

# Infarm Gateway User Manual

## 1. Introduction

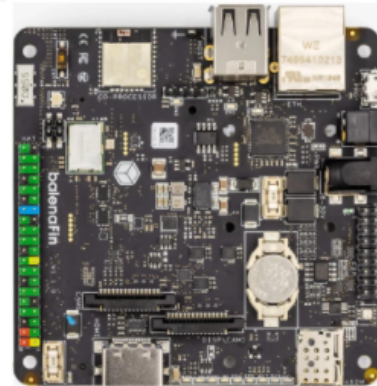
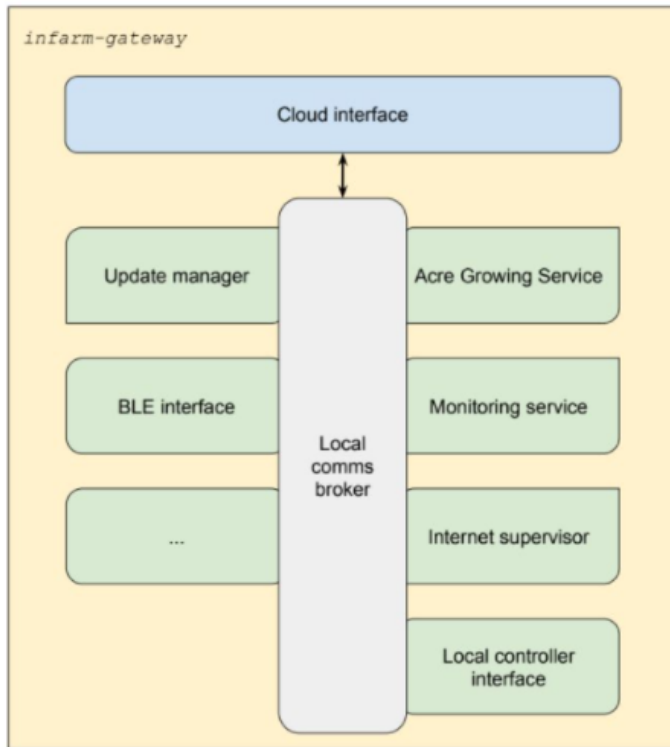
The Infarm Gateway acts as the bridge between the internet and the onboard control systems of the Acre and Instore farms.

The Infarm Gateway runs and maintains the following services:

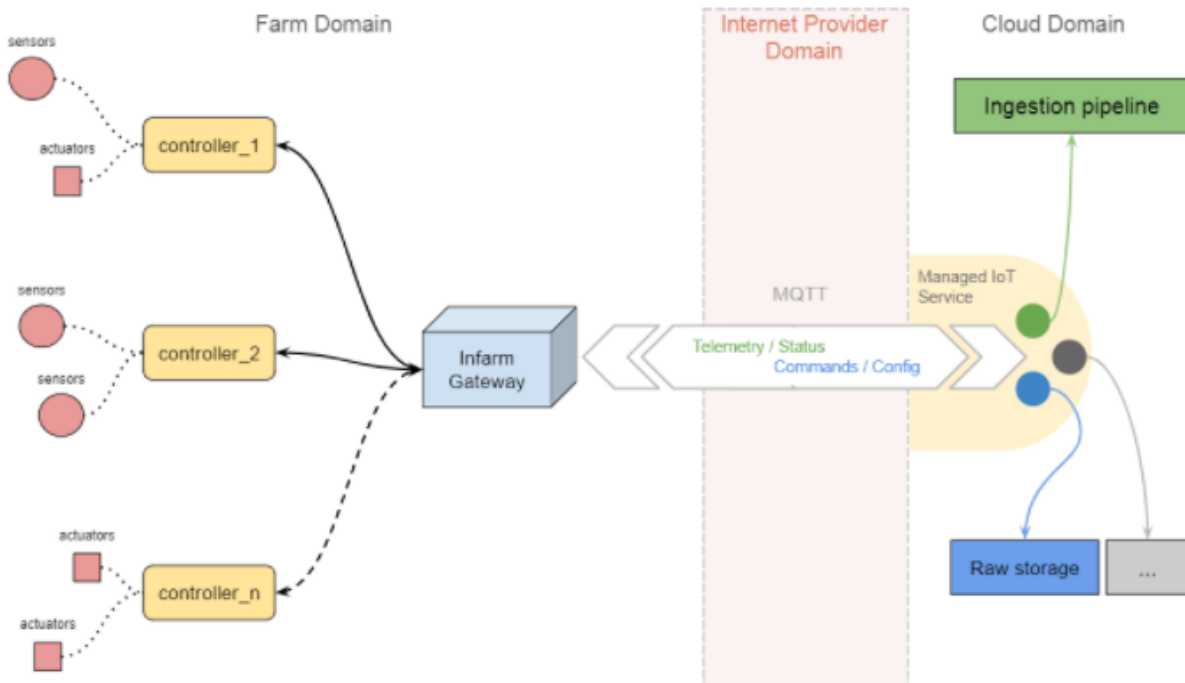
- Link between Infarm BE and Farm
- Controls internet connectivity directly (cellular)
- Facilitates and manages local communications
- Runs business logic services (growing schedules, recipes, etc..)
- Provides local access to the Farm (over BLE)
- System updates (gateway services and controllers firmware)
- Logging services

Function	BalenaFin		Function	BalenaFin
Ethernet	10/100 x1		PSU Connector	DC Barrel, Phoenix Conn
USB	Type A x2		RTC	Yes
CPU	BCM2837 (A53 @ 1.2GHz)		LTE	Yes, via PCIe
RAM	1GB LPDDR2		Sim Slot	Nano Sim
Storage	8GB eMMC		HDMI	Yes
MCU Co Proc.	BGM111 (M4 @ 38 MHz)		DSI	Yes
WiFi	802.11ac/a/b/g/n		CSI	Yes
Bluetooth	4.2		GPIO	CPU + MCU
Antenna	uFL / Embedded			

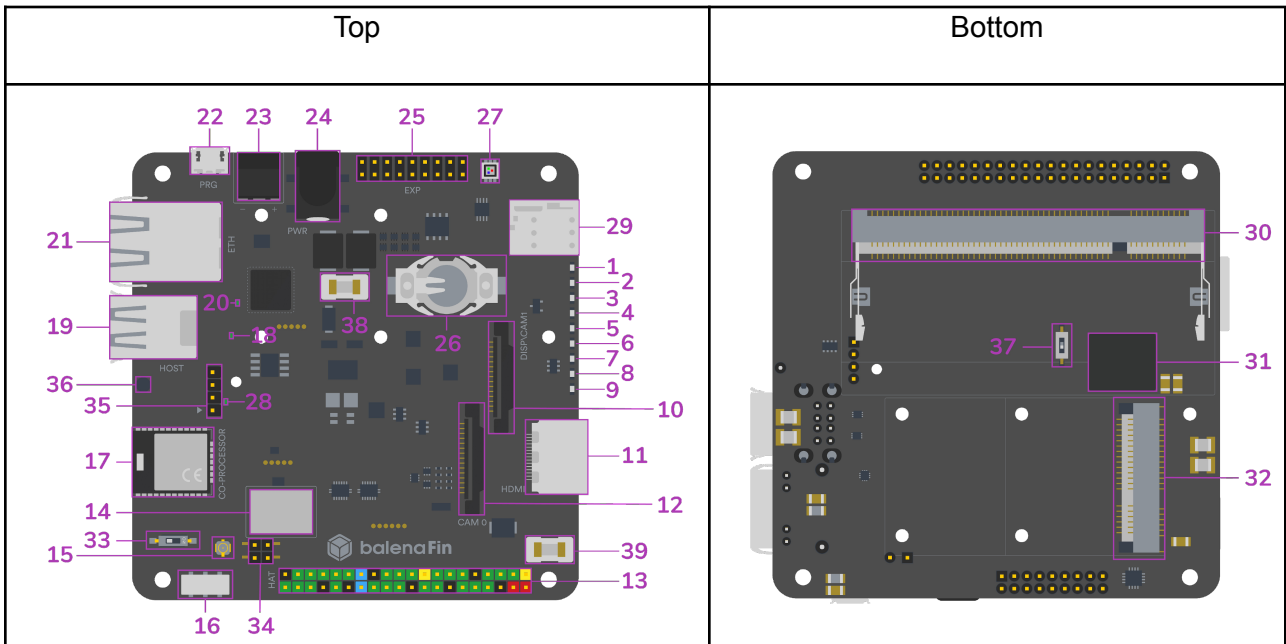
# Overview of the Infarm Gateway



# Architecture Overview



## 2. Images and Description



#	Name	Notes/Description
1	5V Status LED	Indicates 5V current flow
2	3V3 Status LED	Indicates 3.3V current flow; this is the same as the red LED on the Raspberry Pi 3 Model B
3	ACT Status LED	CM3L Activity LED; this is the same as the green LED on the Raspberry Pi 3 Model B
4	SPD Status LED	Ethernet Speed LED; off when in 10-Mbps mode, on when in 100-Mbps mode
5	FDX Status LED	Ethernet Full-Duplex indicator
6	LNK Status LED	Ethernet Link/Activity LED
7	PAN Status LED	If supported by the mPCIE (32) card connected, indicates PAN network activity

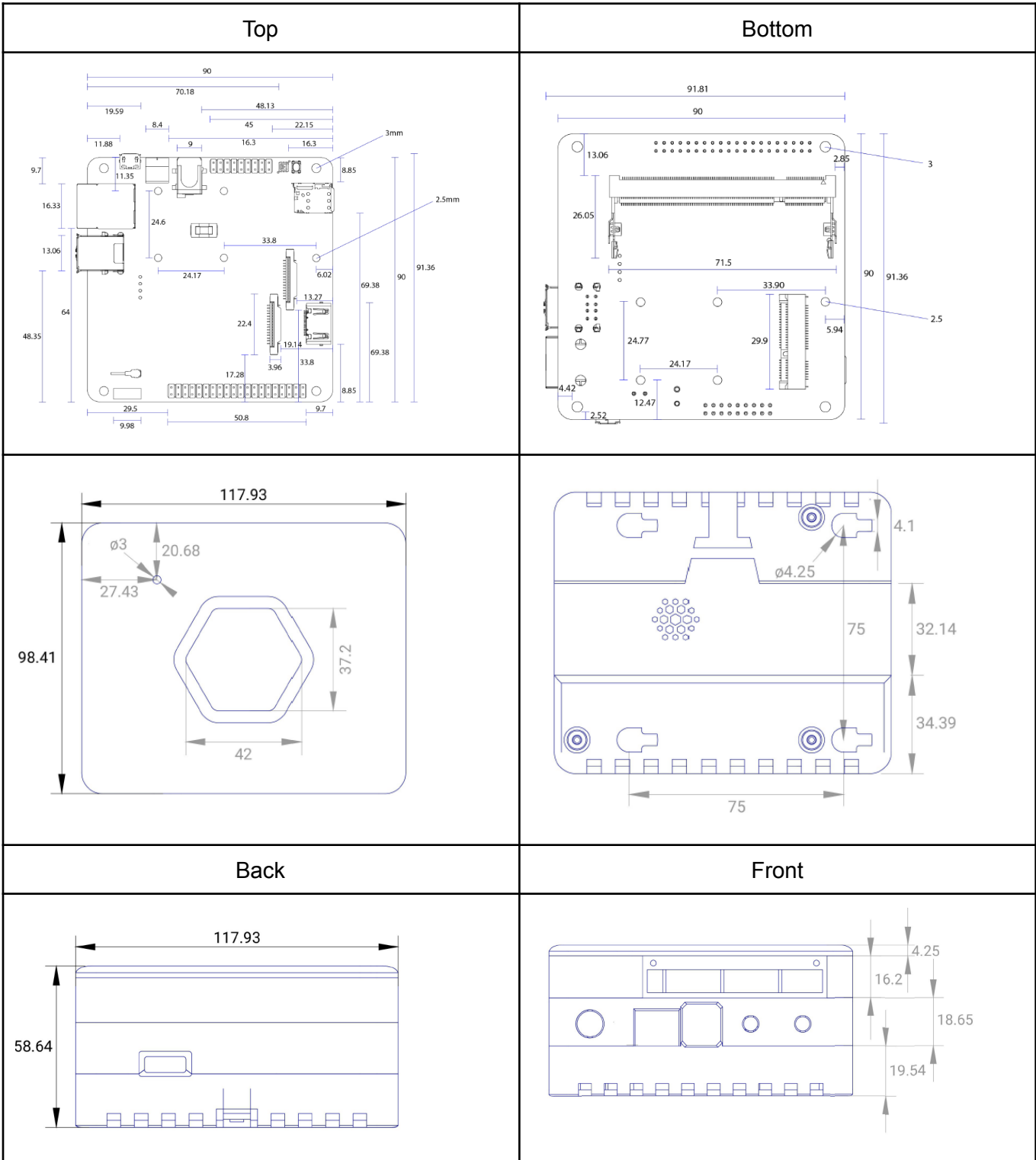
8	LAN Status LED	If supported by the mPCIe (32) card connected, indicates LAN network activity
9	WAN Status	If supported by the mPCIe (32) card connected, indicates WAN network activity
10	DSI/CAM1 connector	Standard full-size Raspberry Pi MIPI connector that can be configured as Display or secondary Camera (cam1) connector; selection is made via the DSI/CAM1 switch (37)
11	HDMI	Full-size HDMI Type A with CEC support
12	CSI connector	Standard full-size Raspberry Pi Camera (cam0) connector
13	HAT connector	40-pin Raspberry Pi HAT (Hardware Attached on Top) standard connector
14	WiFi/BT combo chip	802.11ac/a/b/g/n 2.4 & 5GHz WiFi + Bluetooth 4.2
15	WiFi/BT uFL antenna connector	If the RF switch (33) is set on the external position, the antenna attached to this connector will become the main radio antenna for the WiFi/BT combo chip (14)
16	WiFi/BT embedded antenna	Embedded high-performance SMD antenna covering both 2.4 and 5GHz frequencies; it is the default antenna selected for the WiFi/BT combo chip (14)
17	Co-processor	Silicon Labs BGM111 MCU
18	USB1 ON Status LED	The green LED stays on as long as there is enough current flowing on the top USB port; when this LED is off, it means a fault or under-voltage is happening on the top USB port
19	USB	2 x USB Type-A
20	USB2 ON Status LED	The green LED stays on as long as there is enough current flowing on the bottom USB port; when this LED is off, it means a fault or under-voltage is happening on the bottom USB port
21	Ethernet	10/100 ethernet RJ45 connector

22	PRG - Programming port	micro-USB connector that allows flashing of the eMMC from a host computer using <a href="https://balena.io/etcher">balenaEtcher (balena.io/etcher)</a> or usbboot. If the device is powered via a cable connected to this port, it will enter a programming mode exposing its eMMC as mass-storage to a host computer (via balenaEtcher or usbboot). balenaFin can only be booted into flash mode via this port
23	power in	polarity is denoted on PCB silkscreen
24	Barrel Jack power in	2.1 / 5.5 mm barrel jack type connector for 6-24V input power. Positive polarity (Positive tip, Negative sleeve) - Denoted by symbol on the bottom PCB silkscreen.
25	Co- Processor I/O connector	8 x GPIO / ADC, 1 x SPI, 1 x I2C, 1 x Debug UART
26	CR122 RTC coin-cell battery socket	This allows the embedded RTC to keep track of time while the device is powered off
27	RGB LED	Connected to a PCA9633 controller that allows standard linux sysfs LED control
28	USB3 ON Status LED	The green LED stays on as long as there is enough current flowing on the 4-pin header USB port; when this LED is off, it means a fault or under- voltage is happening on the 4-pin header USB port
29	nano-SIM socket	This allows the use of a wide portfolio of cellular modems via the mPCIe socket (32)
30	CM3L socket	SODIMM-200 socket for the Raspberry Pi Compute Module 3/3+ Lite
31	eMMC	8/16/32/64 GB class 5.1 industrial eMMC - main storage for the CM3L (30). Positioned under the CM3L (30)
32	mPCIe	Mini PCI Express socket
33	Antenna switch	2 position switch - when set to OFF (labeled in silkscreen as "INT"), the WiFi/BT combo chip (14) uses the WiFi/BT embedded antenna (16). When set to ON (labeled in silkscreen as "EXT"), the WiFi/BT combo chip (14) uses the WiFi/BT uFL antenna connector (15)
34	PoE HAT headers	exposes the incoming voltage from the RJ45 (21) port for PoE HATs that step down and flow 5V to the 5V HAT (13) pins

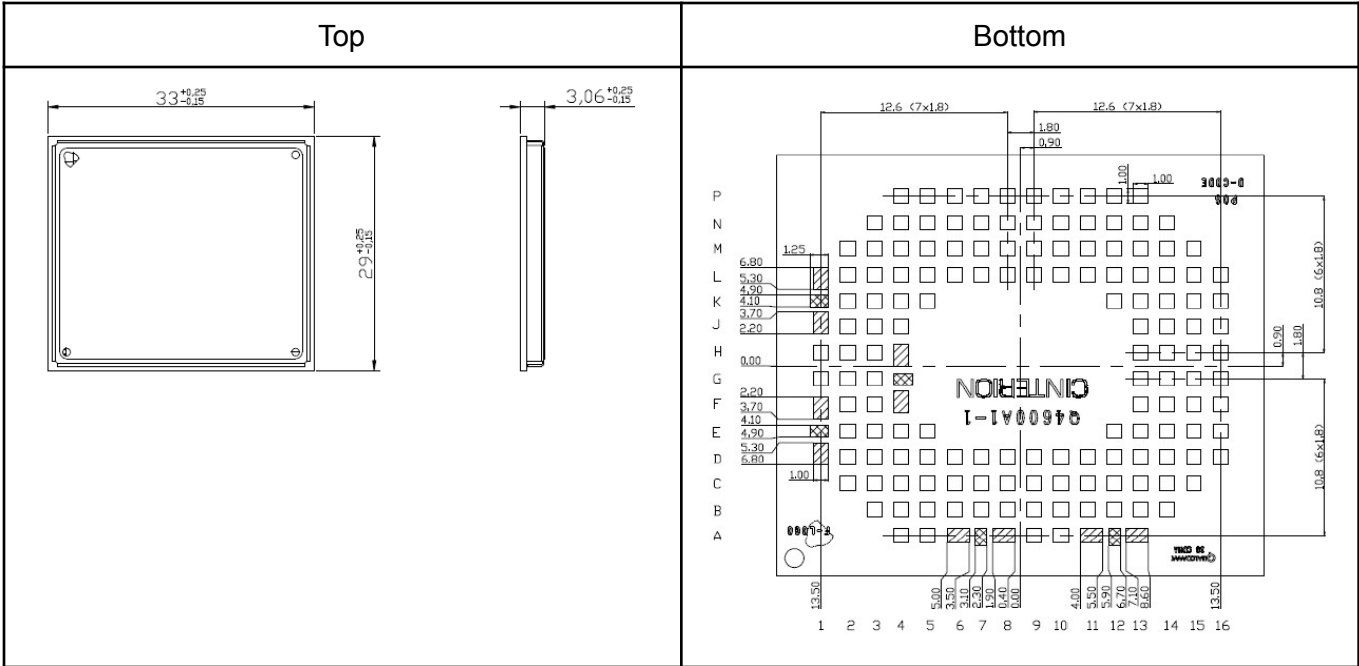
35	USB 2.0 4-pin header	Exposes a USB 2.0 port via male headers. Pin 1 is the one closest to the coprocessor. Pinout: 1->VCC; 2->D-; 3->D+; 4->GND
36	GND probe interface	Exposes a GND probe interface for easy debugging
37	DSI/CAM1 switch	Switches the full-size Raspberry Pi MIPI connector (10) between Display or secondary Camera (cam1) mode - when set to OFF (labeled in silkscreen as "DISP"), the full-size Raspberry Pi MIPI connector (#10) exposes the DSI (disp1) interface. When set to ON (labeled in silkscreen as "CAM1") the full-size Raspberry Pi MIPI connector (10) exposes the secondary CSI (cam1) interface
38	POWER IN Fuse (on 23 & 24)	3A 125VAC/VDC fuse - MPN: 0154003.DR
39	HAT 5V Fuse	3A 125VAC/VDC fuse - MPN: 0154003.DR

# 3. Mechanical Specifications

## WiFi Module



# Cellular Module



## 4. General Specifications

Parameter	Minimum	Typical	Maximum	Conditions
Power input via power connectors	6V	-	24V	12.5W
Power input via HAT connector	5V	5V	5V	12.5W
Operation temperature	-25 celsius	-	70 celsius	



## 5. Radio Specifications

Description	Min.	Typ.	Max.	Unit
11b / g / n (HT20/HT40)	2412	-	2472	MHz
11a / ac (HT80)	5180	-	5825	MHz
BT / BLE (main)	2402	-	2480	MHz
BT / BLE (secondary, co-processor)	2400	-	2483.5	MHz

The more informations can be found in original datasheets of both WiFi and Cellular module.

## 6. Certification

	FCC (USA)	IC (Canada)
WiFi Module	2A2CI-INF001-WF	27413-INF001WF
Cellular Module	2A2CI-INF001-CL	27413-INF001CL

## 7. Antennas

The antennas must be professionally installed when fitted to the ACRE/ Instore systems. Please check the installation guide before installing the antennas.

### ACRE

#### **SMW-414 multiband, 4-cable Global Cellular/LTE, WiFi & GPS**

The SMW-414 Series antennas feature 4 antenna elements in one radome. Cable 1 can cover the traditional GSM/CDMA frequencies, 700 MHz LTE, 1.7 & 2.1 GHz AWS/UMTS, and LTE/WiMAX at 2.5 or 3.7 GHz, all on a single board. This antenna is ready for any 4G or 5G rollout but is also compatible with earlier generations such as GPRS.

The antenna also covers 2.4/5 dual-band WiFi on Cables 2 & 3. This can be used for two separate WiFi modems or for a WiFi MIMO modem. The antenna is enclosed in a 4.2"D x 3.2"H (107 mm x 81 mm) weatherproof radome, and supplied with all mounting hardware and a sealing gasket.

## Peak Gain vs. Frequency Table

2.1-2.5/4.4-6.0 GHz		2.4-2.5 & 4.9-5.0 GHz		695-960 & 1710-1990 MHz	
FREQUENCY	MAX dbi	FREQ	MAX	FREQ	MAX
2100	3.50	2400.00	6.56	700	1.60
2200	3.66	2500.00	7.90	751	2.40
2300	4.09	2600.00	6.70	818	3.65
2400	5.33	2700.00	6.01	885	3.54
2500	7.31	4900.00	8.89	952	1.67
2600	6.97	5000.00	6.99	1705	3.96
2700	6.65	5100.00	6.13	1794	3.14
4400	2.49	5200.00	7.21	1852	2.48
4500	2.88	5300.00	9.06	1947	2.66
4600	5.48	5400.00	8.59	1985	2.17
4700	5.06	5500.00	10.08	2099	2.96
4800	3.71	5600.00	9.45	2175	3.28
4900	4.39	5700.00	7.52	2404	5.22
5000	2.94	5800.00	8.43	2423	6.03
5100	2.42	5900.00	9.22	2442	6.15
5200	2.07	6000.00	5.63	2499	6.62
5300	2.82			2595	5.77
5400	2.91			2690	6.69
5500	3.87			3395	2.48
5600	4.81			3604	7.67
5700	5.32			3699	7.57
5800	5.98				
5900	7.35				
6000	9.23				

# Instore

## Delock LTE MIMO Dual Band WLAN 802.11 ac/ax/a/h/b/g/n Antenna

This antenna by Delock allows the usage of different LTE and WLAN bands indoors and outdoors. It is completely compatible to GSM, UMTS, LTE, ZigBee, DECT, Z-Wave, NB-IoT, Dual Band WLAN, Bluetooth, ISM, MIMO and LoRa 868 MHz / 915 MHz.

### Peak Gain vs. Frequency Table

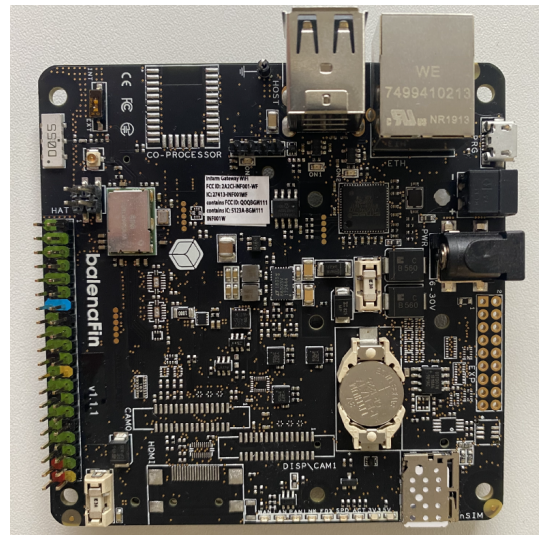
12676 LTE AUX				12676 LTE MAIN				12676 WiFi		
frequency	gain	efficiency		frequency	gain	efficiency		frequency	gain	efficiency
698	-2,42	20,72		698	1,19	54,42		2400	1,02	32,00
824	-0,52	47,51		824	1,66	48,77		2450	-1,67	20,46
868	2,85	53,70		868	2,05	57,49		2483,5	-1,2	16,21
960	-0,5	33,07		960	0,56	50,11		5180	1,98	42,68
1710	2,49	47,95		1710	0,82	38,26		5300	1,9	39,49
1850	1,08	46,08		1850	0,32	45,89		5400	3,86	53,92
1990	1,98	46,50		1990	2,03	35,25		5500	2,44	39,07
2170	2,14	55,46		2170	1,26	41,71		5600	2,67	43,40
2690	2,16	48,13		2690	1,8	46,95		5700	3,95	62,63
								5850	0,84	38,04

# 8. Pictures

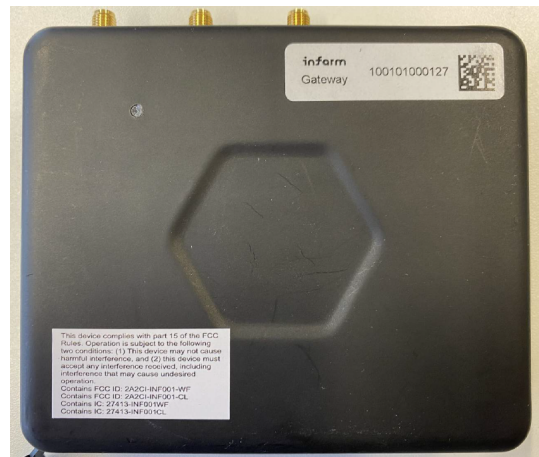
Cellular Module



WiFi Module



Host Device



## 9. Labeling

Location	Labels
WiFi Module	Infarm Gateway WiFi FCC ID: 2A2CI-INF001-WF IC: 27413-INF001WF contains FCC ID: QOQBGM111 contains IC: 5123A-BGM111 INF001W
Cellular Module	Infarm Gateway Cellular FCC ID: 2A2CI-INF001-CL IC: 27413-INF001CL INF001C
Host Product	Infarm Gateway 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. Contains FCC ID: 2A2CI-INF001-WF Contains FCC ID: 2A2CI-INF001-CL Contains IC: 27413-INF001WF Contains IC: 27413-INF001CL

## 10. Regulatory Insert

This device complies with the RF exposure requirement of FCC part 2.1091 for use at >20cm distance from the user

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science, and Economic Development Canada's license-exempt RSS(s).

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.

The radio transmitters IC: 27413-INF001WL and IC: 27413-INF001CL have been approved by Innovation, Science, and Economic Development Canada to operate with the antenna types listed, with the maximum permissible gain indicated.

Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

This device complies with the RF exposure requirement of RSS-102 Issue 5 for use at >20cm distance from the user.

Cet appareil est conforme aux exigences d'exposition RF de la partie 2.1091 de la FCC pour une utilisation à une distance > 20 cm de l'utilisateur

Cet appareil contient un ou des émetteurs/récepteurs exempts de licence conformes aux RSS exempts de licence d'Innovation, Sciences et Développement économique Canada.

Le fonctionnement est soumis aux deux conditions suivantes :

(1) Cet appareil ne doit pas causer d'interférences

(2) Cet appareil doit accepter toute interférence, y compris les interférences pouvant entraîner un fonctionnement indésirable de l'appareil.

Les émetteurs radio IC : 27413-INF001WL et IC : 27413-INF001CL ont été approuvés par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antennes répertoriés, avec le gain maximal autorisé indiqué.

Les types d'antenne non inclus dans cette liste qui ont un gain supérieur au gain maximum indiqué pour tout type répertorié sont strictement interdits pour une utilisation avec cet appareil.

Cet appareil est conforme aux exigences d'exposition RF de RSS-102 Édition 5 pour une utilisation à une distance > 20 cm de l'utilisateur