Heuristic Evaluation of
Three Cellular Phones

Siemens CF62T

Samsung VGA1000

Motorola T720

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Introduction

This is a heuristic evaluation of three different cellular phones, Siemens CF62T, Samsung VGA1000 and Motorola T720 (for pictures, see Appendices E and F).

Evaluation concentrated on two distinct aspects of the phones: 1) the *initial state* or default state of the phone, covering the software display and the physical keypad layout; 2) the *phonebook feature*, covering the software display and functionality. Evaluation was based on a set of nine heuristics and a set of platform standards, established by the evaluators prior to conducting the evaluation (see Appendix A).

In addition to compliance with stated guidelines and standards, a compliance rating was conducted, providing comparison values between phones, for each heuristic considered. Ratings are graphed for each evaluation (*initial state, phonebook feature*), comparing each phone per heuristic (see Appendix B), and overall average rating (see Appendix C).

This evaluation also includes a comparison of the number of steps or key presses for three specific tasks: 1) completing a new phonebook entry (novice method); 2) completing a new phonebook entry (expert method); 3) editing an existing phonebook entry (see Appendix D).

Initial State

1) Feedback and Visibility of System Status

Siemens CF62T - The initial state shows signal strength, battery strength, whether the phone's ringer is turned on, date and time, missed calls and messages. The system visibility is very clear. *Rating: 5*

Samsung VGA1000 - System status is represented by icons on two displays: one internal and the other external. A set of icons provide feedback for system status. These icons include (1) ringer type (2) voice mail (3) signal strength (4) alarm active (5) battery state/level (6) GPS status and (7) missed calls. Incoming call feedback is available on both displays. All of these icons are available on both the internal and external screen save for the GPS status, are easy to see at a glance. *Rating: 5*

Motorola T720 - Feedback and system status of this display includes signal strength, ring volume or vibrate state, battery strength, date and time (analog and digital), missed calls and messages available. All these elements are clearly displayed and easy to read at a glance. *Rating: 5*

2) Speak User's Language and Real-World Conventions

Siemens CF62T - This display uses simple icons which are easily recognizable, such as a picture of a bell crossed out to indicate that the sound is turned off. The battery icon looks just like a real battery and clearly shows how charged the phone is. The keypad

uses a green phone symbol to indicate the start of a call, and a red phone symbol to indicate the end of a call. These correspond with the real world convention of green = go and red = stop. There are only two textual items in the initial state, one is the "Menu" option, and the second is the "T-zones" option. Menu is a common and well-understood word, but the phrase "T-zones" does not correspond with any real world knowledge. The user would have to choose the T-zone option to find out what is meant by that term. *Rating: 4*

Samsung VGA1000 - The initial state of the phone has eight textual references split between the Screens: (1) the time (2) the date and (3) the vibration alert status and the Buttons (4) ok (5) talk (6) back (7) end and (8) menu. The time is in standard format, the hour colon separated from the minute followed by the meridian. The vibration alert message says 'vibrate' if active and the date is in the standard format of day of the week, month, day of the month format. Textual references (1) and (2) are available on both the internal and external displays, reference (3) is available on only the internal screen. *Rating: 5*

Motorola T720 - This initial state has very few textual references, those that do appear are limited to one or two words, which are clear and easy to understand. Time is provided in both analog and digital format, for quick, easy, and detailed reference. The icons on this display are accurate symbols of their real-world counterpart, for example ring styles are represented by bells, the calendar is represented by a date book with a digital date displayed. The pick-up button is green, with a phone handle lifted up, the hang-up button is red, with the phone handle positioned on a phone. *Rating: 5*

3) User Control and Freedom

Siemens CF62T - The user has the opportunity to press the red hang-up button to either back out of whatever menu option they have chosen, or to hold the button down to turn off the phone completely. *Rating: 5*

Samsung VGA1000 - There is no support for Undo and Redo functions, however at any time the 'End' button if pressed can be used as a "emergency exit" button to return to the main screen during any task. If the 'End' button is held down at any time the phone powers off. *Rating: 5*

Motorola T720 - The most common functions of a cell phone are accessible from this state within one click. These include, ring styles, recent calls, calendar, phonebook, internet access, and message center. The ring volume is also located via buttons on the side of the phone. *Rating: 5*

4) Consistency and Standards

Siemens CF62T - The initial state matches cellular phone conventions because the start call button is on the left, the hang-up button is on the right, and the numbers on the key pad follow the traditional ordering of 1 – 0. There is also a directional navigation pad in the center and a charging port on the bottom of the phone. Other standards that are followed are the battery strength icon on the right, the signal strength icon on the left, the time and date and missed call indicators. *Rating: 5*

Samsung VGA1000 - Several adherence to standards can be observed in the initial state of the VGA1000. It has a standard numerical keypad layout, consisting of buttons 0 through 9, a directional pad, a select button and talk and end buttons. However the duplication of the OK function to match that of the select button is slightly confusing. There is a charging plug on the bottom of the phone. *Rating: 3.5*

Motorola T720 - This phone follows standard telephone conventions for the basic numeric key layout, but fails to follow cell or cordless phone conventions for the activation/pick-up and de-activation/hang-up keys. These are clearly indicated by the red and green icons mentioned above, but are in the reversed position to other electronic phones: the activation/pick-up key is on the right side, and de-activation/hang-up key is on the left side. System icons follow standards for reception, battery charge, and date/time formatting. The layout of the phone's main function keys, follows standards in providing a four point directional or navigation pad. The headphone plug, and the speaker and microphone are in positions consistent with standard phones. *Rating: 4*

5) Error Prevention and Error Messages

Siemens CF62T - Not applicable. *Rating: 0*

Samsung VGA1000 - Not applicable. *Rating: 0*

Motorola T720 - Not applicable. *Rating: 0*

6) Recognition rather than Recall

Siemens CF62T - The icons on the initial state make it easy for the user to recognize what they are looking for. There are not many items displayed on the screen, so recognition is easy. *Rating: 5*

Samsung VGA1000 - The presence of common, recognizable and prominent icons on the screen all aid the user in recognition. *Rating: 5*

Motorola T720 - Most functions and options at this state are easily recognized. However, the previously mentioned placement of the pick-up and hang-up buttons caused errors with early use of the phone, and required recall of position and function to avoid errors. In addition, one function key, in the top center of the key layout and bottom center of display, is not easily recognized. The icon consists of a thick horizontal bar, above three thin horizontal bars, intending to represent a computer menu. This icon is not easily recognized, and requires recall of functionality, where to find additional options. *Rating: 3*

7) Flexibility and Efficiency of Use

Siemens CF62T - Instead of pushing the "Menu" button, more experienced users can navigate with the direction pad above the numbers on the key pad. Novice users can simply choose the menu option. *Rating: 5*

Samsung VGA1000 - For advanced users, the direction pad doubles as a four programmable shortcut keys eliminating the need to navigate the menu for common

tasks. For novice users, the menu can be navigated to locate the needed feature. *Rating: 5*

Motorola T720 - There are no advanced features specific to the initial state of the phone. As mentioned, the most frequently used functions are available within one click and shortcut keys for other functions are available from this state. Color and background images can be set to customize the display in this state. *Rating: 5*

8) Aesthetic and Minimalist Design

Siemens CF62T - The things that are available on the initial screen without any navigation are items that are very important when using a cell phone. For example, a user would not make a call if they saw that they absolutely no signal at that time. There is no extraneous information in this display. *Rating: 5*

Samsung VGA1000 - The phone's screen in the initial state has a minimum of items, providing the user with the basic information needed, for example they can see if the battery needs charging or if there is enough signal to place a call. *Rating: 5*

Motorola T720 - The design is clean and minimal, with clear distinction between elements. *Rating: 5*

9) Help and Documentation

Siemens CF62T - No on-line help or documentation is available. *Rating: 0*

Samsung VGA1000 - No on-line help or documentation is available. *Rating: 0*

Motorola T720 - No on-line help or documentation is available. *Rating: 0*

Phonebook Function

1) Feedback and Visibility of System Status

Siemens CF62T - At the top of the "New Entry" screen there is a picture of a pencil and some numbers, and there is also a picture of an open book. These things clearly indicate where the user is and why they are here. *Rating: 5*

Samsung VGA1000 - In the "Add new entry" screen the user isn't aware of the current action as the text at the top of the screen only says "Enter Phone #". *Rating: 5*

Motorola T720 - When viewing the first phonebook page (one's list of saved numbers), the mode is clearly indicated at the top of the display, with the header "Phonebook." This header is actually part of the scrolling list of saved phone numbers, so when one scrolls beyond the displayed list, the header scrolls out of view also, loosing the mode display. Additional pages within the phone book do not have this issue, and are clearly indicated with relevant headers. When a change is made to an entry, feedback is provided, indicating the change has been saved. *Rating: 4*

2) Speak User's Language and Real-World Conventions

Siemens CF62T - When entering a new phone number the user can chose to put it in either a VIP group or no group at all. All the text on the screen is written using common terms that match what people encounter in the real world. *Rating: 5*

Samsung VGA1000 - While adding a new entry into the phone book the dialogs speak the users language with feedback messages and dialog titles. The user is able to group numbers together, select type of number, ie cell phone and add other information about the entry. *Rating: 5*

Motorola T720 - All options and references are in textual format using common terms and language, no icons are used requiring interpretations. The concept of a physical phonebook is maintained through this electronic medium, following normal conventions, storing names and numbers, listed alphabetically. *Rating: 5*

3) User Control and Freedom

Siemens CF62T - There are several features that let the user undo or cancel the process of entering a new phone number. One way is to press the button corresponding to "cancel" on the screen, and another is to press the red hang-up button which is always present on the keypad. Once a character has been typed a "clear" option appears on the left, which allows the user to delete the last character entered. There is no redo feature. *Rating: 4*

Samsung VGA1000 - Like the initial state there is the same support for the emergency exit "End" button. A back button is provided on each of the screens but no undo/redo action was provided. *Rating: 5*

5

Motorola T720 - Several functions are available for storing, editing and sorting phone numbers. At any point, one may exit or abandon their process by using the hang-up key, which returns the user to the initial state. Although, after one steps through and simply views the options within the "edit" mode, when returning to the previous pages they will encounter a display indicating "saved changes," even though no changes were made on the entry. *Rating: 4*

4) Consistency and Standards

Siemens CF62T - The phonebook entry display is consistent with the design of the rest of the phone's displays. The cancel button is on the right side of the keypad just above the hang-up button so it is very easy to remember how to cancel an action. Both of these buttons are on the right side, which is a standard most cellular phones follow. *Rating: 5*

Samsung VGA1000 - The layout of the top of the screen is consistent with the Initial State. The back button selection is on the left of the screen similar to the majority of cellular phones. *Rating: 5*

Motorola T720 - The phonebook function follows consistent placement of options, and follows platform conventions. All selection options, such as "view," "edit" and "change" are on the bottom right of the display (top right of keypad), and all finished options, such as "exit," "back" and "done" are on the bottom left of the display (top left of keypad). *Rating: 5*

5) Error Prevention and Error Messages

Siemens CF62T - Errors occur very easily while entering letters in the name field. Characters must be scrolled to very quickly in order to make a choice before the phone defaults to one. These types of errors could be prevented if a different letter choice system was used. *Rating: 3*

Samsung VGA1000 - Errors can occur when entering the name. A back button is provided which backspaces the last character entered, to help prevent these type of errors another text entry mode can be chosen called predictive text. *Rating: 4*

Motorola T720 - The only errors encountered within this function were during text entering or editing. These errors were easily overcome by a visible and easy to use "delete" key. No error messages were encountered. *Rating: 5*

6) Recognition rather than Recall

Siemens CF62T - There is no recall required in this screen of the phonebook. All the options are textual and easy to see. *Rating: 5*

Samsung VGA1000 - Each of the items on this page were easy to identify. *Rating: 5*

Motorola T720 - All options and functions are clearly indicated with relevant textual reference, all easy to recognize. No icon representation is used, requiring recall of function, other than previously mentioned menu list. *Rating: 5*

7) Flexibility and Efficiency of Use

Siemens CF62T - There is a shortcut to the "New Entry" screen that experienced users might find faster. However, using the center navigation key saves only two button pushes. The novice users should be able to use the system efficiently regardless of what method they use to enter the number. *Rating: 4*

Samsung VGA1000 - There are shortcuts provided to the function "add new entry" that advanced users might exploit. Novice users might choose to use the menu. Experienced users will save 4 clicks over novice users. *Rating: 4*

Motorola T720 - Clearly indicated options allow for ease of use. Alternative methods for saving phone numbers are available; for example, instead of following several steps to create a "new entry," a simple "store" option is available, to store a phone number, after it has been entered. *Rating: 5*

8) Aesthetic and Minimalist Design

Siemens CF62T - The design contains no unneeded elements yet still provides all the necessary information. *Rating: 5*

Samsung VGA1000 - There is no unneeded information on this screen. *Rating: 5*

Motorola T720 - The design is clean and minimal, with clear distinction between elements. *Rating: 5*

9) Help and Documentation

Siemens CF62T - No on-line help or documentation is available. *Rating: 0*

Samsung VGA1000 - No on-line help or documentation is available. *Rating: 0*

Motorola T720 - No on-line help or documentation is available. *Rating: 0*

Conclusion

Initial State - In the initial state the Siemens CF62T, Samsung VGA1000, and Motorola T702 phones received identical ratings in 6 out of the 9 heuristics. The ninth heuristic, help and documentation, was not evaluated because no help or documentation was available on any of the phones. There was a slight difference for the match between the system and real world heuristic between the three phones. The Siemens phone did not speak the users' language as well as the other two phones. Another heuristic that varied among the phones was consistency and standards. The Samsung and Motorola phones both showed some deviation from our set of standards. The last heuristic where differences could be seen was recognition vs. recall. The Motorola phone received a rating of 3 compared to 5 for both of the other phones.

Phone Book The three phones received identical ratings for 5 out of the 9 heuristics after evaluating each phone book. Slight differences were present for visibility of system status, user control and freedom, and flexibility and efficiency of use. None of the phones received the highest score on all three of these heuristics. There were larger differences present for heuristic five, error prevention. The scores ranged from 3 to 5, with only one phone receiving the highest score.

Clicks per Task - For advanced users there were significant differences in the number of clicks required to create a new entry in the phone book. The range went from 4 clicks for the Siemens phone all the way to twelve for the Samsung phone. The range for novice users was fairly large as well, going from 3 clicks up to 8. Editing an existing entry showed no differences between the phones, all required 9 clicks to accomplish the task. Clearly there is room for the Samsung phone to improve its phone book process for the advanced user. The editing task could probably also be simplified for both the Siemens and Samsung phones based on the results from the Motorola phone.

Average Rating - There was very little difference in the average ratings for the three phones. The Siemens and Motorola phones had the same average of 3.89 while the Samsung was slightly higher at 3.99, with 5 being the highest possible score. The average scores from the heuristic evaluation reveal that all three phones have decent user interfaces, but still have room to improve.

Trends - There was only one heuristic that revealed a consistent weakness across both interfaces, and it was only for one phone. All the phones received a score of 0 on heuristic 5 for the initial state interface, but the Siemens phone also received a poor rating for the phone book interface. The consistent bad ratings reveal a design that is not conducive to error prevention.

With the exception of heuristic 9, help users diagnose and recover from errors, there were no other heuristics where a phone received bad ratings across the board.

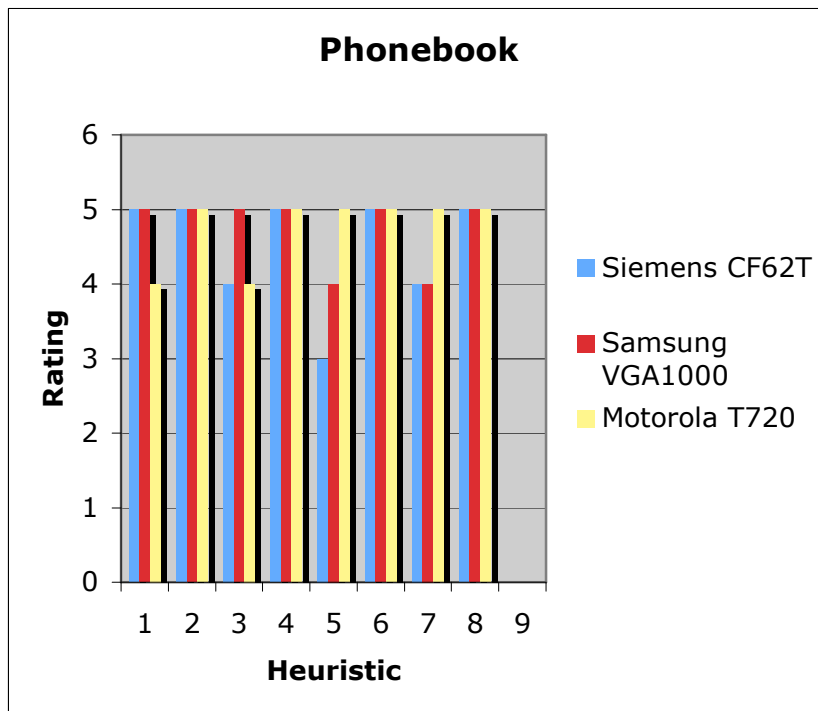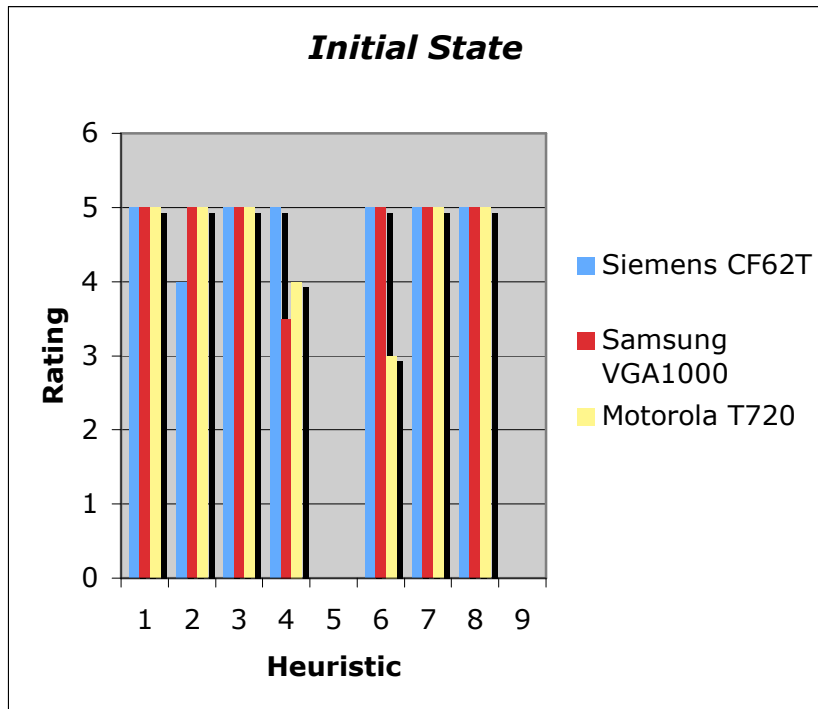# Appendix A

Heuristics and Standards

Heuristics

1) Feedback and System Status

2) Speak User's Language and Real-World Conventions

3) User Control and Freedom

4) Consistency and Standards

5) Error Prevention and Error Messages

6) Recognition rather than Recall

7) Flexibility and Efficiency of Use

8) Aesthetic and Minimalist Design

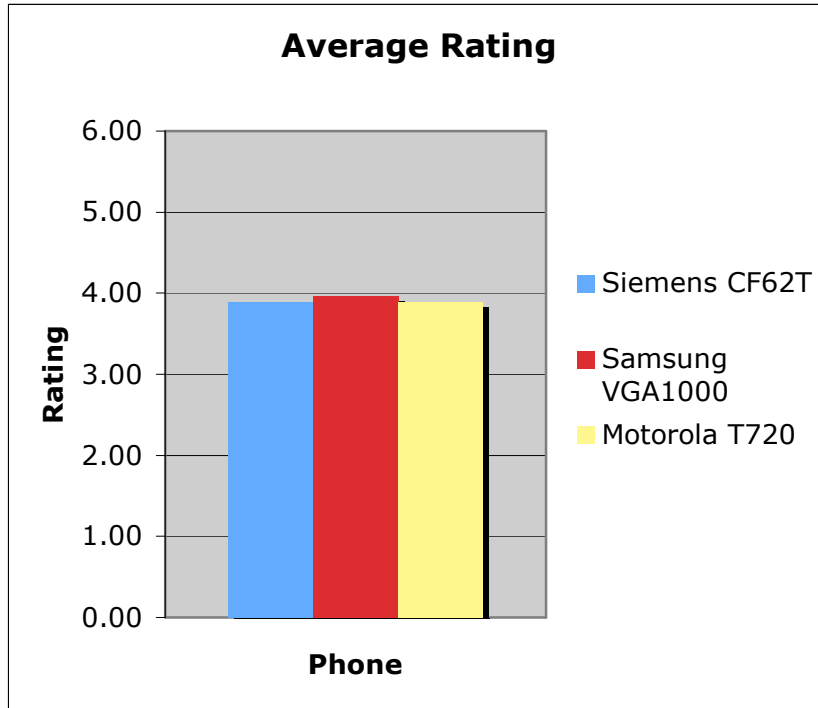9) Help and Documentation

(From: J. Nielson's *Usability Engineering*)

Standards

1) Number / keypad layout (standard telephone layout):
        1st (top) row: 1 2 3
        2nd row: 4 5 6
        3rd row: 7 8 9
        4th row: * 0   #

2) Send-call & Hang-up keys:

    Send-call Key: Top left of keypad
    Hang-up key: Top right of keypad

3) Reception signal indicator:

    Set of incrementally taller vertical bars

4) Battery charge state indicator:

    Image of traditional battery (ex: AA, C, D battery shape), incrementally filled in, indicated level of remaining charge.

5) Direction / Navigation pad:

    4 point directional buttons or keypad (top, right, bottom, left) for navigation through icons or menus.

7) Speaker and microphone location:

    Positioned for most efficient use, most proximate location to ear and mouth when held for conversational use.

6) Headphone plug

    Available
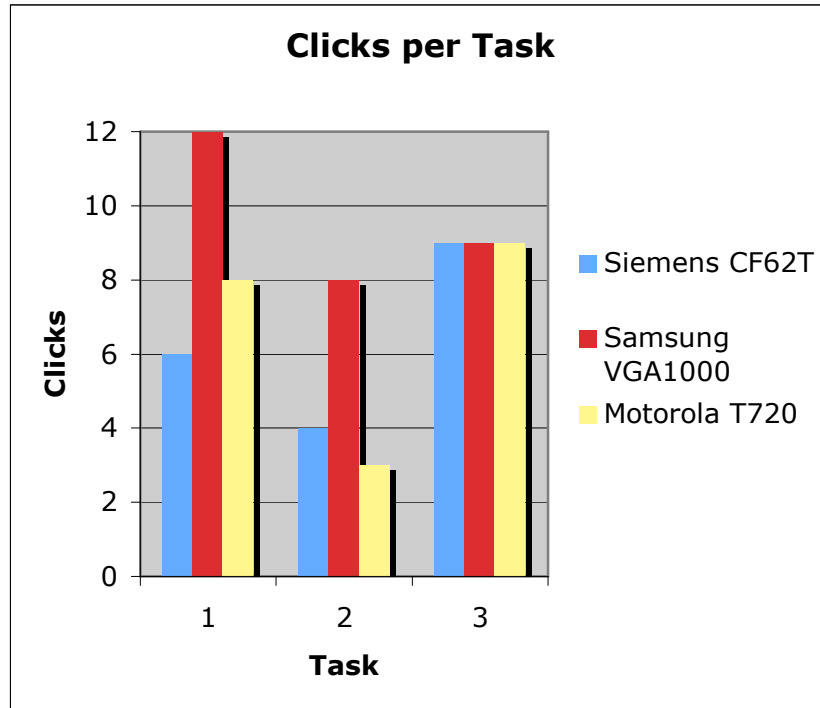
Appendix B

Initial State

Rating vs. Heuristic chart with legend: Siemens CF62T, Samsung VGA1000, Motorola T720

Phonebook

Rating vs. Heuristic chart with legend: Siemens CF62T, Samsung VGA1000, Motorola T720

Appendix C

Average Rating

Appendix D

Clicks per Task

Task 1: Completing a new phonebook entry (novice/long method)

      Siemens CF62T: 6

      Samsung VGA1000: 12

      Motorola T720: 8

Task 2: Completing a new phonebook entry (expert/short method)

      Siemens CF62T: 4

      Samsung VGA1000: 8

      Motorola T720: 3

Task 3: Editing an existing phonebook entry

      Siemens CF62T: 9

      Samsung VGA1000: 9

      Motorola T720: 9

Appendix E

Samsung VGA1000

Appendix F

Motorola T720