

User Manual

V2X-AIR CV2X User Manual

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Contents

1	Hardware setup	4
1.1	Hardware	4
1.1.1	V2X-AIR Exterior View	4
1.1.2	Top panel with antenna ports	5
1.1.3	Bottom panel with I/O interfaces	5
1.1.4	Dimensions	6
1.2	Power supply	6
1.3	GPS antenna connection	6
1.4	V2X antenna connection	6
2	Configuration	7
2.1	Access to V2X-AIR	7
2.1.1	SSH connection (via Ethernet)	7
2.2	Configuration guide	8
2.2.1	Pre-configuration for C-V2X	8
2.2.1.1	Set XML: Configuration	8
2.2.1.2	Set XML: Stop to CV2X	8
2.2.1.3	Set XML: Update to XML	8
2.2.1.4	Set XML: Start CV2X	8
3	Example application Tx/Rx	9
3.1	Test Guide: C-V2X	9
3.1.1	Example Tx Command: \$ acme	9
3.1.2	Example Rx Command: \$ acme -R	10
3.2	Test Guide: Common	11
3.2.1	Example Application Command	11
3.2.2	Example Usage Command: Tx	11
3.2.3	Example Usage Command: Rx	11
4	Troubleshooting	12
4.1	Troubleshoot with RF Tx/Rx	12
4.1.1	C-V2X Status Check	12
4.2	Configuration not working	12
4.2.1	Pre-configuration for C-V2X	12
5	FCC Statement	13

List of Figures

Figure 1-1	V2X-AIR Exterior View	4
Figure 1-2	Antenna ports for V2X-AIR	5
Figure 1-3	I/O interfaces for V2X-AIR	5
Figure 1-4	Dimensions of V2X-AIR CV2X (LTE-V2X)	6

List of Tables

Table 1-1 V2X-AIR Exterior Parts 4

Table 1-2 Antenna description 5

Table 1-3 I/O interfaces 5

Table 2-1 CV2X-CONFIG Option Table 8

Table 3-1 acme Option Table 9

1 Hardware setup

1.1 Hardware

1.1.1 V2X-AIR Exterior View

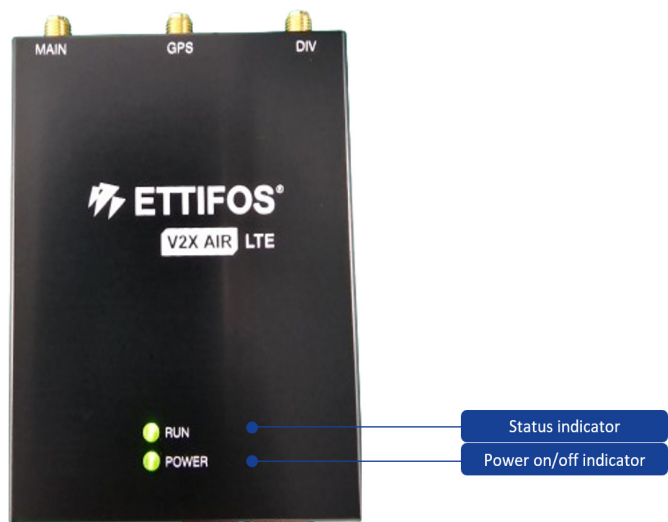



Figure 1-1 V2X-AIR Exterior View

Table 1-1 V2X-AIR Exterior Parts

Part	Description	
Communication Type	LTE-V2X	
RUN	Solid Green Blinking Greed Yellow	Normal Condition Prepare Program Abnormal Condition
Power	Green RED	Suppled USB-PD(5V/3A) NOT Suppled USB-PD(5V/3A)

1.1.2 Top panel with antenna ports

The antenna ports are on the top panel of V2X-AIR.



Figure 1-2 Antenna ports for V2X-AIR

Table 1-2 Antenna description

Antenna port	Type	Description
MAIN	SMA female(pin)	V2X antenna port #MAIN
DIV	SMA female(pin)	V2X antenna port #DIV
GPS	SMA female	GPS antenna port

1.1.3 Bottom panel with I/O interfaces

The I/O interfaces and DC power connector are located on the bottom-side of V2X-AIR.



Figure 1-3 I/O interfaces for V2X-AIR

Table 1-3 I/O interfaces

Interface	Type	Description
USB-A (USB1)	USB-A	USB host port that supports various USB accessories such as USB mass storage, keyboard/mouse, BLE Dongle, etc. Supports USB SS, HS, FS, LS.
POWER	USB-C	USB Type C power connector (USB-PD 2.0 / +5V 3A)
USB-A (USB2)	USB-A	USB host port that supports various USB accessories such as USB mass storage, keyboard/mouse, BLE Dongle, etc. Supports USB SS, HS, FS, LS.

1.1.4 Dimensions

The dimensions of V2X-AIR CV2X (W x H x D) are 72 x 93 x 23.3 mm.

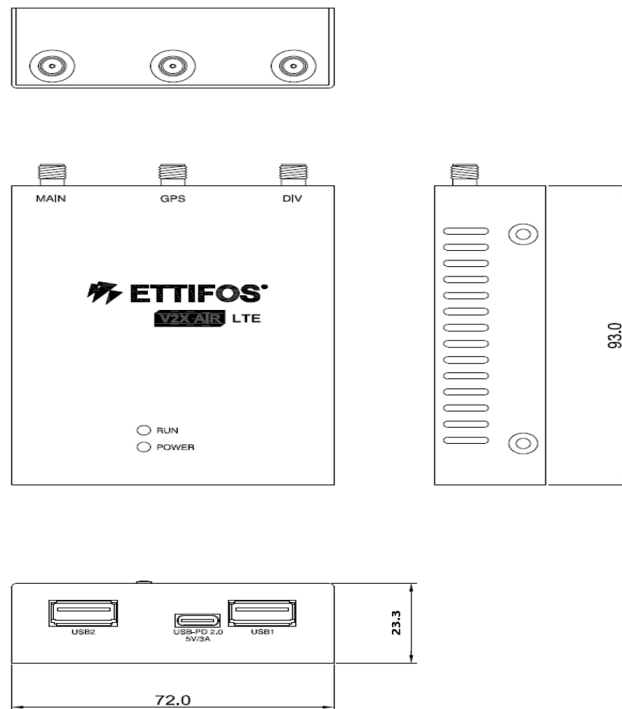


Figure 1-4 I/O Dimensions of V2X-AIR CV2X (LTE-V2X)

1.2 Power supply

- Plug the DC power **USB Type C cable from USB-PD 2.0** provided with V2X-AIR in the **POWER**.
- The **POWER** LED will be green when V2X-AIR is powered on.
- If it is **not a USB PD Power**, the RED LED will come on and it will not operate normally.

1.3 GPS antenna connection

- Connect the GPS antenna cable to the **GPS** antenna port in the top panel.

1.4 V2X antenna connection

- Connect the V2X antennas provided with V2X-AIR to the **MAIN** and **DIV** antenna port in the top panel.
- V2X antenna connections are not port sensitive.

2 Configuration

2.1 Access to V2X-AIR

2.1.1 SSH connection (via Ethernet)

- Connect the **USB-A** (e.g., USB Ethernet Adapter) port in the bottom-side panel of V2X-AIR to a computer.
- Access V2X-AIR via SSH application with the default IP address and the default port number **22**. (**ID: root, Password: 1234asdf**)
- The default IP address is 192.168.1.234.

ID: root Password: 1234asdf	> ssh root@192.168.1.234 root@192.168.1.234's password: root@Ettifos:~#
--------------------------------	---

- **To change the IP settings of V2X-AIR:**

- (1) Open the '50-wired.network' file and change 'Address' and 'Gateway' (Line 14 to 15) values to new ones you want.

```
root@Ettifos:~# vi /lib/systemd/network/50-wired.network
...
# Press 'i' to enter insert mode
11 Name=enx*
~
13 [Network]
14 Address=192.168.1.234/24
15 Gateway=192.168.1.1
...
# Press ':wq!' to save the changes and quit
:wq!
```

- (2) Open the 'resolv.conf' file and change 'nameserver' (Line 0) values to new ones you want.

```
root@Ettifos:~# vi /etc/resolv.conf
...
# Press 'i' to enter insert mode
0 nameserver 8.8.8.8
...
# Press ':wq!' to save the changes and quit
:wq!
```

- (3) Restart 'systemd-networkd' or reboot DUT to apply changes.

```
# Restart systemd-networkd or Reboot DUT
$ systemctl restart systemd-networkd
```

2.2 Configuration guide

V2X-AIR supports user configuration for the user to set C-V2X. But C-V2X and DSRC are different in modules, the method of setting up is also different.

2.2.1 Pre-configuration for C-V2X

2.2.1.1 Set XML: Configuration

```
Usage: cv2x-config --<command name> <command_parameters>
# Interface IDs: 0 - V2X_IP, 1 - V2X_NON_IP
```

Table 2-1 CV2X-CONFIG Option Table

Option	Description
--get-v2x-status	Read the V2X radio receive and transmit status.
--start-v2x-mode	Start V2X mode.
--stop-v2x-mode	Stop V2X mode.
--update-config-file [filepath]	Update xml file.

2.2.1.2 Set XML: Stop to CV2X

```
$ cv2x-config --stop-v2x-mode
[I][init_qmi_services:490] Initialized QMI clients
[I][stop_v2x_radio:637] Stopped V2X radio
[I][deinit_qmi_services:501] De-initialized QMI clients
```

2.2.1.3 Set XML: Update to XML

```
$ cv2x-config --update-config-file [path/xml]
e.g., cv2x-config --update-config-file /root/xml/v2x_omniar.xml
[I][init_qmi_services:490] Initialized QMI clients
[I][update_v2x_config_file:1572] Sent V2X config file successfully
[I][deinit_qmi_services:501] De-initialized QMI clients
```

2.2.1.4 Set XML: Start CV2X

```
$ cv2x-config --start-v2x-mode
[I][init_qmi_services:490] Initialized QMI clients
[I][start_v2x_radio:617] Started V2X radio
[I][deinit_qmi_services:501] De-initialized QMI clients
```


3 Example application Tx/Rx

Describes the test method for use by the user.

3.1 Test Guide: C-V2X

A generic test tool used as either a packet sender (default), receiver(-R) or echo (-e) can also optionally be used as a UDP -> PC5 proxy or vice-versa.

```
$ acme <option>
```

Table 3-1 acme Option Table

option	Ref.	Description
-h	--Help Usage	Print this Usage
-A		ASCII dump packet data after sequence#
-a		Additional SPS/Event Flow Pair. Subsequent -E,-l,-r -o flow params will apply to new reservation
-d		dump raw packet
-k	<qty>	Quit after <qty> packets are received or transmitted
-l	<bytes [bytes] ... >	List of Payload Lengths in bytes, at least one length required specify multiple payloads. TX will send one packet of each length in sequence. Maximum number of length sequence is 1000.
-P	<V2X ID>	V2X session ID to be used
-R		RECEIVE mode, default is TX
-V		Increase verbosity level +1 for each -V, default=0

Examples:

```
$ acme -RV      # Receives and displays all received packets.
$ acme -RVd     # same as above but dumps the hex content.
$ acme -VV -o1 -r300 -M500 -a -r200 -l100 -M100 -o1 # Will setup 2 SPS flows ala J2945/1
$ acme -VV -o1 -r300 -M500 -j1 # Setup SPS flow with pool id 1
```

3.1.1 Example Tx Command: \$ acme

```
$ acme
```

```
[W][radio_listener:556] TX/RX Status Changed to <Active> ****
Modem rmnet_data1 capabilities:
  non IP MTU: 8188 (rmnet_data1)
  IP MTU: 1500 (rmnet_data0)
  min periodicity: 100 ms
  max periodicity (lowest reserved Freq): 1000 ms
  highest priority number supported: 7 (lower # is more urgent)
  lowest priority number supported: 0 (lower # is more urgent)
  tx pool ids supported:
    ID: 0, min_freq: 55090, max_freq: 55190
# SPS Interval periodicity not specified, using packet-gen interval: 100 ms.
Flow#0: type=3 file-descriptors:(-1 -1) sps_port=2500 evt_port=2600, 100 ms, 287 bytes
# traffic_class=3
Setup traffic class=3 on the event socket completed.
Setup traffic class =3 completed the SPS flow socket.
Flow#0: type=3 27 28 sps_port=2500 evt_port=2600, 100 ms, 287 bytes
# interval=100000000 ns ( approximately 10 per second)
TX count: 1, len = 287
TX count: 2, len = 187
```

3.1.2 Example Rx Command: \$ acme -R

```
$ acme -R
[W][radio_listener:556] TX/RX Status Changed to <Active> ****
Modem rmnet_data1 capabilities:
  non IP MTU: 8188 (rmnet_data1)
  IP MTU: 1500 (rmnet_data0)
  min periodicity: 100 ms
  max periodicity (lowest reserved Freq): 1000 ms
  highest priority number supported: 7 (lower # is more urgent)
  lowest priority number supported: 0 (lower # is more urgent)
  tx pool ids supported:
    ID: 0, min_freq: 55090, max_freq: 55190
Epoch-ms | Tot-pkts | New-pkts | PPS | Latency | RV's | CBP %
<1698743818326242> | 0 | + 0 packets | 0.00 packets per second (PPS) | 0.00 ms avg latency | RV Count=0 | CBP= 0%
<1698743819326244> | 0 | + 0 packets | 0.00 packets per second (PPS) | 0.00 ms avg latency | RV Count=0 | CBP= 0%
|#1 |l=287|UE#1|<latency=27030431334.99 ms> |total missed=0| per UE lost/sent=|0|1| 0.0%|
|#2 |l=187|UE#1|<latency=27030431334.54 ms> <ipg= 99.59 ms>|total missed=0| per UE lost/sent=|0|2| 0.0%|
|#3 |l=187|UE#1|<latency=27030431335.16 ms> <ipg=100.62 ms>|total missed=0| per UE lost/sent=|0|3| 0.0%|
```

3.2 Test Guide: Common

3.2.1 Example Application Command

```
Usage: /usr/bin/etf-trx-test [option] [value]
  - t: Select V2X Type[WAVE/C-V2X]
  - m: Select Operate Mode [tx/rx]
  - c: Select V2X Channel [172/174/176/178/180/182/184] / WAVE Only
  - i: Select Tx Interval (ms)
  - p: Select Tx Power (dBm) / WAVE only
  - n: Select The number of Tx Packet
  - h: Help
```

3.2.2 Example Usage Command: Tx

```
$ /usr/bin/etf-v2x-trx-test -t C-V2X -m tx -i 100 -n -1
Ettifos V2X Tx/Rx Test Application (help: -h)
=====
Ettifos V2X (WAVE) Tx Pre-Configuration
  txChannel: 0
  txInterval: 0 ms
  txPower: 0 dBm
  txNumber: -1
=====
```

3.2.3 Example Usage Command: Rx

```
$ /usr/bin/etf-v2x-trx-test -t C-V2X -m rx
Ettifos V2X Tx/Rx Test Application (help: -h)
=====
Ettifos V2X (C-V2X) Rx Pre-Configuration - None
=====
[MQTT_SUB_ConnectCallback] Result: 0
```

4 Troubleshooting

4.1 Troubleshoot with RF Tx/Rx

- No RF signal is transmitted
 - Make sure that V2X antennas are correctly connected to the V2X-1 and V2X-2 antenna ports.

4.1.1 C-V2X Status Check

```
$ cv2x-config --get-v2x-status
[!][init_qmi_services:490] Initialized QMI clients
[!][get_v2x_radio_status:596] Read V2X radio status
V2X rx_status=1, tx_status=1
rx_pool_0_status=1, rx_pool_1_status=0, rx_pool_2_status=0, rx_pool_3_status=0,
tx_pool_0_status=1, tx_pool_1_status=0,
[!][deinit_qmi_services:501] De-initialized QMI clients
```

V2X Status: [0: Initial / 1: Normal / 2: Error]

4.2 Configuration not working

- Check the pre-configuration for AT Command

4.2.1 Pre-configuration for C-V2X

Check the AT-COMMAND setting. If you already have AT-command setup, the xml configuration will not work.

(1) Run busybox microcom

```
$ busybox microcom /dev/ttyUSB2
RDY
```

(2) Set AT Command

```
$ AT+QV2XCFG="preconfig"
+QV2XCFG="preconfig":
2090035D935FD00000000BFFFFE5802540697FFFFCB004A923881000600000000000282300E04A2AC0
94102162C58B162C102162C58B162C102162C58B162C102162C58B162C102162C58B162C102162C58B1
62C102162C58B162C102162C58B162C0A280003072019C420E012E0032107009700
```

- If there is a pre-configuration already set (result is not 'ERROR'), it should be removed

(3) Set AT Command: Initialization

```
$ AT+QV2XCFG="preconfig",0
OK
```

- If the setting is complete, you can exit using the "ctrl + x" key.

5 FCC Statement

Regulatory Compliance

C-V2X OBU

IMPORTANT NOTE:

FCC RF exposure statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End-users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must be at least 20 cm from the user and must not be co-located or operating in conjunction with any other antenna or transmitter.

The FCC ID of the product is: 2BHJL-ETF-AIR-C02

OBU firmware prevents the end user from adjusting power or channel settings that could result in a violation of FCC rules.

The end user is warned that any un-authorized adjustment to OBU firmware could result in a violation of FCC rules. Firmware update may only be performed by or under the immediate supervision and responsibility of a person certified as technically qualified to perform transmitter maintenance by Ettifos Co.

Any modifications made to this product, including the use of unauthorized antennas could result in violation of the FCC regulations and is strictly prohibited.

This product is operated under FCC license, please contact Ettifos Co. regarding all licensing requirements to ensure ongoing regulatory compliance during use.

Caution

Any changes or modifications (including the antenna) made to this device that are not expressly approved by the manufacturer may void the user's authority to operate the equipment.

Antenna Information

Antenna Type: External Dipole Antenna (RP-SMA)

Antenna Max Gain: 2.19 dBi

FCC Compliance 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.

FCC Interference Statement

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 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

Waiver limitations

- The device is authorized for use only by ITS licensees approved by the FCC.
- It is restricted solely to vehicle safety-related communications, such as traffic alerts, collision warnings, and similar safety functionalities.
- The device operates under FCC waiver [DA 24-363], dated [April 18, 2024]. Please refer to this waiver for further details on operational constraints.

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