

Technical Specification
Product: LTE Modem
(Model: TM13LNCAHK2)

History

Ver.	Date	Contents	Written by	Checked by	Approved by	Note
1.0	2020.1.28					

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1. Product Introuction

The **TM13LNCAHK2** are designed for the automotive industry. They support LTE and WCDMA air Interface standards. The **TM13LNCAHK2** are based on the Qualcomm MDM9628 wireless chipsets and support the following bands.

Table 1. Supported Band

Frequency Band						
Band	Uplink	Downlink	CDMA	WCDMA	FDD-LTE	Comment
BC0	824-849	869-894				
BC1	1850-1910	1930-1990				
B2	1850-1910	1930-1990		V	V	
B4	1710-1755	2110-2155			V	
B5	824-849	869-894		V	V	
B7	2500-2570	2620-2690			V	
B12(17)	699-716	729-746			V	
B13	777-787	746-756				

1.1 Block Diagram

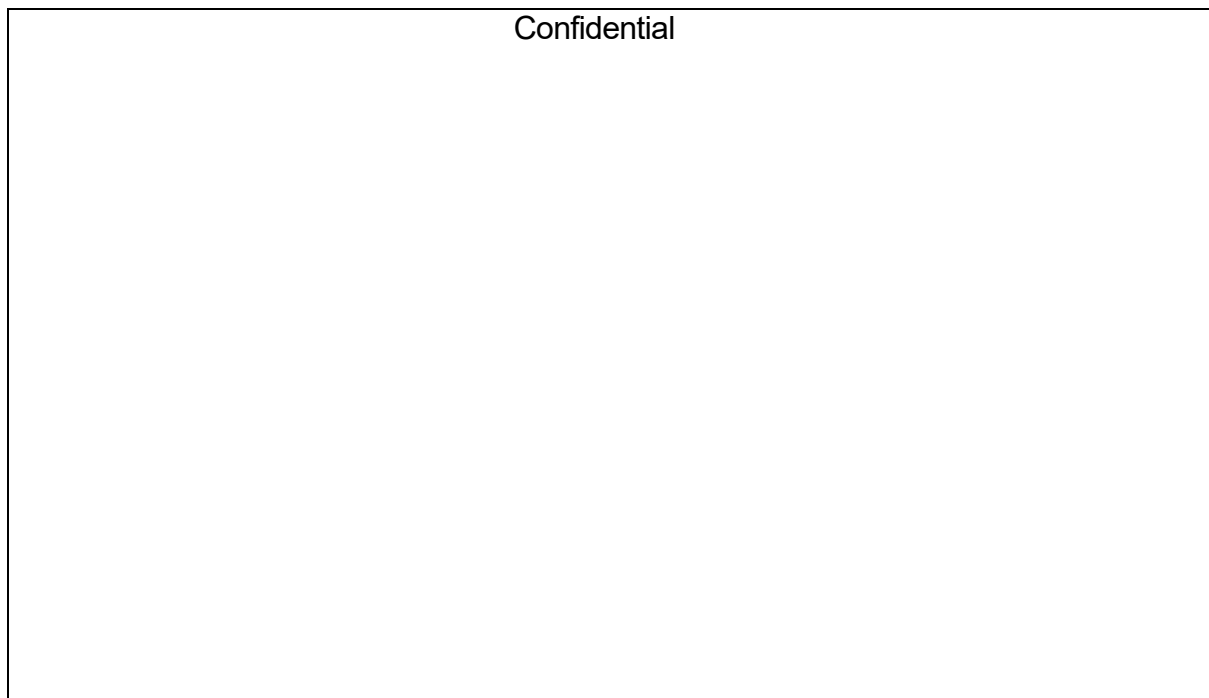


Figure 1.1. TM13LNCAHK2 Block diagram

1.2 Environmental Specifications

The environmental specification for operating and storage of the **TM13LNCAHK2** are defined in the the table below.

Table 2. Environmental Specifications

Parameter	Temperature Range
Operating Temperature	-40°C to 85°C
Storage Temperature	-40°C to +90°C
Humidity	95% or less

1.3 Electrical Specifications

This section provides details for some of the key electrical specifications of the **TM13LNCAHK2** embedded modules.

1.3.1 Absolute Maximum Rating and ESD Ratings

This section defines the Absolute Maximum and Electrostatic Discharge (ESD) Ratings of the **TM13LNCAHK2** 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
+4.0_VPWR	Power Supply Input	-	4.4V	V
VIN	Voltage on any digital input or output pin	-	VREG_MDME+0.5	V
ESD Ratings				
ESD ¹⁾	Primary, Diversity antenna pads - Contact		10	kV

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

Caution: The TM13LNCAHK2 embedded modules are sensitive to Electrostatic Discharge. ESD countermeasures and handling methods must be used when handling the TM13LNCAHK2 devices.

1.3.2 Current Consumption

Table 4. **TM13LNCAHK2** Current Consumption (TBD)

Mode	Parameter	Typical	Max	Units
LTE	Max TX Output /Full RB	600	650	mA
CDMA/WCDMA	Max TX Output	600	650	mA
LTE	Idle, Registered	3.6	4.0	mA
CDMA/WCDMA	Idle, Registered	3.6	4.0	mA
LTE	Sleep Mode, Average Current	1.8	2.2	mA
CDMA/WCDMA	Sleep Mode, Average Current	1.8	2.2	mA

1.4 Mechanical Specifications

1.4.1 Physical Dimensions and Connection Interface

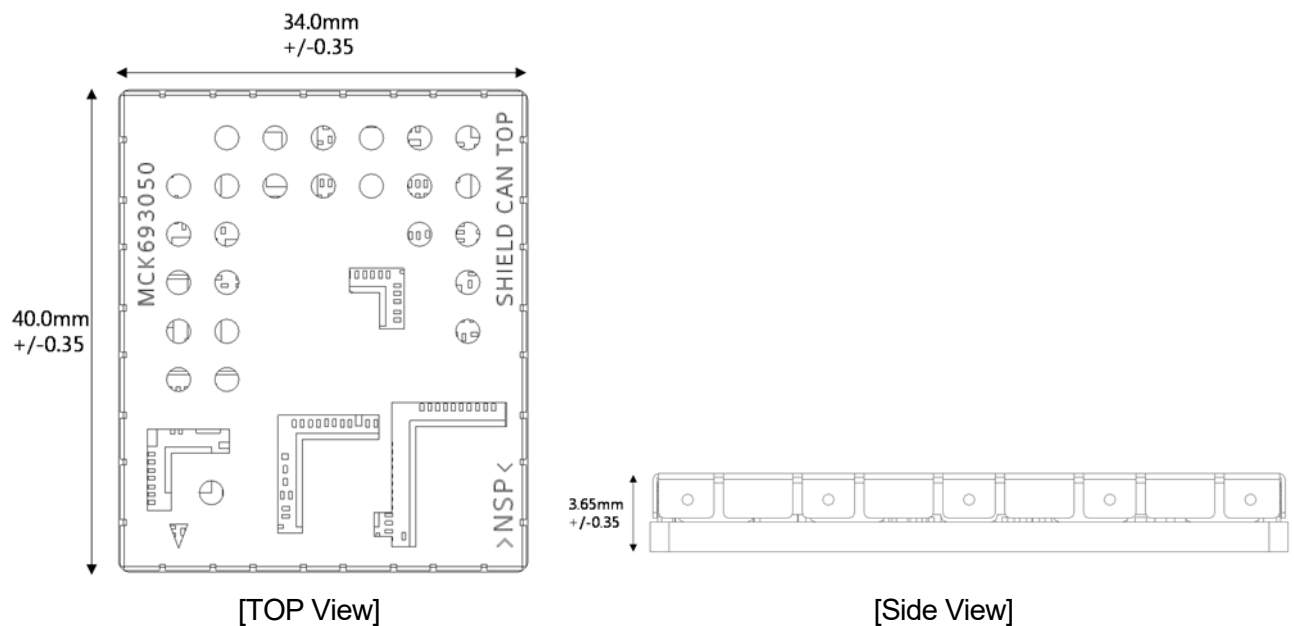
The **TM13LNCAHK2** embedded modules are a Land Grid Array (LGA) form factor device. The device does not have a System or RF connectors. All electrical and mechanical connections are made via the 384 pad **TM13LNCAHK2** on the underside of the PCB.

Table5. **TM13LNCAHK2** Embedded Module Dimensions

Parameter	Nominal	Max	Units
Overall Dimension	34 x 40	34.35 x 40.35	mm
Overall Module Height	3.65	4.0	mm
PCB Thickness	1.0	1.1	mm
Flatness Specification		0.1	mm
Weight	TBD		g

1.4.2 Mechanical Drawing

1.4.2.1 PCB



2. RF Specification

The specifications for the LTE and WCDMA interfaces are defined.

TM13LNCAHK2 is designed to be compliant with the standard shown in the table below.

Table6. Standards Compliance

Technology	Standards
LTE	• 3GPP Release 8
CDMA	• 3GPP2 Release 1xEVDO, REV.H
WCDMA	• 3GPP Release 9

2.1 LTE Specification

2.1.1 LTE TX Output Power

The Maximum / Minimum Transmitter Output Power of the **TM13LNCAHK2** are specified in the following table.

Table7. Conducted TX (Transmit) Max output Power Tolerances – LTE Bands

BAND	Method (UL CH)	Specification
BAND2 UE Maximum Output Power	Measure Max and Min Transmit Power of Mid Channel (18900)	Max Power : 20.3~25.7dBm Min Power : ≤ -39dBm
BAND4 UE Maximum Output Power	Measure Max and Min Transmit Power of Mid Channel (20175)	Max Power : 20.3~25.7dBm Min Power : ≤ -39dBm
BAND5 UE Maximum Output Power	Measure Max and Min Transmit Power of Mid Channel (20525)	Max Power : 20.3~25.7dBm Min Power : ≤ -39dBm
BAND7 UE Maximum Output Power	Measure Max and Min Transmit Power of Mid Channel (21100)	Max Power : 20.3~25.7dBm Min Power : ≤ -39dBm
BAND12 UE Maximum Output Power	Measure Max and Min Transmit Power of Mid Channel (23095)	Max Power : 20.3~25.7dBm Min Power : ≤ -39dBm
BAND17 UE Maximum Output Power	Measure Max and Min Transmit Power of Mid Channel (23790)	Max Power : 20.3~25.7dBm Min Power : ≤ -39dBm

2.1.2 LTE RX Sensitivity

The Receiver Sensitivity of the **TM13LNCAHK2** are specified in the following table.

Table8. Conducted RX (Receive) Sensitivity – LTE Bands

BAND	Method (DL CH)	Specification
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BAND 2 Reference sensitivity level(DUAL)	Measure BLER of Mid Channel (900) in Band2	sensitivity : ≤ -95 BLER : $\leq 5\%$
BAND 4 Reference sensitivity level(DUAL)	Measure BLER of Mid Channel (2175) in Band4	sensitivity : ≤ -97 BLER : $\leq 5\%$
BAND 5 Reference sensitivity level(DUAL)	Measure BLER of Mid Channel (2525) in Band5	sensitivity : ≤ -95 BLER : $\leq 5\%$
BAND 7 Reference sensitivity level(DUAL)	Measure BLER of Low Channel (3100) in Band7	sensitivity : ≤ -95 BLER : $\leq 5\%$
BAND 12 Reference sensitivity level(DUAL)	Measure BLER of Mid Channel (5095) in Band12	sensitivity : ≤ -94 BLER : $\leq 5\%$
BAND 17 Reference sensitivity level(DUAL)	Measure BLER of Mid Channel (5790) in Band17	sensitivity : ≤ -94 BLER : $\leq 5\%$

2.2 WCDMA Specification

2.2.1 WCDMA TX Output Power

The Maximum Transmitter Output Power of the **TM13LNCAHK2** are specified in the following table.

Table9. Conducted TX (Transmit) Max output Power Tolerances – WCDMA Bands

Item	Method (DL CH)	Specification
BAND2 UE Maximum Output Power	Measure Max Transmit Power of Middle Channel (CH=9400) in Band2	Max Power : 21~25dBm
BAND5 UE Maximum Output Power	Measure Max Transmit Power of Middle Channel (CH=4175) in Band5	Max Power : 21~25dBm

2.2.2 WCDMA RX Sensitivity

The Receiver Sensitivity of the **TM13LNCAHK2** are specified in the following table.

Table10. 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
BAND5 BER(Bit Error Rate)	Measure BER of Middle Channel (CH=4400) in Band5	0.1% @ ≤ -106.7 dBm

3. NAD Module installation guide

- HKMC NAD Module is mounted with solder ball on the main AVN board.

4. Installation guide for external antenna connector

4.1. Parts placement and list

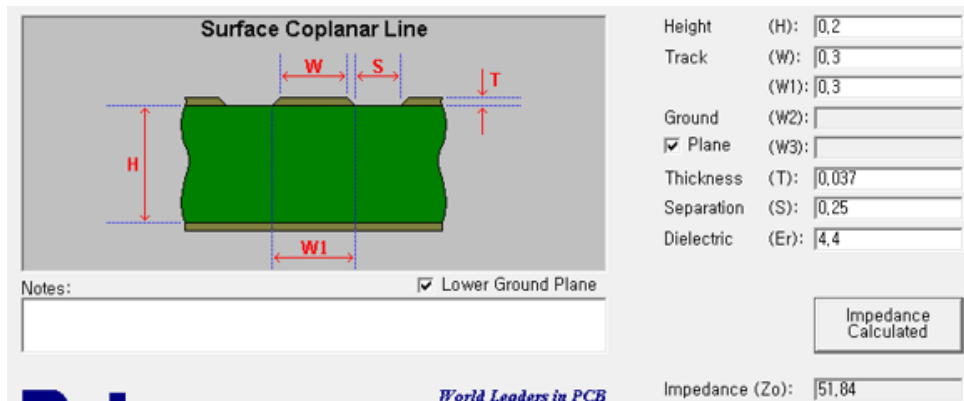
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4.2. Fakra Antenna configuration and Circuit design

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4.3 Design validation & production procedures

To verify compliance of the reference trace, a coupon must be requested with every manufacturing panel form and for which the characteristics are described in the Gerber files.. Then a network analyzer is used to measure the impedance of this coupon in order to validate the antenna trace.



The diagram shows a cross-section of a Surface Coplanar Line (SCL) on a PCB. The green layer represents the signal trace with width W . The blue layer represents the ground plane with width $W1$. The height of the signal layer above the ground plane is H . The separation between the signal layer and the ground plane is S . The thickness of the signal layer is T . The dielectric constant is Er .

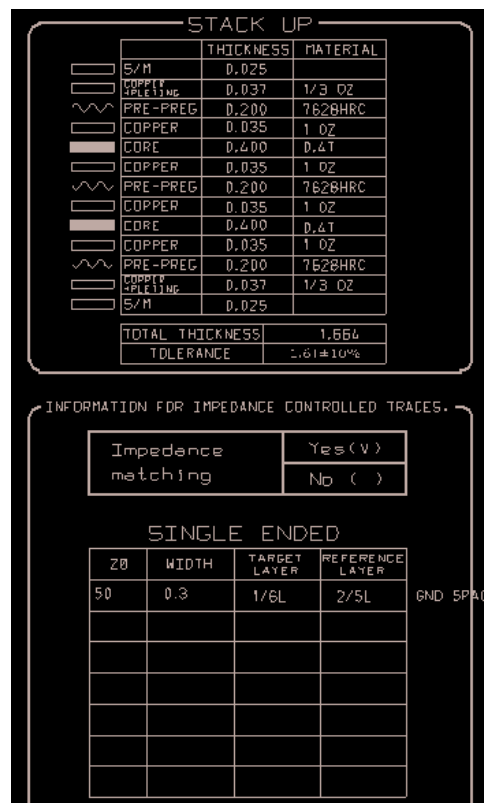
Configuration panel:

- Height (H): 0.2
- Track (W): 0.3
- (W1): 0.3
- Ground (W2):
- ☒ Plane (W3):
- Thickness (T): 0.037
- Separation (S): 0.25
- Dielectric (Er): 4.4

Notes: ☒ Lower Ground Plane

Impedance Calculated

Impedance (Zo): 51.84



STACK UP

	THICKNESS	MATERIAL
S/H	0.025	
COPPER	0.037	1/3 OZ
PRE-PREG	0.200	7628HRC
COPPER	0.035	1 OZ
CORE	0.400	0.4T
COPPER	0.035	1 OZ
PRE-PREG	0.200	7628HRC
COPPER	0.035	1 OZ
CORE	0.400	0.4T
COPPER	0.035	1 OZ
PRE-PREG	0.200	7628HRC
COPPER	0.037	1/3 OZ
S/H	0.025	

TOTAL THICKNESS: 1.654
TOLERANCE: $\pm 10\%$

INFORMATION FOR IMPEDANCE CONTROLLED TRACES.

Impedance matching: Yes (v) / No ()

SINGLE ENDED

Z0	WIDTH	TARGET LAYER	REFERENCE LAYER
50	0.3	1/6L	2/5L

GND SPAC

Note1. Measurement results delivered with boards. Controlled impedance shall be 50 Ohms +/- 15% on layer TOP 0.3mm microstrip traces referenced to layer 2 plane and with a copper clearance of 0.25mm.

5. NAD Pin Description

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FCC Statement

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.

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

The antenna(s) must be installed such that a minimum separation distance of at least 20 cm is maintained between the radiator (antenna) and all persons at all times.

IC Statement

This device complies with Industry Canada license-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.

This device should be installed and operated with minimum distance 20cm between the radiating element of this device and the user.

Cet appareil doit être installé et utilisé avec une distance minimale de 20 cm entre l'élément rayonnant de cet appareil et l'utilisateur.

INTEGRATION INSTRUCTIONS

The module complies with Part 22/24/27 of the FCC rules.

The module complies with RSS-130/132/133/139/199 of the RSS standards.

The modular transmitter is only FCC/IC authorized for the specific rule part listed on the grant. The host product manufacturer is responsible for compliance to any other FCC/IC rules that apply to the host not covered by the modular transmitter grant of certification.

The final host / module combination may also need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device.

The module is authorized with trace antenna design type.

The trace antenna design must be performed as specified in the manual.

The use of any changes to the reference trace design is subject to additional testing and authorization through a Class II permissive change

And the maximum antenna gain including cable loss must not exceed the table below;

Band	Frequency range[MHz]	Maximum antenna gain including cable loss[dBi]
12(17)	699~716	1.18
5	824~849	2.53
4	1710~1755	1.08
2	1850~1910	1.72
7	2500~2570	-1.44

The module is limited to installation in mobile or fixed applications. At least 20 cm of separation distance between the transmitting antenna device and the user's body must be maintained at all times.

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

The module is limited to OEM installation ONLY

The OEM integrator is responsible for ensuring that the end-user has no manual instructions to remove or install module.

The OEM integrator will be responsible to satisfy SAR/ RF Exposure requirements, when the module integrated into the host device.

Separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations.

The module is labeled with its own FCC ID and IC certification. If the FCC ID and IC Certification Number are 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:

"Contains FCC ID: BEJTM13LNCAHK2", "Contains IC: 2703H-TM13LNCAHK2"

Host User Manual

The host manual shall include the following regulatory statement;

FCC

Part 15.19: 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. Part 15.21: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. The antenna(s) must be installed such that a minimum separation distance of at least 20 cm is maintained between the radiator (antenna) and all persons at all times.

IC

This device complies with Industry Canada license-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.

This device should be installed and operated with minimum distance 20cm between the radiating element of this device and the user.

Cet appareil doit être installé et utilisé avec une distance minimale de 20 cm entre l'élément rayonnant de cet appareil et l'utilisateur.