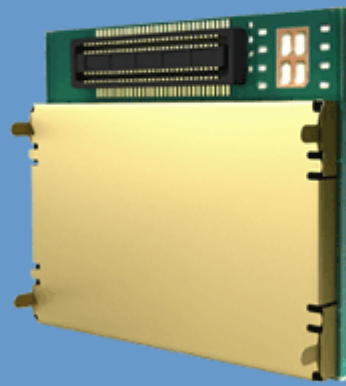




CINTERION
WIRELESS MODULES

BG2-E/BG2-W

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Hardware Interface Overview

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1 Introduction

This document¹ describes the hardware of the BG2-E/BG2-W module that connects to the cellular device application and the air interface. It helps you quickly retrieve interface specifications, electrical and mechanical details and information on the requirements to be considered for integrating further components.

1.1 Related documents

[1] BG2-E/BG2-W AT Command Set

[2] BG2-E/BG2-W Release Notes

Prior to using the BG2-E/BG2-W modules or upgrading to a new firmware release, please carefully read the latest product information.

For further information visit the Cinterion Wireless Modules Website:

<http://www.cinterion.com>

¹ The document is effective only if listed in the appropriate Release Notes as part of the technical documentation delivered with your Cinterion Wireless Modules product.

1.2 Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
ANSI	American National Standards Institute
ARP	Antenna Reference Point
ASC0 / ASC1	Asynchronous Serial Controller. Abbreviations used for first and second serial interface of BG2-E/BG2-W
ASIC	Application Specific Integrated Circuit
B	Thermistor Constant
B2B	Board-to-board connector
BER	Bit Error Rate
BTS	Base Transceiver Station
CB or CBM	Cell Broadcast Message
CE	Conformité Européene (European Conformity)
CPU	Central Processing Unit
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DAC	Digital-to-Analog Converter
DAI	Digital Audio Interface
dBm0	Digital level, 3.14dBm0 corresponds to full scale, see ITU G.711, A-law
DCE	Data Communication Equipment (typically modems, e.g. GSM module)
DCS 1800	Digital Cellular System, also referred to as PCN
DRX	Discontinuous Reception
DSB	Development Support Box
DSP	Digital Signal Processor
DSR	Data Set Ready
DTE	Data Terminal Equipment (typically computer, terminal, printer or, for example, GSM application)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
FCC	Federal Communications Commission (U.S.)

Abbreviation	Description
FDMA	Frequency Division Multiple Access
FR	Full Rate
GMSK	Gaussian Minimum Shift Keying
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HiZ	High Impedance
HR	Half Rate
I/O	Input/Output
IC	Integrated Circuit
IMEI	International Mobile Equipment Identity
ISO	International Standards Organization
ITU	International Telecommunications Union
kbps	kbits per second
	Light Emitting Diode
Li-Ion	Lithium-Ion
Mbps	Mbits per second
MMI	Man Machine Interface
MO	Mobile Originated
MS	Mobile Station (GSM module), also referred to as TE
MSISDN	Mobile Station International ISDN number
MT	Mobile Terminated
MTTF	Mean time to failure
NTC	Negative Temperature Coefficient
OEM	Original Equipment Manufacturer
PA	Power Amplifier
PBCCH	Packet Switched Broadcast Control Channel
PCB	Printed Circuit Board
PCL	Power Control Level
PCM	Pulse Code Modulation
PCN	Personal Communications Network, also referred to as DCS 1800
PCS	Personal Communication System, also referred to as GSM 1900
PDU	Protocol Data Unit
PPP	Point-to-point protocol
PSU	Power Supply Unit
R&TTE	Radio and Telecommunication Terminal Equipment
RAM	Random Access Memory

Abbreviation	Description
RF	Radio Frequency
RMS	Root Mean Square (value)
ROM	Read-only Memory
RTC	Real Time Clock
Rx	Receive Direction
SAR	Specific Absorption Rate
SELV	Safety Extra Low Voltage
SIM	Subscriber Identification Module
SMS	Short Message Service
SRAM	Static Random Access Memory
TA	Terminal adapter (e.g. GSM module)
TDMA	Time Division Multiple Access
TE	Terminal Equipment, also referred to as DTE
Tx	Transmit Direction
UART	Universal asynchronous receiver-transmitter
URC	Unsolicited Result Code
USSD	Unstructured Supplementary Service Data
VSWR	Voltage Standing Wave Ratio

1.3 Regulatory and Type Approval Information

1.3.1 Directives and Standards

BG2-E/BG2-W has been designed to comply with the directives and standards listed below. It is the responsibility of the application manufacturer to ensure compliance of the final product with all provisions of the applicable directives and standards as well as with the technical specifications provided in the "BG2-E/BG2-W Hardware Interface Description".²

Table 1: Directives



1999/05/EC	Directive of the European Parliament and of the council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (in short referred to as R&TTE Directive 1999/5/EC). The product is labeled with the CE conformity mark CE 0682
2002/95/EC	Directive of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) 

Table 2: Standards of North American type approval¹

CFR Title 47	Code of Federal Regulations, Part 22 and Part 24 (Telecommunications, PCS); US Equipment Authorization FCC
UL 60 950-1	Product Safety Certification (Safety requirements) 
NAPRD.03 V5.1	Overview of PCS Type certification review board Mobile Equipment Type Certification and IMEI control PCS Type Certification Review board (PTCRB)
RSS132 (Issue2) RSS133 (Issue5)	Canadian Standards

¹: Applies for the quad band module variant BG2-W only.

Table 3: Standards of European type approval

3GPP TS 51.010-1	Digital cellular telecommunications system (Phase 2); Mobile Station (MS) conformance specification
ETSI EN 301 511 V9.0.2	Candidate Harmonized European Standard (Telecommunications series) Global System for Mobile communications (GSM); Harmonized standard for mobile stations in the GSM 900 and DCS 1800 bands covering essential requirements under article 3.2 of the R&TTE directive (1999/5/EC) (GSM 13.11 version 7.0.1 Release 1998)
GCF-CC V3.39	Global Certification Forum - Certification Criteria
ETSI EN 301 489-1 V1.8.1	Candidate Harmonized European Standard (Telecommunications series) Electro Magnetic Compatibility and Radio spectrum Matters (ERM); Electro Magnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common Technical Requirements

²: Manufacturers of applications which can be used in the US shall ensure that their applications have a PTCRB approval. For this purpose they can refer to the PTCRB approval of the respective module.

Table 3: Standards of European type approval

ETSI EN 301 489-7 V1.3.1	Candidate Harmonized European Standard (Telecommunications series) Electro Magnetic Compatibility and Radio spectrum Matters (ERM); Electro Magnetic Compatibility (EMC) standard for radio equipment and services; Part 7: Specific conditions for mobile and portable radio and ancillary equipment of digital cellular radio telecommunications systems (GSM and DCS)
EN 60950-1:2006	Safety of information technology equipment

Table 4: Requirements of quality

IEC 60068	Environmental testing
DIN EN 60529	IP codes

Table 5: Standards of the Ministry of Information Industry of the People's Republic of China


SJ/T 11363-2006	“Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products” (2006-06).
SJ/T 11364-2006	<p>“Marking for Control of Pollution Caused by Electronic Information Products” (2006-06).</p> <p>According to the “Chinese Administration on the Control of Pollution caused by Electronic Information Products” (ACPEIP) the EPUP, i.e., Environmental Protection Use Period, of this product is 20 years as per the symbol shown here, unless otherwise marked. The EPUP is valid only as long as the product is operated within the operating limits described in the Cinterion Wireless Modules Hardware Interface Description.</p> <p>Please see Table 6 for an overview of toxic or hazardous substances or elements that might be contained in product parts in concentrations above the limits defined by SJ/T 11363-2006.</p> 

Table 6: Toxic or hazardous substances or elements with defined concentration limits

部件名称 Name of the part	有毒有害物质或元素 Hazardous substances					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
金属部件 (Metal Parts)	○	○	○	○	○	○
电路模块 (Circuit Modules)	X	○	○	○	○	○
电缆及电缆组件 (Cables and Cable Assemblies)	○	○	○	○	○	○
塑料和聚合物部件 (Plastic and Polymeric parts)	○	○	○	○	○	○

O:
表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 标准规定的限量要求以下。
Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.

X:
表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006标准规定的限量要求。
Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part *might exceed* the limit requirement in SJ/T11363-2006.

1.3.2 SAR Requirements Specific to Portable Mobiles

Mobile phones, PDAs or other portable transmitters and receivers incorporating a GSM module must be in accordance with the guidelines for human exposure to radio frequency energy. This requires the Specific Absorption Rate (SAR) of portable BG2-E/BG2-W based applications to be evaluated and approved for compliance with national and/or international regulations.

Since the SAR value varies significantly with the individual product design manufacturers are advised to submit their product for approval if designed for portable use. For European and US³ markets the relevant directives are mentioned below. It is the responsibility of the manufacturer of the final product to verify whether or not further standards, recommendations or directives are in force outside these areas.

Products intended for sale on US markets³

ES 59005/ANSI C95.1 Considerations for evaluation of human exposure to Electro-magnetic Fields (EMFs) from Mobile Telecommunication Equipment (MTE) in the frequency range 30MHz - 6GHz

Products intended for sale on European markets

EN 50360: Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electro-magnetic fields (300MHz - 3GHz)







1.3.3 SELV Requirements

The power supply connected to the BG2-E/BG2-W module shall be in compliance with the SELV requirements defined in EN 60950-1.

³. Applies for the quad band module variant BG2-W only.

1.3.4 Safety Precautions

The following safety precautions must be observed during all phases of the operation, usage, service or repair of any cellular terminal or mobile incorporating BG2-E/BG2-W. Manufacturers of the cellular terminal are advised to convey the following safety information to users and operating personnel and to incorporate these guidelines into all manuals supplied with the product. Failure to comply with these precautions violates safety standards of design, manufacture and intended use of the product. Cinterion Wireless Modules GmbH assumes no liability for customer failure to comply with these precautions.

	<p>When in a hospital or other health care facility, observe the restrictions on the use of mobiles. Switch the cellular terminal or mobile off, if instructed to do so by the guidelines posted in sensitive areas. Medical equipment may be sensitive to RF energy.</p> <p>The operation of cardiac pacemakers, other implanted medical equipment and hearing aids can be affected by interference from cellular terminals or mobiles placed close to the device. If in doubt about potential danger, contact the physician or the manufacturer of the device to verify that the equipment is properly shielded. Pacemaker patients are advised to keep their hand-held mobile away from the pacemaker, while it is on.</p>
	<p>Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it cannot be switched on inadvertently. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communications systems. Failure to observe these instructions may lead to the suspension or denial of cellular services to the offender, legal action, or both.</p>
	<p>Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.</p>
	<p>Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. Remember that interference can occur if it is used close to TV sets, radios, computers or inadequately shielded equipment. Follow any special regulations and always switch off the cellular terminal or mobile wherever forbidden, or when you suspect that it may cause interference or danger.</p>
	<p>Road safety comes first! Do not use a hand-held cellular terminal or mobile when driving a vehicle, unless it is securely mounted in a holder for handsfree operation. Before making a call with a hand-held terminal or mobile, park the vehicle.</p> <p>Handsfree devices must be installed by qualified personnel. Faulty installation or operation can constitute a safety hazard.</p>
	<p>IMPORTANT! Cellular terminals or mobiles operate using radio signals and cellular networks. Because of this, connection cannot be guaranteed at all times under all conditions. Therefore, you should never rely solely upon any wireless device for essential communications, for example emergency calls. Remember, in order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength. Some networks do not allow for emergency calls if certain network services or phone features are in use (e.g. lock functions, fixed dialling etc.). You may need to deactivate those features before you can make an emergency call. Some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.</p>

2 Product Concept

2.1 BG2-E/BG2-W Key Features at a Glance

Feature	Implementation
<i>General</i>	
Frequency bands	Dual band (BG2-E): GSM 900/1800MHz Quad band (BG2-W): GSM 850/900/1800/1900MHz
GSM class	Small MS
Output power (according to Release 99, V5)	Class 4 (+33dBm ±2dB) for EGSM850 (quad band only) Class 4 (+33dBm ±2dB) for EGSM900 Class 1 (+30dBm ±2dB) for GSM1800 Class 1 (+30dBm ±2dB) for GSM1900 (quad band only)
Power supply	$3.3V \leq V_{BATT+} \leq 4.5V$
Ambient operating temperature according to IEC 60068-2	Normal operation: -30°C to +85°C Restricted operation: -40°C to -30°C and +85°C to +90°C
Physical	Dimensions: 31mm x 26.7mm x 3mm (5.4mm with soldering tags) Weight: approx. 5g
RoHS	All hardware components fully compliant with EU RoHS Directive
<i>GSM / GPRS features</i>	
Data transfer	GPRS: <ul style="list-style-type: none"> • Multislot Class 8 (dual band) or 10 (quad band) • Full PBCCH support • Mobile Station Class B • Coding Scheme 1 – 4 CSD: <ul style="list-style-type: none"> • V.110, RLP, non-transparent • 2.4, 4.8, 9.6kbps • USSD PPP-stack for GPRS data transfer
SMS	Point-to-point MT and MO Cell broadcast Text and PDU mode Storage: SIM card plus 25 SMS locations in mobile equipment Transmission of SMS alternatively over CSD or GPRS. Preferred mode can be user defined.
Fax	Group 3; Class 1
Audio	Speech codecs: <ul style="list-style-type: none"> • Half Rate (ETS 06.20) • Full Rate (ETS 06.10) • Enhanced Full Rate (ETS 06.50 / 06.60 / 06.80) • Adaptive Multi Rate AMR Handsfree operation, echo cancellation, noise reduction, 7 different ringing tones / melodies

BG2-E/BG2-W Hardware Interface Overview

2.1 BG2-E/BG2-W Key Features at a Glance



Feature	Implementation
<i>Software</i>	
AT commands	Hayes 3GPP TS 27.007, TS 27.005, Cinterion Wireless Modules
SIM Application Toolkit	Supports SAT class 3, GSM 11.14 Release 99, support of letter class "c"
Firmware update	Windows executable for update over serial interface ASC0
<i>Interfaces</i>	
2 serial interfaces	<p>ASC0:</p> <ul style="list-style-type: none"> 8-wire modem interface with status and control lines, unbalanced, asynchronous Fixed bit rates: 1,200bps to 230,400bps Autobauding: 1,200bps to 230,400bps Supports RTS0/CTS0 hardware handshake and software XON/XOFF flow control. <p>ASC1:</p> <ul style="list-style-type: none"> 4-wire, unbalanced asynchronous interface Fixed bit rates: 1,200bps to 230,000bps Supports RTS1/CTS1 hardware handshake and software XON/XOFF flow control
Audio	1 analog interface, with microphone feeding
SIM interface	Supported SIM cards: 3V, 1.8V External SIM card reader has to be connected via interface connector (note that card reader is not part of BG2-E/BG2-W)
GPIO interface	GPIO interface with 10 GPIO lines. The GPIO interface is shared with an I ² C interface, signalling and PWM functionality.
Antenna	50Ω. External antenna can be connected via board-to-board connector
Module interface	60-pin board-to-board connector
<i>Power on/off, Reset</i>	
Power on/off	Switch-on by hardware pin ON Switch-off by AT command (AT^SMSO) Automatic switch-off in case of critical temperature and voltage conditions
Reset	Orderly shutdown and reset by AT command
<i>Special features</i>	
Real time clock	Timer functions via AT commands
Phonebook	SIM and phone
TTY/CTM support	Integrated CTM modem
<i>Evaluation kit</i>	
DSB75	DSB75 Evaluation board designed to test and type approve Cinterion Wireless Module and provide a sample configuration for application engineering. A special adapter is required to connect the module to the DSB75.

3 Application Interface

BG2-E/BG2-W is equipped with a 60-pin board-to-board connector that connects to the external application and incorporates several sub-interfaces: power supply, SIM interface, serial interface ASC0, serial interface ASC1, analog audio interface, GPIO interface, I²C interface and PWM interface (for details see [Chapter 2](#) and [Section 5.5](#)).

3.1 Operating Modes

The table below briefly summarizes the various operating modes referred to in the following sections.

Table 7: Overview of operating modes

Mode	Function	
Normal operation	GSM / GPRS SLEEP	<p>Various powersave modes set with AT+CFUN command.</p> <p>Software is active to minimum extent. If the module was registered to the GSM network in IDLE mode, it is registered and paging with the BTS in SLEEP mode, too. Power saving can be chosen at different levels: The NON-CYCLIC SLEEP mode (AT+CFUN=0) disables the AT interface. The CYCLIC SLEEP modes AT+CFUN=7 and 9 alternately activate and deactivate the AT interfaces to allow permanent access to all AT commands.</p>
	GSM IDLE	<p>Software is active. Once registered to the GSM network, paging with BTS is carried out. The module is ready to send and receive.</p>
	GSM TALK	<p>Connection between two subscribers is in progress. Power consumption depends on network coverage individual settings, such as DTX off/on, FR/EFR/HR, hopping sequences, antenna.</p>
	GPRS IDLE	<p>Module is ready for GPRS data transfer, but no data is currently sent or received. Power consumption depends on network settings and GPRS configuration (e.g. multislot settings).</p>
	GPRS DATA	<p>GPRS data transfer in progress. Power consumption depends on network settings (e.g. power control level), uplink / downlink data rates and GPRS configuration (e.g. used multislot settings).</p>
Power Down	<p>Normal shutdown after sending the AT^SMSO command. Only a voltage regulator is active for powering the RTC. Software is not active. Interfaces are not accessible. Operating voltage (connected to BATT+) remains applied.</p>	
Alarm mode	<p>Restricted operation launched by RTC alert function while the module is in Power Down mode. Module will not be registered to GSM network. Limited number of AT commands is accessible.</p>	

4 Antenna Interface

The RF interface has an impedance of 50Ω. BG2-E/BG2-W is capable of sustaining a total mismatch at the antenna lines without any damage, even when transmitting at maximum RF power.

The external antenna must be matched properly to achieve best performance regarding radiated power, DC-power consumption and harmonic suppression. Matching networks are not included on the BG2-E/BG2-W PCB and should be placed in the host application.

Regarding the return loss BG2-E/BG2-W provides the following values:

Table 8: Return loss

State of module	Return loss of module	Recommended return loss of application
Receive	≥ 8dB	≥ 12dB
Transmit	not applicable	≥ 12dB
Idle	≤ 5dB	not applicable

The connection of the antenna or other equipment must be decoupled from DC voltage. This is necessary because the antenna connector is DC coupled to ground via an inductor for ESD protection.

5 Electrical, Reliability and Radio Characteristics

5.1 Absolute Maximum Ratings

Absolute maximum ratings for supply voltage and voltages on digital and analog pins of BG2-E/BG2-W are listed in [Table 9](#). Exceeding these values will cause permanent damage to BG2-E/BG2-W.

Table 9: Absolute maximum ratings

Parameter	Min	Max	Unit
Supply voltage BATT+	-0.3	+6.0	V
Voltage at all digital pins in Power Down mode	-0.3	+0.3	V
Voltage at digital pins 1.8V domain in normal operation	-0.3	+2.2	V
Voltage at digital pins VDIG domain (1.8V) in normal operation	-0.3	+2.2	V
Voltage at digital pins VDIG domain (2.85V) in normal operation	-0.3	+3.3	V
Voltage at SIM interface, CCVCC 1.8V in normal Operation	-0.3	+2.2	V
Voltage at SIM interface, CCVCC 2.85V in normal Operation	-0.3	+3.3	V
Voltage at analog pins in normal operation	-0.3	+3.0	V
Voltage at analog pins in Power Down mode	-0.3	+0.3	V
VDDL	-0.3	+2.5	V

5.2 Operating Temperatures

Please note that the module’s lifetime, i.e., the MTTF (mean time to failure) may be reduced, if operated outside the restricted temperature range. A special URC reports whether the module enters or leaves the restricted temperature range (see [1]; AT^SCTM).

Table 10: Board temperature

Parameter	Min	Typ	Max	Unit
Normal operation	-30	+25	+85	°C
Restricted operation	-40 to -30		+85 to +90	°C
Automatic shutdown ¹ Temperature measured on BG2-E/BG2-W board	<-40	---	>+90	°C

¹. Due to temperature measurement uncertainty, a tolerance of ±3°C on the thresholds may occur.

Table 11: Ambient temperature according to IEC 60068-2 (w/o forced air circulation)

Parameter	Min	Typ	Max	Unit
GSM Call @ max. RF-Power	-40		+75	°C
GPRS Class 8 @ max. RF-Power	-40		+75	°C
GPRS Class 10 @ max. RF-Power (quad band only)	-40		+60	°C

Table 12: Ambient temperature with forced air circulation (air speed 0.9m/s)

Parameter	Min	Typ	Max	Unit
GSM Call @ max. RF-Power	-40		+80	°C
GPRS Class 8 @ max. RF-Power	-40		+80	°C
GPRS Class 10 @ max. RF-Power (quad band only)	-40		+70	°C

Note that within the specified operating temperature ranges the board temperature may vary to a great extent depending on operating mode, used frequency band, radio output power and current supply voltage.

When data are transmitted over GPRS the quad band module variant automatically reverts to a lower Multislot Class if the temperature rises to the limit specified for normal operation and, vice versa, returns to the higher Multislot Class if the temperature is back to normal.

5.3 Storage Conditions

The conditions stated below are only valid for modules in their original packed state in weather protected, non-temperature-controlled storage locations. Normal storage time under these conditions is 12 months maximum.

Table 13: Storage conditions

Type	Condition	Unit	Reference
Air temperature: Low High	-40 +85	°C	ETS 300 019-2-1: T1.2, IEC 60068-2-1 Ab ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb
Humidity relative: Low High Condens.	10 90 at 30°C 90-100 at 30°C	%	--- ETS 300 019-2-1: T1.2, IEC 60068-2-56 Cb ETS 300 019-2-1: T1.2, IEC 60068-2-30 Db
Air pressure: Low High	70 106	kPa	IEC TR 60271-3-1: 1K4 IEC TR 60271-3-1: 1K4
Movement of surrounding air	1.0	m/s	IEC TR 60271-3-1: 1K4
Water: rain, dripping, icing and frosting	Not allowed	---	---
Radiation: Solar Heat	1120 600	W/m ²	ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb
Chemically active substances	Not recommended		IEC TR 60271-3-1: 1C1L
Mechanically active substances	Not recommended		IEC TR 60271-3-1: 1S1
Vibration sinusoidal: Displacement Acceleration Frequency range	1.5 5 2-9 9-200	mm m/s ² Hz	IEC TR 60271-3-1: 1M2
Shocks: Shock spectrum Duration Acceleration	semi-sinusoidal 1 50	ms m/s ²	IEC 60068-2-27 Ea

5.4 Reliability Characteristics

The test conditions stated below are an extract of the complete test specifications.

Table 14: Summary of reliability test conditions

Type of test	Conditions	Standard
Vibration	Frequency range: 10-20 Hz; acceleration: 3.1mm amplitude Frequency range: 20-500 Hz; acceleration: 5g Duration: 2h per axis = 10 cycles; 3 axes	DIN IEC 60068-2-6
Shock half-sinus	Acceleration: 500g Shock duration: 1msec 1 shock per axis 6 positions (\pm x, y and z)	DIN IEC 60068-2-27
Dry heat	Temperature: $+70 \pm 2^{\circ}\text{C}$ Test duration: 16 h Humidity in the test chamber: < 50%	EN 60068-2-2 Bb ETS 300019-2-7
Temperature change (shock)	Low temperature: $-40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ High temperature: $+85^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Changeover time: < 30s (dual chamber system) Test duration: 1 h Number of repetitions: 100	DIN IEC 60068-2-14 Na ETS 300019-2-7
Damp heat cyclic	High temperature: $+55^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Low temperature: $+25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Humidity: 93% \pm 3% Number of repetitions: 6 Test duration: 12h + 12h	DIN IEC 60068-2-30 Db ETS 300019-2-5
Cold (constant exposure)	Temperature: $-40 \pm 2^{\circ}\text{C}$ Test duration: 16 h	DIN IEC 60068-2-1

5.5 Pin Assignment

The Molex board-to-board connector on BG2-E/BG2-W is a 60-pin double-row receptacle. The names of the pins are listed in the following [Figure 1](#), the board-to-board connector and position of pins are shown in [Figure 2](#).

31	GND	GND	30
32	GND	GND	29
33	GND	ANT	28
34	GND	ANT	27
35	GND	GND	26
36	GND	GND	25
37	RTS1	BATT+	24
38	CTS1	BATT+	23
39	RXD1	BATT+	22
40	TXD1	BATT+	21
41	AGND	DTR0	20
42	MICN	DCD0	19
43	MICP	Do not use	18
44	VMIC	DSR0	17
45	EPN	V180	16
46	EPP	V285	15
47	GND	VDIG	14
48	ADC1	RXD0	13
49	ON	TXD0	12
50	GPIO1	CTS0	11
51	GPIO2	RTS0	10
52	GPIO3	RING0	9
53	GPIO4	CCCLK	8
54	GPIO5 /	CCVCC	7
55	GPIO6 / PWM2	CCIO	6
56	GPIO7 / PWM1	CCIN	5
57	GPIO8	CCRST	4
58	GPIO9 / I2CDAT	Do not use	3
59	GPIO10 / I2CCLK	GND	2
60	VDDL	EMERG_RST	1

Figure 1: Pin assignment

5.6 Power Supply Ratings

Table 15: Power supply ratings¹

Parameter	Description	Conditions	Min	Typ	Max	Unit
BATT+	Supply voltage	Voltage must stay within the min/max values, including voltage drop, ripple and spikes.	3.3	4.0	4.5	V
	Voltage drop during transmit burst	Normal condition, power control level for P _{out max}			400	mV
	Voltage ripple	Normal condition, power control level for P _{out max} @ f ≤ 250kHz @ f > 250kHz			85 25	mVpp
I _{VDDL}	OFF state supply current	RTC backup @ BATT+ = 0V @ VDDL = 2.3V		8.0		µA
		Power Down mode		45		µA
I _{BATT+}	Average supply current	SLEEP mode, GSM ² @ DRX = 2 @ DRX = 5 @ DRX = 9		2.1 1.5 1.1		mA
		SLEEP mode, GPRS ² @ DRX = 2 @ DRX = 5 @ DRX = 9		2.2 1.5 1.2		mA
		IDLE mode ²		8.6		mA
		TALK mode GSM GSM850/EGSM 900 ³ GSM 1800/1900 ⁴		200 150		mA
		DATA mode GPRS 1 TX, 4 Rx GSM 850/EGSM 900 ³ GSM 1800/1900 ⁴		180 145		mA
		DATA mode GPRS 2 Tx, 3 Rx GSM 850/EGSM 900 ³ GSM 1800/1900 ⁴		330 260		mA
	Peak supply current (during transmission slot every 4.6ms)	Power Control Level GSM 850/EGSM 900 ³ GSM 1800/1900 ⁴		1.30 0.95	1.35 0.97	A

1. GSM850 and GSM1900 bands are applicable for the quad band module variant BG2-W only.

2. Measurements start 3 minutes after the module was switched ON, Averaging times: SLEEP mode - 3 minutes; IDLE mode - 1.5 minutes, Communication tester settings: no neighbour cells, no cell reselection etc.

3. Power control level PCL 5

4. Power control level PCL 0

6 Mechanics

The following sections describe the mechanical dimensions of BG2-E/BG2-W and give recommendations for integrating BG2-E/BG2-W into the host application.

6.1 Mechanical Dimensions of BG2-E/BG2-W

Figure 2 shows the top view on BG2-E/BG2-W and provides an overview of the mechanical dimensions of the board.

Length: 31.00mm
 Width: 26.70mm
 Height: 3.05mm (5.37mm with soldering tags)

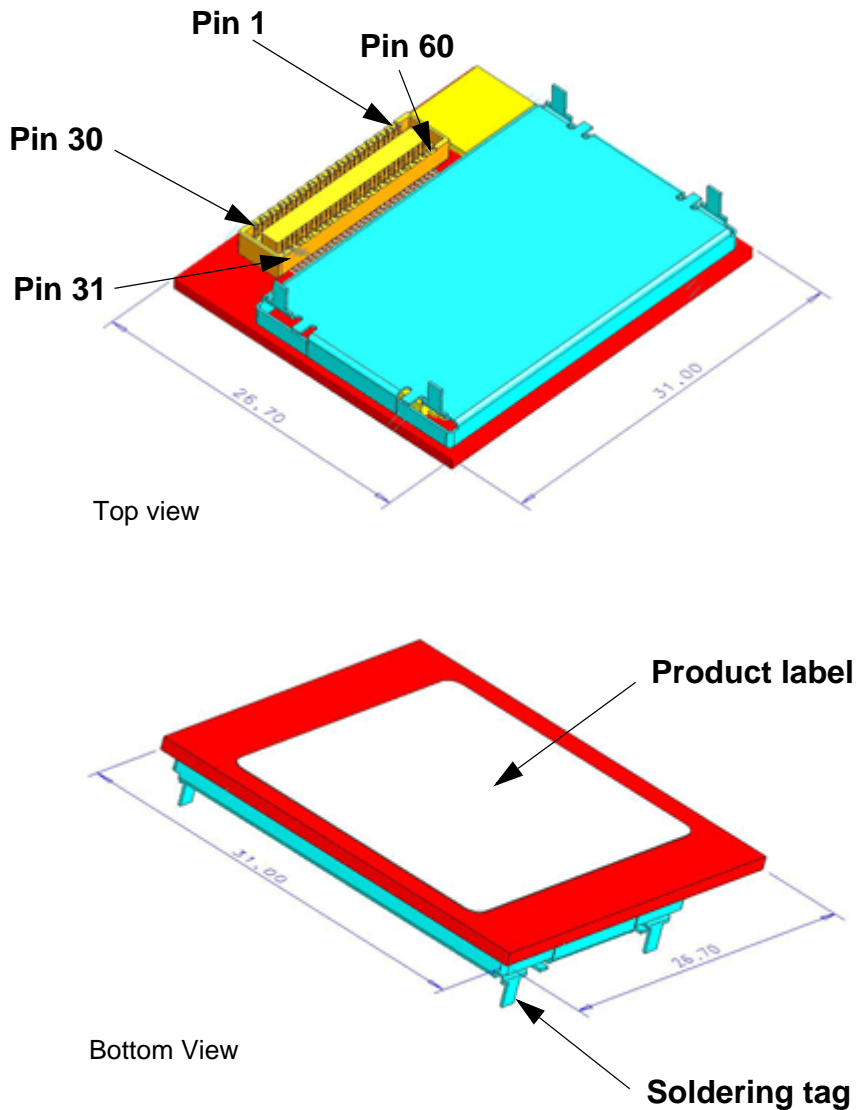


Figure 2: BG2-E/BG2-W – top and bottom view

6.2 Board-to-Board Connector

This section provides specifications for the 60-pin board-to-board connector which serves as physical interface to the host application. The receptacle assembled on the BG2-E/BG2-W PCB is of type Molex 54102-0604 (for dimensions see Figure 3). A mating header would be the Molex type 53885-0608 (see Figure 4)

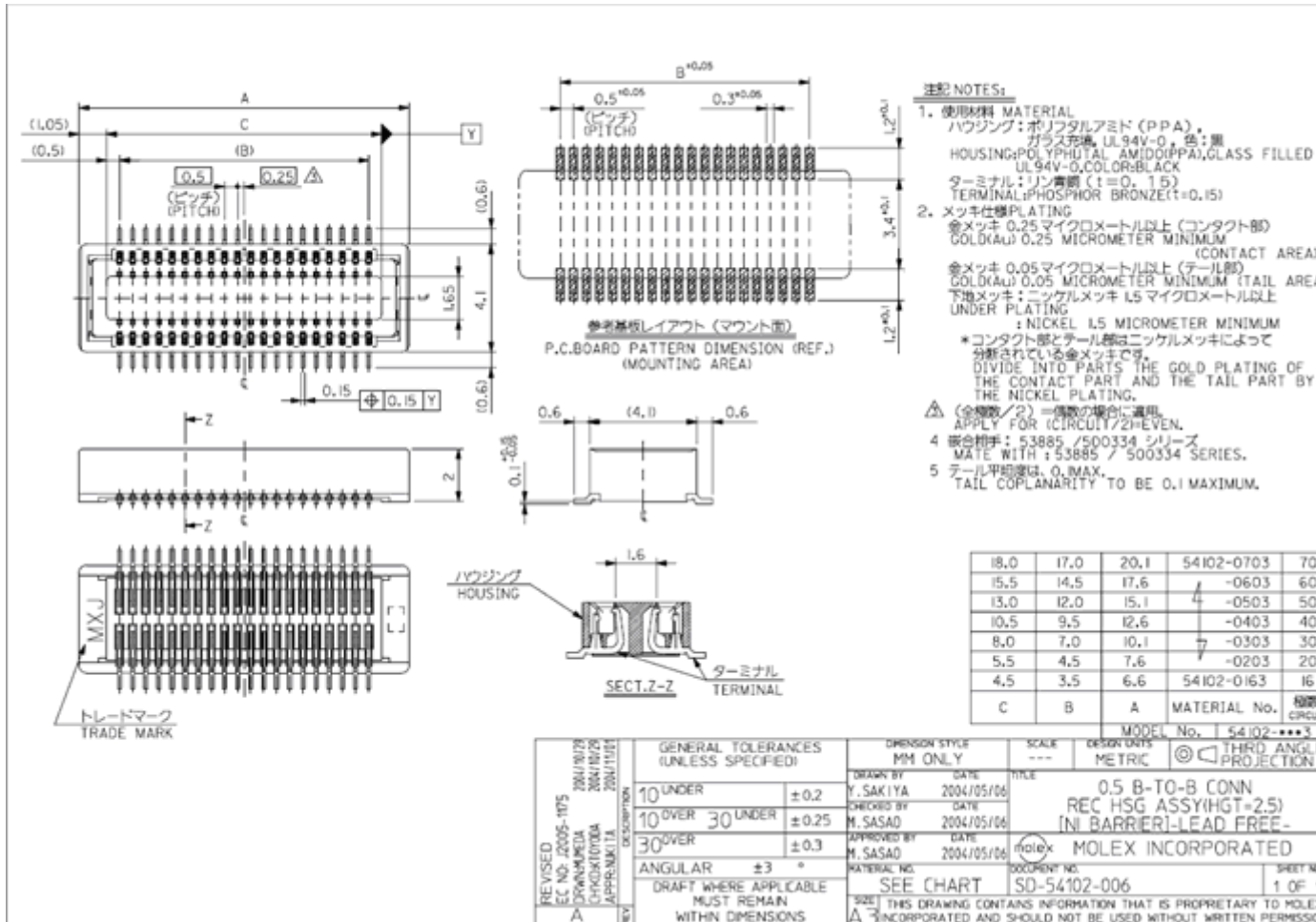


Figure 3: Mechanical dimensions of Molex 54102-0604 connector on BG2-E/BG2-W

BG2-E/BG2-W Hardware Interface Overview

6.2 Board-to-Board Connector

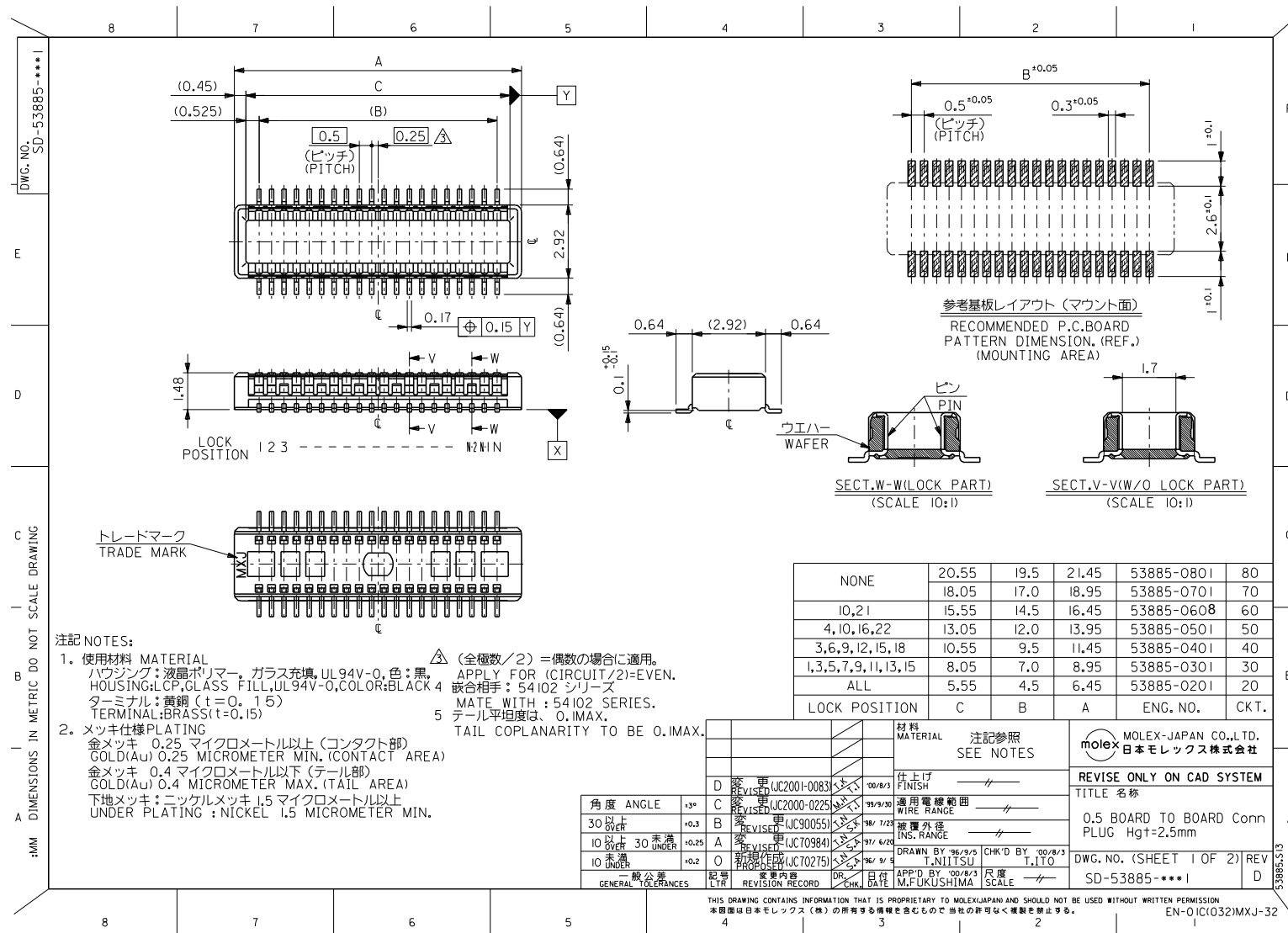


Figure 4: Mechanical dimensions of Molex 53885-0608 connector on application

7 Reference Approval

7.1 Reference Equipment for Type Approval

The Cinterion Wireless Modules reference setup submitted to type approve BG2-E/BG2-W is shown in the following figure.

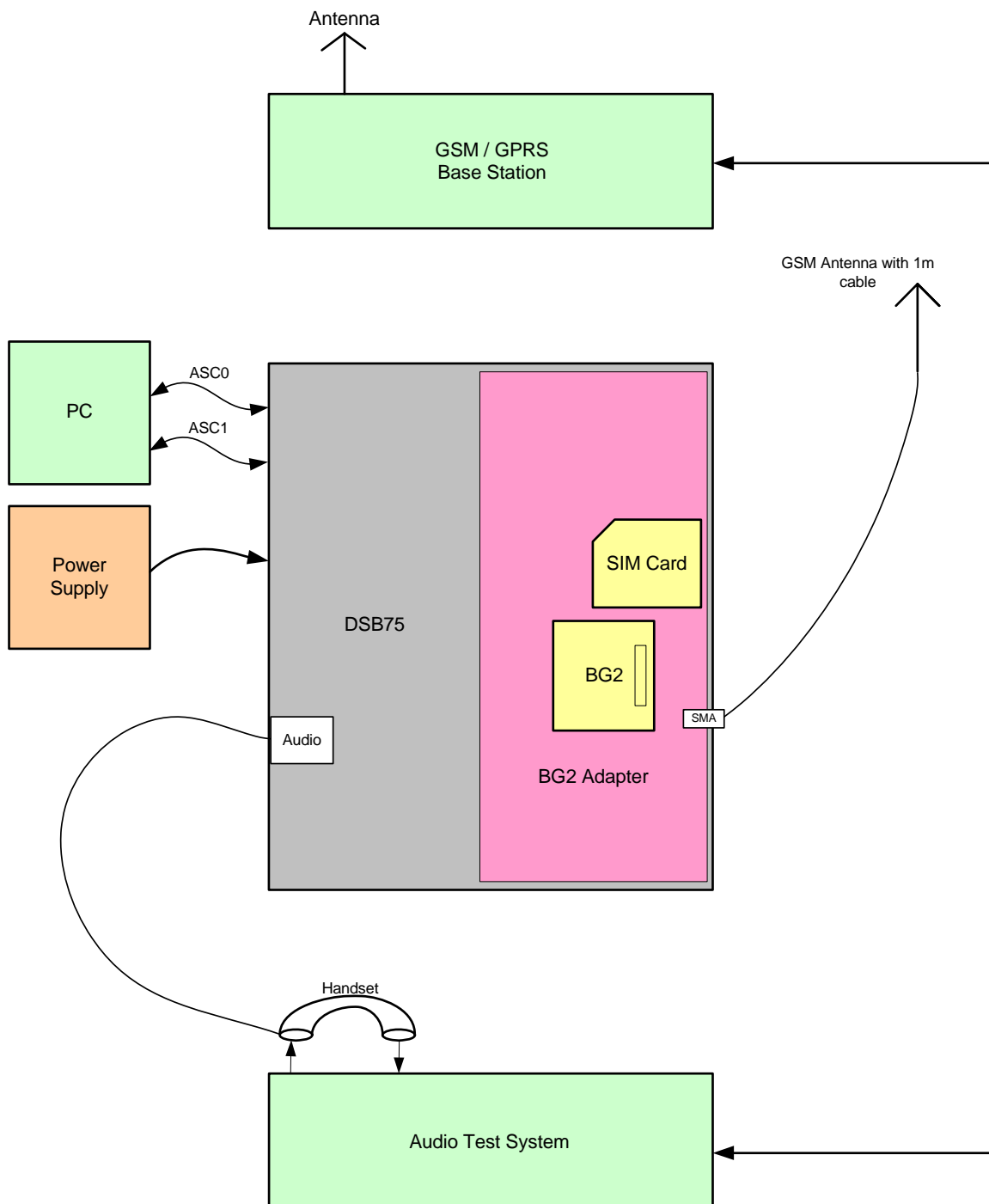


Figure 5: Reference equipment for approval

7.2 Compliance with FCC Rules and Regulations

The Equipment Authorization Certification for the Cinterion Wireless Modules reference application described in [Section 7.1](#) will be registered under the following identifiers⁴:

FCC Identifier: QIPBG2

Industry Canada Certification Number: 7830A-BG2

Granted to Cinterion Wireless Modules GmbH

Manufacturers of mobile or fixed devices incorporating BG2-W modules are authorized to use the FCC Grants and Industry Canada Certificates of the BG2-W modules for their own final products according to the conditions referenced in these documents. In this case, the FCC label of the module shall be visible from the outside, or the host device shall bear a second label stating "Contains FCC ID QIPBG2", and accordingly "Contains IC 7830A-BG2".

IMPORTANT:

Manufacturers of portable applications incorporating BG2-W modules are required to have their final product certified and apply for their own FCC Grant and Industry Canada Certificate related to the specific portable mobile. This is mandatory to meet the SAR requirements for portable mobiles (see [Section 1.3.2](#) for detail).

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

⁴. Applies only for the quad band module variant BG2-W.