APC910M
17dBm Metering Concentrator Module V2.0

Features

- 470-510Mhz ISM frequency band
- Robust MESH network
- Automatically network building
- Network notes plug and play
- 10 levels of routing, up to 1024 notes
- 14.4k GFSK bps data rate, fixed
- 17dBm Max. output power
- Serial baud rate configurable
- Net ID configurable
- Address configurable
- Standby current < 5uA
- Supply voltage 3.5~5.5V
- Network radiating distance > 4km

Application

- Home automation
- Automatic meter reading
- Wireless data logger
- Wireless sensor network

DESCRIPTION

APC910M is a low-cost sub-1 GHz metering concentrator module designed for operations in the MESH network applications, especially for AMR (Automatic Metering Reading) applications. The module adopts high efficient RF chip from ADI and ARM7 processor. APC910M works at 60 MHz system frequency and supports complicated algorithm. It utilizes high efficient looped interleaving EDAC (Error Detection and correction) coding with coding gain up to 3dB which keeps in advance in EDAC and coding efficiency over normal FEC (Forward Error Correction).

By standard UART interface, APC910M communicates with the host (or server) through 15 commands. As to the use of commands, please refer to application document **WMRNET PROTOCOL** for more details.

PIN FUNCTIONS

Connector	PIN	Name	Function	Description
J1	1,2	VCC1	Output	+3.3V
	3,5,7,9,11,13,15,17,19	GND	Ground	Ground (0V)
	4,6,8,10,12,14	NC	---	No connection
	16	Reset	Input	Low: effective
	18,20	VCC2	Input	+5V
	21	RXD	Input	UART input
	22	TXD	Output	UART output
J2	1	GND	---	No connection
	2	VCC	3.3V output	No connection
	3,4,5,6	NC	---	No connection

Table 1 APC910M Pin functions

ELECTRICAL SPECIFICATIONS

Symbol	Parameter (condition)	Min.	Typ.	Max.	Units
VCC	Supply Voltage	4.5		6	V
Temp	Operating temperature range	-30	25	85	°C
RH	Operating relative humidity	10		90	%
Freq	Frequency range	470		510	MHz
F_{DEV}	Modulation frequency deviation		28.8		KHz
Mod	Modulation type		GFSK		
I_{DD}	Receive mode			42	mA
	Transmit mode @ 17dBm			120	mA
	Sleep mode			5	uA
Pout	Output power			17	dBm
Sen	Receiving sensitivity @14.4K bps		-113		dBm
DR_{IN}	Interface data rate	9.6		115.2	Kbps
CH_{BW}	Channel spacing		200		kHz
T_{NET}	Networking time @ 250 nodes		20		Minutes
RL	Routing level		10		
N_{MAX}	Max. network nodes			1024	
Z_{ANT}	Antenna Impedance		50		

Table 2 APC910M Electrical Specifications

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min.	Max.	Units
Vcc	Supply Voltage	-0.3	6	V
V_I	Input voltage	-0.3	5	V
V_O	Output voltage	-0.3	5	V
T_{ST}	Storage temperature	-55	125	℃

Table 3 APC910M Maximum Ratings

COMMAND TABLE

Num.	Command	Description
1	DELNET	Delete network
2	CMD	Host communicating with nodes
3	TST	Testing module
4	BCTIME	Broadcasting time
5	RDNODE	Reading nodes existing in the network
6	RDFREQ	Reading frequency
7	WRFREQ	Writing frequency
8	RDNETID	Reading network ID
9	WRNETID	Writing network ID
10	MTNET	Maintaining network
11	STOPMT	Stop network maintenance
12	STATUS	Inquiring maintenance status
13	RATE	Writing serial data rate
14	IODELAY	Interface delay
15	MRATE	FSK data rate

Table 4 APC910M Commands

APPLICATION

APPCON Technologies utilizes its own communication protocol WMRNET which has been successfully applied into many AMR networks. The WMRNET network includes a concentrator (APC910M) and many nodes (APC230N). The address length of node module is 6 bytes.Mean--while the network also has its unique 2 bytes net ID. In the same network, the net ID of the concentrator must be the same as other node modules'. The network adopts Host/Client mode. The reading command only can be sent to nodes by the concentrator. The nodes can upload data passively as soon as receiving command from the concentrator. The net protocol encapsulates the network building and maintaining functions so the users can inquiry the status of nodes and read data from meters through the concentrator without any attention to the operation of network. The WMRNET network uses one command and can support 180 bytes transmit/receive. It supports

SILENT mode which can be achieved by setting the concentrator in 30 seconds. In SILENT mode, the concentrator and nodes in the same network will not transmit data automatically. The users can cancel the silent mode at any time. With this mode, users can activate the network at different time segments and then can read many networks at the same frequency. The WMRNET network adopts top-to-down networking method and uses the transmit/receive field strength to judge the quality of links, which decides the networking conditions. Each node in the WMRNET network might have many paths and supports many father nodes and can be used as father node so the WMRNET can choose reasonable routing path automatically.

In an activating WMRNET network, the ID of a new node can be recognized and added into network in a certain time when it locates in the covering range of network. As to a deleted node, its corresponding ID will be removed in 18~24 hours automatically. Please note that the recognition and removal of a node can be realized only in an activating network. In the SILENT mode, the routing of network and the status of nodes are in freezing but the users still can read the data of meters through the concentrator.

Before WMRNET network is built, the concentrator and nodes must be configured first. The configurable parameters of the concentrator include frequency, net ID and serial data rate. As to the note modules, users can write frequency, net ID and address into the meter terminal and the meter then compare these data with the node module in it when powering up. If the parameters are different, the meter then changes corresponding parameters of the node module online.

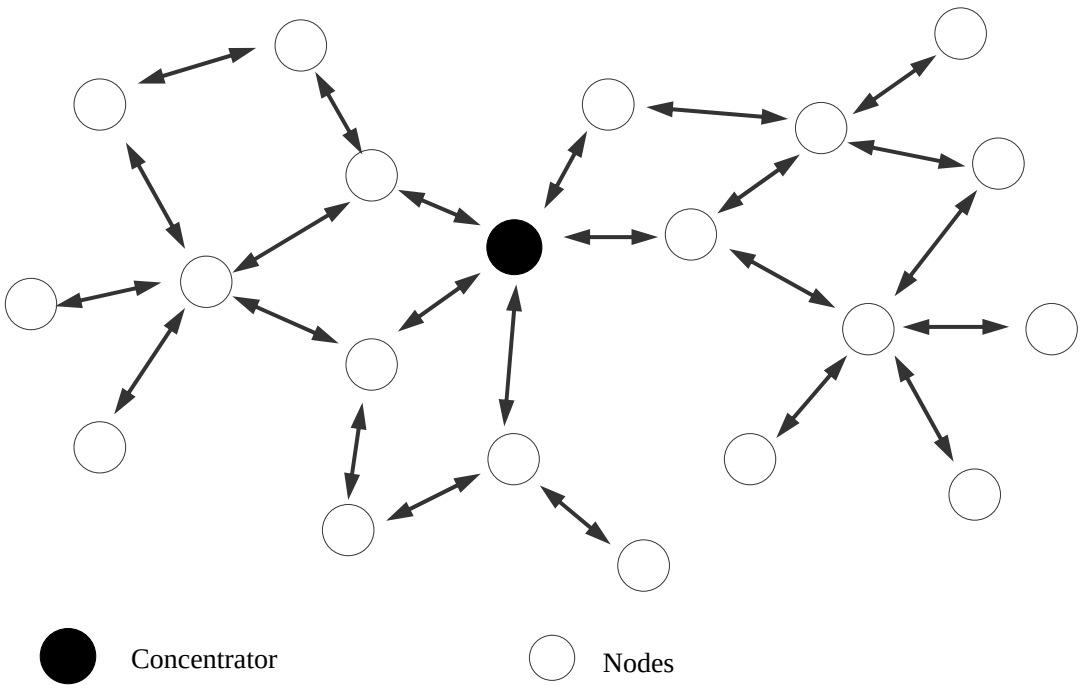

Figure 1: WMRNET Networking Demonstration

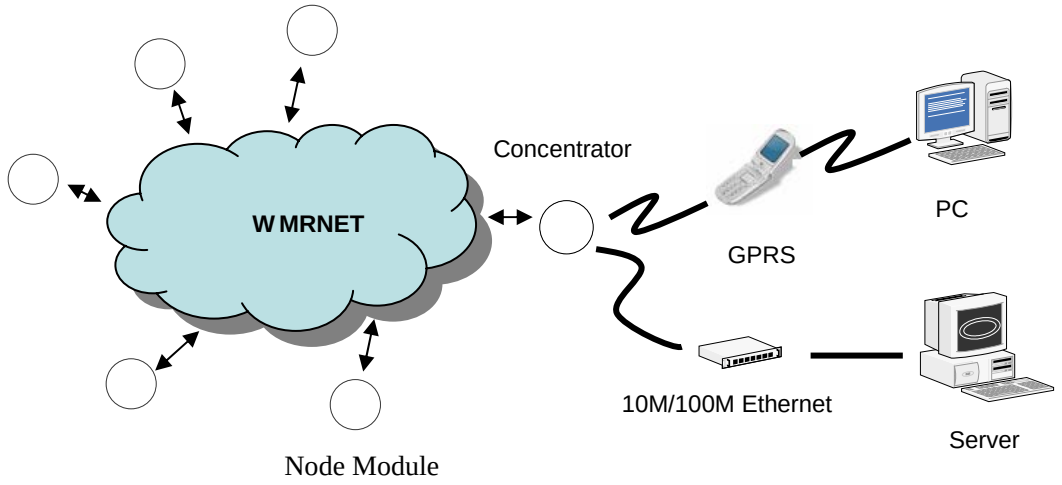

Figure 2: WMRNET Network Application

WMRNET network can work at the same frequency in separated areas, which is similar to GSM network or AM/FM radio broadcasting in different cities. One system can have many WMRNET networks in different channels and the whole spectrum can be utilized in K (number) frequency multiplexing mode. The factors which affect the minimum distance (D) for frequency multiplexing are included but not confined to: the number of the same channel used by neighboring WMRNET , geographical features, active range of each network node, etc. The increasing of K will result in lengthening the frequency multiplexing distance D in order to reduce the co-channel interferences.

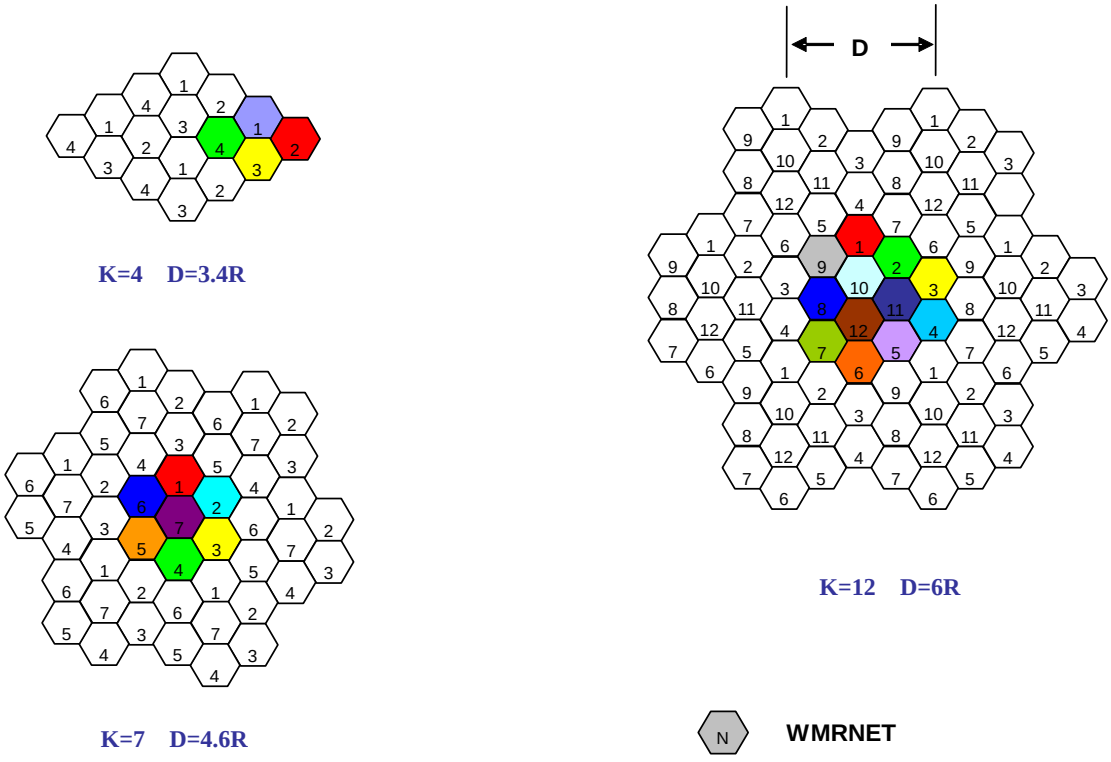

Figure 3: WMRNET Frequency Multiplexing Mode

For the same mechanism, WMRNET also can work in time multiplexing mode by taking advantage of its SILIENT function. The minimum distance (D) for time multiplexing will be decided by the equation: $D = \sqrt{3K}\,R$

MECHANICAL DATA

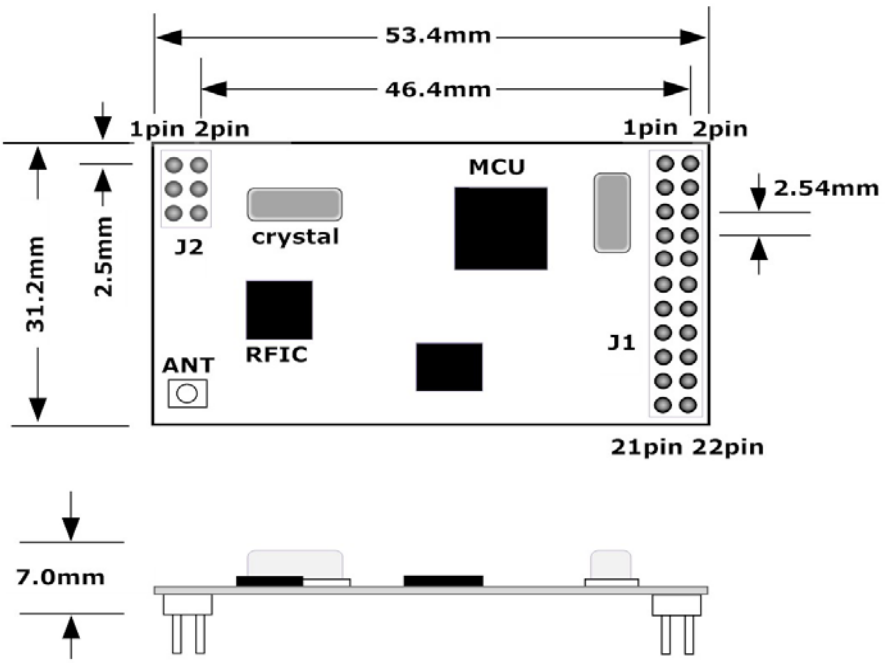

Figure 4: Mechanical Dimensions

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