NM120100 System Integration Manual

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3. System Integration

The following design guidelines must be met for optimal integration of the NM120100 module in the final host application.

3.1. Reference System Schematics

Figure 1 is an example schematic where the NM120100 module is integrated into an application board. In this example, there are two push buttons enabling the user to boot the device into boot loader mode for in field firmware upgrade through the USB port.

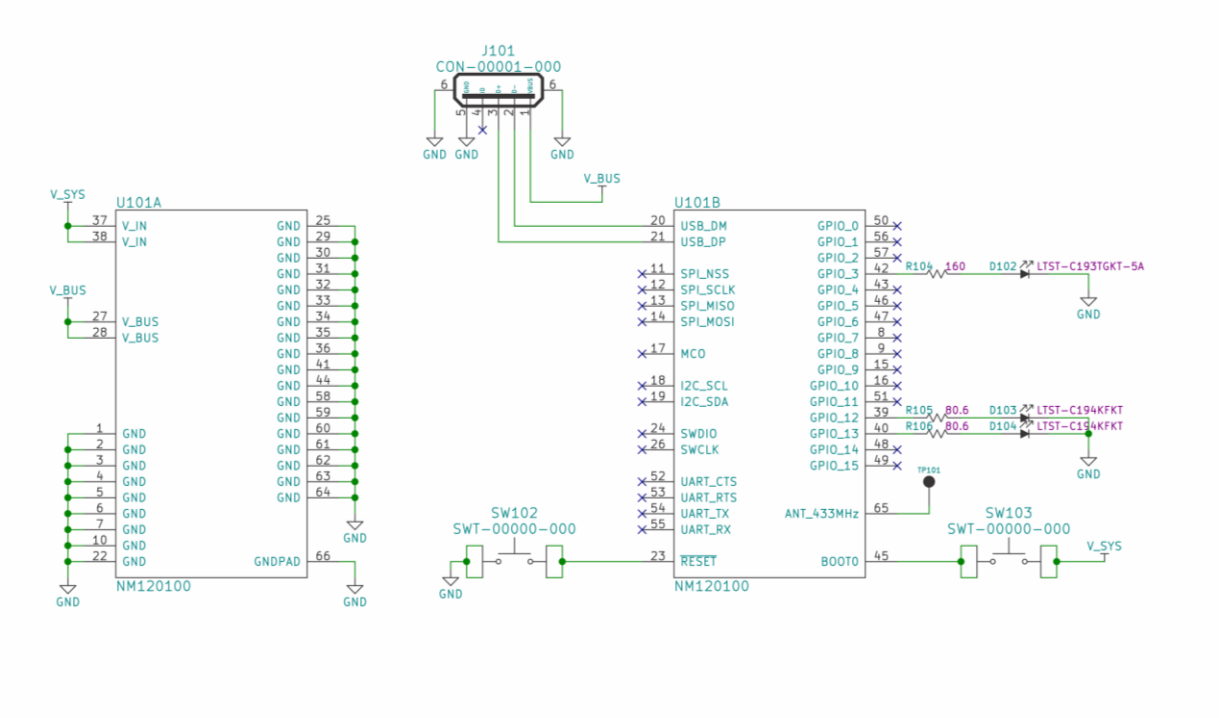


Figure 1 NM120100 carrier board reference schematics

3.2. Placement Guidelines

Optimal placement of the module is needed to maximize the radiated performance. Figure 2 shows the ideal placement locations and orientation of the module. The module should be placed as close as possible to the edge of the host PCB. The surroundings should be free of metallic objects in order for the antenna to operate properly. When corner placement is not feasible, the module should be placed with the antenna as close as possible to the edge of the host PCB.

If the final application makes use of an external antenna, the aforementioned constraints no longer apply. In this case, the recommendations of the antenna manufacturer for correct installation and deployment must be followed. It is therefore the responsibility of the system integrator to ensure optimal radiated performance in the final product.

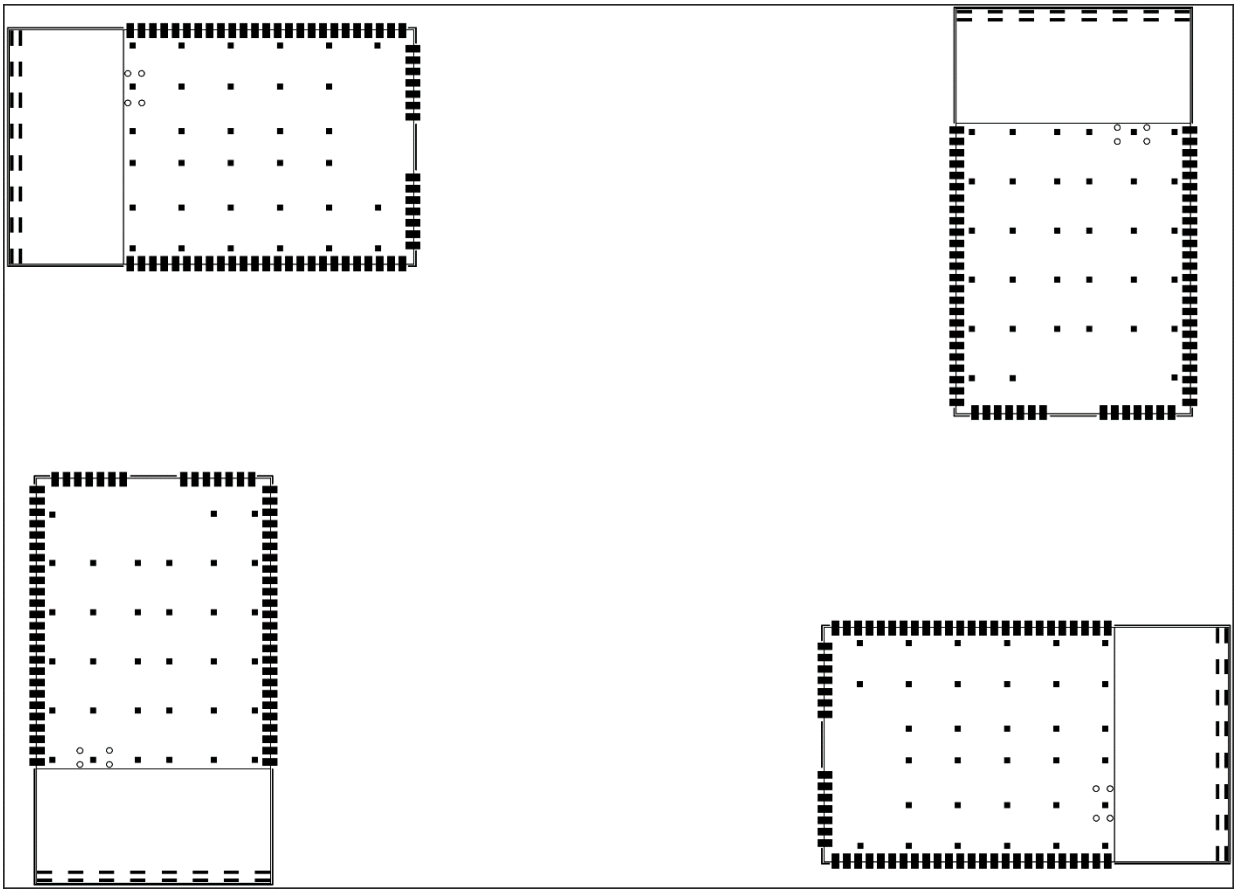
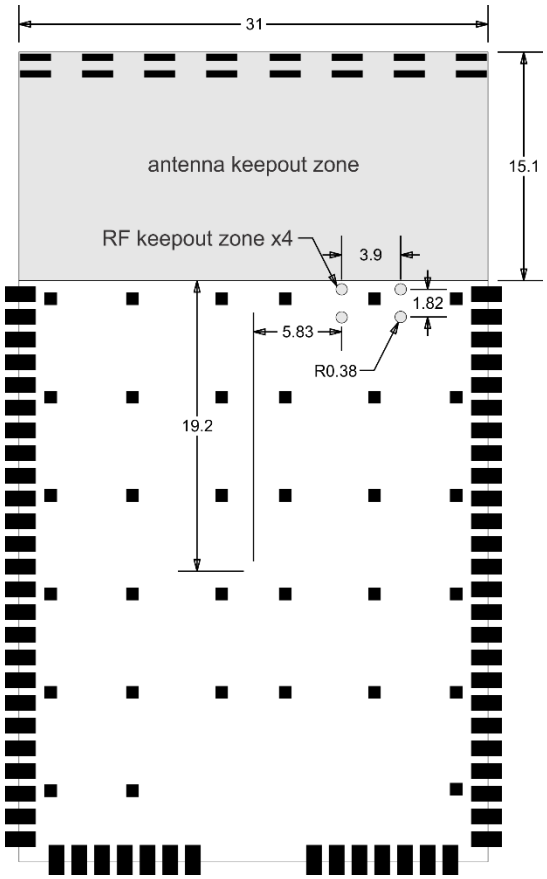


Figure 2 NM120100 placement options

3.3. Layout Guidelines

For optimal radiated performance, there are further consideration in the application PCB layout. There are two mandatory keepout zones with different layout restrictions as shown in Figure 3.

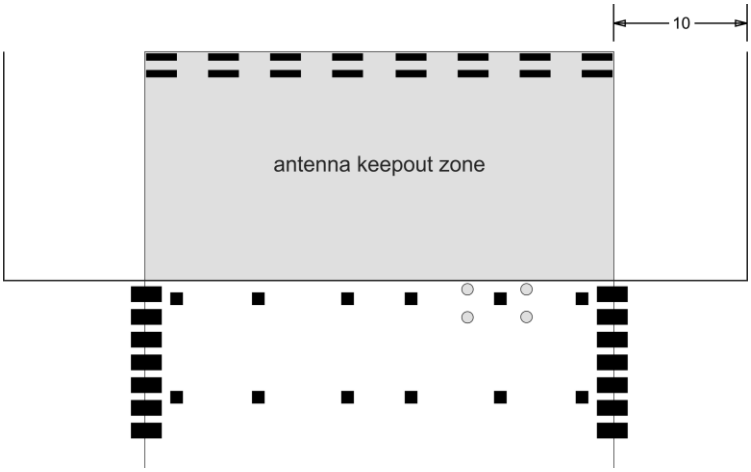


All dimensions are in mm unless otherwise specified.

Figure 3 Keepout regions showing the rectangular antenna keepout zone and the four circular RF keepout zones.

3.3.1. Antenna Keepout

The antenna keepout zone requires copper to be completely cleared of copper in all layers. Furthermore, the keepout zone should extend horizontally by at least 10mm beyond the width of the module as shown in Figure 4. For 433MHz operations, it is recommended to increase this distance to 15mm.



All dimensions are in mm unless otherwise specified.

Figure 4 Copper clearance around the antenna region.

3.3.2. RF Keepout

The RF keepout consists of four circular zones each with a radius of 0.38mm as shown in Figure 5. The keepout requires copper to be cleared within 0.15mm below the circular zones and where the keepout geometry having the same geometries as the four circular zones. In a PCB stack-up where the layer below the mounting layer exceeds 0.15mm, only the layer where the module is mounted on needs to be cleared of copper. For example, if the module is mounted on the top layer and the thickness of the prepreg between the top layer and the first inner layer is greater than 0.15mm, then only the top layer is cleared.

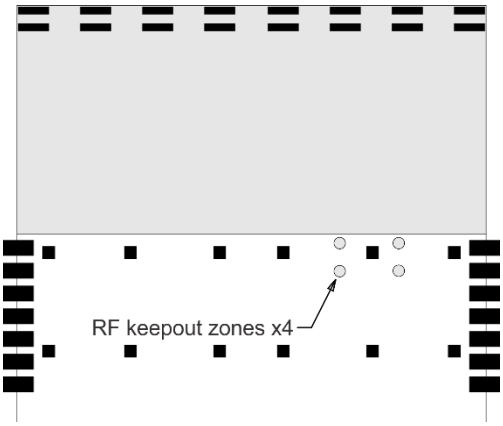


Figure 5 RF keepout zones showing four circular keepouts.

3.4. Regulatory and Compliance

In the United States, the NMI120100 has obtained modular approval under Federal Communications Commission (FCC) CFR47 Telecommunications, Part §15 Subpart C “Intentional Radiators” in accordance with Part §15.212 “Modular Transmitter”.

FCC ID: 2AL5J-120110

In Canada, the NMI120100 has obtained modular approval under Innovation, Science and Economic Development Canada (ISED) Radio Standards Specification (RSS) RSS-247 and RSS-Gen.

ISED: 22729-120110

3.4.1. Note to Module Integrators

This modular approval allows the integration of the NM120100 module into an end product without the module integrator obtaining separate approvals for intentional radiation, provided no changes or modifications are made that would violate the modular approval grant.

The module integrator must comply with all of the instructions provided by Northern Mechatronics Inc., which indicate installation and/or operating conditions necessary for compliance.

An end product, which integrates the NM120100, is required to comply with all applicable FCC/ISED equipment authorization regulations, requirements and equipment functions not associated with the transmitter module portion.

> For example, compliance must be demonstrated to regulations for other transmitter components within the end product, such as requirements for unintentional radiators (Part §15 Subpart B “Unintentional Radiators” and ICES-003 “Information Technology Equipment – Limits and Methods of Measurement”), such as digital devices, computer peripherals, radio receivers, etc.; and compliance to additional authorization requirements for the non-transmitter functions on the transmitter module (i.e., Verification, or Declaration of Conformity), as appropriate.

3.4.2. United States: Federal Communications Commission (FCC) Notice

FCC ID: 2AL5J-120110

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.

Warning: RF Exposure Compliance

- ⚠ **The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.**
- ⚠ **This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC procedures and as authorized in the module certification filing.**
- ⚠ **The gain of the antenna used for NM120100 must not exceed -1.03 dBi in the frequency range 902– 928 MHz.**

Module Usage Conditions

- ⚠ **Changes or modifications not expressly approved by Northern Mechatronics Inc. may void the user's authority to operate the equipment.**
- ⚠ **Manufacturers of mobile or fixed devices incorporating the NM120100 module are authorized to use the FCC Grant of the NM120100 module for their own final products according to the conditions referenced in the grants.**
- ⚠ **The FCC label shall, in the above case, be visible from the outside, or the host device shall bear a second label stating:**

  "Contains FCC ID: 2AL5J-120110"
- ⚠ **The end user is to be notified that any changes or modifications made to the equipment, that are not expressly approved by Northern Mechatronics Inc. could void the user's authority to operate the equipment.**
- ⚠ **IMPORTANT: Manufacturers of portable applications incorporating the NM120100 module are required to have their final product certified and apply for their own FCC Grant related to the specific portable device. This is mandatory to meet the SAR requirements for portable devices.**

3.4.3. Canada: Innovation, Science and Economic Development Canada (ISED) Notice

IC ID: 22729-120110

This device complies with Innovation, Science and Economic Development Canada (ISED) Radio Standards Specification (RSS) RSS-247 and RSS-Gen. 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.

Warning: RF Exposure Compliance

⚠ **The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.**

⚠ **This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with ISED procedures and as authorized in the module certification filing.**

⚠ **The gain of the antenna used for NM120100 must not exceed -1.03 dBi in the frequency range 902– 928 MHz.**

Module Usage Conditions

⚠ **Changes or modifications not expressly approved by Northern Mechatronics Inc. may void the user's authority to operate the equipment.**

⚠ **Manufacturers of mobile or fixed devices incorporating the NM120100 module are authorized to use the ISED certificate of the NM120100 module for their own end products according to the conditions referenced in the certificates.**

⚠ **The user is to be notified that any changes or modifications made to this device, that are not expressly approved by Northern Mechatronics Inc. could void the user's authority to operate the equipment.**

⚠ **The ISED label shall, in the above case, be visible from the outside, or the host device shall bear a second label stating:**

"Contains IC: 22729-120110"

⚠ **IMPORTANT: Manufacturers of portable applications incorporating the NM120100 module are required to have their final product certified and apply for their own ISED Certificate related to the specific portable device. This is mandatory to meet the SAR requirements for portable devices.**

3.4.4. Canada: Avis d'Innovation, Sciences et Développement économique Canada (ISDE)

IC ID: 22729-120110

Cet appareil est conforme à cahiers des charges sur les normes radioélectriques (CNR) CNR-210 et CNR-Gen d'Innovation, Sciences et Développement économique Canada (ISDE). 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.

Attention: Conformité d'exposition aux radiofréquences

⚠ **L'antenne ou les antennes utilisées pour cet émetteur doivent être installées de façon à fournir une distance de séparation d'au moins 20 cm de toutes personnes.**

⚠ **Le transmetteur ne doit pas être placées au même endroit qu'une autre antenne ou transmetteur sauf conformément aux procédures ISDE et autorisé dans le dépôt de certification du module.**

⚠ **Le gain d'antenne utilisé pour NM120100 ne doit pas dépasser -1.03 dBi dans la gamme de fréquences 902–928 MHz.**

Conditions d'utilisation modulaire

⚠ **Tous les changements ou modifications non expressément approuvées par Northern Mechatronics Inc. pourraient annuler l'autorisation de l'utilisateur pour utiliser l'équipement.**

⚠ **Les fabricants d'appareils mobiles ou fixes incorporant le module NM120100 sont autorisés à utiliser le certificat ISDE du module NM120100 pour leurs propres produits finaux selon les conditions référencées dans les certificats.**

⚠ **L'utilisateur doit être informé que tout les changements ou modifications non expressément approuvées par Northern Mechatronics Inc. pourraient annuler l'autorisation de l'utilisateur pour utiliser l'équipement.**

⚠ **L'étiquette ISDE doit, dans le cas ci-dessus, être visible de l'extérieur, ou le dispositif hôte doit porter une deuxième étiquette indiquant:**

"Contains IC: 22729-120110"

⚠ **IMPORTANT: Les fabricants d'applications portables intégrant le module NM120100 sont tenus d'avoir leur produit final certifié et d'appliquer leur propre certificat ISDE relatif à l'appareil portable spécifique. Ceci est obligatoire pour satisfaire aux exigences DAS pour les appareils portables.**