FC01060B10151A1F24292E33383D42474C51565B60656A6F74797E83888D92979CA1A6ABB0
B5BABFC4C9CED3D8DDE2E7ECF1F6FB00050A0F14191E23282D32373C41464B50555A5F64696E73787D82878C919
69BA0A5AAAFB4B9BEC3C8CDD2
```

B.9 Memory Definition #2

This is the Memory Definition #1, but with the tag in the activated state. Memory contents are the same, only the permissions change. Thus the 'Value' field will not be repeated here; only the permissions will be updated from #1.

B.9.9 Reserved Bank

- Read Restrictions: all
- Write Restrictions: all

B.9.10 UII Bank (aka "EPC Bank")

- Read Restrictions: Bits > 79 are locked
- Write Restrictions: all

B.9.11 TID Bank

- Read Restrictions: Bits > 47 are locked
- Write Restrictions: all

B.9.12 User Bank

- Read Restrictions: all
- Write Restrictions: all

B.10 Memory Definition #3

This is the btag memory state for 4.0.5 moving forward in the **initialization state**. This map is in support of **PA SJ5511.V1.0.0**.

B.10.13 Reserved Bank

- Length: 120 bytes
- Read Restrictions: none
- Write Restrictions: none
- Value:

```
0101010101010101010101010101010101000102030405060708090A0B0C0D0E0F101112131415161718191A1B1C1
D1E1F202122232425262728292A2B2C2D2E2FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFF
```

B.10.14 UII Bank (aka "EPC Bank")

- Length: 120 bytes
- Read Restrictions: none
- Write Restrictions: bits 0..15.
  bit 44..45 (BF/TF) can be written to in terms of protocol, but must remain 0.
- Value:

```
BDC018008010001234ADFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFF
```

B.10.15 TID Bank

- Length: 120 bytes
- Read Restrictions: none
- Write Restrictions: no bits may be written to the TID.
- Value:

```
E2819400400000000010FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFF
```

B.10.16 User Bank

- Length: 120 bytes
- Read Restrictions: none
- Write Restrictions: none
- Value:

  0000001111111111AAAAAAAAAAAAAAAAFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
  FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
  FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
  FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
  FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
  FFFFFFFFFFFFFFFFFFFFFFFF

B.11 Memory Definition #4

This is the Memory Definition #3, but with the tag in the activated state. Memory contents are the same, only the permissions change. Thus the ‘Value’ field will not be repeated here; only the permissions will be updated from #1.

B.11.17 Reserved Bank

- Read Restrictions: all
- Write Restrictions: all

B.11.18 UII Bank (aka “EPC Bank”)

- Read Restrictions: Bits > 79 are locked
- Write Restrictions: all

B.11.19 TID Bank

- Read Restrictions: Bits > 47 are locked
- Write Restrictions: all

B.11.20 User Bank

- Read Restrictions: all
- Write Restrictions: all