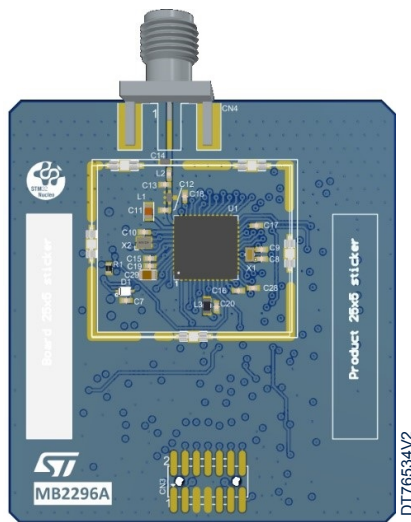


## Reference designs for STM32WBA6xxx microcontrollers



STDES-WBA6I8DA0 top view. Designs with different references show different layouts. Picture is not contractual. PCB color may differ.

### Product link

#### STDES-WBA6xxxxx

STDES-WBA6I8D51,  
STDES-WBA6I8DA0,  
STDES-WBA6U4DA0

### Features

Includes ST state-of-the-art patented technology

#### Reference design

- Microcontroller RF board

#### Microcontroller

- STM32WBA6xxx microcontrollers in a variety of packages
- 2.4 GHz transceiver supporting Bluetooth® specification v6.0
- Dedicated low-layer protocol management for real-time radio layer

#### Connectors

- Two 50-pin MCU RF board headers
- ST-LINK 14-pin STDC14
- RF SMA

#### Power supply

- ST-LINK USB  $V_{BUS}$  through the mezzanine board (MB1801).

#### Debugging/Programming

- Suitable for ST-LINK/V2 and STLINK-V3 debuggers/programmers with USB re-enumeration capability through the mezzanine board: mass storage, Virtual COM port, and debug port

#### Software

- Comprehensive free software libraries and examples available with the [STM32CubeWBA MCU Package](#)
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE

### Description

The main objective of the STM32WBA6xxx microcontroller reference designs is to recommend a layout and associated BOM for dedicated applications (these boards are not for sale).

These reference designs can be manufactured from files available for download from the [www.st.com](http://www.st.com) website. The access to all GPIOs allows the prototyping of a complete application.

Sensitive layout parts can be extracted and pasted in any user board design with the same PCB characteristics and feature set.

The STM32WBA6xxx microcontroller reference designs are provided with the STM32WBA comprehensive software HAL library. The [STM32CubeWBA MCU Package](#) contains many software examples developed with the NUCLEO-WBA65RI Nucleo-64 board. These examples can be easily adapted for the STM32WBA6xxx microcontroller reference designs.

## 1 General information

The STM32WBA6xxx microcontroller reference designs run the Bluetooth® LE stack on STM32WBA6xxx microcontrollers based on the Arm® Cortex®-M33 processor.

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**arm**

## 2 Main features

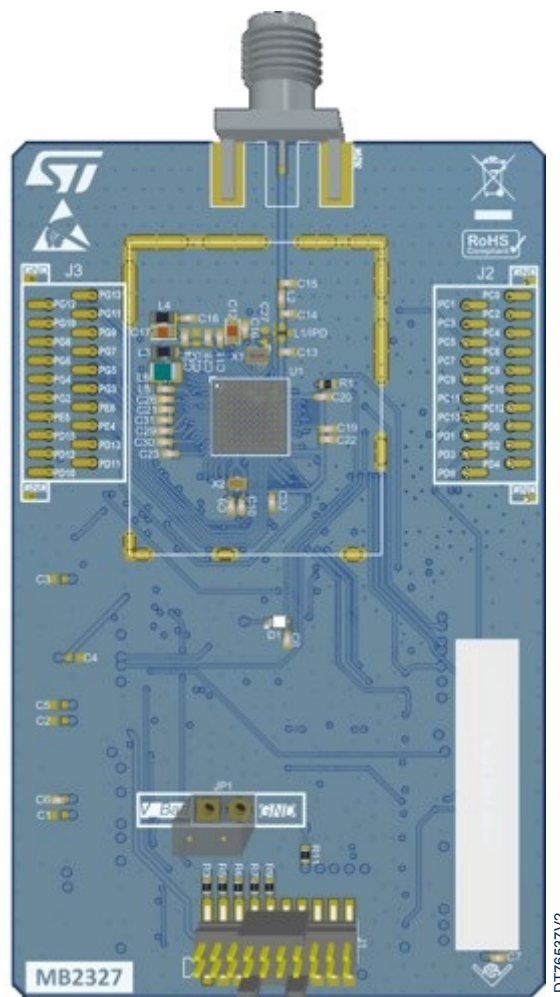
This section presents examples of Tx output power and Rx sensitivity measurements for each reference design. These measurements are not contractual.

For Tx, the following applies:

- Measurements are performed according to three different MCU configurations: 0 dBm, 5 dBm, and 10 dBm
- In LDO mode, the MCU is directly supplied by the board at 3.3 V
- In SMPS mode, the SMPS MCU feature uses the MCU low-power mode, which limits the Tx output power to 5 dBm

### 2.1 STDES-WBA6I8D51 reference design (MB2327)

Figure 1. STDES-WBA6I8D51 (MB2327)

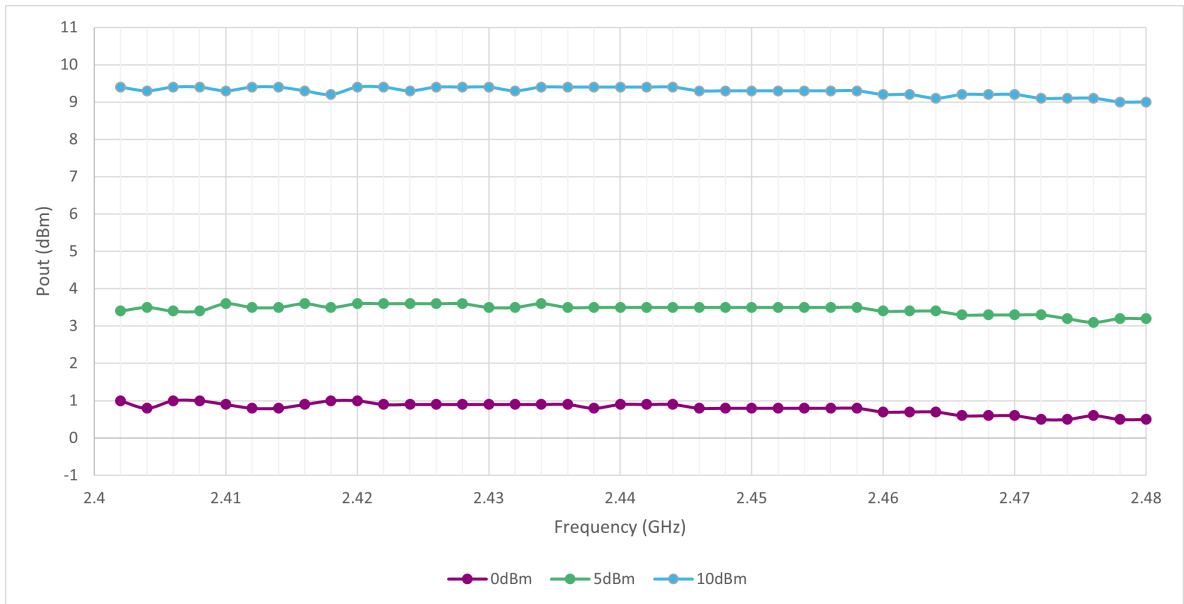


Picture is not contractual.

### MCU Tx power

For the measurements in Figure 2, the MB2327 is configured in LDO mode.

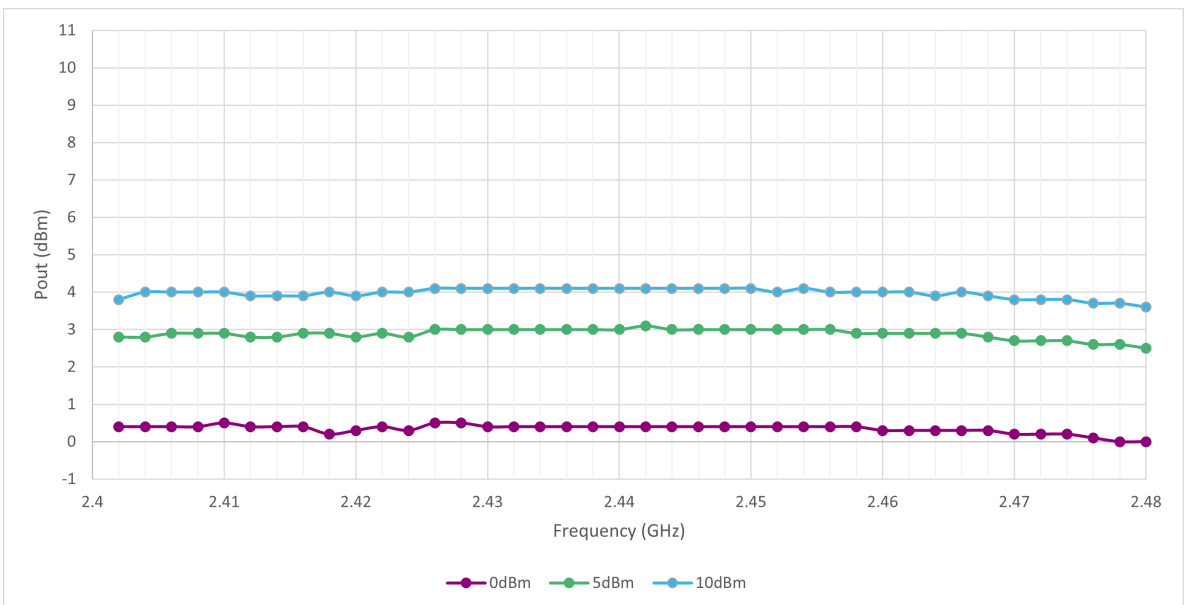
**Figure 2. STDES-WBA6I8D51 Tx power measurements in LDO mode**



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For the measurements in Figure 3, the MB2327 is configured in SMPS mode.

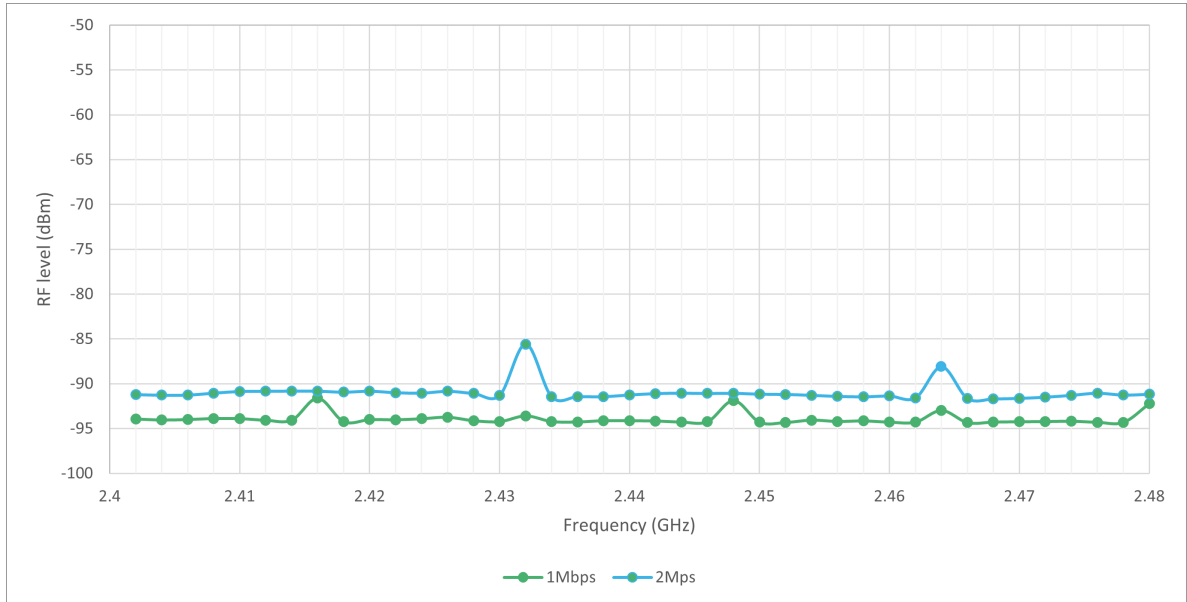
**Figure 3. STDES-WBA6I8D51 Tx power measurements in SMPS mode**



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MCU Rx sensitivity

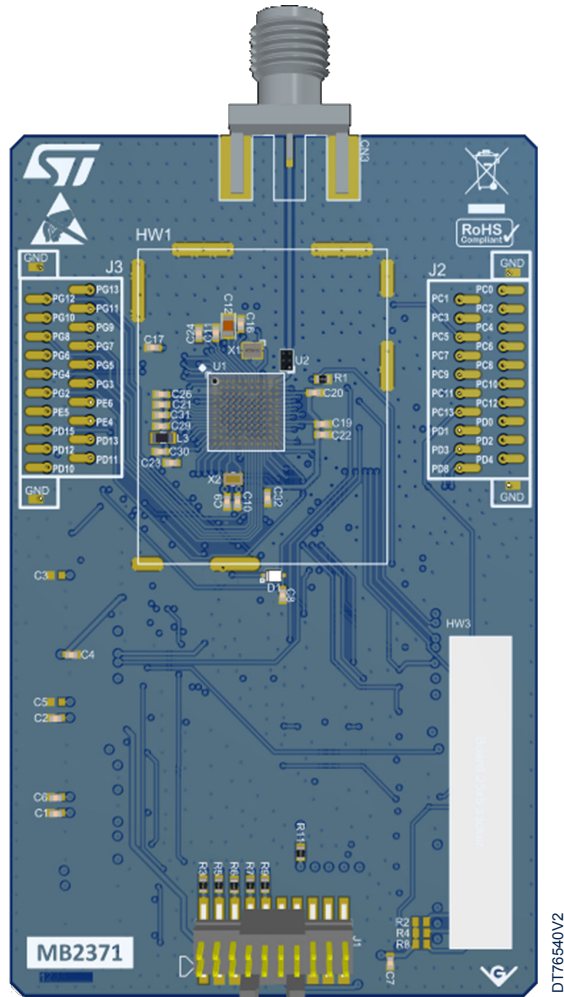
Figure 4. STDES-WBA6I8D51 Rx sensitivity measurements



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## 2.2 STDES-WBA6I8DA0 reference design (MB2371)

Figure 5. STDES-WBA6I8DA0 (MB2371)

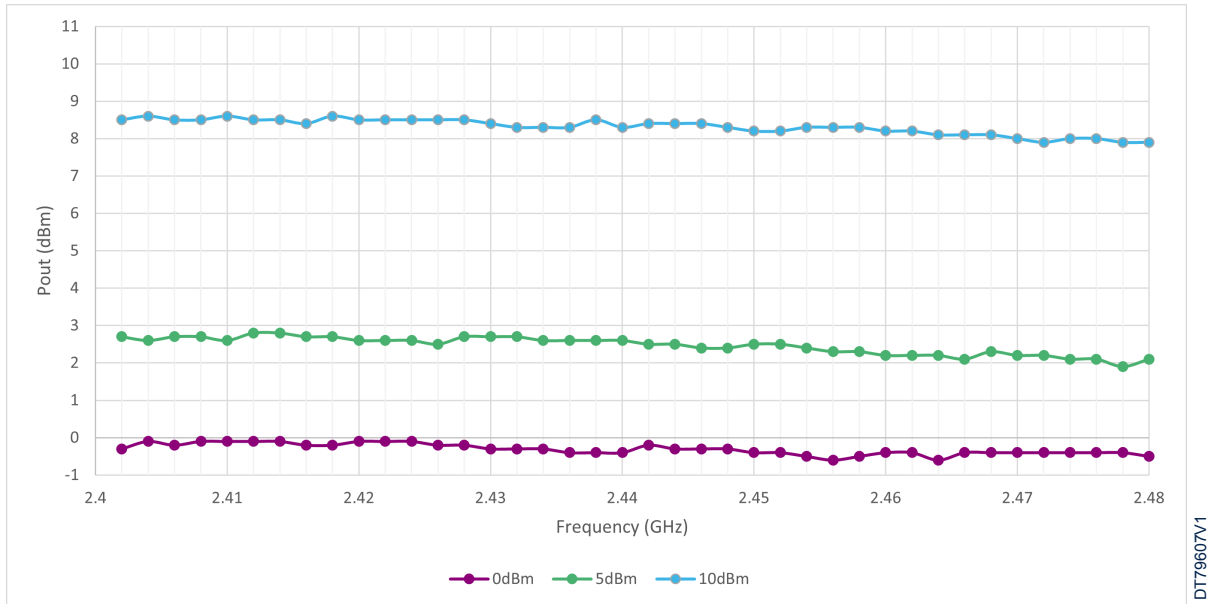


Picture is not contractual.

### MCU Tx power

For the measurements in Figure 6, the MB2371 is in its native LDO mode.

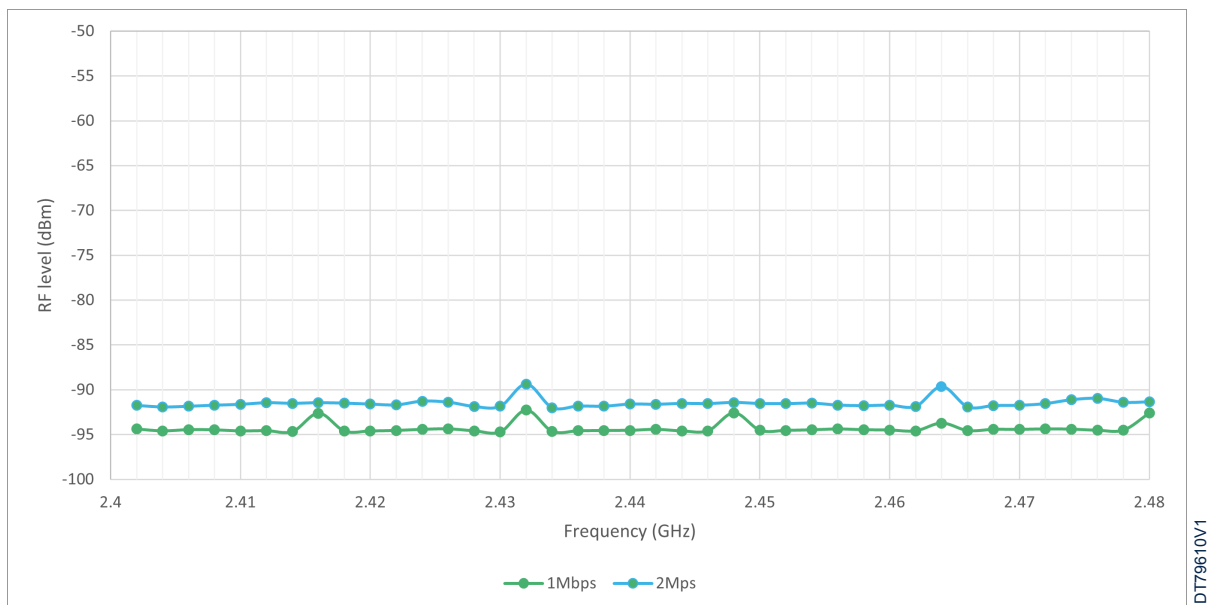
Figure 6. STDES-WBA6I8DA0 Tx power measurements



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### MCU Rx sensitivity

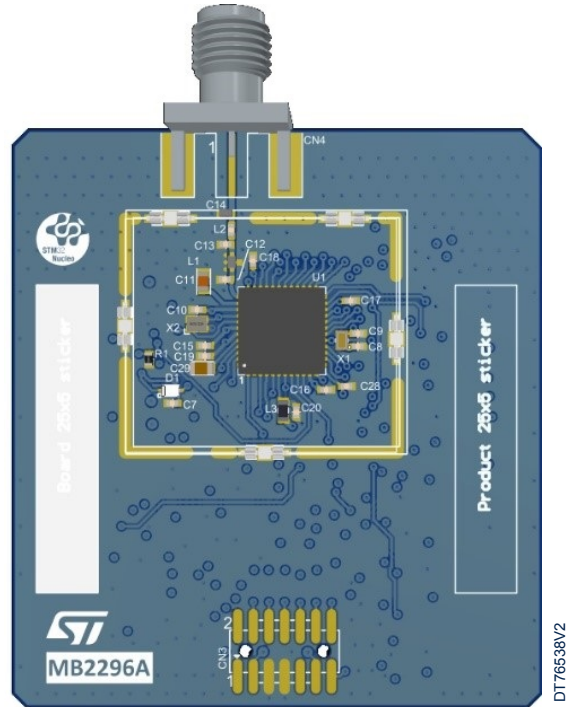
Figure 7. STDES-WBA6I8DA0 Rx sensitivity measurements



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## 2.3 STDES-WBA6U4DA0 reference design (MB2296)

Figure 8. STDES-WBA6U4DA0 (MB2296)

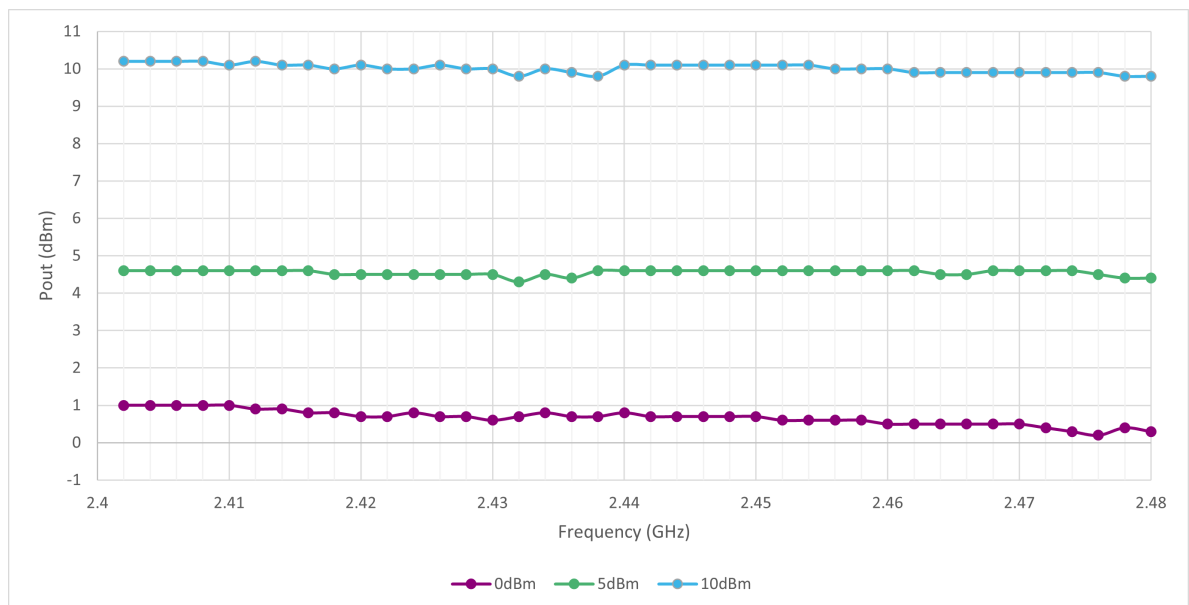


Picture is not contractual.

### MCU Tx power

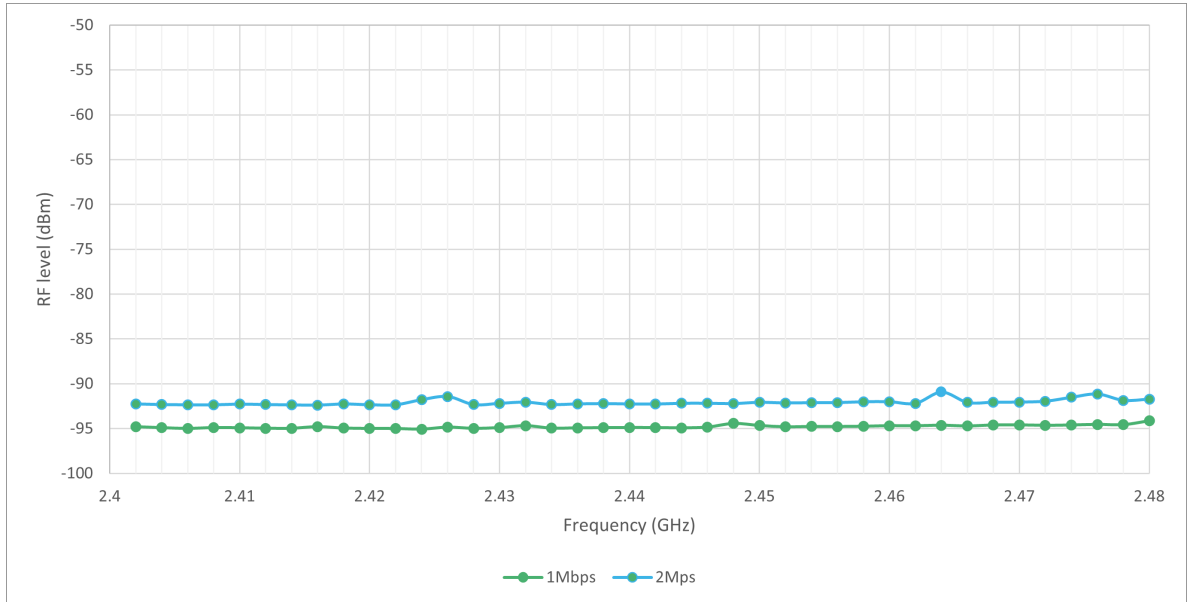
For the measurements in Figure 9, the MB2296 is in its native LDO mode.

Figure 9. STDES-WBA6U4DA0 Tx power measurements



### MCU Rx sensitivity

Figure 10. STDES-WBA6U4DA0 Rx sensitivity measurements



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### 3 Boards overview

The STM32WBA6xxx reference designs are based on four or eight-layer PCBs with an FR4 substrate. [Table 1](#) details the type of PCB used for each reference design.

**Table 1. STM32WBA6xxx microcontroller reference designs**

Web reference	Board reference	Number of layers	Substrate	Vias	Thickness
<a href="#">STDES-WBA6I8D51</a>	MB2327	8	FR4	Plated through holes and hidden vias	1.6 mm
<a href="#">STDES-WBA6I8DA0</a>	MB2371	8	FR4	Plated through holes and hidden vias	1.6 mm
<a href="#">STDES-WBA6U4DA0</a>	MB2296	4	FR4	Plated through holes	1.6 mm

## 4 STM32WBA6xxx microcontroller reference designs and codification

**Table 2. STM32WBA6xxx microcontroller reference designs**

Part number	Board reference	Board variant	MCU order code	MCU package	Number of layers	SMD or IPD
STDES-WBA6I8D51	MB2327	VB-MB2327-01	STM32WBA65PII6	UFBGA121	8	SMD
STDES-WBA6I8DA0	MB2371	VB-MB2371-01	STM32WBA62PII6	UFBGA121	8	SMD
STDES-WBA6U4DA0	MB2296	VB-MB2296-01	STM32WBA62CIU6	UFQFPN48	4	SMD

**Table 3. STM32WBA6xxx microcontroller reference designs codification**

Example:	STDES-	WBA6	I	8	D	A0
<b>Device family</b>						
STDES- = STMicroelectronics reference design						
<b>Wireless product</b>						
WBA6 = Wireless Bluetooth® STM32WBA6xxx microcontrollers						
<b>Wireless microcontroller package</b>						
I = UFBGA121						
U = UFQFPN48						
<b>Number of layers</b>						
4 = Four layers						
8 = Eight layers						
<b>Antenna matching and path connection to antenna</b>						
D = Discrete components with direct tie						
<b>Output power mode or power supply mode</b>						
A0 = 10 dBm, LDO						
51 = 5 dBm, SMPS						

**Note:** The STM32WBA6xxx microcontroller reference designs do not include the dedicated integrated passive device (IPD) for optimized matching, filtering, and balun. Consequently, the codification scheme omits the character related to the IPD implementation.

## 5 Hardware layout and configuration

### 5.1 EDA resources

All board design resources, including schematics, EDA databases, manufacturing files, and the bill of materials, are available from the corresponding product page at [www.st.com](http://www.st.com).

### 5.2 Integrated passive device (IPD)

- STMicroelectronics develops integrated passive device (IPD) companion chips for optimized matching, filtering, and balun (see the [MLPF-WB-04D3](#) datasheet for details).
- The IPD is an all-in-one very compact solution covering each package.

### 5.3 Solder bridges

The reference designs can be configured to meet the specific requirements of the application. Refer to the board schematics for details.

**Table 4. Solder bridge configurations**

Solder bridge function	Board reference			Solder bridge state	Description
	MB2296	MB2327	MB2371		
LSE control (32.768 kHz)	SB37/SB38	SB38/SB40	SB38/SB40	ON	LSE provided by external 32.768 kHz LSE CLK
				OFF	LSE not provided by external 32.768 kHz LSE CLK
HSE control (32 MHz)	SB39/SB40	SB37/SB39	SB37/SB39	ON	HSE provided by external 32 MHz HSE CLK
				OFF	HSE not provided by external 32 MHz HSE CLK
PA power supply LDO	SB6	SB41 <sup>(1)</sup>	SB42	ON <sup>(2)</sup>	RF PA power supply 3V3
PA power supply SMPS	-	SB42 <sup>(1)</sup>	-	ON <sup>(2)</sup>	RF PA power supply SMPS

1. SB41 and SB42 are mutually exclusive. Only one of these solder bridges must be ON at a time on MB2327.
2. The RF PA is not powered when the solder bridge is OFF.

## 6 Firmware programming

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To download firmware, it is enough to connect a serial-wire debug port from an external probe. For example, the [STLINK-V3SET](#) through the MB1801 mezzanine board can be used to perform the connection easily.

## 7 Transparent mode and UART pins

To test the RF performance using the transparent mode firmware, a UART must be connected. The DUT UART Rx and Tx pins are indicated on the CN1 connector of both the miniboard and the mezzanine board (MB1801):

- Pin 45 VCP1\_RX (GPIO23)
- Pin 47 VCP1\_TX (GPIO24)

For more information about how to use the transparent mode firmware for performance measurements, refer to the *RF test panel* section of the user manual *STM32CubeMonitor-RF software tool for wireless performance measurements* (UM2288).

**Table 5. UART Rx and Tx**

UART	Board reference		
	MB2296	MB2327	MB2371
Virtual COM port 1	Rx: GPIO23 Tx: GPIO24	Rx: GPIO23 Tx: GPIO24	Rx: GPIO23 Tx: GPIO24

## 8 Conventions

Table 6 provides the conventions used for the ON and OFF settings in the present document.

**Table 6. Conventions for solder bridges**

Convention	Definition
Solder bridge SBx ON	SBx connections closed by 0 $\Omega$ resistor
Solder bridge SBx OFF	SBx connections left open

## Revision history

**Table 7. Document revision history**

Date	Revision	Changes
24-Apr-2025	1	Initial release.
12-Jun-2026	2	Updated: <ul style="list-style-type: none"> <li>• Cover figure</li> <li>• Features</li> <li>• Section 2: Main features</li> <li>• Section 3: Boards overview</li> </ul> Added: <ul style="list-style-type: none"> <li>• Section 2.1: STDES-WBA6I8D51 reference design (MB2327)</li> <li>• Section 2.2: STDES-WBA6I8DA0 reference design (MB2371)</li> <li>• Section 2.3: STDES-WBA6U4DA0 reference design (MB2296)</li> </ul> Removed: <ul style="list-style-type: none"> <li>• Section 3.1: Printed circuit boards</li> <li>• Section 3.2: Stacking</li> <li>• Section 3.3: RF path: 50-ohm coplanar line</li> <li>• Section 3.4: Top views</li> </ul>

## Contents

<b>1</b>	<b>General information</b> .....	<b>2</b>
<b>2</b>	<b>Main features</b> .....	<b>3</b>
<b>2.1</b>	STDES-WBA6I8D51 reference design (MB2327) .....	3
<b>2.2</b>	STDES-WBA6I8DA0 reference design (MB2371) .....	6
<b>2.3</b>	STDES-WBA6U4DA0 reference design (MB2296) .....	8
<b>3</b>	<b>Boards overview</b> .....	<b>10</b>
<b>4</b>	<b>STM32WBA6xxx microcontroller reference designs and codification</b> .....	<b>11</b>
<b>5</b>	<b>Hardware layout and configuration</b> .....	<b>12</b>
<b>5.1</b>	EDA resources .....	12
<b>5.2</b>	Integrated passive device (IPD) .....	12
<b>5.3</b>	Solder bridges .....	12
<b>6</b>	<b>Firmware programming</b> .....	<b>13</b>
<b>7</b>	<b>Transparent mode and UART pins</b> .....	<b>14</b>
<b>8</b>	<b>Conventions</b> .....	<b>15</b>
	<b>Revision history</b> .....	<b>16</b>
	<b>List of tables</b> .....	<b>18</b>
	<b>List of figures</b> .....	<b>19</b>

## List of tables

<b>Table 1.</b>	STM32WBA6xxx microcontroller reference designs . . . . .	10
<b>Table 2.</b>	STM32WBA6xxx microcontroller reference designs . . . . .	11
<b>Table 3.</b>	STM32WBA6xxx microcontroller reference designs codification . . . . .	11
<b>Table 4.</b>	Solder bridge configurations . . . . .	12
<b>Table 5.</b>	UART Rx and Tx . . . . .	14
<b>Table 6.</b>	Conventions for solder bridges . . . . .	15
<b>Table 7.</b>	Document revision history . . . . .	16

## List of figures

<b>Figure 1.</b>	STDES-WBA6I8D51 (MB2327) . . . . .	3
<b>Figure 2.</b>	STDES-WBA6I8D51 Tx power measurements in LDO mode . . . . .	4
<b>Figure 3.</b>	STDES-WBA6I8D51 Tx power measurements in SMPS mode . . . . .	4
<b>Figure 4.</b>	STDES-WBA6I8D51 Rx sensitivity measurements . . . . .	5
<b>Figure 5.</b>	STDES-WBA6I8DA0 (MB2371) . . . . .	6
<b>Figure 6.</b>	STDES-WBA6I8DA0 Tx power measurements . . . . .	7
<b>Figure 7.</b>	STDES-WBA6I8DA0 Rx sensitivity measurements . . . . .	7
<b>Figure 8.</b>	STDES-WBA6U4DA0 (MB2296) . . . . .	8
<b>Figure 9.</b>	STDES-WBA6U4DA0 Tx power measurements . . . . .	8
<b>Figure 10.</b>	STDES-WBA6U4DA0 Rx sensitivity measurements . . . . .	9

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