



User Manual of CSL RTLS System

CS3151BBCD Wrist Tag

CS3151TC Asset Tag

CS5111TD Reader

CS5112TD Reader

CS5113TD Reader with Ethernet Bridge

CS5114TD Reader with Ethernet Bridge

CS5116TD Reader

CS5118TD Reader with Ethernet Bridge

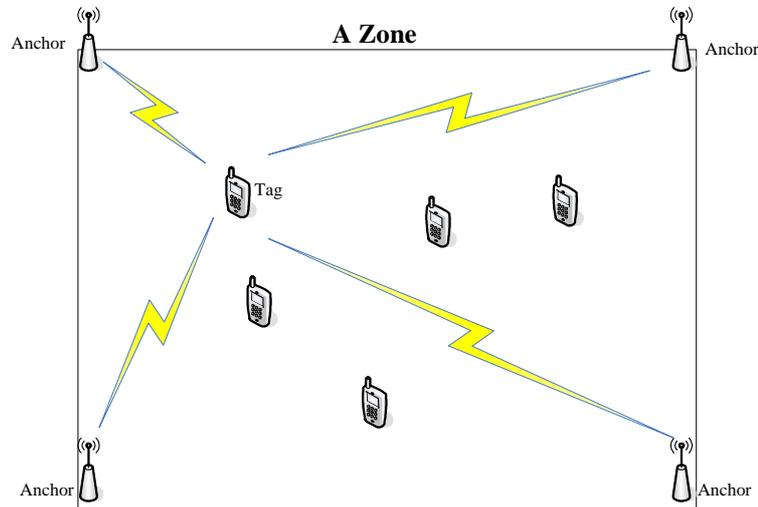
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Introduction

The CSL RTLS solution is based on the application of time of arrival technology.

In the RTLS, an anchor is the device installed in a known position inside a zone, normally, at the corners of the zone. The moving tag inside the zone can measure the range to each anchor so as to obtain its absolute position inside the zone.



In a minimum system, 4 anchors – 3 slave anchors CS5111TD/CS5112TD and 1 master anchor CS5113TD/CS5114TD- are installed in a zone. However, the more the anchors are installed, the higher the accuracy of the tag position to be obtained.

The accuracy of positioning is +/-1 meter.

1 System Component Description

1.1 CS3151BBCD

1.1.1 Product Description

CS3151BBCD is a battery-operated active RFID tag. Rechargeable Lithium Polymer batteries are installed for normal function. Charging interface is a 2-pin charging contact. A charging cradle is required to mount CS3151BBCD on during charging.

CS3151BBCD is designed so that they can be worn on the wrist of human body to track the position of the moving object. There is a button at the front panel of the tag for various emergency applications. Light indicators are located on the bottom side.



1.1.2 Installation Procedure

Batteries are preinstalled in factory. When the batteries are recharged, or when the tag is plugged into the charger, CS3151BBCD tag will be in listening mode. In this mode, the CS3151BBCD tags will listen to the beacons from CS5113LP master anchor and commence registration process. Once registration is completed, CS3151BBCD is in the operating mode and ready for RTLS tracking.

1.1.3 Product Specification

Specifications:	
Physical	Plastic sealed enclosure: 52 mm diameter, 14mm
Characteristics:	thickness; Weight 45 g (with wrist strap)
Read Range:	Up to 100 meters depending on reader power
Frequency:	2400-2483 MHz ISM license-free band
Environment:	Operating Temp: -40° C to 65° C (-40° F to 149° F)
	Storage Temp: -40° C to 85° C (-40° F to 185° F)
	Humidity: 0% to 95% RH non-condensing
Technology:	CHIRP
Output RF Power:	14 dBm EIRP +/-1.5dB
Ranging Method:	Time Of Arrival (TOA)
Ranging Accuracy:	Best case up to +/- 1 meter
Protocol:	CSL RTLS Protocol, orderly inventory method to handle
	large tag population
Battery:	Internal rechargeable Li Polymer battery
Order Code:	CS3151BBCD

1.1.4 Antenna Properties

CS3151BBCD employs two miniaturized SMD antennas for effective RF transmission and reception. The antenna properties are as below :

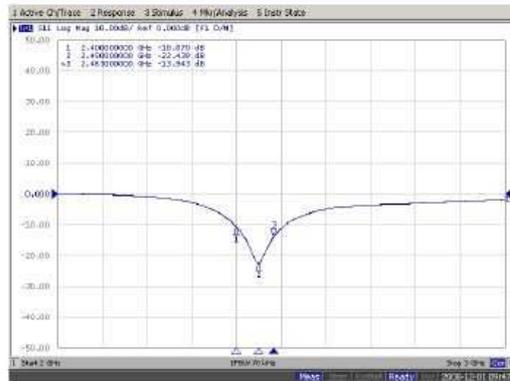
Antenna 2 :

Electrical Specifications (80x40(mm) ground plane)

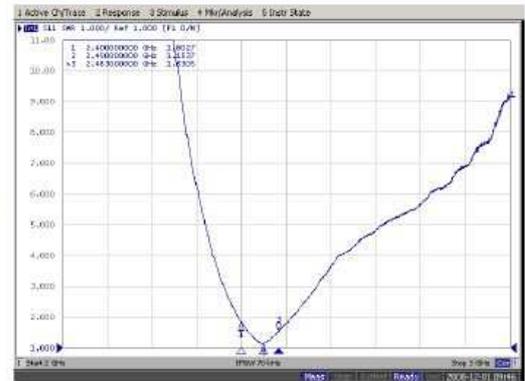
Characteristics		Specifications	Unit
Outline Dimensions		3.2x1.6x0.5	mm
Ground Plane		80x40	mm
Center Frequency*		2450	MHz
Bandwidth (under -10dB return loss)		100 min.	MHz
VSWR		2 max.	
Impedance		50	Ω
Polarization		Linear Polarization	
Gain**	Peak	2.5 (typical)	dBi
	Efficiency	84 (typical)	%
Temperature Coefficient of Frequency		0±20 max (@ -20°C ~80°C)	ppm/°C

Electrical Characteristics (80x40(mm) ground plane)

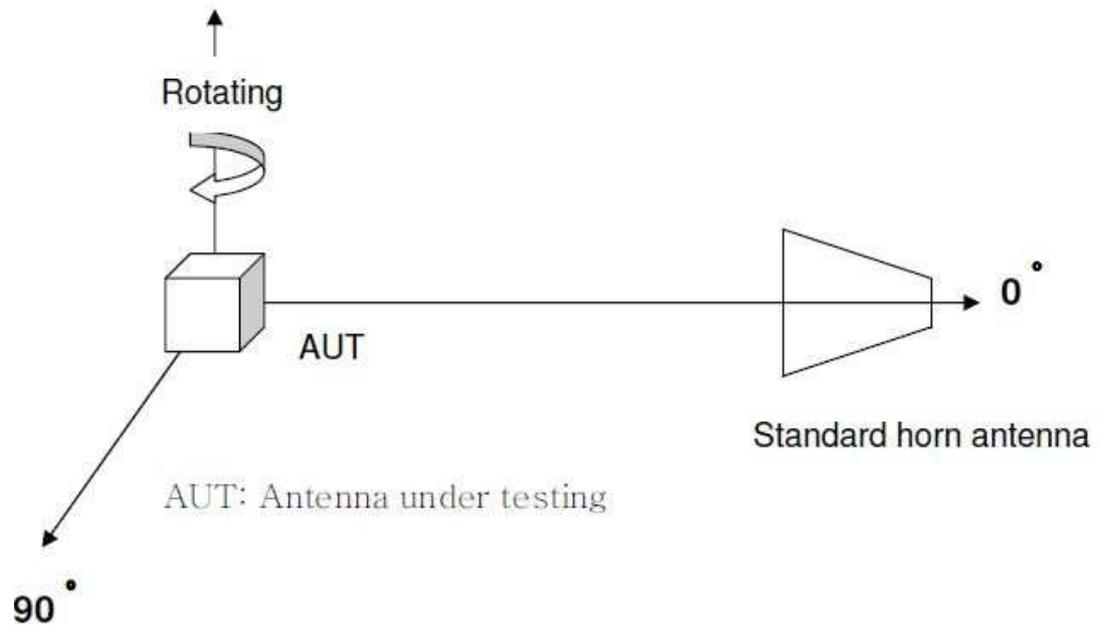
Return Loss(S_{11})

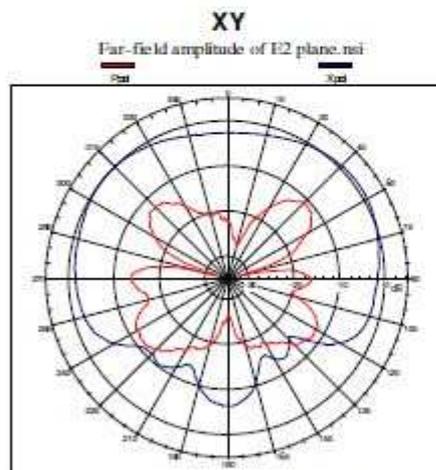
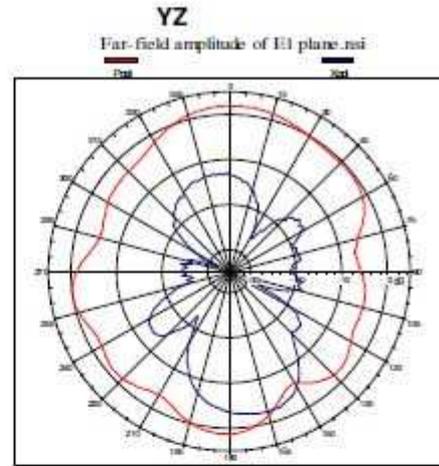
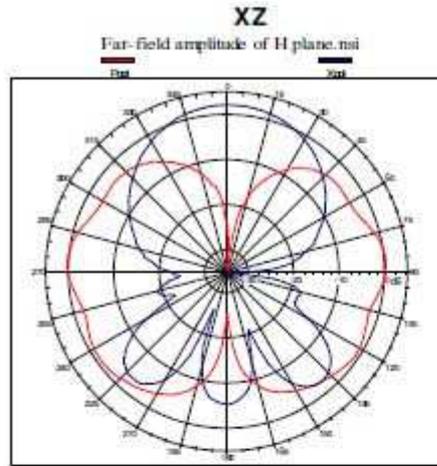


VSWR



. Radiation Pattern (80x40(mm) ground plane)





Source signal: Linearly polarized signal $f_0=2450\text{MHz}$

Gain Table:

Unit: dBi

Plane	XZ	YZ	XY
Peak Gain	2.09	2.05	0.38
Average Gain	-1.68	-1.83	-4.23

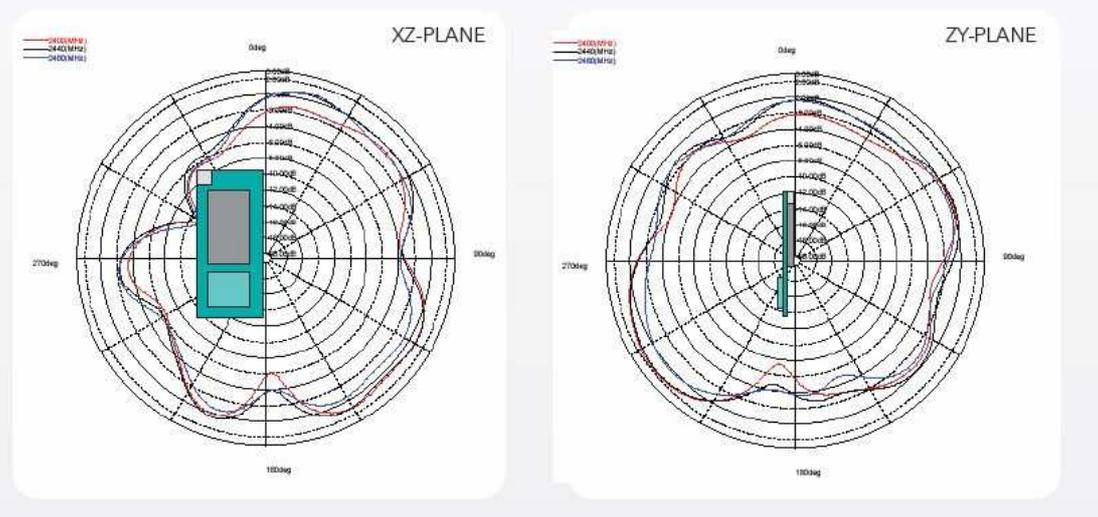
Antenna 1 :

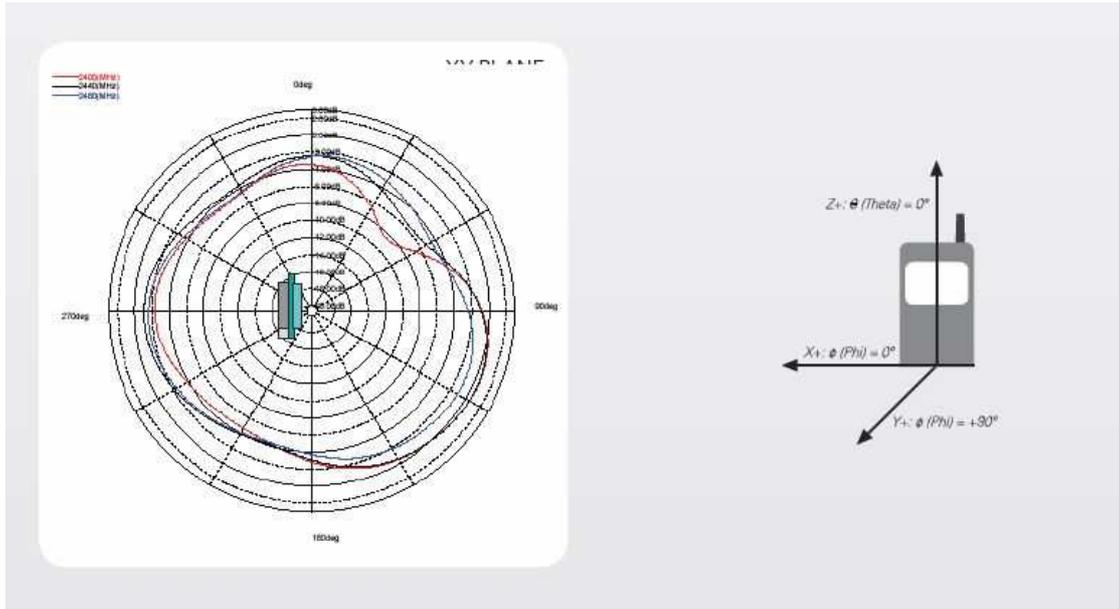
Electrical Items	Specifications
Model	W3108
Type of antenna	SMD type
Frequency range	2400MHz – 2500MHz
Nominal impedance	50 ohm
Polarization	Linear
V.S.W.R	1.5 typically, mounting on CS3151BB2
Gain	1.5dBi typically, mounting on CS3151BB2
Mechanical Items	Specifications
Dimension in millimeter	5(W) x 2.5(L) x 5.5(H)
Weight	0.14gram

2.4 GHz Helical WiFi SMD Antenna

Ground cleared under antenna, clearance area 7.50 x 5.50 mm. Pulse Part Number: W3108

Typical Free space Radiation Patterns



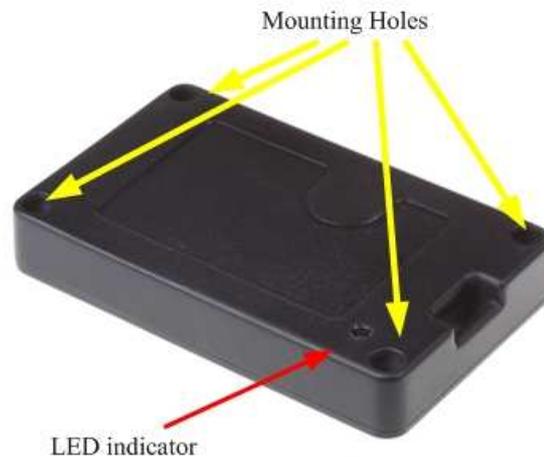


1.2 CS3151TC

1.2.1 Product Description

CS3151TC is a battery-operated active RTLS tag. Three AAA size primary batteries (either alkaline or lithium/Iron Disulfide) or Ni-MH rechargeable batteries can be installed for normal function.

CS3151TC is designed so that it can be attached to the tracking assets or simply hanging on the moving objects, depending on the applications. There are four holes on the corners of the tag housing that can allow the tag to be bolted firmly on the asset. Both of the facets have light indicators so either face can be attached to the asset.



1.2.2 Installation Procedure

When batteries are initially installed, CS3151TC tags will be in listening mode. In this mode, the CS3151TC tags will listen to the commands from CS5113TD/CS5114TD master anchor for configuration.

Once configuration is completed, CS3151TC is in the operating mode and ready for RTLS tracking.

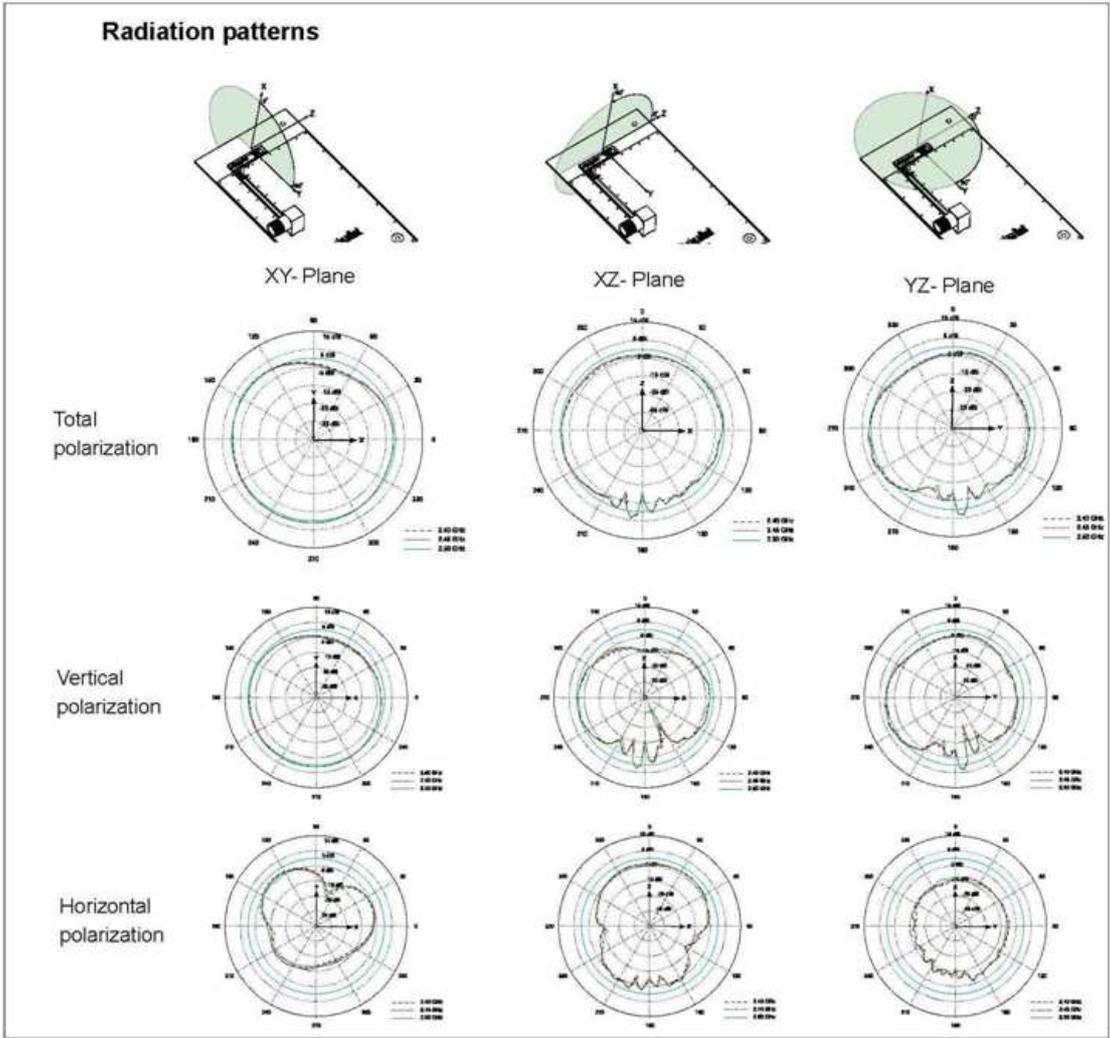
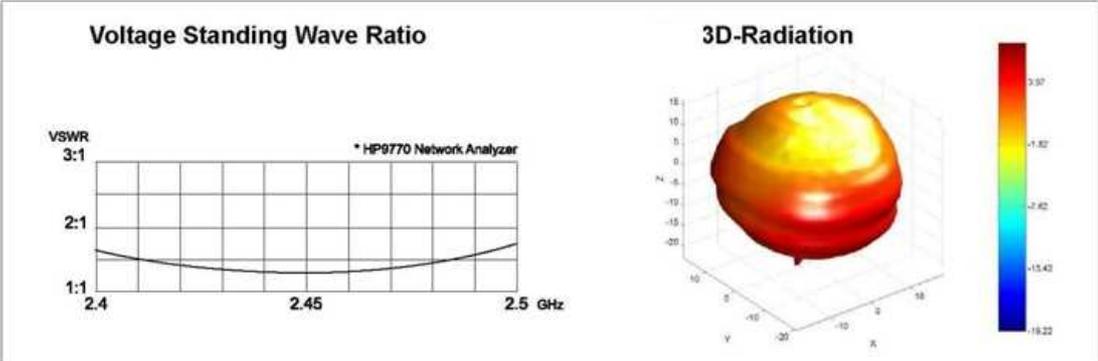
1.2.3 Product Specification

Specifications:	
Physical	Plastic sealed enclosure: 94 mm x 56 mm x 15 mm;
Characteristics:	Weight 84 g
Read Range:	Up to 100 meters depending on reader power
Frequency:	2400-2483 MHz ISM license-free band
Environment:	Operating Temp: -40° C to 65° C (-40° F to 149° F)
	Storage Temp: -40° C to 85° C (-40° F to 185° F)
	Humidity: 0% to 95% RH non-condensing
Technology:	Digital Modulation
Output RF Power:	+10 dBm EIRP
Ranging Method:	Time Of Arrival (TOA)
Ranging Accuracy:	+/- 1 meter
Protocol:	CSL RTLS Protocol, orderly inventory method to handle large tag population
Battery:	AAA battery 3 pieces
Order Code:	CS3151TC

1.2.4 Antenna Properties

CS3151TC employs a miniaturized SMD antenna for effective RF transmission and reception. The antenna properties is as below :

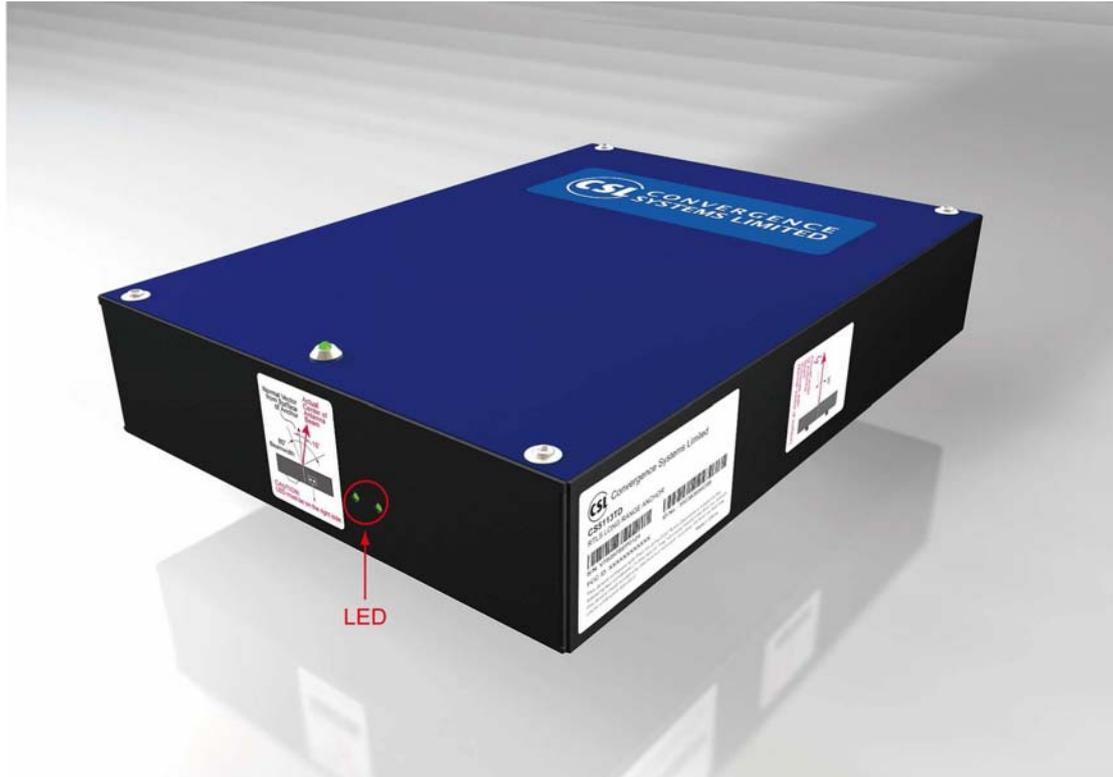
Electrical Items	Specifications
Model	3030A5887-01
Type of antenna	SMD chip type
Frequency range	2400MHz – 2500MHz
Nominal impedance	50 ohm
Polarization	Linear
V.S.W.R	1.5 typically, mounting on CS3151TC
Gain	2dBi typically, mounting on CS3151TC
Mechanical Items	Specifications
Dimension in millimeter	12.8(L) x 3.9(W) x 1.1(H)
Weight	0.1gram



1.3 CS5111TD/CS5112TD

1.3.1 Product Description

CS5111TD/CS5112TD are the RTLS anchor(or reader). The high gain 2.4GHz ISM band antenna and the electronics PCB are integrated into one housing for robustness and easy installation. CS5111TD/CS5112TD are designed to be mounted at the back panel.





1.3.2 Installation Procedure

CS5111TD/CS5112TD can be fed with DC voltage ranges from +12Vdc to +24Vdc. The dc plug is 2.5mm locked type. CS5111TD/CS5112TD are fully programmed and ready for normal operation once power is on. No extra configuration procedure is required.

1.3.3 Product Specifications

1.3.3.1 CS5111TD Product Specifications

Specifications:	
Physical Characteristics:	Sealed enclosure: 29 cm x 22.2 cm x 6.5 cm; Weight 2 Kg
Mounting:	4 mounting holes at corners for screw mounting onto surface, mounting fixture for wall mounting, ceiling mounting, table mounting, shelf mounting available
Read Range:	Up to 100 meters
Frequency Range:	2400-2483 MHz ISM license-free band
Environment:	Operating Temp: -20°C to 65°C (-40°F to 149°F) Storage Temp: -40°C to 85°C (-40°F to 185°F) Humidity: 0% to 95% RH non-condensing
Technology:	CHIRP
Output RF Power:	10 dBm EIRP
Antenna:	Embedded 9 dBi patch antenna
Ranging Method:	Time Of Arrival (TOA)
Ranging Accuracy:	+/- 1 meter
Protocol:	CSL RTLS Protocol, orderly inventory method to handle large tag population
Display:	LED x 2, Power and Signal
Power Requirement:	24Volt DC,100mA; actual supply can range from 5 VDC to 24 VDC, can be operated using battery, battery low detect value needs to be software configured.
Order Code:	CS5111TD

1.3.3.2 CS5112TD Product Specifications

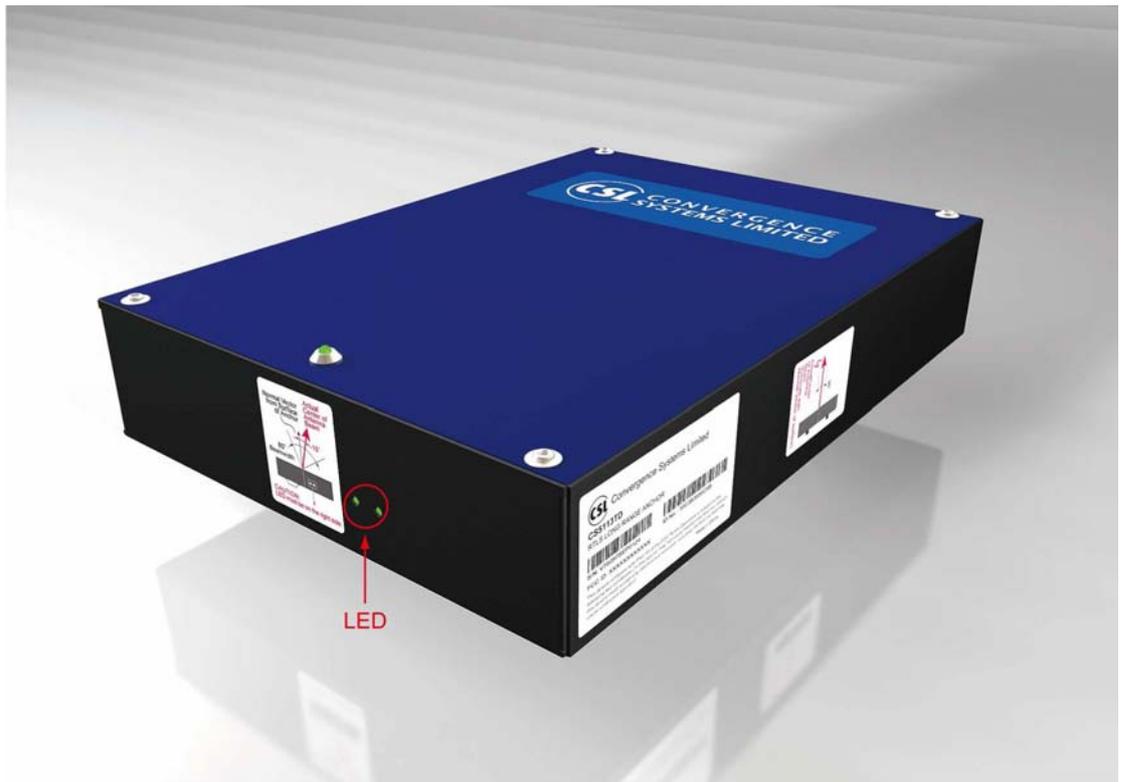
Specifications:

Physical Characteristics:	Sealed enclosure: 29 cm x 22.2 cm x 6.5 cm; Weight 2 Kg
Mounting:	4 mounting holes at corners for screw mounting onto surface, mounting fixture for wall mounting, ceiling mounting, table mounting, shelf mounting available
Read Range:	Up to 100 meters
Frequency Range:	2400-2483 MHz ISM license-free band
Environment:	Operating Temp: -20°C to 65°C (-40°F to 149°F) Storage Temp: -40°C to 85°C (-40°F to 185°F) Humidity: 0% to 95% RH non-condensing
Technology:	CHIRP
Output RF Power:	10 dBm EIRP
Antenna:	Embedded 6 dBi patch antenna
Ranging Method:	Time Of Arrival (TOA)
Ranging Accuracy:	+/- 1 meter
Protocol:	CSL RTLS Protocol, orderly inventory method to handle large tag population
Display:	LED x 2, Power and Signal
Power Requirement:	24Volt DC,100mA; actual supply can range from 5 VDC to 24 VDC, can be operated using battery, battery low detect value needs to be software configured.
Order Code:	CS5112TD

1.4 CS5113TD/CS5114TD

1.4.1 Product Description

CS5113TD/CS5114TD is the RTLS master anchor(or reader). It integrates the high gain 2.4GHz ISM band antenna and the electronics PCB into one housing for robustness and easy installation. CS5113TD/CS5114TD has Ethernet connectivity function to communicate with the server application. CS5113TD/CS5114TD is also a POE PD that can allow it to be powered through IEEE 802.3 certified PSE.







1.4.2 Installation procedure

CS5113TD/CS5114TD can be fed with DC voltage ranges from +12V to +24Vdc. The dc plug is water-proof locked type.. Once powered on, CS5113TD/CS5114TD is ready to communicate with server through Ethernet port for configuration and RTLS functions.

CS5113TD/CS5114TD can also be powered by a IEEE802.3 certified PSE. When the POE is in function, the DC adapter can be unplugged from the DC jack.

When connected to the server via Ethernet connection, Shielded-FTP Ethernet cables should be used to for optimal performance.

1.4.3 Product Specifications

1.4.3.1 CS5113TD Product Specifications

Specifications:	
Physical Characteristics:	Sealed enclosure: 29 cm x 22.2 cm x 6.5 cm; Weight 2 Kg
Mounting:	4 mounting holes at corners for screw mounting onto surface, mounting fixture for wall mounting, ceiling mounting, table mounting, shelf mounting available
Read Range:	Up to 100 meters
Frequency Range:	2400-2483 MHz ISM license-free band
Environment:	Operating Temp: -20°C to 65°C (-40°F to 149°F) Storage Temp: -40°C to 85°C (-40°F to 185°F) Humidity: 0% to 95% RH non-condensing
Technology:	CHIRP
Output RF Power:	10 dBm EIRP
Antenna:	Embedded 9 dBi patch antenna
Ranging Method:	Time Of Arrival (TOA)
Ranging Accuracy:	+/- 1 meter
Network Connectivity	Ethernet, POE (Power Over Ethernet)
Protocol:	CSL RTLS Protocol, orderly inventory method to handle large tag population
Display:	LED x 2, Power and Signal
Power Requirement:	2 methods, auto-select: 1. 5 VDC – 24 VDC supply, at 24 VDC, 100 mA; can be operated using battery, battery low detect value needs to be software configured 2. POE
Order Code:	CS5113TD

1.4.3.2 CS5114TD Product Specifications

Specifications:

Physical Characteristics:	Sealed enclosure: 29 cm x 22.2 cm x 6.5 cm; Weight 2 Kg
Mounting:	4 mounting holes at corners for screw mounting onto surface, mounting fixture for wall mounting, ceiling mounting, table mounting, shelf mounting available
Read Range:	Up to 100 meters
Frequency Range:	2400-2483 MHz ISM license-free band
Environment:	Operating Temp: -20°C to 65°C (-40°F to 149°F) Storage Temp: -40°C to 85°C (-40°F to 185°F) Humidity: 0% to 95% RH non-condensing
Technology:	CHIRP
Output RF Power:	10 dBm EIRP
Antenna:	Embedded 6dBi patch antenna
Ranging Method:	Time Of Arrival (TOA)
Ranging Accuracy:	+/- 1 meter
Network Connectivity	Ethernet, POE (Power Over Ethernet)
Protocol:	CSL RTLS Protocol, orderly inventory method to handle large tag population
Display:	LED x 2, Power and Signal
Power Requirement:	2 methods, auto-select: 1. 5 VDC – 24 VDC supply, at 24 VDC, 100 mA; can be operated using battery, battery low detect value needs to be software configured 2. POE
Order Code:	CS5114TD

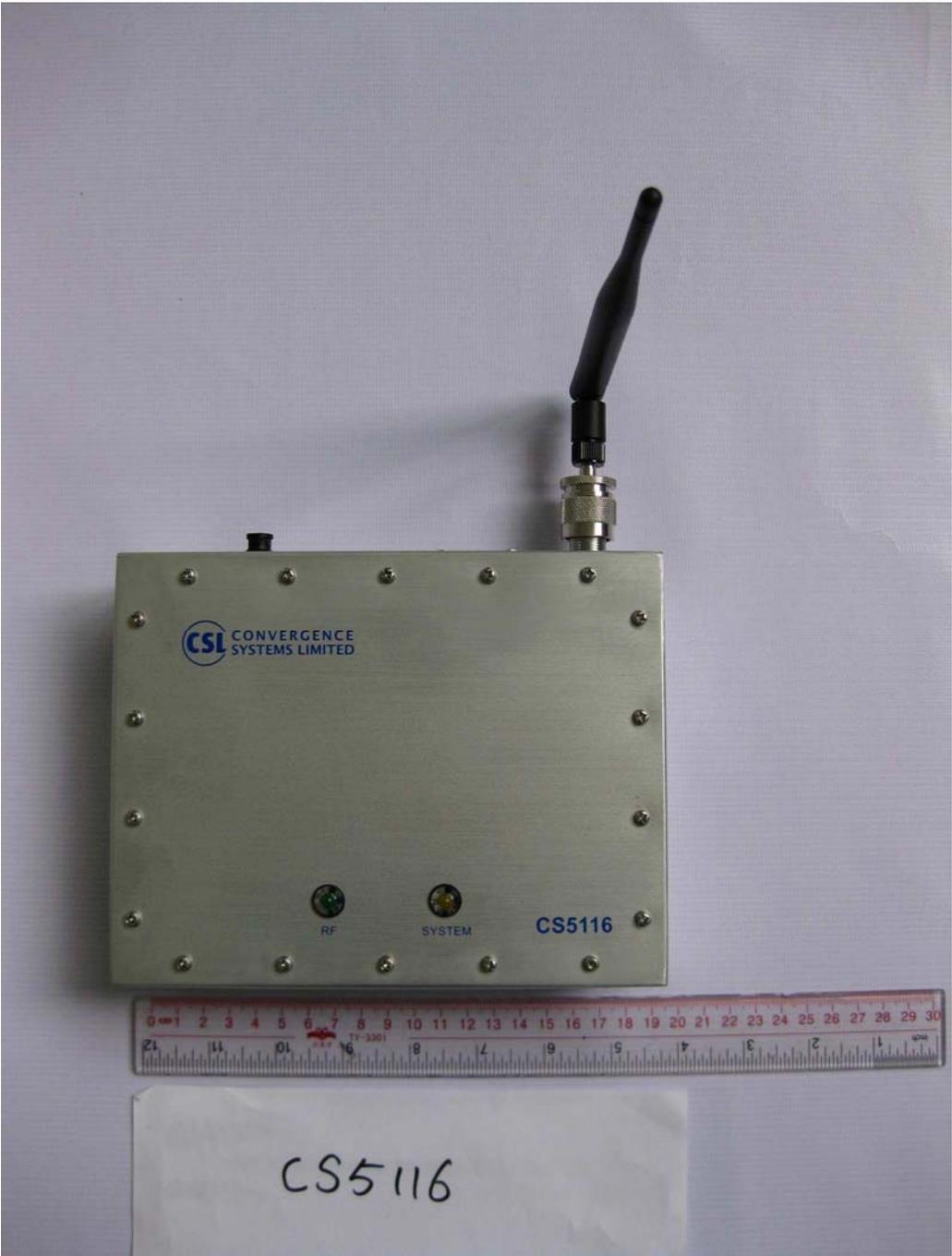
1.5 CS5118/CS5116

1.5.1 Product Description

CS5118 and CS5116 are the equivalence of CS5113TD/CS5114TD and CS5111TD/CS5112TD, with the antenna replaced by omni-directional dipole antennas. CS5118 has Ethernet connectivity function to communicate with the server application. CS5118 is also a POE PD that can allow it to be powered through IEEE 802.3 certified PSE.

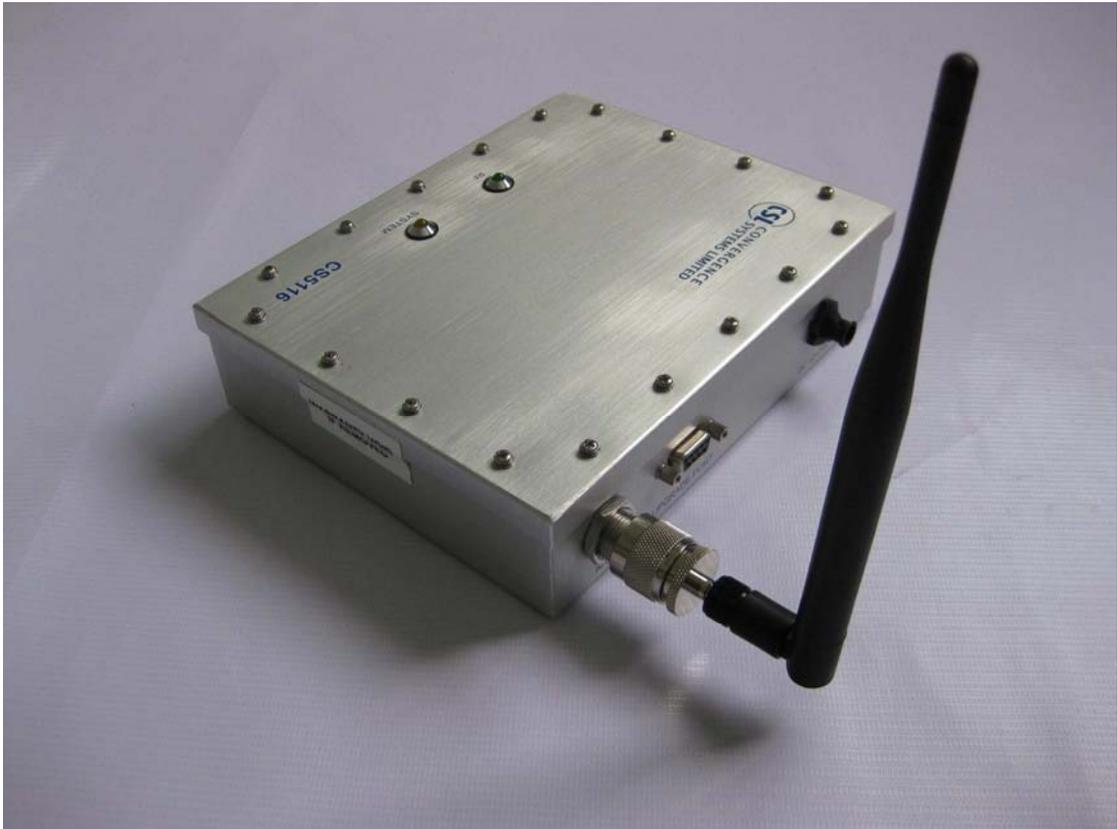
CS5115 Outlook:















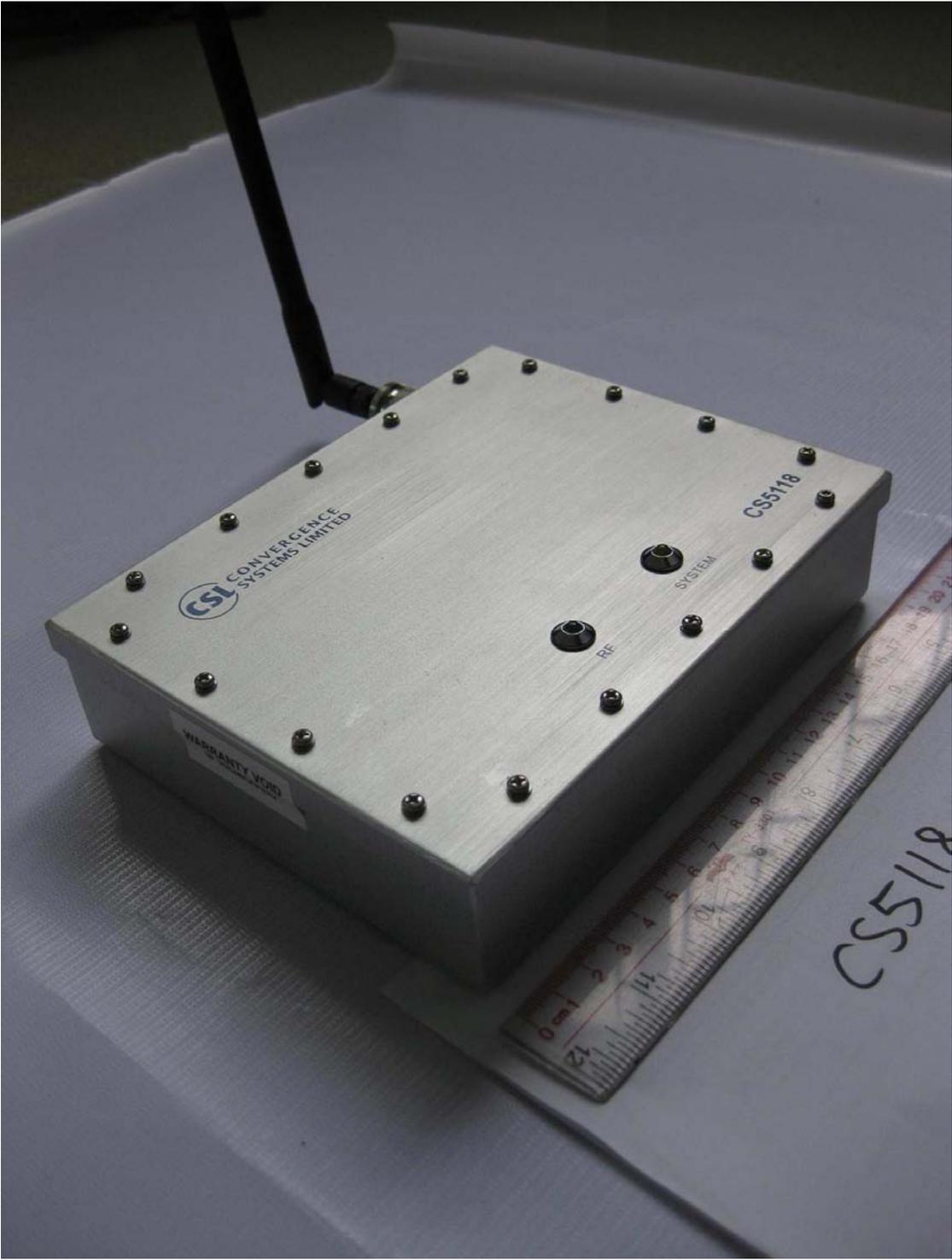
CS5118 Outlook:

















1.5.2 Installation procedure

CS5118/CS5116 can be fed with DC voltage ranges from 5V to 24Vdc. The dc plug is water-proof locked type. The Ethernet connection on CS5118 is also water-proof locked type. Once powered on, CS5118/CS5116 is ready to communicate with server through Ethernet port for configuration and RTLS functions. When connected to the server via Ethernet connection, Shielded-FTP Ethernet cables should be used to for optimal performance.

1.5.3 CS5118/CS5116 Product Specifications

1.5.3.1 CS5118 Product Specifications

Specifications:	
Physical Characteristics:	Sealed enclosure: 4.8cm x 15.4 cm x 19.3cm; Weight 2 Kg
Mounting:	8 mounting holes at corners for screw mounting onto surface, mounting fixture for wall mounting, ceiling mounting, table mounting, shelf mounting available
Read Range:	Up to 100 meters
Frequency Range:	2400-2483 MHz ISM license-free band
Environment:	Operating Temp: -20°C to 65°C (-40°F to 149°F) Storage Temp: -40°C to 85°C (-40°F to 185°F) Humidity: 0% to 95% RH non-condensing
Technology:	CHIRP
Output RF Power:	10 dBm EIRP
Antenna:	9dBi dipole antenna
Ranging Method:	Time Of Arrival (TOA)
Ranging Accuracy:	+/- 1 meter
Network Connectivity	Ethernet, POE (Power Over Ethernet)
Protocol:	CSL RTLS Protocol, orderly inventory method to handle large tag population
Display:	LED x 2, Power and Signal
Power Requirement:	2 methods, auto-select: 1. 5 VDC – 24 VDC supply, at 24 VDC, 100 mA; can be operated using battery, battery low detect value needs to be software configured 2. POE
Order Code:	CS5118

1.5.3.2 CS5116 Product Specifications

Specifications:

Physical Characteristics:	Sealed enclosure: 4.8cm x 19.3cm x15.4cm; Weight 2 Kg
Mounting:	8 mounting holes at corners for screw mounting onto surface, mounting fixture for wall mounting, ceiling mounting, table mounting, shelf mounting available
Read Range:	Up to 100 meters
Frequency Range:	2400-2483 MHz ISM license-free band
Environment:	Operating Temp: -20°C to 65°C (-40°F to 149°F) Storage Temp: -40°C to 85°C (-40°F to 185°F) Humidity: 0% to 95% RH non-condensing
Technology:	CHIRP
Output RF Power:	10 dBm EIRP
Antenna:	9dBi Dipole Antenna
Ranging Method:	Time Of Arrival (TOA)
Ranging Accuracy:	+/- 1 meter
Protocol:	CSL RTLS Protocol, orderly inventory method to handle large tag population
Display:	LED x 2, Power and Signal
Power Requirement:	24Volt DC,100mA; actual supply can range from 5 VDC to 24 VDC, can be operated using battery, battery low detect value needs to be software configured.
Order Code:	CS5116

Federal Communications Commission Interference

Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

This Class [B] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [B] est conforme à la norme NMB-003 du Canada.