

Figure 7.5. Non-Optimal Layout Examples

7.3 Radio Performance vs. Carrier Board Size and Other PCB Characteristics

For many applications, the carrier board size is determined by the overall form factor or size of the additional circuitry. The recommended carrier board width of 50 mm for the BGM220S12A and 55 mm for the BGM220S22A is thus not always possible in the end-application. If another form factor is required, the antenna performance of the integrated antenna will be compromised but it may still be sufficiently good for providing the required link quality and range of the end-application. [Figure 7.6 Efficiency of the Integrated Antenna as Function of the Carrier Board Size for BGM220S12A on page 37](#) and [Figure 7.7 Efficiency of the Integrated Antenna as Function of the Carrier Board Size for BGM220S22A on page 38](#) show the total efficiency of the integrated antenna for different carrier board sizes. As can be seen the best performance is achieved for the carrier board size of 50 mm x 30 mm for the BGM220S12A and 55 mm x 25 mm for the BGM220S22A, with relatively constant performance for larger boards and rapidly declining performance for smaller boards.

The performance of all the sizes tested will be adequate for more than 15 m line-of-sight range and all of the sizes are thus usable.

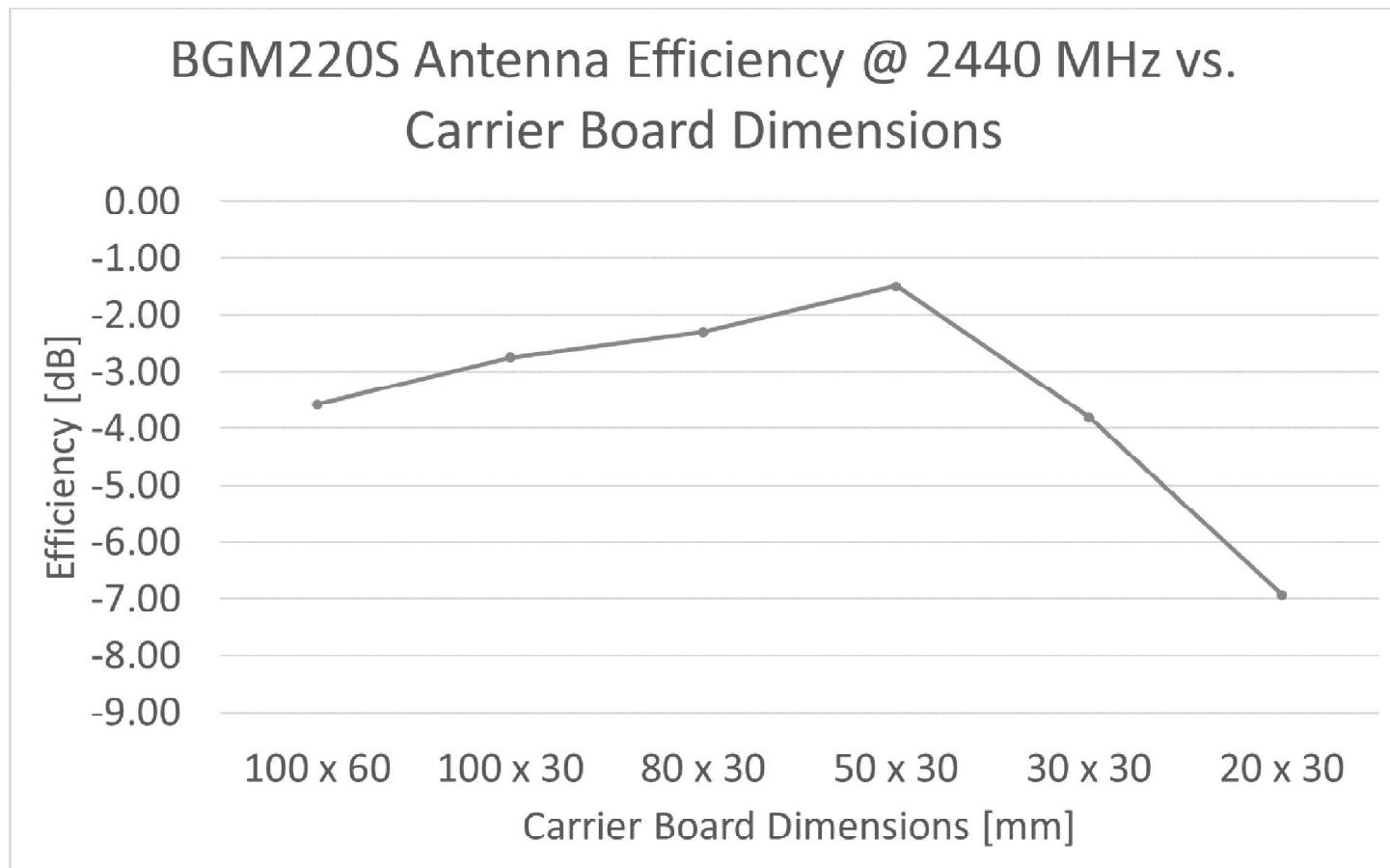


Figure 7.6. Efficiency of the Integrated Antenna as Function of the Carrier Board Size for BGM220S12A

BGM220S22A Antenna Efficiency @ 2440 MHz vs. Carrier Board Dimensions

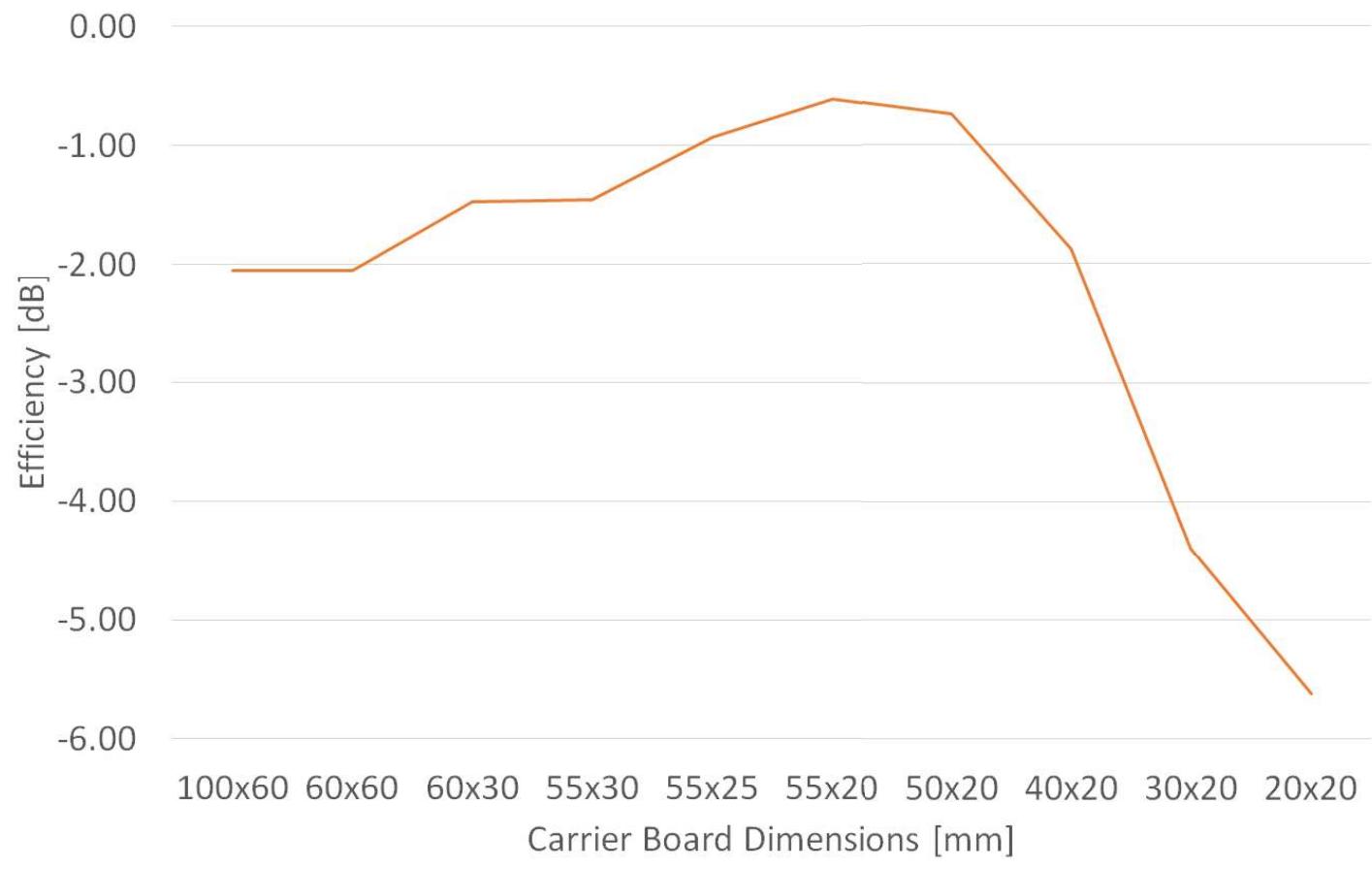


Figure 7.7. Efficiency of the Integrated Antenna as Function of the Carrier Board Size for BGM220S22A

Carrier PCB thickness and relative permittivity might also have an impact on the antenna impedance / antenna resonance frequency. Please refer to [AN1394: BGM220S Antenna Tuning Guide](#) for additional guidance on these properties.

7.4 Proximity to Other Materials

Placing plastic or any other dielectric material directly in contact with the antenna may cause performance degradation. A clearance of minimum 0.5 mm is recommended to avoid excessive detuning of the antenna. Solder mask, conformal coating, and other thin dielectric layers are acceptable directly on top of the antenna region. Any metallic objects in close proximity to the antenna will prevent the antenna from radiating freely. The minimum recommended distance of metallic and/or conductive objects is 10 mm in any direction from the antenna except in the directions of the application PCB ground planes.

7.5 Proximity to Human Body

Placing the module in contact with or very close to the human body will negatively impact antenna efficiency and reduce range. Furthermore, additional certification may be required if the module is used in a wearable device.

7.6 Antenna Tuning and Validity of Modular Certifications

A modular certification is valid if all the design guidelines from the manufacturer with regards to carrier printed circuit board (PCB) size, thickness, relative permittivity, module placement, and antenna loop dimensions are followed. Modular certification is still valid, if no antenna tuning is applied to compensate for reduced performance in terms of range, which may result from sub-optimal carrier PCB size, thickness, relative permittivity, module placement, and/or proximity to other materials such as assembly housing.

Any antenna tuning or change of the antenna loop dimensions might invalidate a modular certification, unless it is done to compensate for the degradation caused by a printed circuit board deviating from the manufacturer's best-case reference in size, thickness, relative permittivity, and/or module placement, or to compensate for the degradation caused by the proximity of assembly housing. Guidance on how to address this type of degradation is provided in [AN1394: BGM220S Antenna Tuning Guide](#), in which case a *Permissive Change* to the modular approval might become necessary depending on the resulting performance of the end device relative to the certified module test reports.

Class 1 Permissive Change (C1PC) is considered if the host PCB modifications do not increase emissions. Class 2 Permissive Change (C2PC) is considered if the modifications degrade the emissions, but remain below regulatory limits.

Whether antenna tuning is applied or not, it is strongly recommended that spot-checking is performed in any case with the end-product having the transmitter(s) operating to confirm that the host product meets all regulatory requirements under any circumstance.

The emission levels established in the module certification are limits for the end device too, and determine whether or not a *Permissive Change* should be considered. Since this is evaluated on a case-by-case basis, customers must consult with the company providing certification services for their product to identify the best approach. Additional information on module certification and *Permissive Changes* is provided in [AN1048: Regulatory RF Module Certifications](#).

8. Package Specifications

8.1 Package Dimensions

The package dimensions are shown in [Figure 8.1 Package Dimensions - Full on page 40](#) and [Figure 8.2 Package Dimensions - Detail on page 40](#).

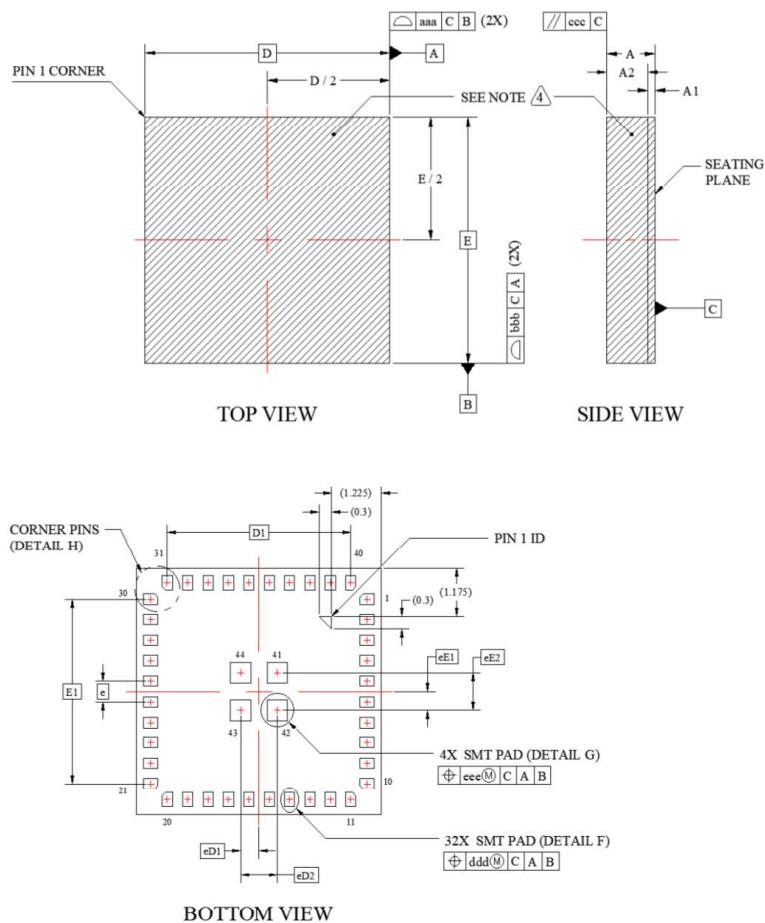


Figure 8.1. Package Dimensions - Full

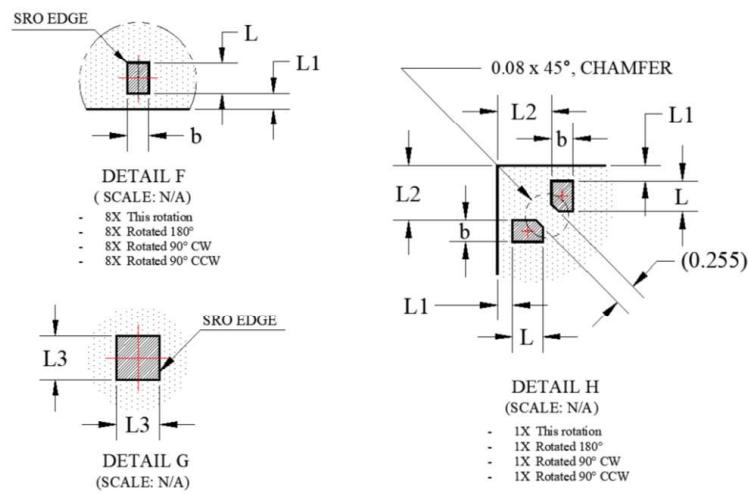


Figure 8.2. Package Dimensions - Detail

Table 8.1. Package Dimensions

Dimension	MIN	NOM	MAX
A	1.080	1.180	1.280
A1	0.140	0.180	0.220
A2	0.950	1.000	1.050
b	0.200	0.250	0.300
D		6.000 BSC	
D1		4.500 BSC	
e		0.500 BSC	
E		6.000 BSC	
E1		4.500 BSC	
L	0.300	0.350	0.400
L1	0.125	0.175	0.225
L2	0.575	0.625	0.675
L3	0.450	0.500	0.550
eD1		0.450 BSC	
eD2		0.900 BSC	
eE1		0.450 BSC	
eE2		0.900 BSC	
aaa		0.100	
bbb		0.100	
ccc		0.100	
ddd		0.100	
eee		0.100	

Note:

1. The dimensions in parenthesis are reference.
2. All dimensions in millimeters (mm).
3. Unless otherwise specified, tolerances are:
 - a. Decimal: X.X = +/- 0.1
X.XX = +/- 0.05
X.XXX = +/- 0.03
 - b. Angular: +/- 0.1 (In Deg)
4. Hatching lines means package shielding area.

8.2 Recommended PCB Land Pattern

The recommended PCB Land Pattern is shown in [Figure 8.3 Module Land Pattern on page 42](#)

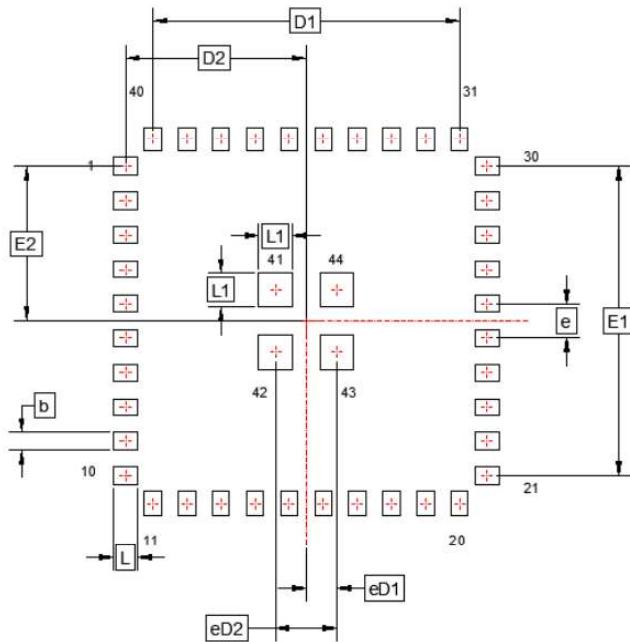


Figure 8.3. Module Land Pattern

Table 8.2. PCB Land Pattern Dimensions

Dimension	Typ (mm)
D1	4.50
D2	2.65
E1	4.50
E2	2.25
eD1	0.45
eD2	0.90
b	0.25
e	0.50
L	0.35
L1	0.50

Note:

1. All feature sizes shown are at Maximum Material Condition (MMC) and a card fabrication tolerance of 0.05mm is assumed.
2. Dimensioning and Tolerancing is per the ANSI Y14.5M-1994 specification.
3. A stainless steel, laser-cut and electro-polished stencil with trapezoidal walls should be used to assure good solder paste release.
4. The stencil thickness should be 0.100 mm (4 mils).
5. The stencil aperture to land pad size recommendation is 80% paste coverage.
6. ***Above notes and stencil design are shared as recommendations only. A customer or user may find it necessary to use different parameters and fine tune their SMT process as required for their application and tooling.***

8.3 Top Marking

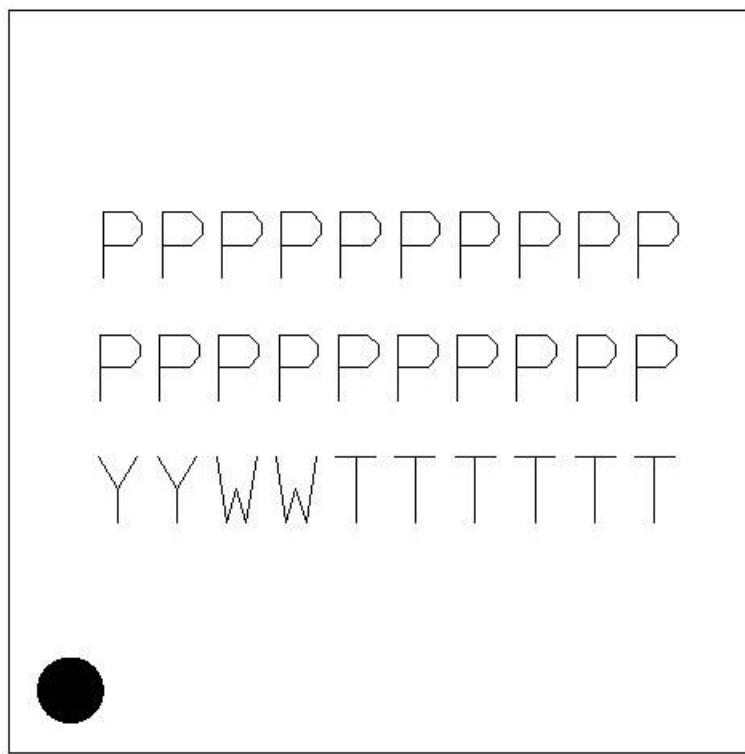


Figure 8.4. BGM220S Top Marking

Table 8.3. Top Marking Definition

OPN	Line 1 Marking	Line 2 Marking	Line 3 Marking
BGM220SC12WGA2	BGM220S12A	SC12WGA2	See note below
BGM220SC22HNA2	BGM220S22A	SC22HNA2	See note below
BGM220SC22WGA2	BGM220S22A	SC22WGA2	See note below

Note: YY = Year. WW = Work Week, TTTTTTT = Trace Code

9. Soldering Recommendations

It is recommended that final PCB assembly of the BGM220S follows the industry standard as identified by the Institute for Printed Circuits (IPC). This product is assembled in compliance with the J-STD-001 requirements and the guidelines of IPC-AJ-820. Surface mounting of this product by the end user is recommended to follow IPC-A-610 to meet or exceed class 2 requirements.

CLASS 1 General Electronic Products

Includes products suitable for applications where the major requirement is function of the completed assembly.

CLASS 2 Dedicated Service Electronic Products

Includes products where continued performance and extended life is required, and for which uninterrupted service is desired but not critical. Typically the end-use environment would not cause failures.

CLASS 3 High Performance/Harsh Environment Electronic Products

Includes products where continued high performance or performance-on-demand is critical, equipment downtime cannot be tolerated, end-use environment may be uncommonly harsh, and the equipment must function when required, such as life support or other critical systems.

Note: General SMT application notes are provided in the AN1223 document.

10. Tape and Reel

BGM220S modules are delivered to the customer in tray (490 pcs / tray) or reel (2500 pcs / reel) packaging with the dimensions below. All dimensions are given in mm unless otherwise indicated.

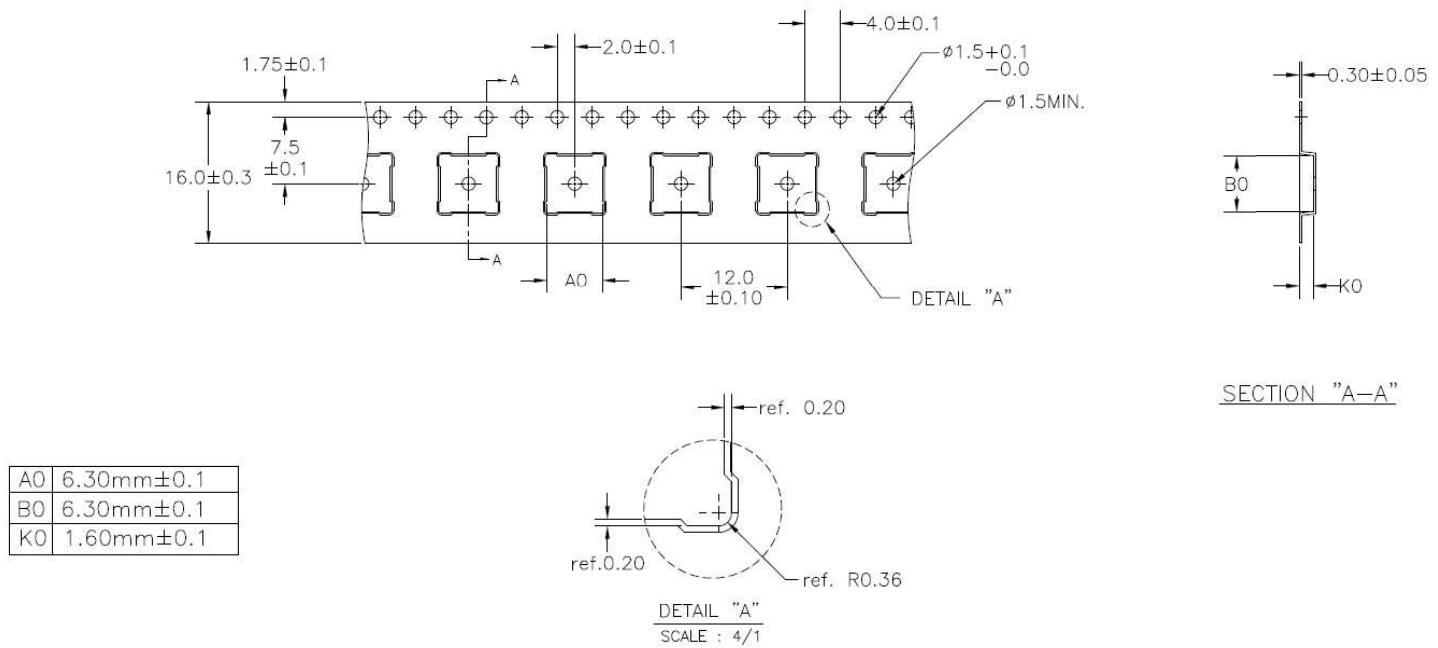


Figure 10.1. Carrier Tape Dimensions

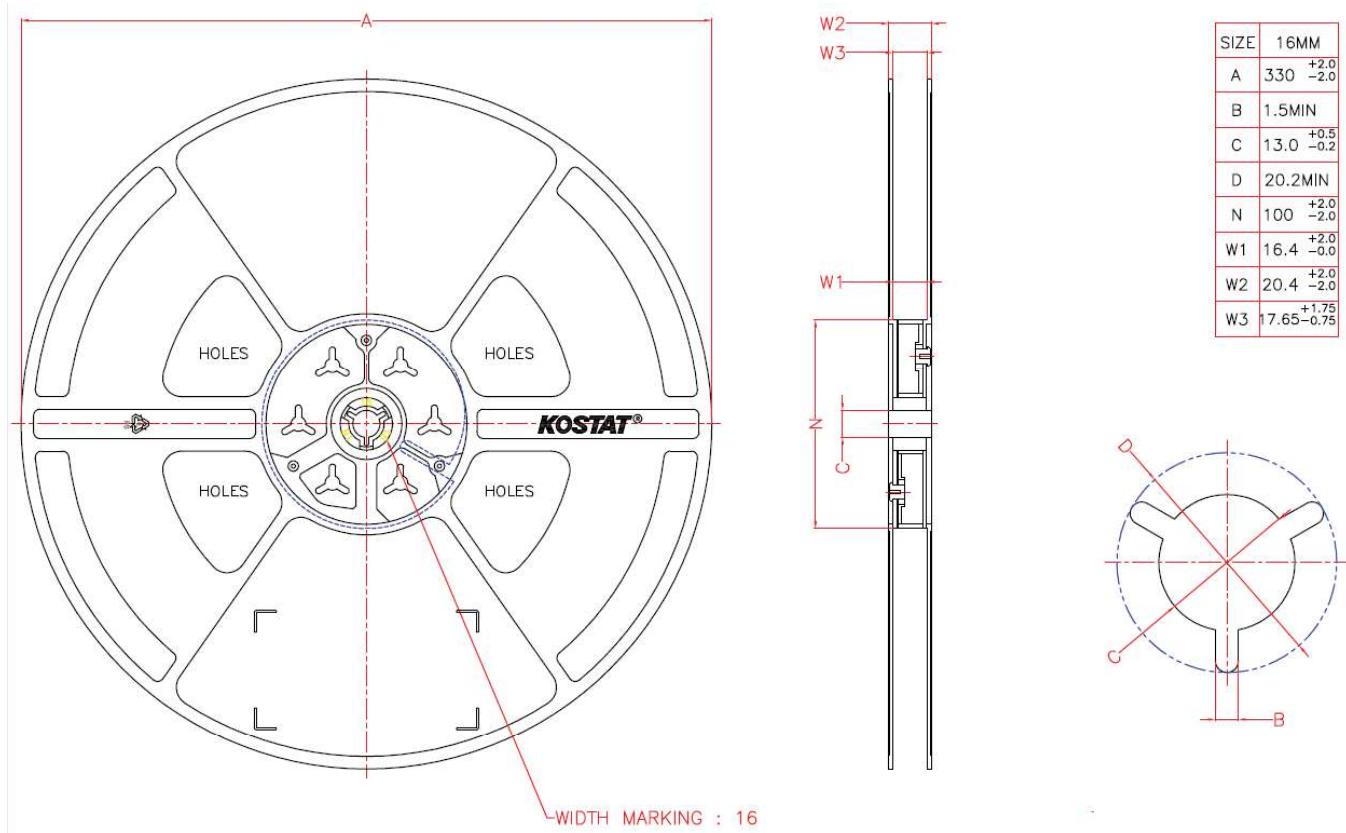


Figure 10.2. Reel Dimensions

11. Certifications

This section details the regulatory certification status of the BGM220S modules in various regions. For certification purposes, the modules are mainly referred to by their formal Model Name of BGM220S12A/BGM220S22A.

The address of the modules' legal manufacturer and certification applicant is:

SILICON LABORATORIES FINLAND OY
Alberga Business Park, Bertel Jungin aukio 3,
02600 Espoo, Finland

The BGM220S12A/BGM220S22A modules have Brand Name of "SILICON LABS".

11.1 Regulatory Certifications

11.1.1 Qualified Antennas

BGM220S modules have been tested and certified both with the on-board antennas and with external antennas attached to the RF pin (RF_2G4). Performance characteristics for the integral antennas are presented in [Table 3.1 Antenna Efficiency and Peak Gain \(BGM220S12A\) on page 7](#), [Table 3.2 Antenna Efficiency and Peak Gain \(BGM220S22A\) on page 7](#) and [4.16.1 Antenna Typical Characteristics](#). Details for the external qualified reference antennas are summarized in the table below.

Table 11.1. Qualified External Antennas for BGM220S

Model	Antenna Type	Maximum Gain	Impedance
BGM220S12A	Connectorized Coaxial Dipole	3.2 dBi	50 Ω
BGM220S22A	Connectorized Coaxial Dipole	2.8 dBi	50 Ω

Any external antenna of the same general type and of equal or less directional gain as listed in the above table, and having similar in-band and out-of-band characteristics, can be used in the regulatory areas that have modular radio approvals, such as USA and Canada, as long as spot-check testing is performed to verify that no performance changes compromising compliance have been introduced. In the particular FCC case, in order to comply with e-CFR Title 47, Part 15, Subpart C, Section 15.203 the module integrator using an external antenna must ensure it has a unique connector or it is undetachable. In countries applying the ETSI standards, like the EU countries, the radiated emissions are always tested with the end-product and the antenna type is not critical, but antennas with higher gain may violate some of the regulatory limits.

When using instead an external antenna of a different type (such as a chip antenna, a PCB trace antenna or a patch) or having non-similar in-band and out-of-band characteristics, but still with a gain less than or equal to the maximum gain listed in the table above, it can be added as a permissive change to the existing grant/certificate. In most of these cases, some radiated emission testing is demanded, but no modular or end-product re-certification is required.

On the other hand, all products with antennas having more gain than the maximum gain listed in the table above are very likely to require a full new end-product certification. Since the exact permissive change procedure is chosen on a case by case basis, please consult your test house and/or a certification body for understanding the correct approach based on your unique design. You might also want or need to get in touch with Silicon Labs for any authorization letter that your certification body might ask for.

11.1.2 EU and UK - CE and UKCA

The BGM220S modules have been tested against the relevant harmonized/designated standards and are in conformity with the essential requirements and other relevant requirements of the Radio Equipment Directive (RED) (2014/53/EU) and of the Radio Equipment Regulations (RER) (S.I. 2017/1206).

Please notice that every end-product integrating a BGM220S module will need to perform the radio EMC tests on the whole assembly, according to the ETSI 301 489-x relevant standards.

Furthermore, it is ultimately the responsibility of the manufacturer to ensure the compliance of the end-product as a whole. The specific product assembly is likely to have an impact to RF radiated characteristics, when compared to the bare module. Hence, manufacturers should carefully consider RF radiated testing with the final product assembly, especially taking into account the gain of the external antenna if any, and the possible deviations in the PSD, EIRP and spurious emissions measurements, as defined in the ETSI 300 328 standard.

The modules are entitled to carry the CE and UKCA Marks, and a formal Declaration of Conformity (DoC) is available at the product web page which is reachable starting from <https://www.silabs.com/>.

11.1.3 USA - FCC

This device complies with FCC's e-CFR Title 47, Part 15, Subpart C, Section 15.247 (and related relevant parts of the ANSI C63.10.2013 standard) when operating with the embedded antenna or with the antenna type(s) listed in [11.1.1 Qualified Antennas](#). 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 undesirable operation.

Any changes or modifications not expressly approved by Silicon Labs could void the user's authority to operate the equipment.

FCC RF Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance.

This transmitter meets the Mobile requirements at a distance of 20 cm and above from the human body, in accordance to the limit(s) exposed in the RF Exposure Analysis.

This transmitter also meets the Portable requirements at distances equal or above those listed for convenience in [Table 11.2 Minimum Separation Distances for SAR Evaluation Exemption \(BGM220S12A\) on page 54](#) and [Table 11.3 Minimum Separation Distances for SAR Evaluation Exemption \(BGM220S22A\) on page 54](#).

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.

OEM Responsibilities to comply with FCC Regulations

This module has been tested for compliance to FCC Part 15.

OEM integrators are responsible for testing their end-product for any additional compliance requirements needed with this module installed (for example, digital device emissions, PC peripheral requirements, etc.). Additionally, investigative measurements and spot checking are strongly recommended to verify that the full system compliance is maintained when the module is integrated, in accordance to the "Host Product Testing Guidance" in FCC's KDB 996369 D04 Module Integration Guide V01.

- **General Considerations**

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B (unintentional radiator) rule requirement, which is applicable to the final host. The final host will need to be assessed for compliance to this portion of rule requirements, if applicable.

- **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, or how to change RF related parameters, in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warnings as shown in this manual.

- **OEM / Host Manufacturer Responsibilities**

OEM/Host manufacturers are ultimately responsible for the compliance of the host system.

The BGM220S12A has a limited single-modular transmitter approval due to the radio portion of the module not being contained in its own RF shielding. Consequently, each new host will require a reassessment of radiated spurious emissions and a Class I Permissive Change to the grant. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and EMF essential requirements of the FCC rules. This module must not be incorporated into any other radio device or system without retesting for compliance as multi-radio and combined equipment.

The BGM220S22A is a shielded design, and comes with full modular approval.

Separation

- To meet the SAR exemption for portable conditions, the minimum separation distance indicated in

[Table 11.2 Minimum Separation Distances for SAR Evaluation Exemption \(BGM220S12A\) on page 54](#) and [Table 11.3 Minimum Separation Distances for SAR Evaluation Exemption \(BGM220S22A\) on page 54](#) must be maintained between the human body and the radiator (antenna) at all times.

- This transmitter module is tested in a standalone mobile RF exposure condition, and in case of any co-located radio transmitter being allowed to transmit simultaneously, or in case of portable use at closer distances from the human body than those allowing the exceptions rules to be applied, a separate additional SAR evaluation will be required, ultimately leading to a Class II Permissive Change, or more rarely to a new grant.
- **Important Note:** In the event that these conditions cannot be met, the final product will have to undergo additional testing to evaluate the RF exposure in order for the FCC authorization to remain valid, and a permissive change will have to be applied. The evaluation (SAR) is in the responsibility of the end-product's manufacturer, as well as the permissive change that can be carried out with the help of the customer's own Telecommunication Certification Body as the grant holder's agent.

End Product Labeling

BGM220S modules are not labeled with their own FCC ID due to their size. Instead, the packaging label contains the FCC ID. In all cases when the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

For BGM220S12A

"Contains Transmitter Module FCC ID: QOQ-BGM220S"

Or

"Contains FCC ID: QOQ-BGM220S"

For BGM220S22A

"Contains Transmitter Module FCC ID: QOQ-BGM220S2"

Or

"Contains FCC ID: QOQ-BGM220S2"

Final note: As long as all the conditions in this and all the above sections are met, further RF testing of the transmitter with full modular approval is not required. However, OEMs are still supposed to follow the good practice and the FCC recommendation to ensure the compliance of the host by spot checking.

Nevertheless, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements which might be mandatory with this module installed.

Class B Device Notice - BGM220S22A Only

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

11.1.4 Canada - ISED

ISED

This radio transmitter (IC: 5123A-BGM220S for the BGM220S12A and IC: 5123A-BGM220S2 for the BGM220S22A) has been approved by *Innovation, Science and Economic Development Canada (ISED Canada, formerly Industry Canada)* to operate with the embedded antenna and with the antenna type(s) listed in [11.1.1 Qualified Antennas](#), with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain listed, are strictly prohibited for use with this device.

This device complies with ISED's license-exempt RSS standards. 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

RF Exposure Statement

Exception from routine SAR evaluation limits are given in [RSS-102 Issue 5](#).

For the Portable use case, RF exposure or SAR evaluation is not required in all cases, at any distance from the human body, except when the BGM220S22A is used at full power with the external reference dipole antenna, in which case the separation distance from the human body must be of 13 mm or more for the exemption.

For more details, refer to the values stated in [Table 11.2 Minimum Separation Distances for SAR Evaluation Exemption \(BGM220S12A\) on page 54](#) and [Table 11.3 Minimum Separation Distances for SAR Evaluation Exemption \(BGM220S22A\) on page 54](#): if the separation distances from the human body are less than the distances mentioned in the tables, then the OEM integrator is responsible for evaluating the SAR.

The module meets the requirements for Mobile use cases when the minimum separation distance from the human body is 20 cm or greater, in accordance to the limit(s) exposed in the RF Exposure Analysis.

OEM Responsibilities to comply with IC Regulations

The module has been certified for integration into products only by OEM integrators under the following conditions:

- The antenna must be installed such that a minimum separation distance as stated above is maintained between the radiator (antenna) and all persons at all times.
- The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter.

Important Note: In the event that these conditions cannot be met, the final product will have to undergo additional testing to evaluate the RF exposure in order for the ISED authorization to remain valid, and a permissive change will have to be applied with the help of the customer's own Telecommunication Certification Body typically acting as the certificate holder's agent.

In the case of the BGM220S12A, this variant has a limited approval due to the radio portion of the module not being contained in its own RF shielding: consequently, each new host will require a reassessment of the radiated spurious emissions, and the ISED will have to be notified with a Class IV Permissive Change.

In the case of the BGM220S22A, this variant is a shielded design, and consequently comes with a full modular approval.

End Product Labeling

The BGM220S modules are not labeled with their own IC ID due to their size. Instead, the packaging label contains the IC ID. In all cases when the IC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

For BGM220S12A

“Contains Transmitter Module IC: 5123A-BGM220S”

or

“Contains IC: 5123A-BGM220S”

For BGM220S22A

“Contains Transmitter Module IC: 5123A-BGM220S2”

or

“Contains IC: 5123A-BGM220S2”

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user manual of the end product.

Final note: As long as all the conditions above are met, further RF testing of the transmitter with full modular approval is not required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

CAN ICES-003 (B) - BGM220S22A Only

This Class B digital apparatus complies with Canadian ICES-003.

ISEDC (Français)

Le présent émetteur radio (IC: 5123A-BGM220S pour le BGM220S12A and IC: 5123A-BGM220S2 pour le BGM220S22A) a été approuvé par Innovation, Sciences et Développement Économique Canada (ISED Canada, anciennement Industrie Canada) pour fonctionner avec l'antenne intégrée et le ou les types d'antenne énumérés à la section [11.1.1 Qualified Antennas](#), avec le gain maximal admissible indiqué. Les types d'antenne non inclus dans cette liste, ayant un gain supérieur au gain maximal indiqué, sont strictement interdits d'utilisation avec cet appareil. .

Ce composant est conforme aux normes RSS, exonérées de licence d'ISED. Son mode de fonctionnement est soumis aux deux conditions suivantes:

1. Ce composant ne doit pas générer d'interférences.
2. Ce composant doit pouvoir être soumis à tout type de perturbation y compris celle pouvant nuire à son bon fonctionnement.

Déclaration d'exposition RF

L'exception tirée des limites courantes d'évaluation SAR est donnée dans le document RSS-102 Issue 5.

Pour le cas d'utilisation Portable, l'exposition RF ou l'évaluation SAR n'est pas nécessaire dans tous les cas, à n'importe quelle distance du corps humain, sauf lorsque le BGM220S22A est utilisé à pleine puissance avec l'antenne dipôle de référence externe, auquel cas la distance de séparation du corps humain doit être de 13 mm ou plus pour l'exemption.

Pour plus de détails, reportez-vous aux valeurs indiquées dans [Table 11.2 Minimum Separation Distances for SAR Evaluation Exemption \(BGM220S12A\) on page 54](#) et [Table 11.3 Minimum Separation Distances for SAR Evaluation Exemption \(BGM220S22A\) on page 54](#): si les distances de séparation du corps humain sont inférieures aux distances mentionnées dans les tableaux, alors l'intégrateur OEM est responsable de l'évaluation du SAR.

Le module répond aux exigences des cas d'utilisation mobile lorsque la distance de séparation minimale du corps humain est de 20 cm ou plus, conformément aux limites exposées dans l'analyse d'exposition RF.

Responsabilités des OEM pour une mise en conformité avec le Règlement du Circuit Intégré

Le module a été approuvé pour l'intégration dans des produits finaux exclusivement réalisés par des OEM sous les conditions suivantes:

- L'antenne doit être installée de sorte qu'une distance de séparation minimale indiquée ci-dessus soit maintenue entre le radiateur (antenne) et toutes les personnes avoisinante, ce à tout moment.
- Le module émetteur ne doit pas être localisé ou fonctionner avec une autre antenne ou un autre transmetteur que celle indiquée plus haut.

Tant que les deux conditions ci-dessus sont respectées, il n'est pas nécessaire de tester ce transmetteur de façon plus poussée. Cependant, il incombe à l'intégrateur OEM de s'assurer de la bonne conformité du produit fini avec les autres normes auxquelles il pourrait être soumis de fait de l'utilisation de ce module (par exemple, les émissions des périphériques numériques, les exigences de périphériques PC, etc.).

Remarque Importante: Dans le cas où ces conditions ne peuvent être satisfaites (pour certaines configurations ou co-implantation avec un autre émetteur), l'autorisation ISED n'est plus considérée comme valide et le numéro d'identification ID IC ne peut pas être apposé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera responsable de la réévaluation du produit final (y compris le transmetteur) et de l'obtention d'une autorisation ISED distincte.

Dans le cas du BGM220S12A, l'approbation de cette variante est limitée car la partie radio du module n'est pas incluse dans son propre blindage RF: par conséquent, chaque nouvel hôte est requis dans tous les cas pour réévaluer les émissions rayonnées et le bureau doit être informé par un C4PC.

Dans le cas du BGM220S22A, cette variante est une conception blindée et est par conséquent livrée avec une approbation modulaire complète.

Étiquetage des produits finis

Les modules BGM220S ne sont pas étiquetés avec leur propre ID IC en raison de leur taille. Au lieu de cela, l'étiquette d'emballage contient l'ID IC. Dans tous les cas, lorsque l'ID IC n'est pas visible lorsque le module est intégré au sein d'un autre produit, cet autre produit dans lequel le module est installé devra porter une étiquette faisant apparaître les références du module intégré. Dans un tel cas, sur le produit final doit se trouver une étiquette aisément lisible sur laquelle figurent les informations suivantes:

Pour le BGM220S12A

“Contient le module transmetteur: 5123A-BGM220S”

or

“Contient le circuit: 5123A-BGM220S”

Pour le BGM220S12A**“Contient le module transmetteur: 5123A-BGM220S2”**

or

“Contient le circuit: 5123A-BGM220S2”

Note finale: L'intégrateur OEM doit être conscient qu'il ne doit pas fournir, dans le manuel d'utilisation, d'informations relatives à la façon d'installer ou de d'enlever ce module RF ainsi que sur la procédure à suivre pour modifier les paramètres liés à la radio.

CAN ICES-003 (B) - BGM220S22A uniquement

Cet appareil numérique de classe B est conforme à la norme canadienne ICES-003.

11.1.5 Proximity to Human Body

When using the BGM220S modules in an application where the radio is located close to the human body, the human RF exposure must be taken into account. FCC, ISED, and CE all have different standards and rules for evaluating the RF exposure. In particular, each regulator has different requirements when it comes to the exemption from having to perform RF exposure and SAR (Specific Absorption Rate) measurements, and the minimum separation distances between the module and human body varies accordingly. The properties of the BGM220S modules allows for the minimum separation distances detailed in the tables below for SAR evaluation exemption in portable use cases (less than 20 cm from human body). The module is approved for the Mobile use case (more than 20 cm) without any need for RF Exposure evaluation.

Table 11.2. Minimum Separation Distances for SAR Evaluation Exemption (BGM220S12A)

Certification	BGM220S12A
FCC	0 mm
ISED	0 mm
CE	The RF exposure must always be evaluated using the end-product when transmitting with power levels higher than 20 mW (13 dBm).

Table 11.3. Minimum Separation Distances for SAR Evaluation Exemption (BGM220S22A)

Certification	BGM220S22A
FCC	0 mm
ISED	13 mm with the reference external antenna 12 mm for integral antenna
CE	The RF exposure must always be evaluated using the end-product when transmitting with power levels higher than 20 mW (13 dBm).

For FCC and ISED, using the module in end-products where the separation distance from the human body is smaller than that listed above is allowed but requires evaluation of the RF exposure in the final assembly and applying for a *Class 2 Permissive Change* or *Change of ID* to be applied to the existing FCC/ISED approvals of the module. For CE, RF exposure must be evaluated using the end-product in all cases when transmitting at more than the power level indicated in the table.

Note: Placing the module in touch or very close to the human body will have a negative impact on the efficiency of the antenna thus a reduced range is to be expected.

11.1.6 Japan - MIC

The BGM22S12A are certified in Japan with certification number 203-JN1080.

The BGM22S22A are certified in Japan with certification number 209-J00429.

It is the end-product manufacturer's responsibility to ensure that the module is configured to meet the limits documented in the formal certification test report available at <https://www.silabs.com/>. If needed, refer to the API reference manual(s) to learn how to configure the maximum RF TX power for the normal operations.

Since September 1, 2014 it is allowed (and highly recommended) that a manufacturer who integrates a radio module in their host equipment places the certification mark and certification number on the outside of the host equipment. This combination of mark and number, and their relative placement, is depicted in figure 11.1, and depending on the size of the module it might also appear on the top shield markings of the radio module. The certification mark and certification number must be placed close to the text in the Japanese language which is provided below. This change in the Radio Law has been made in order to enable users of the combination of host and radio module to verify if they are actually using a radio device which is approved for use in Japan

Certification Text to be Placed on the Outside Surface of the Host Equipment:

当該機器には電波法に基づく、技術基準適合証明等を受けた特定無線設備を装着している。

Translation of the text:

"This equipment contains specified radio equipment that has been certified to the Technical Regulation Conformity Certification under the Radio Law."

The "Giteki" marking shown in the figures below must be affixed to an easily noticeable section of the specified radio equipment.

Note that additional information may be required if the device is also subject to a telecom approval.



Figure 11.1. GITEKI Mark and ID (BGM220S12A)



Figure 11.2. GITEKI Mark and ID (BGM220S22A)

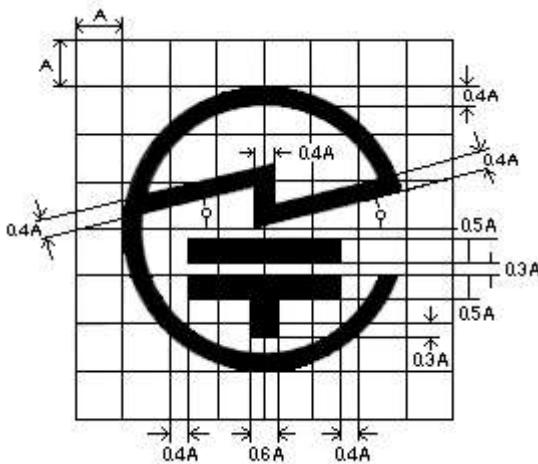


Figure 11.3. GITEKI Mark

11.1.7 South Korea - KC

The BGM220S22A modules have a RF registration for import and use in South-Korea.

Registration number is KC ID: R-R-BGT-BGM220S2

When integrating this RF-certified module, an end-product is exempted from doing the RF emission testing, as long as the recommended design guidance is followed, and the approved antennas are used. In cases when the custom SRD protocol is additionally enabled and used, the registration is valid only with the integral antenna, and the use of any external antenna will require separate testing and certification of the complete new system.

EMC testing and any other relevant test applicable to the end-product as a whole, plus appropriate labeling of the end-product, might still be required for the full regulatory compliance in the country.

11.1.8 Taiwan - NCC

The BGM220S22A modules are certified in Taiwan with NCC certification number CCAI23Y10060T8.

BGM220S22A 模塊在台灣通過了 NCC 認證編號 CCAI23Y10060T8 的認證。



Manufacturers are required to mark their end-products with the following sentence: "This product contains a radio frequency module with certification number CCAI23Y10060T8."

系統製造商應在平台上放置如下聲明：“本產品包含認證號為CCAI23Y10060T8的射頻模塊。”

Note: The outer packaging of the final product must also be marked with the NCC conformity mark by the manufacturer

注意：最終產品的外包裝也必須由製造商打上NCC合格標誌

Additionally, the final product will have to be listed in the NCC database of approved radio-equipped devices. Consequently, the end manufacturer is also supposed to contact the certification house that originally released the full modular approval and apply for the registration of their device under the above certification number (fees might apply.)

此外，該平台必須列在 NCC 批准的無線電設備數據庫中。因此，平台製造商還應聯繫最初頒發全模塊化批准的認證機構，併申請在上述認證編號下註冊其設備（可能需要付費）。

NCC Statement

For low-power radio frequency equipment that has been certified, companies, firms, or users are not allowed to change the frequency, increase the power, or change the characteristics and functions of the original design without further NCC approval.

The use of low-power radio frequency equipment shall not affect flight safety and interfere with legal communications.

If interference is found, it shall be immediately stopped, and the equipment can be brought back into use only after it has been improved, so that interference is found no more.

The aforementioned legal communication refers to radio communications operating in accordance with the provisions of the Telecommunications Management Act.

Low-power radio frequency equipment must withstand interference from legitimate communications or radiating electrical equipment for industrial, scientific, and medical applications.

NCC 警語

取得審驗證明之低功率射頻器材，非經核准，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

低功率射頻器材之使用不得影響飛航安全及干擾合法通信。

經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前述合法通信，指依電信管理法規定作業之無線電通信。

低功率射頻器材須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

11.1.9 Brazil - ANATEL

The BGM220S22A and BGM220S12A are certified for Brazil, and come with a homologation by ANATEL with number of 07556-24-03402.

The user manual of the equipment that integrates this module must contain the following sentences:

- 1] "This equipment integrates a Bluetooth radio wireless module having ANATEL homologation code of 07556-24-03402."
- 2] "This equipment is not entitled to protection against harmful interference and may not cause interference to other duly authorized systems."

O BGM220S22A e o BGM220S12A são certificados para o Brasil e possuem homologação na ANATEL com o número 07556-24-03402.

O manual do usuário do equipamento que integra este módulo deve conter as seguintes frases:

- 1] "Este produto contém um módulo de rádio Bluetooth com código de homologação ANATEL 07556-24-03402."
- 2] "Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados."

11.2 Standards-Based Certifications

11.2.1 Bluetooth Qualification

The BGM220S modules are qualified as a Core Layer RF-PHY Design based on Bluetooth Low Energy Core Specification 5.3, with Declaration ID of D056805 and QDID of 178495.

Additionally, the modules are included in a pre-qualified RF-PHY design based on Bluetooth Low Energy Core Specification 5.4, with Declaration ID of D065594 and QDID of 231196.

The RF-PHY design should be imported and combined with the latest Wireless Gecko Link Layer and Host qualified design(s) by Silicon Labs when qualifying a Product (Core-Complete Configuration Design) that embeds the BGM220S, using the Bluetooth SIG's Qualification Workspace tool.

Please find out more about Bluetooth Qualification on docs.silabs.com.

12. Revision History

Revision 1.3

January, 2025

- Updated Bluetooth version number throughout the document.
- Updated [7.3 Radio Performance vs. Carrier Board Size and Other PCB Characteristics](#)
- Updated [7.6 Antenna Tuning and Validity of Modular Certifications](#)
- Added Certificaton for Brazil - ANATEL
- Updated [11.2.1 Bluetooth Qualification](#).
- Removed warning in [7.3 Radio Performance vs. Carrier Board Size and Other PCB Characteristics](#) and replaced with new section [7.6 Antenna Tuning and Validity of Modular Certifications](#).

Revision 1.2

October, 2023

- Added regulatory certification for BGM220S22A (see Section [11.1.8 Taiwan - NCC](#)).

Revision 1.1

January, 2022

- Updated regulatory certifications in [1. Feature List](#).
- Updated direction finding language in [2. Ordering Information](#).
- Added kits available for evaluation in [2. Ordering Information](#).
- Corrected Storage Temperature range in [4.1 Absolute Maximum Ratings](#).
- Corrected initial calibrated accuracy in [4.11 High-Frequency Crystal](#).
- Added footnote for crystal load capacitance with Gain=2 test condition in [4.12 Low Frequency Crystal Oscillator](#).
- Added RESETn low time to ensure pin reset (T_RESET) specification to [Table 4.14 GPIO Pins on page 20](#).
- Updated [11.1.2 EU and UK - CE and UKCA](#).
- Updated wording for [11.2.1 Bluetooth Qualification](#).

Revision 1.0

September, 2020

- Various wording updates to [11.1 Regulatory Certifications](#) to introduce BGM220S22A model.
- Updated wording for [11.2.1 Bluetooth Qualification](#).

Revision 0.7

July, 2020

- Updated [2. Ordering Information](#) with devices for model BGM220S22A.
- Added [Table 3.2 Antenna Efficiency and Peak Gain \(BGM220S22A\) on page 7](#) for model BGM220S22A.
- Updated [4. Electrical Characteristics](#) with additional specifications for model BGM220S22A and latest characterization data.
- Added [Figure 4.4 BGM220S22A Typical 2D Antenna Radiation Patterns on 55 mm x 20 mm board on page 23](#) for model BGM220S22A.
- Updated [7. Design Guidelines](#) with guidelines and information covering model BGM220S22A.
- Added marking information for model BGM220S22A to [Table 8.3 Top Marking Definition on page 43](#).
- Added section to note pending certification for model BGM220S22A.

Revision 0.6

June, 2020

- Updated 4.2.1 DC-DC Operating Limits to relax lifetime safe operating region.
- Updated 5. Reference Diagrams to mark PTI interface as recommended in figures.
- Updated 4. Electrical Characteristics with latest characterization results and limits.
- Updated 11. Certifications with additional certification details.

Revision 0.5

March, 2019

- In the front page block diagram, updated the lowest energy mode for LETIMER.
- Updated part numbers in 2. Ordering Information to reflect new ordering code scheme.
- In 2. Ordering Information, added note about referencing by family, model, or ordering code.
- Added 4.13 Precision Low Frequency RC Oscillator (LFRCO).
- Added supply voltage, crystal frequencies and RF frequencies to Figure 3.1 BGM220S Block Diagram on page 6.
- Updated 4. Electrical Characteristics with latest characterization details.
- Updated 5. Reference Diagrams.
- Added section 11. Certifications.
- Added section 5. Reference Diagrams.
- Added section 10. Tape and Reel.

Revision 0.1

September, 2019

Initial release.