TG-APP-Data-rate - 100

ETRX2 and ETRX357 Wireless Mesh Networking Modules

Application Note – Data Rates

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1 Introduction

Although the data rate of 2.4GHz ZigBee devices is sometimes quoted as 250kb/s, this is the data rate within a radio packet. The payload is only part of the packet, and with a short message it may be a relatively small part. In addition it is not possible for a device to transmit 100% of the time since there is a maximum packet length, packets require acknowledgements at both 802.15.4 and ZigBee application layers, and the bandwidth must be shared with network management messages.

To ascertain realistic limits for the data rate between two devices, some tests were run on a minimal system and the results are presented here.

2 Test method

It is important to ensure with speed tests that the bottleneck is the radio link and not the computer running the test. Therefore there were no terminal applications running apart from the Python process connected to one device. Only two ZigBee nodes were present on the network, and there were no other PANs in the radio channel being used.

The serial port of each device was set to 57600 baud with no handshaking. Each device had Telegesis version R306 firmware.

The test was run by sending and reading AT commands and their responses to one device by means of a Python script. The messages were sent as a sequence of unicasts, and each time the transmitter reported an ACK a new message was sent. The time to send 1000 messages was recorded; any NACK or timeout terminated the test so all the results relate to a 100% success rate.

Messages were sent between a pair of ETRX2s and a pair of ETRX357s, with short and long payloads, and to the coordinator or another router. End devices were not tested since they are not suitable for high-speed data transmission. Each result was repeatable with about 5% variation in speed. The two charts show either message per second or bit rate for the various combinations of settings.
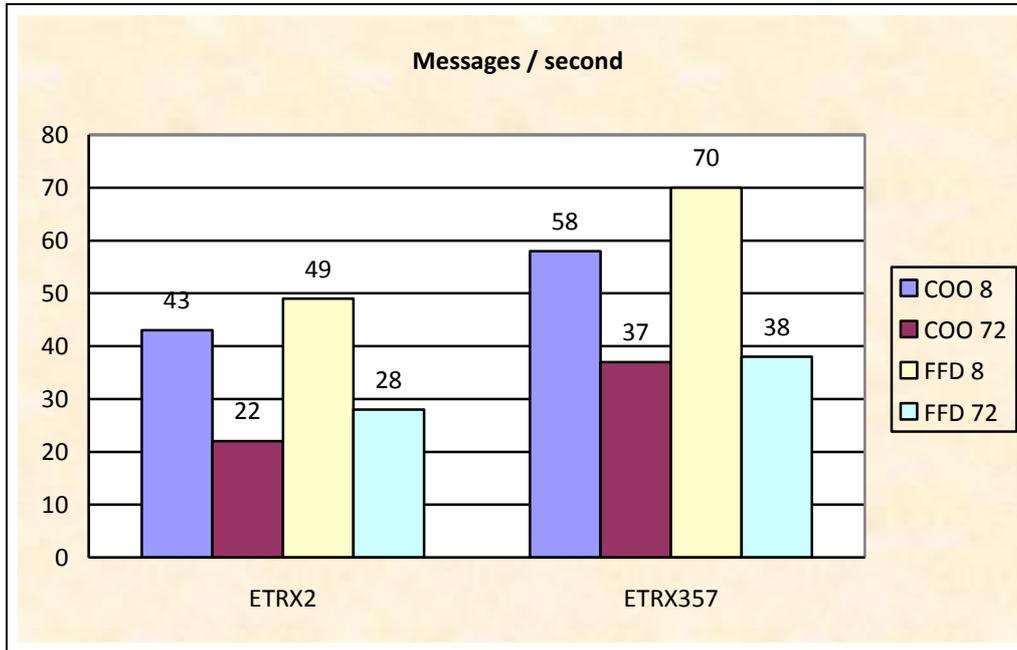
Figure 1. Messages/sec to COO or FFD with 8- or 72-byte payload
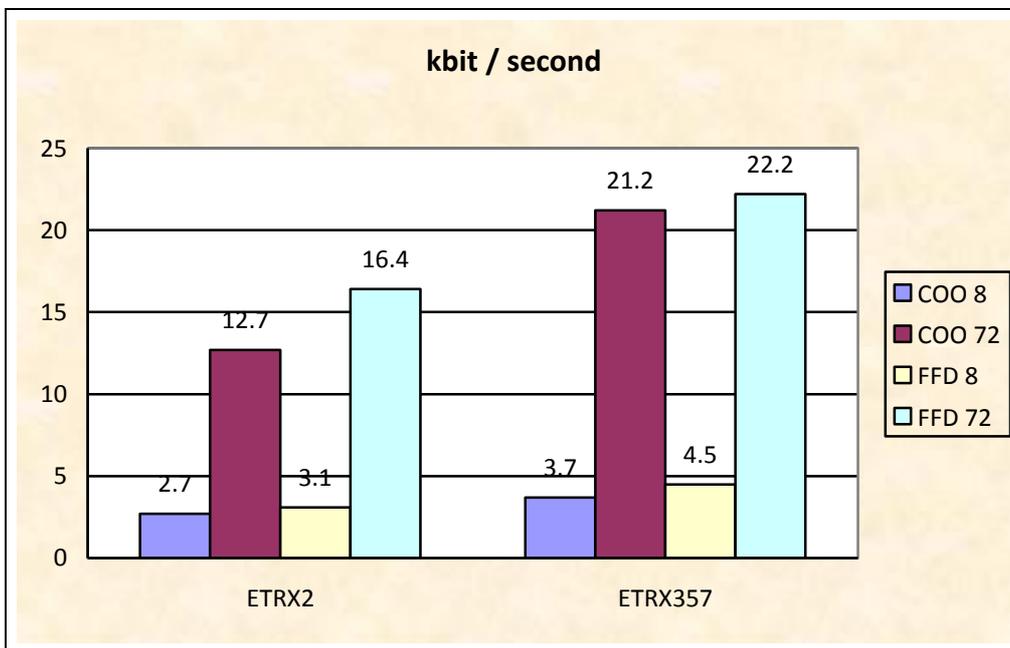
Figure 2. kbit/sec to COO or FFD with 8- or 72-byte payload

3 Conclusions

The most obvious point is that the achievable data rate is well below 250kb/s, which is not surprising. Three points can be taken from these results:

1. To achieve the highest data rate, pack as much data as possible into each unicast. Conversely, for a high message rate use short packets.

2. Transmission between two routers is faster than transmission to or from a coordinator. This is because the latter requires extra messages for the source routing protocol.

3. The ETRX357 is at least 40% faster than the ETRX2.

Anecdotal reports suggest that custom firmware tailored to high-speed data can approach 50kb/s, and Ember have reported similar figures. However, the R3xx firmware is more general-purpose and the lower data rate is the penalty for its extra functions.

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