



# IoT Radio Board User Guide

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## Introduction

Rigado's IoT Radio Board is a modular design containing two wireless SoCs operating in the 2.4GHz ISM band, sharing a single co-radiating antenna structure on a single 2-layer PCB design. Both included radio SoCs offer multi-protocol features to support products in retail infrastructure.

This document provides product details including specifications, operating characteristics, and usage guidelines.

### Covered Models

Model	Name	Description
R-21-0	IoT Radio Board	Two 2.4 GHz IoT radios with co-radiating microstrip patch antenna

### Revision History

Version	Description	By	Date
V0.1	Initial draft	P. Briskey	2025-06-18
V0.2	Add FCC and ISED IDs	P. Briskey	2025-06-19
V0.2	Update product name and include model number	P. Briskey	2025-06-20

# 1 Architecture

The following block diagram illustrates the design architecture.

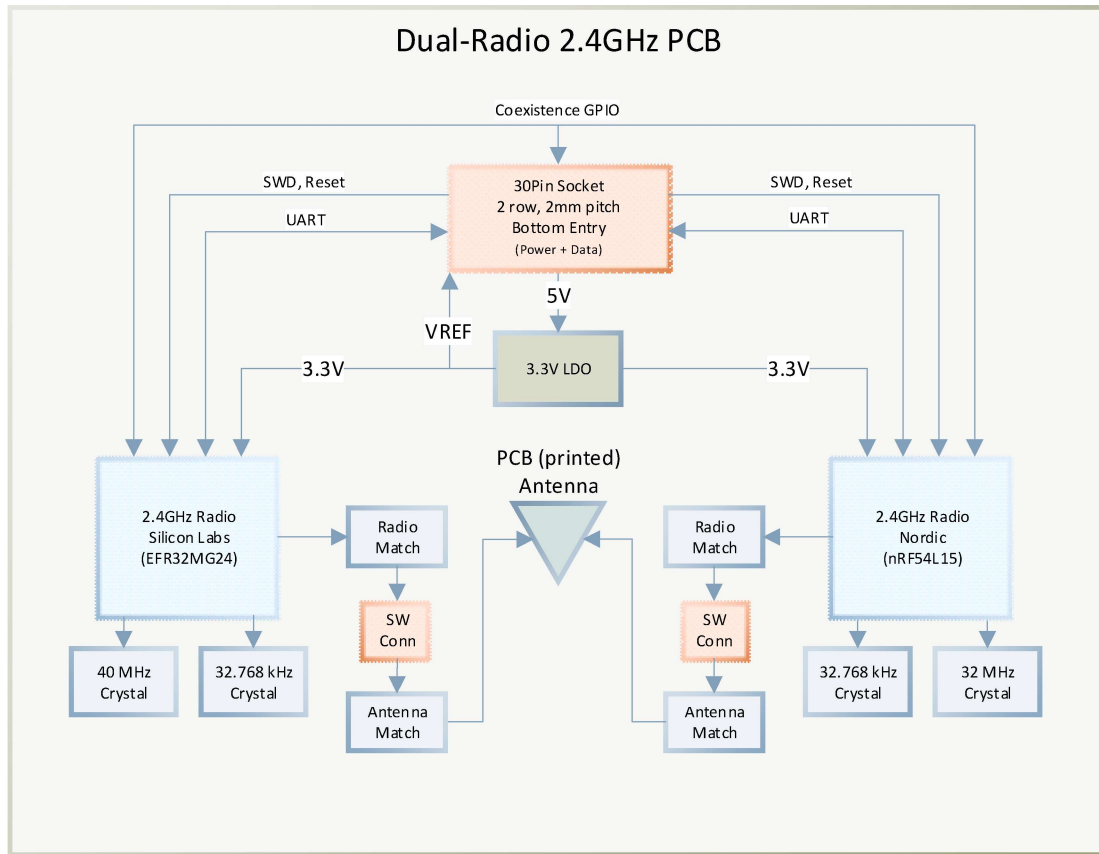


Figure 1 – IoT Radio Board Block Diagram

## 1.1 Power

Power is supplied through the 30pin connector, where pins are designated for 5V in and an IO voltage reference output. An LDO on the radio board reduces the 5V input to 3.3V used as both the IO reference voltage and to supply the radio SoCs. The following diagram shows the power architecture of the design.

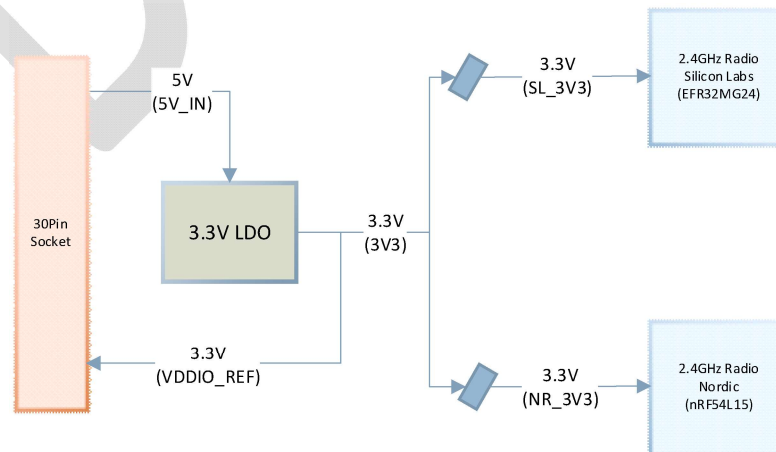


Figure 2 Power Architecture

## 2 Specifications

### 2.1 Radio 1

Silicon Labs	
SoC	EFR32MG24B020F1536IM48
CPU	78 MHz, 32bit ARM® Cortex™-M33
Memory	256 kB RAM
Storage	1536 kB Flash
Bluetooth® Version	5.4 (Bluetooth® Low Energy)
Frequency	2.402 to 2.480 GHz
Modulations	GFSK at 125 kbps, 500 kbps, 1 Mbps, and 2 Mbps data rates
Transmit Power	19.5 dBm
Receiver Sensitivity	-105.4 dBm to -94.8 dBm, depending on modulation
Interfaces	UART w/ HWFC, SWD, GPIO

### 2.2 Radio 2

Nordic Semiconductor	
SoC	nRF54L15-QFAA
CPU	128 MHz, 32bit ARM® Cortex™-M33
Memory	256 kB RAM
Storage	1524 kB RRAM
Bluetooth® Version	5.4 (Bluetooth® Low Energy)
Frequency	2.402 to 2.480 GHz
Modulations	GFSK at 125 kbps, 500 kbps, 1 Mbps, and 2 Mbps data rates
Transmit Power	8 dBm
Receiver Sensitivity	-104 to -96dBm, depending on modulation
Interfaces	UART w/ HWFC, SWD, GPIO

## 2.3 Electrical Specifications

### 2.3.1 Power Supply

Symbol	Parameter	Min.	Typ.	Max.	Unit
V <sub>IN</sub>	Operating supply voltage at J1	3.38V	5	5.5	V

### 2.3.2 Power Consumption

Symbol	Parameter	Min.	Typ.	Max.	Unit
P <sub>2RX</sub>	Dual-Radio receive		TBD		W
P <sub>TXRX</sub>	High-power radio transmit, low-power radio receive		TBD		W
P <sub>2TX</sub>	Dual-Radio transmit		TBD		W

### 2.3.3 I/O Specification

Symbol	Parameter	Min.	Typ.	Max.	Unit
V <sub>IL</sub>	Input high voltage (all I/O, except reset)	0	--	0.3 x VDDIO_REF	V
V <sub>IH</sub>	Input high voltage (all I/O, except reset)	0.7 x VDDIO_REF	--	VDDIO_REF	V

### 2.3.4 Reset Timing

Symbol	Parameter	Min.	Typ.	Max.	Unit
T <sub>N_RESET</sub>	Low time for pin "NR_RST_N" to ensure reset	TBD	--	--	ns
T <sub>S_RESET</sub>	Low time for pin "SL_RST_N" to ensure reset	100	--	--	ns

## 2.4 Environmental

Symbol	Parameter	Min.	Max.	Unit
T <sub>A</sub>	Operating ambient temperature	-40	+85	°C
T <sub>S</sub>	Storage temperature	-40	+85	°C

## 2.5 Mechanical

Symbol	Parameter	Min.	Max.	Unit
Dimensions	140 x 80 x 4			mm
Weight	40			g

## 3 Interface / Pinout

Image of main board with callouts for connectors.

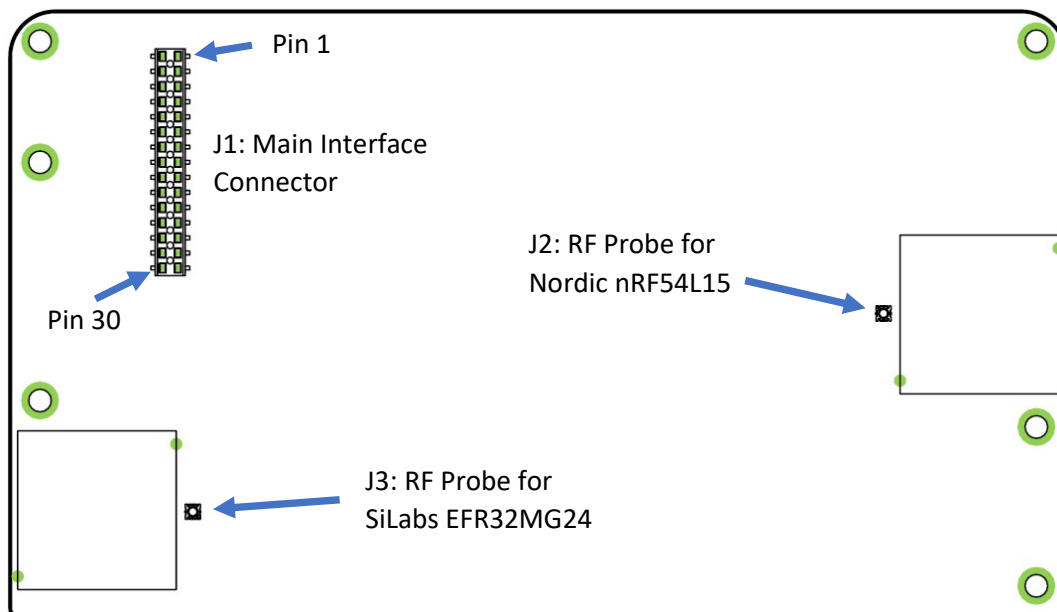


Figure 3 – IoT Radio Board– Top View

### 3.1 Main Interface Connector

The signal assignments for the 30-pin, 2mm pitch bottom-entry socket connector are defined in the following sub-sections.

#### 3.1.1 Power

Pin(s)	Signal Name	Description	Mode	Pull
1, 2, 9, 10, 29, 30	GND	Ground	PWR	--
3	VDDIO_REF	IO reference voltage out	PWR Out	--
4	5V_IN	5V input supply	PWR In	--

#### 3.1.2 Reset and Programming

Pin(s)	Signal Name	Description	Mode	Pull
23	NR_SWDIO	Nordic Serial wire (prog) data in/out	Bi-Dir	14kΩ PD
25	NR_SWCLK	Nordic Serial wire (prog) clock in	Input	14kΩ PU
27	NR_RST_N	Nordic reset	Input	14kΩ PU
24	SL_SWDIO	SiLabs Serial wire (prog) data in/out	Bi-Dir	44kΩ PU
26	SL_SWCLK	SiLabs Serial wire (prog) clock in	Input	44kΩ PD
28	SL_RST_N	SiLabs reset	Input	44kΩ PU

### 3.1.3 GPIO / Coexistence

Pin(s)	Signal Name	Description	Mode	Pull
11	COEX_GNT	GPIO (default: coexistence grant)	AH Input	--
12	COEX_PRI	GPIO (default: coexistence priority)	AL Output	1kΩ PU
14	COEX_REQ	GPIO (default: coexistence request)	AH Output	--

### 3.1.4 UART

Pin(s)	Signal Name	Description	Mode	Pull
15	NR_UART_TX	UART Transmit from Nordic radio	Output	--
16	SL_UART_CTS	UART Clear-To-Send to SiLabs radio	Input	--
17	NR_UART_RX	UART Receive to Nordic radio	Input	--
18	SL_UART_RTS	UART Ready-To-Send from SiLabs radio	Output	--
19	NR_UART_RTS	UART Ready-To-Send from Nordic radio	Output	--
20	SL_UART_RX	UART Receive to SiLabs radio	Input	--
21	NR_UART_CTS	UART Clear-To-Send to Nordic radio	Input	--
22	SL_UART_TX	UART Transmit from SiLabs radio	Output	--

### 3.1.5 Reserved

Pin(s)	Signal Name	Description	Mode	Pull
5	USB_DM	Reserved pin for USB data -	--	--
6	RSVD	Reserved pin (no connect)	--	--
7	USB_DP	Reserved pin for USB data +	--	--
8	RSVD	Reserved pin (no connect)	--	--
13	RSVD	Reserved pin (no connect)	--	--

## 3.2 RF Probe Connectors

Two Murata RF probe connectors, P/N: MM8030-2610, allow for RF verification test during development and manufacturing.



## 4 Mechanical Information

### 4.1 Board Dimensions

The PCB has a length and width of 140 x 80 mm. The assembled height is 4.0 mm.

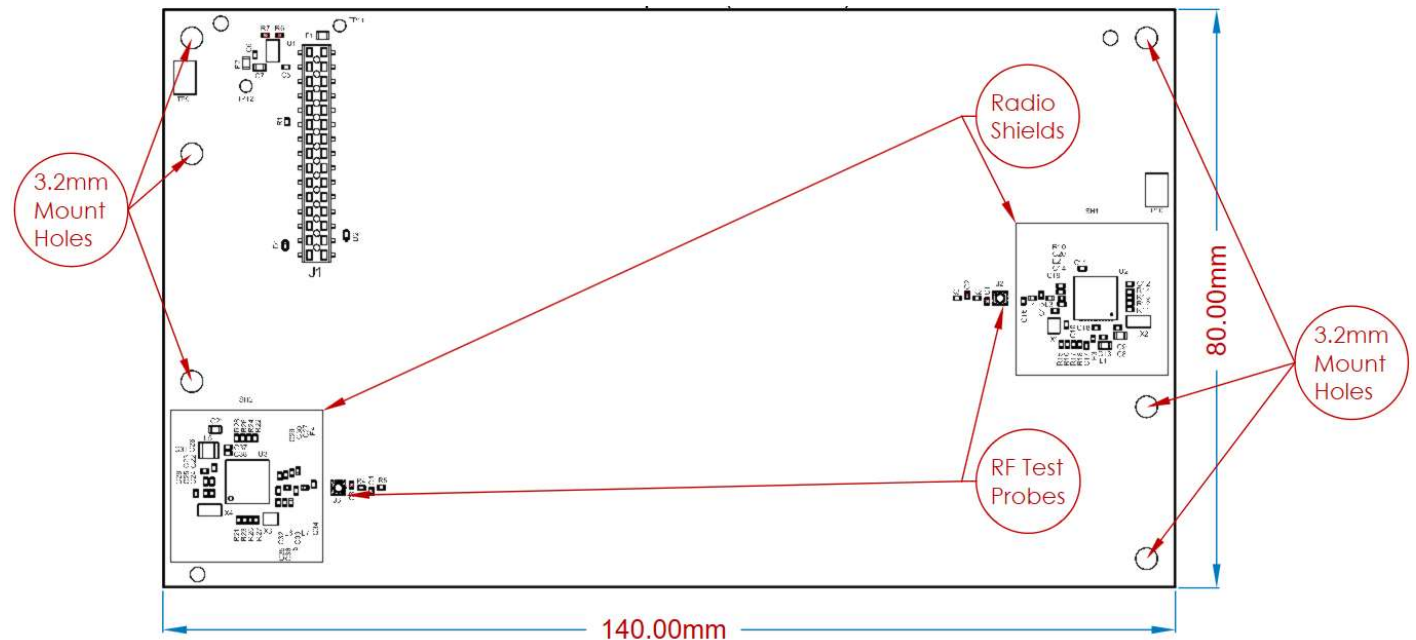


Figure 4 PCBA, View from Top Side

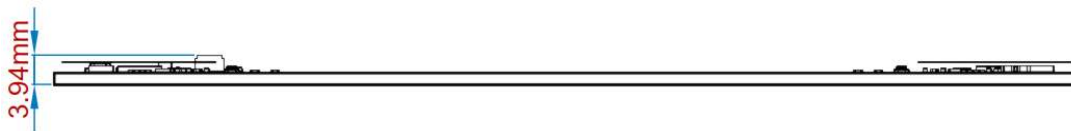


Figure 5 PCBA, View from Front Side

### 4.2 Mounting Holes

Six mounting holes are positioned around the edge of the PCB. All mounting holes are plated through holes with 0-ohm resistor connection to the ground plane.

### 4.3 Shielding

Both radio SoCs and related radio elements are covered by solid, 2-part can shields to prevent interference with other electronics in the host device and to ensure any emissions comply with regulatory requirements.

## 5 Regulatory Information

### 5.1 United States (FCC)

This product has received Federal Communications Commission (FCC) CFR 47 Telecommunications, Part 15, Subpart C “Intentional Radiators” modular approval in accordance with Part 15.212 Modular Transmitter approval. The modular approval allows integration of the module into a finished product without obtaining subsequent and separate FCC approvals for intentional radiation, provided no changes or modifications are made to the module circuitry. Changes or modifications could void the user’s authority to operate the equipment. The end user must comply with all instructions provided by the Grantee, including installation and/or operating conditions necessary for compliance.

The finished product is required to comply with all applicable FCC equipment authorizations regulations, requirements, and equipment functions not associated with the transmitter module portion. For example, compliance must be demonstrated to regulations for other transmitter components within the host product; to requirements for unintentional radiators (Part 15, Subpart B “Unintentional Radiators”), such as digital devices, computer peripherals, radio receivers, etc.; and to additional authorization requirements for the non-transmitter functions on the transmitter module (i.e., Self Declaration of Conformity), (e.g., transmitter modules may also contain digital logic functions) as appropriate.

#### 5.1.1 Labeling Requirements

**The FCC assigned ID is: 2AUPX04**

If the FCC ID is not visible when the module is installed inside another device, then the outside of the finished product into which the module is installed must also display a label referring to the enclosed module. This exterior label can use the following or similar wording:

*Contains FCC ID: 2AUPX04*

In addition to marking the product with the appropriate FCC ID, the end product shall bear the following statement in a conspicuous location on the device (FCC Rules, Title 47, Subchapter A, Part 15, Subpart B, Chapter §15.19):

*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.*

When the device is so small or for such use that it is impracticable to label it with the statement specified above in a font that is four-point or larger, and the device does not have a display that can show electronic labeling, then the information required by this paragraph shall be placed in the user manual and must also either be placed on the device packaging or on a removable label attached to the device.

The user manual may also require specific information based on the digital device classification. Refer to the FCC Rules, Title 47, Subchapter A, Part 15, Subpart B, Chapter §15.105 for specific wording of these notices.

#### 5.1.2 RF Exposure

All transmitters regulated by FCC must comply with RF exposure requirements. KDB 447498 General RF Exposure Guidance provides guidance in determining whether proposed or existing transmitting facilities, operations, or devices comply with limits for human exposure to Radio Frequency (RF) fields adopted by the

Federal Communications Commission (FCC). This module is approved for installation into mobile and/or portable host platforms and must not be co-located or operating in conjunction with any other antenna or transmitter, except in accordance with FCC multi-transmitter guidelines. End users must be provided with transmitter operating conditions for satisfying RF Exposure compliance.

## 5.2 Canada (ISED)

This product is certified for use in Canada under Innovation, Science and Economic Development Canada (ISED) Radio Standards Specification RSS-247 Issue 2 and RSS-Gen.

### 5.2.1 Labeling Requirements

**The ISED assigned IC number is: 25570-04**

Labeling Requirements for the Host Device (from Section 4.3 of RSS-Gen, Issue 5, April 2018):

The Host Marketing Name (HMN) shall be displayed according to the e-labelling requirements of section 4.4 or indicated on the exterior of the host product or on the product packaging, or in the product literature, which shall be supplied with the host product or readily available online.

The host product shall be properly labelled to identify the modules within the host product.

The ISED certification label of a module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the ISED certification number for the module, preceded by the word "contains" or similar wording expressing the same meaning, as follows:

*Contains IC: 25570-04*

User Manual Notice for License-Exempt Radio Apparatus (from Section 8.4 of RSS-Gen, Issue 5, April 2018):

In addition to containing other required statements specified elsewhere in this standard or in the applicable RSS, user manuals for licence-exempt radio apparatus shall contain the following text, or an equivalent notice, that shall be displayed in a conspicuous location, either in the user manual or on the device, or both:

*This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions: (1) This device may not cause interference. (2) This device must accept any interference, including interference that may cause undesired operation of the device.*

### 5.2.2 RF Exposure

All transmitters regulated by ISED must comply with RF exposure requirements listed in RSS-102 – Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands). This module is approved for installation into mobile and/or portable host platforms and must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with ISED's multi-transmitter guidelines. End users must be provided with transmitter operating conditions for satisfying RF Exposure compliance.

#### 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.

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.

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 device and its antenna(s) must not be co-located or operation 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 and your body.

Product Model: R-21-0 PMN: IoT Radio Board

#### ISED Statement:

-English: 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.

The digital apparatus complies with Canadian CAN ICES - 3 (B)/NMB - 3(B).

- French: Le présent appareil est conforme aux CNR d'Industrie 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'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

L'appareil numérique du présent appareil est conforme canadien peut - 3 (b) / nmb - 3 (b).

This device meets the exemption from the routine evaluation limits in section 6.3 of RSS 102 and compliance with RSS 102 RF exposure, users can obtain Canadian information on RF exposure and compliance.

Cet appareil est conforme à l'exemption des limites d'évaluation courante dans la section 6.3 du cnr - 102 et conforme avec RSS 102 de l'exposition aux RF, les utilisateurs peuvent obtenir des données canadiennes sur l'exposition aux champs RF et la conformité.

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment.

Cet équipement est conforme aux limites d'exposition au rayonnement établies par le Canada pour un environnement non contrôlé.

This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé.

Cet équipement doit être installé et utilisé avec une distance minimale de 20 cm entre le radiateur et votre corps.