Document: **User Manual**

Product: GM OnStar Gen12
Telematics Connectivity Platform Module (TCP)

Model: G12N51RG1
G12N50RG1

Date: 8. October 2024

Public

Content

1 Scope of Document

The aim of this document is to provide a short overview on the Telematics Connectivity Platform Module (TCP) of model G12N51RG1, G12N50RG1 and to describe the TCP.

2 General Product Information

2.1 Product type:

Telematics Connectivity Platform Module (TCP)

2.2 Manufacturer, Applicant:

Continental Automotive Systems, Inc.
21440 West Lake Cook Road
Deer Park, IL 60010
United States of America

2.3 Brand/Trademark:

Continental

2.4 Factory/Manufacturing Location:

Continental Automotive Maquila Mexico, S. de R.L. de C.V.
Carretera Panamericana Sur No, Ext. 114+354 No. Int. 9
Colonia: Parque Industrial Finsa Aguascalientes C.P. 20393

2.5 Country of origin:

Mexico

3 SYSTEM OVERVIEW

3.1 Short Description of the TCP

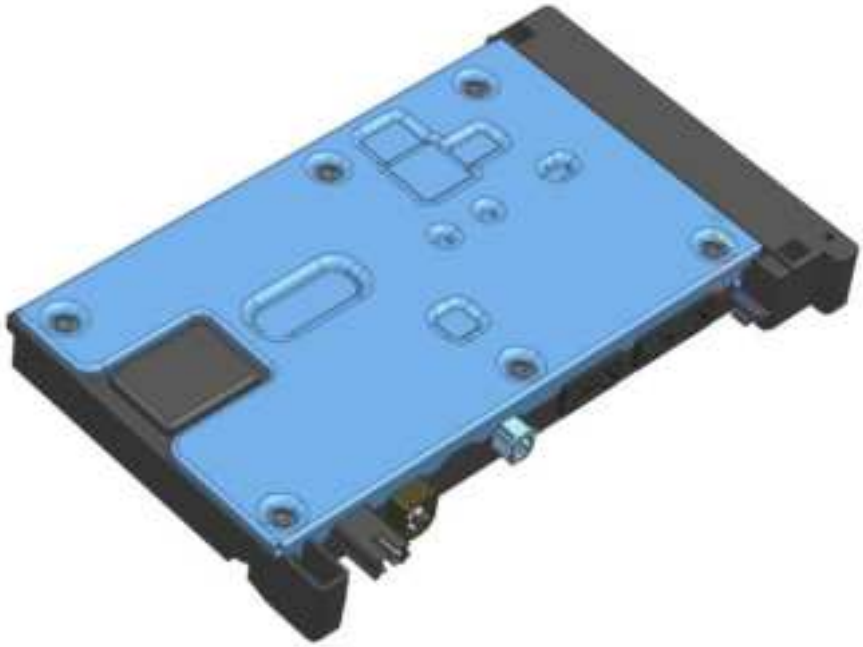
The product described herein is a Telematics Connectivity Platform Module (TCP) for the GM's GEN12 ONSTAR (Telematics and Connectivity Platform) program. It consists of integrated telematics transceivers for different wireless services, as well as several interfaces to the vehicle. The TCP is providing various connectivity services.

4 North America (NA) Variants

TCP Variant	TCP Model number	NAD Model Number
TCP NA	G12N51RG1	FE5NAR110
TCP NA	G12N50RG1	FE5NAR111

5 Mechanical design

5.1 Pictures of the housing



6 Description of the TCP

6.1 Product features

The TCP main parts are:

- NAD with 3G/4G/5G and GNSS
- External and internal antennas
- Voice and Data
- 4G: 4x4 DL-MIMO
- 5G: 4x4 MIMO for DL and 2x2 MIMO for UL
- Internal embedded Sim-IC
- Audio subsystem includes analog microphone input and speaker output
- Digital audio interfaces including CODEC and audio PA (Power Amplifier)
- Service calls
- Emergency calls
- Internal Backup Battery (BUB)
- GNSS L1/L5
- Glonass, Beidou, Galileo, GPS

External interfaces:

- Main power supply
- Primary LTE antennas
- GPS Input
- Three buttons keypad
- LED control
- External microphone (MIC+/-) input/output
- External backup speaker (SPK+/-) output
- CAN
- Ethernet 1000BaseT1
- Debug interfaces (USB, UART)

Ethernet:

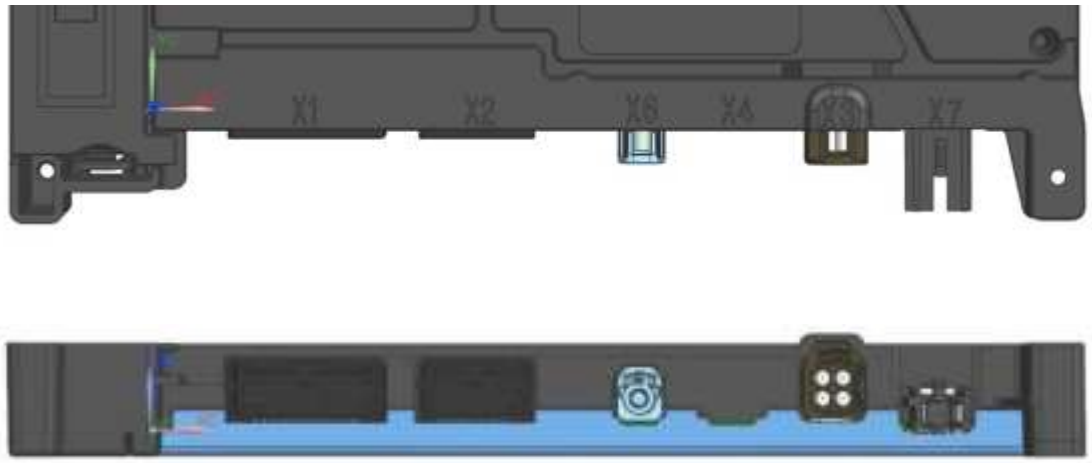
Model number	Speed
G12N51RG1	1 Gbit/s
G12N50RG1	1 Gbit/s

6.2 Wireless services:

- 3G/WCDMA
- 4G/LTE
- 5G
- VoLTE
- Voice/Assistance Calls
    - Emergency Calls
    - Assistance Calls
    - Calls are only possible to some fixed phone numbers
- Global Positioning and Navigation: GPS, GNSS, Beidou, Glonass
- Data Services

6.3 Connectors:

The TCP has 6 types (fully featured variants) of connectors (from left to right):



- X1: 20-Pin Main Signal Connector
- X2: 12-Pin Audio
- (X6: Single RF: C-V2X-2)
- X3: Quad RF (Cellular PRIMARY, DRX0, GNSS, C-V2X-1)
- X7: 1000BASET1

This variant does not support V2X. Therefore, it does not have the X6 connector and CV2X-1 signal populated.

6.3.1 **X1 20-Pin Main Connector Pin Out**

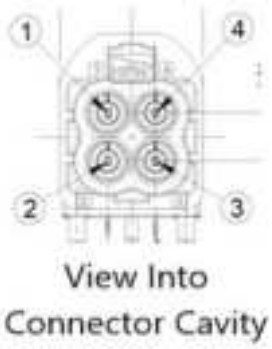
Pin	Signal	Pin	Signal	Pin	Signal
1	VBATT	8	CAN_L (IN)	15	
2	VBATT	9	GND	16	
3	10V_REF	10	GND	17	
4	Keypad_IN	11		18	GND
5	Green_LED	12		19	CAN_H (OUT)
6	Red_LED	13		20	CAN_L (OUT)
7	CAN_H (IN)	14		*Continental Debug Signals	

6.3.2 **X2 12-Pin Audio Connector Pin Out**

Pin	Signal		Pin	Signal
1	SPKR_P		7	MIC_OUT_N
2	SPKR_N		8	MIC_IN_P
3	Not Connected		9	MIC_IN_N
4	Not Connected		10	MIC Shield
5	GND		11	GND
6	MIC_OUT_P		12	GND

6.3.3 **X3 Quad RF Connector**

Pin	**Signal**
1	GNSS
2	V2X_1
3	DRX0/5G Tx2
4	Primary

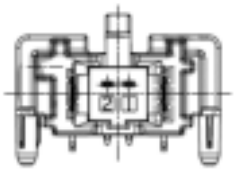


6.3.4 **X6 Single RF Connector** (Present only when V2X is supported)

Pin	**Signal**
1	V2X_2

6.3.5 **X7 1000BASET1 Connector**

Pin	Signal
1	1000BASET1+
2	1000BASET1-



6.4 Audio Subsystem

The TCP audio system will provide a hands-free user interface for emergency calls and call center concierge/personal calling within the vehicular environment.

The audio system provides the following:

- Microphone front end input
- Amplifier speaker driver (class D amplifier)

6.5 Keypad Subsystem

The keypad subsystem will provide an interface between the user and the TCP for emergency calls and call center concierge/personal calling within the vehicular environment.

The keypad includes the following interfaces:

- Three button interfaces
    - Phone Button
        - Accept an incoming phone call
        - End a phone call
        - Initiate OnStar Screen on the infotainment unit
    - OnStar Button
        - Initiate an OnStar phone call to the Backoffice
    - Emergency Button
        - Initiate an Emergency phone call to the Backoffice
- Two color indicator LED's:
    - Green
    - Red

6.6 TCP external Antennas:

- Cell ANT1: 3G/4G/LTE1/5G (outside vehicle), primary external
- Cell ANT2: 4G/LTE2 (Rx LTE only)/5G (outside vehicle), secondary external
- GNSS patch (outside vehicle)
- XM patch (outside vehicle)

6.7 TCP internal Antennas:

- Cell/Backup ANT3, internal ANT1: 3G/4G/LTE1/5G (inside vehicle), primary internal
- Cell/Backup ANT4, internal ANT2: 4G/LTE2 (Rx LTE only)/5G (inside vehicle), secondary internal

6.8 TCP external or internal Antennas usage:

The TCP will only use either internal antennas or external antennas but will not use both external and internal antennas at the same time. It is switched between the external or internal antennas according to the different use cases. The external and internal antennas will not transmit simultaneous at the same time.

6.9 3G, 4G, 5G antenna usage

External transmit antennas:

Ext ANT1			Ext ANT2		
3G/4G	5G NSA	5G SA	3G/4G	5G NSA	5G SA
All 3G and 4G bands	n2, n5, n66	n25, n41, n66, n71, n77, n78	---	n77, n78	n41, n77, n78

Internal transmit antennas:

ANT3/Int ANT1			ANT4/Int ANT2		
3G/4G	5G NSA	5G SA	3G/4G	5G NSA	5G SA
All 3G and 4G bands	n2, n5, n66	n25, n41, n66, n71, n77, n78	---	n77, n78	n41, n77, n78

6.9.1 **5G Uplink MIMO**

MIMO	
Frequency Bands	**Transmit antennas**
41	primary external antenna and secondary external antenna, or primary internal antenna and secondary internal antenna
77	primary external antenna and secondary external antenna, or primary internal antenna and secondary internal antenna
78	primary external antenna and secondary external antenna, or primary internal antenna and secondary internal antenna

6.9.2 **5G SISO**

SISO	
Frequency Bands	**Transmit antennas**
2	primary external antenna or primary internal antenna
5	primary external antenna or primary internal antenna
25	primary external antenna or primary internal antenna
41	secondary external antenna or secondary internal antenna
66	primary external antenna or primary internal antenna
71	primary external antenna or primary internal antenna
77	secondary external antenna or secondary internal antenna
78	secondary external antenna or secondary internal antenna

7 Wireless services

7.1 3G/WCDMA, supported by external ANT1 or internal ANT1:

Wireless service:	**3G/WCDMA**
Frequency bands / range:	Band 2 (1900 UMTS): 1850-1910 / 1930-1990 MHz, Band 4 (1700 UMTS): 1710-1755 / 2110-2155 MHz, Band 5 (850 UMTS): 824-849 / 869-894 MHz
Electrical output power (conducted into 50 Ohm):	+23.0 dBm +1.0/-2.0 dB

7.2 4G/LTE1, supported by external ANT1 or internal ANT1:

Wireless service:	**4G/LTE1**
Frequency bands / range:	FDD Band 2 (1900 LTE): 1850-1910 / 1930-1990 MHz, FDD Band 4 (1700 LTE): 1710-1755 / 2110-2155 MHz, FDD Band 5 (850 LTE): 824-849 / 869-894 MHz, FDD Band 7 (2600 LTE): 2500-2570 / 2620-2690 MHz, FDD Band 12 (700 LTE): 699-716 / 729-746 MHz, FDD Band 13 (750 LTE): 777-787 / 746-756 MHz, FDD Band 14 (700 LTE): 788-798 / 758-768 MHz, FDD Band 28a (700 LTE): 703-718 / 758-773 MHz, FDD Band 28b (700 LTE): 718-748 / 773-803 MHz, FDD Band 29Rx (700 LTE): - / 717-728 MHz, FDD Band 30Rx (2300 LTE): - / 2350-2360 MHz, FDD Band 66 (1700 LTE): 1710-1780 / 2110-2200 MHz, FDD Band 71 (600): 663-698 / 617-652 MHz
Electrical output power (conducted into 50 Ohm):	+23.0 dBm +1.0/-2.0 dB

7.3 4G/LTE2 (Rx LTE only), supported by external ANT2 or internal ANT2:

Wireless service:	**4G/LTE2 (Rx LTE only)**
Frequency bands / range:	Band 2 (1900 LTE): 1930-1990 MHz, Band 4 (1700 LTE): 2110-2155 MHz, Band 5 (850 LTE): 869-894 MHz, Band 7 (2600 LTE): 2620-2690 MHz, Band 12 (700 LTE): 728-746 MHz, Band 13 (750 LTE): 746-756 MHz, Band 14 (700 LTE): 758-768 MHz, Band 28a (700 LTE): 758-773 MHz, Band 28b (700 LTE): 773-803 MHz, Band 29Rx (700 LTE): 717-728 MHz, Band 30Rx (2300 LTE): 2305-2360 MHz, Band 66 (1700 LTE): 2110-2200 MHz, Band 71 (600): 617-652 MHz,

7.4 5G, supported by external or internal antennas:

Wireless service:	**5G**
Frequency bands / range:	**Supported by external ANT1 or internal ANT1:** Band n2 (1900): 1850-1910 / 1930-1990 MHz, Band n5 (850): 824-849 / 869-894 MHz, Band n25 (1900): 1850-1915 / 1930-1995 MHz, Band n41 (2500): 2496-2690 MHz, Band n66 (1700): 1710-1780 / 2110-2200 MHz, Band n71 (600): 663-698 / 617-652 MHz, Band n77 (Part 27O, 3700): 3700-3980 MHz, Band n78 (RSS-192, 3500): 3450-3650 MHz **Supported by external ANT2 or internal ANT2:** Band n41 (2500): 2496-2690 MHz, Band n77 (Part 27O, 3700): 3700-3980 MHz, Band n78 (RSS-192, 3500): 3450-3650 MHz
Electrical output power (conducted into 50 Ohm):	Band n2: PC3: +23.0 dBm +1.0/-2.0 dB Band n5: PC3: +23.0 dBm +1.0/-2.0 dB Band n25: PC3: +23.0 dBm +1.0/-2.0 dB Band n41: PC2: +26.0 dBm +1.0/-2.0 dB Band n66: PC3: +23.0 dBm +1.0/-2.0 dB Band n71: PC3: +23.0 dBm +1.0/-2.0 dB Band n77: PC2: +26.0 dBm +1.0/-2.0 dB *) Band n78: PC3: +23.0 dBm +1.0/-2.0 dB **)

*)
The total loss in vehicle to be declared for n77 is 5.35 dB:

Power_back-off = 4 dB
TCU_Loss = 1.35 dB
LC= TCU_Loss + Power_back-off = 5.35 dB

**)
The total loss in vehicle to be declared for n78 is 2.35 dB:

Power_back-off = 1 dB
TCU_Loss = 1.35 dB
LC= TCU_Loss + Power_back-off = 2.35 dB

7.5 GNSS receiver:

Model number	GNSS
G12N51RG1	L1/L5
G12N50RG1	L1

Wireless service:	GNSS Receiver
Frequency bands / range:	L1: GNSS L1 Frequency Band: Beidou-B1I, GalileoE1, GLONASS-G1, GPS-L1 and SBAS-L1 L5: GNSS L5 Frequency Band: Galileo-E5A and GPS-L5, Beidou-B2A SBAS supported: EGNOS/MSAS/QZSS/WAAS/GAGAN AGNSS not supported.

8 Technical data

8.1 Operating temperature Range

-40°C to 90°C

8.2 Supply Voltage

Nominal.: 12 V dc

Supply Voltage Range: 6 V to 18 V dc

8.3 Supply current consumption

Typical standby current: 250mA dc, (at 12 V)

Typical active current consumption: 350mA dc, (at 12 V)

Maximum active current consumption: 600mA dc, (at 12 V)

8.4 Power Consumption

Typical power consumption: 5.5W
(Cellular, GNSS active)

9 Product Label Information

9.1 USA/Canada

Model: G12N51RG1 or G12N50RG1
Contains FCC ID: LHJ-FE5NAR110
Contains IC: 2807E- FE5NAR110

10 Owner Manual Statements

10.1 Owner manual USA/Canada

Continental
Model: G12N51RG1 or G12N50RG1
Contains FCC ID: LHJ-FE5NAR110
Contains IC: 2807E-FE5NAR110

This device complies with Part 15 of the FCC Rules and Industry Canada licence-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 complies with FCC/ISED radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the ISED radio frequency (RF) Exposure rules.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Please keep at least 1 cm separation distance between the external shark fin antennas of type Molex model/part number 26464255 and model/part number 26464260 and the human body.
The external shark fin antennas of type Molex model/part number 26464255 and model/part number 26464260 are allowed to be installed in a portable distance of at least 1 cm to the human body.

Please keep at least 23 cm separation distance between the external shark fin antenna of type Continental model/part number 86783279 and the human body.
The external shark fin antenna of type Continental model/part number 86783279 is allowed to be installed in a distance of at least 23 cm to the human body.

Please keep at least 27 cm separation distance between the external front fender antenna of type Continental Y2XX composed of part number 86784729 (Primary Antenna, Antenna 1,

right side, passenger side) and part number 86784728 (Secondary Antenna, Antenna 2, left side, driver side) and the human body.
The external front fender antenna of type Continental Y2XX composed of part number 86784729 (Primary Antenna, Antenna 1, right side, passenger side) and part number 86784728 (Secondary Antenna, Antenna 2, left side, driver side) is allowed to be installed in a distance of at least 27 cm to the human body.

Please keep at least 20 cm separation distance between the external window glass antenna embedded in the windshield of type Amphenol L246 composed of part numbers 85038208, 85038209, 85038210, 85732934 and the human body.
The external window glass antenna embedded in the windshield of type Amphenol L246 composed of part numbers 85038208, 85038209, 85038210, 85732934 is allowed to be installed in a distance of at least 20 cm to the human body.

Please keep at least 2.5 cm separation distance between the TCP internal antennas of model number INTANT01 and model number INTANT02 and the human body.
The TCP internal antennas of model number INTANT01 and model number INTANT02 are allowed to be installed in a portable distance of at least 2.5 cm to the human body.

Le présent appareil est conforme à l'exposition aux radiations FCC / ISED définies pour un environnement non contrôlé et répond aux directives d'exposition de la fréquence de la FCC radiofréquence (RF) et RSS-102 de la fréquence radio (RF) ISED règles d'exposition.

L'émetteur ne doit pas être colocalisé ni fonctionner conjointement avec à autre antenne ou autre émetteur.

Veuillez maintenir une distance de séparation d'au moins 1 cm entre les antennes externes en aileron de requin de type Molex modèle/numéro de pièce 26464255 et modèle/numéro de pièce 26464260 et le corps humain.
Les antennes externes en aileron de requin de type Molex modèle/numéro de pièce 26464255 et modèle/numéro de pièce 26464260 peuvent être installées à une distance portable d'au moins 1 cm du corps humain.

Veuillez maintenir une distance de séparation d'au moins 23 cm entre l'antenne externe en aileron de requin de type modèle Continental/numéro de pièce 86783279 et le corps humain.
L'antenne externe en aileron de requin de type modèle Continental/numéro de pièce 86783279 peut être installée à une distance d'au moins 23 cm du corps humain.

Veuillez maintenir une distance de séparation d'au moins 27 cm entre l'antenne d'aile avant externe de type Continental Y2XX composée de la référence 86784729 (antenne principale, antenne 1, côté droit, côté passager) et de la référence 86784728 (antenne secondaire, antenne 2, côté gauche, côté conducteur) et le corps humain.
L'antenne d'aile avant externe de type Continental Y2XX composée de la référence 86784729 (antenne principale, antenne 1, côté droit, côté passager) et de la référence 86784728 (antenne secondaire, antenne 2, côté gauche, côté conducteur) peut être installée à une distance d'au moins 27 cm du corps humain.

Veuillez maintenir une distance de séparation d'au moins 20 cm entre l'antenne de vitre extérieure intégrée au pare-brise de type Amphenol L246 composée des références 85038208, 85038209, 85038210, 85732934 et le corps humain.

L'antenne de vitre extérieure intégrée au pare-brise de type Amphenol L246 composée des références 85038208, 85038209, 85038210, 85732934 peut être installée à une distance d'au moins 20 cm du corps humain.

Veuillez maintenir une distance de séparation d'au moins 2.5 cm entre les antennes internes TCP des numéros de modèle INTANT01 et INTANT02 et le corps humain.
Les antennes internes TCP des numéros de modèle INTANT01 et INTANT02 peuvent être installées à une distance portable d'au moins 2.5 cm du corps humain.

FCC Class B digital device notice

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.

Continental Automotive Systems, Inc. has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate the equipment.

Continental Automotive Systems, Inc *n'approuve aucune modification apportée à l'appareil par l'utilisateur, quelle qu'en soit la nature. Tout changement ou modification peuvent annuler le droit d'utilisation de l'appareil par l'utilisateur.*

CAN ICES-3 (B) / NMB-3 (B)

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

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

END OF DOCUMENT