CAES 9541 Technical English for electrical and electronic engineering

Unit six of the booklet

Reporting and discussing results, making use of analogies, figures and graphics

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Overview

This unit will help you guide your reader to interpret the findings of your study with three essential components and various language features such as the use of tense and hedging devices. The use of technical illustrations will also be introduced with reference to their interactions with the underlying text and common pitfalls. You will also have the opportunity to practise using analogies to simplify sophisticated technical concepts and reporting on figures and graphics in oral presentations.

Learning Outcomes

- By the end of this unit, you will be able to

- identify the main components and language features in reporting and discussing findings/results
- report technical information using figures and graphics
- apply analogies to simplify technical concepts in presentation

6.1 Presenting and Describing Graphics and Figures

- Visual representations are an integral part of many Electrical and Electronic Engineering reports.
- These include graphs, tables, charts, block diagrams, schematics and other illustrations.
- The application of visual elements and a clear and concise description of them often contribute positively to the overall readability and effectiveness of the documents.

6.1.1 Line graph, bar and pie charts (10mins)

In technical reports, findings are often supported by empirical data which gathered from tests, experiments, site surveys and other methods. One of the best ways to represent numerical data is the use of graphs and charts. Line graph is helpful in showing trends while bar charts are effective in comparing figures. Pie charts are often employed to show proportions.

Line Graph

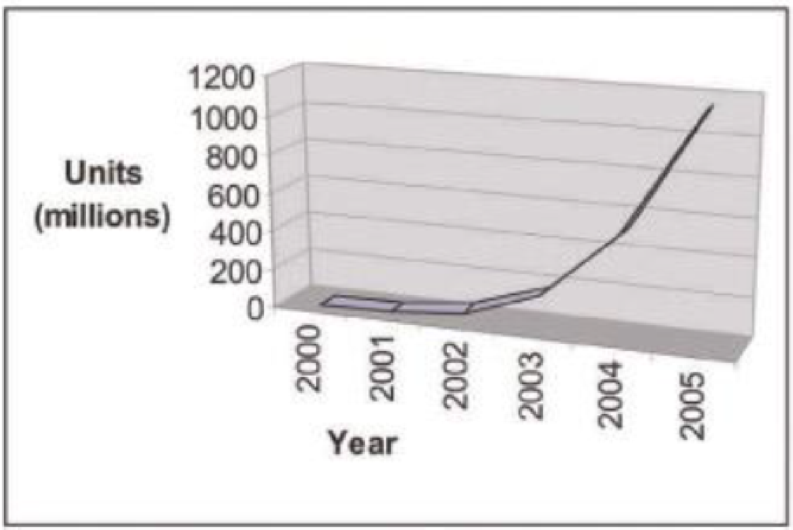

Figure 1.4: Wireless PAN Market Growth Source: Micrologic Research

Figure 1.4 shows the projected growth of the Bluetooth market (Wireless personal area network). This diagram shows dramatic growth as existing proprietary radio devices convert to a standard Bluetooth radio transmission format and as Bluetooth radios find their way into products with new applications. The total number of Bluetooth products shipped in 2000 was approximately 400,000 units. In 2002, the number of devices shipped with Bluetooth was over 35 million units.

TASK 6.1 Below are some examples of graphs and charts. Write descriptions for them on the right hand side

Professional Staff	523
Technical Staff	670
Supporting Staff	530
Total	1723

Table 1. Department staff distribution

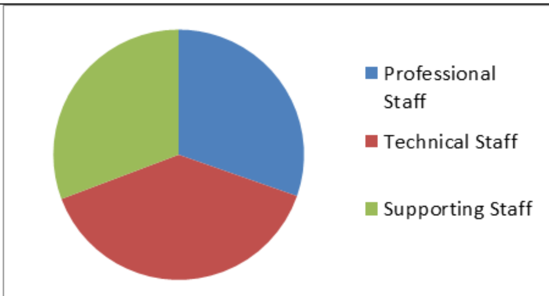

Fig. 3. Department staff distribution

Bar Chart

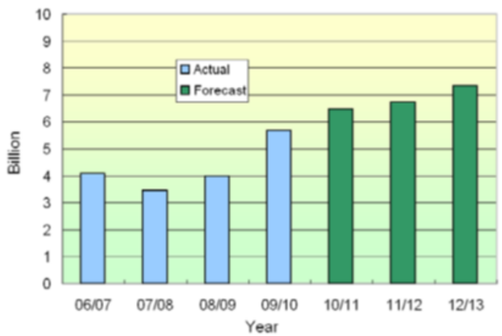

Fig.1. Actual and forecast works expenditure 2006-2013

Descriptions

Table 1 and Fig. 3 complement each other.

Table and Pie Chart:
The Department has an establishment of 1723 staff, about two-thirds are professional and technical staff; the remaining are supporting staff.

Bar Chart:
Comparing from year 06/07 to 09/10, the year 07/08

Combined bar and line graph

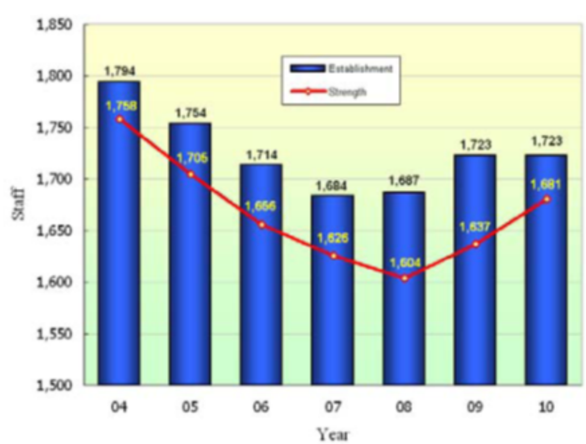

Fig. 2. The establishment and strength figures from 2004 to 2010

Descriptions

The combine bar and line graph clearly shows the trend of staff strength from 04 to 10, it also provides a good reference should comparison is needed.

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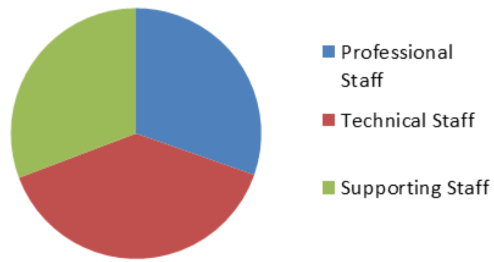

Fig. 3. Department staff distribution

Bar Chart

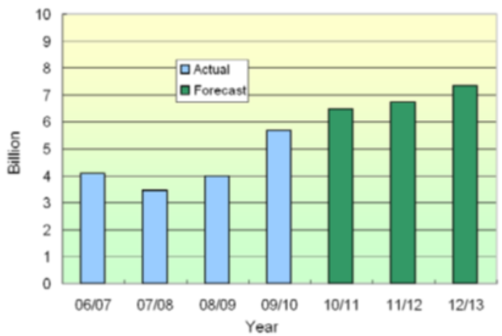

Fig.1. Actual and forecast works expenditure 2006-2013

Descriptions

Table 1 and Fig. 3 complement each other.

Table and Pie Chart:
The Department has an establishment of 1723 staff, about two-thirds are professional and technical staff; the remaining are supporting staff.

Bar Chart:
Comparing from year 06/07 to 09/10, the year 07/08 has the lowest actual works expenditure.

6.1.2 Presenting and describing schematics and block diagrams

Schematic and block diagrams are drawings to illustrate how something operates and works. It is very effective in conveying technical ideas and processes.

Overview: introducing the visual Frequency range, Physical and electrical relationships, Operational parameters and conditions

Example of block diagram and its associated technical explanation

The Bluetooth system uses time division duplex (TDD) operation. TDD operation permits devices to transmit in either direction, but not at the same time.

Figure 1.6 shows the basic radio transmission process used in the Bluetooth system. This diagram shows that the frequency range of the Bluetooth system ranges from 2.4 GHz to 2.483 GHz and that the basic radio transmission packet time slot is 625 µsec. It also shows that one device in a Bluetooth piconet is the master (controller) and other devices are slaves to the master. Each radio packet contains a local area piconet ID, device ID, and logical channel identifier. This diagram also shows that the hopping sequence is normally determined by the master's Bluetooth device address. However, when a device is not under control of the master, it does not know what hop- ping sequence to use to it listens for inquiries on a standard hopping sequence and then listens for pages using its own Bluetooth device address.

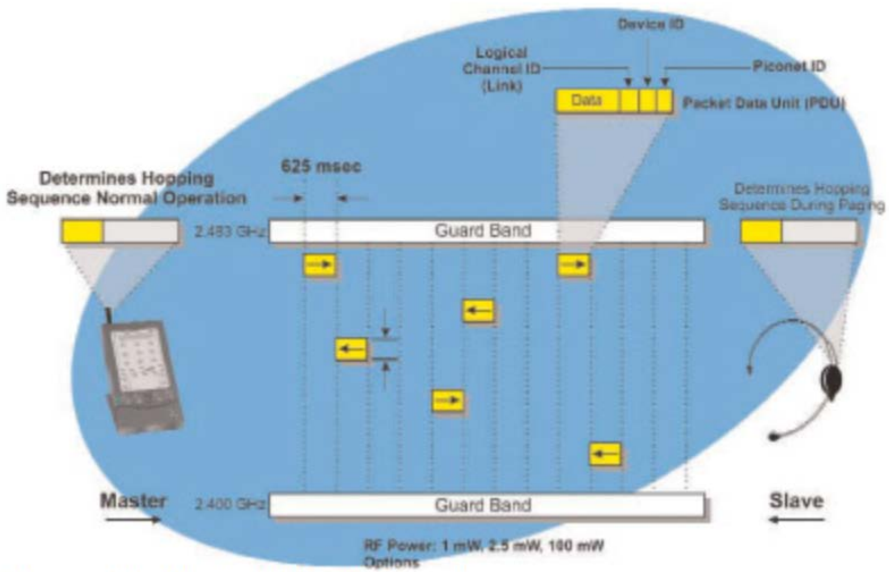

Figure 1.6: Bluetooth Radio Operation

Example of block diagram and its associated technical explanation

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TASK 6.3: Study and block diagram of a radio transceiver above, describe the transmitting and receiving signal paths.

Out of class learning:

Example of block diagram

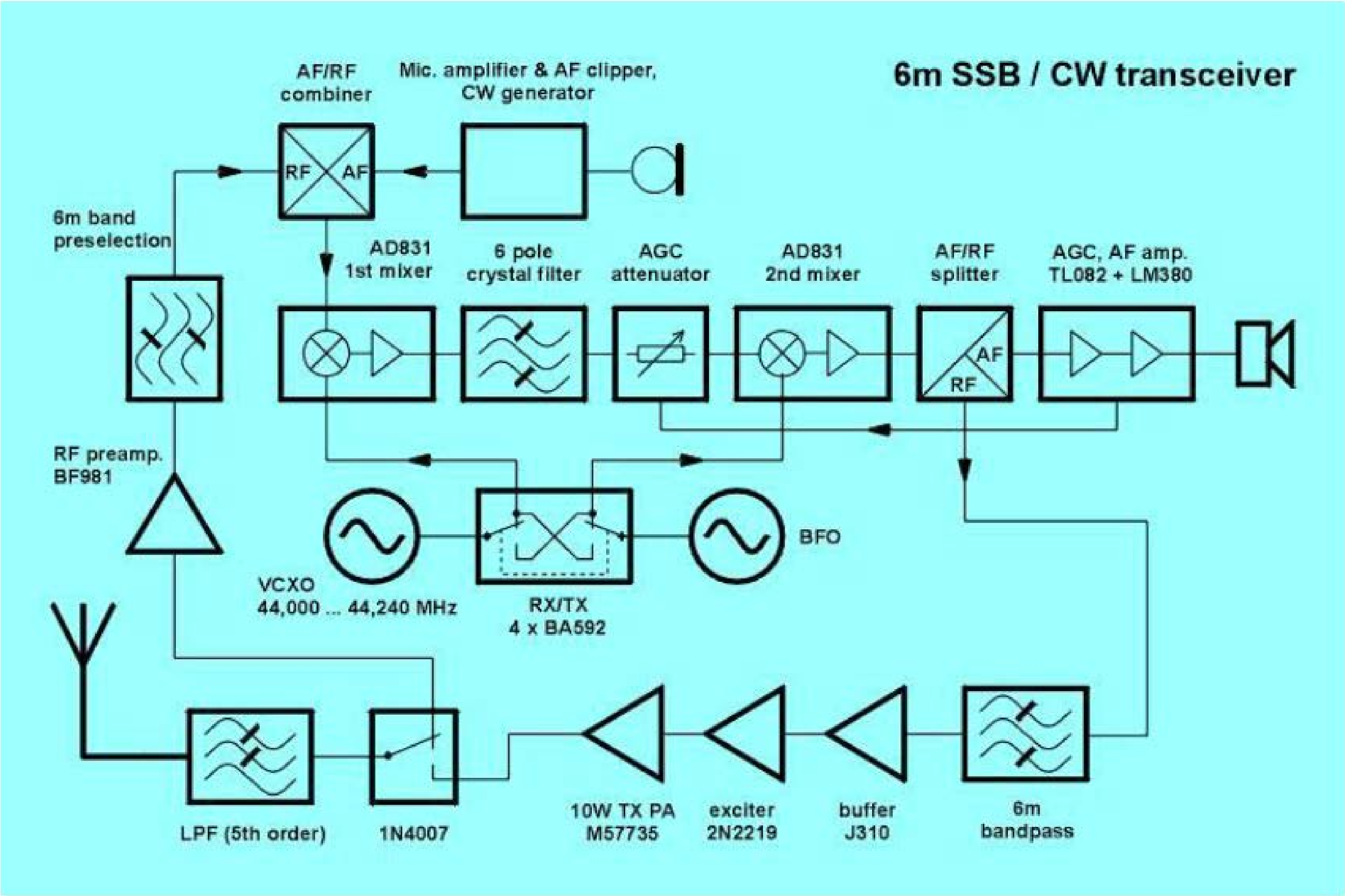


Fig. 2. Block diagram of a radio transceiver
(http://lea.hamradio.si/~s57nan/ham_radio/ssb_6m/ssb6m.html)

6.2 Describing and interpreting (10mins)

Although the information contained in charts, graphs and tables is in general fairly self-explanatory to the informed reader. Visuals usually are accompanied by complementary written comments. The way to verbalise charts, graphs and tables unusually involves three elements, introducing the visuals, reporting the data, and followed by commenting the data. However, not all the information should be mentioned, only the most important or significant data is described and commented on.

6.2.1 Basic components of reporting and discussing results

Similar to using technical illustrations and justifying engineering choices in Unit 4, there are three basic components involved.

Three basic components in Reporting and Discussing Results

1. introducing the results
2. describing the results
3. offering comments on the results

While it appears obvious for the first component to be shown as a graph, chart, or a picture of the deliverable, attention should be paid to the second and third components in writing. An example from advanced writing will provide you with a better understanding of the attention required for all of the components before validity can be established.

These three discrete parts are illustrated in the following excerpt from the Results and Discussion section of the journal article *"Where do we go from here? An assessment of navigation performance using a compass versus a GPS unit"* [6].

Table 1 details the mean total performance times for preparation and waypoint plotting, with compass and with GPS, across the two trial runs. These data were analysed using a series of repeated measures Analysis of Variance (ANOVA) tests, separated according to navigation type, task type and trial, and with expertise as a between-subjects factor. For brevity and clarity, only the significant comparisons will be detailed here; all other tests were nonsignificant.

Introducing the visuals and the methods

There were significant main effects of expertise for preparing the compass [$F(1, 21) = 48.0$, $p < 0.001$], preparing the GPS [$F(1, 21) = 311.1$, $p < 0.001$], navigating with the compass [$F(1, 21) = 1{,}003.5$, $p < 0.001$], and navigating with the GPS [$F(1, 21) = 261.2$, $p < 0.001$].

Reporting the data

Clearly, expertise was a successful manipulation with experts performing more quickly than non-experts across the board.

Commenting the data

Table 1 Mean total performance times (s)

	Compass: T1	Compass: T2	GPS: T1	GPS: T2
For preparation with compass and GPS				
Non-expert	528	516	1,059	1,033
Expert	321	334	823	723
For navigation with compass and GPS				
Non-expert	433	404	178	168
Expert	135	154	50	46

Referring to the visual elements

- Some examples for introducing

- Examples:
- From Fig. 1, …
- Fig. 1 shows …
- As shown in Fig. 1 …
- As can be seen in Fig. 1, …
- According to Table 1, …
- It can be observed from Table 1 …
- … as shown in Table 1.

Describing quantity and numbers

Examples:

Gradual						
no (none) →	almost no →	a few →	Some →	most →	almost all →	all
		a little		many		
		a minority		the majority		
Approximate						
approximately	around	almost	nearly	about		
just over	slightly more	well over				
just under	slightly over	well under				

Describing change

Going down	Going up	steady	varies	adverbial	adjective
decrease	increase	Hold steady	fluctuate	steadily	Steady
fall	rise	Level off	Bounce back	slightly	slight
drop	climb	stabilize	rally	gradually	gradual
decline	ascend	Flatten out	recover	sharply	sharp
slide	jump			rapidly	Rapid
crash	soar			steeply	steep
collapse	rocket			suddenly	sudden
				drastically	drastic
				minimally	minimal, small
				significantly	significant, marked
				substantially	substantial

6.3 Reporting and discussing results

Reporting and discussing results contain a number of basic components and specific language features. Knowledge of these will enable the reader to understand and interpret the results of your study. In many cases, experimental results are reported in conjunction with visuals (e.g. tables and graphs).

TASK 6.4 Identify the three basic components in a results discussion (15 mins)

Identify the three basic components, language features, and practice writing on presenting and describing graphic elements in the results and discussion section of a technical report.

The following graphs and paragraphs are extracted from an IEEE research article *"Effect on radio frequency human exposure of mobile phone inside an enclosed metallic elevator"*. Read the descriptions of research data collected and identify the strategies to present (Introducing the results), describe (describing the results) and verbalise (offering comments on the results) graphic elements. Also, highlight the descriptive words used. (25mins)

Examples	**comments**
The return loss was the first parameter of comparison. Figure 9 shows the return loss from 0.8 GHz to 5 GHz, where very good agreement was observed, except for some shifting at 4.1 GHz. The resonant frequency for the antenna was 1.1 GHz, which was intentionally matched by playing with the feeding-point location. From these results, the differences between an infinite and a finite dielectric were negligible.	Additional information to aid understanding

To take into consideration radiation data, the antenna was measured using a three-dimensional anechoic chamber at Fractus (Satimo Chamber Start-Gate 32) (Figure 10). The directivity was computed from the radiation pattern, and it is compared with the simulation in Figure 11, where the antenna was simulated by considering an infinite substrate. As can be seen from these results, there was a small difference of the peak value, as well as a frequency shift from the fundamental mode up to 3.5 GHz. After that, the differences were larger, especially at the *fractino* mode (3.7 GHz), where the simulation predicted 1 dB less than measured. To check if the difference was due to an anomaly of the foam or a problem with the infinite-substrate assumption, a more-realistic simulation, considering a finite substrate (the same as the foam), was carried out. The results are depicted in Figure 11, where it could be observed that there was very good correlation between simulated and measured data. Based on this, from here on, all the comparisons used the finite-substrate case.	Further explanation of experiment methods. Can be both describing and commenting

6.3.2 Language features of reporting and discussing results

This section focuses on using tenses to guide the understanding of the reader and enhance the acceptance of your arguments, and employing hedging devices to qualify your claims.

6.3.2.1 Different tenses to distinguish reporting and evaluating results

Apart from the basic components in reporting and commenting on results, the use of different tenses is also important in helping the reader to identify the various functions involved.

Various functions in reporting and evaluating results

1. reference to data/findings
2. evaluation of data/findings
3. observations and actions already performed
4. current situation, general phenomena or standard procedures
5. acknowledgement of difficulties encountered
6. suggestions or hypothetical situations

It is not uncommon to see different tenses used not only in the same section but also in the same paragraph. What tense should be used for each of the above?

6.3.2.2 Making your claims more acceptable with appropriate hedging devices

- Experimental results are neutral facts, but their interpretation by the researcher does not necessarily represent the absolute truth because there is often more than one possible interpretation. Therefore, it is essential for the researcher to be modest and cautious.
- Being modest, the writer acknowledges the findings only serve as a step towards acquiring more knowledge.
- Caution helps the writer to avoid over-assertion of claims and personal embarrassment.
- The term ‘hedging’ refers to how modesty and caution are realized in writing through a wide range of language expressions such as ‘it may be possible’, ‘it is likely that’, etc.

A list of hedging devices is presented in the following table.

Device	**Example**	
Hedging verbs	suggest, indicate	Feedback from this group at the end of the task **suggested** that although they had not had enough to complete the task …
Adverbs	probably, possibly	… the degradation of benzoate into acetate was **probably** conducted completely inside the cell.
Adjectives	likely/unlikely	Our findings of a low melanocytic naevi in redheads is **unlikely** to be due to small sample size.
Modal verbs	may/could	Our results indicate that this **may/could** be explained by sun-avoidance in the most sun-sensitive group.
Modal nouns	probability	There appears to be a strong **probability** that the students' use of English discourse patterns do not differ radically from English ones.
Conditional conjunctives	If (this theory is correct), then …	**If** the relationship between melanocytic naevi frequency and melanoma risk is the same for children as for adults, then …

Out of class learning: homework

TASK 6.6 Identify the various tenses and hedging devices used in the results discussion (15 mins)

Identify the tenses highlighted and the underlying rationale in a result discussion section in a report titled "*EFFECT ON RADIO FREQUENCY HUMAN EXPOSURE OF MOBILE PHONE INSIDE AN ENCLOSED METALLIC ELEVATOR*". Map the functions introduced in the previous section to these tenses.

Title: *EFFECT ON RADIO FREQUENCY HUMAN EXPOSURE OF MOBILE PHONE INSIDE AN ENCLOSED METALLIC ELEVATOR*

1. reference to data/findings
2. evaluation of data/findings
3. observations and actions already performed
4. current situation, general phenomena or standard procedures
5. Hedging

3. RESULTS AND ANALYSIS

Considering the impact of metallic enclosures to the RF human safety, SAR is usually used for quantifying the temperature rise caused by the RF energy absorption of human tissue. It is defined as

$$\text{SAR} = \frac{\sigma|E|^2}{\rho} \qquad (1)$$

where σ and ρ are the conductivity and the mass density of human tissue. In ICNIRP [11] and IEEE c95.1 [12], the most commonly cited RF human exposure protection standards; the SAR of mobile phone radiation exposure is limited to 2 W/kg, which will be used as a reference level in later sections. In this study, a mobile phone model with _/4 monopole antenna is used and the excitation source of the antenna is 900 MHz continuous sinusoidal wave (CW). Since the Global System for Mobile communications (GSM) for mobile phone coverage is a pulsed signal with 1/8 duty cycle of the CW, the SAR values obtained have to be multiplied by the duty cycle to make the results comparable with the standards.

Numerical simulation and measurement in the free space environment have been carried out prior to the study of this article in verifying whether the results evaluated from the simulation model is capable of representing the real scenario of the RF human exposure by a mobile phone. The SAR measurement is performed using a precompliance SAR measurement system shown in Figure 3 [13, 14]. In this system, the sealed glass sphere filled with human phantom liquid is used to represent the human head and the isotropic probe is used to measure the induced E-field inside the phantom for SAR calculation. Because of the system configuration, the probe is actually measuring the SAR value of 9 mm from the surface of the spherical phantom. Hence, the peak SAR at this particular position, obtained from both the simulation and the measurement, are compared for the verification. The simulated and measured peak SAR values in the free space environment are 4.903 W/kg and 5.306 W/kg, as shown in Table 1. The percent deviation between the simulation and the measurement is only 7.6% which indicates the simulation model is valid for the study.

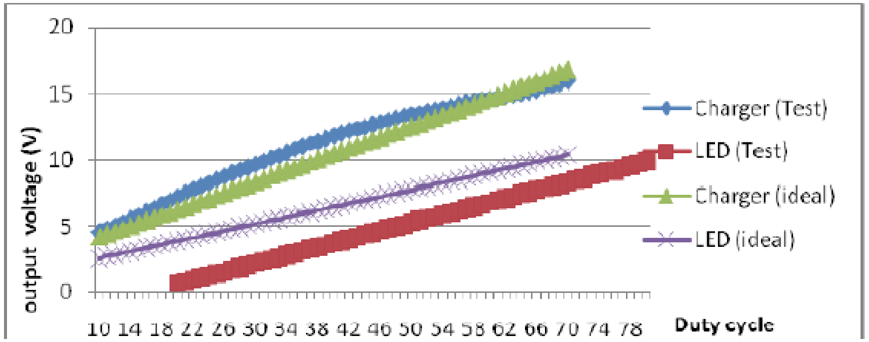
The SAR values and the whole body absorption power in the various elevator configurations and in the free space environment are evaluated and are shown in Table 2. In this study, four different types of elevator configurations are investigated, including a full enclosure shown in Figure 1 and three partial enclosures from Type 1 to Type 3 shown in Figure 2. The peak SAR values of the partial enclosures, once evaluated, will be compared with the free space environment. The results have illustrated that the peak SAR and the whole body absorption power are 7.86 W/kg and 0.74 W, respectively, in the free space, and that the SAR value is 49.1% of the limit, as stated in the RF human safety standards [11, 12] for the pulsed GSM signal.

Among the three types of partial enclosures shown in Figure 2, the level of exposure in the Type 3 was the greatest, with the peak SAR and the whole body absorption power increased by 6.1 and 5.4%, respectively, as compared to the free space environment. The Type 3 elevator is like a rectangular waveguide structure that has the largest number of metallic planes of the three partial enclosures studied. It can support multi-resonant mode standing waves, whereby the field strength will eventually increase inside the cavity. Also, the peak SAR and the whole body absorption power are increased by the multiple reflection and scattering effect of the metallic planes.

For the full enclosure, the peak SAR and the whole body absorption power are significantly increased, by 14.6 and 50% to 9.01 W/kg and 1.11 W, respectively, compared with the free space environment in which the SAR value is 56.3% of the limit for the pulsed GSM signal. The apparent rise in the values is because of the resonance effect of the high Quality (Q) factor of a fully metallic enclosed elevator. As the enclosure has high Q that supports multi-resonant modes simultaneously, the RF radiation energy is mostly stored inside the cavity where the field strength could be greatly increased. From the results, the percentage of increase in the whole body absorption power is much greater than the peak SAR. It indicates that the whole body exposure could be a more important concern for considering the RF human exposure inside an enclosed environment. Also, the whole body exposure can be visualized in the full body SAR distribution as shown in Figure 4. In this figure, the effects of reflection, scattering, and resonance on the SAR in the Types 1–3, and in the full enclosure are visualized by the ripple pattern of SAR distribution, which is in great contrast to the free space environment. It is found that the SAR in the head is similar in these several cases. However, the SAR in the body is considerably increased in the full enclosure, which further means that the whole body RF exposure might be significant when using a mobile phone inside an enclosed environment.

TASK 6.7 Put it altogether by critiquing a past student report (15 mins)

Read an adapted version of the "Experimental results" section in a report titled "*LED lighting system for bus stations*" written by a previous student. This section reports on an experiment conducted within the report. Do you think it is a good discussion? Consider what you have learnt in this unit, what improvements would you recommend in both language and content?

3. Experimental results	*Comments*
We have done the following testes to test the product: Duty cycle to output voltage test; efficient test; No load and Full load test; Output signal;	
Duty cycle to output voltage test;	
Duty cycle has the following relationship with output voltage:	
$D = \frac{Vout}{Vin}$	
To test the circuit can operate as the way we assume; we did test and have the following result. We set the load with full load, i.e. charging the battery and lighting the light. And here are the results.	
	
[Figure. XX]	
As for LED side, losses found, so that big different in duty cycle comparison. You may see our charger part of the system can perform well in the test. Its result is the most similar result to the ideal case.	

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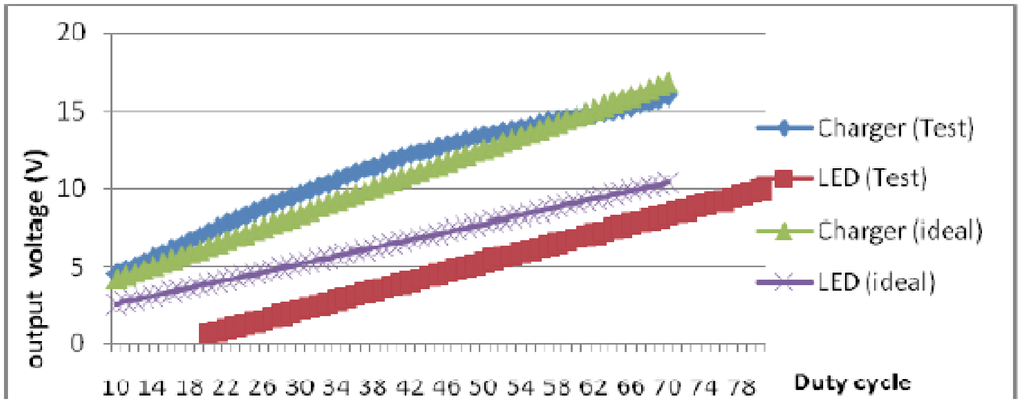


[Figure. XX]

As for LED side, losses found, so that big different in duty cycle comparison. You may see our charger part of the system can perform well in the test. Its result is the most similar result to the ideal case.

Comments

Comments

Use passive
List the four tests

Number the subheadings

Avoid using personal pronouns

Need to apply the three steps:
Introduce
Describe
Comment

Efficient test;

We use the same equipments to do the test but with signal generator. We have the following results. Efficient calculation: $n = \frac{Pin}{Pout}$. On the other hand, Pin $= Vin \times I\ in$ and Pout $= Vout \times Iout$.

The same equipment set-up was te the signal generator and the follov are obtained:

Battery side:

$$n = \frac{Pout}{Pin}$$
$$= \frac{20.74 \times 0.13}{15.09 \times 0.168}$$
$$= 91.2\%$$

LED side:

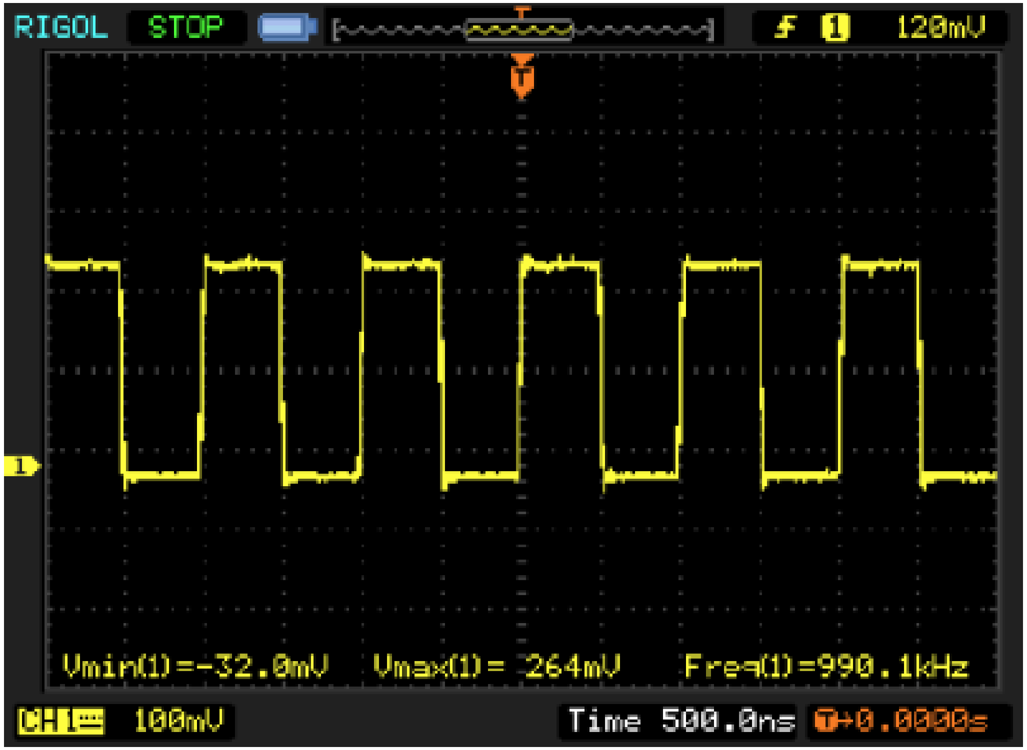
$$n = \frac{Pout}{Pin} = \frac{7.21 \times 1.497}{15.3 \times 1.31}$$
$$= 53.9\%$$

The reason for such poor result in LED side is due to testing procedure. Since LEDs broke down, E- load was used. However, E-load would control the current output as we set the constant current mode. Hence, current is large for both input and output side. I^2R loss is great for such test. As LED side system and Battery side system are under same design and operation principle, the difference among them shall not be great as above. It is believed that the result will be different and being improved when using of LEDs.

No load and Full load test;

By the means of E-load, we may check the no load and full load. To turn on the E-load, the circuit is under full load operation and the result as above. Battery side: 15. 7V; LED side : 7.21V. While the E-load is turned off, the circuit is now no load. Battery side: 20.2V; LED side : 15.67V

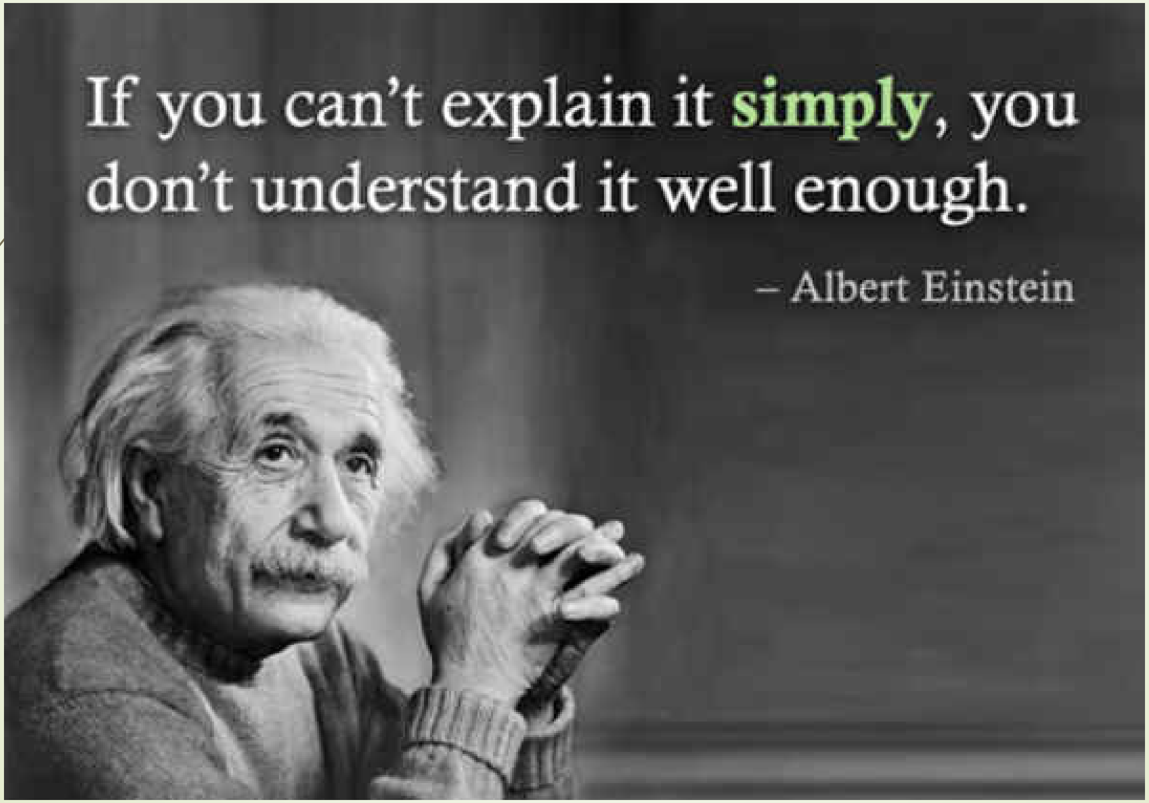
Output Signal



[Figure. XX] Signal from source

Explain technical information with Analogy

EXPLAIN TECHNICAL INFORMATION WITH ANALOGY



Explain technical information with Analogy

- It is a comparison
- It simplifies abstract and complex concepts
- It helps non-technical audience understand

An example of Analogy

Example: Sequencing 30,000 genes in the human genome

It's like obtaining a very *<u>detailed map of a city</u>*. *Each gene is* *<u>like a house</u>* *and each one* ***<u>has an address</u>***. *So when it's all worked out, you have a* *<u>complete map</u>*.

Main Theme: position/location

Explain technical information with Analogy

<u>**TASK 6.8 Create an analogy for an abstract concept (15 mins)**</u>

Work as a group. Create an analogy by pretending that you are trying to explain a technical concept to a group of F.3 students. How would you get them to understand it? You can take some notes in the following space. Some possible concepts are: **Black Hole and Electrical Capacitance**. Choose a representative to present your analogy to the class in less than two minutes.

suggested answers for the two concepts are as follows. Put an emphasis on the THREE elements of a successful analogy: 1) the underlying idea, 2) the similarity between the analogy and the actual concept, and 3) the difference thereof.

Black Hole

Underlying idea – pulling in mass

Analogy – A black hole is like a giant vacuum cleaner that 'pulls' or 'sucks' dusts around it. Or it is like a water sink; when you pull the plug at the bottom of a sink, you can see that water is being 'pulled' away. The difference between the vacuum cleaner/water sink and the black hole is that the black hole exists in space and its suction is so large that even light is being sucked in. That's why it is black.

Electrical Capacitor

Underlying idea – store and release energy

Analogy – An electrical capacitor is like a reservoir and the electrical charge is like water of the reservoir. Similar to a reservoir which holds up the water, a capacitor can hold the electrical charge and release it when needed. The difference between the two is that a reservoir has a concrete dam to hold up the water from flowing whereas a capacitor has an insulator that prevents the electrical charge from flowing.

Signaling expressions to explain technical terms

What is data mining? ***To put it simply, it means*** *that ...*

Logistics means *that you manage the procurement ...*
In other words, it's *to plan, organize, ...*

Today I'm going to show you something about multiplexing that means
... ***Another way of looking at*** *time divisional multiplexing is ...*

TASK 6.9 Create an analogy for a technical concept in your project (10 mins)

Work as a group. Think of an abstract and sophisticated technical concept in your project. Create an analogy and explain it to your classmates who do not have knowledge of your project.

Hint: Think of the essential keyword representing the underlying principle. Use simple words to show this concept. Use a drawing.

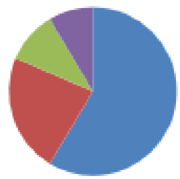
6.5 Describing graphs and figures

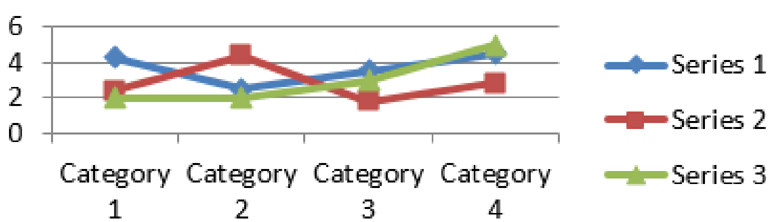
- It is common to include numerical information in a presentation.
- To avoid overwhelming your audience with loads of numbers, you are advised to present this kind of data in graphs, showing the trend and/or highlighting important figures.

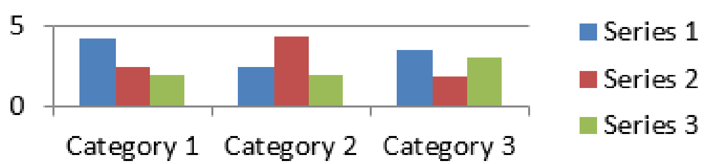
Using various types of graphs and charts

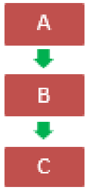
TASK 6.10 Identify graphs and figures (5 mins)

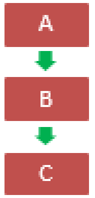
Various types of charts are presented in the following. Write down their names and discuss with your partners under in what situations you would prefer one over the other? Which types of charts do you think you will use in your project?

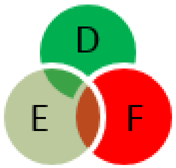


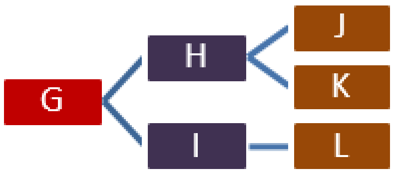












Language used to refer to a visual

TASK 6.11 Explain and highlight a visual (5 mins)

The following are examples of phrases you may use to introduce visuals.[3] With the classmate sitting next to you, come up with **TWO** additional phrases.

Explaining a visual

- Let's now look at the next slide which shows…
- First, let me quickly explain the graph.
- You can see that different colours have been used to indicate…
- The key in the bottom left-hand corner shows you…
- ______________________________
- ______________________________

Highlighting a visual

- I'd like to start by drawing your attention to…
- What I'd like to point out here is…
- I think you'll be surprised to see…
- I'd like you to focus your attention on…
- ______________________________
- ______________________________

Key points to remember

- Discuss your results with the **three components**: introduction, description, and comments
- Use different **tenses for the SIX different situations (refer to Section 6.1.2.1)**, particularly to distinguish between referencing and evaluating findings, or reporting standard and current practices
- Employ **hedging to qualify** your arguments, vary the level of assertion and caution. DO NOT be limited by the definition of the hedging devices. Experience by interchanging them.
- Use a specific type of visual (graph, map, diagram, etc.) for a specific type of purpose
- Keep a good record of the online resources; speak ALOUD with the help of online resource such as iPast and vary your stress and intonation. Think of doing a drama at the beginning – yes you are ACTING it out!

Reminder for next Week

- Submit your SAR by 12 March 2017
- Start writing the results and discussion sections of your report