a module solution provider

WG1300-B0

Evaluation Module User Guide

Revision 0.2

Index

0. REGULATION INFORMATION

Federal Communication Commission Interference 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 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 transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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 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) The monopole chip antenna with 2.5 dBi gain was verified in the conformity testing. Radiated transmit power must be equal to or lower than that specified in the Equipment Authorization. A separate approval is required for all other antenna type, or higher gain antenna.

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: WS2-WG1300B0”. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

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.

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.

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.

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.
As long as 2 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.
3) The monopole chip antenna with 2.5 dBi gain was verified in the conformity testing. Radiated transmit power must be equal to or lower than that specified in the Equipment Authorization. A separate approval is required for all other antenna type, or higher gain antenna.

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: 10462A-WG1300B0”.

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: 10462A-WG1300B0".

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.

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.

1. INTRODUCTION

The purpose of this user guide is to help user understanding how to use WG1300-B0 EM (Evaluation Module) board to complete hardware setup for test to evaluate the performances of CC3000 - WG1300-B0 SiP Module.

2. WG1300-B0 EM BOARD

In the following sub-sections, it'll divide into TOP and BOTTOM Side to explain details on the key parts and its features.

2.1. TOP Side

Figure 1 is TOP-Side picture of WG1300BE00 EM Board.

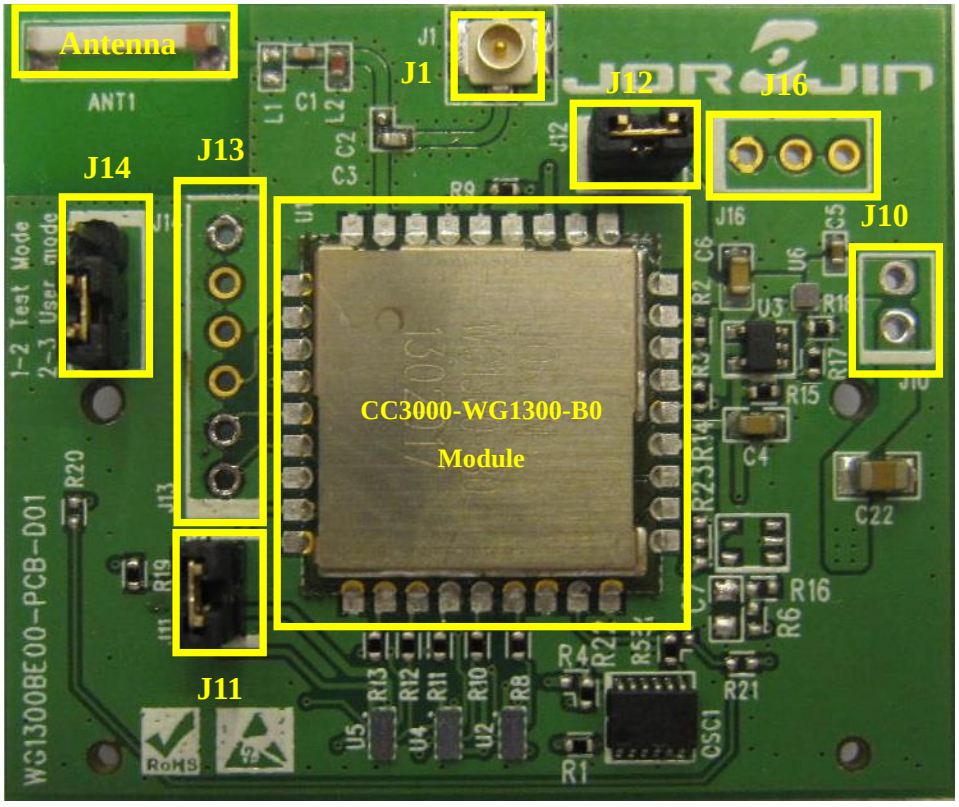

Figure 1. TOP Side of WG1300BE00 EM Board

The picture above marks some key parts and jumpers and Table 1

below shows the explanations to them in the details.

Items	Key Parts	Descriptions
1	CC3000-WG1300-B0 Module	The core module for performance evaluation. It's related feature can be referred to its datasheet.
2	Antenna	It can used for radiated test by reworking cpacitor to correct pads.
3	J1	It's a U.FL RF connector via which you can proceed conducted power test.
4	J14	It is a jumper via which we can swap testing modes, test mode and operation mode. When pin 2 and pin 3 are shorted, it runs in operation mode and it operate in test mode when pin 1 and pin 2 are shorted.
5	J10	It is a jumper for testing power consumption. It is for the power for all circuit in this board. In operation mode, pins of the jumper is shorted. For power testing, the jumper is removed and ammeter crosses the pins to do the testing.
6	J12	It is a jumper for testing VBAT_IN power consumption of WG1300-B0. In operation mode, pins of the jumper is shorted. For power testing, the jumper is removed and ammeter crosses the pins to do the testing.
7	J11	It is a jumper for testing VIO_SOC power consumption of WG1300-B0. In operation mode, pins of the jumper is shorted. For power testing, the jumper is removed and ammeter crosses the pins to do the testing.
8	J13	Refer to Table 2. For more details on these through-hole test points
9	J16	Refer to Table 3. For more details on these through-hole test points

Table 1. TOP-Side Key parts of WG1300BE00 EM Board

Table 2 below shows the signal descriptions of J13

Pin Number	Pin Name	Pin Type	Descriptions
1	WL_RS232_RX	I	Test RS232 receive output; Leave floating for normal operation
2	WL_RS232_TX	O	Test RS232 transmit output; Leave floating for normal operation
3	WL_UART_DBG	I/O	UART Debug Line
4	NS_UARTD	I/O	Networking subsystem UART Debug line.
5	DC2DC_OUT	P	Internal DC2DC output power.
6	GND		Ground

Table 2. TOP-Side J13 of WG1300BE00 EM Board

Table 3 below shows the signal descriptions of J16

Pin Number	Pin Name	Pin Type	Descriptions
1	GND		Ground
2	SDA_EEPROM	I/O	I2C Data signal from EEPROM inside CC3000-WG1300-B0 SiP Module. This pin is connected to SDA_CC3000 via a 0-Ohm resister and is not used by end users.
3	SCL_EEPROM	I	I2C Clock signal input from EEPROM inside CC3000-WG1300-B0 SiP Module. This pin is connected to SCL_CC3000 via a 0-Ohm resister and is not used by end users.

Table 3. TOP-Side J16 of WG1300BE00 EM Board

2.2. BOTTOM Side

Figure 2 is BOTTOM-Side picture of WG1300BE00 EM Board.

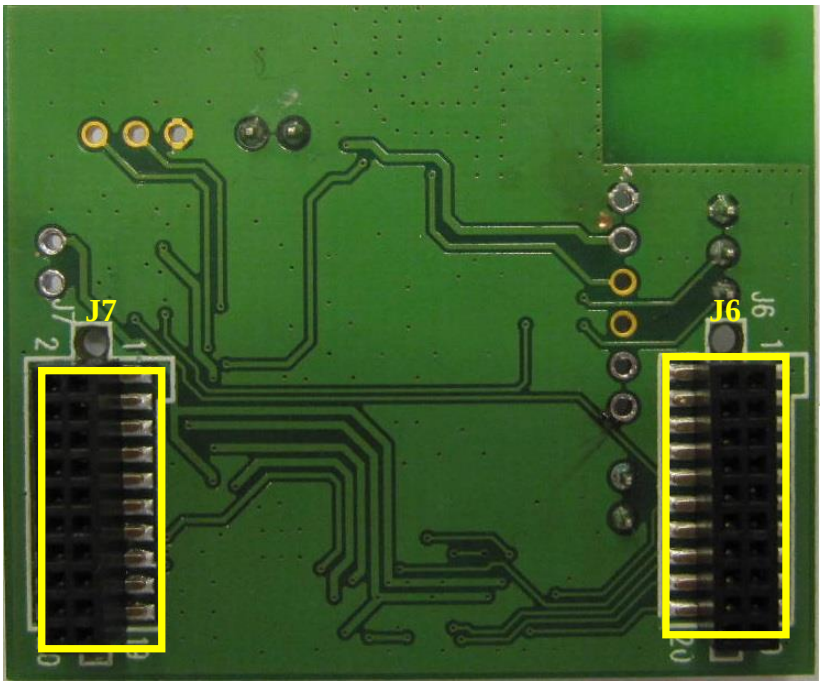

Figure 2. Bottom Side of WG1300BE00 EM Board

There are two EM Board mating connectors which are used for connecting to Host platform and mounted on the bottom side as the picture above. Table 4 and Table 5 show the descriptions on the signals brought out from these two EM mating connectors.

J6 Pin Number	Pin Name	Module Pin Type	Description
1	GND		Ground
5	EXT_32KHz	I	External Slow Clock input from Host device. It can be used for the SiP Module inside which hasn't slow clock source.
10	VBAT_SW_EN	I	Active-high enable signal from Host device.
12	WL_SPI_IRQ	O	Host Interface SPI Interrupt Request

14	WL_SPI_CS	I	Host interface SPI Chip Select
16	WL_SPI_CLK	I	Host interface SPI Clock input
18	WL_SPI_DIN	I	Host Interface SPI Data Input
19	GND		Ground
20	WL_SPI_DOUT	O	Host interface SPI Data Ouput

Table 4. BOTTOM-Side J6 of WG1300BE00 EM Board

J7 Pin Number	Pin Name	Module Pin Type	Description
2	GND		Ground
7	VBAT_IN	PI	Battery voltage input to Module
9	VBAT_IN	PI	Battery voltage input to Module
15	EXT_32KHz	I	External Slow Clock input from Host device.

Table 5. BOTTOM-Side J7 of WG1300BE00 EM Board

2.3. Hardware Setup

Before conducting performance test, EM Board should be connected to Host platform with mating connectors, J6 and J7. For the case of using EM mating connector for hardware connection, the mating EM connector should be lined up and spaced 1.2" apart as Figure 3 below

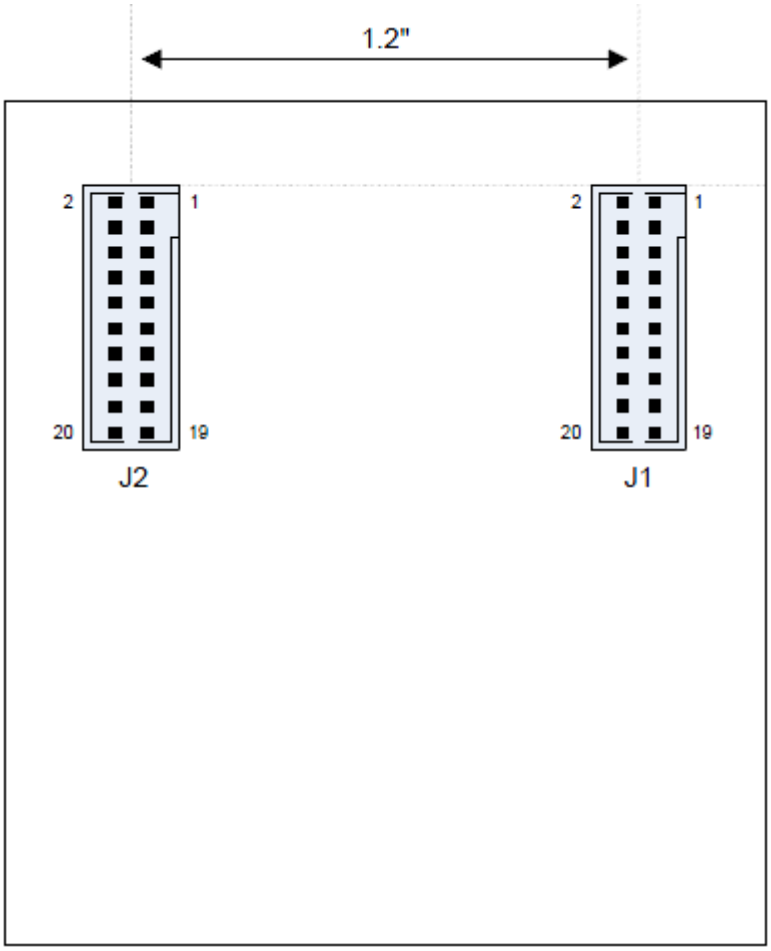

Figure 3. Host PCB Mating Connector Arrangement

2.4. Schematics

Figure 4 is the schematics of WG1300E00 EM Board

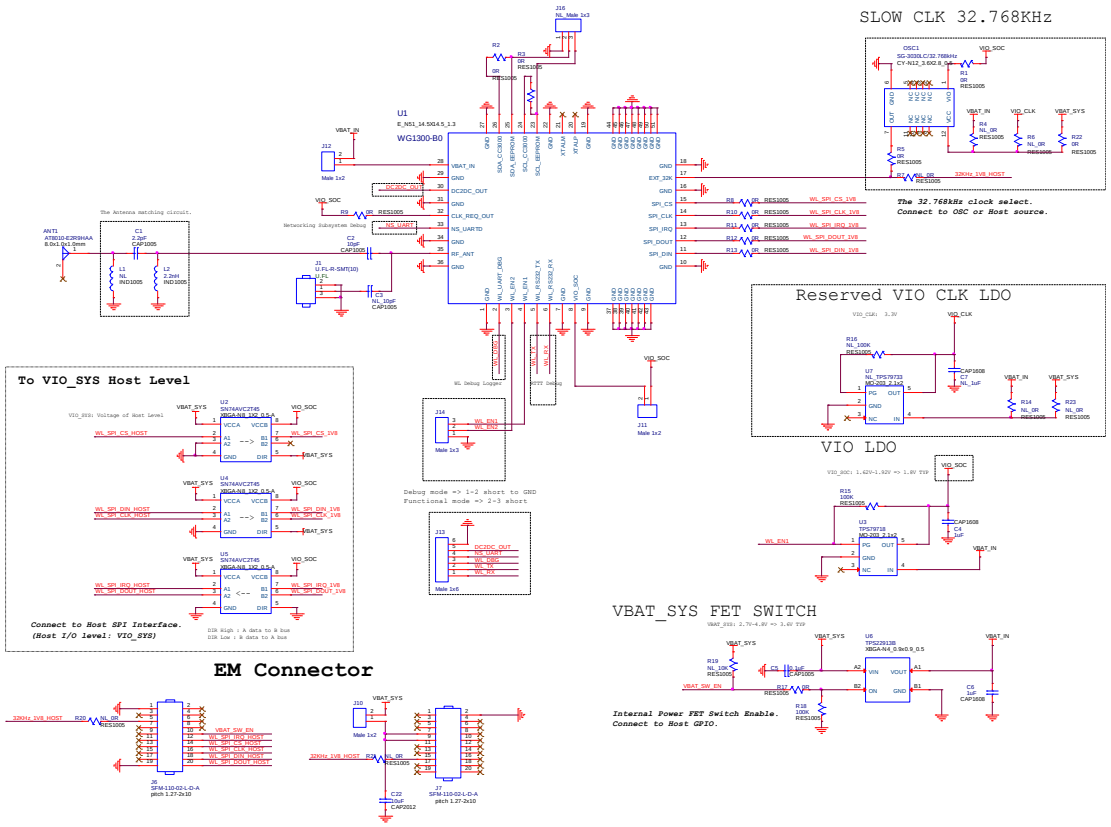

Figure 4. Schematics of WG1300BE00 EM Board

2.5. Bill Of Material (BOM)

Items	Reference Designator	Description
1	U1	TI CC3000 WiFi b/g Module (LC)
2	U2, U4, U5	IC BUS TRANSCEIVER, SN74AVC2T45YZPR
3	U3	IC Regulator, TPS79718DCK
4	U6	IC Power Switch, TPS22913BYZV
5	OSC1	OSC 3225 / 32.768KHz / 1.5~5.5V / 5ppm
6	ANT1	ANT / 2.4GHZ / Peak Gain 2.5DB
7	J10, J11, J12	CON Male 1x2 / Pitch 2.0 mm
8	J14	CON Male 1x3 / Pitch 2.0 mm
9	J6,J7	Female Header / Fool Proof H:4.3 / 2x10 / Pitch 1.27mm / SMT
10	J1	Mini RF Header Receptacle
11	R1, R2, R3, R5, R8, R9, R10, R11, R12, R13, R17, R22	RES 0402 / 0R / ±5%
12	R15, R18	RES 0402 / 100K / ±5%
13	L2	IND 0402 / 2.2nH / ±0.3nH / 0.16ohm / 300mA
14	C1	CAP 0402 / 2.2pF / 50V / NPO / ±0.25pF
15	C2	CAP 0402 / 10pF / 50V / NPO / ±5%
16	C5	CAP 0402 / 0.1uF / 10V / X7R / ±10%
17	C4, C6	CAP 0603 / 1uF / 16V / X7R / ±10%
18	C22	CAP 0805 / 10uF / 10V / X5R / ±10%

Table 6. BOM of WG1300BE00 EM Board

3. ANTENNA CHARACTERISTICS

3.1. Return Loss & VSWR

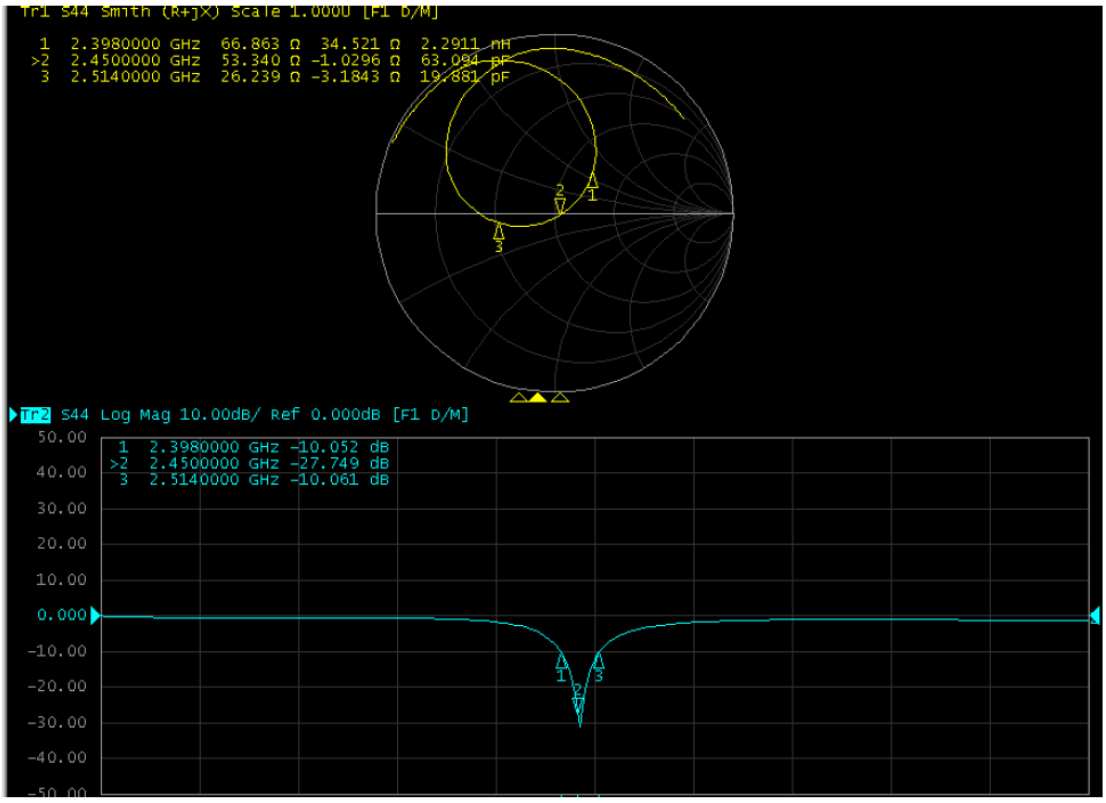

Figure 5. Antenna return loss & VSWR

3.2. Plane Definition

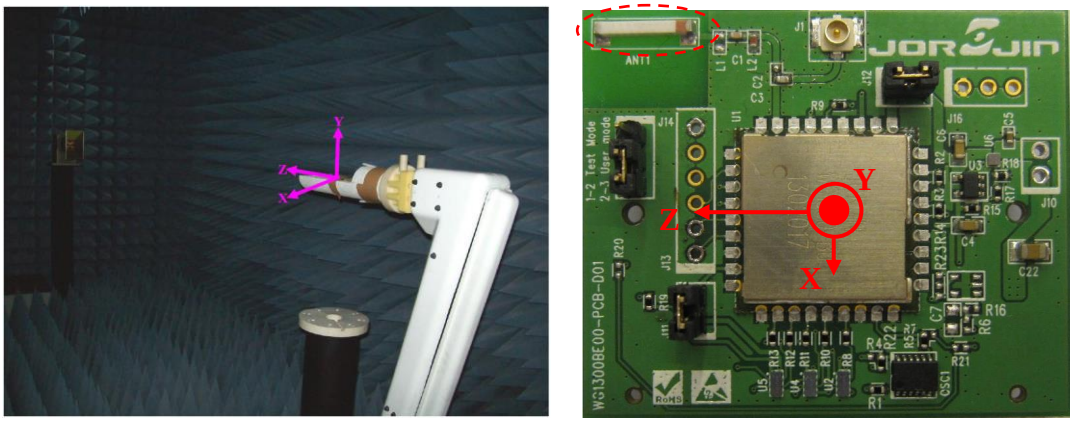

Figure 6. Plane Definition

XY-Plane	Theta=90°
XZ-Plane	Phi=0°
YZ-Plane	Phi=90°

3.3. 3D Radio Pattern

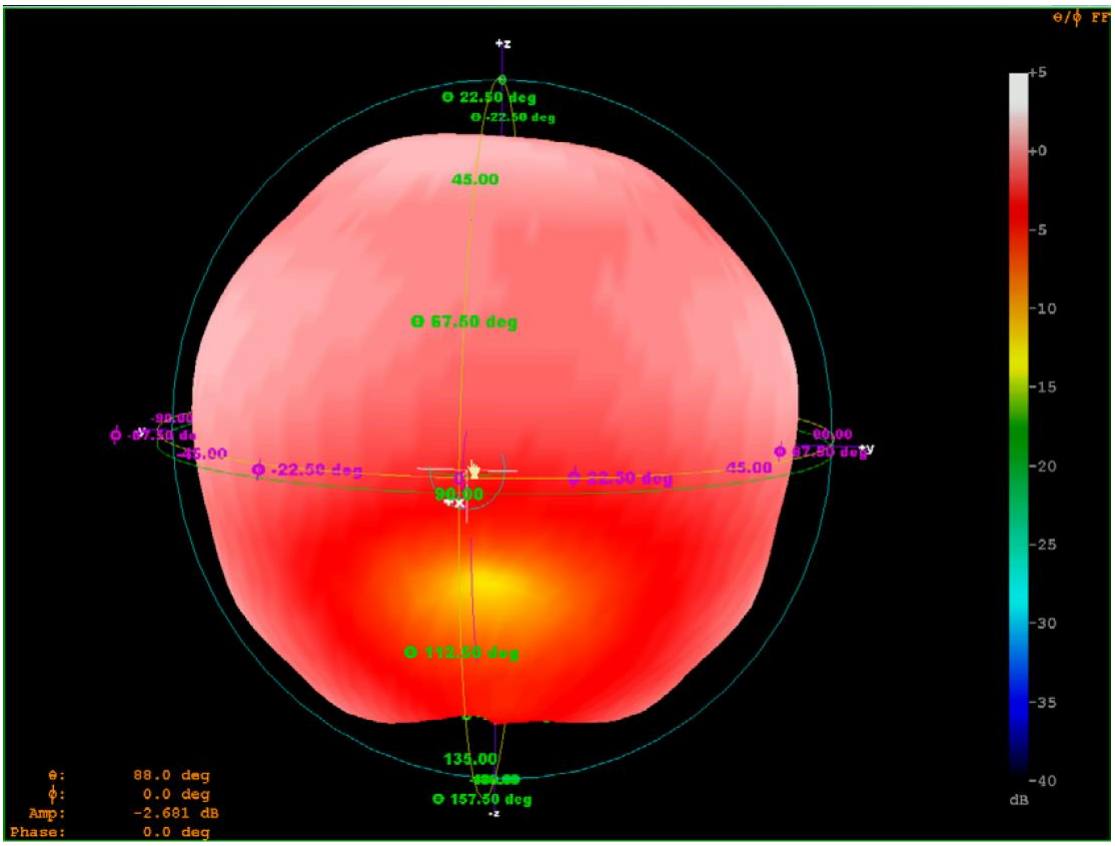

Figure 7. 3D Radio Pattern

3.4. 2D Radio Pattern

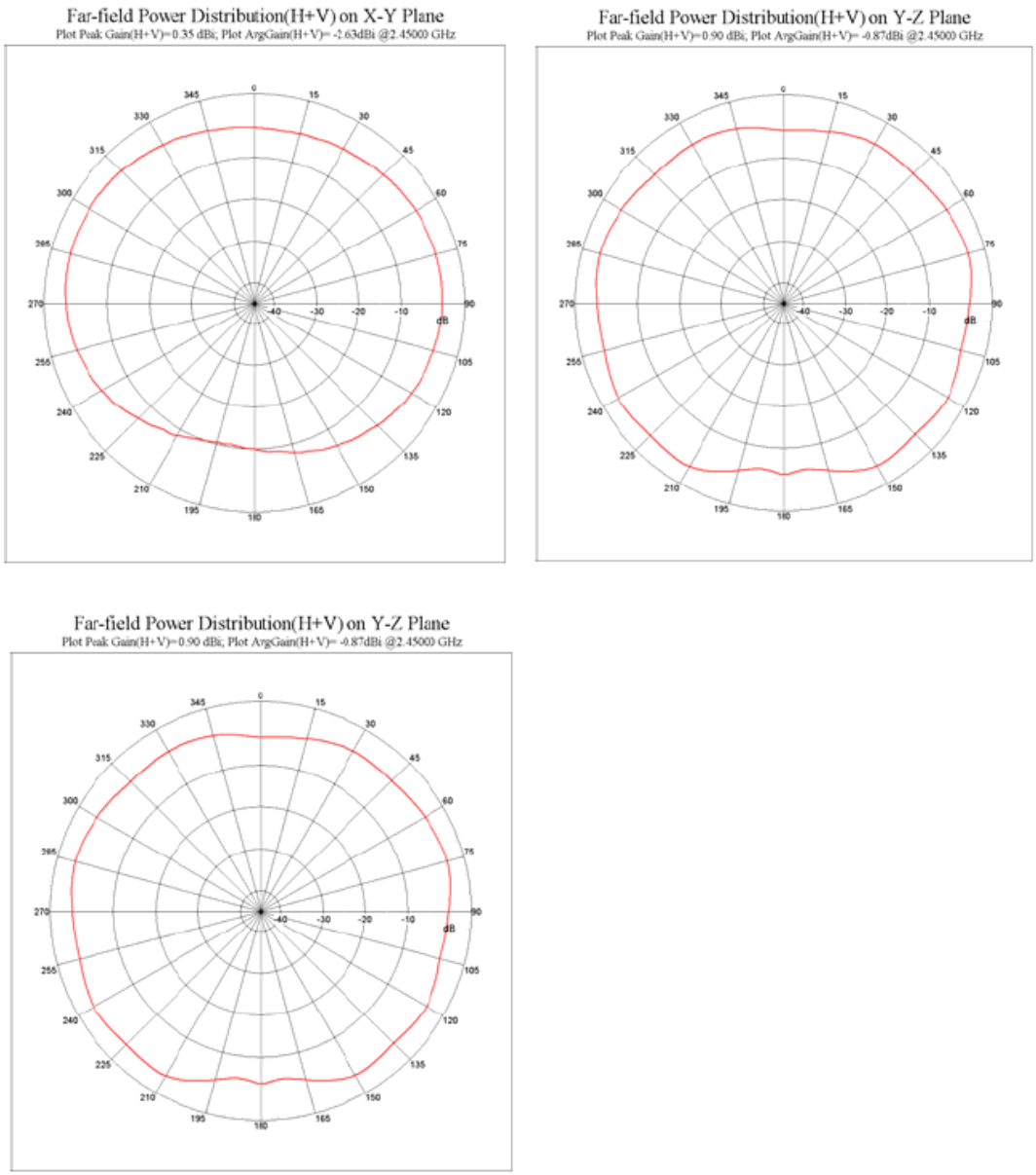

Figure 8. 2D Radio Pattern

XY-Plane		XZ-Plane		YZ-Plane		Efficiency
Peak	Avg.	Peak	Avg.	Peak	Avg.	
0.3	-2.6	1.3	-4.2	0.9	-0.9	66.7%

Table 7. Gain Table

4. LAYOUT GUIDELINES

4.1. Board Layout

Figure 9 shows the 2 layers evaluation board.

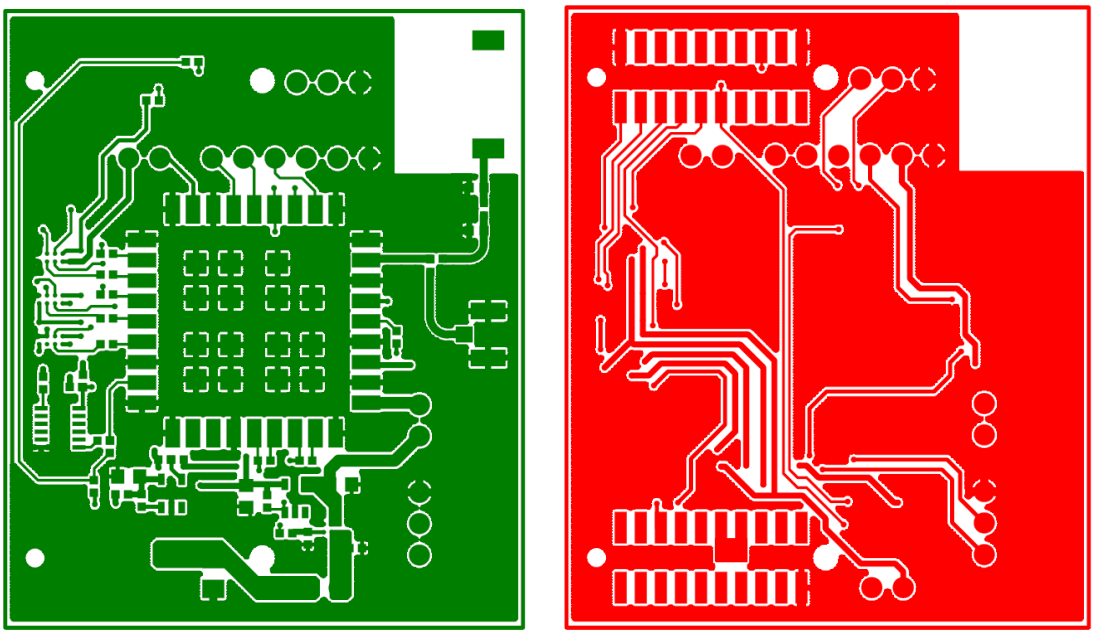

Figure 9. Board Layout

Table 8 and Figure 10 describe instances of good layout practices.

Reference	Guideline Descriptions
1	The proximity of ground vias must be close to the pad.
2	Signal traces must not be run underneath the module on the layer where the module is mounted.
3	Increase the ground pour in the first layer.
4	Have a solid ground plane and ground vias under the module for stable system and thermal dissipation.

Table 8. Module Layout Guidelines

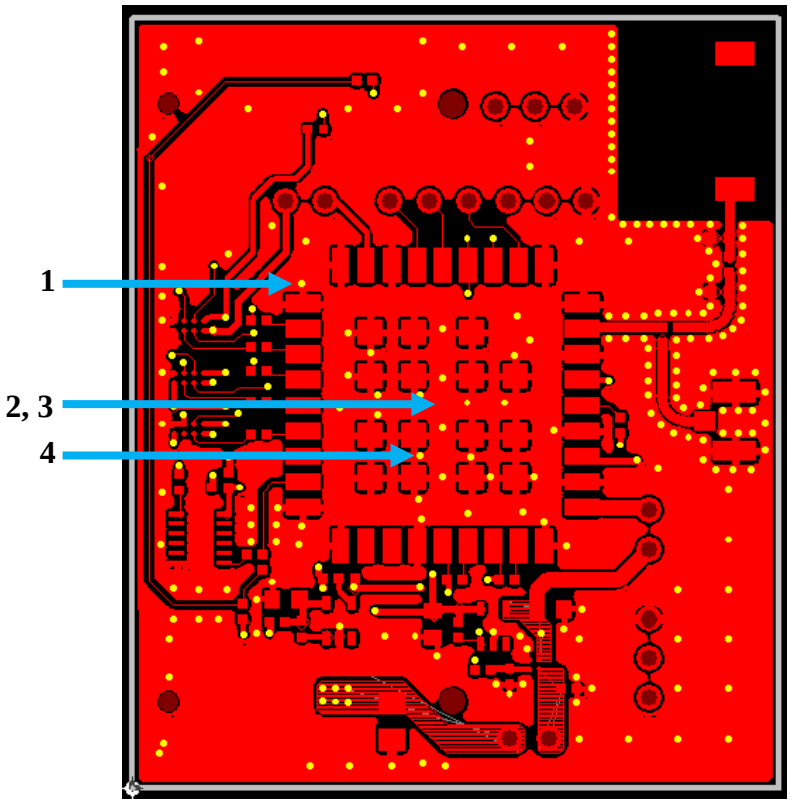

Figure 10. Module Layout Guidelines

Figure 11 shows the RF trace design for the PCB. A 50-Ω impedance match on the trace to the antenna should be used. Also, 50-Ω traces are recommended for the PCB layout. Figure 11 also lists the distances. Figure 12 shows layer 1 with the trace to the antenna over the layer 2. Table 9 and Figure 13 describe instances of good layout practices for the antenna and RF trace routing.

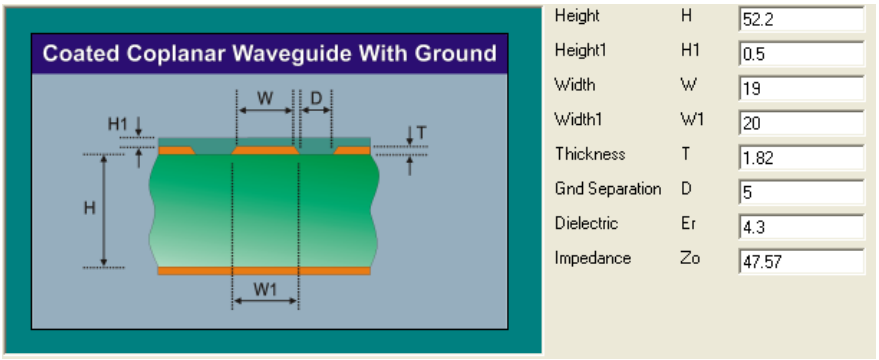

Figure 11. Trace Design for the PCB layout

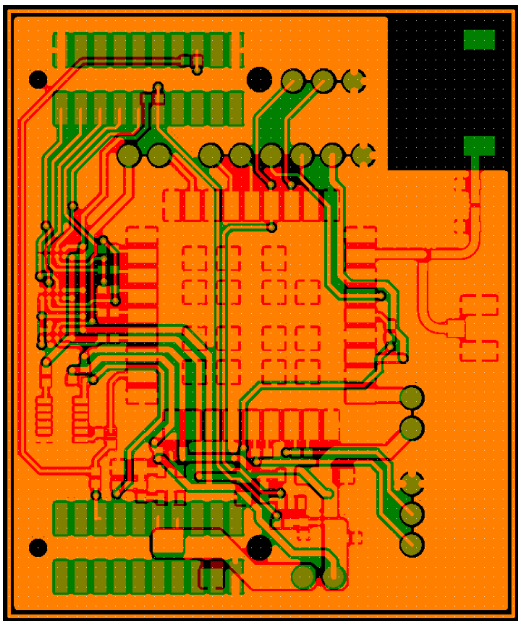

Figure 12. Layer 1 Combined with Layer 2

Reference	Guideline Descriptions
1	The RF trace antenna feed must be as short as possible beyond the ground reference. At this point, the trace starts to radiate.
2	The RF trace bends must be gradual with an approximate maximum bend of 45 degrees with trace mitered. RF traces must not have sharp corners.
3	RF traces must have via stitching on the ground plane beside the RF trace on both sides.
4	RF traces must have constant impedance (microstrip transmission line).
5	For best results, the RF trace ground layer must be the ground layer immediately below the RF trace. The ground layer must be solid.
6	There must be no traces or ground under the antenna section.
7	The PCB designer must understand the microstrip model used and the scale line width according to the microstrip model.
8	RF traces must be as short as possible. The antenna, RF traces, and modules must be on the edge of the PCB product. The proximity of the antenna to the enclosure and the enclosure material must also be considered.

Table 9. Antenna and RF Trace Routing Layout Guidelines

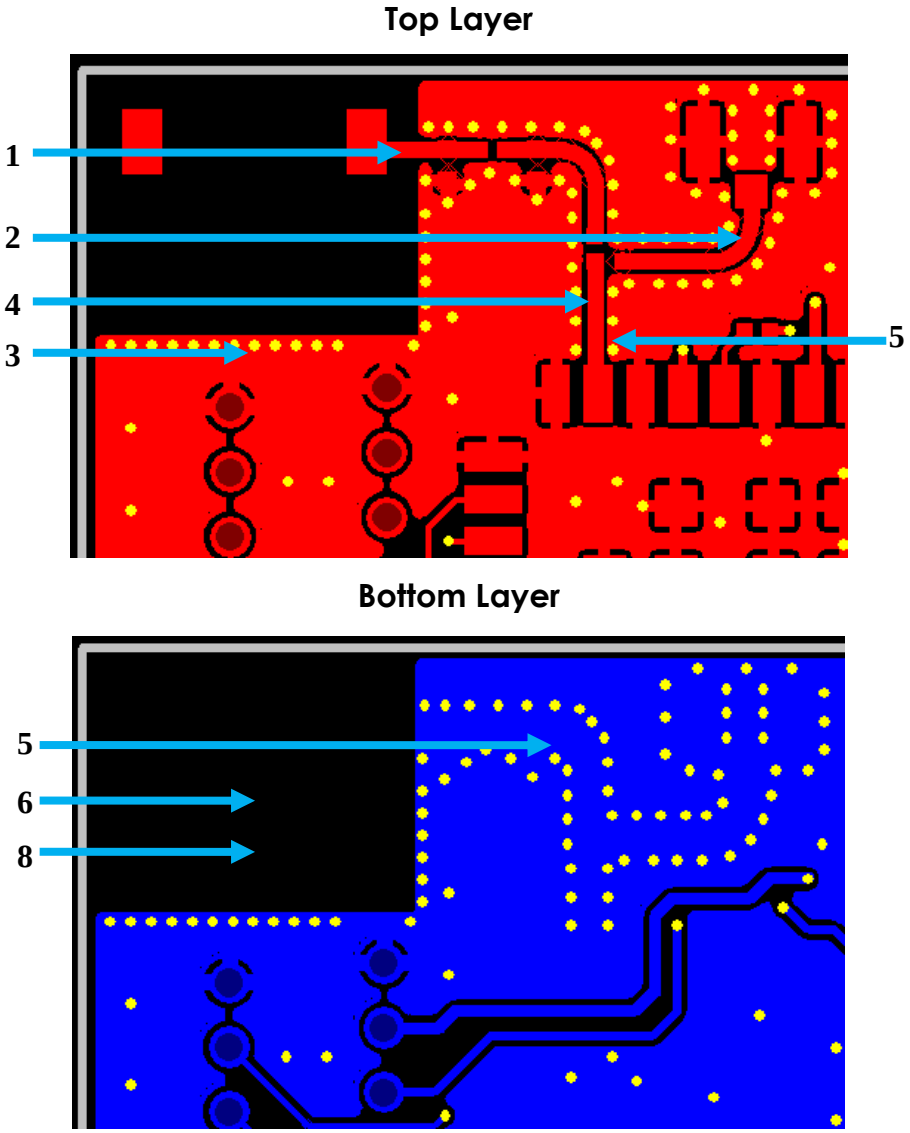

Figure 13. Antenna and RF Trace Routing Layout Guidelines

The following show the supply routing guidelines:

- For power supply routing, the power trace for VBAT must be at least 40 mil wide.
- The 1.8-V trace must be at least 18 mil wide.
- Make VBAT traces as wide as possible to ensure reduced inductance and trace resistance.
- If possible, shield VBAT traces with ground above, below, and beside the traces.

5. APPLICATION DEVELOPMENT

Texas Instrument had developed a HOST platform, MSP-EXP430FR5730, for evaluating CC3000-based SiP Module. Figure 4 shows the platform and WG1300BE00 EM Board

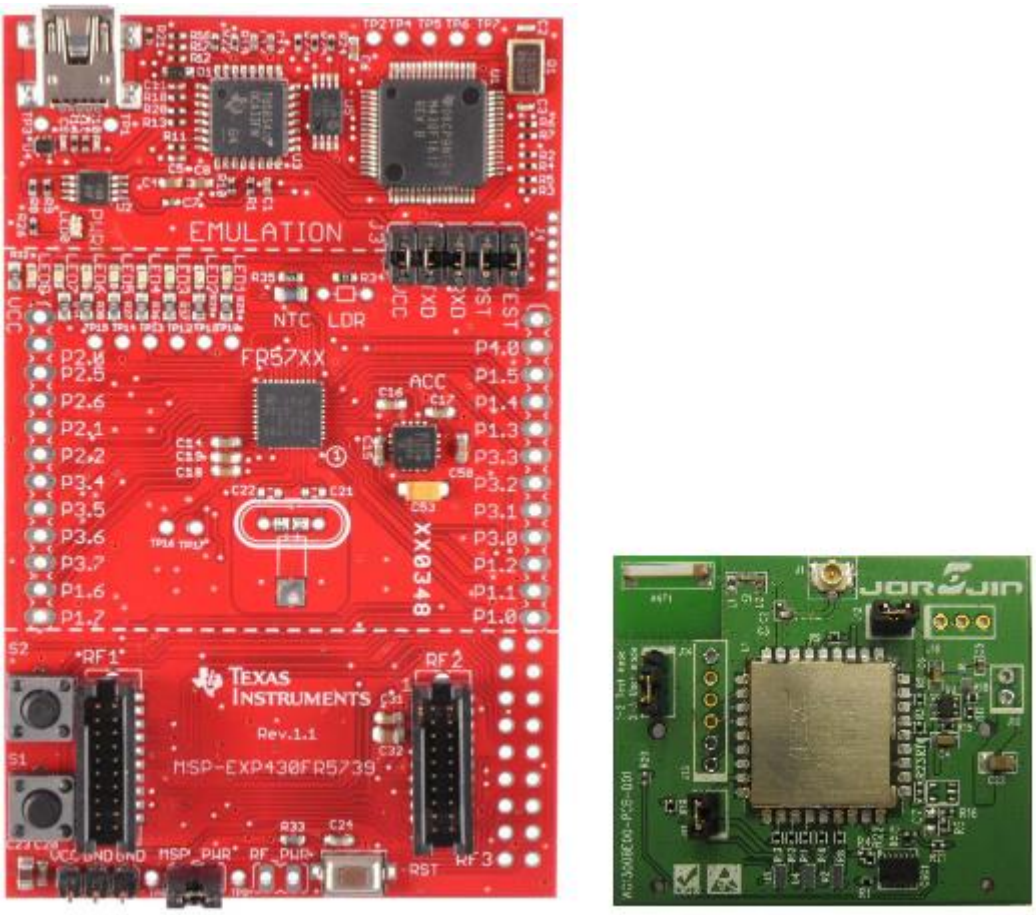

Figure 4. MSP-EXP430FR5730 and WG1300BE00 EM Board

The MSP-EXP430FR5739 test platform can be ordered as the link below.

http://www.ti.com/tool/msp-exp430fr5739

Specific application examples can refer to the link below

http://processors.wiki.ti.com/index.php/CC3000 Wi-Fi for MCU

6. HISTORY CHANGE

Revision	Date	Description
R 0.1	2013/7/22	Release 0.1
R 0.2	2014/May/22	Add 3. Antenna Characteristics 4. Layout Guidelines