RKNBT001 BLE Module User Manual

Version V2.0

Change History

Version	Description	Prepared by	Date
V1.0	1st Edition	Colton Black	July 7, 2023
V2.0	2nd Edition	Colton Black	July 12, 2023

Contents

1.Overall Introduction

REEKON's RKNBT001 is a BT 4.2 and BT 5 stack (Bluetooth low energy or BLE) module designed based on Nordic nRF52833 SoC solution.

2. PCB Dimensions and Pin Indication

2.1. PCB Dimensions

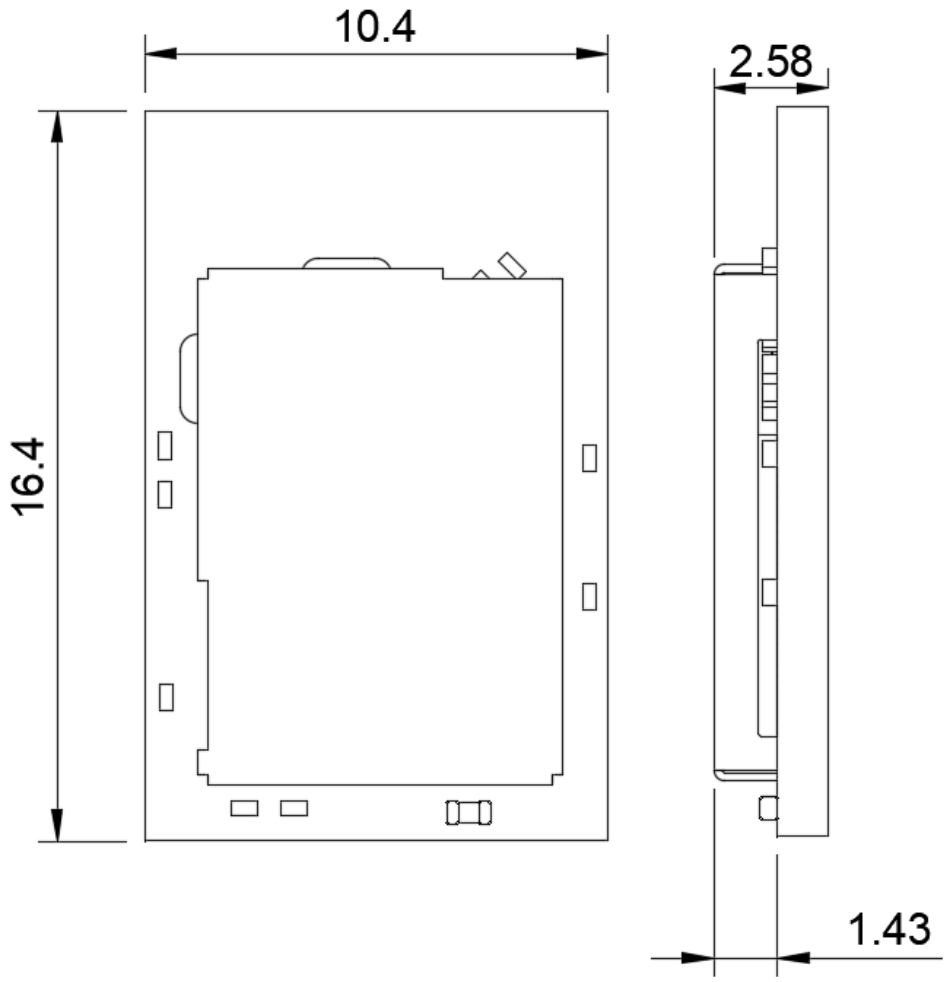

Fig 2.1.1 PCB dimensions

2.2. Pin Indication

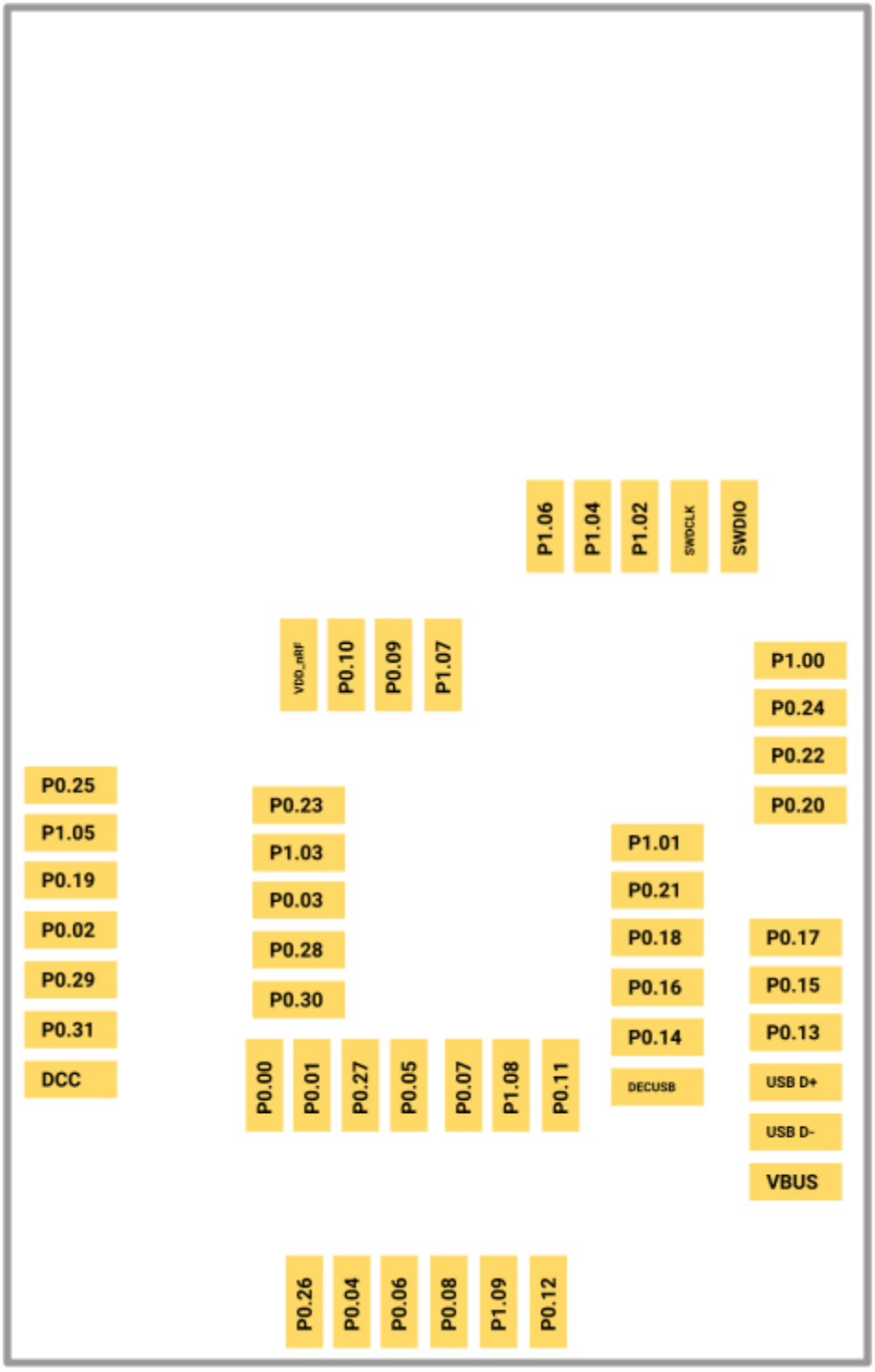

Fig 2.2.1 RKNBT001 Module Pin layout

Name	Pin	Function	Description
P0.31 AIN7	A8	Digital I/O Analog input	General purpose I/O Analog input
P0.29 AIN5	A10	Digital I/O Analog input	General purpose I/O Analog input
P0.02 AIN0	A12	Digital I/O Analog input	General purpose I/O Analog input
P0.19	A14	Digital I/O	General purpose I/O
P1.05	A16	Digital I/O	General purpose I/O
N.C.	A18		
P0.25	A20	Digital I/O	General purpose I/O
VDD	A22	Power	Power supply
XC2	A23	Analog input	Connection for 32 MHz crystal
VDD	B1	Power	Power supply
DCC	B3	Power	DC/DC converter output
Dec4	B5	Power	1.3 V regulator supply decoupling
VSS	B7	Power	Ground
P0.30 AIN6	B9	Digital I/O Analog input	General purpose I/O Analog input
P0.28 AIN4	B11	Digital I/O Analog input	General purpose I/O Analog input
P0.03 AIN1	B13	Digital I/O Analog input	General purpose I/O Analog input
P1.03	B15	Digital I/O	General purpose I/O
P0.23	B17	Digital I/O	General purpose I/O
N.C.	B19		
XC1	B24	Analog input	Connection for 32 MHz crystal
Dec1	C1	Power	1.1 V regulator supply decoupling
P0.00 XL1	D2	Digital I/O Analog input	General purpose I/O Connection for 32.768 kHz crystal
Dec3	D23	Power	Power supply, decoupling
Dec6	E24	Power	1.3 V regulator supply decoupling
P0.01 XL2	F2	Digital I/O Analog input	General purpose I/O Connection for 32.768 kHz crystal

VSS_PA	F23	Power	Ground (radio supply)
P0.26	G1	Digital I/O	General purpose I/O
P0.27	H2	Digital I/O	General purpose I/O
ANT	H23	RF	Single-ended radio antenna connection
P0.04 AIN2	J1	Digital I/O Analog input	General purpose I/O Analog input
P0.10 NFC2	J24	Digital I/O NFC input	General purpose I/O NFC antenna connection
P0.05 AIN3	K2	Digital I/O Analog input	General purpose I/O Analog input
P0.06	L1	Digital I/O	General purpose I/O
P0.09 NFC1	L24	Digital I/O NFC input	General purpose I/O NFC antenna connection
P0.07 TRACECLK	M2	Digital I/O Trace clock	General purpose I/O Trace buffer clock
P0.08	N1	Digital I/O	General purpose I/O
DEC5 Not connected	N24	Power	1.3 V regulator supply decoupling for build codes Axx and earlier. Not connected for build codes Bxx and later.
P1.08	P2	Digital I/O	General purpose I/O
P1.07	P23	Digital I/O	General purpose I/O
P1.09 TRACEDATA3	R1	Digital I/O Trace data	General purpose I/O Trace buffer TRACEDATA[3]
P1.06	R24	Digital I/O	General purpose I/O
P0.11 TRACEDATA2	T2	Digital I/O Trace data	General purpose I/O Trace buffer TRACEDATA[2]
N.C.	T23		
P0.12 TRACEDATA1	U1	Digital I/O Trace data	General purpose I/O Trace buffer TRACEDATA[1]
P1.04	U24	Digital I/O	General purpose I/O
N.C.	V23		
VDD	W1	Power	Power supply
P1.02	W24	Digital I/O	General purpose I/O
VDDH	Y2	Power	High voltage power supply

P1.01	Y23	Digital I/O	General purpose I/O
SWDCLK	AA24	Debug	Serial wire debug clock input for debug and programming
N.C.	AB2		
DECUSB	AC5	Power	USB 3.3 V regulator supply decoupling
P0.14	AC9	Digital I/O	General purpose I/O
P0.16	AC11	Digital I/O	General purpose I/O
P0.18 nRESET	AC13	Digital I/O	General purpose I/O Configurable as pin RESET
N.C.	AC15		
P0.21	AC17	Digital I/O	General purpose I/O
N.C.	AC19		
N.C.	AC21		
SWDIO	AC24	Debug	Serial wire debug I/O for debug and programming
VBUS	AD2	Power	5 V input for USB 3.3 V regulator
D-	AD4	USB	USB D-
D+	AD6	USB	USB D+
P0.13	AD8	Digital I/O	General purpose I/O
P0.15	AD10	Digital I/O	General purpose I/O
P0.17	AD12	Digital I/O	General purpose I/O
VDD	AD14	Power	Power supply
P0.20	AD16	Digital I/O	General purpose I/O
P0.22	AD18	Digital I/O	General purpose I/O
P0.24	AD20	Digital I/O	General purpose I/O
P1.00 TRACEDATA0	AD22	Digital I/O Trace data	General purpose I/O Trace buffer TRACEDATA[0] Serial wire output (SWO)
VDD	AD23	Power	Power supply
VSS	Die pad	Power	Ground pad

3.Module Diagram

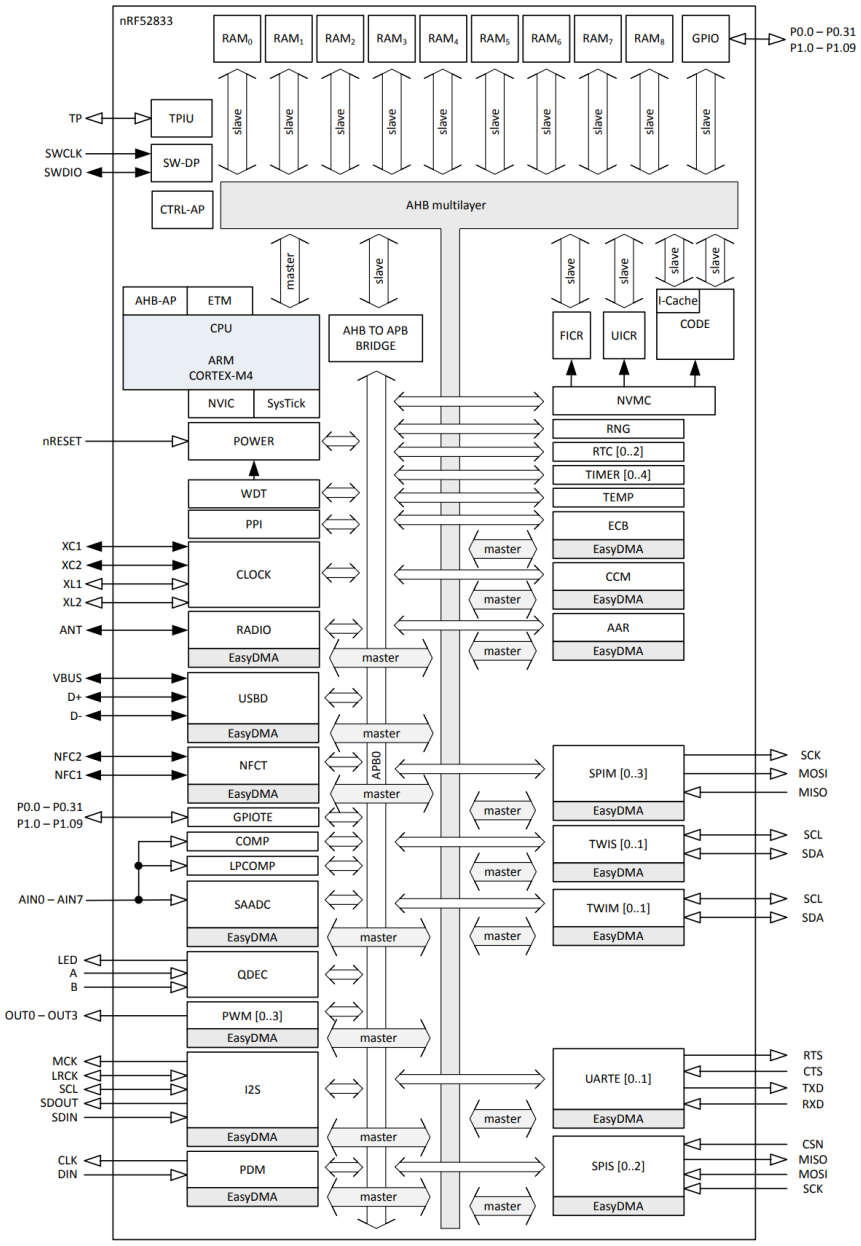

Fig 3.1 NRF52833 SoC Diagram

4.Main Chip Solution

RF IC	Crystal Frequency
Nordic nRF52833	32 MHz

32MHz Crystal is part of the RKNBT001 BLE Module

5.Antenna Specifications

5.1.PCB Trace Antenna Dimensional Drawing

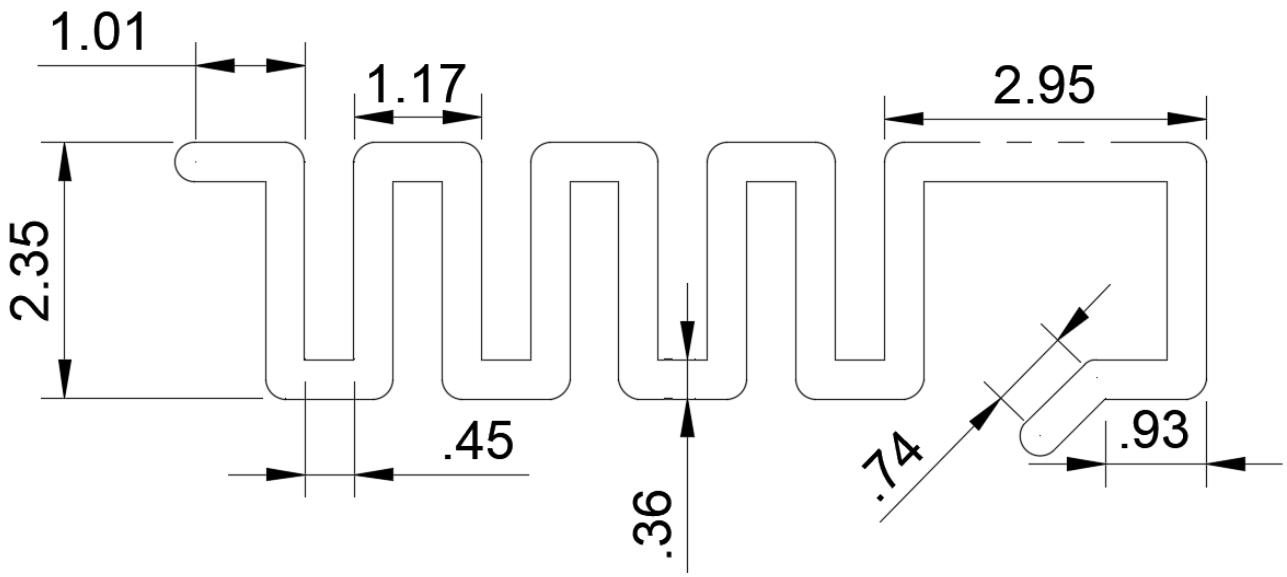

Fig 5.1.1 PCB trace Antenna dimensions

Fig 5.1.2 PCB Trace Antenna Top View

Frequency (MHz)	2400	2410	2420	2430	2440	2450	2460	2470	2480	2490	2500
Gain (dBi)	-3.68	-2.91	-2.34	-1.98	-1.66	-1.60	-1.77	-2.09	-2.60	-3.35	-4.10
Peak EIRP (dBm	-3.68	-2.91	-2.34	-1.98	-1.66	-1.60	-1.77	-2.09	-2.60	-3.35	-4.10
Directivity (dBi)	4.98	5.11	5.12	5.02	4.93	4.76	4.58	4.38	4.11	3.77	3.42

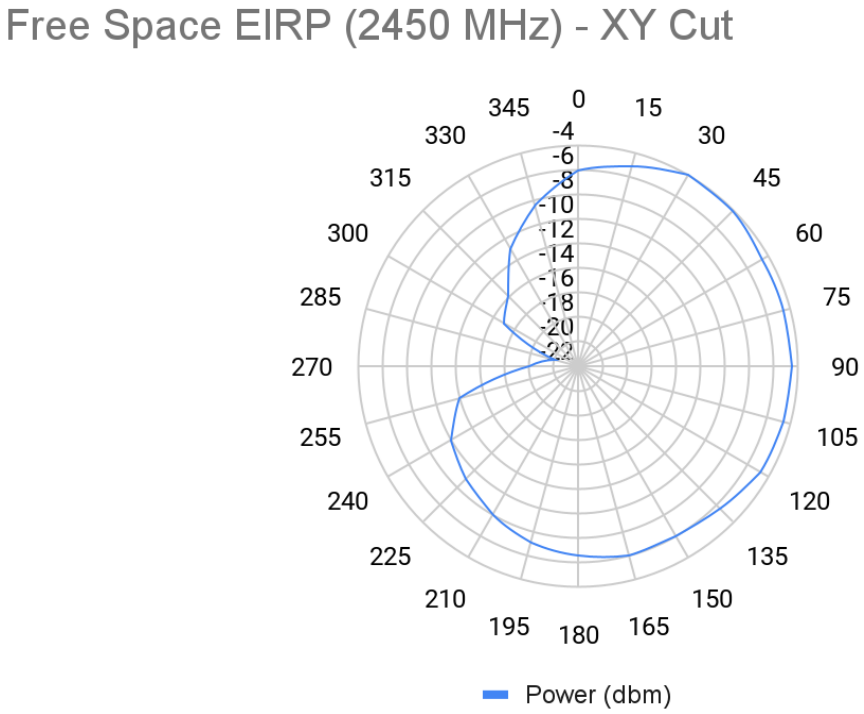

Fig 5.1.3 Free Space EIRP (2450 MHz) - XY Cut

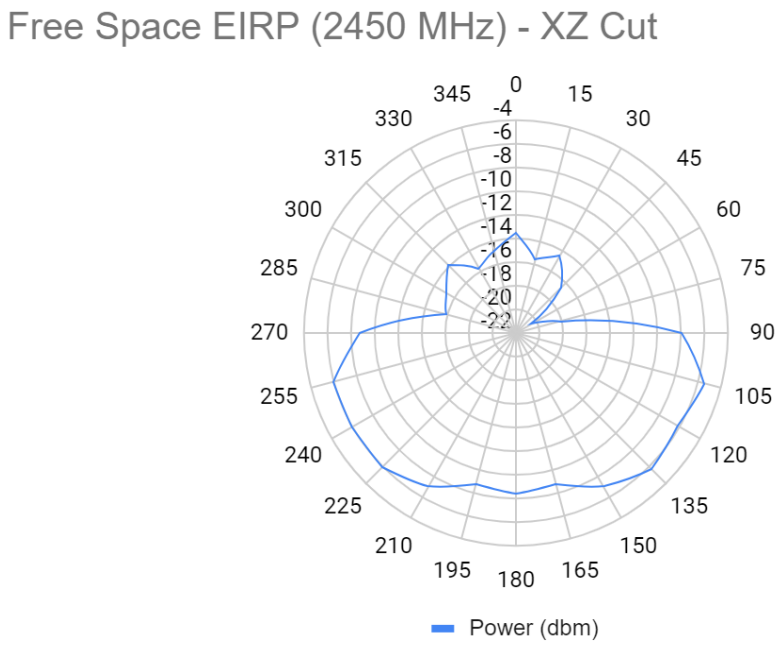

Fig 5.1.4 Free Space EIRP (2450 MHz) - XZ Cut

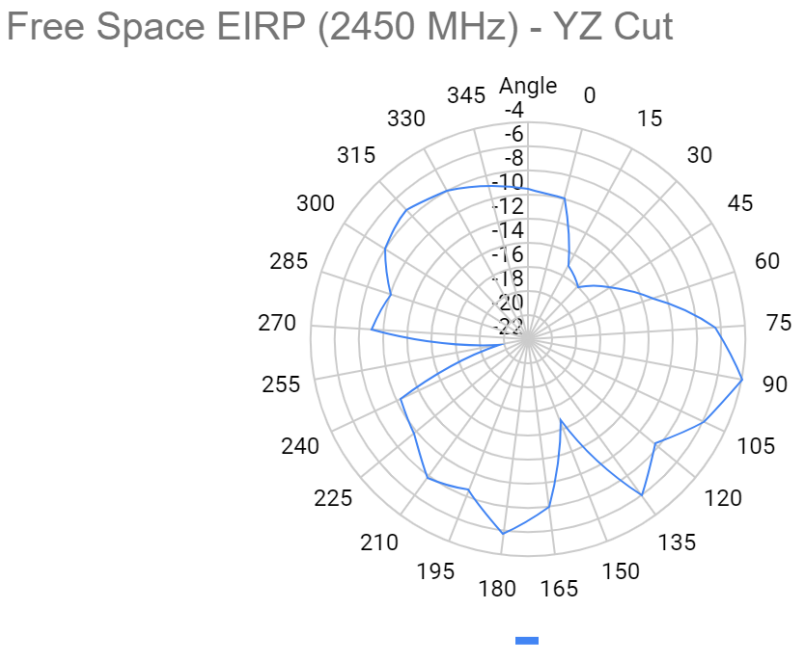

Fig 5.1.5 Free Space EIRP (2450 MHz) - YZ Cut

6.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.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: 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 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.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. The device has been evaluated to meet general RF exposure requirement. The device can be used with minimum distance 0mm between the radiator and your body.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

List of applicable FCC rules
CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter

Specific operational use conditions
This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

Limited module procedures

Not applicable

Trace antenna designs
Not applicable

RF exposure considerations
The device has been evaluated to meet general RF exposure requirement. The device can be used installed and operated with minimum distance 0mm between the radiator and your body.

Antennas
This radio transmitter (FCC ID:2BBSG-RKNBT001) has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Model	Type	Connector	Peak Gain(dBi)
2402-2480MHz BT	PCB	NA	-1.60

Label and compliance information
The final end product must be labeled in a visible area with the following "Contains FCC ID: 2BBSG-RKNBT001 ".

Information on test modes and additional testing requirements
Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

Additional testing, Part 15 Subpart B disclaimer
Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

7.ISED Canada Statement

This radio transmitter has been approved by ISED Canada. This Class B digital apparatus complies with Canadian standard ICES-003. This device complies with ISED Canada licence-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.

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment. The device has been evaluated to meet general RF exposure requirement. The device can be used with minimum distance 0mm between the radiator and your body.

Le présent appareil est conforme aux CNR d'ISDE Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

L'appareil a été évalué pour répondre aux exigences générales d'exposition aux RF.Cet équipement doit être installé et utilisé avec une distance minimale de 0 mm entre le radiateur et votre corps.

This radio transmitter (ISED certification number: 30816-RKNBT001) has been approved by ISED Canada to operate with the antenna types listed with the maximum permissible gain 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 présent émetteur radio (ISED certification number: 30816-RKNBT001) a été approuvé par ISED Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Model	Type	Connector	Peak Gain(dBi)
2402-2480MHz BT	PCB	NA	-1.60

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

1. The transmitter module may not be co-located with any other transmitter or antenna.

As long as the condition above is 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:

1. Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 1 condition 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 cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the ISED cannot 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' ISED 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
The final end product must be labeled in a visible area with the following: Contains IC: 30816-RKNBT001.

Plaque signalétique du produit final
Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: Contient des IC: 30816-RKNBT001.

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.