
Q3095M Bluetooth Module

Datasheet

Mode: Q3095M

FCC ID: 2BUEN-Q3095M

Version: V1.1

2024-03-08

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1. Feature

- Qualified to Bluetooth v6.1 specification
- Dual 240 MHz Qualcomm® Kalimba™ audio DSP
- 32/80 MHz Developer Processor for applications
- Firmware Processor for system
- Flexible QSPI flash programmable platform
- High-performance 24-bit stereo audio interface
- Digital and analog microphone interfaces
- Flexible LED controller and LED pins with PWM support
- Serial interfaces: UART, Bit Serializer (I²C/SPI), USB 2.0
- Advanced audio algorithms System architecture
- Active Noise Cancellation: Hybrid, Feedforward, and Feedback modes, using Digital or Analog Mics, enabled using license keys available from Qualcomm®
- Qualcomm® aptX™ and aptX HD Audio
- aptX Adaptive and aptX Lossless, enabled using license key
- Sony LDAC enabled using license key
- 1 or 2 mic Qualcomm® cVc™ headset speech processing or 1-mic cVc speaker noise reduction and echo cancellation technology
- Integrated PMU: Dual SMPS for system/digital circuits, Integrated Li-ion battery charger
- Small size:: 11.2*14.8*1.5mm
- RoHS compliant

Audio subsystem

- Dual 32-bit Kalimba audio digital signal processor (or processing) (DSP) cores with flexible clocking from 2 MHz to 240 MHz to enable optimization of performance vs. power consumption
- DSPs execute code from ROM and from program RAM
- OEM and third party developed features can execute from program RAM
- 384 KB program RAM
- 1408 KB data RAM

Application subsystem

- Dual-core application subsystem 32/80 MHz operation
- 32-bit Firmware Processor (reserved for system use) executes:
 - ✧ Bluetooth upper stack
 - ✧ Profiles
 - ✧ House-keeping code
- 32-bit Developer Processor executes: Developer applications
- Both cores execute code from external flash memory using QSPI clocked at 32 MHz or 80 MHz

- On-chip caches per core enable optimized performance and power consumption

Bluetooth subsystem

- Qualified to Bluetooth v6.1 specification including 2 Mbps Bluetooth Low Energy and Bluetooth Low Energy Isochronous Channels
- Qualcomm® Bluetooth High Speed Link
- Single ended antenna connection with on-chip balun and Tx/Rx switch
- Bluetooth, Bluetooth Low Energy, and mixed topologies supported
- Class 1 support

Li-ion battery charger

- Integrated battery charger supporting:
 - Internal mode (up to 200 mA)
 - External mode (up to 1.8 A)
- Variable float (or termination) voltage adjustable in 10 mV steps from 3.65 V to 4.50 V with internal configuration
- Variable float (or termination) voltage adjustable in 50 mV steps from 3.65 V to 4.40 V with external configuration
- Thermal monitoring and management are available in application software
- Pre-charge to fast charge transition configurable at 2.5 V, 2.9 V, 3.0 V, and 3.1 V

Power management

- Integrated power management unit (PMU) to minimize external components
- QCC3095 runs directly from a Li-ion, USB, or external supply (2.8 V to 6.5 V)
- Auto-switching between battery and USB (or other) charging source
- Power islands employed to optimize power consumption for variety of use-cases
- Dual switch-mode power supply (SMPS):
 - ✧ Automatic mode selection to minimize power consumption
 - ✧ 1.8 V SMPS generates power for both the device and off-chip circuits
 - ✧ Dedicated digital SMPS (output voltage changes automatically to minimize device power consumption)

Audio engine and digital audio interfaces

- 24-bit inter-integrated circuit sound (I²S) interface with 1 input and 3 output interfaces
- Programmable audio master clock (MCLK)
- Sony/Philips digital interface (SPDIF): Two instances configurable as input or output
- Stereo analog outputs configurable as differential Class AB headphone outputs or differential high efficiency Class D outputs
- Three analog inputs configurable as single ended line inputs or, unbalanced or balanced analog microphone inputs
- 1 microphone bias (single bias shared by four channels)
- Digital microphone inputs with capability to interface up to 10 digital microphones

- Both analog-to-digital converter (ADC)s and DACs support
- sample rates of 8 kHz, 16 kHz, 32 kHz, 44.1 kHz, 48 kHz,
- 96 kHz. DACs also support 192 kHz and 384 kHz

Peripherals and physical interfaces

- A universal asynchronous receiver transmitter (UART) interface
- 3 x Bit Serializers (programmable serial peripheral interface (SPI) and inter-integrated circuit interface (I²C) hardware accelerator)
- 1 x USB interface: □ A full speed USB (USB-FS) Device (12 Mbps)
- QSPI NOR flash interface
 - QSPI encryption to protect developer code and data
 - Encryption programmable with a 128-bit security key of original equipment manufacturer (OEM) choice stored in on-chip one-time programmable (OTP) memory
- Up to 53 programmable input/output (PIO) and 6 open drain/digital input light-emitting diode (LED) pads with pulse width modulation (PWM)

2. Applications

- High-End Stereo Wireless Headsets
- High-END Mono Headsets
- Hands-Free Car Kits
- Bluetooth-Enabled Automotive Dashboards
- Wired/wireless stereo headsets/headphones

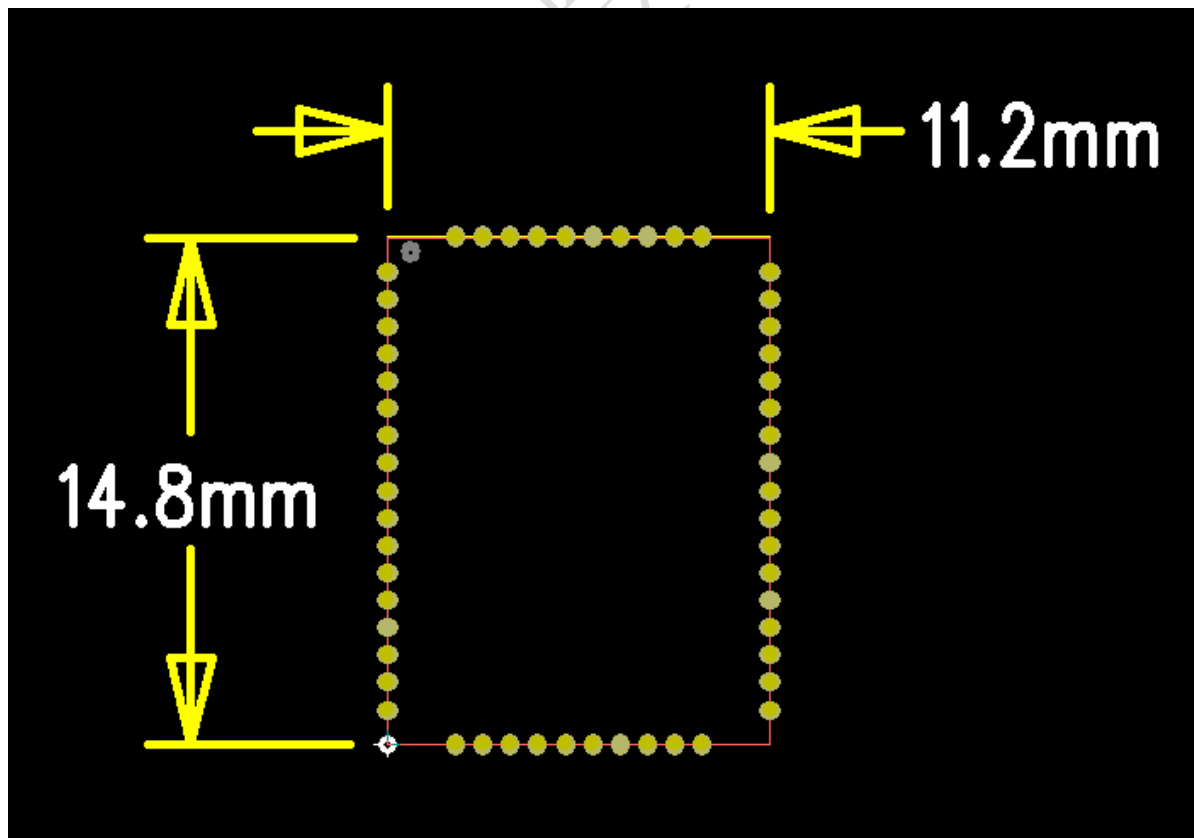
3. Bluetooth performance

Rating	Min	Typ	Max	Unit
Store temperature	-40	+20	+85	°C
Operation temperature	-20	+20	+70	°C
Power supply (VBAT)	3.0	3.6	4.4	V
USB_5V,Charge input	4.5	5	5.5	V
PIO Power supply(VDD_PADS1_3_4 /VDD_PADS_6)	1.8	3.3	3.6	V

4. Electrical Characteristic

Operating Frequency Band	2.402GHz -2.480GHz ISM band
Bluetooth Specification	V6.1
Theoretical range in open field	Bluetooth Class 1
Main Chip	QCC3095
Transmitter Power	10dBm (Typical)
Receive Sensitivity	-97dB at 0.1% BER (Typical)
Antenna	External
Antenna Impedance	50Ω
Power Supply	2.8V-4.4V
Dimension	14.8mm(L) * 11.2mm(W) * 1.5mm(H)

5. Mechanical Dimensions



6. Peripheral reference schematic

Please contact us.

7.UART interface

Q3095M has a standard UART serial interface that provides a simple mechanism to communicate with other serial devices using the RS232 protocol. The UART interface multiplexes with PIOs and other functions. Hardware flow control is optional. [Table](#) lists possible UART settings.

UART configuration options

Parameter		Possible value
Baud rate	Minimum	2400 Bd ($\leq 2\%$ Error)
		19,200 Bd ($\leq 1\%$ Error)
	Maximum	4 MBd ($\leq 1\%$ Error)
Flow control		RTS/CTS or None
Parity		None, Odd, or Even
Number of stop bits		1 or 2
Bits per byte		8

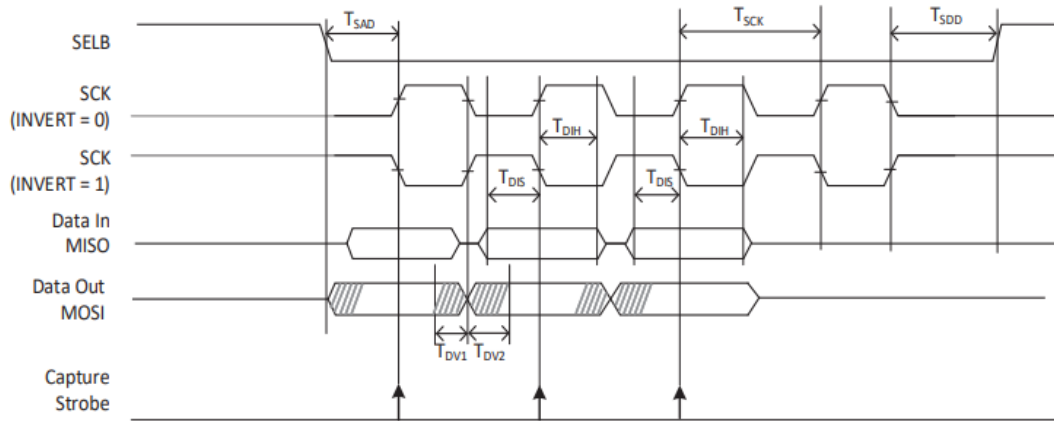
Standard UART baud rates

lists common baud rates and the Q3095M percentage error for that rate.

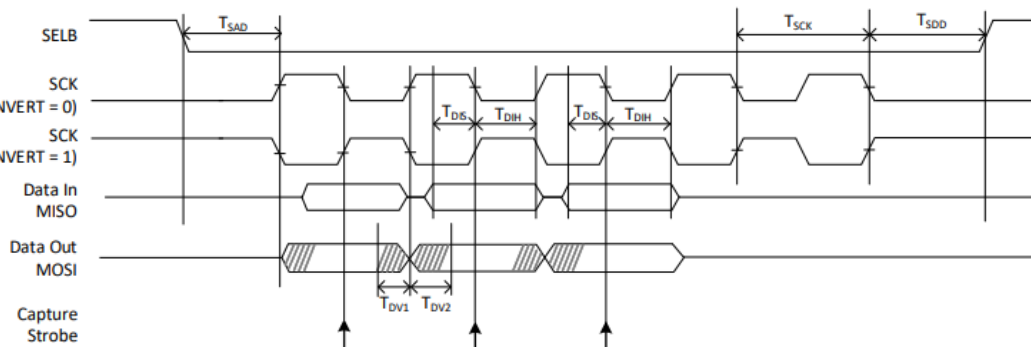
Baud rate	Error (%)
1200	18.62
2400	-1.73
4800	-1.73
9600	-1.73
19200	0.82
38400	-0.45
57600	-0.03
76800	0.18
115200	-0.03
230400	-0.03
460800	-0.03
921600	0.02
1382400	0.01
1843200	0.00
2764800	0.01
3686400	0.00
4000000	0.00

8.SPI master

Figure shows and Table lists bitserial interface timings.



Bitserial M-SPI timing diagram, operating modes with CPHA = 0



Bitserial M-SPI timing diagram, operating modes with CPHA = 1

9.Standard I²S/PCM interface

QCC3095 provides up to three standard I²S/PCM interfaces capable of operating up to 384 kHz sample rate. The I²S/PCM ports are highly configurable with alternate PCM modes, and have the following options:

- SYNC edge position selectable to align with start of channel data (PCM mode), or 1 clock before start of channel data (I²S mode)
- Master (generate CLK and SYNC) or Slave (receive CLK and SYNC) (PCM/I²S)
- SYNC polarity (PCM)
- Long or short SYNC (PCM)
- Left or right justification (PCM/I²S)
- Sign extension / zero pad (PCM)
- Optional tri-state at end of word (PCM)

- Optional invert of clock (PCM/ I²S)
- 13/16/24-bit per sample (PCM/ I²S)
- Up to eight slots per frame (PCM)

I²S/PCM master mode timing diagram

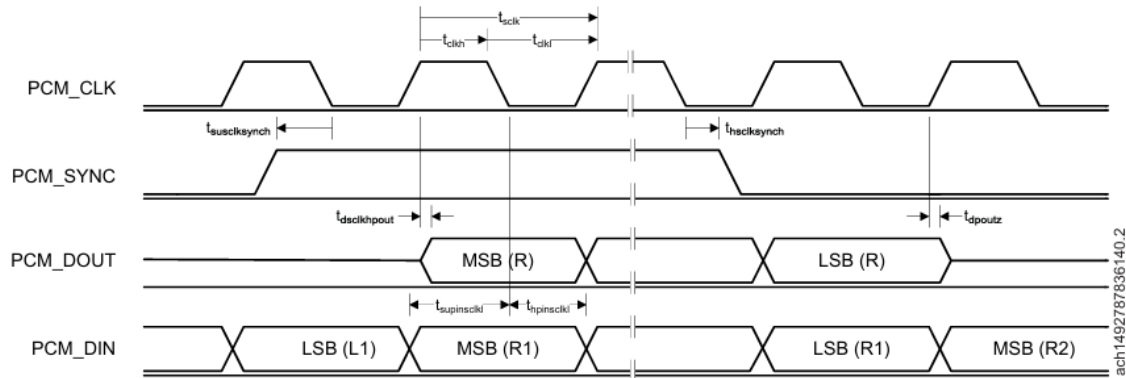


Figure 8-6 I²S/PCM slave mode timing diagram

- NOTE**
- Diagram shows I²S standard format, but timing information also applies to PCM mode.
 - PCM_DOUT to tri-state is not applicable in I²S mode, because I²S standard requires excess bits to be zero padded.
 - With inverted CLK option selected the active CLK edges swap polarity.
 - $1/t_{sclk}$ is the audio sample frequency. I²S specification requires that t_{sclkh} and t_{sckl} must be greater than or equal to $0.35 t_{sclk}$

I²S/PCM master mode timing diagram symbols

Symbol	Parameter	Min	Typ	Max	Unit
$t_{dmclksynch}$	Delay time from PCM_CLK high to PCM_SYNC high	-	-	20	ns
$t_{dmclkpout}$	Delay time from PCM_CLK high to valid PCM_OUT	-	-	20	ns
$t_{dmclksyncl}$	Delay time from PCM_CLK high to PCM_SYNC low	-	-	20	ns
$t_{dmclkhoutz}$	Delay time from PCM_CLK high to PCM_OUT high impedance	-	-	20	ns
$t_{supinckl}$	Set-up time for PCM_IN valid to PCM_CLK low	-	-	20	ns
$t_{hpinckl}$	Hold time for PCM_CLK low to PCM_IN invalid	0	-	-	ns

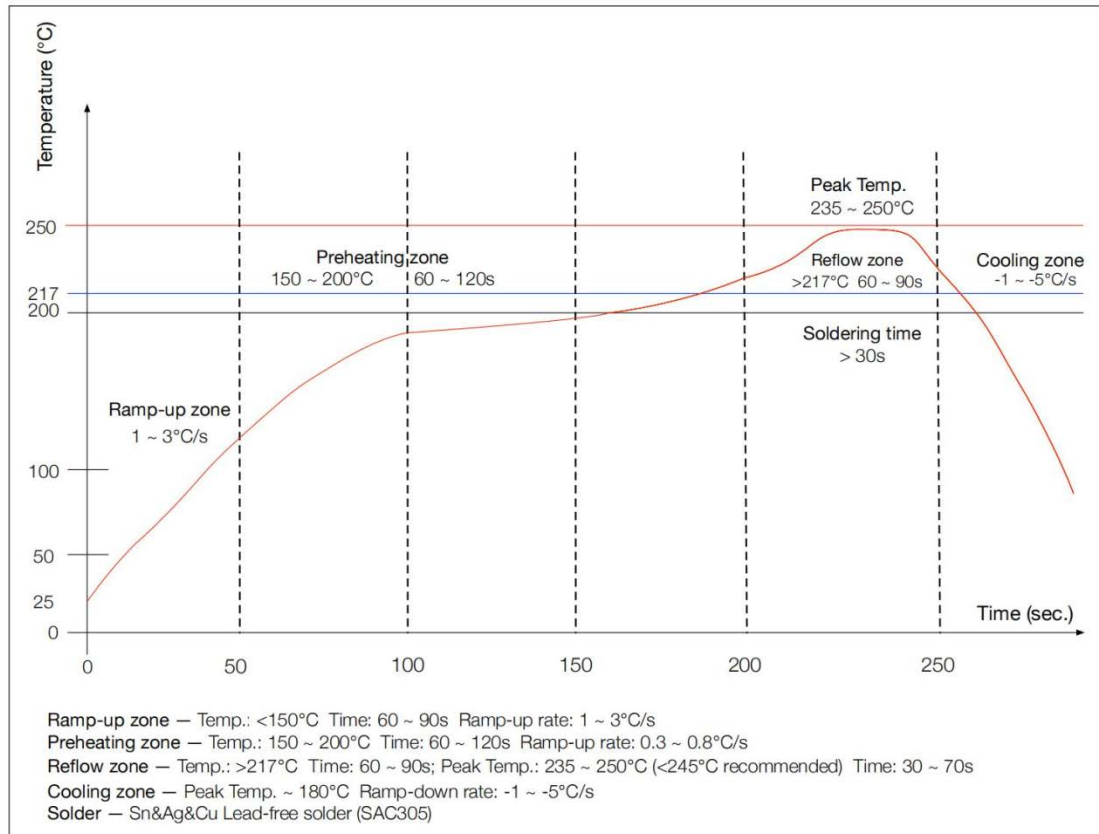
I²S/PCM slave mode timing diagram

- ### I²S/PCM slave mode timing diagram symbols

Symbol	Parameter	Min	Typ	Max	Unit
t _{dmclkssynch}	Delay time from PCM_CLK high to PCM_SYNC high	-	-	20	ns
t _{dmclkpout}	Delay time from PCM_CLK high to valid PCM_OUT	-	-	20	ns
t _{dmclkhsyncl}	Delay time from PCM_CLK high to PCM_SYNC low	-	-	20	ns
t _{dmclkhputz}	Delay time from PCM_CLK high to PCM_OUT high impedance	-	-	20	ns
t _{supinclk}	Set-up time for PCM_IN valid to PCM_CLK low	-	-	20	ns
t _{hpinclk}	Hold time for PCM_CLK low to PCM_IN invalid	0	-	-	ns

SPDIF (IEC 60958) is a digital audio interface. It uses biphasic coding to minimize the DC content of the transmitted signal, and enables the receiver to decode clock information from the transmitted signal. QCC3095 has up to two SPDIF interfaces configurable as input or output. These interfaces are compatible with IEC 60958-1, IEC 60958-3, IEC 60958-4, and AES/EBU standards. Signals are input/output via PIO and typically require external line drivers (for 75 Ω cabling) or optical transceivers ('Toslink'). Any PIO is assignable for SPDIF use

11. SMT reference



FCC regulatory compliance statement

§15.19 Statement

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.

§15.21 Information to user

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

- List of applicable FCC rules:

47 CFR Part 15.247

- Summarize the specific operational use conditions

This module can be used in IOT devices, the input voltage to the module is nominally 5V.

- Limited module procedures

This module is a single module.

- Trace antenna designs

The antenna is not a trace antenna.

- RF exposure considerations

This Module complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

- Antennas

If you desire to increase antenna gain and either change antenna type or use same antenna type certified, a Class II permissive change application is required to be filed by us, or you (host manufacturer) can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

- Label and compliance information

Please notice that if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains FCC ID: **2BDFV-A39H-27S1A**" any similar wording that expresses the same meaning may be used.

§ 15.19 Labelling requirements shall be complied on end user device.

Labelling rules for special device, please refer to §2.925, § 15.19 (a)(5) and relevant KDB publications. For E-label, please refer to §2.935.

- Information on test modes and additional testing requirements

The OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module.

The module is limited to installation in mobile application, a separate approval is required for all other operating configurations, including portable configurations with respect to §2.1093 and difference antenna configurations.

● **FCC other Parts, Part 15B Compliance Requirements for Host product manufacturer**

This modular transmitter is only FCC authorized for the specific rule parts listed on our grant, host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

Host manufacturer in any case shall ensure host product which is installed and operating with the module is in compliant with Part 15B requirements.

Please note that For a Class B or Class A digital device or peripheral, the instructions furnished the user manual of the end-user product shall include statement set out in §15.105 *Information to the user* or such similar statement and place it in a prominent location in the text of host product manual. Original texts as following:

For Class B

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.*
- Increase the separation between the equipment and receiver.*
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- Consult the dealer or an experienced radio/TV technician for help.*

● **FCC WARNING**

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

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

To maintain compliance with FCC's RF Exposure guidelines, This equipment should be installed and operated with minimum 20cm distance between the radiator and your body: Use only the supplied antenna.