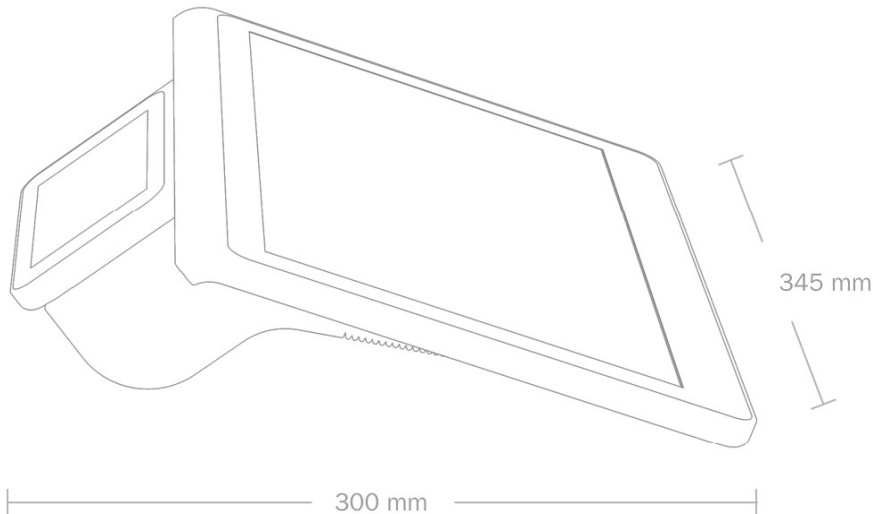


## Quick Guide

This document is based on the Intended Hardware Usage Document V7 from 20170405. It is intended to provide the certification laborator with relevant information on Dasher for performing the relevant tests and to quote for the certification.



## Overview

Usage Scenario	<ul style="list-style-type: none"><li>- countertop POS</li><li>- Wifi Access Point</li><li>- Printer</li></ul>
OS	N4 OS (Linux + Android)
Processor & Memory	App Processor iMX6 Cortex A9 Quad Core RAM: 2GB DDR3 eMMC: 16GB
Displays	<b>Full HD Merchant Display</b> 14" (diagonal) LED-backlit display with IPS technology; 1920x1080 native resolution  <b>Touchscreen Merchant Display</b> Capacitive Touchscreen with multi-touch Anti-Glare and Anti-Fingerprint  <b>5" Customer Display</b> LED-backlit display with IPS technology; 1280x720 native resolution

Wireless	<b>Wi-Fi</b> 802.11n Wi-Fi wireless networking with 2x2 MiMo technology, IEEE 802.11 b/g/n compatible  <b>Bluetooth</b> Bluetooth 2.1+EDR wireless technology
Interfaces	1 x USB OTG 3 x USB 1 x Ethernet (10/100/1000) 1 x HDMI Wifi (b/g/n) Bluetooth 2.1+EDR
Printer	<b>Default:</b> 3" Seiko Thermal Printer Auto Paper Cutter Out of Paper & Open Printer Detection 50 mm Paper Roll Size
Barcode Scanner	CCD Camera Module with fix focus lens Barcodes supported: EAN, QR-Code
Audio	Buzzer
Cash Drawer Port	RJ-11/RJ-12 connector
Electrical and Operating Requirements	Line Voltage: 100-240V AC Operating Temperature: 0 °C to +45 °C Storage Temperature: -20 °C to +60 °C Operating Humidity: 5% - 95% (non-condensing)
In the Box	14" enforceDasher 24V Power Adapter 100-200V AC Power Cord 5mm Printer Paper Roll
Supported Countries	Tier 1: US, UK, DE Tier 2: Indonesia, India, Malaysia, Turkey, ROE Tier 3: ROW TBD: China
Certifications	CE & R&TTE FCC CCC CB RoHS UL

# Usage Guide

## On/Off/Reset

- Device is OFF: press push button -> device gets switched ON
- Device is ON: press push button -> SW functionality: device shows dialog on the screen to the user with the option: device goes to SLEEP, OFF, RESET
- Device is in SLEEP mode: press push button -> device WAKES up and is in ON mode
- Device FORCED SHUTDOWN: press push button >8sec -> device is performing a hardware shutdown. Pressing again will start the device again

## Change Paper

- Open the Printer by pressing down the button at the right side of the device
- Take out any remaining parts from the previous paper roll
- Place the new paper roll inside with the paper towards the printer mechanism and hold the paper while closing the printer lid.

## Concurrent used functions

- All functions of the device can be used at the same time

# Detail Specifications

Please see below the details for the various parts as reference.

## Processor and Memory

Dasher is based on the Freescale iMX6 Cortex-A9 processor. The electrical design is based on reference designs of the different integrated circuits.

The operating system (N4OS) for Dasher is based on Linux and Android. The Linux user space is used for UI less N4 services, network services and to deal with external connected devices via USB or Bluetooth. The Android user space is used for N4 Applications with rich user interfaces.

The N4 software (Apps and Services) are mostly written in C++ and Java and running on top of the operating system (N4OS).

Key Features:

- Operating System: N4OS (Linux- and Android -based OS)
- Boot from eMMC
- Option to use 8, 16 or 32 GB of EMMC memory with fast data transfer
- Option to use 1 or 2 GB of DDR3 RAM, needs to be using the full bandwidth of 64bit of the iMX6 for max. performance
- Operate 3 different screens at the same time (Merchant Screen, Customer Screen, HDMI attached Screen)
- Fast Factory setup to load Operating System (N4OS)
- Numberfour software will enable remote software update via Internet
- Support of RealTimeClock with independent power supply (none-rechargeable battery) for min. 3 years to allow operation in case there is no internet connectivity after startup
- Debugging and Testing for development via JTAG and Serial UART

#### Hardware Requirements:

- Processor
  - freescale iMX6 Quad Core
- Memory
  - eMMC
    - Pin2Pin compatibility supporting sizes from 8 - 16GB
    - eMMC 4.4 / 4.41 Standard with 52 MHZ, 8 BIT Transfer Mode & Dual Data Rate
    - eMMC will be pre-loaded with operating system for fast factory setup
  - DDR3 RAM
    - Pin2Pin compatibility supporting sizes from 1 - 2 GB 4 x 16bit (using the full bandwidth of 64bit of the iMX6 for max. performance to access (read/write) the RAM)
- Firmware Loading (Installation N4OS and N4 Apps/Services)
  - Initial firmware image loading via different options via Boot ROM configuration (SW & HW)
  - Fast Operating System installation via pre-installed OS on eMMC
  - Download image via USB (Serial Downloader)
- Debug for iMX6
  - JTAG
  - Serial Debug via UART output / input

## Wifi

Dasher will communicate via Wifi with the respective Access Point for communication with the

NumberFour Backend in the cloud and to get Software Updates.

Also Dasher can operate as an access point (AP) for a Corporate-Network (for business owner and staff) and for a Guest - Network (for customers of business owner).

Dasher can also be used as a gateway for a mesh network that extends the range of an existing Wifi Network.

Dasher supports auxiliary devices like external Printers, Barcode Scanner, Weighing Scales or Payment Devices that can be connected via Wifi.

#### Hardware Requirements:

- Wifi/BT Module to be used: DHXA-222 Module ( based on AR9462)
  - Support for 802.11b/g/n & BT 2.1+EDR
- Antennas 2.4GHz :2x
  - Two connectors on-board, in order to connect two wired antennas like it's done in standard laptops
  - Antenna specifications : Impedance  $50\Omega$  / VSWR  $\leq 1.5$   
Efficiency  $\geq 40\%$
  - Supports antenna sharing between Bluetooth and Wifi
- Communication with Processor via PCIe

## Bluetooth

Dasher uses the Wifi/BT Module DHXA-222 Module ( based on AR9462)

Dasher supports auxiliary devices like external Printers, Barcode Scanner, Weighing Scales or Payment Devices that can be connected via Bluetooth and Dasher device provisioning via BLE.

#### Key Features from NumberFour selected DHXA-222 Module:

- Bluetooth Host and Client  
Standard Bluetooth Communication with Bluetooth clients and host: distance is determined by shared Wifi Antenna.

- Waiter Lock will be implemented using BT to check the distance between waterkey fob and Dasher for automatic lock-out of user.
- Support for operation as Beacon
- Wifi/Bluetooth coexistence
- Wake-up of Processor via Bluetooth
- Can operate at the same time as Wifi antenna

#### Hardware Requirements:

- Wifi/BT Module to be used: DHXA-222 Module ( based on AR9462)
- Support of antenna sharing between Bluetooth and Wifi (Wifi/Bluetooth coexistence)
- Communication with Processor via USB 2.0

## Camera

Built-in Camera for barcode scanning. Scanning of the most used barcodes used in CRM, Retail and Business (QR-Code, EAN, PDF) from mobile screens and from paper. Primary use case will be to read CRM codes from mobile screens.

The camera is located in the customer display and requires sufficient lighting for reading barcodes. Additional lighting is not planned

#### Key Features:

- Operates in a distance from approx. 5 cm to 15cm based on NumberFour Software
- Detection of multiple barcodes in captured images by Numberfour Software.
- Decoding of most used barcodes (Numberfour software will decode 1D & 2D barcodes, e.g. EAN, QR-Code, PDF)

#### Hardware Requirements:

- Camera Module with
  - Sensor Chip: GalaxyCore GC2155 selected by Hisense based on Requirements-
    - 1/5" CMOS 2MP sensor with internal image processor
    - support image sizes: 1600 x 1200
    - Image Output Format: 10-bit, Bayer RGB, RGB565, YCbCr 4:2:2
    - Sensitivity mini. 3300mV/Lux-sec
  - Connection through USB bus with additional USB chip
  - Optical Lens

- Fix Focus calibrated by supplier with Depth of Field (DOF): approx. 5 cm to 15 cm as tested successfully with samples (7.5-11.2 specified in Lens spec with high contrast and minimum distortions
- FOV (diagonal): approx. 73 degree (no or very small distortion at lens edge)
- IR filter: yes

## Merchant Display

Dasher features a 14" color display with OCR bonded capacitive touch screen.

As the Merchant display with the touch is the single most expensive component it is key to NumberFour to have the flexibility to use different eDP consumer displays in the sizes from 13,3" to 14" without electronic modifications on the main board in order to get the best price possible.

### Key Features:

- IPS-like 13.3" - 14" Display with 1920 x 1080 (FHD) resolution and minimum of 262k color
- Power-saving Features to dimm and shut off the display
- Electronics allow to exchange eDP displays

### Hardware Requirements:

- Interface: eDP
  - Version min 1.1, max. 1.3
  - supported Resolutions & Frame rates:
    - 1920x1080 @ mind. 60Hz
    - 1366x768 @ mind. 60Hz
  - supported Color
    - 262k
    - 16.7M
  - Interface display chip for converting RGB 24bit output from Processor to eDP
    - Chip selected: Analogix ANX9807
    - Embedded DisplayPort 1.3 output support with 1.2/1.1 backward compatibility
    - RGB24 Input to eDP converter chip interface lines
- final LCD choice: 1st choice: LG LP140WF6-SPB6 (2nd choice: M140NWF5 R0)
  - Display: size 14" (IPS-like)
  - Resolution: 1920 x 1080 (FHD)
  - Brightness/Luminance: min. 250 nits



- Contrast: min. 600:1
- Viewing angle: min. 80/80/80/80
- Viewing direction: free view
- Frame Rate: 60Hz
- Color: min. 262k
- Interface to Processor to shut off display
- Backlight
  - Single Voltage (supports from 12-16 Volts without layout change)
  - Dimming (PWM)
  - ON/OFF

## Capacitive Touch & Coverglass

The capacitive touch screen allows the user to operate the device with multi-touch actions. The cover glass needs to sustain daily usage and might be hardent.

### Key Features:

- Capacitive Input
- Multi-touch Input
- Hardened cover glass to sustain reasonable force applied
- OCR Bonding with Display
- Anti-Glare to limit light directly reflecting in the screen and disturbing the user
- Anti-Fingerprinting to enable easy cleaning of fingerprints on the display

### Hardware Requirements:

- Type: capacitive touch
- Interface: I2C or USB
- Self-calibration
- Wake-up signal to Processor by touch event
- Touch Panel, input method: min. 5 touch points
- Physical dimensions according to drawings
- Final Touch Selection: GoWorld GWTC14219A(R)
  - Sensor Resolution: 1920\*1080
  - Touch: 5 Finger touch, Host can be woken by tp touch event
  - Touch Response: min. 100Hz (10ms)
  - OCR Bonding with Display
  - Cover Lens (CG), glass type: tempered glass
  - Cover Lens (CG) Hardness: ≥7H
  - Light transmittance: ≥ 85%
  - Cover Lens Surface Treatment: Anti-Glare

# Brightness Sensor / Ambient Light Sensor

Dasher has a Brightness Sensor aka Ambient Light Sensor to measure the environment light conditions and to adjust brightness of the display to save power and to provide a backlight setting that suits the environmental ambient light. .

## Key Features:

- Sensor will measure the environment light conditions
- Optical filter used with the Brightness Sensor chip that provides a light response similar to that of the human eye

## Hardware Requirements:

- Interface to MCU: I2C
- Differentiation from full darkness to direct sunlight

# Customer Display

Dasher features a 5" color display facing to the customer with specific informations depend on the performed merchant task.

Same as the merchant display the customer display should be exchangeable with other, similar displays. The power supply for the logic needs to be adjustable without modifications on the main board layout.

The currently selected display is connected via MiPi 2 lane. In the future it might be required to use displays with MiPi 4 lanes. In this case an adapter board will be used with a converter chip to convert the signal from MiPi 2 lanes to Mipi 4 lanes. This adapter board needs to be connected to the main PCB of Dasher.

## Key Features:

- shows information independent of the merchant display
- IPS-like 5" display with min 854x480 @ 50Hz resolution and minimum of 262k color
- Power-saving Features to dimm and shut off the display
- Dasher should be able to support other, similar displays electrically

## Hardware Requirements:

- Cover Lens
  - Air-bonding with Display
  - Cover Lens (CG), glass type: tempered glass
  - Cover Lens (CG) Hardness:  $\geq 7H$

- Light transmittance:  $\geq 85\%$
  - Cover Lens Surface Treatment: Anti-Glare
- Selected Display: 1st choice GoWorld GWMTF14435 (2nd choice Techstar TS8250E)
- Each of the 2 displays can be used without any HW changes incl. Plastics, PCBA)
- MIPI 2 data lane (Connection via MIPI-DSI interface)
- supported Resolutions & Frame rates
  - 854x480 @ mind. 50Hz
  - 800x480 @ mind. 50Hz
  - 1280x720 @ mind. 50Hz
- supported Color:
  - 262k
  - 16.7M
  - Color Temperature of Backlight: 7000Kelvin:
- Device Selection Criteria
  - Brightness/Luminance: min. 350 nits
  - Contrast: typ.800:1
  - Viewing angle: typ. 80/80/80/80 degree
- Backlight Dimming and ON/OFF
- Support for different Backlight Voltages for alternative displays (9V - 21V)
- Support for MIPI Display Converter Chip (external PCB) to convert from MIPI 2 data lanes to MIPI 4 data lanes to connect alternate MIPI displays with MIPI 4 data lanes
  - Possible converter chip: Quicklogic - ArcticLink III - BX3B2F: MIPI (2 data lanes) - MIPI(4 data lanes)
  - Additional wires are needed for MIPI Converter Chip (see Quicklogic - ArcticLink III - BX3B2F)
  - Wires for connecting a PCB with MIPI converter chips needs to be layouted/prepared

## Printer

Dasher includes a 3" thermal printer with an auto cutter to print different kind of POS documents (e.g receipt, coupon etc.). The Processor will communicate with the printer controller MCU via SPI or UART to send low level print data. The printer controller MCU located on a separate printer controller board and is responsible to compute the low level printing process and control the printer mechanism.

A protection circuit will take care to protect the thermal print head and motor.

Key Features:

- Thermal Printer with printer controller MCU---ok

- Protection circuits to protect thermal printhead mechanism against software failures (Numberfour software will utilize the protection circuits)
  - Printhead Overheating
  - Paper End detection
  - Cover Open detection
  - 24V power can be cut-off by dead man switch
  - “data bus” can be cut-off by dead man switch
- specific circuit will measure the thermal print head resistance to provide best print results and discover issues at the printhead dots level

#### Hardware Requirements:

- Selected Print Module: 3” Seiko Thermal Printer Mechanism with cutter - CAPD347E-E (24V)
  - Max Print Speed: up to 200mm/s
- MCU (Printer Controller)
  - min Cortex-M4 with FPU and with 256KB flash and 64KB RAM, at least 84MHz 0 Waitstates when executing from flash (e.g. STM32F4)
  - at least 2 32-Bit Timers + 6 other Timers
  - ADCs: at least 6 channels, 12 Bit resolution (not necessarily on the MCU)
  - Debugging Interface: UART output/input, JTAG (Single-Wire) via Testpoints
  - Firmware update via Host CPU
    - in-field usage: will be flashed via freescale Processor (SPI or UART)
    - during production: Printer Module (before soldered on Main PCB) via UART1
- Printer Protection
  - against Printhead Overheating
  - Thermistor against Overheating in print head, readable by 12Bit ADC
  - Paper End detection
  - Cover Open detection
  - 24V power can be cut-off by dead man switch
  - “data bus” can be cut-off by dead man switch
  - 24V voltage measurement, readable by 12Bit ADC
- Stepper-Driver: 2 stepper driver chips are used to control the paper and cutter motor (full step, micro step) with sleep mode
- Printer PCB: The printer controller circuit will be placed on a separate PCB. This PCB is soldered on the Main PCB
- External reference voltage, e.g. 2.5V, readable by 12Bit ADC
- Interfaces to Processor freescale
  - UART and SPI min. 1.5 MHz, aligned with MCU and IMX.6

# Interfaces

Dasher supports auxiliary devices like external Printers, Barcode Scanner, Weighing Scales or Payment Devices that can be connected via USB and Ethernet.

Support of one external HDMI Monitor with a resolution up to FHD for advertising or customer display

Dasher allows to connect a standard cash drawer with 24V.

## Key Features:

- 3 x USB Port for external devices (all can be used simultaneously)
- 1 x USB OTG Port
- 1 x Ethernet Port to connect network (up-link) or to connect with ethernet equipment e.g. printer
- HDMI Port for video (different from customer & merchant display)
- Cash Drawer Port for 24V cash drawer to open and to read open state

## Hardware Requirements:

- USB Port for external devices (all can be used simultaneously)
  - 3x USB
    - Protocol Version 2.0
    - 500mA per port
  - 1x USB OTG
    - 500mA per port
    - Change OTG by software
- Ethernet Port
  - 10/100/1000 Speed (1GBit)
- HDMI Port
  - supported resolutions for individual feed (different from customer & merchant display)
    - 1920x1080@60
    - 1280x720@60
  - Connector: Type-A
  - no power supply
- Cash Drawer Port
  - support of all 24V cash drawers
  - GPIO to open cash drawer and GPIO for drawer open state
  - Configurable impulse length via software
  - RJ11/RJ12 Jack with Pin-Assignment (6 Pin) as Epson Standard

# Push Button

Ergonomic push button for the user for ON / FORCED SHUTDOWN / OFF, SLEEP, WAKE-UP, RESET via Software

Key Features:

Single Push Button ON / FORCED SHUTDOWN / OFF, SLEEP, WAKE-UP, RESET via Software

- Hardware Key Behavior (push button ON/OFF/RESET)
  - Device is OFF: press push button -> device gets switched ON
  - Device is ON: press push button -> SW functionality: device shows dialog on the screen to the user with the option: device goes to SLEEP, OFF, RESET
  - Device is in SLEEP mode: press push button -> device WAKES up and is in ON mode
  - Device FORCED SHUTDOWN: press push button >8sec -> device is performing a hardware shutdown. Pressing again will start the device again.

Hardware Requirements:

- accordingly to Key Features

# Power Supply

Dasher is powered by an external desktop power adapter with single voltage support (24V DC). This power adapter will allow to use Dasher with all features at the same time (maximum power consumption of Dasher). Dasher has his internal power supply to create all required voltages with enough power for all sub-components with their maximum power consumption at the same time.

Key Features:

- External Power Adapter
  - Input Voltage: 100-240V AC
  - Output Voltage: 24V DC
- Internal Power Supply
  - create all required voltages for Dasher parts and components to allow working with their maximum power consumption at the same time
  - required power support for external devices as specified in this Intended Hardware Usage document.
- Power saving in Hardware where possible to minimize power consumption
- Power Saving mode: Sleep
  - reduce power consumption to the minimum

- Wake up from sleep mode

## ESD Protection

Dasher needs to be protected against electronic discharge.

Key Features:

- ESD protection for all areas of the device that need to be protected according to be compliant to local regulations.

Hardware Requirements:

- Merchant Touch Display
- Customer Display
- Cash Drawer connector
- HDMI connector
- USB connector
- Ethernet connector
- Power connector
- Printer Mechanism

## Housing/Casing

Dasher consist of different plastic parts.

Key Features & Hardware Requirements:

- Build to repair - The devices can be opened and closed for repair----: "open /close " means housing can be opened and re-assembled by a certified and authorized technician f.e. by unscrewing screws/bolts: Dasher replaceable/removable parts are f.e. main board ,Printer Head, switch board . While other parts with tape / glue are non removable: f.e. Merchant Display, Customer Display, Cable of camera, WIFI antenna, Rear cover and Iron plate. "Repair", means getting a (partially)failing device in working order again by handling through a certified and authorized technician at a service center or at the factory.(i.e. not in the field). A service manual will be created to identify service / repair procedures.
- Material is PC ABS
  - Specification:
    - Material Definition/Spec according to plastic supplier's spec.
    - Numberfour/Lenovo Gray (see picture)

- Numberfour Black (see picture)
- Surface Texture:
  - According to selected sample--- (see picture)





- Painting / Color
- Silver paint: Numberfour silver (see picture

Picture with arrow pointing to  
A. Numberfour/Lenovo Gray ,  
B. Numberfour Black,



C. Numberfour silver

- Chem. Resist.: Human Sweat and Grease; soft cleaning by damp cloth

## Endurance & Environmental Resistance

Dasher has a designed lifetime of 3 yrs at a small merchant location (not to be confused with factory warranty)

Key Features & Hardware Requirements:

- Average lifetime before Dasher has first failure : 3 yrs OR active use 15,000 hours AND printer with min. 50km printout
  - for time: the cumulative number of days at the merchant locations after delivery of the device to the merchant / number of first failures
  - for active usage hours: the cumulative number of usage hours of devices / number of first failures
  - for print out: the cumulative km of print out / number of first failures of printer
- Operation Environmental Temp: 0C to +45C-
- Storage Temp.: -20C to +60C
- Operating Humidity: 5% - 95% (non-condensing)
- Device can be cleaned outer surface with moist cloth

## Certifications & Compliance

Dasher will be made available for sale in multiple countries/regions and the hardware needs to fulfill all Base Certifications listed below as precondition to be compliant to required local regulations.

Based on previous research performed by Hisense, TÜV SÜD and NumberFour Dasher needs to fulfill the requirement of the below listed Base Certifications and pass these certifications. These certifications are in full or partially required to be compliant in the below listed target countries, but might require additional local approvals & paperwork:

HICS will not perform a formal patent / license check for every component or combination of components for every region/country indicated.

For a defined list of (key) components the supplier of the component will be asked by HICS to verify the country list against the applicable components and provide answers in writing to HICS. HICS will build a file with the replies of the individual suppliers. HICS is not liable for false answers provided by components suppliers.

HICS is not liable for formal usage right approval for every country/region since not all licenses / patents / IP rights on components or the application of combinations of components, technologies can be overseen for every region.

Key Features (List of target countries/regions):

### Europe

- DACH (Germany, Austria, Switzerland)

- UK
- France
- Spain
- Italy
- Benelux (Netherlands, Belgium)
- Scandinavia (Denmark, Sweden, Norway)
- Poland
- Turkey
- Russia

#### **Americas**

- USA
- Canada
- Brazil
- Mexico
- Argentina

#### **Asia**

- China (incl. Hong Kong & Taiwan)
- Japan
- India
- Indonesia
- Philippines
- Malaysia
- Singapore

#### **Other**

- Australia
- South Africa

Hardware Requirements (Base Certifications to be performed):

- CE & R&TTE
- FCC
- CCC
- CB
- RoHS
- UL

## **FCC 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.

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.
- Reorient or relocate the receiving antenna.
- Reorient or relocate the receiving antenna.
- Consult the dealer or an experienced radio/TV technician for help important announcement

Important Note:

## **Radiation Exposure Statement**

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

