

Bluetooth® LE 6.0 Module

Nordic Chipset nRF54L15 Datasheet - Rev. 5.6

- Design Name: Type 2NR
- P/N: LBMA0ZZ2NR

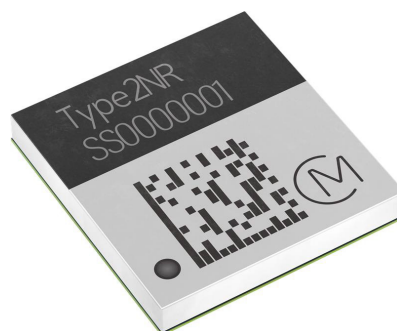


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About This Document

Murata's Type 2NR is a small and highly integrated module based on Nordic nRF54L15 Bluetooth LE SoC, supporting Bluetooth LE 6.0, IEEE802.15.4, and NFC-A Tag. This datasheet describes the Type 2NR module in detail.

Audience & Purpose

The intended audience includes any customer looking to integrate this module into their product, in particular, RF, hardware, software, and systems engineers.

Document Conventions

Table 1 describes the document conventions.

Table 1: Document Conventions

Conventions	Description
	Warning Note Indicates very important note. Users are strongly recommended to review.
	Info Note Intended for informational purposes. Users should review.
	Menu Reference Indicates menu navigation instructions. Example: Insert → Tables → Quick Tables → Save Selection to Gallery 
	External Hyperlink This symbol indicates a hyperlink to an external document or website. Example: Murata  Click on the text to open the external link.
	Internal Hyperlink This symbol indicates a hyperlink within the document. Example: Scope  Click on the text to open the link.
<code>Console input/output or code snippet</code>	Console I/O or Code Snippet This text Style denotes console input/output or a code snippet.
<code># Console I/O comment // Code snippet comment</code>	Console I/O or Code Snippet Comment This text Style denotes a console input/output or code snippet comment. - Console I/O comment (preceded by "#") is for informational purposes only and does not denote actual console input/output. - Code Snippet comment (preceded by "//") may exist in the original code.

1 Scope

This specification characterizes the Type 2NR Bluetooth LE 6.0 / IEEE 802.15.4 IoT module.

2 Key Features

- Nordic nRF54L15 SoC inside
- Bluetooth 6.0 Class 1; IEEE802.15.4; 2.4 GHz Nordic proprietary modes; NFC-A Tag
- Bluetooth 6.0 2 Mbps, 1 Mbps, 500 kbps, and 125 kbps data rate and IEEE 802.15.4-2006 250 kbps data rate, as well as Nordic proprietary 2.4 GHz 4 Mbps, 2 Mbps, and 1 Mbps data rate
- Bluetooth Channel Sounding, Thread, Zigbee, Matter over Thread
- 128 MHz Arm® Cortex®-M33 with 256 KB RAM, 1524 KB RRAM
- +8 dBm Max TX power; -95 dBm RX Sensitivity @ 1 Mbps
- 5.0 mA TX @ 0 dBm / 3.3 V; 3.7 mA RX @ 1 Mbps / 3.3 V; 1.2 µA Sleep @ 3.3 V
- Advanced security including TrustZone® isolation, tamper detection, and cryptographic engine side-channel leakage protection. Design for PSA Certified Level 3 security
- 32 GPIOs, GRTC, UART, SPI, I2C, PWM, I2S, ADC, PDM, NFC, QDEC, SWD, JTAG
- RF signal from pin pad to onboard pattern antenna or optional external antenna
- Temperature Range: -40 °C to 105 °C
- Dimensions: 7.4 mm x 7.0 mm x 1.4 mm (maximum)
- Weight: 0.14 g
- MSL: 3
- Surface-mount type
- Regulatory Certification FCC/ISED/ETSI/MIC
- Bluetooth QDID Q370633
- RoHS compliant

3 Ordering Information

The part number and associated ordering information is shown in **Table 2**.

Table 2: Sample Ordering Information

Ordering Part Number	Description
LBMA0ZZ2NR-SMP	Type 2NR module sample
LBMA0ZZ2NR-001	Type 2NR module
LBMA0ZZ2NR-EVK	Type 2NR EVK

4 Product Overview

Type 2NR is a highly integrated ultra-small wireless module based on the Nordic Semiconductor nRF54L15 SoC. The module supports Bluetooth LE 6.0, IEEE 802.15.4, Matter over Thread, and NFC-A Tag functionality in a compact 7.4 mm × 7.0 mm form factor.

Designed for low-power and high-performance IoT applications, Type 2NR combines advanced wireless connectivity, a powerful Arm Cortex-M33 processor, integrated security features, and flexible peripheral interfaces into a single compact module. The module is optimized for applications requiring low power consumption, robust RF performance, and secure edge processing.

Type 2NR supports multiple wireless protocols including Bluetooth LE, Thread, Zigbee®, Matter over Thread, and proprietary 2.4 GHz communication, enabling interoperability across a wide range of smart home, industrial, healthcare, and asset tracking applications.

The module integrates:

- Nordic nRF54L15 wireless SoC
- Integrated RF matching circuitry
- Onboard PCB antenna support
- Optional external antenna interface
- High-efficiency DC/DC converter support
- NFC interface capability

Type 2NR is designed to simplify customer product development and accelerate time-to-market by providing:

- Pre-certified radio performance
- Compact surface-mount integration
- Low-power operation
- Advanced hardware security features
- Flexible GPIO and peripheral interfaces

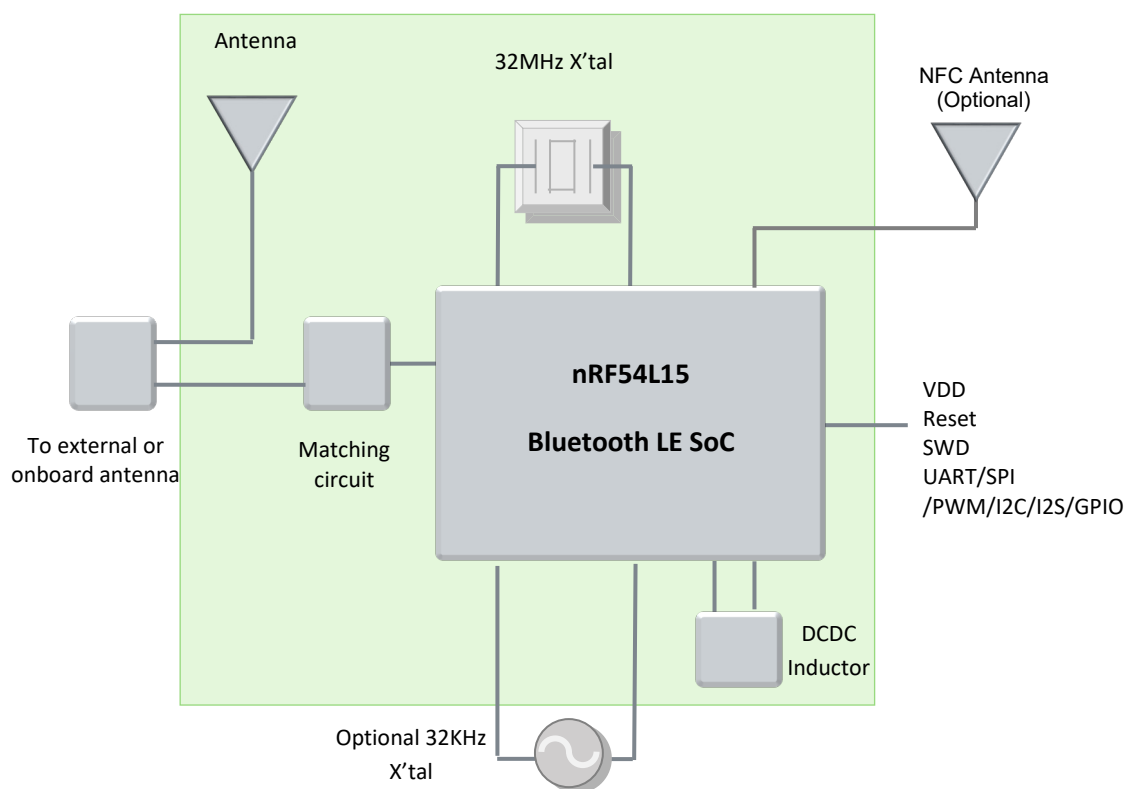
Typical applications include:

- Smart home devices
- Industrial IoT sensors
- Matter-enabled products
- Asset tracking devices
- Medical and healthcare monitoring
- Building automation
- Wireless sensor networks

4.1 Block Diagram

Figure 1 shows the block diagram.

Figure 1: Block Diagram



4.2 Multiprotocol Radio

- Bluetooth 6.0, IEEE 802.15.4-2020, and 2.4 GHz enabled transceiver
- Supported data rates:
 - Bluetooth 6.0 – 2 Mbps, 1 Mbps, 500 kbps, and 125 kbps
 - IEEE 802.15.4-2020 – 250 kbps
 - Proprietary 2.4 GHz – 4 Mbps, 2 Mbps, and 1 Mbps

4.3 Application Microcontroller Core

The Nordic nRF54L15 SoC integrates an Arm Cortex-M33 core for user applications, see [nRF54L15 Datasheet](#) .

- 128 MHz Arm Cortex-M33 with TrustZone-M
- 256 KB integrated RAM

4.4 Peripheral Interfaces

Type 2NR supports a total of 32 GPIOs and rich peripheral interfaces for user applications.

- Global RTC (GRTC) that can run in System OFF mode and implement a shared system timer
- Seven 32-bit timers with counter mode
- Up to five fully featured serial interfaces with EasyDMA, supporting I2C, SPI controller/peripheral, and UART
- Three pulse width modulator (PWM) units with EasyDMA
- I2S two channel Inter-IC sound interface
- ADC with up to eight programmable gain channels. 14-bit at 31.25 ksps, 12-bit at 250 ksps, and up to 10-bit at 2 Msps.
- Pulse density modulation (PDM) interface
- Near field communication (NFC)
- Up to two quadrature decoders (QDEC)
- Comparator and low-power comparator with wake-up from System OFF mode

For details, please refer to [nRF54L15 Datasheet](#) .

4.5 Built-in Security Features

Type 2NR inherits the built-in advanced security features from nRF54L15 SoC.

- Secure/non-secure memory protection
- Symmetric and asymmetric key crypto accelerator
- Secure key management
- Tamper detection
- Immutable boot partition

- Debug access port protection
- Two watchdog timers for secure and non-secure access

For details, please refer to [nRF54L15 Datasheet](#) .

5 Certification Information

This section describes the radio and Bluetooth certification.

5.1 Radio Certification

Table 3 describes the radio certification information.

Table 3: Radio Certification Information

Country	Standard	ID	Country Code
US	FCC Part 15 C	HSW2NR	US
Canada	ISED RSS-247	4492A-2NR*	CA
Europe			DE
Japan	MIC Radio equipment for Article 2-1-19 of Certification Ordinance	201-260225	JP

Note* ISED HVIN LBMA0ZZ2NR

5.2 FCC Notice (USA)

This module has been tested and found to comply with the following requirements for Modular Approval.

- 47 CFR Part 15 Subpart C Intentional Radiators

This radio transmitter has been approved by Federal Communications Commission and Innovation, Science and Economic Development Canada 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.

Cet émetteur radio a été approuvé par la Commission fédérale des communications et Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antennes énumérés ci-dessous, avec le gain maximal autorisé indiqué. Les types d'antennes non mentionnés dans cette liste dont le gain est supérieur au gain maximal indiqué pour l'un des types énumérés sont strictement interdits avec cet appareil.

In the end product, the transmitter must be installed to provide a separation distance of at least 20 cm with the Monopole Antenna and at 5 mm with the PCB Antenna from all persons and must not be co-located or operated in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures. User and installers must be provided with antenna installation instructions and transmitter operating conditions to satisfy the RF exposure compliance.

Table 4: Antenna to comply with FCC and ISSED

Ant. Type	Brand	Model No.	Freq. (MHz)	Peak Gain (dBi)	Remarks
PCB	Inventek Systems, LLC.	W2.4-5P-U	2400-2484	3.73	Necessary for FCC/ISED compliance only.
PCB	Murata Manufacturing	Integrated	2400-2484	-6.7	Necessary for FCC/ISED compliance only.

To be compliant with RED Directive while using TYPE 2NR module with external antenna, the total EIRP including the antenna gain should be less than or equal to 10 dBm.

Warning: Changes or modifications to this device not expressly approved by Murata could void the user's authority to operate the equipment.

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 transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

This device complies with Part 15 Subpart C of the FCC Rules.

The FCC requires the OEM to be notified that any changes or modifications not expressly approved by Murata may void the user's authority to operate the equipment. While an application of the TYPE 2NR module in a product is not required to obtain a new FCC authorization for the module, this does not preclude the possibility that some other form of authorization or testing may be required for that end product.

Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

This module has been tested and found to comply with the following requirements for Modular Approval.

- Part 15.247 - Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

Test Modes

This device uses various test mode programs for test set up which operate separately from production firmware. Host integrators should contact the grantee for assistance with test modes needed for module/host compliance test requirements.

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 shown in User manual.

5.3 FCC Labeling Requirements

When integrating the TYPE 2NR into a product the FCC labeling requirements must be met. This includes a clearly visible label on the outside of the finished product specifying the TYPE 2NR FCC identifier (FCC ID: HSW2NR) as well as the notice above. The exterior label can use wording such as “Contains Transmitter Module FCC ID: HSW2NR” or “Contains FCC ID: HSW2NR” although any similar wording that expresses the same meaning may be used.

The following information must be indicated on the host device of this module.

FCC Compliance Information

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.

*If it is difficult to describe this statement on the host device due to the size, please describe in the user's manual and also either describe on the device packaging or on a removable label attached to the device.

The following statements must be described on the user manual of the host device of this module.

FCC CAUTION

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

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines as this equipment has very low levels of RF energy. []*

[*]But it is desirable that it should be installed and operated keeping the radiator at least 20 cm or more away from person's body.

5.4 ISED Notice (Canada)

This radio transmitter has been approved by FCC and ISED to operate with the antenna types listed below 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.

Cet émetteur radio a été approuvé par la FCC et ISED pour fonctionner avec les types d'antennes répertoriés ci-dessous avec le gain maximal autorisé indiqué. Les types d'antennes non inclus dans cette liste, ayant un gain supérieur au gain maximum indiqué pour ce type, sont strictement interdits pour une utilisation avec cet appareil.

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, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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; (2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This radio transmitter (4492A-2NR) has been approved by Innovation, Science and Economic Development Canada 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.

Le présent émetteur radio (4492A-2NR) a été approuvé par Innovation, Sciences et Développement économique 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 pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

Table 5: Antenna to comply with ISED

Ant. Type	Brand	Model No.	Freq. (MHz)	Peak Gain (dBi)	Remarks
PCB	Inventek Systems, LLC.	W2.4-5P-U	2400-2484	3.73	Necessary for FCC/ISED compliance only.
PCB	Murata Manufacturing	Integrated	2400-2484	-6.7	Necessary for FCC/ISED compliance only.

5.5 ISED Labeling Requirements

The host device should be properly labeled to identify the module within the host device. The Industry Canada certification label of a module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labeled to display the Industry Canada certification number of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows:

Contains transmitter module IC: 4492A-2NR, where 4492A-2NR is the module's certification number.

The following statements must be described on the user manual of the host device of this module.

"This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the ISED radio frequency (RF) Exposure rules as this equipment has very low levels of RF energy. (*1)

*Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'ISDE puisque cet appareil a une niveau très bas d'énergie RF. (*2)"*

* In case of the Mobile equipment : Please add the following text.

(*1) But it is desirable that it should be installed and operated keeping the radiator at least 20 cm or more away from person's body.

(*2) Cependant, il est souhaitable qu'il devrait être installé et utilisé en gardant une distance de 20 cm ou plus entre le radiateur et le corps humain.

5.6 RF exposure considerations

5.6.1 Mobile Operation

1. The host product operating conditions must be such that there is a minimum separation distance of 20 cm (or possibly greater than 20 cm) between the antenna radiating structures and nearby persons. The host manufacturer is obligated to confirm the use conditions of the host product to ensure that the distance specified in the instructions is met. In this case the host product is classified as either a mobile device or a fixed device for RF exposure purposes.
 2. If the modular transmitter to be used in a specific type of host platform and installed such that it can be operated at closer than 20 cm to users or nearby persons, please follow the guidance below.
 - a. For the host product integrated with this modular transmitter as a stand-alone configuration, the maximum conducted power from the original grant shall be retained in order to meet SAR exemption requirements.
 - b. For configuration with multiple transmitters in the same host, routine evaluation or SAR testing for the simultaneous transmission of the co-located transmitters according to KDB 447498 is required. The portable host product shall be evaluated for ensuring to continue compliance FCC rule part 2.1093 & part 1.1310 by C2PC. The additional guidance for the portable host products is provided in KDB Publication 996369 D02 and D04.
 - c. For the host product is not installed according to this guide, the module certification will be invalid, and a new grant certification will be required for the host product.
-
1. *Les conditions de fonctionnement du produit hôte doivent être telles qu'il existe une distance de séparation minimale de 20 cm (ou éventuellement supérieure à 20 cm) entre les structures rayonnantes de l'antenne et les personnes à proximité. Le fabricant hôte est tenu de confirmer les conditions d'utilisation du produit hôte pour s'assurer que la distance spécifiée dans les instructions est respectée. Dans ce cas, le produit hôte est classé comme un appareil mobile ou un appareil fixe aux fins d'exposition aux RF.*
 2. *Si l'émetteur modulaire doit être utilisé sur un type spécifique de plateforme hôte et installé de manière à pouvoir être utilisé à moins de 20 cm des utilisateurs ou des personnes à proximité, veuillez suivre les instructions ci-dessous.*
 - a. *Pour le produit hôte intégré à cet émetteur modulaire en tant que configuration autonome, la puissance conduite maximale de la subvention d'origine doit être conservée afin de répondre aux exigences d'exemption SAR.*
 - b. *Pour une configuration avec plusieurs émetteurs dans le même hôte, une évaluation de routine ou un test SAR pour la transmission simultanée des émetteurs colocalisés conformément à la norme KDB 447498 est nécessaire. Le produit hôte portable doit être évalué pour garantir le maintien de la conformité par un changement permissif ultérieur. Des instructions supplémentaires pour les produits hôtes portables sont fournies dans la publication KDB 996369 D02 et D04.*
 - c. *Si le produit hôte n'est pas installé conformément à ce guide, la certification du module sera invalide et une nouvelle certification sera requise pour le produit hôte.*

5.6.2 Portable Operation

To comply with RF exposure requirements, this equipment must be installed and used with the transmitter kept at a minimum distance of 5 mm from the user's body.

Afin de se conformer aux exigences de conformité en matière d'exposition aux RF, cet équipement doit être installé et utilisé en maintenant l'émetteur à une distance minimale de 5 mm du corps de l'utilisateur.

5.7 ETSI compliance (Europe)

This device has been tested for use in the European Union. TYPE 2NR complies with the following regulation test.

ETSI EN300 328, Ver. 2.2.2

Table 6: External Antenna to comply with ETSI

Ant. Type	Brand	Model No.	Freq. (MHz)	Peak Gain (dBi)
PCB	Inventek Systems, LLC.	W2.4-5P-U	2400-2484	3.73

If this device is used in a product, the OEM is responsible to verify compliance of the final product to the EU standards. A Declaration of Conformity must be issued and kept on file as described in Annex II of the Radio and Telecommunications Terminal Equipment Directive.

5.8 TELEC Notice (Japan)

The following conditions are applicable:

Radio Module

Antennas for Bluetooth:

Table 7: Antenna to comply with TELEC

Ant. Type	Brand	Model No.	Freq. (MHz)	Peak Gain (dBi)	Remarks
PCB	Murata Manufacturing	Integrated	2400-2484	-6.7	Built-in
PCB	Inventek Systems	W2.4-5P-U	2400-2484	3.73	40 x 6.0 x 0.5 mm
dipole	Molex	146187	2400-2484	3.2	40.95 x 9 x 0.7 mm
dipole	Molex	146153	2400-2484	3.2	35 x 9 x 0.1 mm
dipole	Molex	219611	2400-2484	2.67	35 x 15 x 0.7 mm
dipole	Unictron	WT32D1-KX	2400-2484	3	32 x 13 x 1.5 mm
dipole	Unictron	AA258	2400-2484	0.9	25 x 7 x 0.5 mm
dipole	Unictron	TA-38B-A-W01	2400-2484	2.61	10x133.5x19 mm
dipole	Unictron	TA-6B-A-WE01	2400-2484	2.23	φ7.5x89.5 mm
dipole	Taoglas	FXP830.07.0100C	2400-2484	2.5	42 x 7 x 0.1 mm
dipole	Taoglas	GW.48.A151	2400-2484	1.82	φ7.5 x 89.5 mm
dipole	Taoglas	GW.40.2153	2400-2484	3.15	φ10 x 109 mm
dipole	Taoglas	GW.52.A153	2400-2484	2.93	φ13 x 203 mm
dipole	Antenova	SRF2W012	2400-2484	3	30 x 6 x 0.15 mm
dipole	Sansei	STDANTEMD-013	2400-2484	1.9	36 x 8 x 0.6 mm
dipole	Laird	EMF2471A3S	2400-2484	2.2	36 x 12 x 0.3 mm
dipole	Kyocera AVX (KAVX)	1001932FT	2400-2484	2.5	35.2 x 8.5 x 0.2 mm
dipole	Kyocera AVX (KAVX)	1001932PT	2400-2484	2.03	35.2 x 8.5 x 0.4 mm
dipole	Kyocera AVX (KAVX)	W3P35x8W04	2400-2484	2.3	35.2 x 8.5 x 0.4 mm
dipole	Inventek	W24P-U	2400-2484	3.58	30 x 5 mm
dipole	Inventek	W2.4-5P-U	2400-2484	3.73	40 x 6 mm
dipole	TE	2344657	2400-2484	1.1	35 x 8.0 x 0.2 mm

5.9 Bluetooth Qualification

QDID: Q370633

DID/DN: Q380758

6 Dimensions, Marking, and Terminal Configurations

This section provides information about dimensions, markings, and terminal configuration for Type 2NR and the related parameters. **Figure 2** shows the dimensions, marking, and terminal configurations.

Figure 2: Dimensions, Markings, and Terminal Configurations

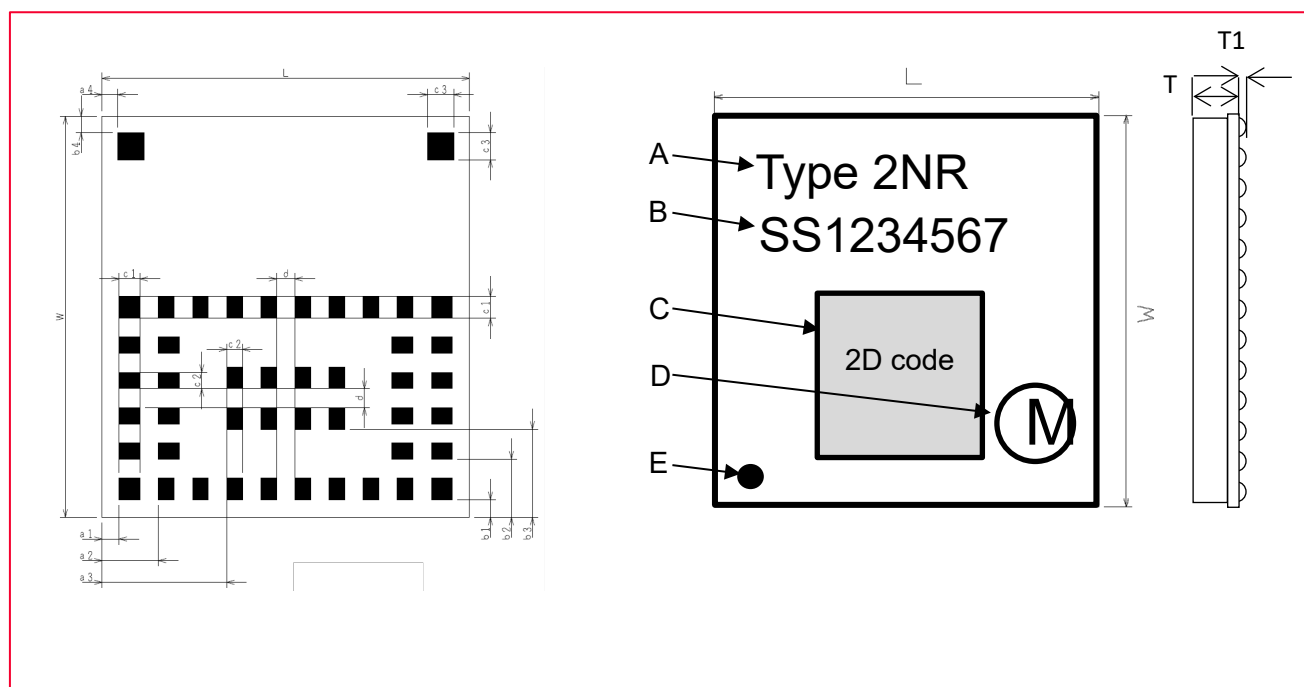


Table 8 describes the marking labels for the top and bottom view as shown in **Figure 2**.

Table 8: Markings (Top View)

Labels	Meaning
A	Module Type
B	Inspection Number
C	2D code
D	Murata Logo
E	Pin 1 Marking

Table 9 describes the markings.

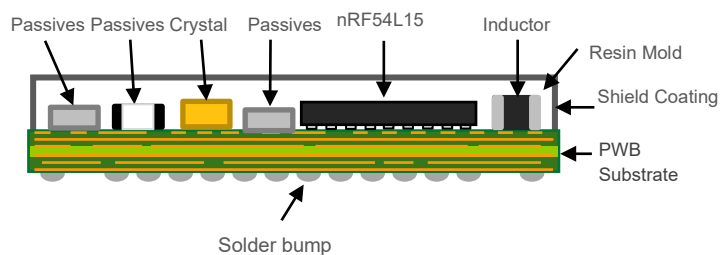
Table 9: Terminal Configuration (Top View, unit: mm)

Labels	Dimensions	Labels	Dimensions	Labels	Dimensions
L	7.0 +/- 0.20	W	7.4 +/- 0.20		
T	1.36 maximum	T1	0.04		
a1	0.325 +/- 0.20	b1	0.325 +/- 0.20	c1	0.40 +/- 0.10
a2	1.075 +/- 0.20	b2	1.075 +/- 0.20	c2	0.30 +/- 0.10
a3	2.375 +/- 0.20	b3	1.625 +/- 0.20	c3	0.50 +/- 0.10
a4	0.300 +/- 0.20	b4	0.300 +/- 0.20	d	0.35 +/- 0.10

6.1 Structure

Figure 3 shows the module structure.

Figure 3: Structure

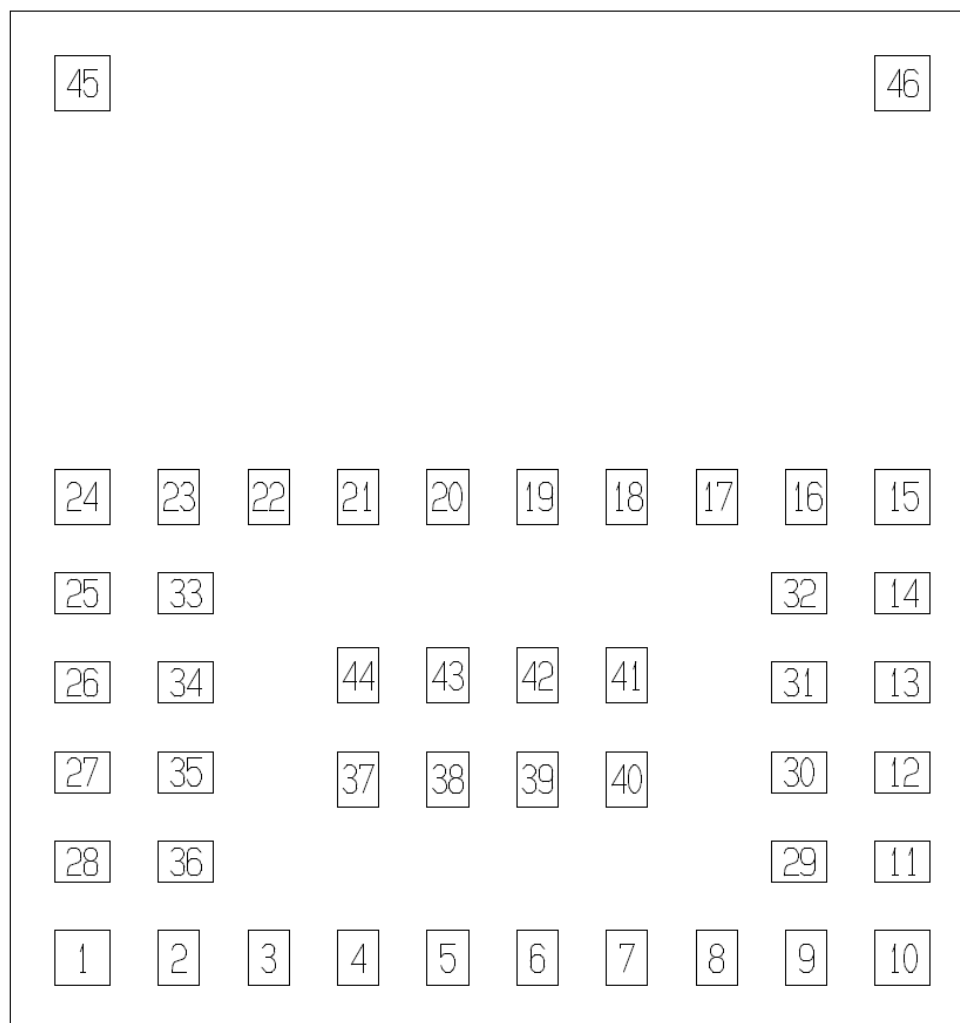


7 Module Pin Descriptions

This section describes the Type 2NR pin assignments and pin descriptions.

Type 2NR pin-assignment top view is presented in **Figure 4**.

Figure 4: Pin Assignments - Top View



The pin names/terminal names are listed in **Table 10**.

Table 10: Type 2NR Terminal Descriptions

No.	Terminal Name	No.	Terminal Name
1	P0.00	24	RF
2	Reset	25	P0.03
3	GND	26	P0.01
4	VDD	27	P1.13
5	SWDIO	28	P2.10
6	SWDCLK	29	P2.05
7	P1.05	30	P1.07
8	P1.08	31	P2.00
9	P1.03	32	P2.04
10	P1.02	33	P2.09

No.	Terminal Name	No.	Terminal Name
11	P1.04	34	P1.11
12	P2.01	35	P1.09
13	P1.00	36	P1.10
14	P1.06	37	GND
15	P1.01	38	P0.02
16	P2.02	39	P2.08
17	P1.15	40	GND
18	P2.03	41	GND
19	P1.14	42	P0.04
20	P2.06	43	P1.12
21	P2.07	44	GND
22	GND	45	NC
23	ANT	46	NC

7.1 Pin Descriptions

Table 11 lists the pin descriptions of Type 2NR.

Table 11: Type 2NR Pin Descriptions

No.	Pin name	Connection to IC		Type	Description	Dedicated Function
		Ball #	Ball Name			
1	P0.00	G1	P0.00	I/O	General purpose I/O	
2	Reset	D2	Reset	I/O	Pin reset with on-chip pull-up	
3	GND			GND		
4	VDD	B7/G3		Power	Power supply	
5	SWDIO	F2	SWDIO	I/O	Debug	
6	SWDCLK	E3	SWDCLK	I/O	Debug	
7					General purpose I/O TAMPC active shield 0 input RADIO DFEGPIO Analog input	TAMPC RADIO
	P1.05	E6	P1.05	I/O		
8					General purpose I/O GRTC HF clock output External reference for SAADC	
	P1.08	F7	P1.08	I/O		
9					General purpose I/O NFC antenna connection	
	P1.03	D5	P1.03	I/O NFC Input		
10					General purpose I/O NFC antenna connection	
	P1.02	C7	P1.02	I/O NFC Input		
11					General purpose I/O TAMPC active shield 0 output Analog input	TAMPC
	P1.04	D6	P1.04	I/O		
12					General purpose I/O SPIM SCK SPIS SCK QSPI SCK	SPIM00/20 SPIS00/S20 FLPR
	P2.01	G7	P2.01	I/O		
13					General purpose I/O Connection for 32.768 kHz crystal	
	P1.00	C5	P1.00	I/O		
14					General purpose I/O TAMPC active shield 1 output Analog input	TAMPC
	P1.06	D7	P1.06	I/O		
15					General purpose I/O Connection for 32.768 kHz crystal	
	P1.01	C6	P1.01	I/O		

No.	Pin name	Connection to IC		Type	Description	Dedicated Function
		Ball #	Ball Name			
16	P2.02	F6	P2.02	I/O	General purpose I/O SPIM SDO SPIS SDO UARTE TXD QSPI D0 Serial wire output (SWO)	SPIM00/20 SPIS00/20 UARTE00/20 FLPR Trace
17	P1.15	B6	P1.15	I/O	General purpose I/O	
18	P2.03	E5	P2.03	I/O	General purpose I/O QSPI D2	FLPR
19	P1.14	B5	P1.14	I/O	General purpose I/O RADIO DFEGPIO Analog input	RADIO
20	P2.06	F4	P2.06	I/O	General purpose I/O SPIM SCK SPIS SCK Trace clock	SPIM00/21 SPIS20/21 Trace
21	P2.07	E4	P2.07	I/O	General purpose I/O Trace data Serial wire output (SWO) SPIM DCX UARTE RXD	Trace Trace SPIM00/21 UARTE00/21
22	GND			GND		
23	ANT			RF	Connection to integrated antenna	
24	RF			RF	RF signal from/to IC	
25	P0.03	E1	P0.03	I/O	General purpose I/O GRTC PWM output	GRTC
26	P0.01	F1	P0.01	I/O	General purpose I/O	
27	P1.13	B4	P1.13	I/O	General purpose I/O RADIO DFEGPIO Analog input	RADIO
28	P2.10	G2	P2.10	I/O	General purpose I/O Trace data SPIM CS UARTE RTS	Trace SPIM00/21 UARTE00/21
29	P2.05	G5	P2.05	I/O	General purpose I/O SPIM CS UARTE RTS QSPI CS	SPIM00/20 UARTE00/20 FLPR
30	P1.07	E7	P1.07	I/O	General purpose I/O TAMPC active shield 1 input Analog input	TAMPC
31	P2.00	G6	P2.00	I/O	General purpose I/O SPIM DCX UARTE RXD QSPI D3	SPIM00/20 UARTE00/20 FLPR (QSPI)
32	P2.04	F5	P2.04	I/O	General purpose I/O SPIM SDI SPIS SDI UARTE CTS QSPI D1	SPIM00/20 SPIS00/20 UARTE00/20 FLPR
33	P2.09	F3	P2.09	I/O	General purpose I/O Trace data SPIM SDI SPIS SDI UARTE CTS	Trace SPIM00/21 SPIS00/21 UARTE00/21
34	P1.11	C4	P1.11	I/O	General purpose I/O TAMPC active shield 3 output RADIO DFEGPIO Analog input	TAMPC RADIO

No.	Pin name	Connection to IC		Type	Description	Dedicated Function
		Ball #	Ball Name			
35	P1.09	B3	P1.09	I/O	General purpose I/O TAMPC active shield 2 output RADIO DFEGPIO	TAMPC RADIO
36	P1.10	C3	P1.10	I/O	General purpose I/O TAMPC active shield 2 input RADIO DFEGPIO	TAMPC RADIO
37	GND			GND		
38	P0.02	E2	P0.02	I/O	General purpose I/O	
39	P2.08	D4	P2.08	I/O	General purpose I/O Trace data SPIM SDO SPIS SDO UARTE TXD	Trace SPIM00/21 SPIS00/21 UARTE00/21
40	GND			GND		
41	GND			GND		
42	P0.04	D3	P0.04	I/O	General purpose I/O GRTC LF clock output	GRTC
43	P1.12	A3	P1.12	I/O	General purpose I/O TAMPC active shield 3 input RADIO DFEGPIO Analog input	TAMPC RADIO
44	GND			GND		
45	NC					
46	NC					

7.2 GPIO Restrictions

GPIOs P1.09, P1.10, P1.11, and P1.12 (module pin 35, 36, 34, 43 respectively) can exhibit radiated emissions. [15.5] Emissions might exceed regulatory limits for some PCB configurations.

Workaround:

If GPIOs P1.09, P1.10, P1.11, and P1.12 are unused, leave the pins unconnected.

If one or more of the mentioned GPIOs are used, apply the following workaround:

- Add a 330 Ω or larger series resistance directly after the tracks enter the outer layer of the PCB.
- Keep PCB tracks as short as possible and in between ground layers if possible.
- Use toggling speed lower than 1 MHz.

Noted that Nordic latest Errata for Rev 2 [15.6] shows that the issue above is fixed.

7.3 Dedicated Pins

Table 12 describes the dedicated pins.

Table 12: Dedicated Pins

Peripheral	Description
UARTE20/21	Can use any pin on P1. Can connect across power domains to dedicated pins on P2.
SPIM00	Has dedicated pins on P2. For 32 MHz operation, the pins must be configured using extra high drive E0/E1 configuration in the DRIVE0/1 fields of the PIN_CNF GPIO register.
SPIM20/21	Can use any pins on P1. Can connect across power domains to dedicated pins on P2.
SPIS20/21	Can use any pins on P1. Can connect across power domains to dedicated pins on P2.
TRACE	Has dedicated pins that must be configured using extra high drive E0/E1 configuration in the DRIVE0/1 fields of the PIN_CNF GPIO register.
GRTC	Has dedicated pins for clock and PWM output.
TAMPC	Has dedicated pins for active shield input and output.
FLPR	Uses dedicated pins on P2 for emulated peripherals such as QSPI.
RADIO	Uses dedicated pins on P1 for antenna switch control (DFEGPIO for direction finding).
NFC	Uses dedicated pins as listed in the pin assignments table for the selected device. These pins are configured as NFC antenna pins from reset. To use the pins for Digital I/O, NFC function must be disabled in the NFCT — Near field communication tag peripheral.

8 Absolute Maximum Ratings

Table 13 Shows the absolute maximum rating values.

Table 13: Absolute Maximum Rating

Parameter	Minimum	Maximum	Unit
Storage Temperature	-40	+105	C
Supply Voltage VDD	-0.3	3.7	V

9 Operating Condition

Table 14 shows the operating conditions for Type 2NR module.

Table 14: Operating Conditions

Parameter	Minimum	Typical	Maximum	Unit
Operating Temperature	-40		+105	C
Supply Voltage (VDD)	1.7		3.4	V

9.1 External Sleep Clock Specifications

Table 15 describes the external low-frequency clock specifications.

Table 15: External Sleep Clock Specifications

Parameter	Minimum	Typical	Maximum	Unit
Nominal output frequency		32.768		KHz

9.2 Digital I/O Requirements

Digital I/O requirement parameters for 1.8V operation are listed in **Table 16**.

Table 16: Digital I/O Requirement Parameters Operation

Symbol	Parameter	Condition	Minimum	Typical	Maximum	Unit
V _{IH}	Input high voltage		0.7 × VDD		VDD	V
V _{IL}	Input low voltage		VSS		0.3 × VDD	V
V _{OH}	Output high voltage		VDD - 0.4		VDD	V
V _{OL}	Output low voltage		VSS		VSS + 0.4	V
I _{GPIO, TOTAL}	Recommended maximum sustained current drawn by all GPIOs				15	mA

10 DC/RF Characteristics

10.1 Typical Power Consumption

Table 17: Typical Power Consumption

Conditions: 25 °C, VDD = 3.3 V

RF Characteristics	Typical	Unit
Transmit LE 1Mbps at 8 dBm, DCDC mode	10.0	mA
Transmit LE 1Mbps at 4 dBm, DCDC mode	6.8	mA
Transmit LE 1Mbps at 0 dBm, DCDC mode	5.0	mA
Receive LE 1Mbps, DCDC mode	3.7	mA
Sleep Mode (System OFF)	1.2	μA

10.2 Bluetooth LE Radio Specification

Conditions: 25 °C, VDD = 3.0 V, at module pin pad

Table 18: Bluetooth LE RF Characteristics

RF Characteristics	Min	Typical	Max	Unit
Center frequency	2402	-	2480	MHz
Channel Spacing	-	2	-	MHz
Number of RF Channels	-	40	-	-
Max output power	-	8	-	dBm
Modulation Characteristics				
$\Delta f_{1\text{avg}}$	225	-	275	kHz
$\Delta f_{2\text{max}}$ (at 99.9%)	185	-	-	kHz
$\Delta f_{2\text{avg}} / \Delta f_{1\text{avg}}$	0.8	-	-	-
Carrier frequency offset and drift				
1) Frequency offset: $ f_n - f_{TX} $	-	-	150	kHz
2) Frequency drift: $ f_0 - f_n $	-	-	50	kHz
3) Drift rate #0: $ f_1 - f_0 $	-	-	23	kHz
4) Drift rate #n: $ f_n - f_{n-5} $	-	-	20	kHz
Receiver sensitivity (PER < 30.8%) 1Mbps mode	-	-95	-	dBm
Maximum input signal level (PER < 30.8%)	-10	-	-	dBm

10.3 IEEE 802.15.4 Radio Specification

Conditions: 25 °C, VDD = 3.0 V, at module pin pad

Table 19: IEEE802.15.4 RF Characteristics

RF Characteristics	Min	Typ.	Max	Unit
Center frequency	2405	-	2480	MHz
Channel Spacing	-	5	-	MHz
Number of RF Channels	-	16	-	-
Max output power	-	8	-	dBm
Modulation Characteristics				
Chip rate		2000		Kchip/s
Receiver sensitivity (PER < 30.8%)	-	-101	-	dBm
Maximum input signal level (PER < 30.8%)	-10	-	-	dBm

10.4 NFC Tag Electrical Specification

Conditions: 25 °C, VDD = 3.0 V, at module pin pad

Table 20: NFC Tag Electrical Characteristics

RF Characteristics	Min	Typ.	Max	Unit
Frequency of operation	12.55	13.56	13.57	MHz
Carrier modulation index	95	-	-	%
Data Rate	-	106	-	kbps
Peak differential field detect threshold level on NFC1-NFC2, with input being high impedance in sense mode	-	1.3	-	Vp
Maximum input current on NFCT pins		80	130	mA
T _{active}			625	μs
T _{sense}		7.2		μs

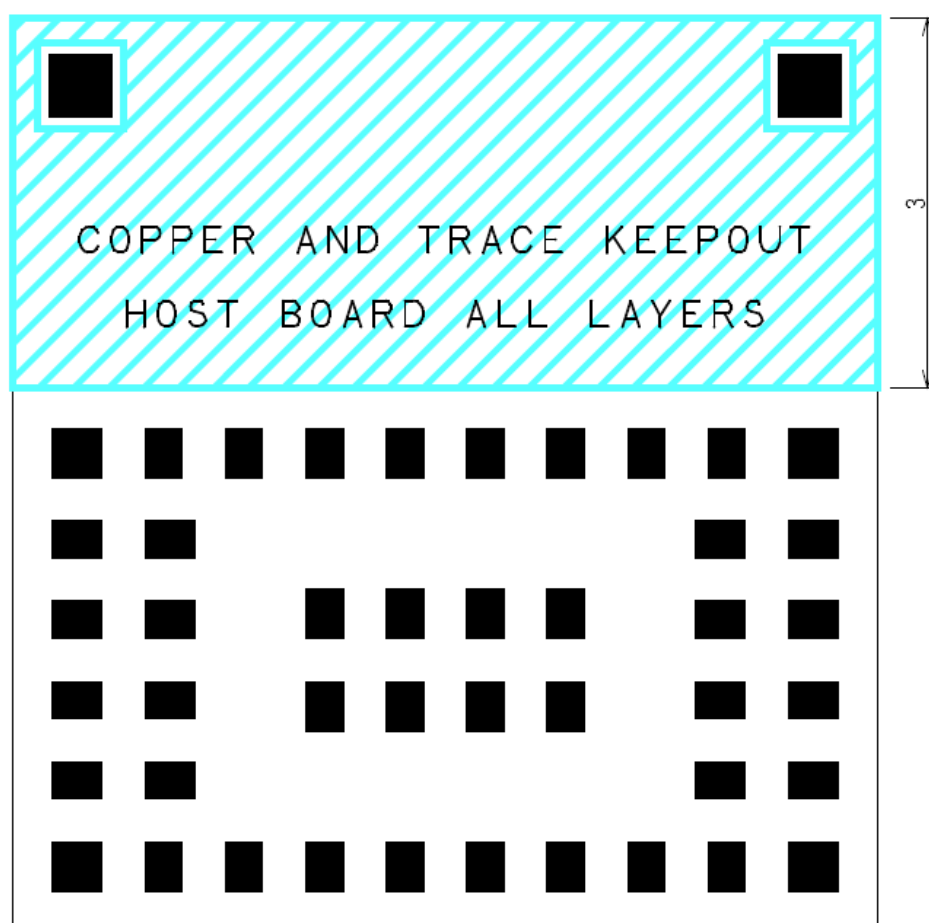
11 Application Information

11.1 Land Pattern

We recommend the host PCB land pattern be the same as the module pin pad pattern.

11.2 Host PCB Layout Recommendations

Figure 5: Host PCB Layout Recommendation, top view



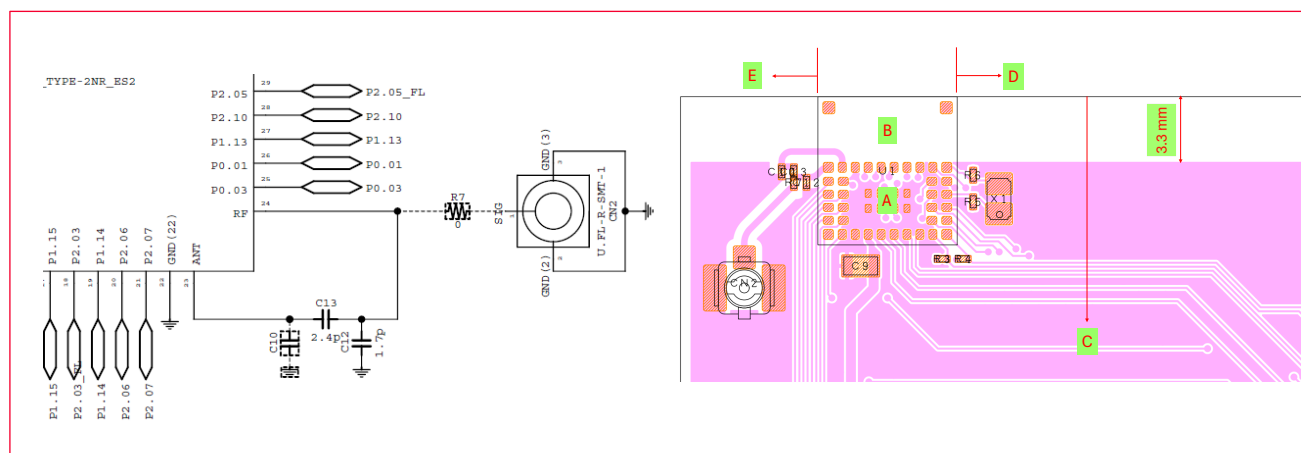
11.3 Onboard Antenna Instruction

The following guidelines should be followed when using the onboard antenna shown in **Figure 6**.

1. The module is recommended to be placed in the upper-left corner of the host PCB.
2. Around the antenna area, all layers of the host PCB should be free of any metal objects. Specifically, there should be no ground plane, traces, or metal shielding.
3. Host PCB length should be longer than 40 mm to achieve optimal performance using the PCB ground plane.
4. The area to the right of the antenna should also remain free of ground copper.

5. Metal and plastic components should be placed at least 3 mm away from the antenna region.
6. To use this onboard antenna, the integrator must provide a simple matching circuit between pins 23 and 24 of the module. This circuit connects the RF interface of the module directly to the onboard antenna. **Figure 6** shows the location of pins 23 and 24.

Figure 6: Location of Pins 23 and 24



11.3.1 Matching Requirement to Use the Onboard Antenna

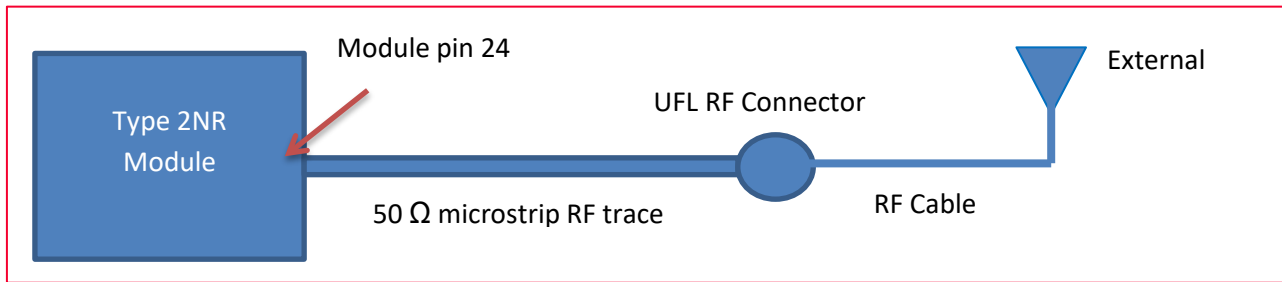
1. The Integrator must place the matching circuit between pins 23 and 24 of the module as shown in **Figure 6** to duplicate the structure used during FCC/IC testing of the Type 2NR module.
 - Use the exact part number provided for C10, C12 and C13 to meet regulatory requirements.
 - On the integrator's host board, place C13 between pins 23 and 24 of the Module. Place the C12 adjacent to pin 24. The other side of C12 should be attached to RF ground.
2. The RF trace impedance should be controlled to 50 Ω . The calculation can be done based on customer stack-up and material, see [Microstrip Structure for RF Trace](#).

11.4 RF Trace Design with External Antenna

11.4.1 External Antenna References

In addition to the internal PCB antenna, the Type 2NR module is also certified with external antennas shown in **Table 4**, **Table 5**, **Table 6**, and **Table 7**.

The external antenna should be connected to the Type 2NR module using 50 Ω microstrip RF trace and a U.FL RF connector as shown in **Figure 7**. The microstrip RF trace and U.FL connectors are placed on the host PCB and are external to the Type 2NR module. The external antenna is then connected to this UFL Connector via a 50 Ω RF adapter cable.

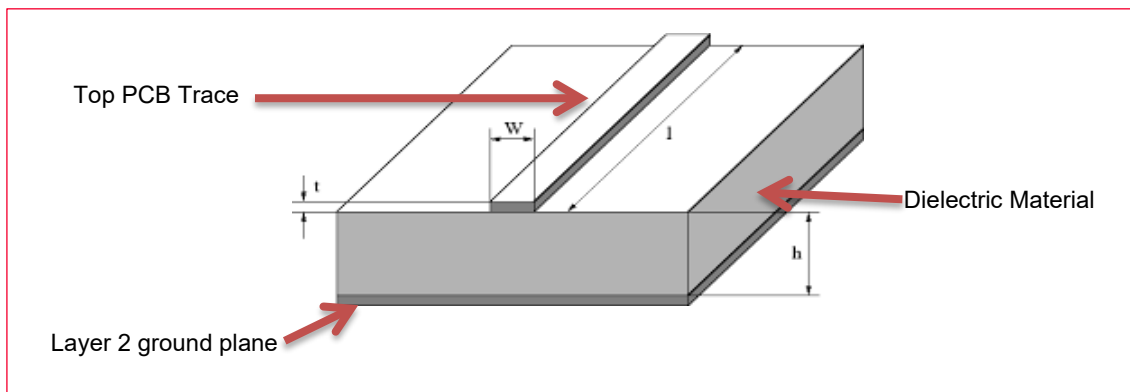
Figure 7: External Antenna Connection to the Module

11.4.2 Microstrip Structure for RF Trace

The diagram below shows the required microstrip structure to be routed between module pin 24 and the U.FL connector.

The top PCB trace carries RF energy from the module to the U.FL connector. The Layer 2 ground plane provides a return path for the circuit. The Dielectric material (along with the dimensions of the microstrip structures) determines the characteristic impedance of the microstrip transmission line.

Figure 8 shows the microstrip structure for the RF trace.

Figure 8: Microstrip Structure for RF Trace

Note the representative dimensions shown in the drawing (**Figure 8**). It is imperative that the module customer (the integrator) use the exact dimensions we recommend ensuring a 50 Ω impedance for this transmission line.

The following dimensions and/or ratios should be used to set the microstrip impedance to 50 Ω.

- **Dielectric (PCB) Material** – We recommend standard FR-4 PCB material. Other dielectrics will work but will require recalculation of microstrip dimensions. The following guidance is predicated on the use of FR-4 Dielectric. If FR-4 is not used for PCB material, please contact Murata Electronics at (678) 684-2009 to determine new dimensions for microstrip structure.
- **H (dielectric height)** – this is the thickness of dielectric between the trace layer (layer 1) and the ground plane on Layer 2. Note that Layer 2 must be electrical ground. We recommend a dielectric thickness of 8-15 mils. This range provides flexibility in PCB stack-up design.

- **t (trace thickness)** – Microstrip impedance is not severely affected by the thickness dimension. Standard 1 oz or 2 oz copper deposition is recommended. Equivalent thickness is 1-2 mils.
- **W (trace width)** – this is the crucial dimension. This width must be set correctly to obtain the desired 50 Ω impedance. When using FR-4 dielectric, the width (W) of the microstrip trace should be set to:
 - $W = H \times 1.8$Where W is microstrip trace width and H is dielectric height. Note that both values must be measured in identical units (mils or mm)
Example:
 - $H = 12 \text{ mils}, W = 12 \times 1.8 = 21.6 \text{ mils}$
 - $H = 0.4 \text{ mm}, W = 0.4 \times 1.8 = 0.72 \text{ mm}$
- **l (trace length)** – the impedance of the microstrip line is not dependent on its length. However, regulatory and performance limitations practically determine the actual length to be used by the customer (integrator). The length of this microstrip line must be longer than 7 mm to mimic the length used during FCC/IC certification of the 2NR module. Lengths greater than 7 mm are acceptable, although additional signal loss may occur. Given these restrictions, Murata recommends microstrip trace lengths between 7 and 25 millimeters.



In any event, the microstrip line must operate over the same Dielectric-Ground Plane configuration shown above to act as a 50 Ω transmission line. Do not run the microstrip trace through sections of PCB that do not have the Dielectric-Ground plane configuration shown above.

A reliable 50 Ω transmission line will be produced if the above guidance is closely followed. Any deviations from the guidance above may cause the module to operate in a non-compliant manner.

11.5 Reference Circuit

Please reference to [Type 2NR Product Webpage](#)

12 Tape and Reel Packing

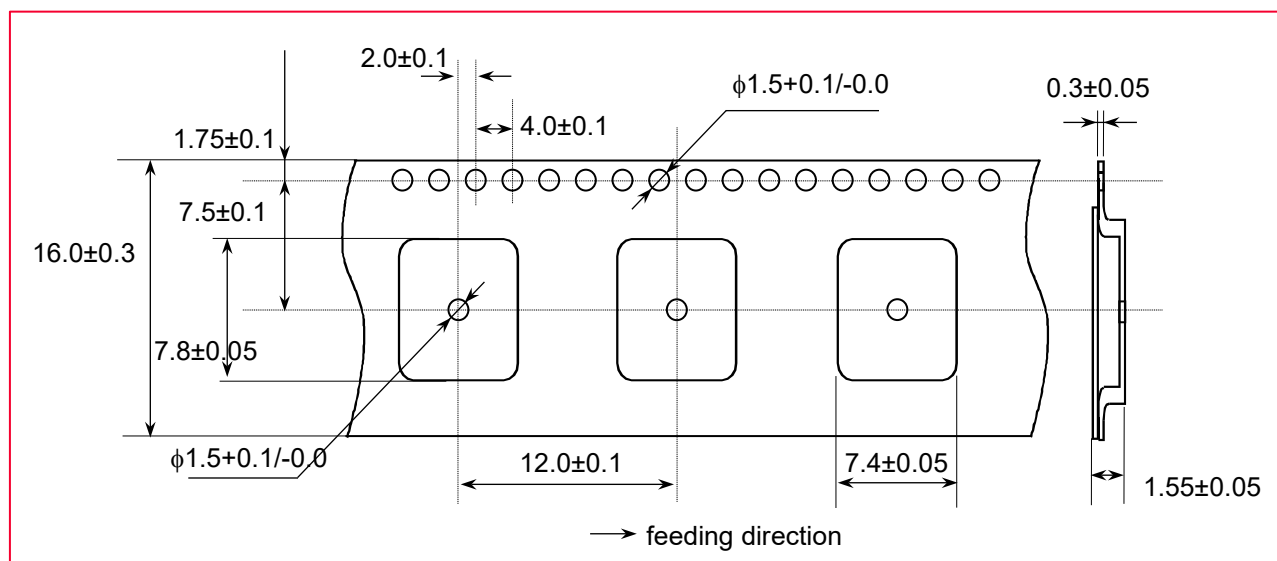
This section contains the following topics:

- Dimensions of Tape (Plastic tape)
- Dimensions of Reel
- Taping Diagrams
- Leader and tail tape
- Packaging

12.1 Dimensions of Tape (Plastic Tape)

Figure 9 is a graphical representation of the tape dimension (plastic tape).

Figure 9: Dimensions of Tape (Plastic Tape)

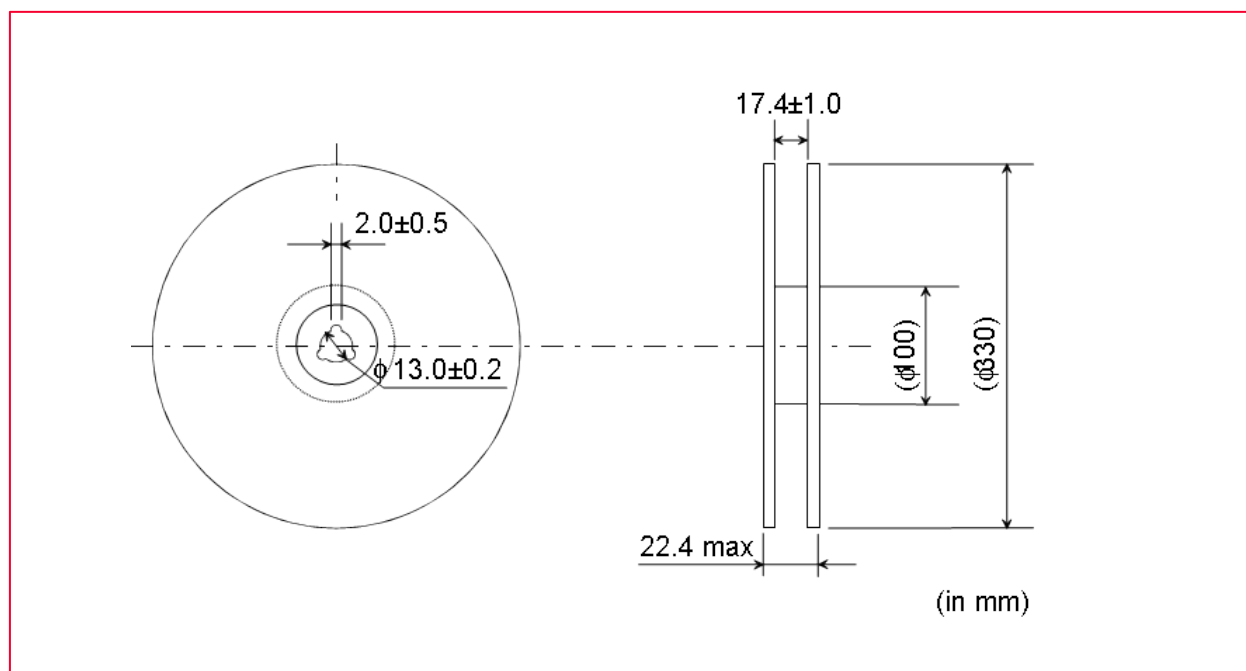


Cumulative tolerance of maximum 40 +/- 0.15 mm for every 10 pitches.

12.2 Dimensions of Reel

Figure 10 shows the reel dimensions.

Figure 10: Dimensions of Reel (Unit: Millimeters)



12.3 Taping Diagrams

Figure 11 shows the taping diagrams.

Figure 11: Taping Diagrams

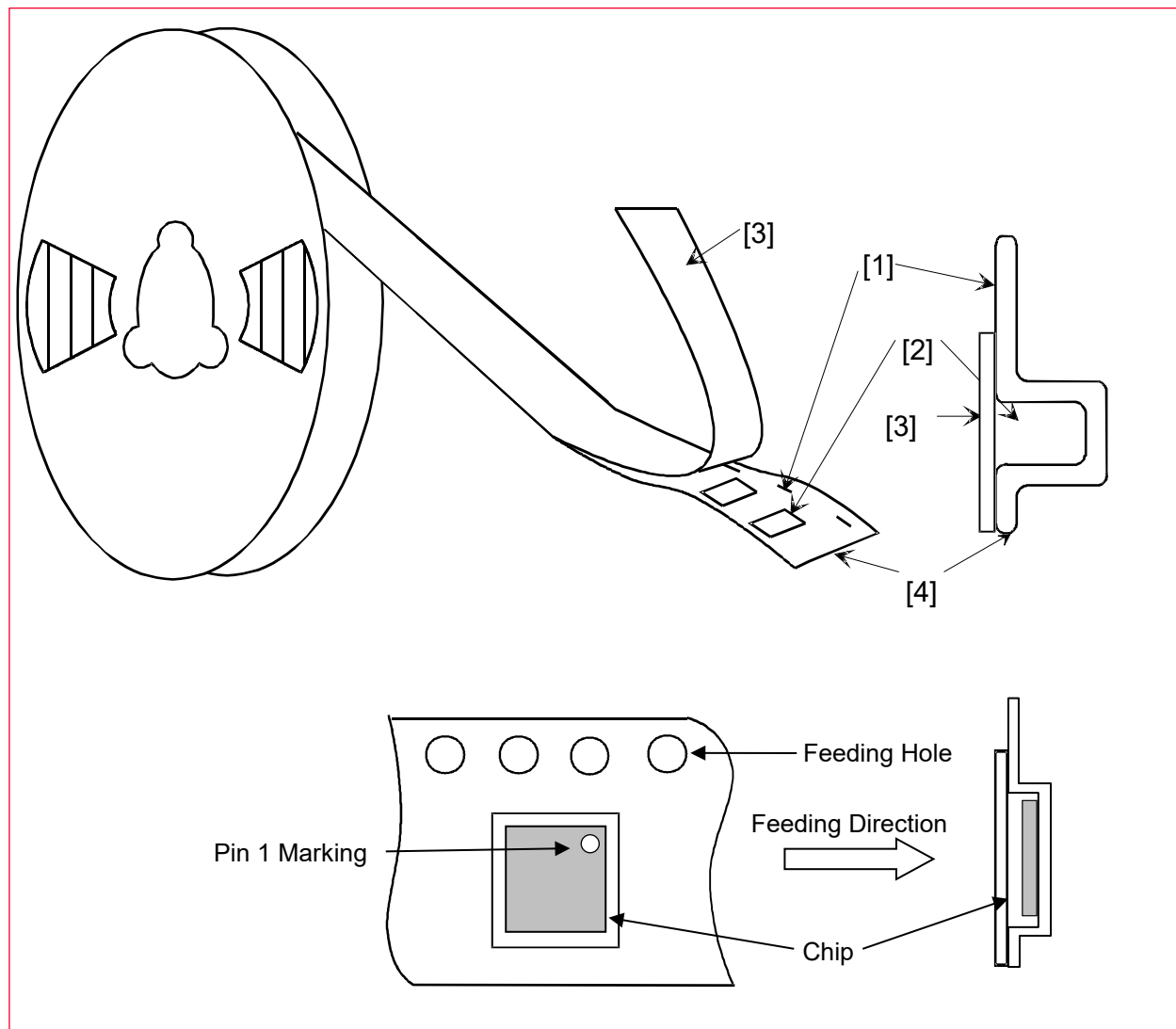


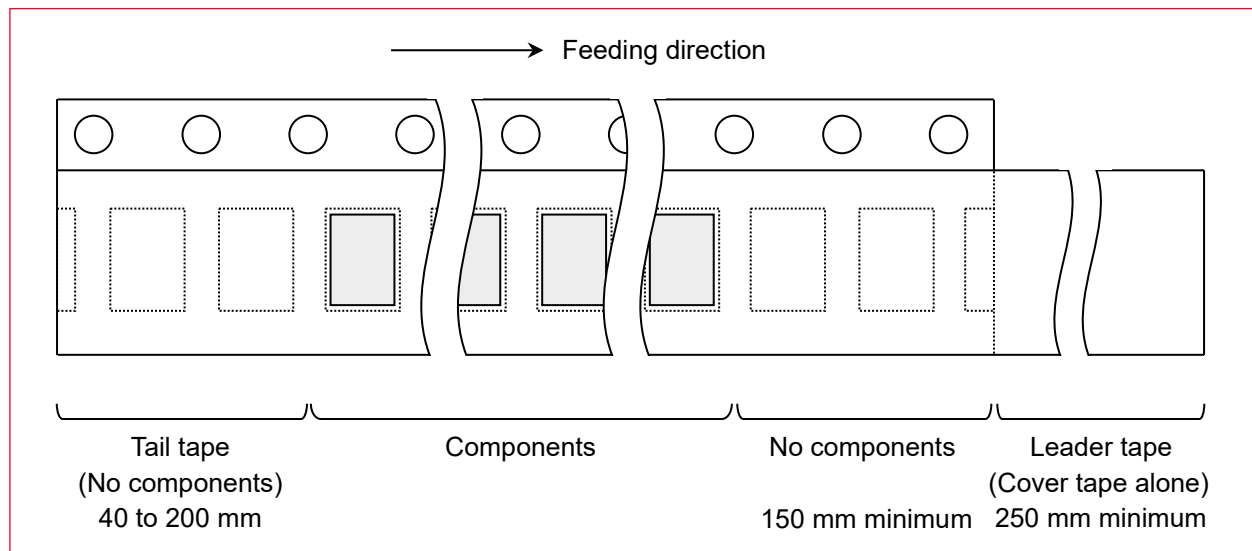
Table 21: Taping Specifications

Mark	Description
1	Feeding Hole. As specified in Dimensions of Tape (Plastic Tape) ☐.
2	Hole for chip. As specified in Dimensions of Tape (Plastic Tape) ☐.
3	Cover tape. 62 μm in thickness.
4	Base tape. As specified in Dimensions of Tape (Plastic Tape) ☐.

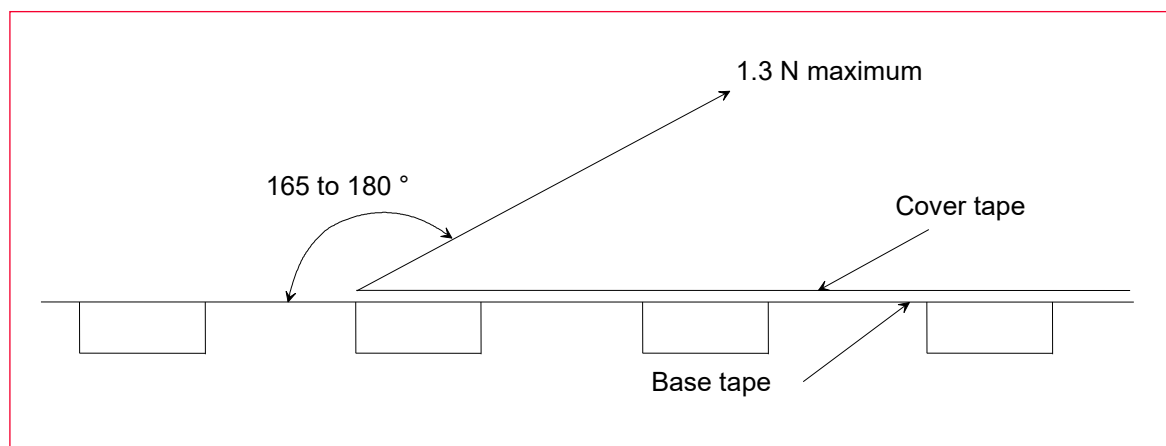
12.4 Leader and Tail Tape

The leader and tail tape are shown in **Figure 12**.

Figure 12: Leader and Tail Tape

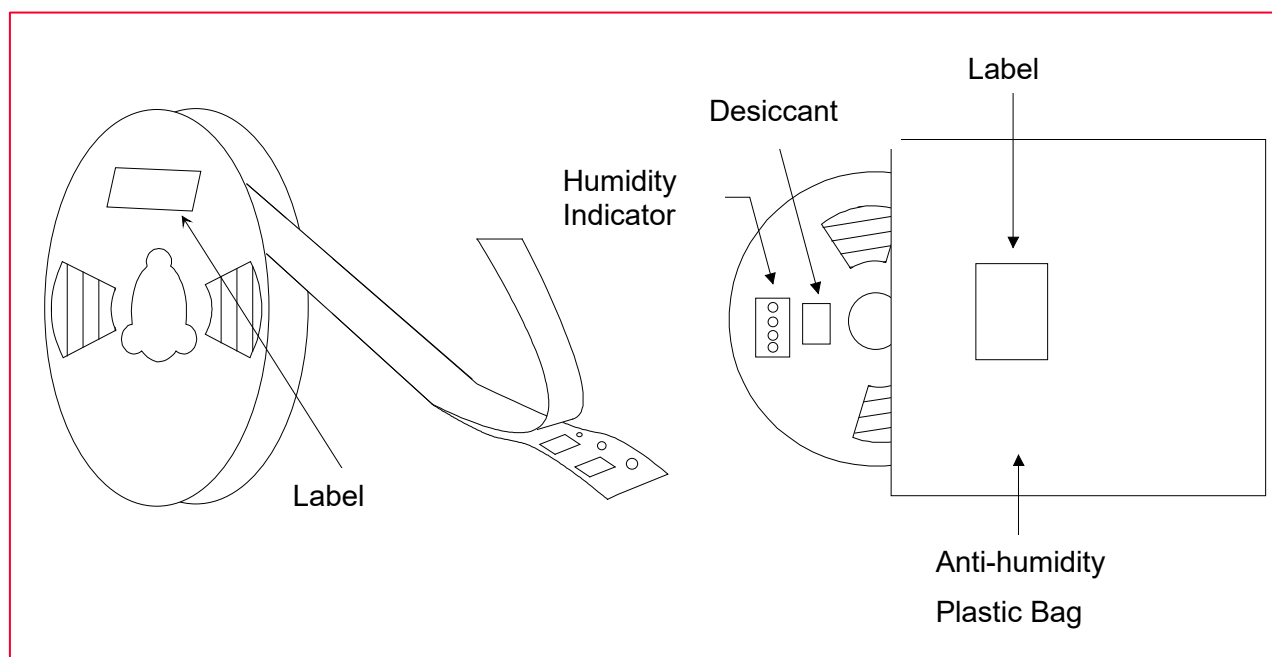


- The carrier tape is wound clockwise, the feeding holes to the right side as the tape is pulled toward the user.
- The cover tape and base tape are not adhered at no components area for 250 mm minimum.
- Tear off strength against pulling of cover tape: 5 N minimum.
- Packaging unit: 1000 pcs./ reel
- Material
- Base tape: Plastic
- Reel: Plastic
- Cover tape, cavity tape and reel are made the anti-static processing.
- Peeling off force: 1.3 N maximum. in the direction of peeling as shown in **Figure 13**.

Figure 13: Peeling Force

12.5 Packaging (Humidity Proof Packing)

The packaging is shown in **Figure 14**.

Figure 14: Humidity Proof Packing

Tape and reel must be sealed with the anti-humidity plastic bag. The bag contains the desiccant and the humidity indicator.

13 Notice

Please use this product within 6 months after receipt.

- The product shall be stored without opening the packing under the ambient temperature from 5 to 35 °C and humidity from 20 ~ 70 %RH.



Packing materials may be deformed at the temperature over 40 °C.

- The product is stored for more than 6 months after receipt, solderability should be verified before use.
- The product shall be stored in noncorrosive gas (Cl₂, NH₃, SO₂, NO_x, etc.).
- Any excess mechanical shock, including, but not limited to, sticking the packing materials by sharp object and dropping the product, shall not be applied in order not to damage the packing materials.

This product is applicable to MSL3 (Based on IPC/JEDEC J-STD-020)

- After the packing opened, the product shall be stored at <30 °C / <60 %RH and the product shall be used within 168 hours.
- When the color of the indicator in the packing changes, the product shall be baked before soldering.
 - **Baking condition:** 125 +5/-0 °C, 24 hours, 1 time



The products must be baked on the heat-resistant tray because the material (Base Tape, Reel Tape and Cover Tape) is not heat-resistant.

13.1 Handling Conditions

Be careful in handling or transporting products because excessive stress or mechanical shock may break products.

Handle with care if products may have cracks or damages on their terminals, the characteristics of products may change. Do not touch products with bare hands that may result in poor solder ability and destroy by static electrical charge.

13.2 Standard PCB Design (Land Pattern and Dimensions)

All the ground terminals should be connected to the ground patterns. Furthermore, the ground pattern should be provided between IN and OUT terminals. Please refer to the specifications for the standard land dimensions.

The recommended land pattern and dimensions is Murata's standard. The characteristics of products may vary depending on the pattern drawing method, grounding method, land dimensions, land forming method of the NC terminals and the PCB material and thickness. Therefore, be sure to verify the characteristics in the actual set. When using non-standard lands, contact Murata beforehand.

13.3 Notice for Chip Placer

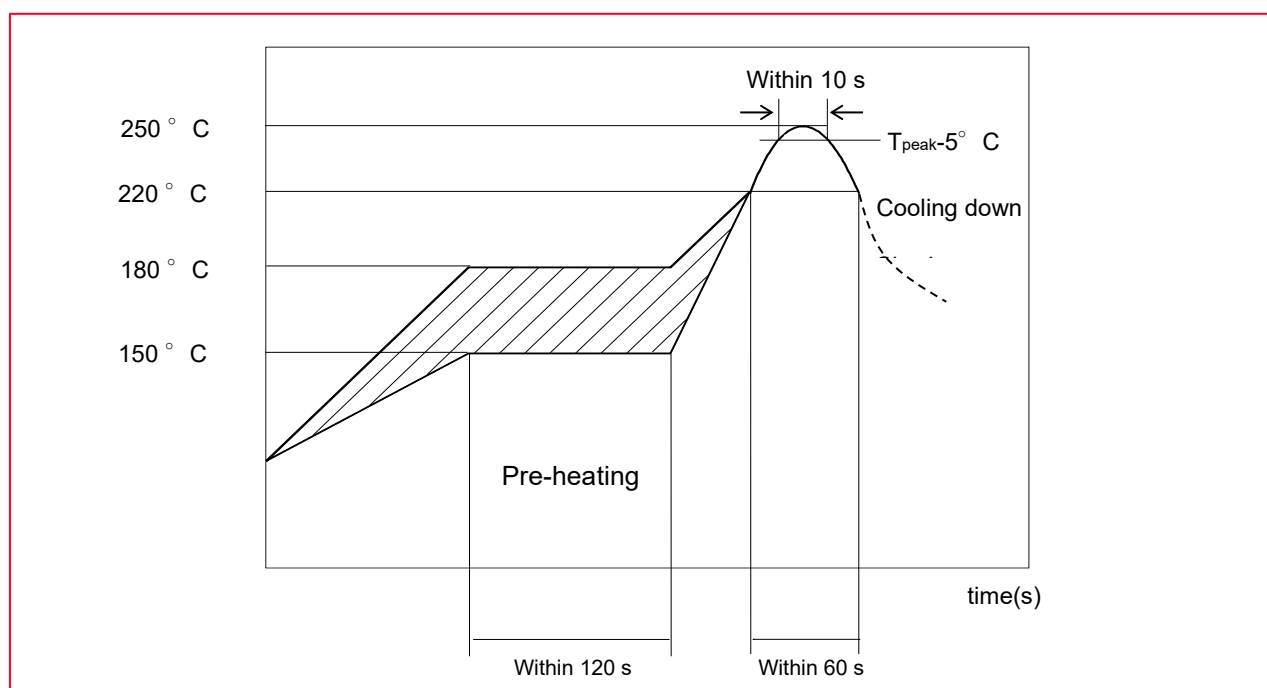
When placing products on the PCB, products may be mechanically stressed and damaged by uneven forces from a worn-out chucking locating claw or a suction nozzle. To prevent products from such damage, make sure to follow the specifications for the maintenance of the chip placer being used. For the positioning of products on the PCB, be aware that mechanical contact may damage products.

13.4 Soldering Conditions

The recommendation conditions of soldering are as shown in **Figure 15**.

Soldering must be carried out under the above-mentioned conditions to prevent products from damage. Set up the highest temperature of reflow within 260 °C. Contact Murata before use if concerning other soldering conditions.

Figure 15: Reflow Soldering Standard Conditions (Example)



Please use the reflow within 2 times.
Use rosin type flux or weakly active flux with a chlorine content of 0.2 wt % or less.

13.5 Cleaning

Since this Product is Moisture Sensitive, any cleaning is not recommended. If any cleaning process is done the customer is responsible for any issues or failures caused by the cleaning process.

13.6 Operational Environment Conditions

Products are designed to work for electronic products under normal environmental conditions (ambient temperature, humidity, and pressure). Therefore, products have no problems to be used under the similar conditions to the above-mentioned. However, if products are used under the following circumstances, it may damage products and leakage of electricity and abnormal temperature may occur.

- In an atmosphere containing corrosive gas (Cl_2 , NH_3 , SO_x , NO_x etc.).
- In an atmosphere containing combustible and volatile gases.
- Dusty place.
- Direct sunlight place.
- Water splashing place.
- Humid place where water condenses.
- Freezing place.

If there are possibilities for products to be used under the preceding clause, consult with Murata before actual use.

As it might be a cause of degradation or destruction to apply static electricity to products, do not apply static electricity or excessive voltage while assembling and measuring.

14 Preconditions to Use Our Products



PLEASE READ THIS NOTICE BEFORE USING OUR PRODUCTS.

Please make sure that your product has been evaluated and confirmed from the aspect of fitness for the specifications of our product when our product is mounted to your product.

All the items and parameters in this product specification/datasheet/catalog have been prescribed on the premise that our product is used for the purpose, under the condition and in the environment specified in this specification. You are requested not to use our product deviating from the condition and the environment specified in this specification.

Please note that the only warranty that we provide regarding the products is their conformance to the specifications provided herein. Accordingly, we shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this specification.

WE HEREBY DISCLAIM ALL OTHER WARRANTIES REGARDING THE PRODUCTS, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, THAT THEY ARE DEFECT-FREE, OR AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS.

You agree that you will use any and all software or program code (including but not limited to hcd, firmware, nvram, and blob) we may provide or to be embedded into our product ("Software") provided that you use the Software bundled with our product. YOU AGREE THAT THE SOFTWARE SHALL BE PROVIDED TO YOU "AS IS" BASIS, MURATA MAKES NO REPRESENTATIONS OR WARRANTIES THAT THE SOFTWARE IS ERROR-FREE OR WILL OPERATE WITHOUT INTERRUPTION. AND MORE, MURATA MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED WITH RESPECT TO THE SOFTWARE. MURATA EXPRESSLY DISCLAIM ANY AND ALL WARRANTIES OR CONDITIONS OF

MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE NOR THE WARRANTY OF TITLE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS.

You shall indemnify and hold harmless us, our affiliates, and our licensor from and against any and all claims, costs, expenses and liabilities (including attorney's fees), which arise in connection with the using the Software.

The product shall not be used in any application listed below which requires especially high reliability for the prevention of such defect as may directly cause damage to the third party's life, body or property. You acknowledge and agree that, if you use our products in such applications, we will not be responsible for any failure to meet such requirements.

Furthermore, YOU AGREE TO INDEMNIFY AND DEFEND US AND OUR AFFILIATES AGAINST ALL CLAIMS, DAMAGES, COSTS, AND EXPENSES THAT MAY BE INCURRED, INCLUDING WITHOUT LIMITATION, ATTORNEY FEES AND COSTS, DUE TO THE USE OF OUR PRODUCTS IN SUCH APPLICATIONS.

- Aircraft equipment.
- Aerospace equipment.
- Undersea equipment.
- Power plant control equipment.
- Medical equipment.
- Transportation equipment (vehicles, trains, ships, elevator, etc.).
- Traffic signal equipment.
- Burning / explosion control equipment.
- Disaster prevention / crime prevention equipment.
- Application of similar complexity and/ or reliability requirements to the applications listed in the above.

Even in the unlikely event that an abnormality or malfunction occurs in this product under operating conditions that conform to the specifications, be sure to add an appropriate fail-safe function to the system to prevent secondary accidents.

We expressly prohibit you from analyzing, breaking, Reverse-Engineering, remodeling altering, and reproducing our product. Our product cannot be used for the product which is prohibited from being manufactured, used, and sold by the regulations and laws in the world.

We do not warrant or represent that any license, either express or implied, is granted under any our patent right, copyright, mask work right, or our other intellectual property right relating to any combination, machine, or process in which our products or services are used. Information provided by us regarding third-party products or services does not constitute a license from us to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from us under our patents or other intellectual property.

Please do not use our products, our technical information and other data provided by us for the purpose of developing of mass-destruction weapons and the purpose of military use.

Moreover, you must comply with "foreign exchange and foreign trade law", the "U.S. export administration regulations", etc.

Please note that we may discontinue the manufacture of our products, due to reasons such as end of supply of materials and/or components from our suppliers.

Customer acknowledges that Murata will, if requested by you, conduct a failure analysis for defect or alleged defect of Products only at the level required for consumer grade Products, and thus such analysis may not always be available or be in accordance with your request (for example, in cases where the defect was caused by components in Products supplied to Murata from a third party).

By signing on specification sheet or approval sheet, you acknowledge that you are the legal representative for your company and that you understand and accept the validity of the contents herein.

When you are not able to return the signed version of specification sheet or approval sheet within 90 days from receiving date of specification sheet or approval sheet, it shall be deemed to be your consent on the content of specification sheet or approval sheet.

Customer acknowledges that engineering samples may deviate from specifications and may contain defects due to their development status.

We reject any liability or product warranty for engineering samples.

In particular we disclaim liability for damages caused by

- The use of the engineering sample other than for evaluation purposes, particularly the installation or integration in the product to be sold by you,
- Deviation or lapse in function of engineering sample,
- Improper use of engineering samples.

We disclaim any liability for consequential and incidental damages.

This Precondition to Use Our Products stipulated in this datasheet can only be modified, amended or altered by documents that explicitly reflect the mutual consent of both parties (including instances where one party explicitly indicates its acceptance of terms provided by the other party through click-through agreements).

If you can't agree the above contents, you should inquire our sales.

15 References

15.1 nRF54L15, nRF54L10, and nRF54L05 Wireless SoCs Datasheet, Rev. 1.0, Nordic Semiconductor

15.2 Type 2NR EVK User Guide, Murata

15.3 Type 2NR EVK Schematic, Murata

15.4 Type 2NR EVK BOM, Murata

15.5 nRF54L15 Revision 1 Errata v1.0

15.6 nRF54L15 Revision 2 Errata v1.0

Revision History

Revision	Date	Author	Change Description
A	Oct 30, 2024	YF	Initial Release
B	Feb 18, 2025	YF	Updated table 4 Markings.
3	May 7, 2025	YF	Correct the part number in section 3. Revised the revision from letter to number.
4	July 2, 2025	YF	Update pin out change; added section 7.2 7.2 GPIO Restrictions; added section 10.1, Typical power consumption
5	Nov 5, 2025	YF	Updated the module height and Section 10.3, Table 15
5.1	Nov 24, 2025	YF	Updated section 13.1, 13.2, and 13.2 Correct typo in Table 6. Pin 36 should be P1.10.
5.2	Dec 16, 2025	YF	Correct the dimensions mistake, b2 and bf3 in table 5.
5.3	Jan 14, 2026	YF	Correct the pin1-marking in Figure 7
5.4	Mar 26, 2026	YF	Updated the certification information and application information. Updated the operating temperature range to: -40 °C to 105 °C Update the storage temperature range to: -40 °C to 105 °C Updated Figure 9
5.5	May 13, 2026	YF	Multiple editorial changes. Removed external antenna reference table from Section 11.4.1.
5.6	July 31, 2026	YF	Remove "Preliminary". Corrected Key Feature: 5.0 mA TX @ 0 dBm / 3.3 V; 3.7 mA RX @ 1 Mbps / 3.3 V; 1.2 µA Sleep @ 3.3 V Updated Section 14, Preconditions to Use Our Products



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