USER MANUAL FOR TEKLINK TL200 BLE RADIO MODULE

MODEL: TL200 (L-5668 subassembly)

FCC ID: 2AKC7-TL200A

VERSION 1.1

DATE: 13 April 2023

KENALL MANUFACTURING, INC
(a brand of legrand NA)
10200 55th Street
Kenosha, WI 53144 USA
(262) 891-9700
(800)-4-KENALL (53-6255)
https://www.kenall.com

Summary:

This document covers the usage and operation of the Kenall TL200 BLE (Bluetooth Low Energy) radio module for use in a TekLink wireless lighting control system.

The TL200 will only be used in Kenall lighting products that offer TekLink wireless controls as an option. The module is not intended for general sale.

Contents

1. OVERVIEW:

The Kenall TL200 radio module will be factory installed as the TekLink control module for use in a wireless mesh lighting control system. The TL200 radio module will be installed in each LED luminaire. The TL200 can be used in indoor and outdoor lighting applications. Optionally a TL200 radio module can be added as a primary site controller that can interconnect to other Kenall TekLink family lighting products (e.g., Kenall TekLink TL1000, TL2000 systems).

The Kenall TL200 Bluetooth Low Energy (BLE) radio transceiver module supports the Bluetooth Low Energy radio data protocol in the 2402-2480 MHz ISM radio band. The module will operate on the 40 channels allocated in this ISM band. The TL200 is comprised of a printed circuit assembly and connected antenna. The module is intended to be used in the USA. There are no other supported or non-supported capabilities for any other country.

The module will not be for sale to the public or be made accessible by users of Kenall products. The module does not directly support software debug or messages that could allow unauthorized users to modify software or adjust radio settings that could affect compliance. The host devices that interface with this radio module are proprietary to Kenall.

Only proprietary software written and distributed by Kenall can be installed on the TL200. Source code (both firmware and/or software) is solely controlled by Kenall and not distributed to end users.

For safety, power off TekLink luminaires with TL200 radio modules prior to disassembly and servicing.

2. SPECIFICATIONS AND FEATURES

Part Number: TL200 (L-5668 module subassembly)

Performance:

Transceiver Chipset	ST Micro BLUENRG-232 2.4 GHz Bluetooth Low Energy
Packet Data Rate	1 Mbps (GFSK, simplex, bidirectional)
Indoor/Urban Range	25 meters
Outdoor Range	100 meters (estimated, line of sight)
Typical Transmit Power	6mW (+8dBm) maximum, adjustable
Receiver Sensitivity	-88 dBm, 0.1% BER
Regulatory Approvals	**FCC ID: 2AKC7-TL200A** (US only)

Features:

Host Serial Data Interface	UART 115.2 kbps, 8N1 (8 data, no parity, 1 stop bit) –factory only
Configuration method	Commands via BLE radio, parameters retained in Flash
Frequency Band	ISM 2.4 GHz, 40 RF channels
Form Factor	Module on printed circuit board
Controller	ST Micro BLUENRG-232 (16 MHz core clock), 512kB Flash ROM
Antenna Options	u.FL connector cabled to external or PCB flex antenna Refer to **APPENDIX A** for antenna specifications

Networking/Security:

Protocol/network	Bluetooth Low Energy, Mesh network with repeaters
Interference Immunity	Adaptive frequency hopping
Encryption	128-bit AES
IDs	MACID, UUID, short address

Power:

Supply Voltage	11 (min) to 13 (max) VDC (from LED driver powered by AC mains)
Processor Voltage	3.3 VDC (regulated)
Transmit Current	35 mA, +25°C, +8 dBm, typical
Receive/Standby Current	20 mA , +25 °C, typical
Maximum Current	80 mA @ 12V when installed in luminaire with occupancy sensor
Power Down/Sleep Mode	Not supported, operated with receive/standby only.
Brown-Out Detection:	Processor will reset and disable Tx when voltage is < 1.7 VDC

Physical:

Operating Temperature range	-30 to 40 °C
Dimensions	1.2 (30) x 2.5 (63) x 0.4 (10) WxLxH inches (mm)
Weight	0.5 ounce (14 grams) module only, without external antenna

ANTENNAS:

The TL200 supports two antennas – full specifications are found in **Appendix A.** The antenna coaxial cable will terminate into a u.FL connected to the TL200 module.

External stub antenna, World Products model WPANT30269-S8A. Includes a 600mm (24 inch) coaxial cable terminated in a u.FL connector. The antenna will be mounted vertically for optimal coverage – either from top or bottom of luminaire. Peak gain is 1.5 dBi which includes the coaxial cable loss.

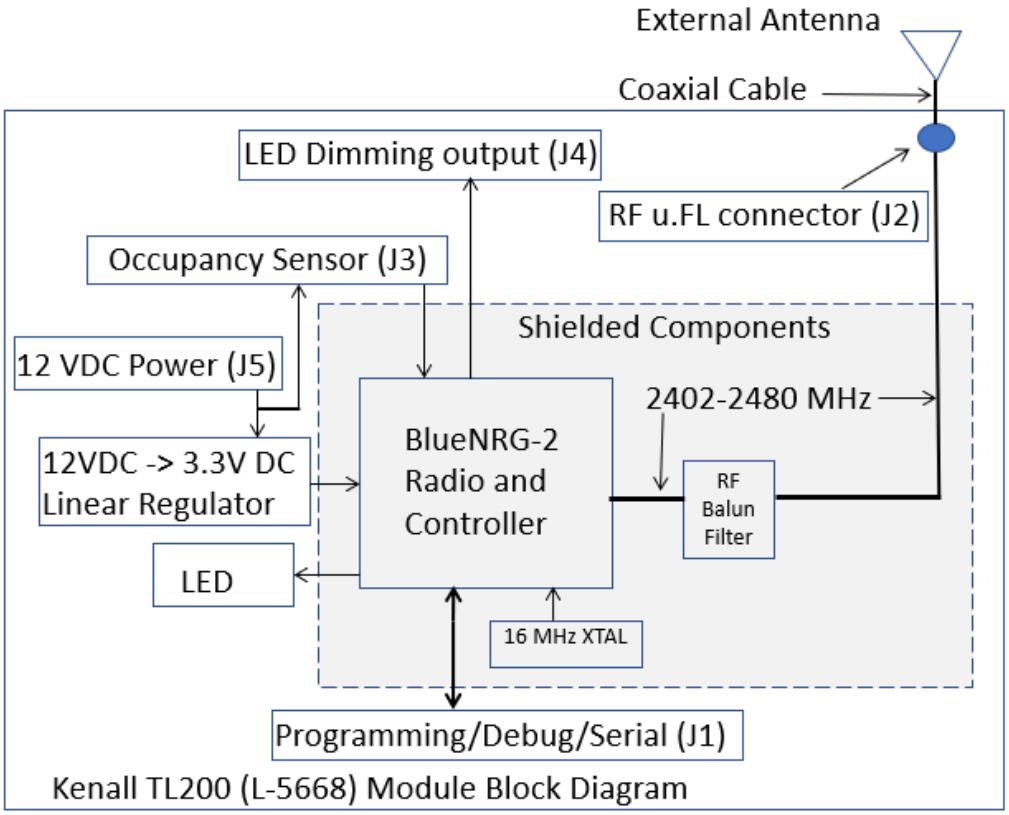
Internal antenna Molex model 1461530200 flex PCB quarter-wave antenna with included 200 mm (8 inch) coaxial cable terminated in a u.FL connector. Peak gain is 2.3 dBi which includes the coaxial cable loss. For optimal coverage, the antenna will be mounted vertically (length wise) inside the luminaire in a location with minimal metallic obstructions.

3. APPLICATIONS

The initial application for the radio module is for Kenall TekLink 200 series LED lighting products. When commissioned and placed into service, the TL200 radio modules will communicate with data packets in a BLE mesh network configuration. The TekLink lighting system will detect occupancy via a sensor and adjust lighting levels per configuration settings.

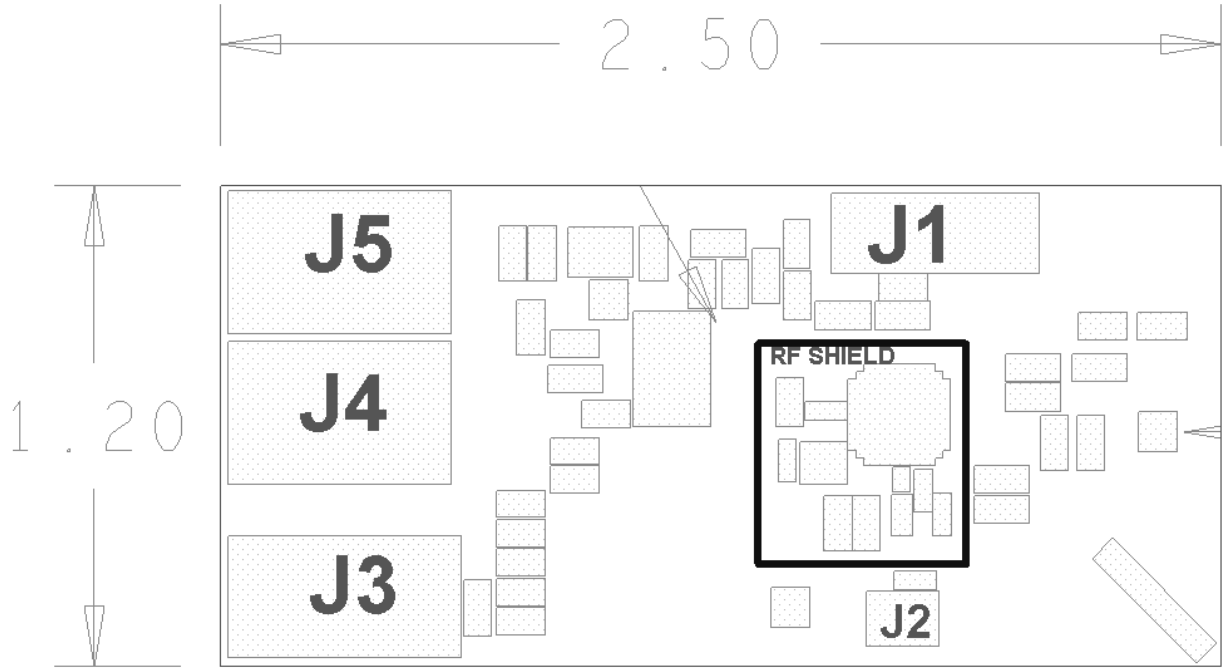
After luminaire installation, a Kenall tablet app (Android or IOS) will allow the end user to modify the factory default lighting modes of the luminaires (e.g., occupancy timeouts and zones, dim levels, repeater mode, etc.). The end user can also lower the transmitter power level to reduce interference, but no other changes to the BLE radio operation are permitted.

4. BLOCK DIAGRAM



5. MECHANICAL DIMENSIONS AND CONNECTORS

The TL200 module will be embedded in Kenall lighting products that offer TekLink wireless controls as an option. No connectors will be accessible by the end customer. Please contact Kenall to request pin-out information – requires NDA. Dimensions are in inches.



6 PROGRAMMING

FACTORY PROGRAMMING AND COMMISSIONING

The TL200 is programmed and commissioned in the Kenall factory on a per order basis. Proprietary application software is programmed into the flash memory of the TL200 processor using a programming pod connected with adapter to J1 on the TL200.

For a given customer purchase order, custom radio module settings and security keys are commissioned (over BLE) by Kenall factory production prior to shipment. Default lighting parameters (occupancy zones and timeouts, dim level, repeaters, etc.) are also set by the factory.

There is no host bootloader or JTAG interface accessible for uploading new software to the TL200 by a customer. After factory programming, a security bit is set to prevent readout or modification of the code from the debug port.

CUSTOMER SETTINGS

The end user of the Kenall luminaire with the TL200 controller will have the option to adjust lighting modes: e.g., occupancy zones and timeouts, dim levels, repeaters and related settings after installation, they will not be able to directly modify the radio operation.

FIELD UPGRADE

The TL200 will support OTA (wireless over-the-air) code updates from a BLE capable tablet or mobile phone running a proprietary Kenall software app. The TL200 code image will be sent from a tablet via BLE to the TL200 module. This will typically be done by Kenall service technicians. TL200 code cannot be read out using OTA update.

7. REGULATORY TESTING AND CONFIGURATION

The TL200 can be loaded with test code to put the radio into different constant transmission or reception states to verify the end device does not emit spurious emissions. The TL200 module can be placed into various test modes using CLI commands issued from the serial port (J1). The test code and CLI commands are proprietary to Kenall, please contact Kenall Manufacturing for further info.

8. REGULATORY STATEMENTS

FCC NOTICE: 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.

Note: This product 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 product 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 product 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.
Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance.

FCC Modular Usage Statement
Note 1: This module certified complies with RF exposure requirements under fixed condition; this module will only be installed in fixed applications.

To comply with FCC RF Exposure requirements, this device must be installed such that a minimum separation distance of 20cm is maintained between its antenna and all persons during normal operation. Luminaires are typically mounted overhead and away from nearby people. This should limit their exposure to the RF signals transmitted by the radio module.

A fixed device is defined as a device that is physically secured at one location and is not able to be easily moved to another location.

Note 2: Host product manufacturers must provide in their user manual the required RF exposure information for mobile & fixed usage of this module. Host product manufacturers must use the following RF exposure statement in their user manual “This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and all persons. This transmitter must not be co-location or operating in conjunction with any other antenna or transmitter.”

Note 3: Any modifications made to the module will void the Grant of Certification, this module is limited to OEM installation only and must not be sold to end-users, end-user shall have no manual instructions to remove or install the device, only software or operating procedure shall be placed in the end-user operating manual of final products. Changes or modifications not expressly approved by Kenall will void the user's authority to operate the TekLink luminaire that incorporates this TL200 radio module.

Note 4: Additional testing and certification may be necessary when multiple modules are used.

Note 5: The module may be operated only with the two external antennas with which it is authorized. Refer to **Appendix A.**

Note 6: To ensure compliance with all non-transmitter functions Kenall is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Supplier's Declaration of Conformity procedure without a transmitter certified module and a module is added, Kenall is responsible for ensuring that the after the module is installed and operational the host continues to be compliant with the part 15B unintentional radiator requirements. Since this may depend on the details of how the module is integrated with the host, Kenall shall confirm compliance with the part 15B requirements.

Note 7: The FCC ID label on the final system must be labeled with "Contains FCC ID: 2AKA7-TL200A" or "Contains transmitter module FCC ID: 2AK7A-TL200A".

Note 8: The FCC rule/s for this module are CFR 47 Part 15 Subpart C.

Note 9: This modular transmitter is only FCC authorized for the specific rule parts listed on its grant. Kenall is responsible for any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product will require Part 15 Subpart B compliance when the modular transmitter is installed.

9 REVISION HISTORY

Revision	Date	Description
1.0	17 Mar 2023	Initial Release
1.1	13 Apr 2023	Updates with Regulatory Info, Antennas, Operation

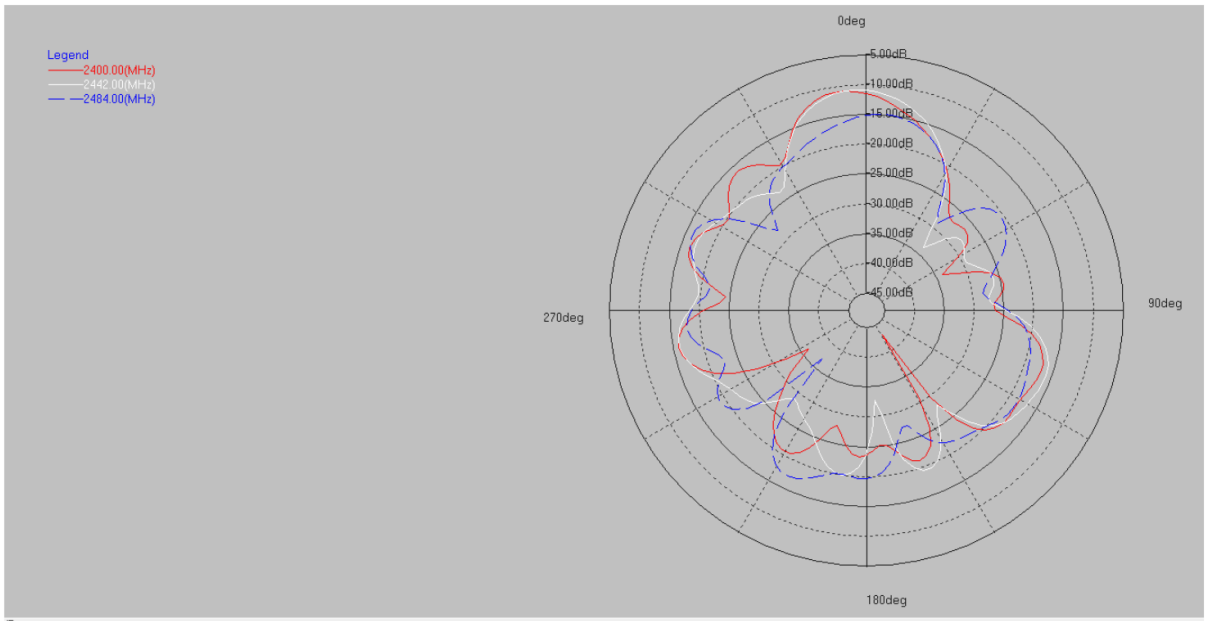
APPENDIX A: ANTENNA SPECIFICATIONS

WORLD PRODUCTS – EXTERNAL STUB ANTENNA

World Products, Inc.
WPANT-30269-S8A Antenna
Regulatory Data

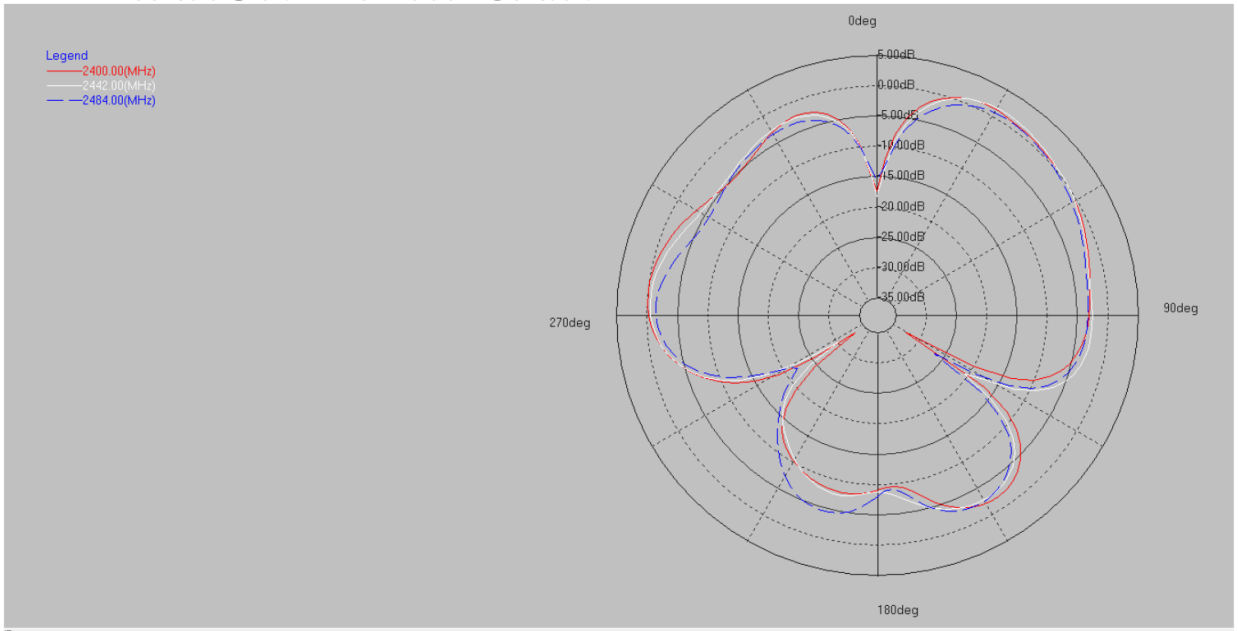
03-16-2023

ELEVATION 1 HORIZ GAIN



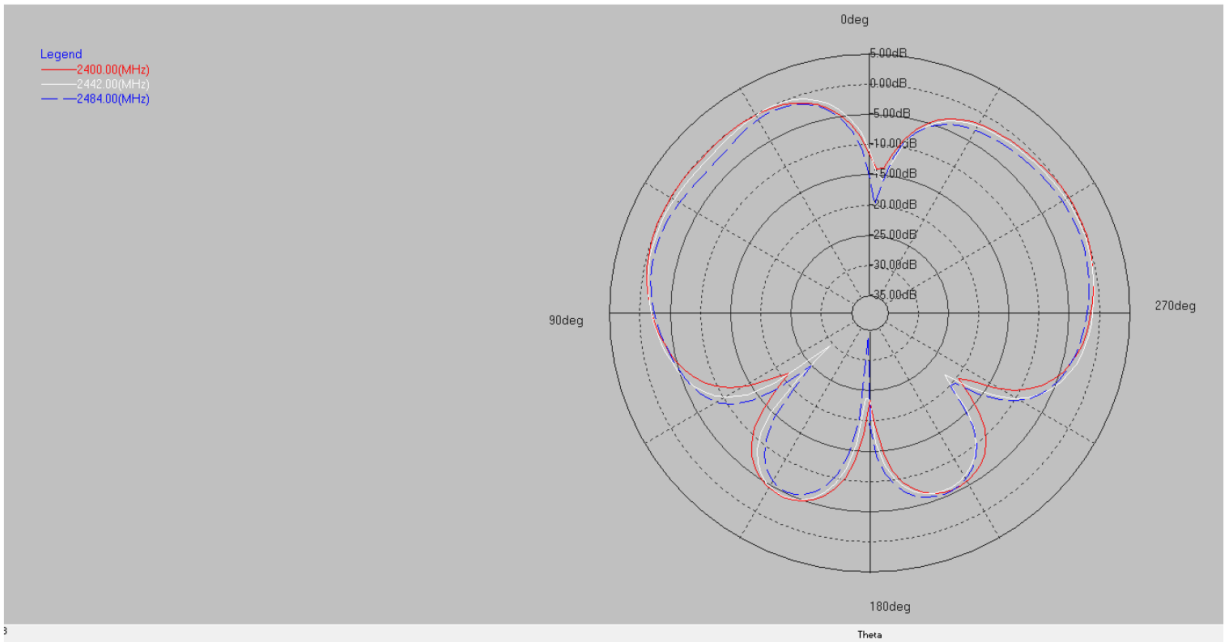
Layer	Max value	Position	Min value	Position	Beam/Wi...	Max/Min	Average	Standar...	Marker 1 pos	Marker 1 value	Marker 2 pos	Marker 2 value
2400(MHz)	-11.07 dB	-5.63 deg	-43.14 dB	146.25 d...	30.40 deg	32.08 dB	-18.56 dB	5.72	----	----	----	----
2442(MHz)	-11.00 dB	-2.81 deg	-33.69 dB	42.19 deg	33.76 deg	22.69 dB	-18.32 dB	5.30	----	----	----	----
2484(MHz)	-15.01 dB	5.63 deg	-36.93 dB	-137.81...	40.20 deg	21.92 dB	-19.74 dB	3.78	----	----	----	----

ELEVATION 1 VERT GAIN



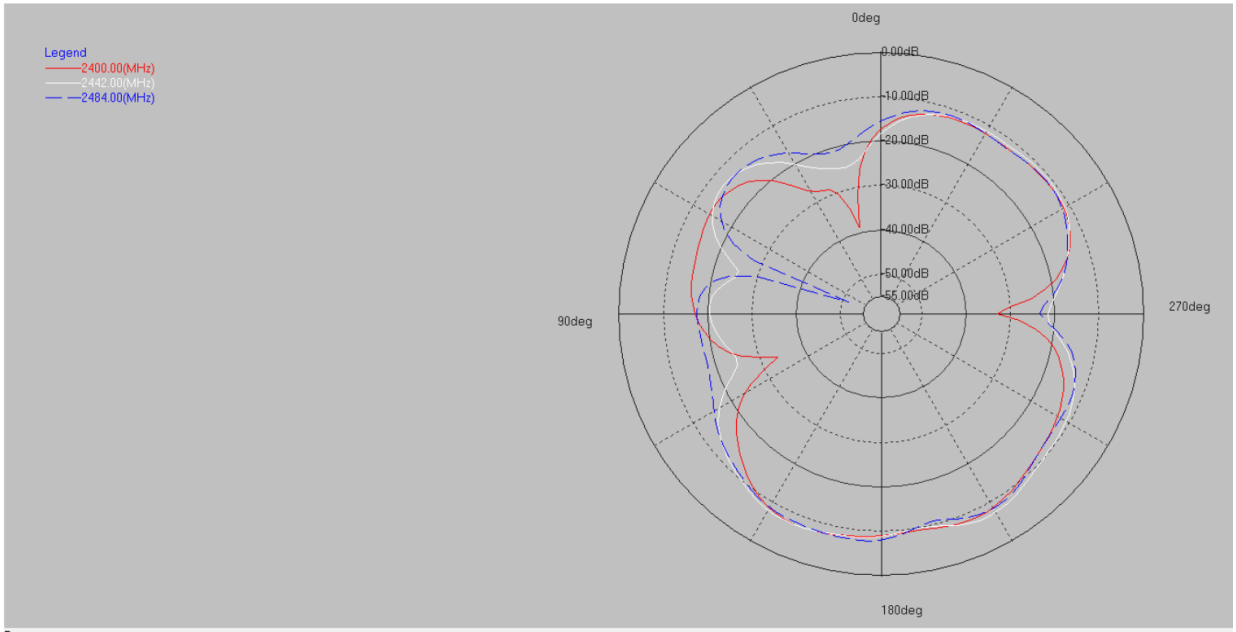
Layer	Max value	Position	Min value	Position	Beamwi...	Max/Min	Average	Standar...	Marker 1 pos	Marker 1 value	Marker 2 pos	Marker 2 value
2400(MHz)	1.12 dB	30.94 deg	-33.33 dB	-126.56 ...	60.78 deg	34.44 dB	-3.45 dB	6.40	----	----	----	----
2442(MHz)	1.51 dB	33.75 deg	-30.23 dB	-123.75 ...	54.16 deg	31.74 dB	-3.46 dB	5.84	----	----	----	----
2484(MHz)	0.75 dB	33.75 deg	-26.70 dB	123.75 d...	55.67 deg	27.45 dB	-4.04 dB	5.25	----	----	----	----

ELEVATION 2 VERT GAIN



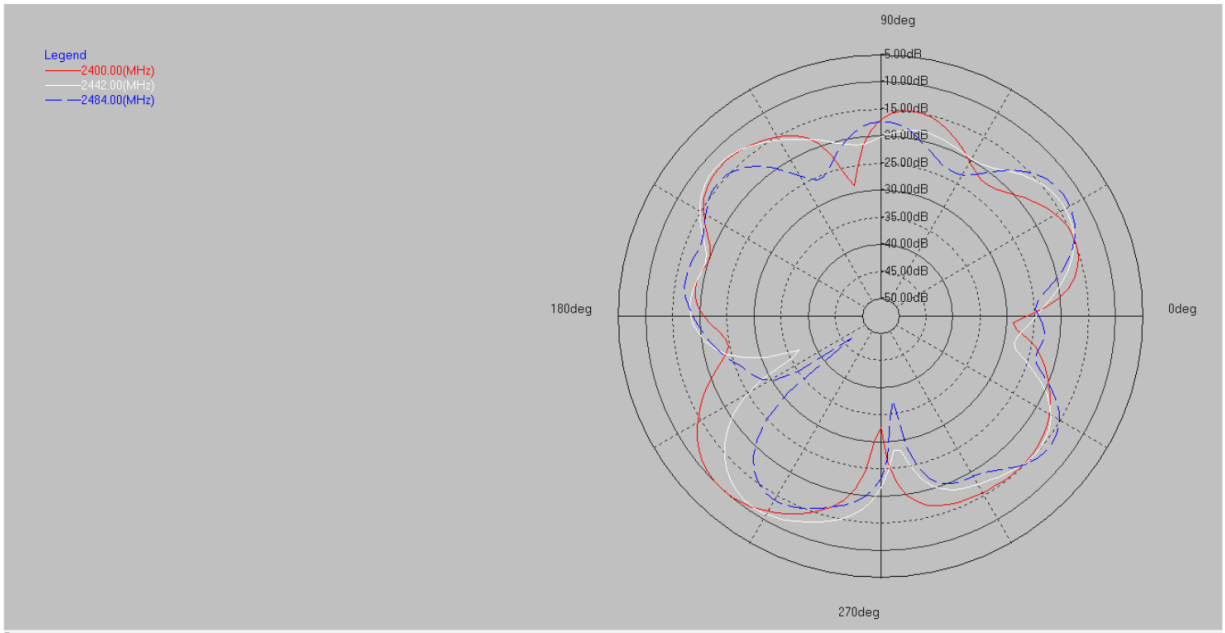
Layer	Max value	Position	Min value	Position	Beamwi...	Max/Min	Average	Standar...	Marker 1 pos	Marker 1 value	Marker 2 pos	Marker 2 value
2400(MHz)	0.19 dB	-64.69 deg	-23.71 dB	-180.00 ...	75.86 deg	23.90 dB	-3.19 dB	5.85	----	----	----	----
2442(MHz)	-0.18 dB	25.31 deg	-29.49 dB	129.38 d...	88.14 deg	29.31 dB	-3.35 dB	6.28	----	----	----	----
2484(MHz)	-0.91 dB	25.31 deg	-34.29 dB	177.19 deg	88.22 deg	33.38 dB	-4.07 dB	6.04	----	----	----	----

ELEVATION 2 HORIZ GAIN



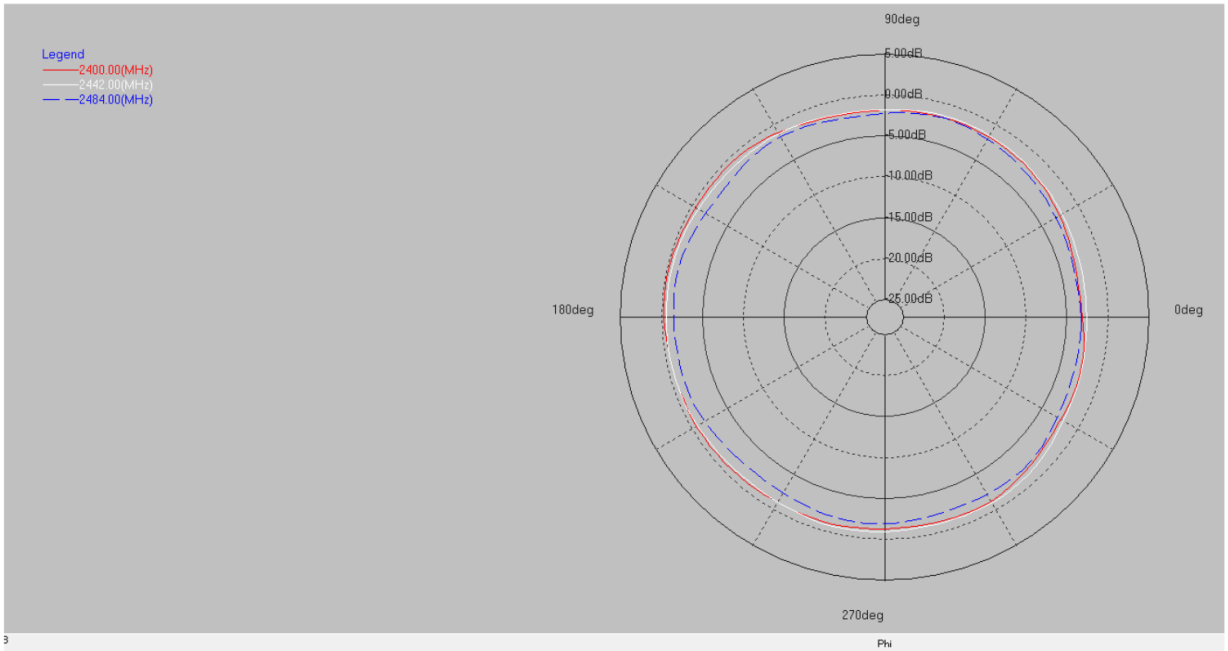
Layer	Max value	Position	Min value	Position	Beam/Wi...	Max/Min	Average	Standar...	Marker 1 pos	Marker 1 value	Marker 2 pos	Marker 2 value
2400(MHz)	-7.82 dB	157.50 deg	-39.14 dB	14.06 deg	----	31.32 dB	-12.78 dB	6.93	----	----	----	----
2442(MHz)	-7.48 dB	-151.88 deg	-25.49 dB	73.13 deg	----	18.00 dB	-12.11 dB	5.44	----	----	----	----
2484(MHz)	-7.84 dB	174.38 deg	-51.42 dB	70.31 deg	----	43.57 dB	-12.40 dB	5.48	----	----	----	----

AZIMUTH HORIZ GAIN



Layer	Max value	Position	Min value	Position	Beam/Wi...	Max/Min	Average	Standar...	Marker 1 pos	Marker 1 value	Marker 2 pos	Marker 2 value
2400(MHz)	-10.02 dB	227.81 deg	-32.85 dB	270.00 d...	31.34 deg	22.82 dB	-16.20 dB	4.48	----	----	----	----
2442(MHz)	-11.03 dB	236.25 deg	-37.20 dB	202.50 d...	31.57 deg	26.17 dB	-16.64 dB	4.84	----	----	----	----
2484(MHz)	-12.86 dB	33.75 deg	-46.67 dB	216.56 d...	26.05 deg	33.82 dB	-17.97 dB	5.31	----	----	----	----

AZIMUTH VERT GAIN



Layer	Max value	Position	Min value	Position	Beamwi...	Max/Min	Average	Standar...	Marker 1 pos	Marker 1 value	Marker 2 pos	Marker 2 value
2400(MHz)	-0.20 dB	171.56 deg	-3.26 dB	8.44 deg	----	3.05 dB	-1.45 dB	0.81	----	----	----	----
2442(MHz)	-0.55 dB	171.56 deg	-2.58 dB	5.63 deg	----	2.03 dB	-1.39 dB	0.58	----	----	----	----
2484(MHz)	-1.40 dB	168.75 deg	-3.40 dB	11.25 deg	----	2.01 dB	-2.26 dB	0.53	----	----	----	----

PEAK GAIN SUMMARY

	GAIN dBi		
	2400 MHz	2442 MHz	2484 MHz
EL1 HORIZ PEAK GAIN	-11	-11.1	-15
EL1 VERT PEAK GAIN	1.1	1.5	0.8
EL2 HORIZ PEAK GAIN	-7.8	-7.5	-7.8
EL2 VERT PEAK GAIN	0.2	-0.2	-0.9
AZ HORIZ PEAK GAIN	-10	-11	-12.9
AZ VERT PEAK GAIN	-0.2	-0.6	-1.4
MAX HORIZ PEAK GAIN		-7.5	
MAX VERT PEAK GAIN		1.5	

PEAK GAIN 1.5 dBi (includes 600mm cable loss ~ 1.6 dB).

MOLEX INTERNAL FLEX PCB ANTENNA – PART 1461530200

The internal flex PCB antenna for BLE is made by Molex. Peak gain: 3.0 dBi minus cable 0.7dB loss (200 mm cable) results in effective 2.3 dBi gain.

Full specifications are available from datasheet on Molex website:

https://www.molex.com/pdm_docs/as/AS-146153-100-001.pdf

PDF document of datasheet on next page (PDF only viewable in MS Word document)

APPLICATION SPECIFICATION

TITLE

WIFI 6E FLEX CABLE BALANCE ANTENNA

TABLE OF CONTENTS