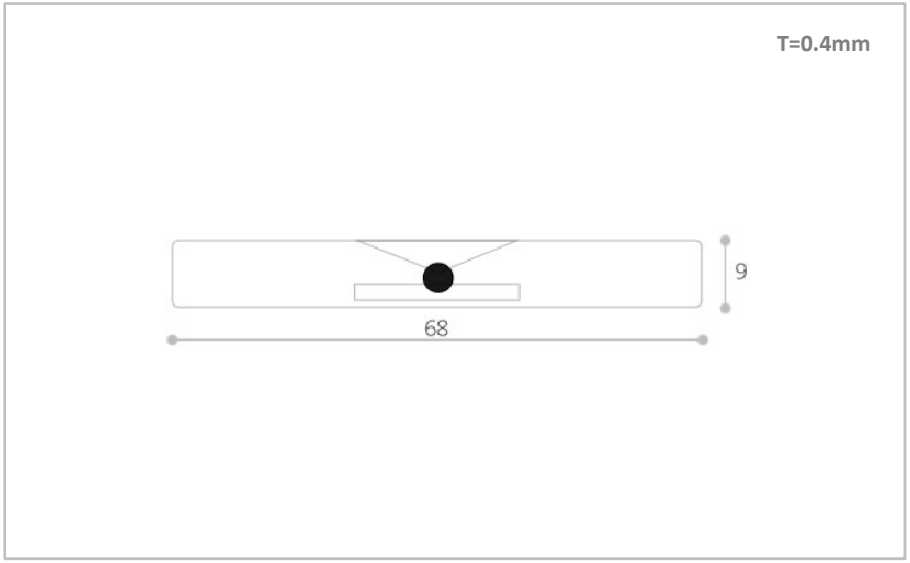
TITANTAG™ Laundry

Frequency	**UHF**
Protocol	**ISO18000-6-C** **EPC C1G2**
Region	**Global**
Dimensions (mm)	**W68 H9 T0.4**
Silicon chip	**Alien Higgs3**
Memory (bits)	**TOTAL 800** **EPC up to 480** **User up to 512**
Metal friendly	**Off metal**
Reads up to meters	**5.0** (US frequency band) **2.5** (EU frequency band)
Operating temperature	**-45<>85℃**
Storage temperature	**-45<>220℃**
IP class	**IP68**
Year of release	**2009**
Product code	**941114G**

UHF C1G2 (US)	Silicon chips	W*H*T (mm)	Read (up to meters)	
			On metal	Off metal
Nail	Alien Higgs3	15*10*2.1	0.2	0.3
Inch TN	Alien Higgs3	26*10*2.1	0.7	0.5
Inch	Alien Higgs3	26*10*3.1	1.0	0.6
Inch SQ	Alien Higgs3	26*26*3.1	1.5	1.0
Inch SQ HT	Alien Higgs3	26*26*2.5	2.0	n/a
Tray NM	Impinj Monza4	35*15*3.1	n/a	1.0
Smallest	Alien Higgs3	38*10*3.1	2.5	1.0
Smallest AC	Alien Higgs3	38*10*3.1	2.5	0.5
Smallest MAG	Alien Higgs3	38*10*4.8	2.0	n/a
Tray U	Alien Higgs3	40*13*4.1	3.0	2.0
Smallest NM	Alien Higgs3	45*10*3.1	n/a	3.5
Spiral	Alien Higgs3	45*44*1.4	n/a	1.0
Strip	Alien HIggs3	60*6*3.1	1.5	0.5
Laundry	**Alien Higgs3**	**68*9 *0.4**	**n/a**	**5.0**
General TN	Alien Higgs3	75*16*2.1	2.5	2.0
General	Alien Higgs3	75*16*3.1	3.5	2.0
General AC	Alien Higgs3	75*16*3.1	3.5	2.0
Basic	Alien Higgs3	92*16*3.1	3.5	1.0
Basic MAG	Alien Higgs3	92*16*5.2	4.0	n/a
Basic L	Alien Higgs3	110*20*3.1	6.5	3.0
Pallet	Alien Higgs3	94*11*1.4	n/a	5.0
Secure	Alien Higgs3	95*25*3.1	5.5	8.0
Secure HT	Alien Higgs3	95*25*2.5		
Blade	Alien Higgs3	139*6*4.0	6.5	5.5
Fastener	Alien Higgs3	148*18*3.1	7.0	9.0
Fastener MAG	Alien Higgs3	148*18*7.1	7.0	n/a
Fastener TK	Alien Higgs3	148*18*4.1	12.0	11.0
4KB5M	Fujitsu 803A	152*30*4.1	3.5	2.5

[1] Laundry Feature

[2] Laundry Dimensions (mm)



[3] Key materials and processes

Silicon chip Alien Higgs3

- Read sensitivity of -20dBm – Best performing among UHF Gen 2 RFID chips
- Total 800bits memory – EPC 96bits (extensible to 480bits), User 512bits, TID 64 bits, Access& Kill password each 32bits and Lock password 64bits
- Most widely adopted chip for metal mounting UHF RFID tags
- RFcamp has adopted Alien Higgs3 since year of 2008.

www.alientechnology.com/wp-content/uploads/ALC-360%20Higgs3%202014-12-21.pdf

Antenna Flexible PCB (KAPTON film based), Copper etched, Gold plated

- Polyimide based KAPTON film withstanding >250℃
- Copper etched antenna has much higher accuracy with lower tolerance than aluminum etched antenna and conductive ink printed antenna, which makes tag performance more consistent with lower read range variance.
- Gold is plated on chip bonded area of copper etched antenna, in order to enhance chip adhesion on antenna as well as electrical interconnection with antenna.

Packaging Double layer flexible PCBs, laminated under high temperature

- Tag is composed of double layer PCBs, tightly combined and laminated under high pressure and temperature of 200℃ for >2 hours.
- Many tag makers copy TITANTAG™ in appearance, but they can not copy tags' durability and read consistency.

Chip bonding Wire bonded, aluminum or gold

- Unlike other tag makers using flip chip bonding or chip soldering, RFcamp has adopted wire bonding technology since year of 2004.
- Wire bonding, though most complicated and expensive chip bonding method, is most stable in electrical interconnection and most durable in mechanical and temperature stresses. It, with highest precision, is also best fit for working on complicated antenna patterns of double layer PCBs.

Chip encapsulation Glob-top packaging with hardest epoxy adhesive

- Chip bonded area is encapsulated with hardest epoxy (with high temperature of glassification), made by Japanese maker.

[4] Laundry Performance

• **Performance table** (www.satcomresources.com/ERP-EIRP-Converter)

Up to meters*	EU band	US band	Up to meters*	EU band	US band
2W ERP**	2.5	5.0	2W EIRP***	1.5	3.0

* Measured at anechoic chamber, national lab. (www.iot.nipa.kr) ,South Korea
** Measured by Alien Reader 9900+ (www.alientechnology.com)
*** Measured by ATID Handheld AT880 (www.atid1.com)

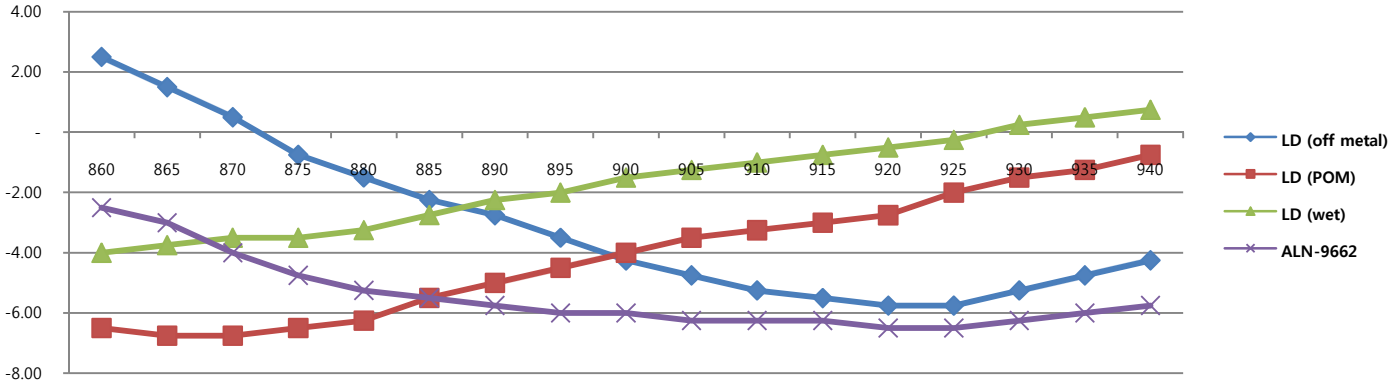
• **Comparison analysis (in terms of sensitivity, dBm)** dBm : Minimum power tag needs in order to respond to RFID reader.

MHz	860	865	870	875	880	885	890	895	900	905	910	915	920	925	930	935	940
LD (off metal)	2.50	1.50	0.50	-0.75	-1.50	-2.25	-2.75	-3.50	-4.25	-4.75	-5.25	-5.50	-5.75	-5.75	-5.25	-4.75	-4.25
LD (POM)[A]	-6.50	-6.75	-6.75	-6.50	-6.25	-5.50	-5.00	-4.50	-4.00	-3.50	-3.25	-3.00	-2.75	-2.00	-1.50	-1.25	-0.75
LD (wet)[B]	-4.00	-3.75	-3.50	-3.50	-3.25	-2.75	-2.25	-2.00	-1.50	-1.25	-1.00	-0.75	-0.50	-0.25	0.25	0.50	0.75
ALN-9662[C]	-2.50	-3.00	-4.00	-4.75	-5.25	-5.50	-5.75	-6.00	-6.00	-6.25	-6.25	-6.25	-6.50	-6.50	-6.25	-6.00	-5.75

POM[A] Measure tag on POM (Poly Oxy Methylene, dielectric constant = 3.7~4.0)

Wet[B] Measure tag under wet tissue

ALN-9662[C] 70*17mm inlay (a.k.a. Short) by Alien Technology



•**LAUNDRY** reads up to 5.0 meters in US band, almost same as ALN-9662. On high dielectric materials such as POM, however, read performance decreases by 20% and under wet covering, it decreases by 30%. However, LAUNDRY is best performing tag under both dry and wet environments among similar sized tag for laundry applications.

[5] Laundry Durability

• **Temperature stress**

Test methods	Descriptions	Pass/Fail
220℃, 2hrs	Stored in convection oven at 220C, 2hrs	Pass
-45<>85℃, 50 cycles	Stored in temperature shock chamber for 50 cycles – One cycle includes 30 min. at-45C, 30 min, transition, 30min. at 85C and 30min. transition.	Pass
85℃/85%, 24hrs	Stored in humidity chamber at 85C/85%RH for 24 hours	Pass
Boling water, 6 hrs	Immersed in boiling water for 6 hours	Pass

• **Ingression** www.dsmt.com/resources/ip-rating-chart

IP Class	IP68	1.5 meter deep immersion, 1hr

• **Mechanical stress**

Test methods	Descriptions	Pass/Fail
Iron ball fall test	Free fall of 1kg iron ball from 1.5meters height on any side of tag - 10 times	Pass
Vibration	IEC60068-2-6/64	Pass
Drop& topple	IEC60068-2-31	Pass
Shock (acceleration)	IEC60068-2-22	Pass
Pressure	50 Bar on any side of tag, 10 times	Pass

• **Chemical stress**

Chemicals	Descriptions	Pass/Fail
Alkali	NaOH (10%, pH13) | Immersed 24 hrs.	Pass
Acid	Sulfuric acid (10%, pH2) | Immersed 24 hrs.	Pass
Petroleum	Gasoline, Diesel, Kerosene, lubricating oil | Immersed 24 hrs.	Pass
Alcohol	Methanol, Ethanol | Immersed 24 hrs.	Pass
Surfactant	Solvent for metal tool oils | Immersed 24 hrs.	Pass
Salt water	IEC60068-2-11	Pass

• **Electrical stress**

ESD	IEC61000-4-2 (LEVEL4 – 8KV)	PASS

• ~~**Radiation stress**~~ **(N/A)**

Gamma ray	kGy	

ISO 11137-1:2012 Radiation/Gamma Ray method

• ~~**Autoclave stress**~~ **(N/A)**

Autoclave conditions	Sterilization processes	

ISO 17665-1:2006 Moist Heat/Steam Sterilization method

[6] Laundry Options

• Chip encoding service

•Encodes EPC memory sector only*.
•Encodes tags with 4 multiple digits - from 16 bits (4 digits decimal or hex or ASCII) up to 480 bits (120 digits decimal or hex or ASCII) - upon customers' request.
•Unless requested by customer, all tags are encoded with 24 digits decimal (Date 8 digits + Serial 16 digits), before shipped to customers. For example, code 201508140000000000001278 tells that tag was 1278th encoded on August 14, 2015.
•Tag code can be permanently locked with password of 8 digits decimal or hex, upon customer's request.

* For special encoding service (e.g. TID to EPC or user memory encoding), please ask RFcamp.

• ~~Label& printing service~~ (Not applicable)

•Provides fast and reasonably priced custom label service with printing variable data, barcode and logo.
•Label material is water proof and "hard to tear off" polysynthetic.

• ~~Laser engraving& direct printing service~~ (Not applicable)

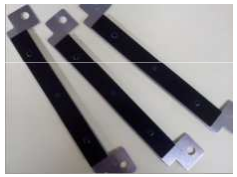
•With CO2 laser, tag surface is precisely and permanently etched into variable data, barcode and logo with black and yellow contrast.
• With silk screen printing or pad printing method, tag surface is permanently printed with various colored logo or text.

• Backing adhesive

(1) Put **heat curable adhesive tape** on fabric and peel out release paper.
(2) On adhesive tape, locate "Laundry" tag.
(3) Heat iron up to around 110C degree.
(4) Put iron on laundry tag for 5 seconds.
(5) Cool down 10 seconds in ambient temperature.

• ~~Fasteners& brackets~~ (Not applicable)

•For some small TITANTAGs, metal fastener may adversely affect tag read performance, so please ask RFcamp for suitable solution.
•Upon customer's request, RFcamp develops metal based brackets for special applications, with optimal tag performance.



• ~~Encapsulations~~ (Not applicable)

•For special environment requiring enhanced chemical durability, RFcamp applies special coating materials over tag.
•Upon customer's request, RFcamp develops injection molded ruggedized case or rubber (polyurethane or silicone) based encapsulation.