



**Wi-SUN Alliance**

**Protocol Implementation Conformance Statement (PICS) for Wi-SUN PHY**

Revision 1v06

## 1

## Release History

Revision	Date	Author	Comments
0V00	19-Jun-12	Chin-Sean Sum	Initial draft.
0V01	3 Aug. 2012	Chin-Sean Sum and Phil Beecher	Completion of WG ballot 1. Modified based on circulation within TCWG group.
1V00	25 Feb. 2013	Chin-Sean Sum	Release of the first official revision.
1V01	14 Feb. 2014	Chin-Sean Sum	Modification in accordance to development in Echonet Profile
1V02	20 Feb. 2014	Chin-Sean Sum	Modification in accordance to development in Echonet Profile
1V03_RC1	29-Aug-18	Kunal Shah	Modifications to align with PHY TPS and Wi-SUN profiles
1V03_RC2	5-Oct-18	Kunal Shah	Updated profile related information as discussed during the PHYWG call
1V03_RC3	25-Jan-19	Kunal Shah	Clean version of the document with editorial touch up
1V03_RC4	5-Apr-19	Kunal Shah	Updated based on the agreed proposed resolutions from the ballot comments
1V04	22-Apr-19	Kunal Shah	Accepted all changes per comments and resolutions with editorial touch up
1V05-RC1	14-Mar-22	Chin-Sean Sum	Draft for revised FSK PHY and OFDM PHY PICS
1V05-RC2	18-Apr-22	Chin-Sean Sum	Revised with alignment to OFDM test cases
1V05-RC3	18-May-22	Chin-Sean Sum	Revised with additional items for Mode Switch
1V05-RC4	2-Jun-22	Chin-Sean Sum	Revised with additional items for Mode Switch
1V05-RC5	7-Jun-22	Chin-Sean Sum	Added Mode Switch and Settling Delay test items
1V05-RC7	16-Jun-22	Takeshi Hayashi and Chin-Sean Sum	Added Mode Switch and Settling Delay recommended test patterns
1V05	8-Jul-22	Chin-Sean Sum	Accepted all changes per comments and resolutions with editorial touch up

## 2 References

- [A1] IEEE Std. 802.15.4<sup>TM</sup> - 2020, IEEE Standard for Low-Rate Wireless Networks
- [A2] Wi-SUN PHY Specification (1V09)
- [A3] Wi-SUN PHY Specification Amendment (1VA9)
- [A4] Wi-SUN PHY Conformance Test Suite Specification (1V24)
- [A5] Wi-SUN PHY Conformance Test Procedures Specification (1V00)

### 3 Abbreviations and Special Symbols

#### 3.1 Abbreviations

CCID	Certification Category ID
CSM	common signaling mode
FEC	forward error correction
FAN	Field Area Network
HAN	Home Area Network
JUTA	Japan Utility Telemetry Association
TCC	Test and Certification Committee
SUN-FSK	Smart utility network frequency shift keying
PHR	PHY header
PHY	physical
PICS	protocol implementation conformance statement
PLP	PHY layer packet
PPDU	PHY protocol data unit
PSDU	PHY service data unit
RF	radio frequency
SUN	smart utility network
TCC	Test and Certification Committee (formerly known as Test and Certification Working Group)

#### 3.2 Special Symbols

M	Mandatory
O	Optional
O.n	Optional, but support of at least one of the group of options labeled O.n is required.
N/A	Not applicable
X	Prohibited
“item”	Conditional, status dependent upon the support marked for the “item”

## **4 Introduction**

To evaluate conformance of a particular implementation, it is necessary to have a statement of which capabilities and options have been implemented for a given standard. Such a statement is called a protocol implementation conformance statement (PICS).

### **4.1 Scope**

This document provides the protocol implementation conformance statement (PICS) proforma for standard specification [A1], [A2] and [A3].

### **4.2 Purpose**

The supplier of a protocol implementation claiming to conform to standard specifications [A1], [A2] and [A3] shall complete the following PICS proforma and accompany it with the information necessary to identify fully both the supplier and the implementation.

The PICS is in the form of answers to a set of questions in the PICS proforma. The questions in a proforma consist of a systematic list of protocol capabilities and options as well as their implementation requirements. The implementation requirement indicates whether implementation of a capability is mandatory, optional, or conditional depending on options selected. When a protocol implementer answers questions in a PICS proforma, they would indicate whether an item is implemented or not, and provide explanations if an item is not implemented.

## 5 Instructions for Completing the PICS Proforma

If a given implementation is claimed to conform to a particular standard, the actual PICS proforma to be filled in by a supplier shall be technically equivalent to the text of the PICS proforma in this document, and shall preserve the numbering and naming and the ordering of the PICS proforma.

A PICS which conforms to this document shall be a conforming PICS proforma completed in accordance with the instructions for completion given in this document.

The main part of the PICS is a fixed-format questionnaire, divided into tables. Answers to the questionnaire are to be provided in the rightmost column, either by simply marking an answer to indicate a restricted choice (such as Yes or No), or by entering a value, set, or range of values.

### 5.1 PHY Certification Category Identification

Category identification provides which region(s) and frequency band(s) the implementation is claimed to conform. Regions that covers frequency bands from 863-928 MHz are shown below in Table 2 and Table 3.

**Table 2 - Certification Category IDs (CCID) for 800MHz Regions**

Certification Category ID	Frequency Bands (MHz)	Regions Covered
1	863-870	Europe (EU1) Only
2	865-867	India Only
3	866-869	Singapore (SG1) Only
4	870-876	Europe (EU2) Only
5	863-876	EU1, EU2, India, Singapore (SG1)
6	863-870	EU1, India, Singapore (SG1)
7	863-876	EU1, EU2
8	865-869	India, Singapore (SG1)

**Table 3 - Certification Category IDs (CCID) for 900MHz Regions**

<b>Certification Category ID</b>	<b>Frequency Bands (MHz)</b>	<b>Regions Covered</b>
9a	902-928	North America
9b	902-928	Mexico
10	902-907.5 & 915-928	Brazil Only
11	915-928	Australia/ New Zealand Only
12	915-918	Philippines Only
13	917-923.5	Korea Only
14	919-923	Malaysia Only
15	920.5-924.5	China Only
16	920-928	Japan Only
17	920-925	Hong Kong, Singapore (SG2), Thailand, Vietnam
18a	902-928	Reserved
18b	902-928	North America, Mexico, Brazil, Australia/ New Zealand, Philippines, Korea, Malaysia, China, Hong Kong, Singapore (SG2), Thailand, Vietnam
18c	902-928	North America, Mexico, Brazil, Australia/ New Zealand, Philippines, Korea, Malaysia, Hong Kong, Singapore (SG2), Thailand, Vietnam
18d	902-928	North America, Brazil
19a	915-928	Philippines, Korea, Malaysia, China, Hong Kong, Singapore (SG2), Thailand, Vietnam, Japan, Australia/ New Zealand
19b	915-928	Philippines, Korea, Malaysia, China, Hong Kong, Singapore (SG2), Thailand, Vietnam, Australia/ New Zealand
19c	915-928	Philippines, Korea, Malaysia, Hong Kong, Singapore (SG2), Thailand, Vietnam, Australia/ New Zealand

## **7 Identification of the Protocol**

This PICS proforma applies to standards given in [A1], [A2] and [A3].

## **8 Global Statement of Conformance**

The implementation described in this PICS proforma meets all of the mandatory requirements of the referenced standards in [A1], [A2] and [A3].

Note -- Answering 'No' indicates non-conformance to the specified protocol standard. Non-supported mandatory capabilities are to be identified in the following tables, with an explanation by the implementer explaining why the implementation is non-conforming.

The supplier will have fully complied with the requirements for a statement of conformance by completing the statement contained in this subclause. However, the supplier may find it helpful to continue to complete the detailed tabulations in the subclauses that follow.



## 6 Identification of the Implementation

### 6.1 Implementation under test (IUT) Identification

6.1.1 IUT Name: Wi-SUN FAN 1.1 PHY Platform  
6.1.2 IUT Version: VC735X

### 6.2 System under test (SUT) Identification

6.2.1 SUT Name: VC735X  
6.2.2 Software Version: V1.0  
6.2.3 Hardware Version: V1.0  
6.2.4 Operating System (optional):

### 6.3 Wi-SUN Profile Identification

Profile Name Supported (FAN/HAN/JUTA): FAN

### 6.4 Certification Category Identification

Category ID Supported (See Tables 2 and 3): 9a, 10, 16

### 6.5 Product Supplier

6.5.1 Name: Vertexcom Technologies, Inc.  
6.5.2 Address: 3F., No.1, Taiyuan 2nd St., Zhubei City, Hsinchu County 302082, Taiwan (R.O.C.)  
6.5.3 Telephone Number: +886-3-5601431  
6.5.4 Facsimile Number:  
6.5.5 Email Address: [sp.hu@vertexcom.com](mailto:sp.hu@vertexcom.com)  
6.5.6 Additional Information:

### 6.6 Client

6.6.1 Name: Vertexcom Technologies, Inc.  
6.6.2 Address: 3F., No.1, Taiyuan 2nd St., Zhubei City, Hsinchu County 302082, Taiwan (R.O.C.)  
6.6.3 Telephone Number: +886-3-5601431  
6.6.4 Facsimile Number:  
6.6.5 Email Address: [sp.hu@vertexcom.com](mailto:sp.hu@vertexcom.com)  
6.6.6 Additional Information:

**6.7 PICS Contact Person**

6.7.1 Name: ShengPing Hu  
6.7.2 Address: 3F., No.1, Taiyuan 2nd St., Zhubei City, Hsinchu County 302082, Taiwan (R.O.C.)  
6.7.3 Telephone Number: +886-3-5601431 ex:225  
6.7.4 Facsimile Number:  
6.7.5 Email Address: [sp.hu@vertexcom.com](mailto:sp.hu@vertexcom.com)  
6.7.6 Additional Information:

## 9 PICS Proforma Tables

The following tables are composed of the detailed questions to be answered, which make up the PICS proforma.

### 9.1 Major Capabilities for the PHY

The requirements for the PHY capabilities are described in this section.

#### 9.1.1 PLP Capabilities

The requirements for the PLP is described in Table 4.

**Table 4 - PHY Packet**

Item number	Item description	Reference	Status			Support	Remarks
			FAN	HAN	JUTA	(Yes/No/NA)	
PLP 1	Transmission of PPDU packets	11 [A1]	M	M	M	Yes	
PLP 2	Reception of PPDU packets	11 [A1]	M	M	M	Yes	
PLP3	PSDU size	11.2 [A1]	M Up to 2047 octets	M Up to 255 octets	M Up to 255 octets	Yes	
PLP4	Mode Switch PHR	6.1.4 [A3]	O	N/A	N/A	Yes	

#### 9.1.2 RF Capabilities

The requirements for the PHY RF capabilities are described in Table 5.

**Table 5 – Radio frequency (RF)**

Item number	Item description	Reference	Status			Support	Remarks
			FAN	HAN	JUTA	(Yes/No/NA)	
RF1	SUN PHYS						
RF1.1	SUN-FSK-PHY	5 [A2], 6 [A3], 19 [A1]	M	M	M	Yes	

RF1.2	SUN-FSK Generic PHY	19.3 [A1]	O	O	O	Yes	
RF1.3	SUN-OFDM-PHY	7 [A3], 20 [A1]	O	N/A	N/A	Yes	
RF1.4	Transmit and receive using CSM	10.1.9 [A1]	M	O	O	Yes	
RF1.5	Support of channel plan in Table 2 or Table 3	5.2.2 [A2]	M	M	M	Yes	
RF1.6	Support at least one of the CCIDs given in Table 2	5.2.2 [A2], Annex A and B [A4]	O.1	N/A	N/A	Yes	
RF1.7	Support at least one of the CCIDs given in Table 3	5.2.2 [A2], Annex A and B [A4]	O.1	N/A	N/A	Yes	
RF1.8	Support CCID 16 in Table 3	5.2.2 [A2], Annex A and B [A4]	O	M	M	Yes	
RF1.9	Support CCID 9a in Table 3	5.2.2 [A2], Annex A and B [A4]	O	N/A	N/A	Yes	
RF1.10	Support CCID 10 in Table 3	5.2.2 [A2], Annex A and B [A4]	O	N/A	N/A	Yes	
RF1.11	Support CCID 1 or 4 or 7 in Table 2	5.2.2 [A2], Annex A and B [A4]	O	N/A	N/A	Yes	

RF2	SUN PHY operating modes						
RF2.1	Support PhyModeID 1 (operating mode #1a)	Annex A and B [A4]	RF1.6: M	N/A	N/A	Yes	
RF2.2	Support PhyModeID 2 (operating mode #1b)	Annex A and B [A4]	RF1.7: M RF1.8: O	RF1.8: O	RF1.8: O	Yes	
RF2.3	Support PhyModeID 3 (operating mode #2a)	Annex A and B [A4]	RF1.6: M RF1.7: O	N/A	N/A	Yes	
RF2.4	Support PhyModeID 4 (operating mode #2b)	Annex A and B [A4]	RF1.8: M	RF1.8: M	RF1.8: M	Yes	
RF2.5	Support PhyModeID 5 (operating mode #3)	Annex A and B [A4]	RF1.7: M RF1.6: O RF1.8: O	N/A	N/A	Yes	
RF2.6	Support PhyModeID 6 (operating mode #4a)	Annex A and B [A4]	RF1.7: O	N/A	N/A	Yes	
RF2.7	Support PhyModeID 7 (operating mode #4b)	Annex A and B [A4]	RF1.8: O	N/A	N/A	Yes	

RF2.8	Support PhyModeID 8 (operating mode #5)	Annex A and B [A4]	RF1.7: O RF1.8: O	N/A	N/A	Yes	
RF2.9	Support PhyModeID 34	Annex A and B [A4]	RF1.9: O RF1.10: O	N/A	N/A	Yes	
RF2.10	Support PhyModeID 35	Annex A and B [A4]	RF1.9: O RF1.10: O	N/A	N/A	Yes	
RF2.11	Support PhyModeID 36	Annex A and B [A4]	RF1.9: O RF1.10: O	N/A	N/A	Yes	
RF2.12	Support PhyModeID 37	Annex A and B [A4]	RF1.9: O RF1.10: O	N/A	N/A	Yes	
RF2.13	Support PhyModeID 38	Annex A and B [A4]	RF1.9: M RF1.10: M	N/A	N/A	Yes	
RF2.14	Support PhyModeID 51	Annex A and B [A4]	RF1.9: O RF1.10: O RF1.8: O	N/A	N/A	Yes	
RF2.15	Support PhyModeID 52	Annex A and B [A4]	RF1.9: O RF1.10: O RF1.8: O	N/A	N/A	Yes	
RF2.16	Support PhyModeID 53	Annex A and B [A4]	RF1.9: O RF1.10: O RF1.8: O	N/A	N/A	Yes	
RF2.17	Support PhyModeID 54	Annex A and B [A4]	RF1.9: M RF1.10: M RF1.8: O	N/A	N/A	Yes	
RF2.18	Support PhyModeID 68	Annex A and B [A4]	RF1.9: O RF1.10: O RF1.8: O	N/A	N/A	Yes	
RF2.19	Support PhyModeID 69	Annex A and B [A4]	RF1.9: O RF1.10: O RF1.8: O	N/A	N/A	Yes	
RF2.20	Support PhyModeID 70	Annex A and B [A4]	RF1.9: M RF1.10: M RF1.8: M	N/A	N/A	Yes	

RF2.21	Support PhyModeID 84	Annex A and B [A4]	RF1.11: O RF1.9: O RF1.10: O RF1.8: O	N/A	N/A	Yes	
RF2.22	Support PhyModeID 85	Annex A and B [A4]	RF1.11: O RF1.9: O RF1.10: O RF1.8: O	N/A	N/A	Yes	
RF2.23	Support PhyModeID 86	Annex A and B [A4]	RF1.11: M RF1.9: M RF1.10: M RF1.8: M	N/A	N/A	Yes	

RF3	SUN-FSK Options						
RF3.1	SUN-FSK FEC	5.3 [A2]	RF1.1: O RF1.2: O	RF1.1: O RF1.2: O	RF1.1: O RF1.2: O	Yes	
RF3.2	SUN-FSK interleaving	19.3.6 [A1]	RF1.1: O RF1.2: O	RF1.1: O RF1.2: O	RF1.1: O RF1.2: O	Yes	
RF3.3	SUN-FSK data whitening	5.4 [A2]	RF1.1: M RF1.2: M	RF1.1: M RF1.2: M	RF1.1: M RF1.2: M	Yes	
RF3.4	FCS Length support for 4-octet	Annex A , B and D [A2]	RF1.1: M RF1.2: M	RF1.1: O RF1.2: O	RF1.1: O RF1.2: O	Yes	
RF3.5	FCS Length support for 2-octet	Annex A , B and D [A2]	RF1.1: O RF1.2: O	RF1.1: M RF1.2: M	RF1.1: M RF1.2: M	Yes	

RF4	PHY Mode Switching						
RF4.1	Mode Switching	6.1.4 [A3], 8 [A4]	O	N/A	N/A		
RF4.2	Support mode switch from PhyModeID 2 to 5 *	6.1.4 [A3], 8 [A4]	RF4.1: M RF1.9: M RF1.10: M	N/A	N/A	Yes	

RF4.3	Support mode switch from PhyModelID 2 to 38 *	6.1.4 [A3], 8 [A4]	RF4.1: M RF1.3: M RF1.9: M RF1.10: M	N/A	N/A	Yes	
RF4.4	Support mode switch from PhyModelID 2 to 70 *	6.1.4 [A3], 8 [A4]	RF4.1: M RF1.3: M RF1.9: M RF1.10: M	N/A	N/A	Yes	
RF4.5	Support mode switch from PhyModelID 4 to 70 *	6.1.4 [A3], 8 [A4]	RF4.1: M RF1.3: M RF1.8: M	N/A	N/A	Yes	
RF4.6	Support mode switch from PhyModelID 1 to 3 *	6.1.4 [A3], 8 [A4]	RF4.1: M RF1.11: M	N/A	N/A	N/A	No PhyModelID 1 used in NA/JP
RF4.7	Support mode switch from PhyModelID 1 to 86 *	6.1.4 [A3], 8 [A4]	RF4.1: M RF1.3: M RF1.11: M	N/A	N/A	N/A	No PhyModelID 1 used in NA/JP

\* Select one Center Frequency per Region

RF5	Delay Settling						
RF5.1	Support timing requirements for FSK to FSK Mode Switch (Same Channel) *	6.1.4.1 [A3], 8 [A4]	RF4.1: M RF1.11: M RF1.8: O RF1.9: O RF1.10: O	N/A	N/A	Yes	
RF5.2	Support timing requirements for FSK to FSK Mode Switch (Different Channel) *	6.1.4.1 [A3], 8 [A4]	RF4.1: M RF1.11: M RF1.8: O RF1.9: M RF1.10: M	N/A	N/A	Yes	

RF5.3	Support timing requirements for FSK to OFDM Mode Switch (Same Channel) *	6.1.4.1 [A3], 8 [A4]	RF4.1: M RF1.11: M RF1.8: M RF1.9: M RF1.10: M	N/A	N/A	Yes	
RF5.4	Support timing requirements for FSK to OFDM Mode Switch (Different Channel) *	6.1.4.1 [A3], 8 [A4]	RF1.3: M RF4.1: M RF1.11: M RF1.8: M RF1.9: M RF1.10: M	N/A	N/A	Yes	

\* Select one pattern from the possible combinations

RF6	Transmitt Clear Channel Assessment (CCA)						
RF6.1	Support Trasmit CCA Energy Detection Threshold	5.5 [A3], 9 [A4]	RF1.1: M RF1.3: M	N/A	N/A	Yes	

### 9.1.3 Transmit Power

The declaration for the PHY transmit power is described in Table 6.

**Table 6 – Device Transmit Power**

Item number	Item description	Reference	Status			Value (dBm or mW)	Remarks
			FAN	HAN	JUTA		
RF7	Transmit Power *						
RF5.1	Maximum transmit power	7.1.3 [A4]	Applicable	N/A	N/A	shown on below table	

\* Vendor to declare the transmit power for each PHY operating mode supported by the DUT



NA/BZ				
Rate	Modulation Index	Maximum transmit power(dBm)	PhyModelID	power code setting
50	0.5	14	1	3
50	1	14	2	3
100	0.5	14	3	3
100	1	14	4	3
150	0.5	14	5	2
200	0.5	14	6	2
200	1	14	7	3
300	0.5	14	8	3

Option	MCS	Maximum transmit power(dBm)	PhyModelID	power code setting
1				
	2	17	34	8
	3	17	35	8
	4	17	36	8
	5	16.5	37	7
2	6	15	38	5
	3	17.5	51	8
	4	17.5	52	8
	5	16	53	6
3	6	15.5	54	5
	4	17.5	68	8

	5	16	69	6
	6	15.5	70	5
4				
	4	17	84	7
	5	16	85	6
	6	14.5	86	5

JP				
Rate	Modulation Index	Maximum transmit power(dBm)	PhyModelID	power code setting
50	0.5	12.5	1	1
50	1	12.5	2	1
100	0.5	12.5	3	1
100	1	12.5	4	1
150	0.5	12.5	5	1
200	0.5	12.5	6	1
200	1	12.5	7	1
300	0.5	12.5	8	1

JP				
Option	MCS	Maximum transmit power(dBm)	PhyModelID	power code setting
1				
2				
	3	12	51	2

	4	12	52	2
	5	12	53	2
	6	12	54	2
3				
	4	12	68	2
	5	12	69	2
	6	12	70	2
4				
	4	12	84	2
	5	12	85	2
	6	12	86	2

**Certification test pattern recommendation**

-	-	Base PHY Mode		New PHY Mode	
		Frequency (MHz)	PhyModelID	Frequency (MHz)	PhyModelID
RF4.2	-	902.4	2	902.4	5
RF4.3	-	903.2	2	903.2	38
RF4.4	-	902.4	2	902.4	70
RF4.5	-	924.1	4	924.1	70
RF4.6	-	863.1	1	863.1	3
RF4.7	-	870.2	1	870.2	86
RF5.1	NA/BZ	902.4	2	902.4	5
	JP	924.1	4	924.1	5
	EU	870.2	1	870.2	3
RF5.2	NA/BZ	902.2	2	902.4	5
	JP	922.5	4	922.6	7
	EU	863.2	1	863.3	3
RF5.3	NA/BZ	903.2	2	903.2	38
	JP	924.1	4	924.1	70
	EU	870.2	1	870.2	86
RF5.4	NA/BZ	902.2	2	902.4	70
	JP	924.1	4	924.2	86
	EU	863.2	1	863.3	86