12.2.5 Making "Hello, World!"

The process of modifying an application, then downloading and running it on the modem, can be demonstrated by altering the Turnkey application to print "`Hello, world!`" to the Logger port.

1. In the IAR workspace window, expand the Turnkey group by clicking on the '+' and then double-clicking on APL.c. This will open the file in the editor window:

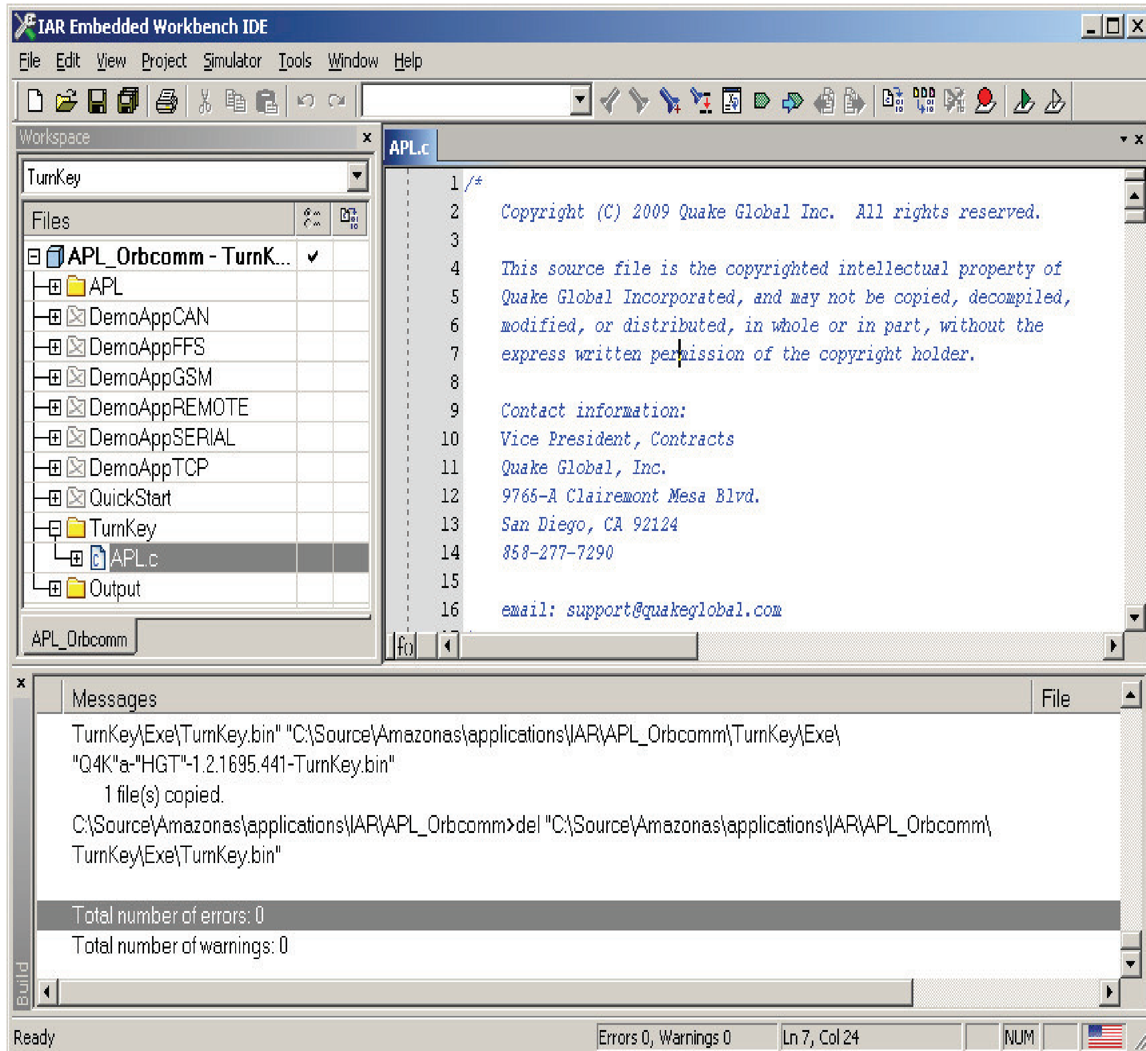

Figure 12-17: Turnkey APL.c file

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2. Use Ctrl/F to search for POWER_ON. In the function `processEvent()`, you should see the line `case POWER_ON:`
3. Modify APL.c by adding printf("\r\nHello, world!\r\n"); under the POWER_ON line. The file with the modifications should appear as in Figure 12-18 below:

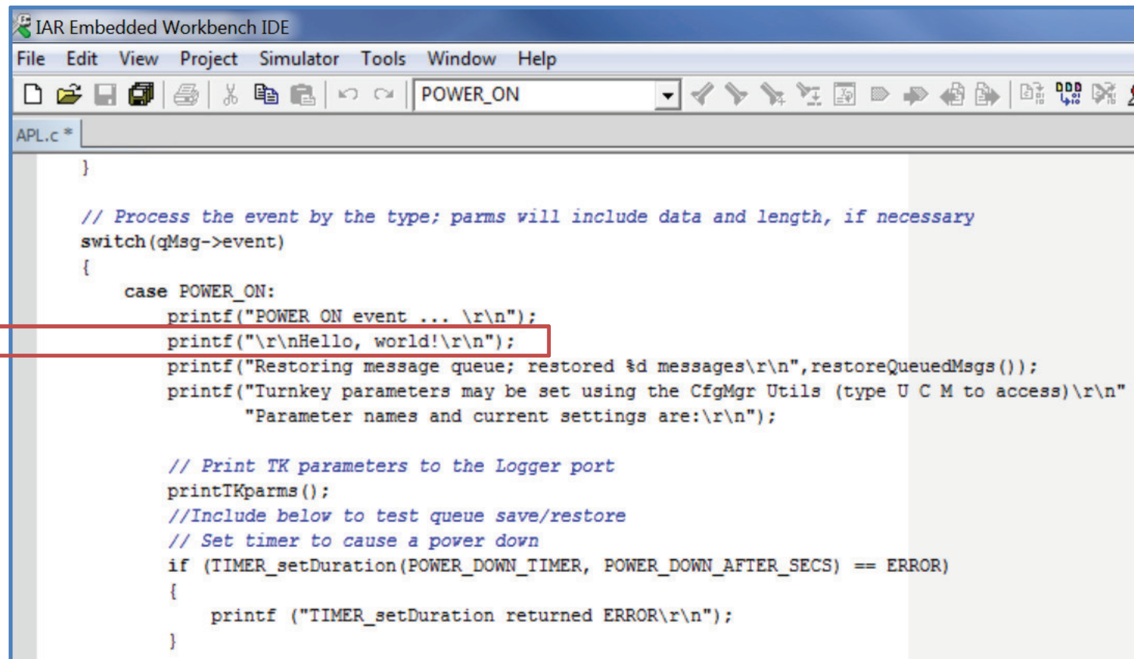

Figure 12-18: Modify Turnkey APL.c by adding a printf statement

4. After making the modification, select Make (F7) to save the changes and rebuild the project. If there are errors shown in the bottom window, correct these and rebuild. This creates the new binary file, TurnKey.bin, which you then load into the modem with the QUAKE Configuration Tool (QCT), as described in Section 12.2.2.

Note: If additional changes are required after compiling, it is a good idea to first select "Clean" from the Project menu before recompiling. This removes the existing object files and insures that the subsequent "Make" does a completely new compile and build, without using any previously compiled object files.

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5. Once you have downloaded the new application file with “Hello, World,” cycle power on the modem. You should see the following output on the Logger port:

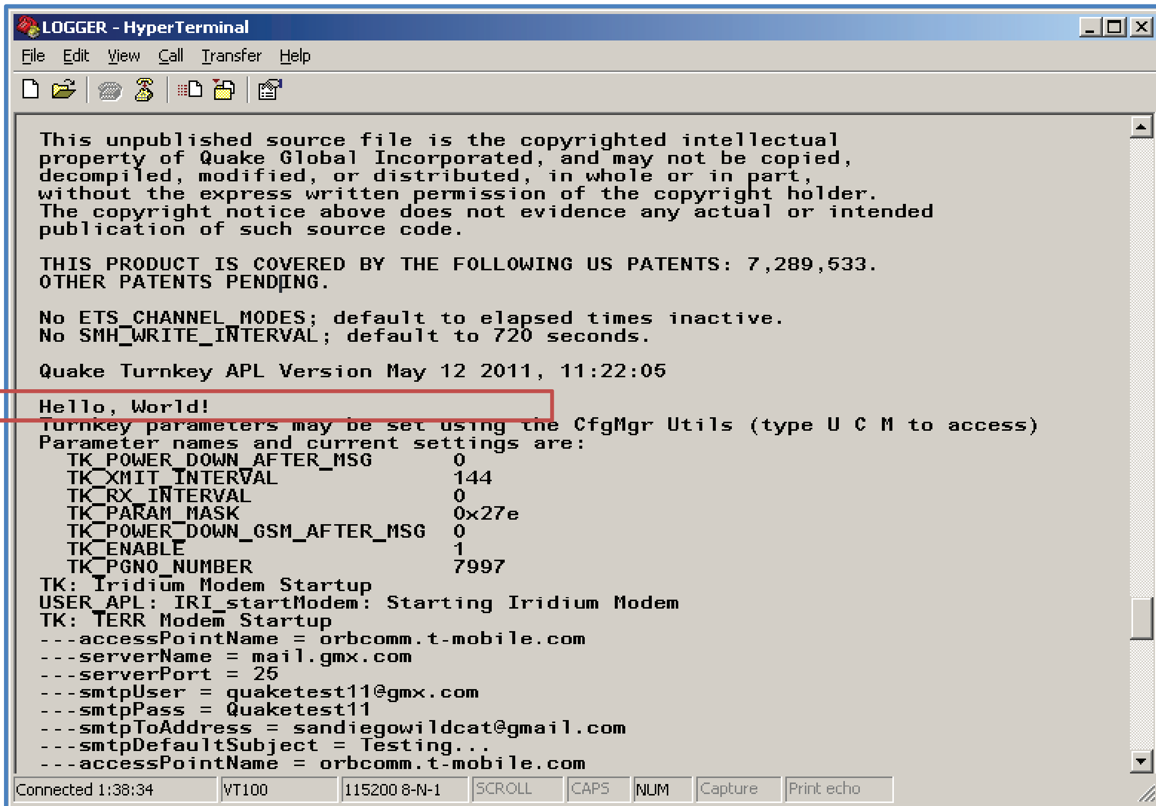

Figure 12-19: Logger output with "Hello, World!"

12.2.6 Additional detail on Turnkey

The Turnkey application allows the user to set configuration parameters to control when it sends a report and what is contained in the report data. The application can report a GPS position fix, DIO and Analog values, as well as CAN data. It accepts parameter changes received over the air or from a serial port. It can also accept an application update over GPRS. The application can be used as is, or it can serve as the basis for a more complex user application. We have seen how to set up the IDE, and build, load and execute the Turnkey application. We now examine the Turnkey code in more detail in order to understand the QUAKE Event Framework.

Note:

> Turnkey is written in network-agnostic code; that is, the same code can be used for any satellite network with no changes required. Please note that Turnkey is the only sample application written in this manner. All the other sample applications are written in network-dependent code, meaning they must be changed when switching between satellite networks.

The main loop of Turnkey initializes configuration parameters, sets up serial port handling by registering a callback function for each serial port in use, generates a power-on event and enters a **`while`** loop where it checks for messages in its queue and processes them. Most events are

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handled in a single function called `processEvent()`. GPS, serial data, CAN events and some others are handled directly from the main loop. This is shown in the figure below.

```
.c | User_libQuake.h | APL.c
2024    //APL_setSerPortMode(UARTPORT_LOGGER, PORT_MODE_PROTOCOL, 0, 0, 0);
2025
2026    // Enter the main task loop
2027    while(1)
2028    {
2029        if(SYS_msgQReceive(aplFromQosMsgQId, (u8*)&qMsg, sizeof(qMsg), TICKS_PER_SEC) == OK)
2030        {
2031            if(qMsg.type != APL_EVENT_MSG && QLM_getLogDownlink())
2032            {
2033                printf("TK: %s: Msg %d rcvd\r\n", __FUNCTION__, qMsg.type);
2034            }
2035            switch (qMsg.type)
2036            {
2037                case APL_EVENT_MSG:
2038                    processEvent(&qMsg.eventOption);
2039
2040                    // Release the memory if it has been allocated
2041                    if (qMsg.eventOption.msg != NULL)
2042                    {
2043                        free(qMsg.eventOption.msg);
2044                    }
2045                    break;
2046
2047                case APL_MENU_MSG:
2048                    displayUtilityMenuOptions(&qMsg.menuOption);
2049                    break;
2050
2051                case APL_UTIL_MSG:
2052                    processUtilModeCmd(&qMsg.utilOption);
2053                    break;
2054
```

Figure 12-20: Turnkey main task loop

We have seen in the Turnkey application how **`processEvent()`** handles a power-on sequence. Depending on the settings of the configuration parameters, it initializes the satellite and GPRS modules, starts the GPS and sets timers to check for GPS and to transmit message timeouts. There is a single TIMER event which occurs when any of the timers has a timeout. Depending on the timer that expired, Turnkey may build and send a message, or it may check for a received message (from GPRS) or process a timeout from the GPS process.

Other events are triggered, for example, when:

- DTR changes state
- a satellite or GPRS goes in or out of view
- a message is received.

The complete list of events is discussed in Chapter 14.

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12.3 QuickStart application

The QuickStart application provides the minimum framework to build a custom application on the Q4000/QPRO. It starts the main application task and lists the events used by the foundation to signal actions to the application.

1. Close any APL.c file that is still open before opening the QuickStart APL.c, in order to avoid the confusion of having two APL.c files open at the same time.

2. Select the QuickStart Workspace from the drop-down list at the top left-hand corner of the IDE screen. This will cause the Turnkey group to be grayed out, and the QuickStart group will become bright yellow.

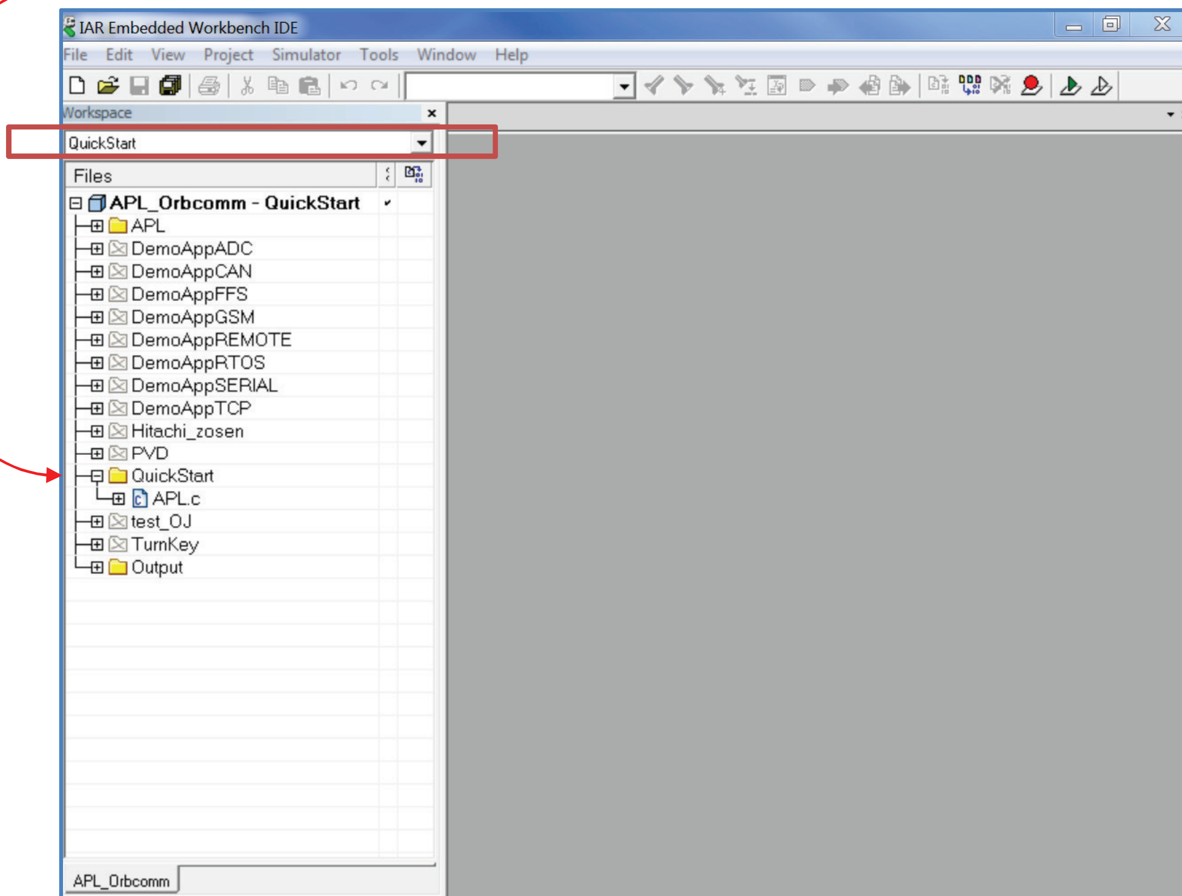

Figure 12-21: Selecting the QuickStart Workspace

3. Open APL.c from the QuckStart application.

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As seen in Figure 12-22, the QuickStart APL.c contains little code under most of the event cases in the switch statement in `processEvent()`. This allows the user to fill in the event cases with customized code.

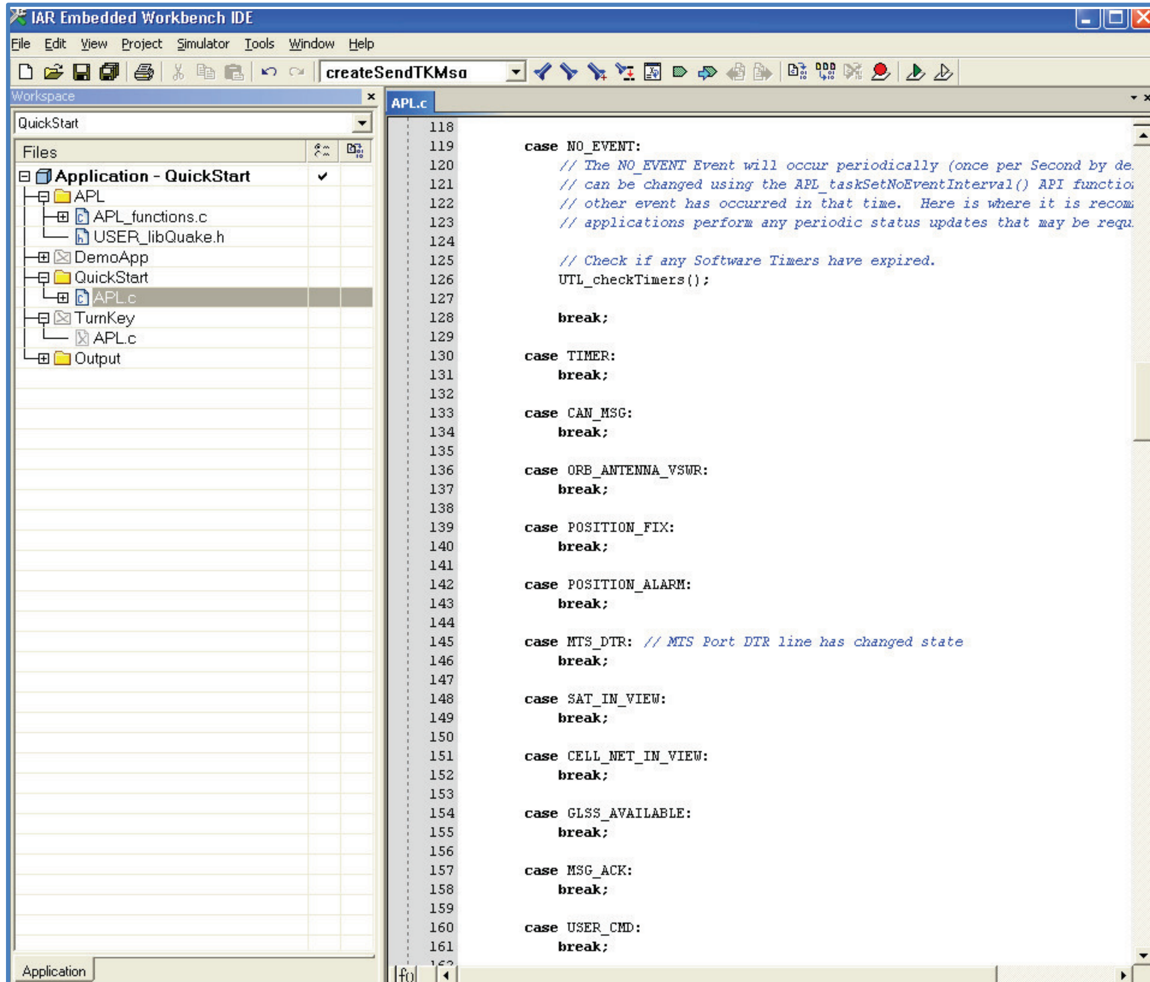

Figure 12-22: QuickStart switch statement

The instructions for building, loading and executing the code are the same as in Section 12, except that after building the application, the executable bin file is: …`/QuickStart/exe/QuickStart.bin`.

Since QuickStart is simply a template and is included as a starting point for a user's custom application, no examples of running the QuickStart application will be shown.

12.4 DemoApp applications

To run the DemoApps, close any open APL.c files and select the DemoAppXXX application on the IAR IDE. Open APL.c under DemoAppXXX. The applications are described in the following sections.

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12.4.1 DemoAppGSM

DemoAppGSM sets a timer to first send out a short message via GSM and then sets a timer to send out a short report via satellite. It uses network-specific calls to do this. It continues to alternate between GSM and satellite messages until the application is stopped. The timers are hardcoded to 60 seconds and are not adjustable from any program parameters.

1. Select the DemoAppGSM Workspace from the drop-down list at the top, left-hand corner of the IAR IDE screen. Open the APL.c file, as shown below:

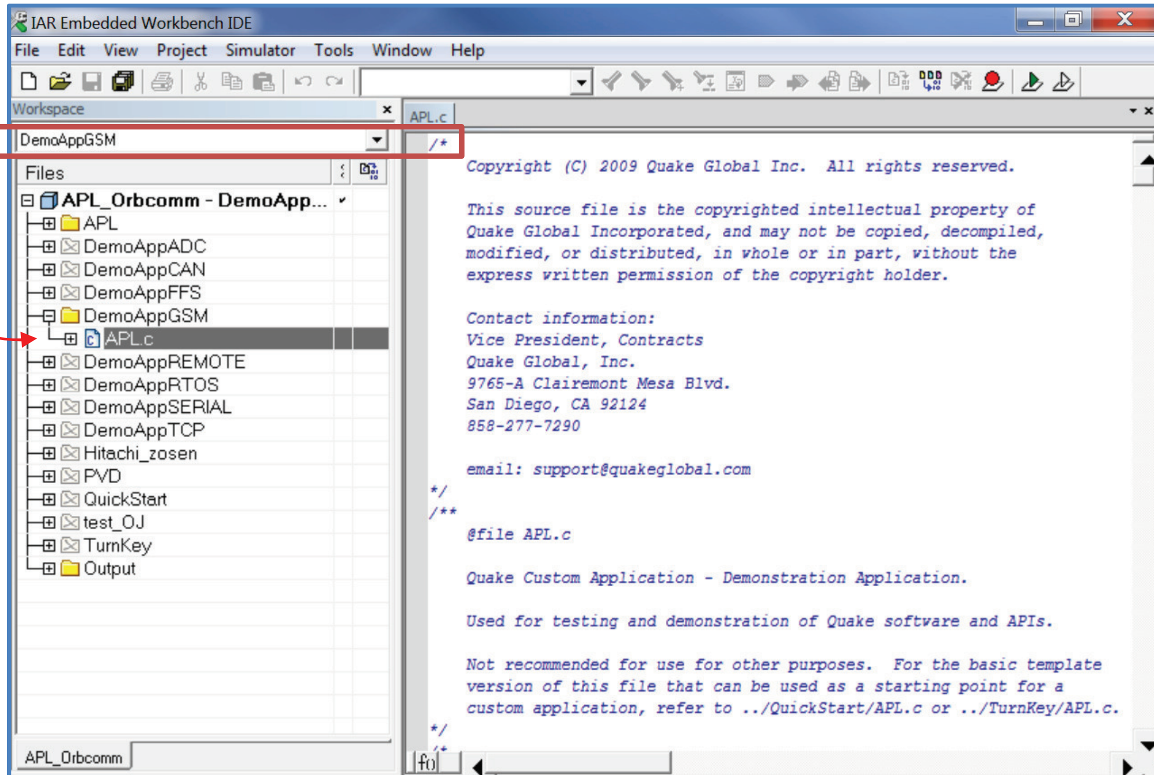

Figure 12-23: DemoAppGSM - Selecting the Workspace

2. Now build, load and execute DemoAppGSM. The instructions for building, loading and executing the code are the same as in Section 12, except that after building the application, the executable bin file is: …`/DemoAppGSM/exe/xxx-DemoAppGSM.bin`.

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3. After startup, check the Logger output for the line **`APL DEMO: GSM then Orbcomm.`** This indicates that the correct DemoApp is running.

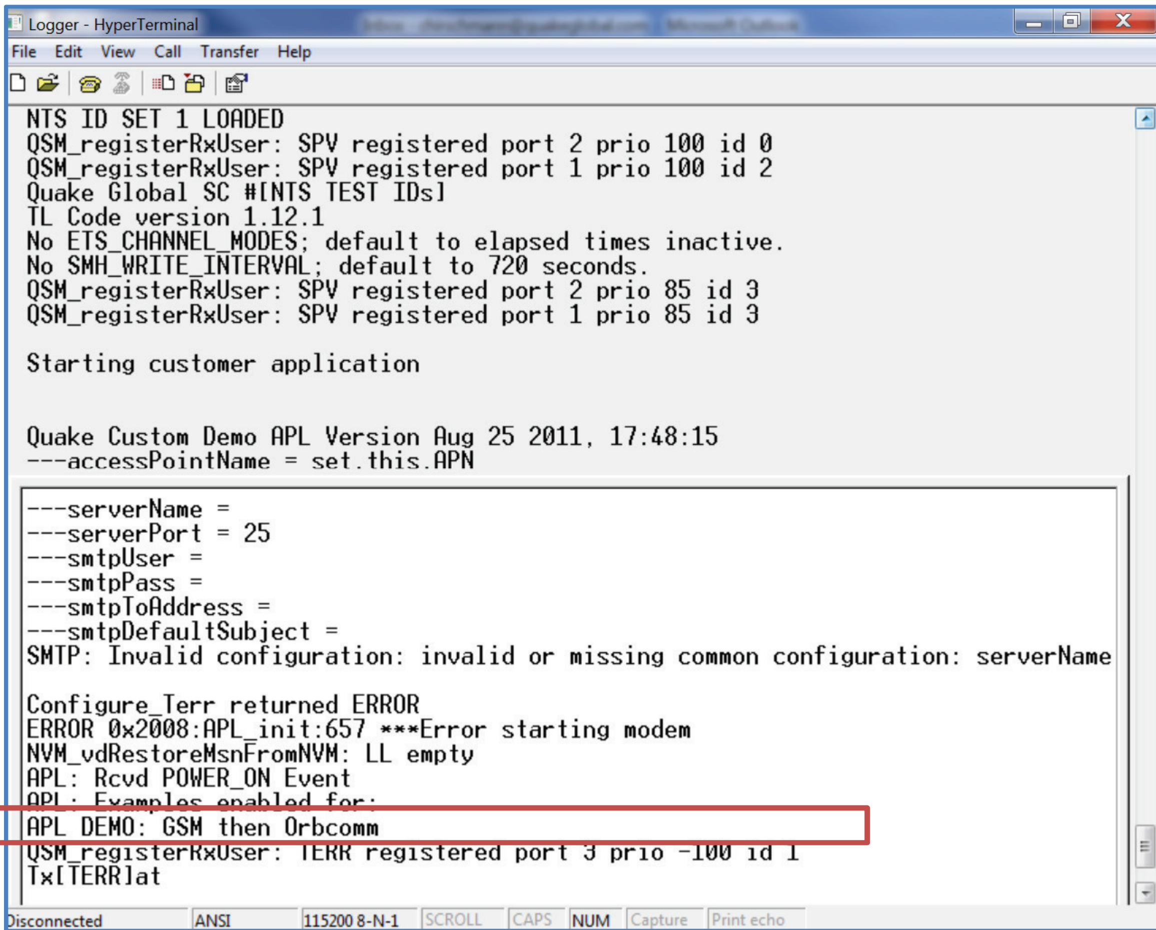

Figure 12-24: DemoAppGSM - Logger output that DemoAppGSM is running

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In the `POWER_ON`, case statement, the application calls `TIMER_setDuration()` and sets it to expire after `GSM_DEMO_GSM_TIMEOUT_SECS`. This causes a `TIMER` event to occur when the timer expires.

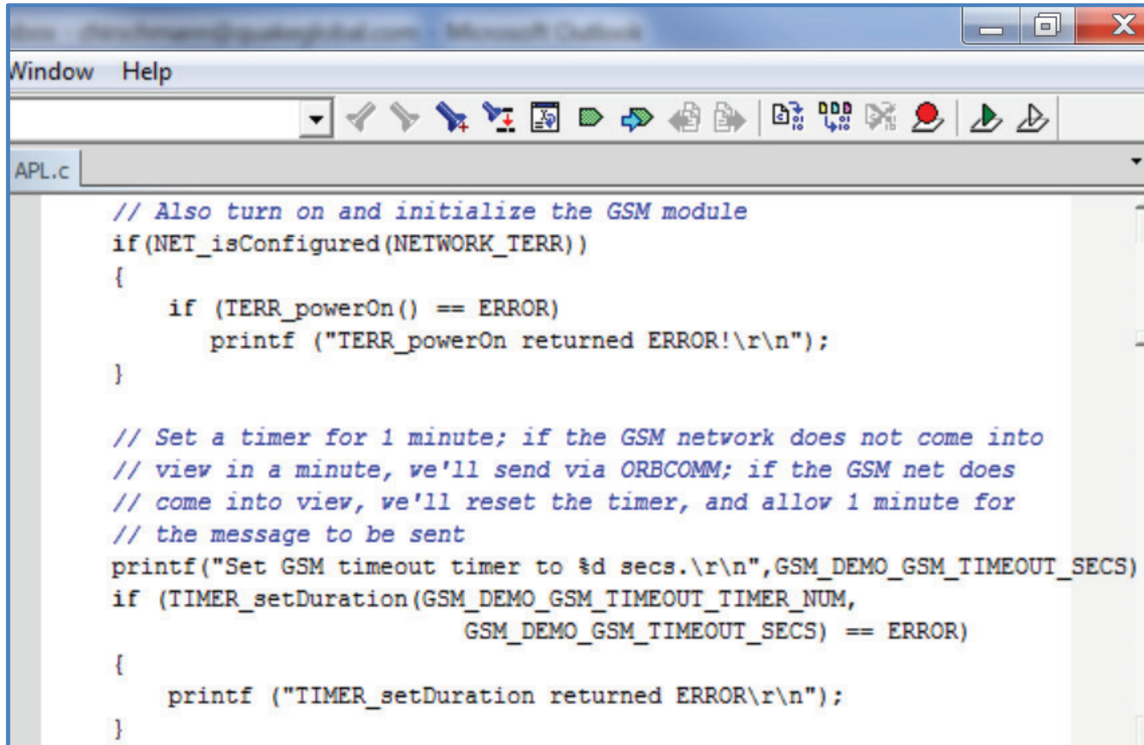

Figure 12-25: DemoAppGSM - Setting the timer

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When the timer expires, the foundation code generates a `TIMER` event which triggers the application's `processEvent()` function. APL.c then executes the case `TIMER` in the `EVENT` switch. There it checks the `msgSentViaGSM` flag to see if a message has been sent via the terrestrial network (GPRS). If not, it reads the DIO's and sends a message via the GSM/GPRS network. It then resets the timer to expire after `GSM_DEMO_GSM_TIMEOUT_SECS`. After the timer expires, if a message has been sent via GSM/GPRS, the application attempts to send the DIO message via the satellite network.

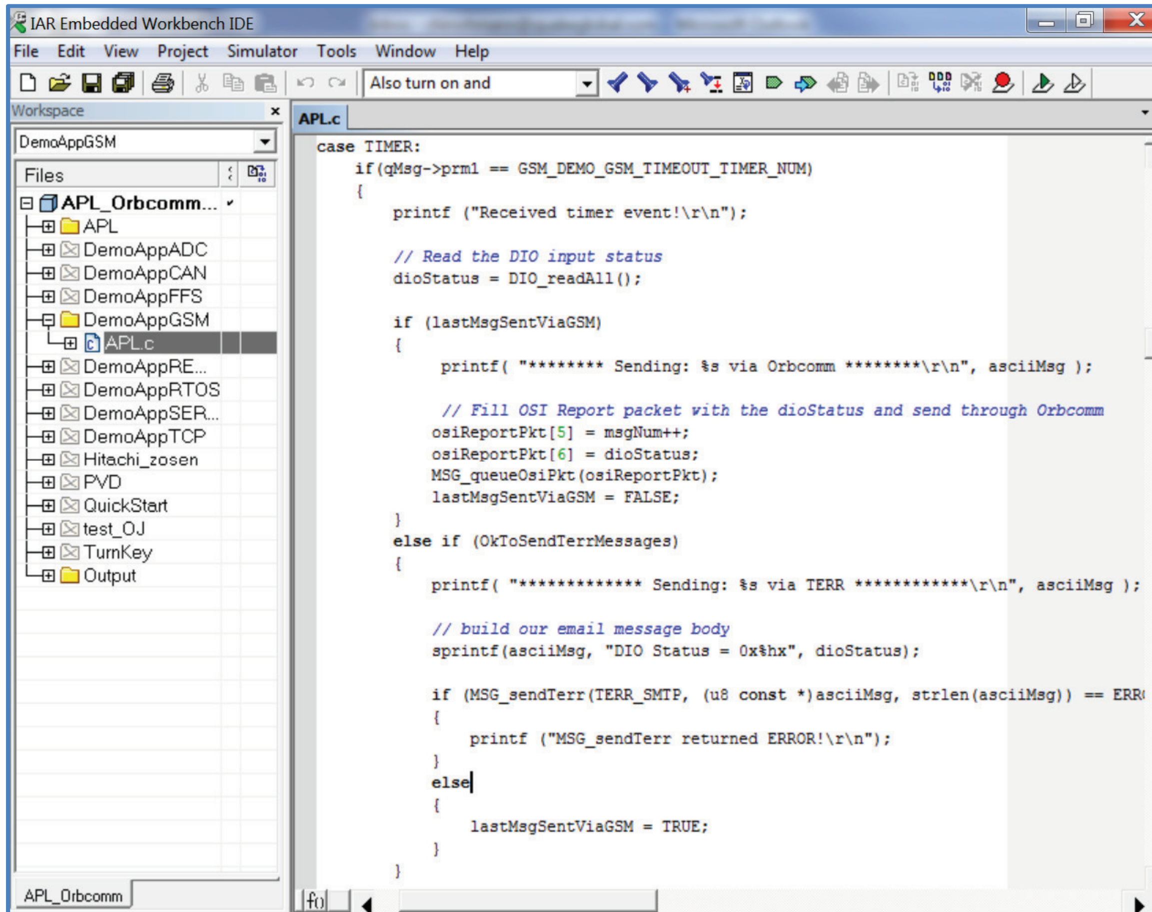

Figure 12-26: DemoAppGSM - Processing a timeout

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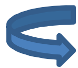
12.4.2 DemoAppSERIAL

This sample application demonstrates some of the Q4000/QPRO's serial port and multitasking functionality. DemoAppSerial may be used with either the AUX port, or the MTS or Logger port. It is necessary to use a different method with the AUX port than with the MTS or Logger port. DemoAppSerial first shows the use of the AUX port to send data. Note that this sample application uses network-specific calls.



Note:

> The AUX port
> - maximum speed is 57600 bps.
> - may **not** be available on certain configurations of the Q4000/QPRO. The Q4000/QPRO with Iridium or Inmarsat, for example, does not have the AUX port available.

1. Select the DemoAppSERIAL Workspace from the drop-down list at the top, left-hand corner of the IAR IDE screen. Open the APL.c file, as shown below:

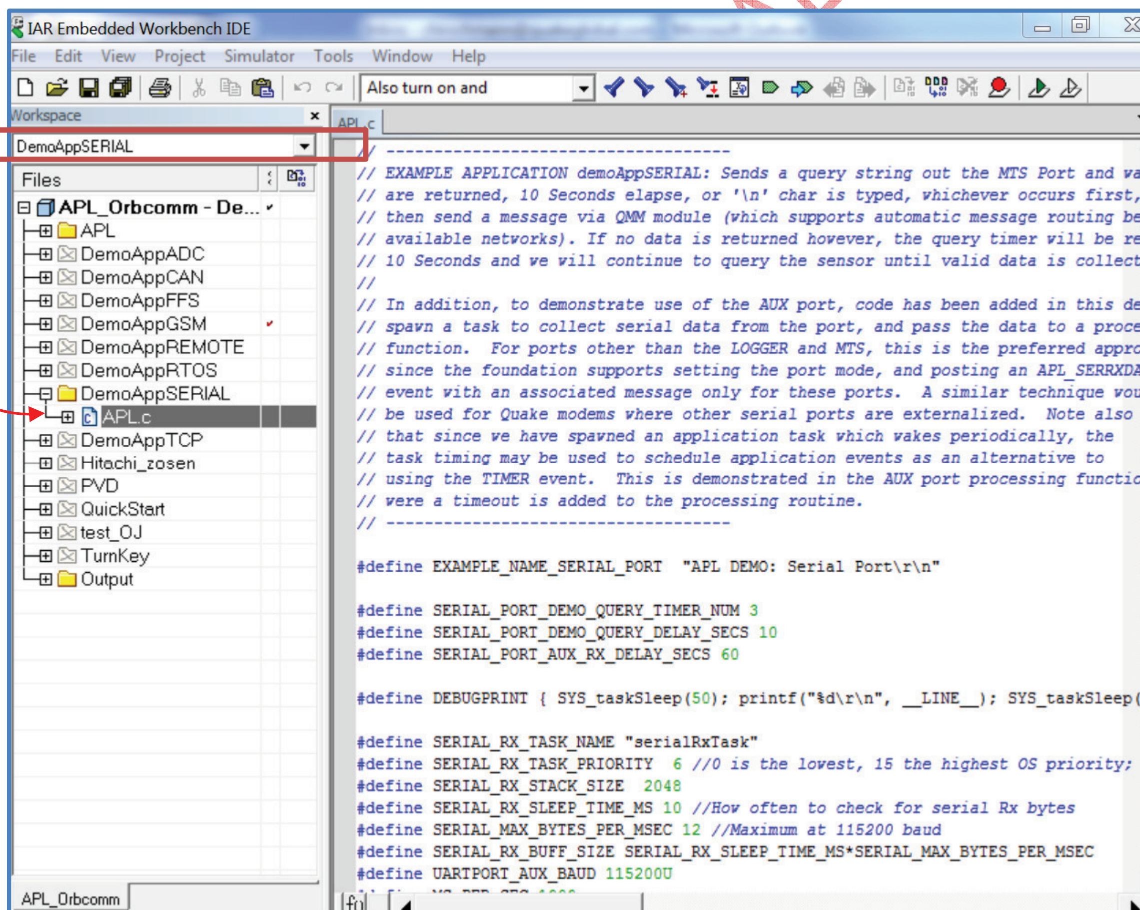


Figure 12-27: DemoAppSERIAL - Selecting the Workspace

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2. Now build, load and execute DemoAppSERIAL. The instructions for building, loading and executing the code are the same as in Section 12, except that after building the application, the executable bin file is: …/DemoAppSERIAL/exe/xxx-DemoAppSERIAL.bin.

3. After startup, check the Logger output for the line **APL DEMO: Serial Port.** This indicates that the correct DemoApp is running.

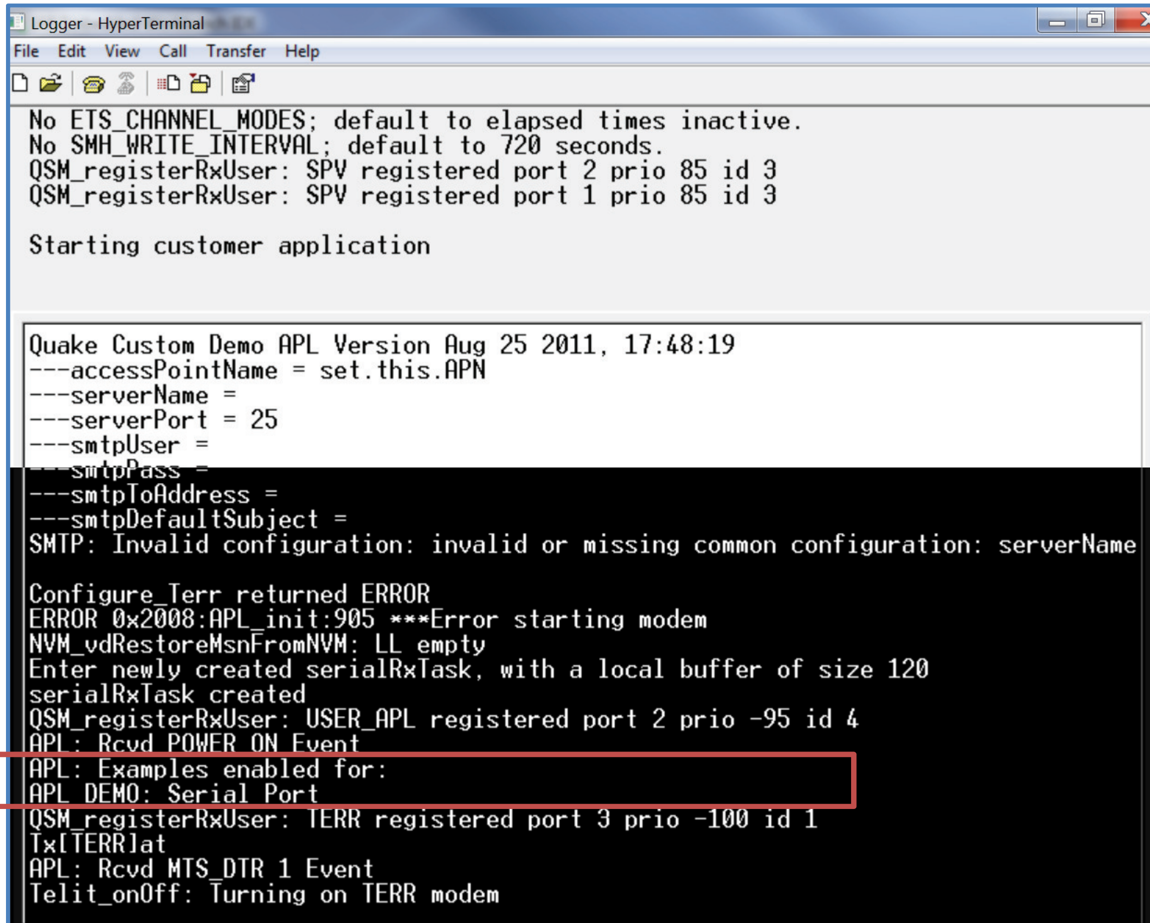

Figure 12-28: DemoAppSERIAL - Logger output that DemoAppSERIAL is running

4. It is necessary to open a Terminal Emulation program window to access the AUX port for this example. Ensure that the port is set to:

Baud rate:	115200 bps
Data bits:	8
Parity:	None
Stop bits:	1
Flow control:	None

12.4.2.1 Receiving data from the AUX port

DemoAppSERIAL spawns a task to check for data on the AUX port and echoes the data back to the AUX port as it is printed. As soon as ten characters or a carriage return have been received,

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the data are ready to be processed. When the Serial Port example begins, APL.c waits for data to be input to the AUX port. As it is typed in, it is echoed back to the port. The application waits for ten seconds, ten characters to be input, or a carriage return to be entered. Once any of those conditions occur, the modem sends the string via either satellite or GSM/GPRS to the configured address.

The string "**`Testing the AUX port`**" was entered below.

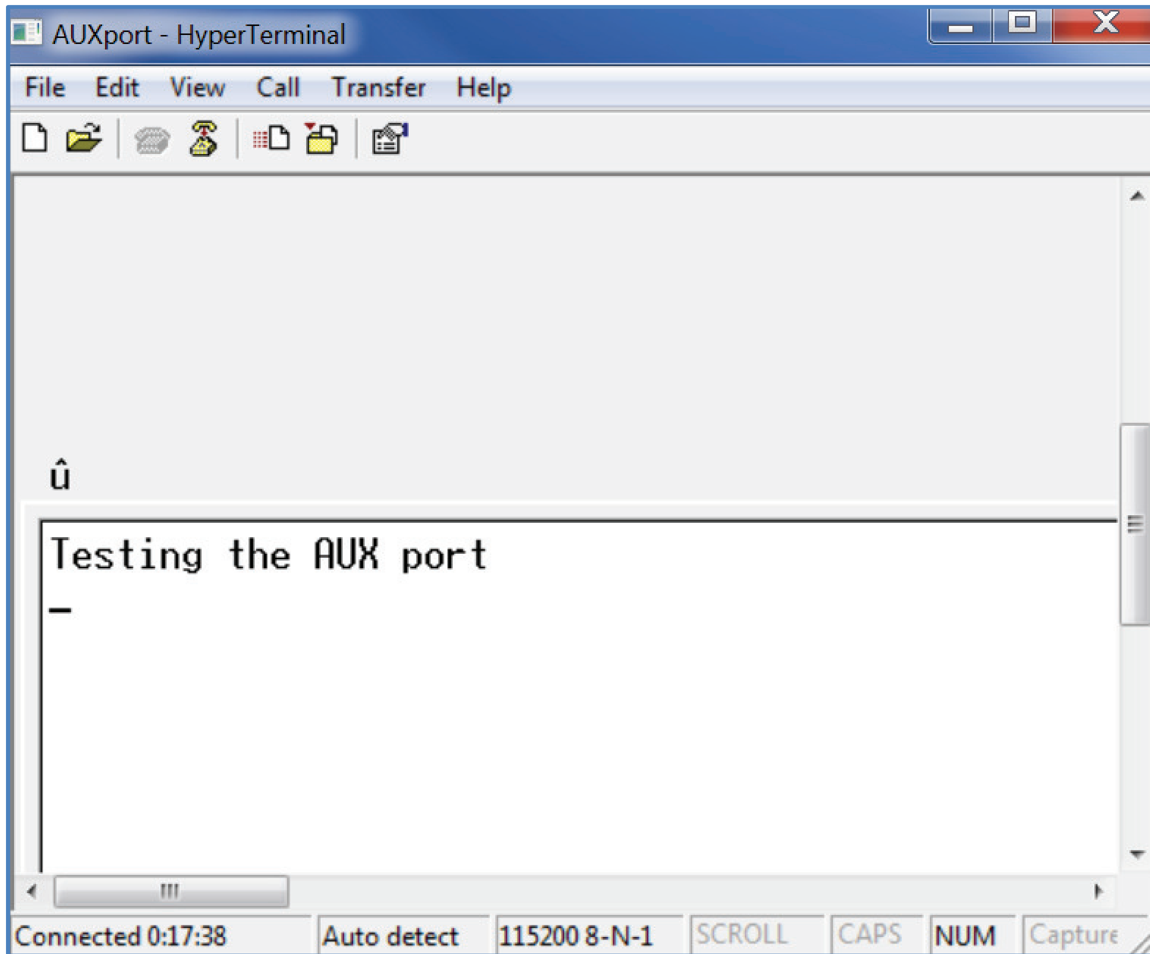

Figure 12-29: DemoAppSERIAL - AUX output of user message

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12.4.2.2 Receiving data from the MTS or Logger port

DemoAppSERIAL demonstrates how to receive data from the AUX port. In order to also receive data from either the Logger or MTS port, it is necessary to set the serial port mode in the application. There are two options for port mode: PORT_MODE_PROTOCOL and PORT_MODE_APL.

- PORT_MODE_APL passes all serial port data to the application.
- PORT_MODE_PROTOCOL gathers bytes together in packets, passes them to all foundation tasks and then to the application. This mode is preferred to allow OSI packet processing and special character trapping.

The following describes how the application is set up to receive data from the MTS port:

1. In Figure 12-30, the MTS port mode is set to `PORT_MODE_PROTOCOL` on line 916.

```
APL.c
899         return;
900     }
901
902     //Initialize modem for SMTP
903     if (initSMTPModem() == ERROR)
904     {
905        LOG_logErrorMsg(__FUNCTION__, __LINE__, FAULT_QCP_MODEM_START_ERROR);
906     }
907
908     //Initialize some serial facilites
909     initSer();
910
911     // Generate POWER_ON Event
912     QEV_sendEvent(POWER_ON, 0, OK);
913
914     // Enable the checkSerRxData() function in this file to be called back when serial port
915     // data is received on the MTS Port
916     SERIAL_setPortMode(UARTPORT_MTS, PORT_MODE_PROTOCOL, 0, 0, 0);
917
918     // Enable the checkSerRxData() function in this file to be called back when serial port
919     // data is received on the Logger Port
920     //APL_setSerPortMode(UARTPORT_LOGGER, PORT_MODE_PROTOCOL, 0, 0, 0);
921
922     // Enter the main task loop
923     while(1)
924     {
925         if(SYS_msgQReceive(aplFromQosMsgQId, (u8*)&qMsg, sizeof(qMsg), TICKS_PER_SEC) == OK)
926         {
927             if(qMsg.type != APL_EVENT_MSG && QLM_getLogDownlink())
928             {
929                 //printf("%s: Msg %d rcvd\r\n", __FUNCTION__, qMsg.type);
930             }
931             switch (qMsg.type)
```

Figure 12-30: DemoAppSERIAL - Setting serial port mode

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2. Figure 12-31 shows that in the main processing loop, a callback function, `checkSerRxData()`, is called when serial port data are received (case APL_SERRXDATA_MSG).

APL.c

```
936                 // Release the memory if it has been allocated
937                 if (qMsg.eventOption.msg != NULL)
938                 {
939                     free(qMsg.eventOption.msg);
940                 }
941
942                 break;
943
944             case APL_MENU_MSG:
945                 displayUtilityMenuOptions(&qMsg.menuOption);
946                 break;
947
948             case APL_UTIL_MSG:
949                 processUtilModeCmd(&qMsg.utilOption);
950                 break;
951
952             case APL_SERRXDATA_MSG:
953                 checkSerRxData(&qMsg.serRxDataOption);
954                 break;
955
956             case APL_FILE_MSG:
957                 verifyAndSaveFile(&qMsg.fileOption);
958                 break;
```

Figure 12-31: DemoAppSERIAL - Setting serial data callback function

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