

# RWC7100A

## RF SHIELDING ENCLOSURE

### Operation Manual



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## I. Information

### 1.1. Warranty Policy

RedwoodComm's RF Shielding Enclosure products are warranted for one year from the date of shipment under normal use. During the warranty period, if it proves to be defective in its materials or workmanship, at RedwoodComm's opinion, it will be repaired or replaced in accordance with the terms of this warranty.

The warranty covers manufacturing defects only. Consumable accessory items such as EMI foam gaskets, antenna and cables are not included.

The liability of RedwoodComm (or its appointed maintenance agent) is limited to the cost of repair and/or replacement of the product under warranty and invalidated in the following cases:

- If the defect is caused (howsoever) by misuse, neglect, tampering and/or incorrect adjustment.
- If unauthorized persons carry out any alterations and/or repairs.
- Where any ancillary equipment not furnished or recommended by RedwoodComm causes problems or damage that is attached to or used in connection with the product.
- Where any additional parts/equipment that is not authorized by RedwoodComm was added and caused problems or damage.
- If the serial number is missing on the product.

For warranty service or repair, customers must notify RedwoodComm of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service.

This warranty is valid only to the original purchaser of the product.

To obtain technical assistance or to book a service/repair for your product under warranty, please contact our customer support. Our engineers (or agent) will support you through video calls, email, phone or in-person visit.

#### Contact Information

- Address: RedwoodComm Co., Ltd.  
#14008, OfficeSection Bld, SK M-city, 195, Baengma-ro, ilsandong-gu, Goyang-si, Gyeonggi-do, Korea
- Tel: +82-70-7727-7011
- email: [support@redwoodcomm.com](mailto:support@redwoodcomm.com) or [sales@redwoodcomm.com](mailto:sales@redwoodcomm.com)
- Online: [www.redwoodcomm.com](http://www.redwoodcomm.com)

## 1.2. Key Features

The RWC7100A RF shielding enclosure offers excellent shielding effectiveness of over 100dB within a wide operating frequency range of 400MHz to 6400MHz, so that the effects of external interference are reduced to a minimum.

In all interior workspaces, absorber material is attached in order to minimize RF reflections.

Users can utilize the three I/O panels differently depending on the purpose of use, and can order a standard I/O panel (Module) or a separate customization panel.

To maintain lasting shielding effectiveness, users can order additional EMI gaskets and easily replace them when necessary.

There are many kinds of wireless standards in various industries that require a strict level of shielding effectiveness. In particular, this product is suitable for measuring radiation of various DUTs (devices under test) in development, production line and QC applications where high accuracy is required as shown below.

LTE, NB-IoT devices (700MHz, 2-6GHz)

LoRa, Sigfox devices (400MHz, 900MHz, 2.4GHz)

WiFi devices (2.4GHz, 5.8-6.2GHz)

Bluetooth devices (2.4GHz)

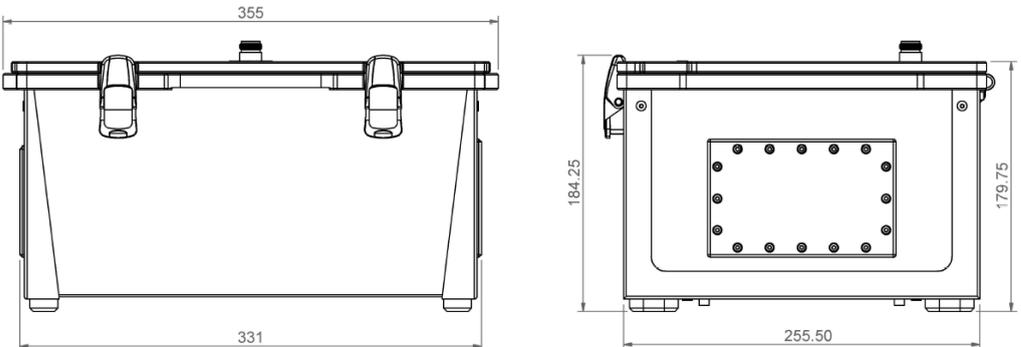
GNSS devices(1.2-1.6GHz)



### 1.3. Specifications

Shielding effectiveness	
400MHz to 6.4GHz	≥ 100 dB

- Shielding effectiveness measurements taken with blank module panels mounted.
- For shielding effectiveness measurement data for each module, please refer to the [3.1 Ordering Information](#).
- For more detail on the test method, please refer to the [2.2. Performance Test](#).
- For details on maintaining the shielding effectiveness, please refer to the [2.3. Maintenance](#).

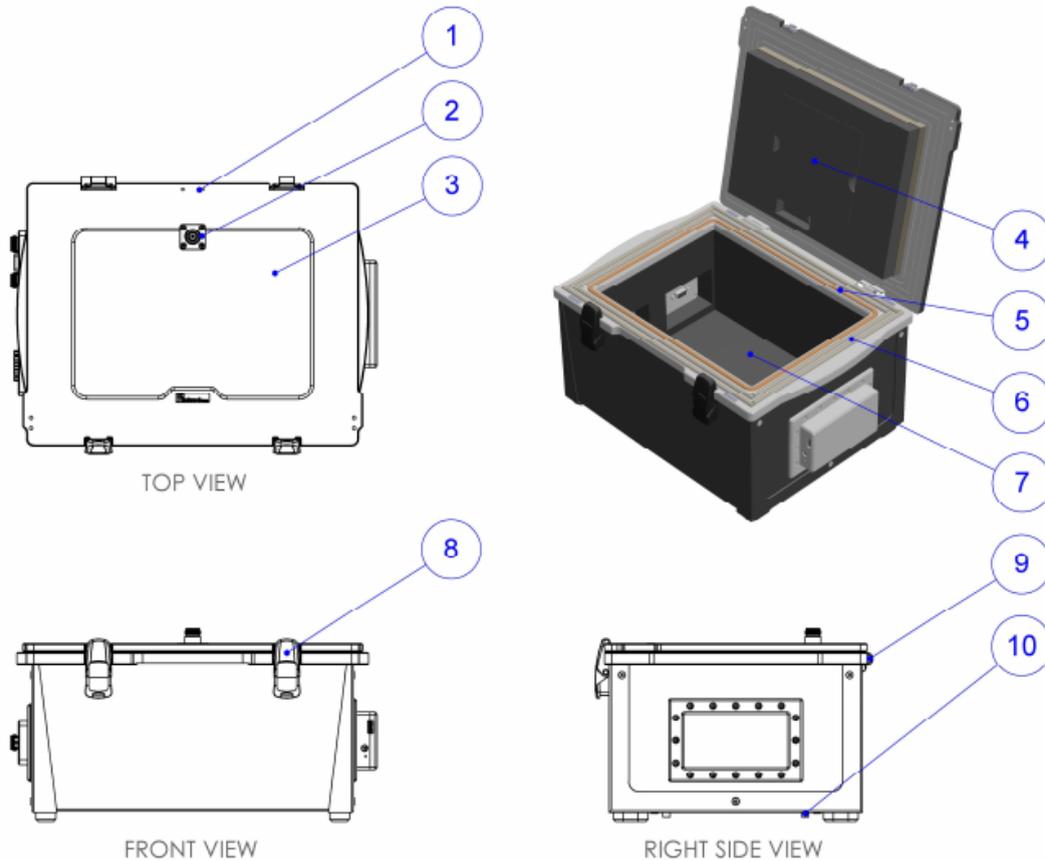
Dimensions and Weight	
	
Dimensions, W x D x H mm (inches)	
Interior (workspace)	260 x 190 x 100 (10.2" x 7.5" x 3.9")
Exterior	355 x 270 x 185 (14.0" x 10.6" x 7.3")
Weight	approx. 8.5 kg
Packing, W x D x H mm (inches)	
Double packing size	450 x 350 x 270 (17.7" x 13.8" x 10.6")
Weight	approx. 10.5 kg (Weight and size may vary depending on the package)
Accessories list	
Operating Manual Test Report For accessories according to other modules, please refer to the <a href="#">3.1 Ordering Information</a> .	

Environmental conditions	
Temperature range	operating temperature range +20 °C to +30 °C
	storage temperature range -10 °C to +50 °C
Damp heat	75 % relative humidity, non condensing at +10 °C to +30°C

- Refrain from using this equipment in a place subject to much vibration, direct sunlight, outdoor and where the ground is not flat.
- If this product is not used for a long time, store it in a dry place away from direct sunlight, covered with vinyl or placed in a cardboard box.
- If this product is left with the lid closed for a long time, the performance of the shield gasket may deteriorate. Before using it again, be sure to open the lid and keep it open for at least one day, then check the shielding effectiveness.

## II. Operation

### 2.1. Identification of RWC7100A



[Figure 2-1] Component Identification of RWC7100A

- |                          |   |
|--------------------------|---|
| ① 2 x M3 Hole (DP 5mm)   | : M3 screw holes for cable fixing                             |
| ② N type Antenna Port    | : Additional RF port for RWC8201A antenna                     |
| ③ Door (Lid)             | : Manual method to open/close the door from the top           |
| ④ 4 x M3 Hole (DP 8mm)   | : Mounting position for RWC8201A only                         |
| ⑤ EMI Mesh Gasket        | : This detachable part is for obtaining optimal RF shielding. |
| ⑥ 2set x EMI Foam Gasket | : This detachable part is for obtaining optimal RF shielding. |
| ⑦ Absorber               | : Absorbers are attached to minimize RF reflections.          |
| ⑧ Latch                  | : Door latch handle   |
| ⑨ Hinge                  | : Door Hinge  |
| ⑩ 4 x M4 Hole (DP5mm)    | : M4 screw holes for the enclosure fixing.                    |

## 2.2. Performance Test

This product is a precision RF Shielding Enclosure manufactured to be robust. Please refer to the test procedure for shielding effectiveness below to ensure optimal performance at all times. This product may need calibration depending on the number of uses and period of use. Please refer to the Maintenance section for more details. This product may require maintenance depending on the number of the lid's opening and closing and the period of use. Please refer to the maintenance section for more details.

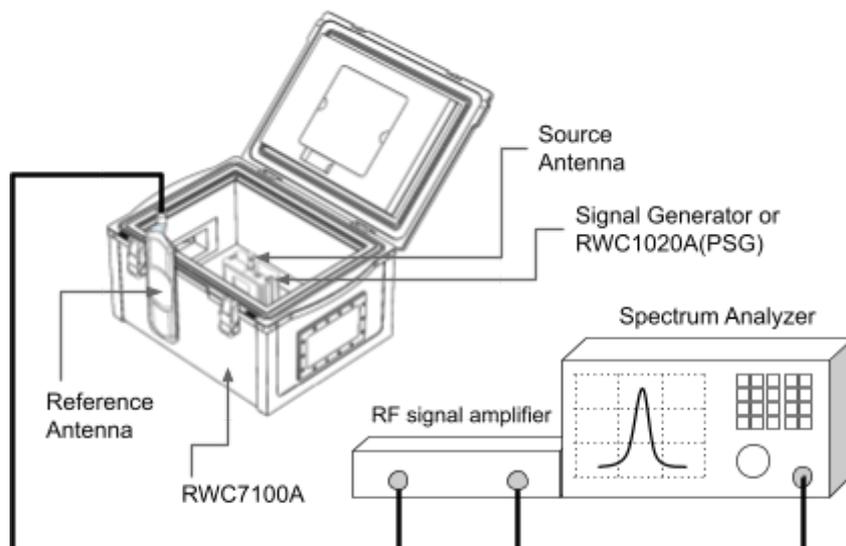
### 2.2.1 How to Set up the Equipment Required for RF Shielding Effectiveness Test

The following devices are required to check the shielding effectiveness.

- Signal generator : capable of generating 400M-6400MHz tone signal
- Signal generator side antenna : omni-directional one
- Signal power meter : A spectrum analyzer or equivalent device that can measure the tone power of a signal source
- Signal receiving side antenna(Reference) : A broadband antenna with high gain characteristics that can receive even weak signals well
- RF signal amplifier : capable of sufficiently amplifying weak RF signals, if necessary

When measuring the shielding effectiveness of RWC7100A, it is recommended to install a signal generator with a built-in battery inside RWC7100A, and perform the measurement outside of RWC7100A. If a signal is generated from the outside and input through a cable, it is not guaranteed that the test results would be accurate.

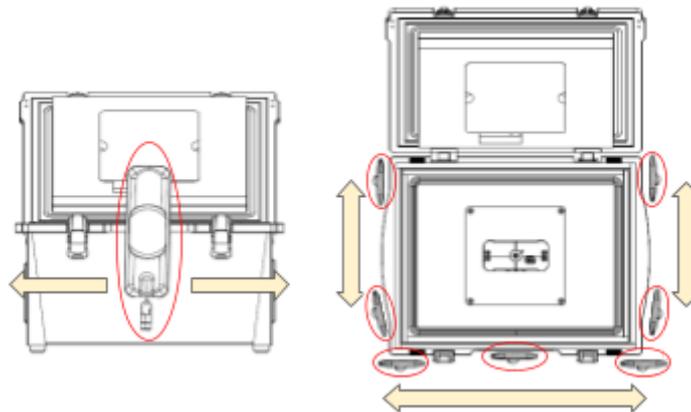
Refer to Figure 2-2 for cable connections for testing.



[Figure 2-2] Test Setup with RWC7100A

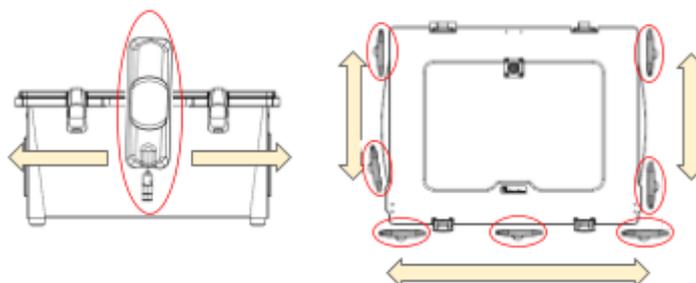
## 2.2.2 Test Procedure

- 1) Set up the source antenna with RWC1020A inside the RWC7100A to be located in the center.
- 2) Connect the spectrum analyzer and reference antenna with RF cable. (If necessary, use an adequate RF amplifier together.)
- 3) Set up the spectrum analyzer as follows:
  - Center Frequency: 400.1MHz (Change to 900.1MHz, 2400.1MHz, 5800.1MHz, respectively)
  - Span: 500Hz
  - Resolution BW: 4.7Hz (or Auto)
  - Reference Level: 0dBm
  - Scale 20 dB/div
- 4) Set up the signal generator or RWC1020A as follows:
  - Frequency : 400.1MHz
  - Power : +10dBm
- 5) Open the RWC7100A door and measure the power (Pref) moving the reference antenna to several points as shown in Figure 2-3.



[Figure 2-3] Check the reference power level (Door Opened)

- 6) Close the RWC7100A door and measure the output power(Pmes) moving the reference antenna at the same positions in step 5)

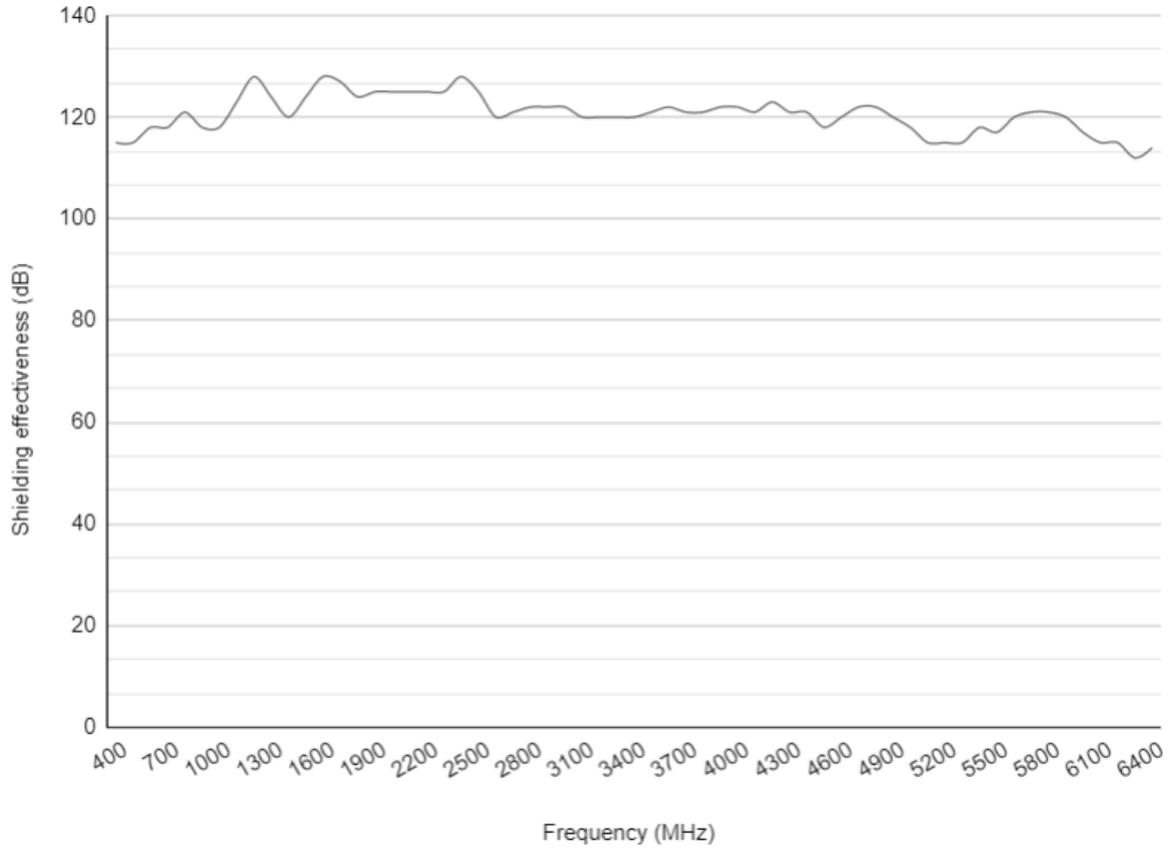


[Figure 2-4] Check the measure power level (Door Closed)

- 7) Calculate the Shielding Effectiveness  $Pse[dB] = Pmes[dBm] - Pref[dBm]$ .
- 8) Change the signal generator to the next frequency and repeat the measurement process, step 3) to 7)

### 2.2.3 An Example Test Result of RF Shielding Effectiveness

The product conformity test was measured using a method modified from the IEEE-STD-299.1 standard.



[Figure 2-5] Shielding effectiveness of RWC7100A

## 2.3. Maintenance

This product is a precision RF Shielding Enclosure manufactured to be sturdy and robust. In order to ensure the optimal performance of the product, periodic inspection is required according to the number of uses and period of use.

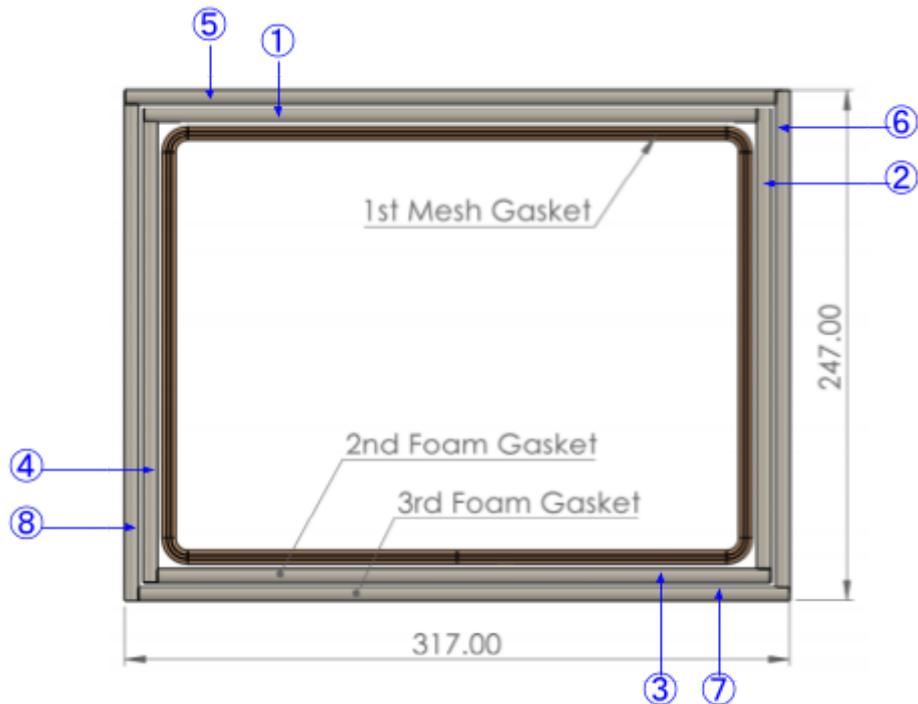
### 2.3.1 Recommended Routine Maintenance and Method

- \* Check to ensure that the Module, Hinge, and Latch screws are not loose and tighten if necessary.
- \* Check to ensure that the torque of the hinge mounted on the door has not weakened. The hinge has passed the 30,000 open-close private cycle test, but the torque may weaken as the number of openings and closings increases. However, weakening of hinge torque does not affect the shielding effectiveness.  
If the torque is weak, the lid could shut abruptly at a certain point, so please be careful as it may be hazardous. If necessary, please contact customer support or an agent for replacement. It can be replaced by the customer, but special attention and consultation are required as it may affect the shielding effectiveness.
- \* Check for damaged cable harnesses and replace them if necessary.
- \* Shielding performance may be greatly reduced if metal corrosion or oxidation progresses on the surface that the gasket touches on the door or on the gasket frame. Clean thoroughly with alcohol and a soft cloth. It must be kept clean at all times.
- \* Typically, the shielding effectiveness performance of new products has passed 10,000 open-closed private cycle tests. However, it is recommended to replace the gasket if the shielding performance does not improve even after regular maintenance has been performed.
- \* To maintain the shielding effect, refer to the performance test on page 7 [2.2. Performance Test](#). It is recommended to perform a test approximately every 5,000 times or at intervals of 6 months.

### 2.3.2 Recommended EMI Gasket replacement Period

- \* Generally, after opening and closing the door about 30,000 times, the gasket's contact surface may be damaged. In this case, perform routine maintenance first, and if it does not improve, replace the gasket.
- \* Generally, long-term storage of the product with the door closed may affect the elasticity of the foam gasket to decrease even if it is used less than the recommended number of lid openings and closings.  
In this case, perform routine maintenance first and keep the door open for more than one day, and then perform the performance test. If there is no improvement, replace the gasket.

### 2.3.3 How to Replace EMI Gasket

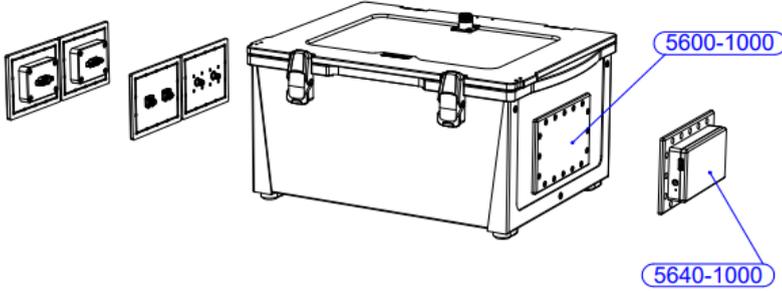
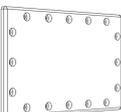
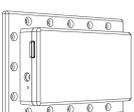


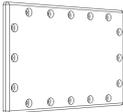
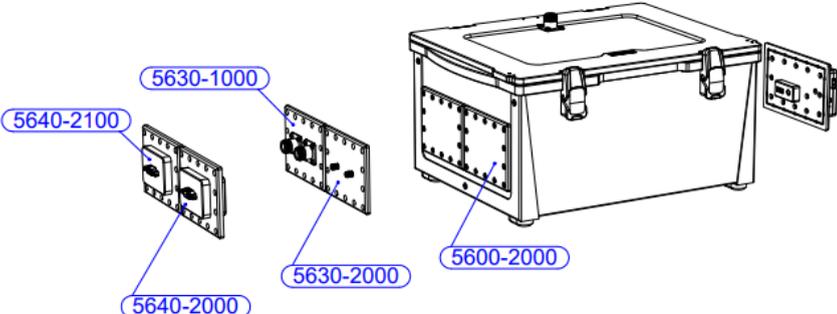
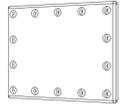
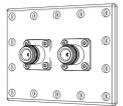
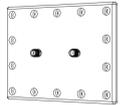
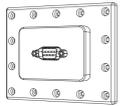
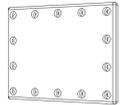
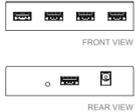
[Figure 2-6] EMI Gasket replacement sequential number and part name

- 1) Order the O7100A-91 option for maintenance.
- 2) Remove all EMI gaskets already installed. (1st Mesh gasket, 2nd Foam gasket, 3rd Foam gasket)
- 3) Wipe the foreign substances on the surface that the gasket touches on the door or inside the gasket frame thoroughly with alcohol and a soft cloth.
- 4) In the case of the 1st Mesh Gasket, place the seam in the center and insert it slowly with an even density.
- 5) In the case of the 2nd and 3rd Foam Gasket, refer to the picture above, remove the tape on the back of the gasket and insert it into the gasket frame in the order of ① to ⑧
- 6) Visually inspect for excess RF gasket between the top door and gasket frame.
- 7) Check the shielding effectiveness by referring to the performance test method. Refer to page 9 for the Performance Tests. If it is not normal even after replacement, please contact customer support.

### III. IO Modules

#### 3.1. Ordering Information

Item	Descriptions	Order code
	<p><b>RWC7100A RF Shielding Enclosure</b></p> <ul style="list-style-type: none"> <li>• Manual method to open/close the door from the top</li> <li>• Select three IO modules based on user usage</li> </ul>	C7100A-00
	<p><b>EMI Shielding Gasket Set for maintenance</b></p> <ul style="list-style-type: none"> <li>• 1 x Mesh Gasket is included</li> <li>• 2 x Foam Gaskets are included</li> <li>• Installation guide sheet included</li> </ul>	O7100A-91
	<p><b>O7100A-92:</b> Wide-band Right Hand Circular Polarized (RHCP) Antenna Set  <b>O7100A-93:</b> Wide-band Left Hand Circular Polarized (LHCP) Antenna Set</p> <ul style="list-style-type: none"> <li>• RWC8201A mounted on the lid of RWC7100A</li> <li>• Antenna Dimensions (W x D x H mm): 130 x 130 x 15</li> <li>• Frequency Range: 700MHz to 8.5GHz</li> <li>• N(F) to SMA(F) Adaptor and RF cables installed</li> </ul>	O7100A-92 O7100A-93
 <p>[Figure 3-1] Type A, IO Module mounted on the right side</p>		
	<p><b>Blank Module, Type A</b></p> <ul style="list-style-type: none"> <li>• Outside dimensions (W x D mm): 135 x 85</li> </ul>	5600-1000
	<p><b>USB 3.0 Fiber Interface Module, Type A</b></p> <ul style="list-style-type: none"> <li>• Outside dimensions (W x D x H mm): 135 x 85 x 26</li> <li>• IO Port: 1 x USB3.0 only (not backward compatible)</li> <li>• IO Port: 1 x DC IN (V In: DC 5V to DC 17V)</li> <li>• IO Port: 1 x DC Out(V Out=VIn), USB3.0 Out(USB Vout:5V3A)</li> <li>• One 1 x DC 12V 3A Adapter included</li> <li>• One USB 3.0 compatible cable included</li> </ul>	5640-1000

	<p><b>Customization Panel, Type A</b></p> <ul style="list-style-type: none"> <li>• Outside dimensions (W x D mm): 135 x 85</li> <li>• Additional customization panel to the use cases</li> </ul>	5690-Axxx
<div style="text-align: center;">  <p>[Figure 3-2] Type B, IO Module mounted on the left side</p> </div>		
	<p><b>Blank Module, Type B</b></p> <ul style="list-style-type: none"> <li>• Outside dimensions (W x D mm): 102 x 80</li> </ul>	5600-2000
	<p><b>RF N Type Module, Type B</b></p> <ul style="list-style-type: none"> <li>• Outside dimensions (W x D x H mm): 102 x 80 x 22</li> <li>• Connector: 2 x N(F) outside to SMA(F) inside</li> <li>• Unused RF ports must be covered with caps, and please use shielded cables to ensure shielding effectiveness.</li> </ul>	5630-1000
	<p><b>RF SMA Module, Type B</b></p> <ul style="list-style-type: none"> <li>• Outside dimensions (W x D x H mm): 102 x 80 x 13</li> <li>• Connector: 2 x SMA(F) outside to SMA(F) inside</li> <li>• Unused RF ports must be covered with caps, and please use shielded cables to ensure shielding effectiveness</li> </ul>	5630-2000
	<p><b>D-Sub 9Pin Module, Type B</b></p> <ul style="list-style-type: none"> <li>• Outside dimensions (W x D x H mm): 102 x 80 x 24</li> <li>• DB 9P(M) outside to DB 9S(F) inside 5,000pF Pi Filter</li> <li>• Unused ports must be covered with a cap, and please use shielded cables to ensure shielding effectiveness</li> </ul>	5640-2000
	<p><b>Customization Panel, Type B</b></p> <ul style="list-style-type: none"> <li>• Outside dimensions (W x D mm): 102 x 80</li> <li>• Additional customization panel to the use cases</li> </ul>	5690-Bxxx
Other accessories		
	<p><b>IO USB 3.0 to 2.0/3.0 HUB</b></p> <ul style="list-style-type: none"> <li>• Dimensions (W x D x H mm): 94 x 63 x 22</li> <li>• IO Port: 1 x USB 3.0 to 1 x USB 2.0 and 3 x USB 3.0</li> <li>• IO Port: 1 x DC IN (12V to 24V)</li> <li>• 1 x DC Plug to DC Plug cable included</li> <li>• 1 x USB A(M) to USB A(M) cable included</li> <li>• This hub can be used inside the enclosure with the 5640-1000, and both USB 3.0 and USB 2.0 are available</li> </ul>	5640-1100

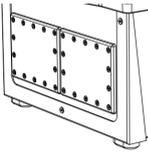
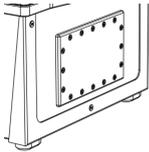
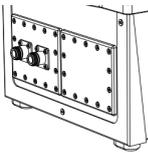
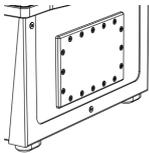
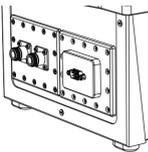
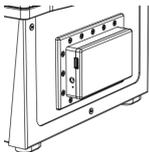
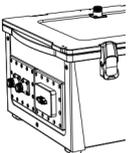
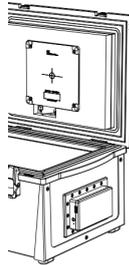
\* When ordering, please refer to the Figure3-1, 3-2 below and select C7100A-0x with IO Modules.

\* All IO modules are shipped after installation in the enclosure.

\* Afterwards, if the customer wants to mount the new modules ordered separately, remove the already installed module from the enclosure first, and check for foreign substances on the surface that the IO Module touches and wipe clean with a soft cloth using alcohol. Then, complete the installation by tightening the included hexagon bolts. (Please perform the [2.2. Performance Test](#) after installation.)

### 3.2. Example of ordering

This is an example of how customers order the RWC7100A with IO Modules. For more information, please contact our sales or distributor before placing an order.

Use case	Module Type		Order code
	Type B (Left side)	Type A (Right side)	
Blank Modules			<ul style="list-style-type: none"> <li>● C7100A-0x</li> <li>● 5600-1000</li> <li>● 2 x 5600-2000</li> </ul>
RF Modules			<ul style="list-style-type: none"> <li>● C7100A-0x</li> <li>● 5600-1000</li> <li>● 5600-2000</li> <li>● 5630-1000 or 5630-2000</li> </ul>
RF, D-Sub and USB Interface			<ul style="list-style-type: none"> <li>● C7100A-0x</li> <li>● 5630-1000 or 5630-2000</li> <li>● 5640-1000</li> <li>● 5640-1100 (Select if necessary)</li> <li>● 5640-2000</li> </ul>
RF, D-Sub, USB and Wide-band Circular Antenna			<ul style="list-style-type: none"> <li>● C7100A-0x</li> <li>● 5630-1000 or 5630-2000</li> <li>● 5640-1000</li> <li>● 5640-1100 (Select if necessary)</li> <li>● 5640-2000</li> <li>● O7100A-92 or O7100A-93</li> </ul>

## Appendix

### A.1. Performance of RWC8201A for LoRaWAN bands

#### General Description

The recommended operating frequency of the RWC8201A antenna is 700MHz to 8500MHz. When measuring LoRaWAN devices in RWC7100A Shield Enclosure equipped with RWC8201A antenna as an option, it is necessary to measure even in the 400MHz band. Therefore, in this application note, the transfer function of the RWC8201A antenna is measured not only in the 400 MHz band but also in the 900 MHz band. Especially, transfer function between antennas in the 400-510 MHz and 860-960 MHz bands are dealt with in detail.

#### Antenna Transfer function

Considering the RWC8201A antenna as a LoRa DUT, place two RWC8201A antennas 7cm apart inside RWC7100A as shown in Fig.A.1 and measure the transfer function (S21) using Network Analyzer. Through the S21 data, the flatness and path loss in the band can be confirmed.

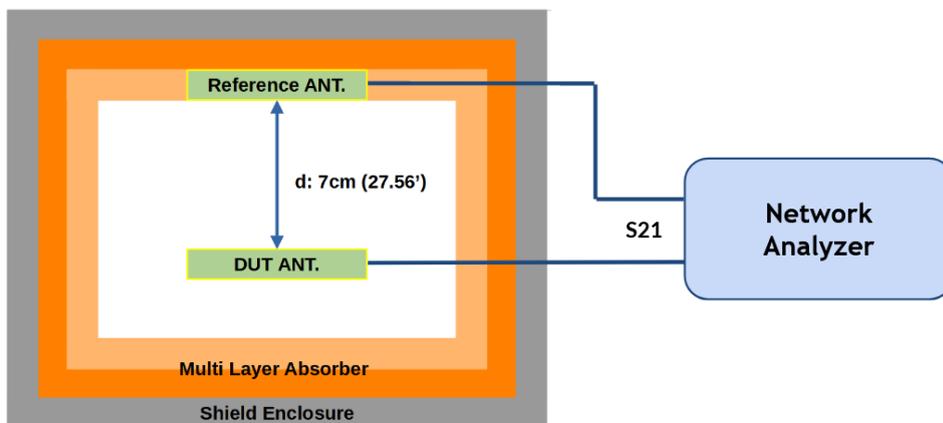


Fig.A.1 Test Condition

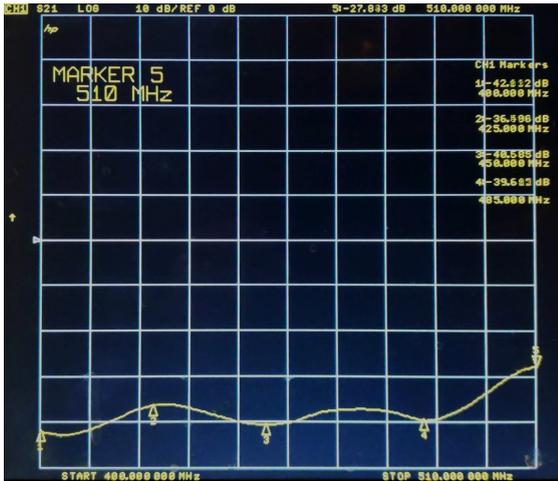


Fig. A.2 Path Loss (400~510MHz)

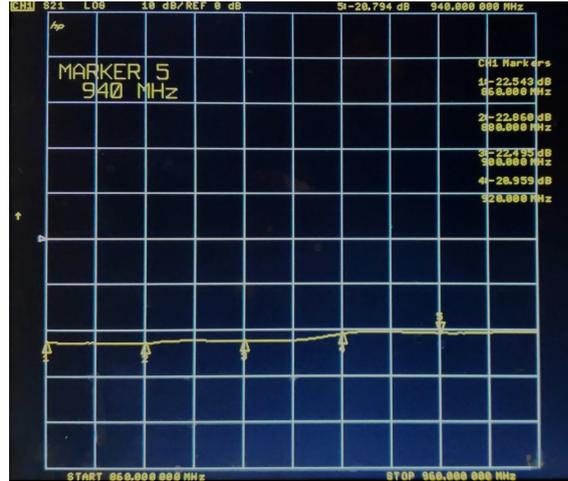


Fig. A.3 Path Loss (860~960MHz)

Table.A.1 Path Loss at each marker

<b>Frequency</b>	<b>400MHz</b>	<b>425 MHz</b>	<b>450 MHz</b>	<b>485 MHz</b>	<b>510 MHz</b>
Path Loss	-42.8 dB	-36.5 dB	-40.5 dB	-39.6 dB	-27.8 dB
<b>Frequency</b>	<b>860 MHz</b>	<b>880 MHz</b>	<b>900 MHz</b>	<b>920 MHz</b>	<b>940 MHz</b>
Path Loss	-22.5 dB	-22.8 dB	-22.4 dB	-20.9 dB	-20.7 dB

- In the 400MHz band, the path loss between RWC8201A antennas is about 40dB, and starting decreasing from 490MHz, it becomes -27dB at 510MHz.
- In the 900MHz band, which is within the recommended frequency range of RWC8201A antenna, the path loss is about -21dB and has a flatness of  $\pm 1$ dB within the band.
- Although the result shows that the loss is larger and the flatness is larger in the 400MHz band than in the 900MHz band, the RWC8201A antenna seems to be good enough to be used in the LoRa Test at the 400MHz band in RWC7100A.

## A.2. DB9 Module Pin map

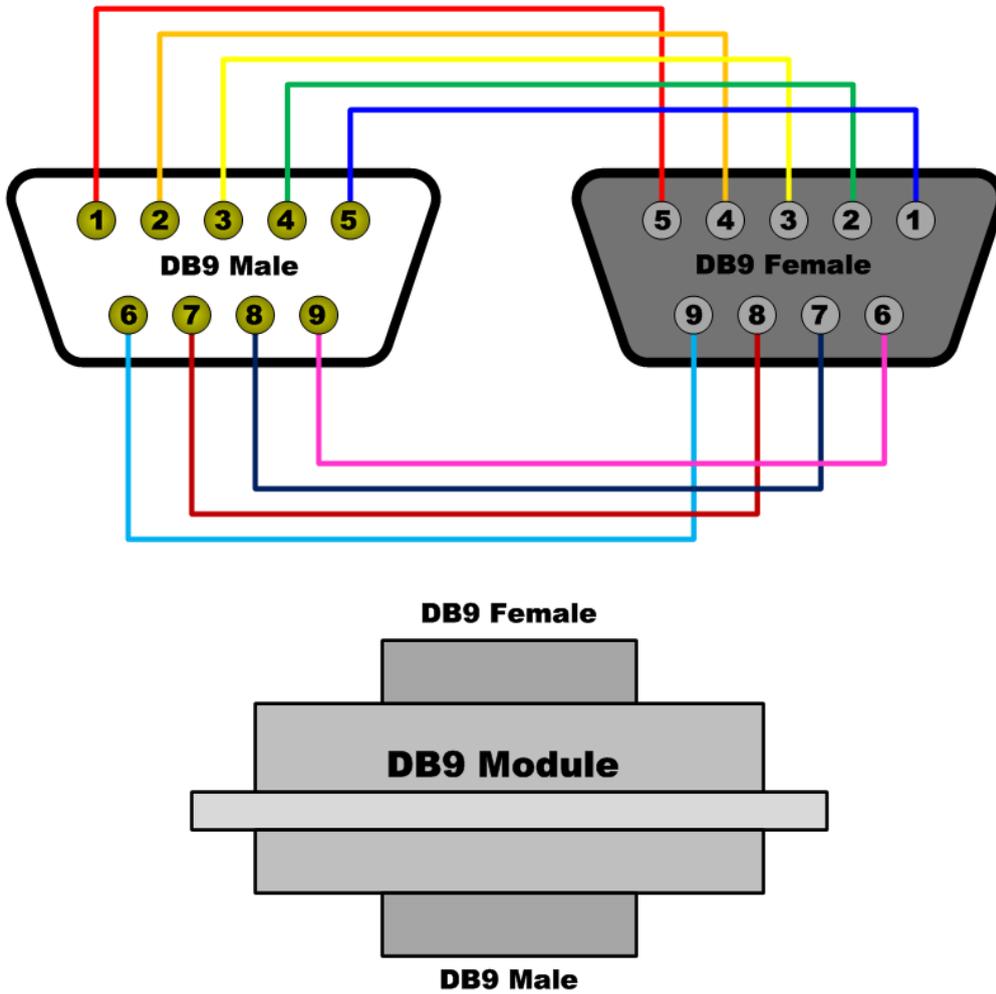


Fig.A.4 DB9 Module Pin Map.