

FW2770p & FW2763p

CDMA Data Modules

Data Sheet

Abstract

Technical data sheet describing FW2770p & FW2763p Wireless CDMA Data Modules.

The FW2770p provides a full-featured EV-DO Rev A dual band CDMA solution, and the FW2763p provides a full-featured CDMA 2000 1xRTT solution. Both modules come in an easy to integrate PCI Express Mini Card form factor.



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Document status information	
Objective Specification	This document contains target values. Revised and supplementary data will be published later.
Advance Information	This document contains data based on early testing. Revised and supplementary data will be published later.
Preliminary	This document contains data from product verification. Revised and supplementary data may be published later.
Released	This document contains the final product specification.

This document applies to the following products:

Name	Type number	Firmware version	PCN / IN
FW2763p	PCI-C100-00S-00	D1.01S106	UBX-TN-11067
	PCI-C101-00S-00	D1.01S106	UBX-TN-11067
	PCI-C100-20S-00	D1.01V100	UBX-TN-11067
	PCI-C101-20S-00	D1.01V100	UBX-TN-11067
FW2770p	PCI-D100-00S-01	C1.02S103	UBX-TN-12024
	PCI-D101-00S-01	C1.02S103	UBX-TN-12024
	PCI-D100-20S-00	C1.02V100	UBX-TN-11067
	PCI-D101-20S-00	C1.02V100	UBX-TN-11067

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1 Functional description

1.1 Overview

The FW2770p module is designed to support CDMA2000 HRPD with data rate of 3.1Mb/s downlink / 1.8Mb/s uplink and 1xRTT with data rate of 153.6 kb/s. The Module operates in 800 MHz (Cell Band) and 1900 MHz (PCS Band). Position location information is captured through a secondary and optional hardware processor for GPS operation.

RF antenna connectivity is provided by dual antenna ports; primary and diversity (FW2770p only) for cellular operation along with a separate (optional) GPS port.

FW2770p highlighted features:

- Bands: 800 MHz/1900 MHz CDMA2000 1xRTT / HRPD Module
- Optional Stand alone GPS receiver
- 153.6 kb/s Circuit Switch Data
- CDMA200 EV-DO support: 3.1 Mb/s Downlink / 1.8 Mb/s Uplink Packet Data (FW2770p only)
- CDMA200 1xRTT support:
- Small footprint 51 x 30 x 4.5 mm (PCI express mini card form factor)
- Comprehensive AT Command Support
- Mini PCI-E compliant

1.2 Product features

Module	Technology	Bands	Interface	Audio	Functions
	CDMA EV-DO [Mb/s] (forward) CDMA EV-DO [Mb/s] (reverse) CDMA 1xRTT [kb/s] (forward/reverse)	CDMA	UART SPI USB I ² C GPIO	Analog Audio Digital Audio	Network indication Antenna Supervisor Jamming detection Embedded TCP/UDP FTP, HTTP, SSL GPS AssistNow Software FW update via serial FOTA Rx diversity
PCI-C100	153	800/1900	1		• • • • •
PCI-C101	153	800/1900	1		• • • • •
PCI-D100	3.1 1.8 153	800/1900	1		• • • • •
PCI-D101	3.1 1.8 153	800/1900	1		• • • • •

1.3 Block diagram

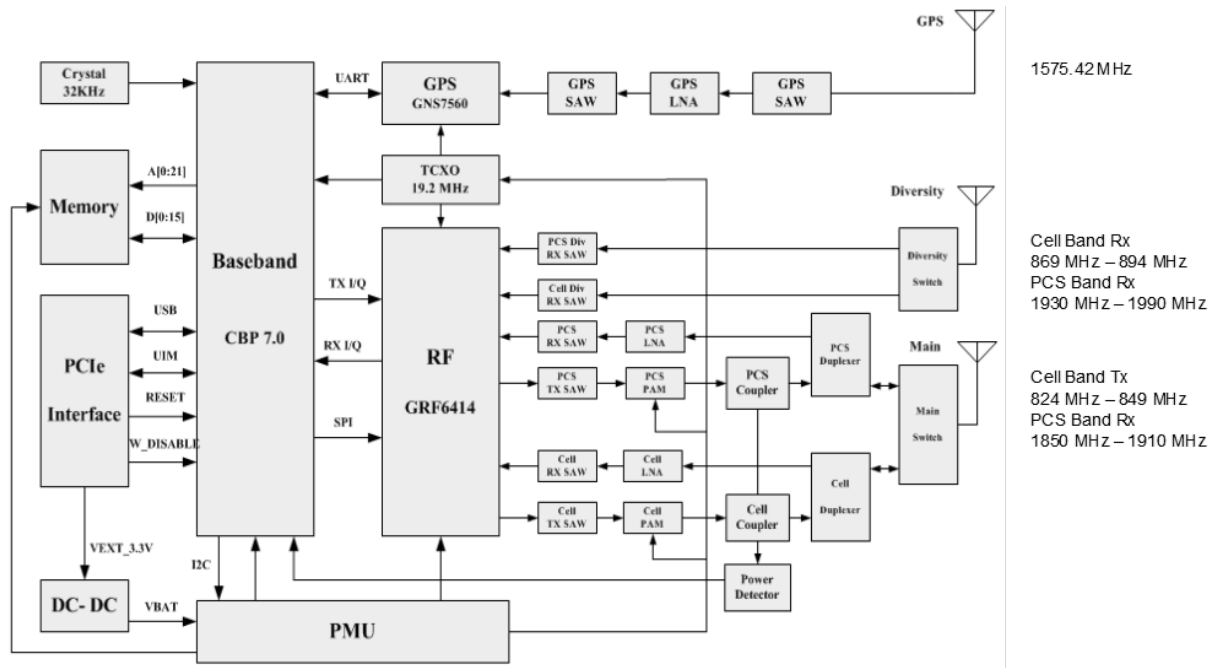


Figure 1: FW2770p/FW2763p block diagram

1.4 Product description

u-blox FW2770p and FW2763P modules are compact, wireless OEM modules that utilize the CDMA2000 standard (Code Division Multiple Access) incorporating CDMA2000 1x, CDMA2000 EV-DO rev 0 (FW2770p only) and CDMA2000 EV-DO rev A (FW2770p only) international communications standard to provide two-way wireless capabilities. The u-blox FW2770p/FW2763p modules are carrier approved devices, enabling application-specific, two-way communication and control.

The small size of the u-blox FW2770p/FW2763p modules allows them to be integrated easily into various electronic products and systems. Table 1 summarizes the main features of the u-blox FW2770p and FW2763p Modules.

Category	Feature	Description
Interface	Data input/output interface	52 position 0.8mm pitch connector
	USB port	USB 2.0 Interface
	Antenna Interface	Hirose U.FL (50 ohm)Antenna Connectors
Power	Command protocol	u-blox AT command set
	Electrical power	3.3+/-0.1 Vdc (Vaux for miniPCle)
	Peak currents and average power dissipation	Refer to the Operating Power table in the Technical Specifications for peak currents and average power dissipation for various modes of operation.
Radio Features	Frequency bands	Band Class 0 & 1. CDMA 800 and PCS 1900
	Features supported	<ul style="list-style-type: none"> Enhanced AT command set: IS-707.3, GSM 07.05, GSM 07.07, ITU-T V.25 Over-the-air (OTA) provisioning, software maintenance & device management (OTASP, OTAPA)

Category	Feature	Description
		<ul style="list-style-type: none"> • SMS Client with inbox functionality
Certifications	Agency approvals	<ul style="list-style-type: none"> • CDG • FCC • IC (Industry Canada) *¹ • Sprint carrier certification • Verizon carrier certification ¹ FW2770p only b/s

Table 1: u-blox FW2770/2763 main features

1.5 CDMA characteristics

- IS-2000 (CDMA2000 Release 0) MOB_P_REV 6
- IS-95A/IS-95B (JSTD-008) backward compatibility (MOB_P_REV1,3,4,5)
- TIA/EIA-98F minimum RF performance
- TIA/EIA-637A; two-way SMS
- TIA/EIA-683A; OTASP and OTAPA
- TIA/EIA-707A; data service options, CSD
- TIA/EIA-683-C
- TIA-856-A: EVDO Support
- TIA-856-0: EVDO Support
- TIA-925; airlink encryption
- TIA-866; Minimum Perf Standards for CDMA2000 High Rate Packet Data
- TIA-835-C; CDMA2000 Wireless IP network standard
- TIA-919-A; Signalling performance specification for High rate packet data air interface

1.6 CDMA modes of operation

The u-blox FW2770p and FW2763p modules support the following CDMA services:

- IS-95 Circuit-switched data
- Short-Message Services (SMS)
- CDMA2000 1xRTT
- CDMA2000 EVDO rev 0 (FW2770p only)
- CDMA2000 EVDO rev A (FW2770p only)

1.6.1 Circuit-Switched Data

In this mode, the u-blox FW2770p and FW2763p modules provide a performance that is closest to using a modem over a fixed Public Switched Telephone Network (PSTN) line.

1.6.2 SMS Short Message Services

Short Message Services (SMS) is a feature-rich service. The u-blox FW2770P and FW2763p modules can perform the following tasks:

- Sending and receiving binary messages of up to 160 characters (7-bit characters)
- Sending and receiving text messages of up to 140 bytes (8-bit data)
- Submitting an SMS Protocol Data Unit (PDU) to a SMSC (Short Message Service Center) and storing a copy of the PDU until either a report arrives from the network or a timer expires
- Receiving a SMS PDU from a SMSC
- Returning a delivery report to the network for a previously received message
- Receiving a report from the network
- Notifying the network when the module has sufficient memory capacity available to receive one or more SMS messages (after the module had previously rejected a message because its memory capacity was exceeded)

1.7 AT Command support

Comprehensive set of AT Commands:

- Can be accessed using the USB serial communication interface with any terminal emulation program from a personal computer
- Text messaging capability
- Optional GPS capability
- OMA-DM capability



For the proprietary AT commands and their syntax refer to the *FW2770p & FW2763p AT Commands Manual* [1].

1.8 Multi-band operation

The u-blox FW2770p/FW2763p modules are dual-band device operating on the 800 and 1900 MHz band. These bands are primarily used in North and South America.

1.9 Wireless data application possibilities

A variety of applications can use the u-blox FW2770p/FW2763p modules for transmitting/receiving data, such as:

- Laptop connectivity
- Tablet connectivity
- Automated Meter Reading (AMR)
- Point of Sale Applications
- E-mail and Internet access
- Automated Vehicle Location (AVL)
- Telematics
- Telemetry
- Wireless Security
- Telemedicine

2 Interfaces

2.1 Application interface

Host Protocol	u-blox FW2770p/FW2763p AT Commands
Internal Protocols	UDP stack, TCP/IP stack, PPP and PAD
Physical Interface	USB

2.2 RF antenna interface

The FW2770p/FW2763p modules have three Hirose RF connectors:

- Main Transceiver input/output
- Diversity receiver input (FW2770p only)
- GPS input (Optional)

These connectors are labeled on the module and are all Hirose U.FL-R-SMT type connectors

2.3 Module physical interface

The FW2770P and FW2763p physical interface is provided by a miniPCIe edge connector and a retaining mechanism.

2.4 Wireless Disable (W_Disable PIN 20)

W-disable (active low) is used to disable the radio components only but leaving the base band active to reduce power consumption

2.5 Universal Serial Bus (USB)

High speed USB2.0 (480Mb/s)

2.6 Software interface

The modem functions are controlled using wireless industry standard AT commands. Data calls/sessions are facilitated over a PPP connection with the modem and carrier network determining either 1x or EVDO (FW2770p only) standards depending on carrier prioritization.

The modem has two functional modes ; COMMAND and ON-LINE

COMMAND mode: Used for configuring the Fusion Wireless FW2770P/FW2763p modules, for interrogating the CDMA network, and for placing and receiving calls. It uses the AT command set via the USB serial port for communication.

On-line mode: Used after a data call has been established. Data is passed between the FW2770P/FW2763p modules and the controlling application without command interpretation. The only AT command that is

interpreted in On-line mode is the +++ command. (This command places the u-blox FW2770P/FW2763p modules in Command mode but does not terminate the circuit-switched data call.)

In the Command mode, characters that are received from the host are treated as AT commands by the module.

In response to the commands received from the HOST, the u-blox module sends characters (AT commands) to the HOST.

Various events can also trigger the module to send characters (AT commands) to the HOST.

In the ON-LINE mode, this is when a data call has been established and all characters are passed through the modem to destination.

2.6.1 Format for the AT commands

The general format of the command line is: <prefix> <command> <CR>

<prefix>	AT
<command>	See AT Command Manual
<CR>	0X0D

The prefix AT obtains synchronization, identifies the character parameters, and indicates that a command may be in the following characters.

AT commands are not case sensitive: use either capital letters or lower-case letters for the AT command.



Some AT Command parameter values ARE case sensitive. These are documented in the *FW2770p & FW2763p AT Commands Manual* [1].

3 Pin definition

3.1 Pin assignment

No	FW2770p / FW2763p	PCI_Express_Mini_CEM 1.2
1	NC	WAKE#
2	3.3V	3.3V
3	NC	COEX1
4	GND	GND
5	NC	COEX2
6	NC	1.5V
7	NC	CLKREQ#
8	UIM_PWR	UIM_PWR
9	GND	GND
10	UIM_DATA	UIM_DATA
11	NC	REFCLK-
12	UIM_CLK	UIM_CLK
13	NC	REFCLK+
14	UIM_RST	UIM_RST
15	GND	GND
16	NC	UIM_VPP
17	NC	NC
18	GND	GND
19	NC	NC
20	W_DISABLE	W_DISABLE
21	GND	GND
22	PERST#	PERST#
23	NC	PERn0
24	3.3V	3.3V
25	NC	PERp0
26	GND	GND
27	GND	GND
28	NC	+1.5V
29	GND	GND
30	NC	SMB_CLK
31	NC	PETn0
32	NC	SMB_DATA
33	NC	PERp0
34	GND	GND
35	GND	GND
36	USB_D-	USB_D-
37	GND	GND
38	USB_D+	USB_D+
39	3.3V	3.3V
40	GND	GND
41	3.3V	3.3V
42	LED_WWAN	LED_WWAN
43	GND	GND
44	NC	LED_WLAN#
45	NC	NC
46	NC	LED_WPAN#

No	FW2770p / FW2763p	PCI_Express_Mini_CEM 1.2
47	NC	NC
48	NC	+1.5V
49	NC	NC
50	GND	GND
51	NC	NC
52	3.3V	3.3V

4 Modules specifications

4.1 Operating conditions



Operating conditions ranges define those limits within which the functionality of the device is guaranteed.

Where application information is given, it is advisory only and does not form part of the specification.

4.1.1 Environmental conditions

Parameter	Min.	Typ.	Max.	Unit	Remarks
Normal operating temperature	-20		+60	°C	Normal operating temperature range (fully CDMA Specification Compliant).
Extended operating temperature	-30		+85	°C	Extended operating temperature range (not fully CDMA Specification Compliant).
Relative Humidity	5		95	%	non condensing
Air pressure (altitude)	70		106	kPa	(-400 m to 3000 m)

Table 2: Environmental conditions (operational)

Parameter	Min.	Typ.	Max.	Unit	Remarks
Storage Duration			24	Months	
Storage Temperature	-40		+105	°C	
Relative Humidity (storage)	5		95	%	non condensing (at 40°C)
Thermal shock			-50 to +23 +70 to +23	°C	< 5 min
Altitude	-400		15,000	m	

Table 3: Environmental conditions (storage and transportation)

4.1.2 Mechanical conditions

Parameter	Tolerance
Operational vibration, sinusoidal	3.0 mm disp, 2 to 9 Hz; 1 m/s ² , 9 to 350 Hz
Operational vibration, random	0.1 m ² /s ³ , 2 to 200 Hz

Table 4: Mechanical conditions (operational)

Parameter	Tolerance
Transportation vibration, packaged	ASTM D999
Drop, packaged	ASTM D775 method A, 10 drops
Shock, un-packaged	150 m/s ² , 11 ms, half-sine per IEC 68-2-27
Drop, un-packaged	4-inch drop per Bellcore GR-63-CORE

Table 5: Mechanical conditions (storage and transportation)

4.1.3 CDMA 1xRTT operating power

Parameter	Min.	Typ.	Max.	Unit	Remarks
CDMA 800 full power		700		mA	
CDMA 1900 full power		700		mA	
Standby		<4.0		mA	
Idle		<1.0		mA	

Table 6: Operating power for CDMA 1xRTT operation (average)

4.1.4 CDMA EVDO rev A operating power

Parameter	Min.	Typ.	Max.	Unit	Remarks
CDMA 800 full power		700		mA	
CDMA 1900 full power		700		mA	
Standby		<4.0		mA	
Idle		<1.0		mA	

Table 7: Operating power for CDMA EVDO rev A operation (average)

4.1.5 CDMA transmit power

Parameter	Min.	Typ.	Max.	Unit	Remarks
800 Cell Band	+23.0	+24.5	+26.0	dBm	@ antenna connection
1900 PCS Band	+23.0	+24.5	+26.0	dBm	@ antenna connection

Table 8: CDMA transmit power

4.1.6 RF performance

Parameter	Min.	Typ.	Max.	Unit	Remarks
800 Cell Band		<-105		dBm	
1900 PCS Band		<-105		dBm	

Table 9: CDMA receiver sensitivity

4.1.7 Supply/Power pins (2, 24, 39, 41, 52)

u-blox FW2770p/FW2763p modules use a single voltage source of $VCC=+3.3\text{ V} \pm 100\text{ mV}$.

Symbol	Parameter	Min.	Typ.	Max.	Unit
Vbat	Module supply input voltage	3.2	3.3	3.4	V

Table 10: Input characteristics of Supply/Power pins

4.1.8 EMC emissions

FCC Parts 22H & 24E, Limited Single Modular.

5 Mechanical specifications

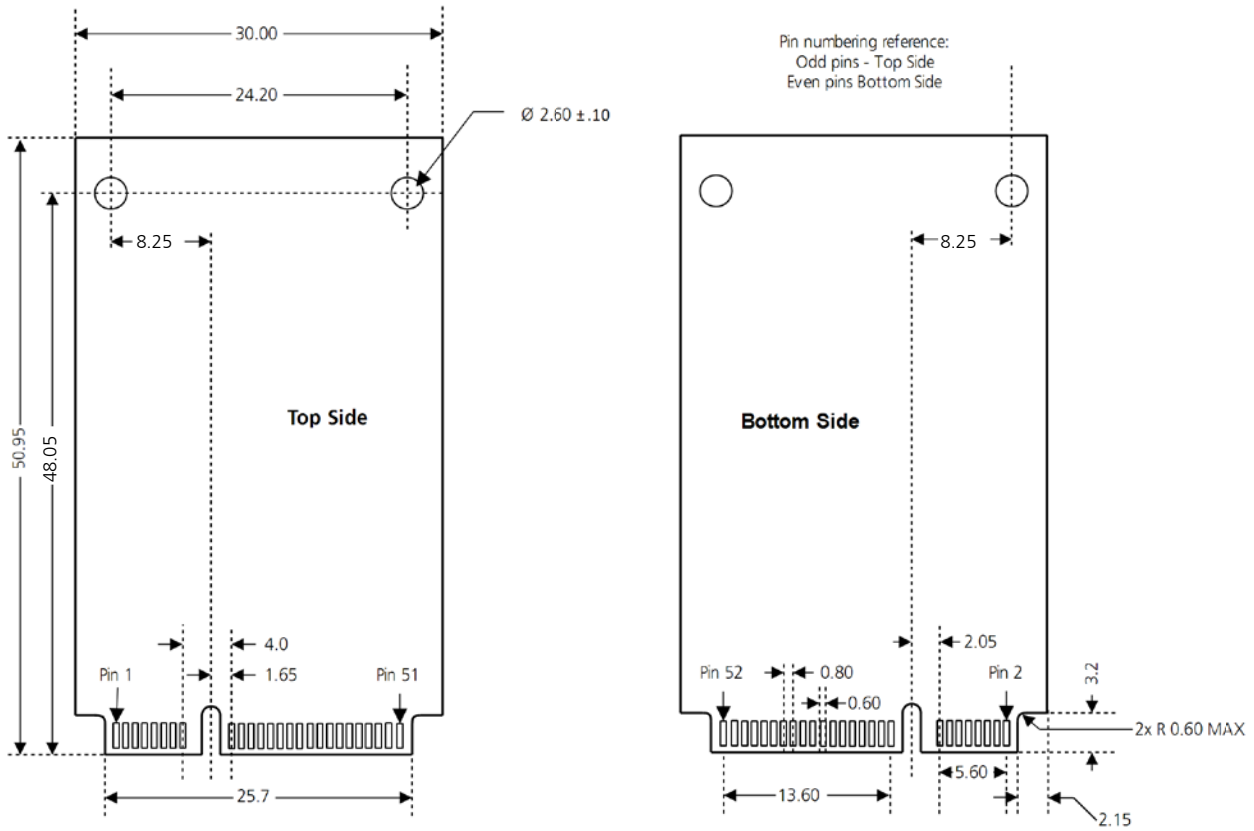


Figure 2: Dimensions (FW2770p top view)

Dimensions 51.0 mm x 30.0 mm x 4.50 mm

Weight 12 g

6 Reliability tests and approvals

6.1 Reliability tests

Qualifications according to ISO 16750 "Road vehicles - Environmental conditions and testing for electrical and electronic equipment".

6.2 Approvals



Products marked with this lead-free symbol on the product label comply with the "Directive 2002/95/EC of the European Parliament and the Council on the Restriction of Use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS).

FW2770p modules are RoHS compliant.

No natural rubbers, hygroscopic materials, or materials containing asbestos are employed.

FW2770p and FW2763p modules are or will be approved under the schemes reported in the below table.

Country	Description	FW2770p	FW2763p
US	FCC	YES	YES
Canada	IC	YES	NO
US	Sprint carrier approval	YES	YES
US	Verizon carrier approval	YES	YES

Table 11: FW2770p/FW2763p certification approvals

For more details on all country certification and network operators please refer to our website www.u-blox.com.

7 Product handling

7.1 Important safety information

The following information applies to the devices described in this document. Always observe all standard and accepted safety precautions and guidelines when handling any electrical device.

- Save this document: it contains important safety information and operating instructions.
- Do not expose the u-blox FW2770p/FW2763p product to an open flame.
- Ensure that liquids do not spill onto the devices.
- Do not attempt to disassemble the product: Doing so will void the warranty.

7.2 FCC installation requirements

For more information regarding regulatory compliance see Appendix A Regulations and Compliance.

The u-blox FW2770p/FW2763p modems are designed for use in a variety of host units, "enabling" the host platform to perform wireless data communications. However, there are certain criteria relative to integrating the modem into a host platform such as a PC, laptop, handheld or PocketPC®, monitor and control unit, etc. that must be considered to ensure continued compliance with FCC compliance requirements.

- Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
- In order to use the u-blox FW2770p/FW2763p modems without additional FCC certification approvals, the installation must meet the following conditions:
- If used in a "portable" application such as a handheld or body worn device with the antenna less than 20 cm (7.9 in.) from the human body when the device is operating, then the integrator is responsible for passing additional "as installed" testing and the device will require its own FCC ID:

f SAR (Specific Absorption Rate) testing, with results submitted to the FCC for approval prior to selling the integrated unit. If unable to meet SAR requirements, then the host unit must be restricted to "mobile" use (see below).

f Unintentional emissions, FCC Part 15; results do not have to be submitted to the FCC unless requested, although the test provides substantiation for required labeling (see below).

f ERP and EIRP measurements for FCC Parts 22 and 24, alternatively a full retest on FCC Parts 22 and 24 can be performed.

- If used in a "mobile" application where the antenna is normally separated at least 20 cm (7.9 in) from the human body during device operation, then an appropriate warning label must be placed on the host unit adjacent to the antenna. The label should contain a statement such as the following:

WARNING

RF exposure. Keep at least 20 cm (7.9 in) separation distance from the antenna and the human body.

- Host unit user manuals and other documentation must also include appropriate caution and warning statements and information.
- If the FCCID for the modem is not visible when installed in the host platform, then a permanently attached or marked label must be displayed on the host unit referring to the enclosed modem.

For example, the label should contain wording such as:

Contains CDMA modem transmitter module

FCC ID: XU9-FW2770p

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) This device must accept any interference received, including interference that may cause undesired operation.

OR

Contains FCC ID: XU9-FW2770p

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) This device must accept any interference received, including interference that may cause undesired operation.

- Any antenna used with the modem must be approved by the FCC or as a Class II Permissive Change (including MPEL or SAR data as applicable). The "professional installation" provision of FCC Part 15.203 does not apply.
- The transmitter and antenna must not be co-located or operating in conjunction with any other antenna or transmitter. Violation of this would allow a user to plug another transmitter in to the product and potentially create an RF exposure condition.

WARNING

The transmitter and antenna must not be collocated or operating in conjunction with any other antenna or transmitter. Failure to observe this warning could produce an RF exposure condition.

7.2.1 Disclaimer

The information and instructions contained within this publication comply with all FCC, IC, CDG, MEID and other applicable codes that are in effect at the time of publication. u-blox disclaims all responsibility for any act or omissions, or for breach of law, code or regulation, including local or state codes, performed by a third party.

u-blox strongly recommends that all installations, hookups, transmissions, etc., be performed by persons who are experienced in the fields of radio frequency technologies. u-blox acknowledges that the installation, setup and transmission guidelines contained within this publication are guidelines, and that each installation may have variables outside of the guidelines contained herein. Said variables must be taken into consideration when installing or using the product, and u-blox shall not be responsible for installations or transmissions that fall outside of the parameters set forth in this publication.

u-blox shall not be liable for consequential or incidental damages, injury to any person or property, anticipated or lost profits, loss of time, or other losses incurred by Customer or any third party in connection with the installation of the Products or Customer's failure to comply with the information and instructions contained herein.

7.3 Circuit protection

Generally, ESD protection (typically TVS/Transzorb devices) should be added to all signals that leave the host board. This includes VBAT/VCC. Series resistors (typically 47 Ω) can also be added in series with data lines to limit the peak current during a voltage excursion.



It is the Integrator's responsibility to protect the FW2770p/FW2763p modules from electrical disturbances and excursions, which exceed the specified operating parameters!

8 Labeling and ordering information

8.1 Product labeling

The label on u-blox modules includes important product information. The location of the product type number is shown in Figure 3.

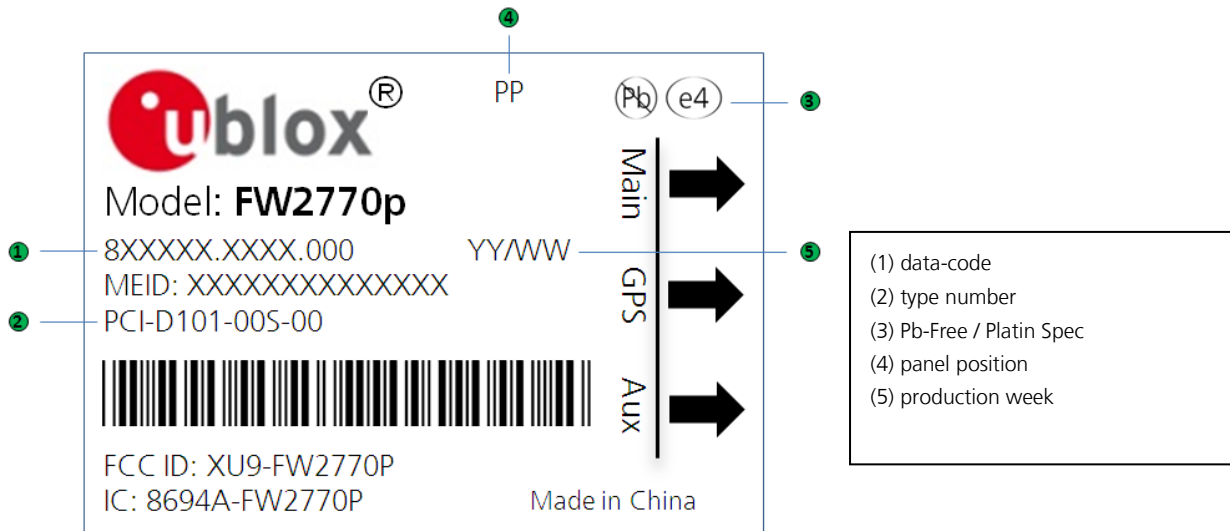


Figure 3: Location of product type number on FW2770p module label

8.2 Explanation of codes

Three different product code formats are used. The **Product Name** is used in documentation such as this data sheet and identifies all u-blox products, independent of packaging and quality grade. The **Ordering Code** includes options and quality, while the **Type Number** includes the hardware and firmware versions. Table 12 details these three different formats:

Format	Structure
Product Name	FW2770p
Ordering Code	PCI-D100-00S
Type Number	PCI-D100-00S-00

Table 12: Product Code Formats

The parts of the product code are explained in Table 13.

Code	Meaning	Example
C	Cellular standard (i.e. G: GSM; E: EDGE; W: WEDGE; H: HSDPA; U:HSUPA ; L: LTE; C: CDMA 1xRTT; D: EV-DO)	U: HSUPA
D	Generation, e.g. chip or function set; range[0...9]	2
V	Variant based on the same cellular chip range: [0...9]	
G	GPS generation (if GPS functionality available)	6 = u-blox 6, 0: no GPS functionality
TT	Major product version	0
Q	Quality grade/production site <ul style="list-style-type: none"> • S = standard / made in Austria • A = automotive / made in Austria 	S
XX	Minor product version (not relevant for certification)	Default value is 00

Table 13: Part identification code

8.3 Ordering information

Ordering No.	Product
PCI-C100-00S-00	FW2763p: 1xRTT module, without GPS, Sprint carrier customizations
PCI-C101-00S-00	FW2763p: 1xRTT module, with GPS, Sprint carrier customizations
PCI-D100-00S-01	FW2770p: EV-DO module, without GPS, Sprint carrier customizations
PCI-D101-00S-01	FW2770p: EV-DO module, with GPS, Sprint carrier customizations
PCI-C100-20S-00	FW2763p: 1xRTT module, without GPS, Verizon carrier customizations
PCI-C101-20S-00	FW2763p: 1xRTT module, with GPS, Verizon carrier customizations
PCI-D100-20S-00	FW2770p: EV-DO module, without GPS, Verizon carrier customizations
PCI-D101-20S-00	FW2770p: EV-DO module, with GPS, Verizon carrier customizations

Table 14: Product ordering codes

Appendix

A Regulations and compliance

This section summarizes the responsibilities and actions required of manufacturers and integrators who incorporate OEM versions of the u-blox FW2770p module into their products. In certain situations and applications, these products will require additional FCC, IC, CDG, Verizon Wireless ODI or other regulatory approvals prior to sale or operation. Appropriate instructions, documentation and labels are required for all products. For more information concerning regulatory requirements, please contact u-blox.

A.1 Verizon Wireless ODI/CDG approval

The u-blox FW2770p module is type approved in accordance with the requirements of, and through the procedures set forth by, Verizon Wireless. Any OEM changes to the antenna port, software or the physical makeup of the unit may require an incremental approval to ensure continued compliance with the above-mentioned standard. For more information concerning type approval, please contact u-blox.

A.2 Electromagnetic Compatibility (EMC) & safety requirements

The u-blox FW2770p module has been tested and approved for application in the United States of America (US) and Canada. The compliance details for each of these markets follow. For other markets, additional or alternative regulatory approvals may be required. Always ensure that all rules and regulations are complied with in every country that the OEM application is to be operated. Regardless of the country or market, the OEM must comply with all applicable regulatory requirements.

A.3 EMC/safety requirements for the USA

Compliance to the US rules and regulations falls under two categories: Radio approvals: Federal Communications Commission (FCC) Transmitter: FCC Rules, Part 22 & 24

Although the u-blox FW2770p module has been authorized by the FCC and listed as a component by an NRTL, products and applications that incorporate the u-blox FW2770p module will require final verification of EM emission and product safety approval.

A.4 Human exposure compliance statement



Particular attention should be made to the following statements regarding RF Exposure!

FW2770p Module

u-blox certifies that the u-blox FW2770p 800/1900 MHz CDMA Radio Module (FCC ID: XU9-FW2770p) complies with the RF hazard requirements applicable to broadband PCS equipment operating under the authority of 47 CFR Part 24, Subpart E and Part 22, Subpart H of the FCC Rules and Regulations. This certification is contingent upon installation, operation and use of the u-blox FW2770p module and its host product in accordance with all instructions provided to both the OEM and end user. When installed and operated in a manner consistent with the instructions provided, the u-blox FW2770p module meets the maximum permissible exposure (MPE) limits for general population / uncontrolled exposure at defined in Section 1.1310 of the FCC Rules and Regulations.



Installation and operation of this equipment must comply with all applicable FCC Rules and Regulations, including those that implement the National Environmental Policy Act of 1969 (Part 1, Subpart I), with specific regard to antenna siting and human exposure to radio frequency radiation. For further guidance, consult the FCC Rules, a certified FCC test house, or u-blox.

A.5 Compliance with FCC regulations

The Federal Communications Commission (FCC) is the agency of the Federal Government that oversees all non-governmental radio frequency transmitters that operate within the United States. Unintentional emissions from digital devices are regulated by Part 15 of the FCC Rules and Regulations, which distinguishes between the environments in which these devices may operate. Intentional radiators operating as a CDMA 800/1900 MHz radio transmitter are regulated under Part 22 & 24, Subpart E— Broadband PCS of the FCC Rules and Regulations.

A.6 Intentional radiators, part 22 & 24

Products incorporating the u-blox FW2770p transceiver operate as Personal Communications Services (PCS) devices under the authority of Part 22 & Part 24, Subpart E—Broadband PCS, of the FCC Rules and Regulations. All such transmitters must be authorized by the FCC through its Certification process, as detailed in Part 2, Subpart J - Equipment Authorization Procedures. Through the Certification process, the FCC verifies that the product complies with all applicable regulatory and technical requirements, including those that address human exposure to radio frequency radiation. In general, radio frequency transmitters cannot be sold or operated in the US prior to FCC approval.

A.7 Instructions to the Original Equipment Manufacturer (OEM)

To comply with the requirements of the National Environmental Policy Act (NEPA) of 1969, operation of an FCC-regulated transmitter may not result in human exposure to radio frequency radiation in excess of the applicable health and safety guidelines established by the FCC. Further information on RF exposure issues may be found in the FCC's Office of Engineering and Technology (OET) Bulletin Number 65, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields" and Supplement C, "Additional Information for Evaluating Compliance of Mobile and Portable devices with FCC Limits for Human Exposure to Radio Frequency Emissions." Both of these documents are available via the Internet at the OET web site: <http://www.fcc.gov/oet>.

The u-blox FW2770p products are CDMA radio transceivers, which operate under the authority of 47 CFR Part 24, Subpart E and Part 22 of the FCC Rules and Regulations. When installed and operated in accordance with the instructions provided in this manual, these devices comply with current FCC regulations regarding human exposure to radio frequency radiation.

The following installation and operation restrictions apply to all u-blox FW2770p products:

- This device may only be used in fixed and mobile applications.
- Portable applications, as defined by the FCC, are prohibited.
- The use of this device for desktop and other applications where the antenna can easily be relocated are considered by the FCC to be mobile applications.
- A separation distance of at least 20 cm (7.87 inches) between the antenna and the body of the user and other persons must be maintained at all times
- In FIXED applications, antenna gain is limited to a maximum of 7 dBi, with a corresponding Equivalent Isotropic Radiated Power (EIRP) of 37 dBm / 5 W.
- In MOBILE applications, antenna gain is limited to a maximum of 2 dBi, with a corresponding EIRP of 33 dBm / 2 W.
- End products must provide instructions to ensure compliance with radio frequency radiation exposure requirements.
- A warning label visible to all persons exposed to the antenna and identical to that described in this manual must be displayed on or next to the antenna.

- Separate FCC approval for RF exposure compliance is required for end products that do not meet these conditions.

Antenna gain is defined as gain in dBi (dB referenced to an isotropic radiator) minus cabling loss.



Additional care must be taken by the installer and/or user of the u-blox FW2770p products to ensure proper antenna selection and installation. Adherence to the above conditions is necessary to comply with FCC requirements for safe operation regarding exposure to RF radiation.

Depending upon the application and type of product into which the u-blox FW2770p module has been incorporated, specific OEM actions and responsibilities required to meet these conditions vary. However, in all cases the primary concern is to ensure compliance with current FCC guidelines and regulations that limit human exposure to radio frequency radiation.

A.7.1 Definitions

For the purpose of determining compliance with current FCC rules addressing human exposure to radio frequency radiation, the FCC has established the following three categories of transmitting devices:

- Portable Devices – devices where the antenna is located within 20 cm (7.87 inches) of any person, including the user, if applicable. Portable devices operating under the authority of Part 22 or 24 (broadband PCS) are limited to a maximum of 2 W EIRP.
- Mobile Devices – devices designed to be used in other than fixed locations and generally such that the antenna is located at a minimum of 20 cm (7.87 inches) from any person, including the user, if applicable. Mobile devices operating under the authority of Part 22 or 24 (broadband PCS) are limited to a maximum of 2 W EIRP.
- Fixed devices – devices in which the antenna, either integral to the product or remotely located, is physically secured at one location and is not able to be easily moved to another location. The antenna for a fixed device is mounted on an outdoor permanent structure with a minimum separation distance of 2 meters (79 inches)

A.8 OEM responsibilities for all products containing the u-blox FW2770p/FW2763p module

In addition to any other regulatory requirements, OEMs and integrators must include or provide the following information, instructions, warnings and labels with any device or product into which the u-blox FW2770p module has been incorporated:

Information	Description
Detailed Operating Instructions for ensuring compliance with current FCC guidelines which limit human exposure to radio frequency radiation	<p>The OEM must provide an operating/installation manual with the final product which clearly indicates that these operating conditions and restrictions must be observed at all times to ensure compliance with current FCC guidelines which limit human exposure to radio frequency radiation.</p> <p>20 cm (7.87 inch) separation distance between the antenna and all persons must be maintained at all times for all fixed and mobile products and applications</p> <p>Portable devices and applications are prohibited unless such devices and products are specifically authorized by the FCC</p> <p>Maximum antenna gain is limited to 2 dBi* in mobile products and applications</p> <p>For fixed applications (2 meter separation) the antenna gain can be as much as 26 dBi.</p> <p>Modifications and/or additions to the u-blox FW2770p GSM transceiver, including use of antennas with higher gain than those authorized by the FCC, are prohibited</p> <p>*dBi = antenna gain in dB relative to an isotropic radiator</p>
Antenna Avoidance Label	<p>Attach the following warning label directly to or displayed next to the antenna. Furthermore, this label must be visible to and easily readable by all persons in the immediate vicinity of the antenna:</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>WARNING</p> <p>To comply with FCC RF exposure requirements, a separation distance of 20 cm (7.87") or more must be maintained between this antenna and all persons</p> </div>
Human Exposure Compliance Statement	<p>Include the following statement in the instruction / operation manual:</p> <div style="border: 1px solid black; padding: 5px;"> <p>u-blox certifies that the Fusion™ MHz GSM Radio Module (FCC ID: MIVGSM0308) complies with the RF hazard requirements applicable to broadband PCS equipment operating under the authority of 47 CFR Part 22 or Part 24, Subpart E of the FCC Rules and Regulations.</p> <p>This certification is contingent upon installation, operation and use of the u-blox FW2770p module and its host product in accordance with all instructions provided to both the OEM and end user. When installed and operated in a manner consistent with the instructions provided, the u-blox FW2770p module meets the maximum permissible exposure (MPE) limits for general population / uncontrolled exposure at defined in Section 1.1310 of the FCC Rules and Regulations.</p> </div>

A.9 Specific OEM responsibilities for portable products and applications

Each device or product, into which the u-blox FW2770p/FW2763p module has been incorporated, and which is intended to be used in an application that meets the definition of "portable" MUST be separately authorized by the FCC for the purposes of determining compliance with current FCC guidelines limiting human exposure to radio frequency radiation.

Portable devices must be evaluated for RF exposure based on Specific Absorption Rate (SAR) limits; further information on such evaluations are available from the FCC via the Internet.

A.10 Specific OEM responsibilities for mobile products and applications

Separate or additional FCC approvals are NOT required for devices or products, into which the u-blox FW2770p/FW2763p module has been incorporated, that are used in applications that meet the definition of "mobile."

For all end products, the OEM or integrator must provide instructions, warnings and labels to ensure that the product complies with current FCC guidelines limiting human exposure to radio frequency radiation.

Current FCC regulations limit the EIRP of mobile devices to 2 W. Because the nominal RF output power of the u-blox FW2770p transceiver is 200mW (+23 dBm), antenna gain for mobile products and applications cannot exceed +10 dBi.

A.11 Specific OEM responsibilities for fixed products and applications

Separate or additional FCC approvals are not required for devices or products, into which the u-blox FW2770p/FW2763p module has been incorporated, that are used in applications that meet the definition of "fixed."

For all end products, the OEM or integrator must provide the instructions, warnings and labels to ensure that the product complies with current FCC guidelines limiting human exposure to radio frequency radiation.

Separate or additional FCC approvals are required for devices or end products used in fixed applications where antenna gain in excess of 7dBi is desired.

B OMA Device management

This section provides an overview of the OMA-DM process and describes best practices for device management using OMA-DM on a FW27XX modem.



OMA-DM functionality is supported by Sprint modules only

The OMA-DM process can be divided into three distinct operations:

- Device configuration
- PRL programming
- Firmware update

Each operation can occur as a result of a network initiated trigger, a client initiated trigger, or as part of the hands-free activation process. All device management sessions are established using MIP Profile 0.

B.1 Device configuration

Device configuration is the programming of parameters needed to access network voice and/or data services. Device configuration data is provided by the Sprint Provisioning System. It is conveyed to the device via the OMA-DM server. Device configuration parameters include:

- NAM Parameters (MDN and MSID)
- MIP Parameters (MIP Profile 1)

B.2 PRL programming

Sprint requires that devices be able to update a subscriber's PRL as needed. This may be up to or exceeding 4 times per year. The OMA-DM Client will trigger a PRL commit following the successful completion of the management session. No power cycle is performed here. Instead, the device performs a radio reset in to load the new PRL. The device will not have service for approximately 10 seconds after the PRL commit.

B.3 Firmware update

Sprint requires that OMA Clients support firmware updates using an alternative download (OMA-DL) where retrieval of the update packages is completed using the "alternative" download mechanism. To satisfy this requirement, the device may make two data calls during the FUMO session – one to check for the existence of an update package and, if an update exists, a second data call to perform the download of the update package.

When the update package download completes the device will jump to the boot loader to install the update package. The device will not respond to AT commands while the update package is being installed. The device will power cycle when the update package installation is complete.

After the firmware update (success or failure) the device will report its final state to the OMA-DM Server. After completing a FUMO update, whether it was network-initiated or client-initiated, the device will perform another client-initiated FUMO to check for additional updates. FUMO transactions may loop multiple times to ensure that the device receives all available updates.

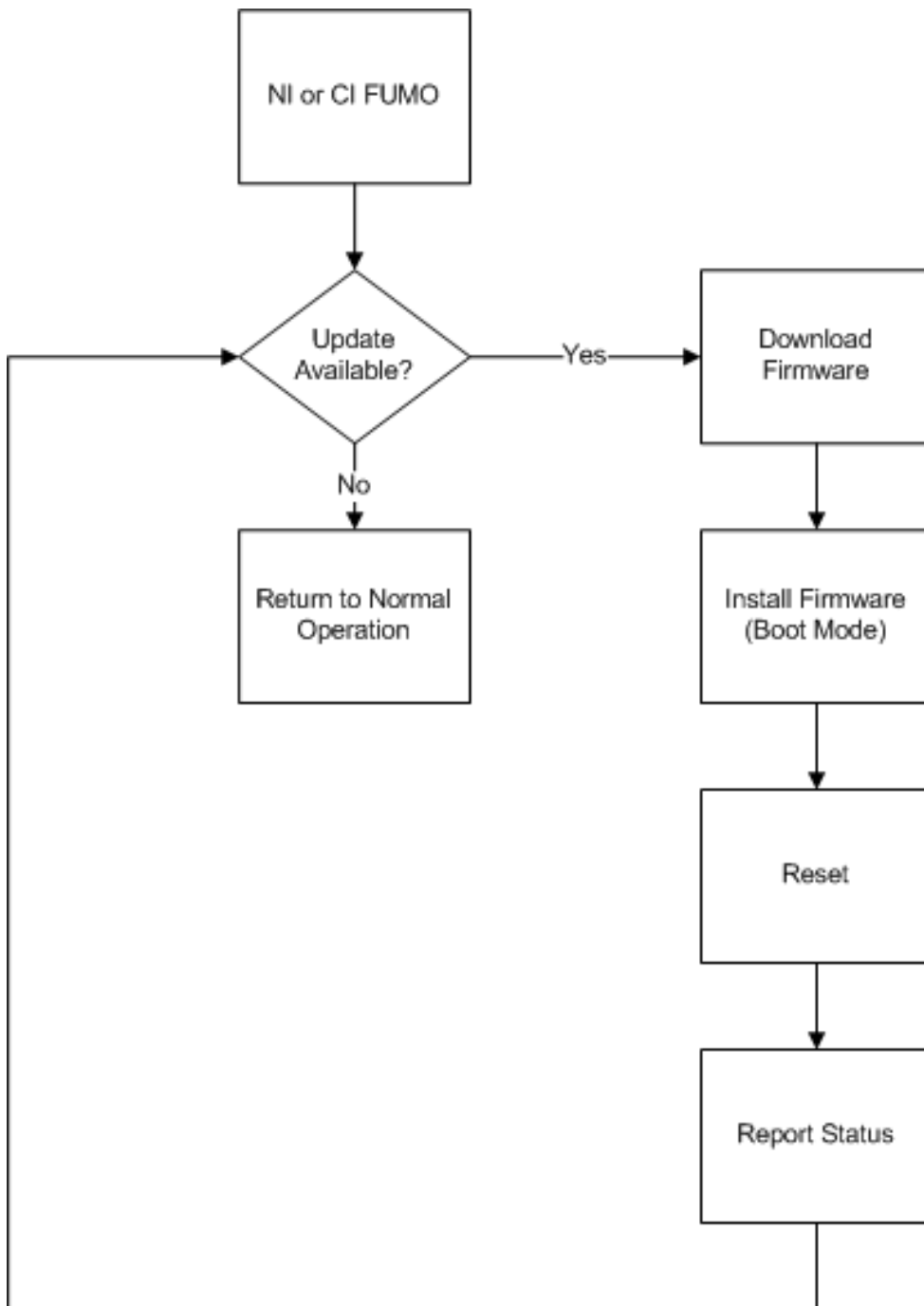


Figure 4: Flow diagram

B.4 Hands Free Activation

Hands-Free Activation (HFA) is a series of client-initiated commands performed when the device is powered on in a factory default state. The device is considered to be in the factory default state when any of the following conditions are true:

- MSID or MDN are default (000-000-xxxx)
- MIP Profile 1 username (Vision NAI) is blank.

Applications can reset the device to the factory default state by sending the \$RTN command.

The transactions below are performed in the order listed during HFA:

1. Client-initiated Device configuration
2. Client-initiated PRL update
3. Client-initiated FUMO

B.5 Session establishment

Device management sessions can be established by the OMA-DM Server using a Notification Initiation Alert (NIA). The NIA is sent in the payload of a WAP-encoded SMS message. The NIA will be processed immediately if the device is not in an active data session. If a data session is active the FW27XX's DM Client will store the NIA until it can be executed. The conditions required for execution are:

- The current data session has moved to an idle or dormant state (i.e. the traffic channel is idle)
- The modem is on either a home or roaming signal.

It should be noted that the dormant data connection will be torn down when the device switches to MIP Profile 0 to process the NIA. Applications should not attempt to re-establish the connection until the OMA-DM session has completed. The +OMASESS and \$QCMIPP commands can be used to determine if an OMA-DM session is in progress.

Device management sessions can also be Client Initiated (CI). In general, the initiation of such sessions are triggered by the Host Application, but they can also be triggered by events external to the OMA-DM Client, for example:

- Asynchronous actions (e.g. reporting status of some action on device)
 - After a firmware update
 - Extensible exec operations (per-device)
 - After a PRL upgrade
- Device initiated sessions
 - Diagnostic events
 - Business logic driven (DSS, etc.)
 - Periodic (monthly, quarterly, etc.)

Applications should not attempt to establish a connection until the OMA-DM session has completed. The +OMASESS and \$QCMIPP commands can be used to determine if an OMA-DM session is in progress. Client initiated attempts will fail if an OMA-DM session is already in progress.

B.6 Best practices

In general, applications should avoid initiating data calls or removing power to the module while an OMA-DM session is active. It is recommended that the OMA session state be read using the +OMASESS command prior to initiating a data call or removing power. The \$QCMIPP command can be used to correlate the session state.

If an active OMA-DM session goes dormant, is disrupted by an external event such as loss of power or signal, or terminates abnormally the FW27XX device may be left in a state where it is unable to initiate a data call on MIP Profile 1.

The state exhibits the following symptoms if the session went dormant or terminated abnormally:

- The OMA Session State is active (i.e. AT+OMASESS? returns 1)
- The OMA Session State remains active for an extended period of time (i.e. ten or more minutes)
- The Active Mobile IP Profile is Profile 0
- There is no OMA-DM related data call activity

The state exhibits the following symptoms if the session was interrupted by a loss of power:

- The OMA Session State is not active (i.e. AT+OMASESS? returns 0)
- The Active Mobile IP Profile is Profile 0

Applications can take the following steps to recover a module exhibiting the symptoms described above:

- Reboot the module using the +REBOOT command
- After power on and successful network registration initiate a +OMADM=2 command to synchronize the module with the OMA Server and return the module to the correct MIP Profile

When the OMA session completes the device should be ready for normal operation. Refer to TABLE 1 for a list of the AT Commands associated with this procedure.

B.7 Psuedo code

The following pseudo code is provided to demonstrate the programming flow.

```
// Best Practices logic
if(at+omasess == 0 AND at$qcripp == 1)
{
    // The OMA Session is not active. It is safe to initiate a data
    // call or remove power.
}
// Best Practices logic

// Recovery logic

// An OMA Session is active but no data call is active
if (at+omasess == 1 AND at^ipcall == 0)
{
    recovery_mode = TRUE; // this must persist across power cycles
    send at+reboot;       // can't send an OMA command while an OMA
                          // Session is Active so must reboot
}

// On power up
if ((recovery_mode == TRUE) OR (at+omasess == 0 AND at$qcripp == 0))
{
    send at+omsadm=2; // initiate an OMA-DM DC session

    // wait for the OMA session to complete and profile
    // one to be set as the active profile
    when (at+omasess == 0 AND at$qcripp == 1)
    {
        recovery_mode = FALSE;
    }
}
// Recovery logic
```


B.8 AT Command reference

Command	Possible responses
Read command: AT\$QCMIPP?	\$QCMIPP:<n> Parameter: <n> (0-7)
Read command: AT+OMASESS?	+OMASESS:<n> Parameter: <n> 0: Inactive 1: Active
Read command : AT^IPCALL?	^IPCALL:<status>[,<IP>] Parameter: <status> 0: Disconnected 1: Connected
Set command: AT+OMADM<mode>	OK Parameter: <mode>: 0: Disable OM-DM capabilities 1: Enable OMA –DM capabilities (default) 2: Perform a client initiated OMA-DM session
AT+REBOOT	OK

Table 15: AT Command reference

Related documents

- [1] FW2770p & FW2763p AT Commands Manual, Docu. No UBX-13003546
- [2] 3GPP TS 51010-1 (850, 900, 1800, 1900 MHz devices).
<http://www.3gpp.org/ftp/Specs/html-info/51010-1.htm>
- [3] FCC Rules, Part 24:
 - f* 47 CFR Subpart E--Broadband PCS
 - f* 47 CFR § 24.52, sections 1.1307(b), 2.1091, and 2.1093<http://www.fcc.gov/>
- [4] FCC Rules, Part 22H
<http://www.fcc.gov/>
- [5] FCC OFFICE OF ENGINEERING AND TECHNOLOGY (OET)
Bulletin Number 65 "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields". <http://www.fcc.gov.oet/>
- [6] FCC OFFICE OF ENGINEERING AND TECHNOLOGY (OET)
Supplement C "Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Exposure to Radio Frequency Emissions". <http://www.fcc.gov.oet/>
- [7] INDUSTRY CANADA, RSS-129. <http://www.ic.gc.ca/>
- [8] INDUSTRY CANADA, RSS-133. <http://www.ic.gc.ca/>
- [9] Sprint OMA-DM Client Functional Requirements Version 1.6.5



For regular updates to u-blox documentation and to receive product change notifications please register on our homepage.

Revision history

Revision	Date	Name	Status / Comments
-	10/12/2011	bric	Initial release Last revision with old docu number CDMA-1X-11004
A	28/08/2013	smoi	Appendix B added Applicability table updated

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