

INTRODUCTION TO BLUETOOTH

Bluetooth is intended for short-range connectivity at relatively low-bandwidth. Typical devices are headsets (or just headphones), mouse, keyboard, whiteboards, etc.

WORKING RANGES

The range of up to 10m Class 2 devices is extended by Class 1 devices to up to 100m (there is a Class 3 with a nominal range of about 1m - but those devices will not be discussed further here).

Note that the range is specified as "up to". Difficult environments will result in ranges less than the specified 10m (Class 2) and 100m (Class 1) ranges.

Note also that the **two-way** range is always less than 100m when a pairing of a Class 1 device and a Class 2 device is used.

Working ranges for Class 1 and Class 2 device pairings are as follows:

Two-way Working Range		Device #1	
		Class 1	Class 2
Device #2	Class 1	up to 100m	up to 20m
	Class 2	up to 20m	up to 10m

Note that the maximum two-way working range is 100m only when both devices are Class 1.

The 10-to-1 increase in the range of Class 1 devices is due partially to higher transmit power (up to 100mW). The maximum allowed transmitter power of a Class 1 device is about 16dB more (about 40 times) the transmitter power of a Class 2 devices (up to 2.5mW). However, the increase in range is the square-root of the increase in transmit power. Therefore the 40 times increase in power gives about 6 times increase in range - from 10m to 60m. Where does the remaining range distance of 40m come from to reach 100m? It comes from an effective increase in the receiver sensitivity of about 6dB (4 times). The square-root of 4 times is 2. So we have up to 16db more transmitter power with about 6dB more receiver sensitivity giving a total link gain of 22dB (158 times). The square-root of 158 is 12.5 - giving a nominal increase from 10m to 125m.

HEADSETS (TWO-WAY - LISTEN AND TALK)

Most (all ?) headsets are Class 2 devices. If they were Class 1 devices then the talk-time would be significantly reduced as the increased range is due partially to higher transmit power. For the same battery capacity in the tiny headsets this would substantially reduce the talk-time (by a factor of roughly 40 if comparing maximum powers...), not a good selling point... Of course, for a Class 1 device plugged into a USB port on a PC the extra current drain is not an issue. The situation for a PDA or mobile phone is somewhere in-between (battery-powered but much bigger battery than a headset).

Typically the connection between a BT headset and a PC (e.g., VoIP) would use a USB BT 'dongle'. Following is a summary of expected ranges for various combinations and uses.

- For a Class 2 headset paired with a Class 2 USB 'dongle' the **two**-way range can be expected to be up to 10m.
- For a Class 2 headset paired with a Class 1 USB 'dongle' the **two**-way range can be expected to be up to 20m (due to the roughly 6dB increase in sensitivity of the Class 1 USB 'dongle' receiver).

HEADSETS (ONE-WAY - LISTEN ONLY)

If you are not interested in talking through your headset and only listen, then the range might be **slightly** greater than the 20m given above for a two-way link between a Class 1 'dongle' and a Class headset.

- For a Class 2 headset paired with a Class 1 USB 'dongle' the **one**-way (listening on the headset to audio from the 'dongle', i.e., using a headset as headphones) range would be **expected** to be up to 60m (due to the roughly 16dB increase in transmit power of the Class 1 USB 'dongle' transmitter. However, the BT protocol requires a response from the headset for the USB 'dongle' to continue to try and transmit to it. As we move further away (but before the headset can no longer 'hear' the USB 'dongle') the USB 'dongle' is no longer getting a consistent enough 'yes - I am still here' signal from the headset to justify it continuing transmitting and the connection is lost. You should only expect to get up to 25 - 30m range.

SPECIAL NOTE:

All the above distances assume open space. In practical terms if you get 10m two-way from a Class 2 'dongle' to Class 2 headset, you may not get 20m two-way with a Class 1 'dongle' and a Class 2 headset if at 11m distance you turn a corner and go behind a brick wall...

USES OF BLUETOOTH CONNECTIVITY

Now that we have covered a rough introduction to bluetooth we can discuss uses.

Typically, my activity on amateur radio is supplemental to other interests. That

is to say, I rarely come into the shack for the express purpose of playing radio. Usually I am tinkering with something else (this website for instance) and the transceiver is on in the background. Most often I am listening in on a net or club news, or sometimes monitoring beacons or a calling frequency.

Occasionally I am on a net with a large number of participants. I would like to duck out to get a cup of coffee (or a reverse direction flow...) without having to turn the speaker up loud thereby disturbing the rest of the household. And lets face it - sometimes you hear something on the air that you would rather not share with the family...

A headset of some description is the answer...

I could use a wired headset of course. I have tried that, but I find (being a forgetful sort of fellow) that I often look like the dog that forgets it is on a chain when I am brought to an abrupt arrest at the limits of the headset lead - not to mention tripping over the cord or running over it with the chair.

So wireless it has to be.

I also have trouble with headphone fatigue and so one of those lightweight "trendy" (LOL) bluetooth mobile phone headsets (one ear) is the go.

So the task will be to set up a BT headset to provide audio to and from my transceiver.

LIMITATIONS OF BLUETOOTH

As mentioned at the start, Bluetooth is intended for short-range connectivity. It was originally intended to connect devices within a few metres of each other. Wandering all over the house using BT to connect to VoIP is not what it was intended for.

At the frequency that BT uses (about 2.5GHz) walls have a definite absorption/reflection characteristic. Walls with an aluminium foil layer for insulation in particular can shield the signal or even create 'hot spots'.

Bluetooth uses an ISM radio band, which is like the wild west of radio - no quarter should be expected and no quarter will be given. You share it with other wireless devices and the grand-daddy of all "unintentional radiators" - the microwave oven. Don't expect to walk past a microwave oven and not have your nice clean audio clobbered. Even with a 'dongle' to headset distance of 2m, our microwave at 5m distance causes a few 'burps' (but only when it is on...:-)

Recognising the design purpose of BT ensures you are not disappointed.

