



TC-5915AP Pneumatic Shield Box

User Manual

R20191111

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Revision History

Revision Record

Revision	Description	Date
v1.0	Initial Draft	2019-10-17
v1.1	First Release	2019-11-12

WARRANTY

TESCOM guarantees that this product will be free from defects in materials and workmanship for one year from the date of shipment. During the warranty period, TESCOm will, at its discretion, either repair or replace defective products.

For the warranty service, customer must notify TESCOm of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to TESCOm or to a service center designated by TESCOm. Customer shall pay for shipping charges as well as any other charges incurred outside of Korea. TESCOm shall pay shipping charge to return the product to the customer.

This warranty does not apply to [Expendables and Accessories](#) and any failure or damage caused by improper use or unauthorized service. In such cases, TESCOm may refuse to offer any service under the warranty.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulted from software (user interface) supplied by the customer or any third party, unauthorized modification or misuse, accident or abnormal condition of operation. Also, Tescom does NOT warrant certain parts which are considered expendable such as gaskets, gas springs, handle assemblies, accessories, antennas, I/O interfaces, modules and fixtures.

TESCOM's responsibility to repair or replace defective products is the sole and exclusive remedy provided to the customer for breach of this warranty. TESCOm will not be liable for any indirect, extraordinary, incidental, or consequential damages, despite any advance notice of the possibility of such damages.

Safety Considerations

Review the following safety precautions to avoid personal injury, damage to this product, or damage to any product connected.

Do not disassemble any part unless listed replaceable in this manual

Do not operate in wet/damp conditions

To avoid injury or fire hazard, do not operate this product in wet or damp conditions.

Do not operate in explosive atmosphere

To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Provide proper ventilation

To prevent product overheating, provide proper ventilation.

Do not operate with suspected failures

If there is any damage to this product, have it inspected by qualified service personnel

Environmental Conditions

Refrain from using this equipment in a place subject to intense vibration, direct sunlight, or uneven ground. Also, use it where the temperature is between 0 °C to 50 °C and relative humidity is less than 85%.

Safety Symbols and Terms





Various symbols are used in this manual and on the product itself to ensure correct usage, to prevent danger to the user and others, and to prevent property damage. The meanings of these symbols are described below. It is important that you read these descriptions thoroughly and fully understand its context.

Safety Terms

WARNING: Identifies conditions or practices that could result in injury or loss of life.

CAUTION: Identifies conditions or practices that could result in damage to the product or other property.

Symbols: The following symbols may appear in this manual or on the product.

Symbol	Meaning
	<input checked="" type="checkbox"/> Crush hazard Moving part can cause serious injury. Must not operate Shield Box when unauthorized person is in proximity.
	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury and/or equipment damage.
	Indicates a potentially hazardous situation which, if not avoided, may result in a minor or moderate injury and/or equipment damage. It may also be used to alert against unsafe practices.
	Indicates necessary information or useful information for operation and maintenance.

PART 1.

Getting Started

1. Introduction and Specifications

1.1 Introduction

Shield Box is an equipment that shields wireless products from RF interference which flows in by radiation or through I/O cables while running tests.

Shield Box is highly effective in shielding as well as being small and sturdy. Therefore, it offers efficient and economical testing solution for mass production, service, and development.

Key Features

- High RF shielding
- Pneumatic control of lid open-close and optional fixture motions
- EMI filter on all Data and DC lines
- Easily customizable to meet various test needs
- Red and Green LED's for Pass/Fail indication
- RS-232C Remote Control

1.2 Specifications

Mechanical Specifications

Input voltage		24 VDC
Power Consumption		Max 1.5 W
Remote Control		RS-232C, 3 wire, DB9(s)
Air Connector	Main connector	6 mm OD hose, one-touch push-on fitting
	Fixture control connector	4 mm OD hose, one-touch push-on fitting
	Input air pressure	5 to 10 bar

Dimensions	Inside	236(W) x 297(D) x 180(H) mm
	Outside	324(W) x 432(D) x 252(H) mm, lid closed, 373(H) mm, lid open
Weight		Approx. 11 kg
*Packing	Size	490(W) x 550(D) x 380(H) mm
	Weight	Approx. 13 kg
*The size and/or weight of packing may vary depending on how the product is packed.		

Typical RF Shielding

- The shielding effectiveness below is measured with blank panels; other I/O interface panels may cause different results.

Frequency	Shielding effectiveness (dB)
100 to 2000 MHz	> 70 dB
2000 to 3000 MHz	> 70 dB
3000 to 6000 MHz	> 60 dB

1.3 Initial Inspection

When TC-5915AP is delivered, inspect the package and its content as follows:

- ① Check for any damage that could have occurred during the shipment.
- ② Verify that you have received the accessories supplied with the TC-5915AP and its options, which are listed in [4.1 Exterior and Accessory Inspection](#)
- ③ In case of any abnormality, do not install or operate the product for your own safety. Please contact TESCOM immediately.

1.4 Operating Environment

Avoid locations with severe vibration, chance of explosion, or direct sunlight. Set Shield Box in a place at 5 °C ~ 40 °C with humidity of less than 85%.

If Shield Box is not supposed to be used for a long time, securely pack it and store in a dry place at room temperature.

1.5 Optional Parts Check

Referring to [3. Optional Panels & Fixture](#) , check optional panels and accessories whether they are in place as you ordered.

1.6 TESCOM Sales and Service Office

If you have difficulty with the product, call or write to our Technical Support specialists at:

NOTICE

TESCOM Company Limited # 927 Unitechvil, 142, Ilsan-ro, Ilsandong-gu, Goyang-si, Gyunggi-do, Korea [ZIP 10442]

TEL.: 82-31-920-6600

FAX: 82-31-920-6607

Email: support@tescom.org

Website: <http://www.tescom.co.kr>

PART 2.

Hardware Description

2. Hardware Overview

2.1 Component Identification



Figure 2-1 TC-5915AP Component Identification

Table 2-1 TC-5915AP Component Identification

No.	Description	No.	Description
1	Lid	9	Air Cylinder
2	Lid Handle	10	Lid Close Sensor
3	Lid Open/Close Button	11	Hinge
4	Power ON/OFF Switch	12	I/O Interface Panel
5	Green LED for PASS	13	AC Input Connector
6	Orange LED for TEST	14	RS-232C Connector
7	Red LED for FAIL	15	Air Inlet
8	Fixture Operation Button		

2.1.1 TC-5915AP Inside

TC-5915AP Fixture Air Ports

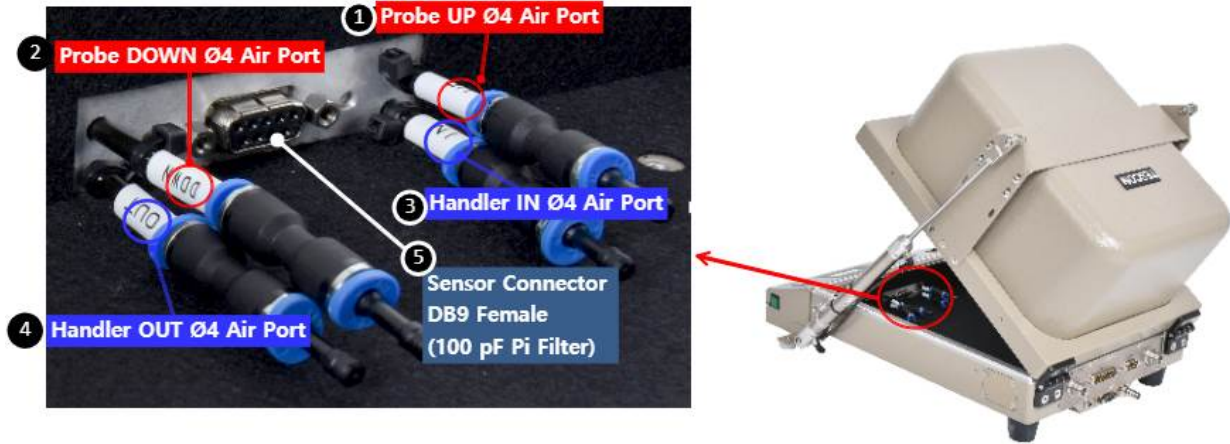
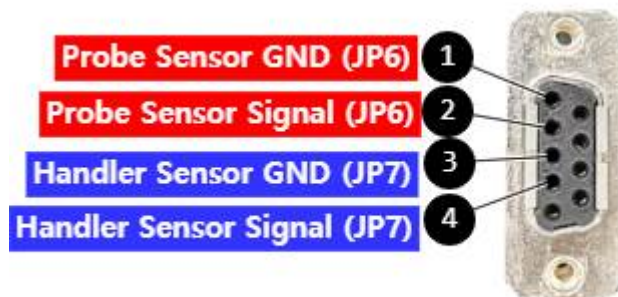


Figure 2-2 TC-5915AP Fixture Air Ports

Table 2-2 TC-5915AP Fixture Air Ports & Sensor Connector

No.	Description
①	Probe UP Air Port (Ø4) , Speed control function excluded
②	Probe DOWN Air Port (Ø4), Speed control function excluded
③	Handler IN Air Port (Ø4), Speed control function excluded
④	Handler OUT Air Port (Ø4), Speed control function excluded
⑤	Sensor Connector DB9 100 pF Filter, for connecting a sensor cable

Sensor Connector Pin Map



TC-5915AP Inside D-SUB 9P (FEMALE)

Figure 2-3 TC-5915AP Inside D-SUB 9P (Female) Sensor Connector Specification

Table 2-3 TC-5915AP Inside D-SUB 9P (Female) Connector Pin Map

Pin Number (Female)	Description
1	Probe Sensor GND
2	Probe Sensor Signal
3	Handler Sensor GND
4	Handler Sensor Signal

2.1.2 TC-5915AP Control Box

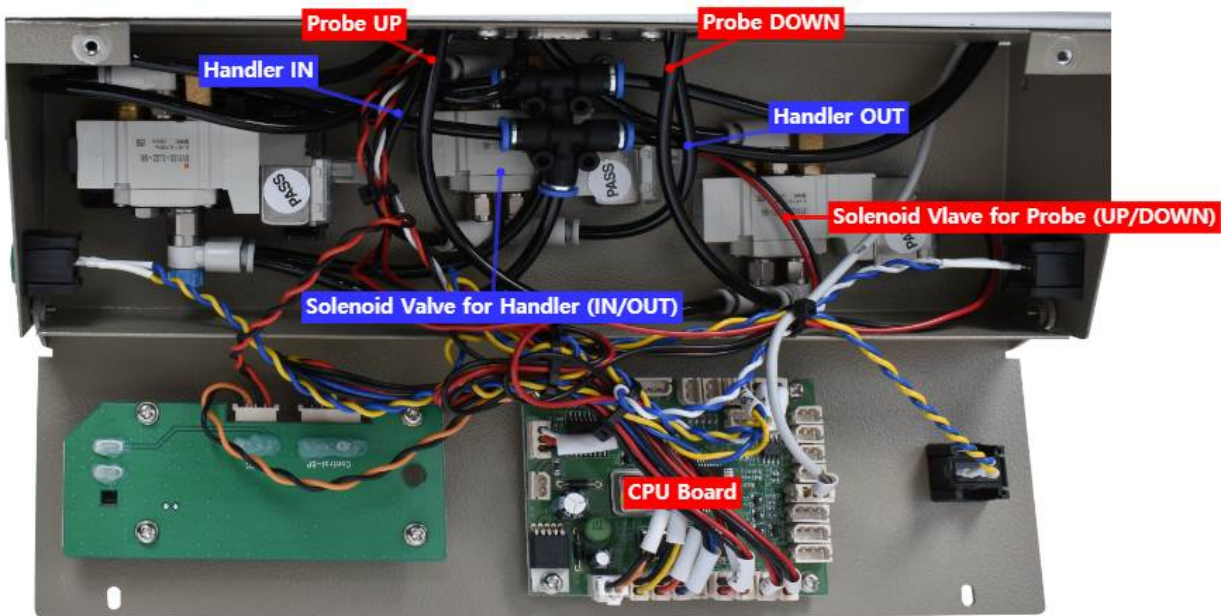


Figure 2-4 5915AP Control Box

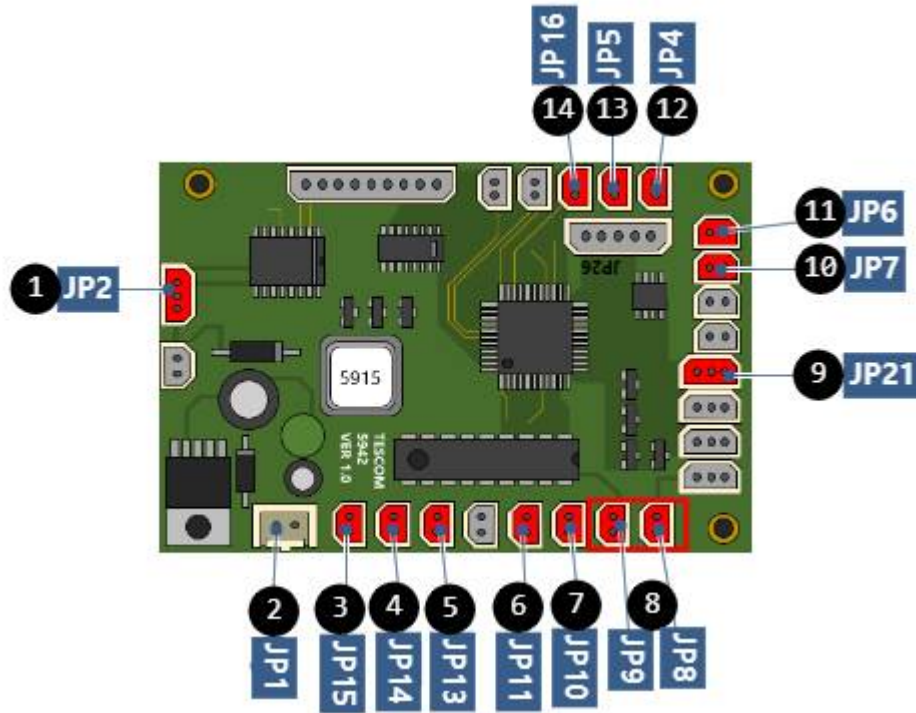
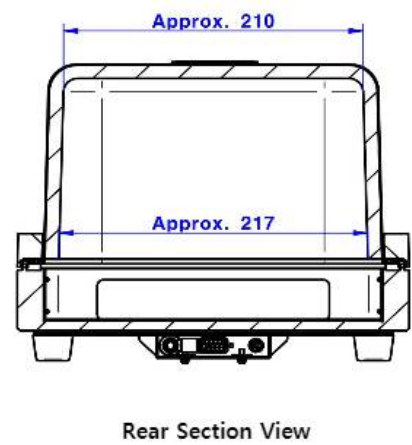
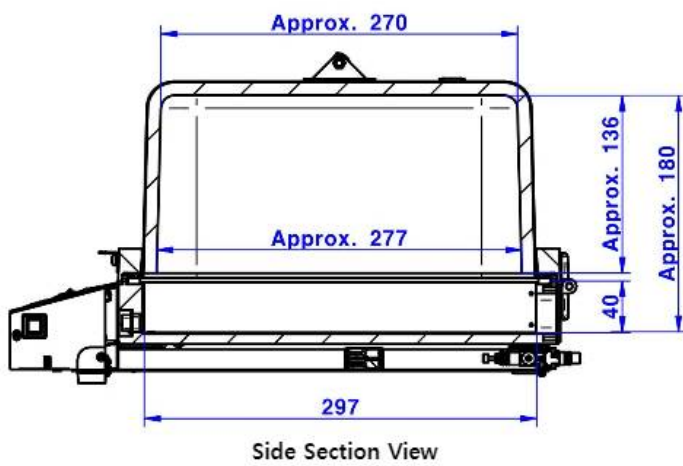
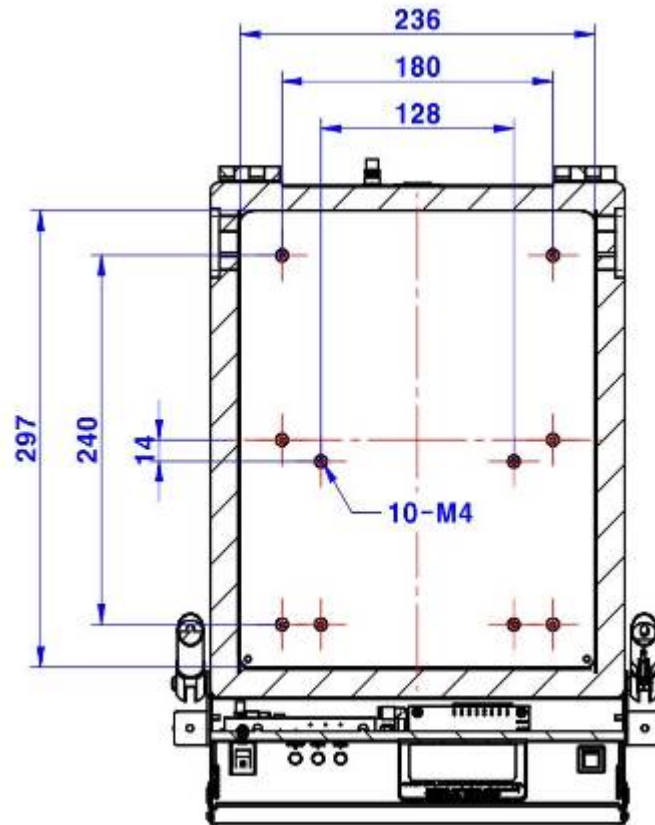


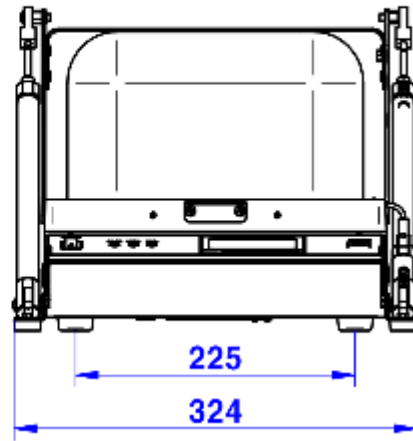
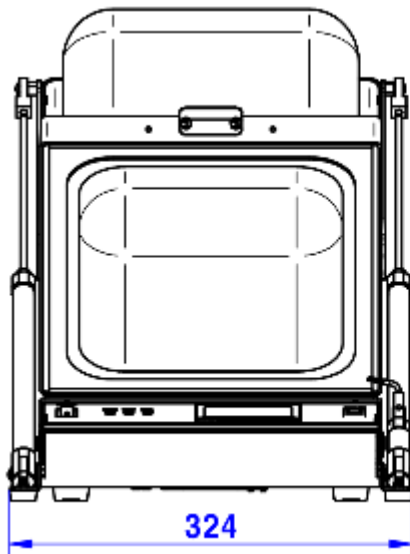
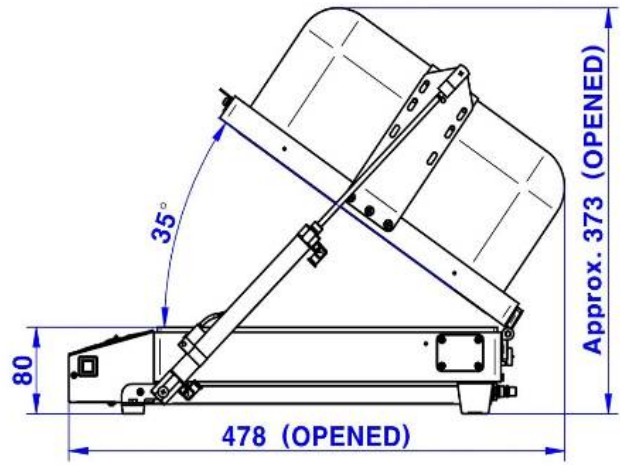
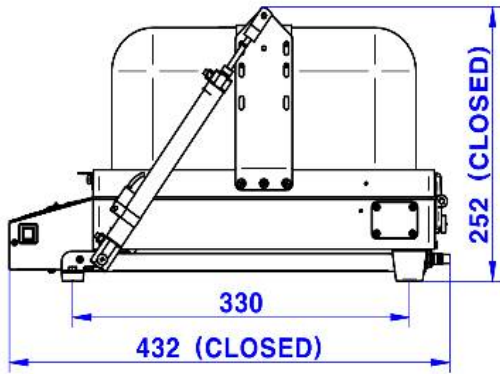
Figure 2-5 5915AP CPU Board

Table 2-4 TC-5915AP Control Board Connector

No.	Function	Connector	Description
1	RS-232C Communication	JP2	RS-232C Connector
2	Power Supply	JP1	+24V DC Input Connector
3	LED	JP15	FAIL LED Connector
4		JP14	PASS LED Connector
5		JP13	TEST LED Connector
6	Solenoid Valves	JP11	Solenoid Valve Connector for Handler
7		JP10	Solenoid Valve Connector for Probe
8		JP9	Solenoid Valve Connector for Lid
		JP8	Solenoid Valve Connector for Lid
9	Sensors	JP21	Lid Close Detection Sensor Connector
10		JP7	Handler Inward Detection Sensor Connector
11		JP6	Probe Downward Detection Sensor Connector
12	Operation Buttons	JP4	Right-Hand Side Lid Open Button Connector
13		JP5	Left-Hand Side Lid Open Button Connector
14		JP16	Fixture Operation Button Connector

2.2 Dimensions





3. Optional Panels & Fixture

3.1 I/O Interface Panels

TC-5915AP has several types of panel options for connecting data interface, power, etc.. It can be customized to suit your needs.

3.1.1 Pre-configured Panels

List of I/O interface panels already configured by us

Table 3-1 Pre-configured I/O Interface Panel for TC-5915AP







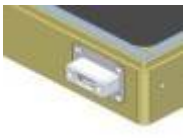
I/O Interface Panel	Order Number	Configuration
 Data Interface Panel	M591502B	<ul style="list-style-type: none"> • Two(2) N(f) outside and SMA(f) inside • One(1) DB9(p) outside and DB9(s) inside, 1000 pF Pi filter • One(1) DB25(p) outside and DB25(s) inside, 1000 pF Pi filter
 Data Interface Panel	M591502D	<ul style="list-style-type: none"> • Two(2) N(f) outside and SMA(f) inside • One(1) DB25(p) outside and DB25(s) inside, 1000 pF Pi filter • One(1) USB 2.0 outside and inside
 Data Interface Panel	M591542B	<ul style="list-style-type: none"> • Two(2) N(f) outside and SMA(f) inside • One(1) DB9(p) outside and DB9(s) inside, 1000 pF Pi filter • One(1) USB 2.0 outside and inside
 Data Interface Panel	M591518A	<ul style="list-style-type: none"> • Two(2) N(f) outside and SMA(f) inside • One(1) DB9(p) outside and DB9(s) inside, 100 pF Pi filter • One(1) USB 2.0 outside and inside • One(1) RJ-45 outside and inside




Table 3-2 Pre-configured Side I/O Interface Panel for TC-5915AP

I/O Interface Panel	Order Number	Configuration
 DC Power Side Interface Panel	M591532A	<ul style="list-style-type: none"> One(1) DC power jack adapter
 DB9 Side Interface Panel	M591533A	<ul style="list-style-type: none"> One(1) DB9(p) outside and DB9(s) inside, 1000 pF Pi filter
 USB 2.0 Side Interface Panel	M591534B	<ul style="list-style-type: none"> One(1) USB 2.0 outside and inside

3.1.2 Custom Panels

By selecting and combining from the list below, you can set your own I/O interface panel



Table 3-3 Custom I/O Interface

I/O Interface	Order Number	Transmission Speed / Line Voltage	*Typical Shielding
 DB25, 1000pF pi Filter	3409-0009-1	3 Mbps / 100 VDC, 5 Amps max	>70 dB from 0.5 to 2 GHz >80 dB from 2 to 3 GHz >70 dB from 3 to 6 GHz
 DB25, 100pF pi Filter	3409-0014-1	10 Mbps / 100 VDC, 5 Amps max	>50 dB from 0.5 to 2 GHz >60 dB from 2 to 3 GHz >60 dB from 3 to 6 GHz
 DB9, 1000pF pi Filter	3409-0008-1	3 Mbps / 100 VDC, 5 Amps max	>70 dB from 0.5 to 2 GHz >80 dB from 2 to 3 GHz >70 dB from 3 to 6 GHz

I/O Interface	Oder Number	Transmission Speed / Line Voltage	*Typical Shielding
 DB9, 100pF pi Filter	3409-0010-1	10 Mbps / 100 VDC, 5 Amps max	>50 dB from 0.5 to 2 GHz >60 dB from 2 to 3 GHz >60 dB from 3 to 6 GHz
	3409-0018A-3	480 Mbps / 5 V, 500 mA / Max Current: 5A	>60 dB from 0.5 to 2 GHz >70 dB from 2 to 3 GHz >70 dB from 3 to 6 GHz
 USB 3.0 Filter(Active)	3409-0042A-2	5 Gbps / 5 V, 600 mA / Max Current: 1.5 A	>80 dB from 0.5 to 2 GHz >80 dB from 2 to 3 GHz >75 dB from 3 to 6 GHz
 RJ-45 Filter	3409-0022A	1 Gbps Copper-Line Ethernet (1000 BASE-T)	>60 dB from 0.5 to 2 GHz >70 dB from 2 to 3 GHz >70 dB from 3 to 6 GHz
 DC Power Adaptor,	3406-0004A	50 VDC, 3 Amps max	>70 dB from 0.5 to 2 GHz >80 dB from 2 to 3 GHz >80 dB from 3 to 6 GHz
 DC Power Adaptor, Banana Jack Type	3406-0004A 3406-0006A	50 VDC, 10 Amps max	>70 dB from 0.5 to 2 GHz >80 dB from 2 to 3 GHz >80 dB from 3 to 6 GHz
 AC Power Adaptor	3103-0009A	250 VAC, 7 Amps max	>70 dB from 0.5 to 2 GHz >80 dB from 2 to 3 GHz >80 dB from 3 to 6 GHz

NOTICE

1. Shielding effectiveness is an estimated value with each I/O interface applied.
2. The data above was measured by TESCOM, and they may be different depending on the measuring method and environment.
3. Each shielding effectiveness is measured without according cable. It is likely affected when a cable is connected. Also, it may vary depending on the type of cable.

I/O Interface	Order Number	Frequency Range / Impedance / V.S.W.R
 RF, N-SMA Connector	3408-0038	From DC to 6 GHz / 50 Ω / 1.15 max
 RF, SMA-SMA Connector	3408-0039	From DC to 8 GHz / 50 Ω / 1.15 max

3.2 Fixtures

TESCOM offers flexible fixtures that can change the position of the DUT. Depending on the shape of DUT, you can create your own fixture with fixture blocks in a few seconds. In addition, custom fixtures can be ordered and supplied to suit your needs.

3.2.1 Standard Grid Fixture

Table 3-4 TC-5915AP Standard Grid Fixture

Grid Fixture	Order Number	Configuration
	F59154A	<ul style="list-style-type: none"> • Antenna Coupler Fixed Type Fixture • Antenna Coupler(Optional): TC-93026A • 203(W) x 280(D) x 25(H) mm

3.2.2 Custom Fixtures

TESCOM offers custom fixtures as well as standard fixtures to meet your demand. In addition, there are various Antenna Coupler options to set the best measuring system for your specific device.

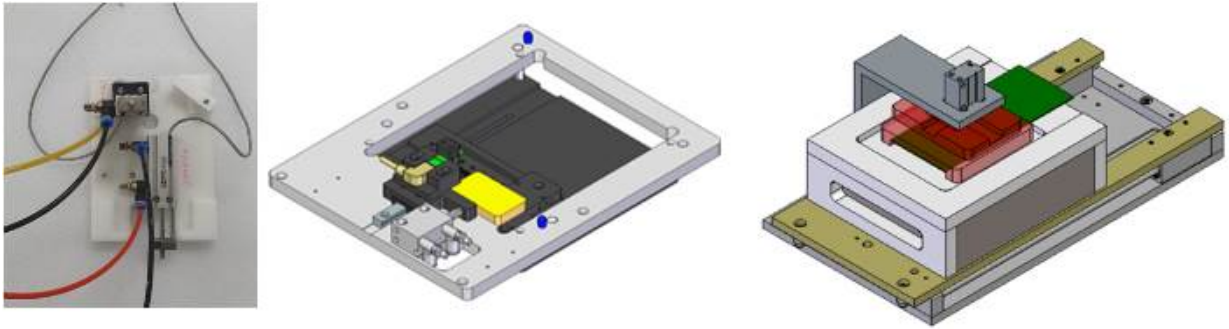


Figure 3-1 Sample images of custom fixtures

PART 3.

Putting into Operation

4. Setup and Operation

4.1 Exterior and Accessory Inspection

When Shield Box is delivered, inspect the package and check whether the following accessories are included:

Exterior and Accessory Inspection

1. Upon receiving the TC-5915AP, check for any damages that could have occurred during shipment.
2. Referring to the list below, verify that you have received the accessories supplied with the TC-5915AP and its options.



Figure 4-1 TC-5915AP Accessories List

Table 4-1 TC-5915AP Accessories List

No.	Part Number	Name	Spec.	Quantity
		Operating Manual		1
		Test Report		1
①	4003-0025	Data Cable, DB9(p)-DB9(s)	2m	1
②	4010-0002	Power Cable, 220V	1.5m	1
③	3001-0039	Switching Power Supply	1.5m	1
④	4011-0001	SS-402, N(m) to N(m)	1m	1
⑤	9703-0074	Air Coupler (CPS15-6W)		1
⑥	C5915AP-0010	Cylinder Lock		1

CAUTION

In case of any abnormality, do not install or operate Shield Box for your own safety. Please contact TESCOM immediately.

4.2 Connecting & Setting Up



Figure 4-2 Cable Connection

No	Item	Description	Part Number	Quantity
①	DC 24V Power Cable	Supplies power to Shield Box	3001-0039	1EA
②	DATA, DB9(p)-DB9(s) 2m	Connects Shield Box to PC for control	4003-0025	1EA
③	Air Coupler	Main air inlet, 6 mm OD hose, 5 ~ 10 bar	9703-0074	1EA

4.2.1 Power Supply

Connecting Power Supply Cable

In order to set TC-5915AP Shield Box in motion, connect the 24V DC Power Supply Adapter bundled with the product.



CAUTION

For your own safety, please use the 24V DC Power Supply Adapter provided by TESCOM.

Turning Shield Box On



- 1 Press the power switch on the TC-5915AP control box to the direction of "-" mark.
- 2 POWER LED Indicator will glow white when the power is on.

4.2.2 Compressed Air Supply

CAUTION

Please make sure to turn off compressed air supply before connecting or disconnecting air hose.

Compressed Air Requirement

- Input air pressure : 5 ~ 10 bar
- Main air connector : 6 mm OD hose, one-touch push-on fitting

CAUTION

It is highly recommended that the compressed air system must be used in conjunction as shown below. Insufficient air quality may cause deterioration of performance.

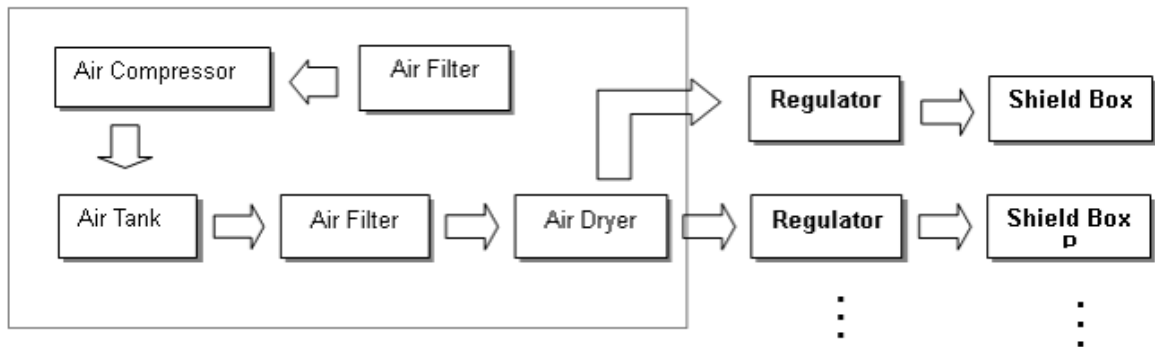


Figure 4-3 General Compressed Air System

Connecting Compressed Air Supply

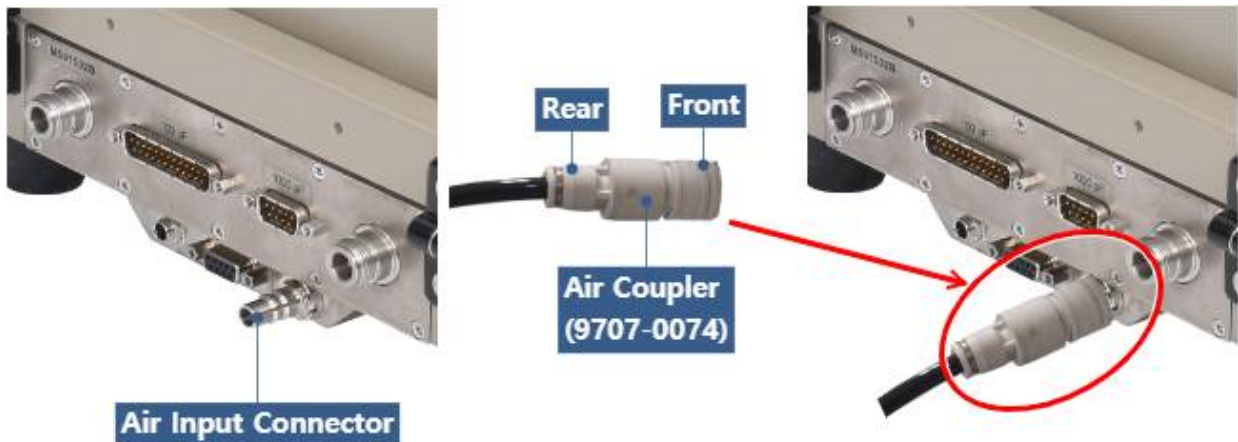


Figure 4-4 Connecting/Disconnecting Compressed Air Supply

- 1 The compressed air inlet port is located at the TC-5915AP rear panel.
- 2 Insert the 6 mm Air Hose to the rear point of Air Coupler.
- 3 Push the front side of Air Coupler on Air Input Connector until you hear a "click" sound.
- 4 Open the air valve and supply the compressed air.

CAUTION

The lid of Shield Box will pop open if you turn the power on while the compressed air is connected.


4.2.3 Lid Control

Closing The Lid

- Press two OPEN/CLOSE buttons (■) simultaneously on both sides of the control box.
- A red light will blink on the lid-close sensor.



NOTICE

An orange light will glow at the TEST LED () on the front control box when the lid is fully closed.

Opening The Lid

- Press **either one** of the two OPEN/CLOSE buttons () to open the lid.



Counting Function

TC-5915AP counts the number of lid open/close cycle and saves it on the memory. The cumulative number of open/close motion can be viewed on a PC by sending “COUNT?” query through RS-232C. TC-5915AP will return the number in 8 digits.

4.2.4 PASS/FAIL LED Indicator



Green and red LED indicators will be on if the command "PASS" or "FAIL" is sent through RS-232C while the lid is closed.

This function can be useful to visualize the result when the Shield Box is controlled via RS-232C.

NOTICE

The red LED will glow automatically if the lid close sensor does not detect the lid or a problem occurs during the fixture operation.

4.3 Shield Box Operation with Fixture

NOTICE

The fixture operation mode of standard TC-5915AP is set as 'Handler Mode: Off', 'Probe Mode: Timer' at the time of release. (You can check it with the query 'SOLENOID MODE?') You need to configure the fixture operation mode if you are to use it.

4.3.1 Fixture Operation Modes

The handler and the probe of fixture can operate in 3 modes each, and the operation is automatic according to the open or close of Shield Box.

The operation of fixture can be controlled with commands via RS-232C. Refer to the list of commands and each command in detail at [5.6.2.2 Handler & Probe Configuration Commands](#)

Table 4-2 Handler and Probe Operation Modes

Operation Mode	Description
Sensor Mode	The operation of fixture is detected by sensors. This mode can prevent damage from malfunction to either the product or DUT.
Timer Mode	The operation runs by timer without using sensors. The waiting time is already fixed upon release and can not be changed.
Off Mode	The operation of fixture is off.

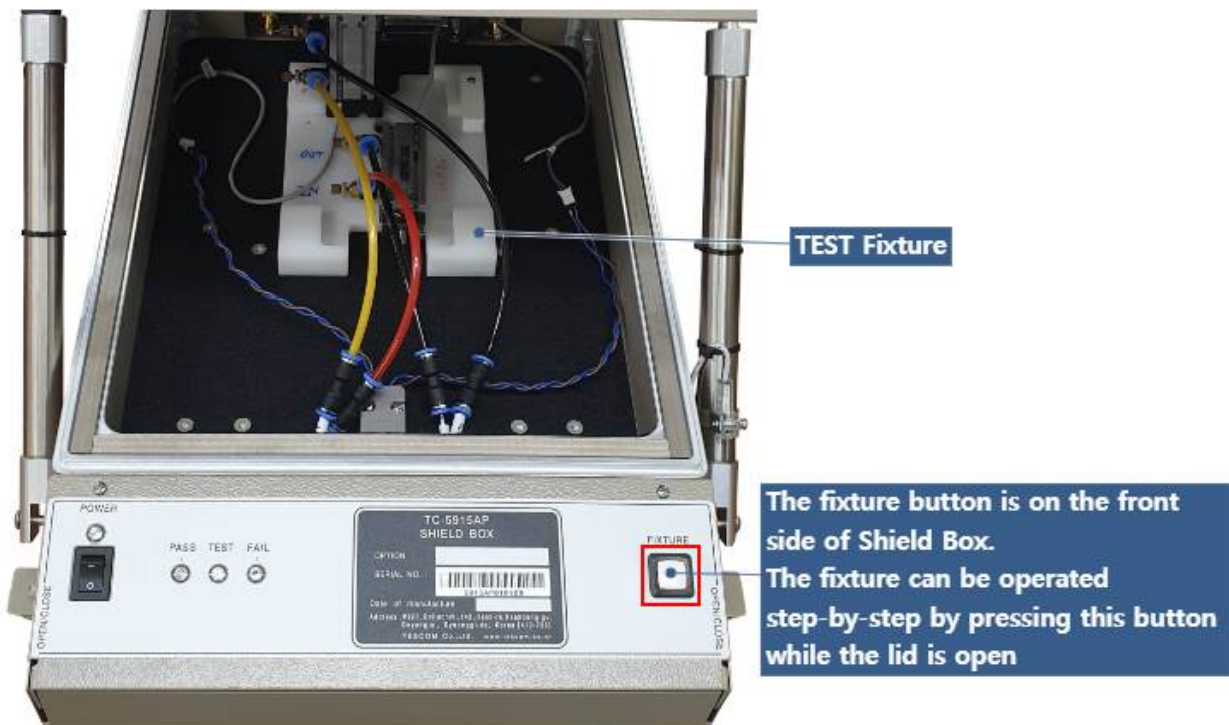
CAUTION

It is NOT recommended operating fixture with the Timer Mode. Without sensors, the lid may close even when the fixture operation is incomplete, thus causing damage to the product or DUT.

4.3.2 Fixture Button () Operation

The fixture can be moved step-by-step if you press the fixture button while the lid is open.

Each step can be run under sensor mode or timer mode, and every move can return to the previous step if there is any problem.



CAUTION

- ① If the air supply is cut off while the lid is open, the lid will close whether the fixture is in position or not. This may cause damage to the product or the DUT.
- ② If any sensor detects that the operation is incomplete, everything returns to the previous position and the red LED will be turned on.

4.3.3 Fixture Connection

Connecting air hose

NOTICE

The air hose for fixture is 4 mm outside diameter hose.



Figure 4-5 Air Hose Connection for Fixture

- ① Remove the Fitting Plug, and connect 4 mm OD Air Hose to the Fitting.
- ② With all Probe and Handler air hoses connected, it will look like below.

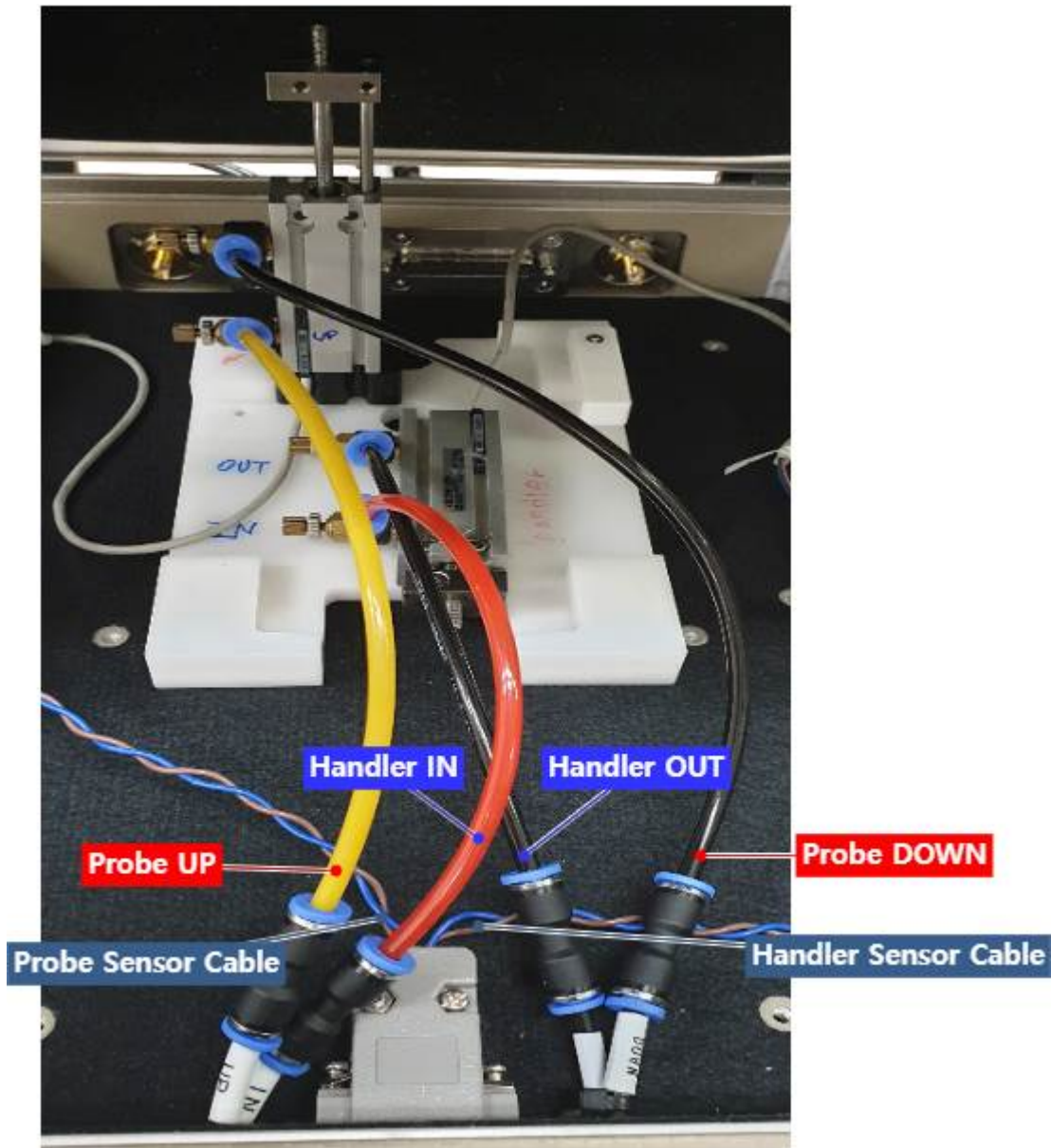


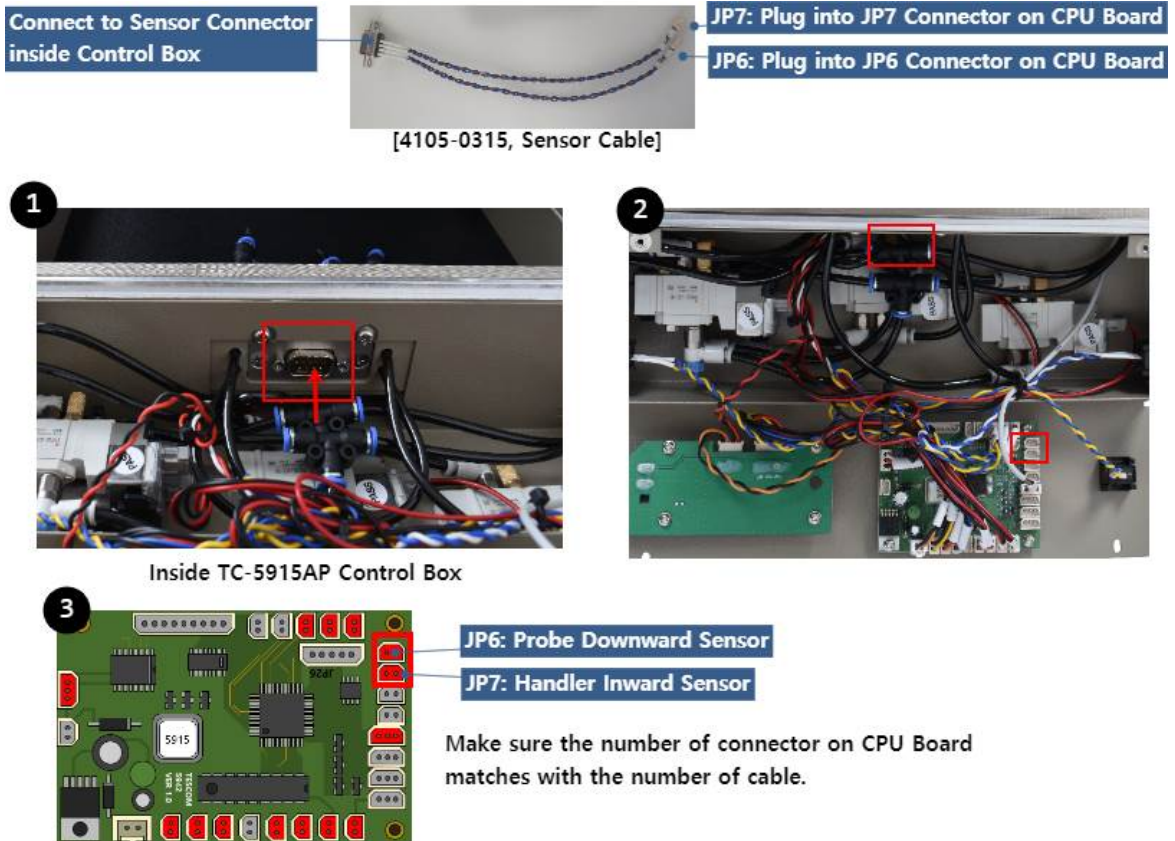
Figure 4-6 TC-5915AP Fixture Connection

NOTICE

Figure 4-6 TC-5915AP Fixture Connection above is just a recommendation, so the actual connection may be adjusted for your convenience.

Connecting Sensor Cables

In order for your fixture to work in sensor mode, the sensor connector of Shield Box must be connected to the control board.



4.4 Shield Box Operation without Fixture

In order to work Shield Box without fixture, the fixture mode must be set to 'Off Mode.'

NOTICE

Refer to [5.6.2.2 Handler & Probe Configuration Commands](#)

If the fixture mode is set to 'Sensor Mode,' sensors will detect nothing and thus the lid will stay open as if there is a problem..

Also, if it is set to 'Timer Mode,' the lid will take certain time to open and close, hence the operation is delayed.

5. Remote Operation Using RS-232C

TC-5915AP can be controlled remotely via RS-232C

5.1 RS-232C Cable Connection

Connect RS-232C Cable to RS-232C DB9 Connector on the rear side of Shield Box.

CAUTION

RS-232C Port on Shield Box is a DB9 Connector Female, so DB9 Data Cable (DB9(p) to DB9(s) Male to Female) should be used to connect Shield Box and PC.

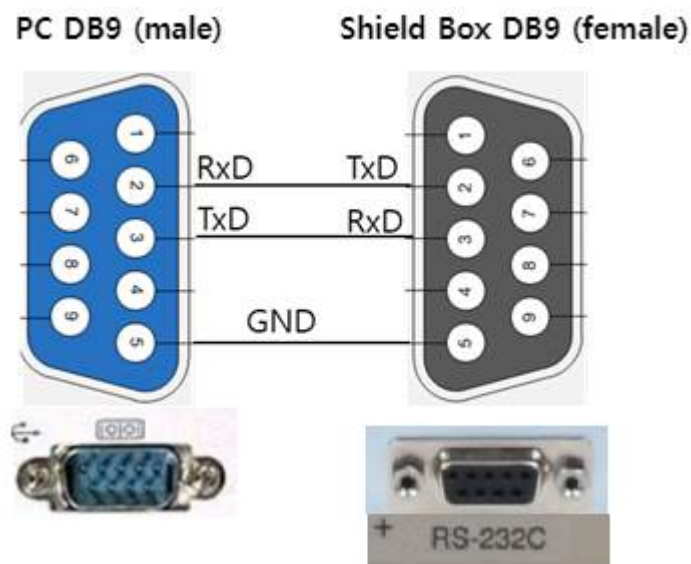


Figure 5-1 RS-232C Cable Pin Configuration

5.2 RS-232C Port Setting

UART port setting is required as follows in order to control the shield box via RS-232C.

Table 5-1 RS-232C Port Setting

Data rate	9600 bps
Data bits	8 bit
Parity	None
Stop bits	1 bit
Flow Control	None

5.3 RS-232C Command Protocol

5.3.1 Command and Response Message

- ① Every time a command is sent from PC to Shield Box, a CR(Carriage Return : $\backslash r$ (0x0D)) is sent at the end of it. (Command+ $\backslash r$ (0x0D))
- ② When a command is sent, a response (Response Data+ $\backslash r$ (0x0D)) comes back after a moment.
- ③ If an invalid command is sent, an error (Error Data+ $\backslash r$ (0x0D)) comes back after a moment.
- ④ Commands are capitalization-free.

CAUTION

You must wait for a response whenever you send a command from PC to Shield Box. Otherwise, an error will occur.


5.4 Control with Terminal Application on PC

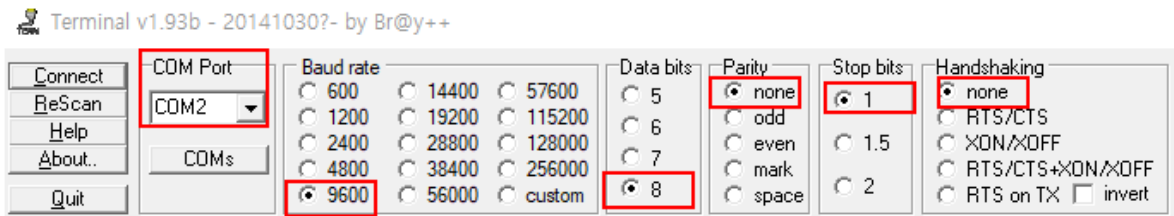
NOTICE

Below you will see how you can control Shield Box using a communication software 'Terminal.'
 The application is free to download from here:
<https://sites.google.com/site/terminalbpp/>

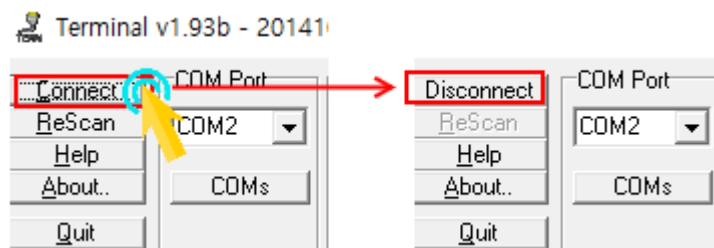
NOTICE

Before beginning, set everything up in [4.2 Connecting & Setting Up](#) chapter.

- 1 Execute  Terminal .
- 2 Set COM Port, Baud Rate (9600 bps), Data Bit (8 bit), Parity Bit (None), Stop Bit (1 bit), Handshaking (none).

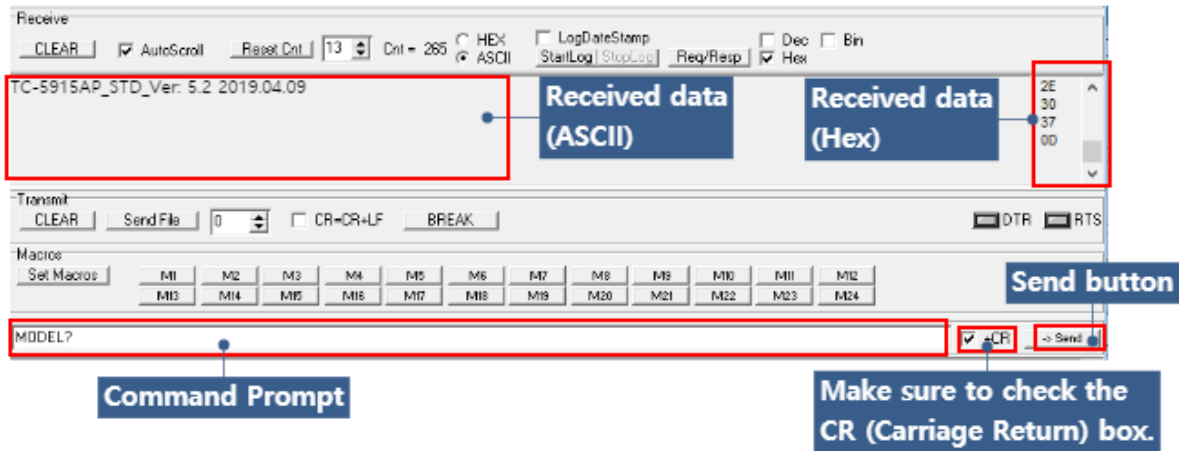


- 3 Press Connect.



4 Send a command and get a response.

1. Enter MODEL? on the command prompt and check +CR (+CR - 2. A response (the model name and the firmware version) will appear on Receive window.
- 3. Check the Command List and try other commands.



5.5 RS-232C Command List

Table 5-2 List of RS-232C Commands for TC-5915AP

Category	RS-232C Command	Response	Description
System	MODEL?	Name+Version+Date	Verify model name, firmware version and date.
	COUNT?	Numeric 8 digits (ex: 00000001)	Display cumulative number of lid operation.
Configuration (Lid Button)	DUAL HAND?	DUAL HAND ON DUAL HAND OFF	Check Lid OPEN/CLOSE Button Mode.
	DUAL HAND ON	OK	Turn the Dual Hand Mode on.
	DUAL HAND OFF	OK	Turn the Dual Hand Mode off.
Configuration (Handler & Probe)	SOLENOID MODE?	Handler:xxx, Probe:xxx xxx: {OFF TIMER SENSOR}	Check Handler and Probe Mode.
	HANDLER MODE SENSOR	OK	Set Handler Mode to Sensor Mode.
	HANDLER MODE TIMER	OK	Set Handler Mode to Timer Mode.
	HANDLER MODE OFF	OK	Set Handler Mode to Off Mode.
	PROBE MODE SENSOR	OK	Set Probe Mode to Sensor Mode.
	PROBE MODE TIMER	OK	Set Probe Mode to Timer Mode.
	PROBE MODE OFF	OK	Set Probe Mode to Off Mode.
Lid Operation Commands	LID?	OPEN CLOSE	Check the current lid status.
	OPEN	OK	Open the lid.
	CLOSE	READY ERR20 ERR30 ERR60	Close the lid.
Handler Operation Commands	HANDLER?	INWARD OUTWARD	Check the current Handler status.
	INWARD	OK ERR20 ERR40	Push the Handler in.
	OUTWARD	OK ERR40 ERR90	Drag the Handler out.
Probe Operation Commands	PROBE?	UPWARD DOWNWARD	Check the current Probe status.
	UPWARD	OK ERR40 ERR90	Lift the Probe up.
	DOWNWARD	OK ERR30 ERR40 ERR90	Lower the Probe down.
Pass/Fail (While The Lid is Closed)	PASS	OK ERR40	Turn the green Pass LED on. Then open the lid.
	FAIL	OK ERR40	Turn the red Fail LED on.

5.5.1 Error Data List

Table 5-3 List of Error Data

Error Code	Description
ERR10	Syntax error. The command does not exist or is invalid.
ERR20	Handler-inward sensor error. It only occurs when the Handler is in Sensor Mode. (The horizontal operation of fixture is incomplete.)
ERR30	Probe-downward sensor error. It only occurs when the Probe is in Sensor Mode. (The vertical operation of fixture is incomplete.)
ERR40	Status error, It occurs when an invalid command is sent. For example, a Handler OUTWARD or Probe UPWARD while the lid is closed. It is returned if the command is sent when the motion can not be done in conjunction with the current status.
ERR50	Lid-open sensor error. It occurs only to certain products which should always detect whether the lid is open. The response comes when the lid-open sensor does not detect the cylinder in open position.
ERR60	Safety error. The Lid Close Sensor does not detect the cylinder in close position.
ERR90	It occurs when the command is sent while the Handler or the Probe is in Off Mode.

5.6 RS-232C Commands in Detail

5.6.1 System Queries

MODEL?
COUNT?

MODEL?

A query to see the model name, firmware version, and the date of manufacture.

Type	Query
Input	MODEL?
Response	<Name>_<Version> <Date>
Example	MODEL? TC-5915AP_STD_Ver: 5.2 2019.04.09

COUNT?

A query to check how many times the lid has opened.

Type	Query
Input	COUNT?
Response	8 digit number (ex, 00000029)

5.6.2 Configuration Commands

[5.6.2.1 Lid Button \(OPEN/CLOSE\) Configuration Commands](#)

[5.6.2.2 Handler & Probe Configuration Commands](#)

NOTICE

Shield Box will reset whenever the lid or fixture operation mode is changed, resulting in opening the lid. If the lid is already open, it will close and then open amid the motion.

5.6.2.1 Lid Button (OPEN/CLOSE) Configuration Commands

DUAL HAND?
 DUAL HAND ON
 DUAL HAND OFF

DUAL HAND?

A query to check the operating mode of the lid.

Type	Query
Input	DUAL HAND?
Response	{ DUAL HAND ON DUAL HAND OFF } <ul style="list-style-type: none"> • DUAL HAND ON : Both Lid OPEN/CLOSE Buttons should be pressed to close. • DUAL HAND OFF: Only one Lid OPEN/CLOSE Button is enough to close.

DUAL HAND ON

A command to set the Lid OPEN/CLOSE operation in Dual Hand Mode.

Two buttons on both sides of the control box must be pressed simultaneously to close the lid. Either one of the two buttons works to open the lid.

Type	Command
Input	DUAL HAND ON
Response	OK

DUAL HAND OFF

A command to turn the Dual Hand Mode off.

Only one button on the right hand side will work to open/close the lid.

Type	Command
Input	DUAL HAND OFF
Response	OK

CAUTION

It is strongly recommended to use the Dual Hand Mode unless absolutely unnecessary. The other hand may be trapped if the mode is off.

5.6.2.2 Handler & Probe Configuration Commands

```
SOLENOID MODE?
HANDLER MODE SENSOR
HANDLER MODE TIMER
HANDLER MODE OFF
PROBE MODE SENSOR
PROBE MODE TIMER
PROBE MODE OFF
```

SOLENOID MODE?

A query to check the operating mode of Handler & Probe.

Type	Query
Input	SOLENOID MODE?
Response	Handler:<mode>, Probe:<mode> <ul style="list-style-type: none"> • <mode>: {OFF TIMER SENSOR }
Example	// Below is how to change the Probe Mode from Off to Timer. SOLENOID MODE? Handler:OFF, Probe:OFF PROBE MODE TIMER OK

CAUTION

It is NOT recommended operating fixture in Timer Mode. Without sensors, the lid may close even when the fixture motion is incomplete, thus causing damage to the product or DUT.

HANDLER MODE SENSOR

A command to set the Handler in Sensor Mode.

Type	Command
Input	HANDLER MODE SENSOR
Response	OK

HANDLER MODE TIMER

A command to set the Handler in Timer Mode.

Type	Command
Input	HANDLER MODE TIMER
Response	OK

HANDLER MODE OFF

A command to set the Handler in Off Mode.

Type	Command
Input	HANDLER MODE OFF
Response	OK

PROBE MODE SENSOR

A command to set the Probe in Sensor Mode.

Type	Command
Input	PROBE MODE SENSOR
Response	OK

PROBE MODE TIMER

A command to set the Probe in Timer Mode.

Type	Command
Input	PROBE MODE TIMER
Response	OK

PROBE MODE OFF

A command to set the Probe in Off Mode.

Type	Command
Input	PROBE MODE OFF
Response	OK

5.6.3 Lid Operation Commands

OPEN
CLOSE
LID?

OPEN

A command to open the lid.

Type	Command
Input	OPEN
Response	OK

- OK : The lid opens (or is already open)

NOTICE

If the lid does not open while the 'OPEN' command is sent and 'OK' response comes back, check the compressed air supply.

CLOSE

A command to close the lid.

The lid-close sensor on a cylinder will blink red if the lid is closed regularly.

Type	Command
Input	CLOSE
Response	{ READY ERR20 ERR30 ERR60 } <ul style="list-style-type: none"> • READY : Lid closed. Ready to test. • ERR20 : Handler-inward sensor error. It occurs only when the Handler is in Sensor Mode. (The horizontal operation of the fixture is incomplete.) • ERR30 : Probe-downward sensor error. It occurs only when the Probe is in Sensor Mode. (The vertical operation of the fixture is incomplete.) • ERR60 : Safety error. The lid-close sensor does not detect the lid..

LID?

A query to check the current status of the lid.

Type	Query
Input	LID?
Response	{ OPEN CLOSE } <ul style="list-style-type: none"> • OPEN : Lid opened • CLOSE : Lid closed

5.6.4 Handler Operation Commands

HANDLER?
INWARD
OUTWARD

HANDLER?

A query to check the current status of the Handler.

Type	Query
Input	HANDLER?
Response	{ INWARD OUTWARD } <ul style="list-style-type: none"> • INWARD: The Handler is at inward position. • OUTWARD: The Handler is at outward position.

INWARD

A command to put the Handler in.

When the lid is closed, only the INWARD command works. The OUTWARD command will not work and will return 'ERR40.'

Type	Command
Input	INWARD
Response	{ OK ERR20 ERR40 } <ul style="list-style-type: none"> • OK: The Handler is at inward position. • ERR20: Handler-inward sensor error. It occurs only when the Handler is in Sensor Mode. (The horizontal operation of fixture is incomplete.) • ERR40: Status error, It occurs when an invalid command is sent. For example: <ul style="list-style-type: none"> ◦ Handler OUTWARD or Probe UPWARD command is sent while the lid is closed. ◦ Probe DOWNWARD or UPWARD command is sent while the Handler is at outward position. ◦ Handler OUTWARD command is sent while the Probe is at downward position.

OUTWARD

A command to drag the Handler out.

If the OUTWARD command is sent while the lid is closed or the Probe operation commands (DOWNWARD/UPWARD) are sent while the Handler is at outward position, it will only return 'ERR40.'

Type	Command
Input	OUTWARD
Response	{ OK ERR40 ERR90 } <ul style="list-style-type: none"> • OK: The Handler is at outward position. • ERR40: Status Error, It occurs when an invalid command is sent. For Example: <ul style="list-style-type: none"> ◦ Handler OUTWARD or Probe UPWARD command is sent while the lid is closed. ◦ Probe DOWNWARD or UPWARD command is sent while the Handler is at outward position. ◦ Handler OUTWARD command is sent while the Probe is at downward position. • ERR90: The command is sent while the Handler is in Off Mode.

5.6.5 Probe Operation Commands

```

PROBE?
UPWARD
DOWNWARD
    
```

PROBE?

A query to check the current status of the Probe.

Type	Query
Input	PROBE?
Response	{ UPWARD DOWNWARD } <ul style="list-style-type: none"> • UPWARD: The Probe is at upward position. • DOWNWARD: The Probe is at downward position.

UPWARD

A command to lift the Probe up.

Type	Command
Input	UPWARD
Response	{ OK ERR40 ERR90 } <ul style="list-style-type: none"> • OK: The Probe is at upward position. • ERR40: Status error, It occurs when an invalid command is sent. For example: <ul style="list-style-type: none"> ◦ Handler OUTWARD or Probe UPWARD command is sent while the lid is closed. ◦ Probe DOWNWARD or UPWARD command is sent while the Handler is at outward position. ◦ Handler OUTWARD command is sent while the Probe is at downward position. • ERR90: The command is sent while the Probe is in Off Mode.

DOWNWARD


A command to lower the Probe down.

Type	Command
Input	DOWNWARD
Response	{ OK ERR30 ERR40 ERR90 } <ul style="list-style-type: none"> • OK: The Probe is at downward position. • ERR30: Probe-downward sensor error. It occurs only when the Probe is in Sensor Mode. (The vertical operation of fixture is incomplete.) • ERR40: Status error, It occurs when an invalid command is sent. For example: <ul style="list-style-type: none"> ◦ Handler OUTWARD or Probe UPWARD command is sent while the lid is closed. ◦ Probe DOWNWARD or UPWARD command is sent while the Handler is at outward position. ◦ Handler OUTWARD command is sent while the Probe is at downward position. • ERR90: The command is sent while the Probe is in Off Mode.

5.6.6 PASS/FAIL Commands (While The Lid is Closed)

PASS

A command that decides PASS after a test.

If the PASS command is sent, the PASS LED on the control box will glow green () , and the lid will open automatically.

Type	Command
Input	PASS
Response	{ OK ERR40 } <ul style="list-style-type: none"> • OK : turns the green PASS LED on, and the lid opens. • ERR40: Status error, The command is sent while the lid is open.

FAIL

A command that decides FAIL after a test.

The FAIL LED on the control box will glow red () , and the lid will **NOT** open.

Type	Command
Input	FAIL
Response	{ OK ERR40 } <ul style="list-style-type: none"> • OK : turns the red FAIL LED on. • ERR40: Status error. The command is sent while the lid is open.

PART 4.

Maintenance

6. Maintenance

6.1 Maintenance

TC-5915AP Pneumatic Shield Box is designed and built for long life and easy maintenance.

Optimal RF shielding is obtained by using gaskets between the body and the lid. It must be checked periodically for wear and tear which would compromise the performance. Pressure on the gasket by the lid results in a proper RF seal.

Check List for Maintenance

- Check for loose screws and tighten with proper tools, if necessary.
- Check for a loose connection. If a loose connector is found, tighten the connector with proper tools.
- Check for a damaged cable, especially near the connector-cable neck. Replace any damaged cables found.
- Visually inspect the RF seal (gasket) between the Shield Box body and lid for wear and tear.
- If there is excessive amount of dust or foreign substance on the aluminum surface (especially parts contact with gaskets), wipe it out with dry cloth.



Figure 6-1 TC-5915AP Gasket Locations

CAUTION

Do not clean this equipment with organic solvents such as benzene, toluene or acetone as they will damage the gasket parts.

6.2 Performance Test

TESCOM Shield Boxes are precision RF devices built very sturdily. Their electrical performance can, however, deteriorate with mechanical damages.

Worn out shielding gaskets, as well as metal corrosion or oxidation on the surface of lid-contacting area, can significantly reduce the effectiveness of the Shield Box. This section describes the test and calibration procedure for the Pneumatic Shield Box.

CAUTION

Performance test should be carried whenever there is a maintenance or repair work.

6.2.1 Calibration Period

- Recommended calibration period : less than 6 months

NOTICE

The calibration period can vary depending on the number of operations and the equipment management method.

6.2.2 Required Equipment

- Spectrum Analyzer : < 6 GHz
- Signal Generator : < 6 GHz
- Dipole Antenna : TESCOM 900 MHz, 1.8 GHz, 2.4 GHz, 5.8 GHz

6.2.3 Performance Test Set Up

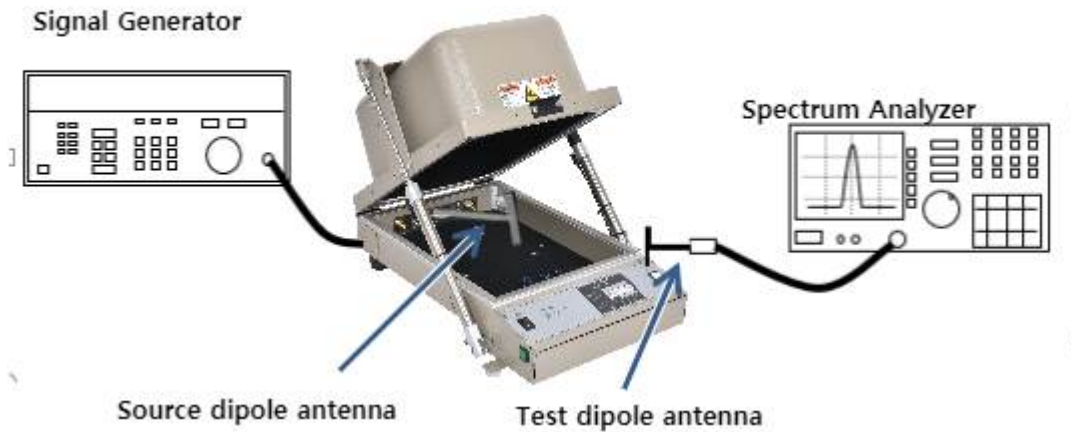


Figure 6-2 TC-5915AP Performance Test Set Up

6.2.4 Specification Standards

Frequency	Shielding effectiveness (dB)
100 to 2000 MHz	> 70 dB
2000 to 3000 MHz	> 70 dB
3000 to 6000 MHz	> 60 dB

NOTICE

The shielding effectiveness above is measured with blank panels; other I/O interface panels may result in different shielding effectiveness of the shield box. Please refer to [3.1.1 Pre-configured Panels](#) and [Table 3-3 Custom I/O Interface](#).

6.2.5 Test Procedure

NOTICE

Before measuring, check the shielding gasket around the lid. If there is a damaged part, replace the gasket and wipe the contact area, which is between the lid and the body except the gasket, with alcohol.

- 1 Turn the spectrum analyzer and signal generator on.
- 2 Using an RF cable, connect the RF Connector(N Type) on the rear side of TC-5915AP Shield Box to the RF output port(N Type) of signal generator.
- 3 Open the Shield Box lid and connect the 900 MHz Source Dipole Antenna to RF Port(SMA Type) inside the Shield Box. (Place the antenna at the center of the Shield Box.)
- 4 Set the output of signal generator to CW900 MHz, 10 dBm.
- 5 Connect the test antenna to the spectrum analyzer.



- 6 Set the spectrum analyzer as follows:
 - Center Frequency : 900 MHz
 - Span : 1 MHz
 - Amplitude: +10 dB
- 7 Circle the test antenna around the Shield Box lid, and check the maximum reception. (Make sure the lid is OPEN.)
 - Press Peak Search button on the spectrum analyzer to set the maximum value of measurement standard.

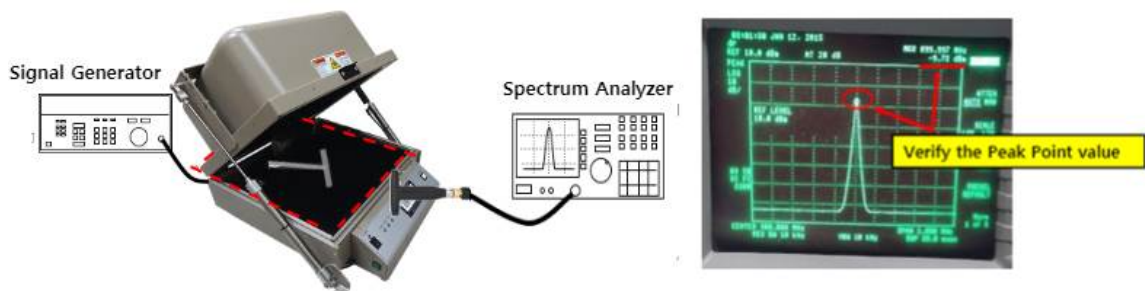


Figure 6-3 Searching for Maximum Reception

- 8 Close the lid.
- 9 Set the input range of the spectrum analyzer as follows:
 - Center Frequency : 900 MHz
 - Span : 1 MHz
 - Amplitude: -30 dB
- 10 Circle the test antenna around the entire Shield Box, particularly around the lid and modules on the rear panel. Check the maximum leakage.



Figure 6-4 Measuring Maximum Leakage (Ex, value : -90 dBm)

CAUTION

Make sure the test antenna does not contact the surface of the Shield Box or the lid.

- 11 See if the difference between the measurement standard (a) and the maximum leakage (b) is within the specification (Shielding Effectiveness) of the product.

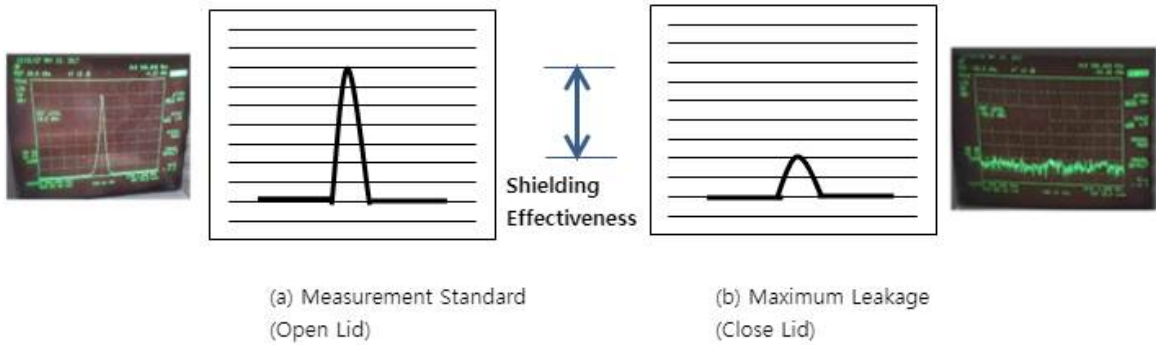


Figure 6-5 Spectrum Analyzer Display

- 12 Repeat the procedure with the frequency set to 1.8 GHz, 2.4 GHz, 5.8GHz.

7. Expendables and Accessories

Below is the list of expendables and accessories of TC-5915AP Shield Box. Please contact Tescom headquarters or your local distributor to order.

7.1 Expendables and Accessories

Below is the list of expendables and accessories. Please note that these items are NOT under warranty.

Table 7-1 List of Expendables & Accessories

No.	View	Part designation	Order number	Qty	Remarks
1		Foam Gasket Set	R5915A-80	1 Set	4 kinds, 2 pcs each. 8 pcs total.
		SS-402, N(m) to N(m) 1m	4011-0001	1 ea	
		Data, DB9(p)-DB9(s) 2M	4003-0025	1 ea	See Figure 4-2 Cable Connection



Figure 7-1 TC-5915AP Gasket Location

8. Check List for Common Problems

Below is the check list for common mistakes. Before calling for help, make sure the problem is NOT one of following issues nor a malfunction of any OTHER connected equipment.

Power Supply Check

- Verify that the power cord is connected to the product and the switch is on.
- Verify that the power supply is not short or out.
- Verify that the line voltage is within range of 100 ~ 240 VAC.

Compressed Air Check

- Check the connection of compressed air supply.
- Check the pressure. It should be within range of 5 ~ 10 bar.

Data Cable Connection Check

- If you are using PC to control the product, check the connection of RS-232C cable and the software settings.