MOTOROLA *SOLUTIONS*

Title: **XWING1 Users Guide**	

Description/Abstract/Synopsis:
The purpose of this document is to provide a user's and integrator's guide
targeted for module integrators

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•Federal Communication Commission 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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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.

IMPORTANT NOTE:
FCC 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.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Operations in the 5.15-5.25GHz band are restricted to indoor usage only.

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and

2) The transmitter module may not be co-located with any other transmitter or antenna,

3) For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

As long as 3 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

- **End Product Labeling**

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: UZ7XWING1".

- **Manual Information To the End User**

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.
The end user manual shall include all required regulatory information/warning as show in this manual.

Industry Canada statement:

This device complies with RSS-210 of the Industry Canada 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.

Ce dispositif est conforme à la norme CNR-210 d'Industrie Canada applicable aux appareils radio exempts de licence. Son fonctionnement est sujet aux deux conditions suivantes: (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

IMPORTANT NOTE:

Radiation Exposure Statement:

This equipment complies with IC 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.

Caution:

(i) the device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;

(ii) the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall comply with the e.i.r.p. limit; and

(iii) the maximum antenna gain permitted for devices in the band 5725-5825 MHz shall comply with the e.i.r.p. limits specified for point-to-point and non point-to-point operation as appropriate.

(iv) Users should also be advised that high-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

NOTE IMPORTANTE:

Déclaration d'exposition aux radiations:
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.

Avertissement:

Le guide d'utilisation des dispositifs pour réseaux locaux doit inclure des instructions précises sur les restrictions susmentionnées, notamment :

(i) les dispositifs fonctionnant dans la bande 5 150-5 250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;

(ii) le gain maximal d'antenne permis pour les dispositifs utilisant les bandes 5 250-5 350 MHz et 5 470-5 725 MHz doit se conformer à la limite de p.i.r.e.;

(iii) le gain maximal d'antenne permis (pour les dispositifs utilisant la bande 5 725-5 825 MHz) doit se conformer à la limite de p.i.r.e. spécifiée pour l'exploitation point à point et non point à point, selon le cas.

(iv) De plus, les utilisateurs devraient aussi être avisés que les utilisateurs de radars de haute puissance sont désignés utilisateurs principaux (c.-à-d., qu'ils ont la priorité) pour les bandes 5 250-5 350 MHz et 5 650-5 850 MHz et que ces radars pourraient causer du brouillage et/ou des dommages aux dispositifs LAN-EL.

(The user manual of transmitter devices equipped with detachable antennas shall contain the following information in a conspicuous location:)

This device has been designed to operate with an antenna having a maximum gain of 5dBi. Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms.

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 so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

(Le manuel d'utilisation de dispositifs émetteurs équipés d'antennes amovibles doit contenir les informations suivantes dans un endroit bien en vue:)

Ce dispositif a été conçu pour fonctionner avec une antenne ayant un gain maximal de 5dBi. Une antenne à gain plus élevé est strictement interdite par les règlements d'Industrie Canada. L'impédance d'antenne requise est de 50 ohms.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peutfonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pourl'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectriqueà l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que lapuissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire àl'établissement d'une communication satisfaisante.

This device is intended only for OEM integrators under the following conditions: (For module device use)

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and

2) The transmitter module may not be co-located with any other transmitter or antenna,

3) For all products market in Canada, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

As long as 3 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

1) L'antenne doit être installée de telle sorte qu'une distance de 20 cm est respectée entre l'antenne et les utilisateurs, et
2) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne,
3) Pour tous les produits vendus au Canada, OEM doit limiter les fréquences de fonctionnement CH1 à CH11 pour bandes de fréquences 2.4G grâce aux outils de microprogrammation fournis. OEM ne doit pas fournir d'outil ou d'informations à l'utilisateur final en ce qui concerne le changement de réglementation de domaine.

Tant que les 3 conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

- **IMPORTANT NOTE:**

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

NOTE IMPORTANTE:
Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

- **End Product Labeling**

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains IC: 109AN-XWING1".

Plaque signalétique du produit final
Ce module émetteur est autorisé uniquement pour une utilisation dans un dispositif où l'antenne peut être installée de telle sorte qu'une distance de 20cm peut être maintenue entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 109AN-XWING1".

- ## **Manual Information To the End User**

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final
L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.
Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

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1. Introduction

1.1. Background

XWING1 is a radio module that will provide Wireless Local Area Network (WLAN), features to target MPA2 Motorola Solutions' EMS products.

1.2. General Note

This is a living document. Some descriptions are based on the current phase of the XW1 module design program. Changes to this document will occur without direct notification to its users. Users who wish to have the latest information should co-ordinate with the module team leader. The terms "preferred" and "recommend" are used throughout this document. Preferred can be thought of as a "nice-to-have" or "in-good practice". The term "recommendation" should be taken as a stronger implementation guideline where if not implemented performance degradation may occur.

1.3. Purpose

The purpose of this document is to provide a theory of ops and block diagram targeted for module developers and product

1.4. Part Numbers

Part Number	SKU
21-130752-01	3.3V VIO configuration Diversity with WLAN and BT on SHARED RF paths

Table 1 - Module Part Numbers and Description

1.4. Key Features and Standards supported

The XWING1 uses Texas Instrument WiLink 6.0 - WL1273 Single-Chip WLAN/BT/FM Device (SoC) The XWING1 exploits only the WLAN and BT features. The 1273 has the following feature sets:

1.4.1. WLAN

• WLAN Dual Band 802.11 a/b/g/n (MCS7-0, 20MHz Channel Bandwidth)
• WLAN MAC Baseband Processor and RF transceiver which is IEEE802.11a/b/g and IEEE802.11n PICS compliant
    Optimized for ultra low current consumption in all operating modes including extremely low power modes

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Accepts 19.2, 26, 38.4, 52-MHz reference clock Inputs for easy integration into cellular handsets

IEEE Std 802.11d,e,h,i,k,r,s PICS compliant

Supports Cisco Client eXtensions (CCX) standard

Supports serial debug interface

Supports Secure Digital Input/Output (SDIO) Serial Peripheral Interface (SPI) Host Interfaces

Medium-Access Controller (MAC)

– Embedded ARM™ Central Processing Unit (CPU)

– Hardware-Based Encryption/Decryption Using 64-, 128-, and 256-Bit WEP, TKIP or AES Keys,

– Supports requirements for Wireless Fidelity (Wi-Fi) Protected Access (WPA and WPA2.0) and IEEE Std 802.11i [Includes Hardware-Accelerated Advanced-Encryption Standard (AES)]

– Designed to Work With IEEE Std 802.1x for Virtual Private Network (VPN) Solutions

Baseband Processor

– IEEE Std 802.11n single-stream data rates (MCS0-7) and SGI support

2.4/5.0 GHz Radio

– Digital Radio Processor (DRP) implementation

– Internal LNA

– Supports : IEEE Std 802.11a, 802.11b, 802.11g, 802.11b/g and 802.11n

1.4.2.   Bluetooth

Bluetooth 1.1, 1.2, 2.0+EDR and 2.1+EDR specification compliant (Lisbon release) - up to HCI level.

BT Enhanced Data Rate (2 and 3 Mbps)

Enhanced host interfaces (UART, btSPI)

Very low power consumption

On-chip Embedded radio

– Integrated 2.4 GHz RF transceiver

– All digital PLL transmitter with digitally controlled oscillator

– Near zero IF architecture

– On-chip TX/RX switch

– Support for Class-1.5 applications

Embedded ARM Microprocessor System

– High rate four wire UART HCI (H4) and Three Wire UART HCI (H5)

– Automatic clock-detection mechanism

Flexible PCM and I_2S interfaces: full flexibility for data order, sampling and positioning

Temperature detection and compensation mechanism ensures minimal variation in the RF performance over the entire temperature range

TI-proprietary low-power scan achieves paging and inquiry scans at 1/3 normal power.

Digital Radio Processor (DRP) single-ended 50   I/O for easy RF interfacing

Patch trap mechanism and reserved RAM enables easy bug fixes

Advance Audio Interfaces and capabilities

– A2DP support

– A2DP internal loopback

– Wide-Band Speech support

– On board SBC encoder/decoder - offloads host for A2DP and WideBand speech processing

2. Architecture

2.1. System Architecture

The XWING1's fundamental design is based on the Texas Instrument WiLink 6.0 (WL1273) reference design.   The XW1 contains the TI1273, a FEM, a high-accuracy low phase-noise 26MHz TXCO, a LBPF, a LB/HB Diplexer and a SPDT RF switch used for transmit and receive antenna selection diversity. It contains level translators to interface the 1.8V chipset to 3.3V MPA2 architecture. It also contain a switching mode power supply for ANA 1.8V and a LDO for DIG 1.8V. The design has been made such that the BOM can be configured to support 1.8V architectures as well.
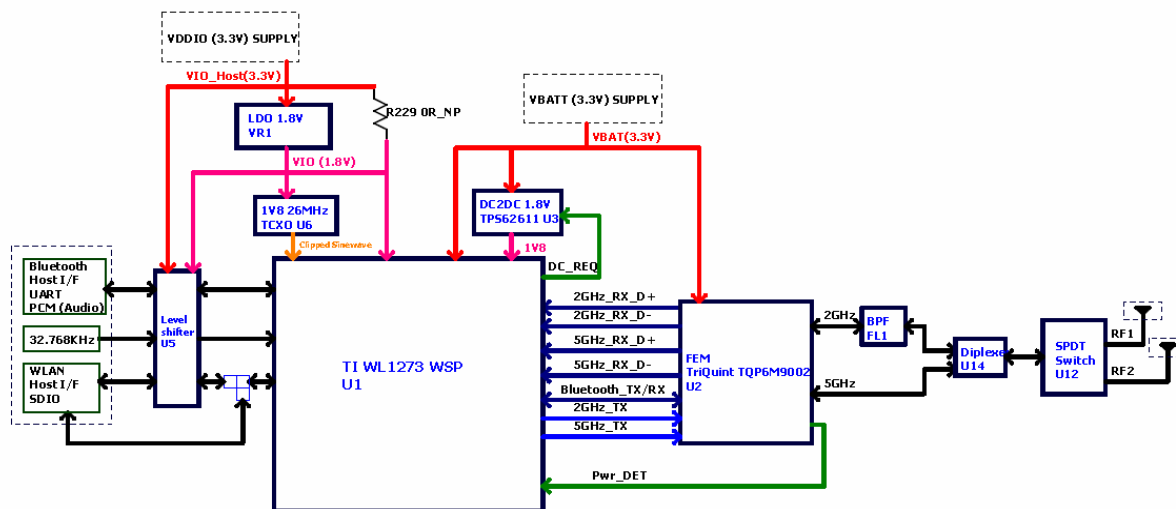
2.2. Block Diagram

Figure 1 - Block Diagram

2.3. WLAN

2.3.1. Host Communications

The WLAN core requires a total of eight (8) dedicated signals in order to communicate to the host processor. The WLAN core is enabled via the WL_EN signal (1) and communicates to the host processor via SDIO (6) with an additional interrupt signal WL_IRQ(1).

2.3.1.1. Hardware Interface

The interface between the host and the XW1 Module is a standard SDIO interface (see SDIO spec version 2.0), supporting maximum clock rate of 25MHz.

2.3.2. WLAN MAC

The TI1273 MAC implements the IEEE standard 802.11 MAC via an Embedded ARM™ Central Processing Unit (CPU)
– Hardware-Based Encryption/Decryption Using 64-, 128-, and 256-Bit WEP, TKIP or AES Keys,
– Supports requirements for Wireless Fidelity (Wi-Fi) Protected Access (WPA and WPA2.0) and IEEE Std 802.11i [Includes Hardware-Accelerated Advanced-Encryption Standard (AES)]
– Designed to Work With IEEE Std 802.1x for Virtual Private Network (VPN) Solutions

2.3.3. WLAN Baseband Processor

The TI1273 baseband processor is situated between the on-chip MAC and radio. IEEE Std 802.11n single-stream data rates (MCS0-7) and SGI support

2.3.4. RF Architecture

2.3.4.1. XW1 WLAN RF Paths

The XWING1 expands upon the Texas Instrument WiLink 6.0 (WL1273) reference design to accommodate the MPA2's WLAN diversity requirements. The XW1 module has tightly integrated some additions / deviations to this reference design.   The 5GHz BPF has been replaced by a diplexer and the combined 2.4/5GHz RF path is switched between two RF ports. This solution provides transmit and receive antenna-selection-diversity between two dual-band RF ports.

2.4. Bluetooth

2.4.1. Host Communications

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The Bluetooth subsystem requires nine (9) connections to the host in order for full operation, including PCM (4), High-Speed UART (4) and BT_GPS_FM_EN (1) , which shall be connected to the host to enable the Bluetooth IP. It should also be noted that an additional line from the WL1283 can be used for debug purposes, namely BT_UART_DBG.

2.4.1.1.   Hardware Interface

2.4.1.1.1. HCI UART Transport layers

The HCI UART Supports 4-wire UART interface to host. Supports most baud rates for all fast clock frequencies, up to a maximum of 4Mbps. Default baud rate after power up is 115.kkbps with a deviation of +1.5%, -2.5%, until baud is changed via a vendor specific command.

- BT_GPS_FM_TX
- BT_GPS_FM_RX
- BT_GPS_FM_RTS
- BT_GPS_FM_CTS

2.4.1.1.2. PCM Audio

PCM audio interface to the host uses the following signals:
In Slave mode, input frequencies up to 16MHz supported. In master mode, the TI1283 can generate any clock frequency between 64KHz and 4.096MHz.

- BT_PCM_OUT
- BT_PCM_IN
- BT_PCM_SYNC
- BT_PCM_CLK

The BT Audio Codec has a fully dedicated programmable serial port
- Two voice channels
- Supports Master/slave modes
- u-law, a-law, linear and transparent coding schemes
- Long and short frames
- Different data sizes, order and positions
- UDI profile
- High rate PCM

2.4.2.   Power Class

XW1 supports up to Power Class 1.5 Operation.

2.1. Power Sub System

The XW1 3.3V only BOM requires one external voltage source : VBAT=3.3V nominal.
The VBAT is used to supply voltage to the SoC, FEM, the LDO, SMPS, and the
antenna selection level translator. The SMPS supplies an internal 1.8V to the SoC.
The LDO supplies an internal 1.8V that is used to supply the Soc Digital circuits,
digital level translators and power to the 26MHz TCXO.

2.2.   Internal Clock Frequencies

The XW1 has on-module TCXO operating at 26MHz
2.2.1.   WLAN
WLAN has an Zero-IF architecture and thus the LO operates at ~10GHz that is divided
by 2 for 5G Band operation and divided by 4 for 2.4GHz Band operation.
2.2.2.   BT
The TCXO is used to produce the relevant BT channel, between 2.402G to 2.480GHz.
The ADPLL produces the frequencies between 4.804GHz to 4.96GHz, which divided by
2 to provide the BT frequencies.

3. Signal Descriptions

3.1.   Signal Descriptions

Listed below are the pin numbers and signals on the XW1 module.
GEN = General (No specific function), PWR= Power Supply, ANA= Analog

Table 2 – Signal Descriptions

TI WL1273 Pin Definition		
Power	Ball	I/O type
VBAT	B6, B7	I
VBAT2X	C16	I
VIO_Host	B19, C18, C19, U16, U17, V16,V17	I
GND	A1~A22, B3, B4, B5, B8~B11, B13~B17, B20~B22, C1~C14, C20~C22, D3, D22, E1~E3, E22, F3, F6~F17, F22, G1, G6~G17, G22, H1, H6~H17, H22, J1~J3, J6~J17, J22, K1, K3, K6~K17, K21, K22, L1~L3, L6~L17, L20~L22, M1, M6~M17, M22, N1, N6~N17, N22, P1~P3, P6~P17, P22, R1, R20~R22, T1, T22, U1~U8, U11, U12, U14, U15, U18, U20~U22, V1~V3, V8, V11~V15, V18, V21, V22, W1~W22, N2, N3, M2, M3, T2, T3, R2, R3	
NC	G20, F20, K2, G2, G3, H2, H3, E20, U10, E21, D20, D21, K20, U13,	
Test point	J21, B18	
Serial Host Interfaces	Ball	I/O type
SDIO_CLK	M20	I
SDIO_CMD	N21	I/O
SDIO_DAT0	P20	I/O

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SDIO_DAT1	N20	I/O
SDIO_DAT2	P21	I/O
SDIO_DAT3	M21	I/O
WLAN_IRQ_HOST	T20	O
Misc Interfaces	Ball	I/O type
UARTSIN	F21	I
UARTSOUT	G21	O
SLEEP_CLK	B12	I
For Test Purpose	Ball	I/O type
WL_UART_DBG	C17	I/O
RF1 (SECONDARY RFPORT)	B2	I/O
RF2 (PRIMARY RF PORT)	D2	I/O
WL_EN_HOST	C15	I
BT_EN_BGA	U9	I
BT ***	F2	I/O
General Purpose Pins	Ball	I/O type
WLAN_ACTIVITY_HOST	J20	O
COEX_STATUS_HOST	H20	I
BT_PRIORITY_HOST	H21	I
BT_FUNC2_BGA	V9	I
BT_FUNC5_BGA	V10	O
PCM	Ball	I/O type
BT_PCM_CLK_BGA	V4	I/O
BT_PCM_SYNC_BGA	V5	I/O
BT_PCM_IN_BGA	V6	I/O
BT_PCM_OUT_BGA	V7	I/O
BT UART	Ball	I/O type
BT_UART_TXD_BGA	U19	I/O
BT_UART_RTS_BGA	V19	I/O
BT_UART_RXD_BGA	V20	I/O
BT_UART_CTS_BGA	T21	I/O

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