UMPZ2-EVK Hardware Manual

Preliminary Draft

V2X, GNSS module with host controller

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					CHKD.	TITLE UMPZ2-EVK		PRELIMINARY SPECIFICATION
					APPD.			
SYMB.	DATA OR NO.	APPD.	CHKD.	DSGD.	ALPS ELECTRIC CO., LTD.			

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1. INTRODUCTION

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.

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 & your body.

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2. GENERAL DESCRIPTION

2-1. Overview

This document describes hardware specifications of V2X board with host controller (UMPZ2-EVK).
UMPZ2-EVK provides wireless communication in 5.9GHz band as well as 802.11 stack, IEEE1609 and ETSI.

2-2. Features

2-2-1. Product overview

- **UMPZ2-EVK uses double (single) antenna at frequency 5.9GHz and fully implements 802.11p PHY function**
  Optional it's possible to use this product only with single antenna.

- **IEEE1609 ETSI TC-ITS security protocols**
  It becomes exclusive option at the time of start-up software for IEEE1609 and ETSI function.

- **GNSS positioning and tracking system**
  High accuracy positioning system
  Dead Reckoning system to predict position and speed under weak radio signal condition will be supported in next revision

- **Applications and communication protocols processor**
  - Quad Core processor (ARM Cortex-A9、Max 1GHz)
  - 2GB RAM (4×512MB DDR3)
  - Linux Operating System (Kernel Versin3.10.17)

- **Interfaces**
  - Ethernet 10/100Base-T (IPv4/IPv6 network protocols)
  - USB2.0 High Speed interface (Host)
  - UART interface (for Linux Console usage)
  - High Speed Can (optional)
  - LVDS Display interface

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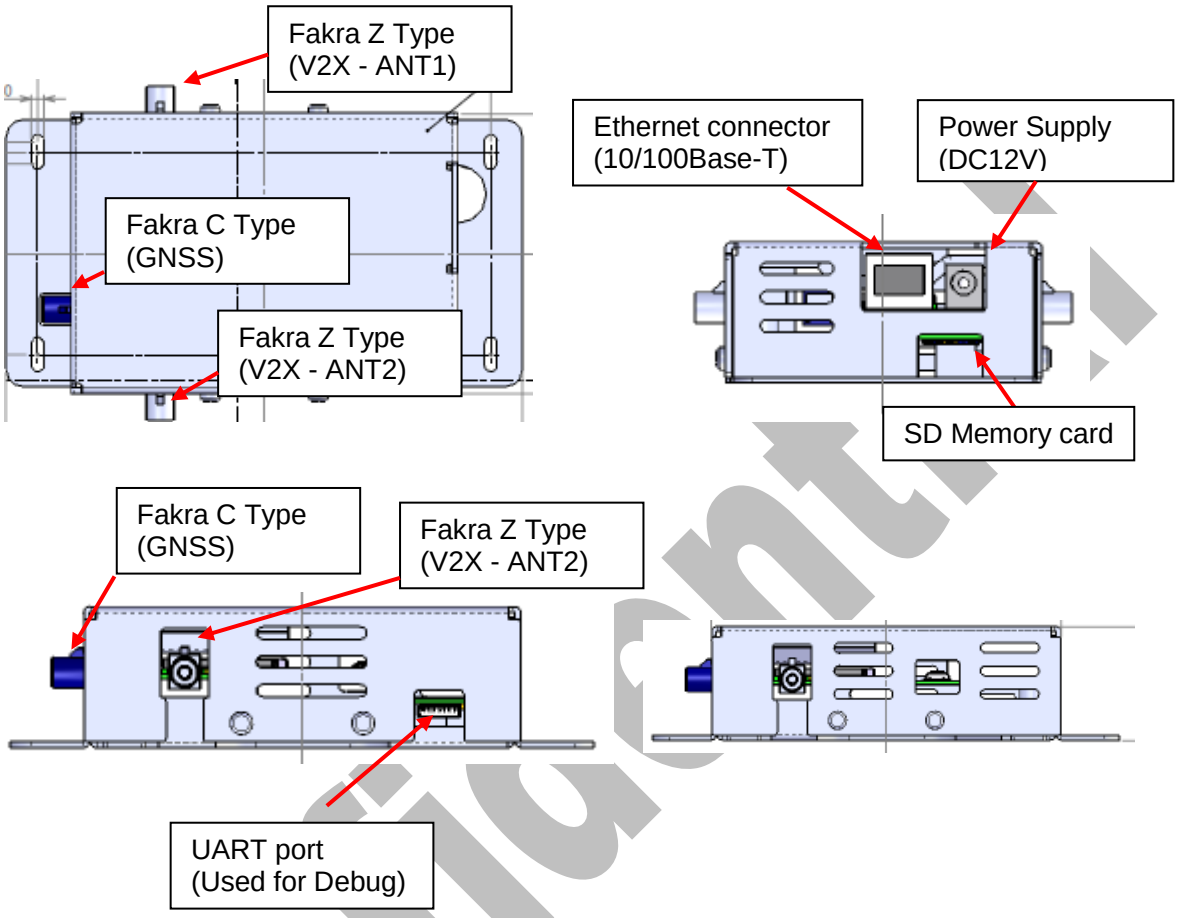
Housing Sketch



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3. FEATURES

3-1. CPU

Items	Description
CPU Core	ARM Cortex-A9 MPCore 4xCPU processor (with TrustZone®)
Cache	- 32 KByte L1 Instruction Cache - 32 KByte L1 Data Cache - 1 MB unified I/D L2 cache, shared by four cores
Co-processor	Cortex-A9 NEON MPE (Media Processing Engine) Co-processor
Memory	- Boot ROM, including HAB (96 KB) - Internal multimedia / shared, fast access RAM (OCRAM, 256 KB) - Secure/non-secure RAM (16 KB)
USB	- High Speed (HS) USB 2.0 OTG (Up to 480 Mbps)
UART	- Five UARTs, up to 4.0 Mbps
I2C	- Three I2C, supporting 400 kbps
Ethernet	- Ethernet Controller (IEEE1588 compliant), 10/100/Mbps
CAN	- Two Controller Area Network (FlexCAN), 1 Mbps each
Security	- ARM TrustZone including the TZ architecture (separation of interrupts, memory mapping, etc.) - CAAM—Cryptographic Acceleration and Assurance Module, containing 16 KB secure RAM and True and Pseudo Random Number Generator (NIST certified) - SNVS—Secure Non-Volatile Storage, including Secure Real Time Clock

3-2. Memory

Item	Description
Speed grade	DDR3-1600
Memory Capacity	- 4 DDR 32M*16*8banks each
Supply Voltage	- 1.5V
Timing Latency	- 1.5ns @ CL = 9 (DDR3-1333)

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3-3. SD Memory

SD card is used for UMPZ2-EVK start up. Software stack is saved on internal storage.

Item	Description
Density	8Gbyte
Class	10

3-4. Antenna

4. ELECTRICAL CHARACTERISTICS

4-1. Absolute maximum raitings

Items	Conditions
Storage Temperature	(TBD)
Storage Humidity	(TBD)

Terminal Name	Conditions
UART RX	-0.5 ~ 3.6 [V]
UART RTS	-0.5 ~ 3.6 [V]
Power Supply	-0 ~ 20 [V]
RF Input	+0dBm(V2X)
	+10dBm(GNSS)

4-2. Operating Conditions

Items	Conditions
Operating Temperature	Nominal: -10～+50 [ºC] (without condensation)

Pin No. / Pin Name	Conditions
Power Supply	Nominal: 12±0.5[V] Extreme: 7.5～18[V]

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4-2-1. Digital Input / Output Operating Conditions

Pin No. / Pin Name	Conditions
UART Interface UART RX UART RTS	V_{IN_Low}: < 0.98 [V] V_{IN_High}: > 2.4 [V]
UART Interface UART TX UART CTS	V_{OUT_Low} : 0.15 [V] V_{OUT_High} : 3.117 [V] Note1: I_{OUT_Low} = +1.0 [mA] Note2: I_{OUT_High} = -1.0 [mA]

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4-3. DC Characteristics

Following characteristics are guaranteed over recommended operating conditions unless otherwise stated.

4-3-1. Maximum Current Consumptions

Condition	Vcc=12V [mA]		
	Min.	Typ.	Max.
VCC=12V	-	-	T.B.D

4-3-2. IEEE Std 802.11p™

4-3-2-1. Receiver Current Consumptions

Mode	V_{CC}=12V [mA]		
	Min.	Typ.	Max.
Standby	-	500	-.

4-3-2-2. Transmitter Current Consumptions

Mode	V_{CC}=12V [mA] *1)		
	Min.	Typ.	Max.
Transmit	-	700	-

Note: Single Antenna mode

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5. RADIO CHARACTERISTICS

5-1. Common Physical Layer Characteristics

5-1-1. IEEE Std 802.11p™

Items	Conditions
Operating center frequency [MHz]	5855 ~ 5920
Operating channel spacing [MHz]	10
Number of channels	7 / Channel 172~ 184
Modulation	OFDM

Data Rate [Mbps]	Modulation	Code Rate
3	BPSK	1/2
4.5	BPSK	3/4
6	QPSK	1/2
9	QPSK	3/4
12	16QAM	1/2
18	16QAM	3/4
24	64QAM	2/3
27	64QAM	3/4

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5-2. Receiver Characteristics

Following characteristics are guaranteed over recommended operating conditions unless otherwise stated. All performance is referred to a 50 Ohm antenna connector.

5-2-1-1. Minimum Input Level Sensitivity

Data Rate [Mbps]	Min.	Typ.	Max.	Units
3	-	-	-85	dBm
4.5	-	-	-84	
6	-	-	-82	
9	-	-	-80	
12	-	-	-77	
18	-	-	-73	
24	-	-	-69	
27	-	-	-68	

Note: PER < 10 [%] at PSDU length of 1000 [packets].

5-2-1-2. Maximum Input Level

Data Rate [Mbps]	Min.	Typ.	Max.	Units
3	-30	-	-	dBm
4.5	-30	-	-	
6	-30	-	-	
9	-30	-	-	
12	-30	-	-	
18	-30	-	-	
24	-30	-	-	
27	-30	-	-	

Note: PER < 10 [%] at PSDU length of 1000 [packets].

5-2-1-3. Receiver Adjacent Channel Rejection

Data Rate [Mbps]	Min.	Typ.	Max.	Units
3	28	-	-	dB
4.5	27	-	-	
6	25	-	-	
9	23	-	-	
12	20	-	-	
18	16	-	-	
24	12	-	-	
27	11	-	-	

Note: PER < 10 [%] at PSDU length of 1000 [packets].

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5-2-1-4. Non-Adjacent Channel Rejection

Data Rate [Mbps]	Min.	Typ.	Max.	Units
3	42	-	-	dB
4.5	41	-	-	
6	39	-	-	
9	37	-	-	
12	34	-	-	
18	30	-	-	
24	26	-	-	
27	25	-	-	

Note: PER < 10 [%] at PSDU length of 1000 [packets].

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5-3. Transmitter Characteristics

Following characteristics are guaranteed over recommended operating conditions unless otherwise stated. All performance is referred to a 50 Ohm antenna connector.

5-3-1. IEEE Std 802.11p™

5-3-1-1. Power Levels

Data Rate [Mbps]	Min.	Typ.	Max.	Units
3	T.B.D	20	T.B.D	dBm/10MHz
4.5				
6				
9				
12				
18				
24				
27				

5-3-1-2. Center Frequency Tolerance

Data Rate [Mbps]	Min.	Typ.	Max.	Units
3	-20	-	+20	ppm
4.5				
6				
9				
12				
18				
24				
27				

5-3-1-3. Modulation Accuracy (EVM)

Data Rate [Mbps]	Min.	Typ.	Max.	Units
3	-	-	-5	dB
4.5	-	-	-8	
6	-	-	-10	
9	-	-	-13	
12	-	-	-16	
18	-	-	-19	
24	-	-	-22	
27	-	-	-25	

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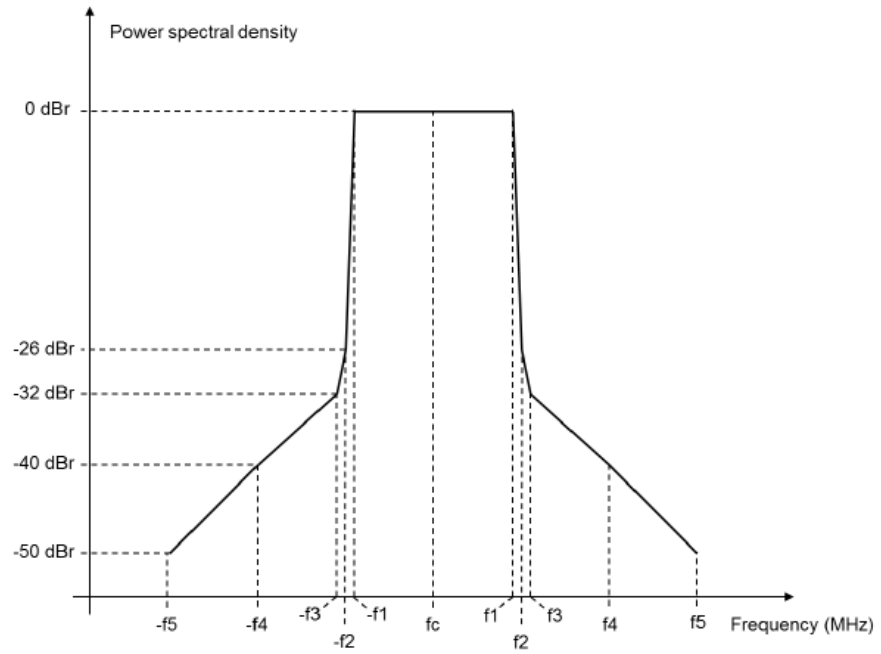
5-3-1-4. Spectrum Mask

Spectrum Mask



Frequency offset	Frequency(MHz)
f1	4.5
f2	5.0
f3	5.5
f4	10
f5	15

5-3-1-5. Center Frequency Leakage

Data Rate [Mbps]	Min.	Typ.	Max.	Units
3	-	-	-15	dBc
4.5				
6				
9				
12				
18				
24				
27				

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5-4. GNSS MODULE CHARACTERISTICS

Following characteristics are guaranteed over recommended operating conditions unless otherwise stated. All performance is referred to a 50 Ohm antenna connector.

FUNCTION	FEATURE
Support Satellite system	GPS/GLONASS
Support Protocol	NMEA / OSP
SBAS	EGNOS / MSAT /MASS
Sensitivity	Acquisition -147dBm Tracking -160dBm(Navigation)
TTFF	Hot Start 1sec Warm Start 28sec Warm Start(CGEE) 8sec Cold Start 35sec

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6. HOST INTERFACE CHARACTERISTICS

Following characteristics are guaranteed over recommended operating conditions unless otherwise stated.

6-1-1. UART Interface

The followings describe options and characteristic of UART interface provided by host CPU. UART can be used for U-Boot environmental settings and Linux console.

Parameter	Value
Baud rate	115200 [bps]
Flow control	None
Parity	None
Number of stop bits	1
Bits per byte	8

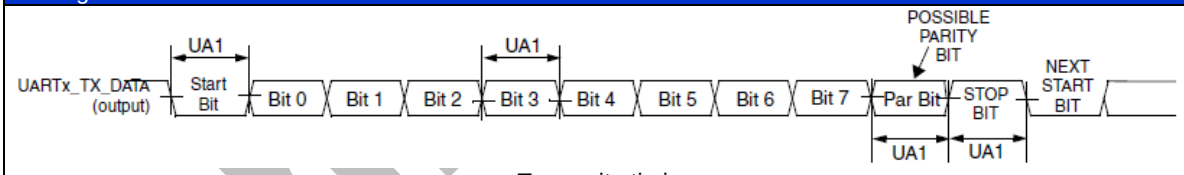
6-1-1-1. Signal Description

Pin No. / Pin Name	I/O	Description	
UART_TX	O	[UART]	Data output
UART_RTS	I	[UART]	Request to send (active low)
UART_RX	I	[UART]	Data input
UART_CTS	O	[UART]	Clear to send (active low)

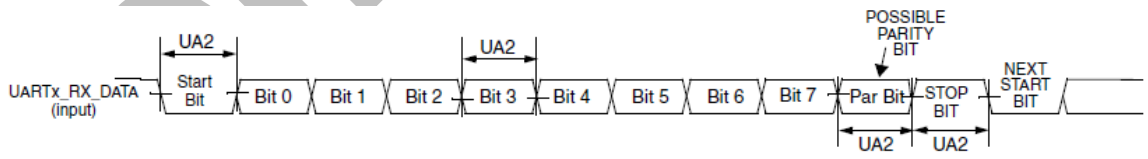
Note: I/O status : I = input / O = output

6-1-1-2. Timing with Hardware Flow Control

Timing



Transmite timing



Recieve timing

Symbol	Parameter	Min.	Typ.	Max.
UA1	Transmit Bit Time	$1/F_{baud\_rate}-T_{ref\_clk}$	-	$1/F_{baud\_rate}+T_{ref\_clk}$
UA2	Receive Bit Time	$1/F_{baud\_rate}-1/(16*F_{baud\_rate})$	-	$1/F_{baud\_rate}+1/(16*F_{baud\_rate})$

Note F_{baud_rate}=115200, T_{ref_clk} = 66MHz

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6-2. Ethernet Interface

Function	Description
Speed	10/100Base-T
Duplex	Full/Half
LED	Active (Yellow)
	10/100Mbps (Green)
Specification	IEEE1588 compliant

6-3. USB Interface

This board support USB 2.0 host interface.

Function	Description
Speed	High Speed(480Mbps)/Full speed(12Mbps)/Low speed(1.5Mbps)
Supply Current(5V)	500mA(Max)

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REVISION HISTORY

Revision	Date	Contents of change	author
0.0.1		Initial Release	M6-3G
0.0.2	20. May 016	Delete Schematics and Mechanical Specification. (Chapter 5-4,6)	M6-3G

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