

User Manual (TM05FNNAGM0 Alt. TM05FNNAGM1)

BEJTM05FNNAGM0 [FCC ID]
2703H-TM05FNNAGM0 [ISED ID]

History

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1. Product Introduction

The **TM05FNNAGM0** are designed for the automotive industry. They support 5G NR, LTE and WCDMA air Interface standards. The **TM05FNNAGM0** are based on the Qualcomm SA515M wireless chipsets and support the following bands.

Table 1. Supported Band

Region		NA (North America)	MX (Mexico)
Band	NR	n2/n5/n7/n12/n13/n14/n25/n26/ n29(Rx only)/n30(Rx only)/n41/n66 /n71/n77/n78	-
	LTE	B2/B4/B5/B7/B12/B13/B14/ B29(Rx only)/B30(Rx only)/B66	B2/B4/B5/B12/B13/B14/B17/B28 / B29(Rx only)/B30(Rx only)/B66
	WCDMA	B2/B4/B5	B2/B4/B5

1.1 Block Diagram

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REFER TO SEPARATED DOCUMENT

Figure 1.1. TM05FNNAGM0 Block diagram

1.2 Environmental Specifications

The environmental specification for operating and storage of the **TM05FNNAGM0** are defined in the table below.

Table 2. Environmental Specifications

Parameter	Temperature Range
Operating Temperature	-40°C to 90°C
Storage Temperature	-40°C to 95°C
Humidity	95% or less

1.3 Electrical Specifications

This section provides details for some of the key electrical specifications of the **TM05FNNAGM0** embedded modules.

1.3.1 Absolute Maximum Rating

This section defines the Absolute Maximum Ratings of the **TM05FNNAGM0** embedded modules.

Warning: If these parameters are exceeded, even momentarily, damage may occur to the device.

Table 3. Absolute Maximum Ratings (input voltage of PMIC)

Parameter		Min	Max	Units
VPH_PWR	Power Supply Input	-	6	V
VIN	Voltage on any digital input or output pin	-	6	V

1.3.2 Current Consumption

Table 4. **TM05FNNAGM0** Current Consumption (@3.9V)

Mode	Parameter	Typical	Max	Units
LTE	Max TX Output /Full RB	550	TBD	mA
WCDMA	Max TX Output /Full RB	550	TBD	mA
LTE	Idle, Registered	2	-	mA
WCDMA	Idle, Registered	2	-	mA

1.4 Mechanical Specifications

1.4.1 Physical Dimensions and Connection Interface

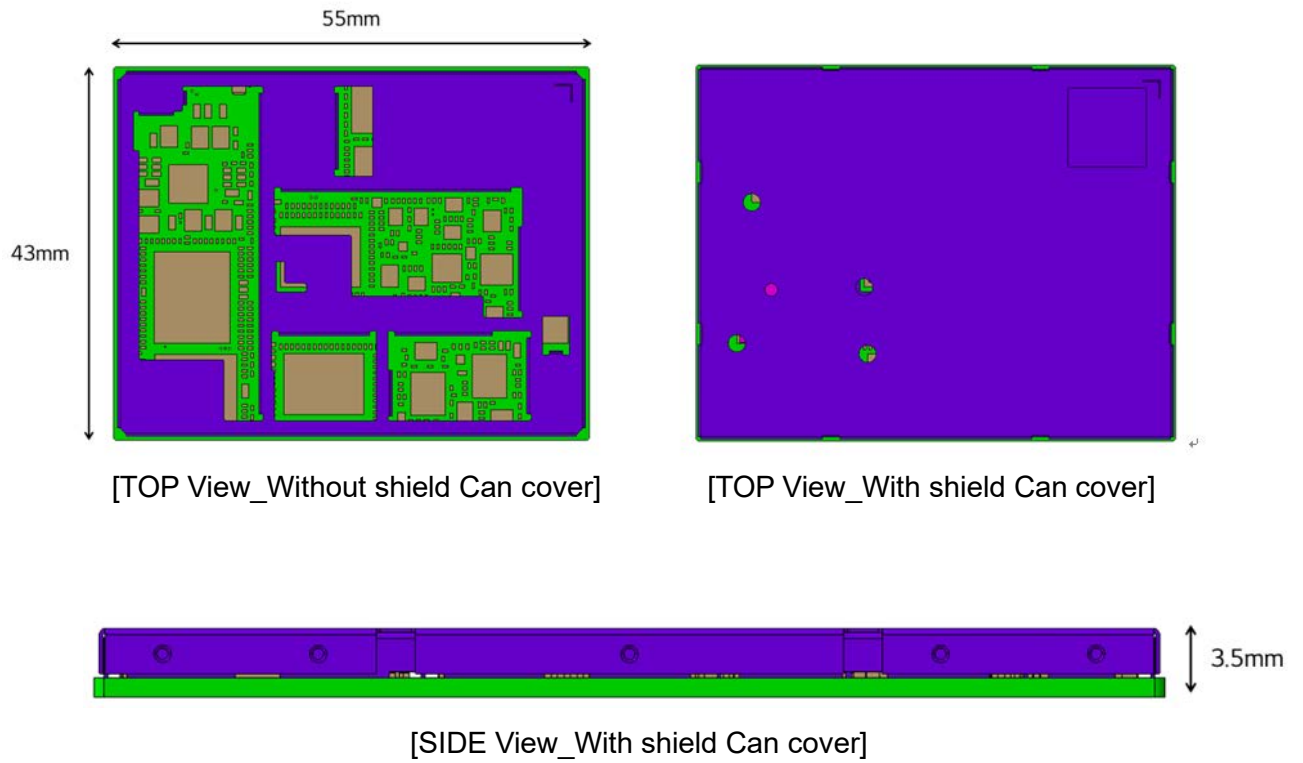
The **TM05FNNAGM0** embedded modules are a Land Grid Array(LGA) form factor device. The device does not have a System or RF connectors. All electrical and mechanical connections are made via the LGA pad on the underside of the PCB.

Table5. **TM05FNNAGM0** Embedded Module Dimensions

Parameter	Nominal	Max	Units
Overall Dimension	55 x 43	55.35 x 43.35	mm
Overall Module Height	3.5	3.7	mm
PCB Thickness	1.0	1.1	mm
Flatness Specification		0.15	mm
Weight	TBD		g

1.4.2 Mechanical Drawing

1.4.2.1 NAD PCB



2. RF Specification

The specifications for the 5G NR, LTE and WCDMA interfaces are defined.

TM05FNNAGM0 is designed to be compliant with the standard shown in the table below.

Table6. Standards Compliance

Technology	Standards
5G NR	• 3GPP Release 15
LTE	• 3GPP Release 15
WCDMA	• 3GPP Release 9
GSM*	• 3GPP Release 9

* This product does not use GSM.

2.1 5G NR Specification

2.1.1 NR RX Sensitivity

The Receiver Sensitivity of the **TM05FNNAGM0** are specified in the following table.

Table7. Conducted RX (Receive) Sensitivity – NR Bands

BAND	Method (DL CH)	Specification
n2 Reference sensitivity level	Measure BLER of Mid Channel (392000) in Band2	sensitivity : ≤ -91.1 BLER : $\leq 5\%$ (SCS:15 kHz / BW:20 MHz)
n5 Reference sensitivity level	Measure BLER of Mid Channel (176300) in Band5	sensitivity : ≤ -90.1 BLER : $\leq 5\%$ (SCS:15 kHz / BW:20 MHz)
n7 Reference sensitivity level	Measure BLER of Mid Channel (531000) in Band7	sensitivity : ≤ -91.1 BLER : $\leq 5\%$ (SCS:15 kHz / BW:20 MHz)
n12 Reference sensitivity level	Measure BLER of Mid Channel (147500) in Band12	sensitivity : ≤ -83.3 BLER : $\leq 5\%$ (SCS:15 kHz / BW:15 MHz)
n13 Reference sensitivity level	Measure BLER of Mid Channel (150200) in Band13	sensitivity : ≤ -93.1 BLER : $\leq 5\%$ (SCS:15 kHz / BW:10 MHz)
n14 Reference sensitivity level	Measure BLER of Mid Channel (152600) in Band14	sensitivity : ≤ -93.1 BLER : $\leq 5\%$ (SCS:15 kHz / BW:10 MHz)
n25 Reference sensitivity level	Measure BLER of Mid Channel (392500) in Band25	sensitivity : ≤ -89.6 BLER : $\leq 5\%$ (SCS:15 kHz / BW:20 MHz)

n26 Reference sensitivity level	Measure BLER of Mid Channel (175300) in Band26	sensitivity : ≤ -87.6 BLER : $\leq 5\%$ (SCS:15 kHz / BW:20 MHz)
n29 Reference sensitivity level	Measure BLER of Mid Channel in Band29	sensitivity : ≤ -93.8 BLER : $\leq 5\%$ (SCS:15 kHz / BW:10 MHz)
n30 Reference sensitivity level	Measure BLER of Mid Channel (471000) in Band30	sensitivity : ≤ -95.1 BLER : $\leq 5\%$ (SCS:15 kHz / BW:10 MHz)
n41 Reference sensitivity level	Measure BLER of Mid Channel (518598) in Band41	sensitivity : ≤ -84 BLER : $\leq 5\%$ (SCS:30 kHz / BW:100 MHz)
n66 Reference sensitivity level	Measure BLER of Mid Channel (431000) in Band66	sensitivity : ≤ -92.6 BLER : $\leq 5\%$ (SCS:15 kHz / BW:20 MHz)
n71 Reference sensitivity level	Measure BLER of Mid Channel (126900) in Band71	sensitivity : ≤ -85.3 BLER : $\leq 5\%$ (SCS:15 kHz / BW:20 MHz)
n77 Reference sensitivity level	Measure BLER of Mid Channel (650000) in Band77	sensitivity : ≤ -84.1 BLER : $\leq 5\%$ (SCS:30 kHz / BW:100 MHz)
n78 Reference sensitivity level	Measure BLER of Mid Channel (636667) in Band78	sensitivity : ≤ -84.6 BLER : $\leq 5\%$ (SCS:30 kHz / BW:100 MHz)

2.2 LTE Specification

2.2.1 LTE RX Sensitivity

The Receiver Sensitivity of the **TM05FNNAGM0** are specified in the following table.

Table7. Conducted RX (Receive) Sensitivity – LTE Bands

BAND	Method (DL CH)	Specification
BAND 2 Reference sensitivity level	Measure BLER of Mid Channel (900) in Band2	sensitivity : ≤ -94.3 BLER : $\leq 5\%$
BAND 4 Reference sensitivity level	Measure BLER of Mid Channel (2175) in Band4	sensitivity : ≤ -96.3 BLER : $\leq 5\%$
BAND 5 Reference sensitivity level	Measure BLER of Mid Channel (2525) in Band5	sensitivity : ≤ -94.3 BLER : $\leq 5\%$

BAND 7 Reference sensitivity level	Measure BLER of Mid Channel (3100) in Band7	sensitivity : ≤ -94.3 BLER : $\leq 5\%$
BAND 12 Reference sensitivity level	Measure BLER of Mid Channel (5095) in Band12	sensitivity : ≤ -93.3 BLER : $\leq 5\%$
BAND 13 Reference sensitivity level	Measure BLER of Mid Channel (5230) in Band13	sensitivity : ≤ -93.3 BLER : $\leq 5\%$
BAND 14 Reference sensitivity level	Measure BLER of Mid Channel (5330) in Band14	sensitivity : ≤ -93.3 BLER : $\leq 5\%$
BAND 28 Reference sensitivity level	Measure BLER of Mid Channel (9435) in Band28	sensitivity : ≤ -94.8 BLER : $\leq 5\%$
BAND 29 Reference sensitivity level	Measure BLER of Mid Channel (9715) in Band29	CA operation
BAND 30 Reference sensitivity level	Measure BLER of Mid Channel (9820) in Band30	CA operation
BAND 66 Reference sensitivity level	Measure BLER of Mid Channel (66886) in Band66	sensitivity : ≤ -95.8 BLER : $\leq 5\%$

2.3 WCDMA Specification

2.3.1 WCDMA RX Sensitivity

The Receiver Sensitivity of the **TM05FNNAGM0** are specified in the following table.

Table8. Conducted RX (Receive) Sensitivity – WCDMA Bands

Item	Method (DL CH)	Specification
BAND2 BER(Bit Error Rate)	Measure BER of Middle Channel (CH=9800) in Band2	0.1% @ ≤ -106.7 dBm
BAND4 BER(Bit Error Rate)	Measure BER of Middle Channel (CH=1675) in Band4.	0.1% @ ≤ -106.7 dBm
BAND5 BER(Bit Error Rate)	Measure BER of Middle Channel (CH=4400) in Band5	0.1% @ ≤ -106.7 dBm

Notice

Changes or modifications not expressly approved by the party responsible for compliance 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.

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.

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. This device should be installed and operated with minimum distance **17 cm** between the radiating element of this device and the user.

Notice

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance **17 cm** between the radiator & your body.

NOTE: THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

Avis d'Industrie Canada sur l'exposition aux rayonnements

Cet appareil est conforme aux limites d'exposition aux rayonnements d'Industrie Canada pour un environnement non contrôlé.

Il doit être installé de façon à garder une distance minimale de **17 centimètres** entre la source de rayonnements et votre corps.

REMARQUE: LE FABRICANT N'EST PAS RESPONSABLE DES INTERFÉRENCES RADIOÉLECTRIQUES CAUSÉES PAR DES MODIFICATIONS NON AUTORISÉES APPORTÉES À CET APPAREIL. DE TELLES MODIFICATIONS POURRAIT ANNULER L'AUTORISATION ACCORDÉE À L'UTILISATEUR DE FAIRE FONCTIONNER L'APPAREIL.

Operation is subject to the following two conditions:

- 1.This device may not cause interference.
- 2.This device must accept any interference, including interference that may cause undesired operation of the device.

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.

KDB 996369 D03 OEM Manual, Integration Instructions

2.2 List of Applicable FCC Rules

Part 22, 24, 27, 90

2.3 Summarize the specific operational use conditions

Single module, vehicle-use only. Only vehicle manufacturer can use/install this device on their vehicle.

2.4 Limited module procedure

N/A

2.5 Trace antenna designs

N/A

2.6 RF Exposure consideration

RF Exposure evaluation was performed with very specific installation condition at 17 cm. Any other installation condition may require additional test and permissive change procedure.

2.7 Antennas

The product test was performed with metal antenna. Any other antenna may require additional test and permissive change procedure.

2.8 Label and compliance information

Host equipment shall have compliance information and label information 'Contains FCC ID' with FCC ID: BEJTM05FNNAGM0

Notice;

The host manufacturer is responsible for additional testing to verify compliance as a composite system. when testing the host device for compliance with part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant. The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in part 15 Subpart B or emissions are complaint with the transmitter rule. The grantee will provide guidance to the host manufacurer for part 15 Subpart B requirements if needed.