TITLE	**Internal Product Specification**
MODEL	**Sony SPP-900 - Analog 900MHz Cordless Telephone**

Internal Product Specification for the
Sony SPP-900
Analog 900MHz Cordless Telephone

Revision History:

Revision	Description	Page	Effective Date
Draft	Draft Release.	All	Aug 10/98
0	Incoporate comments from draft release	All	Aug 28/98
1	Delete POTS mode and spare battery requirements. Delete one base LED. Add further details on keypad backlight. Modify channel plan. Add/change specification data. Change duration of PAGE tone.	4-6,21,22 10 9,14 26-28 23-29 10,15-17	Oct 13/98
2	Update model number Revise specification data Further refinements to channel plan	All 23-24 26-28	Nov 7/98
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TITLE	Internal Product Specification
MODEL	Sony SPP-900 - Analog 900MHz Cordless Telephone

Contents

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1 Overview

This specification defines the functional and electrical performance requirements of the Sony SPP-900 900MHz analog cordless telephone. The SPP-900 is intended to be compatible with most type of central office equipment in use in Canada, the United States and South America.

1.1 General Description

The Sony SPP-900 is a basic analog cordless telephone. It is based on the design of the latest generation of the VTECH analog cordless telephone – the ADL MK2B. The main changes from the ADL MK2B include the mechanical chassis, backlit keypad, minor keypad layout changes, 30-channel operation, visual indication of low-battery condition, and factory-programmable line-flash timing parameter.

1.2 Regulatory Standards

As a requirement for sale in the United States, the SPP-900 will comply with the electrical specifications defined in the following documents:

- FCC Part 15 Radio Emissions Requirements
- FCC Part 68 Telephone Line Interface Requirements
- UL 1459 Safety Requirements

As a requirement for sale in Canada, the SPP-900 will comply with the electrical specifications defined in the following documents:

- IC RSS-210 Radio Emissions Requirements
- IC CS-03 Telephone Line Interface Requirements
- CSA 225 Safety Requirements

In addition to the above mandatory regulations, the recommendations provided in EIA 470-B will be used as a guideline.

1.3 Preliminary Feature List

The SPP-900 will offer many of the same features as the VTECH ADL MK2B, with only a few unique features to this Sony model.

1.3.1 Basic Features

The following basic features should be considered as standard features for a quality 900MHz cordless phone:

- 30 channel, 900 MHz operation
- Automatic search for available channel (when handset on cradle)
- Manual channel change when handset in PHONE mode
- 16 bit digital security code
- Pulse, DTMF, and temporary DTMF dialling
- 10 number speed dial memory; each number can be up to 16 digits
- Redial memory (16 digits)
- Low battery detection and warning indicator
- Battery charge interval: 6 days in STANDBY mode, 7 hours in PHONE mode
- One-way page function from base unit to handset
- Hearing aid compatible receiver

- Three-level receiver volume control on handset

1.3.2 Unique Features

The following features will be offered on the SPP-900, but are not considered as standard for this type of product. These features help define a marketing advantage for this product.

- Non-volatile storage of speed dial numbers
- Non-volatile storage of security code at base unit protects against power failure
- In-the-dark answering of incoming calls
- Backlit keypad
- Compact 'connectorless' removable battery pack
- Compatibility with remote charger system

1.3.3 Features Not Provided

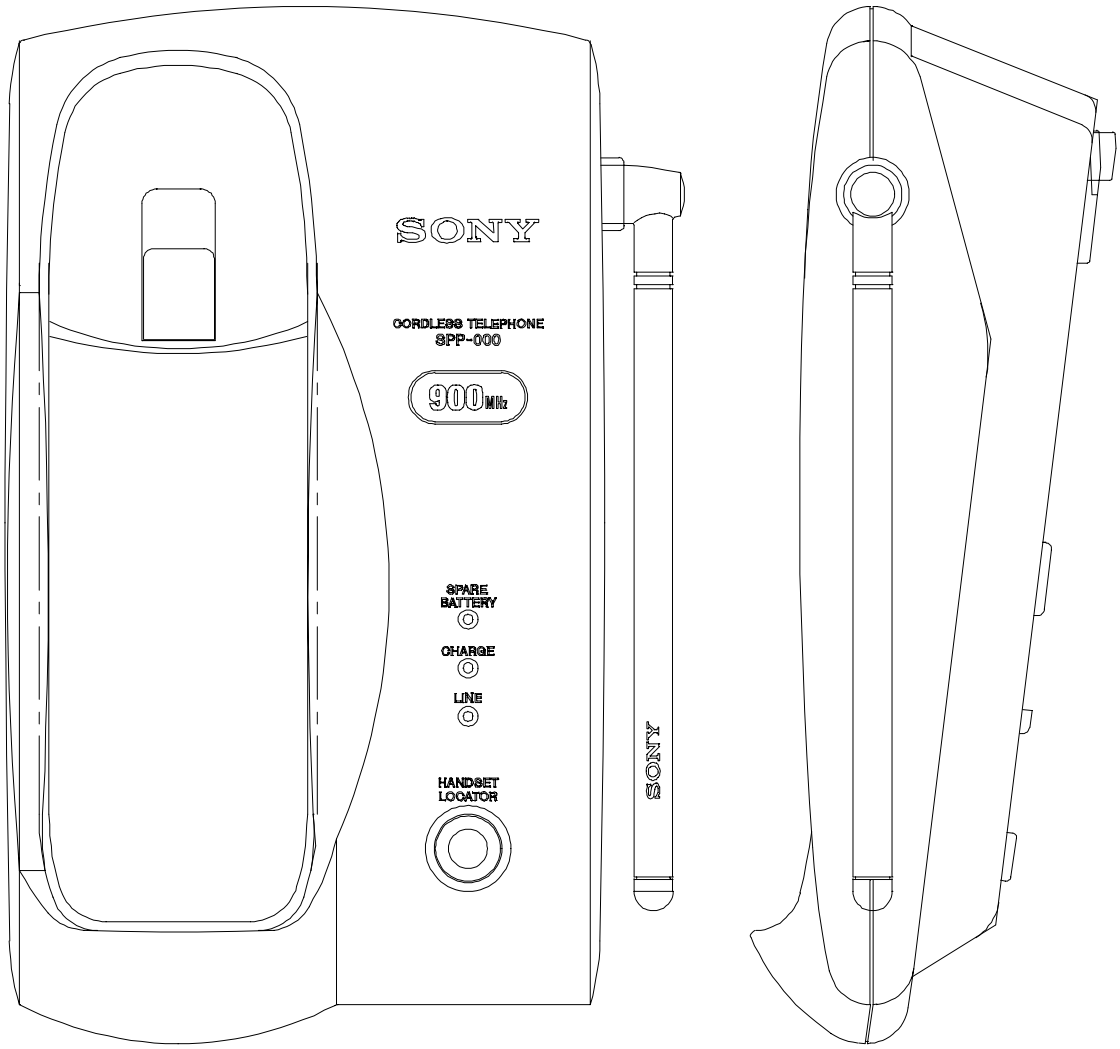
The following features will not be offered in the SPP-900. These are explicitly listed below to ensure there are no misunderstandings on the intended operation of the product.

- Low battery LED
- Separate <Flash> key
- Pause function available on <Redial> key
- Spare battery charger in base unit (optional spare battery purchased separately)
- Battery back-up in case of power failure (optional spare battery purchased separately)
- Headset jack and belt clip
- Ringer volume adjustment on base unit
- Side-mounted tone/pulse switch on base unit (switch is located on bottom of base unit)

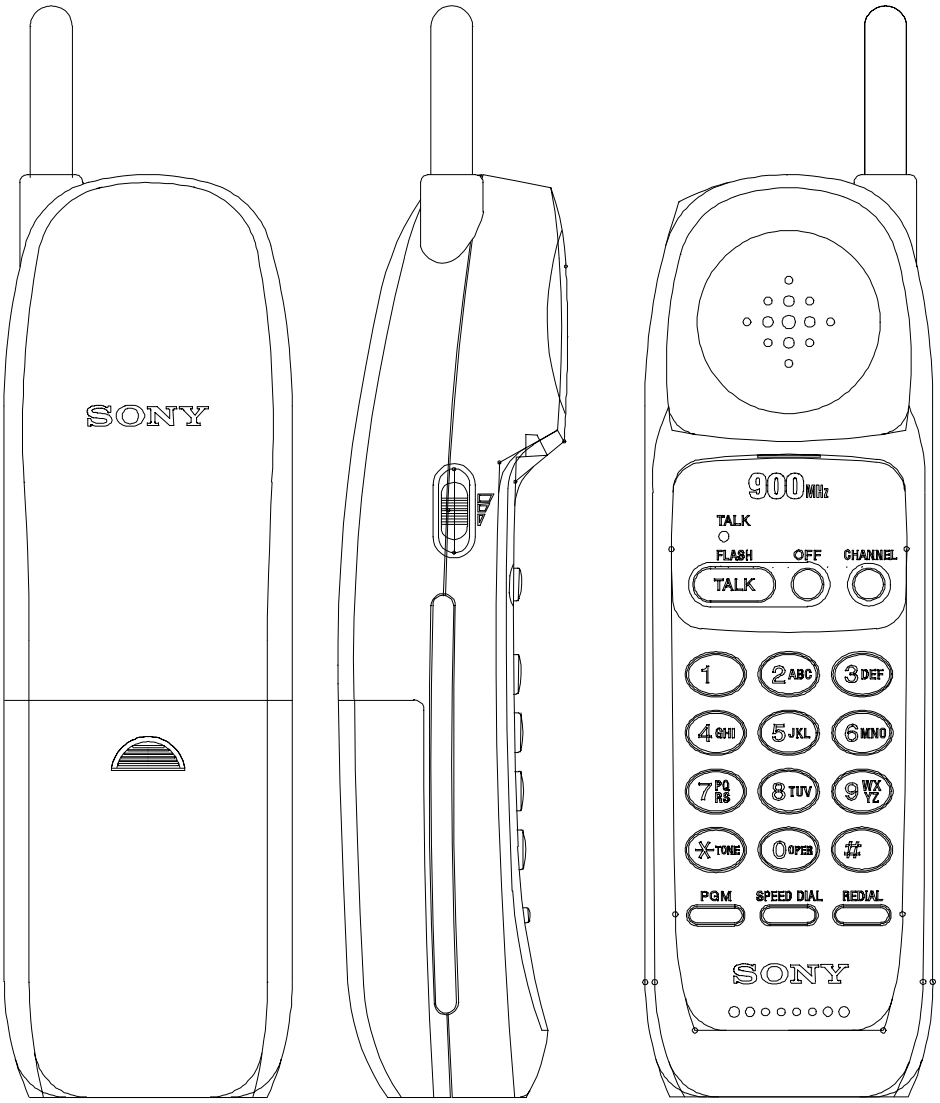
1.4 Cosmetic Styling

Line drawings for the SPP-900 base unit and handset are in the following sections.

1.4.1 Base Unit Line Drawing



1.4.2 Handset Line Drawing



2 Functional Layouts

2.1 Handset Functional Layout

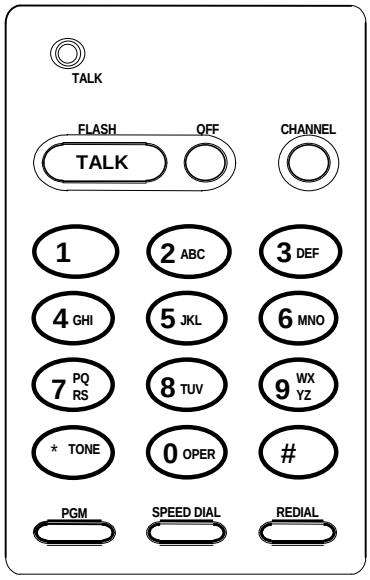


Figure 1 - Handset Keypad Layout

2.1.1 Handset LED Indicators

Talk LED - this LED illuminates steadily when the handset is in the PHONE mode. It will flash in cadence with an incoming ring from the PSTN line. It will flash quickly when the handset is in the PROGRAM mode. It will flash slowly when a low battery condition in the handset is detected.

2.1.2 Handset Key Descriptions

<**Talk**> **key** - this key is used to enter the PHONE mode. If the handset is already in the PHONE mode, pressing this key will generate a hook-flash on the PSTN line. This key will be inactive for four seconds after the phone has auto-answered to prevent accidental flashing of the PSTN line.

<**Off**> **key** - this key is used to exit all modes of operation and return the handset and base unit to the STANDBY mode.

<**Channel**> **key** - this key is used to initiate a channel change to the next available RF channel. This key is only active in the PHONE mode; it has no function in the STANDBY mode.

<**Program**> **key** - this key is used to enter the PROGRAM mode. This key is only active in the STANDBY mode; it has no function in the PHONE mode.

<**Speed Dial**> **key** - this key is used to enter the memory dialling mode for dialling speed dial numbers. The sequence used is <Talk> <Speed Dial> digit key, where digit key is one of 0-9.

<**Redial**> **key** - this key is used to dial the contents of the redial buffer. This key is active in the PHONE mode only if no other dialling keys have been pressed. This key is also active in the PROGRAM mode for storing the redial buffer into a memory location.

<**Tone/***> **key** - this key is used to initiate temporary DTMF dialling. This key is only active in the PHONE mode, and only if the default dialling method is pulse.

2.1.3 Keypad Illumination

Generally, the backlight on the keypad illuminates if the <Talk> or <Program> key is pressed when the handset is not in use, or when any of the DTMF keys or the <Talk> or <Speed Dial> key is pressed when the phone is off-hook. After a key is pressed, the illumination remains on for five (5) seconds and then automatically turns off. Pressing any key during or after the 5-second interval restarts the 5-second timer. The backlight will not illuminate when the <Off> key is pressed since user is assumed to have completed the desired phone operation. When the phone is off-hook, the backlight will also not be activated by the <Channel> or <Redial> key. In addition, the illumination will turn off immediately after a speed-dial programming sequence is successfully completed (see section 3.3.1for further details on programming speed dial numbers into the SPP-900).

Backlight illumination also occurs during handset ringing for incoming calls. The backlighting follows the cadence of the ringing signal (i.e., illumination when ring on and no illumination when ring off). After termination of ringing, if the call is not answered, the illumination goes off and remains off until a key is pressed or another call is received. If the call is answered, the illumination remains on for 5 seconds (5 second timer restart as a result of pressing a key) and then turns off automatically provided no other keys are pressed.

Backlight illumination turns off immediately after handset is placed on cradle.

2.2 Base Unit Functional Layout

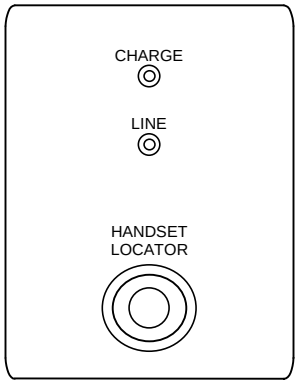


Figure 2 - Base Unit Layout

2.2.1 Base Unit LED Indicators

Charge LED - this LED illuminates steadily when the handset is resting in the base unit cradle and the handset battery is being charged.

Line LED - this LED illuminates steadily when the phone is in the PHONE mode. It will flash in cadence with an incoming ring. This LED also flashes momentarily immediately after the handset

is cradled to indicate that initialisation (assigning a new security code and RF channel) is in progress.

2.2.2 Base Unit Key Descriptions

<**Handset Locator**> **key** - this key is used to enter the PAGE mode. In the PAGE mode, the handset will emit a series of rings. Pressing the <Handset Locator> key a second time (while in the PAGE mode) will terminate PAGE mode, stopping the handset rings. The PAGE mode will also be terminated automatically after 60 seconds (the STANDBY mode) or one page tone (the PHONE mode) is heard at the handset. This key is inactive if the handset is resting in the base unit cradle.

Tone/Pulse switch - this switch, located on the side of the base unit, is used to set the default method of dialling to either PULSE or DTMF. The Tone/Pulse switch is read when the PHONE mode is entered; it cannot be used to change the dialling method once a call is in progress.

3 Operating Modes

The SPP-900 has a number of operating modes, including:

- STANDBY
- PHONE
- PROGRAM
- RINGING
- PAGE
- PHONE/PAGE
- PROGRAM/PAGE
- PROGRAM/RINGING

These operating modes can be triggered by any of the following events:

- pressing keys on the handset
- receiving an incoming call from the PSTN
- pressing the <Handset Locator> button on the base unit
- replacing the handset on the cradle
- removing the handset from the cradle
- a timeout (where appropriate)

For this section, the following definitions apply:

- *Number Keys* = {<1> <2> <3> <4> <5> <6> <7> <8> <9> <0>}
- *DTMF Keys* = {<1> <2> <3> <4> <5> <6> <7> <8> <9> <0> <*> <#>}
- *Dialling Keys* = {<1> <2> <3> <4> <5> <6> <7> <8> <9> <0> <*> <#> <Redial> <Speed Dial>}

3.1 STANDBY Mode

The STANDBY mode is the idle mode of the SPP-900. In this mode, both the base unit and handset RF transmitters are turned off, the base unit has released the PSTN connection, and the handset goes into a sleep sub-mode to conserve battery power. The handset 'wakes up' (turns on its receiver) periodically to check for an incoming RF link (incoming PSTN call or Page signal).

It is possible for the handset to be either in-cradle, or away from the cradle in STANDBY mode. Operation in both of these cases are essentially the same with the following exceptions:

1. The sleep cycle for the handset is slightly longer when the handset is resting in the base unit cradle to improve the cradle contact communication reliability.
2. The handset monitors both the RF link (for incoming PSTN or Page calls) and the cradle contacts (for new channel information) when resting on the base unit cradle; it monitors only the RF link when away from the cradle.
3. The base unit monitors the interference level of the default channel and has the option to select a new channel only when the handset is resting on the base unit cradle (refer to section 4.3.1for more details).

When in the STANDBY mode:

<**Talk**> - causes the SPP-900 to go to the PHONE mode
<**Channel**> - this key is locked out
<**Off**> - this key is locked out

Dialling Keys - these keys are locked out
<**Redial**> - this key is locked out
<**Program**> - causes the SPP-900 to go to the PROGRAM mode
Ringing - causes the SPP-900 to go to the RINGING mode
<**Handset Locator**> - causes the SPP-900 to go to the PAGE mode
On Cradle - maintains the SPP-900 in the STANDBY mode
Off Cradle - maintains the SPP-900 in the STANDBY mode

3.2 PHONE Mode

The PHONE mode is the main operating mode of the SPP-900. In this mode, an RF link is established between the handset and the base unit; the base unit has seized the PSTN connection; and both the transmit and receive audio paths are open for voice communication. Dialling is also possible while in the PHONE mode.

Pressing the <Channel> key causes the SPP-900 to seek a new RF channel for operation (refer to section 4.3.2 for more details).

Placing the handset into the base unit cradle will automatically release the PSTN connection, and return the phone to the STANDBY mode (*auto hang-up*).

When in the PHONE mode:

<**Talk**> - causes the base unit to generate a hook flash to the PSTN
<**Channel**> - causes the SPP-900 to change to a new RF channel
<**Off**> - causes the SPP-900 to return to the STANDBY mode
Dialling Keys - cause the base unit to dial the corresponding digits
<Redial> - dials the content of redial buffer
<**Program**> - this key is locked out
Ringing - invalid condition
<**Handset Locator**> - causes the SPP-900 to go to the PHONE/PAGE mode
On Cradle - causes the SPP-900 to return to the STANDBY mode
Off Cradle - invalid condition

3.2.1 Dialling Methods

The SPP-900 supports three dialling methods: pulse, tone (DTMF), and temporary DTMF. The pulse or tone dialling mode can be set as the default dialling method by the switch located on the side of the base unit. The default dialling mode must be set before entering the PHONE mode of operation; it is not possible to change the default dialling mode while a call is in progress.

Temporary DTMF dialling mode is only available when the default method is set to pulse. In that case, pressing the <Tone/*> key on the handset will initiate temporary DTMF dialling such that all subsequent digits dialled will be in DTMF (including <*> and <#>). Temporary DTMF dialling will continue until the SPP-900 returns to the STANDBY mode, at which point the default pulse dialling resumes.

During DTMF dialling, the <Tone/*> key will dial the DTMF <*> digit. During Pulse dialling, the <#> key has no function and will be ignored (even though a key-beep will be generated at the handset).

3.2.2 Redial Buffer

The redial buffer stores the first 16 digits of the number dialled during the previous call. The number may have been dialled using the DTMF keys, the <Redial> key, the memory dialling feature, or any allowable combination of these.

The contents of the redial buffer can be dialled to the PSTN by pressing the <Redial> key immediately following the <Phone> key. The redial buffer becomes invalid as soon as any of the DTMF keys is pressed, or if the memory dialling feature is used and cannot be accessed until the phone returns to the STANDBY mode.

It is possible to dial further digits after the <Redial> key is pressed, either by using the DTMF keys, or the memory dialling feature. Any suffix digits (including memory dialling) will be appended to the redial buffer.

The redial buffer is stored in volatile memory — the contents of the redial buffer will be lost if a power failure occurs at the base unit.

3.2.3 Memory Dialling

Numbers can be dialled out from any of the 10 speed dial memories by pressing the <Speed Dial> key, followed by the number key corresponding to the desired memory location. After the <Speed Dial> key is pressed, only the number keys (memory locations), the <Phone> key (hook flash) and the <Off> key (return to the STANDBY mode) will be accepted - the remaining keys on the handset will be locked-out. There is no timeout on the memory dialling mode.

It is possible to dial digits before and after using the memory dialling feature; these digits can be dialled using the DTMF keys, the <Redial/Pause> key, or the memory dialling feature.

3.3 PROGRAM Mode

The SPP-900 supports two programming sub-modes: speed dial programming, and ringer type programming. The speed dial programming sub-mode is used to program a number into one of the 16 speed dial memory locations; the ringer type programming sub-mode is used to select the handset ringer tone.

When in the main PROGRAM mode:

<**Talk**> - causes the SPP-900 to go to the PHONE mode
<**Channel**> - this key is locked out
<**Off**> - causes the SPP-900 to go to the STANDBY mode
Number Keys - cause the SPP-900 to go to speed dial PROGRAM sub-mode
<***>, <#> Keys** - cause the SPP-900 to go to the ringer type PROGRAM sub-mode
<**Redial**>, <**Speed Dial**>, <**Program**> **Keys** - these keys are locked out
Ringing - causes the SPP-900 to go to the PROGRAM/RINGING mode
<**Handset Locator**> - causes the SPP-900 to go to the PROGRAM/PAGE mode
On Cradle - causes the SPP-900 to return to the STANDBY mode
Off Cradle - invalid condition
30s Timeout - returns the SPP-900 to the STANDBY mode (*sad tone*)

When in the speed dial PROGRAM sub-mode:

<**Talk**> - causes the SPP-900 to go to the PHONE mode (*sad tone*)
<**Channel**> - this key is locked out
<**Off**> - causes the SPP-900 to go to the STANDBY mode (*sad tone*)
DTMF Keys - enter the number to be stored
<**Redial**> - access contents of redial buffer (if pressed first, otherwise locked out)
<**Speed Dial**> - number stored, return SPP-900 to the STANDBY mode (*happy tone*)
<**Program**> - this key is locked out
Ringing - causes the SPP-900 to go to the PROGRAM/RINGING mode
<**Handset Locator**> - causes the SPP-900 to go to the PROGRAM/PAGE mode

On Cradle - returns SPP-900 to return to the STANDBY mode (*sad tone*)
Off Cradle - invalid condition
30s Timeout - returns the SPP-900 to the STANDBY mode (*sad tone*)

When in the ringer type PROGRAM sub-mode:

<**Talk**> - causes the SPP-900 to go to the PHONE mode
<**Channel**> - this key is locked out
<**Off**> - causes the SPP-900 to go to the STANDBY mode
<**1**>, <**2**>, <**3**>, <**4**>, <**5**>, <**0**> **Keys** - cause the ringer type to be changed accordingly
<**6**>, <**7**>, <**8**>, <**9**>, <***>, <#> **Keys** - these keys are locked out
<**Redial**>, <**Speed Dial**>, <**Program**> **Keys** - these keys are locked out
Ringing - causes the SPP-900 to go to the PROGRAM/RINGING mode
<**Handset Locator**> - causes the SPP-900 to go to the PROGRAM/PAGE mode
On Cradle - causes the SPP-900 to return to the STANDBY mode
Off Cradle - invalid condition
30s Timeout - returns the SPP-900 to the STANDBY mode (*sad tone*)

3.3.1 Speed Dial Programming

The SPP-900 has 10 speed dial memory locations, accessed by the digit keys 0 to 9. Each location can hold up to 16 digits.

To program a speed dial number:

1. Press the <Program> key on the handset. The Talk LED on the handset will flash to indicate the SPP-900 is in the PROGRAM mode.
2. Enter the memory location to be used for storing the number (0 to 9). The SPP-900 goes to speed dial PROGRAM sub-mode and establishes an RF link.
3. Dial the number to be stored in the memory location. Numbers are transferred to the base unit for subsequent storage in non-volatile memory.
4. Press the <Speed Dial> key on the handset. The phone will store the digits in the non-volatile memory in the base unit, shut-down the RF link, terminate the PROGRAM mode, and return to the STANDBY mode. A *happy tone* will be emitted from the handset to indicate successful programming of the number and the keypad illumination will turn off.

Any of the DTMF dialling keys can be used to store numbers in the speed dial memory independent of the default dialling method. If the default dialling method is pulse when using the speed dial number, the digit <#> will be ignored and the digit <*> will initiate temporary DTMF dialling.

The <Redial> key can also be pressed to store the contents of the redial buffer to the memory location, but only if no other digit keys have been pressed first.

A pause can be inserted into a memory location by pressing and holding the digit after the pause is required for two (2) seconds. A key-beep will be heard with the initial key-press, and then again after two (2) seconds; the second key-beep indicates that a pause has been programmed. Further key-beeps (and additional pauses) will be inserted every two (2) seconds if the DTMF key is held continuously.

3.3.2 Ringer Type Programming

The SPP-900 supports four different ringer types and a ringer off state. The ringer type is programmed as follows:

1. Press the <Program> key on the handset. The Talk LED on the handset will flash to indicate the SPP-900 is in the PROGRAM mode.
2. Press either the < *> or < #> keys to go to the ringer type PROGRAM sub-mode.
3. Press any of the {<1> <2> <3> <4>} keys to select a new ringer type, the <5> key to turn the ringer off, or the <0> key to maintain the current ringer selection. After one of these keys is pressed, the current ringer selection is sounded from the handset buzzer for the user's reference. These keys can be continuously pressed indefinitely.
4. Press the <Off> key to return the SPP-900 to the STANDBY mode.

3.4 RINGING Mode

The RINGING mode occurs when a valid ring signal is applied to the base unit from the PSTN connection. The base unit establishes an RF link to the handset, and sends commands to the handset causing it to ring with the currently selected ring type (if the ringer is turned off, the handset will not ring). The commands are sent in cadence with the received ring signal, making the SPP-900 virtually transparent to speciality ring types.

If the handset is away from the base unit cradle, pressing any key on the handset (except <Off>) will cause the SPP-900 to go off-hook and answer the incoming call. The feature is referred to as *In the Dark Answering*.

If the handset is resting on the base unit cradle, lifting the handset from the cradle will cause the SPP-900 to automatically answer the incoming call. In this case, the Phone key will be disabled for the first 4 seconds to prevent the user from accidentally flashing the PSTN connection.

When in the RINGING mode:

<**Talk**> - causes the SPP-900 to go to the PHONE mode
<**Channel**> - causes the SPP-900 to go to the PHONE mode
<**Off**> - this key is locked out
Dialling Keys - causes the SPP-900 to go to the PHONE mode
<**Program**> - causes the SPP-900 to go to the PHONE mode
Ringing - causes the SPP-900 to remain in the RINGING mode
<**Handset Locator**> - this key is locked out
On Cradle - causes the SPP-900 to remain in the RINGING mode
Off Cradle - causes the SPP-900 to go to the PHONE mode
5s Ringing Timeout - returns the SPP-900 to the STANDBY mode

3.5 PAGE Mode

The PAGE mode only occurs if the handset is in the STANDBY mode, the handset is away from the base unit cradle, and the <Handset Locator> button on the base unit is pressed. In the PAGE mode, the handset emits a series of page tones for 60 seconds; the page tones can be turned off by either pressing the <Off> key on the handset, or the <Handset Locator> key on the base unit.

When in the PAGE mode:

<**Talk**> - causes the SPP-900 to go to the PHONE mode
<**Channel**> - this key is locked out
<**Off**> - causes the SPP-900 to return to the STANDBY mode
Dialling Keys - these keys are locked out
<**Program**> - this key is locked out

Ringing - causes the SPP-900 to go to the RINGING mode
<**Handset Locator**> - causes the SPP-900 to return to the STANDBY mode
On Cradle - causes the SPP-900 to return to the STANDBY mode
Off Cradle - invalid condition
60s Page Timeout - returns the SPP-900 to the STANDBY mode

3.6 PHONE/PAGE Mode

The PHONE/PAGE mode is only entered if the <Handset Locator> key is pressed on the base unit while the SPP-900 is in the PHONE mode. In this mode, the handset begins to ring as it does in the PAGE mode, but voice path to the PTSN is still available (as in the PHONE mode). The page tone in this mode is lower frequency that standard page tone to reduce the volume level; also, there is only one page tone (as opposed to a series that occur in the PAGE mode).

If the user presses the <Off> key, the PAGE is terminated, and the SPP-900 returns to the PHONE mode.

When in the PHONE/PAGE mode:

<**Talk**> - causes the base unit to generate a hook flash to the PSTN
<**Channel**> - causes the SPP-900 to change to a new RF channel
<**Off**> - causes the SPP-900 to return to the PHONE mode
Dialling Keys - cause the base unit to dial the corresponding digits
<**Program**> - this key is locked out
Ringing - invalid condition
<**Handset Locator**> - causes the SPP-900 to return to the PHONE mode
On Cradle - causes the SPP-900 to return to the STANDBY mode
Off Cradle - invalid condition
1-ring Page Timeout - returns the SPP-900 to the PHONE mode

3.7 PROGRAM/PAGE Mode

The PROGRAM/PAGE mode is only entered if the <Handset Locator> key is pressed on the base unit while the phone is in the PROGRAM mode. In this mode, the handset begins to ring as it does in the PAGE mode, but the user can complete his operation in the PROGRAM mode.

If the user presses the <Off> key, the PAGE is terminated, and the phone returns to the PROGRAM mode.

When in the main PROGRAM/PAGE mode:

<**Talk**> - causes the SPP-900 to go to the PHONE mode
<**Channel**> - this key is locked out
<**Off**> - causes the SPP-900 to go to the PROGRAM mode
Number Keys - goes to the speed dial PROGRAM/PAGE sub-mode
<***>, <#> Keys** - puts the SPP-900 in the ringer type PROGRAM/PAGE sub-mode
<**Redial**>, <**Speed Dial**>, <**Program**> **Keys** - these keys are locked out
Ringing - causes the SPP-900 to go to the PROGRAM/RINGING mode
<**Handset Locator**> - returns the phone to the PROGRAM mode
On Cradle - returns the phone to the STANDBY mode
Off Cradle - invalid condition
30s Keypad Timeout - puts the SPP-900 in the PAGE mode (*sad tone*)
60s Page Timeout - returns the SPP-900 to the PROGRAM mode

When in the speed dial PROGRAM/PAGE sub-mode:

<**Talk**> - causes the SPP-900 to go to the PHONE mode (*sad tone*)
<**Channel**> - this key is locked out
<**Off**> - causes the SPP-900 to go to the PROGRAM mode
DTMF Keys - enter the number to be stored
<**Redial**> - access contents of redial buffer (if pressed first, otherwise locked out)
<**Speed Dial**> - number stored, puts SPP-900 in the PAGE mode (*happy tone*)
<**Program**> - this key is locked out
Ringing - causes the SPP-900 to go to the PROGRAM/RINGING mode
<**Handset Locator**> - returns the phone to the PROGRAM mode
On Cradle - puts the SPP-900 in the STANDBY mode (*sad tone*)
Off Cradle - invalid condition
30s Keypad Timeout - puts the SPP-900 in the PAGE mode (*sad tone*)
60s Page Timeout - returns the SPP-900 to the PROGRAM mode

When in the ringer type PROGRAM/PAGE sub-mode:

<**Talk**> - causes the SPP-900 to go to the PHONE mode
<**Channel**> - this key is locked out
<**Off**> - causes the SPP-900 to go to the PROGRAM mode
<**1**>, <**2**>, <**3**>, <**4**>, <**5**>, <**0**> **Keys** - cause the ringer type to be changed accordingly
<**6**>, <**7**>, <**8**>, <**9**>, <*****>, <**#**> **Keys** - these keys are locked out
<**Redial**>, <**Speed Dial**>, <**Program**> **Keys** - these keys are locked out
Ringing - causes the SPP-900 to go to the PROGRAM/RINGING mode
<**Handset Locator**> - returns the phone to the PROGRAM mode
On Cradle - puts the SPP-900 in the STANDBY mode
Off Cradle - invalid condition
30s Keypad Timeout - puts the SPP-900 in the PAGE mode (*sad tone*)
60s Page Timeout - returns the SPP-900 to the PROGRAM mode

3.8 PROGRAM/RINGING Mode

The PROGRAM/RINGING mode is only entered if an incoming PSTN call occurs while the phone is in the PROGRAM mode. In this mode, the handset begins to ring as it does in the RINGING mode, but the user can complete his operation in the PROGRAM mode.

If the user presses the <Phone> key, the PSTN call is answered, the phone leaves the PROGRAM mode and enters the PHONE mode.

When in the main PROGRAM/RINGING mode:

<**Talk**> - causes the SPP-900 to go to the PHONE mode
<**Channel**> - this key is locked out
<**Off**> - causes the SPP-900 to go to the RINGING mode
Number Keys - goes to the speed dial PROGRAM/RINGING sub-mode
<*****>, <**#**> **Keys** - puts the SPP-900 in the ringer type PROGRAM/RINGING sub-mode
<**Redial**>, <**Speed Dial**>, <**Program**> **Keys** - these keys are locked out
Ringing - causes the SPP-900 to remain in the PROGRAM/RINGING mode
<**Handset Locator**> - this key is locked out
On Cradle - causes the SPP-900 to go to the RINGING mode

Off Cradle - invalid condition
30s Keypad Timeout - puts the SPP-900 in the RINGING mode (*sad tone*)
5s Ringing Timeout - returns the SPP-900 to the PROGRAM mode

When in the speed dial PROGRAM/RINGING sub-mode:

<**Talk**> - causes the SPP-900 to go to the PHONE mode (*sad tone*)
<**Channel**> - this key is locked out
<**Off**> - causes the SPP-900 to go to the RINGING mode (*sad tone*)
DTMF Keys - enter the number to be stored
<**Redial**> - access contents of redial buffer (if pressed first, otherwise locked out)
<**Speed Dial**> - number stored, puts SPP-900 in RINGING mode (*happy tone*)
<**Program**> - this key is locked out
Ringing - causes the SPP-900 to remain in the PROGRAM/RINGING mode
<**Handset Locator**> - this key is locked out
On Cradle - puts the SPP-900 in the RINGING mode (*sad tone*)
Off Cradle - invalid condition
30s Keypad Timeout - puts the SPP-900 in the RINGING mode (*sad tone*)
5s Ringing Timeout - returns the SPP-900 to the PROGRAM mode

When in the ringer type PROGRAM/RINGING sub-mode:

<**Talk**> - causes the SPP-900 to go to the PHONE mode
<**Channel**> - this key is locked out
<**Off**> - causes the SPP-900 to go to the RINGING mode
<**1**>, <**2**>, <**3**>, <**4**>, <**5**>, <**0**> **Keys** - cause the ringer type to be changed accordingly
<**6**>, <**7**>, <**8**>, <**9**>, <*>, <#> **Keys** - these keys are locked out
<**Redial**>, <**Speed Dial**>, <**Program**> **Keys** - these keys are locked out
Ringing - causes the SPP-900 to remain in the PROGRAM/RINGING mode
<**Handset Locator**> - this key is locked out
On Cradle - puts the SPP-900 in the RINGING mode
Off Cradle - invalid condition
30s Keypad Timeout - puts the SPP-900 in the RINGING mode (*sad tone*)
5s Ringing Timeout - returns the SPP-900 to the PROGRAM mode

4 RF Link Operation

The radio frequency (RF) link is a full-duplex communication path between the SPP-900 base and the handset units. It is used to transfer both audio (voice) and data between the base and hands. There are a total of 30 RF channels available for communication. Only one channel may be selected as the active channel at any instant, though there are provisions to select to a different active channel when there are perceived interference on the current channel.

4.1 RF Link Data

Data transmitted over the RF link are generally operational commands from the base to handset and vice-versa. When the SPP-900 is in the PHONE or PHONE/PAGE mode, both audio and data will be transmitted over the RF link. To minimise any perceptible impact on audio quality when data is interspersed within the voice transmission, receiver audio at the handset will be muted within ten (10) ms of start of data transfer. Furthermore, normal data transfers will be limited to no more than 100 ms in duration. There will be no periodic muting during audio speech.

When the SPP-900 is in the STANDBY mode, the base and handset will listen for data transmission from the other relating to the initiation of the PHONE, RINGER, PROGRAM or PAGE mode. If the handset is away from the cradle, the handset will be in battery-conservation mode of operation, in which the on-board electronics is essentially "asleep" but will wake up periodically to check for incoming data transmitted from the base. The handset will detect commands sent from the base within one (1) second (maximum ringing delay), while the base will detect commands sent from the handset within 200 ms (maximum on/off-hook delay).

4.2 Security Code

All data communication over the RF link will include a security code as required by FCC Part 15. When a data packet is received over the RF link, the security code contained in the packet will be verified before any data is processed. This prevents the handset from receiving commands from another base unit and vice-versa.

The handset and base units will use an identical, 16-bit security code. The security code is stored in the non-volatile memory in the base unit. Part of the initialisation procedure of the SPP-900 includes the base generating a new security code and transferring the security code to the handset via the charging contacts when the handset is placed in the cradle.

4.3 RF Channel Selection

In order for the handset and base unit to communicate over the RF link, the selection of the active channel must be synchronised between the two units. An active channel is initially selected during the SPP-900 initialisation process. If the RF link subsequently degrades during operation, recovery involves the selection of a new communication channel that may be either automatically or manually (user) initiated depending on the current operating mode of the phone.

4.3.1 Background Channel Scanning

Background channel scanning is the only automatic channel selection performed on the SPP-900. Background channel scanning occurs only when the handset is resting in the base unit charging cradle.

When the base unit is in the STANDBY mode with the handset resting in its charging cradle, the base unit will monitor the current channel for RF activity (through the use of the RSSI logic signal). If the base unit detects activity for a continuous period exceeding 50 seconds, the base unit will initiate a channel scanning operation.

The base unit will tune its receiver to the next RF channel, and monitor that channel for RF activity — if activity is present, it will continue scanning on the next RF channel; if no activity is present, that channel will be selected as the new RF channel. If no available channels can be found, the base unit will terminate channel scanning and return to the STANDBY mode with the same active RF channel.

If a new RF channel is found, the base unit will communicate the new selection over the original channel. Once the acknowledgement is received, the new RF channel will become the active channel, and the phone will return to the STANDBY mode.

When the phone is back in the STANDBY mode, the base unit will resume monitoring the new channel for continuous RF activity, and initiate channel scanning operation again as required.

During background channel scanning:

Handset Key-presses - invalid condition (handset in cradle)
Ringing - puts SPP-900 in the RINGING mode (active channel)
<**Page**> - this key is locked out (handset in cradle)
On Cradle - invalid condition (handset in cradle)
Off Cradle - puts SPP-900 in the STANDBY mode (default channel)
New Channel Select - puts SPP-900 in the STANDBY mode (new channel)
No New Channel - puts SPP-900 in the STANDBY mode (default channel)

4.3.2 Manual Channel Selection

Manual channel change is available only when the SPP-900 is in the PHONE or PHONE/PAGE mode. A manual channel change is initiated by the user pressing the <Channel> key on the handset.

Upon receipt of the channel change request, the base will tune its receiver to another RF channel and listens for RF activity. If the channel is free, it will be selected as the new active channel; if it is occupied, the base will tune its receiver to the another channel and continue. If all 30 channels are occupied, the new channel will be last channel checked in the scanning sequence.

After a new channel is selected, the base will return to the original active channel and transmit the new channel selection to the handset. The handset will receive the channel and tunes its transmitter/receiver accordingly.

4.3.3 Channel Resynchronisation

If the active channel between the base and handset becomes out of synchronisation so that further communications between the two units cannot be established, replacing the handset onto the base unit cradle will re-synchronise the channel selection. At that point, the SPP-900 will resume operation in the STANDBY mode.

5 Power Management

The SPP-900 is powered by a battery pack in the handset and by AC power in the base unit.

5.1 Battery

The handset of the SPP-900 operates from a three-cell, 600 mAh battery pack which is rechargeable. There are no connectors attached to the battery pack. When fully charged, the battery will provide a minimum of seven (7) hours of operation in the PHONE mode or six (6) days of operation in the STANDBY mode before requiring recharge. The battery pack will recharge automatically whenever the handset is placed in the cradle of the base unit. In addition, the battery pack can also be recharged via a compatible remote charger.

5.2 Low Battery Indication

The SPP-900 will provide both audible and visual warning when low battery condition in the handset is detected. During the PHONE mode, the Talk LED will be on steady. When the SPP-900 determines that the handset battery is running low, the Talk LED will change to flash at a rate of 33.3 cycles per second, with the LED is on for 50 ms and then off for 2.95 seconds during each cycle. In addition, a beep will be sounded for the duration (50 ms) when the Talk LED is on. When the SPP-900 is in the STANDBY mode and low battery is detected, the Talk LED will flash in a similar pattern. However, there will only be a single audible beep that accompanies the initial flash of the LED in this mode.

If the user presses the <Talk> key when the handset battery is low (but not completely drained), the SPP-900 will still go into the PHONE mode. In this case, there will be no visual indication at the handset to signify the SPP-900 is in the PHONE mode. Instead of steady illumination, the Talk LED will continue to flash in the pattern that indicates a low battery condition. Only audible indication of the PHONE mode will be available, through the repeated beep warning and the audio feedback from the PSTN.

5.3 Power Interruption

Either the handset or base unit may occasionally suffer from power interruption during operation. The handset power supply may be interrupted if the battery is physically removed from the compartment. Alternatively, the handset battery may be completely drained of its charges. In the base unit, the power supply is interrupted when AC power is available.

In either case, the SPP-900 provides the capability to recover from the power interruption. Operation in the PHONE mode will be maintained through a brief power interruption (up to 125 ms in duration) to the base unit. In all other instances, the affected unit will be reset to allow the handset and base unit to re-establish RF communication and resume operation in the STANDBY mode. As detailed in section 4, the critical information that will be restored to allow initiation of RF communication is the security code and the last active RF channel. For the handset reset, this information will be downloaded by the base unit through the charging contact when handset is placed in the cradle. For the base unit, this information will be restored directly from non-volatile memory.

6 Data Requirements

Only the base unit in the SPP-900 will provide non-volatile memory for storing data and configuration information. The former is defined by the user and will be written (or re-written) into the on-board EEPROM during normal operation. The latter is preset during production and will not be changed during operation.

Data that will be stored in the EEPROM include:

- speed-dial numbers (10 numbers, up to 16 digits each)

When the user-defined data is changed during the PROGRAM mode, the data is immediately transferred from the handset to the base for storage.

Configuration information that will be stored in the EEPROM include:

- flash time (100, 270 and 650 ms).

7 Electrical Specifications

7.1 Operating Conditions

	Parameter	Min	Typ	Max	Units
7.1.1	Operating Temperature Range	0	25[1]	50	°C
7.1.2	Chassis Surface Temperature[2]			40	°C
7.1.3	AC Adaptor Temperature[2]			45	°C
7.1.4	Base Unit Operating Voltage (AC Voltage, 60Hz)	96	120[1]	144	Vrms
7.1.5	Base Unit Operating Voltage (AC Adapter Output)		9[1]		Vdc
7.1.6	Handset Operating Voltage[3]	3.2	3.6[1]	4.2	Vdc

Notes:
1. Typical value represents the nominal testing value
2. Ambient temperature = 25°C
2. Handset operates from a 3-cell NiCd battery

7.2 DC Electrical Characteristics

Specifications marked with * are guaranteed at the nominal testing temperature and voltage on all units with the use of automated production test equipment (ATE)

	Parameter	Min	Typ	Max	Units
7.2.1 *	Base Unit Current - Standby Mode[1,2]	35	45	55	mA
7.2.2 *	Base Unit Current - Talk Mode[1,2]	55	65	75	mA
7.2.3 *	Handset Current - Sleep Sub-mode[4]	3	4	12	mA
7.2.4 *	Handset Current - Wake Sub-mode	38		60	mA
7.2.5 *	Handset Current - Talk Mode	58		95	mA
7.2.6	Handset Charging Current	50	60	70	mA
7.2.7 *	Low Battery Detection Threshold (HS)	3.4			Vdc
7.2.8 *	MCU Shutdown Threshold (HS)	3.2			Vdc
7.2.9	Handset Standby Time	6			Days
7.2.10	Handset Continuous Talk Time	7			Hours

Notes:
1. DC current from 9 V power supply
2. Cradle and spare battery charge currents = 0 mA
3. Voltage measured across a 50 Ω charge circuit load resistor
4. Average current per cycle (not MCU current consumption)

7.3 Audio Specifications

Specifications marked with * are guaranteed at the nominal testing temperature and voltage on all units with the use of automated production test equipment (ATE).

	Parameter	Min	Typ	Max	Units
7.3.1 *	Transmit Objective Loudness Rating (TOLR) @ 0 kft[1]	-40	-46	-53	dB
7.3.2 *	Receive Objective Loudness Rating (ROLR) @ 0 kft [1]	51	46	41	dB
7.3.3 *	Sidetone Objective Loudness Rating (SOLR) @ 0 kft [2]	3	8	19	dB
7.3.4 *	Receive Volume Adjustment Range	12			dB
7.3.5 *	Transmit Direction Acoustic Overload (into microphone)[3]	103			dBspl
7.3.6 *	Receive Direction Acoustic Overload (from receiver)[3]	103			dBspl
7.3.7	Transmit Direction Noise[4]			20	dBrnC
7.3.8	Receive Direction (Handset Background) Noise[1,4]			40	dB(A)
7.3.9	Peak Acoustic Pressure[5]			130	dBspl

Notes:
1. Tested at normal (low) volume level
2. Base unit connected to 0 kft of simulated telephone line terminated with 900 Ω
3. Acoustic level that results in 5% THD, measured at 1 kHz through a 5 kHz low-pass filter
4. Handset isolated from sound input and mechanical disturbances
5. Tested at high volume level

7.4 Telephone Line Interface Specifications

Specifications marked with * are guaranteed at the nominal testing temperature and voltage on all units with the use of automated production test equipment (ATE).

	Parameter	Min	Typ	Max	Units
7.4.1 *	DTMF Frequency Tolerance	-1.5		+1.5	%
7.4.2 *	DTMF Low Group Tone Level[1]	-7.5	-5.0	-4.0	dBm
7.4.3 *	DTMF High Group Tone Level[1]	-5.5	-3.0	-2.0	dBm
7.4.4	DTMF Combined Tone Level[1]			+2.0	dBm
7.4.5	DTMF High Group Pre-emphasis (Twist)		2.0	4.0	dB
7.4.6	Pulse Dialling Break Duration		60		ms
7.4.7	Pulse Dialling Make Duration		40		ms
7.4.8	Pulse Dialling Rate		10		pps
7.4.9	Hook Switch Flash Duration[2]		650		ms
7.4.10	Ring Detection Frequency[3,4]	15		68	Hz
7.4.11	Ring Response Voltage[4]	40			Vrms
7.4.12	Ring No-Response Voltage[5]			25	Vrms

Notes:
1. Measured across a 900 Ω terminating impedance
2. Value can be changed via EEPROM setting (650 ms is default for North America)
3. The ringer must ring with signals within this range
4. Measured with a frequency of 20 Hz
5. The ringer must not ring with signals within this range
6. Measured at 1 kHz, -20 dBV_{oc} with 20 mA lop current applied to tip and ring
7. Measured with 20 mA lop current applied to tip and ring

7.5 Radio Specifications

Specifications marked with * are guaranteed at the nominal testing temperature and voltage on all units with the use of automated production test equipment (ATE).

	Parameter	Min	Typ	Max	Units
7.5.1	Number of RF Duplex Channels[1]		30		-
7.5.2	Duplex Frequency	18.25		17.95	MHz
7.5.3	RF Channel Spacing		150		kHz
7.5.4	RF Bandwidth[2]		150		kHz
7.5.5	IF Frequency		10.70		MHz
7.5.6	Base Unit Transmission Frequency	902.30		906.65	MHz
7.5.7	Handset Transmission Frequency	923.40		927.75	MHz
7.5.8	Transmitter Frequency Error (over temperature range)	-10		+10	kHz
7.5.9 *	Handset Transmit Power	-7.5		-2.5	dBm
7.5.10 *	Base Unit Transmit Power	-7.5		-2.5	dBm
7.5.11 *	Handset FM Peak Deviation; Acoustic Test Tone[3]	23	25	27	kHz
7.5.12 *	Base Unit FM Peak Deviation; Audio Test Tone[4]	24	25	26	kHz
7.5.13	Base & Handset FM Peak Deviation - Overload Level[5]		40		kHz
7.5.14 *	Base FSK Peak Deviation - Data	35	40	45	kHz
7.5.15 *	Handset FSK Peak Deviation - Data	30	40	55	kHz
7.5.16 *	Handset Recovered Acoustic Level - RF Test Signal[6,7]	95	97	99	dBspl
7.5.17 *	Base Unit Recovered Audio Level - RF Test Signal[6,8]	-11	-10	-9	dBv
7.5.18 *	Receiver Sensitivity – 12 dB SINAD[9]	-112	-115		dBm
7.5.19	Receiver Sensitivity – 25 dB SINAD[9]		-110		dBm
7.5.20 *	Receiver Sensitivity – 100% Data Reception	-110			dBm
7.5.21	Adjacent Channel Rejection (at 300 kHz offset)[10]	50	55		dB
7.5.22	Image Rejection[10]	55	60		dB
7.5.23 *	Clear Channel Detection Level	-100			dBm
7.5.24	Intermodulation[10,11]	55	60		dB
7.5.25	Co-channel Rejection	-14	-10		dB

Notes:
1. A duplex channel includes one base-to-handset link and one handset-to-base link

2. 3 dB bandwidth of IF filter
3. Acoustic test tone: 1 kHz tone, 97 dBspl at artificial mouth output
4. Audio test tone: 1 kHz tone, -5 dBV open circuit voltage from 900 Ω source
5. Overload level corresponds to acoustic overload of 105 dBspl (transmit and receive)
6. RF test signal: 1 kHz audio signal FM modulated onto an RF carrier with ±25 kHz deviation
7. Acoustic level into artificial ear tested at normal (low) volume level
8. Measured at telephone line interface across 900 Ω termination
9. Measured through a CCITT audio weighting filter
10. RF level of desired signal set to provide 25 dB SINAD (CCITT); rejection is relative level of interference signal above desired signal to reduce SINAD to 20 dB (CCITT)
11. Interfering carriers injected at ±600 kHz and ±1200 kHz offset from the desired signal.

7.6 Frequency Allocation Tables

The RF channels for the SPP-900 are allocated in fixed pairs as indicated in the tables below. The duplex frequency is maintained at 22.75 MHz for 19 of the 30 channels and 17.95 MHz for the remaining 11 channels.

7.6.1 Base Unit Frequencies

Channel #	Transmit Frequency	Receive Frequency	Rx LO Frequency
1	902.30 MHz	925.05 MHz	914.35 MHz
2	902.60 MHz	925.35 MHz	914.65 MHz
3	902.90 MHz	925.65 MHz	914.95 MHz
4	903.20 MHz	925.95 MHz	915.25 MHz
5	903.50 MHz	926.25 MHz	915.55 MHz
6	903.80 MHz	926.55 MHz	915.85 MHz
7	904.10 MHz	926.85 MHz	916.15 MHz
8	904.40 MHz	927.15 MHz	916.45 MHz
9	904.70 MHz	927.45 MHz	916.75 MHz
10	905.00 MHz	927.75 MHz	917.05 MHz
11	902.45 MHz	925.20 MHz	914.50 MHz
12	902.75 MHz	925.50 MHz	914.80 MHz
13	903.05 MHz	925.80 MHz	915.10 MHz
14	903.35 MHz	926.10 MHz	915.40 MHz
15	903.65 MHz	926.40 MHz	915.70 MHz
16	903.95 MHz	926.70 MHz	916.00 MHz
17	904.25 MHz	927.00 MHz	916.30 MHz
18	904.55 MHz	927.30 MHz	916.60 MHz
19	904.85 MHz	927.60 MHz	916.90 MHz
20	905.15 MHz	923.10 MHz	912.40 MHz
21	905.45 MHz	923.40 MHz	912.70 MHz

Channel #	Transmit Frequency	Receive Frequency	Rx LO Frequency
22	905.75 MHz	923.70 MHz	913.00 MHz
23	906.05 MHz	924.00 MHz	913.30 MHz
24	906.35 MHz	924.30 MHz	913.60 MHz
25	906.65 MHz	924.60 MHz	913.90 MHz
26	905.30 MHz	923.25 MHz	912.55 MHz
27	905.60 MHz	923.55 MHz	912.85 MHz
28	905.90 MHz	923.85 MHz	913.15 MHz
29	906.20 MHz	924.15 MHz	913.45 MHz
30	906.50 MHz	924.45 MHz	913.75 MHz

7.6.2 Handset Frequencies

Channel #	Transmit Frequency	Receive Frequency	Rx LO Frequency
1	925.05 MHz	902.30 MHz	913.00 MHz
2	925.35 MHz	902.60 MHz	913.30 MHz
3	925.65 MHz	902.90 MHz	913.60 MHz
4	925.95 MHz	903.20 MHz	913.90 MHz
5	926.25 MHz	903.50 MHz	914.20 MHz
6	926.55 MHz	903.80 MHz	914.50 MHz
7	926.85 MHz	904.10 MHz	914.80 MHz
8	927.15 MHz	904.40 MHz	915.10 MHz
9	927.45 MHz	904.70 MHz	915.40 MHz
10	927.75 MHz	905.00 MHz	915.70 MHz
11	925.20 MHz	902.45 MHz	913.15 MHz
12	925.50 MHz	902.75 MHz	913.45 MHz
13	925.80 MHz	903.05 MHz	913.75 MHz
14	926.10 MHz	903.35 MHz	914.05 MHz
15	926.40 MHz	903.65 MHz	914.35 MHz
16	926.70 MHz	903.95 MHz	914.65 MHz
17	927.00 MHz	904.25 MHz	914.95 MHz
18	927.30 MHz	904.55 MHz	915.25 MHz
19	927.60 MHz	904.85 MHz	915.55 MHz
20	923.10 MHz	905.15 MHz	915.85 MHz
21	923.40 MHz	905.45 MHz	916.15 MHz
22	923.70 MHz	905.75 MHz	916.45 MHz
23	924.00 MHz	906.05 MHz	916.75 MHz
24	924.30 MHz	906.35 MHz	917.05 MHz

Channel #	Transmit Frequency	Receive Frequency	Rx LO Frequency
25	924.60 MHz	906.65 MHz	917.35 MHz
26	923.25 MHz	905.30 MHz	916.00 MHz
27	923.55 MHz	905.60 MHz	916.30 MHz
28	923.85 MHz	905.90 MHz	916.60 MHz
29	924.15 MHz	906.20 MHz	916.90 MHz
30	924.45 MHz	906.50 MHz	917.20 MHz

7.7 Safety Specifications

	Parameter	Min	Typ	Max	Units
7.7.1	HI POT current[1]			5	mA

Notes: 1. Current drawn when 1 kV is applied simplex on tip and ring for 60 s.