Application Note #5476
Mode 6
April 18, 2012

Functional Description
Mode 6 is designed to give you control as to which Slave a Master links to in a Point-to-Point configuration. Essentially, the Master is told to 'call' a certain Slave. This is useful for non-addressable devices where a MultiPoint network does not work. Mode 6 is also useful when there is not a specific Master, any transceiver can be programmed to call any other transceiver.

Using the Point-to-Point Slave/Master Switchable Operation Mode (Mode 6)
When using the **Point-to-Point Slave/Master Switchable** operation mode, remember the following:

- Mode 6 is *only* available while using an RS232 interface. (The DTR line is not available in RS485/422 mode.)
- Diagnostics may be enabled when using FGR or FGR2 models; however, when using DGR models, diagnostics must be turned off for Mode 6 to work.
- The transceiver remains in Slave mode until called by another transceiver in its Call Book or is instructed to call another transceiver through an AT command. All script file or AT commands issued to the transceiver in switchable operation mode must be in ALL CAPS.
- If the DTR line is asserted when the command is given, the transceiver calls out immediately. After an AT command is given, the transceiver will not call out until DTR goes high.
- The Master disconnects when DTR goes low.
- Settings may be changed in the user interface without using the Setup button.
- Predetermined script files may be used that allow many of the transceiver's settings to be changed upon execution of that file. This allows you to establish push-button command sets that instruct the transceiver to call a predetermined Slave.

Script File or AT Commands
The following list includes the commands available to use in **Point-to-Point Slave/Master Switchable** operation mode and the functions the command controls.

Script File or AT Command	Function Controlled
ATXF	Frequency Key
ATXT	Max Packet Size
ATXD	Min Packet Size
ATXX	Transmit Rate
ATXR	RF Data Rate

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Script File or AT Command	Function Controlled
ATXP	RF Transmit Power
ATDT	Position in Call Book to Call
ATD	Allows a specific FreeWave serial number to be entered to call
ATXC	Used in conjunction with the ATD command, instructs transceiver which Repeater path to follow
ATXS	Instructs transceiver to go into Setup mode

AT-commands the transceiver supports can be divided into two types:

- **Setting** commands – Result in changes on the local transceiver and include ATXF_, ATXT_, ATXD_, ATXX_, ATXR_, ATXP_, or ATXS. After receiving a Setting AT-command, the transceiver processes the command and, when finished, it remains in **Point-to-Point Slave/Master Switchable** mode.

- **Communication – Link** commands – Result in the transceiver trying to establish the communication links with other transceivers and include ATDT_, ATD_ or ATXC_ in conjunction with the ATD_. If a Communication - Link command is sent to a transceiver, the transceiver processes the command and, when finished, changes its mode of operation to a Point-to-Point Master-like mode. In this mode the transceiver does not react to incoming AT-commands; however, it transmits them across the RF link as user's data. The transceiver stays in this mode until its DTR line is de-asserted.

For a transceiver to accept any AT-commands, its DTR line must be asserted. However, the DTR line has to be held asserted for different time durations depending on which type of command is given.

Assert and de-assert voltage levels depend on the data port interface type. For transceivers with a **TTL** interface:

- Assert line means to provide logic low TTL level (0 VDC) at the input of the transceiver.
- De-assert line means to provide logic high TTL level (+5 VDC) at the input of the transceiver.

For transceivers with an **RS232** interface:

- Assert line means to provide positive voltage at the input of RS232 transceiver (+3.0 to +12 VDC).
- De-assert line means to provide negative voltage at the input of RS232 transceiver (-3.0 to -12 VDC).

Follow the steps below to ensure the proper functionality of a transceiver in Mode 6 operation.

For Setting AT-commands:

1. Ensure the **Baud Rate** setting on the transceiver matches Baud Rate of AT-commands. (Menu 1).

2. Assert the DTR line on the transceiver's data port.

3. Send the AT-command(s) to the transceiver on the Data Receive Line.

4. De-assert the DTR line after the transceiver responds to all the AT-commands sent to it.

5. Repeat all steps, if needed.

For Communication - Link AT-commands:

1. Assert the DTR line on the transceiver's data port.

2. Send the AT-command(s) to the transceiver on the Data Receive Line.

3. Hold the DTR line asserted until the communication link between the local and remote transceiver is established over the RF channel or the protocol reports a timeout.

4. Repeat all steps, if needed.

ATDT Commands

ATXC_ is similar to manually changing the **Entry to Call** parameter in the transceiver's Call Book. For example:

- **ATXC0** changes **Entry to Call** to **0** (zero).

- **ATXCA** changes **Entry to Call** to **All**.

If a link to a Slave needs to be made without using a Repeater, it is imperative that the ATXC# command is issued. Otherwise, issue the command ATD####### where ####### is the serial number of the transceiver with which a link is being made. The transceiver follows the path defined in the Call Book and links first to the Repeater(s) specified and then to the Slave transceiver.

ATDT_ is similar to ATXC_, except after the **Entry to Call** parameter in the transceiver's Call Book has been changed, the transceiver starts calling this number. For example, sending **ATDT0** to a transceiver changes its **Entry to Call** to **0** (zero). This causes it to start calling the transceiver with the serial number listed in the main column of the Call Book on line **0**.

When this command is issued, the transceiver's Call Book must not have any 000-0000 entries in it at any position before the number to be used per the **ATDT**_ command. Issuing **ATDT0** or **ATDT1** results in the transceiver calling the transceiver entered on Line 0 or 1, respectively. However, issuing **ATDT3** does not work because 000-0000 is entered on Line 2.

0 900-1234
1 900-5678
2 000-0000
3 900-4321
4 000-0000
5 000-0000
6 000-0000
7 000-0000
8 000-0000
9 000-0000

ATD_ This command does not work if **Entry to Call** is set to **All** or if the Call Book is empty. If **Entry to Call** is set to **All**, the transceiver that received the **ATD**_ command tries to communicate with any Slave in the network that is listening, regardless of the serial number specified in the **ATD**_ command.

The line to which **Entry to Call** is referring to should have one of the following:

- A non-zero serial number entry in the main column and no entries in the Repeaters columns if no Repeaters are to be used.

- A non-zero serial number entry in the main column followed by valid entry(s) in the Repeaters column(s) if one or more Repeaters are to be used.

ATXS forces the transceiver to enter Setup mode. While in Setup mode, the transceiver's RS232 baud rate is set as what was programmed in the Baud Rate menu rather than the typical 19200 bps.

Calling a Transceiver that is Not Listed in the Call Book

Point-to-Point Slave/Master Switchable operation mode accepts the command ATD####### where ####### is any transceiver serial number. Upon receipt of this command the transceiver calls the defined transceiver, even if the number is not in the sending transceiver's Call Book.

The **Slave Security** parameter may be disabled so that a transceiver operating as a Slave in Modes 1, 4, or 6 connects to any transceiver calling it regardless of whether or not the calling transceiver is in the Slave's Call Book. This feature is necessary when more than 10 transceivers may call into a Slave. For more information, see the **Slave Security** parameter description in the user manual for the transceiver model you are using.

Calling a Transceiver through One or Two Repeaters

In conjunction with the **ATD** command, the transceiver may be instructed to use the Repeater(s) specified in the Call Book. This means it is possible to call an unlimited number of Slaves through script files in **Point-to-Point Slave/Master Switchable** operation mode and have up to 10 different Repeater combinations.

Before calling a transceiver through one or two Repeaters, the Repeaters to be used must first be set up in the Call Book. This is done by setting up a line in the Call Book to call through the Repeater(s) which are to be used.

> **Note:** All serial Repeaters must be entered in the Call Book with respect to the Master. For example, Repeater 1 is the first transceiver the Master communicates with. Repeater 2 is the second, and so on.

AT Commands That Write EEPROM

The use of certain AT commands executes a write to the EEPROM (Electrically Erasable Programmable Read-Only Memory) of the transceiver, which has a *10,000 write lifetime limit*. For more information please contact FreeWave Technical Support at (303) 381-9200.

Script File or AT Command	Does the Command write EEPROM? (EEPROM has a 10,000 write lifetime limit)
ATDT	Writes EEPROM
ATXR	Writes EEPROM
ATXD	Writes EEPROM
ATXT	Writes EEPROM
ATXF	Writes EEPROM
ATXC	Writes EEPROM
ATXP	Writes EEPROM
ATXX	Writes EEPROM
ATD	Does not write EEPROM
ATXS	Does not write EEPROM

FreeWave Technical Support

For up-to-date troubleshooting information check the Support page at www.FreeWave.com.

FreeWave provides Technical Support, Monday through Friday, 7:30 AM to 5:30 PM, Mountain Time (GMT -7). Call toll-free at 1-866-923-6168, within Colorado 303-381-9200, or contact us through email at moreinfo@FreeWave.com.