

FOTA (Firmware Over The Air)

Introduction

This document describes the FTP FOTA procedures that can be used on Janus modems which incorporate a Telit cellular module. FOTA (Firmware Over the Air) is a method that allows for updating device firmware via the cellular radio data connection.

Verizon now requires that all LTE cellular modems used on its network demonstrate the ability to support FOTA for the cellular radio module firmware. Options for FOTA implementation include using the Verizon Mobile Device Management (MDM) FOTA service, a third party service, or a user implemented FTP FOTA system.

In a typical implementation, the user will maintain an FTP server that holds the (delta) firmware upgrade files. The FOTA application on the user's host system in the device that incorporates the Janus cellular modem must periodically check the FTP server to see if new firmware is available. If new firmware is available, it should be downloaded and installed. It is recommended that a method of updating the host application software be implemented as well.

The certification of the following devices for use on the Verizon Wireless network **REQUIRES** that the end user implement an automated FOTA procedure on their devices that would allow the cellular module firmware to be updated if required:

LTE910CF V3.0	LTE910XF V6.0
LTE910CF V6.0	LTE910XF V8.0
LTE910CF V11.0	LTE910XF V11.0

Failure to implement an automated FOTA procedure violates the certification requirements of the cellular modem and may result in units becoming unusable on the cellular network in the future. Your end device must support the firmware over the air update for the cellular modem

You may use your own FOTA system to update the cellular modem firmware over the air. You may also be able to use the Verizon Wireless FOTA system, and FOTA services may be available from other 3rd party vendors.

To inquire about Verizon Wireless FOTA system information and technical specifications, contact VZW.FOTA-Services@VerizonWireless.com

The frequency of future required updates is unknown, but expect upgrades to be available every year or so. Notification of a required update should be available several months before any new any changes are made to the network. Janus will make every effort to provide customers with notification of required firmware upgrades as they are provided by Verizon and/or Telit.

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References

- [1] IP Easy User Guide, Telit Document 80000ST10028A
- [2] Telit FOTA AT Script, Telit Document 80000NT11347A
- [3] Telit LE910-V2 Modules AT Commands, Telit Document 80446ST10707A
- [4] Verizon Wireless LTE OTA DM Requirement Plan
- [5] Verizon Application, Device and Network Usage Guidelines for IoT

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Overview

The FOTA process uses the TCP/IP stack on the module and the FTP download is conducted using AT commands. Firmware files on the FTP server can be checked using the standard Telit FTP operations commands. See the Telit IP Easy User Guide [1]. The firmware transfer is initiated using an FTP FOTA download command so that the firmware update is stored on the module. Following the download, a FOTA check and update command is issued. See the Telit FOTA AT Script document [2]. This command causes the module to validate and install the update firmware and reboot the module.

Following the firmware update procedure the application running on the host system should verify that the firmware has been upgraded to the new version.

Delta firmware files are available from Telit technical support: TS-AMERICAS@telit.com

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FOTA Procedures

There are different procedures for performing a FOTA update depending on the module used. In the Telit FOTA AT Script document [2] these are divided in Groups A and B as follows:

Telit FOTA Group	Janus product	Telit module
Group A	LTE910CF V6.0	LE910-SV1
	LTE910CF V11.0	ME910C1-NV
	LTE910XF V6.0	LE910-SV1
	LTE910XF V8.0	LE910-NA V2 Single SKU
	LTE910XF V11.0	ME910C1-NV
Group B	LTE910CF V3.0	LE910-SVG

Group A FOTA

In order to use the built in FOTA commands, a module must meet some preliminary conditions:

- Check for registration on the network and adequate signal strength.
- Check for proper data context settings
- Make changes to the default packet size and FTP time-out parameters
- Perform the firmware download
- Install the firmware

Group A FOTA: Registration

Network registration can be checked with the `AT+CEREG?` command. A properly registered unit will respond with:

```
+CEREG: 0,1
```

```
OK
```

See the AT Commands Guide for other responses.

Group A FOTA: Signal strength

Check the signal strength of the received signal using the `AT+CSQ` command. The response will be in the form

```
+CSQ: 18,3
```

```
OK
```

The first number returned (18 in the above example) is the RSSI (Received Signal Strength Indication). The RSSI must be 6 or better to insure a reliable data transfer can take place, and preferably it should be 10 or better. Note that a value of 99 indicates an undetectable signal.

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Group A FOTA: Context

The AT+CGDCONT? command will display the default context settings for the module. Default settings are similar to the following:

```
+CGDCONT: 1,"IPV4V6","vzwims","",0,0
+CGDCONT: 2,"IPV4V6","vzwadmin","",0,0
+CGDCONT: 3,"IPV4V6","vzwinternet","",0,0
```

OK

The first two contexts are for network use, while the third is available for data connections. The default "vzwinternet" context may need to be different if you are using a specialized data plan with Verizon (e.g. a static IP address) or have a data plan managed by a different vendor.

The context can be activated with the AT#SGACT=3,1 command. After a successful context activation, the IP address is returned followed by the OK response. Context activation can be checked with the AT#SGACT? command. The following response would indicate the third context is activated:

```
#SGACT: 1,0
#SGACT: 2,0
#SGACT: 3,1
```

OK

Group A FOTA: Socket Settings

The Telit FOTA process also requires changes to the default socket packet size. The socket configurations can be read with the AT#SCFG? command. The default settings will appear as follows:

```
#SCFG: 1,3,300,90,600,50
#SCFG: 2,3,300,90,600,50
#SCFG: 3,3,300,90,600,50
#SCFG: 4,2,300,90,600,50
#SCFG: 5,2,300,90,600,50
#SCFG: 6,2,300,90,600,50
```

OK

The Telit FOTA AT Script document specifies a packet size of 1460 bytes, and this can be set by issuing the socket configuration command AT#SCFG=1,3,1460,90,600,50 to change the settings on the first socket. The response to the AT#SCFG? command now becomes:

```
#SCFG: 1,3,1460,90,600,50
#SCFG: 2,3,300,90,600,50
#SCFG: 3,3,300,90,600,50
#SCFG: 4,2,300,90,600,50
#SCFG: 5,2,300,90,600,50
#SCFG: 6,2,300,90,600,50
```

OK

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Group A FOTA: Delta Firmware Download

The standard FTP commands found in the Telit IP Easy Guide [1] are used to establish the data connection with a FOTA FTP server.

The Telit FOTA AT Script document specifies an FTP time out setting of 2400ms; this can be accomplished by issuing the command `AT#FTPTO=2400`. Expect the OK response.

Open a connection to the FTP server using the command `AT#FTPOPEN=<server:port>,"anonymous","",1` where `<server:port>` identifies the FTP server. The port is optional; it will be 21 by default. An OK response indicates the FTP connection is open and active.

If necessary, change the working directory using the `AT#FTPCWD=<dirname>` command. (By using the `AT#FTPLIST` command an automated FOTA implementation can examine the available filenames to determine if a new delta firmware file is available.)

A delta firmware file should be transferred using an ASCII transfer. Specify this by issuing the `AT#FTPTYPE=1` command. Expect the OK response. This must be issued after the FTP connection is open.

The Telit FOTA FTP delta download command takes the form `AT#FTPGETOTA=<filename>, <verbose_lev>`. Here `<filename>` specifies the filename to be transferred and `<verbose_lev>` can be used to enable hash mark responses for every 4096 bytes transferred. Refer to the Telit FOTA AT Script document for more information. A successful transfer will result in an OK response.

Following a successful transfer, use `AT#FTPCLOSE` to close the FTP connection and `AT#SGACT=3,0` to close the data context. Each should return the OK response.

Group A FOTA: Delta Firmware Install

Following a successful delta firmware file download, firmware on the module can be updated using the `AT#OTAUP=0,0` command. A successful update will result in the following response:

```
OK
```

```
#OTAUV: Module Upgraded To New Fw
```

Group A FOTA: Other Considerations

The installed firmware can be checked using the `AT+GMR` command. A typical response will look as follows:

```
20.00.002
```

```
OK
```

It may be desirable for the automated procedure used to implement the FOTA process to retry certain commands if they result in an error. When implementing retry attempts the user should be aware of the requirements found in the Verizon Application, Device and Network Usage Guidelines for IoT [5]. These guidelines include limiting the frequency of connection attempts, limiting concurrent updates at a single cell site, and other measures that help the network operate efficiently.

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Group A FOTA: Sample Log

The following is a hypothetical sample log from updating a Janus LTE910XF V6.0 modem that incorporates a Telit LE910-SV1 module. It shows the interaction between a host and the cellular modem when upgrading the firmware from the 20.00.012 version to the 20.00.014 version.

- Commands issued to the module are shown in **bold**.
- // Comments are preceded with two slash marks and have been added for clarity.
- The remaining text is module responses.

```
// Check firmware version
AT+GMR
20.00.012

OK

// Check signal strength
AT+CSQ
+CSQ: 17,3

OK

// Check that the modem is registered on the network
AT+CEREG?
+CEREG: 0,1

OK

//Configure the context; use context ID #3
AT+CGDCONT=3,"IP","VZWINTERNET"

OK

// Activate the context
AT#SGACT=3,1
#SGACT: 100.81.17.36

OK

//Configure a socket
AT#SCFG=1,3,1460,90,600,50

OK
```

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Group A FOTA: Sample Log continued

```
// Set FTP timeout
AT#FTPTO=2400

OK

// Use ascii transfer
AT#FTPTYPE=0

OK

// Open FTP connection
AT#FTPOPEN="fota.example.com","anonymous","",1

OK

// Start FTP transfer transfer
AT#FTPGETOTA="delta_20.00.012_20.00.014_UpdPkg.bin",1

#####
OK

// Close FTP connection
AT#FTPCLOSE

OK

// Close context
AT#SGACT=3,0

OK

// Upgrade firmware
AT#OTAUP=0,0

OK

#OTAEV: Module Upgraded To New Fw

// Check new firmware version after reboot
AT+GMR

20.00.014
```

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Group B FOTA

In order to use the built in FOTA commands, a module must meet some preliminary conditions:

- Check for registration on the network and adequate signal strength.
- Check for proper data context settings
- Perform the firmware download
- Install the firmware

Group B FOTA: Registration

Network registration can be checked with the `AT+CEREG?` command. A properly registered unit will respond with:

```
+CEREG: 0,1
```

```
OK
```

See the AT Commands Guide for other responses.

Group B FOTA: Signal strength

Check the signal strength of the received signal using the `AT+CSQ` command. The response will be in the form

```
+CSQ: 18,3
```

```
OK
```

The first number returned (18 in the above example) is the RSSI (Received Signal Strength Indication). The RSSI must be 6 or better to insure a reliable data transfer can take place, and preferably it should be 10 or better. Note that a value of 99 indicates an undetectable signal.

Group B FOTA: Context

The `AT+CGDCONT?` command will display the default context settings for the module. Default settings are similar to the following:

```
+CGDCONT: 1,"IPV4V6","vzwims","",",0,0  
+CGDCONT: 2,"IPV4V6","vzwadmin","",",0,0  
+CGDCONT: 3,"IPV4V6","VZWINTERNET","",",0,0  
+CGDCONT: 4,"IPV4V6","vzwapp","",",0,0  
+CGDCONT: 5,"IPV4V6","",""," ,0,  
+CGDCONT: 6,"IPV4V6","VZWCLASS6","",",0,0
```

```
OK
```

The third context is available for data connections. The default "vzwinternet" context may need to be different if you are using a specialized data plan with Verizon (e.g. a static IP address) or have a data plan managed by a different vendor.

Note that the Group B products require the internet data context to be initially closed for the FTP download command to work properly. This is different from the Group A devices that require opening a data context before the FTP download can take place. Make sure that the data context is not active by issuing the `AT#SGACT=3,0` command.

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Group B FOTA: Context continued

Context activation can be checked with the `AT#SGACT?` command. The following response would indicate that all contexts are inactive:

```
#SGACT: 1,0
#SGACT: 2,0
#SGACT: 3,0
#SGACT: 4,0
#SGACT: 5,0
#SGACT: 6,0
```

OK

Group B FOTA: Delta Firmware Download

The `AT#FTPGETOTAENH` command is used to retrieve the Delta Firmware file.

The standard FTP commands found in the Telit IP Easy Guide [1] are used to establish the data connection with a FOTA FTP server.

Group B FOTA: Delta Firmware Install

Following a successful delta firmware file download, firmware on the module can be updated using the `AT#OTAUP=0,0` command. A successful update will result in the following response:

OK

```
#OTAEV: Module Upgraded To New Fw
```

Group B FOTA: Other Considerations

The installed firmware can be checked using the `AT+GMR` command. A typical response will look as follows:

```
20.00.002
```

OK

It may be desirable for the automated procedure used to implement the FOTA process to retry certain commands if they result in an error. When implementing retry attempts the user should be aware of the requirements found in the Verizon Application, Device and Network Usage Guidelines for IoT [5]. These guidelines include limiting the frequency of connection attempts, limiting concurrent updates at a single cell site, and other measures that help the network operate efficiently.

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Group B FOTA: Sample Log

The following is a hypothetical sample log from updating a Janus LTE910CF V3.0 modem that incorporates a Telit LE910-SVG module. It shows the interaction between a host and the cellular modem when upgrading the firmware from the 17.01.572 version to a 17.01.579 version.

- Commands issued to the module are shown in bold.
- // Comments are preceded with two slash marks and have been added for clarity.
- The remaining text is module responses.

```
// Check firmware version
AT+GMR
17.01.572

OK

// Check signal strength
AT+CSQ
+CSQ: 26,4

OK

// Check that the modem is registered on the network
AT+CEREG?
+CEREG: 0,1

OK

//Check the context
AT+CGDCONT?
+CGDCONT: 1,"IPV4V6","vzwims","","0,0
+CGDCONT: 2,"IPV4V6","vzwadmin","","0,0
+CGDCONT: 3,"IP","VZWINTERNET","","0,0
+CGDCONT: 4,"IPV4V6","vzwapp","","0,0
+CGDCONT: 5,"IPV4V6","","",0,0
+CGDCONT: 6,"IPV4V6","VZWCLASS6","","0,0

OK

// Start FTP transfer transfer
at#ftpgetotaenh="black.conwin.com",,"/deltafota_LE910VZN_V_17.01.572_
to_V_17.01.579.upd","anonymous",,""
OK
```

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Group B FOTA: Sample Log continued

```
#OTAEV: #907
```

```
#OTAEV: #919
```

```
#OTAEV: #DREL
```

```
// Upgrade firmware
```

```
AT#OTAUP=2
```

```
OK
```

```
#OTAEV: #000
```

```
#OTAEV: Module Upgraded To New Fw
```

```
// Check new firmware version after reboot
```

```
AT+GMR
```

```
17.01.579
```

```
OK
```