

EVA V4 - Operating Description

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Introduction

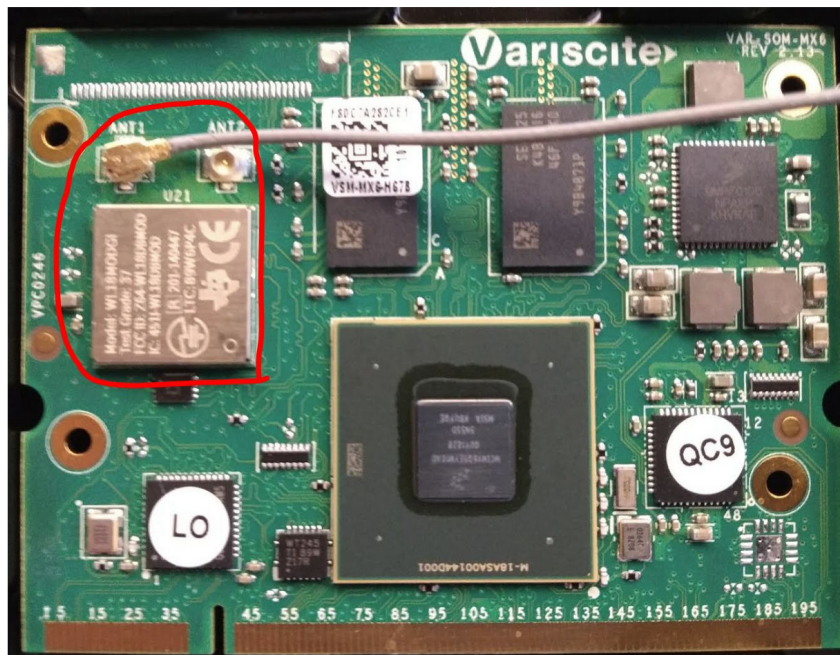
The following operational description is provided as an exhibit to the FCC submission for EVA V4 (FCC ID: 2AU3MEVA415).

This document provides detailed information on the intentional transmitter (WiFi module) and associated antenna contained within the product. WiFi connectivity allows users to communicate with the robot as an alternative to a direct connection via Ethernet. Users are able to control and monitor robot functions via a browser on their computer, tablet or phone.

System on Module (SOM)

The WiFi module is mounted on a System on Module (SOM), the [Variscite VAR-SOM-MX6](#).

VAR-SOM-MX6 datasheet [here](#), SOM EMC test report [here](#).





WiFi Module

The SOM is fitted with a pre-certified WiFi module [Texas Instruments WL1837MOD](#), WiLink™ 8 industrial dual band, 2x2 MIMO Wi-Fi®, Bluetooth® & Bluetooth Smart module.

Bluetooth functionality is not used and is disabled in the robot.

Only 2.4 GHz WiFi is used on the robot. 5 GHz WiFi has been disabled.

FCC ID: Z64-WL18DBMOD

Docs:

- TX testing - http://processors.wiki.ti.com/index.php/WL18xx_TX_Testing
- RX testing - http://processors.wiki.ti.com/index.php/WL18xx_RX_Testing
- http://processors.wiki.ti.com/index.php/WL18xx_Testing_Misc_Commands
- http://processors.wiki.ti.com/index.php/WL18xx_Driver_Debug
- Wlconf - <http://www.ti.com/lit/an/swra489/swra489.pdf>
- 5 GHz diversity - <http://www.ti.com/lit/an/swaa161/swaa161.pdf>
- Ini file - <http://www.ti.com/lit/an/swru422a/swru422a.pdf>
- WiLink 8 guide - <http://www.ti.com/lit/ug/swru423a/swru423a.pdf>
- HW integration - <http://www.ti.com/lit/ug/swru437a/swru437a.pdf>
- Datasheet - <http://www.ti.com/lit/ds/symlink/wl1837mod.pdf>



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Testing and certification

This module has been tested against the following specifications. Certification reports and DoC from Texas Instruments [can be found here](#).

6.4 Device Certification

The WL18MODGI modules from TI (test grades 07 and 37) are certified for **FCC**, IC, ETSI/CE, and Japan MIC. Moreover, the module is also Wi-Fi certified and has the ability to request a certificate transfer for Wi-Fi alliance members. TI customers that build products based on the WL18MODGI device from TI can save on testing costs and time per product family. [Table 6-4](#) shows the certification list for the WL18MODGI module.

Table 6-4. Device Certification

Regulatory Body	Specification	ID (If Applicable)
FCC (USA)	Part 15C + MPE FCC RF exposure	Z64-WL18DBMOD
ISED (Canada)	RSS-102 (MPE) and RSS-247 (Wi-Fi, Bluetooth)	4511-WL18DBMOD
ETSI/CE (Europe)	EN300328 v2.1.1 (2.4-GHz Wi-Fi, Bluetooth)	—
	EN301893 v2.1.1 (5-GHz Wi-Fi)	—
	EN62311:2008 (MPE)	—
	EN301489-1 v2.1.1 (general EMC)	—
	EN301489-17 v3.1.1 (EMC)	—
	EN60950-1:2006/A11:2009/A1:2010/A12:2011/A2:2013	—
MIC (Japan)	Article 49-20 of ORRE	201-140447

TI have a wiki page with information on how to certify:

http://processors.wiki.ti.com/index.php/WL18xxMOD_Regulatory_Product_Certification#ETSI.2FCE_Certification

Module output power - 2.4 GHz

From [WL1837 datasheet](#) 5.7 WLAN Performance: 2.4-GHz Transmitter Power, page 13.

5.7 WLAN Performance: 2.4-GHz Transmitter Power

over operating free-air temperature range (unless otherwise noted). All RF and performance numbers are aligned to the module pin.

PARAMETER	CONDITION ⁽¹⁾	MIN	TYP	MAX	UNIT
	RF_ANT1 Pin 2.4-GHz SISO				
Output Power: Maximum RMS output power measured at 1 dB from IEEE spectral mask or EVM ⁽²⁾	1 Mbps DSSS		17.3		dBm
	2 Mbps DSSS		17.3		
	5.5 Mbps CCK		17.3		
	11 Mbps CCK		17.3		
	6 Mbps OFDM		17.1		
	9 Mbps OFDM		17.1		
	12 Mbps OFDM		17.1		
	18 Mbps OFDM		17.1		
	24 Mbps OFDM		16.2		
	36 Mbps OFDM		15.3		
	48 Mbps OFDM		14.6		
	54 Mbps OFDM		13.8		
	MCS0 MM		16.1		
	MCS1 MM		16.1		
	MCS2 MM		16.1		
	MCS3 MM		16.1		
	MCS4 MM		15.3		
	MCS5 MM		14.6		
	MCS6 MM		13.8		
	MCS7 MM ⁽³⁾		12.6		
	MCS0 MM 40 MHz		14.8		
	MCS7 MM 40 MHz		11.3		
		RF_ANT1 + RF_ANT2 MIMO			
	MCS12 (WL18x5)		18.5		dBm
	MCS13 (WL18x5)		17.4		
	MCS14 (WL18x5)		14.5		
	MCS15 (WL18x5)		13.4		
	RF_ANT1 + RF_ANT2				
Operation frequency range		2412		2484	MHz
Return loss			−10.0		dB
Reference input impedance			50.0		Ω

(1) Maximum transmitter power (TP) degradation of up to 30% is expected, starting from 80°C ambient temperature on MIMO operation

(2) Regulatory constraints limit T1 module output power to the following:

- Channel 14 is used only in Japan; to keep the channel spectral shaping requirement, the power is limited: 14.5 dBm.
- Channels 1, 11 @ OFDM legacy and HT 20-MHz rates: 12 dBm
- Channels 1, 11 @ HT 40-MHz rates: 10 dBm
- Channel 7 @ HT 40-MHz lower rates: 10 dBm
- Channel 5 @ HT 40-MHz upper rates: 10 dBm
- All 11B rates are limited to 16 dBm to comply with the ETSI PSD 10 dBm/MHz limit.
- All OFDM rates are limited to 16.5 dBm to comply with the ETSI EIRP 20 dBm limit.
- For clarification regarding power limitation, see the [WL18xx .INI File Application Report](#).

(3) To ensure compliance with the EVM conditions specified in the PHY chapter of IEEE Std 802.11™ – 2012:

- MCS7 20 MHz channel 12 output power is 2 dB lower than the typical value.
- MCS7 20 MHz channel 8 output power is 1 dB lower than the typical value.

Antenna

[Laird 001-0016 2.4GHz/5GHz FlexPIFA Antenna](#). Peak antenna gain 2 dBi for 2.4 GHz. This antenna is [recommended by TI](#) which was used in their certification testing. The software configuration is the same as used in their certification test.

WL1837MOD/WL1807MOD modules:

Antenna Type	Brand	Antenna gain 2.4GHz~2.5GHz(dBi)	Antenna gain 4.9GHz~5.8GHz(dBi)	Part number(for reference only)
PCB	Ethertronics	-0.6	4.5	1000423
Dipole	LSR	2	2	001-0012
PCB	Laird	2	4	CAF94505
Chip	Pulse	3.2	4.2	W3006
PIFA	LSR	2	3	001-0016
Chip	TDK	2.4	3.96	ANT016008

Mounting location

The antenna is external to the module. Connection via SMA connector on PCB. Antenna adhesively mounted internally to the robot.

