FENWAY Global User Guide for UMTS/GSM

80-JA863-1 Rev. A

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Customer Affirmation for Technical Support*

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Customer confirms that this support request is for a wireless terminal made, sold and used solely outside the USA if it falls within the following table:

UMTS	**Qualcomm will not support for the U.S.:** MSM6275, MSM6280, MSM7200, MSM7200A, ESM6270, ESM7205, ESM7205A

The foregoing restrictions shall not apply to wireless terminals represented to Qualcomm by Verizon Wireless as being exclusively made on their behalf.

*Reference: 80-VH591-1 Revision B

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Revision history

Revision	Date	Description
A	January 2009	Initial release

1 Introduction

1.1 Documentation overview

The Fenway Module is a data and voice enabled wireless module using the Windows Mobile operating system. This module solution delivers WWAN data and voice connectivity for the UMTS (HSDPA and HSUPA), and GSM/GPRS/EDGE protocols, Bluetooth and 802.11b/g connectivity, plus GPS position location, in a single package.

This FENWAY global regulatory user guide is organized as follows:

Chapter 1 Provides an overview of FENWAY documentation.

Chapter 2 Provides pin assignments and detailed descriptions.

Chapter 3 Defines how to power and control the FENWAY platform and describes its operating modes.

Chapter 4 Provides RF integration guidelines.

Chapter 5 Provides standards compliance and regulatory information.

Table 1-1 FENWAY documentation

Document Number	Title/Description
80-JA852-1	*FENWAY Regulatory Test Plan* The primary objective of this document is to convey all regulatory requirements for the FENWAY module and outline test methods.
80-JA863-1 (this document)	*FENWAY Global User Guide for UMTS/GSM* This document describes all FENWAY functions and interfaces, defines how to power and control the platform, and provides hardware integration guidelines.

Table 1-2 lists documents referred to throughout the FENWAY document set; consult these documents for additional information.

Table 1-2 Reference documents

Ref No.	Document
[1]	*FCC Regulations - CFR 47, Part1, 2, 15, 22, 24, and 27*
[2]	*Protection of Electrical and Electronic Parts, Assemblies, and Equipment* (ANSI/ESD S20.20-1999)

1.2 Application description

The FENWAY module includes a small circuit board support all functionality and the associated software suite. Its supported airlinks are as follows:

- Quad-band UMTS (WCDMA R99, HSDPA, and/or HSUPA):
  - Cellular band
    - Band V: 869 to 894 MHz reception; 824 to 849 MHz transmission
  - AWS band
    - Band IV: 1710-1755 MHz reception; 2110 to 2155 MHz transmission
  - PCS band
    - Band II: 1930 to 1990 MHz reception; 1850 to 1910 MHz transmission
  - IMT band
    - Band I: 2110 to 2170 MHz reception; 1920 to 1980 MHz transmission
- Quad-band GSM (GSM, GPRS, and/or EDGE):
  - GSM850 band
    - 869 to 894 MHz reception; 824 to 849 MHz transmission
  - GSM900 band
    - 925 to 960 MHz reception; 880 to 915 MHz transmission
  - GSM1800 band
    - 1805 to 1880 MHz reception; 1710 to 1785 MHz transmission
  - GSM1900 band
    - 1930 to 1990 MHz reception; 1850 to 1910 MHz transmission
- GPS reception centered at 1575.42 MHz (GPS L1 band)
- Bluetooth 802.15 ISM band
  - 2400 MHz to 2500MHz
- WLAN 802.11B/G ISM Band
  - 2400 MHz to 2500MHz

Table 1-2 lists documents referred to throughout the FENWAY document set; consult these documents for additional information.

Table 1-3 Reference documents

Ref No.	Document
[1]	*QUALCOMM WWAN Connection Manager API (ISOD)*
[2]	*Supplement to Streaming Download Protocol*
[3]	*FCC Regulations - CFR 47, Part1, 2, 15, 22, 24, and 27*

Table 1-3 Reference documents (continued)

Ref No.	Document
[4]	*Universal Serial Bus Specification*, Revision 2.0
[5]	*Protection of Electrical and Electronic Parts, Assemblies, and Equipment* (ANSI/ESD S20.20-1999)

1.3 Terms and acronyms

Table 1-4 defines the terms and acronyms used throughout this document.

Table 1-4Terms and acronyms

Term	Definition
AWS	Advanced Wireless Services
CDMA	Code Division Multiple Access
CE	Mandatory conformity marking on many European products
Cell	Cellular band
CTIA	Cellular Telecommunications and Internet Association
DCS	Digital cellular system at 1800 MHz
DDR SDRAM	Dual data rate synchronous dynamic random access memory
EDGE	Enhanced Data Rate for GSM Evolution
EMC	Electromagnetic compatibility
ESD	Electrostatic discharge
FCC	Federal Communications Commission
GPRS	General packet radio service
GPS	Global positioning system
GSM	Global System for Mobile communications
HSDPA	High speed downlink packet access
HSUPA	High speed uplink packet access
IMT	International mobile telecommunications
JTAG	Joint Test Action Group
PCS	Personal communication system
PM, PMIC	Power management, power management integrated circuit
RFR	Radio frequency receiver
RoHS	Restriction of hazardous substances
RTR	Radio frequency transceiver
RUIM	Removable user identity module
TIA/EIA	Telecommunication Industry Association / Electronic Industries Alliance
TS	Technical specification
UMTS	Universal Mobile Telecommunications System

Table 1-4Terms and acronyms (continued)

Term	Definition
USB	Universal serial bus
USIM	Universal subscriber identity module
WCDMA	Wideband Code Division Multiple Access
WLAN	Wideband local area network
WWAN	Wireless wide area network

2 External Connections

The FENWAY add-in card is compatible with the PCI Express Mini Card 52-pin card edge type connector. The PCI Express Mini Card connector pin assignments are listed in Table 2-1.

Table 2-1 Card connector pin assignments

Pin	Name	Pin	Name
1	VBUS_USB	61	KEYSCAN_N5_FLT
2	VBATT_TEMP	62	UART2DM_TX_FLT
3	VBUS_USB	63	UART2DM_CTS_FLT
4	VBATT_ID	64	UART2DM_RX_FLT
5	USB_CONN_D_P	65	MDDI_RESET_N_FLT
6	VBATT	66	GPIO_18_FLT
7	USB_CONN_D_M	67	CAMIF_FLASH_CTL_FLT
8	VBATT	68	I2C_SDA_FLT
9	GND	69	KEYSCAN_N6_FLT
10	VBATT	70	I2C_SCL_FLT
11	USB_CONN_ID	71	GPIO_26_FLT
12	VEXT_DC	72	KEYSENSE_N0_FLT
13	SPKR_CONN_OUT_L_P	73	GPIO_97_FLT
14	VEXT_DC	74	PHONE_ON_N_FLT
15	SPKR_CONN_OUT_L_M	75	ACCL_INT0_FLT
16	VEXT_DC	76	KEYPAD_BKLT_DRV_N
17	LINE_IN_CONN_L_P	77	ACCL_INT1_FLT
18	EAR1O_CONN_P	78	GND
19	LINE_IN_CONN_R_P	79	SLEEP_CLK_CONN
20	EAR1O_CONN_M	80	VREG_MSME2
21	AUD_IN_CONN_GND	81	KEYSCAN_N7_FLT
22	VREG_GP6	82	VREG_GP3
23	MIC_CONN_P	83	GPIO_89_FLT
24	SDC1_DATA_CONN(0)	84	VREG_GP4
25	MICBIAS_CONN	85	GPIO_90_FLT
26	SDC1_DATA_CONN(1)	86	VREG_GP5
27	LINE_OUT_R_CONN	87	CAMIF_MCLK_FLT

Table 2-1 Card connector pin assignments

Pin	Name	Pin	Name
28	SDC1_DATA_CONN(2)	88	PMIC_VCOIN
29	LINE_OUT_L_CONN	89	CAMIF_PCLK_FLT
30	SDC1_DATA_CONN(3)	90	VBATT_GND
31	GND	91	CAMIF_HSYNC_FLT
32	SDC1_CLK_TF	92	VBATT_GND
33	GND	93	CAMIF_VSYNC_FLT
34	SDC1_CMD_TF	94	VBATT_GND
35	MDDI_P_DATA_M	95	VREG_CAM_DCORE
36	KEYSENSE_N1_FLT	96	CAM_RESET_N_FLT
37	MDDI_P_DATA_P	97	VREG_CAM_ACORE
38	KEYSENSE_N2_FLT	98	FM_RESET_N_FLT
39	GND	99	CAMIF_DATA_FLT_11
40	KEYSENSE_N3_FLT	100	GND
41	MDDI_P_STB_M	101	CAMIF_DATA_FLT_10
42	KEYSENSE_N4_FLT	102	TSCRN_WIPER_FLT
43	MDDI_P_STB_P	103	CAMIF_DATA_FLT_09
44	KEYSENSE_N5_FLT	104	TSCRN_YM_LR_FLT
45	GND	105	CAMIF_DATA_FLT_08
46	UIM1_P_RESET	106	TSCRN_XM_LL_FLT
47	KEYSENSE_N6_FLT	107	CAMIF_DATA_FLT_07
48	UIM1_P_CLK	108	TSCRN_YP_UR_FLT
49	GND	109	CAMIF_DATA_FLT_06
50	UIM1_P_DATA	110	TSCRN_XP_UL_FLT
51	KEYSCAN_N0_FLT	111	CAMIF_DATA_FLT_05
52	VREG_UIM1	112	VIB_DRV_N
53	KEYSCAN_N1_FLT	113	CAMIF_DATA_FLT_04
54	FLASH_DRV_N	114	AV_TV_OUT
55	KEYSCAN_N2_FLT	115	CAMIF_DATA_FLT_03
56	GEN_LED_DRV_N	116	GND
57	KEYSCAN_N3_FLT	117	CAMIF_DATA_FLT_02
58	VREG_5V_GATED	118	VPH_PWR
59	KEYSCAN_N4_FLT	119	CAM_SD_N_FLT
60	UART2DM_RFR_FLT	120	VPH_PWR

All electrical interfaces to the FENWAY Module are highlighted in Figure 2-1 and Figure 2-2.

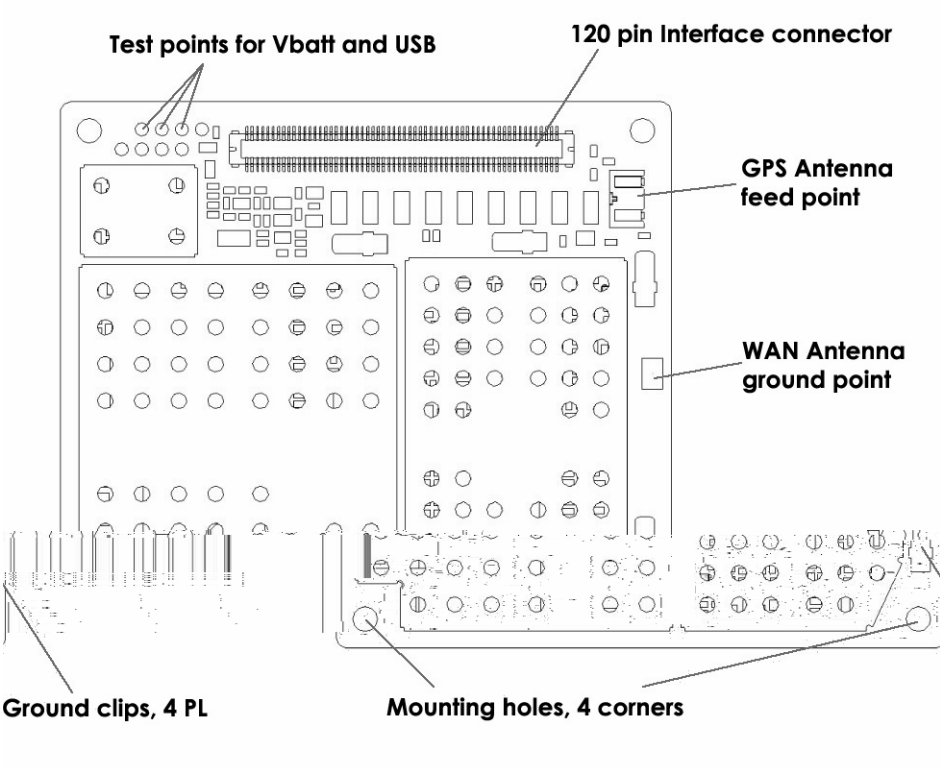

Figure 2-1 External connections — Front View

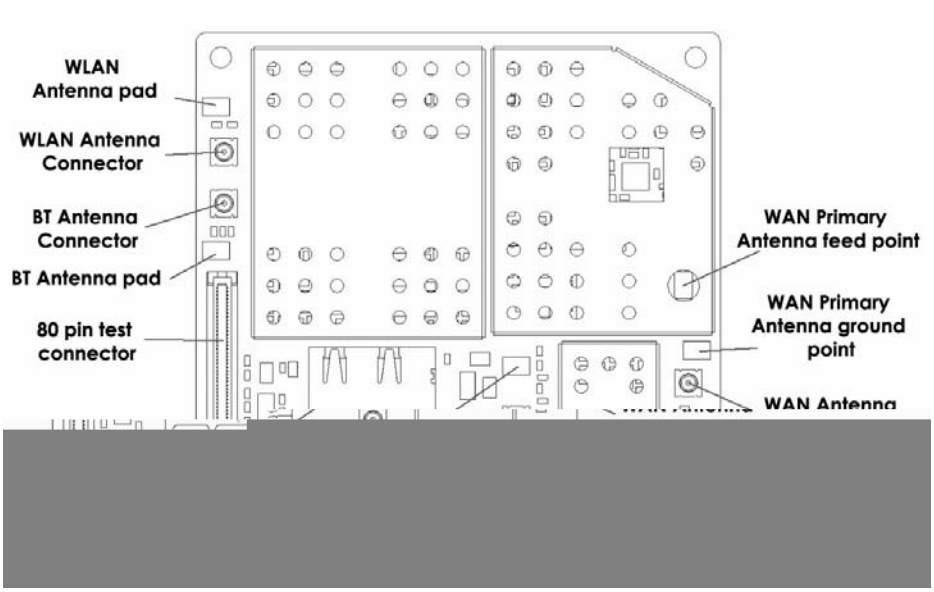

Figure 2-2 External connections — Back View

3 DC Power and FENWAY Operating Modes

3.1 DC power source

DC input is provided by either an external DC source providing 4.6V/1.5A or battery DC source with a max input voltage of 4.2V. Power management system on the FENWAY module accepts these input voltages and regulates as necessary to manage the module operation.

3.2 FENWAY operating modes

Example FENWAY module operating modes and their expected data throughput rates are summarized in Table 3-1. Operating modes are set by the host computer via the USB interface.

Table 3-1 FENWAY operating modes and throughput rates [1]

Operating mode	Data throughput rate [2]	
	Forward-link	Reverse-link
WCDMA R99	384 kbps	384 kbps
WCDMA - HSDPA	7.2 Mbps	---
WCDMA - HSUPA	---	2.0 Mbps
GSM	14.4 kbps	14.4 kbps
GPRS	115 kbps	115 kbps
EDGE	384 kbps	384 kbps

1 GPS position location can be enabled simultaneously with any airlink operating mode.

2 Target peak data rates are listed; actual throughput performance varies depending on operating and RF environment conditions.

3.3 Electrostatic discharge protection

Electrostatic discharge (ESD) occurs naturally in laboratory and factory environments. An established high-voltage potential is always at risk of discharging to a lower potential. If this discharge path is through a semiconductor device, destructive damage may result.

ESD countermeasures and handling methods must be developed and used to control the FENWAY module's environment.

QUALCOMM products must be handled according to the ESD Association standard: ANSI/ESD S20.20-1999, *Protection of Electrical and Electronic Parts, Assemblies, and Equipment*.

FENWAY electrostatic discharge (ESD) performance is specified in *FENWAY Regulatory Test Plan* (80-JA852-1).

4 RF Integration

4.1 RF operating frequencies

The FENWAY RF operating frequencies are summarized in Table 4-1.

Table 4-1 RF operating frequencies

Operating band	Tx frequency range	Rx frequency range
UMTS (WCDMA)		
Cell (band V)	824 to 849 MHz	869 to 894 MHz
AWS (band IV)	2110 to 2155 MHz	1710-1755 MHz
PCS (band II)	1850 to 1910 MHz	1930 to 1990 MHz
IMT (band I)	1920 to 1980 MHz	2110 to 2170 MHz
GSM		
GSM850	824 to 849 MHz	869 to 894 MHz
GSM900	880 to 915 MHz	925 to 960 MHz
GSM1800	1710 to 1785 MHz	1805 to 1880 MHz
GSM1900	1850 to 1910 MHz	1930 to 1990 MHz
GPS position location	---	1574.42 to 1576.42 MHz
Bluetooth 802.15 ISM band	---	2400 MHz to 2500MHz
WLAN 802.11B/G ISM Band	---	2400 MHz to 2500MHz

4.2 RF connections

Fenway module provides two options for each antenna system interconnect:

- **RF Connectors.** The primary and secondary, GPS, Bluetooth and WLAN antenna connector locations are identified in Figure 2-1. Integrated antenna elements can be connected to the FENWAY module via flexible RF coaxial cables with Murata model number MM8430 connectors. The FENWAY RF ports are designed to operate in 50 Ω systems; their inband source and load characteristic impedances are always 50 Ω nominal. A 10 dB return loss or better should be maintained over all operating bands throughout the antenna plus cabling systems.

  Two additional points are worth highlighting:

  - Use short 50 Ω cables for host-to-FENWAY RF interconnections to minimize loss. Losses between an antenna and the receiver degrade sensitivity; loss in the transmit path requires additional PA output power (more DC power consumption).

- If Rx diversity and GPS position location are not supported, leave the unused secondary antenna unconnected.

- **RF Feed points.** The primary and secondary, GPS, Bluetooth and WLAN antenna feed point locations are identified in Figure 2-1. These can be used to integrate antenna elements directly to the FENWAY module without coaxial cables which may result in a smaller overall system solution.

4.3 Ground connections

Grounding is extremely important to FENWAY performance. The main system ground connections are mechanical, implemented by the ground clips identified in Figure 2-1. Use these ground clips to ensure proper grounding. If system level design does not allow use of these grounds, extensive performance testing must be completed to show they are not necessary. In addition to these primary ground connections, the card's 120-pin connector provides additional electrical ground connections as listed in Table 2-1, and the RF connectors provide the RF return paths that are also connected to system ground.

4.4 Shielding and interference

Shielding is an extension of the system ground and must be installed to prevent interference between the host computer and the FENWAY platform. The platform is fully shielded (Figure 4-1) in accordance with FCC regulations (see [1] listed in Table 1-2).

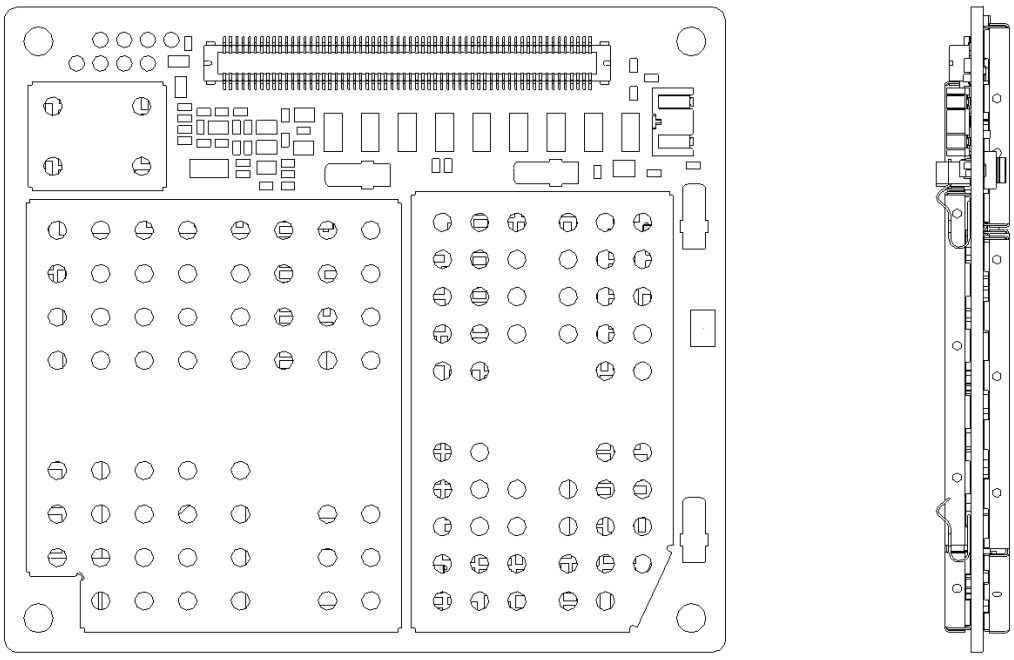

Figure 4-1 FENWAY shields

NOTE These FENWAY shields must not be removed.

The host device is a hostile environment for RF transceivers, making the shields absolutely necessary. Potential interference sources include the following:

- Noise or ripple on the DC power supply voltage input lines, including transients due to switching-mode power supplies or host operating mode changes.
- High-speed digital logic transitions – The fast rising and falling edges include high frequency harmonics that can fall into the FENWAY Rx and/or Tx passbands. Host circuits most likely to cause problems are the microprocessor, memory, and its displays and display drivers.
- Clocks – Also due to their high-speed transitions.
- Other wireless devices, if not integrated onto the FENWAY module, whether integrated into the host device or external, such as WLAN (802.11) and Bluetooth® devices. Transmit channels and their associated wideband noise can jam the FENWAY receivers, and even their LO frequencies, digital logic, or clock signals can be disruptive.

Careful design is required to minimize the interference. FENWAY performance parameters, such as receiver sensitivity and transmitter spurious signals, should be evaluated to confirm adequate grounding and shielding, location of the FENWAY antennas, and perhaps even placement and routing of host device functions. This evaluation should be performed for all FENWAY operating bands.

4.5 Antenna considerations

As mentioned in Section 4.4, the location of the antenna elements is critical to FENWAY RF performance. Routing the connecting coaxial cables could also impact FENWAY performance; they should be routed away from corruptive noise sources (like the switching-mode power supplies, LCD assemblies, microprocessor, memory, etc.).

5 Standards and Regulatory Compliance

5.1 Standards and certification

The Fenway module conforms to the following standards and certification requirements:

- UMTS (WCDMA)
  - TS 25.101
- GSM
  - TS 45.005
- BT
  - RF.TS/2.1.E.0
- WLAN
  - 802.11 b & g
- FCC
  - 47 CFR Part 1 – RF radiation exposure limits
  - 47 CFR Part 2 – Equipment authorization
  - 47 CFR Part 15 – Unintentional and Intentional radiators
  - 47 CFR Part 22 – Cellular
  - 47 CFR Part 24 – PCS
  - 47 CFR Part 27 - Wireless Communication Services
- CE
  - EMC protection requirements
    - EN 301 489-1 – Common technical requirements
    - EN 301 489-7 – GSM and DCS
    - EN 301 489-24 – WCDMA 2100
    - EN 301 489-17 - WLAN & BT
  - Effective use of spectrum to avoid unwanted interference requirements
    - EN 301 908-1 – General requirements
    - EN 301 908-2 – WCDMA 2100
    - EN 301 511 – GSM900/GSM1800

  - EN 301 607-1 – GSM900/GSM1800
  - EN 300 328 - WLAN & BT
- CTIA/GCF/PTCRB
- Safety
  - EN 50360/61 full carrier certification (carriers TBD)
- RoHS compliance

5.2 Regulatory information

5.2.1 Safety warnings

Do not operate the Fenway module in the following environments:

- In active blasting areas
- In potentially explosive environments such as refuelling points, fuel depots, or chemical plants
- Near medical equipment, especially life support equipment that might be susceptible to radio interference
- In an aircraft as follows:
  - Fenway module transmissions could interfere with aircraft electrical and communication systems. Like cell phones, using the Fenway module in an aircraft is illegal in some jurisdictions.
  - If cell phone usage is permitted while the aircraft is on the ground, normal Fenway module operation is permitted as well.

5.2.2 North American compliance

The Fenway module has been authorized for mobile operation in North America. The initial authorization grant does not permit end-user installation.

For mobile applications, the following conditions must be met:

1. Maintain at least a 20 cm separation between the antenna and the user's body.
2. Radiated transmit power must be equal to or lower than that specified in the FCC Grant of Equipment Authorization for FCC ID: J9CUFENWAY-1.
3. To comply with FCC/IC regulations limiting both maximum RF output power and human exposure to RF radiation, maximum antenna gain (including cable loss) must not exceed:
   - Cellular band < 0 dBi
   - AWS band < 0 dBi
   - PCS band < 0 dBi

- UMTS band < 0 dBi
- ISM band < 2.0 dBi

4. Independent Fenway module operation — the Fenway module must not be co-located or jointly operated with any other transmitter or antenna within the host device.
5. A label with the following statements must be attached to the host end product:
   - This device contains Tx FCC ID: J9CFENWAY-1
   - This equipment contains equipment certified under IC: 2723A-FENWAY-1
6. The host end product must include a user manual that clearly defines operating requirements and conditions that must be observed to ensure compliance with current FCC/IC RF exposure guidelines.
7. The host end product must also pass the FCC Part 15 unintentional emission testing requirement and be properly authorized per FCC Part 15.

For portable devices, in addition to conditions 3 through 6 described above, a separate approval is required to satisfy the SAR requirements of FCC Part 2.1093 and IC RSS-102.

5.2.3 EU compliance

The technical construction file of the Fenway module has been approved by the CCS notify body. The product is in conformity with the following standards for mobile operation in the EU:

- EN 301 489 -01
- EN 301 489 -07
- EN 301 489 - 17
- EN 301 489 -24
- EN 301 511
- EN 301 908 -01
- EN 301 908 -02
- EN 300 328
- EN 50360

A CE mark shall be attached to the product.