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## MRF49XA Radio Utility Program

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**Note:** The hex files for the PIC18 Explorer and Explorer 16 development boards are different.

### INTRODUCTION

The MRF49XA Radio Utility Driver Program provides design engineers a development and testing platform for the MRF49XA 433/868/915 MHz RF transceiver. The program configures and runs tests of basic transceiver functionality such as transmission, reception, and Sleep mode using a command-line and menu-driven user interface.

The MRF49XA utility program can run on either the PIC18 Explorer or Explorer 16 development boards, to which the MRF49XA RF transceiver daughter board is attached. The development board is connected to the PC's serial port and a simple hyper-terminal program can be used as user interface. For more details on the setup, see the **Section "Getting Started"**.

The MRF49XA utility program source code and hex files are in the application note's compressed file. Additional reference material is listed in the "References" section.

First time users of MPLAB® ICD 2, see the "MPLAB® ICD 2 User's Guide" (DS51331), Section 4.3.2, "Loading a Hex File".

### Using the PIC18 Explorer Board

The MRF49XA daughter board can be connected to the PICtail™ connector J3 on the PIC18 Explorer board. This connection supports 4-wire SPI, Reset, interrupts and other MRF49XA handshake signals between the PIC® microcontroller and the MRF49XA daughter board. Figure 1 is an illustration of this setup (using the PIC18 Explorer board).

For the schematics of the MRF49XA daughter board with PICtail connector, refer to the "MRF49XA PICtail/PICtail Plus Daughter Board User's Guide" (DS51843).

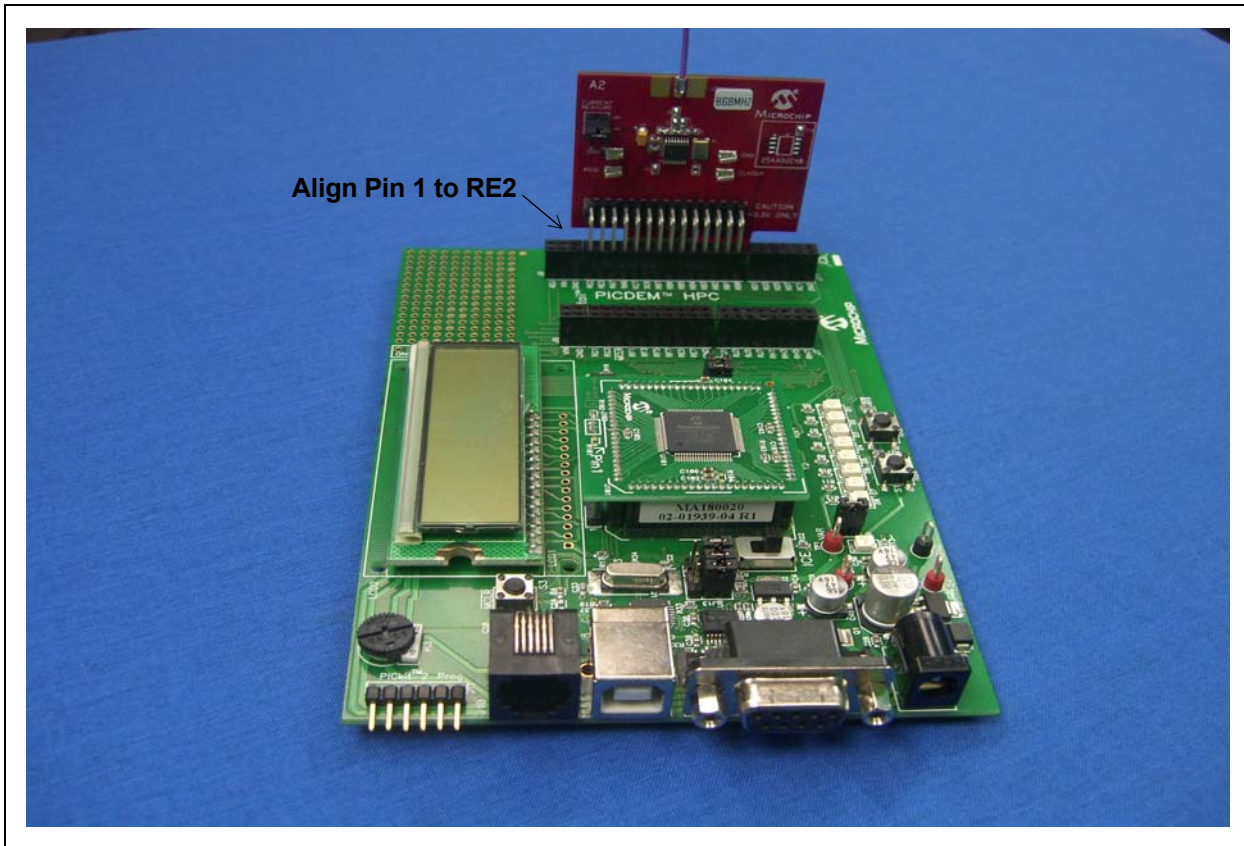
### GETTING STARTED

The procedure below helps you to setup the MRF49XA Utility program on the development/testing platform:

1. Insert the MRF49XA RF transceiver daughter card into the development board.  
  
If you are using the PIC18 Explorer development board, refer to the **Section "Using the PIC18 Explorer Board"**.  
  
If you are using the Explorer 16 development board, refer to the **Section "Using the Explorer 16 Board"**.
2. Plug in the power cord for the development board that will hold the MRF49XA RF transceiver daughter card.
3. Connect an RS-232 serial cable between the development board and the PC that will display the MRF49XA utility program interface.
4. Program the demonstration kit with the appropriate hex file.

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**FIGURE 1: CONNECTING THE MRF49XA DAUGHTER BOARD TO THE PICTail™ CONNECTOR J3 ON THE PIC18 EXPLORER BOARD**



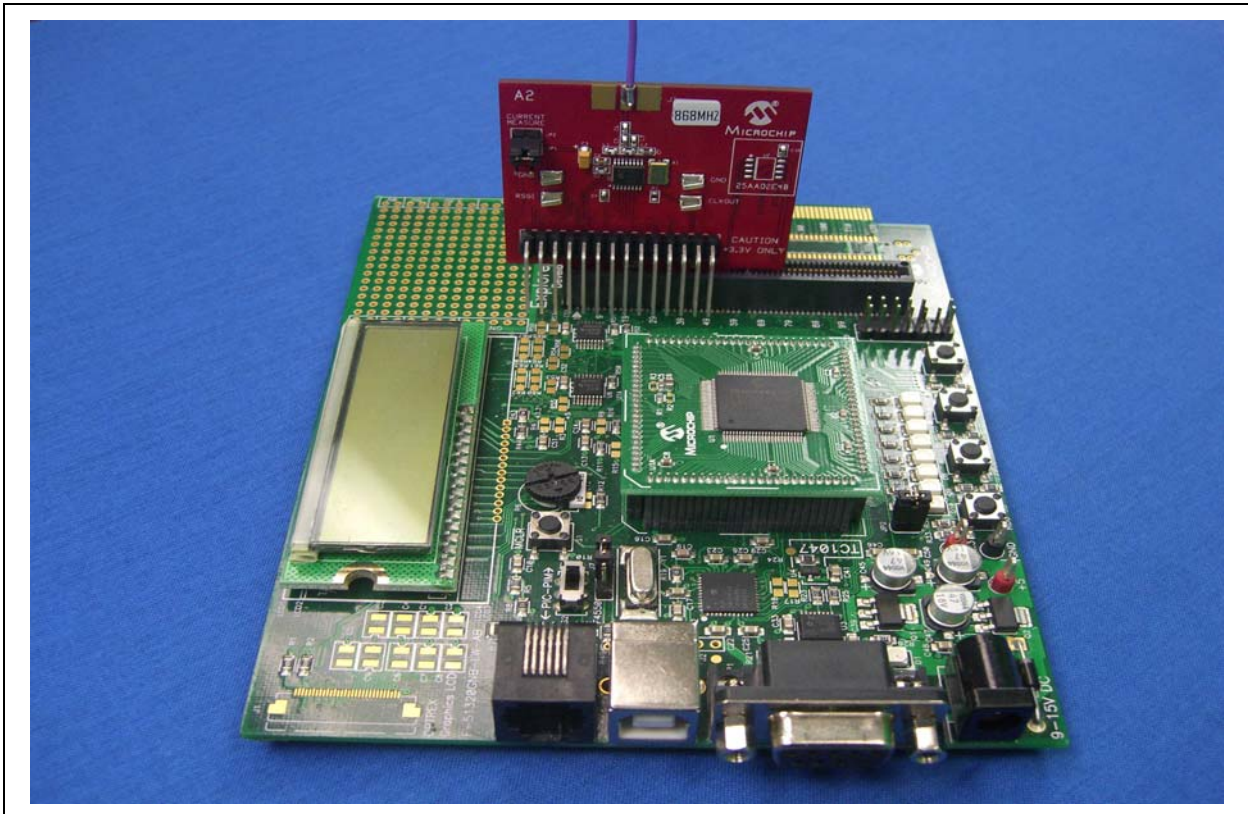
## Using the Explorer 16 Board

The MRF49XA daughter board's PCB-edge connector can be used to connect to the Explorer 16 development board's PICtail Plus connector. This connection supports 4-wire SPI, reset, interrupts and other MRF49XA handshake signals between the PIC microcontroller and the MRF49XA daughter board. The

setup between the Explorer 16 Development Board and the MRF49XA daughter board is as shown in Figure 2.

For the schematics of the MRF49XA daughter board with PICtail Plus connector, refer to the "MRF49XA PICtail/PICtail Plus Daughter Board User's Guide" (DS51843).

**FIGURE 2: CONNECTING THE MRF49XA DAUGHTER BOARD TO THE EXPLORER 16 DEVELOPMENT BOARD'S PICtail™ PLUS CONNECTOR**



## Connecting to the Host PC

The Radio Utility Driver Program's user interface can be accessed by connecting an RS-232 serial cable between the development board and the PC. PCs with operating systems such as Windows® XP or Windows NT can use the HyperTerminal program. Other serial port communication utilities/application programs can also be used based on your familiarity and availability.

Table 1 shows the configuration settings for the serial port communication.

**TABLE 1: SERIAL PORT SETTINGS**

Parameter	Setting
Bits per second	19200
Data bits	8
Parity	None
Stop bits	1
Flow control	None

## USING THE DRIVER UTILITY PROGRAM

The MRF49XA utility program is operated through the user interface – menu displayed on the host computer.

There are two major menus, shown in Figure 3.

**FIGURE 3: THE TWO MENUS**

<p>Main Menu:</p> <ul style="list-style-type: none"> <li>a) Configure MRF49XA</li> <li>b) Transmit</li> <li>c) Receive</li> <li>d) Program MRF49XA Registers</li> <li>e) Program MRF49XA to Sleep mode</li> <li>f) Ping-Pong Test</li> <li>g) PER Test</li> <li>h) Program Radio to CW mode</li> <li>i) Receive mode with FIFO disabled</li> </ul>
<p>Configure Menu:</p> <ul style="list-style-type: none"> <li>a) Set Operating Frequency</li> <li>b) Select the bandwidth</li> <li>c) Program TX Data Rate</li> <li>d) Program Packet Delay</li> <li>e) Enable/Disable Data Indicator output on INT/DIO pin</li> <li>f) Select LNA Gain</li> <li>g) Set RSSI Threshold</li> <li>h) Set Output Power</li> <li>i) Program Ping-Pong Package Size</li> <li>j) Program PER Test Packet Size</li> <li>k) Select the Frequency Deviation</li> </ul>

The Main Menu contains the test function commands. The Configure Menu – accessed from the Main Menu – configures the transceiver.

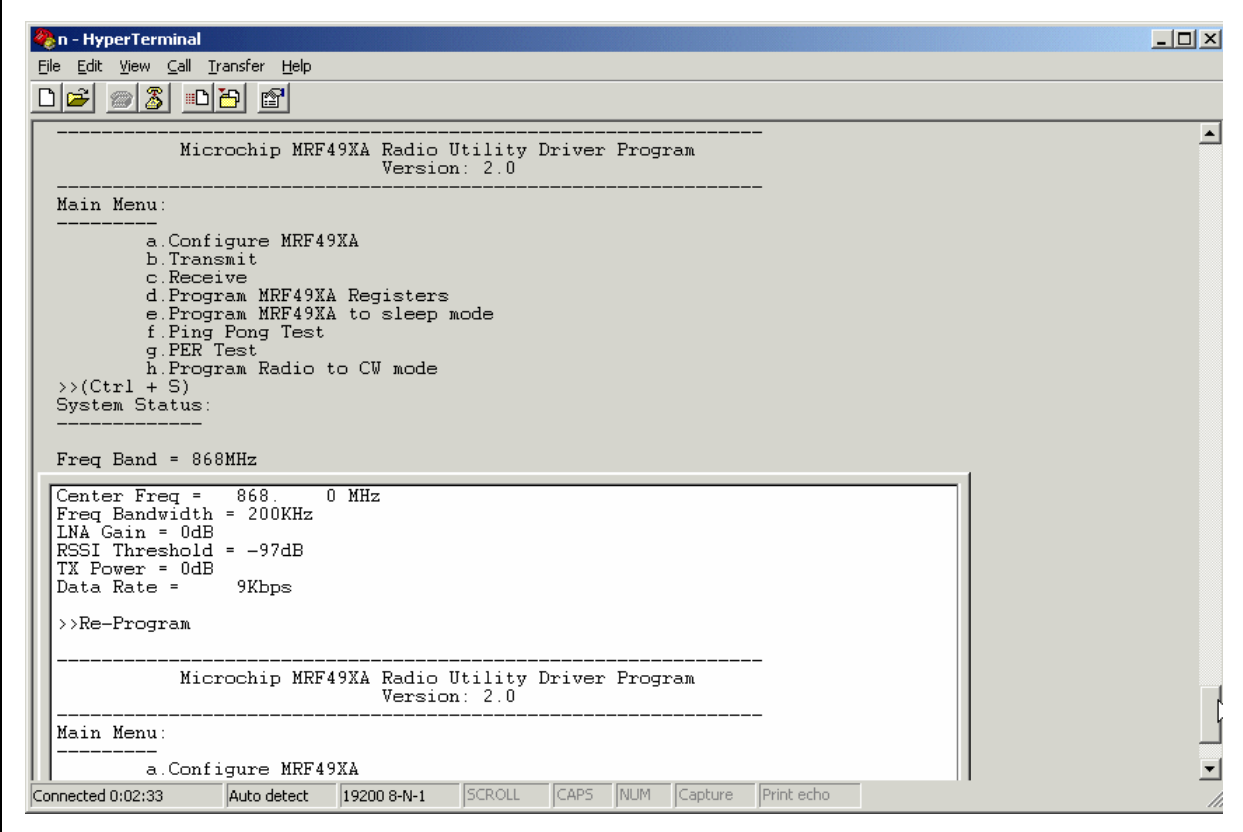
Hot keys can be used to navigate through the menus.

**TABLE 2: KEYBOARDS HOT KEY COMMANDS**

Hot Key	Functionality
<Ctrl> + <z>	Exit and Return to Main Menu. This hot key is used to stop/exit from any step.
<Ctrl> + <x>	Reset the transceiver. Stops the current process and programs the transceiver with default values (shown in Table 3).
<Ctrl> + <s>	Display the current system status and configuration values (shown in Table 3). This hot key can be used at any step in the program.

Figure 4 displays the Main Menu and a sample status command output.

**FIGURE 4: THE MAIN MENU**



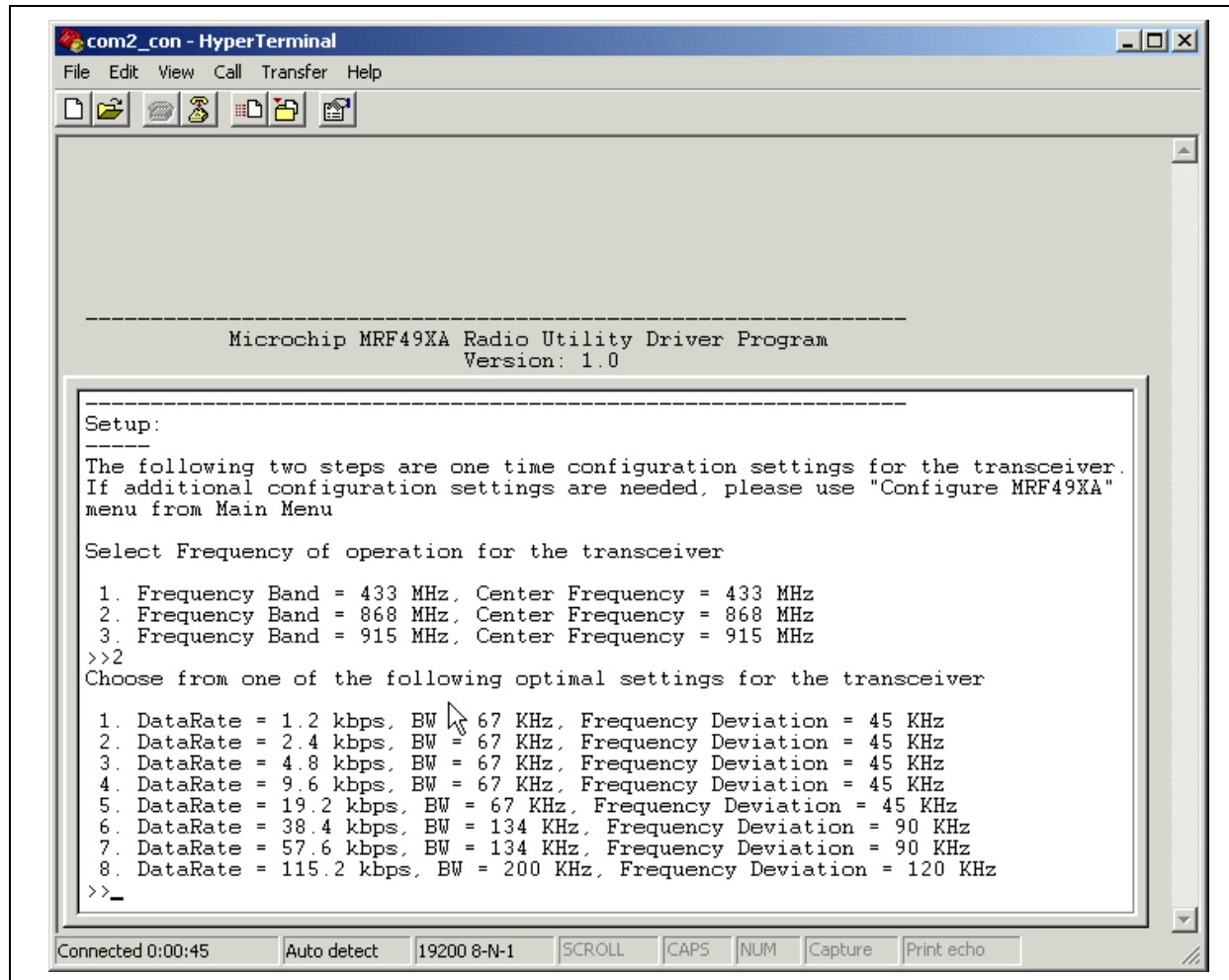
```
n - HyperTerminal
File Edit View Call Transfer Help
-----
Microchip MRF49XA Radio Utility Driver Program
Version: 2.0
-----
Main Menu:
-----
a. Configure MRF49XA
b. Transmit
c. Receive
d. Program MRF49XA Registers
e. Program MRF49XA to sleep mode
f. Ping Pong Test
g. PER Test
h. Program Radio to CW mode
>>(Ctrl + S)
System Status:
-----
Freq Band = 868MHz
-----
Center Freq = 868.0 MHz
Freq Bandwidth = 200KHz
LNA Gain = 0dB
RSSI Threshold = -97dB
TX Power = 0dB
Data Rate = 9Kbps
>>Re-Program
-----
Microchip MRF49XA Radio Utility Driver Program
Version: 2.0
-----
Main Menu:
-----
a. Configure MRF49XA
-----
Connected 0:02:33 Auto detect 19200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

After powering up the PIC18 Explorer or the Explorer 16 development boards with the MRF49XA daughter board, the user needs to configure the default device settings by following the below mentioned 2-step setup procedure.

1. The user needs to choose the frequency of operation.
2. The user needs to choose the data rate, bandwidth and frequency deviation. This setup procedure is depicted in Figure 4.

**Note:** The configuration options in step 2 of the setup procedure are the optimal bandwidth and frequency deviations settings for those data rates.

**FIGURE 5: SETUP PROCEDURE**



## EXECUTING FIRMWARE COMMANDS

This section gives details about the commands issued by the Main and Configure menus. Its subsections include:

- Configuration Commands – the Main Menu command for accessing the Configure Menu and Configure Menu commands.
- Test-Function Commands – the Test and functional commands on the Main menu.

## Configuration Commands

The MRF49XA RF transceiver is ready to operate, using the MRF49XA utility program's default values. These values are shown in Table 3:

**TABLE 3: DEFAULT CONFIGURATION SETTINGS**

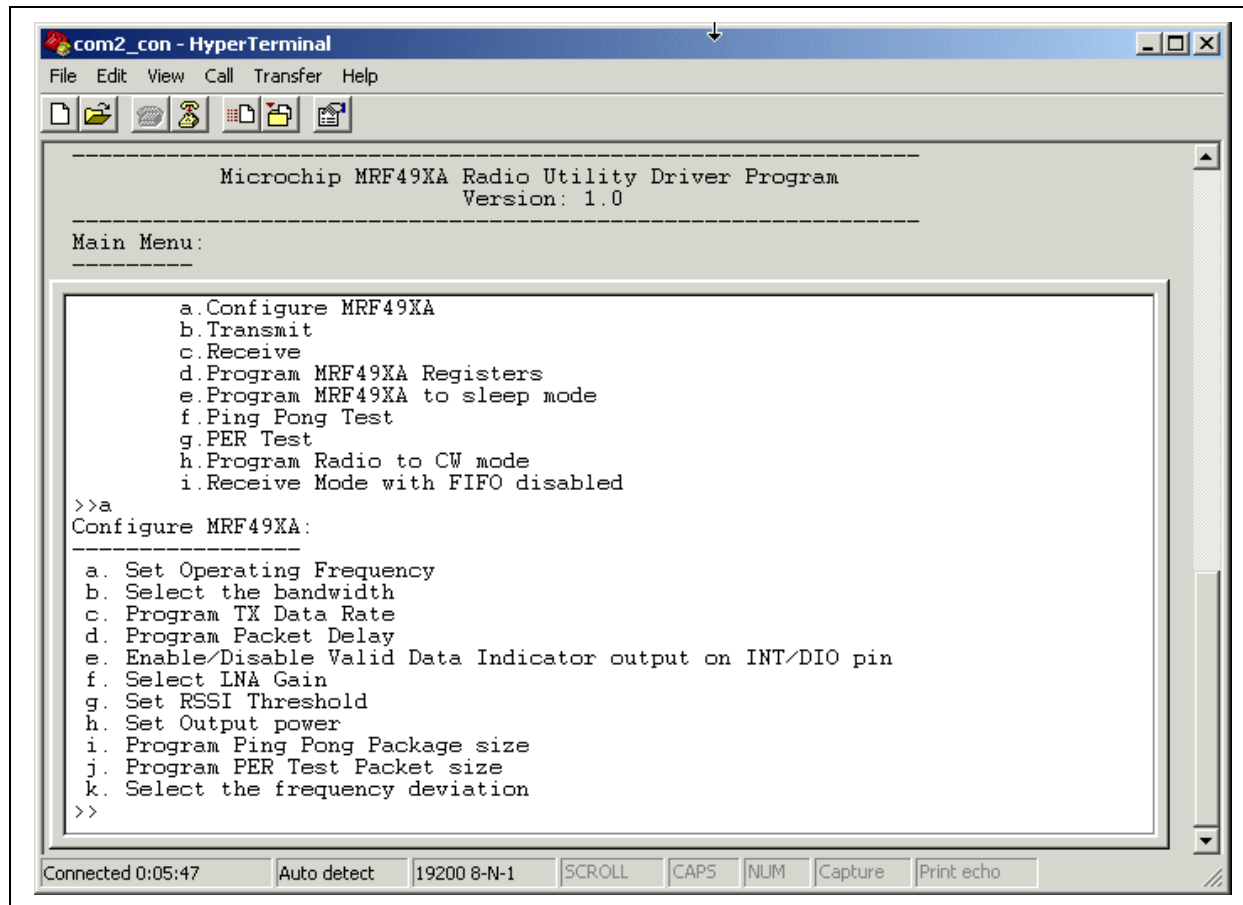
Attribute	Setting
Frequency Band	Value chosen during Setup Procedure
Center Frequency	Value chosen during Setup Procedure
Bandwidth	Value chosen during Setup Procedure
Data Rate	Value chosen during Setup Procedure
Packet Delay	1 (Explorer 16: 5 ms, PIC18 Explorer: 4 ms)
DIO (Data Indicator Output) on PIN	Disabled
LNA Gain	Maximum allowed Gain
RSSI Threshold	-97 dBm
TX Output Power	Maximum allowed and No Attenuation
Ping-Pong package size	100 packets
PER Test packet size	16 bytes

**Note:** Resetting the MRF49XA RF transceiver returns the settings to these default values.

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If desired, the values can be reconfigured by the user through the Configuration Menu, displayed in Figure 6.

**FIGURE 6: CONFIGURATION MENU**



## CONFIGURE MRF49XA

This Main Menu command displays the Configuration Menu, shown in Figure 6.

## SET OPERATING FREQUENCY

This menu option allows the user to select the frequency band and program the center frequency for the operation of the MRF49XA transceiver. The default values for the frequency band and center frequency are the values chosen during the Setup Procedure.

The user can choose to operate at one of the frequency bands: 433, 868 or 915 MHz, and then proceed to program the center frequency.

To program the required center frequency, the user has to program value F greater than or equal to 96 and less than 3903.

The center frequency can be calculated using Equation 1:

## EQUATION 1:

$$10*FA1*(FA0 + F/4000) \text{ [MHz]}$$

Where the constants FA0 and FA1 are:

**TABLE 4: FREQUENCY SETTING**

Band [MHz]	FA1	FA0	PLL Step (kHz)
433	1	43	2.5
868	2	43	5
915	3	30	7.5

The sample center frequency values are shown in Table 5.



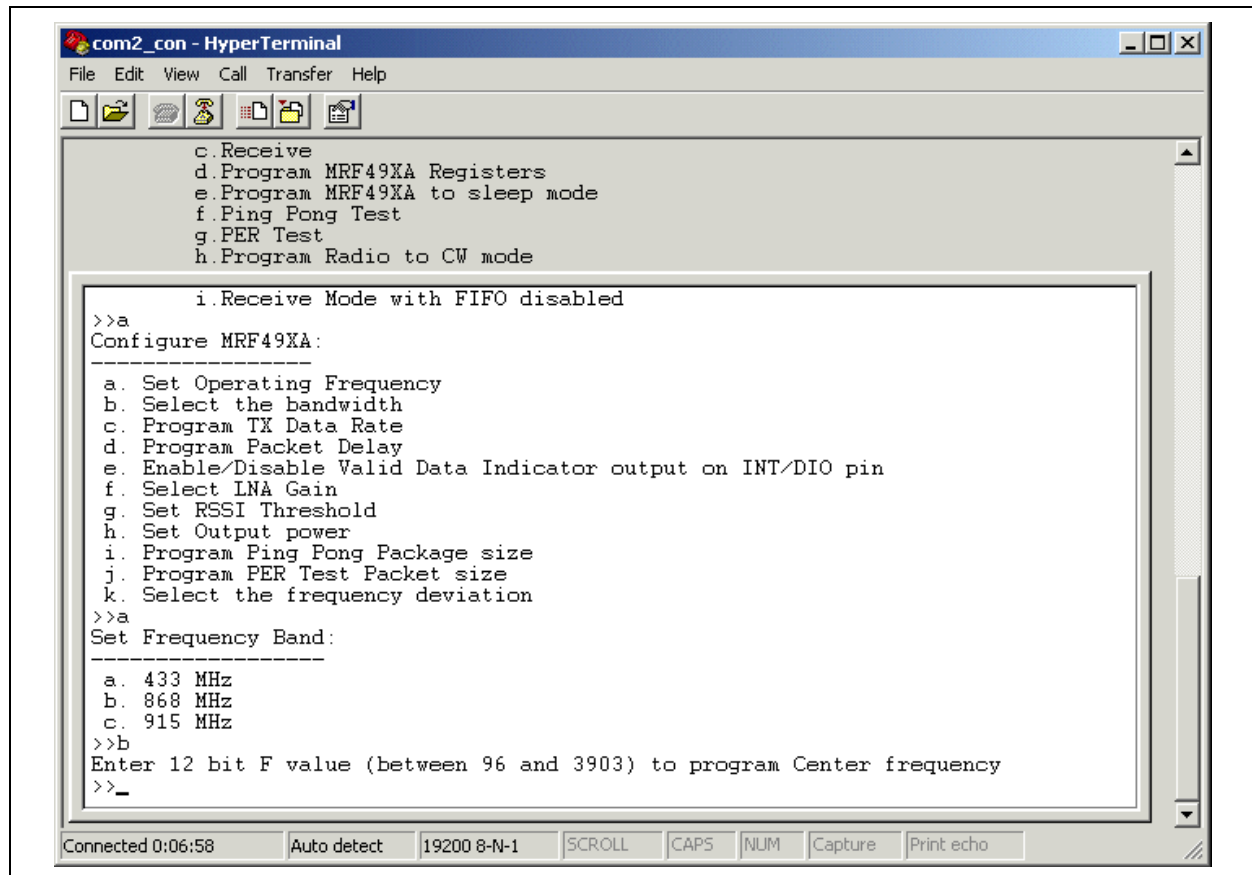
**TABLE 5: SAMPLE CENTER FREQUENCY VALUES**

Programmable Center Frequency-F (F ≥ 96 and F ≤ 3903)	Band (MHz)	Center Frequency Value (MHz)
F = 96	433 (PLL Step 2.5 kHz)	430.2400
	868 (PLL Step 5 kHz)	860.4800
	915 (PLL Step 7.5 kHz)	900.7200
F = 97	433 (PLL Step 2.5 kHz)	$430.2400 + 0.0025 = 430.2425$
	868 (PLL Step 5 kHz)	$860.4800 + 0.0050 = 860.4850$
	915 (PLL Step 7.5 kHz)	$900.7200 + 0.0075 = 900.7275$
F = 98	433 (PLL Step 2.5 kHz)	$430.2400 + (2 * 0.0025) = 430.2450$
	868 (PLL Step 5 kHz)	$860.4800 + (2 * 0.0050) = 860.4900$
	915 (PLL Step 7.5 kHz)	$900.7200 + (2 * 0.0075) = 900.7350$

When the frequency is programmed, the current system status will be printed on the screen. Check the "Freq Band = " and "Center Freq = " value to confirm the setting.

For details about the optimal settings of frequency, bandwidth and data rate, refer to the MRF49XA data sheet (DS70590).

**FIGURE 7: SELECTING FREQUENCY BAND AND CENTER FREQUENCY**



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## SELECT THE BANDWIDTH

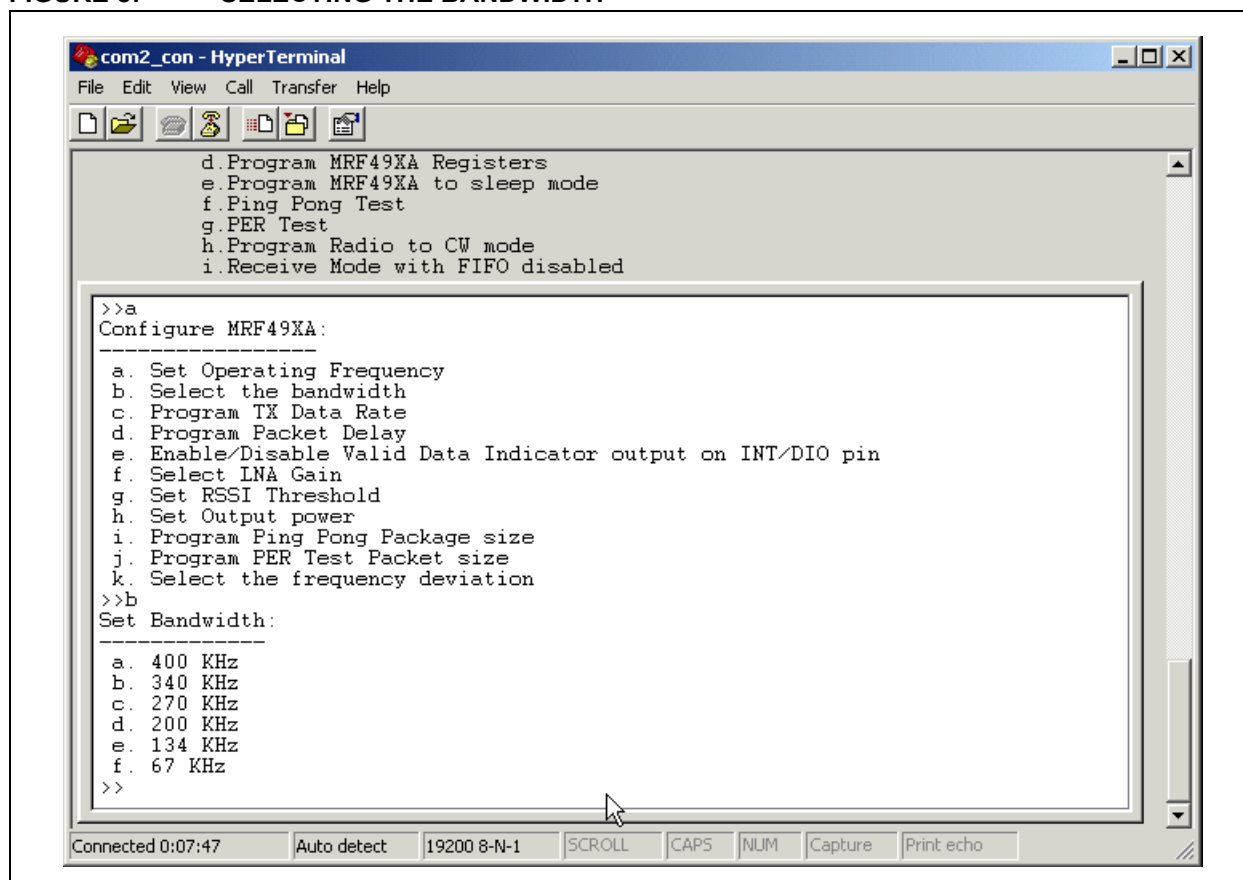
This Configuration Menu option enables the selection of the bandwidth of operation.

The MRF49XA transceiver supports 400 kHz, 340 kHz, 270 kHz, 200 kHz, 134 kHz and 67 kHz bandwidth operation. These bandwidths can accommodate different data rates and deviations during frequency keying.

The default value for bandwidth is the value chosen during the Setup Procedure. While choosing the bandwidth, the user needs to consider programming the data rate and frequency deviation. Refer to MRF49XA Data Sheet (DS70590) for more details.

After programming the bandwidth, the current system status will be printed on the screen. Check "Bandwidth = " value on the screen to confirm the setting.

**FIGURE 8: SELECTING THE BANDWIDTH**



## PROGRAM TX DATA RATE

This Configuration Menu option allows programming the desired data rate. The minimum value that can be programmed is 600 bps and the maximum value that can be programmed is 115.2 kbps. The default value is the value chosen during the Setup Procedure. MRF49XA Radio Driver Utility Program allows the user to select from standard data rates – 1.2 kbps, 2.4 kbps, 4.8 kbps, 9.6 kbps, 19.2 kbps, 38.4 kbps, 57.6 kbps, 115.2 kbps. For programming the MRF49XA daughter board to more advanced options, chose “i” from the data rate menu and program the values for DRPE and DRPV.

Current system status will be printed on the screen after programming the data rate. Check “Data Rate = “ value on the screen to confirm the setting.

### EQUATION 2:

$$\text{DRPV} = (10000/29/(1+\text{DRPE} * 7)/\text{DREx}) - 1$$

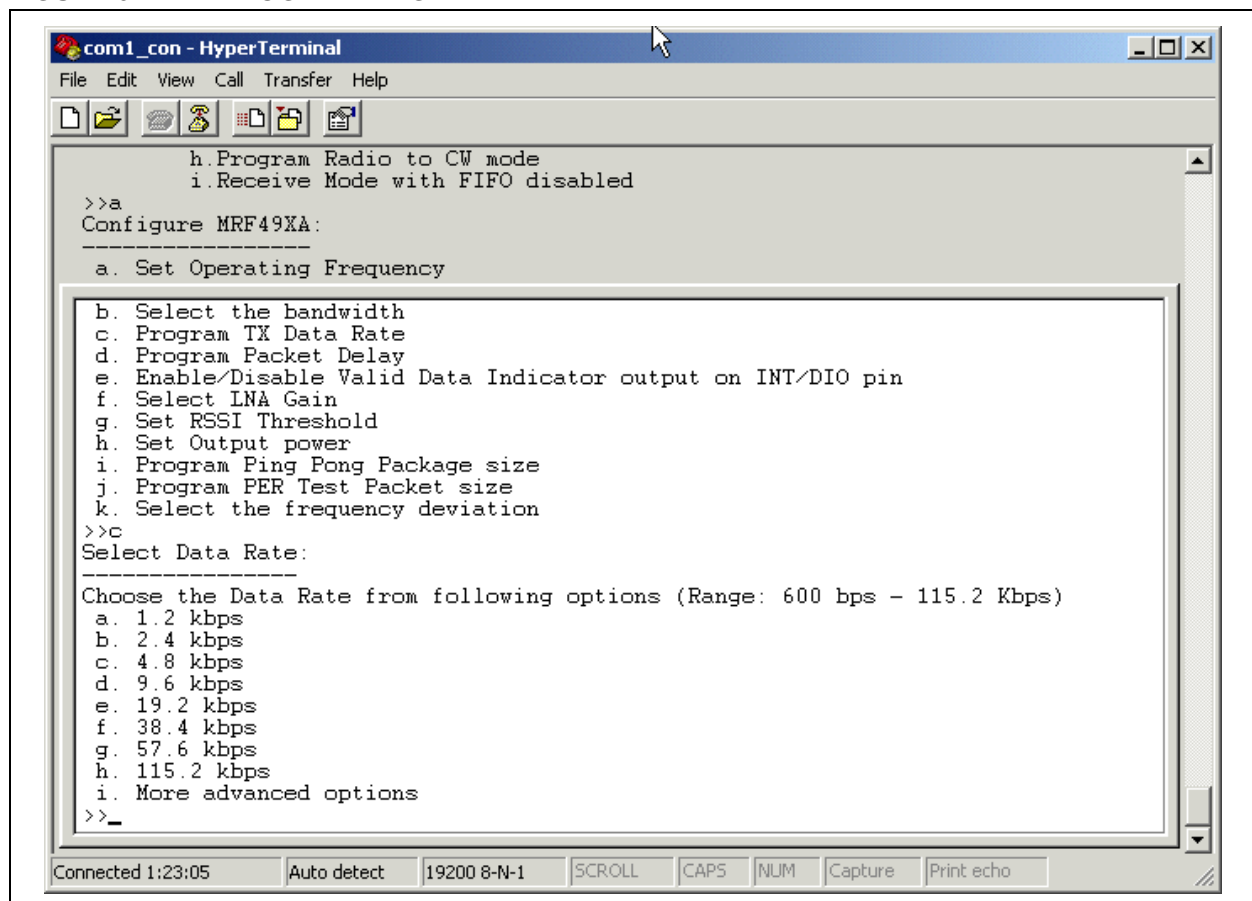
where

DRPE – Data Rate Prescaler Enable (set to 1 for lower data rates)

DRPV – Data Rate Parameter Value (in kbps)

DREx – Expected Bit Rate (in kbps)

**FIGURE 9: PROGRAMMING THE TX DATA RATE**



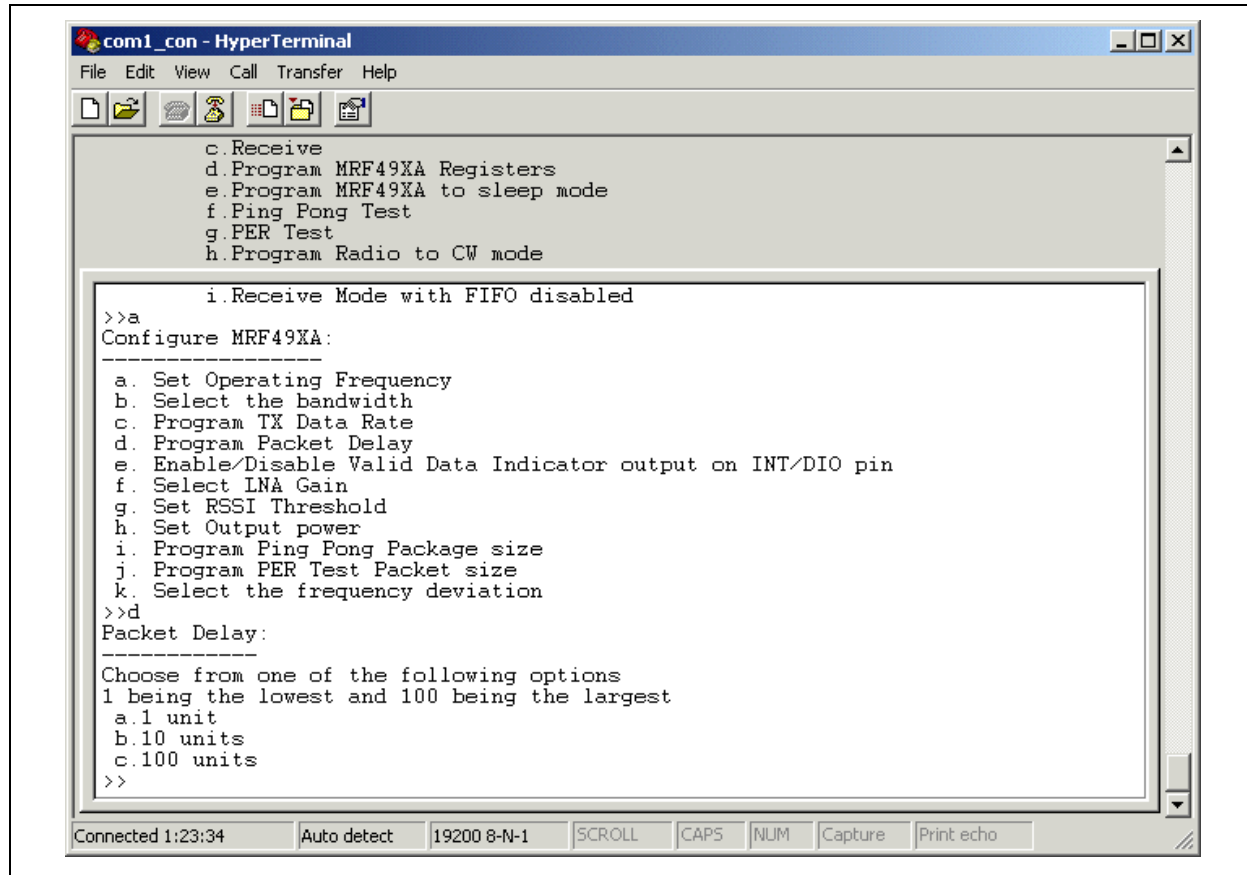
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## PROGRAM PACKET DELAY

This Configuration Menu option, shown in Figure 10, determines the size of inter-packet delay between a continuous stream of packets (during Transmit/Ping-Pong Test/PER Test). The main purpose of this feature is to enable the user to choose the interval between packets transmitted on air. If the user needs to transmit packets at approximately every 1 sec, then he can choose "option b" to set packet delay 10 units.

The size of packet delay can be set to 1 or 10 or 100 units. Where, 1 unit corresponds to 5 ms on the Explorer 16 demo board and 4 ms on the PIC18 Explorer. The default value is 1 unit.

**FIGURE 10: PROGRAMMING THE PACKET DELAY**

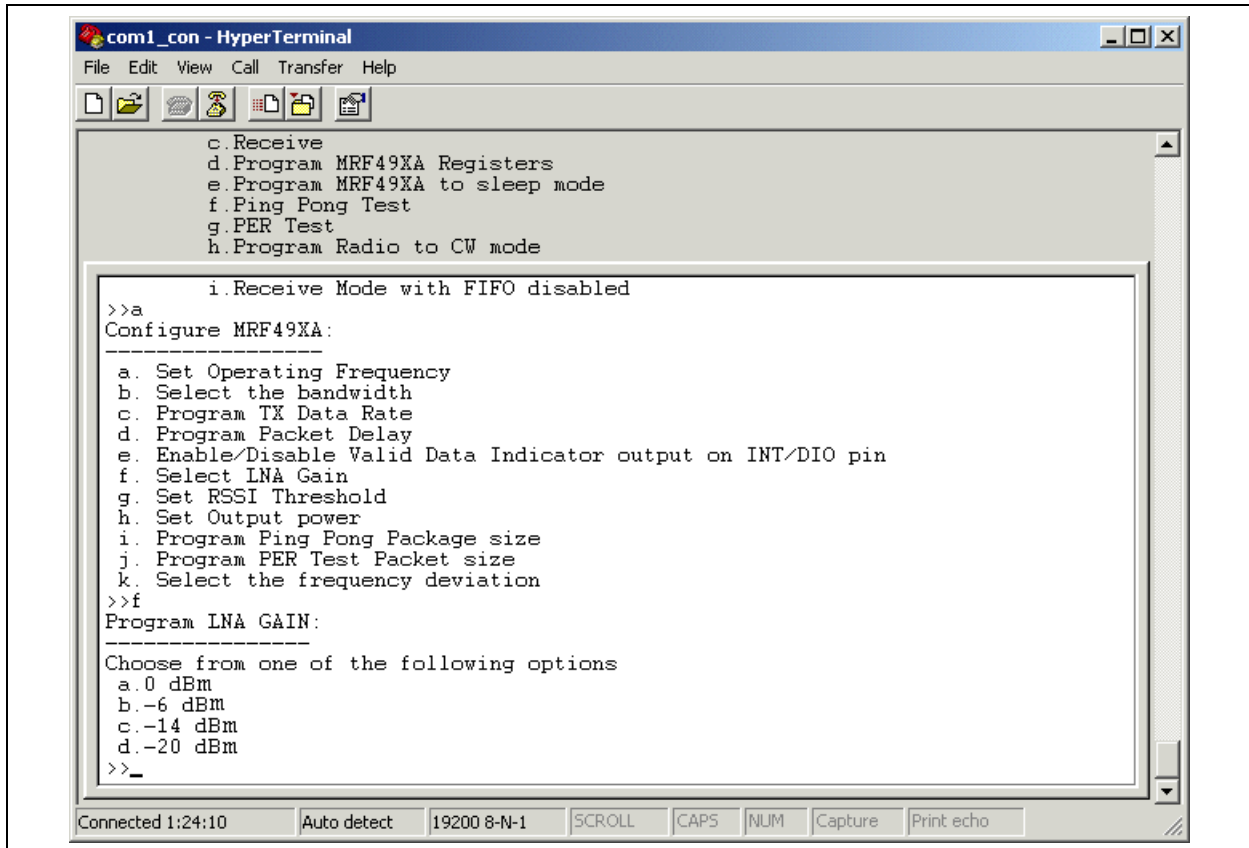


## SELECT LNA GAIN

This Configuration Menu option, shown in Figure 11, enables programming the LNA Gain. The LNA Gain can be programmed to different attenuation -0 dB, -6 dB, -14 dB or -20 dB. The default value for this parameter is 0 dBm.

System status will be printed on the screen after programming this parameter. Check "LNA Gain = " value to confirm this setting.

**FIGURE 11: SELECTING THE LNA GAIN**



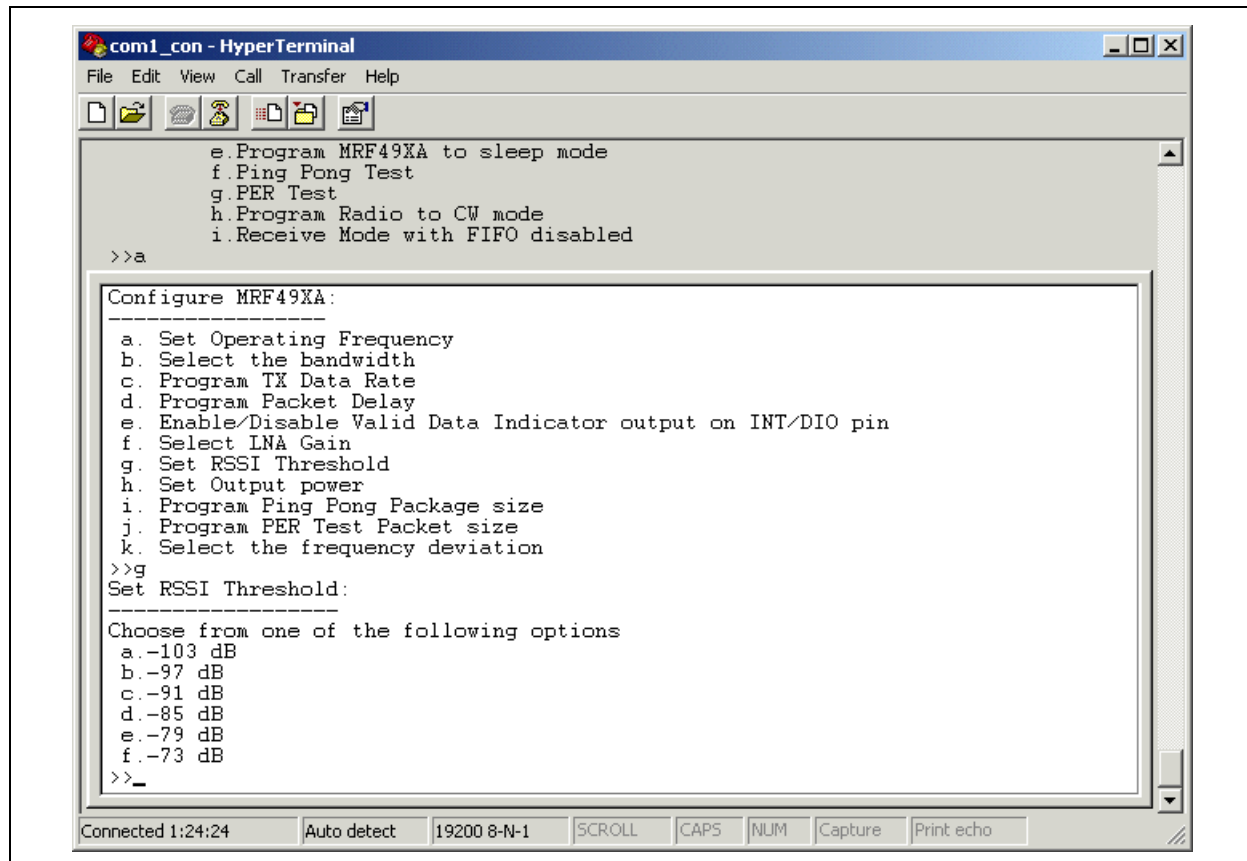
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## SET RSSI THRESHOLD

This Configuration Menu option, shown in Figure 12, allows setting different values for the RSSI threshold parameter. The RSSI threshold value can be set to -103 dBm, -97 dBm, -91 dBm, -85 dBm, -79 dBm, -73 dBm. If the received packet's RSSI is above the threshold, then the ARSSI pin and RSSI Status bit in the STATUS register will indicate logic high. The default value for the RSSI Threshold limit is -97 dBm.

The system status will be printed on the screen after programming this parameter. Check "RSSI Threshold = " value to confirm this setting.

**FIGURE 12: SETTING THE RSSI THRESHOLD**

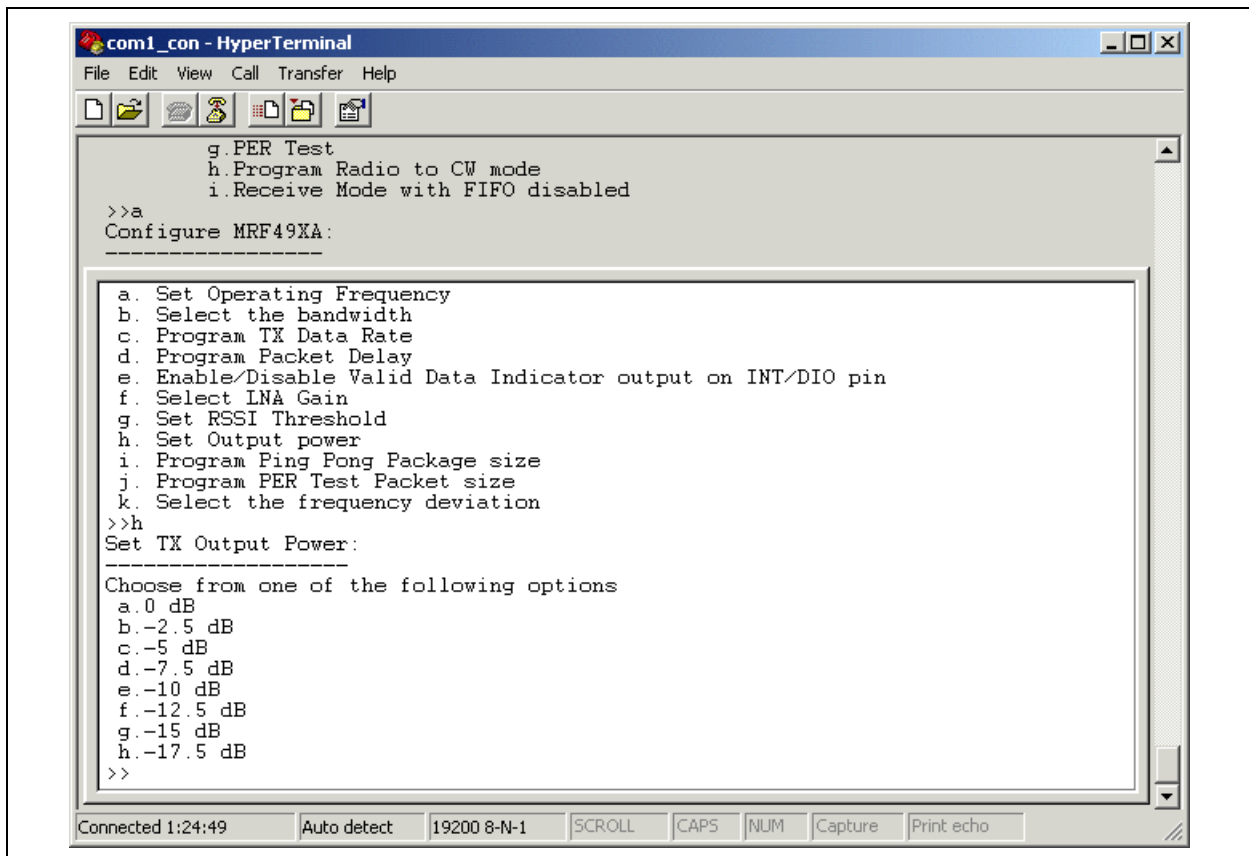


## SET OUTPUT POWER

This Configuration Menu option, shown in Figure 13, enables programming the TX Output Power. The Output Power can be set to different levels of attenuation: 0 dB, -2.5 dB, -5 dB, -7.5 dB, -10 dB, -12.5 dB, -15 dB, -17.5 dB. The default value for the TX Output Power is the maximum allowed, that is 0 dB attenuated.

System status will be printed on the screen after programming this parameter. Check "TX Power = " value to confirm this setting.

**FIGURE 13: SETTING THE OUTPUT POWER**



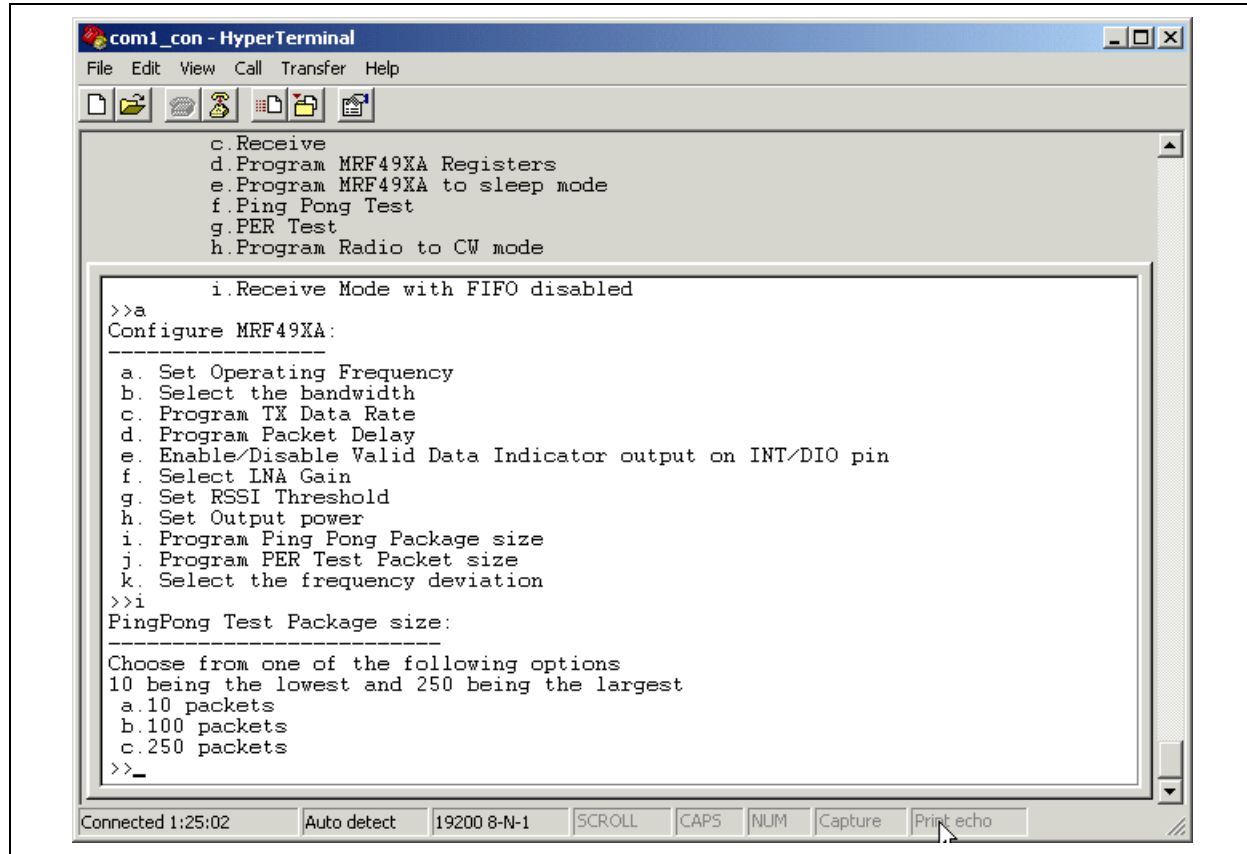
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## PROGRAM PING-PONG PACKAGE SIZE

This Configuration Menu option, shown in Figure 14, sets the number of packets to be exchanged between each transceiver for ping-pong. The ping-pong package size can be set to 10 or 100 or 250 packets. (For more details about ping-pong tests, see the Section “Ping-Pong Test”)

A message will be printed on the screen confirming the setting.

**FIGURE 14: PROGRAMMING THE PING-PONG PACKAGE SIZE**



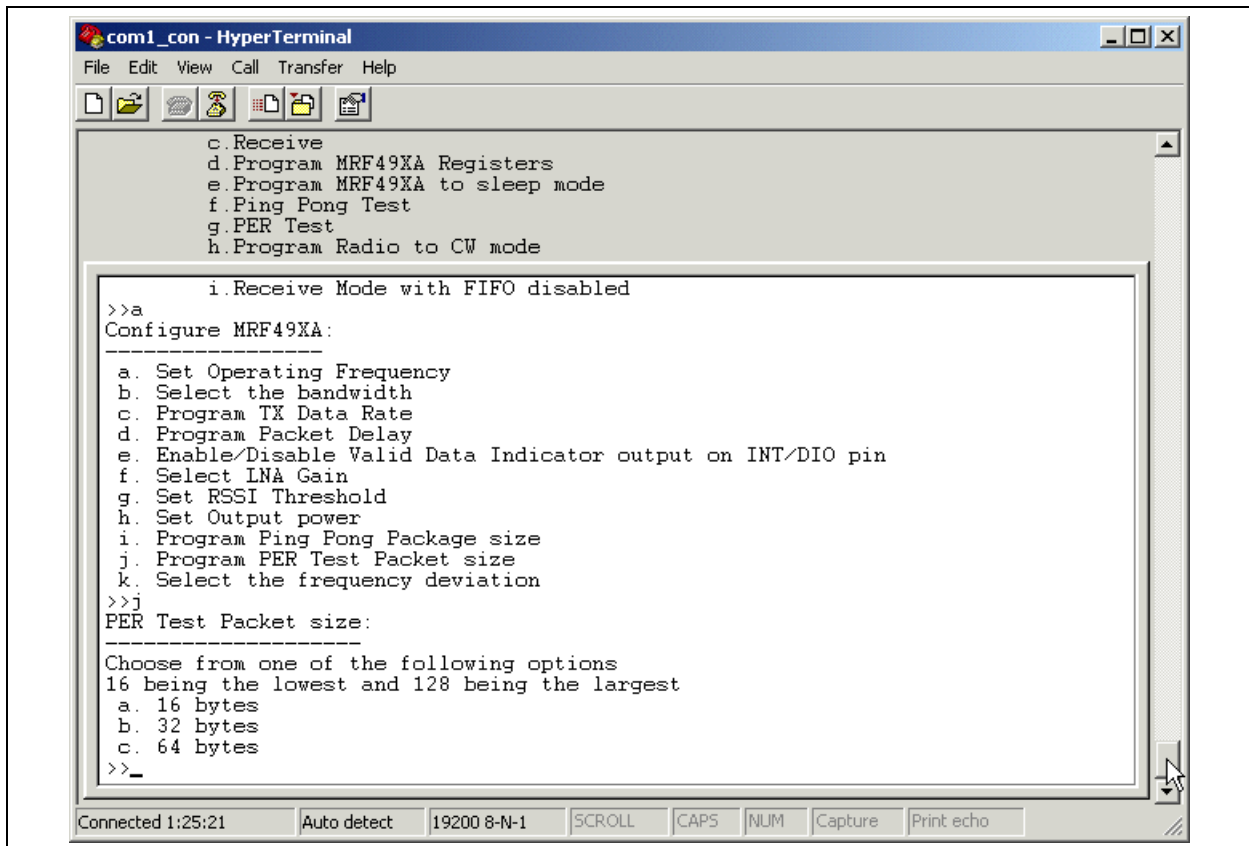


## PROGRAM PER TEST PACKET SIZE

This Configuration Menu option, shown in Figure 15, sets the length the packet that will be used for performing PER test between transceivers. Using the PER Test Packet size, one could find out the PER percentage for different packet lengths. The PER Test Packet size can be set to 16 or 32 or 64 or 128 or 256 bytes. The PER percentage for large packet lengths is expected to be more than the PER percentage for small packet lengths. Hence, the user is given an option to test the PER at different packet lengths.

A message will be printed on the screen confirming the settings after programming this parameter.

**FIGURE 15: PROGRAMMING PER TEST PACKET SIZE**



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## SELECT THE FREQUENCY DEVIATION

This configuration option, shown in Figure 16 enables programming the frequency deviation. The frequency deviation can be set to – 15 kHz, 30 kHz, 45 kHz, 90 kHz or 120 kHz. Frequency deviations for MRF49XA can be set in steps of 15 kHz up to 240 kHz, so for more advanced options, the user can option 'f' from frequency deviation menu. Using this option 'f' the user can set the frequency deviation according to Equation 3.

## EQUATION 3:

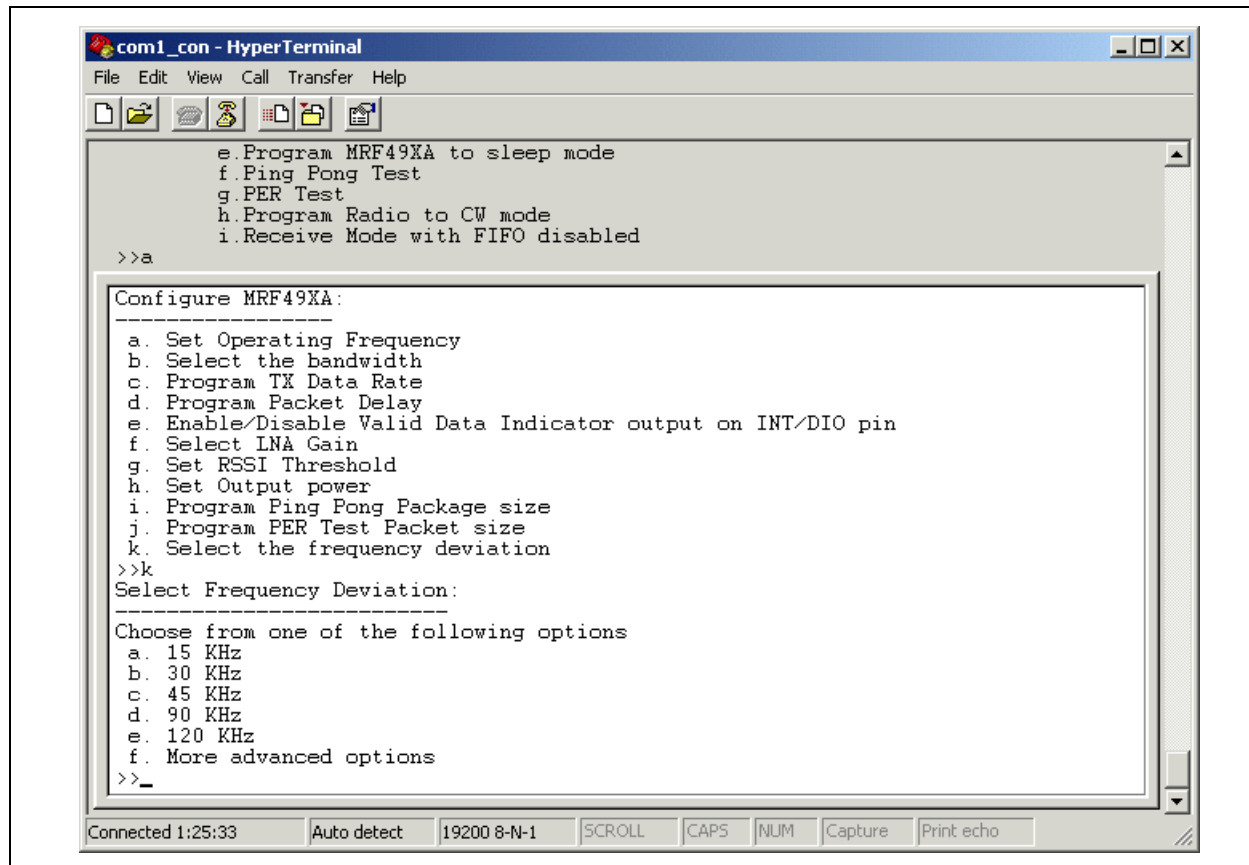
$$\text{Frequency Deviation} = (\text{MB}+1) * 15 \text{ kHz}$$

Where MB-Modulation Bandwidth is a value in the range 0-15

The default value for the frequency deviation is the value chosen during the setup procedure.

System status will be printed on the screen after programming this parameter. Check "Frequency Deviation =" value to confirm this setting.

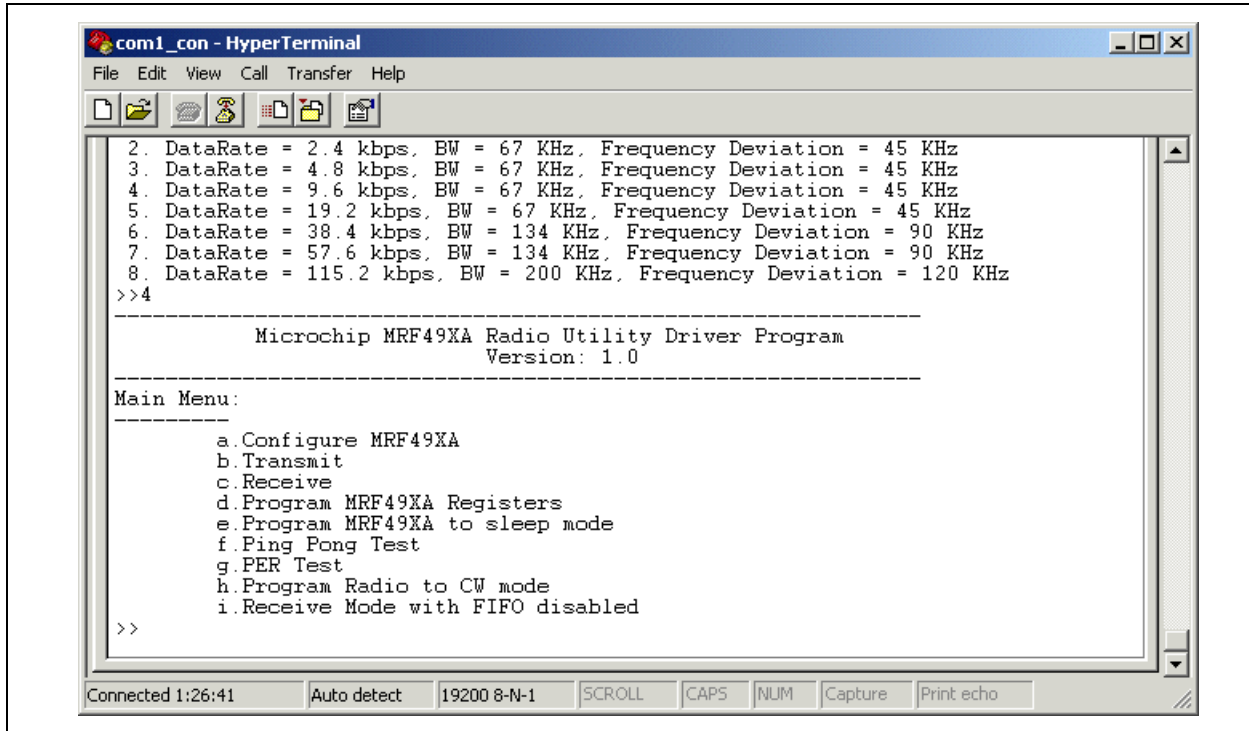
**FIGURE 16: PROGRAMMING THE FREQUENCY DEVIATION**



## TEST FUNCTION COMMANDS

Test activation and other functional commands are issued through the Main Menu, shown in Figure 17. To display this menu (Main Menu) from anywhere through the program interface, press <Ctrl> + <z>.

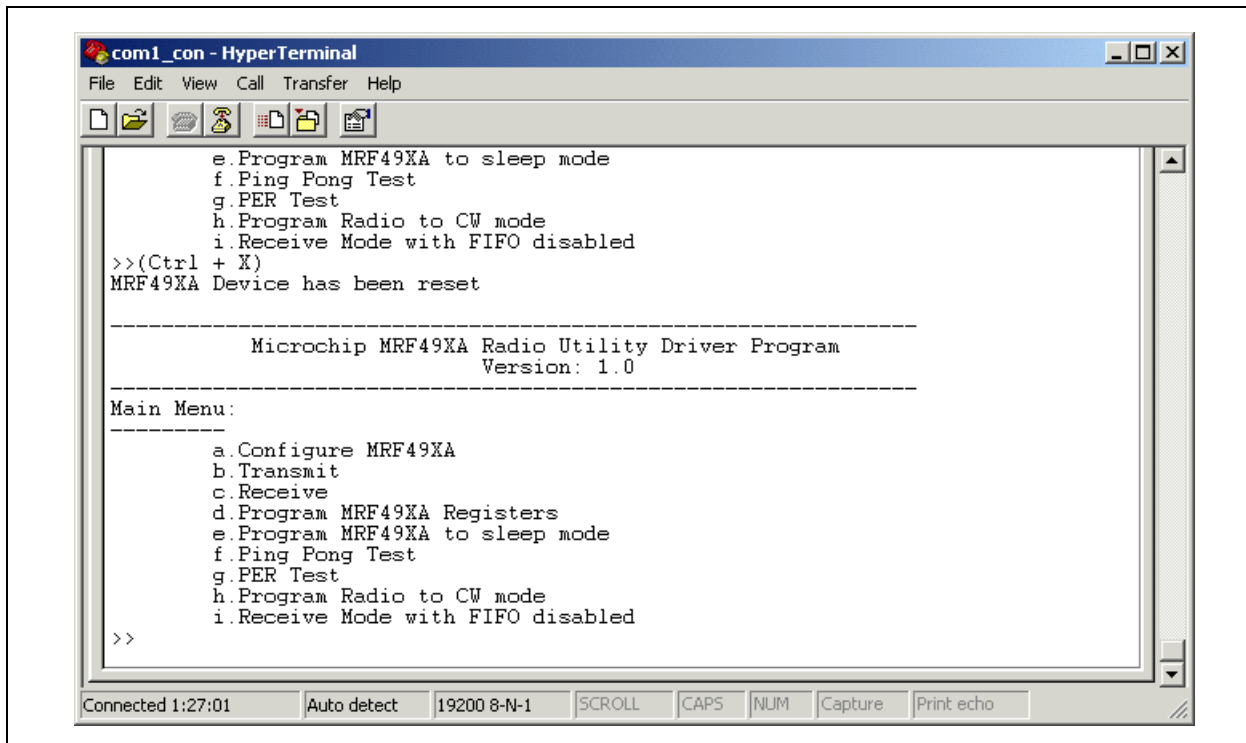
FIGURE 17: MAIN MENU



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To change the Configuration settings to the default settings, use <Ctrl>+<x>. This is illustrated in Figure 18.

**FIGURE 18: BACK TO THE DEFAULT SETTINGS**



## TRANSMIT

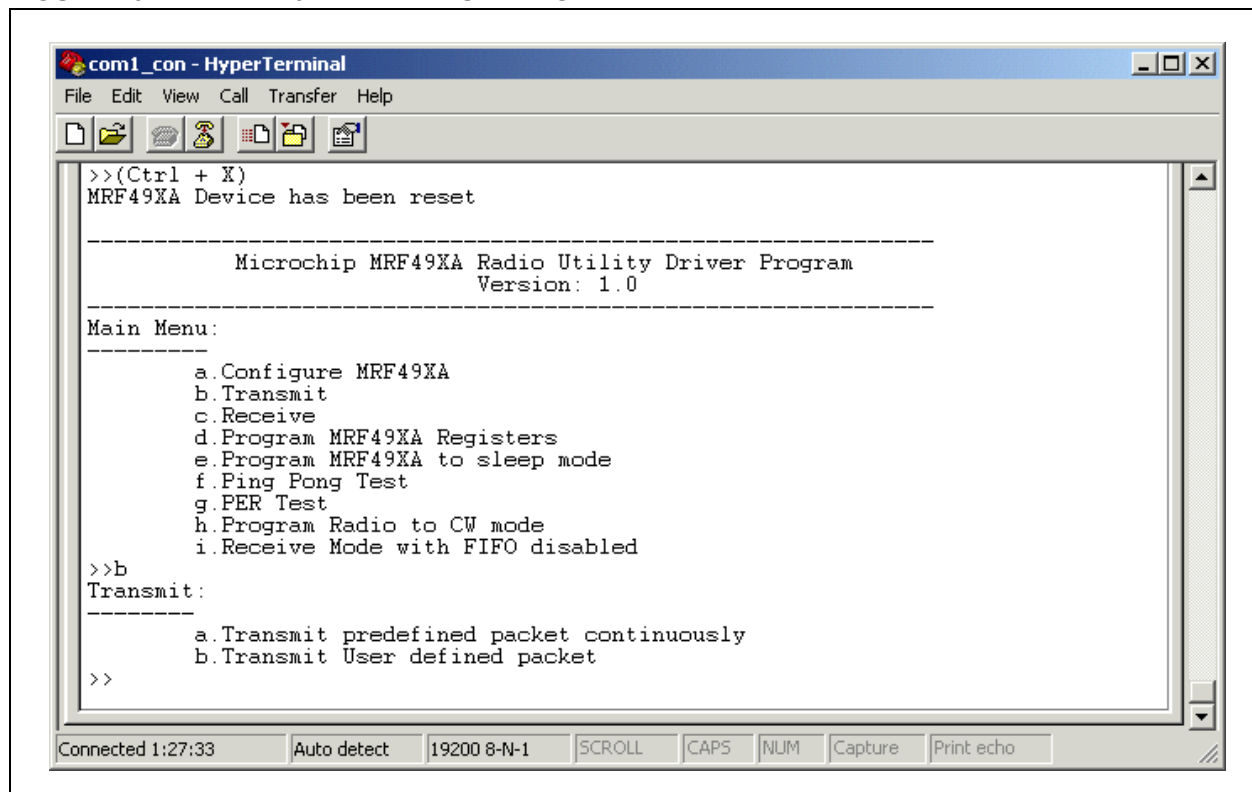
This Main Menu option, shown in Figure 19, can be used to transmit a continuous stream of packets. The packet structure can be either user-defined structure or a pre-defined structure.

The predefined packet structure is:

```
01 08 C4 FF FF FF FF 07 01 00 01 00
```

The inter-packet delay between the continuous packets can be defined using the “Program Packet Delay” option in the Configuration Commands. To verify transmission, users need to setup two units (development boards with MRF49XA daughter cards) one in Transmit mode and the other in Receive mode.

**FIGURE 19: MRF49XA IN TRANSMIT MODE**

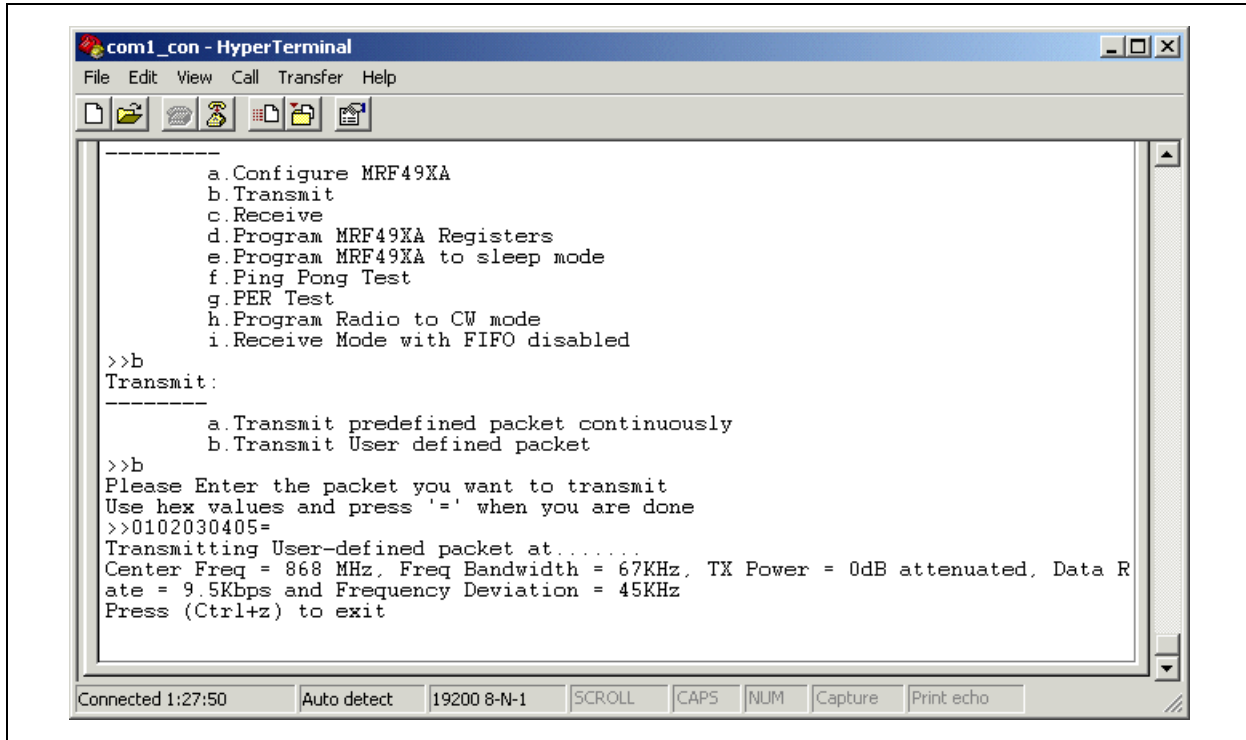


Before using this option:

- Review the transmitting transceiver's and receiver's configuration values (most of these values can be displayed by pressing <Ctrl> + <s>).  
The default configuration values are shown in Table 3.
- If some of the configuration settings need to be modified:  
Display the Main Menu (by pressing <Ctrl> + <z>) and select (a) *Configure MRF49XA*.  
Edit the desired parameters.  
Return to the Main Menu (<Ctrl> + <z>).

- The transceiver being used as the receiver can be configured either in Verbose mode or Summary mode, where the user can choose to either display the entire contents of the packet or just print the received packet count for every minute. Refer to the **Section “Receive”** for more details.
- Use the “*Program Packet Delay*” option to modify the inter-packet delay.
- Choose the Transmit mode – Pre-defined packet or User-defined packet. If you need to transmit a user-defined packet, type the hexadecimal values to be transmitted and press <=> “equals” key after typing the entire packet contents. This process is illustrated in Figure 20.
- Transmission starts immediately.
- To stop transmission, press <Ctrl> + <z>

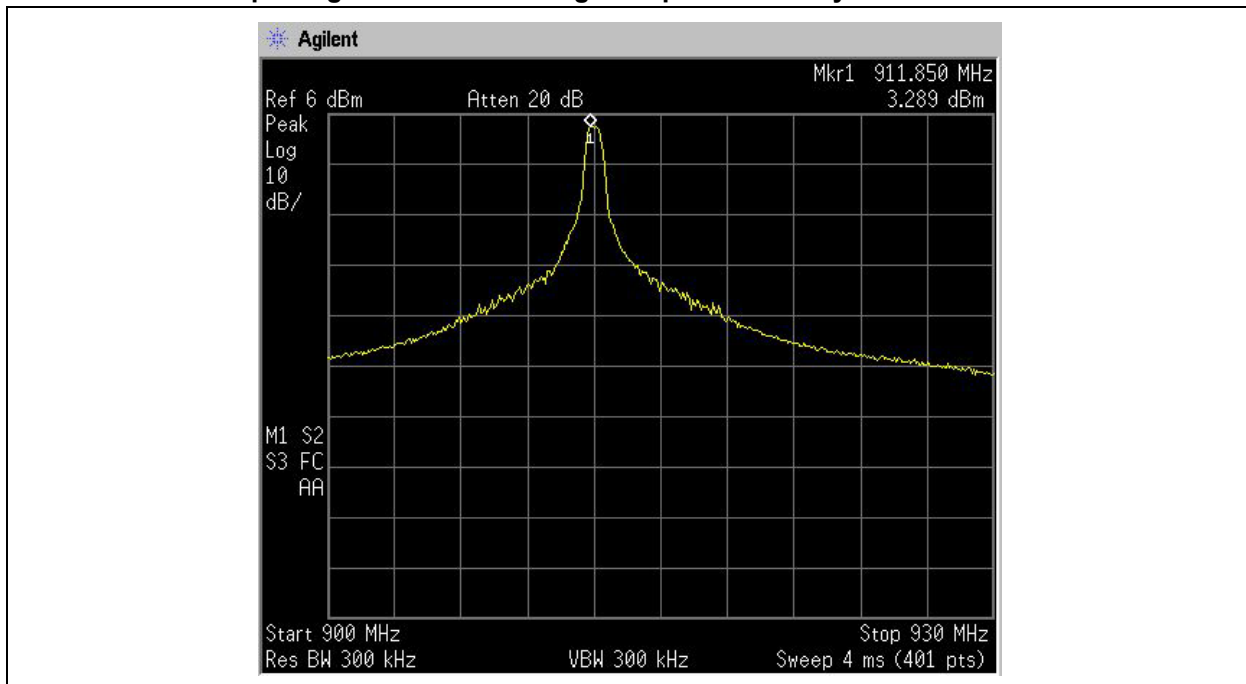
FIGURE 20: TRANSMIT USER-DEFINED PACKET



**Note:** The frequency band, center frequency, bandwidth and the data rate values on both transceivers (sender and receiver units) must be the same for successful reception of the transmitted content.

Instead of using a receiver at the other end, RF engineers can also use the Spectrum Analyzer on the other end, and observe the spectrum of the transmitted packets.

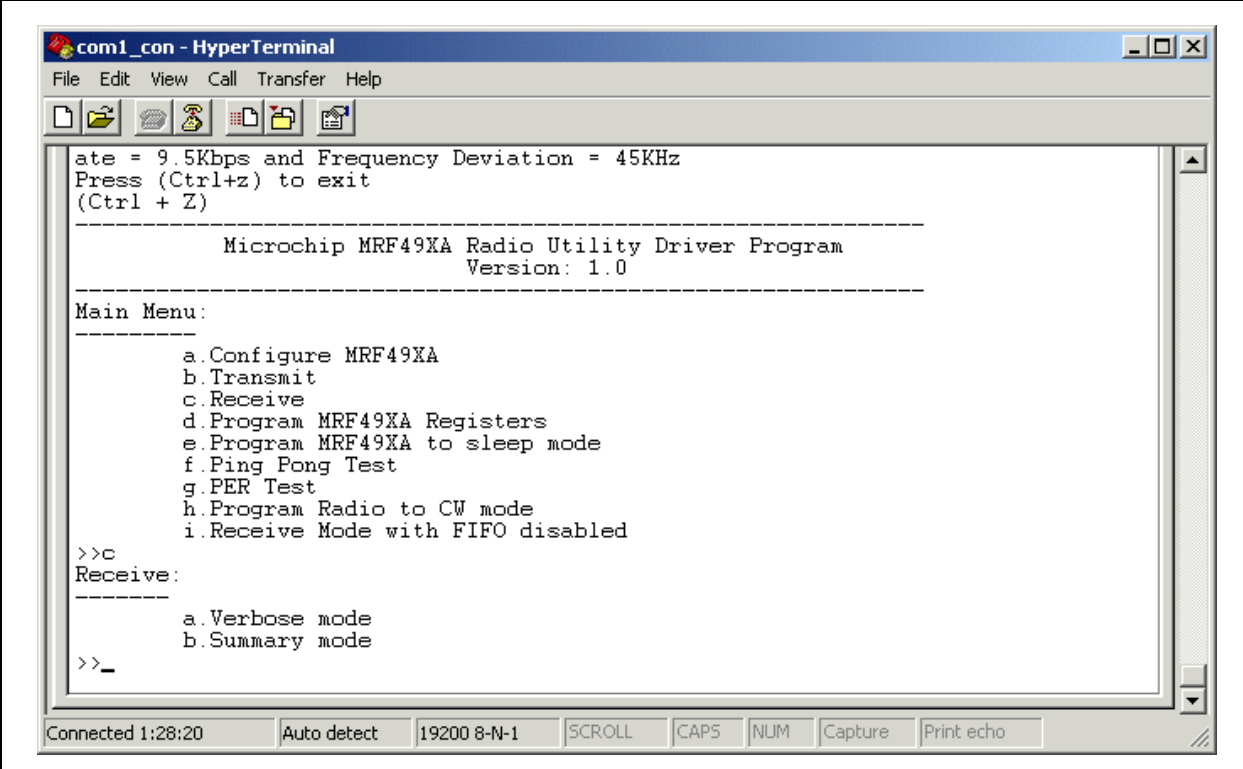
FIGURE 21: Capturing the Transmit Using the Spectrum Analyzer at 915 MHz



## RECEIVE

This Main Menu option, displayed in Figure 22, allows users to capture and display the received packet statistics on the screen. Two display modes – Verbose mode, Summary mode – are available to the user. In Verbose mode, the entire contents of the packet are dumped on the screen. One can use this mode as a Sniffer mode. In Summary mode, only the packet count received for each second will be displayed. This works like a Counting mode, where we can observe a packet drop if any interferer was introduced into the channel.

FIGURE 22: MRF49XA IN RECEIVE MODE

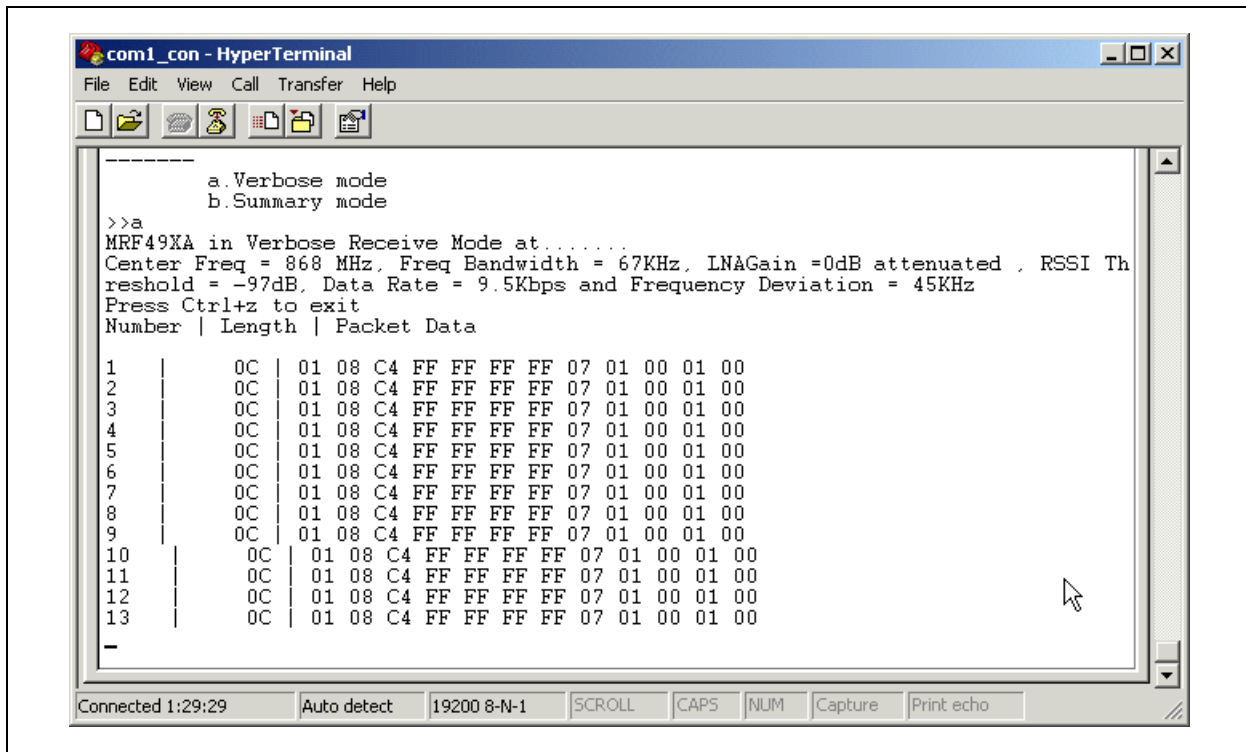


```
com1_con - HyperTerminal
File Edit View Call Transfer Help
[Icons]
ate = 9.5Kbps and Frequency Deviation = 45KHz
Press (Ctrl+z) to exit
(Ctrl + Z)
-----
Microchip MRF49XA Radio Utility Driver Program
Version: 1.0
-----
Main Menu:
-----
a. Configure MRF49XA
b. Transmit
c. Receive
d. Program MRF49XA Registers
e. Program MRF49XA to sleep mode
f. Ping Pong Test
g. PER Test
h. Program Radio to CW mode
i. Receive Mode with FIFO disabled
>>c
Receive:
-----
a. Verbose mode
b. Summary mode
>>_
Connected 1:28:20 Auto detect 19200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

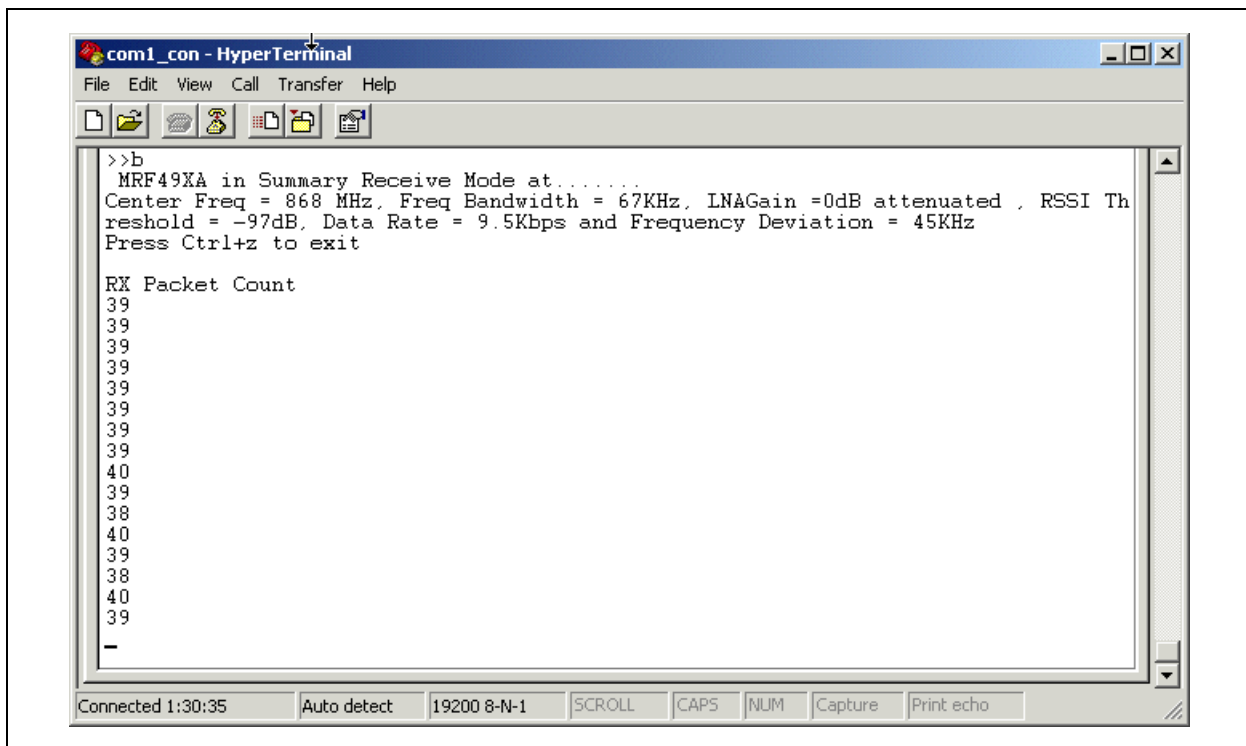
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Sample screen shots for Verbose mode and Summary mode are displayed in Figure 23 and Figure 24, respectively.

**FIGURE 23: VERBOSE MODE**



**FIGURE 24: SUMMARY MODE**





Before using this option, check the transceiver's configuration settings and program them according to the settings of the transmitter.

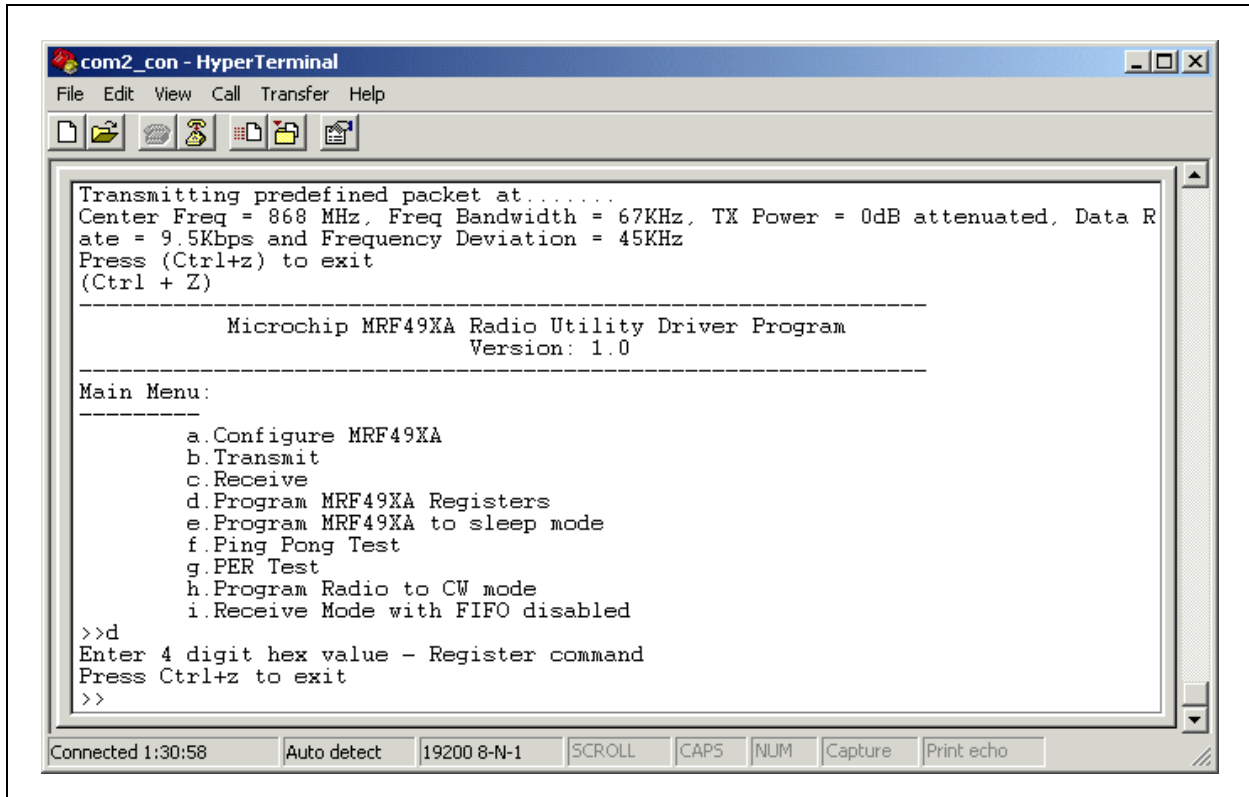
To exit the reception mode, press <Ctrl> + <Z>.

**Note:** The frequency band, center frequency, bandwidth and the data rate values on both transceivers (sender and receiver units) must be same for successful reception of the transmitted content.

## PROGRAM MRF49XA REGISTERS

This Main Menu option, displayed in Figure 25, enables MRF49XA register programming. For register programming, enter the 4-digit hexadecimal value, which contains both the address and data information. Refer to the MRF49XA Data Sheet (DS70590) for more information on available registers and programming options.

**FIGURE 25: PROGRAM MRF49XA REGISTERS**



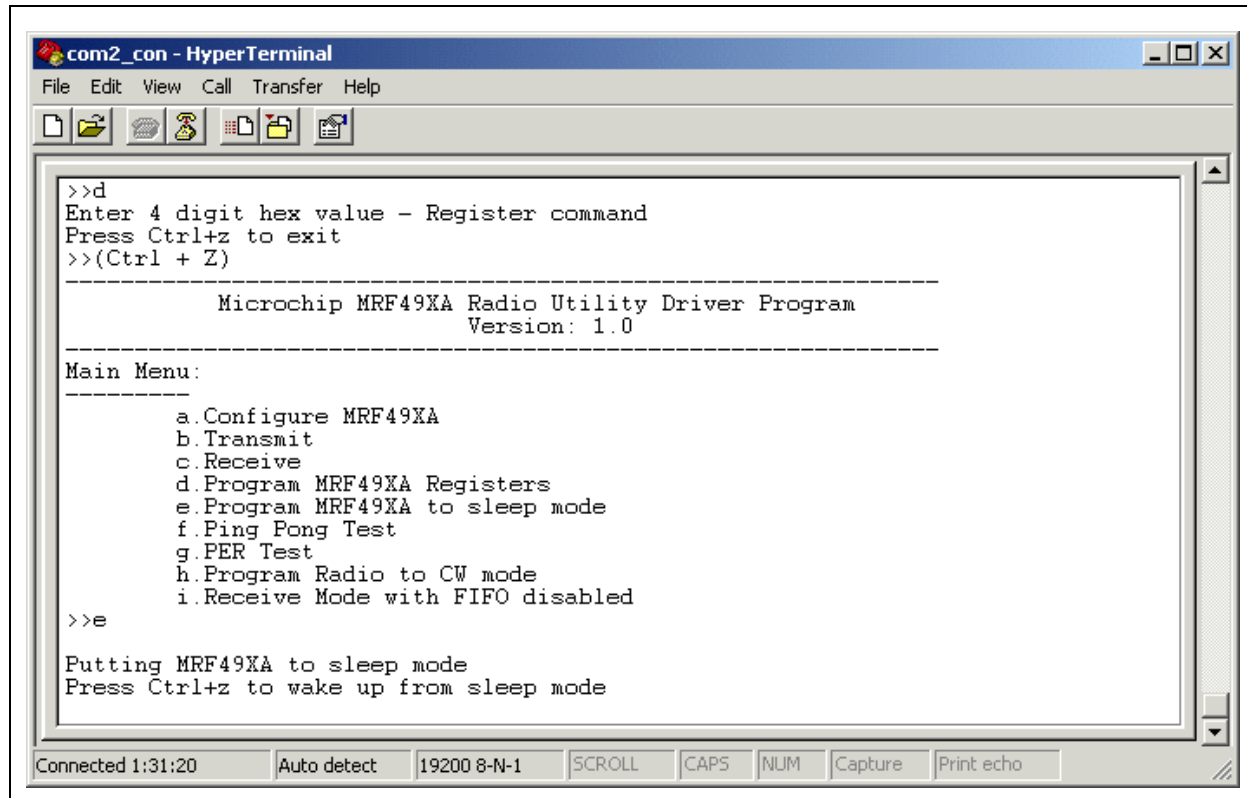
After successful programming, the Main Menu will be displayed on the screen.

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## PROGRAM MRF49XA TO SLEEP MODE

This Main Menu option, displayed in Figure 26, aids in putting the MRF49XA device to Sleep mode. The Sleep mode current that is measured at this step should be equal to the current in Sleep mode (refer to MRF49XA Data Sheet (DS70590) for Sleep current values). Jumper JP2 on the MRF49XA RF transceiver daughter boards can be used for measuring Sleep current.

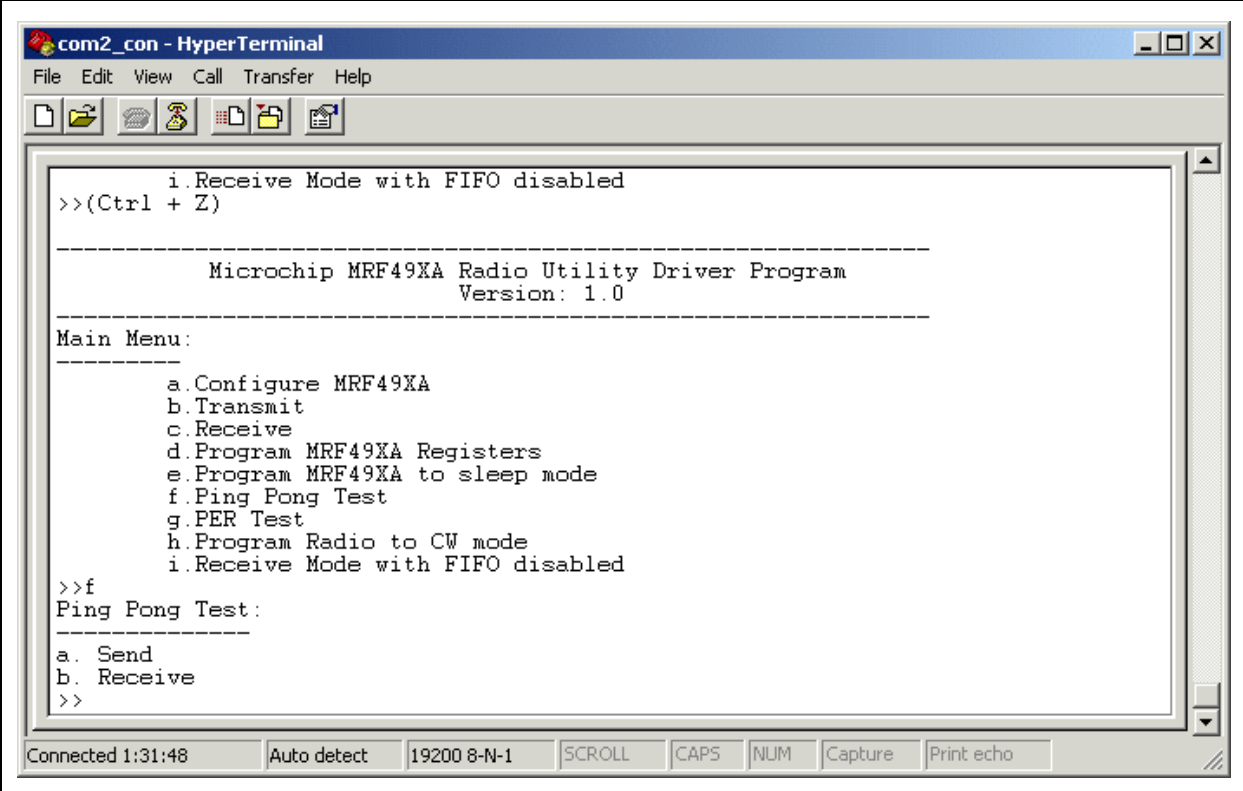
**FIGURE 26: MRF49XA IN SLEEP MODE**



Press <Ctrl> + <z> to exit Sleep mode.

## PING-PONG TEST

This Main Menu option, displayed in Figure 27, can be used to test the compliance with a European Standard for blocking and desensitization. It measures the capability of a device to receive a signal without degradation due to unwanted signals at other frequencies. The wanted signal's degradation of the Packet Error Rate (PER) must be less than 1%, or the Bit Error Rate (BER) less than 0.1%.

**FIGURE 27: PING-PONG TEST**

```
com2_con - HyperTerminal
File Edit View Call Transfer Help
-----
i. Receive Mode with FIFO disabled
>>(Ctrl + Z)

-----
Microchip MRF49XA Radio Utility Driver Program
Version: 1.0
-----

Main Menu:
-----
a. Configure MRF49XA
b. Transmit
c. Receive
d. Program MRF49XA Registers
e. Program MRF49XA to sleep mode
f. Ping Pong Test
g. PER Test
h. Program Radio to CW mode
i. Receive Mode with FIFO disabled

>>f
Ping Pong Test:
-----
a. Send
b. Receive
>>
```

Connected 1:31:48    Auto detect    19200 8-N-1    SCROLL    CAPS    NUM    Capture    Print echo

# AN1309

This test can also be used by the user to perform a range test. The test requires two MRF49XA transceivers – each one running the MRF49XA utility program. Prior to initiating the test, both transceivers must be configured for the same operating frequency, data rate and ping-pong test package size. If you are trying to perform a desensitization test, a signal generator will also be needed.

To perform the test:

1. Program ping-pong package size
2. On Unit 1, select the Main Menu option “Ping-Pong Test”, and select the option “Receive”
3. On Unit 2, activate the command and select option “Send”

Unit 2 transmits the designated number of packets to Unit 1, and Unit 1 (Figure 28) reports the number of received packets and transmits the number of specified packets to Unit 2.

The process continues until stopped. To stop the process, press Ctrl + z.

4. While the packets are being exchanged activate a signal generator; perform a sweep large enough to create interference signals for the two transceivers. This step can be avoided if the user intends to perform range testing.
5. Watch the two dialog boxes and record the number of lost packets. Based on the number of lost packets and the package size, the user can calculate the “Packet Error Rate”.

## EQUATION 4: PACKET ERROR RATE

$$\text{Packet Error Rate} = (\text{Number of Lost Packet} / \text{Ping-Pong Package Size}) * 100$$

If so desired, this test can be repeated while the units are at different distances – to determine the device’s coverage.

FIGURE 28: PING-PONG RECEIVE

```
com1_con - HyperTerminal
File Edit View Call Transfer Help

f.Ping Pong Test
g.PER Test
h.Program Radio to CW mode
i.Receive Mode with FIFO disabled

>>f
Ping Pong Test:
-----
a. Send
b. Receive
>>b
Ping Pong Test working at.....
Center Freq = 868 MHz, Freq Bandwidth = 67KHz, TX Power = 0dB attenuated, LNA Gain = 0dB attenuated, RSSI Threshold = -97dB, Data Rate = 9.5Kbps and Frequency Deviation = 45KHz
Press Ctrl+z to exit

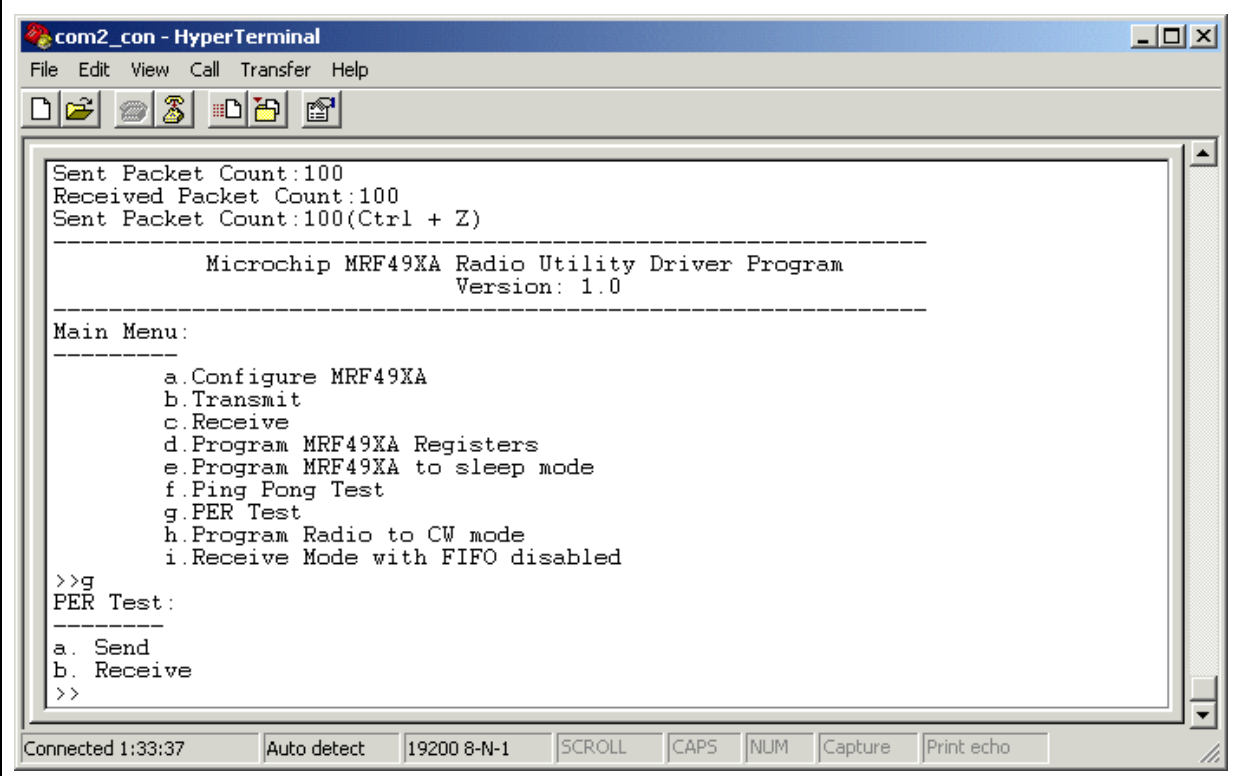
Received Packet Count:100
Sent Packet Count:100
Received Packet Count:100
Sent Packet Count:100
Received Packet Count:100
Sent Packet Count:100
Received Packet Count:100
Sent Packet Count:100
Received Packet Count:100
Sent Packet Count:100

Connected 1:32:43  Auto detect  19200 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo
```

## PER TEST

This Main Menu option displayed in Figure 29 performs a test of the Packet Error Rate (PER) between two transceivers. The length of the packet can be chosen using the option "PER test packet size" in the configuration commands. Refer to the **Section "Configuration Commands"** for more details about the PER test packet size. The PER test option can be used when testing the PER observed at the receiver, when the other transceiver is configured as a sender. This PER test was designed to be used for range testing purposes.

FIGURE 29: PER TEST



```
com2_con - HyperTerminal
File Edit View Call Transfer Help
[Icons]
Sent Packet Count:100
Received Packet Count:100
Sent Packet Count:100(Ctrl + Z)
-----
Microchip MRF49XA Radio Utility Driver Program
Version: 1.0
-----
Main Menu:
-----
a. Configure MRF49XA
b. Transmit
c. Receive
d. Program MRF49XA Registers
e. Program MRF49XA to sleep mode
f. Ping Pong Test
g. PER Test
h. Program Radio to CW mode
i. Receive Mode with FIFO disabled

>>g
PER Test:
-----
a. Send
b. Receive
>>
```

Connected 1:33:37   Auto detect   19200 8-N-1   SCROLL   CAPS   NUM   Capture   Print echo

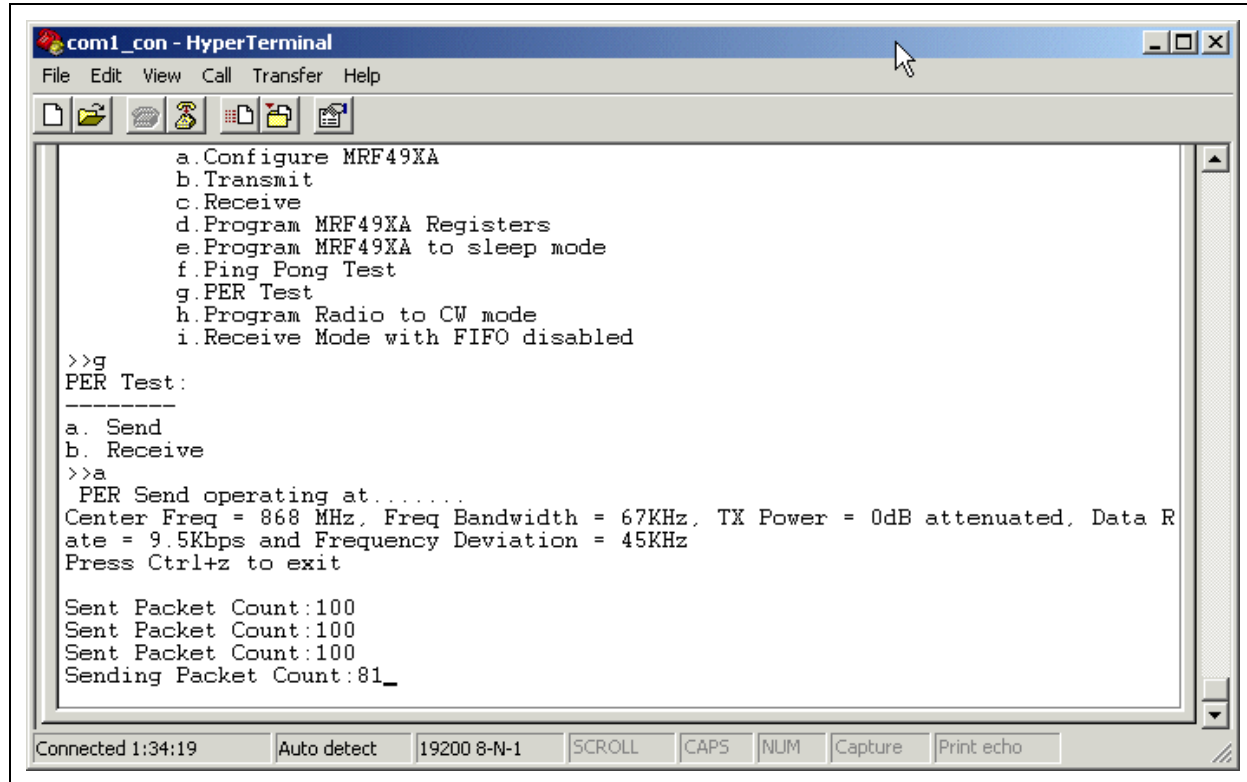
# AN1309

The test requires two MRF49XA RF transceivers – each one running the MRF49XA utility program and set to the same frequency, bandwidth and data rate.

To begin the test:

1. Configure Unit 1 as receiver by choosing “Receive” under the PER test menu.
2. Configure Unit 2 as transmitter by choosing “Send” under the PER test menu. Unit 2 sends 100 packets. This is shown in Figure 30.

**FIGURE 30: PER TEST – SEND**



- Unit 1 reports the number of packets received and the PER percentage (Figure 31).

**FIGURE 31: PER TEST – RECEIVE**

```
com2_con - HyperTerminal
File Edit View Call Transfer Help
b. Transmit
c. Receive
d. Program MRF49XA Registers
e. Program MRF49XA to sleep mode
f. Ping Pong Test
g. PER Test
h. Program Radio to CW mode
i. Receive Mode with FIFO disabled

>>g
PER Test:
-----
a. Send
b. Receive
>>b
PER Receive operating at.....
Center Freq = 868 MHz, Freq Bandwidth = 67KHz, LNA Gain = 0dB attenuated, RSSI Th
reshold = -97dB, Data Rate = 9.5Kbps and Frequency Deviation = 45KHz
Press Ctrl+z to exit

Received Packet Count:100      PER = 0%
Received Packet Count:100      PER = 0%
Received Packet Count:100      PER = 0%
Received Packet Count:100      PER = 0%
_

Connected 1:34:11  Auto detect  19200 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo
```

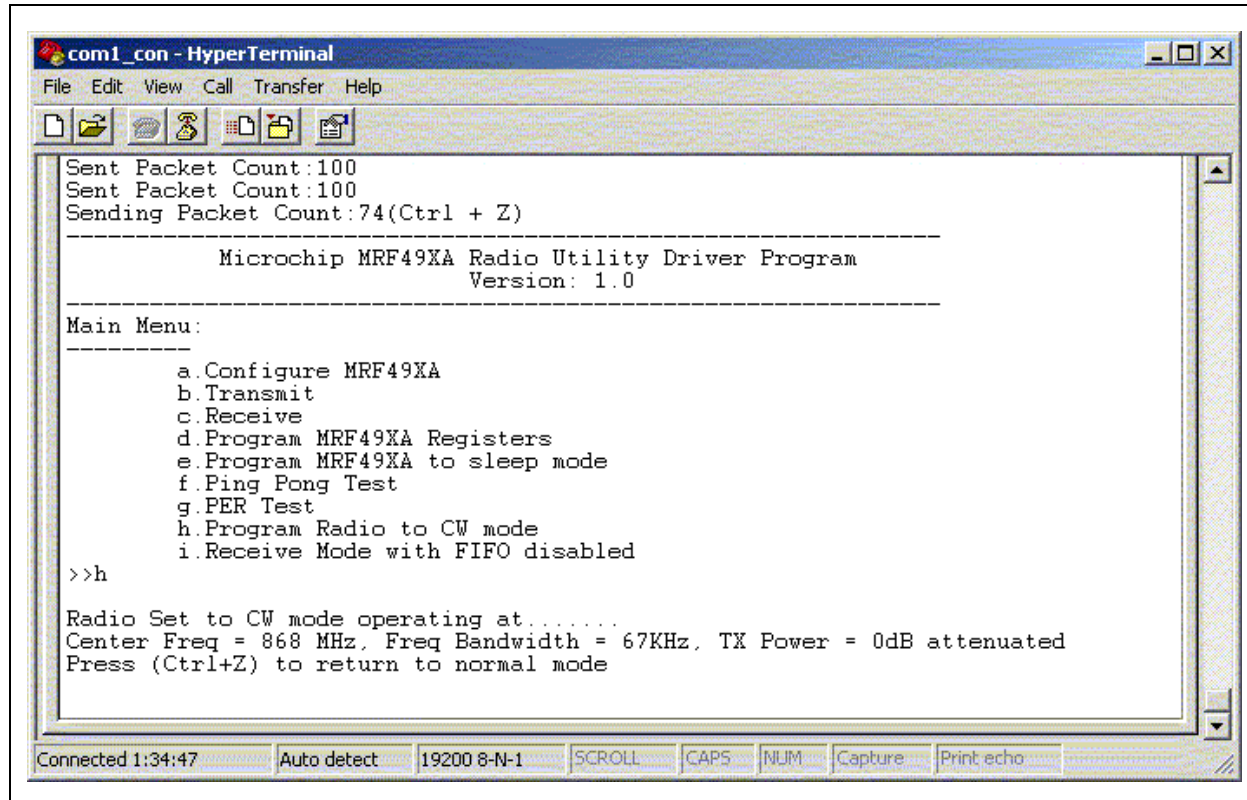
- Unit 2 continues to Send 100 packets at a time continuously, and Unit 1 reports the observed PER rate. To exit the PER test mode, press Ctrl+z.

# AN1309

## PROGRAM RADIO TO CONTINUOUS WAVE (CW) MODE

This Main Menu option, displayed in Figure 32, can be used to check the frequency and output of the local oscillator for a specific frequency setting. This command enables the local oscillator to start running without any modulation.

**FIGURE 32: CONTINUOUS WAVE MODE**

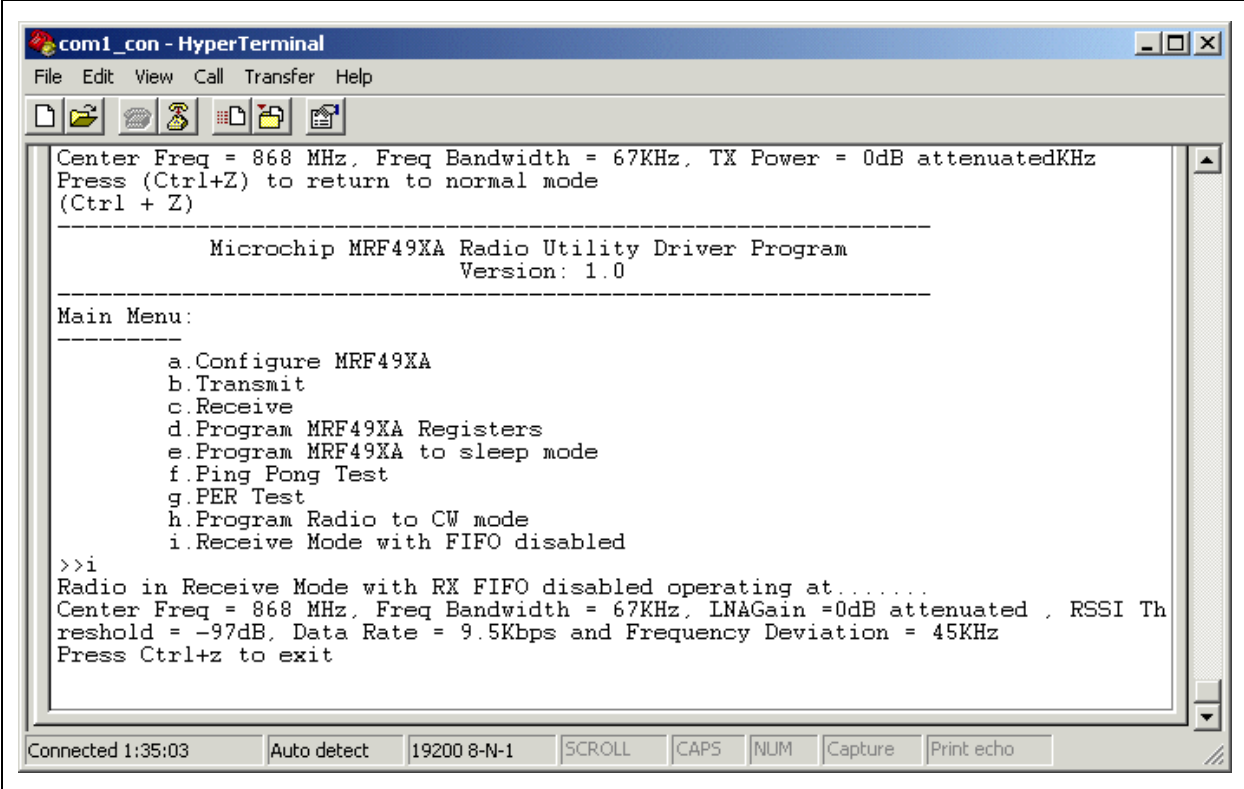




## RECEIVE MODE WITH FIFO DISABLED

This mode can be used for Bit-Error-Rate (BER) measurement using a signal generator/signal analyzer. In this mode the FIFO is disabled and the received data will be available on the DATA pin (Pin 6 – FSK/DATA/FSEL). Refer to the MRF49XA Data Sheet (DS70590) for more details about this mode.

FIGURE 33: RECEIVE MODE WITH FIFO DISABLED



```
com1_con - HyperTerminal
File Edit View Call Transfer Help

Center Freq = 868 MHz, Freq Bandwidth = 67KHz, TX Power = 0dB attenuatedKHz
Press (Ctrl+Z) to return to normal mode
(Ctrl + Z)

-----
Microchip MRF49XA Radio Utility Driver Program
Version: 1.0
-----

Main Menu:
-----
a. Configure MRF49XA
b. Transmit
c. Receive
d. Program MRF49XA Registers
e. Program MRF49XA to sleep mode
f. Ping Pong Test
g. PER Test
h. Program Radio to CW mode
i. Receive Mode with FIFO disabled

>>i
Radio in Receive Mode with RX FIFO disabled operating at.....
Center Freq = 868 MHz, Freq Bandwidth = 67KHz, LNA Gain = 0dB attenuated, RSSI Th
reshold = -97dB, Data Rate = 9.5Kbps and Frequency Deviation = 45KHz
Press Ctrl+z to exit

Connected 1:35:03 Auto detect 19200 8-N-1 SCROLL CAPS NUM Capture Print echo
```

# AN1309

---

NOTES:

---

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