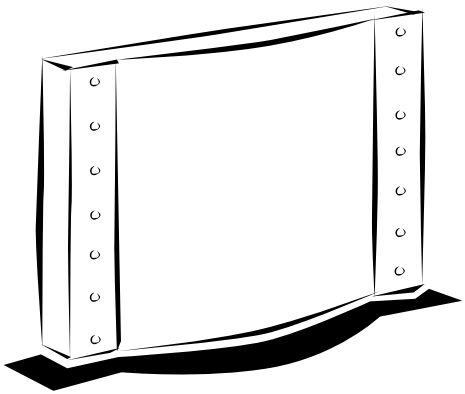
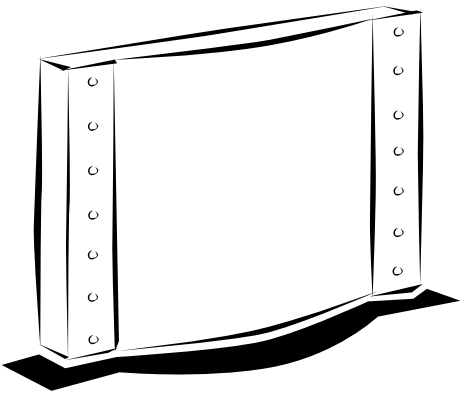
Survey Kit



Survey Kit

DEPLOYMENT/SITE SURVEY MANUAL



Issue: 1

A Publication of
NEC PHILIPS UNIFIED SOLUTIONS
HILVERSUM, THE NETHERLANDS

Order No.: **3522 009 11912**

Manual No.:

Date: July 2005

Great care has been taken to ensure that the information contained in this handbook is accurate and complete. Should any errors or omissions be discovered or should any user wish to make a suggestion for improving this handbook, they are invited to send the relevant details to :

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Appendices

1. INTRODUCTION

1.1. GENERAL

This document contains guidelines for surveying DECT System sites. A site survey is necessary in advance of a product offer or in advance of installation. Radio coverage is rather difficult to predict on the basis of maps and other information, making an on-site survey necessary to determine the number and position of RFPs (Radio Fixed Part) in the majority of cases. A survey will serve to complete the information necessary to plan an installation.

1.2. OBJECTIVE

The objective of a site survey is to determine the number and positions of RFPs to implement radio coverage in the area required and to determine how to install the RFPs including the connection to the DECT system.
The result of a Site survey gives you a clear overview of where RFPs (radios) must be installed, how the coverage will be, where the cell boundaries are, and the required number of RFPs..

1.3. PROCEDURE

The procedure for a site survey comprises the following steps:

- Acquiring site information.
- Preparing tools.
- Execution of Site Survey.
- Reporting the results.
- Checklist to check whether there are no things forgotten.

The sections in this chapter are arranged according to the execution sequence.

1.4. ABBREVIATIONS

The following abbreviations are used in this manual:

- DECT = Digital Enhanced Cordless Telecommunications.
- FE = Frame Error.
- LED = Light Emitting Diode (lamp)
- RFP = Radio Fixed Part (DECT transmitter/receiver connected to DECT system).
- RFPI = Radio Fixed Part Identification (unique DECT system and RFP identifier)

- RSSI = Radio Signal Strength Indication (received signal strength)

1.5. IP DECT

This manual is applicable for traditional DECT Systems only. In case you use this manual and the Site Survey equipment for a Site Survey for **IP DECT** systems, you must also read the manual *"**Mobile@Net IP DECT Site Survey - Additional Info**"*. This "Additional Info" manual contains information on the characteristics of IP DECT systems and additional measurements for IP DECT systems.

2. INFORMATION REQUIRED IN ADVANCE

The following information should preferably be available in advance of a survey:

- **Maps of the site.**
  Maps of the site are an essential requirement in advance of a survey !
  A map of the complete site (if more than one building) and plans of each floor of each building are required. Make sure that dimensions are clearly stated on the maps. Additional information such as the use of buildings (e.g. office, hotel, factory, store, etc.), construction materials (walls, floors, ceilings, etc.), cabling infrastructure, etc. are helpful in estimating RFP positions in advance.

- **Number of users (PPs)**
  Number of users (handsets), both initial and foreseeable growth, and areas of above average and below average traffic density.

- **Allowed and prohibited RFP positions**
  A customer may prohibit installation of RFPs in certain areas, require the RFPs to be installed out of sight, etc.

- **Details of required coverage.**
  It should be clear in advance where coverage is required, e.g. whether elevators, stairwells, toilets, outdoor areas etc. are to be covered as well.

- **Position of the DECT System and available Cabling**
  Check whether existing cabling can be used for the connection between the DECT System and the RFPs. If the type and quality of the available cabling is not sufficient for the connection and therefore limits the maximum distance between the RFP and DECT System, new cabling can be required.

- **Sensitive electronic equipment**
  Check whether sensitive electronic equipment is present or not, e.g. laboratory, medical, etc. Although the transmitted power of the RFPs is very low (about 250 mW) it might interfere with sensitive electronic equipment.

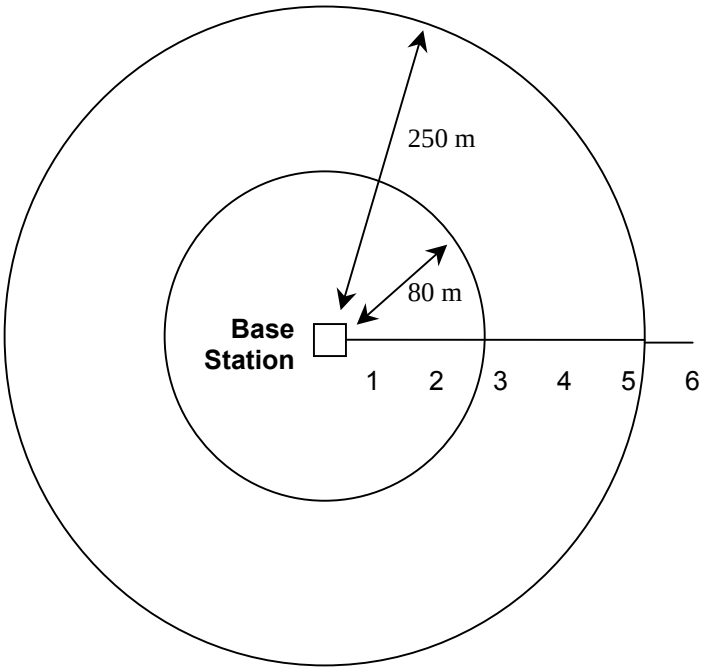
- **Traffic information**
  It is necessary to gather information on user density, amount of traffic, whether redundancy is required, etc. This must be clear in advance because it determines the number of RFPs that are required and therefore also the cabling that is required.

  An RFP must always have at least one channel free to allow handover (either-intra-cell or inter-cell handover). So if you are using a 6 channel RFP, make sure that the maximum expected traffic density will not be more than 5 channels simultaneously.

3. COVERAGE AND SPEECH QUALITY

3.1. GENERAL

There is always a relation between coverage and speech quality. The further you get away from the RFP, the lower the quality. Therefore it is important to see the relation between the coverage and the expected voice quality. Figure 1 gives an impression on the relation between coverage and voice quality in an open environment.



1 = Excellent
(ISDN Telephone Quality)

2 = Good
(Occasionally a click)

3 = Satisfactory
(Clicks, occasionally a mute)

4 = Poor
(Clicks, mutes, just intelligible speech)

5 = Very poor
(Unintelligible)

6 = No speech at all

Figure 1. Coverage and Speech Quality in open Environment.

Be aware that DECT is a digital communication system. It incorporates a “transmission errors hiding” system. This means that it tries to hide the transmission errors. The results of this mechanism are as follows:

Small incidental transmission error	→	Not noticeable in speech
Minor transmission error	→	Click in speech
Major transmission error	→	Mute of speech

3.2. WHICH QUALITY IS REQUIRED WHERE

The required quality depends on the customer requirements and the environment. The following quality levels are required:

- Excellent and Good
  In business and office environments, the excellent and good quality is mandatory!! A lower speech quality is not allowed!
  Also in First Aid environments, only excellent and good voice quality is allowed!!

- Excellent, Good, Satisfactory
  In less critical areas like basements, stocks and cold stores, a satisfactory quality is also allowed. In a noisy environment people will not notice a click in the voice connection anymore, because the environment produces a lot of background noise already. This environmental background noise may also contain clicks. Sometimes, the speech of the telephone extension cannot be heard because of the background noise.

Notes:

- *A maximum of 20% of the whole coverage may be considered as Satisfactory.*

- *It may be necessary to install a hardwired emergency telephone in those areas where the quality is satisfactory. This ensures that people can always make a call in case of emergency.*

- *If you agree with the customer on lower speech quality, then make sure that this is well documented and signed by the customer. If the customer complains about it afterwards, then you can always refer to the agreement. Also, be aware that, if the speech quality is low in certain areas, you might get blamed for having delivered a bad system!!*

- *If you allow less voice quality, make sure that it will never result in a dropped call. Dropped calls are never allowed!!!.*

3.3. OTHER QUALITY EFFECTING FACTORS

The following factors effects the voice quality as well:

- **Moving speed.**
  The DECT techniques allow a maximum moving speed of 5 km/h. Bear this in mind if your DECT system must cover an elevator.

- **Metal Construction**
  If the construction materials of the building are mainly made of metal, there will be a lot of reflections. *In that case the voice quality will be poor (a lot of "clicks" and "mutes") even if you are next to the RFP.* Only if the handset doesn't move, the voice quality will be good.
  If you know (or expect) that there is a lot of metal in the construction of the building, make sure that you do a site survey thoroughly and very accurate. During the site survey, check for frame errors (in C944 display "FE") and check the voice quality.
  If you want to have a more accurate survey in metal environments, you must use a small DECT system which a minimum of four RFPs and demonstrate to the customer the maximum possible quality.

  If you install a DECT system in metal environments, it will normally result in higher cost prices for the DECT system than usually.

4. COVERAGE CALCULATION

The coverage can be calculated in advance, before executing a site survey. Calculation is based on the following theory.

The transmission path between RFP and the PP is the link. It is subject to radio-propagation related peculiarities, such as:

- Dynamically changing environment;
- Attenuation of the signal, due to fixed and moving objects;
- Multi-path propagation of the signal.

The signal from the transmitter is attenuated in the link before arriving at the receiver. The link consists usually of a path through “free air” and obstacles as walls, etc. Air causes attenuation and the obstacles causes also attenuation, called “insertion loss”. Table 1 gives typical insertion losses of some obstacles.

MATERIAL	INSERTION LOSS (dB)
Glass	2
Glass, metal reinforced grid	10
Glass, metal clad sunguard	10
Wall, indoor, plaster, wood	2
Wall, brick, 10 cm	3.5
Wall concrete, 10 cm	6
Wall concrete, 15 cm	9
Wall concrete, 20 cm, large windows	6
Wall concrete, 40 cm	17
Ceiling, concrete, reinforced, tiles	17 - 20

Table 1. Typical Insertion Losses of some Obstacles.

With the actual DECT equipment, the "available link budget" is **38 dB**. This is the maximum allowed loss in the link, under constraints of excellent and good speech quality and the ability for the user to move.

The distance between RFP and PP can be calculated by using the **“**DECT range calculation chart” see figure 2.
It must be used as follows:
At the map of the building, start at the possible RFP location. Move away from the RFP location. Calculate the distance; encountering an obstacle, calculate the insertion loss. At the chart, start in the left lower corner **(0,0)**, move horizontally to the right corresponding with the (actual) distance. Move vertically corresponding with the insertion loss of the encountered

“obstacle”, etc. If the curve is crossed, read the max. distance for the case of that specific RFP in that specific situation. This gives an indication of the cell size in that specific direction.
It must be emphasised that outside the calculated range, communication is possible but a good voice quality is no longer guaranteed!

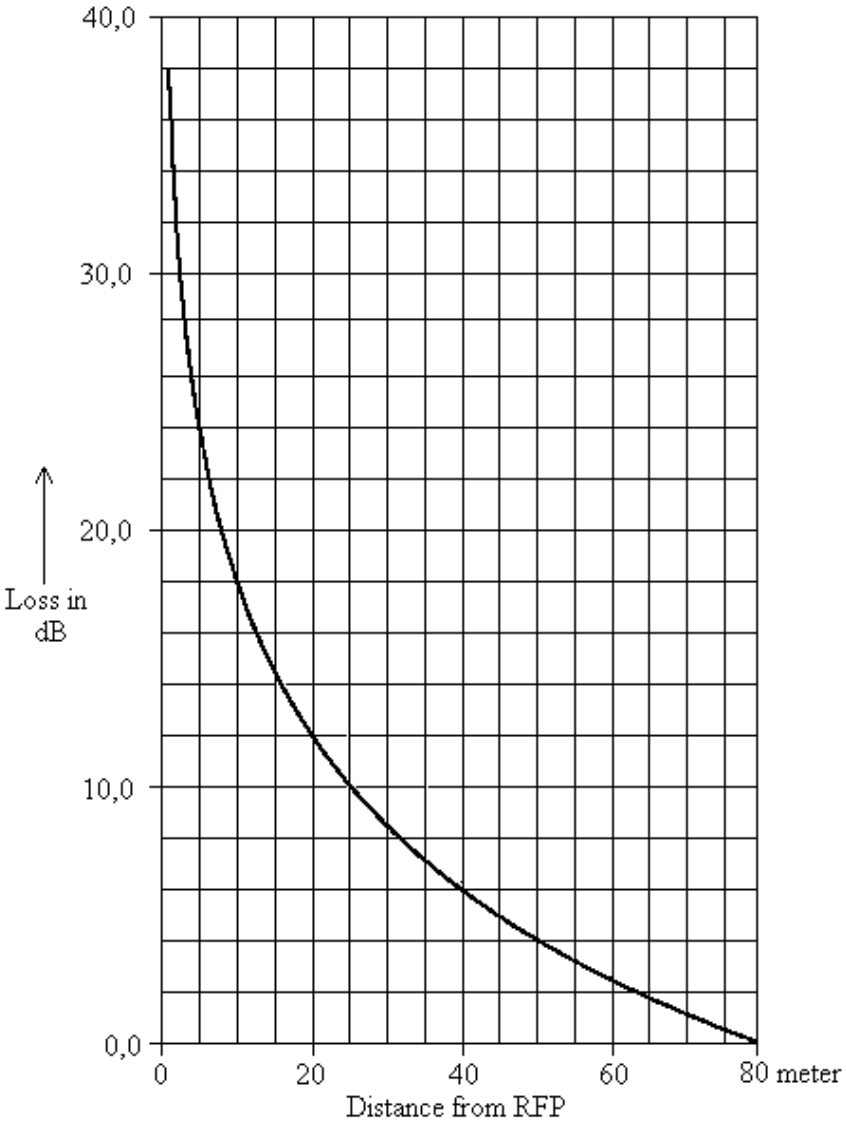


Figure 2. DECT Range Calculation Chart.

In “open air” the range is 80 m. from the RFP, again under constraints of good communication quality.

The result of this coverage calculation should be a map with possible RFP positions. Now the cell boundaries must be determined by walking around and doing measurements. Therefore tools are required. This is explained in the next sections.

5. TOOLS – “PBC Site Survey Kit”

5.1. GENERAL

The “PBC Site Survey Kit” allows you to do a Site Survey for all types of DECT System that Philips Business Communications supplies.:

The contents of the “PBC Site Survey Kit” deployment suitcase:

- Suitcase to carry all of the items (except for the Tripod)
- A Base Station.
- Two omni directional antenna’s (mounted to the Base Station).
- One directional antenna 8dBi with two cables.
- One Ethernet cable RJ45 – RJ45 (25 cm.)
- One plastic board for mounting the Battery cabinet and the Base Station.
- Two Battery cabinets (“RFP like” housing) including batteries and a power converter from battery voltage to 48 Volt for the Base Station power provision.
- A power supply for charging the Batteries.
- 3x C944 handsets for measurements.

  Note: *The C944 Site Survey handsets are specifically selected for the Site Survey Kit. Do not use these handsets for other purposes, and do not use other C944 handsets instead of the handsets that came with the Kit. If a handset needs to be replaced, you need send the Site Survey Kit for repair. You will then get a new certificate with updated serial numbers.*

- 2x protective pouch for the C944
- 3x desktop charger for C944
- 3x AC adapter for desktop charger.
- 2x Headset for C944
- Documentation.
  - Deployment Manual (= this document)
  - C944 User Guide
  - Charger User Guide

- A Tripod is not included in the Site Survey package. However, you can order the standard Site Survey tripod separately.

The following picture shows the contents of the Site Survey kit.

Figure 3. Site Survey Kit

Besides the equipment in the Site Survey Kit, you will need the following tools:

- **Measuring equipment** (such as a tape measure).
- **Clipboard**, **pencils for marking the survey map(s), and an eraser.**

5.2. CHARGING BATTERIES.

To charge the batteries, follow the following steps:

1. Take the Battery cabinets out of the case.

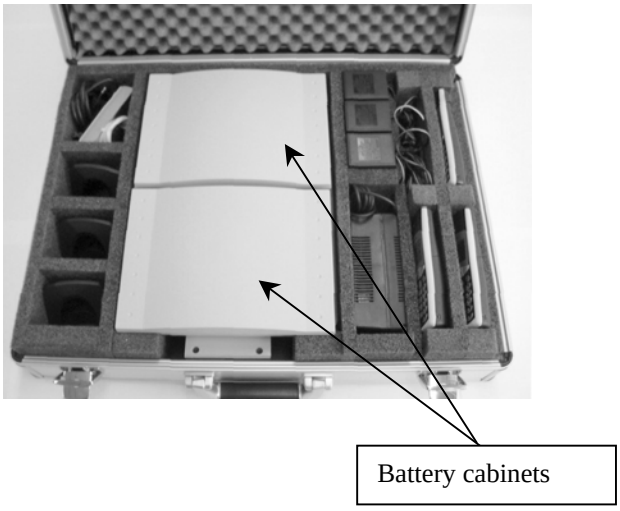


Figure 4. Battery Cabinets in the Site Survey Kit.

2. Take the Battery Charger out of the case and connect it to one of the battery cabinets. In the following picture you see an overview of the connectors, LED indications and switch at the side of the Battery cabinet.

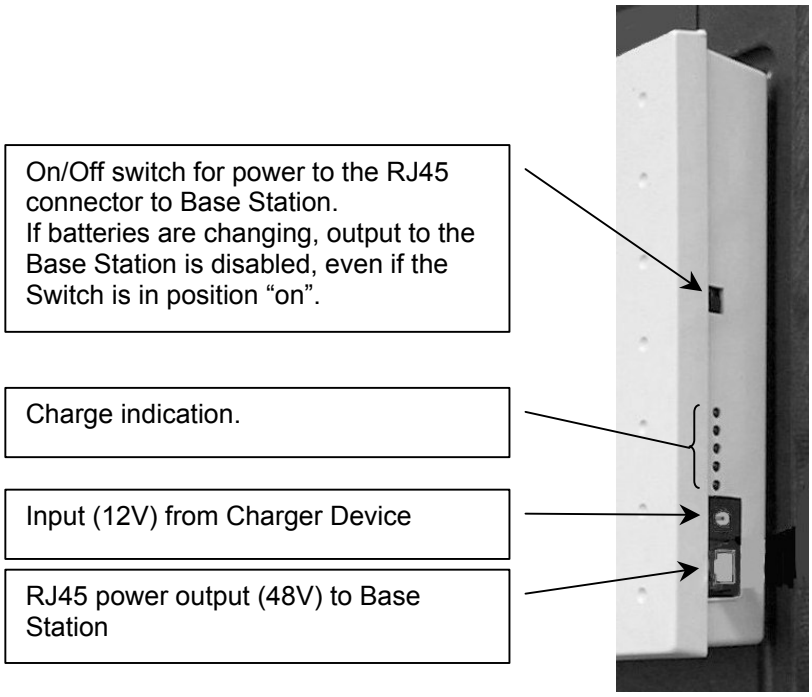


Figure 5. Controls on the Battery Cabinet

3. Connect the Battery Charger to the Mains. The **red** LED on the charger will be steady "on" to indicate that the charging sequence has started.
   When the **green** LED is lit, the charging sequence is finished.

Note: *When the batteries are charged for the first time, make sure that the complete charging sequence is not interrupted until the batteries are fully charged. After that make sure that the next three times that the batteries are charged, the charging sequence is also not interrupted before it is completely finished.*

Note: *Pressing the Yellow button on the Charger, starts **dis**charging the batteries! (The red LED is flashing during a discharge*

Note: *A complete charging sequence takes about <u>four</u> hours.*

   To check whether the charging is finished, watch the green LED on the charger. If the green LED is steady "on", charging is finished.

4. Disconnect the Battery Charger from the Battery cabinet, and connect it to the second Battery cabinet. Charging the second Battery cabinet has now been started. Be aware of the previous "Notes" and do not interrupt the charging sequence.

5.3. SETTING UP THE TOOL

In the previous section, you have charged the batteries. Now you are ready to setup the tool for operation. To setup the tool for operation, execute the following steps:

1. When you have taken out the battery cabinets from the case, the case will look like the following picture:

Figure 6. Battery Cabinets Removed from Site Survey Kit

2. Take out the plastic board. At the (rear) other side of the plastic board, the Base station is mounted.
   In the following steps you will mount one of the Battery Cabinets to the plastic board (at the counter side of where the Base Station is mounted). The other one is considered as a spare Battery Cabinet.

3. Watch the “key holes” in the Battery Cabinet and put the key holes over the screws on the plastic board. (See figure 7).

4. Push the Battery Cabinet down to lock the key holes over the screws. Now the Battery Cabinet is fixed to the plastic board.

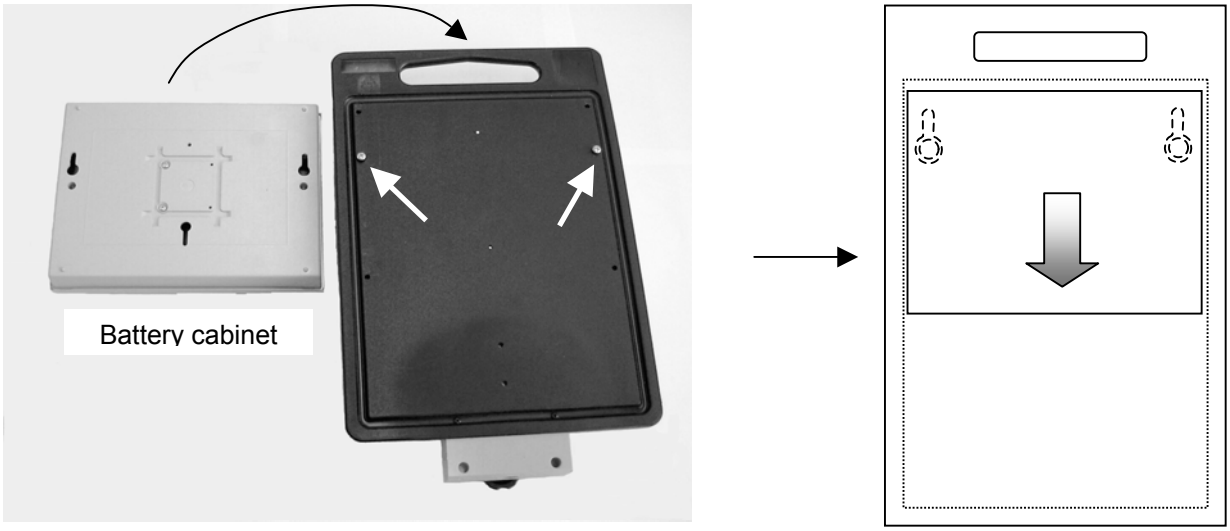


Figure 7. Mounting a Battery Cabinet on the Plastic Board.

5. Connect the power cable (RJ45 – RJ45) between the Battery Cabinet and the Base Station, as shown in figure 8.

Figure 8. Mounting the Cable between the Battery Cabinet and the Base Station..

6. Mount the plastic board with Battery Cabinet and Base Station to the Tripod. (See figure 8.).

7. Switch on the power, using the switch at the side of the Battery Cabinet.
   The red LEDs on the battery cabinet should be on, indicating the charge level of the batteries.
   When the yellow LED on the Base Station is steady on, it is ready for use. (Starting up can take up to 2 minutes.)

8. Continue with the next chapter. If you need to do a Site Survey with a Directional Antenna, continue with the next section.

5.4. USING DIRECTIONAL ANTENNAs.

The Site Survey Kit allows you to use directional antennas. An 8 dBi directional antenna is included in the Site Survey Kit. The following step procedure explains how to mount the antenna to the plastic board, and how to connect to the Base Station.

Note: *When changing antenna's, always make sure that the Base Station is switched off!*

1. You must remove the omni directional antennas from the Base Station. To do that, you must remove the cover that is mounted over the connectors on the Base Station. Use the following sub-procedure.
   - To remove the cover, remove the plastic "nuts" that keep the cover in place.
   - Remove the cover as shown in the picture.
     Note that there is a "click" mechanism involved when removing the cover.

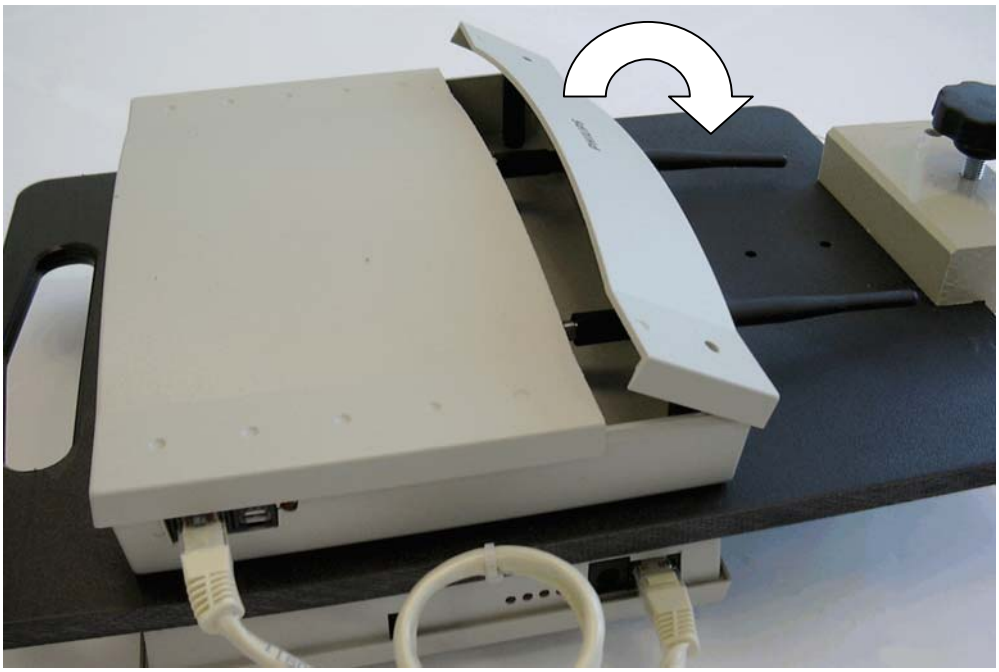


Figure 9. Removing the cover from the Base Station.

2. After the cover is removed, un-screw the antennas from the base station and put them back into the Site Survey case.

3. Mount the directional antenna at the plastic board site where the Battery Cabinet is mounted. (See figure 10)

4. Mount the cables between the directional antenna and the connectors on the Base Station.

Note: *Be careful fixing the SMA cable connectors to the SMA connectors on the Base Station. Using a wrench can easily damage the connectors. Fix them "hand tight" only or use a dedicated SMA Torque Wrench*

5. Close the cover on the Base Station again and use to nuts to fix the cover on the Base Station.

6. Switch on the power on the Battery Cabinet and wait for the yellow LED to be steady-on on the Base Station.

Figure 10. Directional Antenna mounted.

To remove the directional antenna and install the omni directional antennas again, follow the above procedure in reverse order.

6. PREPARATION

The thoroughness with which all preparations can be done depends upon the information available regarding the site to be surveyed.

6.1 CHECKING THE SURVEY EQUIPMENT FOR CORRECT OPERATION

To check the equipment execute the following procedure:

1. Make sure that the Survey Base Station Battery Cabinets and handset batteries are fully charged.

2. Make sure that the two omni directional antennas (black) are installed on the Base Station.

3. Mount the Plastic board (with Base Station and Battery Cabinet on it) to the Tripod.

4. If not yet done, connect the Battery Cabinet to the Base Station. Switch the Base Station on using the switch on the Battery Cabinet and check that the LED is steady on (after a while). This means the Base Station is up and running.

5. Make sure that the C944 handsets are switched on and “on-hook”.

6. Go “off-hook” on one C944. A tone must be heard. If not, check that the Base Station is switched on and that the battery of the handset is fully charged.
   Repeat this step for each C944 handset.
   (If everything is OK, and yet you don’t hear a tone on one handset, the problem might be that the handset is not subscribed. In that case, consult Appendix C.)

7. Put the Base Station in a corridor. Keep a distance of 20 metres between the C944 handsets and the Base Station and make sure that there is nothing/nobody in-between.

8. Press: `<menu> R***76#` on each C944 handset that you want to involve in the Site Survey.

9. Now you are in a menu. Scroll to “`Site Survey`” and press the soft key `<OK>`.
   The following is displayed (for explanation of the fields, consult section 7.2. “Setting up the Equipment”)

```
RFPI  100F062501
FE PP:   FP:
-dBm 65
RPN  01
Options       Ø
```

10. Check that the RSSI reading is between -62 and –67 dBm. If not then, the Survey Kit must be repaired.

6.2. MAPS

Maps should be prepared in a format that can be easily carried around the site. When enlarging or reducing the format make sure that dimensions are not lost (be sure that there is a calibration line at each map). Also, each map must be clearly marked with the location identity.

6.3. OTHER PAPERWORK

Before executing a survey, a query list needs to be assembled, listing the information to be gathered during the survey apart from the radio coverage information (see chapter 9.).

6.4. RFP POSITIONS DURING SURVEY

If possible, plan the RFP positions to be measured before starting the survey, including alternative configurations, taking into account estimated cell sizes.
The following RFP ranges can be used as a rough guide to planning the RFP positions:

- In the line of sight the RFP has a range of about 80m.
- In halls the RFP has a range of < 80m.
- In buildings the RFP has a range of about 15-40m. This assumes that walls are made of light brick, plasterboard or wallboard with metal frames. Normal electrical wiring, central heating pipes, office furniture and desktop computer equipment have no significant effect. The signal shadowing effect of stairways, lift shafts shielded rooms etc. should be considered.

The following items may well cause shadowing of the radio signal:
- Thick walls, especially cavity walls and reinforced concrete walls.
- Windows or glass in doors with steel wire reinforcement or metallic reflection film.
- Steel doors, partitions or walls.
- Fire resistant doors.
- A wall of steel cabinets, large computer equipment or machinery.
- Thick concrete floors.

During the site survey, be aware of the following:

- Choose a corridor or other large open space rather than an enclosed area so that the radio signal passes through as few walls as possible to reach as large an area as possible.

- Radio reception inside a vehicle may be poor unless very close to the RFP.

- The RFP should be placed high enough to be unaffected by surrounding objects. For example, an RFP in a car park needs to be placed higher than a vehicle that may be parked next to it.

- RPFs must be placed at least 1 metre apart from each other!

- The presence of another un-synchronised DECT System or similar system in adjacent buildings may cause interference.

- An RFP or a PP might interfere with sensitive laboratory equipment, medical equipment etc. (E.g. do not install an RFP in an operating-room in a Hospital!)

- Check that no significant interference from un-suppressed engines or electric motors has been experienced.

6.5. CUSTOMER PREPARATION

If a customer contact person is assigned, this gives the opportunity to collect additional information as required, set times and dates, discuss accessibility (access to certain areas may be restricted at certain times or altogether, some areas may be locked), and give the customer an idea of what to expect i.e. how a survey is done. It may be a good idea to have other employees on the customer site informed that a 'stranger' with a handset might be seen wandering around in their workspace.

7. EXECUTION

7.1. GENERAL

Site Survey execution should be done with at least one, preferably two persons.
There are three main criteria for the cell boundary:

- Voice quality;
- Signal strength
- Frame errors (if there are audible clicks in the voice connection).

To check the voice quality, a voice connection should be set-up between two persons. One person should stay close to the Base Station, the other one should move away to determine the cell boundary. This gives a good impression on the radio signal behaviour close to the base station and at the cell boundary.
The person determining the cell boundary checks on voice quality, signal strength and frame errors. He/she can do this by means of a single handset with headset, or one handset for listening and another handset for checking the signal strength.

In figure 5, the functions of the persons are depicted.

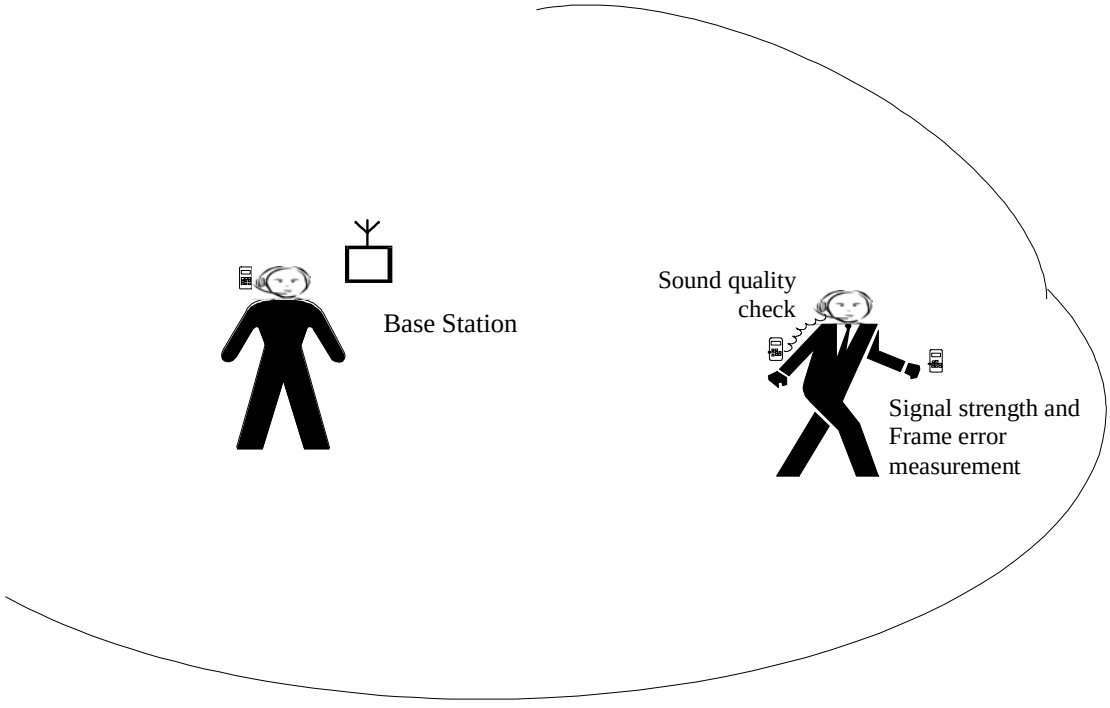


Figure 5. Site Survey / Deployment in Action

Note: *Keep the handset in vertical position when doing a Site Survey. If in horizontal position, the reading is not correct !*

If you are with two persons, one should stay at the Base Station position and the other one should determine the cell boundary.

7.2. SETTING UP THE EQUIPMENT

Before starting the execution make sure that the handset(s) for the site survey are subscribed to the Survey Base Station. Now execute the following steps:

1. Make sure that the Survey Base Station and handset batteries are fully charged.

2. Make sure that the two omni directional antennas (black) are installed on the Base Station.

3. Mount the Plastic board (with Base Station and Battery Cabinet on it) to the Tripod.

4. If not yet done, connect the Battery Cabinet to the Base Station. Switch the Base Station on using the switch on the Battery Cabinet and check that the LED is steady on (after a while). This means the Base Station is up and running.

5. Set-up a Survey Base Station at a planned RFP position.
   Choose the locations for the Survey Base Station as close as possible to the locations where the RFPs can be actually installed. Look also for suitable cable ducts.

6. Adjust the tripod to put the Survey Base Station near the ceiling (for an office environment) or as high up as possible in a large area (such as a warehouse). If the Survey Base Station is outside then put it at a height of about 5 m.

7. Make sure that the C944 handsets are switched on and “on-hook”.

8. Press: `<menu> R***76#` on each C944 handset that you want to involve in the Site Survey.

9. Now you are in the service menu. On each handset that you want to involve in the site survey, scroll to `“Site Survey”` and press the soft key `<OK>`.
   The following is displayed (for explanation of the fields, see step 12.

```
RFPI  100F062501
FE PP:   FP:
-dBm 60
RPN  01
Options      Ø
```

10. Go off hook and dial the one digit extension number of one of the other C944 handsets that you use in the Site Survey.
    Or if you are doing the site survey on your own, dial “0” and you will hear dial tone continuously, which can be used to check the sound quality. You can skip step 11 if you are doing the site survey on your own.

11. If you dialled another extension, the dialled extension starts ringing. Go off hook. Now you have a voice connection which can be used to check the sound quality.

12. In the C944 display you will see the following important fields displayed:

    - **RFPI:**
      This is the unique number (PARI) of your Base Station. By means of this number you can see that the handset is “locked” to (looks at) your Base Station and not to another DECT system, if operational in the environment. The indication in your display should be identical to the example above.

    - **FE**
      Here you see the Frame Errors. Frame errors may occur from time to time. Each 1 seconds the accumulative value over the 1 seconds is displayed! Note that you see the frame errors received at the FP (Base Station) and the frame errors received at the PP (handset) are displayed.

    - **RSSI**
      The RSSI (Received Signal Strength Indication) is the actual signal strength of the signal received from the Base Station. It will never be better than about –40dB, because the RSSI value is internally limited in the C944 to this value.

13. For finding the cell boundaries you must check the following three parameters:

    - ***Voice Quality***
      Check the speech quality. This can be done in the following ways:
    - Using the voice connection from the C944 to the C944 handset as mentioned in step 12.
      Now you have a voice connection and you can check the speech quality.
      If you are all on your own, go off hook (if you are already off hook, go on hook first) and dial a “0”. You will hear a 425 Hz tone. Use this tone for sound quality check.

    Note: *The sound should be without “clicks” or other interruptions.*
    If there are sync errors and clicks while you are moving, it may indicate that there are a lot of reflections in the area. Reflections are caused by metal walls, etc. Check whether there is a lot of metal in the walls. In some exceptional

cases, DECT cannot be installed in environments with a lot of metal due to excessive reflections against the walls and ceiling.

- ***Signal Strength***
  Check the RSSI reading in the display.
  The cell boundary is reached when the RSSI value is –72 dBm.
  You are allowed to add -2 to that value, so that the value for the cell boundary is higher and the cell boundary will be wider. (E.g. instead of –72, you might go to –74). Note that the sound quality will be a bit worse, but in normal circumstances this is not noticeable.

- ***Frame errors****.*
  Frame errors may occur in DECT, but not to many.
  The number of frame errors per reading may not be more than 4!
  If the number of frame errors is more than 4, normally it is an indication that there are many reflections, which will result in clicks in the sound. Check the sound quality to find out if this is still acceptable or not.

(The survey handset should be held at about 1,2m above the ground when making measurements.)

Note: *Keep the handset in vertical position when doing a Site Survey. If in horizontal position, the reading is not correct !*

14. Note the results on the relevant maps. Take care that the relation between the Survey Base Station position and the corresponding cell is clearly defined, using the numbering scheme given in chapter 8.
    Note that for a multi-story building it must be clear on what floor the Survey Base Station was positioned and that the result may be several cell contours on different floors. In this case in particular a careful record must be kept for later unambiguous analysis.

    The position of an elevator shaft, lorry or other large movable object may also effect radio reception. If possible arrange for the object to be moved and check the cell boundary again.

15. Repeat steps 1...10 for the remaining planned RFP positions.
    Make sure that, when applicable, positions are also measured that may be relevant for alternative configurations.
    Cells should be at least adjacent to one another; overlap is not required except where traffic density requires this.

16. It may, at this stage, be necessary to move some of the planned RFP positions or add new RFP positions to eliminate shadows or optimise cell size. If so, it may also be

necessary to do additional measurements to check that the new RFP positions do not create other problems.

17. Choose the RFP positions required. This may need to be done in consultation with a customer engineer.
    In choosing RFP positions, the required cabling to the DECT System should be considered. RFP positions must be defined such that later installation problems are minimised, i.e. the RFP can be physically attached at the planned position and the wiring can be laid with the minimum of effort.

    Record details of the planned RFP positions, including wiring considerations, special installation instructions etc.
    Depending on the materials (no metal in it, thin materials etc.) of the ceiling, an RFP can be concealed above a suspended ceiling, provided it is not of a metal construction. An RFP can be installed within a metre or two of the planned position without adversely affecting radio reception.

18. Execute the above step 15 till 20 for each individual cell, to determine the cell boundary.

19. To leave the Site Survey mode on the handset: Go on hook.
    Then press the following: `<menu> R***76#`
    Then press the following: `<esc> <esc>`

7.3. HINTS and TIPS on “HOW TO SURVEY”

7.3.1. General

During the execution of a Site Survey, you must make sure that you know all the details about the required coverage, e.g.

- If a car park must be covered, must it be covered for an empty car park, full car park, only outside cars or also inside cars. If also inside the cars, then must this be measured with the doors and windows of the cars closed or open etc.

- Must toilets be covered as well, and how good must the voice quality be in a toilet with the doors closed.

- Are basements to be covered as well, if so, how good must the coverage be.

It is very important that these details are written down on paper, and that the customer agrees with that.

Note: *If you do the site survey, make sure that all doors are closed. Close all fire doors as well.*

7.3.2. How to Survey A Single Floor

The following is the basic procedure to determine the cell centre and the cell boundaries. In figure 6, an example of a single floor is depicted.

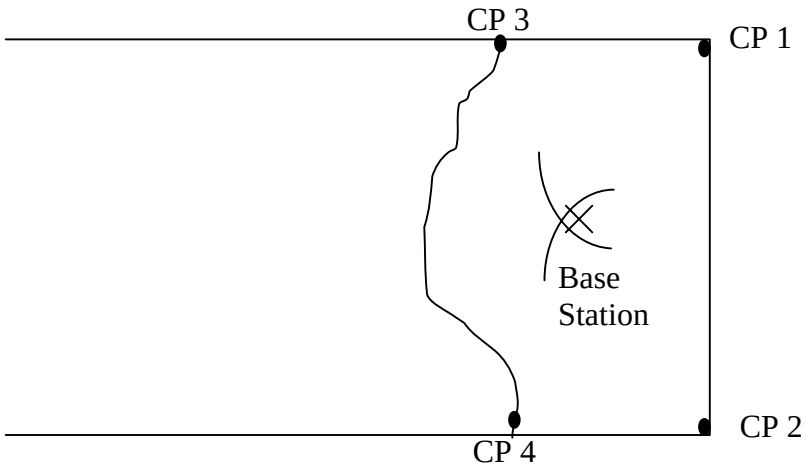


Figure 6. Example of a Single Floor Coverage.

The procedure is as follows:

1. Determine the outer points in the building. These points are the so-called “Critical Points”. (In figure 6, these are CP1 and CP2).

2. Place the Survey Base Station on CP 1 on a height of approximately 1.2 meters. Walk away from the Base Station at an angle of roughly 45 degrees. Write down where the cell boundary is.

3. Place the Survey Base Station on CP2 on a height of approximately 1.2. Walk away from the Base Station at an angle of roughly 45 degrees. Write down where the cell boundary is.

4. The best location for the cell centre is where the critical point contours cross.

5. Position the Site Survey Base Station on the CP1/CP2 cross, and raise it to the height where the base station must be fitted.

6. Now check the cell boundary. Check that the RSSI value at CP1 and CP2 are sufficient. Draw the cell on the map.

7. Determine new Critical Points (CP 3 and CP 4 in figure 6) at the external walls and repeat the procedure from step 1 onwards.

7.3.3. How to Survey a Wider Single Floor

If the width of the area is more (see figure 7) than the area that is depicted in figure 6, then the following procedure must be executed:

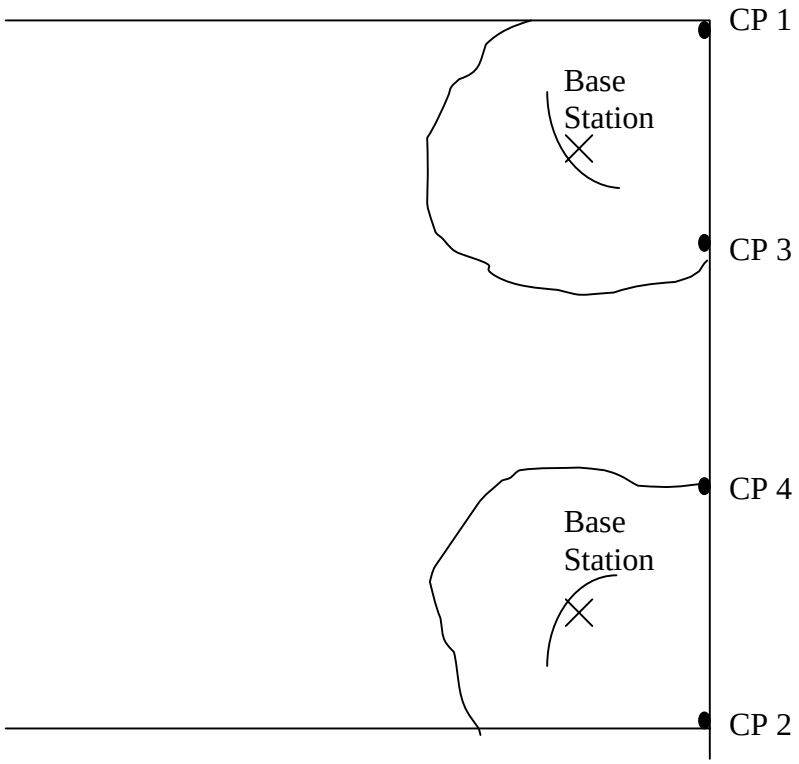


Figure 7. Example of a Single Floor Coverage.

The procedure is as follows:

1. Determine the outer points in the building (see figure 7). These points are the so-called “Critical Points”. (in figure 7, these are CP1 and CP2).

2. Place the Survey Base Station on CP 1 on a height of approximately 1.2 meters. Walk away from the Base Station at an angle of roughly 45 degrees. Write down where the cell boundary is.

3. Place the Survey Base Station on CP2 on a height of approximately 1.2. Walk away from the Base Station at an angle of roughly 45 degrees. Write down where the cell boundary is.

4. Now you probably found out that the contours of CP1 and CP2 do not overlap.
   Move the Site Survey Base Station to a point on the contour line of CP1. This point is considered as being the cell centre.
   Measure the cell boundary for cell 1.

5. Move the Site Survey Base Station to a point on the contour line of CP2. This point is considered as being the cell centre.
   Measure the cell boundary for cell 2.

6. Where the cells cross the outer walls of the building, two new Critical Points (CP3 and CP4) are defined.

7. Use the procedure “How to Survey A Single Floor” in section 7.3.2. to determine the cell centre of the next cell

7.3.4. How to Survey a Multi Floor Area

There are two approaches in surveying a multi story building:

1. Survey each floor as individual parts. The radiation between floors is not used for coverage, but is only used to allow higher traffic density.
   In this approach you are always sure that the coverage on each floor is reliable.

2. Survey one floor and write down the cell boundaries on the higher and lower floor as well.
   Knowing the cells on the higher and lower floors, you can survey these floors, to determine where additional Base Stations must be placed.

   Note: *Radiation through floors depends highly on the construction materials of the floors. These materials are normally reinforced concrete, which gives a lot of signal loss. Also, in ceilings there are most likely cable ducts, which produces holes in the coverage on the higher and lower floors. Therefore, coverage via floors is not always reliable!!!!!*

7.4. TRAFFIC DENSITY CALCULATIONS

Traffic density calculations must be done to make sure that you have a low blocking probability in the system.

For traffic calculations you must know:

- the number of users,
- the type of users.

There are three user types distinguished:

TRAFFIC	APPLICATION ARE	ERLANG/USER
Low	normal offices	0,05
Average	Exec-secretary groups	0,1– 0,15
High traffic	help desks, Tele-services	0,2 – 0,25

Table 2. Three user types.

Table 3 shows an overview of the maximum Erlang values for the number of available RFP channels. Note that in traditional DECT, there are two types of RFPs: 6 channel and 12 channel. In IP DECT the number of channels can be 2, 4, 6, 8, 10, 11 or 12 per RFP. The Erlang values in table 3 are valid for a blocking probability of 0.5%.

CHANNELS AVAILABLE ON RFP	ERLANG VALUE
2	0,1
4	0,7
6	1,6
8	2,7
10	3,95
11	4,6
12	5,25

Table 3. Erlang value for Radio Channels with blocking probability of 0.5%.

Now you can calculate the traffic density as follows:

$$\text{Nbr of RFPs} = \frac{\text{(nbr of users) x Erlang/user}}{\text{Max. load per RFP}}$$

Example:

In one cell there will be 20 users: 5 average traffic and 15 low traffic.
The load will be: (5 x 0,15) + (15 x 0,05) = 1,5 Erlang

Conclusion: One 6 channel RFP will be sufficient for this cell.

8. REPORTING RESULTS

It is important to make a comprehensive survey report that records test results and provides useful information for the engineer who is to actually install the equipment. The following information should be included in the survey report (see chapter 10 for a possible template):

- A description of the site, explaining which buildings and grounds are to be included in the report. A description of the topography of outdoor areas may be useful.
- A specification of the construction of the buildings and construction materials.
- Determine the customer requirements for:
  - the number of handsets
  - required coverage
  - performance requirements (traffic density, grade of service etc.)
- The location of the DECT System.
- Cabling details. Include a specification of cables already present on the site and a list of new cabling required. Include the distance between RFP and the DECT System for existing and new cabling.
- Copies of the maps of the site with the positions of Survey Base Stations and the cell boundaries.
  - Different cell boundaries can be marked with different patterns to avoid confusion i.e. dotted, dashed, dot dash etc. Do not use colours, as these may be lost when photocopying.
  - Use the following **numbering conventions**:

    xCyy refers to the identity of the cell, where:
    x: is the level at which the measurement was made.
    (-1 is basement, 0 is ground floor, 1 is 1st floor etc.)
    yy: is the RFP position number which was being measured.

    Example of labelling floor plans:
    0C1 = Ground floor Cell 1
    0C2 = Ground floor Cell 2
    1C3 = First floor Cell 3
    2C4 = Second floor Cell 4
    -1C5 = Basement/cellar Cell 5

- A list of possible configurations will help the customer to decide exactly what is required.
- A specification of where RFPs should be placed. This can be marked on the survey map, but additional information such as height and fixing instructions should be included where appropriate.
- A specification of the areas that will be covered by the RFPs and areas that may cause problems. This can be useful when testing the system.

The theoretical maximum number of overlapping cells is 10 for 12 channel RFPs and 20 for 6 channel RFPs, if all timeslots and frequencies are used. If not all timeslots and frequencies are used, this value is higher. However this is unlikely to be reached in practical situations.

For a large site where a thorough survey has been impossible, it may be prudent to add 10% extra RFPs to the product offer to allow for unforeseen problem areas.

An example of a survey report is given in appendix A.

9. CHECKLIST FOR SURVEY DATA

- Building characteristics (list for each building)
  - Building identification (refer to maps if available)
  - Type of use
  - Dimensions (refer to maps if available)
  - Number of floors (refer to maps if available)
  - Height per floor
  - Partitioning per floor (refer to floor plans if available)
  - Construction details (type of construction and materials used)

- Radio coverage requirements
  List areas where radio coverage is not absolutely required or are to be excluded from radio coverage.

- Radio coverage
  List areas where radio coverage is not feasible or requires specific RFPs.

- Objects inside buildings
  Details of furniture, cupboards, machinery, etc. in the interior of buildings per floor.

- DECT System
  Position of the DECT System.

- Connections between DECT System and RFP(s)
  For each RFP the following details of its connection to a DECT System are required:
  - length of cable between DECT System and RFP.
  - whether existing cabling is present that might be used and if so, the type of cabling (twisted pairs, star quad, wire diameter, etc.), presence of free pairs, etc.
  - cabling layout (risers, horizontal wiring, distribution frames) and whether existing cabling can be used or new wiring is required.

10. DECT SURVEY REPORT TEMPLATE

Number : .....

From : .....
[Engineer doing the survey]

To : .....
[Sales Manager]

Copy : .....

Date : ..... /..... /.....

1. Site : .....
   [Full address of site]

2. Execution of survey
   Engineers : .....
   [Names and addresses of engineers who executed the survey]

   Customer engineer(s) : .....
   [Name and address of customer engineer(s)]

   Date :
   [Date of survey]

3. Outline description of site
   [Short description of site (dimensions, environment, number/ type of buildings, etc.]

4. Number of handsets and expected traffic
   [Description of expected traffic and indication of above or below average traffic areas]

5. Test results.
   [This should include the site maps and any additional information that may be useful]

6. Connections DECT System - RFPs

6.1 Location of DECT System.
   [Indicate the location of the DECT System]

6.2 Existing cabling

[Indicate what cabling is available and how it is distributed across the site]

6.3 Connection of RFPs and cable lengths

[List for planned RFP approximate cable length, and whether existing wiring can be used or new cabling is required]

6.4 RFP installation

[For each RFP indicate exactly where it can be installed, e.g. "in the corridor against the wall of room 32, 2.5 m high") and whether customer restrictions apply as to where RFPs may be installed]

7. Possible configurations

[List alternative configurations regarding the deployment of RFPs. Refer to coverage maps and detail areas where coverage cannot be guaranteed]

A. SURVEY EXAMPLE

Number : MS/001

From : John Johnson, Business Communication, U.S.

To : J. R. Hartley, Business Communication, U.S.

Copy : B.J. Mcleod, Engineering Manager, Save Stores PLC
DECT Marketing, Business Communication,
P.O. Box 1234567, 1234JD Hilversum, The Netherlands.

Date : 01/05/96

1. Site :
   Save Stores,
   105 Washinton Road,
   Baltimore
   United States

2. Execution of survey

Engineers :	John Johnson,	Business Communication, U.S.
	Dave Nice	Business Communication, U.S.
Customer engineer(s) :	H. King	Save Stores PLC,Baltimore
Date :	12th - 15th April 1998	

3. Outline description of site
   This survey is for a supermarket approximately 70m x 90m surrounded by car parks. A petrol station at the side of the road also belongs to the site. See the site plan on figure X.1.

   Construction of the building(s)
   The main building is approximately 6m high. All areas are at ground level except for some plant installations on the first floor of the warehouse.
   The building has a steel frame construction. The east and west sides of the building are constructed with brick walls to a height of 3m, above this height the walls are made of steel panels. The south side (front) of the building is mostly glass up to a height of 3,5m above this, brick. The north side (back) of the building is brick, with windows 2,5m high starting at 1m above the ground. The roof is steel.
   Lowered ceilings in the sales area are made of aluminium panels suspended 5m

above the ground. Lowered ceilings in the staff area are also aluminium panels suspended 3m above the ground.

The petrol station consists of a single brick building and a covered petrol pump area.

4. Number of handsets and expected traffic
The maximum number of portable handsets required is 12, but the number is expected to rise to 25 in the future.

5. Test results:
Refer to the site map, figure A.1. The RFP and cells are numbered as follows:

xRyy refers to the identity of the RFP, where :
x is the level (-1 is basement, 0 is ground floor, 1 is 1st floor etc.)
yy is the RFP position number. This number should be unique.
xCyy refers to the identity of the cell, where :
x is the level at which the measurement was made (-1 is basement, 0 is ground floor, 1 is 1st floor etc.)
yy is the RFP position number which was being measured.

6. Connections DCCs - RFPs

6.1 Location of the DECT System
The DECT System is located in the staff entrance hall.
One DCC board is sufficient to connect four RFPs.

6.2 Existing cabling
All cabling is 0,5 mm unshielded twisted pair. Cables are distributed in cable ducts throughout the supermarket in the floor and above the lowered ceiling. There is a cable to the petrol station building with spare pairs.
Cable runs are expected to be less than 200 m using existing spare pairs.

6.3 Connection of RFPs and cable lengths
- RFP 0R02 cable length : 35m using existing cables.
- RFP 0R03 cable length : 27m using existing cables.
- RFP 0R04 cable length : 150m using existing cables.
- RFP 0R05 cable length : 15m using existing cables.

6.4 RFP installation
The RFPs are positioned as follows :
- RFP 0R02 is fixed to the wall inside the sales area at approximately 1m under the lowered ceiling.
- RFP 0R03 is fixed to the outside wall at a height of approximately 3m.

- RFP 0R04 is fixed at a convenient location at the petrol station at a height of 2,5m to 3m.
- RFP 0R05 is fixed at a convenient location in the staff entrance hall.

7. Possible configurations:

Configuration 1

The minimum configuration would have RFPs at positions 0R02 and 0R03 plus an RFP at position 0R04 to cover the petrol station building.

The cell coverage would be as follows :

- RFP 0R02 covers the sales area, the cold store, staff area and part of the offices.
- RFP 0R03 covers the offices, most of the staff area and the north of the building.
- RFP 0R04 all the outside areas to the south and east of the building, including the loading bay and staff car park.

The RFP tested at position 0R01 is not required.

Note: *There is no redundancy; failure of an RFP would result in a large area being out of range of any other RFP.*

Configuration 2

This configuration is the same as configuration 1, but with the addition of an RFP at location 0R05. This covers most of the offices and staff area. This will give some redundancy in the event of RFP 0R02 or 0R03 failing.

This configuration requires five RFPS.

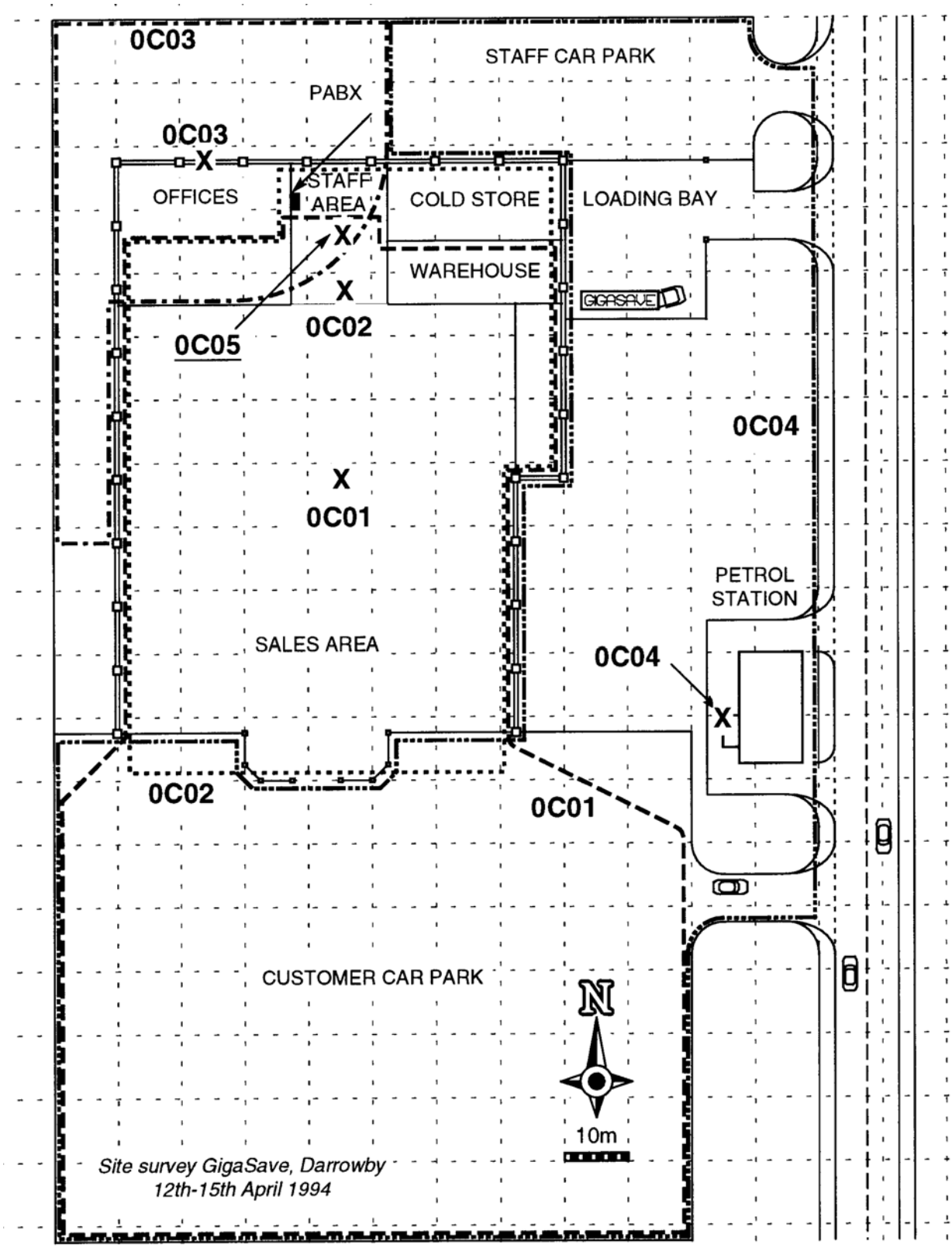


Figure A.1. Example Site Plan.

B. ESTIMATION OF THE NUMBER OF RFPs

B.1. GENERAL

A rough estimation of the number of RFPs, can be useful for an initial negotiation about a new DECT system.

Note: *This estimation method is based on "average sites" and is not applicable for any site. The result is only an indication and must not be used for the final product offer. A Site Survey is always required to determine the exact number of RFPs.*
No rights can be obtained from these estimation tables.

This estimation method is based on tables. These tables are based on the following assumptions:

- No radiation between floors.
- Average building types.
- Average call density.

There are two tables for two types of estimations:

- **Estimation for coverage of typical indoor environments**.
  This gives information about the number of RFPs required for typical indoor environments. The information is given in table B.1.

- **Estimation for coverage in typical open space (indoor/outdoor)**
  In table B.1 you find information about coverage in an open space environment.

A complex site may be more easily split into areas which are estimated separately and the resulting number of RFPs totalled together.
One example of this would be a site with an office building, an open warehouse and a car park, using table B.1 for the offices and table B.2 for the warehouse and the car park.

To use the estimation tables in this chapter, execute the following procedure:

1. Collect site info from the customer.

2. Find out the length(s) and the width(s) of the area(s) to be covered.
   Round up these dimensions to the nearest multiple of 20 metres.

3. Find out if the single area(s) of the site fall(s) within the scheme for "Estimation for coverage in typical Open Space" and calculate the number of RFPs for this/these area(s).

4. The remaining areas are most likely "Typical Indoor Environments". If so, calculate the number of RFPs according to the table for "Estimation for coverage of typical Indoor Environments".
   If there are parts of the site that do not fit into the specification "Typical Indoor" or "Typical Outdoor" then, you cannot use the estimation tables at all!!

5. Find out how many handsets will be purchased for use on the system

6. Remember that the customer can always add more handsets in the future once the basic infrastructure (RFPs and common equipment) is in place.

B.2. ESTIMATION FOR COVERAGE OF TYPICAL INDOOR ENVIRONMENTS

Table B.1. gives information about the number of RFPs, that are required for estimation the coverage of typical indoor environments. Using the table, bear in mind the following remarks:

- Using the length and width of each area, rounded up to multiples of 20 metres, look-up the number of RFPs from the table B.1.
- This table have been calculated on the basis that each RFPs provides 1200 sq.m. coverage.
- The resulting estimate is used for budgetary purposes to guide the customer on whether to proceed with a site survey.
- A firm price can only be quoted after a Site Survey.
- A complex site may be more easily split into areas which are estimated separately and the resulting number of RFPs totalled together.
  One example of this would be a site with an office building, an open warehouse and a car park, using table B.1 for the offices and table B.2 for the warehouse and the car park.

Dimensions (m)	**20**	**40**	**60**	**80**	**100**	**120**	**140**	**160**	**180**	**200**	**220**	**240**	**260**	**280**
20	1	1	2	2	3	3	4	4	5	5	6	6	7	7
40	1	2	2	3	4	4	5	6	6	7	8	8	9	10
60	2	2	3	4	5	6	7	8	9	10	11	12	13	14
80	2	3	4	6	7	8	10	11	12	14	15	16	18	19
100	3	4	5	7	9	10	12	14	15	17	19	20	22	24
120	3	4	6	8	10	12	14	16	18	20	22	24	26	28
140	4	5	7	10	12	14	17	19	21	24	26	28	31	33
160	4	6	8	11	14	16	19	22	24	27	30	32		
180	5	6	9	12	15	18	21	24	27	30	33			
200	5	7	10	14	17	20	24	27	30	34				
220	6	8	11	15	19	22	26	30	33					
240	6	8	12	16	20	24	28	32						
260	7	9	13	18	22	26	31							
280	7	10	14	19	24	28	33							

Table B.1: Estimated number of required RFPs for coverage of typical indoor environments.

B.3. ESTIMATION FOR COVERAGE IN TYPICAL OPEN SPACE

Table B.2. gives information about the number of RFPs, that are required for estimation for coverage in typical open space (indoor/outdoor). Using the table, bear in mind the following remarks:

- Using the length and width of each area, rounded up to multiples of 20 metres, look-up the number of RFPs from the table B.1.
- This table have been calculated on the basis that each RFP provides 2400 sq.m. coverage
- The resulting estimate is used for budgetary purposes ONLY, to guide the customer on whether to proceed with a site survey.
- A firm price can only be quoted after a Site Survey.

Dimensions (m)	**20**	**40**	**60**	**80**	**100**	**120**	**140**	**160**	**180**	**200**	**220**	**240**	**260**	**280**
20	1	1	1	1	2	2	2	2	3	3	3	3	4	4
40	1	1	1	2	2	2	3	3	3	4	4	4	5	5
60	1	1	2	2	3	3	4	4	5	5	6	6	7	7
80	1	2	2	3	4	4	5	6	6	7	8	8	9	10
100	2	2	3	4	5	5	6	7	8	9	10	10	11	12
120	2	2	3	4	5	6	7	8	9	10	11	12	13	14
140	2	3	4	5	6	7	9	10	11	12	13	14	16	17
160	2	3	4	6	7	8	10	11	12	14	15	16	18	19
180	3	3	5	6	8	9	11	12	14	15	17	18	20	21
200	3	4	5	7	9	10	12	14	15	17	19	20	22	24
220	3	4	6	8	10	11	13	15	17	19	21	22	24	26
240	3	4	6	8	10	12	14	16	18	20	22	24	26	28
260	4	5	7	9	11	13	16	18	20	22	24	26	29	31
280	4	5	7	10	12	14	17	19	21	24	26	28	31	33

Table B.2. Estimated number of required RFPs for coverage of typical open space (indoors and outdoors)

C. SUBSCRIBING THE SURVEY HANDSETS

Caution: *- Subscribing/registering the handsets, is normally never necessary! Only if the handsets are not subscribed anymore due to a human mistake (very exceptional) then you must subscribe the handset(s) again.*

- Do not replace a handset. The handsets in your Site Survey Kit are carefully selected to assure an accurate signal strength reading. If a handset is broken or malfunctioning, you must send the Site Survey Kit for repair.

C.1. GENERAL

The Site Survey handsets are already subscribed (registered) to the Base Station, and therefore ready for use.
The extension numbers of the handsets are 1, 2 and 3.

In case the Handset is de-subscribed, (e.g. as result of a human mistake) you can subscribe the handset again. The new handset must be subscribed to the next number in sequence, so 4 (or 5, etc.).

C.2. SUBSCRIPTION

Note: *Normally you never need to subscribe a handset. Only in case the handset was de-subscribed as result of a human mistake, you need to subscribe a handset to the Base Station. To subscribe, execute the procedure below.*

A C944 handset can be subscribed to a maximum of 10 DECT systems. When the handset is not yet subscribed to a system at all, the display is showing ”No subscription”. In the following procedure you will subscribe the handset to the Site Survey Base Station. It is assumed that the handset is not yet subscribed to any other DECT system.

To subscribe the deployment handset to a system, execute the following procedure:

1. Check the Base Station is up and running and check that you are within reach of the base station.

2. Press the soft key: `<menu>`. You are now in the handset menu.

3. Scroll to `“System”` and press the soft key `<OK>`

4. Scroll `to “Subscriptions”` and press the soft key `<OK>`

5. Press the soft key <New>.
   (Or if there already a subscription in the handset, press <Options>.)
   "New" is displayed.
   Press the softkey <OK>.

6. The IPEI is displayed. Press <OK>.

7. The handset asks for entering the PARK. The PARK is derived from the PARI and is the same in all PBC Site Survey Kits.
   Enter: 31100170142241
   Press the soft key <OK>.

8. The handset asks you to enter the PIN code. The PIN code to enter depends on the extension number of the handset, see next table:

Extension number	PIN Code
1	1111
2	2222
3	3333
4	4444
5	5555
6	6666
7	7777
8	8888
9	9999

   Enter the PIN code for the extension number that you want to subscribe, and press the soft key <OK>.

9. The handset asks for entering the System Name. Enter the name of your Site Survey Kit. (This can be any given name.)
   Press the soft key <OK>.

10. The handset asks for entering the Local Phone Number. Enter the phone number associated with the PIN code that you have entered.
    Press the soft key <OK>.

11. Now the "Subscriptions" list is displayed. You should see the system name that you have entered in this list. Using the scroll buttons, select the your system name and press the soft key <Options>.

12. Using the scroll buttons, select "Select" from the menu and press the soft key <OK>.your system name and press the soft key <Options>.

13. Check that there is a mark in front of your system name. Press the soft key <Esc>.

14. Now your handset is subscribed. But be careful: leave the system untouched for two minutes after finishing the subscription procedure. (Do not switch off the handset or the Base Station in this two minute period!)

15. To test your new subscription, try to call another handset.

C.3. SELECT A SUBSCRIPTION

Note: *This function is only used when the handset is subscribed to more than one DECT system, e.g. for doing a "post survey" on the installed and operational system. Note that you must not forget to remove the added subscription for the post survey on the operational system after the post survey is finished.*

The C944 Site Survey handset can be subscribed to up to 10 systems. The Select subscription function is used to switch between these systems.

To select a subscription (DECT system) in the handset, execute the following procedure:

1. Press the soft key: <menu>. You are now in the handset menu.

2. Scroll to "System" and press the soft key <OK>

3. Scroll to "Subscriptions" and press the soft key <OK>.

4. Now the "Subscriptions" list is displayed. Using the scroll buttons, select the system name of the subscription that you want to select.

5. Press the soft key <Options>. Using the scroll buttons,, scroll to "Select". Press the soft key <OK>.

6. Now the handset will use the subscription that you have selected, and therefore will listen to the DECT System that you have selected.

D. UPGRADING BASE STATION SOFTWARE

Note: *Upgrading the Base Station software is normally never needed. This information is given on basis of your own risk. No legal rights can be obtained from the information in this Appendix. The manufacturer of this Kit is not liable for any malfunctioning of the Site Survey Kit, after using this procedure.*

Note: *The procedure below assumes a good level of IP technology skills. Do not execute the procedure of you do not have sufficient IP network knowledge.*

Warning: *Do not execute this procedure in an Ethernet network with an IP DECT system connected to it.*

Procedure:

1. Make sure that you have a PC with a DHCP Server and a TFTP Server installed.

2. Make sure that the DHCP server issues:
   - An IP address. (can be any given IP address)
     Subnet mask (preferably the default subnet mask for the IP address)
   - Default Gateway address (can be any given IP address)
   - Next boot server IP address. This is the TFTP servers IP address.

3. Make sure that the IP network settings in your PC are correct for using the DHCP server with the settings above.

4. Make sure that you have the new software available in the TFTP directory.

5. Create a text file called `dapcfg.txt` using an ASCII text editor of your choice (e.g. Notepad). The contents of the text file should be one single line with the name of the firmware file, followed by a <CR>, <LF>.. Put this text file in the TFTP directory.

6. Make sure that the DHCP Server and the TFTP Server are running

7. Connect the Base Station to a PC using an Ethernet connection with PoE (IEEE 802.3af). When the Base Station powers up, it will contact the DHCP server and subsequently the TFTP server.

8. Now the software download will start automatically. This can take a few minutes. Check in the logging of the TFTP Server that configuration file `dapcfg.txt` was uploaded to the Base station and that the software file was uploaded to the Base Station.

9. After the uploading the software to the Base Station, the Base Station should become operational again. (Yellow LED steady on.)

10. Disconnect the Ethernet Cable

11. Connect the Base Station to the Battery Cabinet.

12. The Base Station should become operational (yellow LED steady on)

13. Now your Site Survey Kit should be up and running again. Try to make a call between the handsets.