

## Product Description

The LumenRadio MWA-N3 (Third generation Mira Wide Area) module is an industrial grade, long-range, multi-standard radio module, designed for high volume production.

MWA-N3 has an improved link budget due to a new state of the art RF-frontend design. The improved link budget results in longer operational range possible compared to MWA-N2.

An onboard antenna option has been added to the MWA-N3 and selecting between onboard and external antenna is easily done in firmware. MWA-N3 is based on the Nordic Semiconductor nRF52840 and features a powerful ARM Cortex M4 microcontroller and a dual radio for Bluetooth-based protocols and 802.15.4-based protocols. MWA-N3 is optimized for running MiraOS and the MiraMesh radio stack.

The MiraOS, MSS (Multi-Standard Support) feature allows concurrent operation of MiraMesh and Bluetooth v5.0, as well as 802.15.4 based protocols. This feature provides reliable mesh networking through MiraMesh with concurrent support for easy commissioning, local control and user interaction (UX/UI) over Bluetooth v5.0/NFC using a smartphone or tablet. Ultra-low energy consumption allows for battery-powered products or energy harvesting operation. MWA-N3 is an SMD module and thanks to its small footprint it can be easily integrated into any product.

Best-in-class range (up to 1500m line-of-sight), thanks to the improved built-in PA and LNA.



## Features

- Optimized for MiraOS operation
- Based on Nordic Semiconductor nRF52840 chipset
- External antenna connector interface
- Onboard antenna option
- Automated PA and LNA control for ultra-long range operation.
- Concurrent Bluetooth operation
- NFC-A support
- ARM Cortex-M4F at 64MHz operation
- 1MB flash and 256kB RAM
- AES 128-bit ECB/CCM/AAR hardware accelerator
- 12bit ADC, SPI, I2C, UART, PWM, USB 2.0, GPIO
- Pre certified for Europe (ETSI RED), US (FCC/CFR 47 Part 15 unlicensed modular transmitter approval), Canada (IC RSS)

## Specifications

- Range: up to 1500m free line of sight between two devices.
- External antenna connector RF Output: Max 19.5 dBm
- Sensitivity: -96dBm
- 115.5dB link budget
- u.FL/IPEX external antenna connector
- Frequency band: 2.45 GHz, ISM band (2402-2480 MHz)
- Supply voltage range 3.0 - 3.6V
- Peak average current consumption 150mA in high power mode.
- -40 – +75 °C operating temperature
- Dimensions: 33.5 x 18.5 x 3.77mm

## Table of Contents

1	Specifications.....	4
1.1	Absolute maximum ratings.....	4
1.2	Operating temperature range.....	4
1.3	Power supply.....	4
1.4	Digital I/O pins.....	5
1.5	RF Performance.....	5
1.6	Mechanical specification.....	6
2	Pin assignments.....	7
3	Power supply recommendations.....	9
4	Layout considerations.....	9
4.1	Antenna.....	9
4.2	MWA-N3 module PAD dimensions.....	9
4.3	Layout considerations for the main board.....	10
4.4	Guidelines for optimal performance for optional internal antenna.....	10
5	Recommended antennas.....	12
5.1	LumenRadio, 2.15dBi dipole antenna.....	12
5.2	LumenRadio, 5dBi dipole antenna.....	13
6	Product Verification and Testing.....	14
6.1	Design Verification.....	14
6.2	Production Testing.....	14
7	MWA-N3 module Packaging.....	14
7.1	Carrier tape dimensions.....	14
7.2	Reel marking.....	15
8	MWA-N3 reflow soldering specification.....	16
9	Compliance information.....	17
9.1	FCC information.....	17
9.1.1	Federal Communication Commission Interference Statement.....	17
9.1.2	FCC Declaration of Conformity.....	17
9.1.3	FCC Radiation Exposure Statement.....	17
9.1.4	End Product Labelling.....	18
9.1.5	Manual Information to the End User.....	18
9.1.6	Approved antennas.....	18
9.2	Industry Canada statement.....	18

**MWA-N3 radio module integration guide**

Version: 4, Sep 14, 2022

---

9.3 CE ..... 19

9.4 Other Compliances..... 19

10 RoHS / REACH..... 19

11 Contact and Ordering information .....20

## 1 Specifications

- External antenna connector RF Output: Max 19.5 dBm
- Sensitivity: -96dBm
- 115.5dB link budget
- u.FL/IPEX external antenna connector
- Frequency band: 2.45 GHz, ISM band (2402-2480 MHz)
- Dimensions: 33.5 x 18.5 x 3.77mm

### 1.1 Absolute maximum ratings

Maximum ratings are the extreme limits to which the MWA-N3 module can be exposed for a limited amount of time without permanently damaging it. Exposure to absolute maximum ratings for prolonged periods of time may affect the reliability of the device.

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{DD}$	Supply voltage	-0.3		3.9	V
$T_A$	Operating temperature	-30		75	°C
$V_{IO}$	IO Input voltage $V_{DD} \leq 3.6V$			$V_{DD} + 0.3$	V
$V_{IO}$	IO Input voltage $V_{DD} > 3.6V$			3.9	V
$V_{SS}$	Ground pad voltage			0.0	V
$T_S$	Storage temperature	-40		+125	°C
$RF_{in}$	RF input power			+10	dBm
<b>ESD</b>	ESD all pins, Human Body Model			1	kV

### 1.2 Operating temperature range

Symbol	Parameter	Min.	Typ.	Max.	Unit
$T_A$	Operating temperature	-30		75	°C

### 1.3 Power supply

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{DD}$	Supply voltage	3.0	3.3	3.6	V
$I_{DD}$	Peak supply current		150	250	mA
$V_{RISE}$	Supply rise time (0 V to 3.7 V)			60	ms

## 1.4 Digital I/O pins

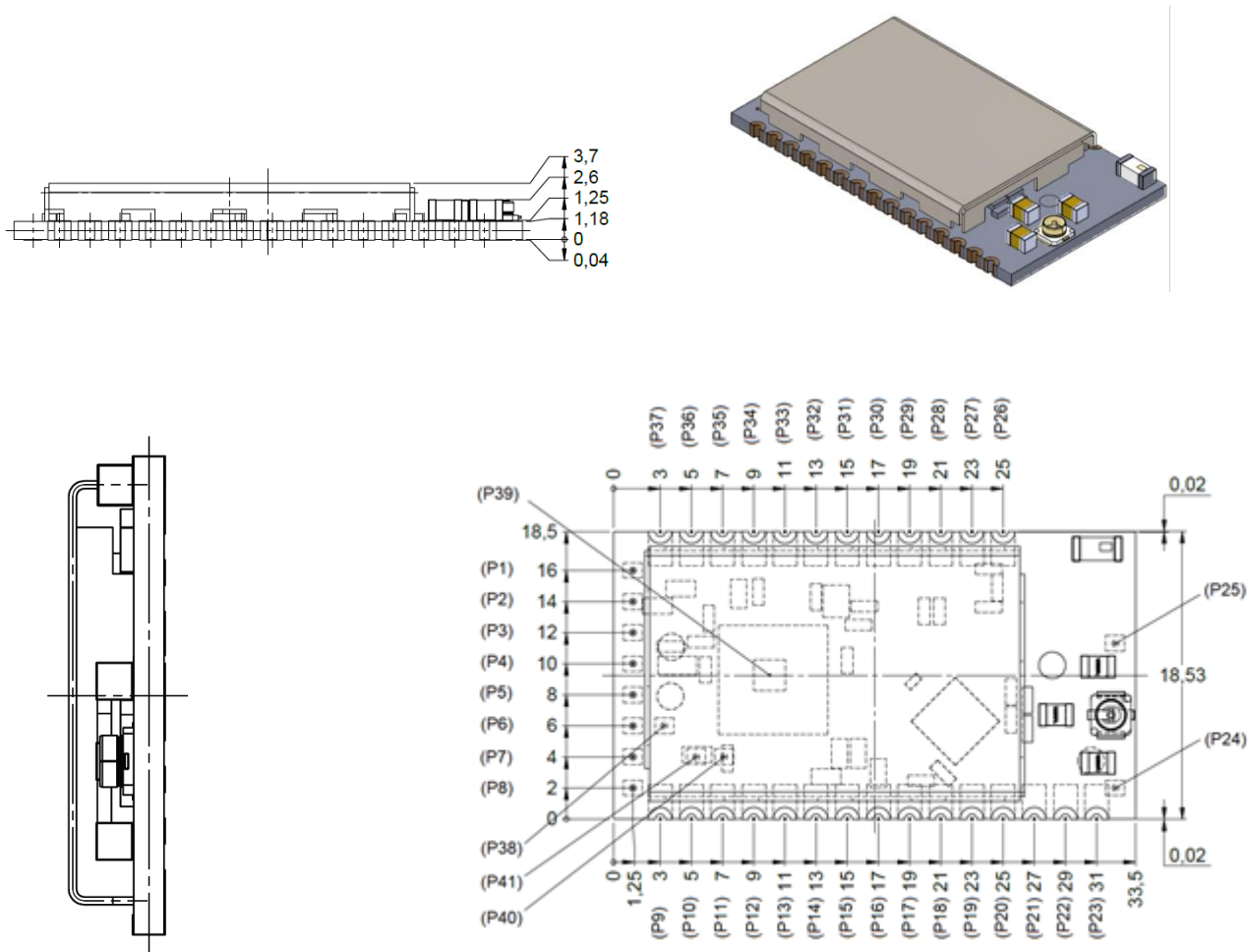
Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{IL}$	Input voltage logic low	0		$0.3 \cdot V_{DD}$	V
$V_{IH}$	Input voltage logic high	$0.7 \cdot V_{DD}$		$V_{DD}$	V
$V_{OL}$	Output voltage logic low	0		0.4	V
$V_{OH}$	Output voltage logic high	$V_{DD}-0.4$		$V_{DD}$	V

## 1.5 RF Performance

RF performance below is valid at an ambient temperature of 25°C and a supply voltage of 3.3 V.

Symbol	Parameter	Min.	Typ.	Max.	Unit
$f_{range}$	Operating frequency range	2402		2480	MHz
$RX_{sens}$	Receiver sensitivity (0.1% BER)		-96		dBm
$TX_{pout}$	TX output power		19.5		dBm

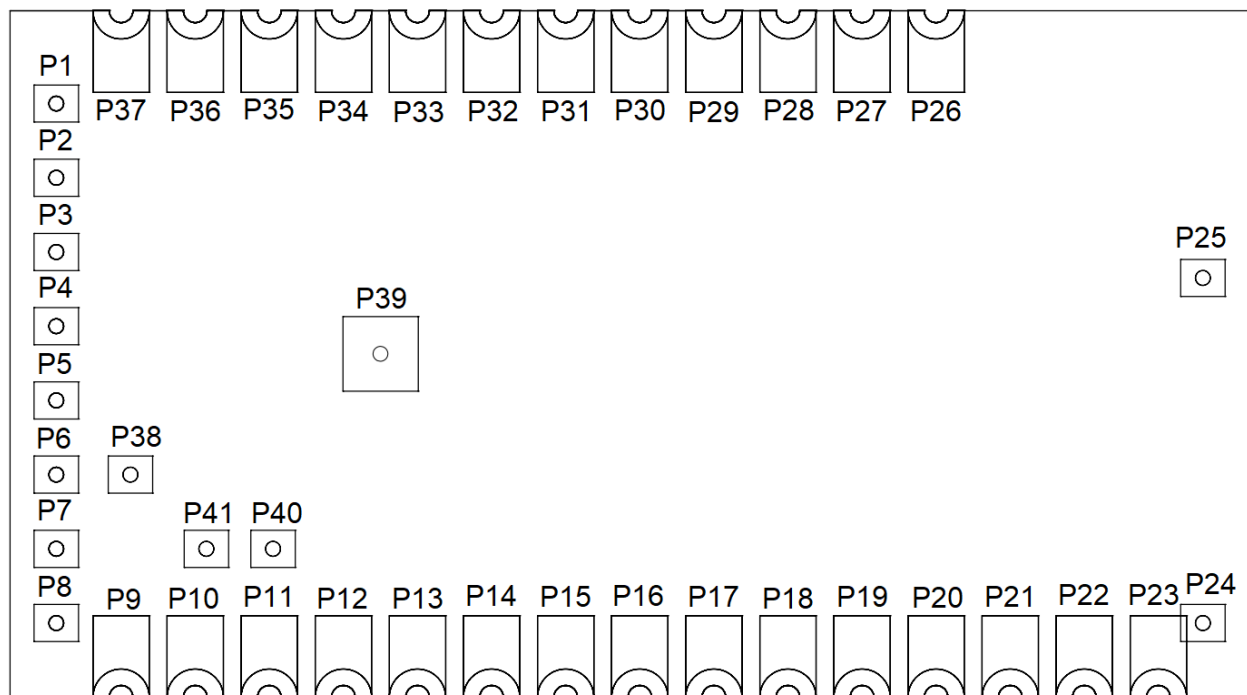
## 1.6 Mechanical specification



All dimensions in mm

Mechanical design files in .stp and .dxf format is available for download at the [LumenRadio online support page](#) for the MWA-N3 module.

## 2 Pin assignments



### Module seen from the top

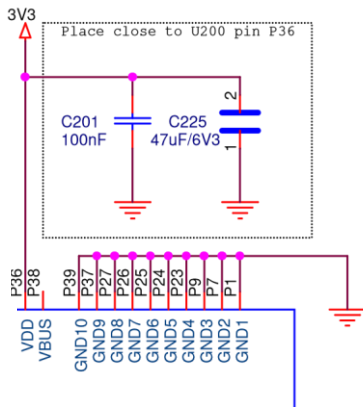
Pin number	nRF52840 pin name	Pin type	Description
<b>P1</b>	VSS	Power	Ground (0V)
<b>P2</b>	P0.04/AIN2	Digital I/O, Analog Input	
<b>P3</b>	P0.05/AIN3	Digital I/O, Analog Input	
<b>P4</b>	P0.06	Digital I/O	
<b>P5</b>	P0.08	Digital I/O	
<b>P6</b>	P1.08	Digital I/O	
<b>P7</b>	VSS	Power	Ground (0V)
<b>P8</b>	P1.09	Digital I/O	
<b>P9</b>	VSS	Power	Ground (0V)
<b>P10</b>	P0.12	Digital I/O	
<b>P11</b>	P0.11	Digital I/O	
<b>P12</b>	P0.18/nRESET	Digital I/O, Configurable as system RESET	
<b>P13</b>	P0.20	Digital I/O	
<b>P14</b>	P0.22	Digital I/O	
<b>P15</b>	P0.23	Digital I/O	
<b>P16</b>	P0.24	Digital I/O	
<b>P17</b>	P1.00	Digital I/O	
<b>P18</b>	P0.10/NFC	Digital I/O, NFC antenna connection	Low frequency I/O
<b>P19</b>	P0.09/NFC	Digital I/O, NFC antenna connection	Low frequency I/O
<b>P20</b>	SWDIO	Serial wire debug I/O (debug and programming)	

<b>P21</b>	SWDCLK	Serial wire debug I/O (debug and programming)	
<b>P22</b>	P1.02	Digital I/O	Low frequency I/O
<b>P23</b>	VSS	Power	Ground (0V)
<b>P24</b>	VSS	Power	Ground (0V)
<b>P25</b>	VSS	Power	Ground (0V)
<b>P26</b>	VSS	Power	Ground (0V)
<b>P27</b>	VSS	Power	Ground (0V)
<b>P28</b>	P1.13	Digital I/O	Low frequency I/O
<b>P29</b>	P1.15	Digital I/O	Low frequency I/O
<b>P30</b>	P0.03/AIN1	Digital I/O, Analog Input	Low frequency I/O
<b>P31</b>	P0.02/AIN0	Digital I/O, Analog Input	Low frequency I/O
<b>P32</b>	P0.28/AIN4	Digital I/O, Analog Input	Low frequency I/O
<b>P33</b>	P0.29/AIN5	Digital I/O, Analog Input	Low frequency I/O
<b>P34</b>	P0.30/AIN6	Digital I/O, Analog Input	Low frequency I/O
<b>P35</b>	P0.31/AIN7	Digital I/O, Analog Input	Low frequency I/O
<b>P36</b>	VDD	Power	Power supply (3.3V)
<b>P37</b>	VSS	Power	Ground (0V)
<b>P38</b>	VBUS	Power	5V input for USB 3.3V regulator
<b>P39</b>	VSS	Power	Ground (0V)
<b>P40</b>	D+	USB Data +	
<b>P41</b>	D-	USB Data -	

For detailed information about pin functionality, see the [Nordic Semiconductor nRF52840 product specification document](#).



## 3 Power supply recommendations



The MWA-N3 module is designed for 3.3V operation. All pins should not have any power applied to them before the +3.3V rail is applied.

To ensure reliable operation the supply pin should be decoupled with a 100nF ceramic capacitor located as close to the supply pins as possible. It is also recommended to add a high value ceramic capacitor close to the supply pin.

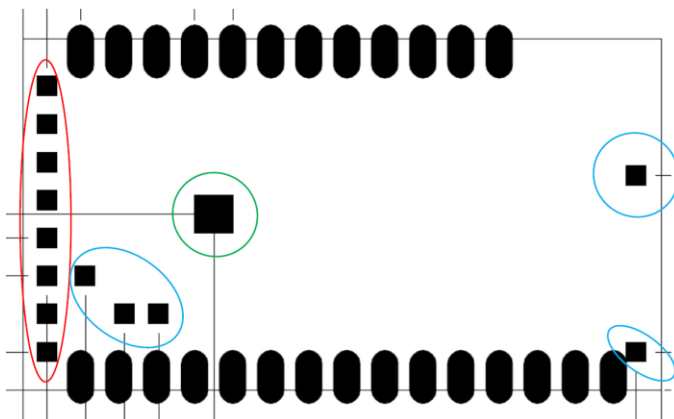
## 4 Layout considerations

Electrical and mechanical design files are available for download at the [LumenRadio online support page](#) for the MWA-N3 module.

### 4.1 Antenna

The antenna connector of the module is a u.FL type. The antenna shall have a characteristic impedance of 50 ohm at 2.45GHz. See section 5. “Recommended antennas” for more information.

### 4.2 MWA-N3 module PAD dimensions



All units in mm

Refer to the picture above

Oblong 1.4 x 2.79 (oblong edge a half circle with diameter 1.4)

Small rectangles left edge 1.0 x 0.8 (red)

Small squares right edge 1.02 x 1.02 (blue)

Large square 2.0 x 2.0 (green)

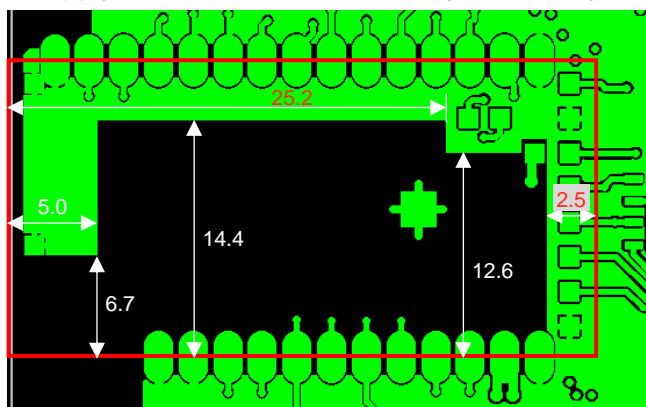
## 4.3 Layout considerations for the main board

The MWA-N3 module has been specifically designed to achieve optimal RF performance. To maintain this, there are some important guidelines that is recommended to follow:

- The use of ground planes on the carrier board for the MWA-N3 module cannot be emphasized enough. Good decoupling of any high-speed digital circuitry utilized on the carrier board is a must. Many embedded type microprocessors today have clock frequencies with clocks or overtones that reach well into the GHz range. It is possible for an embedded design to pass any EMC certification and still cause disturbances that will block the RF reception of the MWA-N3 module. The sensitivity of the MWA-N3 receiver is -96dBm therefore it is recommended to keep disturbances below -100dBm in the frequency range of operation.

A near field probe connected to a spectrum analyzer will show if there are any disturbances present on the 2.45 GHz band generated by the microprocessor or any other device that is placed on the main board. Pay special attention to readymade LAN-products "Server in a RJ connector". They pass EMC certifications, but some of them radiate badly on 2.45 GHz. If disturbances can be seen on a spectrum analyzer - then the MWA-N3 module will have impaired reception.

- MWA-N3 has a supply voltage decoupling on the circuit board. The supply voltage still needs to be adequately filtered. If any disturbance or intermittent communication failures occur, as one of the troubleshooting steps; check the supply voltage for drop-outs, switch supply ripple etc.
- The top layer inside the MWA-N3 module footprint must be free from copper as indicated in drawing below. There is a ground plane on the MWA-N3 module bottom layer, but there are also supply lines. It is an unnecessary risk to rely on solder mask lacquer for isolation.



All clearance dimensions in drawing above are minimum recommended clearance area.

## 4.4 Guidelines for optimal performance for optional internal antenna.

If the internal antenna is planned to be used the following guidelines must be followed. Failure to do so may result in inferior performance.

The MWA-N3 module has been tested on 1.6mm carrier boards of the brands ITEQ IT180 and Isola 370HR. For optimal performance it is recommended to use those for the carrier board design or a PCB with similar specification.

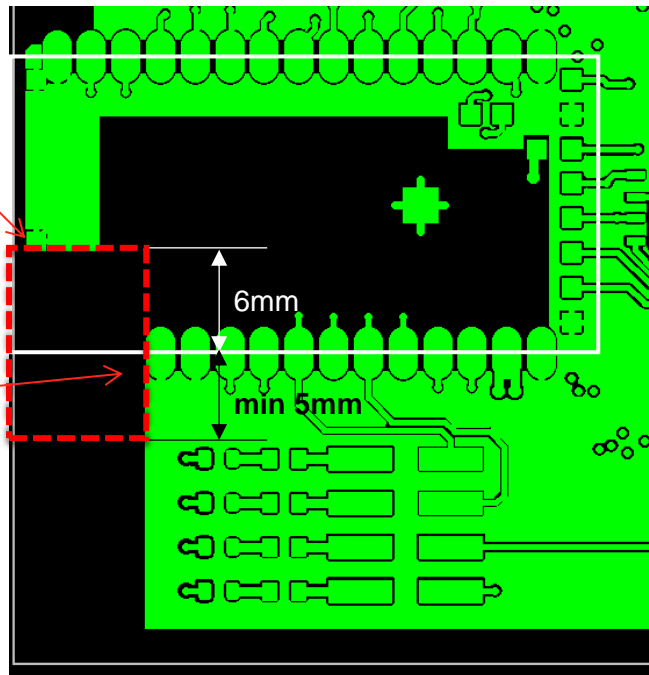
## MWA-N3 radio module integration guide

Version: 4, Sep 14, 2022

Minimum dimensions for ground plane clearance for optimum antenna performance are shown below:

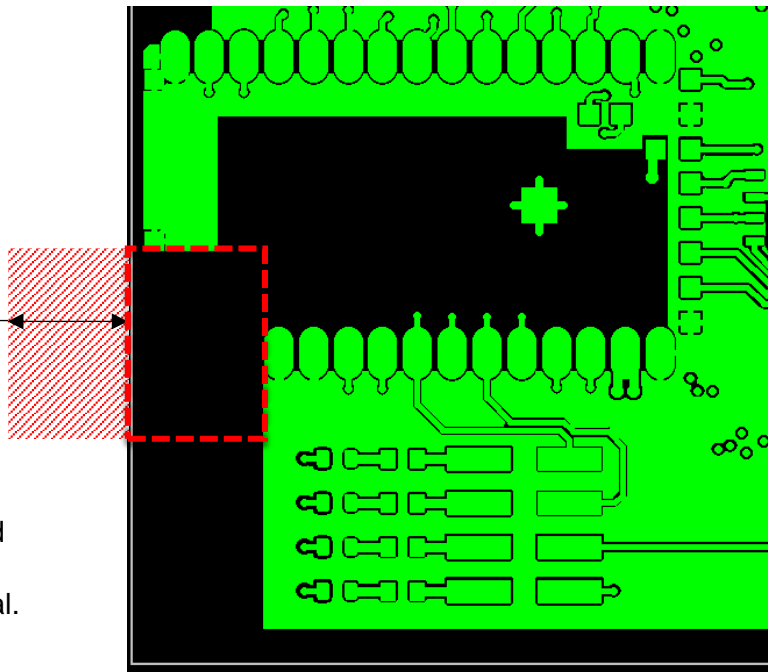
Carrier board clearance area. No components or traces/GND planes are allowed in this area. This area should be min 5mm from the board edge and 6mm under the MWA-N3 module to any solid object or ground plane.

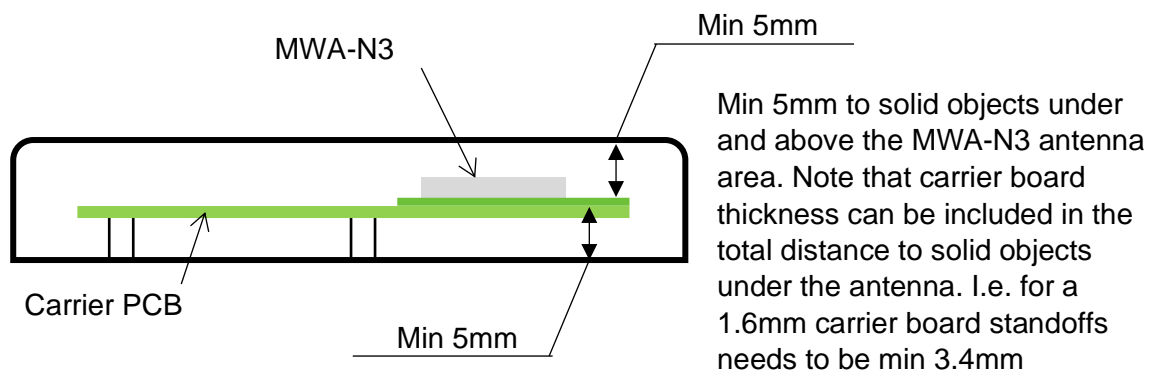
Clearance area width starts from last PAD of MWA-N3 module



min 5mm

Red diagonal striped area is a keep out area "air gap" from any solid objects or carrier board PCB material.





## 5 Recommended antennas

Apart from the internal chip antenna, MWA-N3 has been tested against FCC and IC regulatory requirements and is approved with the following antennas.

### 5.1 LumenRadio, 2.15dBi dipole antenna

The LumenRadio 2.15dBi dipole antenna delivers outstanding performance and orientation flexibility.

The antenna can be tilted and swiveled and comes with a rugged RP-TNC connector.

Together with MWA-N3 the total maximum radiated power is 21.65dBm (145mW).



**LumenRadio order code: 104-1001**

#### Electrical Specifications

Frequency Range	2400-2483.5 MHz
Gain	2.15dBi
V.S.W.R.	<2
Nominal impedance	50Ω
Polarization	Vertical
Max Power	25W
Connector	RP-TNC
Length	144mm
Radome material	TPEE
Radome Color	Black

## 5.2 LumenRadio, 5dBi dipole antenna

The LumenRadio 5dBi antenna is a high gain antenna for long range operation.

The antenna can be tilted and swiveled and comes with a rugged RP-TNC connector.

The antenna has a somewhat narrower radiation pattern compared to the LumenRadio 2.15dBi antenna and should be aligned properly for best performance.

The total maximum power output together with MWA-N3 is 24.5dBm (280mW).



**LumenRadio order code: 104-1003**

### Electrical Specifications

Frequency Range	2400-2483.5 MHz
Gain	5dBi
V.S.W.R.	<2
Nominal impedance	50Ω
Polarization	Vertical
Max Power	25W
Connector	RP-TNC
Length	210mm
Radome material	TPEE
Radome Color	Black

## 6 Product Verification and Testing

### 6.1 Design Verification

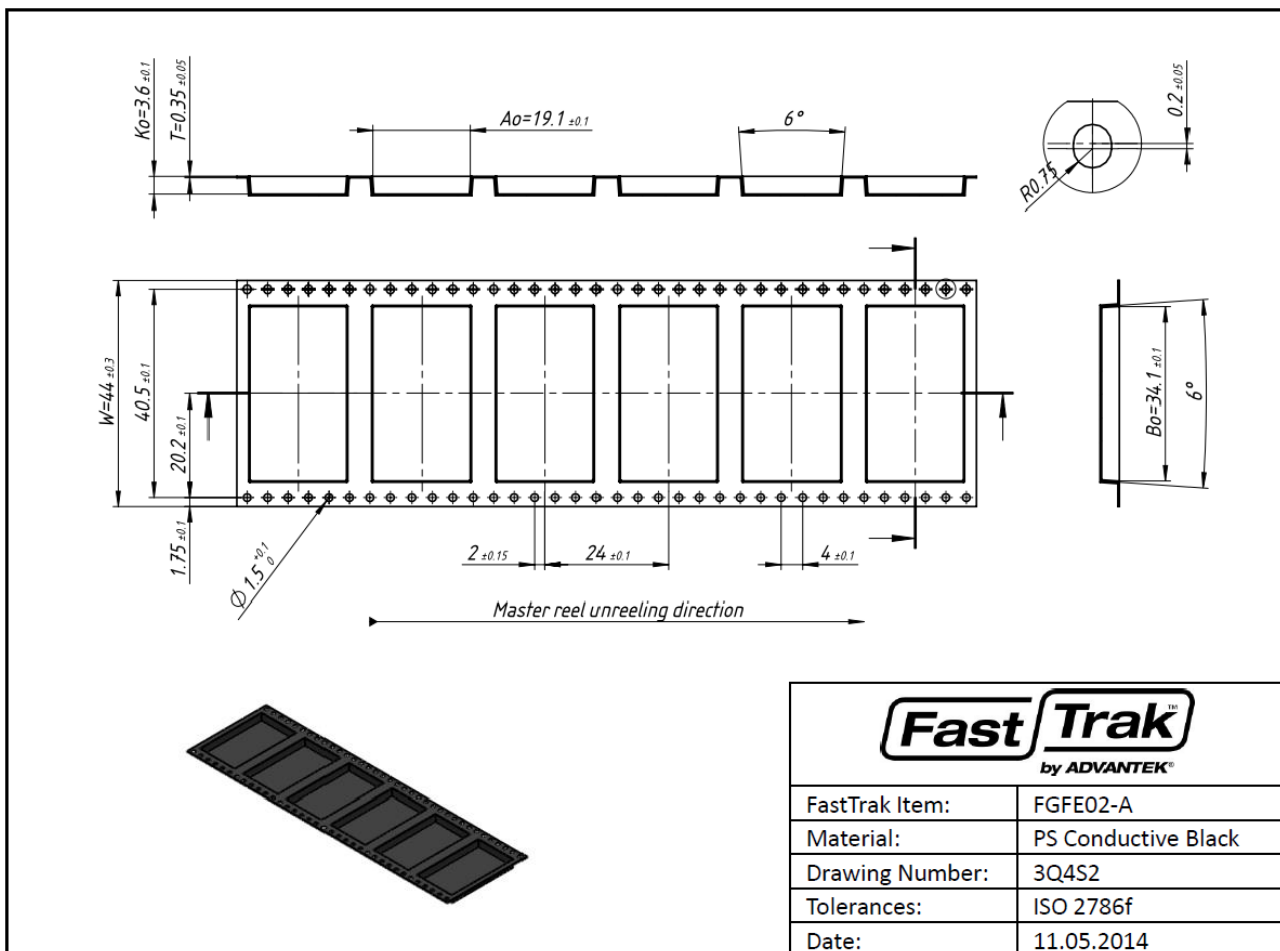
LumenRadio operates a full RF laboratory in Sweden and can offer design verification and testing services – please contact LumenRadio for advice (for contact information see section 11 “Contact and Ordering information”)

### 6.2 Production Testing

All MWA-N3 modules are factory tested before being shipped. However, it is advised to perform some level of testing as part of your products overall test process. Please contact LumenRadio for product testing advice (for contact information see section 11 “Contact and Ordering information”).

## 7 MWA-N3 module Packaging

### 7.1 Carrier tape dimensions




## 7.2 Reel marking

Every reel has an identifier sticker both on the reel and the reel package.



The identifier sticker contains the following information:

PRODUCT <b>XXX-XXXX</b>	SOFTWARE VERS. <b>SW: XXXX</b>		
PACKED DATE <b>XXXX-XX-XX</b>	<b>XX:XX:XX</b>	QUANTITY <b>XXX</b>	

**XXXXXX** (serial number)

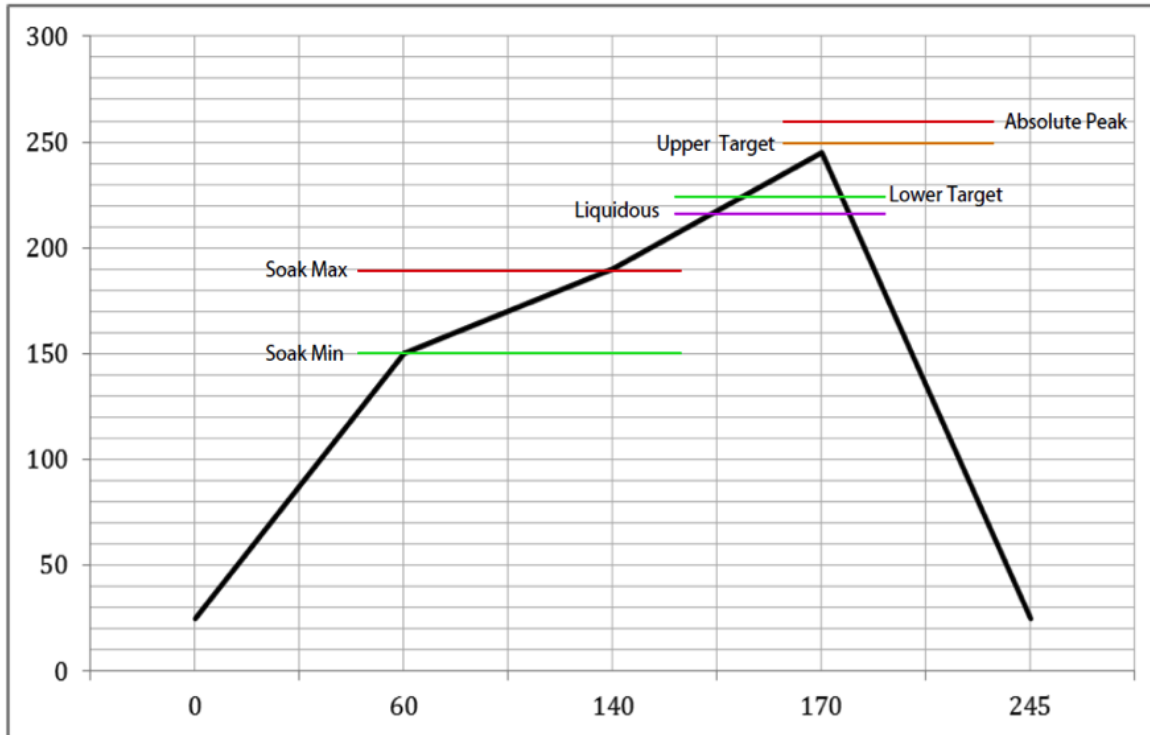


FCC ID: XRSTIMOMWAN301  
IC ID: 8879A-TIMOMWAN301



## 8 MWA-N3 reflow soldering specification

MWA-N3 is a surface mounted device (SMD) designed to be easily integrated into high-volume production lines including reflow soldering to a PCB. It is ultimately the responsibility of the customer to choose the appropriate solder paste and to ensure oven temperatures during reflow meet the requirements of the solder paste. The MWA-N3 module conforms to JSTD-020D1 standards for reflow temperatures.



Temperatures should not exceed the minimums or maximums presented in the table below.

Specification	Value	Unit
Temperature Inc./Dec. Rate (max)	3	°C / sec
Temperature Decrease rate (goal)	2-3	°C / sec
Soak Temp Increase rate (goal)	0.5 – 1.0	°C / sec
Flux Soak Period (min)	70	sec
Flux Soak Period (max)	120	sec
Flux Soak Temp (min)	150	°C
Flux Soak Temp (max)	190	°C
Time Above Liquidous (max)	70	sec
Time Above Liquidous (min)	50	sec
Time In Target Reflow Range (goal)	30	sec
Time At Absolute Peak (max)	5	sec
Liquidous Temperature (SAC305)	218	°C
Lower Target Reflow Temperature	225	°C
Upper Target Reflow Temperature	250	°C
Absolute Peak Temperature	260	°C



## 9 Compliance information

### 9.1 FCC information

MWA-N3 FCC ID: XRSTIMOMWAN301

#### 9.1.1 Federal Communication Commission Interference Statement

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 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.

#### FCC Caution

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

#### 9.1.2 FCC Declaration of Conformity

We LumenRadio AB, Johan Willins Gatan 6, 41648 Gothenburg, Sweden, declare under our sole responsibility that Mira MWA-N3 comply with Part 15 of FCC Rules.

#### 9.1.3 FCC 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 & your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This device is intended only for OEM integrators under the following conditions:

- (1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- (2) The transmitter module may not be co-located with any other transmitter or antenna,

#### IMPORTANT NOTE:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

#### 9.1.4 End Product Labelling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20cm may be maintained between the antenna and users. The final end product must be labelled in a visible area with the following: "Contains FCC ID: XRSTIMOMWAN301".

#### 9.1.5 Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter (MWA-N3) installed.

#### 9.1.6 Approved antennas

Following external antennas are approved for use with the MWA-N3 module:

- LumenRadio 104-1001, 2.15dBi dipole antenna.
- LumenRadio 104-1003, 5dBi dipole antenna

## 9.2 Industry Canada statement

IC: 8879A-TIMOMWAN301

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

- (1) this device may not cause interference, and
- (2) this device must accept any interference, including interference that may cause undesired operation of the device.

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.

#### Caution Exposure:

This device meets the exemption from the routine evaluation limits in section 2.5 of RSS102 and users can obtain Canadian information on RF exposure and compliance.

Le dispositif répond à l'exemption des limites d'évaluation de routine dans la section 2.5 de RSS102 et les utilisateurs peuvent obtenir des renseignements canadiens sur l'exposition aux RF et le respect.

This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

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

The final end product must be labeled in a visible area with the following:

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 labelled 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: 8879A-TIMOMWAN301

where 8879A-TIMOMWAN301 is the module's certification number.

### 9.3 CE

Mira MWA-N3 comply with the Essential Requirements of RED (Radio Equipment Directive) of the European Union (2014/53/EU). Mira MWA-N3 meet the ETSI EN 300 328 V2.2.2 conformance standards for radio performance.

### 9.4 Other Compliances

For other local compliance regulations (CE, UL, CSA, SRRC, C-Tick, etc.) you are responsible as the product manufacturer to ensure all required compliance testing is completed. LumenRadio are happy to advise on compliance testing – please contact LumenRadio for details.

## 10 RoHS / REACH

The MWA-N3 module complies with directive 2011/65/EU, 2015/863/EU (**RoHS**) of the European Parliament and the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The MWA-N3 module modules do not contain the SVHC (Substance of Very High Concern), as defined by Directive EC/1907/2006 Article according to **REACH** Annex XVII.

## 11 Contact and Ordering information

LumenRadio AB  
Johan Willins Gatan 6  
SE-416 48 Gothenburg  
Sweden  
Phone: +46 31 301 03 70

VAT reg. no: SE556761749201

[www.lumenradio.com](http://www.lumenradio.com)

[sales@lumenradio.com](mailto:sales@lumenradio.com)

The LumenRadio support team can be reached through our [support portal](#).

Product	Order Code
<b>MWA-N3 module 400pc reel</b>	800-8205
<b>LumenRadio, 2.15dBi dipole antenna</b>	104-1001
<b>LumenRadio, 5dBi dipole antenna</b>	104-1003
<b>u.FL to RP-TNC female 15cm</b>	102-2006