User Manual

(TM16FNNABM0)

FCC ID: BEJTM16FNNABM0

IC: 2703H-TM16FNNABM0

Contents [hide]

Product Introduction

The TM16FNNABM0 are designed for the automotive industry. They support 5G NR, LTE and WCDMA air Interface standards. The TM16FNNABM0 are based on the Qualcomm wireless chipsets and support the following bands.

Table 1. Supported Band

Region		US
	NR	n1/n2/n3/n5/n7/n8/n12/n20/n25/n28/ n41/n48/n66/n71/n77/ n78

Band	LTE	B1/B2/B3/B4/B5/B7/B8/B12/B13/B17 /B20/B25/B26/B28/B29/B38/B42/B48/B66/B71
	LTE ULCA	CA_2A-12A/CA_12A-66A
	WCDMA	B1/B2/B5/B8

*The red marks are bands for USA and Canada

*LTE B42 is not used in USA

1.1 Environmental Specifications

The environmental specification for operating and storage of the TM16FNNABM0 are defined in the the table below.

Table 2. Environmental Specifications

Parameter	Temperature Range
Operating Temperature	-40℃ to 90℃ (ecall 95℃)
Storage Temperature	-40℃ to +95℃
Humidity	95% or less

1.2 Electrical Specifications

This section provides details for some of the key electrical specifications of the TM16FNNABM0 embedded modules.

1.2.1 Absolute Maximum Rating and ESD Ratings

This section defines the Absolute Maximum and Electrostatic Discharge (ESD) Ratings of the TM16FNNABM0 embedded modules.

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

Table 3. Absolute Maximum Ratings

Parameter		Min	Max	Units
VPH_PWR	Power Supply Input	–	6	V

VIN	Voltage on any digital input or outpu t pin	–	2.145	V
ESD Ratings				
ESD1)	Primary, Diversity antenna pads – C ontact		1	kV

1) The ESD Simulator configured with 330pF, 2000Ω.

Caution: The TM16FNNABM0 embedded modules are sensitive to Electrostatic Discharge.

ESD countermeasures and handling methods must be used when handling the TM16FNNABM0 devices.

1.2.2 Current Consumption

Table 4. TM16FNNABM0 Current Consumption (@4.1V)

Mode	Parameter	Typical	Max	Units
LTE	Max TX Output /Full RB	550	TBD	mA
WCDMA	Max TX Output /Full RB	850	TBD	mA
LTE	Idle, Registered	2	–	mA
WCDMA	Idle, Registered	2	–	mA

1.3 Mechanical Specifications

1.3.1 Physical Dimensions

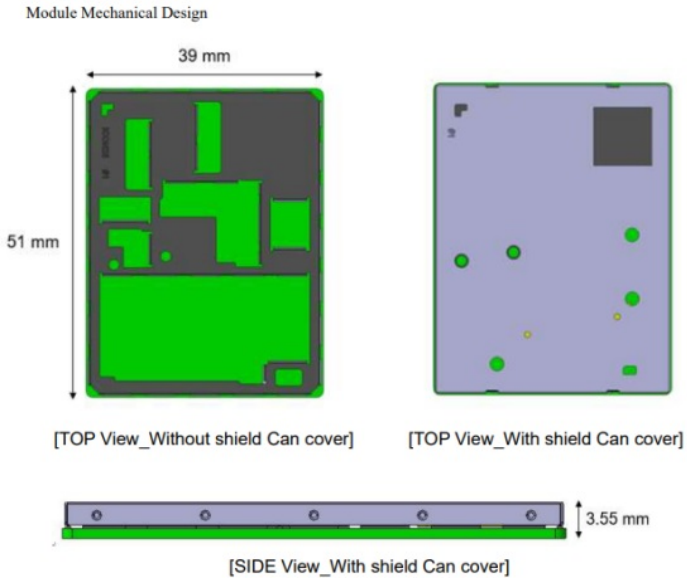
The TM16FNNABM0 embedded modules are a Land Grid Array (LGA) form factor device. The device does not have a System or RF connectors. All electrical and mechanical connections are made via the lga pad on the underside of the PCB.

1.3.2 Mechanical Drawing

Module Dimension

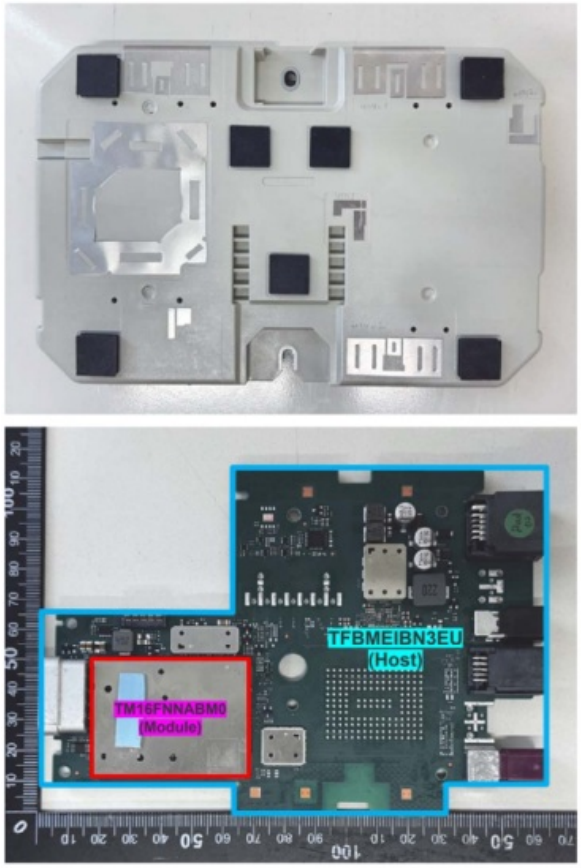
Parameter	Nominal	Max	Units

Overall Dimension	39 x 51	39.35 x 51.35	mm
Overall Module Height	3.55	3.8	mm
PCB Thickness	1.0	1.1	mm
Flatness Specification		0.1	mm
Weight	TBD		g



1.3.3 Host Equipment

This module is limited module and tested with a specific host equipment TFBMEIBN3EU and its internal antenna. Any other host equipment that has different RF/EMC characteristics and antenna would require permissive change procedure and may need additional testing.



RF Specification

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

TM16FNNABM0 is designed to be compliant with the standard shown in the table below.

Table6. Standards Compliance

Technology	Standards
5G NR	• 3GPP Release 16
LTE	• 3GPP Release 15
WCDMA	• 3GPP Release 9

2.1 Module support Band

UMTS/LTE/NR	Frequency		FDD / TDD	Supported RAT
Band	Tx	Rx		NA

B1	1920~1980	2110~2170	FDD	W,L,NR
B2	1850~1910	1930~1990	FDD	W,L,NR
B3	1710~1785	1805~1880	FDD	L,NR
B4	1710~1755	2100~2155	FDD	L
B5	824~849	869~894	FDD	W,L,NR
B6	830~840	875~885	FDD	
B7	2500~2570	2620~2690	FDD	L,NR
B8	880~915	925~960	FDD	W,L,NR
B9	1749.9~1784.9	1844.9~1879.9	FDD	
B10	1710~1770	2110~2170	FDD	
B11	1427.9~1447.9	1475.9~1495.9	FDD	
B12	669~716	729~746	FDD	L,NR
B13	777~787	746~756	FDD	L
B14	788~798	758~768	FDD	
B17	704~716	734~746	FDD	L
B18	815~830	860~875	FDD	
B19	830~845	875~890	FDD	

B20	832~862	791~821	FDD	L,NR
B21	1447.9~1462.9	1495.9~1510.9	FDD	
B24	1626.5~1660.5	1525~1559	FDD	
B25	1850~1915	1930~1995	FDD	L,NR
B26	814~849	859~894	FDD	L
B28	703~748	758~803	FDD	L,NR
B29	–	717~728	FDD	L(RXonly)
B30	(2305~2315)	2350~2360	FDD	
B32	–	1452~1496	FDD	
B34	2010~2025		TDD	
B38	2570~2620		TDD	L
B39	1880~1920		TDD	
B40	2300~2400		TDD	
B41	2496~2690		TDD	NR
B42	3400~3600		TDD	L
B43	3600~3800		TDD	
B47(C-V2X)	5855~5925		TDD	
B48	3550~3700		TDD	L,NR

B66	1710~1780	2110~2200	FDD	L,NR
B71	663~698	617~652	FDD	L,NR
B75	1432~1517		SDL	
n77	3300~4200		TDD	NR
n78	3300~3800		TDD	NR
n79	4400~5000		TDD	

– W : WCDMA

– L : LTE

– NR : 5G NR

*The red marks of bands are used for USA and Canada

*LTE Band 42 is not use in USA

2.2 Module Support Power Level

Main Antenna	FUNCTION	BAND	TARGET
MIMO1	WCDMA	B2	24.00
MIMO1	WCDMA	B5	24.00
MIMO1	LTE	B2	23.00
MIMO1	LTE	B4	23.00
MIMO1	LTE	B5	23.00
MIMO1	LTE	B7	23.00
MIMO1	LTE	B12	23.00
MIMO1	LTE	B13	23.00

MIMO1	LTE	B17	23.00
MIMO1	LTE	B25	23.00
MIMO1	LTE	B26	23.00
MIMO1	LTE	B38	23.00
MIMO1	LTE	B42_ISED	23.00
MIMO1	LTE	B48_CBRS	22.00
MIMO1	LTE	B66	23.00
MIMO1	LTE	B71	23.00
MIMO1	NR	n2	23.00
MIMO1	NR	n5	23.00
MIMO1	NR	n7	23.00
MIMO1	NR	n12	23.00
MIMO1	NR	n25	23.00
MIMO1	NR	n41	23.00
MIMO1	NR	n48_CBRS	22.00
MIMO1	NR	n66	23.00
MIMO1	NR	n71	23.00
MIMO1	NR	n77	23.00
MIMO1	NR	n78	23.00
MIMO2	LTE	B42_ISED	23.00
MIMO2	LTE	B48_CBRS	22.00

MIMO2	NR	n48_CBRS	22.00
MIMO2	NR	n77	23.00
MIMO2	NR	n78	23.00
MIMO3	WCDMA	B2	24.00
MIMO3	WCDMA	B5	24.00
MIMO3	LTE	B2	23.00
MIMO3	LTE	B4	23.00
MIMO3	LTE	B5	23.00
MIMO3	LTE	B7	23.00
MIMO3	LTE	B12	23.00
MIMO3	LTE	B13	23.00
MIMO3	LTE	B17	23.00
MIMO3	LTE	B25	23.00
MIMO3	LTE	B26	23.00
MIMO3	LTE	B38	23.00
MIMO3	LTE	B42_ISED	23.00
MIMO3	LTE	B48_CBRS	21.50
MIMO3	LTE	B66	23.00
MIMO3	LTE	B71	23.00
MIMO3	NR	n2	23.00
MIMO3	NR	n5	23.00

MIMO3	NR	n7	23.00
MIMO3	NR	n12	23.00
MIMO3	NR	n25	23.00
MIMO3	NR	n41	23.00
MIMO3	NR	n48_CBRS	21.50
MIMO3	NR	n66	23.00
MIMO3	NR	n71	23.00
MIMO3	NR	n77	23.00
MIMO3	NR	n78	23.00
MIMO1+2	NR	n48_CBRS	20.00
MIMO1+2	NR	n77	23.00
MIMO1+2_Tx diversity	NR	n77	25.00
MIMO1+2	NR	n78	23.00

Module Installation

Module should be covered its shield-can cover before operation. In case of modules were supplied separately with shield-can cover, it should be covered by shield-can before use. Shield-can can covers whole part of module as below picture.

Installation of Shield-can cover

FCC 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 20cm between the radiating element of this device and the user.

ISED 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 20 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.

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.

KDB 996369 D03 OEM Manual

List of Applicable FCC

Rules Part 22, 24, 27, 90, 96

Summarize the specific operational use conditions

Limited module, designated enclosure that contains specific antenna inside. Professional installation equipment. Vehicle-use only. Only vehicle manufacturer can use/install this device on their vehicle.

Limited module procedure

Limited module, only specific host equipment can be used with this module. Applying this module to other host equipment may require additional test and permissive change procedure.

RF Exposure was evaluated with specific host and certain condition.

-Test plan for different host configuration

Module was tested with a specific host configuration. Any other host configuration for this module would require additional test. New host configuration shall be approved with

additional test.

Following tests shall be considered to add new host configuration on this modular approval with Class II permissive change.

– All radiated testing shall be performed on new host equipment and new antenna.

– RF Exposure shall be evaluated on new host equipment.

TEST ITEM	RULE PART
ERP/EIRP	§22.913(a)(5) §24.232(c) §27.50(b)(9) §27.50(c)(9)(10) §27.50(d)(4) §27.50(h)(2) §27.50(j)(3) §27.50(k)(3) §90.635(b) §96.41(b)
Radiated Spurious Emissions	§22.917(a) §24.238(a) §27.53(c)(2) §27.53(f) §27.53(g) §27.53(h)(1) §27.53(m)(4) §27.53(l)(2) §27.53(n)(2) §90.691(a) §96.41(e)(ii)
RF Exposure	§2.1091, §2.1093

Trace antenna designs

N/A

RF Exposure consideration

RF Exposure evaluation was performed with very specific installation condition at 200 mm.

Any other installation condition may require additional RF exposure evaluation procedure in the module or host equipment.

Antennas

Radiated emission test was performed with internal antenna configuration with host device. any other antenna may require additional test and permissive change procedure.

Internal antenna configuration with host equipment

Ant. No.	Frequency Range	Support Band		
		LTE	NR	WCDMA
Ant. 1	Below 3 , Above 3	2, 4, 5, 7, 12, 13, 17, 25, 26, 38, 42, 48, 66, 71	2, 5, 7, 12, 25, 41, 42, 48, 66, 71, 77, 78	II, V
Ant. 2	Above 3	42, 48	48, 77, 78	
Ant. 3	Below 3 , Above 3	2, 4, 5, 7, 12, 13, 17, 25, 26, 38, 42, 48, 66, 71	2, 5, 7, 12, 25, 41, 42, 48, 66, 71, 77, 78	II, V
Ant.1 + Ant. 2	Above 3		48, 77, 78	

Band	Operating Frequency ( )	Antenna Peak Gain (i)			
		Ant. 1	Ant. 2	Ant. 3	Ant. 1 + Ant. 2
LTE 25/2 WCDMA II NR 25/2	1 850 ~ 1 915	1.86		-0.32	

LTE 66/4 NR 66	1 710 ~ 1 780	1.37		-0.03	
LTE 26/5 WCDMA V NR 5	824 ~ 849	-2.43		-3.16	
LTE 7 NR 7	2 500 ~ 2 570	0.92		2.79	
LTE 12/17 NR 12	699 ~ 716	-3.98		-1.20	
LTE 13	777 ~ 787	-4.60		-3.16	
LTE 26	814 ~ 824	-2.43		-3.16	
LTE 38	2 570 ~ 2 620	0.92		2.79	
LTE 42	3 450 ~ 3 600	-0.66	-1.37	0.96	
LTE 48	3 550 ~ 3 700	-0.66	-1.37	0.96	
NR 48	3 550 ~ 3 700	-0.66	-1.37	0.96	2.00
LTE 71 NR 71	663 ~ 698	-2.45		-1.60	
NR 41	2 496 ~ 2 690	0.92		2.79	
NR 77	3 450 ~ 3 550	0.34	0.12	1.58	3.24
	3 700 ~ 3 980	0.34	0.12	1.58	3.24
NR 78	3 450 ~ 3 550	0.34	0.12	1.58	3.24
	3 700 ~ 3 800	0.34	0.12	1.58	3.24

Note;

1) According to KDB 662911 D01 Multiple Transmitter Output v02r01 F)2)d)(i),

Port 1 + Port 2 Antenna Gain = 10* log[(1061/20 + 10G2/20)2/NANT] Where,

G_1 = antenna gain of port 1,

G2 = antenna gain of port 2,

NANT = the number of antennas

Host product labelling requirements

The host product shall be properly labelled to identify the modules within the host product. The FCC/ISED certification label of a module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the FCC/ISED certification number for the module, preceded by the word “contains” or similar wording expressing the same meaning, as follows:

Contains FCC ID: BEJTM16FNNABMO

Contains IC: 2703H-TM16FNNABMO

Documents / Resources

	LG Electronics TM16FNNABM0 5G NR LTE Embedded Modules [pdf] User Manual TM16FNNABM0, TM16FNNABM0 5G NR LTE Embedded Modules, 5G NR LTE Embedded Modules, LTE Embedded Modules, Embedded Modules, Modules

References

- User Manual

LG Electronics

5G NR LTE Embedded Modules, Embedded Modules, LG Electronics, LTE Embedded Modules, Modules, TM16FNNABM0, TM16FNNABM0 5G NR LTE Embedded Modules

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