For this purpose we use data from two longer-term deployments with different field node characteristics according to table 1.

|  |  |  |
| --- | --- | --- |
| **Node properties** | **Strawberry farm** | **Tomato farm** |
| Mikrocontroller | ATmega328 (www-microchip.com) | |
| LoRa module | RFM95: 14 dBm output power (www.hoperf.com) | RFM95PW: 25 dBm output power (www.hoperf.com) |
| Antennas | PCB or whip antenna (approx. 0 dBi gain) | |
| Height of field node antenna | 2 m | 1 m (outdoor) and 0.1 m (greenhouse) |
| Height of base station antenna | 10 m | 1 m |
| Sensors | SHT21: humidity and temperature (www.sensirion.com) | 3 x SMT100 and AquaFlex or 4 x SMT100: soil moisture and temperature (www.truebner.de) |
| Payload | Comma separated node id, packet counter, battery voltage, temperature, humidity  typ. 25 bytes | Comma separated node id, packet counter, battery voltage, temperature, soil moisture  typ. 50 bytes (compressed by a factor of two by combining two characters to a single byte) and XTEA encryption |
| Power supply (transmitting nodes in the field) | 2 x AA cell (3V) | 6 x AA cell (9V) |
| Power supply (receiving nodes at base station) | USB powered | |
| LoRa settings | SF 9, CR 4/5, BW 125 kHz, 868 MHz band | |

The two farms are near Heidelberg in south-western Germany. The 1 km radio path for the strawberry farm setting is none line of sight passing agricultural areas, a few houses and some trees. The tomato farm is a complex radio environment with lots of greenhouses built of glass and steel. Distances are only between 100 and 200 m, but the receiver was placed in an office on the ground floor not facing to the direction of the field nodes. 3 of the field nodes were placed outdoors and 1 inside a greenhouse.