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Installation

This section describes how to install device for using wireless LAN services by inter-working with the OfficeServ system.

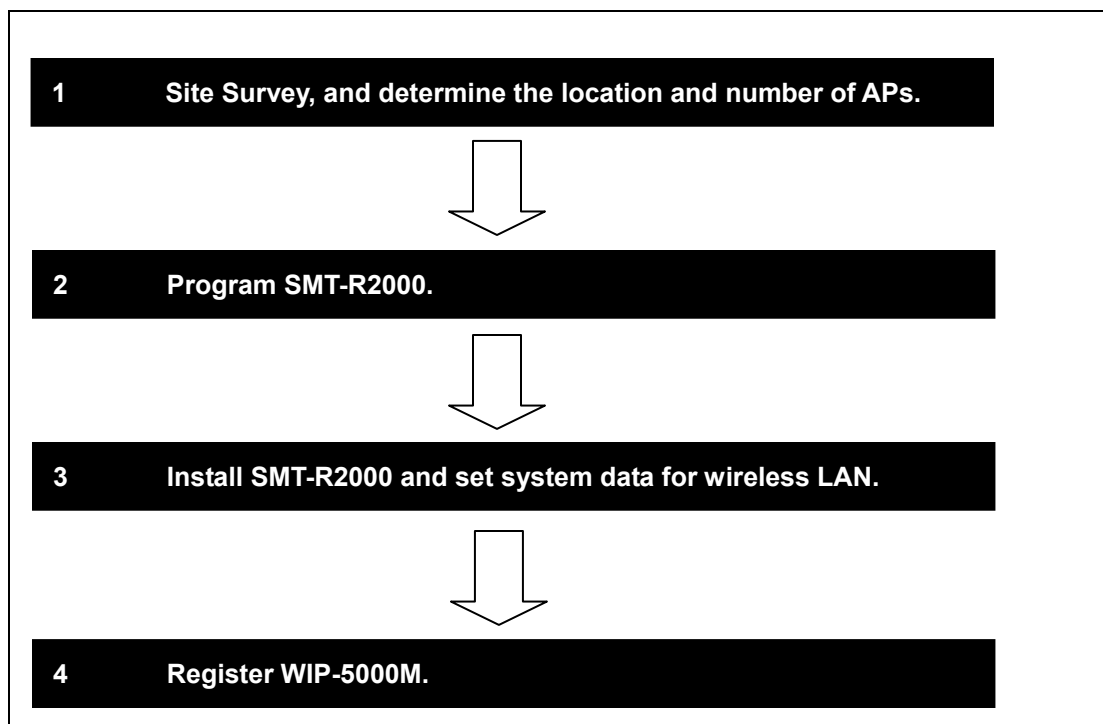


Installation

Install this product when the product turns off. This is to prevent electrocution and fire.

1 Installation Procedure

Follow the steps below to install SMT-R2000 Combo by inter-working with the OfficeServ system:



2 Selecting Installation Location for SMT-R2000

This section introduces the cell where SMT-R2000 will be installed, and describes the data rate affected by the terminal location in an office. This section is targeted for 2.4 GHz IEEE 802.11b/g portion of radio.

2.1 Cell Overview

The figure below illustrates the wireless transmission range of SMT-R2000. Theoretically, the range of a cell is represented as a circle, but in reality, the shape may be altered depending on the surrounding environment such as the location of SMT-R2000 or the surrounding structures. Typically, the boundary of a cell indicates the frequency range of SMT-R2000, however actually it should be perceived as a wireless service range and a boundary where hand-off to another cell can occur. WIP-5000M is always connected to one SMT-R2000 within the cell zone. Even if the WIP-5000M is in an overlapped range between cells, the WIP-5000M maintains communications with one SMT-R2000.

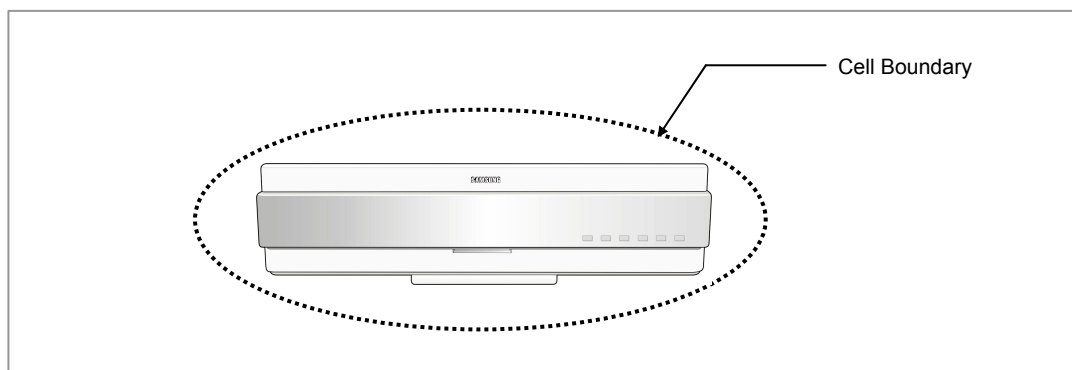


Figure 2.1 Cell Zone of SMT-R2000

Single Cell

Typically, only one cell configures environments such as wireless terminals for use in homes. Single cells are independent service areas; thus, the cells do not affect one another. Configuration of single cells is illustrated in the figure below:

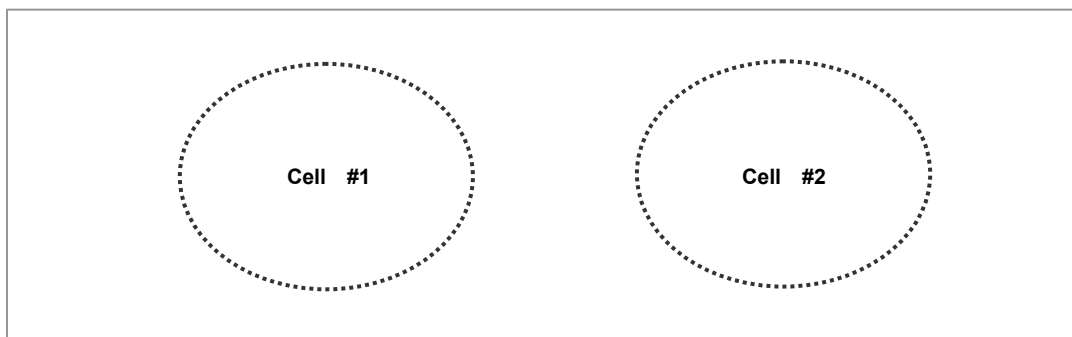


Figure 2.2 Single Cell Configuration

Multiple Cell

The multiple cell type is an environment where more than one cell is overlapped, and where the service for the terminal in use can be maintained even while the terminal is moving among single cells.

The service areas of cells vary depending on the installation location of SMT-R2000.

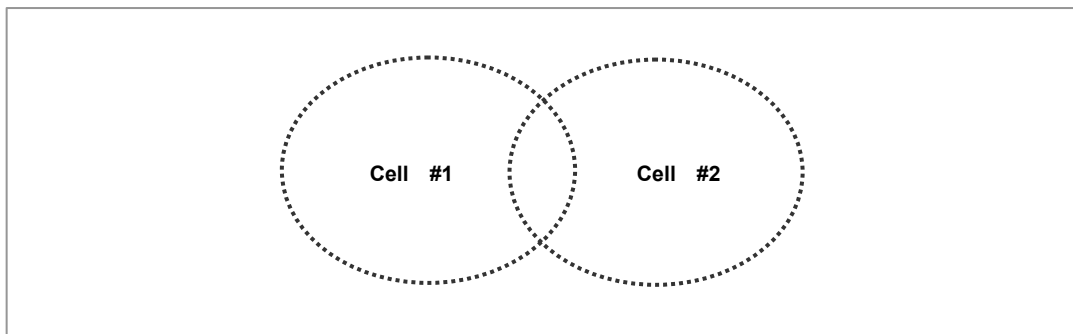


Figure 2.3 Multiple Cell Configuration

Handover

In the multiple cell configuration, if the terminal moves to another cell, the terminal should receive services from the AP in the cell before moving to the cell. In such a case, the OfficeServ system enables the moving WIP-5000M to receive services from the SMT-R2000 of the cell, and connects the WIP-5000M to the SMT-R2000 that may be changed to a voice path connected to the system in order to enable voice calls continuously regardless of whether WIP-5000M moves to another cell or not.

Location Register

By registering the current location of the terminal in a multiple cell environment, the system can easily transmit information to the terminal. Thus, the terminal registers its location in the system when it moves among different cells.

2.2 Data Rate Depending on Terminal Location

Data rate and speech quality vary depending on the terminal location in an office. Refer to Figure 3.4 and Table 3.1.

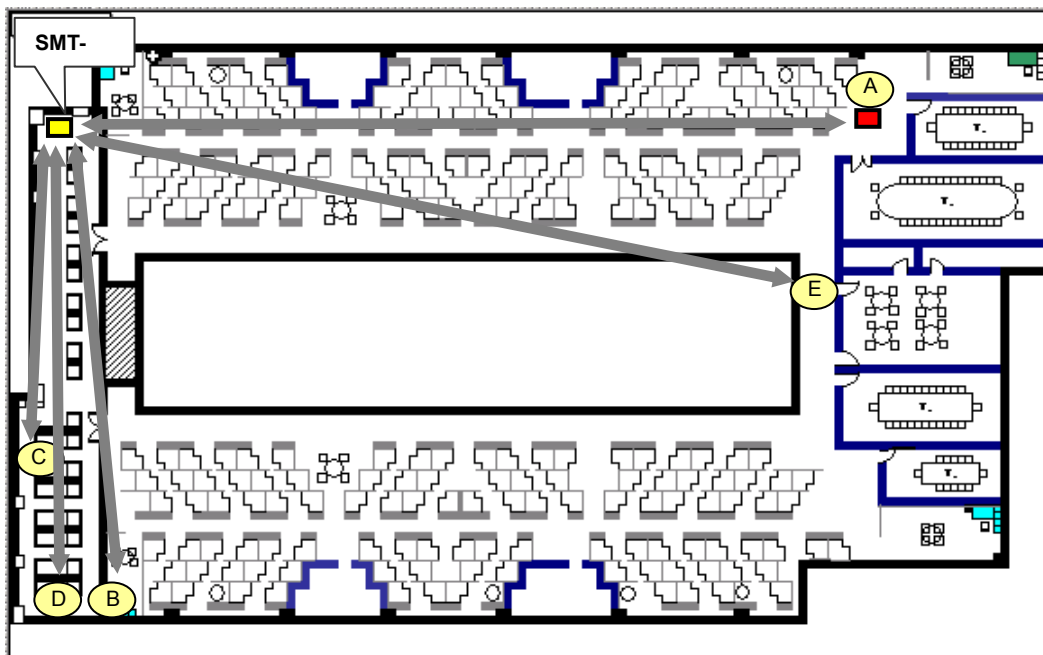


Figure 2.4 Data Rate Depending on Terminal Location

Table 2.1 Data Rate Depending on Terminal Location

No.	Terminal Location	Tx(Mbps)	Rx(Mbps)	Note
1	SMT-R2000 (in 802.11b) ↔ Terminal (Closer distance: 20 cm)	3.97	3.04	-
2	Test location 'A'	3.52	3.05	-
3	Test location 'B'	3.97	3.04	-
4	Test locations 'C', 'D', and 'E'	Link Failure	Link Failure	Locations 'C' and 'D' have shields blocking signals



NOTE

Data Rate

Tx is the rate of data transferred from SMT-R2000 to the terminal.

Rx may have different test results depending on the performance of the network board mounted on the terminal.

3 Deployment Process

This section describes how to deploy cells.

3.1 Cell Coverage

This is the first step of cell deployment. Required cell coverage should be set.

The cell designer must understand the service area set in the map and users' requirements, and should deploy cells taking account of the following:

- Building materials
- Business type
- Building size
- Number of building floors
- Height of the building
- Division of building floors

3.2 Cell Capacity

Determine the number of APs taking account of frequency bandwidth and voice traffic density in the selected area.

Density of user voice traffic in the service area where SMT-R2000 is used is the most important factor of cell capacity design since SMT-R2000 is focused on Voice Over WLAN (VoWLAN).

The number of required SMT-R2000s is calculated based on data throughput. The formula is as follows. In this case, the user refers to a data user.

$$\frac{\text{Bandwidth} * \text{Number of user} * \text{Activity rate per user}(\%)}{\text{Efficiency}(\%) * \text{Association rate per AP}}$$

For instance, if the required data throughput is bidirectional data of 500 kbps for 100 users in 802.11g, the number of required SMT-R2000s will be calculated as shown below:

$$\frac{(2 * 500\text{kbps}) * 100 * 25\%}{20\text{Mbps}} = \frac{(1\text{Mbps}) * 100 * 25\%}{20\text{Mbps}} = \frac{1.5\text{Mbps}}{20\text{Mbps}} = 5.7 \cong \text{Two SMT-R2000s are required}$$

Determine the number of APs taking account of the number of simultaneous calls.

If 27 simultaneous calls are required, the number of required SMT-R2000s will be calculated as shown below. One SMT-R2000 processes four simultaneous calls.

$$\frac{\text{Number of simultaneous voice calls}}{\text{simultaneous voice calls per one AP}} = \frac{27}{8} = 3.3 \cong \text{Four SMT-R2000s are required}$$

3.3 Cell Zone

Determine the number of SMT-R2000s, and select the installation location.

The number of SMT-R2000s can be calculated based on the cell coverage.

$$\frac{\text{The total service areas}}{\text{The coverage of AP}(\pi * r^2)}$$

* $\pi = 3.14$, r = Radius

3.4 Selecting the Installation Location of SMT-R2000 and Setting RF Power

The designer can estimate the number of SMT-R2000s by designing cell capacity and cell zone. After designing the cell capacity and cell zone, RF power should be set. To select the installation location of SMT-R2000, measure network performance in several locations, and take into account of cell zone and performance. Plans for cell deployment must be made in advance to be aware of required cell capacity and cell coverage.

Follow the steps below to set RF power:

- 1) Select the installation location of SMT-R2000, and set the RF power by referring to the known factors. In such a case, channel interference may occur if the distance between the SMT-R2000s is too short. Consider the following:
 - Changes in the actual cell coverage by the RF power of SMT-R2000
 - Signal attenuation caused by in-door obstructions
- 2) Select the installation location of SMT-R2000, and set the RF power by using WIP-5000M.

Table 3.1 Signaling Level in WIP-5000M

Quality	Call Quality(CQ)	Signaling Level(SL)
Good	92-40	72 - 43 (48-2b)
Poor	40-20	43 - 27 (2b - 1b)
Bad	20-0	27 - 0 (1b - 0)

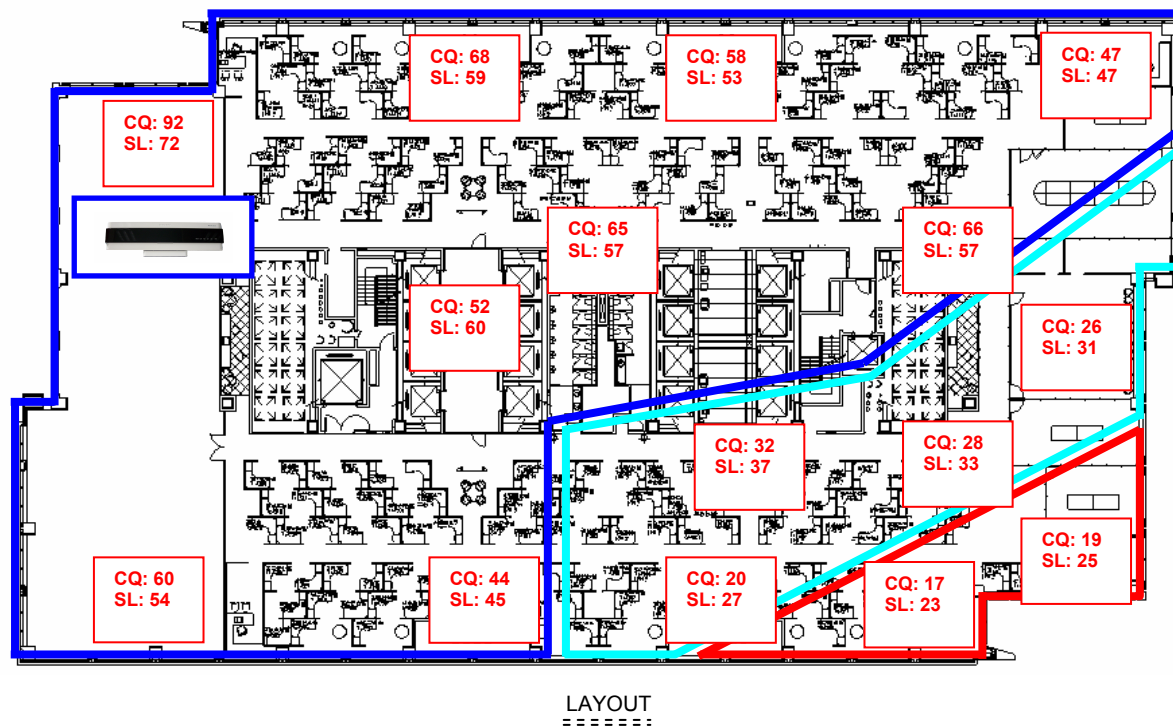


Figure 3.1 Size of Internal Cell

Table 3.2 Signal Attenuation by Internal Obstructions

Obstruction	Signal Attenuation [dB]
Floor or ceiling	30
Brick wall with a window	2
Office wall	6
Iron door in the office	6
Concrete wall	4
Iron door on a brick wall	12.4
Brick wall behind an iron door	3

3.4.1 Site Survey Tool

The OfficeServ 100 or OfficeServ 7200 demo kit can be used as the WLAN site survey deployment tool:

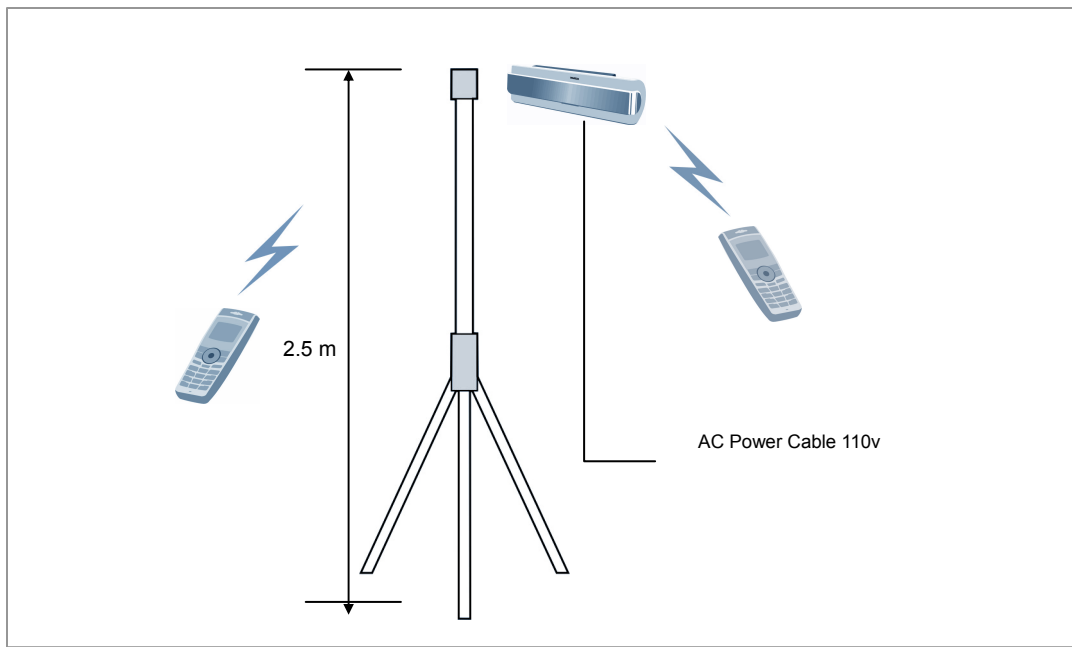


Figure 3.2 Cell Deployment

Entering into the WIP-5000M Test Mode

For the test mode, press the [Menu] button of WIP-5000M while WIP-5000M is in the idle state, and press the [Hold], [*], [#], [5] button in sequence. If WIP-5000M is busy, press the [🎵], [#] button in sequence. Then, the following message will appear in the WIP-5000M LCD screen and you can continue making a call.

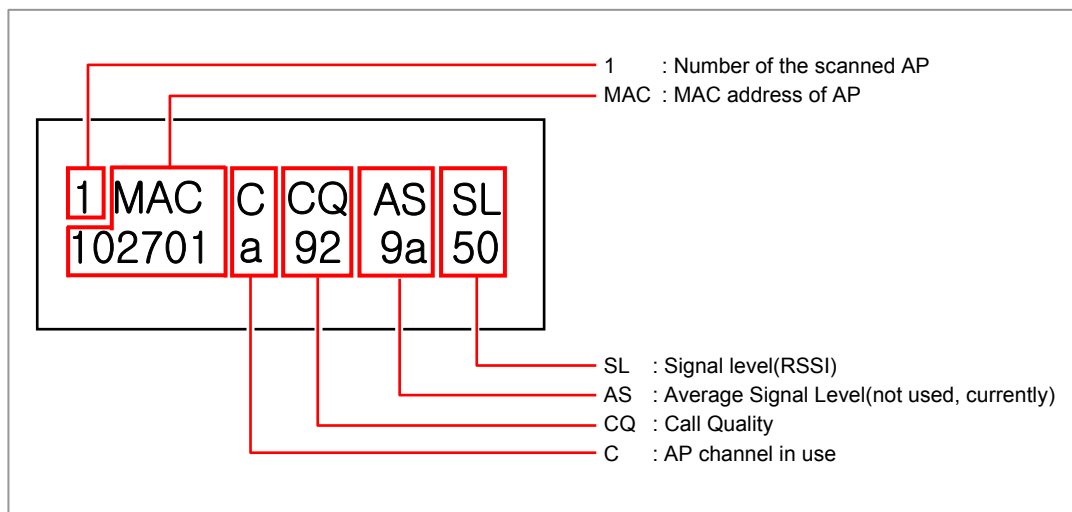


Figure 3.3 WIP-5000M Test Mode Screen



After WIP-5000M Test

After testing the SL(Signal Level) value, change WIP-5000M from the Test mode to the General mode.(If you enter ENDKEY once in the Test mode, it is converted to the General mode.) The data is updated every second.

3.4.2 Cell Design Execution

Perform the cell deployment as follows:

- 1) Mark the location of SMT-R2000 on the site map.
- 2) Install SMT-R2000. Set the test configuration.
- 3) Fasten the tripod around the wall and put SMT-R2000 on it.
- 4) Enter into the Test mode of WIP-5000M.
- 5) Mark the CQ and SL value on the map, keeping apart from SMT-R2000.
- 6) Mark a boundary line with the CQ (=45) marked on the map through WIP-5000M to make a cell.
 - When the distance between SMT-R2000 and WIP-5000M is moved, read the CQ and SL value at each place.
 - When a designer measures the CQ and SL value, separate WIP-5000M from the body of the tester, and read the CQ and SL value for 2~3 seconds while stopped. To gain a correct SL value, at this time, the tester should always take the same pose.
 - Draw a boundary line in different types(e.g., solid line, dotted line) to avoid confusion. Since the line cannot be identified if copied, it is recommended not to use a highlighter.
 - In case of multi-floor building, recognize on which floor the SMT-R2000 has been installed because signals of the cell on another floor can be interfered.
- 7) If the map is completed, check the CQ and SL value of an area overlapped with other adjacent cells. If the overlapped part of each cell is not appropriate, adjust the location of SMT-R2000 or the SMT-R2000 RF Power.
- 8) Determine the cell overlapping and coverage, considering the user's requirements as well as traffic density and use of the mobile phone at a special place(e.g., elevator, rest room).
- 9) **The distance between APs should be at least 15 ft.**

3.5 Channel Allocation

Channels should be assigned to minimize interference between cells. In the wireless specification 802.11b, there are only 3 non-overlapped channels available. The figure below shows the general channel allocation:

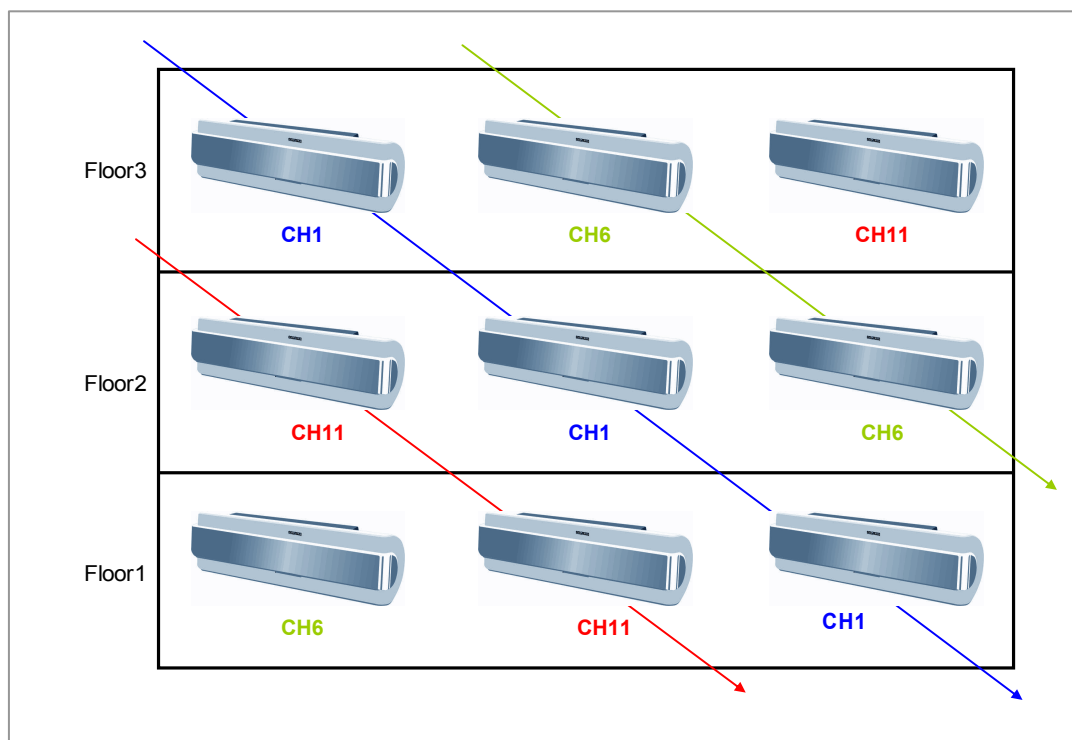


Figure 3.4 Example of Sequential Channel Allocation 1

- To design cells on the same floor, assign CH 1, 6, 11 to AP in sequence in order to minimize the interference between channels.
- At the same place of each floor, assign CH1, 6, 11 to AP in sequence in order to minimize the channel interference between adjacent floors.
- To design broader cells than the example above, make sure the sequence of channel allocation is on the extended line of the arrow as shown in the figure above in order to minimize the interference between channels.

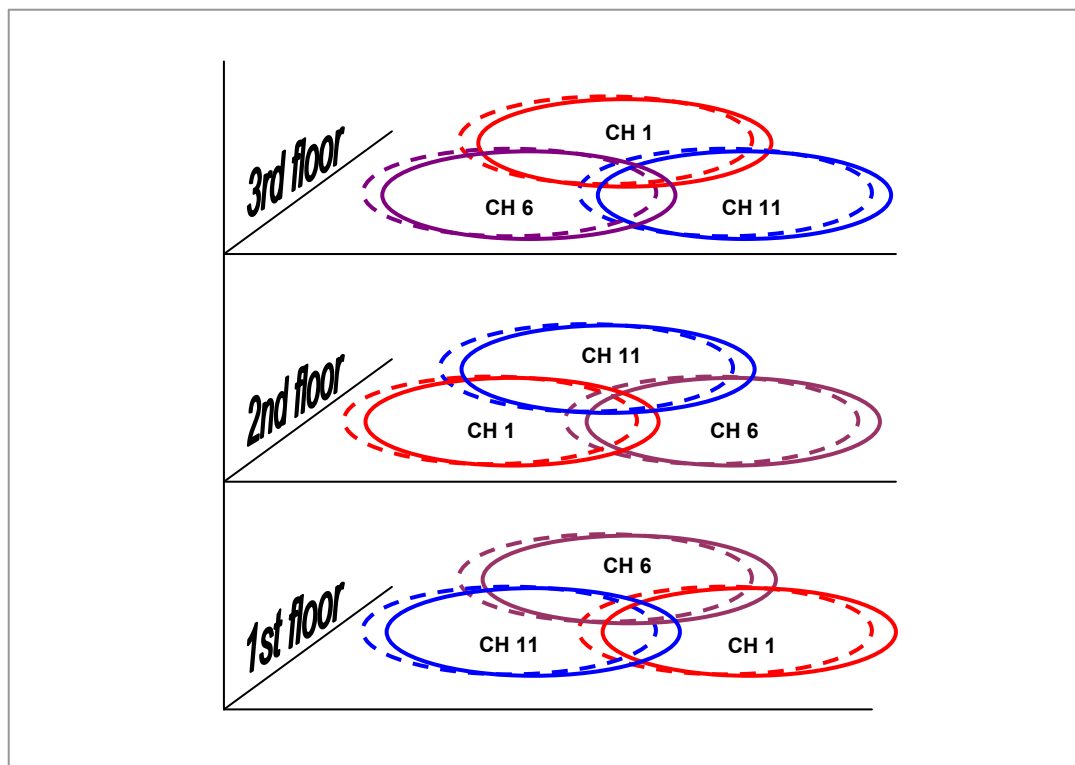


Figure 3.5 Example of Sequential Channel Allocation 2

The figure above illustrates the example of channel allocation for minimizing the interference between channels.

3.6 Restriction of Cell Design

This section describes the restriction of cell design.

- The OfficeServ system does not support a general commercial AP.
- Hand-off can't take place when all SMT-R2000 use the same IP address.
- The distance between SMT-R2000s should be at least 15 ft.
- SMT-R2000 uses an internal 2dBi Omni-directional antenna.
- WIP-5000M does not support CTI (Computer Telephony Interface) packet related to calls.
- If the CQ level is less than 45, WIP-5000M will perform hand-off.

4 Mounting SMT-R2000

SMT-R2000 can be mounted on a wall surface or on a table at your option. The SMT-R2000 must be mounted at upright position.

4.1 Mounting on a Concrete Wall

Prepare the following tools in advance when mounting SMT-R2000 on a concrete wall:

- Electric drill, hammer
- Wall bracket
- Cross-tip screwdriver(6.5 mm)
- Two plastic anchors
- Two cross-tip screws
- SMT-R2000

Follow the steps below to mount SMT-R2000 on a wall surface:

- 1) Attach the <screw position diagram>, which ships with SMT-R2000, on the wall where the SMT-R2000 will be mounted.



NOTE

Marking Screw Position

If the <screw position diagram> is not available, press a sheet of paper against the bottom surface of SMT-R2000, and mark the two positions of the screw hole.

- 2) Drill a hole at the 'screw position' illustrated in the <screw position diagram>. The hole is at least 35mm deep and 5.5mm wide, which will enable the plastic anchor to enter the hole easily.

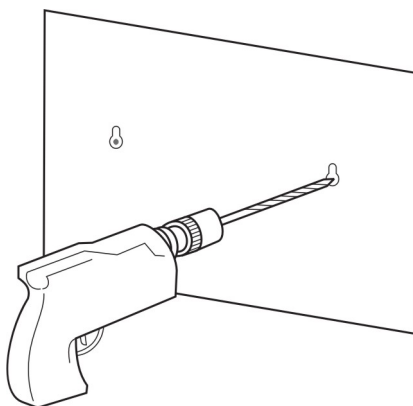


Figure 4.1 Mounting SMT-R2000 on a Concrete Wall (1)

- 3) Detach the <screw position diagram> after drilling the hole.
- 4) Insert the plastic anchor into the hole using a hammer.

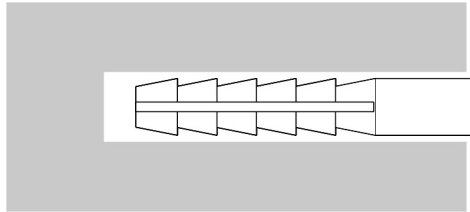


Figure 4.2 Mounting SMT-R2000 on a Concrete Wall (2)

- 5) Insert a screw into the plastic anchor and tighten the screw with a cross-tip screwdriver. Do not fully tighten the screw, and leave a gap of 5 mm.

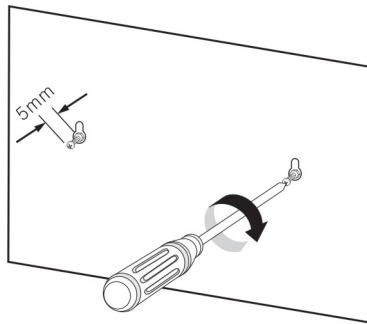


Figure 4.3 Mounting SMT-R2000 on a Concrete Wall (3)

- 6) Two screw holes are located at the bottom surface of SMT-R2000. With two hands, match the two holes of the SMT-R2000 with the screws on the concrete wall, and pull the SMT-R2000 downwards. For information on how to install a wall bracket into SMT-R2000, [refer to Figure 4.5](#). Stand the support shown in [Figure 4.5](#) and install the support into SMT-R2000 as shown in the figure below to mount SMT-R2000 on a wall:

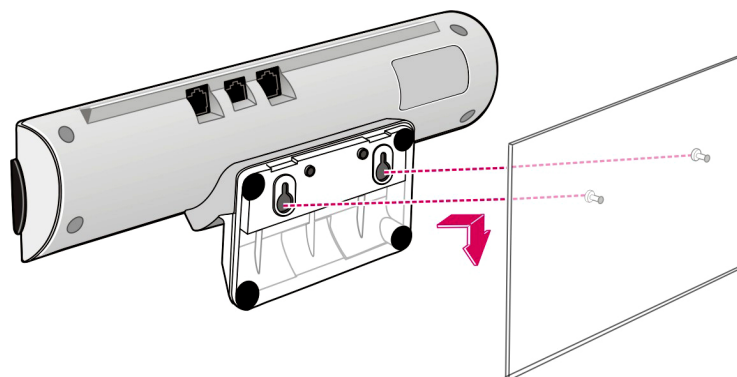


Figure 4.4 Mounting SMT-R2000 on a Concrete Wall (4)

4.2 Mounting on a Table

Prepare the following tools in advance when mounting SMT-R2000 on a table:

- Plastic support
- SMT-R2000

Two holes that can be attached to the support exist on the bottom of SMT-R2000. As shown in the figure below, firmly attach SMT-R2000 to the support, and place the SMT-R2000 on the table:

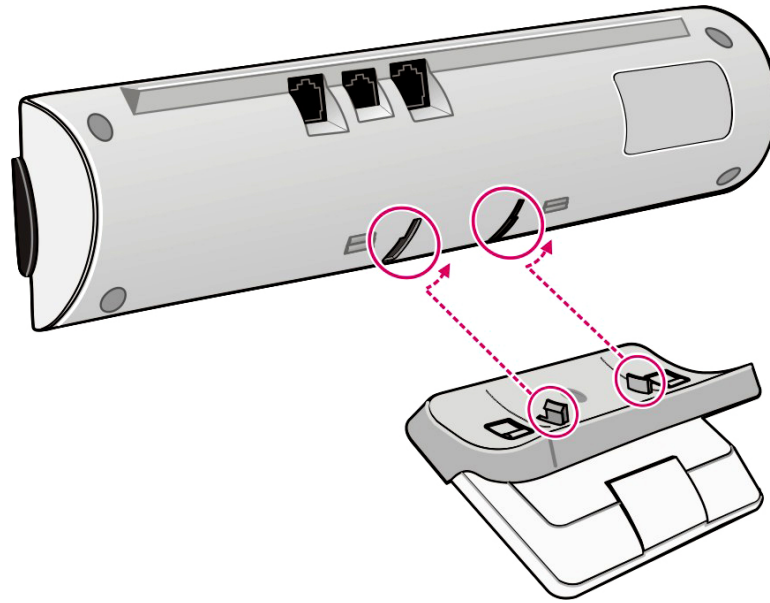


Figure 4.5 Mounting SMT-R2000 on a Table



CAUTION

Mounting SMT-R2000 on a Table

- Do not mount SMT-R2000 on an unstable table or on a table smaller than SMT-R2000. This is to prevent the SMT-R2000 from being damaged.
- Mount SMT-R2000 in a place where any obstructions do not exist in front of SMT-R2000. This is to prevent wireless services from being affected.

5 Setting Up SMT-R2000



The following items are required to be programmed:

- Country Code
- SSID must be setup to numbers
- RF Channel
- IP Address: Each IP must have unique IP address. IP addresses do not need to be the same subnet as the system.

6 Setting System Database

To enable WIP-5000M in the OfficeServ System, you should set values of the following items, using using the MMC program.

- Select DUAL AP for SMT-R2000
- WIP-5000M IP assignment
- WIP-5000M registration

6.1 AP Type Setting

Set the type of SMT-R2000 required for the wireless LAN system. You can change the type of SMT-R2000 in [AP TYPE] of [MMC 849]. Change the value of [AP TYPE] will reset the system.

6.2 WIP-5000M IP Assignment

Enter an available IP address in [MMC 848] in each WIP-5000M before registering WIP-5000M. An IP address is assigned to WIP-5000M in DHCP or static mode. The assigned IP address can be changed in [MMC 849]. Depending on the mode in the system, the WIP-5000M registration procedure may vary.

6.3 WIP-5000M Registration Authorization

WIP-5000M should be registered in the system DB in order to be enabled in the OfficeServ System. After authorizing the registration in [REGISTER VoWLAN] of [MMC 849], register the terminal following the registration procedure. Once the WIP-5000M registration is completed, restrict WIP-5000M registration to be authorized again in [REGISTER VoWLAN] of [MMC 849]. In addition, WEP(Wired Equivalent Privacy), which is an encryption method for wireless LAN, is used to maintain data confidentiality in a wireless environment.



NOTE

Wireless LAN MMC Programming

For detailed information on how to program MMCs for the OfficeServ Wireless LAN, [refer to the Programming Section.](#)

7 Registering/Clearing WIP-5000M

7.1 Registering WIP-5000M

Follow the steps below to register WIP-5000M in the system:

- 1) Check if the system DB items are set correctly according to the [‘Setting System Database’ section of this chapter](#).
- 2) Register the WIP-5000M using the ‘Register Terminal’ menu.
Refer to the [‘WIP-5000M User Guide’](#) for the registration procedure.
 - You should enter the system ID correctly from the WIP-5000M registration procedure.
 - Set the system ID to the same value as the DB in the system since the registration procedure may vary depending on the IP setting mode(DHCP/Static) and SMT-R2000 type(AP type). Particularly, the user ID and password must be the same as the values in the system. If registration is not performed properly, check if the system DB is set properly, and perform the above steps.
- 3) Once the registration is completed, an extension number is assigned to WIP-5000M.

7.2 Clearing WIP-5000M

If theft or damage of a WIP-5000M or system key/encryption is changed, the registration of the WIP-5000M should be cleared. Clearing procedures for the WIP-5000M are described below:

Clearing From the System

To clear a WIP-5000M in use, which is within the wireless LAN service area, set [WIP REGIST CLEAR] of [MMC 849] to normal mode.

If the terminal is not within the service area or is not available, delete only the WIP-5000M DB in forced mode.

Clearing from WIP-5000M

The registration DB may be deleted from a WIP-5000M within the wireless LAN service area. Refer to the [‘WIP-5000M User Guide’](#) for the termination procedure in detail.