

TWB-049 Base/Repeater Operational Description

The TWB-049 unit is a 902-298MHz frequency hopping transceiver consisting of the main micro board PCB and a high power radio PCB.

Features/Specs

- The TWB-049 functions as a repeater or base for companion TWS-049 Sensor units.
- The system supports over 500 sensors with 15 minute transmission intervals.
- Connects to PC via USB to transfer sensor data to database on PC (Base only)
- Powered from either USB or external AC/DC 5V converter. Internal Li_Ion battery used for burst current needs. Charger incorporated into Power management IC (Linear LTC3455)
- Jumper P2 acts to disable battery as source of power (off w/o jumper)
- The TWB-049 utilizes a Chipcon CC1020 RFIC (radio frequency integrated circuit) with RFMD 2162 Power Amplifier for maximum output power of +29dBm
- Baud Rate = 4800 bps, Modulation is FSK with a 4.9kHz deviation
- 60 channel frequency hopping system, minimum 400KHz channel separation
- Dwell time per channel is 120mS maximum, 72mS typical
- The TWB-049 is controlled by 8 bit Atmel AVR micro (ATMega168V) clocked by internal 8MHz LC oscillator.
- The ATMega168V contains Flash ROM for program code, EEPROM for configuration/serial number, and SRAM for CPU operation, all internal to the IC.
- Real Time clock maintained by 32.768KHz crystal

Operation

- The TWB-049 monitors each channel in succession for sensor transmissions. Upon reception of error free data packet, it generates an Acknowledge packet back to the originating sensor on the same channel.
- Unit then forwards sensor data by radio on the next available channel (if a Repeater) or by USB (if a Base)
- All transmitted packets incorporate header that contains unique serial number ID of the transmitting unit.
- Channel selection is based on the response to numerous TWS-049 sensors in the area. Each TWS-049 sensor has a unique, random hopping plan.
- The TWB-049 generates at most one burst per channel.
- Acknowledge packets contain RTC data to keep system synchronized.

Clocks and Crystals:

- 32.768 KHz Crystal on Main PCB
- 12.00 MHz Crystal on Main PCB
- 14.7456 MHz Crystal on Radio PCB
- SPI Clock line at 2MHz, active only when unit is transmitting

Frequency Map

Channel #	Frequency MHz	Separation KHz	Channel #	Frequency MHz	Separation KHz
0	902.4		30	915.2	400
1	902.8	400	31	915.6	400
2	903.2	400	32	916	400
3	903.6	400	33	916.4	400
4	904	400	34	916.8	400
5	904.4	400	35	917.4	600
6	904.8	400	36	917.8	400
7	905.4	600	37	918.2	400
8	905.8	400	38	918.6	400
9	906.2	400	39	919	400
10	906.6	400	40	919.4	400
11	907	400	41	919.8	400
12	907.4	400	42	920.4	600
13	907.8	400	43	920.8	400
14	908.4	600	44	921.2	400
15	908.8	400	45	921.6	400
16	909.2	400	46	922	400
17	909.6	400	47	922.4	400
18	910	400	48	922.8	400
19	910.4	400	49	923.4	600
20	910.8	400	50	923.8	400
21	911.4	600	51	924.2	400
22	911.8	400	52	924.6	400
23	912.2	400	53	925	400
24	912.6	400	54	925.4	400
25	913	400	55	925.8	400
26	913.4	400	56	926.4	600
27	913.8	400	57	926.8	400
28	914.4	600	58	927.2	400
29	914.8	400	59	927.6	400

Typical Hopping Plan

The hopping plan is in response to multiple TWS-049 Sensors. For one sensor in the system, this is a typical hopping plan:

```
47 -> 21 -> 50 -> 49 -> 58 -> 28 -> 57 -> 24 -> 43 -> 5 -> 33 -> 44 ->
19 -> 32 -> 45 -> 10 -> 2 -> 34 -> 31 -> 22 -> 37 -> 8 -> 16 -> 23 ->
1 -> 14 -> 27 -> 12 -> 6 -> 39 -> 0 -> 55 -> 52 -> 48 -> 30 -> 7 ->
51 -> 54 -> 56 -> 13 -> 18 -> 40 -> 41 -> 29 -> 36 -> 42 -> 59 -> 3 ->
9 -> 11 -> 20 -> 46 -> 35 -> 38 -> 4
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