FreeMile 5.8 GHz MIMO TDD
Quick Installation Guide
# Table of Contents

## 1 Introduction
1.1 List of Abbreviations ................................................................. 3  
1.2 Safety Precautions ..................................................................... 4  
1.2.1 Electrical Safety ................................................................. 4  
1.2.2 Microwave Radiation ........................................................... 4  

## 2 Getting Started
2.1.1 Unpacking and Inventory ..................................................... 5  
2.1.2 Contents of Transportation Package for SAF FreeMile 5.8GHZ MIMO link ......................................................... 5  
2.1.3 Package Weight and Dimensions .......................................... 5  
2.1 Required Installation Tools ....................................................... 6  
2.1.1 SAF FreeMile 5.8GHz MIMO Installation Tools .................. 6  
2.1.2 Antenna Installation Tools ................................................... 6  
2.2 Labels ....................................................................................... 6  
2.2.1 SAF FreeMile 5.8GHz MIMO Label ..................................... 6  

## 3 Installing SAF FreeMile 5.8GHz MIMO radio link
3.1. Initial equipment setup at the customer’s premises ................... 7  
3.2. Initial configuration ................................................................. 7  
3.2.1. Initial configuration from Web GUI .................................. 8  
3.3. Attaching SAF FreeMile 5.8GHz MIMO to Mast .................... 9  
3.4. Assembling SAF FreeMile 5.8GHz MIMO Ethernet cable connector ................................................................. 10  
3.5. Antenna Alignment ................................................................. 11  
3.5.1. Calculating Expected Received Signal Level (RSL) .......... 11  
3.5.2. Alignment Procedure ....................................................... 11  

# References

---

SAM FreeMile 5.8GHz MIMO Quick Installation Guide • Rev. 1.0 • Software version 6.77  
© SAF Tehnika JSC 2011
Proprietary notice
The information presented in this guide is the property of SAF Tehnika, JSC. No part of this document may be reproduced or transmitted without proper permission from SAF Tehnika, JSC.
The specifications or information contained in this document are subject to change without notice due to continuing introduction of design improvements. If there is any conflict between this document and compliance statements, the latter will supersede this document.
SAF Tehnika, JSC has no liability for typing errors in this document or damages of any kind that result from the use of this document.

To get up to date information about accessories and their availability, please contact sales representative.

Note: FODU/ODU does not contain serviceable parts. Warranty will not be applicable in the event FODU/ODU has been hermetically unsealed.

Note: SAF Tehnika, JSC is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user’s authority to operate the equipment.

Copyright Notice
Copyright © 2012 SAF Tehnika, JSC. All rights reserved.

1 Introduction
This manual describes the installation procedure of SAF FreeMile 5.8GHz MIMO microwave radio link consisting of Full Outdoor Units (FODUs) with integrated antennas.

1.1 List of Abbreviations
128QAM – 128-Quadrature Amplitude Modulation
16APSK – 16-Amplitude and Phase Shift Keying
32APSK – 32-Amplitude and Phase Shift Keying
64QAM – 64-Quadrature Amplitude Modulation
AC – Alternating Current
ASCII - American Standard Code for Information Interchange
BNC connector - Bayonet Neill-Concelman coaxial connector
DC – Direct Current
FODU – Full Outdoor Unit
FTP – File Transfer Protocol
GUI – Graphical User Interface
IEEE - Institute of Electrical and Electronics Engineers
QPSK - Quadrature Phase-Shift Keying
RSL – Received Signal Level
RSSI – Received Signal Strength Indicator
Rx - Receive
SNMP - Simple Network Management Protocol
Tx – Transmission
1.2 Safety Precautions

- Installation and service must be done by personnel having appropriate technical training and experience necessary to be aware of hazards during installation and/or service. The installation and/or service must be done under measures to minimize any danger to the involved person or any other person.
- Use the necessary safety devices when working on or around the mast. Be aware of the risk of falling objects. Consider the safety catch when hoisting the antenna and radio.
- Do not use any components (screws, nuts, etc.) other than those delivered together with the SAF Tehnika JSC microwave radio equipment or recommended by SAF Tehnika JSC.

1.2.1 Electrical Safety

- The equipment meets the requirements for class I EN 60950 (protection against electric shock).
- All external circuits are TNV-1 (as defined in EN 60950).
- All equipment must be grounded before the power cable is connected.
- For electrical safety the DC power supply shall have reinforced insulation to the mains supply.

1.2.2 Microwave Radiation

- The transmitter should be switched off before disassembling the equipment to avoid microwave radiation.

No dangerous levels of microwave radiation exist outside the antenna while in operation when the antenna is connected to the radio, yet any part of the body shall not be exposed to the radiation in front of the open radio waveguide output closer than 20 cm while radio transmitter is turned on.

---

**Figure 1. Microwave radiation**
2 Getting Started

2.1.1 Unpacking and Inventory

There are two types of packages, - the box for transportation and the commercial package. SAF FreeMile 5.8GHZ MIMOs are packed in commercial packages whereas commercial boxes are packed in transportation boxes.

Transportation package for two SAF FreeMile 5.8GHZ MIMOs contains two trading packages for SAF FreeMile 5.8GHZ MIMO.

\[\text{Figure 2. FreeMile 5.8GHz MIMO with integrated antenna}\]

2.1.2 Contents of Transportation Package for SAF FreeMile 5.8GHZ MIMO link

- SAF FreeMile Full Outdoor Unit with integrated 23dBi antenna, 2 pcs.
- Sealing for RJ45 connectors, 1 pcs.;
- Documentation and software DVD (optional);
- RJ-45 connectors for SAF FreeMile, 2 pcs. (upon order);
- Grounding screw, 2 pcs.;
- Installation instruction, 1 pcs.

2.1.3 Package Weight and Dimensions

The following table lists all the included packages and their weight and dimensions.

<table>
<thead>
<tr>
<th>Package type</th>
<th>Weight of empty package [g]</th>
<th>Dimensions [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial package for SAF FreeMile 5.8GHZ MIMO</td>
<td>486</td>
<td>532x365x75</td>
</tr>
<tr>
<td>Transporting package for SAF FreeMile 5.8GHZ MIMO</td>
<td>700</td>
<td>562x385x283</td>
</tr>
</tbody>
</table>
2.1 Required Installation Tools

2.1.1 SAF FreeMile 5.8GHz MIMO Installation Tools

- Power supply unit, injector and Ethernet cable (Cat.5e);
- Necessary tools for assembling the cables and connectors – RJ45 crimping tool.

2.1.2 Antenna Installation Tools

- Mounting bracket and necessary wrench (10mm), nuts, screws and clamps;
- Grounding cable;
- Binoculars and compass for clear sight installation.

2.2 Labels

2.2.1 SAF FreeMile 5.8GHZ MIMO Label

The label can be found on the front side of the unit.

The label contains the following information (see the sample in the picture below):

- Model name (“FreeMile xx”), where xx stands for frequency band:
- SAF FreeMile 5.8 for FreeMile 5.8GHZ MIMO
- Product Number (Z05FEE01); identifies the product type
- Unit Serial Number (363710100001); the serial number uniquely identifies SAF FreeMile 5.8GHZ MIMO unit

![Figure 3. Label of FreeMile 5.8GHz MIMO with integrated antenna](image-url)
3 Installing SAF FreeMile 5.8GHZ MIMO radio link

The installation of SAF FreeMile 5.8GHZ MIMO link involves the following steps:

3.1. Initial equipment setup at the customer’s premises

- Unpack all equipment;
- Visually investigate the equipment;
- Prepare necessary cables and tools;

3.2. Initial configuration

In order to perform initial configuration you will need a laptop with LAN card, 2 Category 5e Ethernet cables and a Power over Ethernet injector.

- Your connected laptop should be in the same subnet with manageable SAF FreeMile, so you can “see” them; that is why, the laptop Ethernet port settings should be set as follows: (in 'Microsoft Windows' go to Control panel → Network Connections → Local Area Connection → Properties → Internet Protocol (TCP/IP) → Properties):
  - IP address 192.168.2.1;
  - Net mask 255.255.255.0;
  - everything else is blank.

- You must have PoE (Power over Ethernet) injector with 48V DC power supply to connect the laptop to the SAF FreeMile FODU. Power over Ethernet injector can be purchased from SAF Tehnika JSC as optional accessory.

Note that “−” polarity of SAF FreeMile 5.8 power supply should be grounded or neither of both polarities grounded. Use of a power supply with an inappropriate ground reference may cause damage to SAF FreeMile 5.8 and/or the power supply.

- Connect to SAF FreeMile 5.8GHz MIMO by entering IP address in the browser address line - by default the IP address is 192.168.2.66

(I) Default username for Web access is admin and the password is admin01.
3.2.1. Initial configuration from Web GUI

Initial configuration in Web GUI should be done individually for each SAF FreeMile 5.8GHz MIMO before unit installation on a mast. For initial configuration use the section Configuration → Radio:

**STEP 1**
Specify the operation mode: Master or Slave. The difference in configuration of Master and Slave is that the frequency does not need to be specified for the Slave. The Slave scans the air and chooses the frequency automatically after finding the Master.

**STEP 2**
Specify a Link ID. Link ID must be identical for each unit of the same link.

**STEP 3**
Choose the Country in which the FreeMile 5.8GHz MIMO link will operate. The unit will automatically adjust Radio settings to meet country/region specific regulations.

**STEP 4**
Set Channel width and Frequency at which the link will operate on Master unit. Change Frequency applies only for Master unit. The Slave unit will choose the frequency automatically after the Master unit will be found.

**STEP 5**
Set link encryption for secure data transfer between the units. The security settings (encryption and passphrase) must be the same on each side of the link otherwise the link will not establish.

**STEP 6**
Reduce Transmit Power before testing the units placed on a table. The units placed in short distance with high transmit power may not work or even damage the peer’s radio’s receiver.

**STEP 7**
Change web management login password. This is strongly recommended for security reasons. Go to Configuration → System and change the password.

**STEP 8**
Apply and save all the performed changes. Configure the second unit of the link in the same way and verify if configured units established a Link testing on a table. Note that units should have different IP addresses.
3.3. Attaching SAF FreeMile 5.8GHz MIMO to Mast

**Figure 4. Attaching SAF FreeMile 5.8GHz MIMO with integrated antenna to the mast**

**Fig. 4(1).** Prepare the mounting bracket and necessary tools: wrench (10mm), nuts, screws and clamps as shown in the figure.

**Fig. 4(2).** Adjust the mounting bracket to the pole as shown in the figure. The smallest part of the mounting bracket should not be attached in this stage.

![Image 1](image1.jpg) ![Image 2](image2.jpg)

**Note** that the mounting bracket supports pole diameter in the range 32-130mm.

**Fig. 4(3).** Attach the FreeMile 5.8GHz MIMO unit with integrated antenna to the mounting bracket. The grounding cable should also be attached at this stage. The smallest part of the bracket should be attached at this moment from the back side of the mounting bracket.

**Fig. 4(4).** The antenna can be aligned by loosening the screws marked in red circles (elevation direction) and in blue circles (azimuth direction). After the signal values during the alignment have peaked secure the screws using 10mm wrench.
3.4. Assembling SAF FreeMile 5.8GHZ MIMO Ethernet cable connector

Figure 5. Assembling Ethernet weatherproof connector

Fig. 5(1). Put rubber sealing inside the connector as shown. Fastening screw should be placed on the front part of connector.

Fig. 5(2). Put connector parts on the cable.

Fig. 5(3). Stick the rubber gasket on the connector.

Fig. 5(4). Plug RJ45 connector into the Ethernet socket.

Fig. 5(5). Fix the connector to the socket with screw.

Note that cable sealing screw is still not fixed at this moment.

Fig. 5(6). Push the RJ45 connector into the socket by pushing the cable and at the same time seal and fix the cable using cable sealing screw.

Fig. 5(7). Assembled cable. Fix the cable to the mast as close as possible to FreeMile unit. Do not bend it! The radius of bending should not be less than 10cm.

Fig. 5(8). Example of correct positioning of RJ45 connector during weatherproof connector assembly.

Fig. 5(9). Example of incorrect position of connector – improper alignment.

Note, that it is too deep in the connector.
3.5. **Antenna Alignment**

3.5.1. Calculating Expected Received Signal Level (RSL)

The expected RSL (receive signal level) can be estimated using “path calculator” provided by SAF Tehnika JSC.

3.5.2. Alignment Procedure

The antenna alignment procedure can be made easier by placing one person at each antenna location during alignment process. However, alignment should be performed on one antenna at a time, each person alternatively turns antenna until the RSL is optimized.

The following steps are required to properly align the antennas:

1. Start at one end of the link; Run the Antenna Alignment tool on the selected interface:

   ![Antenna Alignment Tool](image)

   The antenna alignment test measures signal quality between the Master and Slave units. For best results during the antenna alignment test, turn off all wireless networking devices within range of the device except the device(s) with which you are trying to align the antenna. Watch the constantly updated display in the antenna alignment test window as you adjust the antenna.

2. Loosen the antenna hardware that is used for securing the antenna movement in the azimuth directions.
3. Roughly aim the antenna directing the main lobe of the far-end antenna.
4. Slowly sweep the antenna while observing the readings of RSSI. The higher is the RSSI, the higher is the RSL.
5. Secure the azimuth adjustment hardware once main lobe is found and the highest signal level is achieved.
6. Loosen the antenna hardware that is used for securing the antenna movement in the elevation direction. Slowly sweep the antenna while observing the RSSI reading. Once the signal is peaked, the elevation adjustment hardware can be secured.
7. Perform steps 1 through 6 on the opposite end of the link until the signal level is peaked for both azimuth and elevation.

After the “RSSI” values have been peaked on both ends of the link, observe the RSL indicated in Web management window. Ensure that the RSL is within +/- 2dB of calculated RSL.
References

All the documents comprised in this chapter can be ordered from SAF Tehnika JSC or its sales representatives.

• Technical Descriptions
  Available technical descriptions:
  The SAF FreeMile Series Full Outdoor Unit Technical Description and Configuration Guide - a generic technical description of the SAF FreeMile series products, it comprises the installation and commissioning issues and accessories, functional description, technical data, a.o.