Philips Innovation Services

PInS WiFi reference design

Datasheet PInS WiFi module Draft

PRELIMINARY

COMPONENT FOR PHILIPS PRODUCT USE ONLY

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DOCUMENT CHANGE HISTORY

Date	Person	Version	Reason
15-02-2017	Wim van den Dungen	0.1	First draft
29-03-2017	Wim van den Dungen	0.2	Cleanup and added details
31-03-2017	Wim van den Dungen	0.9	Proposed for release
03-04-2017	Wim van den Dungen	0.91	Added footprint information
14-04-2017	Wim van den Dungen	0.92	Minor updates MSL level, Footprint
14-04-2017	Wim van den Dungen	0.93	Minor updates, explaining MSL level and WoW
02-06-2017	Ioannis Pappous	0.94	Added information about standards compliance. Update labeling, added external antenna information. Layout schematics included. Added missing information. Document reorganized
21-06-2017	Luc Tan	1.0	Release the document • Add country settings. • State that China regulation is under development. • Update external antenna directivity. • Update FCC ID and IC ID. • Clarify the 12 variants • Use full 12NC not 11NC+x • Add HVIN:

1 Introduction

1.1 Introduction

PInS WiFi module V1.0 is a PCB Wi-Fi module designed by Philips innovation services (PInS) and based on the latest Cypress WiFI SoC. The design is based on an internal Philips study and is backwards compatible with an already used Philips module called Philips YD (obsolete), Additional functionality is added to optimize usability and a cost effective solution of adding connectivity to Philips products.
The design is aligned with Philips CDPP, PSSO, PInS, and multiple business and making fast and easy integration possible.
See datasheet of CYW43903 WICED™™ IEEE 802.11 a/b/g/n SoC with an Embedded Applications Processor [1] for detailed specifications.
General description of the CYW43903 SoC that forms the bases of the module reference design:
The Cypress CYW43903 embedded wireless system-on-a-chip (SoC) is uniquely suited for Internet-of-Things applications. It is IEEE 802.11n compliant and provides full IEEE 802.11 b/g legacy compatibility with enhanced performance. The device includes an ARM Cortex-based applications processor, a single stream IEEE 802.11n MAC/baseband/radio, a power amplifier (PA), and a receive low-noise amplifier (LNA). It also supports optional antenna diversity for improved RF performance in difficult environments. The CYW43903 is an optimized SoC targeting embedded Internet-of-Things applications in the industrial and medical sensor, home appliance markets. Using advanced design techniques and process technology to reduce active and idle power, the device is designed for embedded applications that require minimal power consumption and a compact size. The device includes a PMU for simplifying system power topology and allows for direct operation from a battery while maximizing battery life.

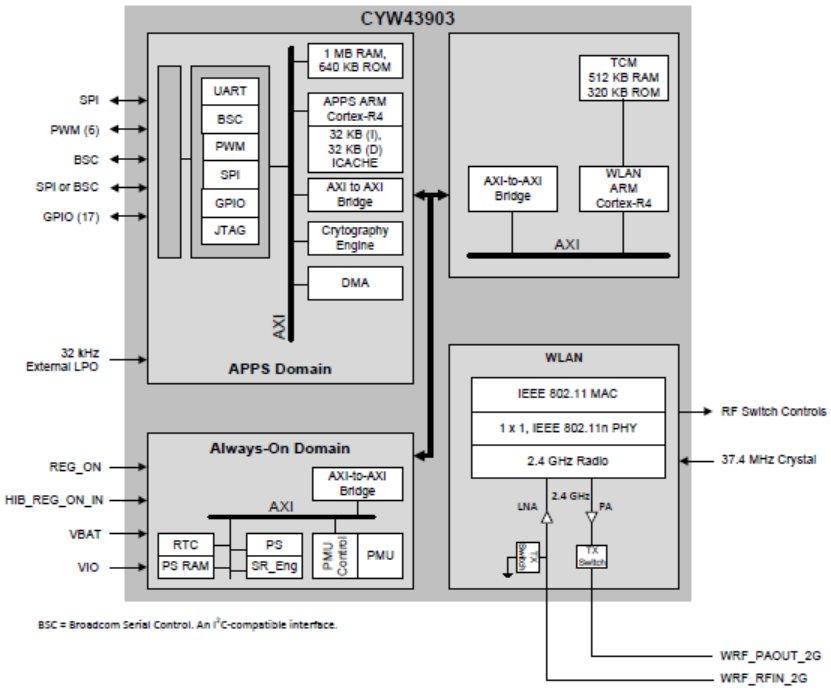


Figure 1: Block Diagram

1.2 Overview specifications

• *D*ual ARM clocked at 160 MHz
• 1 MB of SRAM and 640 KB ROM available for the applications processor.
• *64Mb encrypted flash storage*
• IEEE 802.11 b/g/n 1×1 2.4 GHz radio.
• Single- and dual-antenna support. *PCB and external including diversity.*

The module supports the following standards:
• IEEE 802.11n
• IEEE 802.11b
• IEEE 802.11g
• IEEE 802.11d
• IEEE 802.11h
• IEEE 802.11i

• Security:
– WEP
– WPA Personal
– WPA2 Personal
– WMM
– WMM-PS (U-APSD)
– WMM-SA
– AES (hardware accelerator)
– TKIP (hardware accelerator)
– CKIP (software support)

Proprietary Protocols:
– CCXv2
– CCXv3
– CCXv4
– CCXv5
– WFAEC
The module supports the following additional standards:
• IEEE 802.11r—Fast Roaming (between APs)
• IEEE 802.11w—Secure Management Frames
• IEEE 802.11 Extensions:
– IEEE 802.11e QoS enhancements (already supported as per the WMM specification)
– IEEE 802.11i MAC enhancements
– IEEE 802.11k radio resource measurement

Supported countries:
- *Europe (ETSI)*
- *United states*
- *Canada*
- *China (TBC)*

- External Flash 8MB
- (1) PCB Trace antenna
- (2) Connector for external antenna
- Antenna diversity
- (3) Castellation SMT solder mounting
- (4) 10 pin wire connector
- 16 I/O (14 shared)
- I2C
- SPI
- Main UART
- Debug UART
- JTAG
- 3V3 supply voltage
- (5) High speed production programming
- RF Shield
- FCC, ETSI, IC module certified
- SRCC TBC
- Wi- Fi Alliance certified
- 40mm * 22mm * 9mm

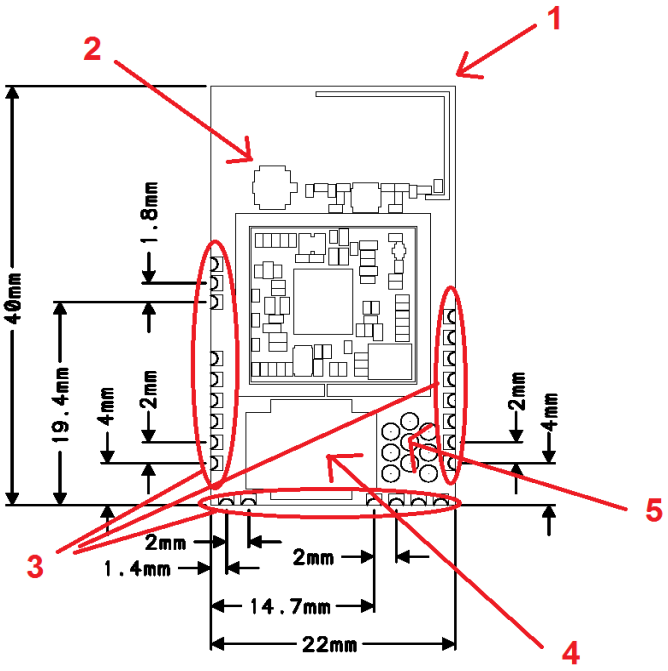


Figure 2: Module Design

1.3 Functional block diagram

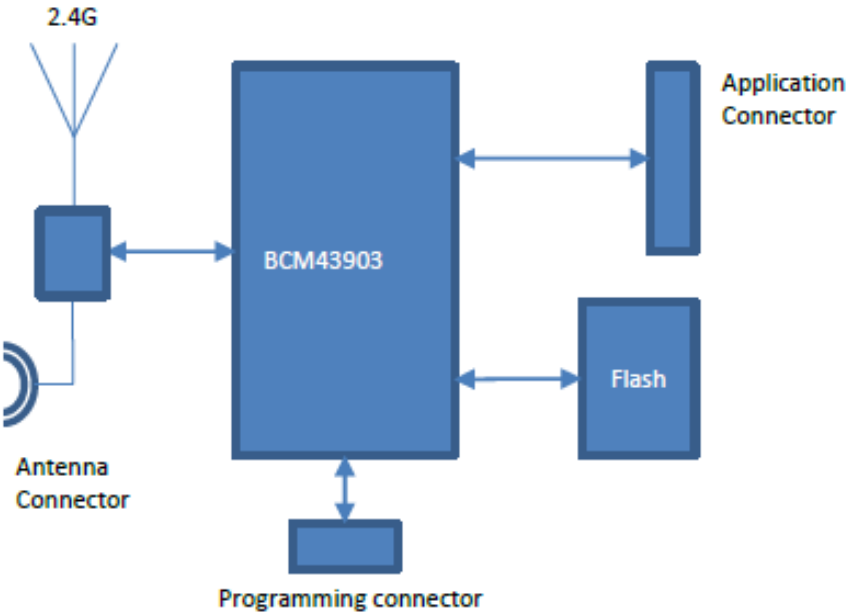


Figure 3: Functional block diagram

1.4 Open Points

Adding details on request of Philips Business units and manufacturer.

1.5 Definitions, Acronyms & Abbreviations

PInS	Philips Innovation Services
CDPP	Philips Connected Digital Platforms & Propositions
Wi-Fi	Wireless Fidelity
RF	Radio Frequency
IEEE	Institute of Electrical and Electronics Engineers
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
MAC	Media Access Control
AP	Access Point
ARM	Semiconductor IP company
SMT	Surface Mount Technology
ESD	Electrostatic Discharge
EU	European Union
USA	United States of America
FCC	Federal Communications Commission
SRRC	State Radio Regulation of China
RSS	Radio Standards Specifications
ETSI	European Telecommunications Standard Institute
ISTA	International Safe Transit Association
PMU	Power Management Unit
IEC	International Electrotechnical Commission
MCU	Micro-Controller Units
MSL	Moisture Sensitive Level
CE	Conformity European
UL	Underwriters Laboratories (safety organization)
TLL	Transistor-Transistor Logic
UART	Universal Asynchronous Receiver/ Transmitter
I2C	Inter-Integrated Circuit
SPI	Serial Peripheral Interface
JTAG	Joint Test Action Group (electronics industry association)
I/O	Input/ Output
RX	Receiver
FW	FirmWare
HW	HardWare
SoC	System on Chip
AWG	American Wire Gauge
PVC	Polyvinylchloride
DSSS	Direct-Sequence Spread Spectrum
OFDM	Orthogonal Frequency Division Multiplexing
PSDU	Physical layer Service Data Unit
MCS	Modulation and Coding Scheme
LNA	Low-Noise Amplifier
PER	Packet Error Rate
STBC	Space-Time Block Codes
GI	Guard Interval
BLE	Bluetooth Low Energy
EMC	Electromagnetic Compatibility
ESF	European Safety Federation
WEP	Wired Equivalent Privacy
WPA	Wi-Fi Protected Access
AES	Advanced Encryption Standard
TKIP	Temporal Key Integrity Protocol

CKIP	Cisco Key Integrity Protocol
WMM	Wi-Fi Multimedia
SRAM	Static Random-Access Memory
ROM	Read-Only Memory
TBC	To Be Confirmed
HVIN	Hardware Version Identification Number

2 Applications

The PInS Wi-Fi reference design / platform is intended to be used inside Philips to enable connected propositions and maximize the re-use with Philips and CDPP connectivity platforms. The application supported are all Philips products including medical class products. The module is designed to be non-blocking for medical product integration (all tests and documentation are available). The module itself is not a medical device as such.

3 Interface

The interfaces of the module are defined as below. The interfaces are considered part of the platform in order to have a common base, to maximize re-use and to provide backward compatibility and future extensions of the platform.

3.1 4 main interfaces

There are 4 main interface sections in the module design (see Figure 2):

- (3) Castellations. Main interface for SMT placement of the module on product specific PCB board holding communication, programming, supply and test interfaces. (X101..X124)
- (4) 10 pin AWG24 Board to Wire connector (JST SM10B-ZPDSS-TF(LF)(SN)): Main interface for product integration based on Wired connection. This connector having Supply, Main UART, SPI, I2C and I/O. (X125)
- (2) RF external connector (Hirose U.FL-R-SMT-1(10)), interface to support external antenna and antenna diversity. (X2)
- (5) Fast programming pads: The fast programming pads are intended for in production high speed programming and testing. (I1…I9)

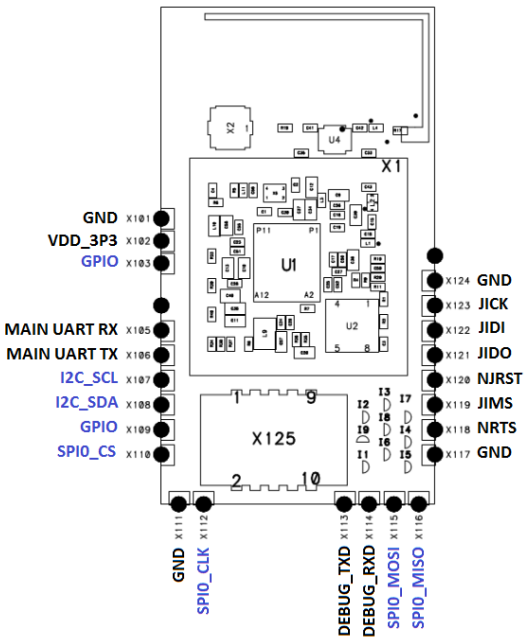


Figure 4: Interface functions

4 Antennas

The design includes 3 antenna options, PCB trace antenna, external antenna and antenna diversity.

The PCB trace antenna is design to have a performance of > 30% efficiency and maximum gain of 3dBi.

4.1 External Antenna

- This chapter gives an overview of the external antenna that can be fitted to the WiFi module. This radio transmitter IC has been approved by Industry Canada to operate with the antenna type listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

- Le chapitre suivant donne un aperçu de l'antenne externe qui peut être installée sur le module WiFi. Cet émetteur radio IC été approuvé par Industry Canada pour fonctionner avec le type d'antenne énumérés ci-dessous avec le gain maximum autorisé et l'impédance nécessaire pour chaque type d'antenne indiqué. Les types d'antenne ne figurant pas dans cette liste et ayant un gain supérieur au gain maximum indiqué pour ce type-là sont strictement interdits d'utilisation avec cet appareil.

For each antenna, the "Approvals" field defines in which test reports the antenna is included. Definitions of the «Approvals» field are:

- FCC - The antenna is included in the FCC test reports and thus approved for use in countries that accept the FCC radio approvals, primarily US.
- IC - The antenna is included in the IC (Industry Canada) test reports and thus approved for use in countries that accept the IC radio approvals, primarily Canada.
- ETSI - The antenna is included in the ETSI test reports and thus approved for use in countries that accept the ETSI radio approvals (EU).
- SRRC – TBC.

4.1.1 Approved antenna

TE	
Manufacturer	TE connectivity
Part Number	2118309-2
Polarization	Linear
Gain	2.5 dBi (2.4GHz band)
Impedance	50 Ω
Size	40.0 x 8.0 x 1.0 mm
Connector	u.fl
Approval	FCC, IC and ETSI (SRCC TBC)

5 Operation, storage and transport conditions

5.1 Operational conditions normal operation

Description	***Range***
Temperature range	-20°C...+70°C
Atmospheric pressure range	60kPa...110kPa
Relative humidity range	5%...95%

5.2 Operational conditions storage

Description	Range
Temperature range	5°C...+50°C
Atmospheric pressure range	60 ... 110 kPa
Relative humidity range	10 ... 95 % rH non-condensing
Tested for time in storage	6 months.
Devices are stored in a vacuum sealed barrier bag and stored in a reel to support SMT pick and place mounting	MSL3

5.3 Operational conditions Transport

Description	Range
Temperature range	-30 ... 70 °C
Atmospheric pressure range	60 ... 120 kPa
Relative humidity range	10 ... 95 % rH non-condensing
Conform broadband random vibrations according to IEC 60068-2-64	Severity level IEC 60721-4-7, Class- 7M2 And in line with ISTA standard
conform the shock test IEC 60068-2-27 mounting	Severity level IEC 60724-4-7 Class-7M3 And in line with ISTA standard
The device packaging complies with ISTA standard 2A	ISTA standard 2A

5.4 Additional conditional specifications

- Module is MSL 3 level, transport and storage in sealed packaging,
  (limit open air “life out of the bag” to <168 hours: make use of sealed vacuum bag which will limit exposure of the chip to moisture to less than 168 hours prior to the last reflow round (MSL3= 168 hours). in case the chips were exposed for more than 168 hours, IPC/JEDEC J-STD-020B defines a “baking” process to get the parts fit for use again. (min 8 hours @125°C))
- Packaging supports SMT (Pick and Place) tape and reel.
- Module should be handle as component, handle with care, and ESD protection should be used.
- Supply should be within specifications and clean, injected noise can be amplified and cause the module to fail and work out of specification.
- All modules are functional tested, Wi-Fi connection speed, Carrier Wave tests, I/O tests and UART tests. The Wired interface connector is not tested, needs to be tested at product level when used.
- Maximum reflow processes allowed is 1. (Critical Murata 2.4 GHz filter).

5.5 Environmental

- Module complies to Philips Regulated Substances List PHGR-GS-BP01-012.
- CE compliance

6 Architectural Choices and Constraints

The PInS Wi-Fi reference design is based on an internal Philips study on common requirements and product examples. Out of this study the below strategic interfaces, shape and dimensions are defined.
Strategic interfaces, shape and dimensions of the reference design are beneficial to leverage scale, compatibility and future updates and extensions. Wi-Fi and BLE chip updates, combo solutions and other IoT technologies are on the roadmap and planned to be compatible.

6.1 Strategic interfaces

1- PCB Trace antenna (Omnidirectional and optimized for easy integration, > 30% efficiency)
2- Connector for external antenna option (In combination with RF switch optional) (Diversity option)
3- Castellation's, SMT solder mounting option, See specific interface functions in figure 4.
4- Connector (AWG 24 compatible wires connector), strategic, Main MCU interface, Supply, SPI, I2C and I/O (see figure 2).
5- Direct High Speed Flash programming, production.

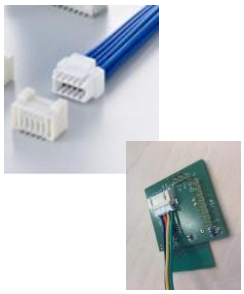


Image 1: Connector

6.2 Strategic module size

Model strategic size is 40mm (+/- 0.25mm) * 22mm (+/- 0.25mm) * 9mm
The module can be mounted into a slotted sliding fixture. Mechanical castellations are added for locking in place. See detailed mechanical drawings in chapter 8.1 for more information.

7 General, Safety, Legal & Security Standards

See Philips Safety, Legal and security standards used, see specific documents available on request. Fully compliant with *Product and Services Security Office (PSSO) and fully compliant to Philips requirements.*
On request detailed documentation can be provided on Production, Approbation and certification. For specific requirements and tractability.
Contact PInS for re-use module level certification and referrals

7.1 General Standards

The PInS WiFi module complies to the Safety Standard EN 62368-1 and is manufactured following the ROHS/REACH directives.

7.2 Contamination

The module is validated as Pollution degree 2 equipment, normally only nonconductive pollution occurs. Temporary conductivity caused by condensation is to be expected.

7.3 FCC, IC, SRRC, ETSI Compliance

The following modes of operation is supported by the module with

WLAN Firmware : wl0: Dec 19 2016 19:29:37 version 7.15.168.78 (r663126) FWID 01-8ba7c839

Country/setting	***XX/17***	***NL/1***
US	Applicable	Not Applicable
Canada	Applicable	Not Applicable
Europe	Applicable	Applicable
China	TBC	TBC

The system is designed to comply with the standards as mentioned below as part of a complete assembly. The unit is classified as a class B product.

The PInS WiFi module is IC and FCC certified for the radio aspects (in the USA and Canada) and complies with radio tests ETSI EN 300 328 V2.1.1 for EU. In addition, the module is complies with the EMC standards for USA (FCC 15.209), EU (ETSI EN 301 489-17) and Canada. The certification of China is to be confirmed.

7.3.1 IC compliance

This device complies with Industry Canada license-exempt RSS standard(s).
Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be chosen in such a way that the equivalent isotropically radiated power (e.i.r.p.) is not more than that is necessary for successful communication.
This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment.

7.3.2 Conformité aux normes d'Industrie Canada

Cet appareil est conforme à la(aux) norme(s) RSS sans licence d'Industry Canada.
Son utilisation est soumise aux deux conditions suivantes :

1. Cet appareil ne doit pas causer d'interférences et
2. il doit accepter toutes interférences reçues, y compris celles susceptibles d'avoir des effets indésirables sur son fonctionnement.

Conformément aux réglementations d'Industry Canada, cet émetteur radio ne peut fonctionner qu'à l'aide d'une antenne dont le type et le gain maximal (ou minimal) ont été approuvés pour cet émetteur par Industry Canada. Pour réduire le risque d'interférences avec d'autres utilisateurs, il faut choisir le type d'antenne et son gain de telle sorte que la puissance isotrope rayonnée équivalente (p.i.r.e) ne soit pas supérieure à celle requise pour obtenir une communication satisfaisante. Cet équipement respecte les limites d'exposition aux rayonnements IC CNR-102 définies pour un environnement non contrôlé.

7.3.3 FCC 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.

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 the 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 or more 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.

The PInS WiFi module is for OEM integrations only. The end-user product will be professionally installed in such a manner that only the authorized antennas are used.

7.4 Installation instruction

Changes or modifications made to the module not expressly approved by Philips Innovation Services may void the FCC / IC authorization to operate this equipment.

The use of the transceiver module is authorized in mobile or fixed host devices taking into account the conditions listed below:

- Philips Business Units (integrator) must ensure that the end user manual may not contain any information about the way to install or remove the module from the final product.
- Depending on the final host device additional authorization requirements for the non-transmitter functions of the transmitter module may be required (i.e., Verification, or Declaration of Conformity) Philips Business Units (integrator) are responsible for ensuring that after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements.
- The information on the label and in the user manual is required to be incorporated in the user manual of the final host. see 47 CFR15 requirements for more details (e.g. 15.19 / 15.21 / 15.101 / 15.105 / RSS-GEN / ICES)
- The module must be installed and used in strict accordance with Philips Innovation Services instructions as described in the user documentation that comes with the module.
- The end user manual for the final host product operating with this transmitter must include operating instructions to satisfy RF exposure compliance requirements.

e.g

Radiofrequency radiation exposure Information:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

- The antenna of the module may not be removed, replaced nor modified. The antenna must not be co-located or operating in conjunction with any other antenna or transmitter. No additional antenna must be used.

- When the final host product operating with this transmitter deviate from above, installation of this module into specific final hosts may require the submission of a Class II permissive change application containing data pertinent to RF Exposure, spurious emissions, ERP/EIRP, and host/module authentication, or new application if appropriate.

7.5 Label requirements for end product

For an end product using the PInS WiFI module there must be a label containing, at least, the following information:

This device contains FCC ID: 2AALC0031357 IC ID: 22799-0031357 CMIIT ID: *TBC*

The label must be affixed on an exterior surface of the end product such that it will be visible upon inspection in compliance with the modular approval guidelines developed by the FCC.

In accordance with 47 CFR § 15.19, the end product shall bear the following statement in a conspicuous location on the device:
"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."

7.6 UL compliance

UL94V-0 compliance on PCB level.

8 Specifications

8.1 Mechanical

The dimensions and footprint are part of the platform and are considered strategic to have a common base. Supporting backwards compatibility and future extensions of the platform proposition.
The main dimensions are 40mm * 22mm (+/- 0.250mm) and a maximum height of <9mm.
Refer to the latest sheet 110 [3] of the PCB for more information about the mechanical drawings.

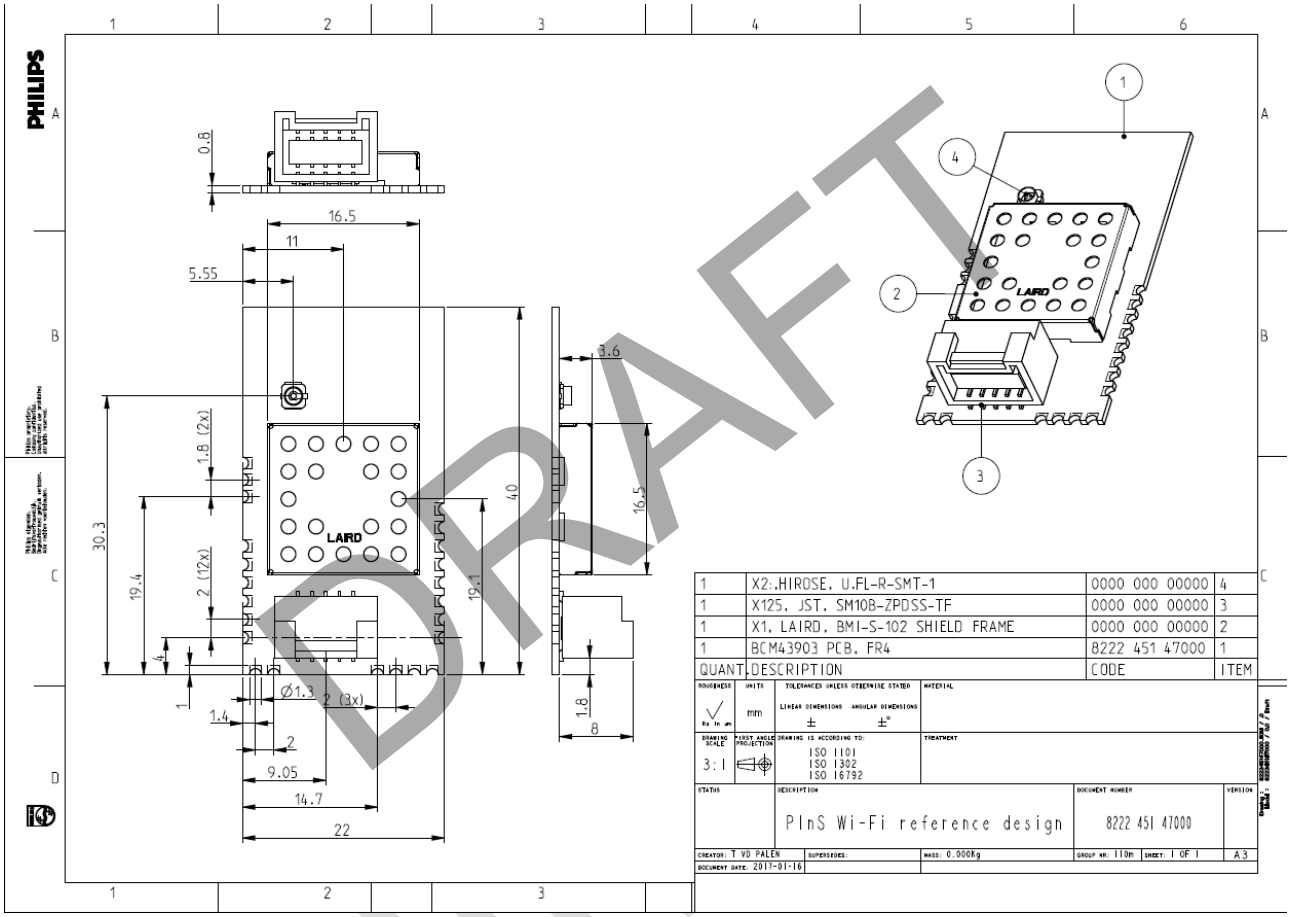


Figure 9: Mechanical drawing

8.2 Electrical

General electrical specifications as tested on module level, for detailed specifications see datasheet of CYW43903 WICED™™ IEEE 802.11 a/b/g/n SoC with an Embedded Applications Processor.

8.3 Typical Values

Description	Value
Supply voltage	*3.3V*
I/O input high voltage	*3.3V*
I/O input low voltage i	*0V*
I/O output high voltage equal or larger than	*2.4V*
I/O output low voltage equal or less than	*0.4V*
Supply voltage	*Vpp <5mV recommended, use correct decoupling and filters if needed*

8.4 Communication

Description	Typical
Main product UART interface that operates at 3V3 TTL levels.	115200
Debug UART interface that operates at 3V3 TTL levels	115200
SPI 4-wire master interface bit-bang driver	1Mbps
SPI 4-wire master interface hardware driver	20Mbps
I2C master interface operating at a frequency	100kHz and 400kHz
JTAG interface	

8.5 Absolute Maximum Ratings

Caution! The absolute maximum ratings indicate levels where permanent damage to the device can occur, even if these limits are exceeded for only a brief duration. Functional operation is not guaranteed under these conditions. Operation at absolute maximum conditions for extended periods can adversely affect long-term reliability of the device. Information out of CYW43903 datasheet core SoC.

Parameter	Symbol	Value	Unit
3.3V DC supply voltage	VDD_3P3	-0.5 to 3.9	V
Maximum undershoot voltage for I/O	$V_{undershoot}$	-0.5	V
Maximum overshoot voltage for I/O	$V_{overshoot}$	VDD_3P3 + 0.5	V
Maximum junction temperature	T_J	-0.5 to 3.9	°C

8.6 Module level recommended Maximum ratings

Description	***Range***
Supply voltage in the range	*3.13V…3.6V*
I/O input high voltage in the range	*2.0 V…3.8V*
I/O input low voltage in the range	*-0.5V…0.8V*
I/O output high voltage equal or larger than	*2.4V*
I/O output low voltage equal or less than	*0.4V*
Supply voltage	*Vpp <5mV recommended, use correct decoupling and filters if needed*

8.7 Electrostatic Discharge Specifications

Extreme caution must be exercised to prevent electrostatic discharge (ESD) damage. Proper use of wrist and heel grounding straps to discharge static electricity is required when handling these devices. Always store unused material in its antistatic packaging. ESD specifications are based directly on the core components specifications. No additional protection added on module level.

ESD specifications

Pin Type	Symbol	Condition	ESD Rating	Unit
ESD, Handling Reference: NQY00083, Section 3.4, Group D9, Table B	ESD_HAND_HBM	Human body model contact discharge per JEDEC EID/ JESD22-A114	1.5 kΩ	V
CDM	ESD_HAND_CDM	Charged device model contact discharge per JEDEC EIA/ JESD22-C101	250	V

9 RF characteristics

Also see datasheet of CYW43903 WICED™™ IEEE 802.11 a/b/g/n SoC with an Embedded Applications Processor.

Parameter	Condition/Notes	Minimum	Typical	Maximum	Unit
Frequency range	–	2400	–	2500	MHz
RX sensitivity IEEE 802.11b (8% PER for 1024 octet PSDU)	1 Mbps DSSS	–	–98.9	–	dBm
	2 Mbps DSSS	–	–96.0	–	dBm
	5.5 Mbps DSSS	–	–93.9	–	dBm
	11 Mbps DSSS	–	–90.4	–	dBm
RX sensitivity IEEE 802.11g (10% PER for 1024 octet PSDU)	6 Mbps OFDM	–	–95.0	–	dBm
	9 Mbps OFDM	–	–93.8	–	dBm
	12 Mbps OFDM	–	–92.7	–	dBm
	18 Mbps OFDM	–	–90.3	–	dBm
	24 Mbps OFDM	–	–87.1	–	dBm
	36 Mbps OFDM	–	–83.6	–	dBm
	48 Mbps OFDM	–	–79.3	–	dBm
	54 Mbps OFDM	–	–78.0	–	dBm
RX sensitivity IEEE 802.11n (10% PER for 4096 octet PSDU) [1] Defined for default parameters: 800 ns GI and non-STBC.	20 MHz channel spacing for all MCS rates				
	MCS0	–	–94.6	–	dBm
	MCS1	–	–92.1	–	dBm
	MCS2	–	–89.8	–	dBm
	MCS3	–	–86.6	–	dBm
	MCS4	–	–83.0	–	dBm
	MCS5	–	–78.3	–	dBm
	MCS6	–	–76.6	–	dBm
	MCS7	–	–75.0	–	dBm
Input in-band IP3	Maximum LNA gain	–	–8	–	dBm
	Minimum LNA gain	–	+9	–	dBm
Maximum receive level @ 2.4 GHz	@ 1, 2 Mbps (8% PER, 1024 octets)	–3.5	–	–	dBm
	@ 5.5, 11 Mbps (8% PER, 1024 octets)	–9.5	–	–	dBm
	@ 6, 9, 12 Mbps (10% PER, 1024 octets)	–9.5	–	–	dBm
	@ MCS0–2 rates (10% PER, 4095 octets)	–9.5	–	–	dBm
	@ 18, 24, 36, 48, 54 Mbps (10% PER, 1024 octets)	–14.5	–	–	dBm
	@ MCS3–7 rates (10% PER, 4095 octets)	–14.5	–	–	dBm
Adjacent channel rejection-DSSS (Difference between interfering and desired signal at 8% PER for 1024 octet PSDU with desired signal level as specified in Condition/Notes.)	**Desired and interfering signal 30 MHz apart**				
	1 Mbps DSSS –74 dBm	35	–	–	dB
	2 Mbps DSSS –74 dBm	35	–	–	dB
	Desired and interfering signal 25 MHz apart				
	5.5 Mbps DSSS –70 dBm	35	–	–	dB
	11 Mbps DSSS –70 dBm	35	–	–	dB

Description	***Range***
Closed-loop TX power variation at highest power level stetting. *Across full temperature and voltage range.* *Applies to 10dBm to 20dB output power range*	*Max +/- 1.5dB* *See* [1] *for actual value*

See datasheet CYW43903 WICED™ IEEE 802.11 a/b/g/n SoC with an Embedded Applications Processor [1] for additional information.

10 Reliability

Lifetime target of 7 years,
Field failure rate target equal to or less than 0.5%
Target warranty period of 2 years

11 Reflow profile

11.1 Typical profile

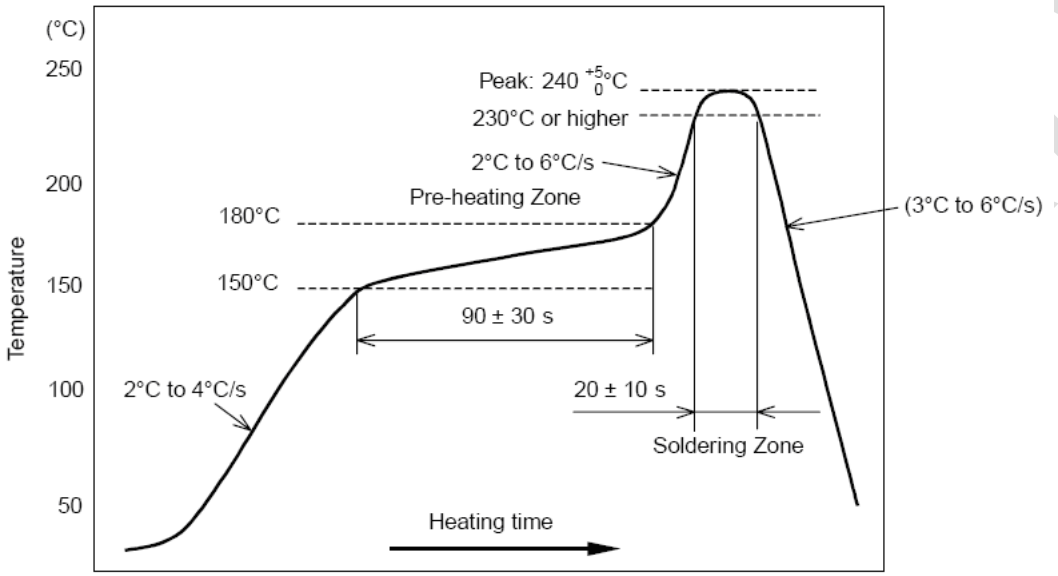


Figure 11: Reflow profile

11.2 Measured reflow profile during test runs

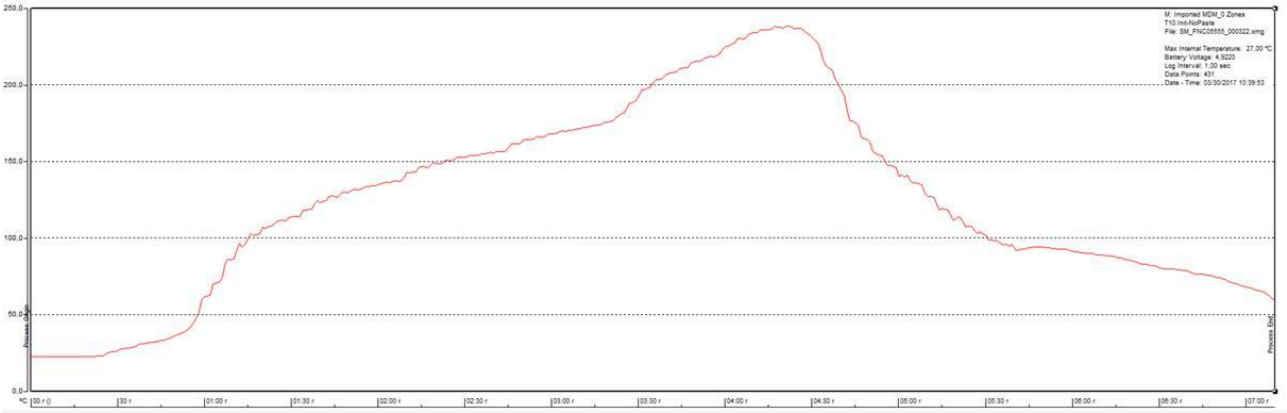


Figure 12: Reflow profile during test runs

12 Footprint details

TOP view

- Handle it as a module, black box to solder it on a PCB
- Module length 40 mm
- Module width 22 mm
- Module PCB thickness = 0.8±0.1 mm
- Module max height 10 mm (connector)
- Solder method is reflow
- Number of SMD pins are 23.
- Pad – edge shape from the module are castellation shapes.
- Use Partly metallized mounting base terminal
- Implement PCB edge indication = top of metal screening box (28 mm from the bottom)
- Place route keep out under the component (no via's and prevent interference)
- There are 2 position non plated 1.3 mm castellation shapes at the side, needed for its own PCB assembly.

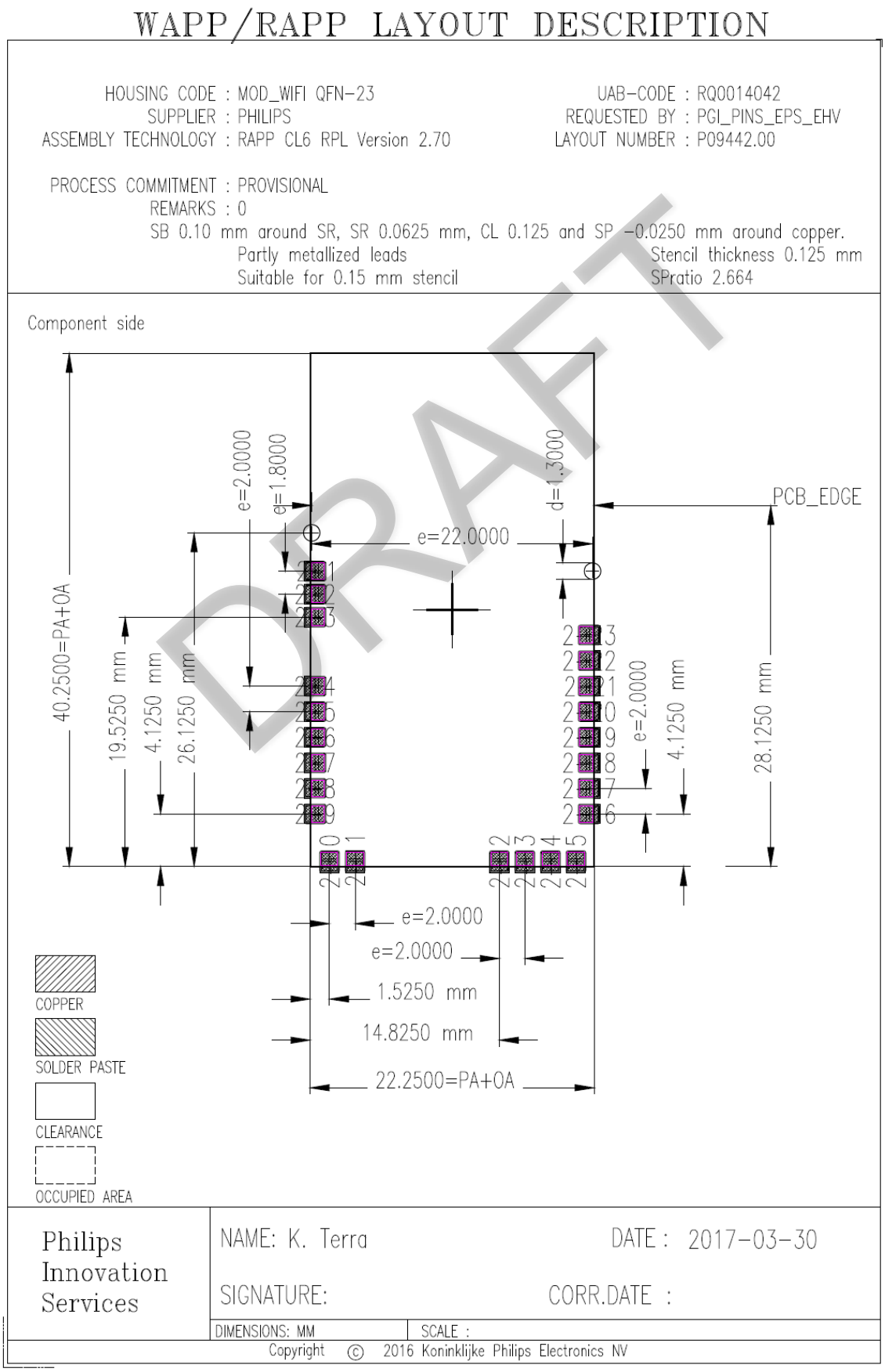


Figure 13: Layout

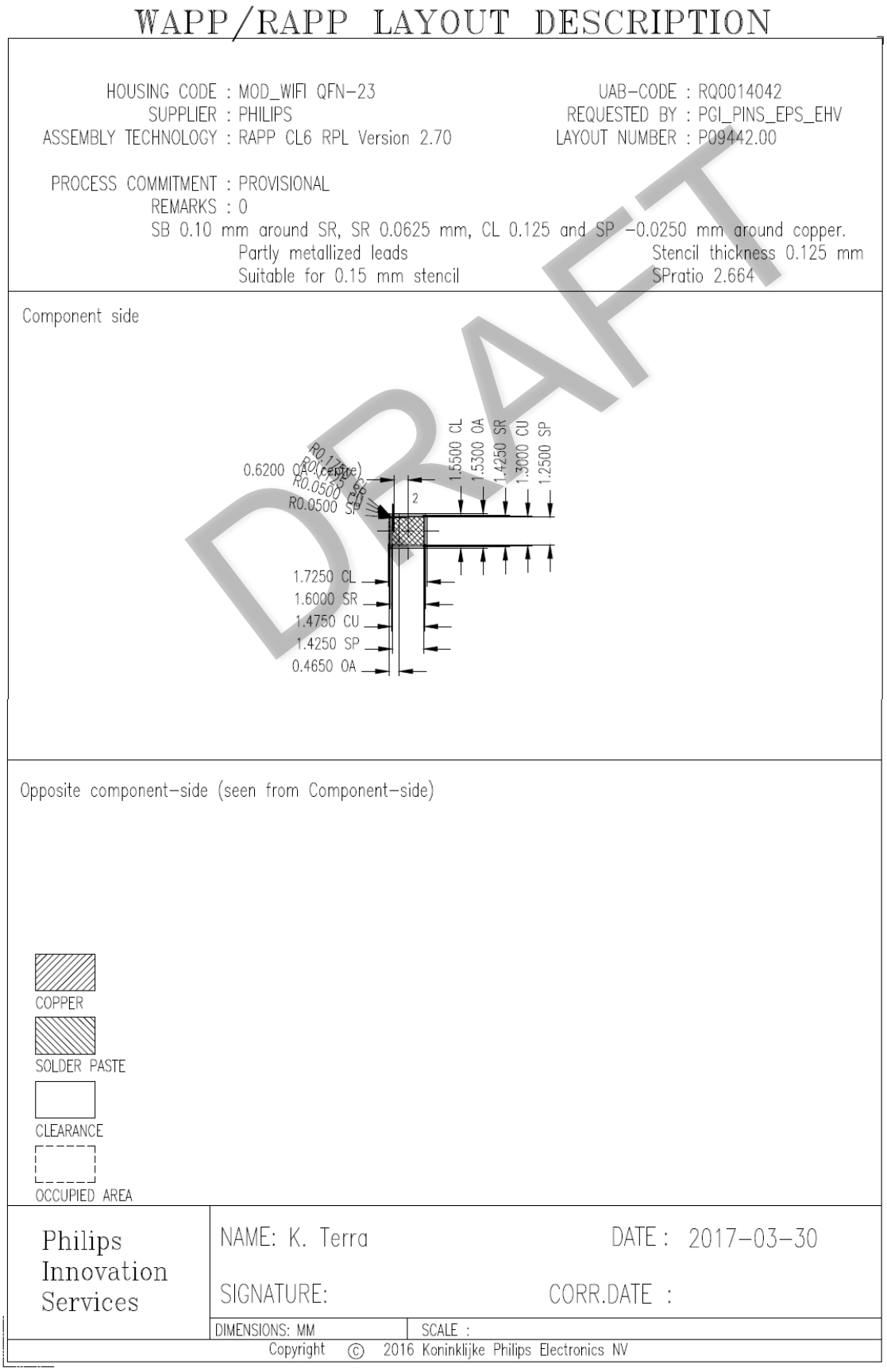


Figure 14: Layout detail

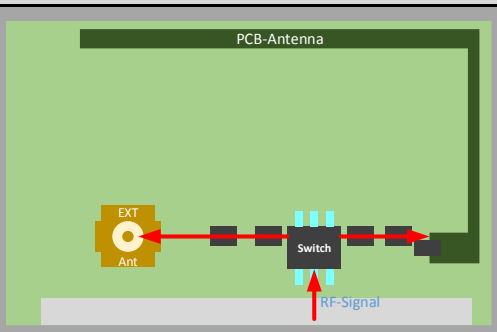
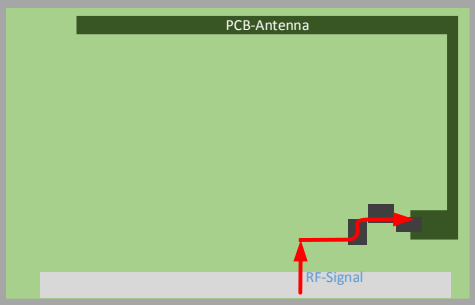
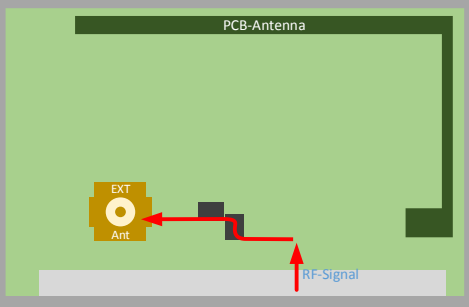
13 Ordering information

13.1 Ordering variant of module, product specific

1. Business needs to supply specific module FW 12NC (product specific, including MAC, Security ICP KEYS and Cloud ID)
2. Select common PInS HW variant 12NC, see below
3. Business needs to create and supply new module 12NC (product specific)

13.2 Common PInS HW variant, PCBA 12NC ordering information

There will be 12 different variants.

Hardware Version Identification Number (12NC-PCBA)	0 ohms resistor	X125	Antenna setup
3000 003 13592	Mounted	Mounted	
3000 003 13682		Mounted	
3000 003 13612	Mounted		
3000 003 13722			
3000 003 13742	Mounted	Mounted	
3000 003 13762		Mounted	
3000 003 13782	Mounted		
3000 003 13802			
3000 003 13822	Mounted	Mounted	
3000 003 13842		Mounted	
3000 003 13862	Mounted		
3000 003 13882			

- In case the 0 ohms resistors mounted GPIO (X103 and X109), I2C (X107 and X108) and SPI bus (X110, X112, X115 and X116) are available on the castelations.

13.3 Module Labeling

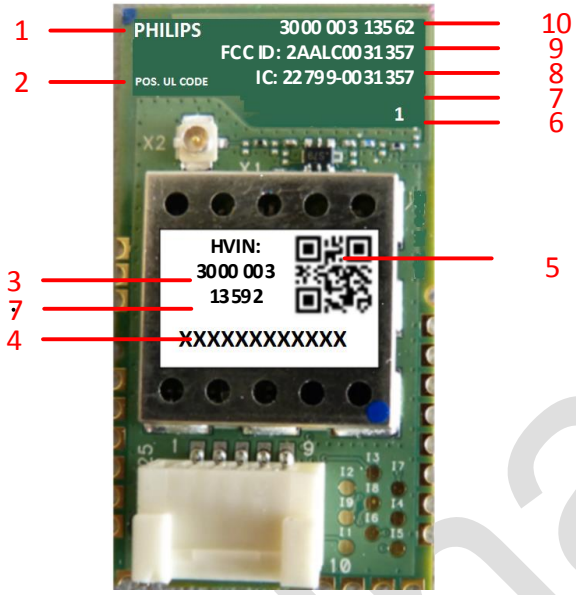


Image2: Module labeling

	Number	Description	
Label	3	12NC-PCBA	Hardware version identification number (HVIN)
	4	Model 12NC	Identification of specific product code including end-application
	5	QR code	Traceability information of the single module. See content below.
Silkscreen	1	PHILIPS	Manufacturer name
	2	POS UL code	Needs to be added by the PCB supplier. Identification of the bare-board materials.
	6	Cavity number	Needs to be added by the PCB supplier or End supplier. Added for traceability purpose.
	7	CMIIT Identification	China (Position for the china ID)
	8	IC Identification	Canada
	9	FCC Identification	United States
	10	12NC-PCB	Identification of the bare-board.

QR CODE LABEL INFORMATION

CODE	INFORMATION
YY	YEAR
WW	WEEK
D (PRODUCTION DAY)	H: MONDAY
	I: TUESDAY
	J: WEDNESDAY
	K: THURSDAY
	L: FRIDAY
	M: SATURDAY
	N: SUNDAY
MAC Address (12 digit)	XXXXXXXXXXXX
Model 12NC (12 digit)	XXXXXXXXXXXX

14 References

Ref.#	Document Title	Document ID
[1]	CYW43903 WICED™™ IEEE 802.11 a/b/g/n SoC with an Embedded Applications Processor Datasheet	002-14826 Rev. *C
[2]	Integration manual PInS Wi-Fi module V0.1	N/A
[3]	3000_003_13xxx_110_2017xxxx_WIFI_MECH	N/A