TESTING THE REMOTE SURGERY LASER COMMUNICATIONS DEVICE

YOUR TASK

Having successfully assembled the prototype RSLCD, as a highly skilled NHS clinical engineer your task now is to test the device and produce an evaluation which will consider the following things:

- the suitability of the device concept for the proposed purpose.
- the performance limits of the device.
- possible ways of improving performance.
- possible ways of improving cost effectiveness.

BEFORE YOU START

In order to provide a fair evaluation you are going to need to carry out some tests on the device. Remember that this device is a prototype so you could expect that certain, obvious changes will be made before it reaches production. For example, it would be unfair to say that the device will get wet when it rains and the electronics will short out, as a production device would obviously be weather proofed.

Don't forget to try to suggest solutions as well as just pointing out problems.

Before you start to do any tests write down a plan. Take a look at the following *Testing the device* section for some ideas. Your plan will need to clearly show:

- what you are going to do
- why you are going to do it
- safety precautions you are going to take

Remember that these are just suggestions – try to come up with your own ideas.

Get your plan approved by your teacher or lecturer before you start to do anything.

TESTING THE DEVICE

1. The effect of different operating conditions

Think about the conditions that the device might have to operate in. How will these conditions affect the propagation of the laser beam?

What experiments can you devise to test this?

2. Safety

Think about any risks the device might pose to people or wildlife.

3. The effect of transmission distance

Is the device capable of transmitting information over the required 200 metres?

- It is likely that your laser beam will spread fairly quickly. Measure the diameter of your beam at several different distances from the laser module, plot a graph and see if you can extrapolate to estimate the beam diameter at 200 metres.
- What effect will the increased beam diameter have on the quality of the signal at the receiver and how might you either compensate for the problem or reduce the beam diameter?
- Will there be any attenuation of the signal over 200 metres? To test this you could use a signal generator to input a sinusoidal waveform of known amplitude to the transmitter. An oscilloscope could then be connected to the receiver and the amplitude of the waveform measured at different distances from the laser module. Plot your results on a graph and extrapolate up to 200 metres.
- How could you determine how much of the signal attenuation is due to the electronics in the transmitter?
- Can you estimate the combined effect of the signal attenuation and beam spreading over 200 metres?

4. The effect of ambient light on the receiver

As the receiver is a photovoltaic cell, it will also respond to ambient light and this might cause interference.

- Can you evaluate whether this is likely to be a significant problem?
- Could any interference problem resulting from ambient light be reduced by careful positioning of the transmitter and receiver?
- Could you suggest any modifications to the RSLCD that might reduce or eliminate this problem?

5. Cost effectiveness

One of the main limiting factors when it comes to marketing the RSLCD to hospitals will be the cost. At the moment one of the more expensive components is the bi-colour LED which protects the laser module against voltage spikes. This could actually be replaced with a cheaper component. Explain what this component should be and how you might go about calculating/measuring a value for it.

6. Communication

At the moment your device is configured to transmit analogue audio only.

- If this device were to be used for remote surgery communications, what kind of data would it need to transmit and why?
- Draw a simple schematic diagram showing how you might make any necessary changes.

PRESENT YOUR FINDINGS

Once you have completed your evaluation you will be asked to present your findings back to the rest of the group. Here are a few tips about how you might do this:

- Make sure that your presentation has a clear structure. A suggestion might be to use the five categories outlined above as a framework.
- Explain how the device works – paying particular attention to the role of the transformer.
- Explain how you came to your conclusions and show any data you have that supports your conclusions.
- Mention any errors you think there may be in any of the tests you carried out and, if possible, explain how you dealt with those errors or how they might be reduced or eliminated if you had time to re do the test.
- Don't forget to suggest solutions to any problems you might have discovered with the device.