Wireless TVOC / Temperature / Humidity Sensor

R720E

User Manual

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1. Introduction

R720E is the temperature, humility and TVOC detection device which is Class A device of NETVOX based on LoRaWAN™ protocol.

LoRa Wireless Technology:

LoRa is a wireless communication technology dedicated to long distance and low power consumption. Compared with other communication methods, LoRa spread spectrum modulation method greatly increases to expand the communication distance. Widely used in long-distance, low-data wireless communications. For example, automatic meter reading, building automation equipment, wireless security systems, industrial monitoring. Main features include small size, low power consumption, transmission distance, anti-interference ability and so on.

LoRaWAN:

LoRaWAN uses LoRa technology to define end-to-end standard specifications to ensure interoperability between devices and gateways from different manufacturers.

2. Appearance

3. Main Features

- Adopt SX1276 wireless communication module

- 2 ER14505 lithium batteries AA size (3.6V / section) in parallel

- TVOC concentration, temperature, and humidity detection

- The base is attached with a magnet that can be attached to a ferromagnetic material object

- Protection class IP65

- Compatible with LoRaWAN^{TM} Class A

- Frequency hopping spread spectrum

- Configuration parameters can be configured via a third-party software platform, data can be read and alerts can be set via SMS text and email (optional)

- Applicable to third-party platforms: Actility/ ThingPark, TTN, MyDevices/ Cayenne

- Low power consumption and long battery life

Note:

Battery life is determined by the sensor reporting frequency and other variables, please refer to

http://www.netvox.com.tw/electric/electric_calc.html

On this website, users can find battery life time for varied models at different configurations.

4.Set up Instruction

On/Off

Power on	Insert batteries. (users may need a screwdriver to open)
Turn on	Press and hold the function key for 3 seconds till the green indicator flashes once.
Turn off (Restore to factory setting)	Press and hold the function key for 5 seconds, and the green indicator flashes 20 times.
Power off	Remove Batteries.
Note:	1. Remove and insert the battery; the device is at off state by default. Press and hold the function key for 3 seconds till the green indicator flashes once to turn on the device. 2. On/off interval is suggested to be about 10 seconds to avoid the interference of capacitor inductance and other energy storage components. 3. At the first 5 seconds after power on, the device will be in engineering test mode.

Network Joining

Never joined the network	Turn on the device to search the network. The green indicator stays on for 5 seconds: success The green indicator remains off: fail
Had joined the network	Turn on the device to search the previous network. The green indicator stays on for 5 seconds: success The green indicator remains off: fail
Fail to join the network	Suggest to check the device verification information on the gateway or consult your platform server provider.

Function Key

Press and hold for 5 seconds	Restore to factory setting / Turn off The green indicator flashes 20 times: success The green indicator remains off: fail
Press once	The device is in the network: green indicator flashes once and sends a report The device is not in the network: green indicator remains off

Sleeping Mode

The device is on and in the network	Sleeping period: Min Interval. When the reportchange exceeds setting value or the state changes: send a data report according to Min. Interval.

Low Voltage Warning

Low Voltage	3.2V

5. Data Report

The device will immediately send a version packet report and a data report including voltage of the battery and TVOC value.

The device sends data according to the default configuration before any other configuring.

Default Setting:

Maximum time: Max Interval = 15 min

Minimum time: Min Interval = 15 min   * Minimum time should <u>not be less than 4min</u>.

Battery Change = 0x01 (0.1V)

TVOC Change = 0x012C (300 ppb)

TVOC Measurement Range: 0 ppb to 60000 ppb

Excellent	0 to 65 ppb
Good	65 to 220 ppb
Moderate	220 to 660 ppb
Poor	660 to 2200 ppb
Unhealthy	2200 to 60000 ppb

Note:

1. R720E needs to **work for 13 hours after the first power-on**.

   (The sensor needs to be calibrated automatically during the 13 hours, and the data will be biased during this period. The

   accurate data shall prevail after 13 hours. At present, <u>this step has been completed before the shipment.</u>)

2. On the condition that the sensor can operate normally, the read data is valid after the device is powered off and has

   been turned on again for **20 minutes**.

   (The 20 minutes is the time for the sensor to enter a stable state.)

3. The device will report **0xFFFF** when the sensor is damaged, the initiation fails, and the device fails to read the data

   three times continuously after warming up.

   *The above process will be completed automatically after the device is turned on; therefore, users do not need to

   operate by self.

The data parsing reported by the device is referenced by the Netvox LoraWAN Application Command document and

http://loraresolver.netvoxcloud.com:8888/page/index

Data report configuration and sending period are as following:

Min Interval (Unit: second)	Max Interval (Unit: second)	Reportable Change	Current Change ≥ Reportable Change	Current Change＜ Reportable Change
Any number ≥ 240	Any number between 240~65535	Can not be 0	Report per Min Interval	Report per Max Interval

Example of ConfigureCmd

Bytes	1 Byte	1 Byte	Var (Fix =9 Bytes)
	CmdID	DeviceType	NetvoxPayLoadData

Config ReportReq	R720E	0x01	0xA5	MinTime (2bytes Unit: s)	MaxTime (2bytes Unit: s)	BatteryChange (1byte Unit:0.1v)	TVOC Change (2bytes Unit：1ppb)	Reserved (2Bytes, Fixed 0x00)
Config ReportRsp		0x81		Status (0x00_success)			Reserved (8Bytes, Fixed 0x00)	
ReadConfig ReportReq		0x02		Reserved (9Bytes, Fixed 0x00)				
ReadConfig ReportRsp		0x82		MinTime (2bytes, Unit: s)	MaxTime (2bytes, Unit: s)	BatteryChange (1byte, Unit: 0.1v)	TVOC Change (2bytes, Unit: 1ppb)	Reserved (Bytes, Fixed 0x00)
ResetTVOC BaseLineReq		0x03		Reserved (9Bytes, Fixed 0x00)				
ResetTVOC BaseLineRsp		0x83		Status (0x00_success)			Reserved (8Bytes, Fixed 0x00)	

(1) Command Configuration:

MinTime = 5min, MaxTime = 5min, BatteryChange = 0.1v, TVOC Change=100ppb

Downlink： 01A5012C012C0100640000

Response：

81A5000000000000000000（Configuration success）

81A5010000000000000000（Configuration failure）

* When min time < 4min, Configuration fails

(2) Read Configuration:

Downlink： 02A500000000000000000000

Response：

        82A5012C012C0100640000（Current configuration）

(3) Calibrate the baseline:

    After the configuration is successful, users can re-acquire and set the baseline value after 13 hours.

    Downlink：03A5000000000000000000

    Response：

        83A5000000000000000000（Configuration success）

        83A5010000000000000000（Configuration failure）

Example of ReportDataCmd

Bytes	1 Byte	1 Byte	1 Byte	Var(Fix=8 Bytes)
	Version	DeviceType	ReportType	NetvoxPayLoadData

Version– 1 byte–0x01——the Version of NetvoxLoRaWAN Application Command Version

DeviceType– 1 byte – Device Type of Device

ReportType – 1 byte –the Presentation of the NetvoxPayLoadData，according the devicetype

NetvoxPayLoadData– Fixed bytes (Fixed =8bytes)

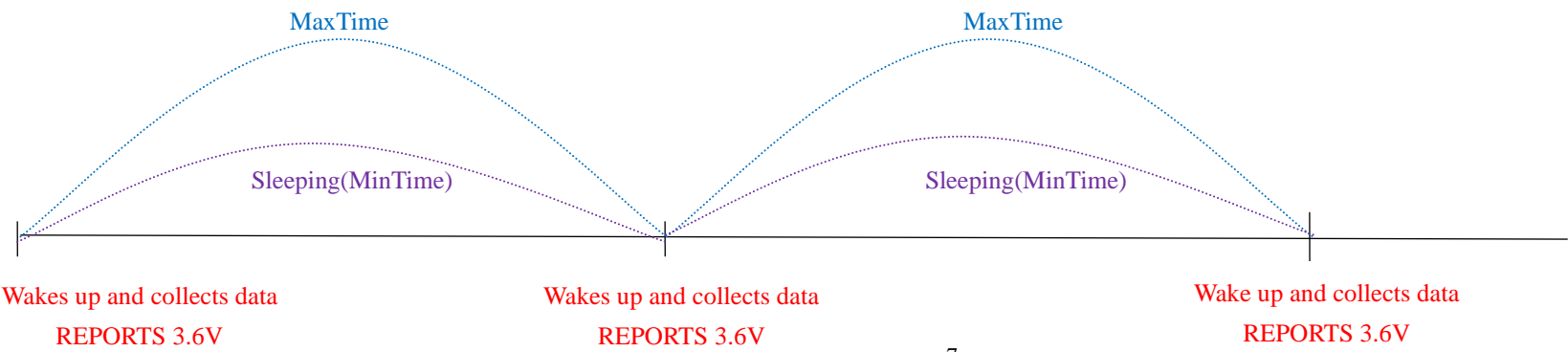| Device	Device Type	Report Type	NetvoxPayLoadData				
R720E	0xA5	0x01	Battery (1Byte, Unit: 0.1V)	TVOC (2Bytes, 1ppb)	Temperature (Signed2Bytes, Unit: 0.01°C)	Humidity (2Bytes, Unit: 0.01%)	Reserved (1Byte, fixed 0x00)

    Uplink：01A5012400290A4B11B400

        TVOC= 0029 H_{ex} = 41 D_{ec} , 41 ppb

        Temperature= 0A4B H_{ex} = 2635 D_{ec} , 2635*0.01° = 26.35 °C

        Humidity= 11B4 H_{ex} = 4532 5 D_{ec} , 4532*0.01% = 45.32 %

Example for MinTime/MaxTime logic:

Example#1 based on MinTime = 1 Hour, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange=0.1V

MaxTime   MaxTime

Sleeping(MinTime)   Sleeping(MinTime)

Wakes up and collects data   Wakes up and collects data   Wake up and collects data
REPORTS 3.6V   REPORTS 3.6V   REPORTS 3.6V

Note: MaxTime=MinTime. Data will only be report according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

Example#2 based on MinTime = 15 Minutes, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange= 0.1V.
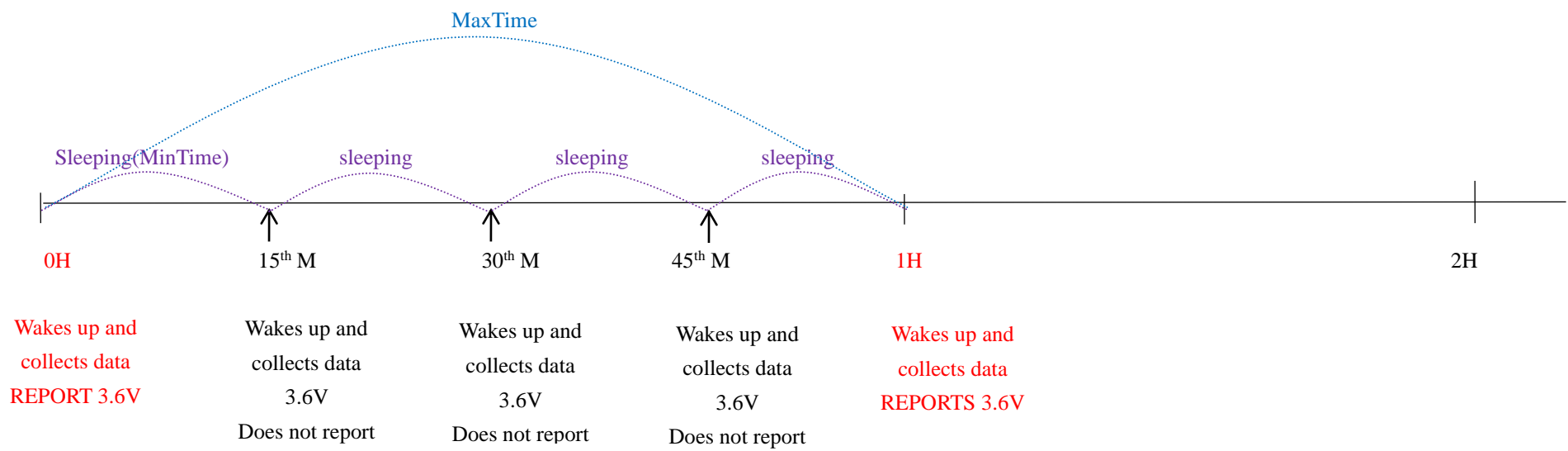
Example#3 based on MinTime = 15 Minutes, MaxTime= 1 Hour, Reportable Change i.e. BatteryVoltageChange= 0.1V.
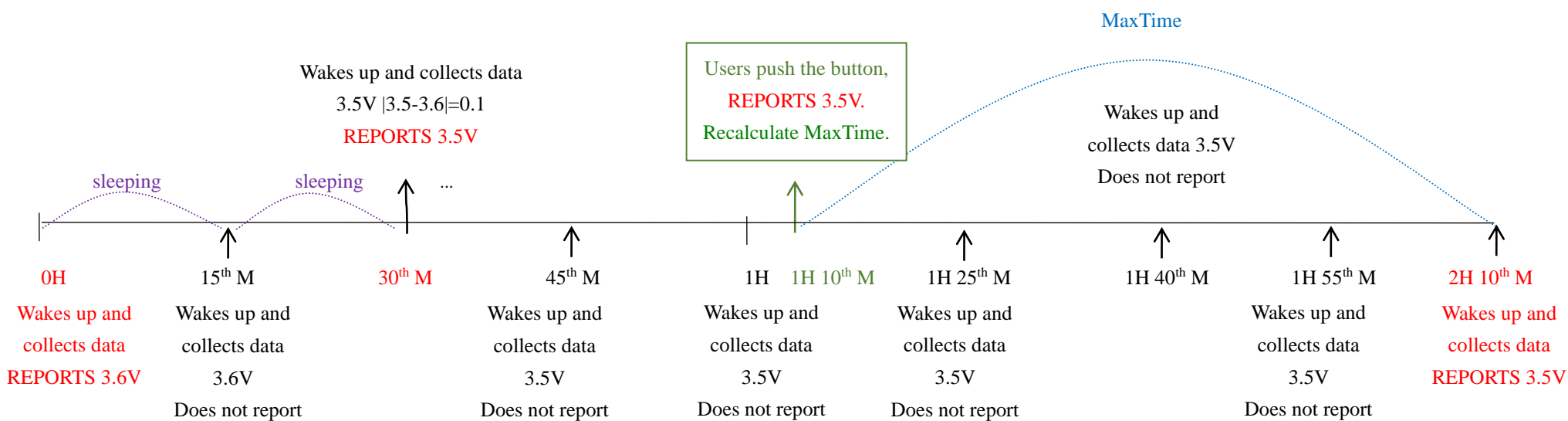
Notes :

1) The device only wakes up and performs data sampling according to MinTime Interval. When it is sleeping, it does not collect data.

2) The data collected is compared with the last data reported. If the data variation is greater than the ReportableChange value, the device reports according to MinTime interval. If the data variation is not greater than the last data reported, the device reports according to MaxTime interval.

3) We do not recommend to set the MinTime Interval value too low. If the MinTime Interval is too low, the device wakes up frequently and the battery will be drained soon.

4) Whenever the device sends a report, no matter resulting from data variation, button pushed or MaxTime interval, another cycle of MinTime/MaxTime calculation is started.

6. Installation

1. R720E has a built-in magnet (the dotted line in the figure below). When installing, the sensor can be attached to the surface of iron objects.

2. If it is installed on a wall or other object without iron, users can install another piece of iron on the wall or other object, and then attach the sensor to the iron.

Note:

● Do not install the device in a metal shielded box or an environment with other electrical equipment around to avoid affecting the wireless transmission signal of the device.
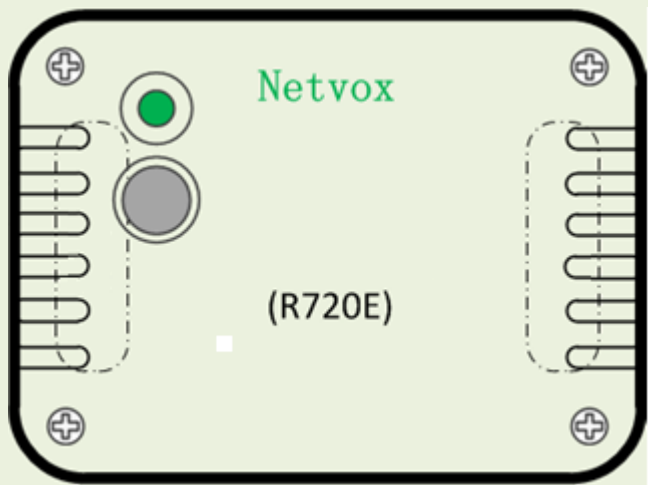
(R720E)

4. R720E detects according to Min Time. When the detected TVOC value or battery voltage is compared with the last report, the value exceeds the set value. (Default TVOC Value: 300ppb; Default Battery Voltage: 0.1V) If the TVOC concentration exceeds 300ppb or the battery voltage exceeds 0.1V, the currently detected TVOC, temperature, and humidity will be sent.

5. If the variation of TVOC concentration or battery voltage does not exceed the set value, the data is reported regularly according to the Max Time.

Note: Min Time and Max Time defaults 15 minutes.

R720E is suitable below scenarios:

● Residential
● Shopping mall
● Station
● School
● Airport
● Construction site

The place needs to detect the TVOC, temperature, or humidity.

R720E

Ground
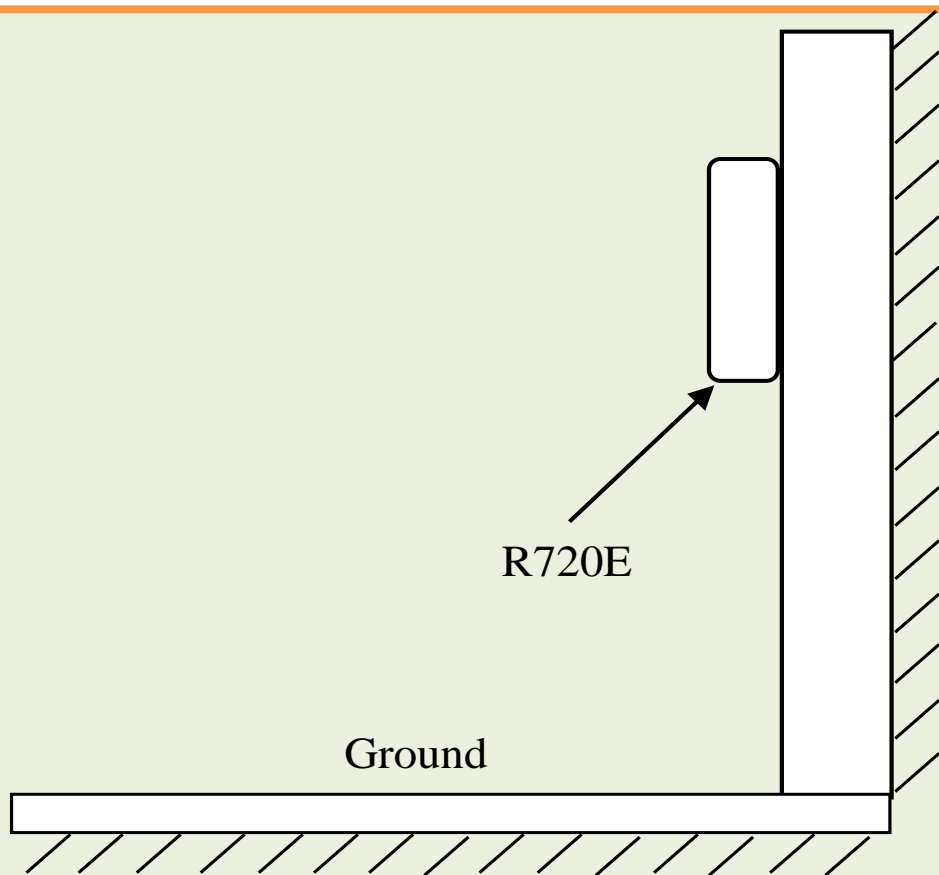
Installation Diagram

7. Information about Battery Passivation

Many of Netvox devices are powered by 3.6V ER14505 Li-SOCl2 (lithium-thionyl chloride) batteries that offer many advantages including low self-discharge rate and high energy density.

However, primary lithium batteries like Li-SOCl2 batteries will form a passivation layer as a reaction between the lithium anode and thionyl chloride if they are in storage for a long time or if the storage temperature is too high. This lithium chloride layer prevents rapid self-discharge caused by continuous reaction between lithium and thionyl chloride, but battery passivation may also lead to voltage delay when the batteries are put into operation, and our devices may not work correctly in this situation.

As a result, please make sure to source batteries from reliable vendors, and <u>it is suggested that if the storage period is more than one month from the date of battery production, all the batteries should be activated.</u>

If encountering the situation of battery passivation, users can activate the battery to eliminate the battery hysteresis.

ER14505 Battery Passivation:

7.1 To determine whether a battery requires activation

Connect a new ER14505 battery to a resistor in parallel, and check the voltage of the circuit.

<u>If the voltage is below 3.3V, it means the battery requires activation.</u>

7.2 How to activate the battery

a. Connect a battery to a resistor in parallel

b. Keep the connection for 5~8 minutes

c. <u>The voltage of the circuit should be ≧3.3, indicating successful activation.</u>

Brand	Load Resistance	Activation Time	Activation Current
NHTONE	165 Ω	5 minutes	20mA
RAMWAY	67 Ω	8 minutes	50mA
EVE	67 Ω	8 minutes	50mA
SAFT	67 Ω	8 minutes	50mA

Note:

If you buy batteries from other than the above four manufacturers, then the battery activation time, activation current, and required load resistance shall be mainly subject to the announcement of each manufacturer.

8. Important Maintenance Instruction

The device is a product with superior design and craftsmanship and should be used with care.

The following suggestions will help you use the warranty service effectively.

• Keep the equipment dry. Rain, moisture and various liquids or water may contain minerals that can corrode electronic

  circuits. In case the device is wet, please dry it completely.

• Do not use or store in dusty or dirty areas. This way can damage its detachable parts and electronic components.

• Do not store in excessive heat place. High temperatures can shorten the life of electronic devices, destroy batteries, and

  deform or melt some plastic parts.

• Do not store in excessive cold place. Otherwise, when the temperature rises to normal temperature, moisture will form

  inside which will destroy the board.

• Do not throw, knock, or shake the device. Treating equipment roughly can destroy internal circuit boards and delicate

  structures.

• Do not wash with strong chemicals, detergents, or strong detergents.

• Do not paint the device. Smudges can make debris block detachable parts up and affect normal operation.

• Do not throw the battery into the fire to prevent the battery from exploding. Damaged batteries may also explode.

All the above suggestions apply equally to your device, batteries, and accessories.

If any device is not operating properly, please take it to the nearest authorized service facility for repairing.