Wireless Cigarette Smoke, Vaping, and Bullying Alarm Sensor

RA02G
User Manual

For Hardware v0.5

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1. Introduction

RA02G is an indoor sensor with smoking, noise, and anti-tamper detection. New functions such as power outage detection, sensitivity adjustment, audio alerts customization, and PoE splitter connection are now added. The new RA02G makes indoor monitoring easier and flexible than you ever imagined.

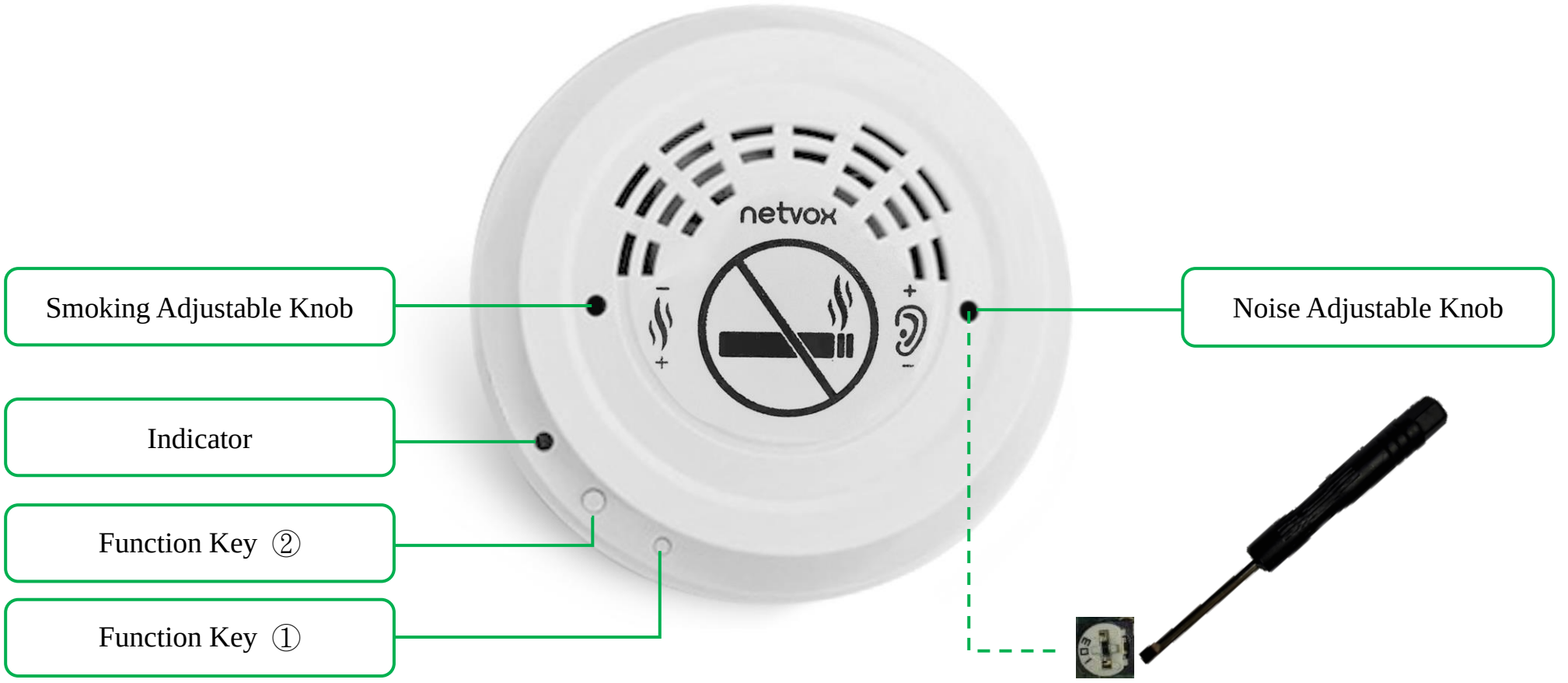
LoRa Wireless Technology

LoRa is a wireless communication technology famous for its long-distance transmission and low power consumption. Compared with other communication methods, LoRa spread spectrum modulation technique greatly extends the communication distance. It can be widely used in any use case that requires long-distance and low-data wireless communications. For example, automatic meter reading, building automation equipment, wireless security systems, and industrial monitoring. It has features like small size, low power consumption, long transmission distance, strong 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



▲ RA02G powered by 12V adapter

▲ RA02G powered by 12V PoE splitter

The above figure is for reference only. The 12V PoE splitter is not included when purchasing RA02G.

Note:

(1) To adjust the sensitivity of the noise and smoking sensor, the user may use a small screwdriver to poke in the hole and slowly turn the knob.

(2) The knobs could only be turned 180°. Rough handling could damage the components.

3. Features

- Power supplied by 12V power adapter and PoE splitter
- 2* AAA 1.5V Alkaline batteries as backup power
- Type-C port for audio alerts transmission
- Smoking, noise, and anti-tamper detection
- Power outage detection
- Compatible with LoRaWAN™ Class C
- Frequency hopping spread spectrum
- Applicable to third-party platforms: Actility/ThingPark, TTN, MyDevices/Cayenne

4. Set up Instructions

On/Off

Turn on	Plug in the power adapter. Note: When the device is powered by backup batteries as the DC power disconnects, the device cannot be turned on.
Restart (back to factory setting)	Press the function key① for 5 seconds and the green indicator will flash 20 times.
Power off	Unplug the power adapter.
Note	1. After powering on, the device will enter the engineering test mode. 2. To avoid the interference of capacitor inductance and other energy storage components, the interval between On and Off should be 3 minutes when the device is powered by DC without backup batteries.

Network Joining

Never joined the network	Turn on the device to search the network. The green indicator stays on: Success The green indicator remains off: Fail
Had joined the network (not back to factory setting)	Turn on the device to search the previous network. The green indicator stays on: Success The green indicator remains off: Fail
Fail to join the network	Please check the device verification information on the gateway or consult your platform server provider.

Function Key

Press and hold the function key① for 5 seconds	<u>Back to factory setting and restart the device</u> The green indicator flashes 20 times: Success The green indicator remains off: Fail
Short press the function key①	<u>The device is in the network:</u> The green indicator flashes once, sends a data packet, and stops all audio alerts.
Press and hold the function key② for 2 seconds	<u>Restart</u> The green indicator flashes 10 times: Success The green indicator remains off: Fail Note: 10 seconds after the device is on, user may press the function key for 2 seconds to restart.
Short press the function key②	<u>The device is in the network:</u> The red indicator flashes and the audio alert sounds. The device sends a report of IncenseSmokeAlarm = 0x01. 7 seconds later, the device sends a report of IncenseSmokeAlarm= 0x00 and ceases flashing and sounding. <u>The device is not in the network:</u> The red indicator flashes and the audio alert sounds. 7 seconds later, the red indicator ceases flashing and the audio alert stops sounding. Note: 10 seconds after the device is on, user may short press the function key to test the alarm.

5. Data Report

The device will immediately send a version packet report and a data packet with the IncenseSmokeAlarm, HighSoundAlarm, ShockAlarm, and PowerOffAlarm. Data will be reported by default setting before any configuration.

Default setting:

Max Interval = 0x0384 (900s)

Min Interval = 0x0384 (900s) // The MinTime configuration is not available, but the MinTime must be configured a number greater than 0.

HighSoundAlarmTriggerThreshold = 0x0005 // Range: 0x0001 to 0xFFFE, the smaller the configuration value, the more sensitive it is.

HighSoundAlarmTriggerDuration = 0x0A // Range: 0x0001 to 0xFFFE

// When the HighSoundAlarmTriggerThreshold= 0xFFFF or HighSoundAlarmTriggerDuration 0xFFFF, the noise detection is off.

SmokesensorSensitivity = 0x00 (Accroding the hardware sensitivity knob) //The knob would be set to level 1 before shipment.

SmokeDebounceTime = 0x012C (300s)

SmokeResumeTime = 0x0A (10s)

ShockSensorSensitivity = 0x0A // Range: 0x01 to 0x14, the smaller the configuration value, the more sensitive it is.

BeeperDuration = 0x000F (15s) // Range: 0x0001 to 0xFFFF, 0x00= Disable buzzer.

// When user presses the function key②, the buzzer will ring for 7 seconds. (cannot be configured)

AlarmSoundLevel = 0x1E (30)

1. Alarm and Indicator

● : remain on ◐ : flash slowly ◐◐ : flash

Type	Status	Indicator	Audio alert (duration: 15s; volume: 30)	Report data
Smoking	Triggered	◐◐	003.mp3	IncenseSmokeAlarm=1
	x	●	x	IncenseSmokeAlarm=0
Noise	Triggered	◐	002.mp3	HighSoundAlarm =1
	x	●	x	HighSoundAlarm =0
Vibration	Triggered	◐	001.mp3	ShockAlarm = 1
	x	●	x	ShockAlarm = 0
Power Outage	Triggered	◐◐ ◐	x	PowerOffAlarm = 1
	DC power reconnected	●	x	PowerOffAlarm = 0

Note: (a) Green indicator always remains on when no sensor is triggered.

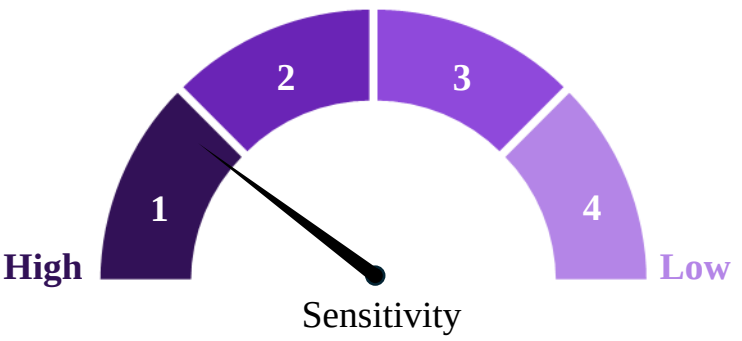
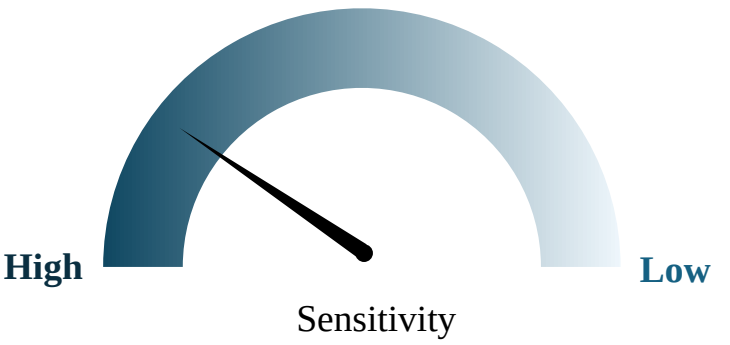
(b) The green indicator remains on when the SmokeDebounceTime ends and no smoke is detected during SmokeResumeTime.

(c) The power outage alarm only functions when the device is powered by backup batteries.

(d) When power outage and other alarms are triggered at the same time, the indicator for other alarms flashes first.

(e) No audio alert for power outage alarm when the device is powered by backup batteries.

2. Sensitivity Adjustment of Smoking and Noise Detection

	(1) Smoking detection (IncenseSmokeAlarm)	**(2) Noise detection** (HighSoundAlarm)
		
Levels	4 levels (every 45° for one level)	x
Sensitivity	Level 1 > Level 2 > Level 3 > Level 4	The lower the HighSoundAlarmTriggerThreshold is, the higher the sensitivity is.
Adjust through Knobs	Turn clockwise to decrease sensitivity	Turn clockwise to decrease sensitivity (The knob would be turned to the middle before shipment.)
Adjust through Commands	Set SmokesensorSensitivity. Range: 0x01 to 0x14 (The last setting would be saved when the device is reset to factory setting.)	Set HighSoundAlarmTriggerThreshold and HighSoundAlarmTriggerDuration. Range: 0x0001 to 0xFFFE

(2-1) Testing result of noise detection (only for reference)

The test results were obtained when the horizontal distance between the noise detector and the noise was 1 meter.

Noise Type	**Detected Decibel Value (set sensitivity to the highest)**	**Detected Decibel Value (set sensitivity to the lowest)**
100HZ	90dB	109dB
1KHZ	100dB	>110dB
10KHZ	103dB	>110dB
Knocking Sound	73dB	92dB
Music	85dB	>110dB

Note: When the knob is turned counterclockwise, it refers to the highest sensitivity of the noise sensor, which means the noise is more likely to be detected.

(3) Anti-tamper alarm (ShockAlarm)

A. Configuration range: 0x01 to 0x14.

B. When the ShockSensorSensitivity = 0xFF, the vibration detection is off and the default setting = 0x0A.

C. 10 seconds after turning on the device, the vibration sensor will start the detection.

(4) Power Outage Detection (PowerOffAlarm)

The PowerOffAlarm only works when the backup batteries are inserted beforehand.

A. When device is powered by backup batteries, all audio alerts stop working.

B. The backup batteries are able to support the device for 1 hour.

C. Please check and reconnect the device with DC power or the device may have false reports.

Note:

(1) When the audio alert sounds, the anti-tamper alarm doesn't work.

(2) The smoking sensor always remain on no matter what sensor was triggered.

(3) The length of the audio alert is 15 seconds by default. When the audio alert sounds before smoking and vibration sensors, the device would report HighSoundAlarm=0 during the 15 seconds.

Please visit Netvox *Lorawan Application Command document* and *Netvox Lora Command Resolver* http://www.netvox.com.cn:8888/cmddoc to resolve uplink data.

5.1 Example of ReportDataCmd

FPort: 0x06

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

CmdID– 1 byte

DeviceType– 1 byte – Device Type of Device

ReportType – 1 byte – the presentation of the NetvoxPayLoadData, according to the devicetype

NetvoxPayLoadData– var bytes (Max=9bytes)

Tips

1. Battery Voltage:

If the battery is equal to 0x00, it means that the device is powered by a DC power supply.

2. Version Packet:

When Report Type=0x00 is the version packet, such as 01D7000A03202309250000, the firmware version is 2023.09.25.

3. Data Packet:

When Report Type=0x01 is the data packet.

Device	**Device Type**	**Report Type**	**NetvoxPayLoadData**					
RA02G	0xD7	0x01	Battery (1Byte, unit:0.1V)	IncenseSmokeAlarm (1 Byte, 0-noalarm, 1: alarm)	HighSoundAlarm (1 Byte, 0-noalarm, 1: alarm)	ShockAlarm (1 Byte, 0-noalarm, 1: alarm)	PowerOffAlarm (1 Byte, 0-noalarm, 1: alarm)	Reserved (3 Bytes, fixed 0x00)

Example of Uplink: 01D7010000010000000000

1st byte (01): Version

2nd byte (D7): DeviceType 0xD7－RA02G

3rd byte (01): ReportType

4th byte (00): DC power supply

5th byte (00): IncenseSmokeAlarm－noalarm

6th byte (01): HighSoundAlarm－alarm

7th byte (00): ShockAlarm－noalarm

8th byte (00): PowerOffAlarm－noalarm

9th–11th byte (000000): Reserved

5.2 Example of Report Configuration

FPort: 0x07

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

CmdID– 1 byte

DeviceType– 1 byte – Device Type of Device

NetvoxPayLoadData– var bytes (Max=9bytes)

Description	**Device**	**Cmd ID**	**Device Type**	**NetvoxPayLoadData**		
ConfigReportReq	RA02G	0x01	0xD7	MinTime (2 bytes Unit: s)	MaxTime (2 bytes Unit: s)	Reserved (5 Bytes, Fixed 0x00)
ConfigReportRsp		0x81		Status (0x00_success)	Reserved (8 Bytes, Fixed 0x00)	
ReadConfigReport Req		0x02		Reserved (9 Bytes, Fixed 0x00)		
ReadConfigReport Rsp		0x82		MinTime (2 bytes Unit: s)	MaxTime (2 bytes Unit: s)	Reserved (5 Bytes, Fixed 0x00)
SetSmokeSensitivityReq (Remain Lastconfig when resettofac)		0x03		SmokesensorSensitivity (1 Byte, 0x00_accroding the hardware sensitivity knob, 0x01_Level1 0x02_Level2, 0x03_Level3, 0x04_Level4)	Reserved (8 Bytes, Fixed 0x00)	
SetSmokeSensitivityRsp		0x83		Status (0x00_success)	Reserved (8 Bytes, Fixed 0x00)	
GetSmokeSensitivityReq		0x04		Reserved (9 Bytes, Fixed 0x00)		
GetSmokeSensitivityRsp		0x84		SmokesensorSensitivity (1 Byte, 0x00_accroding the hardware sensitivity knob, 0x01_Level1 0x02_Level2, 0x03_Level3, 0x04_Level4)	Reserved (8 Bytes, Fixed 0x00)	

SetShockSensor SensitivityReq		0x05		ShockSensorSensitivity (1 Byte)	Reserved (8 Bytes, Fixed 0x00)	
SetShockSensor SensitivityRsp		0x85		Status (0x00_success)	Reserved (8 Bytes, Fixed 0x00)	
GetShockSensor SensitivityReq		0x06		Reserved (9 Bytes, Fixed 0x00)		
GetShockSensor SensitivityRsp		0x86		ShockSensorSensitivity (1 Byte)	Reserved (8 Bytes, Fixed 0x00)	
SetHighSound AlarmTrigger ThresholdTimeReq		0x07		HighSoundAlarm TriggerThreshold (2 Bytes)	HighSoundAlarm TriggerDuration (2 Bytes, unit:1s)	Reserved (5 Bytes, Fixed 0x00)
SetHighSound AlarmTrigger ThresholdTimeRsp		0x87		Status (0x00_success)	Reserved (8 Bytes, Fixed 0x00)	
GetHighSound AlarmTrigger ThresholdTimeReq		0x08		Reserved (9 Bytes, Fixed 0x00)		
GetHighSound AlarmTrigger ThresholdTimeRsp		0x88		HighSoundAlarm TriggerThreshold (2 Bytes)	HighSoundAlarm TriggerDuration (2 Bytes, unit: 1s)	Reserved (5 Bytes, Fixed 0x00)
SetBeeperDurationReq		0x09		BeeperDuration (2 Bytes, Unit:1s) (0x0000_DisableBeeper)	AlarmSoundLevel (1 Byte)	Reserved (7 Bytes, Fixed 0x00)
SetBeeperDurationRsp		0x89		Status (0x00_success)	Reserved (8 Bytes, Fixed 0x00)	
GetBeeperDurationReq		0x0A		Reserved (9 Bytes, Fixed 0x00)		
GetBeeperDurationRsp		0x8A		BeeperDuration (2 Bytes, Unit: 1s) (0x0000_DisableBeeper)	AlarmSoundLevel (1Byte)	Reserved (7 Bytes, Fixed 0x00)
StopCurrentBeeperAlarmReq		0x0B		Reserved (9 Bytes, Fixed 0x00)		
StopCurrentBeeperAlar		0x8B		Status (0x00_success)	Reserved (8 Bytes, Fixed 0x00)	

mRsp						
SetSmokeDebounceandResumeCheckTimeReq		0x0C		SmokeDebounceTime (2 Bytes, Unit:1s)	SmokeResumeTime (1 Bytes, Unit:1s)	Reserved (6 Bytes, Fixed 0x00)
SetSmokeDebounceandResumeCheckTimeRsp		0x8C		Status (0x00_success)	Reserved (8 Bytes, Fixed 0x00)	
GetSmokeDebounceandResumeCheckTimeReq		0x0D		Reserved (9 Bytes, Fixed 0x00)		
GetSmokeDebounceandResumeCheckTimeRsp		0x8D		SmokeDebounceTime (2 Bytes, Unit: 1s)	SmokeResumeTime (1 Bytes, Unit: 1s)	Reserved (6 Bytes, Fixed 0x00)

(1) Command Configuration

MinTime = 15min (0x0384), MaxTime = 15min (0x0384)

Downlink: 01D7038403840000000000

Response:

81D7000000000000000000 (Configuration success)

81D7010000000000000000 (Configuration failure)

(2) Read Configuration:

Downlink: 02D7000000000000000000

Response:

82D7038403840000000000 (Current configuration)

(3) SetSmokeSensitivityReq:

SmokesensorSensitivity = 0x02

Downlink: 03D7020000000000000000

Response: 83D7000000000000000000

(4) GetSmokeSensitivityReq:

Downlink: 04D7000000000000000000

Response: 84D7020000000000000000

(5) SetShockSensorSensitivityReq

Set ShockSensorSensitivity as 20 (0x14)

Downlink: 05D7140000000000000000

Response: 85D7000000000000000000

The vibration value could only be configured between 0x01 to 0x14.

When the ShockSensorSensitivity = 0xFF, the vibration detection is off.

(6) GetShockSensorSensitivityReq

Downlink: 06D7000000000000000000

Response: 86D7140000000000000000

(7) SetHighSoundAlarmTriggerThresholdTimeReq

HighSoundAlarmTriggerThreshold = 10 (0x0A); HighSoundAlarmTriggerDuration = 10s (0x0A)

Downlink: 07D7000A000A0000000000

Response: 87D7000000000000000000

When the HighSoundAlarmTriggerThreshold= 0xFFFF or

HighSoundAlarmTriggerDuration=0xFFFF, the noise detection is off.

(8) GetHighSoundAlarmTriggerThresholdTimeReq

Downlink: 08D7000000000000000000

Response: 88D7000A000A0000000000

(9) SetBeeperDurationReq

Set the length of the audio alert as the alarm is triggered.

BeeperDuration = 0x0000 (DisableBeeper)

Downlink: 09D7000000000000000000

BeeperDuration = 0x0014 (20s); AlarmSoundLevel = 0x0A (10)

Downlink: 09D700140A000000000000

Response: 89D7000000000000000000

(10) GetBeeperDurationReq

Read the duration and level of the audio alert.

Downlink: 0AD7000000000000000000

Response: 8AD7001400000000000000

(11) StopCurrentBeeperAlarmReq

Stop audio alert.

Downlink: 0BD70000000000000000

Response: 8BD70000000000000000

(12) SetSmokeDebounceandResumeCheckTimeReq:

SmokeDebounceTime: 5 mins (no detection); SmokeResumeTime: 10s (start detection)

The device starts detection after SmokeDebounceTime ends. During SmokeResumeTime, the device would report IncenseSmokeAlarm= noalarm as the data is lower than the threshold

Downlink: 0CD7012C0A000000000000

Response: 8CD70000000000000000

(13) GetSmokeDebounceandResumeCheckTimeReq:

Read current SmokeDebounceTime and SmokeResumeTime

Downlink: 0DD70000000000000000

Response: 8DD7012C0A000000000000

5.3 Example of NetvoxLoRaWANRejoin

(Note: check if the device is still in the network. If the device is disconnected, it will automatically rejoin back to the network.)

Fport: 0x20

CmdDescriptor	CmdID (1 byte)	Payload (5 bytes)	
SetNetvoxLoRaWANRejoinReq	0x01	RejoinCheckPeriod (4 Bytes, Unit: 1s 0xFFFFFFFF Disable NetvoxLoRaWANRejoinFunction)	RejoinThreshold (1 Byte)
SetNetvoxLoRaWANRejoinRsp	0x81	Status (1 Byte, 0x00_success)	Reserved (4 Bytes, Fixed 0x00)
GetNetvoxLoRaWANRejoinReq	0x02	Reserved (5 Bytes, Fixed 0x00)	
GetNetvoxLoRaWANRejoinRsp	0x82	RejoinCheckPeriod (4 Bytes, Unit: 1s)	RejoinThreshold (1Byte)

(1) Command Configuration

Set RejoinCheckPeriod = 60min (0x0E10), RejoinThreshold = 3 (times)

Downlink: 0100000E1003

Response:

810000000000 (Configuration success)

810100000000 (Configuration failure)

(2) Read current configuration

RejoinCheckPeriod = 60min (0x0E10), RejoinThreshold = 3 (times)

Downlink: 020000000000

Rthe esponse: 8200000E1003

Note:

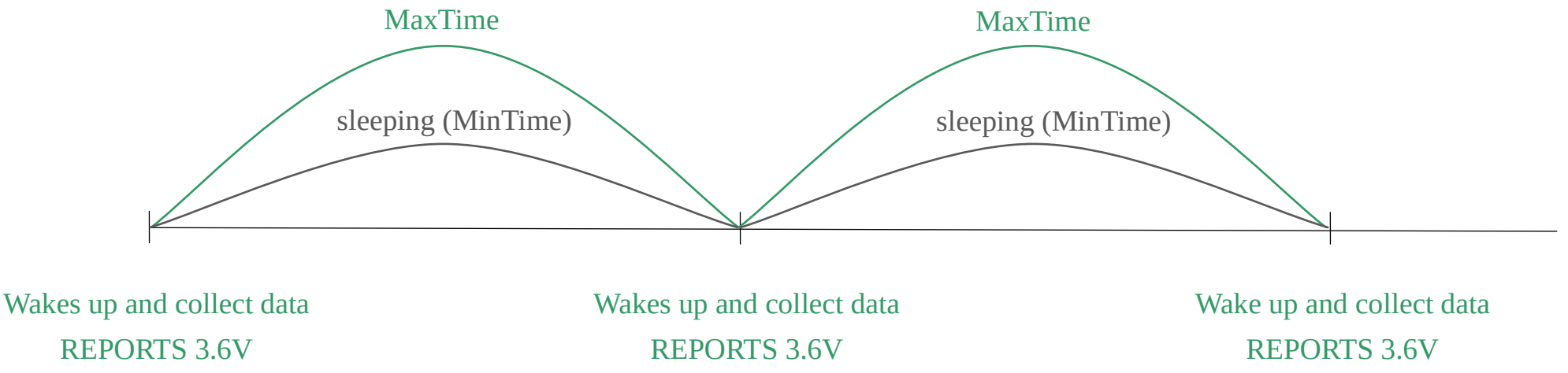
a. Set RejoinCheckThreshold as 0xFFFFFFFF to stop the device from rejoining the network.

b. The last configuration would be kept as user reset the device back to the factory setting.

c. Default setting: RejoinCheckPeriod = 2 (hr) and RejoinThreshold = 3 (times)

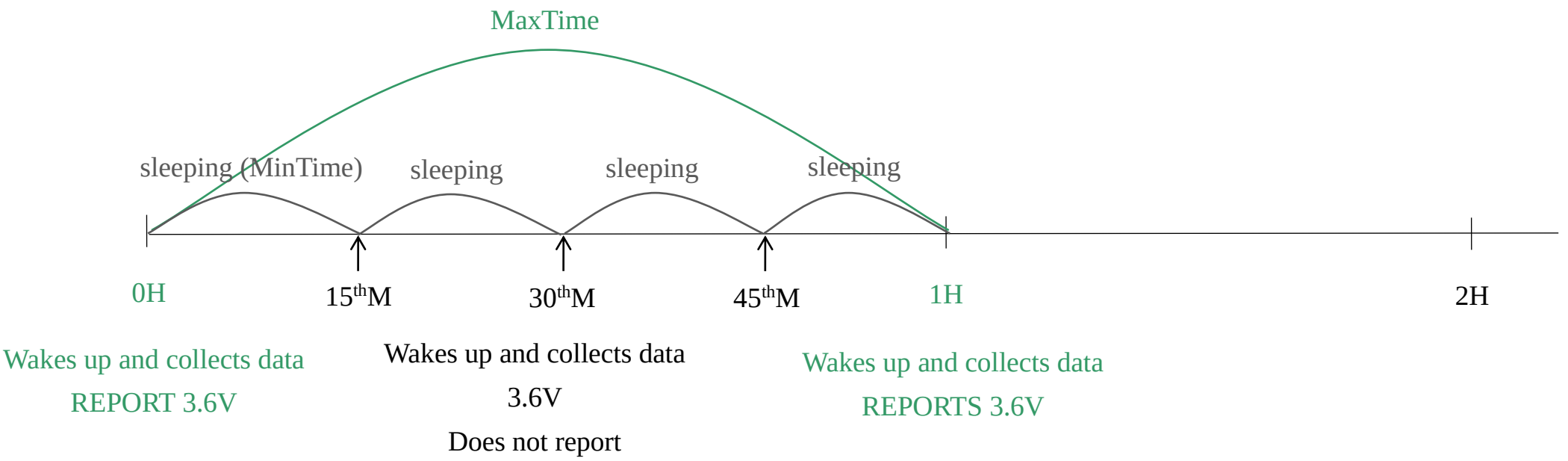
5.4 Example for MinTime/MaxTime logic

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

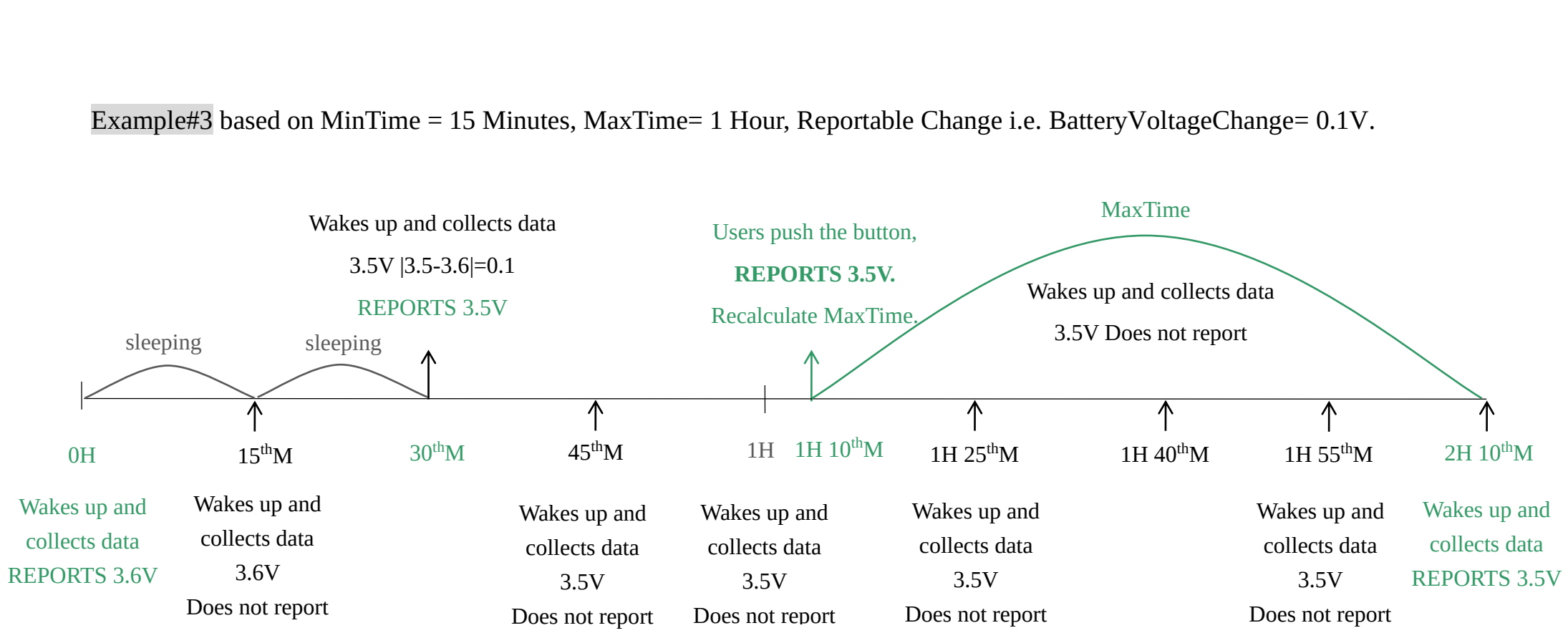


Note: MaxTime = MinTime. Data will only be reported according to MaxTime (MinTime) duration regardless BatteryVoltageChange value.

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.

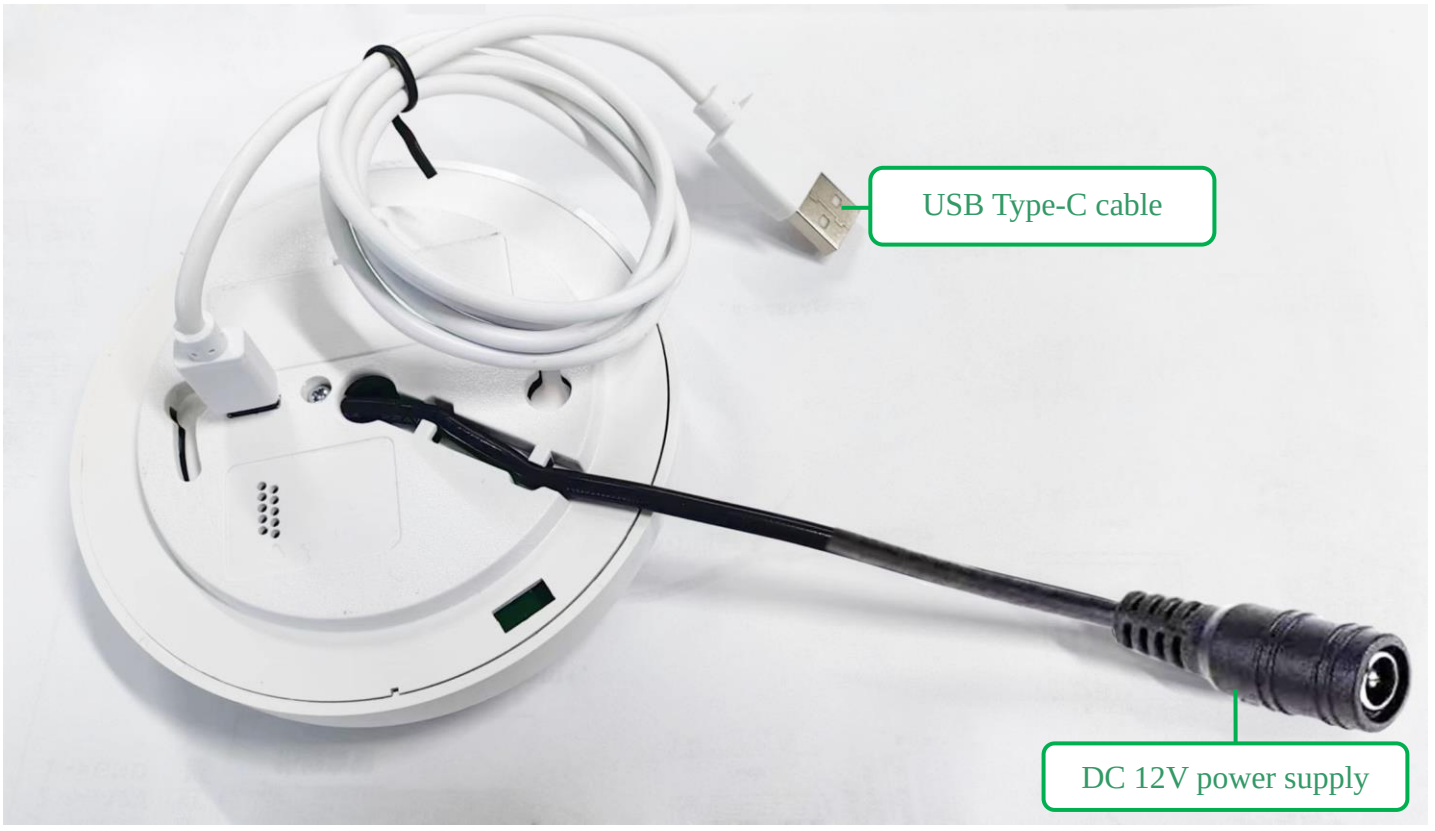
(2) The data collected is compared with the last data reported. If the data variation is greater than the ReportableChange value, the device reports according to MinTime interval. If the data variation is not greater than the last data reported, the device reports according to MaxTime interval.

(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.

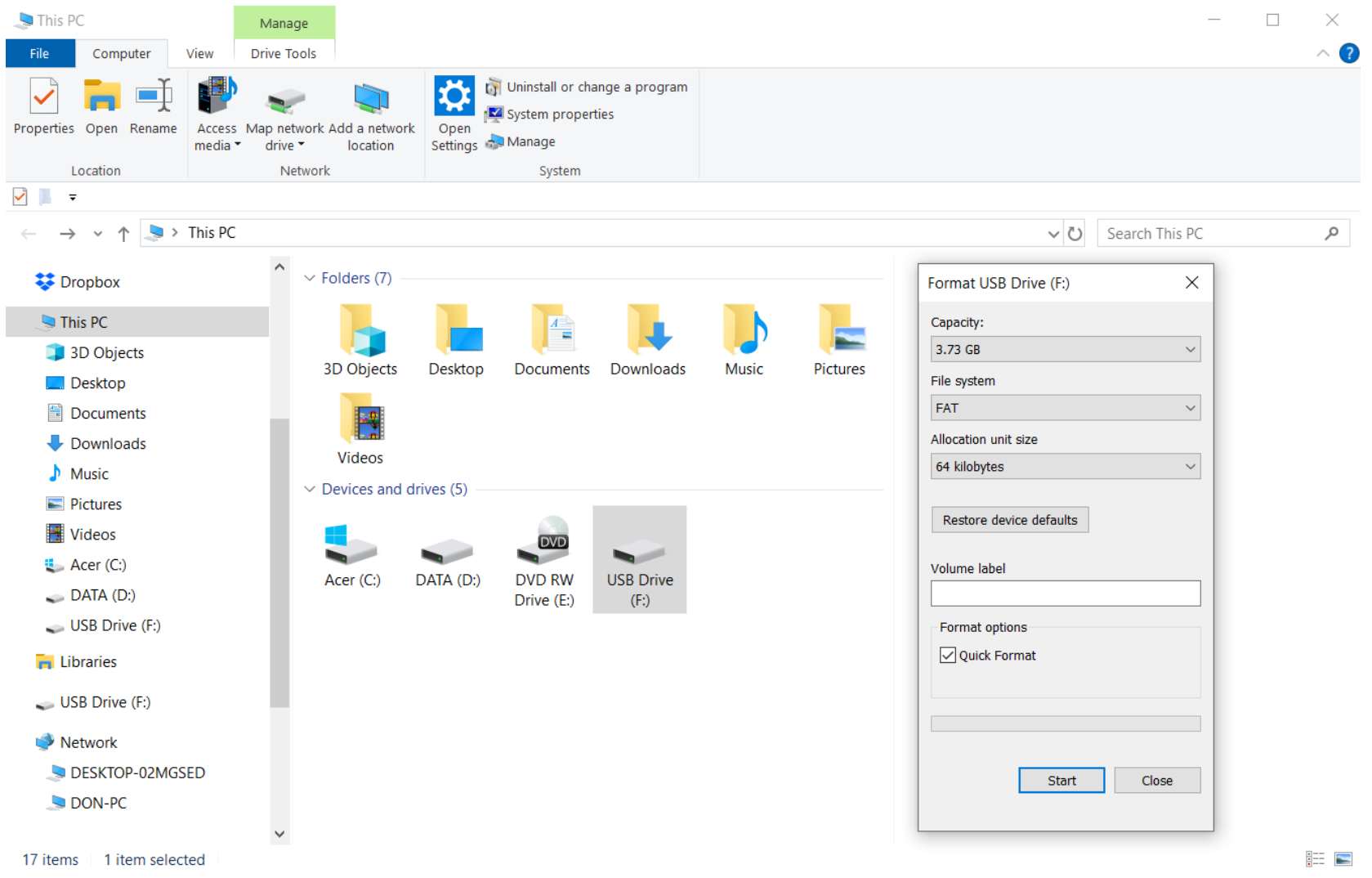
6. Audio Alerts Customization

(1) Connect the computer and device with a TYPE-C cable.

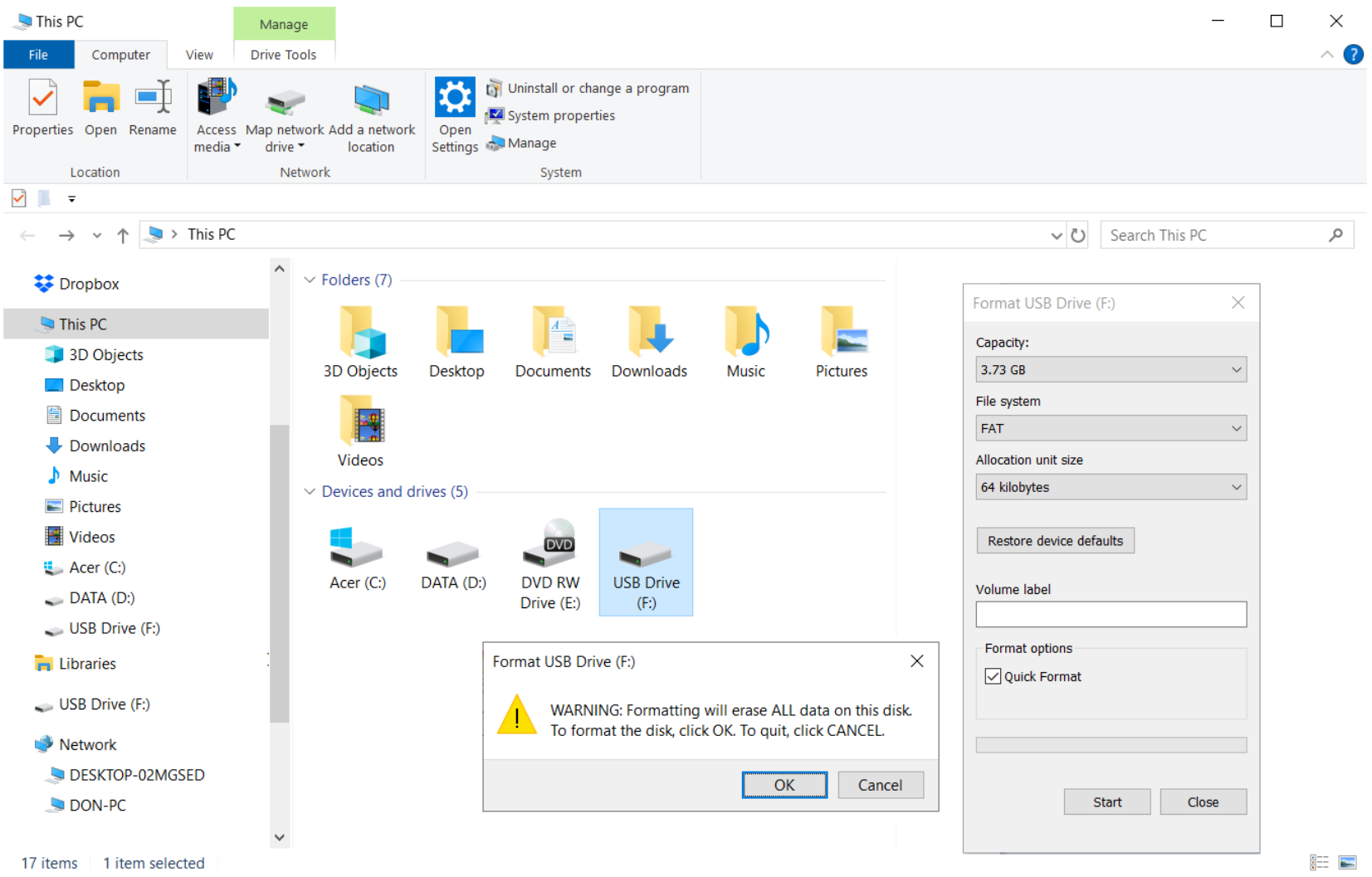


(2) Wait 1 to 2 minutes until the virtual USB drive appears.

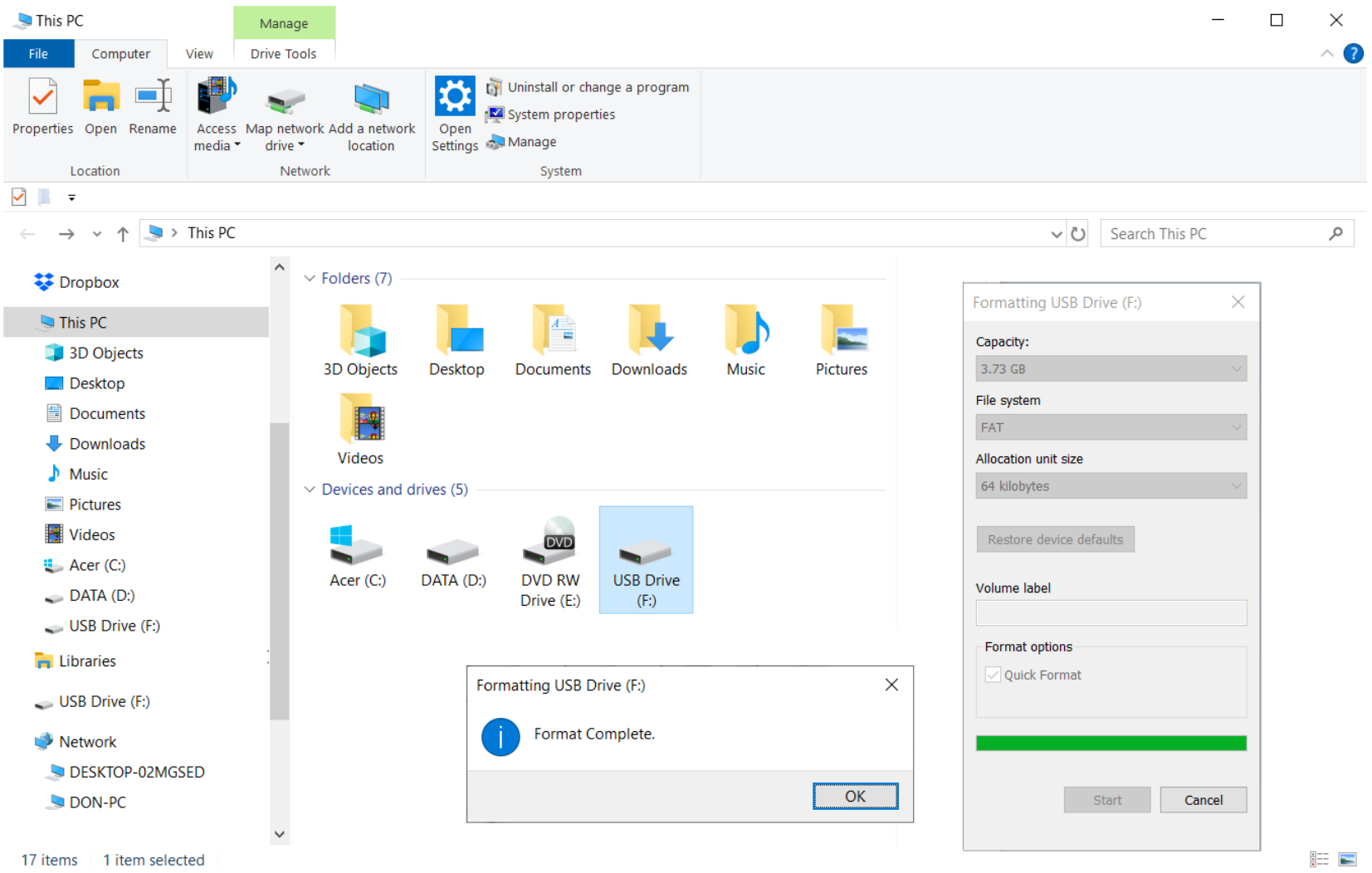
(3) Right click the USB Drive and select format.



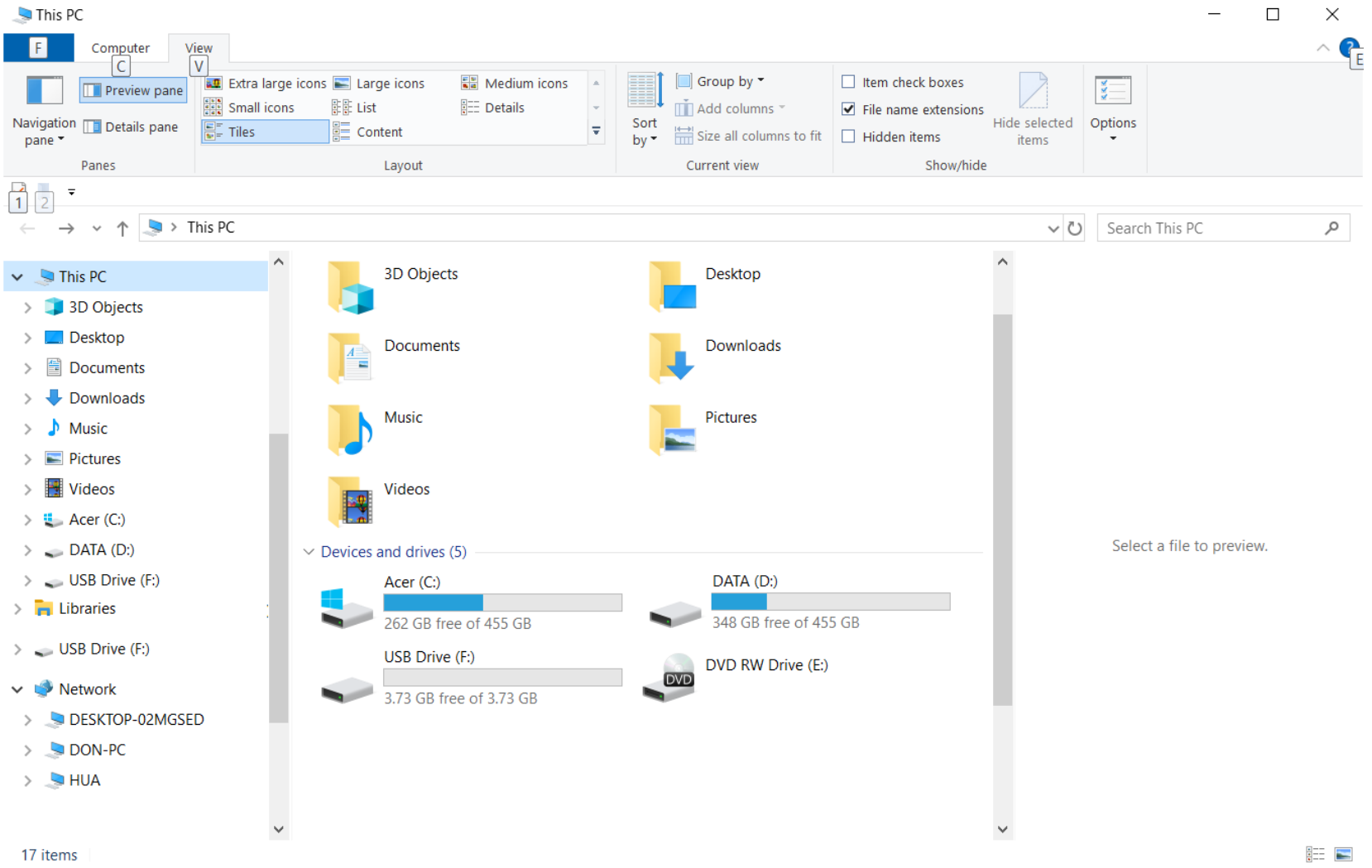
(4) Click OK to start formatting.



(5) Format complete.

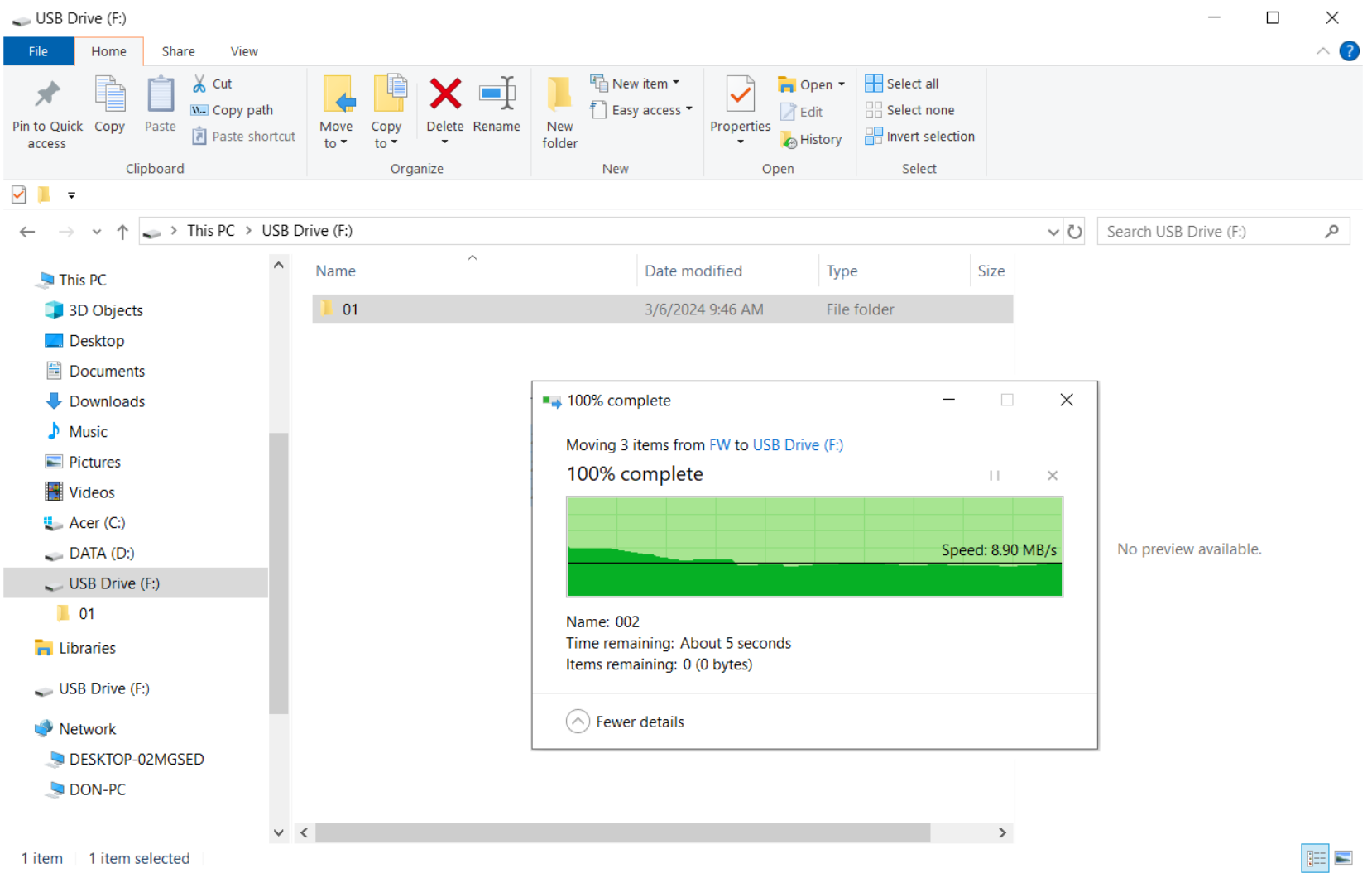


(6) Turn off and on the device. The flash drive should be empty as the picture shown below.



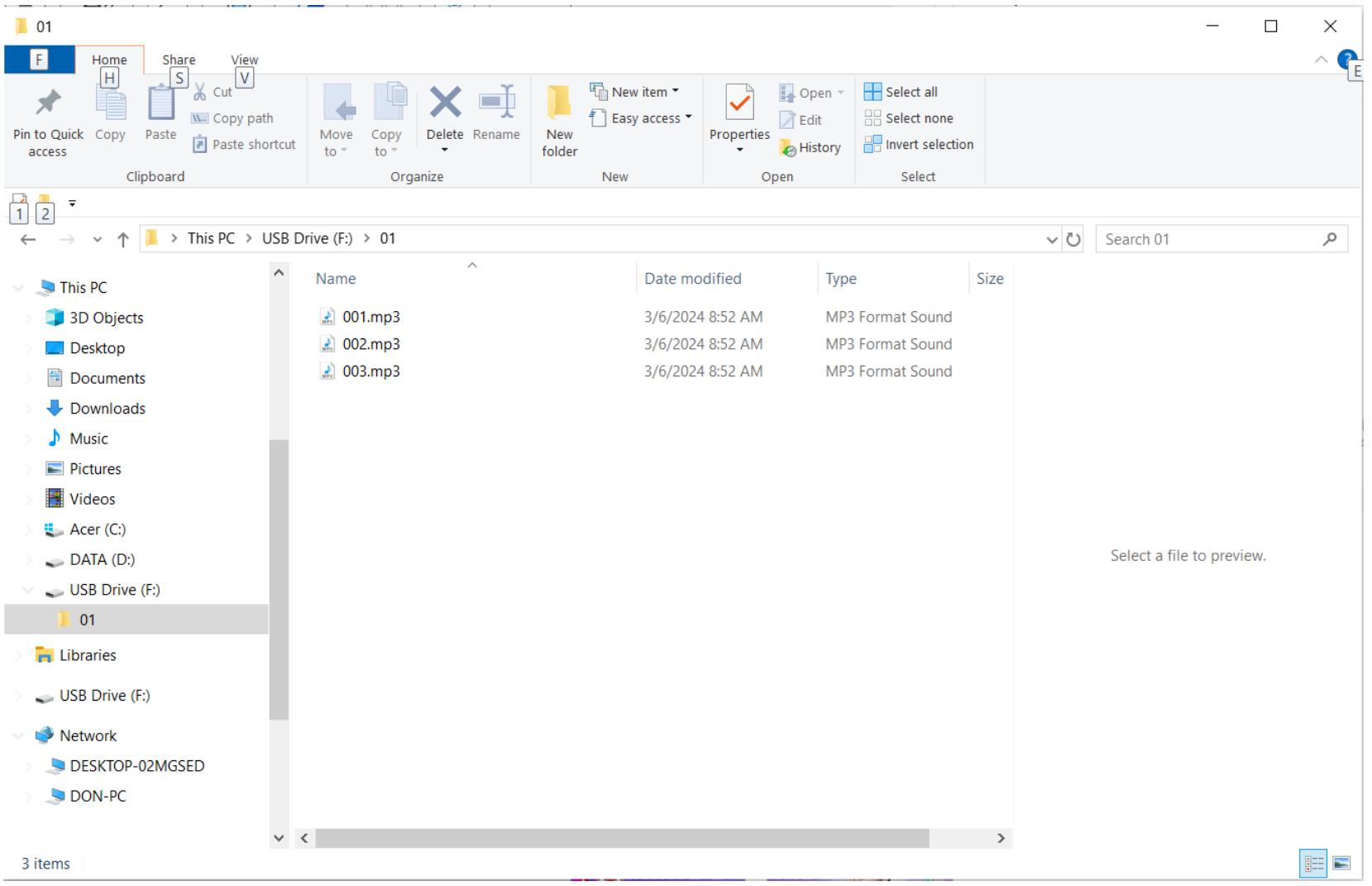
(7) Create a new folder in USB Drive and rename it as 01.

(8) Put all files of audio alerts in the 01 folder.



(9) Name all audio alerts as **00x.mp3** or **00x.wav**.

Default: 001: anti-tamper detection; 002: noise detection; 003: smoking detection



Note: (1) The folder and audio alerts should be named according to the default setting.

(2) The file type of audio alerts should always be mp3 or wav.

(3) The above procedure should be followed when uploading new audio alerts.

(4) The storage capacity of the flash drive is 4MB by default.

7. Installation

- Installation around vents, electrical appliances, and in environments with extremely high/low temperatures, or excessive amounts of dust might affect the operation of the device and cause inaccurate results.
- RA02G could only alert users as the possible danger occurs. Only by staying alert to the surroundings can users prevent the occurrence of damage and disasters.
- Due to the high sensitivity of smoking detection, RA02G could have false alarms. Users may need to adjust the sensitivity to a suitable value for different environments.

8. Important Maintenance Instructions

Kindly pay attention to the following to achieve the best maintenance of the product:

- Keep the device dry. Rain, moisture, or any liquid might contain minerals and thus corrode electronic circuits. If the device gets wet, please dry it completely.
- Do not use or store the device in a dusty or dirty environment. It might damage its detachable parts and electronic components.
- Do not store the device under excessively hot conditions. High temperatures can shorten the life of electronic devices, destroy batteries, and deform or melt some plastic parts.
- Do not store the device in places that are too cold. 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. Rough handling of equipment can destroy internal circuit boards and delicate structures.
- Do not clean the device with strong chemicals, detergents, or strong detergents.
- Do not apply the device with paint. Smudges might block the device and affect the operation.
- Do not throw the battery into the fire, or the battery will explode. Damaged batteries may also explode.

All of the above applies to your device, battery, and accessories. If any device is not working properly, please take it to the nearest authorized service facility for repair.