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.

FCC Caution:

Changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

FCC RF Radiation Exposure Statement Caution: This Transmitter must be installed to provide a separation distance of at least 20 cm from all persons.

The host OEM user manual must also contain clear instructions on how end users canfind and/or access the module and the FCC ID: ZHZPG1302

FCC Statement:

"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."

The proposed FCC IC label format is to be placed on the module. If it is not visible when the module is installed into the system, "Contains FCC ID: ZHZPG1302," shall be placed on the outside of final host system.

Antenna info

Model	Manufacturer	Antenna Gain	Antenna Type	Connector Type
BLG-AN-040 Datasheet	Dragino Technology Co., Limited.	2.69dBi	Fibre-glass epoxy antenna	-
-	Dragino Technology Co., Limited.	3.0	External antenna	-

LG01 LoRa Gateway User Manual

Document Version: 1.0.1

Image Version: v1.0

Version	Description	Date
1.0	Release	2020-Dec-9
1.0.1	Add FAQ for how to get lorapktfwd.deb	2021-May-17

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✓ Logistics and Supply Chain Management 7
✓ Smart Metering 7
✓ Smart Agriculture 7
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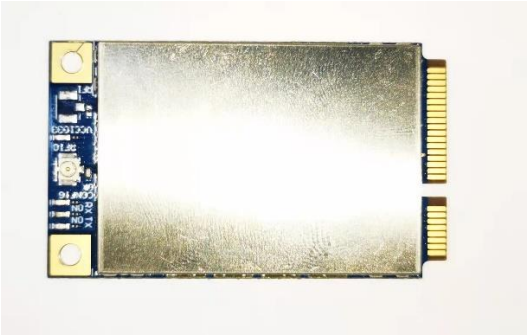
1 Introduction

1.1 What is PG1301 LoRaWAN Concentrator?



The PG1302 is a multi-channel high performance transmitter/receiver designed to simultaneously receive several LoRa packets using random spreading factors on random channels. Its goal is to enable robust connection between a central wireless data concentrator and a massive amount of wireless end-points spread over a very wide range of distances.

The PG1302 is design to use with Raspberry Pi to build smart metering fixed networks and Internet of Things applications with up to 5000 nodes per km2 in moderately interfered environment.

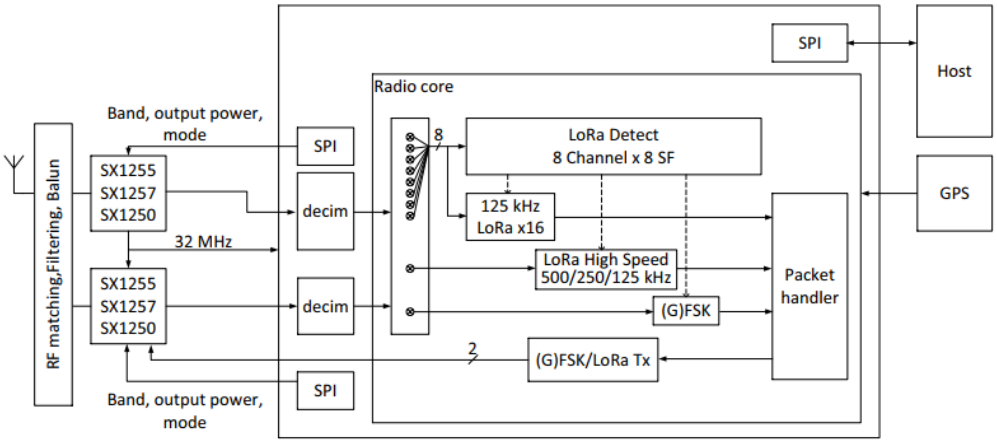
1.2 Features

- ✓ Support Raspberry Pi 3B/3B+/4
- ✓ Up to -142.5dBm sensitivity with SX1257 Tx/Rx front-end (see reference design)
- ✓ 70 dB CW interferer rejection at 1 MHz offset
- ✓ Able to operate with negative SNR, CCR up to 9Db
- ✓ Emulates 49x LoRa demodulators and 1x (G)FSK demodulator
- ✓ Dual digital TX&RX radio front-end interfaces
- ✓ 10 programmable parallel demodulation paths
- ✓ Dynamic data-rate (DDR) adaptation

1.3 General Interfaces

- ✓ SPI interface for LoRa
- ✓ Specifications:
- ✓ Power Input: 5v, 1A
- ✓ 1 x SMA antenna for LoRa

1.4 System Structure



1.5 Pin Mapping

Pin No	Raspberry Pi BCM pin number	PG1301 Definition
1	3.3V	3.3V
2	5V	5V
3	GPIO2/SDA1(I2C)	I2C_SDA
4	5V	5V
5	GPIO3/SCL1(I2C)	I2C_SCL
6	GND	GND
9	GND	GND
14	GND	GND
16	GPIO23	SX1302_RESET
19	GPIO10	HOST_MOSI
20	GND	GND
21	GPIO9	HOST_MISO
23	GPIO11	HOST_SCK
24	GPIO8	HOST_CSN
25	GND	GND
30	GND	GND
34	GND	GND
39	GND	GND

1.6 Power Consumption

TBD

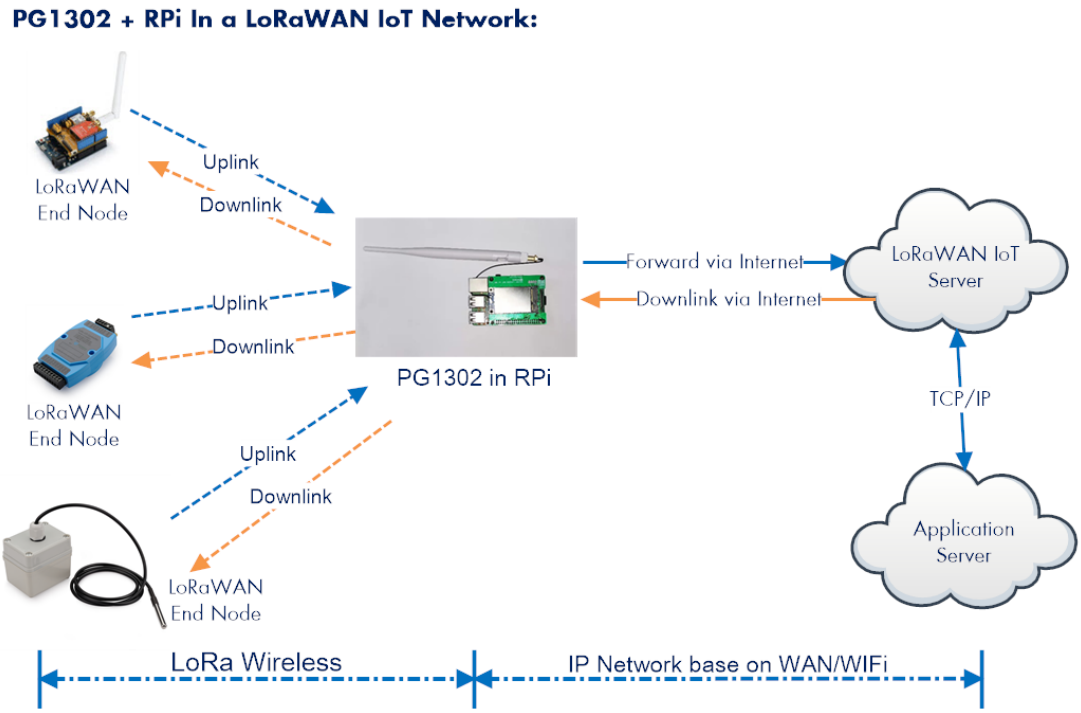
1.7 Applications

- ✓ Smart Buildings & Home Automation
- ✓ Logistics and Supply Chain Management
- ✓ Smart Metering
- ✓ Smart Agriculture
- ✓ Smart Cities
- ✓ Smart Factory

2 Example: Set up as LoRaWAN gateway.

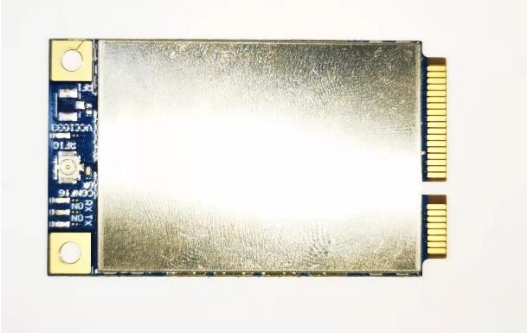
2.1 System structure

This example is an example to show how to set up the PG1301 + RPi as a LoRaWAN gateway to use with TheThingsNetwork(TTN) LoRaWAN server.. Set up method for other server are similar



2.2 Hardware Installation

Important Notice: Please power the RPI with 5V,2A cable.



RPI in this example is RPI model 3B with fresh Raspbian OS install.

```
pi@raspberrypi:~$ cat /etc/os-release
PRETTY_NAME="Raspbian GNU/Linux 8 (jessie)"
NAME="Raspbian GNU/Linux"
VERSION_ID="8"
VERSION="8 (jessie)"
ID=raspbian
ID_LIKE=debian
HOME_URL=http://www.raspbian.org/
SUPPORT_URL=http://www.raspbian.org/RaspbianForums
BUG_REPORT_URL=http://www.raspbian.org/RaspbianBugs
```

2.3 Install the software

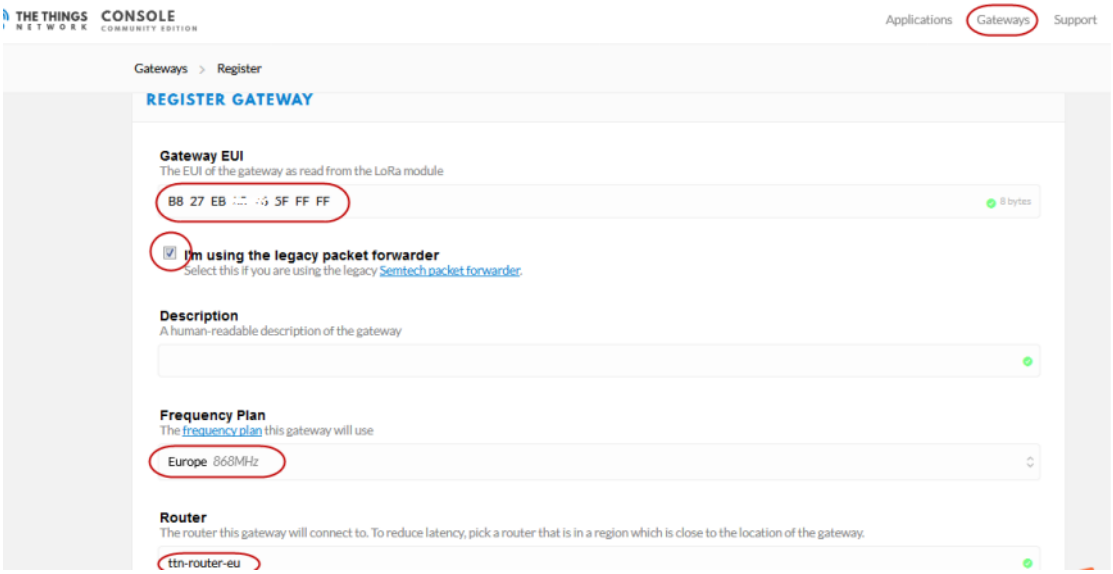
2.3.1 Get Gateway ID in Raspberry and input this in TTN.

In RPI, run below command to generate a Gateway ID

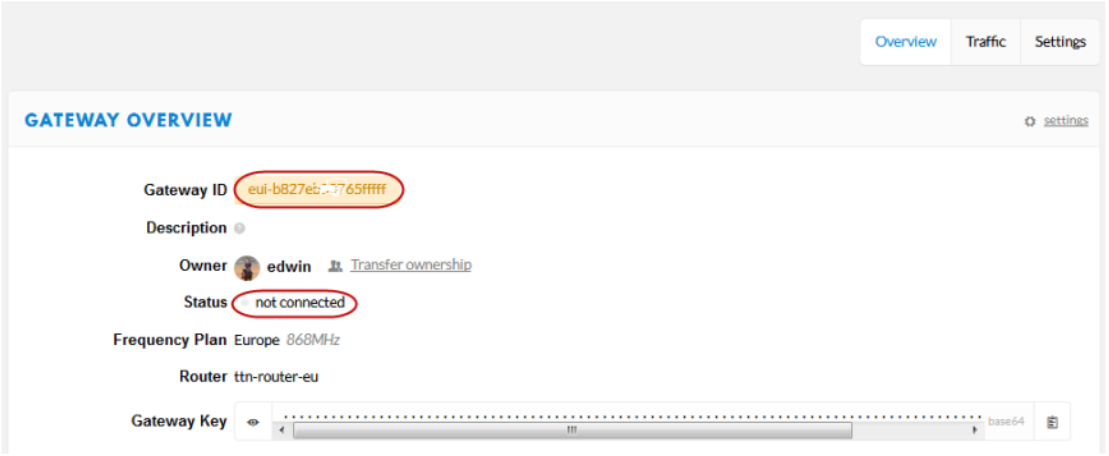
```
ifconfig eth0 | grep eth0 | awk '{gsub(/:/,"");print $5"ffff"}'
```

```
pi@raspberrypi:/etc/lora$ ifconfig eth0 | grep eth0 | awk '{gsub(/:/,"");print $5"ffff"}'
b827eb30a65fffff
pi@raspberrypi:/etc/lora$
```

Here we got b827xxxxx65fffff. Input this to TTN. Make sure to select legacy packet forwarder



After set up, the status should show not connected as below:



2.3.2 Download and install LoRaWAN packet forwarder

In RPI , run:

wget http://www.dragino.com/downloads/downloads/LoRa_Gateway/PG1301/software/lorapktfwd.dep

```
pi@raspberrypi:~$ wget http://www.dragino.com/downloads/downloads/LoRa_Gateway/PG1301/software/lorapktfwd.dep
--2019-06-24 11:16:31--  http://www.dragino.com/downloads/downloads/LoRa_Gateway/PG1301/software/lorapktfwd.dep
Resolving www.dragino.com (www.dragino.com)... 173.254.28.23
Connecting to www.dragino.com (www.dragino.com)|173.254.28.23|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 72168 (70K)
Saving to: 鈥榣orapktfwd.dep鈥?

lorapktfwd.dep                    100%[===================================================================================>]  70.48K   197KB/s   in 0.4s

2019-06-24 11:16:32 (197 KB/s) - 鈥榣orapktfwd.dep鈥?saved [72168/72168]

pi@raspberrypi:~$
```

This will download the packet forwarder package from Dragino Server to RPI.

run “sudo dpkg -i lorapktfwd.dep” to install pkt fwd, pktfwd will auto run after this command. But the TTN will still show not connected because the Gateway ID doesn’t match.

```
pi@raspberrypi:~$ sudo dpkg -i lorapktfwd.dep
(Reading database ... 127839 files and directories currently installed.)
Preparing to unpack lorapktfwd.dep ...
Unpacking lorapktfwd (1) over (1) ...
Removed symlink /etc/systemd/system/multi-user.target.wants/lorapktfwd.service.
Setting up lorapktfwd (1) ...
Created symlink from /etc/systemd/system/multi-user.target.wants/lorapktfwd.service to /lib/systemd/system/lorapktfwd.service.
pi@raspberrypi:~$
```

2.3.3 Config Gateway ID, Frequency Band and Server address

After installation, user can find the configuration file in **/etc/lora.** Replace the gateway ID we got above to the **gateway_ID** in file **local_conf.json**

The default frequency band is EU868 in **global_conf.json** file and the default LoRaWAN server points to TTN.

- If user want to change to other frequency bands, User can copy the file from **/etc/lora/cfg** and rename it to **global_conf.json** and put it into **/etc/lora .**
- If user wants to change to other LoRaWAN server, modify the **global_conf.json** file.
- To enable/disable GPS module, modify file **/etc/lora/local_conf.json**

2.3.4 Check result

Run below command to restart the pkt_fwd:

```
sudo systemctl stop lorapktfwd
sudo systemctl start lorapktfwd
```

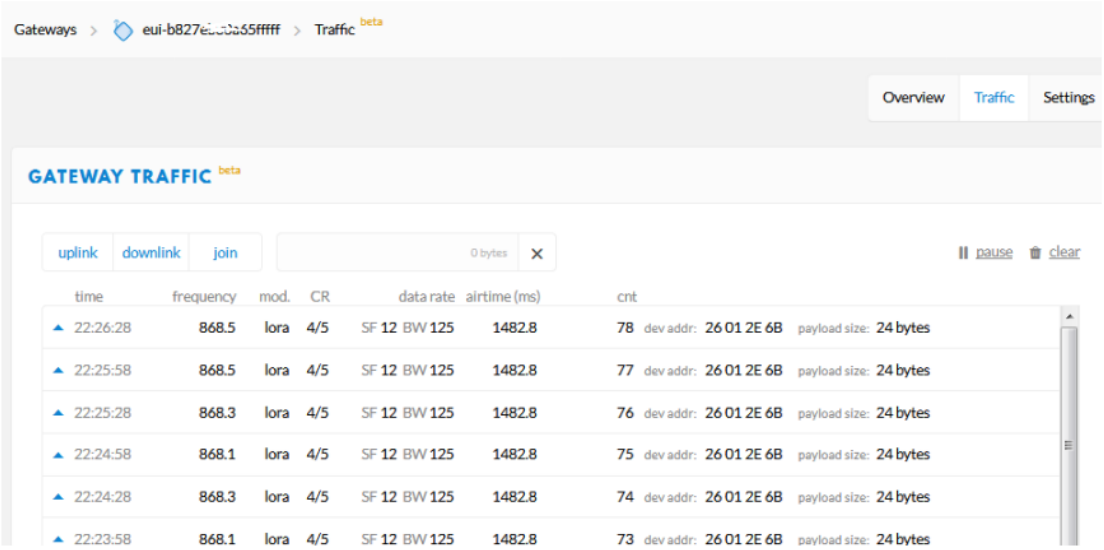
The pktfwd will start with the new gateway ID and TTN should show the connection ok:

We can check pkt_fwd running states in RPi by running:

```
sudo journalctl -u lorapktfwd -f
```

```
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: ##### END #####
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: RXTX: {"stat":{"time":"2019-06-25 14:22:49 GMT","rxnb":2,"rxok":1,"rxfw":1,"ackr":0.0,"dwnb":0,"txnb":0}}
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: RXTX: {"rxpk":[{"tmst":1631340292,"chan":0,"rfch":1,"freq":868.100000,"stat":1,"modu":"LORA","datr":"SF12BW125","codr":'
1/5","lsnr":12.0,"rssi":-27,"size":24,"data":"QGSuASaARwACKCPDOSRL3TkkFA1qtDlw"}]}
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: ################## Report at: 2019-06-25 14:23:19 GMT ##################
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: ### [UPSTREAM] ###
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # RF packets received by concentrator: 1
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # CRC_OK: 100.00%, CRC_FAIL: 0.00%, NO_CRC: 0.00%
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # RF packets forwarded: 1 (24 bytes)
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # PUSH_DATA datagrams sent: 2 (319 bytes)
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # PUSH_DATA acknowledged: 0.00%
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: ### [DOWNSTREAM] ###
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # PULL_DATA sent: 6 (50.00% acknowledged)
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # PULL_RESP(onse) datagrams received: 0 (0 bytes)
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # RF packets sent to concentrator: 0 (0 bytes)
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # TX errors: 0
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # TX rejected (collision packet): 0.00% (req:2, rej:0)
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # TX rejected (collision beacon): 0.00% (req:2, rej:0)
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # TX rejected (too late): 0.00% (req:2, rej:0)
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # TX rejected (too early): 0.00% (req:2, rej:0)
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # BEACON queued: 0
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # BEACON sent so far: 0
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: # BEACON rejected: 0
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: REPORT: ### [JIT] ###
Jun 25 14:23:19 raspberrypi lora_pkt_fwd[1373]: INFO: # SX1301 time (PPS): 1622469559
Jun 25 14:23:28 raspberrypi lora_pkt_fwd[1373]: sr1gw receive:1155: FIFO content: 1 32 1 5 18
```

If there are LoRaWAN nodes transmits nearby, we can see the traffic in TTN –> Gateway -> Traffic



2.3.4 Commands to handle service

- **Stop** lorapktfwd service: sudo systemctl stop lorapktfwd
- **Disable** lorapktfwd auto run after boot: sudo systemctl disable lorapktfwd
- **Start** lorapktfwd : sudo systemctl start lorapktfwd
- **Auto run** lorapktfwd after boot: sudo systemctl enable lorapktfwd
- **Show status** of lorapktfwd: sudo systemctl status lorapktfwd

3 Order Info

Part Number: **PG1302XX**

- PG1301-868 (For Bands: EU868,IN865)
- PG1301-915 (For Bands: US915,AU915,AS923,KR920)
- PG1301-470 (For Band: CN470)

4 Packing Info

Package Includes:

- ✓ PG1301 x 1
- ✓ LoRa Antenna x 1

Dimension and weight:

- ✓ Device Size: cm
- ✓ Device Weight:
- ✓ Package Size / pcs : cm
- ✓ Weight / pcs :

5 FAQ

5.1 How to compile the pkt-fwd for RPi?

Step 1: Update Raspian to the latest one.

sudo apt-get update

sudo apt-get upgrade

Step 2: Get source code:

git clone https://github.com/dragino/pi_gateway_fwd.git

Step3: Enter into pi_gateway_fwd and run

make && make deb

Then you will get the lorapktfwd.deb

6 Reference

✧ Datasheet, User Manual & Software Download:

http://www.dragino.com/downloads/downloads/LoRa_Gateway/PG1302/

7 Support

➢ Support is provided Monday to Friday, from 09:00 to 18:00 GMT+8. Due to different timezones we cannot offer live support. However, your questions will be answered as soon as possible in the before-mentioned schedule.

➢ Provide as much information as possible regarding your enquiry (product models, accurately describe your problem and steps to replicate it etc) and send a mail to

https://www.dragino.com/

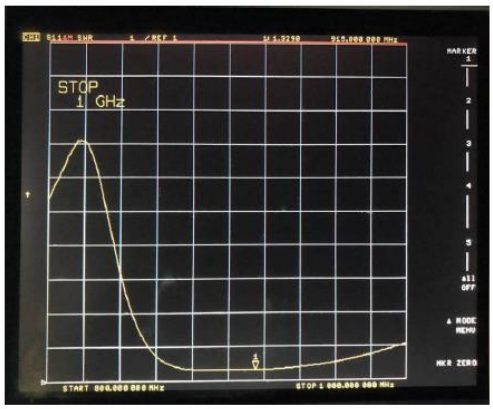
ANT 1

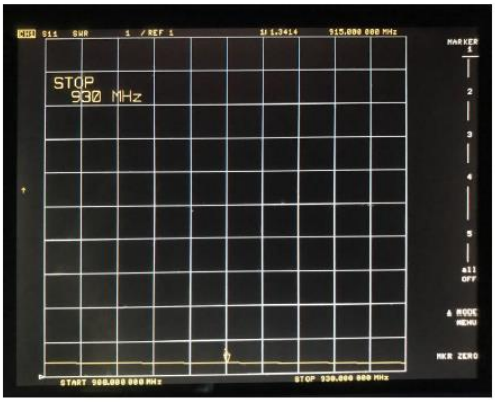
ANT 1: Fibre-glass epoxy antenna

2. Specification

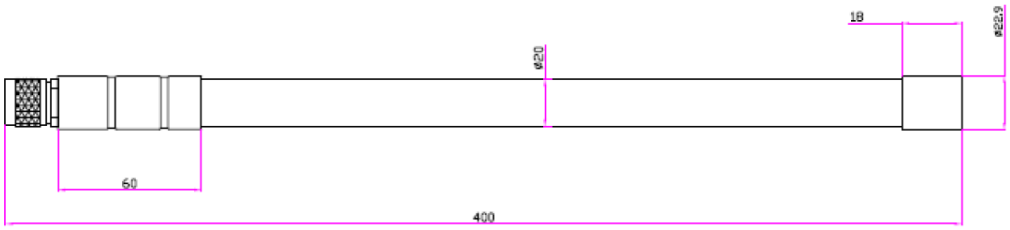
Frequency Range	860 ~ 930Mhz
Average Gain	3.0dB
VSWR	≤ 2.0
Efficient	> 65%
Beam Width	360°
Impedance	50 Ω
Polarization Form	Vertical
Material	Glass Fiber
Interface (Antenna Side)	N Type Male
Interface (Cable Side)	SMA Plug
Dimension	Φ 22 x L400 ±10mm
Extend Cable Length	60cm

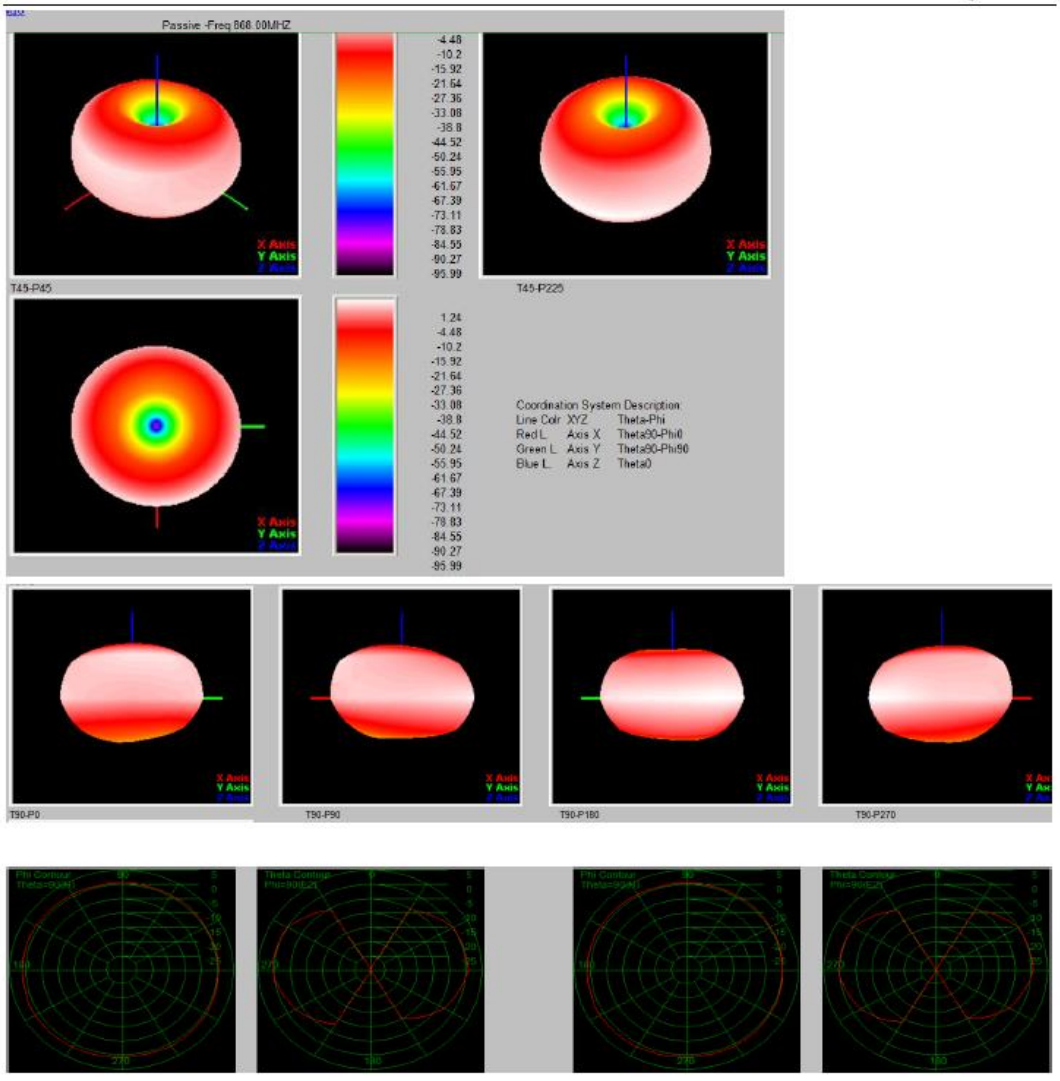
915MHz



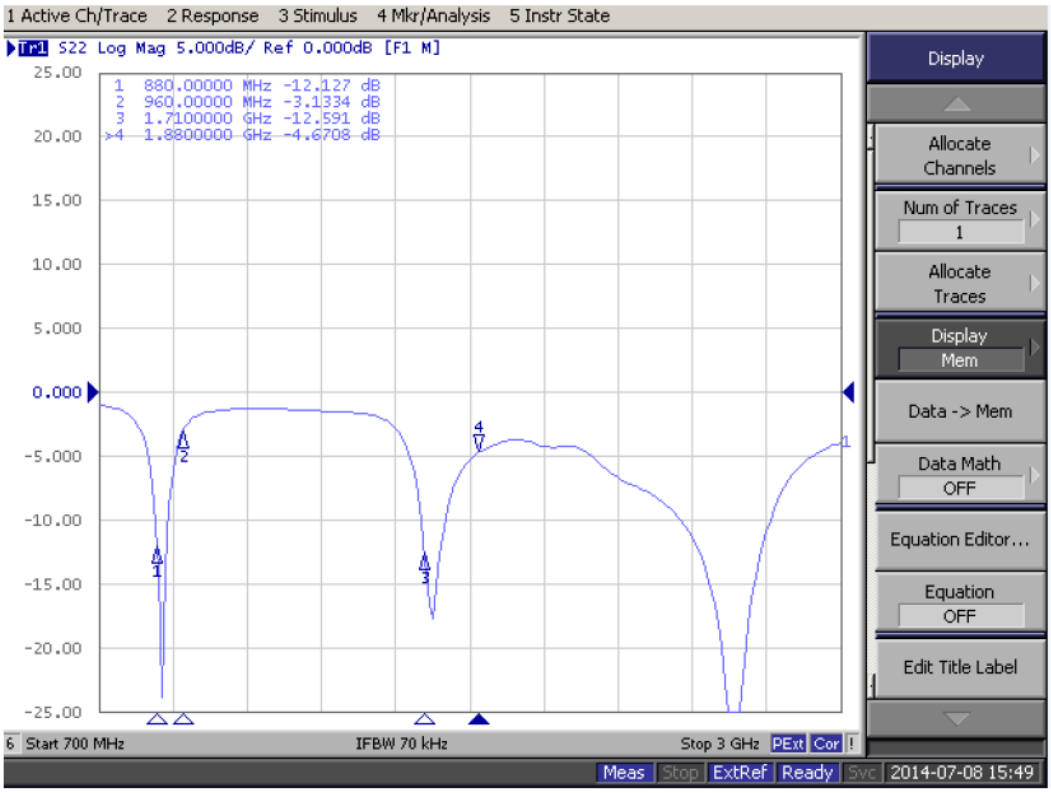


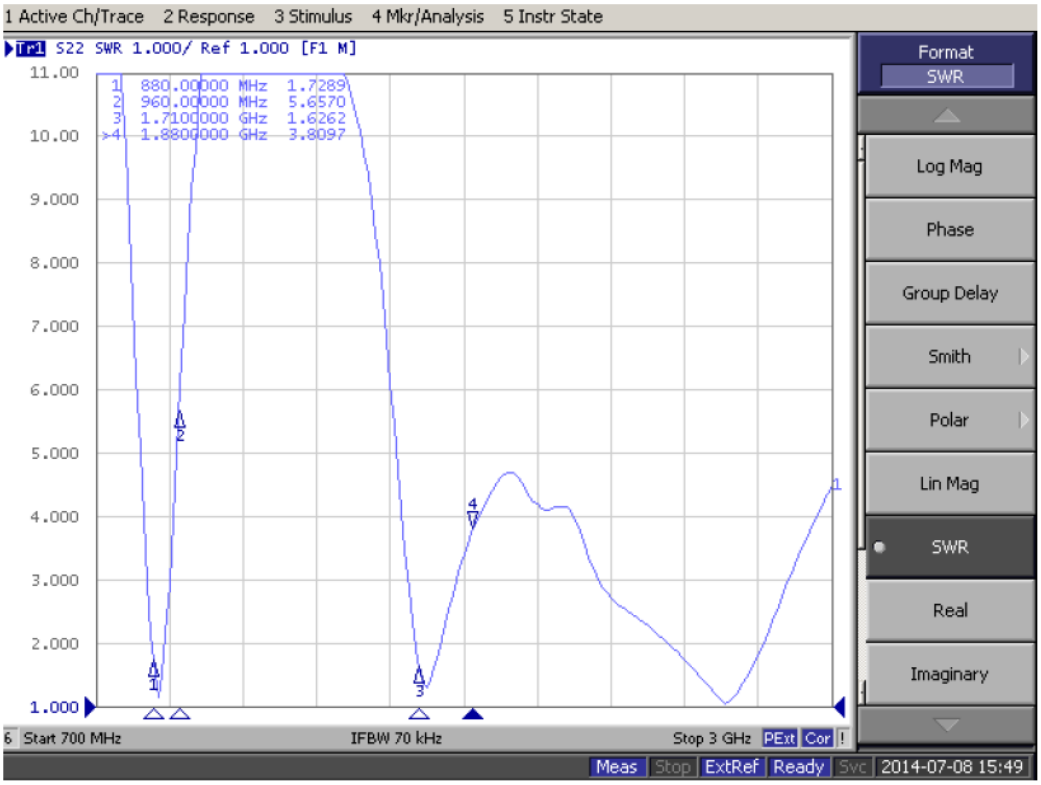
4. Mechanical

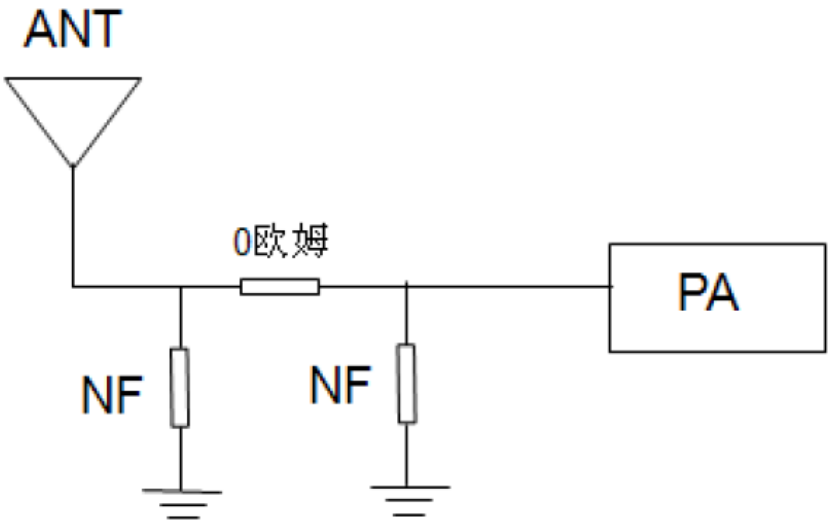



Passive -Freq:868.00MHZ
-4.48
-10.2
-15.92
-21.64
-27.36
-33.08
-38.8
-44.52
-50.24
-55.95
-61.67
-67.39
-73.11
-78.83
-84.55
-90.27
-95.99
T45-P45
T45-P225
1.24
-4.48
-10.2
-15.92
-21.64
-27.36
-33.08
-38.8
-44.52
-50.24
-55.95
-61.67
-67.39
-73.11
-78.83
-84.55
-90.27
-95.99
Coordination System Description
Line Colr XYZ Theta-Phi
Red L Axis X Theta90-Phi0
Green L Axis Y Theta90-Phi90
Blue L Axis Z Theta0
T90-P0
T90-P90
T90-P180
T90-P270

ANT 2


1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Tr1 S22 Log Mag 5.000dB/ Ref 0.000dB [F1 M]
1 880.00000 MHz -12.127 dB
2 960.00000 MHz -3.1334 dB
3 1.7100000 GHz -12.591 dB
>4 1.8800000 GHz -4.6708 dB
25.00
20.00
15.00
10.00
5.000
0.000
-5.000
-10.00
-15.00
-20.00
-25.00
6 Start 700 MHz
IFBW 70 kHz
Stop 3 GHz
PExt Cor
Meas Stop ExtRef Ready Svc 2014-07-08 15:49
Display
Allocate Channels
Num of Traces 1
Allocate Traces
Display Mem
Data -> Mem
Data Math OFF
Equation Editor...
Equation OFF
Edit Title Label

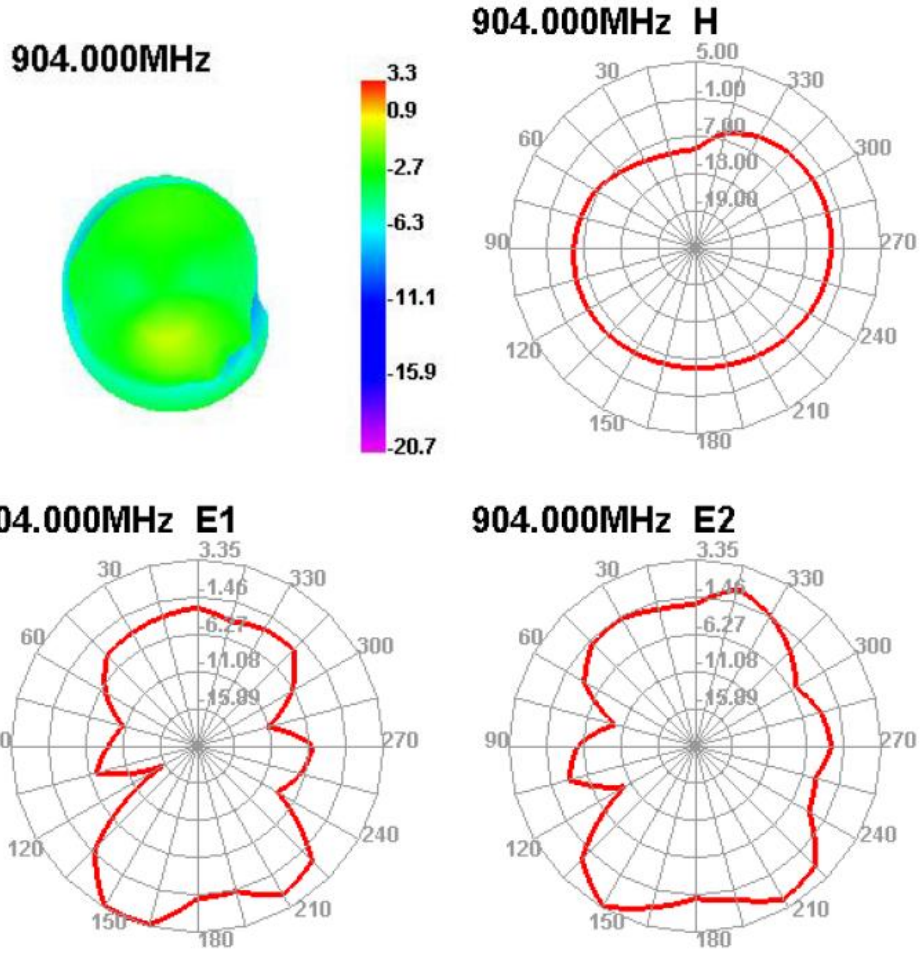

1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Tr1 S22 SWR 1.000/ Ref 1.000 [F1 M]
1 880.00000 MHz 1.7289
2 960.00000 MHz 5.6570
3 1.7100000 GHz 1.6262
>4 1.8800000 GHz 3.8097
11.00
10.00
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
6 Start 700 MHz
IFBW 70 kHz
Stop 3 GHz
PExt Cor
Meas Stop ExtRef Ready Svc 2014-07-08 15:49
Format SWR
Log Mag
Phase
Group Delay
Smith
Polar
Lin Mag
SWR
Real
Imaginary

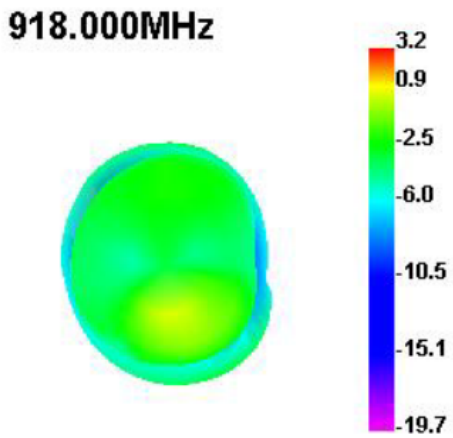


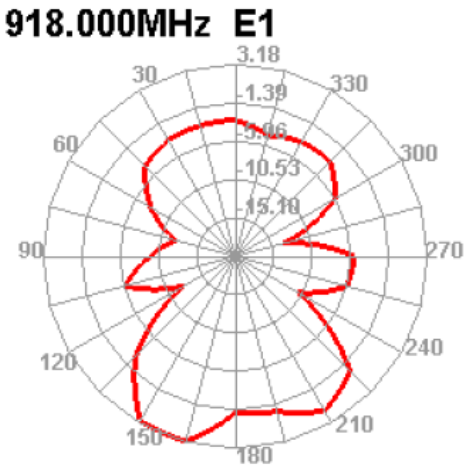
3.3 Passive-EFF

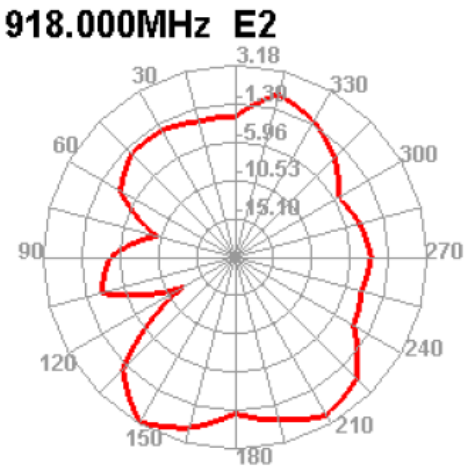
Freq (MHz)	Effi (%)	Gain (dBi)
904	50.42	2.69
918	49.68	2.69
922.5	49.64	2.69
932	48.47	2.69

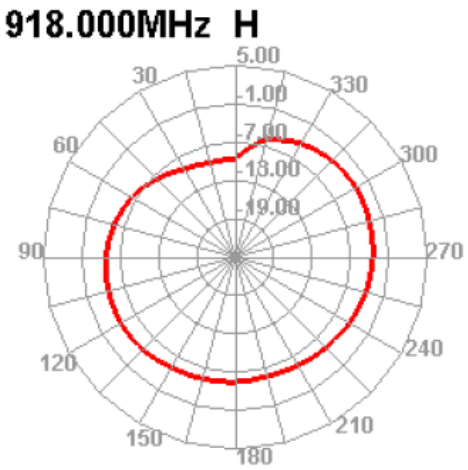
3.4 Radiated pattern

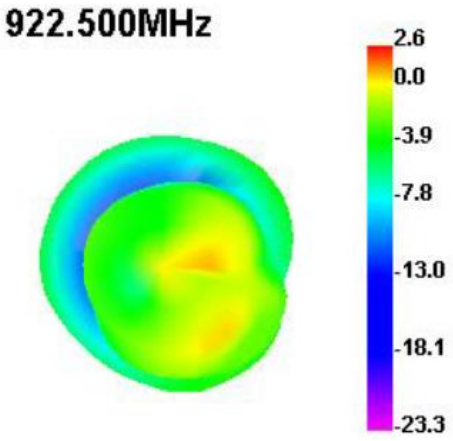


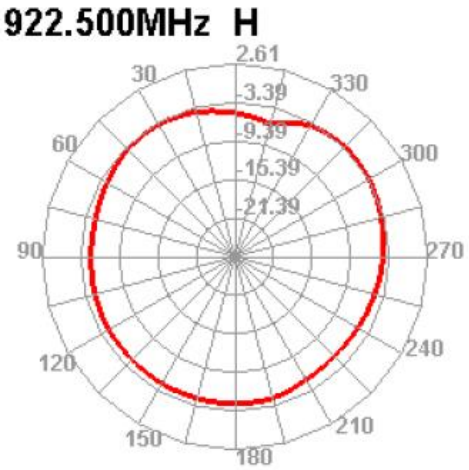

918.000MHz
3.2
0.9
-2.5
-6.0
-10.5
-15.1
-19.7


918.000MHz E1
3.18
-1.39
-5.96
-10.53
-15.10
30
330
60
300
90
270
120
240
150
210
180


918.000MHz E2
3.18
-1.39
-5.96
-10.53
-15.10
30
330
60
300
90
270
120
240
150
210
180


918.000MHz H
5.00
-1.00
-7.00
-13.00
-19.00
30
330
60
300
90
270
120
240
150
210
180


922.500MHz
2.6
0.0
-3.9
-7.8
-13.0
-18.1
-23.3


922.500MHz H
2.61
-3.39
-9.39
-15.39
-21.39
30
330
60
300
90
270
120
240
150
210
180

FCC WARNING

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 equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.