

HandyPort
Multipoint Mode
User's Manual

2013. 08. 01.
SYM-2300-2E
Version 1.1



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¹ To support the multipoint functions, the HandyPort has to be the software version 3.2 and above.

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1. Introduction

This document describes the multipoint functions in HandyPort network.

1.1. HandyPort Network

HandyPort network has been supporting just Point-to-Point networking. It is supporting Point-to-Multipoint functions from the software version 3.2.

1.2. Features

The HandyPort supports the following features to support the multipoint network.

- Supports Point-to-Point, Point-to-Multipoint, and Multipoint-to-Multipoint Communications
- Supports the MN (Master Node), SN (Sub Node), and EN (End Node)
- Supports a Repeater Function
- Supports up to 260 Nodes for the Master-Slave Communications
- Supports HUB and Unicast Networking
- Supports Unicast, Broadcast, and Multicast

1.3. Organization

This document is organized as follows:

Chapter 1. Introduction

Chapter 2. Network Architecture of HandyPort

Chapter 3. Network Topology of HandyPort

Chapter 4. Network Nodes of HandyPort

Chapter 5. Usage of Multipoint Functions

1.4. Revision History

Table 1-1 Revision History

Revision	Date	Reason for Change
1.1	2013. 08. 01	Added a UART mode for MN and SN

1.5. Acronyms

Table 1-2 Acronyms

Acronym	Definition
CoD	Class of Device
DCE	Data Circuit-Terminating Equipment
DTE	Data Terminal Equipment
EN	End Node
ENm	Master End Node
MN	Master Node
SN	Sub Node

1.6. References

1. HPS-120 User's Manual
2. HPS-110 User's Manual

2. Network Architecture of HandyPort

This chapter describes the network architecture of HandyPort.

2.1. Connection Types

There are two connection types, which are the incoming connection type and the outgoing connection type, in the HandyPort network. The HandyPort used to have a connection type either the incoming connection or outgoing connection to support point-to-point network. To support the multipoint functions, the HandyPort has to have more than one connection type. From the software version 3.2, the HandyPort can have one outgoing connection and up to 6 incoming connections to support the multipoint functions.

2.1.1. Outgoing Connection

To make a connection, a party needs to initiate a connection using a paging message. That is called the outgoing connection in the HandyPort network. And this party acts as a master in the HandyPort network. For an instance, the HandyPort has an outgoing connection when it is in Register & Connect connection mode.

2.1.2. Incoming Connection

To make a connection, there should be a party that needs to accept a paging message from the other party. That is called the incoming connection in HandyPort network. And this party acts as a slave in the HandyPort network. For an instance, the HandyPort has an incoming connection when it is in WAIT connection mode.

2.2. Node Types

There are two types of node that are a point-to-point node and a point-to-multipoint node. The EN (End Node) is the point-to-point node including ENm (Master End Node). The MN (Master Node) and SN (Sub Node) are the point-to-multipoint nodes.

2.2.1. Master Node (MN)

This is a routing master in HandyPort Network. The master node (MN) has features as follows:

- Must be 1 in a HandyPort network
- Allowed an outgoing connection and up to 6 incoming connections
- Must have a connection to an ENm using an outgoing connection
- Can have up to 6 EN and/or SN using up to 6 incoming connections
- Must be in the Register and Connect mode

- Acts as the master role in the HandyPort network
- Can be three types of MN that are MN, MN HUB and MN Unicast
- Has the routing functions
- A serial port can be used for monitoring purpose only

2.2.2. Sub Node (SN)

There are two types of SN. One is a SN Repeater that can be located only between two ENs. The other SN is almost the same as the MN except it can connect to a MN or other SN using an outgoing connection. The SN has features as follows:

- Can be many in a HandyPort network
- Allowed an outgoing connection and up to 6 incoming connections (SN)
- Allowed an outgoing connection and an incoming connection (SN Repeater)
- Must have a connection to a MN or SN using an outgoing connection (SN)
- Can have up to 6 EN and/or SN using the incoming connections (SN)
- Can have an outgoing connection and an incoming connection between two ENs (SN Repeater)
- Must be in Register & Connect Connection Mode
- Acts as the master and slave roles in HandyPort network
- Can be four types of SN that are SN, SN HUB, SN Unicast and SN Repeater
- Has the routing functions
- A serial port can be used for monitoring purpose only

2.2.3. End Node (EN)

The HandyPort used to support the end node functions only for point-to-point network. The end node has features as follows:

- Can be many in a HandyPort network
- Allowed 1 outgoing connection or 1 incoming connection only
- The ENm has an incoming connection and will be connected by the MN
- Can make a connection with MN, SN, or EN
- Acts as either the master or slave role
- A serial port can be connected to DTE or DCE
- No routing function

2.3. Network Hierarchy

There are Peer-to-Peer and Master-Slave network hierarchies in the HandyPort network. The point-to-point connection is based on the Peer-to-Peer hierarchy. And the point-to-multipoint connections are based on the master-slave hierarchy.

2.3.1. Master-Slave Hierarchy

There are a master and slaves in the master-slave network. The master can initiate communication to others anytime, but the slaves have to wait a poll from the master to send data to network. This is a basic concept of HandyPort multipoint network. It could be the same as RS-422 and RS-485 half duplex networks. The following are the Master-Slave hierarchy.

- MN-SN-EN network
- MN HUB-SN HUB-EN network

2.3.2. Peer-to-Peer Hierarchy

Any network node can initiate communication in peer-to-peer hierarchy. It could be the same as RS-232 full duplex. The following are the Peer-to-Peer hierarchy.

- MN-SN-EN network with address mode
- MN Unicast-SN Unicast-EN network
- EN-SN Repeater-EN network
- EN-EN network

2.4. Network Address

2.4.1. Tree Architecture and Network Size

The HandyPort network consists of a MN, SNs, and ENs. The EN can be connected to DTE or DCE. The MN and SN cannot be connected to DTE or DCE. The MN and SN act as a router in the HandyPort network. You can connect up to 217 DTE or DCE in a HandyPort network like Figure 2-1.

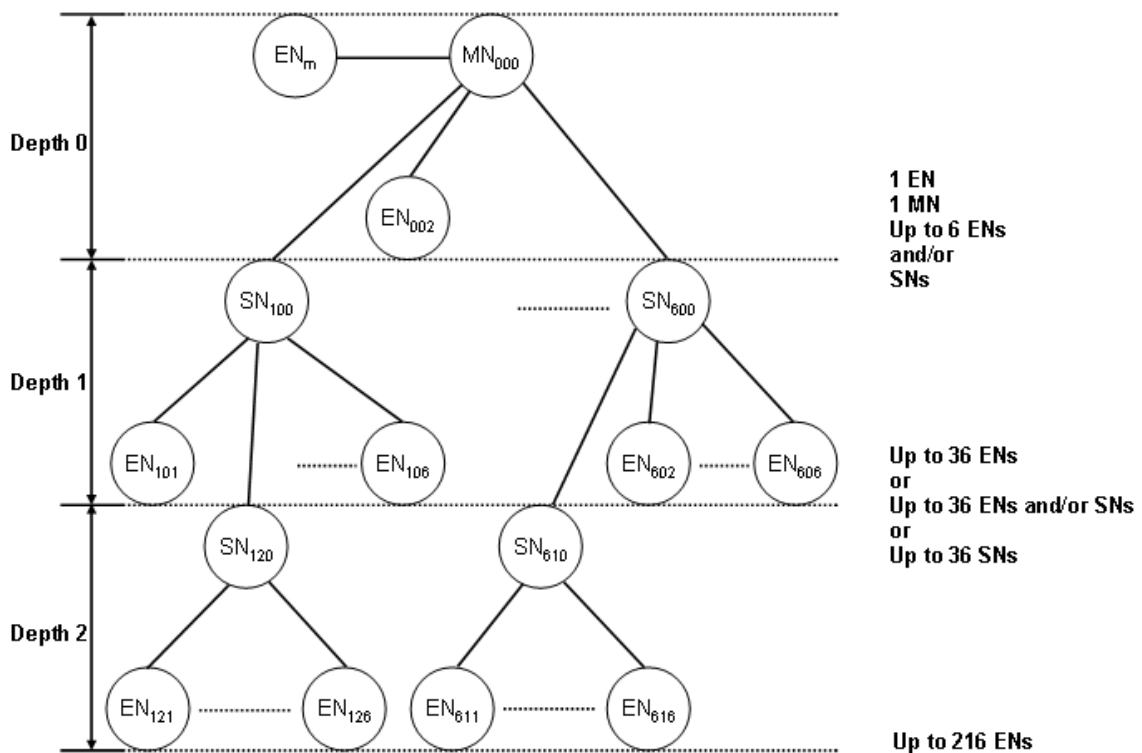


Figure 2-1 Tree Architecture

2.4.2. Address

The HandyPort can have a logical address like Figure 2-2 and Figure 2-1. The MN and EN_m will have a (0, 0, 0) address. The address will be used for Unicast mode and address mode.

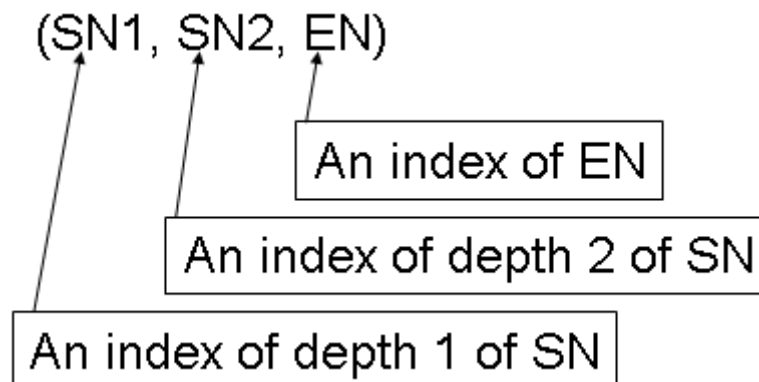


Figure 2-2 Address in HandyPort Network

2.4.3. Address Mode

The HandyPort has just a serial port. Some applications are required to distinguish data from ENs. And some applications need to use Unicast, multicast and broadcast data by data. To do this, you can utilize the address mode.

The address mode can be used in MN-SN-EN network only. And the EN_m cannot be set to the

address mode to use the address information in user's applications.

The EN will make a packet with the STX, address, length, user data, and ETX in address mode like Figure 2-3. The address will be configured for each EN when it is engaged in a connection with MN or SN. The address will be like Figure 2-2. The MN and SN will not do anything on the data from the ENs in address mode. The MN and SN will pass data to ENm, MN or SN transparently. Therefore, the user's application, which is connected to ENm, can use the address information in packet.

The MN and SN will be routing the packets from ENm or MN (or upper SN) using address in packet, when it is in address mode. It will route the packets according to the address that is inserted by user's application. And the last SN will remove the overhead information including address for the ENs. Therefore, the ENs will receive the user's data only. The user's application utilizes the address like Figure 2-4.

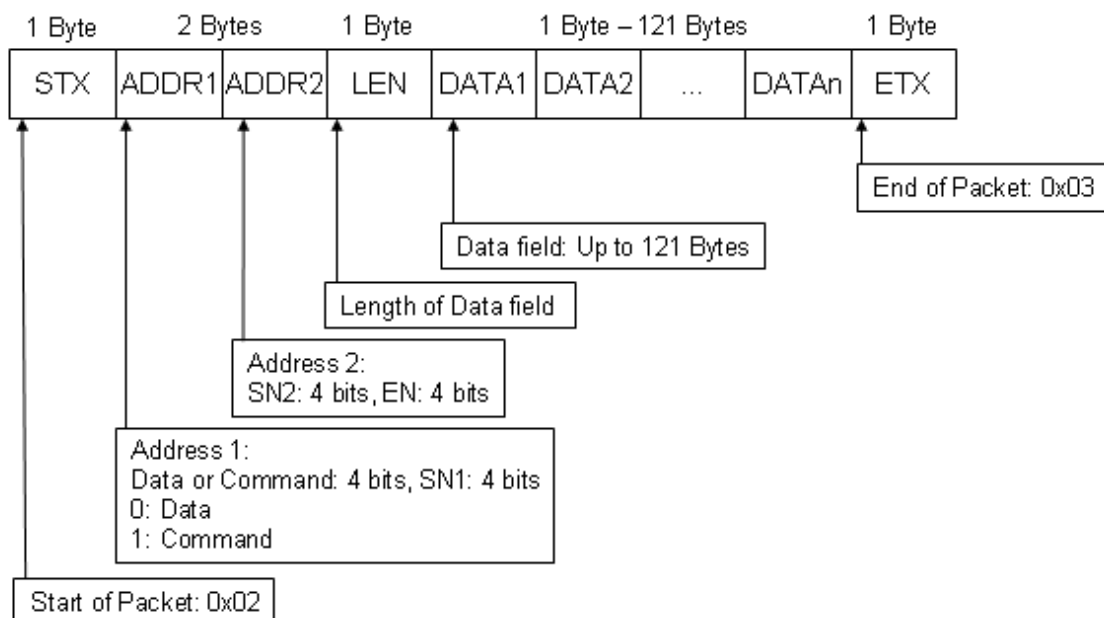


Figure 2-3 Packet Structure in Address Mode

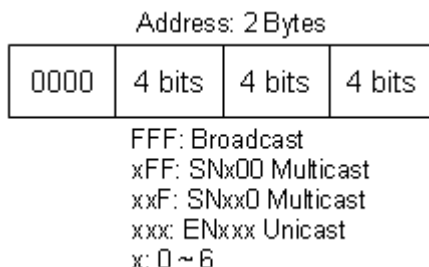


Figure 2-4 Structure of Address in the Packet

The Figure 2-5 shows the format of response packet in the address mode.

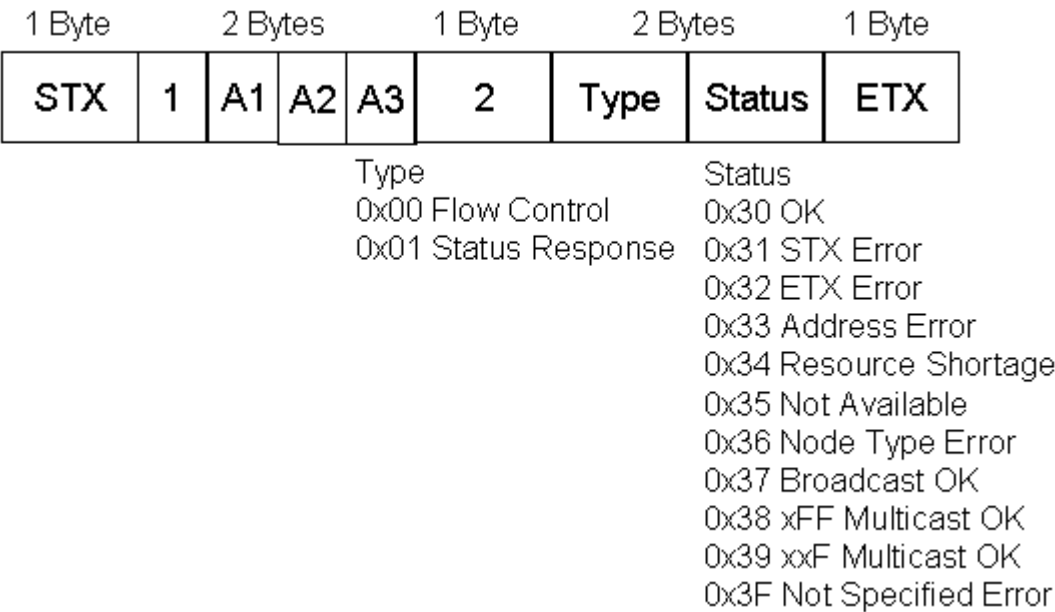


Figure 2-5 Response Packet Format

2.5. Data Flow and Routing

2.5.1. EN-EN

The EN can connect to the DTE or DCE using a serial interface. There is a simple routing mechanism for the EN. The EN sends data from the DTE to the remote EN as long as the RF resource is available. And the EN sends data to the local DTE as long as the UART resource is available.

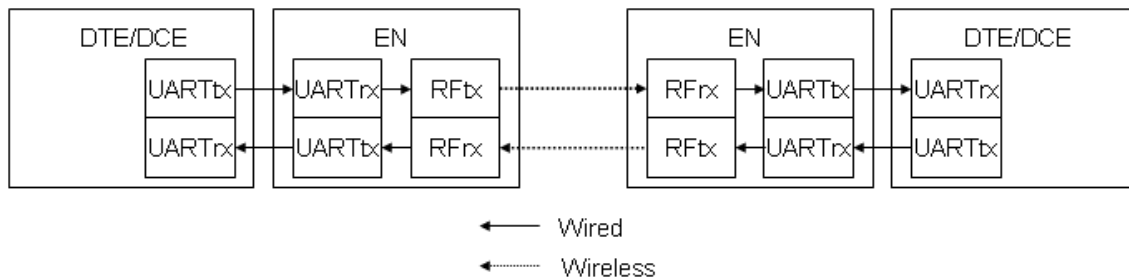


Figure 2-6 EN-EN Data Flow

2.5.2. EN-SN Repeater-EN

The SN repeater has two pair of RF resources. And it acts as a repeater between the two ENs. It can be used for extending the coverage between two ENs. And it can be deployed for cascade networking. It has a similar routing mechanism to EN except handling data between the RF resources. You can use a serial port at the SN repeater for monitoring the network.

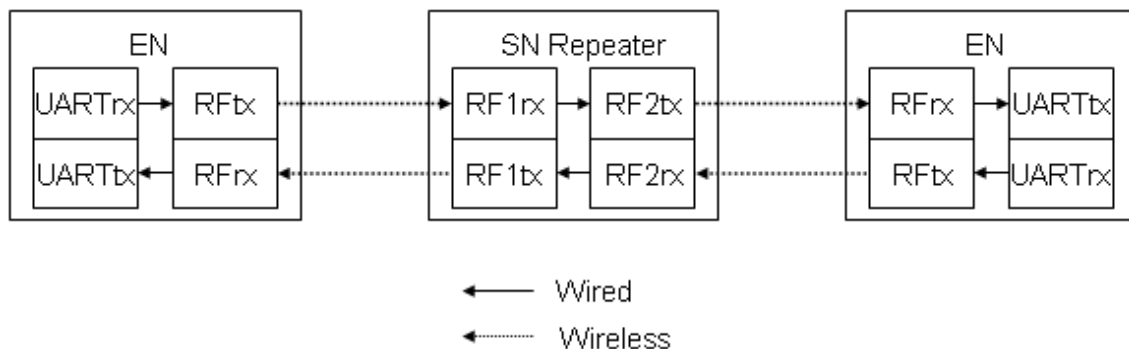


Figure 2-7 EN-SN Repeater-EN Data Flow

2.5.3. MN-SN-EN

2.5.3.1. EN-MN-SN or EN

The MN can have up to 7 pair of RF resources. And it has to connect to the ENm using an outgoing connection and can be connected up to 6 SN and/or EN using the incoming connections. You can use a serial port at the MN for monitoring the network. It has the routing mechanisms as follows:

- Data from the ENm: Sends data to the all of connected SNs and ENs like broadcast
- Data from the SNs or ENs: Sends data to ENm only

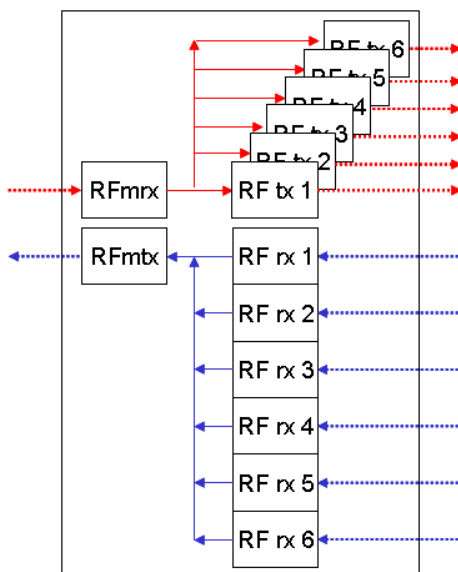


Figure 2-8 Data Routing at MN

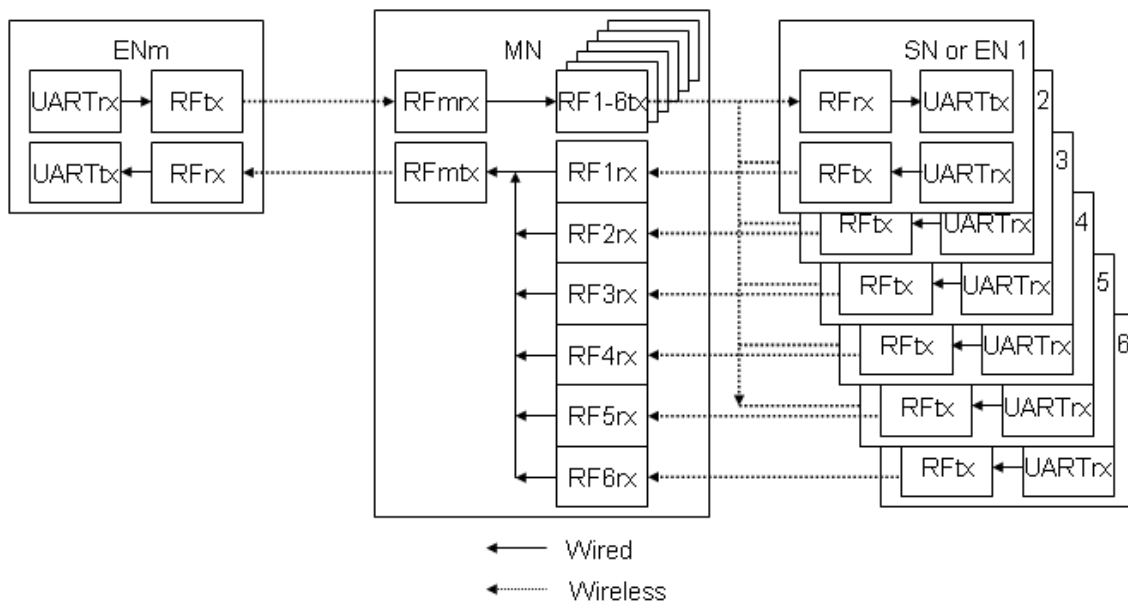


Figure 2-9 EN-MN-SN or EN Data Flow

2.5.3.2. MN or SN-SN-SN or EN

The SN has up to 7 pair of RF resources. And it has to connect to an MN or SN using an outgoing connection and can be connected up to 6 SN and/or EN using the incoming connections. You can use a serial port at the SN for monitoring the network. It has the routing mechanisms as follows:

- Data from the MN or upper SN: Sends data to the all of connected the lower SNs and ENs like broadcast
- Data from the lower SN or ENs: Sends data to the connected MN or upper SN only

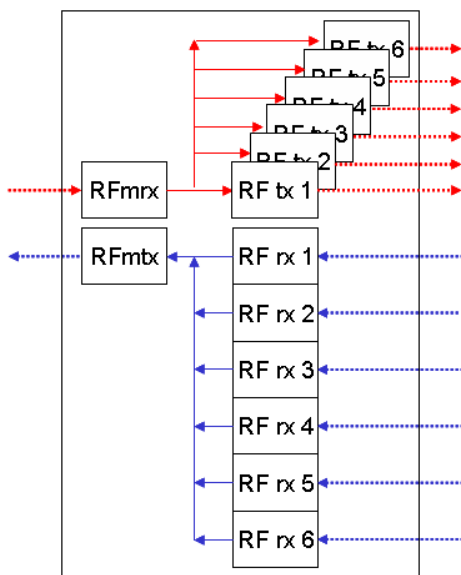


Figure 2-10 Data Routing at SN

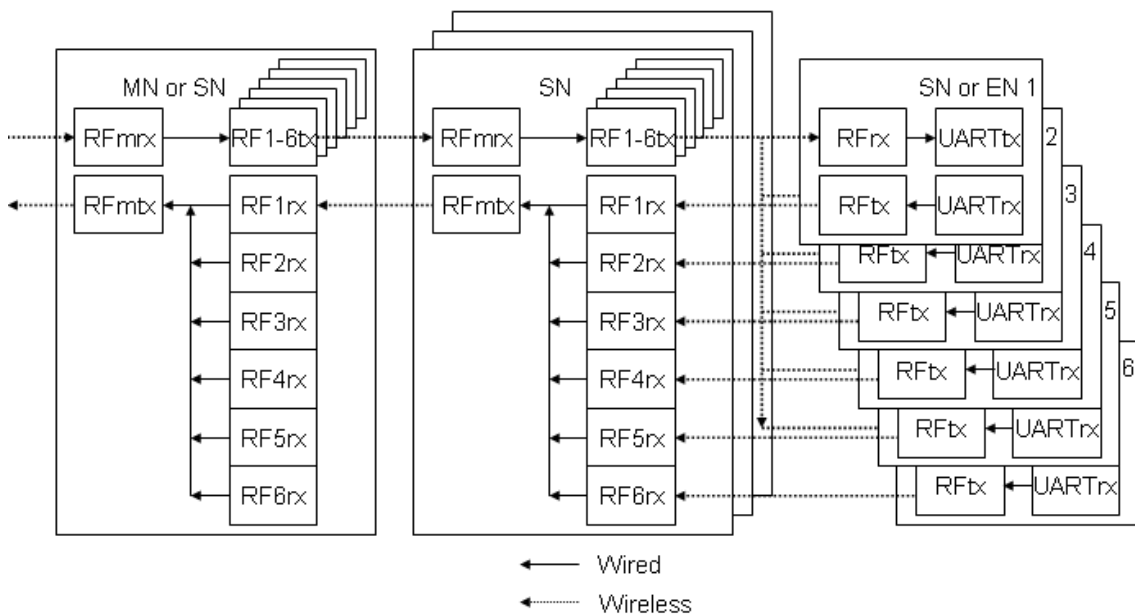


Figure 2-11 MN or SN-SN-SN or EN Data Flow

2.5.4. MN HUB-SN HUB-EN

To use the MN HUB-SN HUB-EN network, the HandyPorts have to be configured to MN HUB and SN HUB mode. The MN HUB and SN HUB have the exactly same functionality compare to the MN and SN except routing. The MN HUB and SN HUB provide RS-422 and RS-485 like network. It has the routing mechanisms as follows:

- Data from the upper node: The MN HUB and SN HUB send data to the all of connected SNs and ENs like broadcast
- Data from the lower nodes: The MN HUB and SN HUB send data to the all of connected upper and lower nodes except originating node

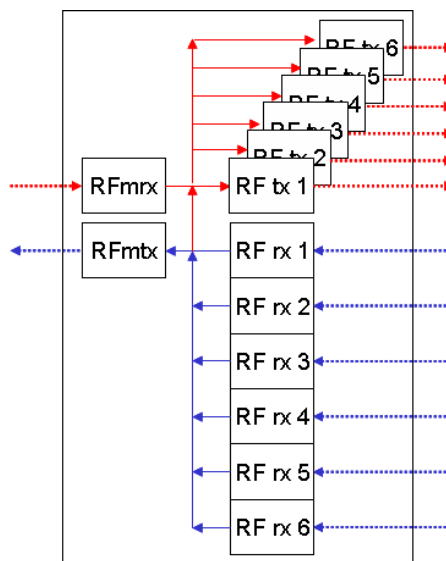


Figure 2-12 Data Routing at MN HUB and SN HUB

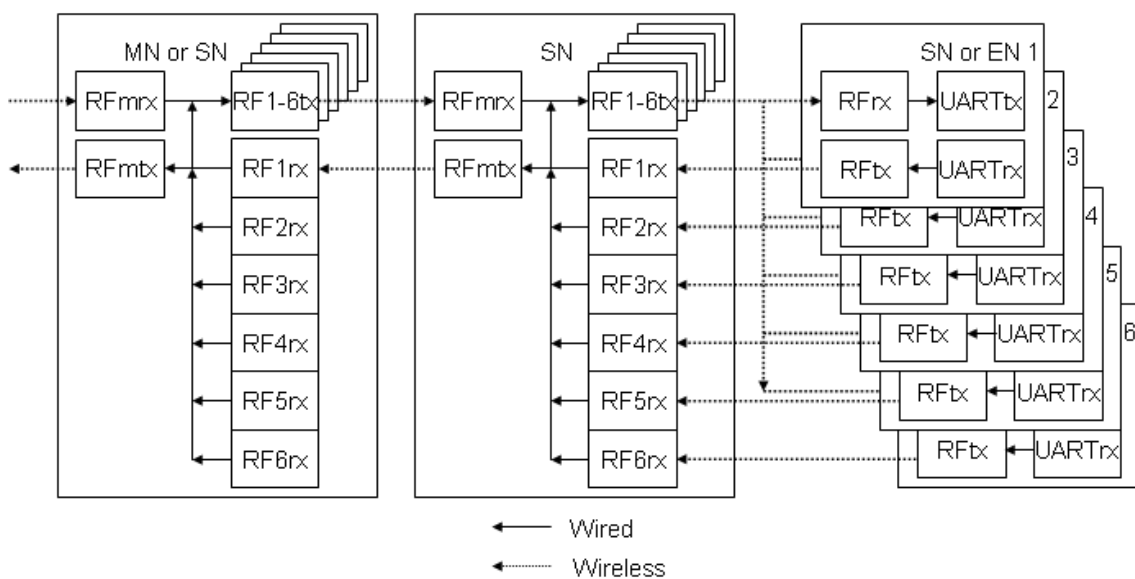


Figure 2-13 MN HUB-SN HUB-EN Data Flow

2.5.5. MN Unicast-SN Unicast-EN

To use the MN Unicast-SN Unicast-EN network, the HandyPorts have to be configured to MN Unicast and SN Unicast mode. The MN Unicast and SN Unicast have the exactly same functionality compare to the MN and SN except routing. You have to setup path first in the MN Unicast-SN Unicast network at DTE or DCE, which is connecting to ENm, using a command like WAIT COMMAND mode in the extended command mode. That means The ENm shall be in the extended command mode. But you don't need to setup a connection. Therefore, you can save the time to make a connection. You may use a command for path setup with network address that was described in 2.4.2. And you can only use a Unicast in this mode.

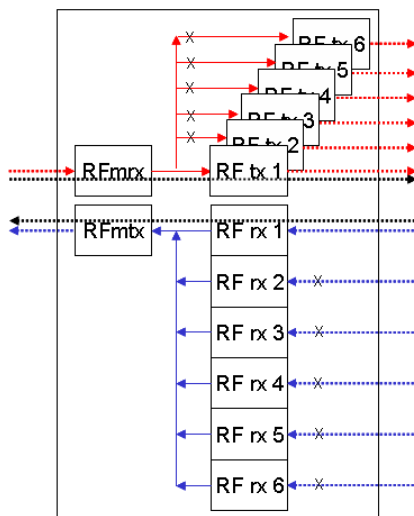


Figure 2-14 Data Routing in MN Unicast and SN Unicast

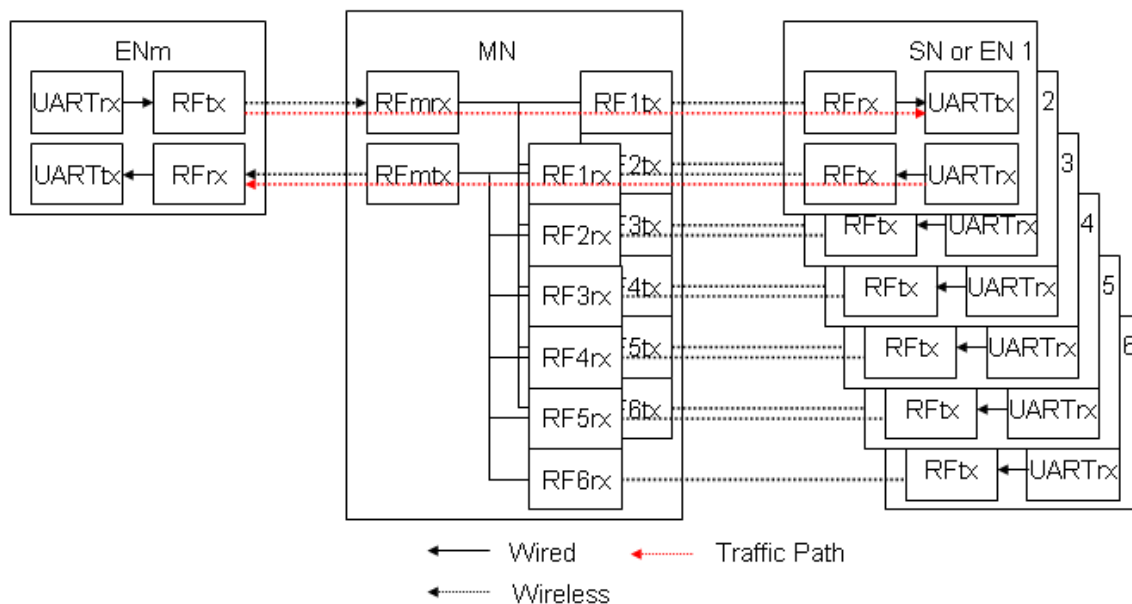


Figure 2-15 MN Unicast-SN Unicast-EN Data Flow

2.6. Communication Mode

There are 3 communication modes in HandyPort network that are Unicast, broadcast, and multicast. The EN supports Unicast only. The MN and SN can support Unicast and broadcast according to the configuration. And the MN and SN can support multicast in the address mode only.

2.7. Duplex

There are full duplex and half duplex data transmission. Full-duplex data transmission means that data can be transmitted in both directions on a signal carrier at the same time like RS-232. Half-duplex data transmission means that data can be transmitted in both directions on a signal carrier, but not at the same time like RS-422 or RS-485 multi-drop.

The following is the summary of multipoint modes in HandyPort network.

Table 2-1 Summary of Multipoint Modes in HandyPort Network

No.	Multipoint Mode	Topology	Hier-archy	Comm. Mode ¹	Always On	Local UART	Node Type	AT CMD ²	Duplex	# Nodes ³
1	OFF	PTP ⁴	P-P ⁵	Unicast	Yes	Used	EN	Used	Full	1
2	Repeater	Star	P-P	Unicast	Yes	No	SN	Used	Full	2
3	MN	Star/Tree	M-S ⁶ P-P ⁷	Broadcast Unicast	Yes	No	MN	Used	Half	7
4	MN HUB	Star/Tree	M-S	Broadcast	Yes	No	MN	Used	Half	7
5	SN	Tree	M-S P-P	Broadcast/ Unicast ⁸	Yes	No	SN	Used	Half	6
6	SN HUB	Tree	M-S	Broadcast	Yes	No	SN	Used	Half	6
7	MN Unicast	Star/Tree	M-S	Unicast	Yes	No	MN	Used	Full	7
8	SN Unicast	Tree	M-S	Unicast	Yes	No	SN	Used	Full	6
9	AT Mode ⁹	PTP	M-S	Unicast	No	Used	EN	Used	Full	No limited

¹ Comm. Mode: Communication Mode

² CMD: Command

³ # Nodes: The number of accommodation nodes

⁴ PTP: Point-to-Point

⁵ P-P: Peer-to-Peer

⁶ M-S: Master-Slave

⁷ It can be supported with enabling the address mode (addr_mode).

⁸ It uses broadcast to send data from the MN and uses Unicast to send its data and EN's data to the MN.

⁹ AT Mode: AT Command Mode

2.8. UART Mode for MN and SN

You can use a UART to monitor the status of MN or SN as default. This is for improving the performance of multipoint network. You can connect a device to MN and SN with enabling UART mode.

2.8.1. Applicable Network Node

The UART mode is applicable for MN and SN only.

2.8.2. Limitation

You have to consider the network traffic when it is turn on. It will be added extra work for MN and SN. Therefore, it is required the network traffic observation before turn it on.

2.8.3. Changes in UART Mode per Node

2.8.3.1. MN

When the UART mode is on at MN, the MN will have some changes as follows:

- Connection Mode: Shall be WAIT Mode
- Can have max. 7 incoming connections
- Can be connected to a network's master device
- Supported Half Duplex only

2.8.3.2. SN

It will have the original functionality of SN except being able to connect to device using a serial interface.

2.8.3.3. SN Repeater

It will have the original functionality of SN Repeater except being able to connect to device using a serial interface.

2.8.4. Data Flow and Routing

2.8.4.1. MN

The MN can have max. 7-pair of RF resources as UART mode is on. A serial interface at MN can be connected to the network master device and 7-pair of RF resources can be used for 7 EN and/or SN. The MN provides routing functions as follows:

- Data from the network master device: Send that data to all connected nodes that are connecting to MN via RF resources
- Data from RF resources (EN or SN): Send that data to the network master device

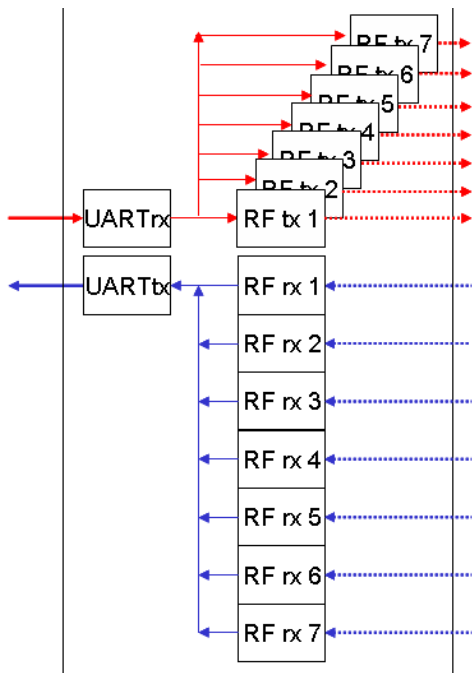


Figure 2-16 Data Routing as UART Mode ON at MN

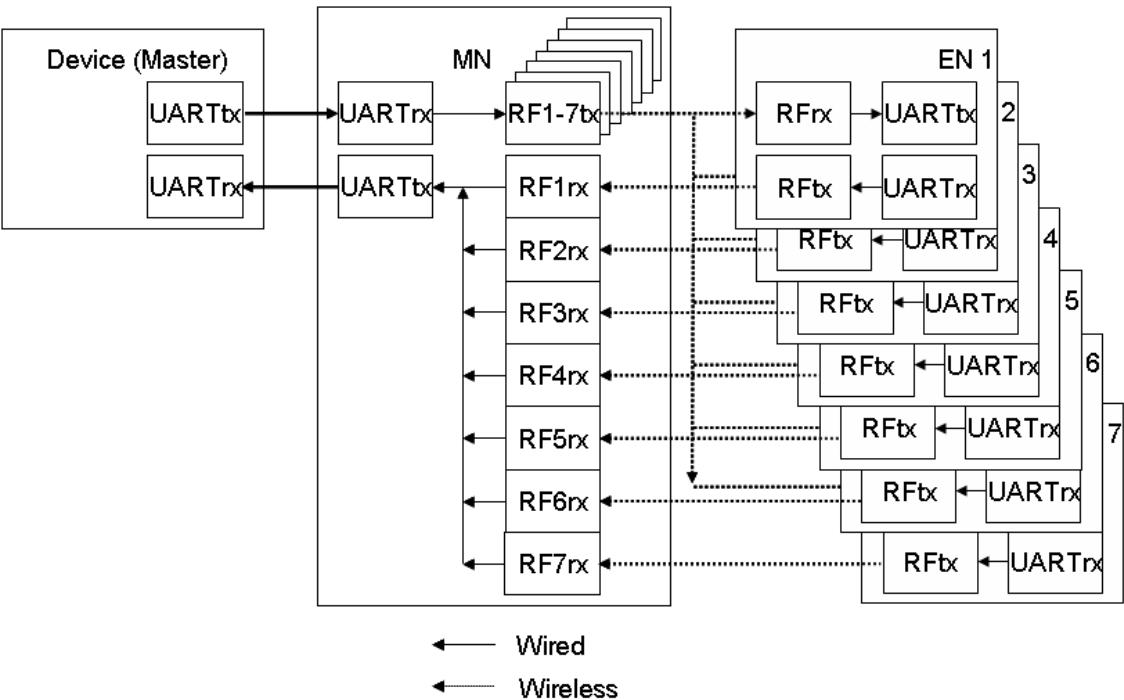


Figure 2-17 MN-EN Data Flow as UART Mode ON at MN

2.8.4.2. SN

The SN will have the same functionality of data flow and routing as the original SN except being able to send data to the device that is connecting to SN with a serial interface.

2.8.4.3. SN Repeater

The SN Repeater will have the same functionality of data flow and routing as the original SN Repeater except being able to send data to the device that is connecting to SN Repeater with a serial interface.

No text.

3. Network Topology of HandyPort

This chapter describes network topologies in the HandyPort network. There are Point-to-Point, Star, and Tree topology.

3.1. Point-to-Point Topology

This topology supports the peer-to-peer network and full duplex.

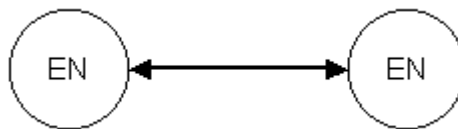


Figure 3-1 Point-to-Point Topology

3.2. Star Topology

3.2.1. SN Repeater Network

This network supports the peer-to-peer network and full duplex. And the SN repeater can be deployed cascade network.



Figure 3-2 SN Repeater

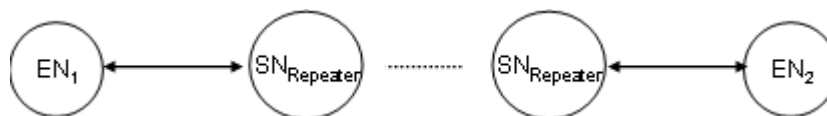


Figure 3-3 SN Repeater Cascade Network

3.2.2. Up to 7 Nodes Master-Slave Network

A device, DTE or DCE, is connecting to the EN_m that is in charge of this network. The MN will do what is described in 2.5. The MN and MN HUB mode support the master-slave network and half duplex. And the MN Unicast mode supports the master-slave network and full duplex.

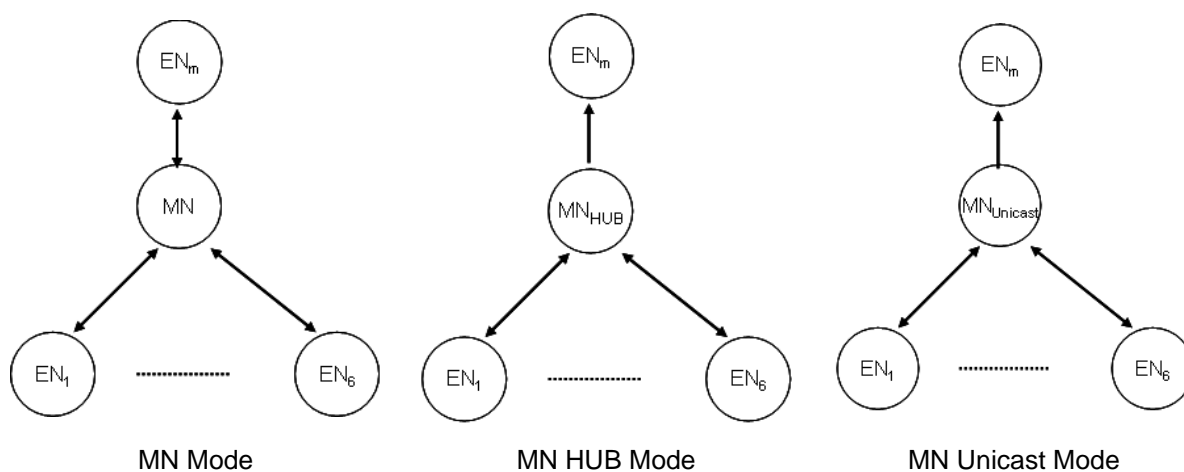


Figure 3-4 7 Nodes Master-Slave

3.3. Tree Topology

3.3.1. Architecture

The tree topology in HandyPort network consists of as follows:

- Depth 0: 1 EN_m, 1 MN and up to 6 ENs and/or SNs
- Depth 1: Up to 36 ENs or up to 36 ENs and/or SNs or up to 36 SNs
- Depth 2: Up to 216 ENs

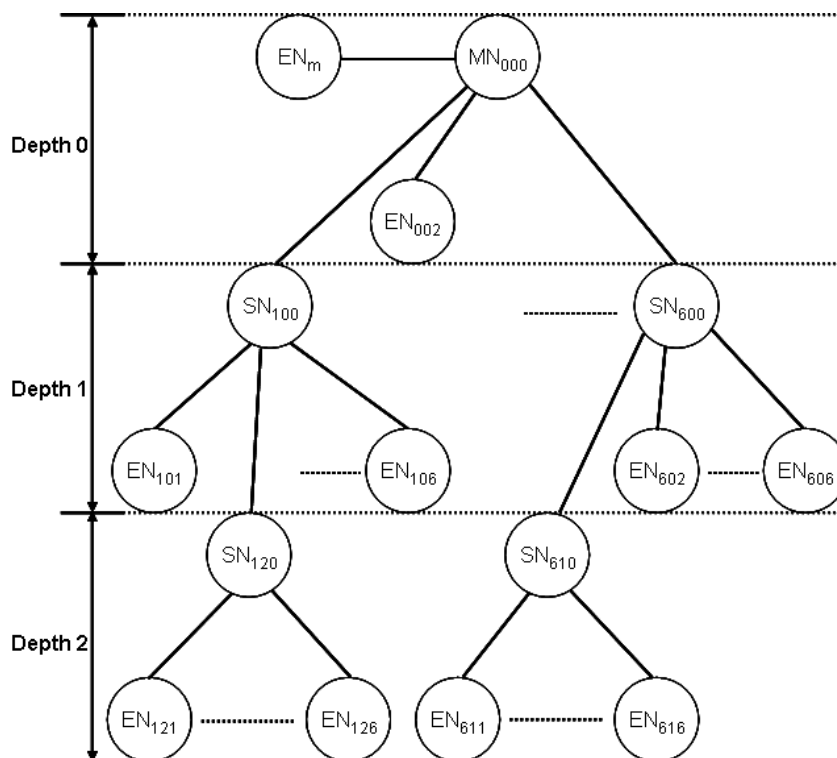


Figure 3-5 Tree Architecture

3.3.1.1. MN

The MN can accommodate an ENm and up to 6 SN and/or EN. It has to connect to the ENm.

3.3.1.2. SN

The SN can accommodate a MN or upper SN and up to 6 SN and/or EN. It has to connect to the MN or upper SN. The SN in depth 2 can have up to 6 ENs only.

3.3.1.3. EN

The EN can be connected to a DTE or DCE. And it can connect to a MN or SN.

3.3.2. Up to 260 nodes Master-Slave network

The HandyPort network can have max. 260 nodes as follows:

- 1 ENm
- 1 MN
- 42 SNs
- 216 ENs

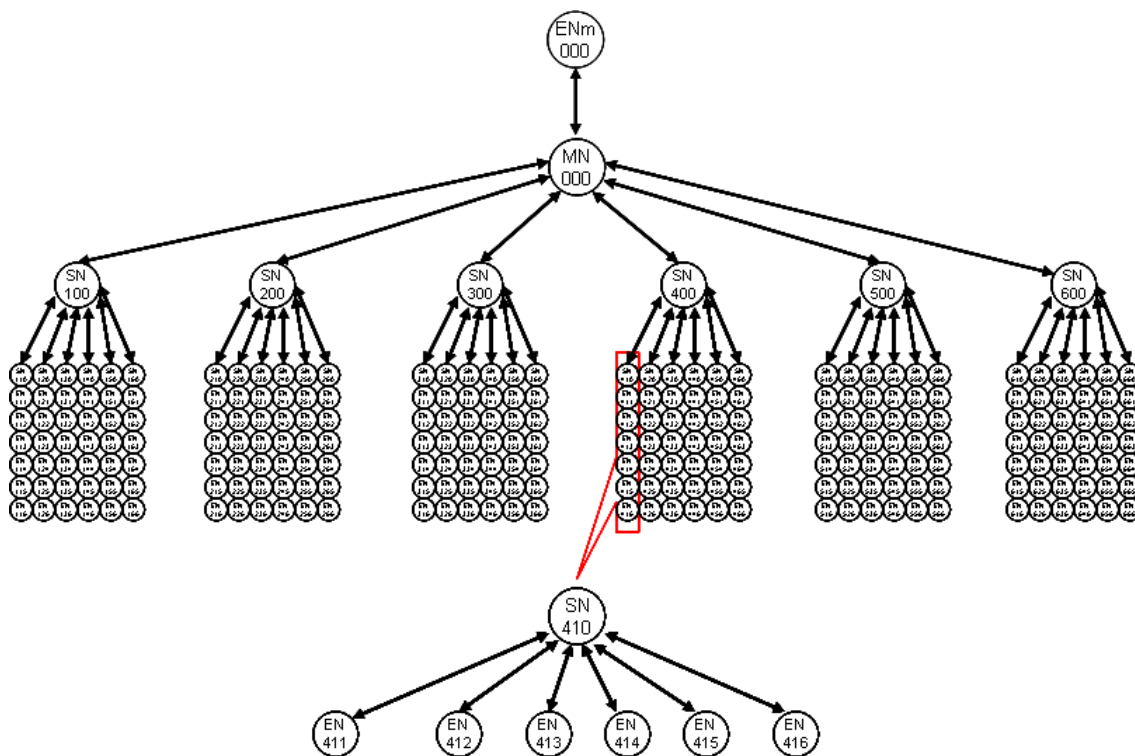


Figure 3-6 N Nodes Master-Slave

No text.

4. Types of Network Node

There can be a master end node (ENm), a master node (MN), several sub nodes (SN), and end nodes (EN) in HandyPort Network. This chapter describes the types of network node in HandyPort Network.

4.1. Master End Node (ENm)

The ENm has features as follows:

- Can make a connection with MN only
- Must be in WAIT Mode
- Allowed 1 incoming connection

4.2. Master Node (MN)

The master node (MN) has features as follows:

- Must be 1 in network
- Can have 1 ENm and up to 6 EN and/or SN
- Must be in Register & Connect Mode
- Allowed 1 outgoing and 6 incoming connections
- Shall connect to a ENm
- There are MN, MN HUB, and MN Unicast.

4.3. Sub Node (SN)

The sub node (SN) has features as follows:

- Can be many in network
- Must have 1 MN or 1 SN
- Can have up to 6 EN and/or SN (In case of Repeater, can have 2 EN only)
- Must be in Register & Connect Mode
- Allowed 1 outgoing and 6 incoming connections
- There are SN Repeater, SN, SN HUB, and SN Unicast.

4.4. End Node (EN)

The end node has features as follows:

- Can make a connection with MN or SN
- Must be in Register & Connect Mode

- Allowed 1 outgoing connection

5. Usage of Multipoint Functions

This chapter describes the commands for multipoint mode.

5.1. Objectives

This chapter describes the multipoint functions only. You can refer to the user's manuals of each model regarding to Point-to-Point functions.

There are some other commands that are not related to the multipoint functions in multipoint command section. Those commands are related to the very important system parameters. If you change those parameters improperly, the HandyPort will not work properly. Therefore, you shall not use those commands, if you don't know what it is. To get more information on those commands, please contact us.

5.2. Applicable Hardware

You can use the HPS-110, and HPS-120 for the multipoint functions.

5.3. Software Restriction

To use the multipoint network, the software shall be version 3.2 and above. To implement the multipoint network, the MN, SN, and EN have to have the software version 3.2 and above.

5.4. Changing Configuration

To change the configuration of HandyPort, you shall connect the HandyPort to your computer using a COM port. And you can change the configuration of it using the HandyPort commands and terminal emulator program like HyperTerminal.

5.4.1. Brief Steps for Changing Configuration

Step 1: Plug a HandyPort into a COM port of your computer. And power it on.

Step 2: Open a HyperTerminal at your PC and set it up (default: 9600 8-N-1, Flow Control: none).

Step 3: If the HandyPort is in the Button mode, push the RST button to enter the setup mode. If you enter the setup mode successfully, the LNK LED will be flashing every second. If the HandyPort is not in the Button mode, type an "AT+ZV" command to verify the current settings. You may change the connection mode to "WAIT" to make easy for configuring the HandyPort

using "AT+ZM1<CR>" and "AT+ZX"¹.

Step 4: Hit a <CR>² to verify the current configuration of HandyPort in the Button mode. If it's not in the Button mode, type an "AT+ZV" command to verify its configuration.

Step 5: Change the configurations of HandyPort with the provided commands, if necessary.

5.4.2. Command Format

5.4.2.1. Button Mode

L<command>[Data Type][<CR>]

5.4.2.2. Non-Button Mode or Extended Command Mode

<command sequence>L<command>[Data Type][<CR>]

5.4.2.3. Notation

- <>: Mandatory parameter
- []: Optional parameter
- <command>: a capital alphabet or symbol
- Data Type: input parameter for each command
- <CR>: Carriage Return (0x0D)
- <command sequence>: "AT+Z"

5.4.3. Commands for Multipoint Functions

The commands for multipoint functions are consists of configuring the multipoint mode, related to the address mode, related to searching and auto-connecting, related to Unicast network, and status display command.

¹ If the HandyPort is configured as master, it will reboot periodically. Therefore, it'll not be easy to change its configuration. To avoid that, you can change its connection mode to "WAIT". If you don't want to change anything, change it back to the original.

² <CR>: An <Enter> key in keyboard

Table 5-1 Command List

Command	Syntax	Remarks
A : Address mode setting	[AT+Z]L<A><am><CR>	For EN, MN, and SN/Not for ENm
B : UART Mode setting	[AT+Z]L<mm><CR>	For MN and SN
C : Print nodes status	AT+ZL<C>	For MN and SN
F : Search Mode setting	[AT+Z]L<F><mm><CR>	For EN and SN/ON: executing L
L : Node Level setting	[AT+Z]L<L><ll><CR>	For EN and SN/Required activating F
M : Multipoint Mode setting	[AT+Z]L<M><mm><CR>	
O : Unicast Path setup	AT+ZL<O><#1,#2,#3><CR>	For ENm in Extended Command mode
P : Packet Size setting	[AT+Z]L<P><ss><CR>	For EN (Address Mode shall be ON)
Q : Searching CoD setting	[AT+Z]L<Q><cod><CR>	For EN and SN
R : Print Operation Mode	[AT+Z]L<R>	
V : Print all of nodes status	AT+ZL<V><mm><CR>	For ENm in Extended Command mode
? : Print Help	[AT+Z]L<?>	

Table 5-2 Command Usability per Node

Command	EN	MN	SN	SN Repeater	Remarks
A	O	O	O	X	Not for ENm
C	X	O	O	O	
F	O	X	O	X	
L	O	X	O	X	
M	O	O	O	O	
O	O	X	X	X	For Unicast Network
P	O	X	X	X	
Q	O	X	O	X	
R	O	O	O	O	
V	O	X	X	X	
?	O	O	O	O	

Table 5-3 Button Mode Possibility per Node

Node	Button Mode	Extended Command Mode	Remarks
EN/ENm	O	O	ENm shall be in the Extended Command Mode in Unicast Network
MN	X	O	
SN	X	O	
SN Repeater	X	O	

5.4.3.1. Command for Multipoint Mode**Table 5-4 Command 'M' for configuring Multipoint Mode**

Syntax	Parameter	Response	
		Success	Failure
[AT+Z]L<M><mm><CR>	<mm>: ASCII - '0': OFF - '1': SN Repeater - '2': MN - '3': MN HUB - '4': SN - '5': SN HUB - '6': MN Unicast - '7': SN Unicast	Print the changed configuration and the Operation Mode will be changed accordingly.	Print an error message.
Remarks	The Operation Mode will be changed accordingly. '0': Button Mode (Point-to-Point) '1' – '7': Extended Command Mode		

5.4.3.2. Commands for Address Mode

Table 5-5 Command 'A' for configuring Address Mode

Syntax	Parameter	Response	
		Success	Failure
[AT+Z]L<A><am><CR>	<am>: ASCII - '0': OFF - '1': ON	Print the changed configuration and Operation Mode will be changed accordingly.	Address mode is OFF.
Remarks	For MN-SN-EN Network only, but not for ENm. If Address Mode is ON at MN and SN, a device that is connected to ENm shall make a packet, which is defined 2.4.3, and send it to ENm for every data. In case of EN, Operation Mode will be changed to the Extended Command Mode, if Address Mode is ON.		

Table 5-6 Command 'P' for configuring Packet Size

Syntax	Parameter	Response	
		Success	Failure
[AT+Z]L<P><ss><CR>	<ss>: ASCII - '0': OFF - '1' – "121": ON	<CR><LF>OK<CR><LF>	Print an error message.
Remarks	For EN only. If the packet size is fixed, the HandyPort will send data after reaching that size. Therefore, you should be very carefully using this command. You may use this function as you use the same size of data every time. You can verify the changed packet size with [AT+Z]LR.		

5.4.3.3. Commands for Searching and Auto-Connecting**Table 5-7 Command 'F' for configuring Search Mode**

Syntax	Parameter	Response	
		Success	Failure
[AT+Z]L<F><mm><CR>	<mm>: ASCII - '0': OFF - '1': ON	OFF: Print the changed value. ON: Executes a command 'L'.	Print an error message.
Remarks	For EN and SN only. If it is ON, the command for setting the Node Level will be executed. And the CoD for searching will be changed accordingly.		

Table 5-8 Command 'L' for configuring Node Level

Syntax	Parameter	Response	
		Success	Failure
[AT+Z]L<L><ll><CR>	<ll>: ASCII - '0': Connecting to MN - '1': Connecting to Level 1 SN - '2': Connecting to Level 2 SN	Print the changed value.	Print an error message.
Remarks	For EN and SN only. It is valid only if the Search Mode is ON.		

Table 5-9 Command 'Q' for configuring Query CoD

Syntax	Parameter	Response	
		Success	Failure
[AT+Z]L<Q><cod><CR>	<cod>: ASCII 6 Characters ('0' – 'F')	Print the changed value.	Print an error message.
Remarks	For EN and SN only. It is valid only if Search Mode is ON. It is changed accordingly when you set the Node Level. If you change this value improperly, the HandyPort will not make a connection with the desired Node. Therefore, you shall handle this command with caution.		

5.4.3.4. Commands for Unicast Network

Table 5-10 Command 'O' for setting up Path

Syntax	Parameter	Response	
		Success	Failure
AT+ZL<O><#1,#2,#3><CR>	#1/#2/#3: ASCII - ',': 0x2C - #1/#2/#3: '0' – '6'	<CR><LF>OK<CR><LF>	- Data Mode: Echo inputs. - <CR><LF>ERR<CR><LF>: Invalid parameters. - <CR><LF>NOK<CR><LF>: Requested on the inactive node.
Remarks	<p>For ENm only. The HandyPort shall be in the Extended Command Mode to use this command. This command will use at device that is connecting to ENm in Unicast Network.</p> <p>The logical address shall be for EN only.</p> <p>You shall send the Escape Mode Sequence ("+++") to ENm to enter the command mode. The Escape Mode Sequence does tear down the existing path setup.</p>		

Table 5-11 Command 'V' for Printing all of nodes Status

Syntax	Parameter	Response	
		Success	Failure
AT+ZL<V><mm><CR>	<mm>: ASCII - '0': Only once - '1': Periodic ON (1/min.) - '2': Periodic OFF	<CR><LF>OK<CR><LF> <Print Status>: refer to Figure 5-1.	<CR><LF>ERR<CR><LF>
Remarks	<p>For ENm only and required the Extended Command Mode.</p> <p>You shall send the Escape Mode Sequence ("+++") first at the device that is connecting to ENm to enter the command mode.</p> <p>The MN and SNs will send its status with lower nodes information.</p>		

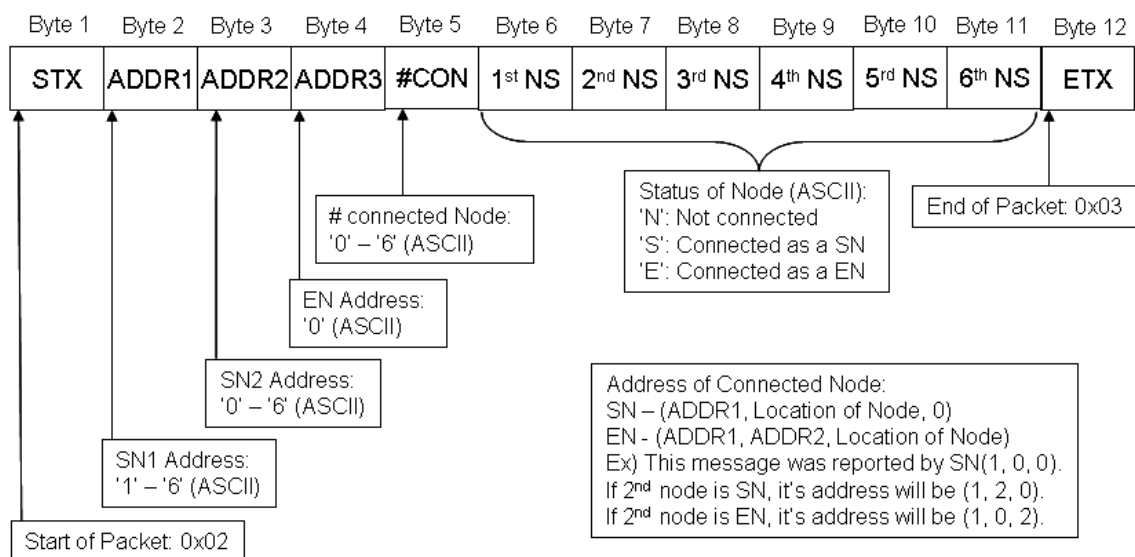


Figure 5-1 Status Information by Command 'V'

5.4.3.5. Commands for Status Display

Table 5-12 Command 'C' for printing the status of lower nodes

Syntax	Parameter	Response	
		Success	Failure
AT+ZL<C>	None	Print an address of MN or SN, the number of connected nodes, and the status of lower nodes.	Print an error message.
Remarks	For MN and SN only. The status of lower nodes will be the same as Figure 5-1.		

Table 5-13 Command 'R' for printing Operation Mode

Syntax	Parameter	Response	
		Success	Failure
[AT+Z]L<R>	None	Print the operation parameters.	None
Remarks	In case of EN, if the HandyPort is connected, you shall send the Escape Mode Sequence ("+++") first in Extended Command Mode.		

Table 5-14 Command '?' for printing Help

Syntax	Parameter	Response	
		Success	Failure
[AT+Z]L<?>	None	Print helps.	None
Remarks	In case of EN, if the HandyPort is connected, you shall send the Escape Mode Sequence ("+++") first in Extended Command Mode.		

5.4.3.6. UART Mode Command

Table 5-15 UART Mode Command, 'B'

Syntax	Parameter	Response	
		Success	Failure
AT+ZL<mm><CR>	<mm>: ASCII - '0': UART Mode Off - '1': UART Mode On	Print the status of UART mode and operation mode parameters.	Disable UART mode and print operation mode parameters.
Remarks	For MN and SN only. If HandyPort is connected, you shall send the escape mode sequence ("+++") for changing UART mode.		

No text.