Ministry of Defence

Air Command Secretariat
Spitfire Block
Headquarters Air Command
Royal Air Force
High Wycombe
Buckinghamshire
HP14 4UE

Ref: FOI2019/03450

[redacted]

16 April 2019

Dear [redacted]

Thank you for your e-mail of 18 March 2019, which has been considered to be a request for information under the Freedom of Information Act 2000 (FOIA).

In your e-mail you clarified the following:

- *In your response you said "For instance, we may be able to retrieve and extract the relevant data for Question 2, if you reduce the expanse of your request from all RAFAC personnel to a particular ATC Wing." To clarify, Question 2 does not refer to the personnel authorised to use the equipment, I am only interested in what equipment is authorised to be used by RAFAC personnel and the training they would need.*
- *Please limit the scope of questions 2-10 to the time period of 1/1/18 to present.*
- *I amend question 3 to as follows - A list of radio equipment (including masts, antennas, all types of radio transceivers on all bands and all other equipment used in the training of the RAFAC or Amateur Radio syllabuses) held by West Scotland Wing ATC and Scotland & Northern Ireland Region ATC (Please include both Regional Radio Training Cell and SNI equipment held at* ***any location****).*
- *Please limit the scope of questions 4, 6, 7 and 10 to SNI Region. If this is too broad of a request, please limit the scope of questions 4, 6, 7 and 10 to West Scotland Wing.*
- *I amend question 7 to only include radio equipment held at all RAFAC Regional Activity Centres*
- *Please amend question 8 to include a request of the location of the course*

- *If question 8 is too broad of a request, please limit the request to only Scotland*

This is clarification in relation to your original request, as follows:

> *1) **All** materials involved in the deliver of all modules of the Silver and Gold communication courses. Please include all powerpoints, handouts, training exercises, instructor guides etc. Please include draft and completed material from 1/1/16 onwards. If this is too broad of a request, please limit the scope to Scotland & Northern Ireland Region only.*
>
> *2) A list of all equipment authorised to be used by RAFAC personnel in the delivery of the radio training such as radio transceivers, masts, antennas etc. Please also include the training required to operate this equipment.*
>
> *3) A list of radio equipment (including masts, antennas, all types of radio transceivers etc) ,**available for Sqns/Wing to use/borrow** held within the Scotland & Northern Ireland Region.*
>
> *4) The number of cadets who achieved foundation/intermediate/full amateur radio licences since 2012. Please break this down into number of qualifications per year and (if available) location of course undertaken.*
>
> *5) Information as to what the lawful authority of a Master Authority Operating Certificate (MOAC) is. Please include references if possible.*
>
> *6) The number of MOACs revoked since 2012. Please include the Sqn number (or if this is not possible the Wing/Region) affected and reason for revoking the certificate. Please do not include MOACs revoked due to time lapsed or qualified staff leaving, I am seeking only those revoked due to lack of discipline, breach of procedure, committing criminal offences etc.*
>
> *7) A list of equipment available at all Regional Activity Centres (RACs). If this is too broad of a request, please limit the scope to Scotland & Northern Ireland Region only.*
>
> *8) The availability of ACF Signals courses to ATC cadets. Please include number of courses, name of the course and places given per year. Please include figures from 2012 including 2019 figures if available.*
>
> *9) The number of instructors/assessors per module of the radio syllabus (Blue, Bronze, all 3 Silver modules, all gold modules). If this is too broad of a request, please limit the scope to Scotland & Northern Ireland Region only.*

10) Approved styles of HF antenna for use on Sqn, guidance on placement of these and list of funding schemes available for HF antennas and transceivers.

A search for the information has now been completed, and I can confirm that some information in scope of your request is held.

Question 1. The Silver and Gold communication courses are currently under development. There is no recorded information held on the Gold communications course. Please find the draft Instructor Guide and draft PowerPoint slides for the Advanced Radio Operator Course and Foundation Radio Licence for the Silver communications course attached at Annex A.

Question 2 and 3. No information held.

Question 4. RAF Air Cadets (RAFAC) do not offer the intermediate or full amateur radio qualifications. The number of Air Cadets in the Scotland and Northern Ireland Region who have achieved foundation level since 2012 is 8. This information is not collated by course location or by year. The number of Air Cadets who subsequently go on to apply for the foundation amateur radio licence following completion of the foundation level course and exam is not recorded.

Question 5. Please find attached, at Annex B, the authority to radiate from Joint Spectrum Authority (JSA), MOD Blandford. The Master Authority Operating Certificate (MAOC) is the dissemination of this authority.

Question 6. The number of MAOCs revoked since 2012 is nil.

Question 7. Information not held.

Question 8. The Army Cadet Force (ACF) Signals courses are not currently available to Air Cadets. Historical data is not held.

Question 9. The instructor/trainer and assessor ratio is one of each for the various modules. Please see table below for the breakdown of the number of trainers and assessors in the Scotland and Northern Ireland region:

Cadet Region	Advanced Radio Operator Trainer/Assessor	Basic Radio Operator Assessor	Basic Radio Operator Trainer/Assessor
Scotland & Northern Ireland	~	35	18

Due to the small populations generated by this level of detail, and the possibility of identifying individual personnel, data has been suppressed and "~" denotes a number less than or equal to 5.

Question 10. There are no approved styles for HF antenna. Guidance is given on a case-by-case basis dependent on unit location and size. There are no funding schemes available.

In accordance with the Data Protection Act, under S40(2) of FOIA (third party personal data), information contained within the presentation material at Annex A and B is withheld as exempt information. This is an Absolute Exemption and not subject to the Public Interest Test.

If you have any queries regarding the content of this letter, please contact this office in the first instance.

If you are not satisfied with this response or wish to complain about any aspect of the handling of your request, then you should contact me in the first instance. If informal resolution is not possible and you are still dissatisfied then you may apply for an independent internal review by contacting the Information Rights Compliance Team, Ground Floor, MOD Main Building, Whitehall, SW1A 2HB (e-mail CIO-FOI-IR@mod.uk). Please note that any request for an internal review must be made within 40 working days of the date on which the attempt to reach informal resolution has come to an end.

If you remain dissatisfied following an internal review, you may take your complaint to the Information Commissioner under the provisions of Section 50 of the Freedom of Information Act. Please note that the Information Commissioner will not normally investigate your case until the MOD internal process has been completed. The Information Commissioner can be contacted at: Information Commissioner's Office, Wycliffe House, Water Lane, Wilmslow, Cheshire, SK9 5AF. Further details of the role and powers of the Information Commissioner can be found on the Commissioner's website at https://ico.org.uk/.

Yours sincerely,

Air Command Secretariat

Encs:

Annex A - Draft Instructor Guide: Advanced Radio Operator (Silver VP Award Level) and, draft Powerpoint slides for Advanced Radio Operator Course and Foundation Radio Licence: Silver Badge Module.

Annex B - JSA Authority to Radiate - Air Cadets VHF & UHF

ANNEX A.

ROYAL
AIR FORCE
AIR CADETS
the next generation

air cadet publication

instructor guide

Advanced Radio Operator (Silver VP Award Level)

V1.43

air cadet
R
radio

Radio Communications Training
Advanced Radio Operator (Silver) Level

CONTENTS

DOCUMENT REVISION HISTORY

Revision	Date	Author
Initial Issue	Apr 16	[redacted]
Updated with new content	Jun 17	[redacted]
Revised	Mar 19	[redacted]

FOREWORD

This guide is intended to help accredited instructors to deliver and assess the Radio Communications training package for the Advanced Radio Operator (Silver) award.

The Silver Award is the qualification for cadets which follows the Bronze level Award and comprises this course, an additional course chosen from three options and a cyber security video.

On successful completion of this course the students should be able to set up a directed net, operate as both a member station and the control operator on a directed net and be able to send and receive plaindress messages on the net. They will also have an understanding of advanced radio operating procedures and techniques.

The course also covers Health and Safety related to ACP5 and radio operations.

The contents of this document, the associated Powerpoint presentation, handouts and any other related materials are OFFICIAL and must not be released into the public domain. The document must not be published on non-Bader web sites or shared on social media.

THE SILVER COMMUNICATOR AWARD

To qualify for the silver comms badge, students must complete all of the training objectives and assessments listed in the Training Performance Statement (see annex A). ACP44 contains further details of the entire RAFAC communications training syllabus.

NOTES:

1. Students attending this course must hold a Bronze Comms Badge.

2. Although this course is designed to be run as a weekend course, it is modular so it is also suitable for parade-evening training.

3. A suitable and sufficient Risk Assessment must be completed prior to the course. All personnel are to be given appropriate information, instruction and training as necessary, in accordance with ACP5.

4. At the start of the course each student is to be given a copy of the handouts. These contain useful information which can then be referred to and added to during the course.

5. The first session in the course revises the Blue and Bronze Badge content to prepare students for the rest of the course.

6. In examples of Voice Operating Procedures (VOP or VP) the equals sign = is a very brief pause in speech between elements in the procedure.

7. Numbers in square brackets [ ] refer to the slide number in the associated presentation.

RUNNING THE COURSE

1. Depending on numbers of students and instructors this course (including practical exercises) and on-air assessments can be completed in approximately 14 hours.

2. Ensure cadets have 'booked in' with their rank, name and Sqn details.

3. Allocate each cadet an abbreviated callsign for the course, based on their Sqn callsign. Avoid suffixes A, F, M, X and Z, OC, IC, AC and CC. There are one or two others which should be avoided, FO and FU for example.

4. Handouts should be distributed prior to starting the course.

5. Students should add their name, Sqn and course callsign to their 'Aide Memoire' sheet. Additional notes (authentication codes for example) can also be added to the rear of this sheet during the course.

6. Assessment methodology and student / assessor papers are included at Annex A

7. An equals sign (=) indicates a brief pause during a transmission.

COURSE CONTENT

REVISION OF BLUE / BRONZE BADGE COURSES

[9-43] The first part of the PowerPoint presentation revises the Blue and Bronze course content.

PHONETICS

Quick round-the-class review of phonetic letters and numerals.

OPERATING TECHNIQUES

R S V P - Remind students of the meaning of RSVP.

Keep a steady **R**hythm when transmitting.

Slow the speech **S**peed down a little to help the other station understand them.

Speak with good **V**olume – if they are naturally quiet or loud they might need to adjust their voice.

Keep a nice steady **P**itch when speaking. Also, remind students about Pronunciation – when using a radio, words need to be pronounced more clearly and deliberately.

S A D - Remind students of the meaning of SAD

They must follow **S**ecurity rules

Information transmitted must be **A**ccurate

And that **D**iscipline means no messing about on the air – ever.

CALLSIGNS

Remind students that RAFAC callsigns are internationally allocated and are covered in ACP100 - an Allied Communications Publication, not an Air Cadet Publication.

RAFAC callsigns CANNOT be changed without the permission of the CRCO.

Remind students about full and abbreviated callsigns. On HF Directed Nets full callsigns are usually used.

Explain how suffixes are added to a callsign to identify individuals or tasks.

To invite ANY station to reply – use the open callsign ALPHA CHARLIE (Air Cadets).

The callsign the Net Control Station (NCS) uses to call their net is CHARLIE CHARLIE (Collective Callsign).

CALLING AND ANWERING

Initial call and response – both callsigns are always used. Once the two stations are in good contact only the transmitting station's callsign can then be used.

If they are called and miss the other station's callsign they are to say 'UNKNOWN STATION' in place of the other callsign, for example UNKNOWN STATION = THIS IS MIKE ROMEO BRAVO TOO FOWER = (say again callsign) = OVER

UNIT A/B/C/D AUTHENTICATION

Check the students' knowledge on how to Authenticate A, B, C and D. Revise as necessary.

UNIT AUTHENTICATION (GRID)

It is sometimes necessary to authenticate suffixed-callsigns based on a single Sqn callsign, where Authenticate A, B, C and D would get the same response from each callsigns. To do this we use a table which can be downloaded from the SharePoint HQAC Document Library Radio folder, along with the instructions. Remind students not to use the same look-up code twice. These tables change each year.

MESSAGE AUTHENTICATION (GRID)

It is sometimes necessary to authenticate important transmissions. We do this based on the time of the transmission and a look-up code table. The code table can be downloaded from the SharePoint HQAC Document Library Radio folder. These tables change each year.

RADIO CHECKS

Revise radio checks. Remind students that two words are sent as a radio check – Signal Strength and Signal Readability.

Signal strength can be described as LOUD = sit back and listen, GOOD – lean forwards and listen, WEAK, listen carefully, VERY WEAK – listen very carefully.

Signal readability – if the signal is readable choose one of five words to describe it. CLEAR or READABLE means easily understandable. INTERFERENCE, DISTORTED and INTERMITTENT means you are having some difficulty understanding what is being said.

If it is not at all readable, say UNREADABLE after the strength proword.

Check the students' knowledge of typical common radio check responses.

SECURITY

Remind students that people are employed to eavesdrop on other people's transmissions to gather intelligence. In the military, it is critical not to give information away over the radio which could be of use to an enemy. Our radio transmissions can be received by anyone with a suitable radio, which are now very cheap to buy. Remind students what information must not be transmitted.

Distress and emergency messages are not practised since they might get confused with real-life emergencies. If students hear a distress or emergency message they must deal with it.

Sometimes it is necessary to transmit information on a radio which would be of use to an enemy. These are some of the ways information can be secured when sent over a radio net.

BEADWINDOW

Revise the use of BEADWINDOW and check students know when to use it.

PROWORDS

Revise commonly used prowords from previous courses:

CALLSIGN – The following group is a callsign (sent in phonetics).

NOTHING HEARD = OUT- I have not heard a reply from you.

DISREGARD THIS TRANSMISSION = OUT - Disregard this entire transmission.

SAY AGAIN - Say all your last transmission again. Response is **I SAY AGAIN**

ALL AFTER / ALL BEFORE / WORD AFTER / WORD BEFORE / (word) TO (word) – Used with SAY AGAIN. Response is e.g. **I SAY AGAIN = ALL AFTER** etc

CORRECT - Your last transmission is correct.

WRONG - Your last transmission is wrong.

CORRECTION - I have made a mistake. Correct version is... (Start from last correct word).

WAIT OUT - I am not ready – I will call you back shortly.

UNKNOWN STATION – Used in place of an unidentified callsign

AFFIRM – Yes

NEGATIVE - No

VERIFY - Verify the information indicated, e.g. VERIFY GRID xxxxx. Response is **I VERIFY**

GRID - Following is a grid reference (do NOT use 'figures').

FIGURES - Numbers follow ('Figures' is NOT used after GRID, GROUPS, NUMBER and in CALLSIGNS. If in doubt leave it out).

THROUGH ME / RELAY / FROM / TO - Relay procedure prowords

SPEAK LOUDER - Speak louder. **SPEAK SLOWER -** Speak slower.

BEADWINDOW - You have broken security.

ROGER SO FAR – Have you received this transmission so far? Reply is **'ROGER'**

PRIORITY – I have an urgent message for you. Response is **'SEND YOUR PRIORITY'**

MINIMISE MINIMISE MINIMISE – Only send Priority traffic until further notice. Ended with **MINIMISE LIFTED**

SILENCE SILENCE SILENCE – Stop all transmissions immediately. Ended with **SILENCE LIFTED (**This is sent in more detail on Directed Nets).

RELAYING

Sometimes one callsign on a free net cannot contact another callsign direct. If students hear this happening they can say 'THROUGH ME' and then relay the message.

The prowords are:

Initial instruction is 'RELAY TO (callsign)'.

The relaying station then calls the addressee and says 'RELAY FROM (callsign)'.

If the message needs to be relayed by more than one callsign then RELAY = FROM (callsign) = TO (callsign) is used.

TYPES OF RADIO NET

Free Net

May or may not have a Net Control Station (NCS). All member stations are free to communicate with each other direct.

Directed Net

Always has a Net Control Station (NCS), sometimes called a Net Directing Station (NDS). Member stations may only communicate with each other with the permission of the NCS.

The NCS can address all callsigns on the net using CHARLIE CHARLIE.

ADVANCED RADIO OPERATOR COURSE

LOGGING

All ACO radio stations must keep a log book. Usually this is done at the Sqn HQ base station and at the control station on exercises. All plaindress messages, callsigns heard, changes of net control station and other occurrences must be recorded in the radio station's logbook.

The log book should be checked and signed by the SRCO from time to time.

NET CONTROL STATION PROCEDURES

SETTING UP A NET

[44-51] Before messages can be exchanged on a Directed Net the Net Control Station (NCS) must first organise the net. There are three elements to this:

1. Give the net an identifying callsign – usually Charlie Charlie but CC1, CC2 etc can be used for subsequent nets or sub-nets. In the same transmission, the NCS tells all stations what the callsign order is. This whole procedure is done twice with 'I Say Again' in the middle.

2. Radio check the net. Note that member stations do not request a radio check at this point – the NCS automatically does this at the end of the net radio check. The use of 'Roger' at this point may confuse students – it is used here to mean 'all callsigns are Loud Clear'. Callsigns not Loud Clear will be given individual radio check reports.

3. Tell all stations that the net is directed.

[52-54] The NCS will aim to arrange the list of callsigns such that every station can hear the callsign they follow in the net list. If one callsign doesn't hear the preceding callsign they wait 5 seconds and then make their own transmission.

[55] The NCS can instruct another callsign to assume control. To take control of the net and prevent any confusion the new NCS will set up the net again.

ASSUMING CONTROL

[56] If the NCS stops answering calls and appears to have gone off-air, another (experienced) station can step in and take control of the net. The phrase used is 'I AM ASSUMING CONTROL'.

CHANGING NET TYPE

[57] If the NCS wishes to change the net from Directed to Free they use the phrase 'THIS IS A FREE NET'. Member stations acknowledge in turn.

[58] At the end of the exercise or for another reason the NCS can close down the net using the procedure shown in this slide.

RADIO SILENCE

[59 -60] Radio Silence may be imposed for a number of reasons. Note the Silence procedure on a directed net is different to that taught at the Radio Operator (Bronze) level and includes a time and authentication (from the transmission authentication table on SharePoint).

[61] Similarly, lifting an imposed radio silence period is time-stamped and authenticated.

TIME SYNCHRONISATION

[62-63] A time may be announced by the NCS so that all stations' time references are synchronised. Note that it is important to plan this and allow a pause so that operators can prepare their clocks / watches / phones ready to change the time if necessary.

FREQUENCY CHANGE

[64] The NCS can order a frequency change using the procedure shown. Note that if a transmission authentication code is not given the first member station should request an authentication.

ADDITIONAL PROWORDS

MORE TO FOLLOW

[68] If there is additional information on the same subject to be sent the phrase 'MORE TO FOLLOW' is used at the end of the plaindress message, before 'OVER'.

DO NOT ANSWER

[69] If a response is not required, the transmitting station can use the phrase 'DO NOT ANSWER' before sending the information. The transmission is made twice with 'I SAY AGAIN' in the middle and is time-stamped and authenticated.

SERVICE

[70] If instructors need to pass traffic relevant to the net operation, or their radio stations, the traffic is preceded by the proword 'SERVICE'.

ADDITIONAL NET CONTROL STATION PROWORDS

USE ABBREVIATED CALLSIGNS / USE FULL CALLSIGNS

[71-78] If radio conditions are good and all stations can hear each other well the NCS can instruct the net to 'USE ABBREVIATED CALLSIGNS'. This simply means the 'MIKE ROMEO' is removed from all callsigns, so MRH19 would become H19.

If conditions deteriorate the NCS can instruct 'USE FULL CALLSIGNS'.

USE ABBREVIATED PROCEDURES / USE FULL PROCEDURES

Again, if all stations are hearing each other well the NCS can instruct 'USE ABBREVIATED PROCEDURES'. This means preliminary calls to 'get in touch' with the other station are optional, callsigns are used abbreviated and 'THIS IS' can be dropped.

If ABBREVIATED PROCEDURES are in use and conditions deteriorate or some stations can't hear other stations too well the NCS can instruct the net to 'USE FULL PROCEDURES'.

In the ATC the majority of Directed Nets will be run using full procedures but may be run using abbreviated callsigns.

NET CONTROL EXERCISE 1

[79] Split the class into small groups of three or four and separate each group from the other groups. Allocate one student in each group to be Net Control and tell them to set up a net, then instruct another callsign to ASSUME CONTROL. When all students have set up a net terminate the exercise and de-brief in groups.

ABBREVIATED PLAINDRESS (TACTICAL) MESSAGES

[83-84] Students are reminded about simple 'tactical' messages taught on previous courses, which are used on VHF or UHF at exercises and events.

PLAINDRESS MESSAGES

[85-87] Plaindress messages are practised on the Sunday HF nets between stations across the Corps. An example of a plaindress message is shown in the slide. This uses the standard message components and format used by the ACO. Each element in this message will be explained in the next set of slides.

A plaindress message is made up from three sections, the Heading, Text and Ending.

The heading contains addressee and originator callsigns, a serial number, instructions on whether to read it back for checking correct receipt, how urgent it is, when it was written and the type of message. 'DO NOT ANSWER' is used in the header after the initial callsigns.

The text is the 'body' of a plaindress message and contains the information, like an email or text message.

The ending is generally 'OVER' although 'MORE TO FOLLOW' can be used before 'OVER' where applicable.

HEADING

[88-89] Both addressee and originator callsigns are always transmitted. There may be more than one addressee callsign.

The proword 'MESSAGE' is then transmitted to remind the receiving station(s) to write everything down.

[90-93] The message is given a full serial NUMBER made up from:

The operator number and grade. The operator number is allocated at Sqn level and is generally a two-digit number. Some Sqns don't reallocate cadet operator numbers so three-digit numbers may be heard. This is followed by a grade letter.

If a cadet is at Basic Radio Operator (Blue Badge) level they will add 'CHARLIE'.
If a cadet is at Radio Operator (Bronze Badge) level they will add 'BRAVO'.
If a cadet is at Advanced Radio Operator (Silver Badge) level or above, they will add 'ALPHA'

This is followed by the PROWORD 'SLANT' (/) and a serial number.

The serial number starts at 01 at midnight on each channel in use at that callsign and increments by one when a message is sent on that channel. It is not operator-dependant.

So, just after midnight, operator 12C could send NUMBER 12C/01 on N1. Operator 04B could then send 04B/02 on N1 followed by operator 33A sending 33A/03 on N1, with operator 12C send the first message on N3 as NUMBER 12C/01.

[94] An instruction to READ BACK TEXT is generally sent. When the message has been sent, unless there is a 'SAY AGAIN' required, the addressee will say 'I READ BACK TEXT' and read back the text (only) for the sending station to check correct receipt.

[95] 'READ BACK' may also be used – this instructs the receiving station to 'I READ BACK' <u>everything</u> transmitted, including the original callsign group.

It can be seen, therefore, that the receiving station must write down everything transmitted to them.... A form of shorthand is described later.

[96-97] The precedence for the message is sent next:

ROUTINE is used for non-urgent / training traffic
PRIORITY is used for more urgent traffic. Messages with a PRIORITY precedence are completed before ROUTINE.
IMMEDIATE is used for very urgent messages. Messages with an IMMEDIATE precedence are completed before PRIORITY or ROUTINE plaindress messages.

[98-102] The time the message was written is sent next, preceded by the proword 'TIME'. This is called the Date Time Group, or DTG, and comprises:

The date (always two digits, so 03 would be used for the 3rd of the month).
The 24-hour clock time.
The time-zone. ZULU is used for GMT/UTC, ALPHA is used for BST. Note that 1 (OS) Sqn may use a different time zone for Cyprus time. Z is generally used and is BST minus one hour.
The month in full.

The message time is all sent as one string without separation marks or gaps, e.g.

TIME ZERO TOO TOO WUN FOWER FIFE ZULU JULY

To practise composing DTGs get all the students to write out the TIME as shown, and read them out in turn. Check they start with the proword 'TIME'.

[103-106] The type of text is then sent. This could be:

THIS IS A CODEX MESSAGE
THIS IS A CODED DRILL MESSAGE
THIS IS A CODED MET REPORT
THIS IS A SITREP ROMEO
THS IS A DRILL MESSAGE

TEXT

[108] Only if the text is coded are the number of groups in the text sent, as 'GROUPS'. (A group comprises five alpha-numeric characters, e.g. DM7R3)

The actual text is then sent, slow enough for the receiving station to write down.

If it is a DRILL MESSAGE (i.e. 'plain language') and it is a training message, the proword DRILL is used at the start and end of the text. This proword is also read back as part of the 'I READ BACK TEXT' procedure. (Instructors – note the proword GROUPS is NOT read back as part of the 'I READ BACK TEXT' procedure…) for coded messages.

ENDING

[109] After the text, 'MORE TO FOLLOW' may be sent if relevant, followed by 'OVER'.

[110] The slides highlight the differences between Coded messages and Drill / SITREP messages.

[111 Remind students that it's important to write Ø for zero and underline a 1 so that they don't get confused with O and I. Some students may also find it beneficial to differentiate between Z and 2, S and 5 etc when writing down incoming (and outgoing) messages.

SPELLING IN TEXTS

[115-117] There are two options for spelling words in message texts – one if a word can be pronounced but there is a chance it may be spelt wrongly by the receiving station, and another if the word cannot be easily pronounced.

Where a word can be pronounced, the operator will say the word, pause, say 'I SPELL', spell the word in phonetics, then <u>say the word again</u>.

If a word cannot be pronounced the operator will pause before the word, say 'I SPELL, spell the word in phonetics, pause again, then carry on with the rest of the text.

FIGURES IN CODED MESSAGE TEXTS

[118] Where there are mixed numerals and letters in a coded text, under Full Procedures the proword FIGURES is sent before each number or group of numbers.

FIGURES may also be used in drill message texts, but is not used in the header of a plaindress message, in callsigns or after the prowords NUMBER, TIME, GROUPS or GRID.

PUNCTUATION

[119] In drill message texts it is necessary to make punctuation clear. The following prowords are used:

FULLSTOP for a fullstop / period punctuation mark (.)
COMMA for a comma punctuation mark (,)
HYPHEN for a hyphen punctuation mark (-)
COLON for a colon punctuation mark (:)
SEMICOLON for a semicolon punctuation mark (;)
SLANT for a slant punctuation mark (/)

MESSAGE HANDLING

[122-124] There are two methods for moving plaindress messages between stations on a directed net.

The NCS can instruct a station to 'SEND ONE ROUTINE / PRIORITY / IMMEDIATE' to another callsign. ROUTINE is usually used for training message texts.

Alternatively, a net member station can call the NCS and say 'ONE ROUTINE FOR (c/s) = OVER. If the NCS is happy for the message to be sent they will say 'SEND YOUR MESSAGE = OUT'. The net member station then calls the other callsign and says 'MESSAGE = OVER'. The reply will be 'SEND YOUR MESSAGE = OVER'.

If the message is for the NCS the phrase is 'ONE ROUTINE FOR YOU = OVER'

Note that if the net member station has a Priority or Immediate for another station they will say 'ONE PRIORITY (or IMMEDIATE) for (c/s) = OVER'. The NCS will reply with 'SEND YOUR PRIORITY (or IMMEDIATE) = OUT'. The phrase 'SEND YOUR MESSAGE' is only used for Routine precedence messages.

LONG TEXT PROCEDURES

[125-130] If the message has a long text it is good practice to split the text up into suitably-sized chunks and check receipt up to that point. How large each chunk is dependent on the operator's experience and conditions between the two callsigns. It is suggested that receipt should be checked after every three or four groups or each sentence in a drill message if reception between the callsigns is not perfect.

To check receipt up to that point the operator will pause and say 'ROGER SO FAR = OVER'. If the message has been received up to that point the reply will be 'ROGER = OVER'.

If the message has not been fully received up to that point, this is the time to request a 'SAY AGAIN ---'. For example, 'SAY AGAIN = GROUP TOO' or 'SAY AGAIN = WORD AFTER RUNWAY = OVER'

The response would be 'I SAY AGAIN = GROUP TOO = ECHO FIGURES TREE ATE KILO GOLF = OVER' or 'I SAY AGAIN = WORD AFTER RUNWAY = OPEN = OVER'.

When the message has been received up to that point the receiving station will say 'ROGER = OVER' and the sending station will continue from where the message was stopped to check receipt. In long texts, it is helpful at this point to say the group number from where the text is restarting, e.g. 'GROUP WUN SIX (pause) and continue with group 16.

When the text (or whole message) is read back using the 'I READ BACK TEXT' or 'I READ BACK' procedure and an error is detected, the sending station will say 'WRONG', identify what is wrong and send the correct version, for example 'WRONG = GROUP SIX = MIKE ALPHA GOLF ROMEO TANGO = OVER' or WRONG = WORD AFTER PISTON = ENGINE = OVER'.

The response from the receiving station would be 'ROGER = GROUP SIX = MIKE ALPHA GOLF ROMEO TANGO = OVER' or ROGER = WORD AFTER PISTON = ENGINE = OVER.

To confirm correct receipt the sending station would say 'CORRECT = OUT'.

If an error is made whilst sending a message the operator will pause, say 'CORRECTION' say the group number or the last correct word again and continue with the correct version. For example: 'CORRECTION = <u>GROUP TREE</u> = FIGURES ATE NINER ZERO SIX SAYVEN = OVER' or 'CORRECTION = <u>RUNWAY</u> WUN SIX IS CLOSED = OVER'

[131-132] To speed up writing out plaindress messages being received, students can use a form of shorthand, for example:

MSG for Message
N for Number
RBT for Read Back Text (or RB for Read Back).

R / P / I or Routine / Priority / Immediate
T for Time
CDM for This is a Coded Drill Message
CDX for This is a Codex Message
CPR for This is a Coded Position Report
DMSG for This is a Drill Message
DFS for Drill Fullstop / FSD for Fullstop Drill
// can indicate the start and end of the text

FINAL EXERCISE PREPARATION

[136-137] Using the handout message forms students can write out two plaindress messages, optionally making one a Read Back instead of Read Back Text. These are then checked by the DS and kept by the students ready for the final exercise / assessment.

FINAL EXERCISES

[138 -144] With the class split into small groups nominate a callsign in each group to be the initial Net Control Station. They will set up a net and arrange for one plaindress message to be sent between two callsigns. When that has been completed the NCS will instruct another callsign to ASSUME CONTROL. The new station will then set up a new net and continue as above. All students should practise setting up a net and send and receive at least one coded and one drill message during the exercise.

When competent, students can start inserting an error when reading back a text so that WRONG procedures can be practised.

'USE ABBREVIATED CALLSIGNS', 'SILENCE SILENCE SILENCE' and other advanced radio operator procedures can be practised as well.

HEALTH AND SAFETY

[145-152] ACP5 contains the H&S requirements for activities within the ACO. Radio comms training and operation requires a specific Risk Assessment to be produced and briefed for each activity.

ACTO73 also contains other H&S information

MAINS VOLTAGES

Mains voltages are dangerous to life and can kill if they come into contact with people. Bare wires carrying mains voltages are highly dangerous. All connectors used for AC mains must be approved to BS1363 and have the correct fuse fitted for the equipment it is connected to. All mains connectors / leads should be PAT tested annually and inspected each time they are used. Any mains connectors or leads which appear damaged should be taken out of service immediately, labelled and inspected / repaired by a competent person.

BATTERIES

Most small radio sets use rechargeable batteries. These can be made of a number of battery chemistries. Sealed Lead-Acid (SLA), Nickel-Cadmium (NiCad), Nickel Metal Hydroxide (NiMH), Lithium Ion (Li-Ion) are the most popular.
Batteries should be considered as potentially dangerous and must be kept dry, handled with care and charged using the correct charger only for the recommended time for that battery. If the battery terminals are short-circuited (for example by coins or keys in a pocket) the battery will discharge very rapidly, get hot and potentially explode. They must be carried wrapped in a plastic bag and on their own in a pocket or bag. They must be kept dry, or dried before being fitted into a radio or charger. Due to the chemicals inside batteries care must be taken when disposing of old batteries. Many are not suitable for disposal in domestic waste.

RF RADIATION and RF BURNS

Transmitted Radio Frequency (RF) energy can be dangerous to humans and there are safe distances to be adopted between transmitting antennas and people. These distances depend on the transmitter power, the frequency being used and whether the transmission is continuous or intermittent (known as the transmit-receive duty cycle). ACTO 73 has full details for safe distances to be adopted when installing and using transmitting antenna.

Some antennas, particularly end-fed quarter-wave types, will have a very high radio frequency voltage present on the end when the connected transmitter is operating. Anybody touching these antennas is likely to receive a burn from this high voltage. These burns can penetrate deep below the skin and are very painful. Keep away from the ends of antennas…!

TRIP and SLIP HAZARDS

Power and mains cables should be attached to walls or run around the edge of tents (or buried) when in the field, to prevent people from tripping over them or pulling radio equipment off the desk accidently. Guy ropes to antenna masts should be marked with hazard tape at eye-level, and any cables running on the ground where people are likely to walk must also be clearly marked. Trip hazards must be briefed from the RA. Wet floors, wet ground and icy conditions can produce a slip hazard and care must be taken when operating in these areas.

LIFTING

Heavy and large objects should be assessed before they are moved or lifted. There should be a safe number of personnel involved in any lifting or moving of these objects and Personnel Protective Equipment (PPE) worn as required.

FIRE

Radio equipment, battery chargers, generators and power supplies can get hot and need adequate ventilation. They must not be covered when in use.
Most radio stations generate a lot of paperwork which can be a fire hazard. Paperwork should be neatly stored away from any potential ignition sources.
A fire extinguisher of the correct type (dry powder / CO2) should be available in rooms and other structures used for radio operations.

Fire evacuations procedures should be recorded in the RA, briefed and practiced.

ANTENNAS and MASTS

As mentioned above there should be a 'safe' distance between transmitting antennas and people.
Antenna masts must be carefully erected when in the field, securely guyed and checked for security on a regular basis. An out-of-bounds area must be taped-off to prevent people from interfering with the mast or guys, and guys must be marked to prevent accidental damage.
Prior to knocking any guy pegs into the ground the area must be checked for any services (power cables, gas and water pipes, communication cables etc) which could cause injury to the installer, or be damaged. Repairing these cables or pipes could be very expensive.

WEATHER

Prior to an Exercise the weather forecast should be checked and arrangements made to protect all personnel from the weather conditions which could affect them. Changes in the weather should also be monitored. Lightning is a particular hazard and serious consideration should be given to abandoning any radio exercise if lightning is forecast, or is present within a reasonable distance from your operating location (perhaps up to 100Km). As well as lightning, static build up on antennas can be an issue when electrical storms are in your locality.

RISK ASSESMENTS

Before any radio training takes place ensure you have a robust RISK ASSESSMENT in place which covers all aspects of the training or activity you are expecting to carry out. A copy should be held on file and a copy with you if you are operating radios of site. Be realistic in your expectations use the headings listed above as a start. Some other things to consider are shown on the slides. Your particular operating venue may have additional items to include in an RA and your brief.

ACF/CCF/SCC CALLSIGNS

[153-156] The RAFAC operates on Military radio frequencies which other Uniformed groups may share; you may come across this during national radio exercises, competitions or routine traffic. Sea Cadet Corps (SCC) begin with MIKE FOXTROT, Army Cadet Force (ACF) & Combined Cadet Force (CCF) will begin with MIKE ALPHA, MIKE CHARLIE OR MIKE ZULU.

They will use the same prowords etc that you have been trained to use so you should not notice anything different except their callsign prefix.

You are encouraged to operate between organisations were possible.

PLANNING COMMS EVENTS

[157-162] When planning the use of radio communications during an event or activity there are a number of topics which need to be reviewed and covered to make it

successful. By understanding what the event is and the radio requirements you can best cover it with either handhelds or base/mobiles. It would be recommended that the local area be viewed to take note of the terrain, any large objects or obstructions which would cause concern with communications, a test of handheld/mobile coverage at various locations would also be of benefit.

Test all radio equipment for serviceability prior to the event this includes pre-charging all batteries to full capacity, clearly mark anything that is un-serviceable and quarantine from the main batch of equipment so that it does not get taken and issued out.

Make a 'Callsign Board' available which has all callsigns listed down on the left hand column, a column with the name of callsign holder and a column for the location of that callsign with a final column for comments or remarks. You will find this will greatly aid you during the event, make this visible to the control team.

A Logbook is very useful in recording 'radio traffic' and will help with control of your callsigns if you need them to carry out a task or change over operators.

Brief out the lost contact procedure to all callsigns and check they understand how it works and its benefits.

Complete a Risk Assessment using ACP5 for guidance, this needs to be completed at the planning stage, review before the event in case anything has changed in the interim period. Include the Risk Assessment in with the PiPE Application when this is submitted to Wing or Region.

Check the weather forecast before and during the event, any foreseeable problems should be noted and briefed out and the appropriate action taken when required.

NATIONAL HF, VHF and UHF EXERCISES

[163-166] Dates for the national radio exercises are set each year and are available on SharePoint.

EXERCISE RADIATE

Exercise Radiate is an HF exercise designed to help units setting up radio stations and antennas on HF to test their equipment with other stations.

EXERCISE WEEK SIGNAL

Exercise Week Signal is a national exercise using all ACO HF, VHF and UHF radio channels. The exercise is competitive and runs over 5 weekday parade evenings. A listener exercise is included for cadets who want to listen at the Squadron or at home, maybe using one of the SDR receivers available on the internet. Full details are in Chapter 9 to ACP44 on SharePoint.

EXERCISE SATSIG

Exercise SatSig is similar to Week Signal, but takes place on a Saturday.

NATIONAL HF

This event is open to Squadrons who have HF capability, it takes place generally on a Sunday three times a year, it can take place in the Squadron Radio room or can be Field located in a tent or out in the open.

ADVANCED RADIO OPERATOR – Next Level

[168] Completion of either ACP 46, LAN/WAN or Practical Data Communications is mandatory for completion of the Silver Award.

ANNEX A – SILVER LEVEL RADIO OPERATOR ASSESSMENT

ADVANCED RADIO OPERATOR COURSE PRACTICAL ASSESSMENT SHEET INSTUCTORS GUIDE

Cadet Surname: ______________________ **Forename** ____________ **Rank:**________
Sqn:________________________ **Wing:**___________

The following elements are to be tested 'on- air' and are to be completed successfully for the Advanced Radio Comms (Silver) Award.

Assessment methodology:	
The cadet is given a sheet with their callsign (CS1) and the assessor's callsign (CS2), and a simple numeric grid and a time for transport. They are to be told to authenticate the assessor and to then find out how the assessor is receiving them (RADIO CHECK) at the start of their assessment. BOTH and FULL CALLSIGNS are to be used during the assessment at this level. ***After they have authenticated you, request an AUTHENTICATION from them. Listen for the correct response (CS2 THIS IS CS1 = I AUTHENTICATE BRAVO = ZERO TOO FOWER = OVER) etc*** ***After they have requested a radio check from you, request a RADIO CHECK in response. Listen for the correct response (LOUD CLEAR, GOOD READABLE, WEAK WITH INTERFERENCE etc without any additional words eg CS2 THIS IS CS1 = LOUD CLEAR = OVER)*** ***Ask them at what time and at what location will the fuel will be available. Listen for a full answer and the correct use of 'GRID' and the time sent. (CS2 THIS IS CS1 = FUEL WILL BE AVAILABLE AT GRID WUN TOO TREE FOWER AT = SIXTEEN THIRTY HOURS (or FIGURES WUN SIX TREE ZERO HOURS) = OVER*** ***Request a 'SAY AGAIN GRID' and listen for the correct response (CS2 THIS IS CS1 = I SAY AGAIN GRID etc).*** ***Tell them their assessment is complete and to return to your location. During this transmission drop the PTT a couple of times at key points to miss words so that they request a 'SAY AGAIN'. (Assessor replies with 'I SAY AGAIN…').***	
Action	**Initials**
Correct Use of Both Full Callsigns	
Authenticate Requested	
Authenticate Answered Correctly	
Radio Check Requested	
Radio Check Answered Correctly	
Tactical Message Fully Answered	
I Say Again used	
Say Again used	
Prowords OVER, OUT etc used correctly. General quick responses, RSVP and confidence.	
Verbally check understanding of CORRECT, CORRECTION, I SPELL, NOTHING HEARD, FIGURES, ROGER, WAIT OUT, SPEAK SLOWER.	
Verbally check understanding of security – must not transmit ranks, names, locations, move of arms and ammunition, personal or Sqn details etc…	
PASS / FAIL ***Comments*** ***Instructor/Assessor Name:***______________ ***Signature:***___________ ***Date***________	

ADVANCED RADIO OPERATOR COURSE (Silver Award) PRACTICAL ASSESSMENT SHEET

Cadet Forename: ______________ **Surname:** _____________ **Rank:** ______

Sqn _________________________ **Sqn No:**______________ **Wing:**____________

The following elements are to be tested 'on- air' during the course.

Action	Initial
Correct Use of Callsigns	
Radio Check carried out	
Authenticate	
Say Again	
Relay procedures	
Security	
Tactical Messages	
Establish Net	
Radio Check of a Net	
Direct Traffic on the Net	
Radio Silence	
Assuming Control as NCS	
Frequency Change	
Do Not Answer	
Log Keeping	
Delegating a NCS to a callsign	
Synchronising Time	
Plaindress Messages	
Close Net	
General response speed and operating confidence suitable for Silver Award	
PASS/FAIL **Comments:** **Instructor/Assessor Name:** **Position/Sqn:** **Signed:** **Date:** **Entered onto SMS by Name:** **Date Entered:**	
Send completed Assessment Sheet to RRCO for issue of Badge and Certificate	

ADVANCED RADIO OPERATOR COURSE – Student's Practical Assessment Handout

YOUR CALLSIGN FOR THIS ASSESSMENT IS ______________

THE OTHER STATION'S CALLSIGN IS _____________

YOU MAY ALSO NEED TO SPEAK TO CALLSIGN _____________

WORK OUT YOUR AUTHENTICATION CODES FOR TODAY:

A __________ B __________ C __________ D __________

During this Assessment, you will need to set up a net, direct traffic, send and receive a plaindress message and hand net control to another callsign.

WHEN YOU ARE READY, CALL THE OTHER CALLSIGN AND:

1) **Authenticate them. They will then authenticate you.**
2) **Radio check them. They will then radio check you.**
3) **Reply to any question they may ask you (use prowords taught on the training course where required).**
4) **You will be told when the assessment has been completed.**

YOU MAY NEED THE FOLLOWING INFORMATION:

FUEL IS GOING TO BE AVAILABLE AT THE FOLLOWING MAP REFERENCE (assessor - circle the location to be used)

293873 74Ø162 597695 39714Ø 4532Ø6 210954

YOUR TIME TO FILL UP IS (assessor - circle when)

1. ***HALF PAST SIX IN THE EVENING***
2. ***TWENTY TO EIGHT IN THE MORNING***
3. ***NINE O'CLOCK EXACTLY IN THE MORNING***
4. ***QUARTER TO SIX IN THE EVENING***
5. ***QUARTER PAST SEVEN IN THE EVENING***
6. ***TWENTY TO THREE IN THE AFTERNOON***

ANNEX B - DSAT SILVER

TRAINING PERFORMANCE STATEMENT (TPS)			
ROLE/TEAM PS REFERENCE:	Advanced Radio Operator (Cadet) On completion of Part ONE & TWO Modules a cadet will be able to establish, run, maintain and close down a Radio Net.		
DUTY TITLE (as appropriate):	Advanced Operator (Silver Badge)	DUTY NUMBER:	1.0
TRAINING ACTIVITY TITLE:	Module 1 Basic Communications	HRMS/JPA ACTIVITY NUMBER:	
TRA:	Comdt ACO	ISSUE STATUS:	V0.1

TO Number	Training Objective (Performance)		Condition	Standard	Requirement			Final Training Category	Notes
	Performance	Sub-Performance			C	L	A		
1.1	Radio Communications Theory		In a classroom	Complete the radio theory sections of the 1st class workbook to at least Pass level.	Y			N/A	
1.2	Initial Calls		In a classroom	Using a radio, complete an initial radio call to another station using the correct callsigns, phonetics and prowords.	Y				
1.3	Radio Check		In a classroom	Using a radio, complete a radio check with another station.	Y				
1.4	Basic Prowords		In a classroom	Using a radio pass simple messages Exchange messages with another station incorporating 'Grid', 'Time' and at least one instance of 'Say Again'.	Y				
1.5	Message Relay		In a classroom	Using a radio, relay a message from one station to another by being the 'man in the middle'.	Y				
1.6	Use of prowords		In a classroom	Using a radio messages should contain the following Prowords. Correct, Correction, Say Again, I Spell, Nothing Heard, Over, Figures, Roger, Speak Slower, Out	Y				

TRAINING PERFORMANCE STATEMENT (TPS)									
ROLE/TEAM PS REFERENCE:			Advanced Radio Operator (Cadet) On completion of Part ONE & TWO Modules a cadet will be able to establish, run, maintain and close down a Radio Net.						
DUTY TITLE (as appropriate):			Advanced Operator (Silver Badge)		DUTY NUMBER:			1.0	
TRAINING ACTIVITY TITLE:			Module 1 Basic Communications		HRMS/JPA ACTIVITY NUMBER:				
TRA:			Comdt ACO		ISSUE STATUS:			V0.1	
1.7	Net Control 1		In a classroom	Using a radio establish a local radio net, using Prowords Charlie Charlie, Radio Check, Free Net, Directed Net, Exempt.	Y				
1.8	Net Control 2		In a classroom	Once net established use prowords - Assume Control, Freq Change, Do Not Answer, Synchronise Time, Relay Message, Delegate NCS to Callsign, Do Not Answer, Close Down.	Y				
1.9	Plaindress Msg		In a classroom	Send four Plaindress Messages (2x Coded & 2x Drill) to some stations on the net.					
1.10	Logbook		In a classroom	Cadets must demonstrate that they are able to complete the Logbook sheet	Y				
1.11	Health & Safety		In a classroom	Understanding of Mains & Battery Voltage, RF Radiation & Burns, Slips, Trips, Lifting Hazards, Fire, Rigging Antennas and Masts, Weather and Risk Assessment.	Y				
1.12	Other Callsigns		In a classroom	Aware of other MoD Users who are entitled to share/occupy the frequencies.	Y				
1.13			In a classroom	Understanding of	Y				
1.14	National Radio Exercises		In a classroom	Understanding of Radio events and activities that they can participate in.	Y				
1.15	Planning Comms Events		In a classroom	How to plan a radio activity or event and what is required.	Y				

WORKPLACE TRAINING STATEMENT (WTS)

ROLE/TEAM PS REFERENCE:	None		
DUTY TITLE (as appropriate):		DUTY NUMBER:	
TRAINING ACTIVITY TITLE:		HRMS/JPA ACTIVITY NUMBER:	
TRA:		ISSUE STATUS:	

TO Number	Training Objective (Performance)		Condition	Standard	Requirement			Final Training Category	Notes
	Performance	Sub-Performance			C	L	A		

RESIDUAL TRAINING GAP STATEMENT (RTGS)[1]

ROLE/TEAM PS REFERENCE:			
DUTY TITLE(as appropriate):		DUTY NUMBER:	
TRAINING ACTIVITY TITLE:		JPA/HRMS ACTIVITY NUMBER:	
TRA:		ISSUE STATUS:	

Task Number	Performance	Condition	Standard	Reason(s)[2]	Consequences[3]
1	Handling Actual Emergency Calls	On exercise or event	Relay emergency messages to the emergency services.	Unable to produce real emergencies on demand	Inefficiency

[1] This part of the FTS is to be used to state which task in terms of Performance, Conditions and/or Standards, specified in the Role/Team PS, will not be achieved during training and the reason(s) why the task can/will not be achieved, and the consequences of not providing this training. Not all training requirements will require a Residual Training Gap Statement. A Residual Training Gap is to not be confused with a Training Deficiency, which is a shortfall in the intended training that was not agreed by the TRA.

[2] State the reason why the task will not be achieved as part of the training (for example, resources).

[3] State the consequences of not delivering the training for this task.

RESIDUAL TRAINING GAP STATEMENT (RTGS)[1]			
ROLE/TEAM PS REFERENCE:			
DUTY TITLE(as appropriate):		DUTY NUMBER:	
TRAINING ACTIVITY TITLE:		JPA/HRMS ACTIVITY NUMBER:	
TRA:		ISSUE STATUS:	

Annex C to Pt 2, Ch 1.3: Learning Specification (LSpec)	
Learning Specification (LSpec)	
Section 1: Administration	
Training activity	
Training activity Number/Title:	**1.0**
Module Number/Title:	**Module 1**
Lesson/Event Title:	
Individual/Collective Training Objective(s) (TOs/CTOs):	
TO/CTO (Perf)	**1.1 List Make-up of call signs**
Enabling Objective(s) (EOs):	
EO (Perf, Cond, Stds)	**1.1.1Sequencing** **1.1.2 Purpose**
Issue number:	
Review Date:	
Administration	
Duration:	**45 mins**
Location:	**Classroom**
Reference(s):	**Nil Workbook**
Resources	
Handouts:	
Exercises:	
Equipment:	**Nil**
Preparation:	
Key Learning Points (KLPs)	
KLP	**Country first digit** **RAF 2nd character etc**
Risk Assessment(s)	
Risk	
Section 2: Execution	
Part 1: Introduction	
Interest:	**See Lesson Pack 2**
Need:	
Title:	
Range:	
Objectives:	
Safety Brief:	
Part 2: Development	
KLP	**Prowords**
Part 3: Consolidation	
Summary:	
Assessment of EOs:	
Link:	
References:	
Trainee Questions:	

Air Cadet
Advanced Radio Operator Course
(Silver VP Level)

Ver 2.32

ROYAL AIR FORCE AIR CADETS the next generation

Air Cadet
Advanced Radio Operator Course

INTRODUCTION

REVIEW OF BLUE / BRONZE

ESTABLISHING A NET

PLAINDRESS MESSAGES

MESSAGE HANDLING

NET CONTROL

Air Cadet
Advanced Radio Operator Course

EXERCISE

HEALTH AND SAFETY

OTHER CALLSIGNS

PLANNING EVENTS

NATIONAL EXERCISES

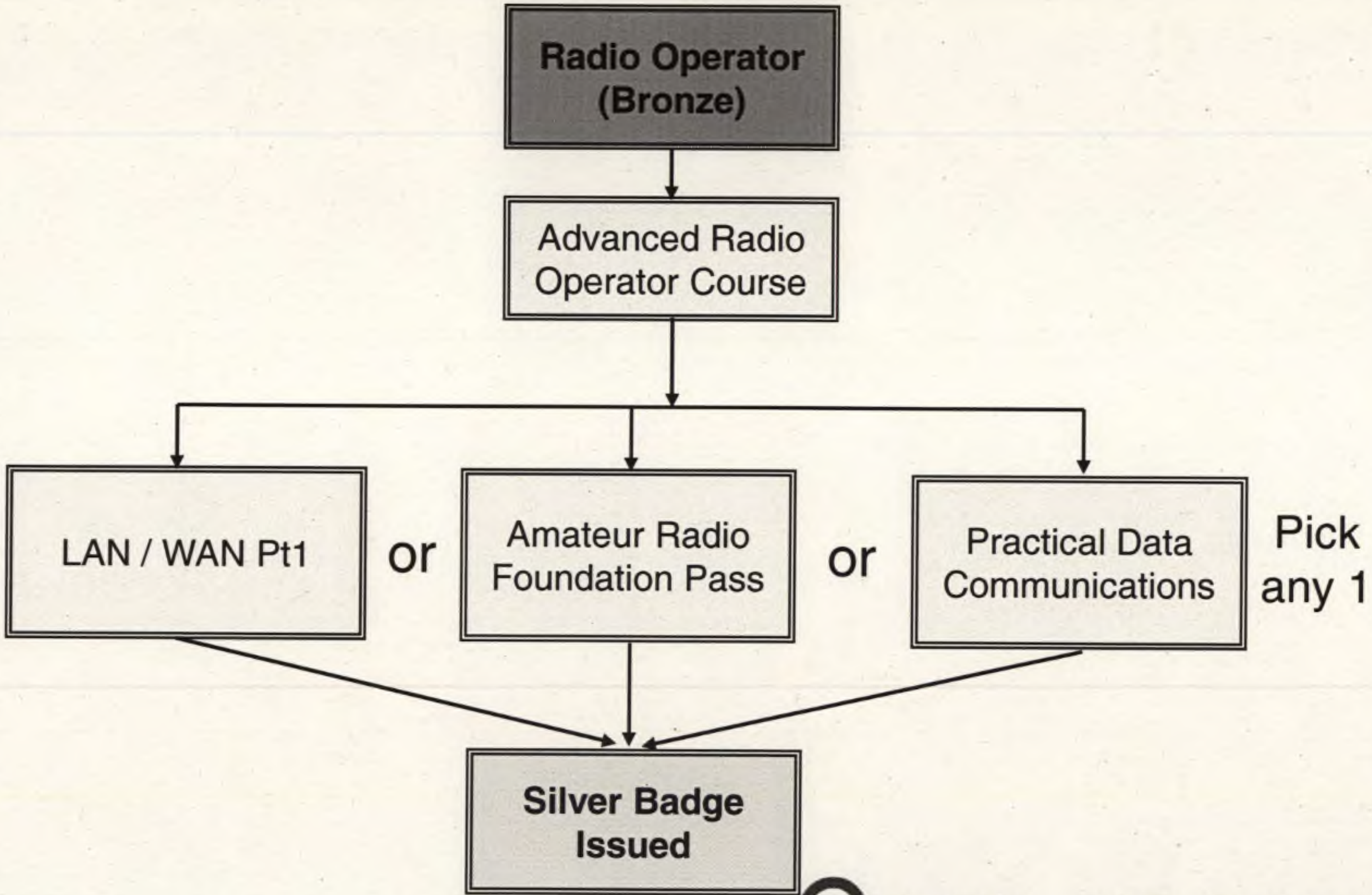
Aims of the course

- To become competent in advanced radio operating and radio net control procedures.
- To become competent in controlling a directed radio net unsupervised.
- To have knowledge of the elements in a plaindress messages (in ACP45)

Aims of the course

- Manage a Directed Net unsupervised and send, receive and check / correct plaindress messages.
- Have a good understanding of H&S when training or operating radio equipment.
- To be able to safely plan radio comms events and activity.
- To know where to find information on national radio exercises.

Communications Award
Radio Operator to Communicator



Advanced Radio Operator Course

Session 1

ROYAL AIR FORCE AIR CADETS the next generation

Advanced Radio Operator Course

Brief Revision of
Basic Radio Operator
and
Radio Operator
Courses

PHONETICS

Phonetic Alphabet

Phonetic Numbers

R.S.V.P.

stands for…

- Rhythm
- Speed
- Volume
- Pitch

S.A.D.

stands for…

- Security
- Accuracy
- Discipline

CALLSIGNS

How is the ACO callsign MRO43 abbreviated ?

What cannot be added as a suffix ?

ABBREVIATED CALLSIGNS

MRO25

MIKE ROMEO OSCAR TOO FIFE

OSCAR TOO FIFE DELTA

DELTA GOLF

DELTA SIX

~~**TREE SIX**~~

CALLING AND ANSWERING

How do you call
a SPECIFIC station?

CALLING AND ANSWERING

(THEIR CALLSIGN) =

THIS IS

(MY CALLSIGN) =

OVER

CALLING AND ANSWERING

What callsign would you use to invite ANY ACO station to reply?

CALLING AND ANSWERING

ALPHA CHARLIE

CALLING AND ANSWERING

You are the Net Control Station.

What callsign do you use to call ALL STATIONS on your net ?

CALLING AND ANSWERING

CHARLIE CHARLIE

- CC1
- CC2

AUTHENTICATE

What is AUTHENTICATE used for ?

How do you authenticate ?

What do you do if you get the wrong answer ?

RADIO CHECK

How do you request a radio check ?

What are the standard responses ?

RADIO CHECK

Strength	Readability
Loud	Clear
Good	Readable
Weak	With Interference
Very weak	Distorted
Fading	Intermittent
	Unreadable

SECURITY

What information must not be transmitted ?

SECURITY

We are not allowed to send messages containing …

- Names
- Ranks
- Location (unless very temporary)
- Squadron Details
- Meeting places/times
- Movements of arms or ammunition
- Aircraft movements
- Radio frequencies

SECURITY

CRASHES
ACCIDENTS
EMERGENCIES

Or anything requiring external help...

SECURITY

CURRENT AIRCRAFT OPERATIONAL INFORMATION

or...

Anything likely to provoke an unreasonable response...

Slide 27

[redacted] Is "Curent Aircraft Ops Info" an expansion on "Aircraft Movements"? Would this slide be better positioned as No. 26? Would "Anything likely to provoke an unreasonable response" be better on the "CRASHES, ACCIDENTS, EMERGENCIES" slide?

[redacted] 28/11/2016

SECURITY BREACHES

If a callsign breaks security, call them and say

BEADWINDOW

BEADWINDOW

1 - Position

2 - Capabilities

3 - Operations

5 - Personnel

6 - Comsec

7 – Wrong net

(4 – not used in the ACO)

BEADWINDOW

B33D THIS IS B48A =
BEADWINDOW 6 =
OUT

PROWORDS

Give some examples of PROWORDS

RELAYING

If two callsigns are having trouble passing a message and you know you can contact both you can offer to relay their message by saying:

"THROUGH ME"

OVER

RELAYING

Prowords are:

- **RELAY TO** (if you are starting the relay)
- **RELAY** (if you are relaying the message)
- **FROM** (the original sender)
- **TO** (who it is finally for).

Slide 33

[redacted] At Bronze level, cadets are just taught RELAY TO, FROM and RELAY COMPLETE

[redacted], 28/11/2016

RADIO NETS

So, what is a radio net ?

RADIO NETS

There are two types of radio net...

FREE NET - stations can communicate freely with each other

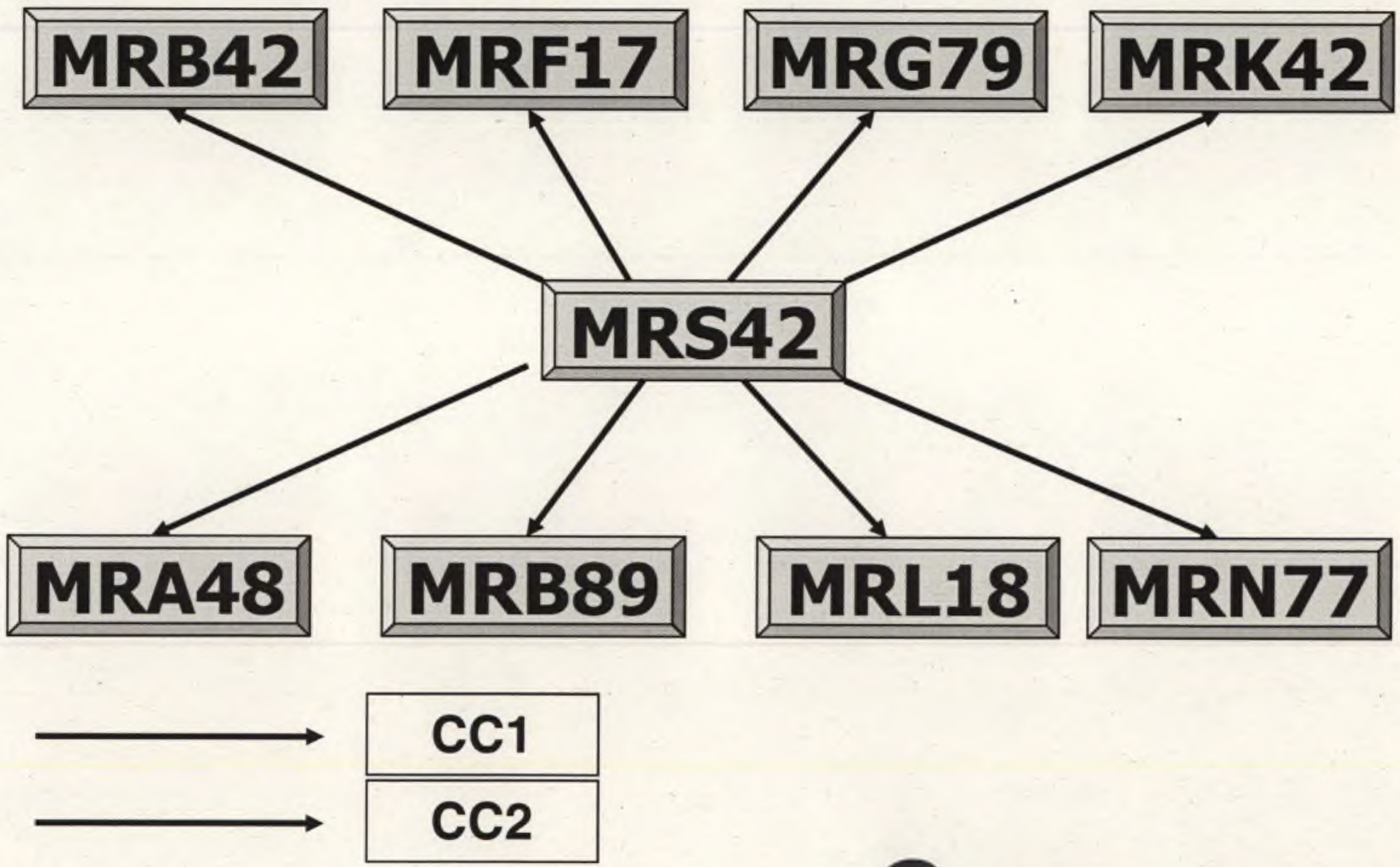
DIRECTED NET - stations only communicate with the control station unless told otherwise

RADIO NETS

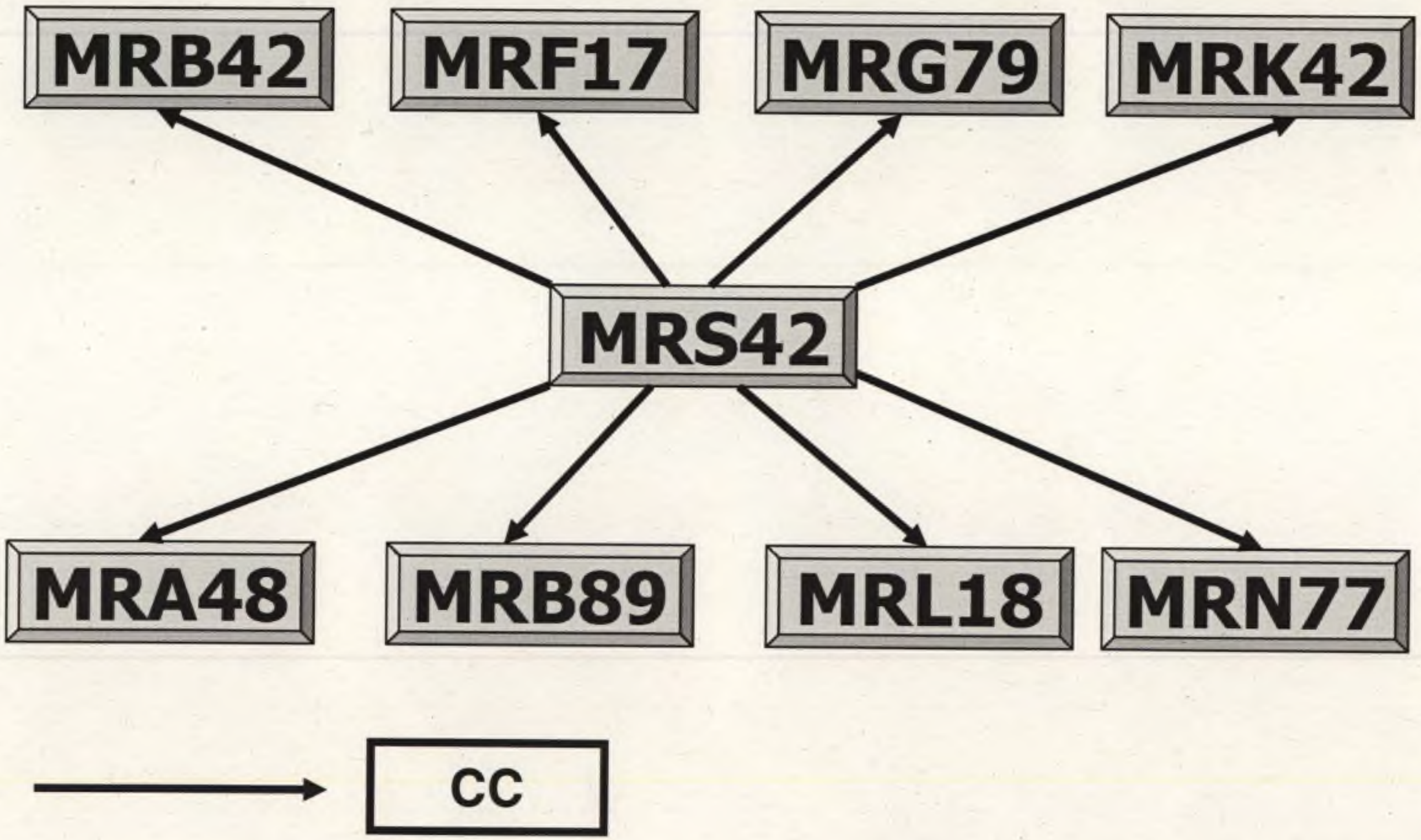
If there are two or more nets running the NCS can allocate different callsigns to each net:

- CC1 - one group of callsigns
- CC2 - another group of callsigns
- CC - would be ALL callsigns.

NET CALLSIGNS



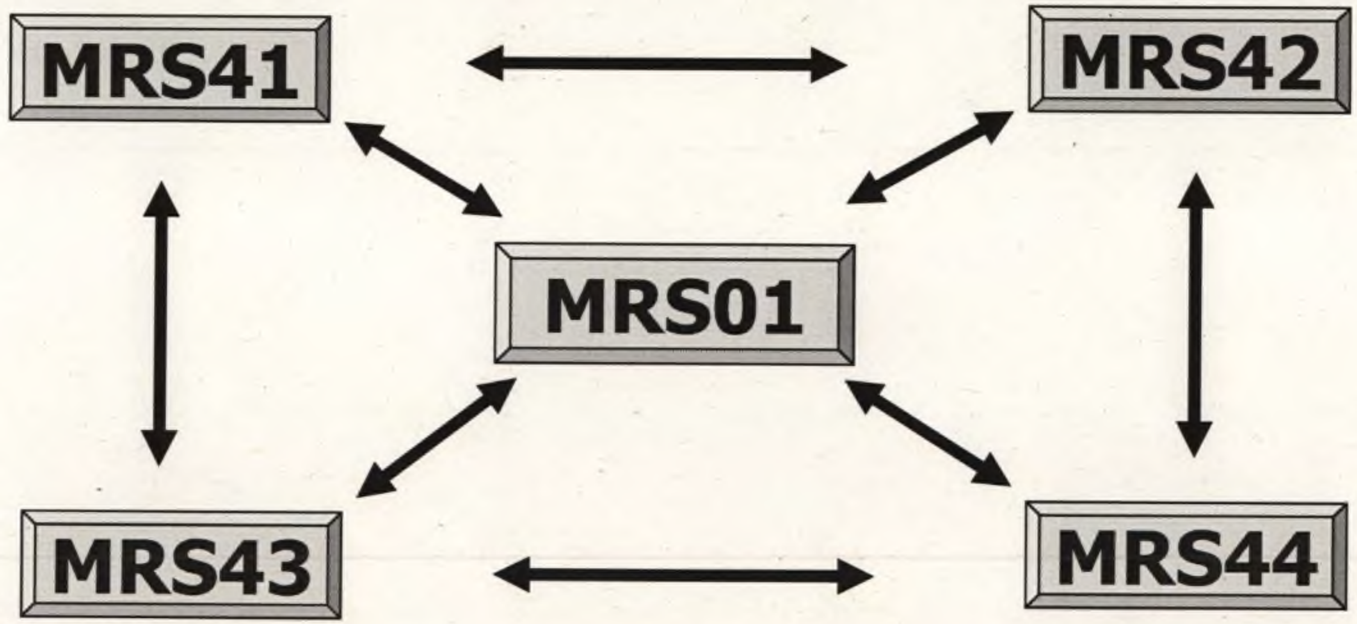
NET CALLSIGNS



ROYAL AIR FORCE AIR CADETS the next generation

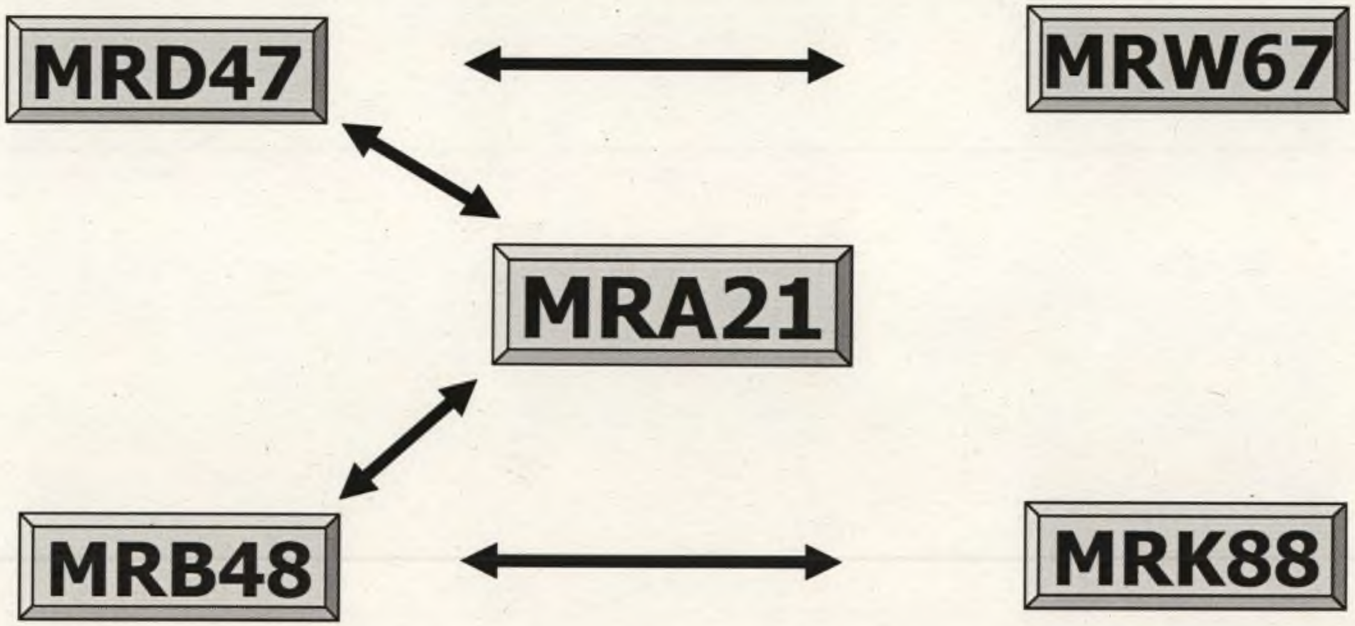
TYPES OF NET

Free Net



TYPES OF NET

Directed Net



After a CC call stations answer the control station in alpha-numeric order - or an order pre-arranged by the Net Control Station

MRB43 → Answers first

MRD24 → Answers next

MRS15 → Answers next

Advanced Radio Operator Course

Any Questions...?

ROYAL AIR FORCE AIR CADETS the next generation

Session 2

NEW VOICE PROCEDURES

1. Establishing a Net
2. New Prowords
3. Writing a Plaindress message
4. Plaindress message handling

NET CONTROL PROCEDURES
Establishing a Directed Net

- The NCS gives the net a callsign (CC, CC1 etc) and announces the order of stations on the net (twice).
- The NCS then radio checks the net.
- The NCS then confirms the type of net (Directed).

NET CONTROL PROCEDURES
Establishing a Directed Net

CC = THIS IS MRD85 =

STATIONS ON THIS NET =

MRD34 = MRD28 = MRD67 =

I SAY AGAIN =

STATIONS ON THIS NET =

MRD34 = MRD28 = MRD67 =

OUT

NET CONTROL PROCEDURES
Establishing a Directed Net

CC = THIS IS MRD85 =

RADIO CHECK =

OVER

NET CONTROL PROCEDURES
Establishing a Directed Net

- Each callsign will then reply in order, using 'OVER' at the end of their transmission.

- The NCS will then answer the net - using ROGER for Loud Clear – and tell any stations not LC what their radio check is by callsign…

NET CONTROL PROCEDURES

Establishing a Directed Net

Net Radio Check...

CHARLIE CHARLIE = THIS IS = MRD85 =

RADIO CHECK = OVER

THIS IS = MRD34 = G/R = OVER

THIS IS = MRD28 = L/C = OVER

THIS IS = MRD67 = G/R = OVER

CHARLIE CHARLIE = THIS IS = MRD85 = ROGER
= MRD67 = W/R = OUT

NET RADIO CHECK...

What happens if the station before you doesn't reply?

Wait between 5 - 10 seconds. If you hear nothing, you say..........

NET RADIO CHECK...

CHARLIE CHARLIE = THIS IS = MRD85 = RADIO CHECK = OVER

THIS IS = MRD34 = G/R = OVER

MRD28 should reply next. MRD67 hears nothing so waits 10 seconds.

THIS IS = MRD67 = L/C = OVER

CHARLIE CHARLIE = THIS IS = MRD85 = ROGER = MRD34 = G/R = MRD28 = NOTHING HEARD = OUT

NET CONTROL PROCEDURES

The NCS will then tell all callsigns that the net is DIRECTED

CHARLIE CHARLIE = THIS IS MRD85 =

THIS IS A DIRECTED NET =

OUT

NET CONTROL PROCEDURES
Changing Net Control Station

If you are told to ASSUME CONTROL

- You reply WILCO = OUT
- You then set up a new net before directing any radio traffic.

NET CONTROL PROCEDURES
Assuming Control

If the NCS is not answering calls and appears to have gone off-air, another station can assume control of the net.

To ASSUME CONTROL you transmit

CHARLIE CHARLIE = THIS IS = MRD30 = I AM ASSUMING CONTROL = OUT

Slide 55

[redacted] Add "and then set up the net before directing traffic"?

[redacted], 28/11/2016

PHRASES USED ON A DIRECTED NET

AC = EXEMPT CC = THIS IS MRD85 = STATIONS WISHING TO JOIN OR LEAVE THIS NET = SEND NOW = OVER

MRD85 = THIS IS = MRB46 = JOINING YOUR NET = OVER

MRB46 = THIS IS = MRD85 = ROGER = OUT

MRD85 = THIS IS = MRC25 = THIS STATION IS CLOSING DOWN = OVER

MRC25 = THIS IS = MRD85 = ROGER = OVER

MRD85 = THIS IS = MRC25 = CLOSING DOWN NOW = OUT

NET CONTROL PROCEDURES

If the NCS wants to change the net to a Free Net it will tell all callsigns that the net is a free net now.

All callsigns reply with 'Roger = over '.

CHARLIE CHARLIE = THIS IS MRD85 = FREE NET NOW = OUT

NET CONTROL PROCEDURES

If the NCS needs to close down the net it will tell all callsigns…

CHARLIE CHARLIE = THIS IS MRA11 =

CLOSE DOWN = OVER

THIS IS MRC28 = ROGER = OVER

THIS IS MRF19 = ROGER = OVER

THIS IS MRA11 = CLOSE DOWN NOW =

OUT

NET CONTROL PROCEDURES

Radio Silence

If there is a good reason for stopping all transmissions on a net, for example a non-recognised callsign is trying to join the net, the NCS can tell all callsigns RADIO SILENCE is required.

The transmission will be given a time and an authentication (from the current message authentication table).

RADIO SILENCE

CHARLIE CHARLIE = THIS IS MRD39 =

SILENCE SILENCE SILENCE =

TIME .... =

AUTHENTICATION IS .... =

I SAY AGAIN =

CHARLIE CHARLIE = THIS IS MRD39 =

SILENCE SILENCE SILENCE =

TIME .... =

AUTHENTICATION IS .... =

OUT

NET CONTROL PROCEDURES
Silence Lifted

The NCS can tell all callsigns on the net that RADIO SILENCE has been lifted…

CHARLIE CHARLIE = THIS IS MRD50 =

SILENCE LIFTED =

TIME ……. =

AUTHENTICATION IS ……. =

OUT

NET CONTROL PROCEDURES
Time Check

The NCS can give a time check so all stations can synchronise their clocks or watches.

It is important to plan this in advance and to give a pause to allow operators to prepare.

NET CONTROL PROCEDURES

Time

CHARLIE CHARLIE = THIS IS MRB01 = TIME CHECK AT ZERO NINER TREE ZERO ZULU

(pause to allow operators to prepare) =

WUN FIVE SECONDS = WUN ZERO SECONDS = FIFE FOWER TREE TOO WUN = TIME ZERO NINER TREE ZERO ZULU = OUT

NET CONTROL PROCEDURES

Frequency Change

CHARLIE CHARLIE = THIS IS MRB50 = CHANGE TO FREQUENCY VICTOR WHISKEY = AUTHENTICATION IS - - OVER

THIS IS MRL47 = ROGER = OVER

THIS IS MRU04 = ROGER = OVER

THIS IS MRB50 = VICTOR WHISKEY NOW = OUT

Advanced Radio Operator Course

Any questions ?

ROYAL AIR FORCE AIR CADETS the next generation

Session 3

NEW PROWORDS

More To Follow

Used in the final instruction when formatting a message if there is more to follow on the same subject.

NEW PROWORDS

Do Not Answer

MRA11 = THIS IS MRO43 = DO NOT
ANSWER = (information) =
TIME =
AUTHENTICATION IS ....
I SAY AGAIN =
MRA11 = THIS IS MRO43 = DO NOT
ANSWER = (information) =
TIME =
AUTHENTICATION IS .... =
OUT

NEW PROWORDS

Service

SERVICE is used to identify information traffic between stations…

MRQ46 = THIS IS MRA11 = SERVICE = WE ARE HAVING A PRACTICE FIRE EVACUATION SO WILL BE CLOSING DOWN AT ELEVEN HUNDRED HOURS = OVER

Slide 70

[redacted]

This could do with more explanation. A plaindress message also contains information so the obvious question is what makes this a SERVICE message and not an abbreviated plaindress message?

[redacted] 28/11/2016

NCS PROWORDS

Use Abbreviated Callsigns

Once a net is established and conditions are good the NCS can order all callsigns to operate using abbreviated callsigns.

NCS PROWORDS

Use Abbreviated Callsigns

CHARLIE CHARLIE = THIS IS MRS20 = USE ABBREVIATED CALLSIGNS = OVER

Each station answers in turn

THIS IS S20 = ROGER = OVER

NCS PROWORDS

Use Full Callsigns

If a net is using abbreviated callsigns and conditions deteriorate the NCS can order all stations to operate using full callsigns.

NCS PROWORDS

CHARLIE CHARLIE = THIS IS MRD05 =
USE FULL CALLSIGNS = OVER

Each station answers in turn.....

THIS IS MRO15 = ROGER = OVER

NCS PROWORDS

Use Abbreviated procedures

If a net is using full procedures and conditions are good the NCS can order all stations to operate using abbreviated procedures until further notice.

Slide 75

[redacted]

Delete "abbreviated callsigns and". Use abbreviated callsigns is dealt with in the previous slides

[redacted] 28/11/2016

NCS PROWORDS

CHARLIE CHARLIE = THIS IS MRO55 = USE ABBREVIATED PROCEDURES = OVER

Each station answers in turn

MRO55 THIS IS MRO43 = ROGER = OVER

Slide 76

[redacted] Abbreviated Procedure needs clarifying (see earlier comments). The reply shown in the slide is longer than the procedure used in previous slides.

[redacted] 28/11/2016

NCS PROWORDS

Use Full Procedures

If a net is using abbreviated procedures and conditions deteriorate the NCS can order all stations to operate using full callsigns and procedures.

Slide 77

[redacted] Delete "full callsigns and"
[redacted] 28/11/2016

[redacted] Question. Is the proword "Use Full/Abbreviated ProcedureS" or Procedure?
[redacted] 29/11/2016

NCS PROWORDS

CHARLIE CHARLIE = THIS IS MRO55 = USE FULL PROCEDURE = OVER

Each station answers in turn

MRO55 THIS IS MRO43 = ROGER = OVER

Net Control Exercise 1

- NCS – Give net a callsign and list stations x2 (Out)
- NCS – Net Radio Check (Over)
- Member stations reply in order (Over)
- NCS replies to Radio Check (Roger) (Out)
- NCS – This is a Directed Net (Out)
- NCS – Tell another Callsign to Assume Control
- Back to the top

Advanced Radio Operator Course

Any questions ?

ROYAL AIR FORCE AIR CADETS the next generation

Session 4

MESSAGE TYPES

Tactical

(Abbreviated Plaindress)

Messages

For example...

TACTICAL MESSAGES

- CAR PARK 2 IS NOW FULL = OVER
- SEND TEAM 3 TO THE BANNER DRILL COMPETITION = OVER
- SEND A FIRST AIDER TO THE MAIN GATE = OVER

MESSAGE TYPES

Plaindress Messages

PLAINDRESS MESSAGES

MRO45 THIS IS MRV68
MESSAGE
NUMBER Ø4C SLANT Ø2
READ BACK TEXT
ROUTINE
TIME 131945 ZULU OCTOBER
THIS IS A CODED DRILL MESSAGE
GROUPS 3
PYMXJ G5D9R CLSWU
OVER

PLAINDRESS MESSAGES

How to compose a plaindress message...

PLAINDRESS MESSAGES

HEADING

TEXT

ENDING

PLAINDRESS MESSAGES

The Heading...

Gives the addressee and sender callsigns, details about and instructions for the handling of the message...

PLAINDRESS MESSAGES

Use Both Callsigns

A plaindress message must contain both addressee and sender callsigns.

PLAINDRESS MESSAGES

MESSAGE

Indicates that the following message must be written down.

PLAINDRESS MESSAGES

NUMBER

Made up from cadet operator's number followed by a slash (SLANT)

The message serial number (for that channel / day)

Operator's number is suffixed with:

A = Silver / Gold badge operator

B = Bronze badge operator

C = Blue or Non-badge operator

PLAINDRESS MESSAGES

NUMBER

An identifying number, for example:

16B/15

or

Ø2C/14

PLAINDRESS MESSAGES

READ BACK TEXT

Is an instruction to Read Back the text of the message.

PLAINDRESS MESSAGES

READ BACK

Note:

READ BACK is also an option. In this case the whole of the message, including the original callsigns sent, is read back after

'I READ BACK'.

Slide 95

[redacted]

Move this slide to below the following slide

[redacted] 29/11/2016

PLAINDRESS MESSAGES

The PRECEDENCE

ROUTINE is usually used

Other precedencies are:

- PRIORITY
- IMMEDIATE.

PLAINDRESS MESSAGES

The PRECEDENCE

1. IMMEDIATE
2. PRIORITY
3. ROUTINE.

PLAINDRESS MESSAGES

TIME

Proword TIME then…

- **DATE** - always two digits
- **TIME** - 24 hour clock time – 4 digits
- **TIME ZONE** – ZULU (GMT)
- **MONTH** - in full

Known as the **Date Time Group (DTG)**

PLAINDRESS MESSAGES

DATE TIME GROUP - EXAMPLE

2nd July, 9.45pm, GMT

TIME Ø 2 2 1 4 5 ZULU JULY

- GMT = ZULU
- We generally use ZULU time.

PLAINDRESS MESSAGES

DTG EXERCISE

Write out the DTG for your birthday – Assume you were born at quarter to seven in the evening – GMT

Don't forget the initial proword...!

PLAINDRESS MESSAGES

THIS IS A...

- CODEX MESSAGE
- CODED MET REPORT
- CODED POSITION REPORT
- CODED DRILL MESSAGE
- DRILL MESSAGE

Identifies the type of message in the text

PLAINDRESS MESSAGES

GROUPS

Identifies the number of groups in a coded text.

Each group consists of 5 letters / numbers

<u>Only used for coded texts</u>

PLAINDRESS MESSAGES

The Text …

…either…

PLAINDRESS MESSAGES

CODED text, where the text is split up into groups of 5 letters / numbers and are sent in phonetics with a pause between each group.

i.e. CODED POSITION, CODEX, CODED MET REPORT, CODED DRILL MESSAGE

LW7TR KJY8Ø 2LQ93 5549G LPPAB

PLAINDRESS MESSAGES

CODEX message texts must not contain official or confidential information.

PLAINDRESS MESSAGES

CODED DRILL message texts are only used to practise sending phonetics and numerals - they cannot be decoded - even by GCHQ computers…

P2J88 GWKZ7 L2NVP KKW63 UQX79

PLAINDRESS MESSAGES

...or...

PLAINDRESS MESSAGES

A DRILL MESSAGE, ie plain language.

DRILL FULLSTOP = REPORT ON TASK 6C/22D FULLSTOP = ALL TARGETS PHOTOGRAPHED FULLSTOP = NOW RETURNING TO BASE = FULLSTOP DRILL

PLAINDRESS MESSAGES

The Ending

OVER

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MRD33 THIS IS MRM52
MESSAGE
NUMBER 12C SLANT Ø2
READ BACK TEXT
ROUTINE
TIME Ø61145ZOCTOBER
THIS IS A CODED DRILL
MESSAGE
GROUPS xx
(text)
OVER

MRO97 THIS IS MRW28
MESSAGE
NUMBER 12C SLANT Ø3
READ BACK TEXT
ROUTINE
TIME Ø61145ZOCTOBER
THIS IS A DRILL MESSAGE
DRILL FULLSTOP
(text)
FULLSTOP DRILL
OVER

IMPORTANT !

When writing out messages to send, and those being received…

Use **O** for Oscar and **Ø** for Zero

I for India and ⊥ for Wun

Advanced Radio Operator Course

Any questions ?

ROYAL AIR FORCE AIR CADETS the next generation

Session 5

SPELLING

Spelling names and words which may be confused or mis-spelt by the receiving station.

There are two spelling techniques…

SPELLING

If you can pronounce the word…

PHARAOH = I SPELL =
PAPA HOTEL ALPHA ROMEO ALPHA
OSCAR HOTEL = PHARAOH = …..

SPELLING

If you can't pronounce the word…

I SPELL

(pause)

LIMA LIMA ALPHA PAPA GOLF WHISKY YANKEE LIMA LIMA

(pause)

(carry on…)

NUMERALS

If coded text precede one or more numbers with the proword 'FIGURES'

KD82Y

=

KILO DELTA FIGURES ATE TOO YANKEE

PUNCTUATION

- FULLSTOP
- COMMA
- HYPHEN
- COLON
- SEMICOLON
- SLANT

PLAINDRESS MESSAGES

Exercise 1

Write out a Coded Drill Message with 2 groups of mixed letters / numbers as the text ie 2 groups of 5.

Address it to another callsign in the room.

PLAINDRESS MESSAGES

Exercise 2

Write out a Drill Message with the text:

The Land Rover is to take 22 litres of Phlygwllston to callsign Pharaoh at Grid 448236 immediately.

MESSAGE HANDLING

At the start of the net or when new stations join the NCS can also ask stations 'OF WHAT PRECEDENCE AND FOR WHOM ARE YOUR MESSAGES = OVER'

The stations will reply in net order 'THIS IS MRA01 = ONE PRIORITY FOR MRS46 = ONE ROUTINE FOR MRM44 = OVER'

The NCS will then direct traffic based on the higher precedence messages first.

MESSAGE HANDLING

ON A DIRECTED NET, EITHER...

- Wait for the NCS to instruct you to ‘SEND ONE ROUTINE TO’ a callsign.
- Reply with ‘WILCO = OUT’
- Call the addressee callsign and offer the message to them by saying ‘MESSAGE = OVER’
- They will accept by saying ‘SEND YOUR MESSAGE = OVER’

NEW PROWORDS

Before sending a Plaindress Message it is 'offered' to the other station…

MRB20 = THIS IS MRA01 = MESSAGE = OVER

When they are ready to write it down they say….

MRA01 = THIS IS MRB20 = SEND YOUR MESSAGE = OVER

MESSAGE HANDLING

……. OR ……

- Call the NCS and say 'ONE ROUTINE FOR MRA01 = OVER'
- The NCS will say 'SEND YOUR MESSAGE = OUT' or 'WAIT = OUT'
- Call the designated callsign and offer the message to them by saying 'MESSAGE = OVER'
- They will accept by saying 'SEND YOUR MESSAGE = OVER'
- or…. 'WAIT = OUT'

MESSAGE HANDLING

LONG TEXTS....

Split long texts into small chunks and check receipt by saying

ROGER SO FAR = OVER

Response is...

ROGER = OVER

MESSAGE HANDLING

- Send the message, slowly and clearly, use ROGER SO FAR / ROGER if needed.
- Listen to the I READ BACK TEXT carefully, reply with CORRECT = OUT if text is correct when read back.

Or..

- Reply with WRONG - and identify what was wrong / send the correct information.

MESSAGE HANDLING

For example…

WRONG = GROUP TOO = ACFWY = OVER

Or..

WRONG = WORD AFTER BROKEN = ANTENNA = OVER

MESSAGE HANDLING

Response would be:

ROGER = GROUP TOO = ACFWY = OVER

Or..

ROGER = WORD AFTER BROKEN = ANTENNA = OVER

MESSAGE HANDLING

OUTGOING CORRECTIONS

If you make a mistake whilst transmitting, pause, say

CORRECTION and continue from the last correct word.

For example… LAND ROVER TYRE = CORRECTION

= ROVER BONNET = WILL NEED REPLACING AT NEXT SERVICE =

MESSAGE HANDLING
Techniques

Write out all messages received in 'shorthand'

MRB44 MSG N18C/14 RBT R
TØ91135ZMAY
DMSG // DFS (text) FSD //

MESSAGE HANDLING
Techniques

Listen for 'READ BACK' instructions…

DON'T GET CAUGHT OUT…!

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Any questions ?

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Session 6

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PLAINDRESS MESSAGE WRITING EXERCISE 2

BRIEFING

PLAINDRESS MESSAGES EXERCISE

- Write out 2 messages, 1 of your choice of each type – use the message forms

- Do not insert an addressee callsign yet

- Optionally one message can be given a ‘READ BACK’ instruction (instead of Read Back Text)

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Any questions ?

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DIRECTED NET EXERCISE 1

BRIEFING

DIRECTED NET EXERCISE 1

Using your plaindress messages written earlier..

- First callsign – you need to set up your net.
- Direct traffic – SEND ONE ROUTINE TO….
- Hand over control to another callsign - ASSUME CONTROL.
- New NCS – set up your net and direct traffic then hand over control to another callsign.
- Keep a log of transmissions sent and received.
- Keep going until everyone has sent and received one of each type of message.

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DIRECTED NET EXERCISE 1

DEBRIEF

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DIRECTED NET EXERCISE 2

BRIEFING

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DIRECTED NET EXERCISE 2

Using your plaindress messages written earlier..

- First callsign – you need to set up your net.
- Direct traffic – ONE ROUTINE FOR….
- Change frequency - CHANGE FREQUENCY.
- RADIO CHECK – after frequency change.
- Time synchronisation - TIME.
- Information message – DO NOT ANSWER
- Close down net – CLOSE DOWN
- Next callsign in list sets up a net, continue until all callsigns have acted as NCS.

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DIRECTED NET EXERCISE 2

DEBRIEF

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Any questions ?

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Session 7

Advanced Radio Operator Course

Basic Health & Safety in Radio Communications

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Health & Safety

Recall your 1st Class Basic Radio Module…

What were the key safety factors whilst planning radio operations or using radios?

Health & Safety

What Health & Safety priorities would you have to consider when setting up and operating any Radio Equipment?

Slide 149

[redacted] What is the difference between this slide and the previous slide?

[redacted] 29/11/2016

Health and Safety

- Mains voltages
- Batteries
- RF radiation and RF burns
- Trip / slip hazards
- Lifting
- Fire
- Antenna/Mast security

Health and Safety

- Overhead Voltages/Underground Services
- Correct Headset/Speaker volume
- Power and Antenna cable tidiness and security
- Weather
- H&S Documentation

Health and Safety

Every Squadron should have an up to date

RISK ASSESSMENT

for Radio Training

Details are in ACP5 & ACP44

The Generic Risk Assessment will give you an idea of what to include.

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Health & Safety

Any questions?

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Other Callsigns

You may occasionally hear other operators using the frequecncies we use....

These could be

ACF/CCF and SCC Callsigns which you are allowed to contacted

ACF/CCF and SCC Callsigns

Sea Cadet Corps callsigns begin with MF

Army Cadet Force / Combined Cadet Force callsigns begin with MA, MC and MZ

For example **MZB74**

Health & Safety

Any questions?

Session 8

Planning Comms Events

When planning a radio event some consideration should be given to the following to make the event successful:

- What is the event?
- Where is the event being held?
- What type of radio traffic will be required?
- What is the terrain like – and hence what is the radio coverage likely to be at the location?

Planning Comms Events

- Where will the control station be situated?
- Is mains power available?
- What type of radios are required?
- How many radios are required?
- What callsigns will be issued?
- How long will the event last?
- Have you carried out a 'Test Coverage Ex'

Planning Comms Events

- Will an elevated antenna on a mast be required?
- What reserve radio equipment is required?
- Is there a sufficient supply of charged / spare batteries for the event?
- Who will operate at each location and who will maintain the Control Station Logbook?
- What is your 'lost contact procedure'?

Planning Comms Events

- Is an overhead and ground survey required (for masts and mast guy pegs)?
- Has a survey and Risk Assessment been carried out and approved?
- Is a PiPE or other approval required?
- Who will deliver the event safety briefing?
- Any weather / shelter considerations required?

Planning Comms Events

Any questions?

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Session 9

National Radio Exercises

- Throughout the year the ACO provides radio exercises, some competitive, for Squadrons, Wings and Regions to take part in.
- Exercise dates are distributed annually.
- Details of each exercise can be found on Bader Sharepoint – ACP 44 (Chapter 9)

National Radio Exercises

- Providing you have Qualified Operators you can participate.

- All competitive radio exercises require a logsheet to be submitted to the Exercise Co-Ordinator within a certain timescale - usually 4 weeks.

National Radio Exercises

Any questions?

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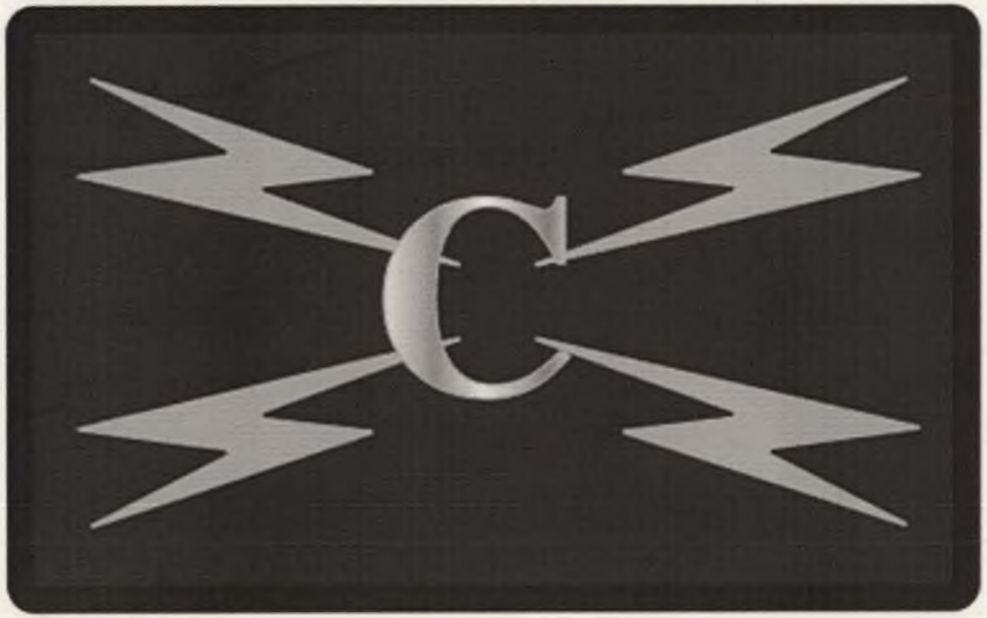
Advanced Radio Operator Course

You can now start to plan for the ACP46 Foundation Equivalent Amateur Licence Module.

Foundation Radio Licence

Silver Badge Module



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the next generation

Local H&S Brief

- Local hazards
- Local alarms and procedures
- Toilets
- Breaks
- Eating and drinking
- Phones
- Smoking

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the next generation

Proposed Timetable - Saturday

- **08.30**
  - Brief history
  - Licences and callsigns
- **Break 09.15**
  - Technical basics
- **Lunch 12.00**
  - Transmitters
- **Break 14.00**
  - Receivers
  - Aerials and feeders
  - EM waves and propagation
- **Dinner 17.00**
  - Mock exam paper

ROYAL AIR FORCE AIR CADETS
the next generation

Proposed Timetable - Sunday

- **08.30**
  - Licence conditions & parameters
  - Operating practice
- **Break 09.30**
  - EM Compatibility
  - Safety
  - ATC and amateur practice
- **Break 10.30**
  - HF Practical Assessment
- **Lunch 12.00**
  - HF Practical Assessment (continued if necessary).
- **Break 14.30**
  - Exam

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the next generation

COMMUNICATOR QUALIFICATION (SILVER)

a. The Advanced Radio Operator module will teach the cadets how to run a radio Network Control Station (NCS) and supervise radio operators under their command. This module is **required** for this qualification.

b. The Foundation Amateur Radio Module is completely described within ACP46 and allows the cadet to get a nationally recognised qualification in Radio and Electronics that employers will value. **Optional**

c. The Local Area Networking module will teach the cadet how to install a network in a home or small office. It will include setting up routers and switches, configuring PCs, configuring and setting security for Wi-Fi, setting up a file server and configuring shared folders. **Optional**

d. The Practical Data Communications module is fully described in ACP45A and will allow cadets to connect a computer to a radio, normally HF, and send data messages instead of voice. **Optional**

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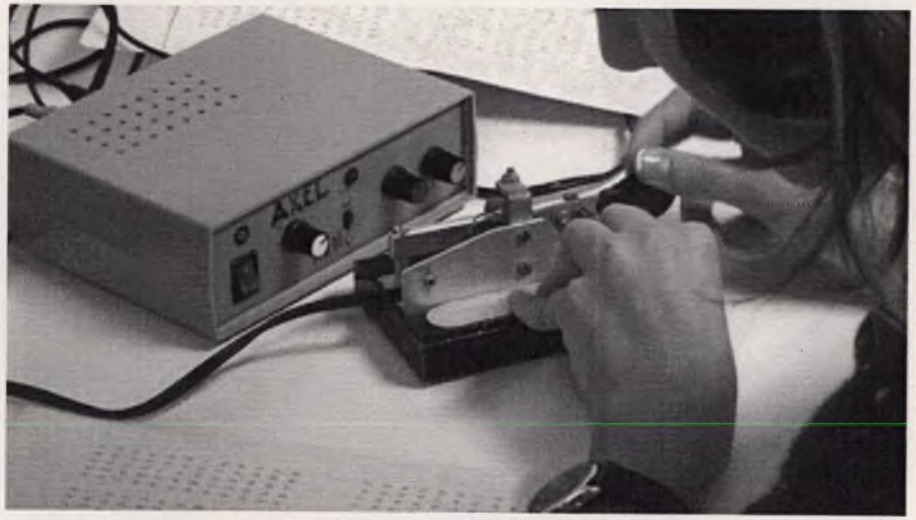
Radio Telegraphy

- Radio Telegraphy is used to refer to the transmission of messages (usually in Morse code).
- The older term 'wireless telegraphy' (W/T) is still sometimes used.
  - Morse telegraphy is relatively slow
  - Operators must be trained in Morse code.
- It can often get through where voice or other modes fail. Radio telegraphy uses an RF signal as the carrier of data.
  - This used to take the form of RF carrier switched on and off to form Morse signals (CW) or the use of a modulated audio tone similarly switched (MCW).
  - Modern telegraphy is usually achieved by shifting the carrier frequency of the transmitter by a small amount which is heard in the receiver as a tone (Frequency Shift Keying, FSK).
  - There are others, particularly used where the data may be a picture (Slow scan TV) or digital data such as "packet radio".



Radio Telegraphy

- By the use of Data modes large amounts of data can be transmitted quickly, but there can be a built-in time lag due to the need to encode/decode and present the data, even with the aid of a fast computer.

- The content of a message is not readily understood by a casual listener unless the encoding process is known, so a measure of confidentiality is maintained.

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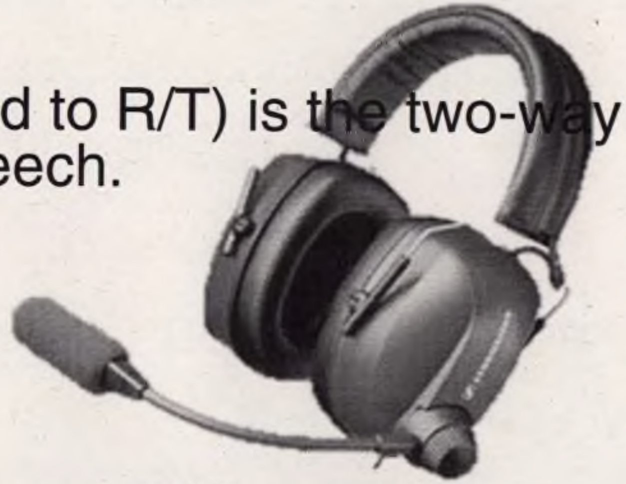
Radio Telephony

- Radio Telephony, (properly abbreviated to R/T) is the two-way communication by radio, usually of speech.
  - ground-to-ground
  - ground-to-air
  - air-to-air



- The basic principle behind radio telephony (R/T) is that a transmitted RF carrier has upon it “impressed”, or modulated, speech or audio tones using amplitude, frequency or (sometimes) pulse modulation.

- No skilled operator is needed and the final output is immediately intelligible to the person receiving (codes & ciphers excepted).

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Broadcast

- The term “Broadcast Radio” covers all aspects of commercial radio and television operations such as those operated by the BBC and ITV etc.
- These services are strictly one way
- Any contact with the studio being conducted by letter, telephone and, more recently, e-mail.
- There is often an element of ‘pecuniary interest’ (ie, profit) which is strictly forbidden within the Amateur service.
- Apart from the basic necessities for adjusting volume and tuning, it is not important to this course except in providing examples of standard technical practices in the field of radio engineering.

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Citizens Band

- Low power personal radio communication system
  - legalised in UK 1981.
  - Operates in the 27 MHz to 28 MHz part of the radio spectrum.

- The licensing authority has placed strict restrictions on transmitter and aerial design and manufacture in an attempt to ensure that operation is restricted to the local area.

- Unlike Amateur Radio, it is not intended that CB is used for long-distance work.

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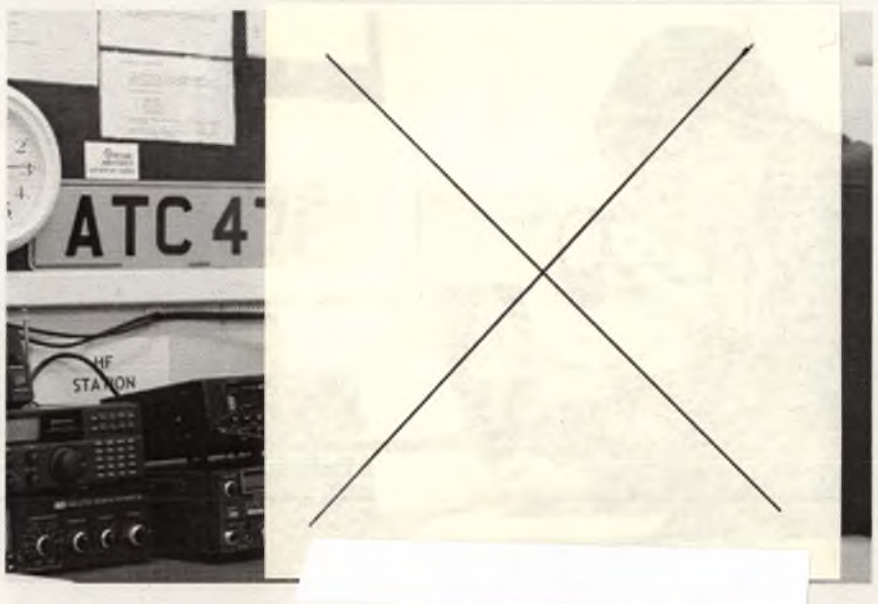
Amateur Radio

- Amateur Radio is a hobby, the purpose of which is “self-training in Radio Communication”.
  - intended for both long range and local communication on several ‘bands’ (blocks of spectrum space)
- It may be applied to:
  - Emergency communications (as an aid to the Civil Power) Technical innovation and development
  - Recreation International friendship Development of personal skills
  - A stepping stone into a career in radio in the services or civilian life



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Radio Amateur Licences

Foundation	Low power limit of 10 watts, restricted privileges
Intermediate	Higher power level of 50 watts, more bands
Full	Maximum power of 400 watts, all bands, full privileges. Can be used overseas

* note the Foundation Licence is only for use within the UK

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Callsigns

- The call signs allocated to the United Kingdom are in the series of the letters G or M or in the number 2 series.

- There is normally a question on call signs in the exam paper. The UK Amateur Call

- Signs indicate the level of licence held by the operator and a geographical locator.

G0 G1 G2 G3 G4 G6 G7 G8	England Full Licence
M0 M1 M5	England Full Licence
M3 M6	England Foundation Licence
2E0 2E1	England Intermediate/Novice Licence

Callsigns

- Regional locators are added after the UK prefix

	Personal		Club
D	Isle of Man	T	Isle of Man
I	Northern Ireland	I	Northern Ireland
J	Jersey	J	Jersey
M	Scotland	S	Scotland
U	Guernsey	P	Guernsey
W	Wales	C	Wales
		X	England

- Regional locators are added after the UK prefix

EA	Spain	EI	Eire	F	France
HA	Hungary	HB	Switzerland	HV	Vatican
I	Italy	LA	Norway	OE	Austria
OK	Czech Republic	ON	Belgium	OM	Slovakia
OZ	Denmark	PA	Netherlands	SP	Poland
SV	Greece	3A	Monaco	4U1	United Nations

Be back in 5 minutes

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Technical Basics

Hope you like physics and/or electronics!

Voltage, Current and Resistance

- Numbers

Multipler	Prefix	Symbol	In Decimal
10^6	Mega	M	One million
10^3	Kilo	k	A thousand
10^{-3}	Milli	m	Divided by a thousand
10^{-6}	micro	μ	Divided by one million

Voltage, Current and Resistance

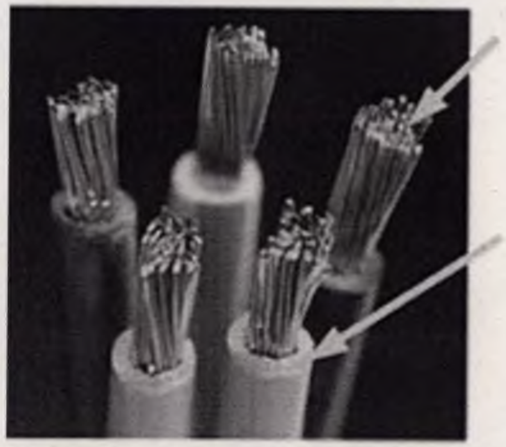
- Symbols

Principle Unit	Symbol	Description
Amperes	I	measurement of the current flowing in a circuit. It is measured with an Ammeter which is connected 'in line' (series) with the load
Ohms	Ω or R	A unit of measurement of resistance. Multiple units of the OHM are sometimes employed, eg, Kilo ohm, Mega ohm and even milli-ohm.
Volts	V	A unit of measurement for electric potential (or electric potential difference) between two parts of a circuit. It is measured with a Voltmeter in parallel with the points where the potential difference is being measured.
Watts	W	A measurement of power. The power consumption of an electrical device can be found by multiplying the voltage supplied by the current drawn

Conductors and Insulators

- A **conductor** is a material that allows a ready unimpeded flow of electricity; examples being copper, aluminium, silver, gold and most other metals to one degree or another.

- An **Insulator** is a material that does not conduct electricity e.g. glass, china and most plastics.

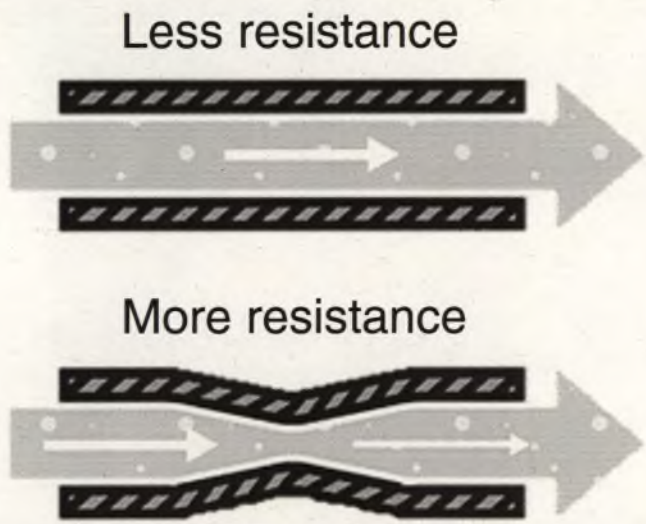


- There is another class of materials called “semi-conductors”, from which electronic circuits are made. We’ll deal with them in the Intermediate and Advanced courses.

Resistance

- An electric current is a flow of free electrons through a conductor.

- The size (or quantity) of current flowing through a conductor for a given applied voltage depends upon the opposition to free movement of the electrons caused by the structure of the material.



- A good conductor is a material which has low resistance and which allows a large current to flow.

- A poor conductor has high resistance, and allows a smaller current to flow for the same applied voltage.

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Ohms Law

"The current in a circuit is directly proportional to the applied voltage and inversely proportional to the circuit resistance".

current (I) = voltage (V) divided by resistance (R)

$$V = I \times R \qquad I = \frac{V}{R} \qquad R = \frac{V}{I}$$

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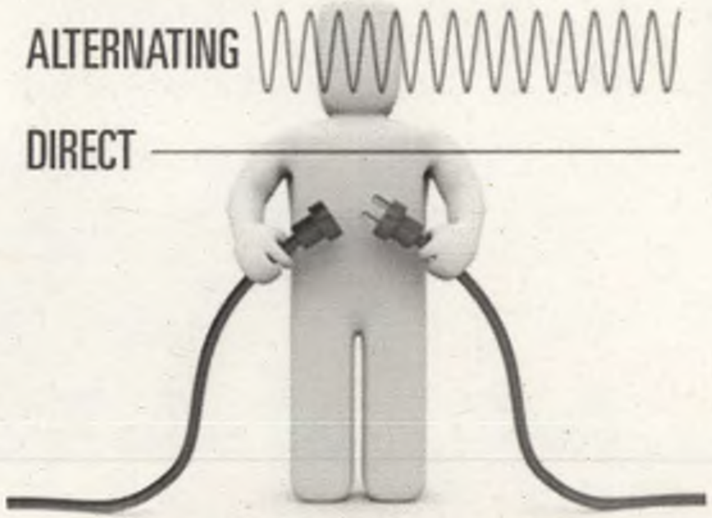
Current

- **Direct Current.** A direct current (dc) consists of a flow of electrons in ONE direction only in a circuit.
  - An example of a source of dc is a battery.
  - Some circuits require a particular way of connecting it (a filament lamp in your torch is not sensitive to polarity, but your Transistor Radio definitely is!).

- **Alternating Current.** An alternating current (ac) consists of electrons which flow BACK AND FORTH at regular intervals.
  - The domestic mains supply AC (Alternating current) going from a peak, through zero and to a peak negative value.
  - In the case of our mains supply, this happens 50 times per second (measured in Hertz, symbol Hz).



Advantages/Disadvantages of AC over DC

Advantages	Disadvantages
Conversion of dc from one voltage to adifficult and inefficient The device used to convert ac from one value to another is called a TRANSFORMER. It is easier to generate ac using a Generator. Converting voltages easily increases efficiency.	Electronic circuits are normally supplied by dc, so the ac has to be converted to dc by special power supply circuits.

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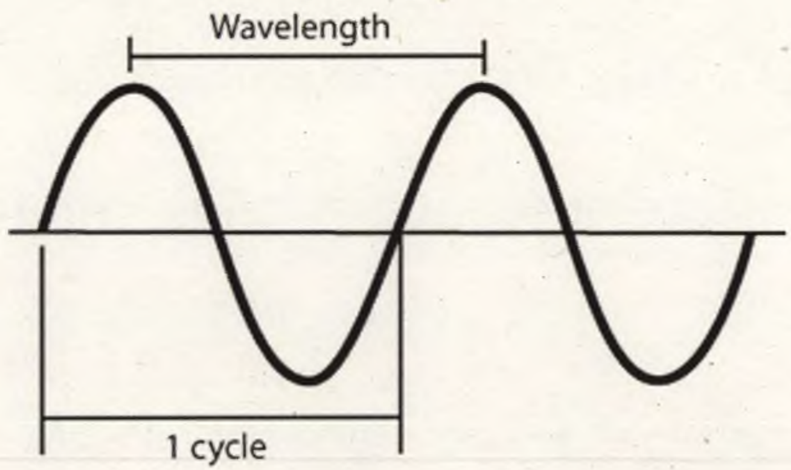
More about Alternating Current

- One **CYCLE** is that current (or voltage) variation from zero, through the maximum positive value, back through zero to the maximum negative value and then back to zero again.

- **Period or Periodic Time** (T).
  - The time taken to complete one cycle,



- **Wavelength.** The wavelength is the linear **distance** occupied by one complete cycle. (has the Symbol λ)

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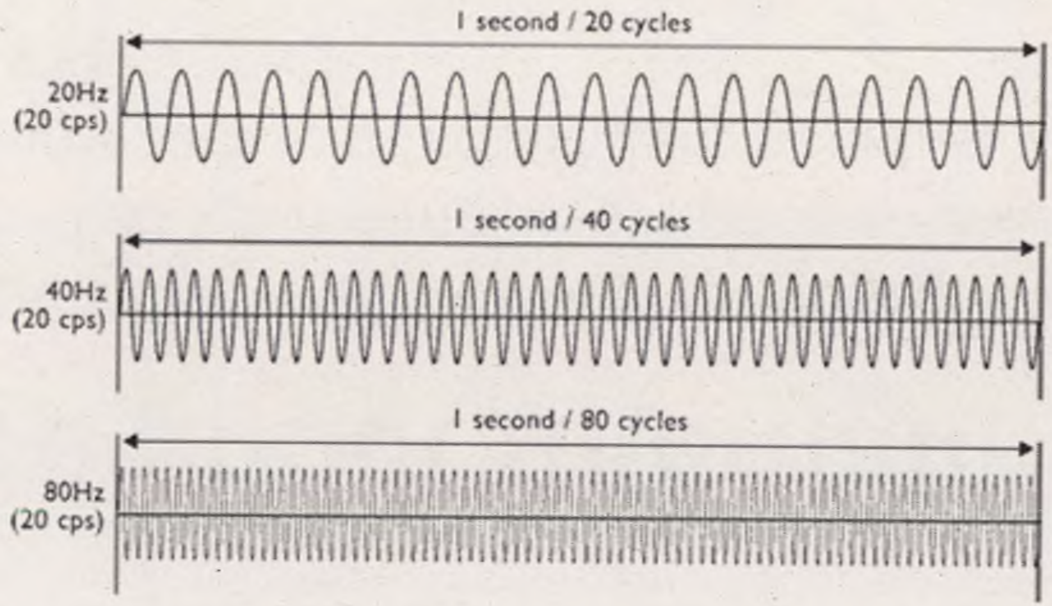
More about Alternating Current

- **Frequency**. The number of cycles which are completed in one second.
  - The unit is the Hertz (Hz).
    - If 10 cycles are completed in one second, the frequency is 10 Hz.
    - If 100 million are completed, the frequency is 100 MHz.



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Frequency Spectrum

Abbreviation	Description
AF	Audio frequency, 20Hz to 20kHz
VLF	Very low frequency, 3 kHz – 30 kHz
LF	Low frequency, 30 kHz – 300 kHz
MF	Medium frequency, 300 kHz – 3 MHz
HF	High frequency, 3 MHz – 30 MHz
VHF	Very high frequency, 30 MHz – 300 MHz
UHF	Ultra high frequency, 300 MHz - 3000 MHz

Can you remember…

- What's the mains frequency?
- 50Hz

- What is it's Voltage?
- 230 Volts AC

Frequency for normal hearing: 20Hz – 20kHz

Frequencies for audio communication by telephone and radio : 300 Hz – 3 kHz

It is useful to remember:

Metres x MHz = 300

$$f = c / \lambda$$

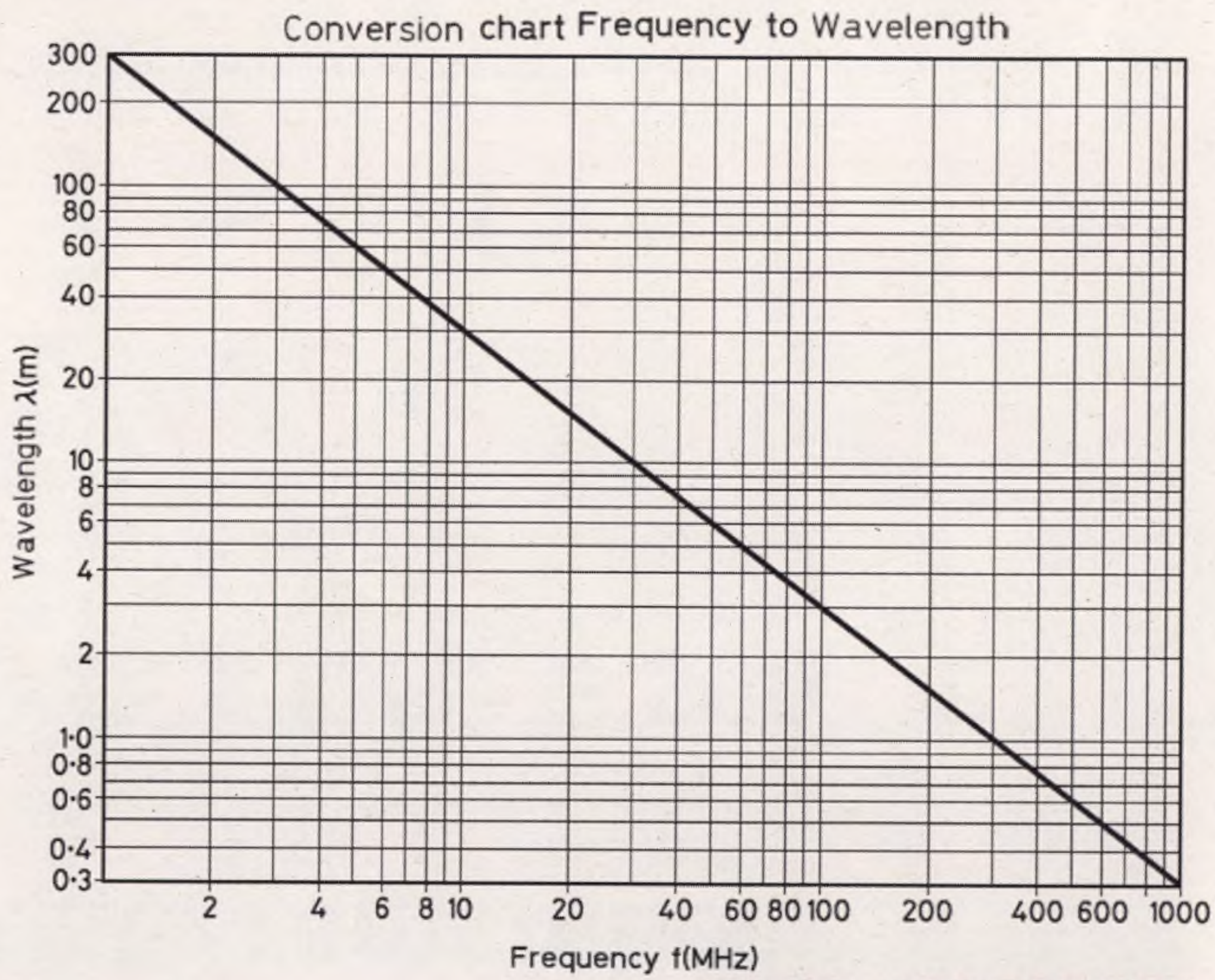
$$\lambda = c / f$$

Where c = speed of light = 300,000 km/sec

Use the chart…

- Convert to λ:
  - 150Mhz
  - 100MHz
  - 10MHz
  - 50MHz

- Convert to f:
  - 100m
  - 3m
  - 1m
  - 5m

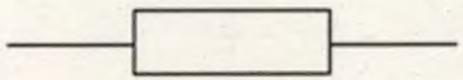


Circuit symbols

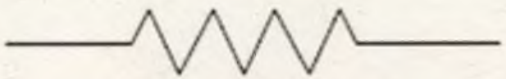
Single
Cell

2-cell
Battery

Multiple cell
Battery



Resistor
(preferred symbol)



Resistor
(alternative symbol)

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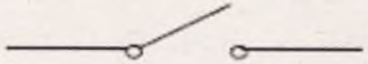
Light bulb

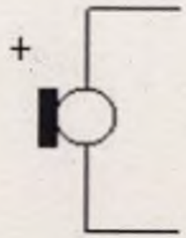


Switch

Aerial
(Antenna)

Earth

Loudspeaker



Microphone

LUNCH

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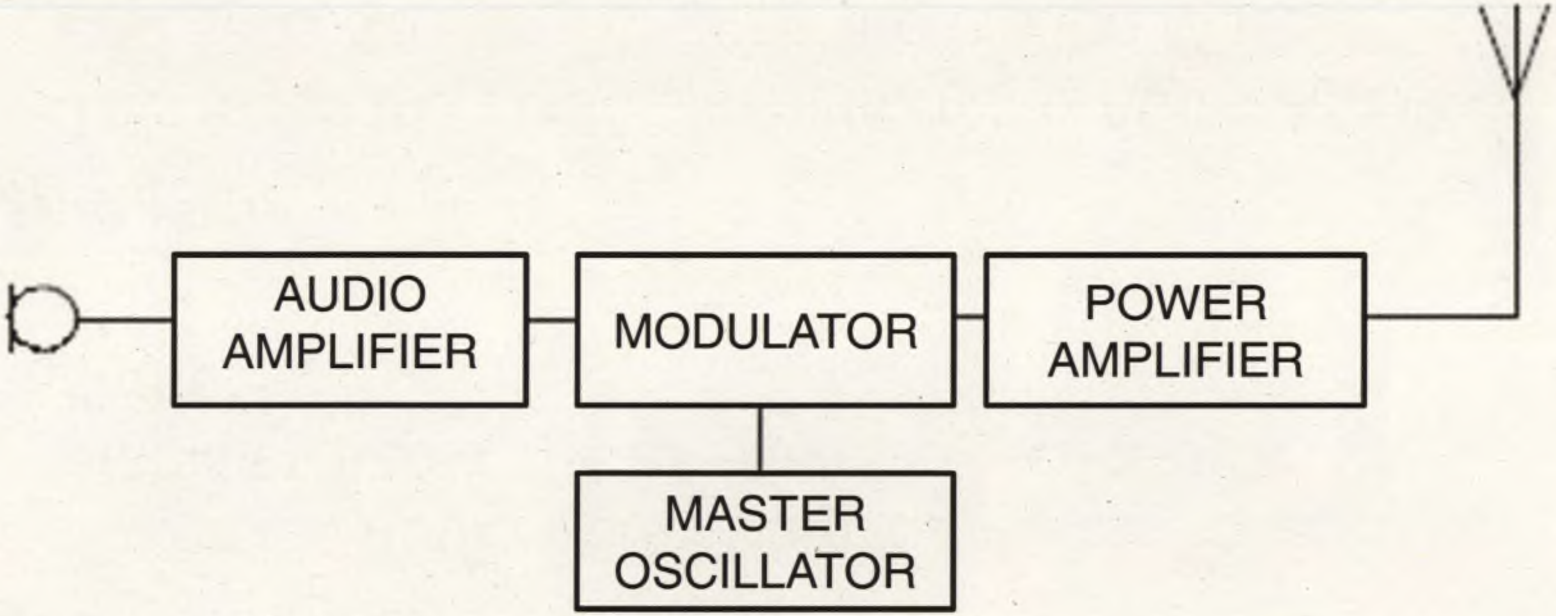
Can’t concentrate on an empty stomach…

Transmitters

After all, communicating means sending!

Simple AM Transmitters



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What these bits do...

- **Audio Amplifier.**
  - Takes the audio signal from the microphone and amplifies it to a suitable level to be added to the carrier.

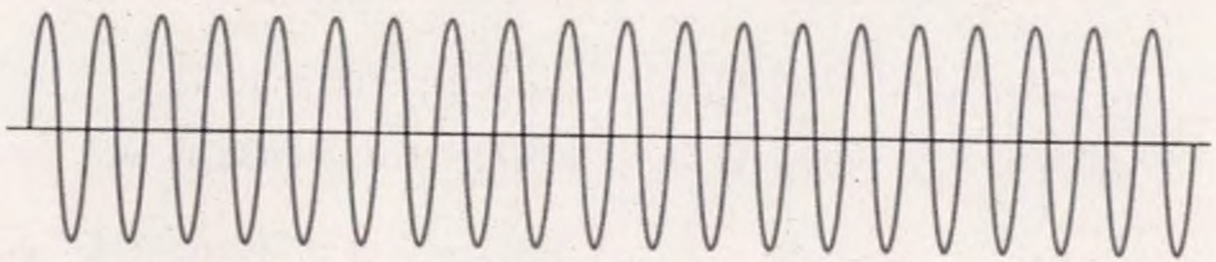
- **Modulator.**
  - This takes the audio signal from the Audio Amplifier and adds it to the RF generated in the Master Oscillator. It defines the **Amplitude** of the combined signal.

What these bits do…

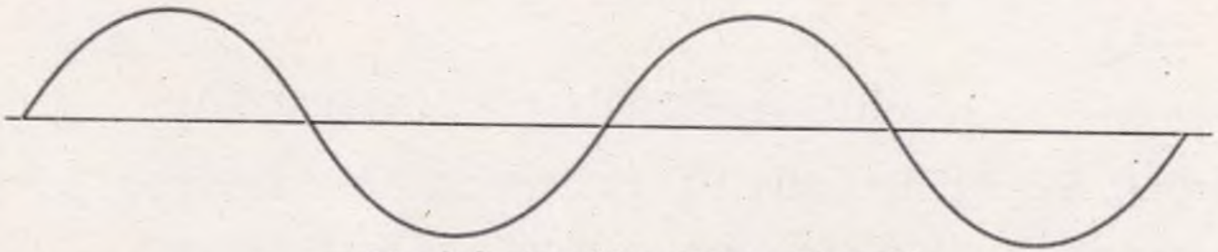
- **Master Oscillator**
  - The master oscillator (MO) is the source of RF, and determines the sine wave of constant amplitude and frequency which usually defines the final output frequency of the transmitter.

- **Power Amplifier**
  - Provides sufficient power to overcome losses in the transmission path to the antenna.

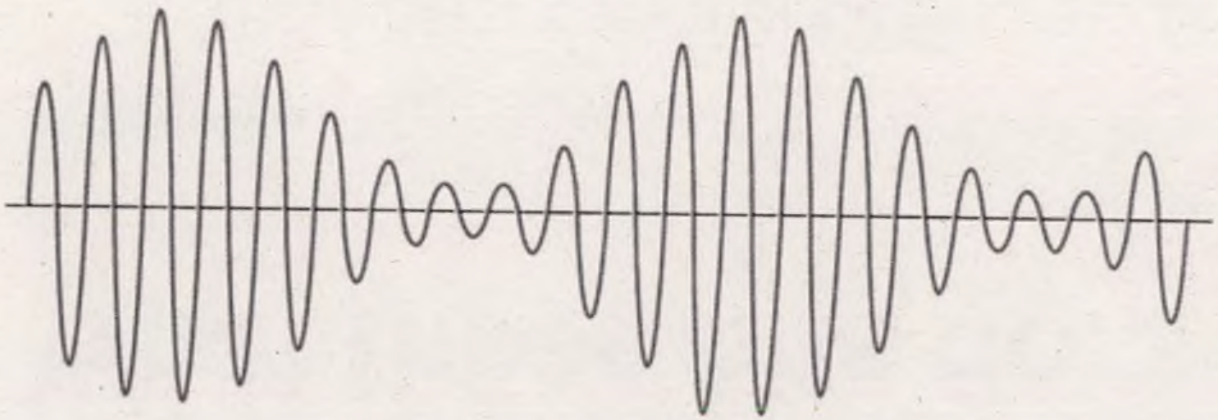
Amplitude Modulation



Carrier Signal



Modulating Sine Wave Signal



Amplitude Modulated Signal

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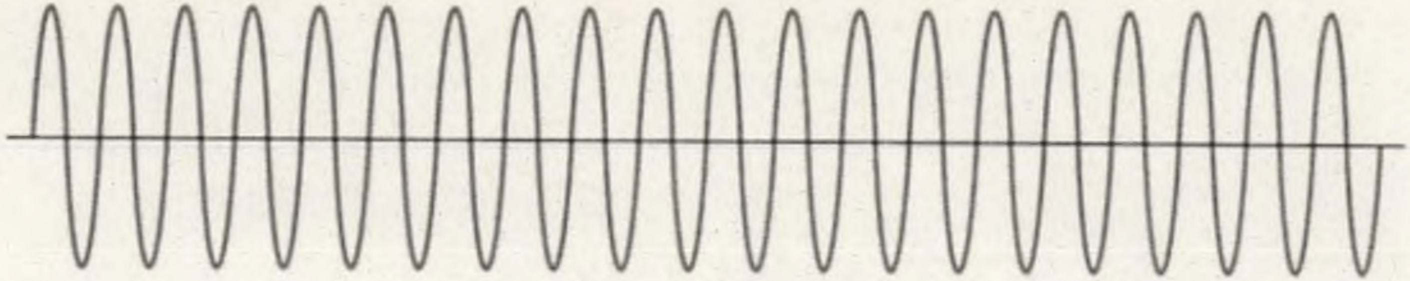
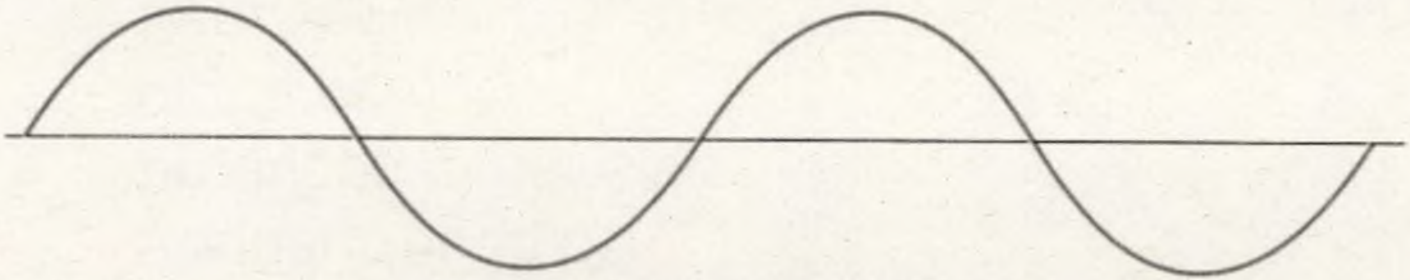
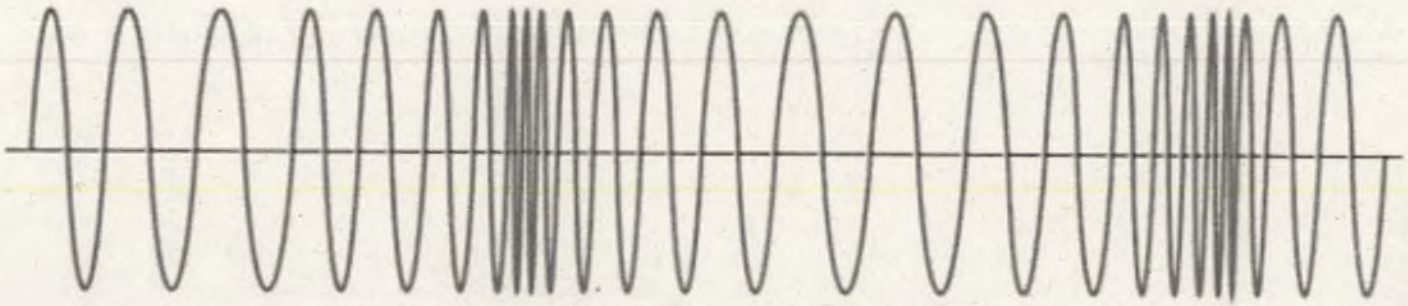
Frequency Modulation



Carrier Signal



Modulating Sin Wave Signal

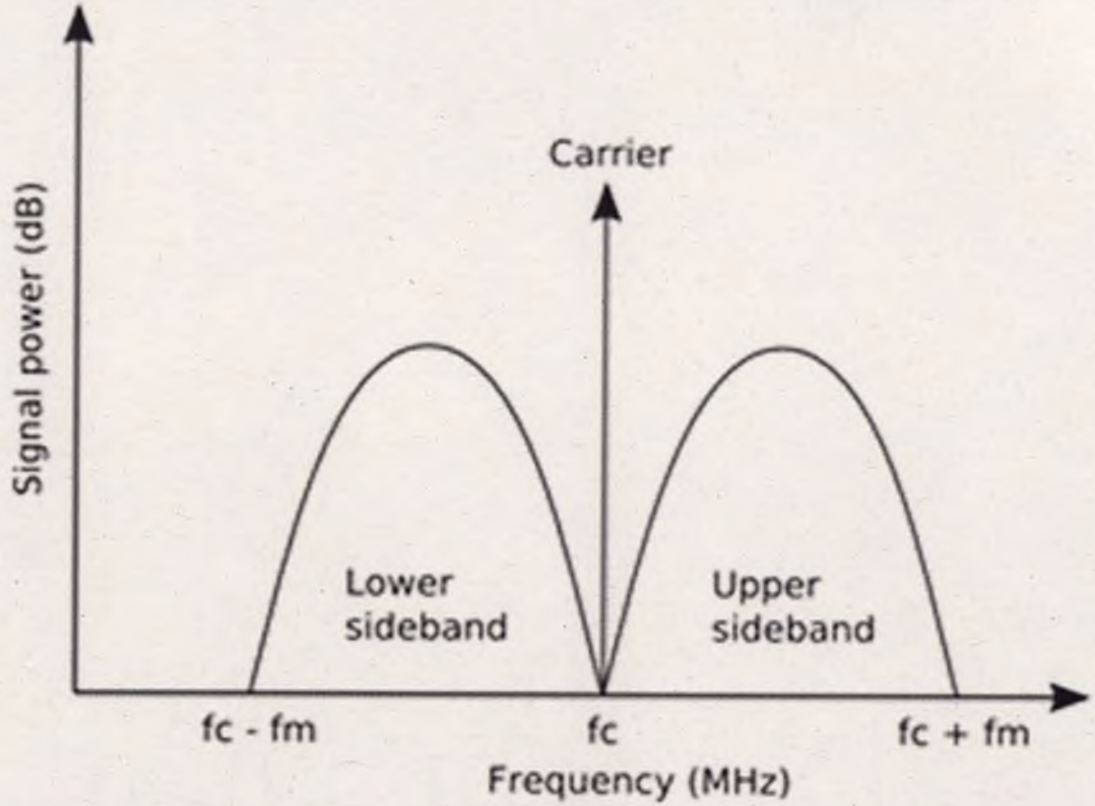


Frequency Modulated Signal

Sidebands

- Modulation causes additional frequencies to be produced either side of the carrier frequency.

- These are called Sidebands.



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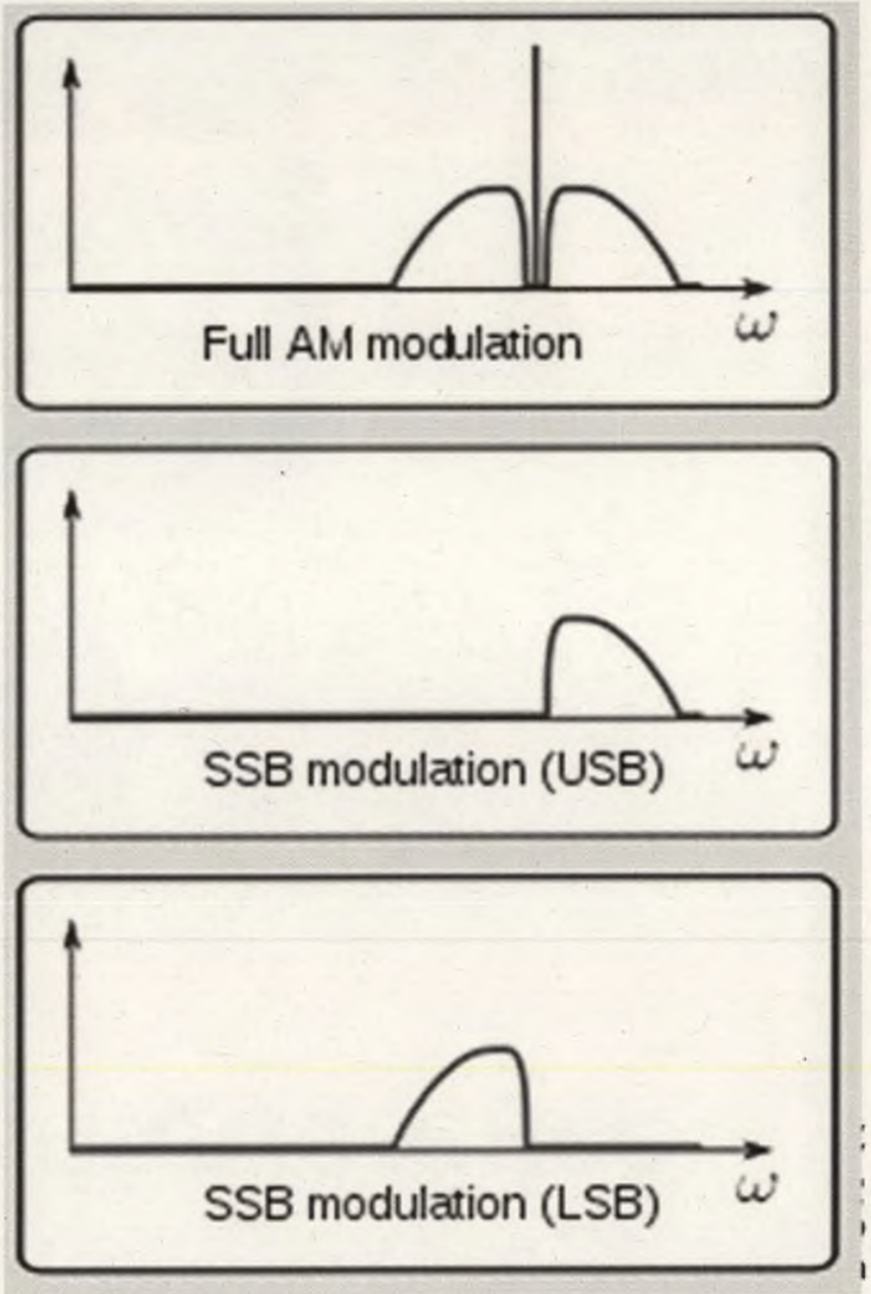
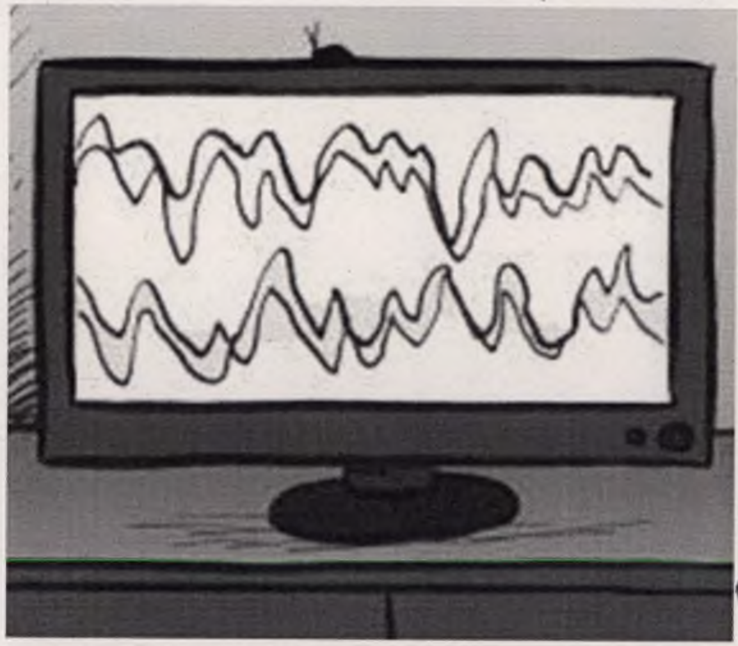
SSB

- Single Side Band
- The carrier wave and one of the sidebands are suppressed in the transmitter.
- This concentrates the power nearly 4 times!
- Does increase chance of interference (TV)



Modulation and interference

Least Likely	FM
Slight Likelihood	CW
Most Likely	AM and SSB



Frequency Allocations

FREQUENCY	USED BY
87.5 - 108.0 MHz	Broadcasting
108.0 - 117.975 MHz	Aeronautical Radio navigation
117.975 - 137.0 MHz	Aeronautical mobile
137.0 - 138.0 MHz	Space operations and space research
138.0-144.0 MHz	Land mobile
144.0 - 146.0 MHz	Amateur and Amateur satellite
146.0 - 149.9 MHz	Mobile (except aeronautical mobile)
149.9 - 150.05 MHz	Radio navigation-satellite
150.05 - 152.0 MHz	Radio Astronomy
152.0 - 156.0 MHz	Land mobile
156.0 - 158.525 MHz	Maritime mobile
158.525 - 160.6 MHz	Land mobile
160.6 - 160.975 MHz	Maritime mobile

Be back in 5 minutes

TIME FOR A BREAK

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Receivers

We would like to hear someone…

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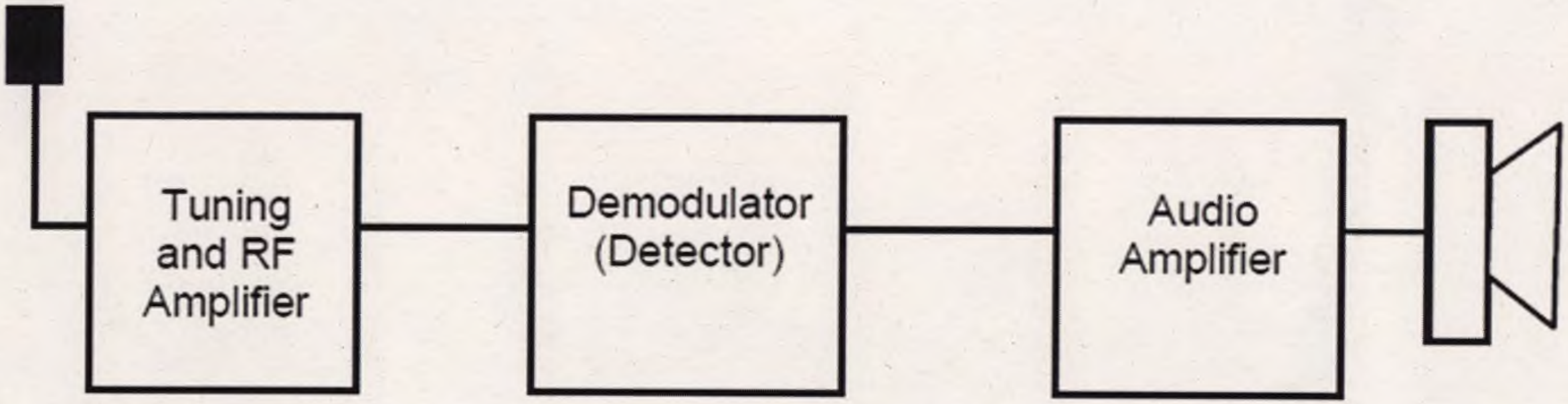
Receivers



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Receiver Requirements

- **Tuning.**
  - With many signals present at the input to a receiver, selection of the required one is necessary to prevent distortion of the output.
  - All other signals must be rejected or attenuated to a level at which they produce no interference at the receiver output.

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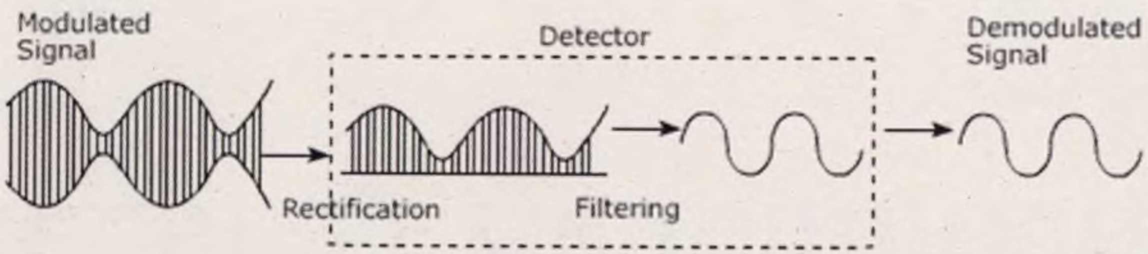
Receiver Requirements

- **Demodulation.**
  - (or Detection). All signals received are at radio frequency. To obtain the intelligence (audio) from the signal, an appropriate method of demodulation (extracting the original audio) is essential. This will depend on the type of modulation that was used at the transmitter.



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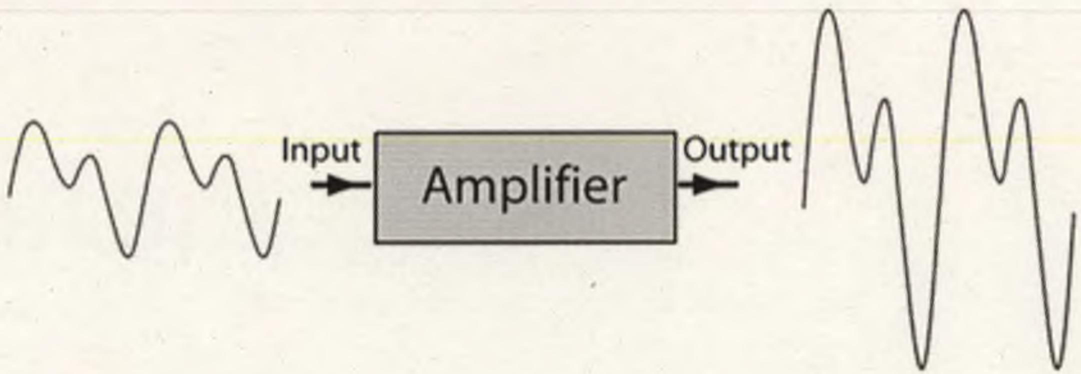
Receiver Requirements

- **Amplification**.
  - Signals picked up by an aerial and fed to a receiver are of very small amplitude, usually microvolts (μV). To obtain a usable output, therefore, a large amount of amplification is required.
  - The output from the demodulator (or detector) is at audio frequency, but at very low level.
  - A simple amplifier will drive the headphones or speaker.



Receiver Parameters

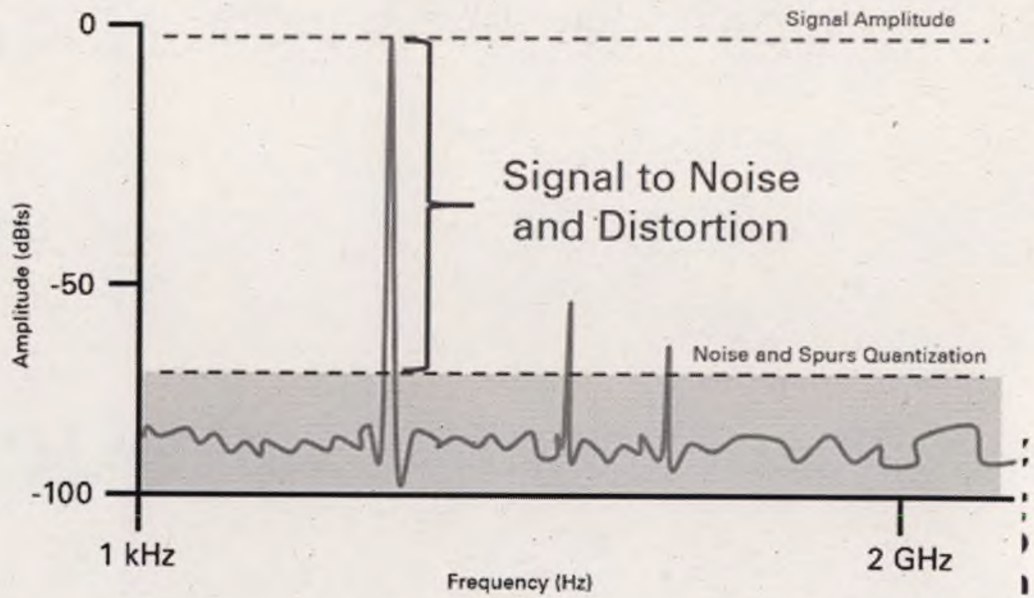
- **Selectivity**
  - Selectivity (done by tuning) is the **ability** of the receiver to select the desired signal frequency and reject, or attenuate to a low level, other, unwanted, signals.
  - The effective Q factor of the tuned circuits will determine the sharpness (it's called 'bandwidth') of the frequency selected.

Receiver Parameters

- **Sensitivity.**
  - Sensitivity is the level of RF input signal required to give a standard power output level from the AF amplifier.
  - Sensitivity is usually expressed in terms of microvolts input (RF) for a given audio output.

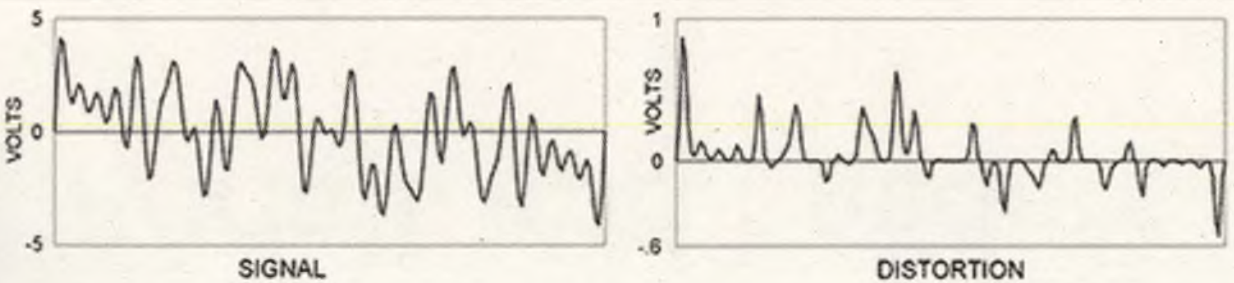
Receiver Parameters

- **Signal-to-Noise Ratio**
  - The maximum sensitivity of any receiver is limited by the ratio of the desired signal's strength to the strength of all interfering noise rather than by the actual gain of the receiver.
  - Noise is also added by the devices in the receiver itself.



Receiver Parameters

- **Fidelity (Distortion)**
  - Fidelity, now usually known as distortion; may be defined as the ability of a receiver to reproduce an output which is an exact copy of the input (modulation) signal.
  - The bandwidth of the receiver must be sufficiently wide to allow good reproduction of the audio, but not so wide as to pass other, adjacent, signals.



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Aerials and Feeders

We would like to receive them well…

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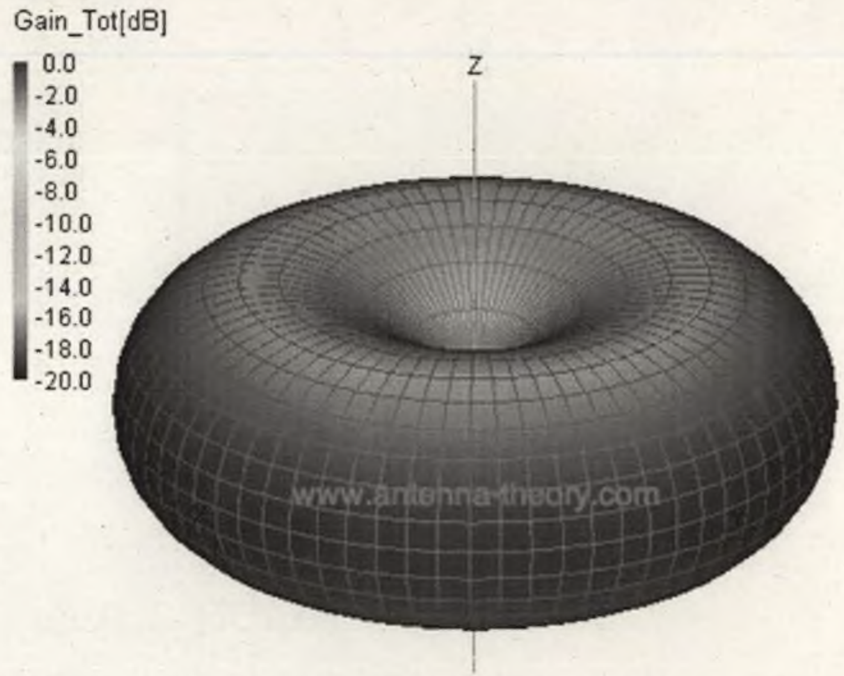
Half Wave Dipole

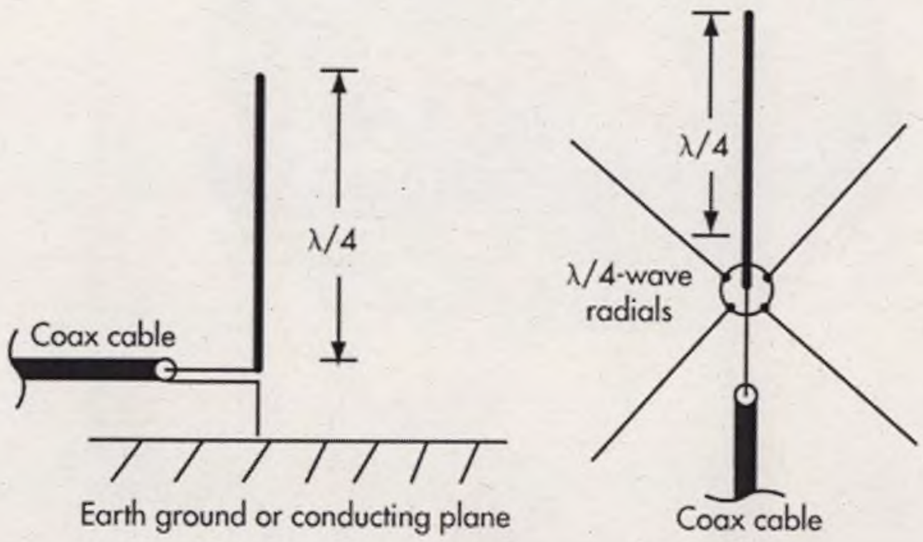
- Nominal Impedance set to 72Ω
  - If we use a 75Ω cable they match well!

- A vertical aerial in free space does not radiate equally in all directions.
  - It cannot, radiate any energy from the ends.



Marconi Aerial

- The aerial consists of a vertical conductor, a quarter-wavelength long, the lower end being just above the earth. One of the feeders is connected to the bottom of the aerial, the other to earth.
- To improve the earth connection with ground based HF aerials, a 'mat' of copper wires radiating out from the aerial may buried in the ground.
- On an aircraft the metal skin acts as a ground plane. It is sometimes known as a 'Monopole' or simply "quarter-wave".



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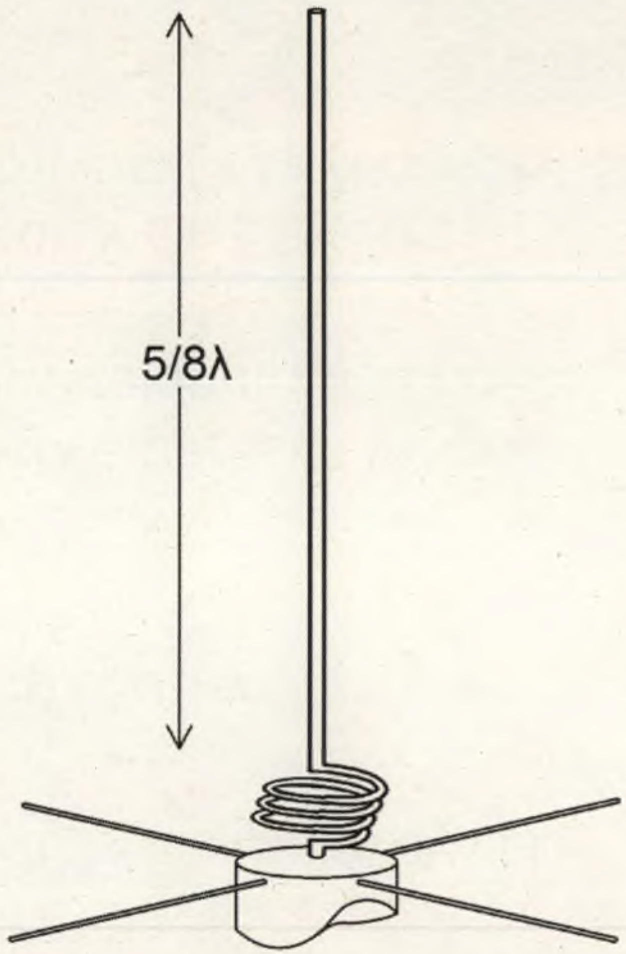
5/8 Whip Aerial

- This type of aerial has more gain than a conventional ¼ wave whip Aerial.
- The loading coil at its base is used to ensure the correct impedance is presented to the feeder and should be physically rigid enough to prevent dimensional changes when in a strong wind.
- This type of aerial is suitable for mobile operation as the vehicle roof usually provides a good ground plane.



How to direct radiation

- If a metal rod is placed in the field radiated from a driven dipole current will be induced, and it will radiate.
  - Parasitic element - The rod gets energy from the driven dipole.

- Both the parasitic element and the driven element radiate EM energy.

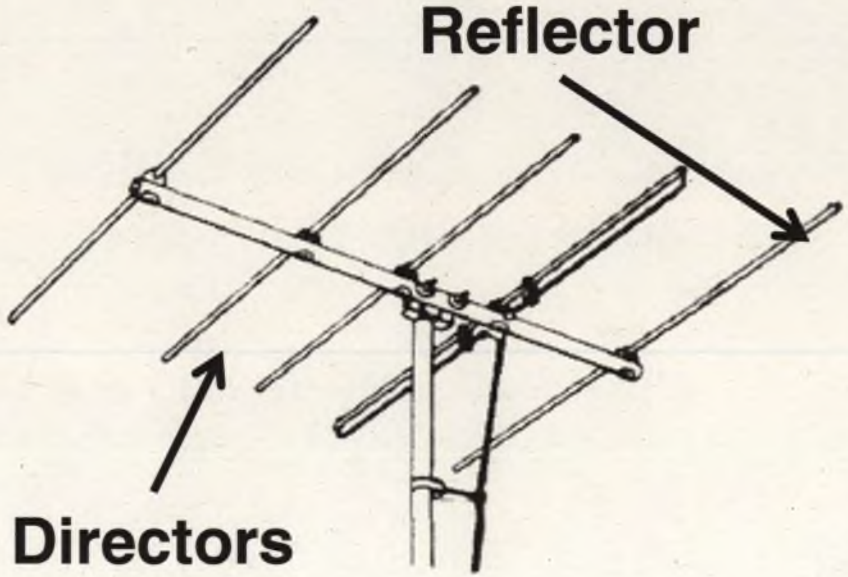
- Best results are obtained when an inductive parasite longer than the dipole is placed a quarter of a wavelength behind the dipole.
  - This parasitic element is called a **reflector**. If the parasitic element is placed in front of the radiator, it is called a **director**.

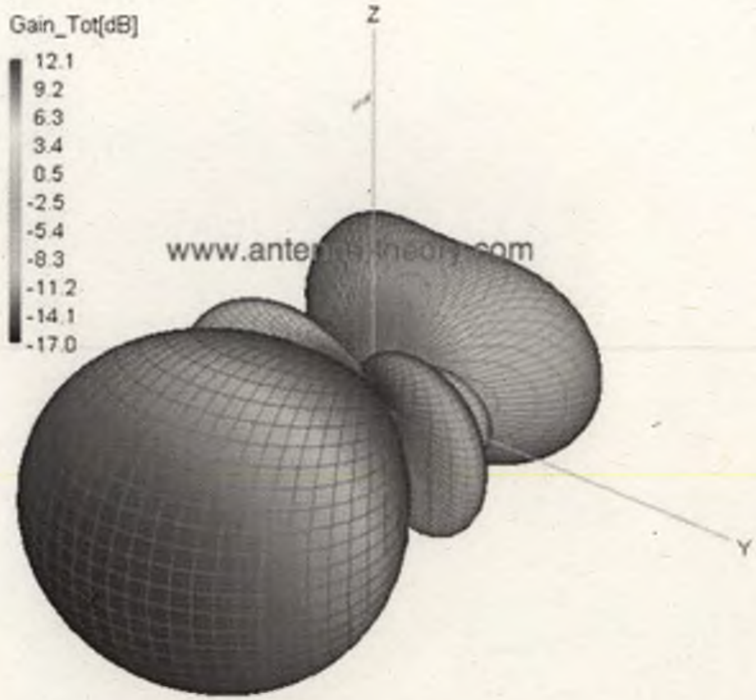
Yagi Array

- A combination of reflector and director used with a driven dipole, gives greater forward radiation.

- The spacing and relative lengths of the elements can be found in many reference manuals.

- The directivity (and gain) can be increased if the number of directors is increased.





Aerial Gain (Directivity)

- An aerial, which radiates in all directions, is called isotropic
- The gain (giving the Effective Radiated Power, ERP) of the aerial is a measure of its ability to radiate energy in a particular direction.
- Gain is usually expressed in **decibels (dB)**, but it is always referred to a reference figure (rather in the same way a Per Cent).
- This is a **logarithmic ratio** in which a power gain of 3dB is equivalent to doubling the **power**
  - eg, if the reference level is **1W,** then the power is written as **dBW**. If the reference is **1mW**, then it is written **dBm**.

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Aerial Gain

dBW	Power (Watts)		Power (Watts)	dBW		Power (mW)	dBm
0	1		1	0	and to	0.25	-6
3	2	or	2	3	demonstrate	0.5	-3
6	4		5	7		1	0
9	8		10	10	dBm	2	3
12	16		20	13		4	6
15	32		50	17		8	9

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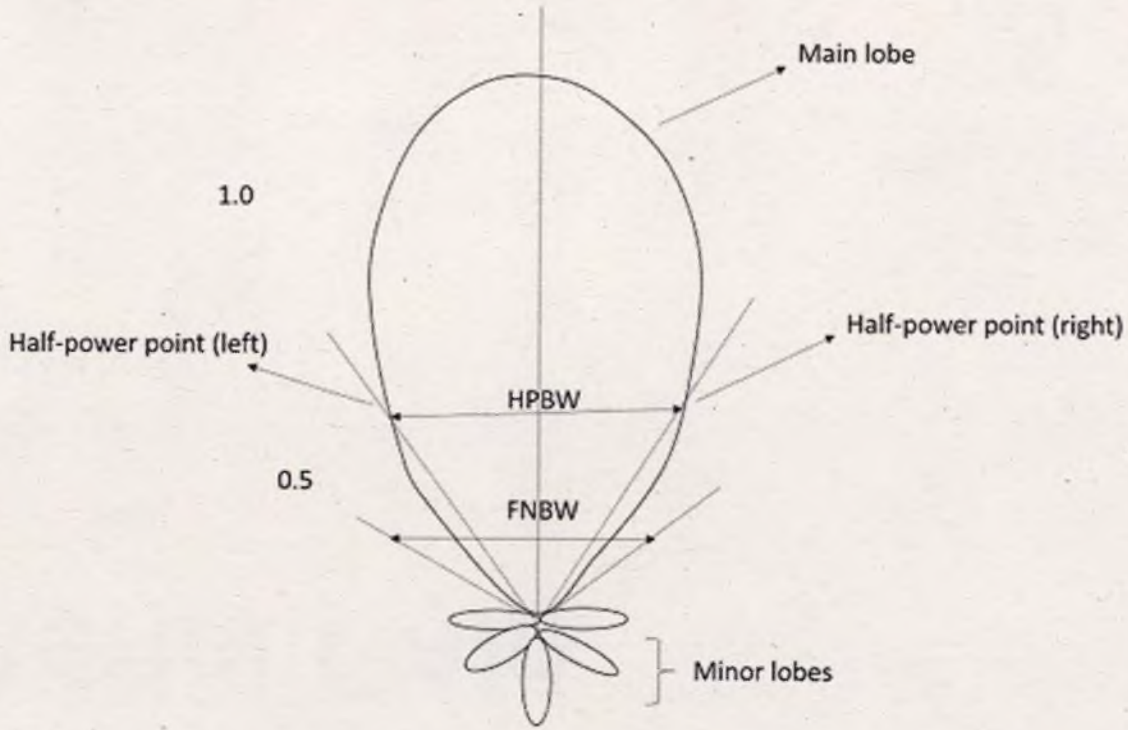
Beamwidth

- The beamwidth of an aerial is defined as the angle between the points of the main lobe corresponding to half the maximum power.



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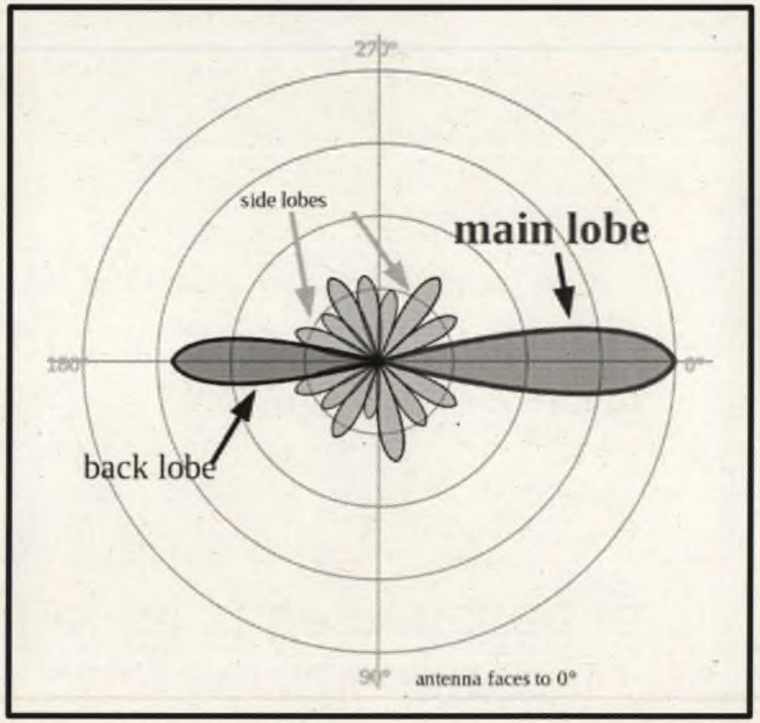
Side Lobes

- All radiation patterns from aerials generate side lobes.
  - They are smaller than the main lobe.
  - Side lobes are generated in directions other than that of the main lobe.



- Their existence is undesirable since they represent wasted power and may receive unwanted signals,
  - eg, deliberate jamming

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Types of Feeder or Line

- In order to achieve maximum transfer of power, the internal impedance of the generator (transmitter) must be matched to the impedance of the aerial at the feed point.

- If a transmission line (or feeder) is used to convey the energy from transmitter to aerial, the characteristic impedance of the line must be matched to the internal impedance of the transmitter .

- A variety of impedance transformers are used to achieve matching; at low frequencies these tend to be coupled coils of wire or coil and capacitor circuits. At higher frequencies they may be transformers or stubs.

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Mismatching a feeder...

- Mismatches between an aerial and its transmission line result in standing waves being set up on the line (Voltage Standing Wave Ratio, VSWR, or just Standing Wave Ratio, SWR).

- These give rise to radiation losses and in extreme cases could damage the transmitter.

- Most modern transmitters automatically shut down or reduce power output if an abnormally high VSWR is detected.

- We can use an "Aerial Tuning Unit" (ATU), to ensure that the transmitter is operating properly.

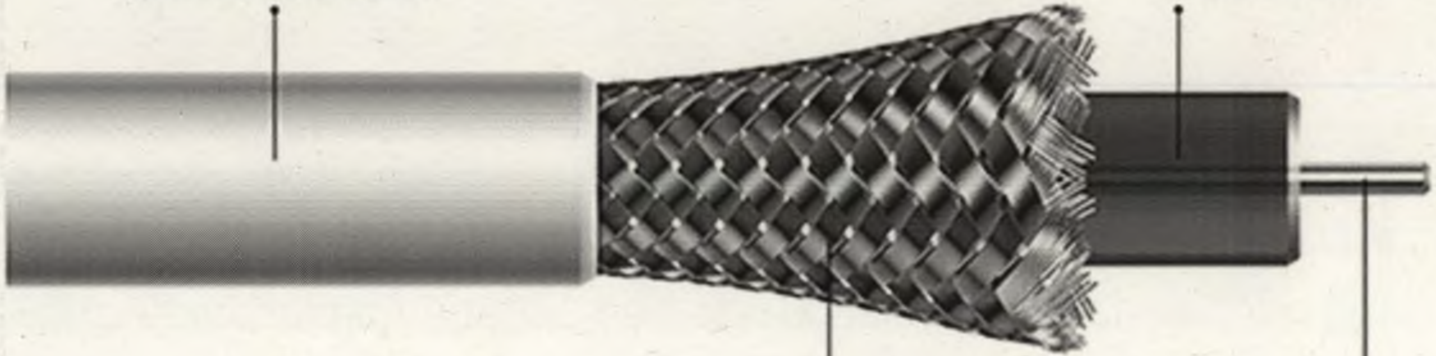
Open (Twin Wire) Feeder.

- 2 parallel wires maintained at a fixed distance apart by insulating spacers (rather like a ladder). It is said to be "balanced",
  - ie, the impedance between each line and earth is the same. This property is useful when matching to aerials.

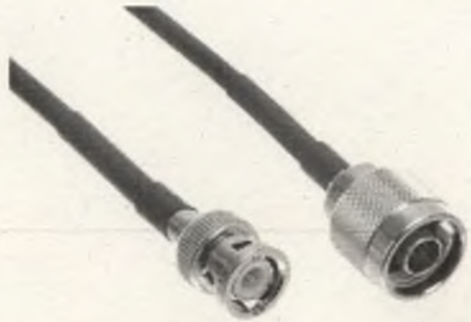
- In ground installations the conductor are only a few centimetres apart and usually run above the ground, supported on insulators spaced at intervals.

Advantages	Disadvantages
High transmitter power outputs can be handled without danger of 'flash over' between conductors.	They are bulky and rigid and can only be used in static installations.
Standing waves can be easily measured and maintenance of the line is easy.	The practical upper frequency limit is about 100 MHz
	The line must be kept clear of ground and walls
	Safety of personnel can be an issue.

Coaxial Cable



UHF/PL259
Coaxial Plug



BNC & N-Type
Coaxial Plug

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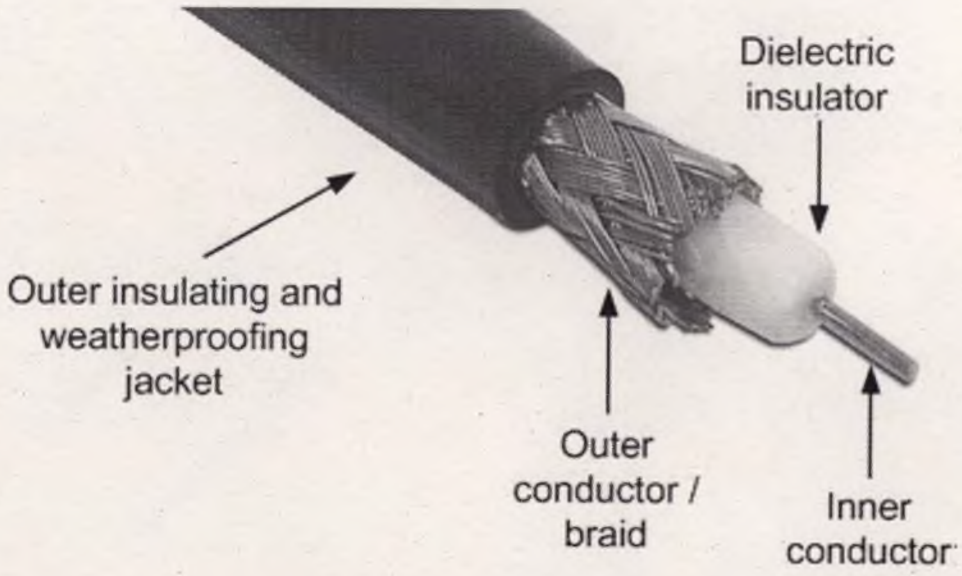
Coaxial Cable

- The most common types of coax are 50Ω and 75 Ω.

- The function of the outer braid is to contain the signal, so that it does not radiate from the coax.



- This is a sample of braided screen coaxial cable; some types may have a foil wrapped screen instead of braid but the principle is the same.

Advantages	Disadvantages
The coaxial cable is a screened cable and radiation losses are low. It can be used for frequencies up to 1000 MHz or higher.	The power handling capacity is less than an open wire feeder.
It is flexible and can be buried in the ground.	The coaxial line is unbalanced, one conductor is at earth potential and the other isolated from it. This can introduce matching problems requiring the use of a **balun** at the aerial end of the feeder.

BALUN

- This is an abbreviation for **bal**anced to **un**balanced.

- These are devices that convert coaxial cables (unbalanced feed) to balanced aerials or conversely convert balanced wire feeders to aerials that are unbalanced.

- For transformers, a variety of core materials may be used, but Ferro-magnetic materials such as powdered iron are often used (they work better at HF). Some types of balun may be constructed from short lengths of coaxial cable.

- Commercially available types include Ferrite baluns manufactured in the following ratios 1:1, 4:1 and 6:1.

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Quarter Wave Matching Transformer

- When the load seen by the transmitter is a pure resistance, but not equal to Z0, (characteristic impedance) a quarter wave section of line acting like a transformer can be placed between the line and load to provide matching.
- If we have ¼ wavelength piece of transmission line that is terminated in a short circuit, its input impedance is very high and, if terminated in an open circuit, it is very low. This effect can be used to match aerials to lines.

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Dummy load (Dummy Aerial)

- A dummy load is a screened resistance that is connected to the transmitter in place of an aerial.

- This allows the transmitter to be operated without radiating a signal, so when you set up your transmitter, you can do it knowing that you'll cause neither interference nor a mismatch to the transmitter output.

- The value of the resistance is normally 50Ω

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Aerial Tuning Units

- The function of an Aerial Tuning Unit is to match two different impedances and get maximum power transfer between the two parts,
  - for example, the 50Ω output of a modern transmitter to a dipole aerial.
- The ATU can be automatic and may be installed within the transceiver, or installed between the end of the feeder and the aerial (where it is more efficient at matching the feed to the aerial).

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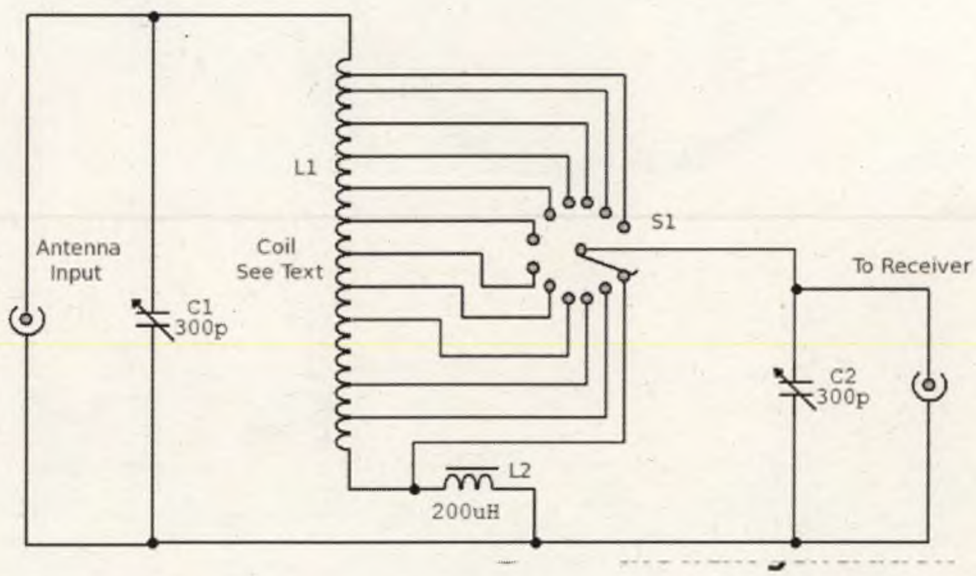
ATU... continued

- A typical ATU consists of a basic network of tuned circuits.
- The centre knob normally switches the tapping points on a coil; this is used to select the range of impedances being used on the band in use.
  - It is normally set up to indicate the Band in use.

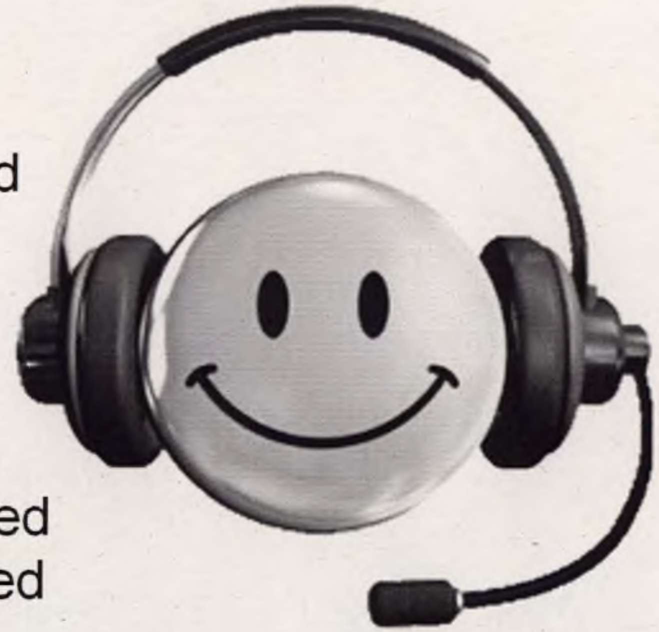
- The other two controls are variable capacitors (like the normal tuning knob on your transistor radio).
  - One is to tune the transceiver output to match to the ATU;
  - the other knob is to match the ATU to the aerial feeder.



Advantages of ATUs

- A well tuned aerial will reduce the amount of radiation in the radio room (safer)

- The received signal will appear stronger and the background noise will seem to have diminished



- Any harmonics of your required transmitted frequency will also be rejected by these tuned circuits leaving you with a cleaner transmitted signal

- Some ATUs have built in meters to enable you to tune for maximum forward power and minimum reflected power (VSWR)

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Disadvantages…

- When installing the ATU at the transmitter end of the coax feeder there is always a small amount of signal reflected back along the feeder.
- This can be in the form of what are known as “braid currents” as it is a current induced in the braid of the coax. This can be overcome by using a choke or balun at the aerial end of the feeder.
  - This would consist of a few turns of coax in a flat coil
    - causing a high impedance to these currents and “choke” them off
  - This reflected signal is different from the SWR, and if allowed to remain, it will be radiated and cause interference to nearby equipment, such as the TV.

Connectors

- The minimum number of connectors should be employed in any aerial system
- All outdoor plugs and sockets should be well waterproofed.
- Never mix 75Ω cable with 50Ω, unless it is a deliberate part of an aerial system.
- The pins on the connectors are different diameters for the different impedances and trying to mix them may cause damage or unreliable connections.

BNC Connector

PL259 Connector

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Electromagnetic Waves and Propagation

How your signal gets there…

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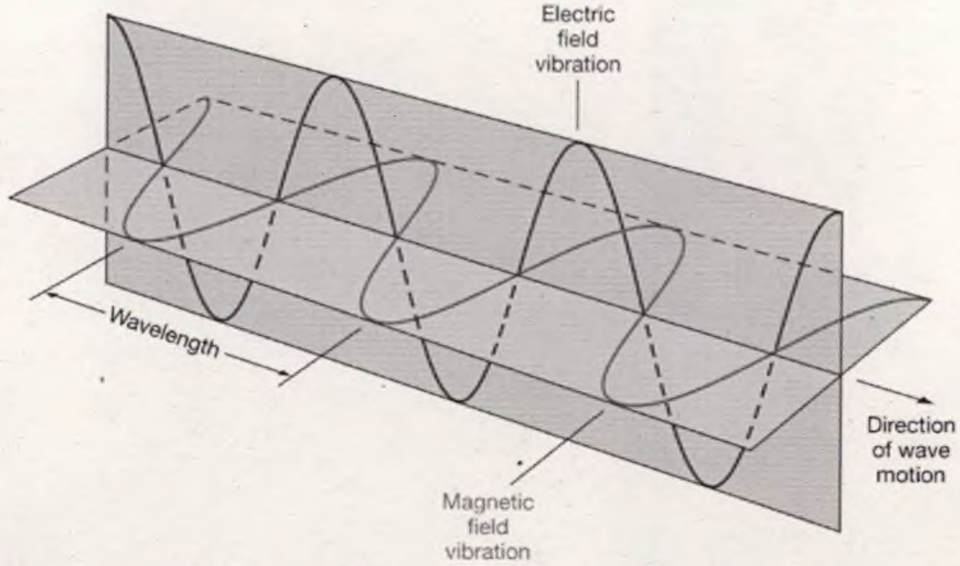
Basic Theory



- Electromagnetic (EM) waves are radiated from an aerial when we supply it with an alternating current (energy).
- It is the alternating current in the aerial oscillates the electrons in the aerial, causing the electrons to radiate as a magnetic field.
- The energy is radiates from the aerial at the speed of light. The energy is sent out as a combination of electric and magnetic fields – an electromagnetic wave.
- The E (electrical) and H (magnetic) fields are at right angles with each other, which are in turn at right angles to the direction of travel of the wave.

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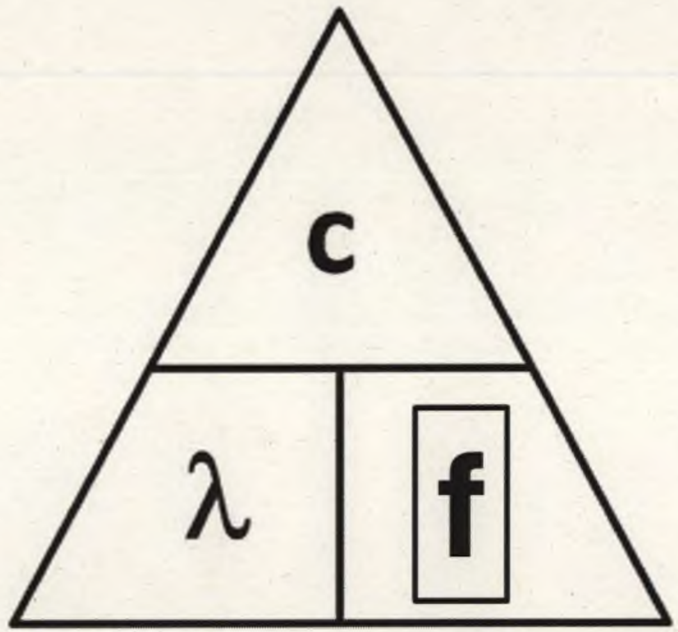
Speed of travel vs frequency

- $\lambda = c / f$
- $c = \lambda \times f$
- $f = c / \lambda$



C: Speed of light = 3.0×10^8 m/s

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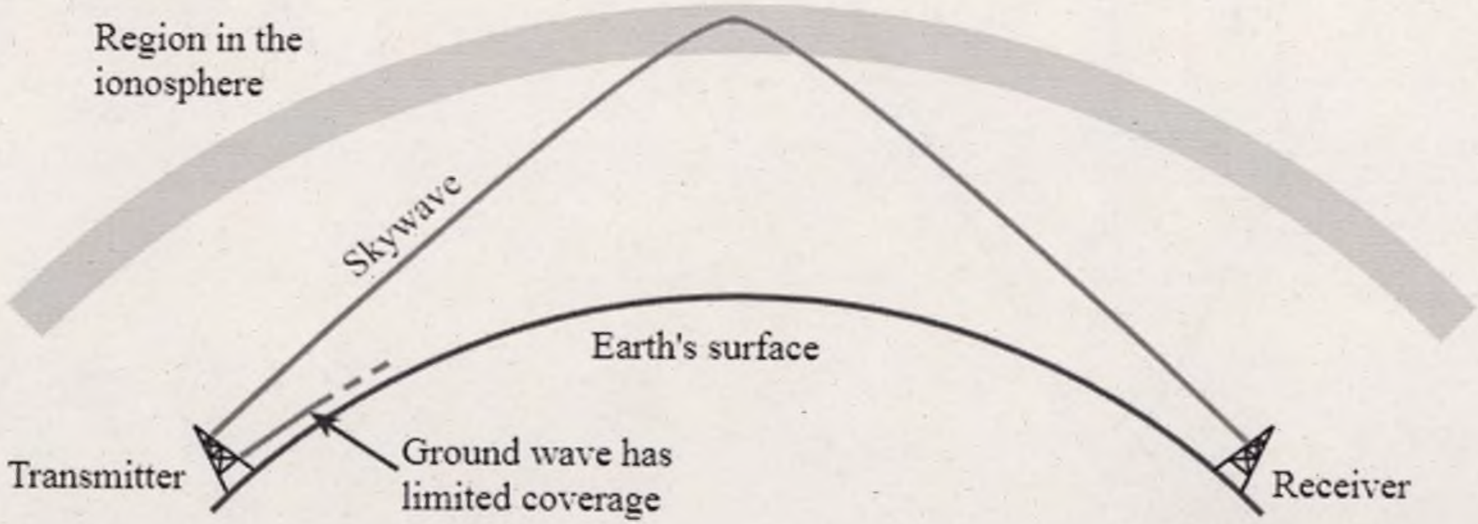
Propagation of EM Waves

- Ground Waves
- Sky Waves



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Ground Waves

- Divided into 2 types:

- Group 1:
  - LF and MF
  - Suffer attenuation
  - Maximum range depends on frequency

- Group 2: Line of sight
  - Also called Direct Waves
  - Include ground reflected transmissions (space waves)

Line of Sight

- Limited to a direct path
- May suffer reflections
  - E.g. hills, buildings
- Used in short-range comms at VHF/UHF
- Greater the aerial height, the greater the range
- The higher the frequency, the shorter the range.
- Can benefit from a Tango

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Sky Wave

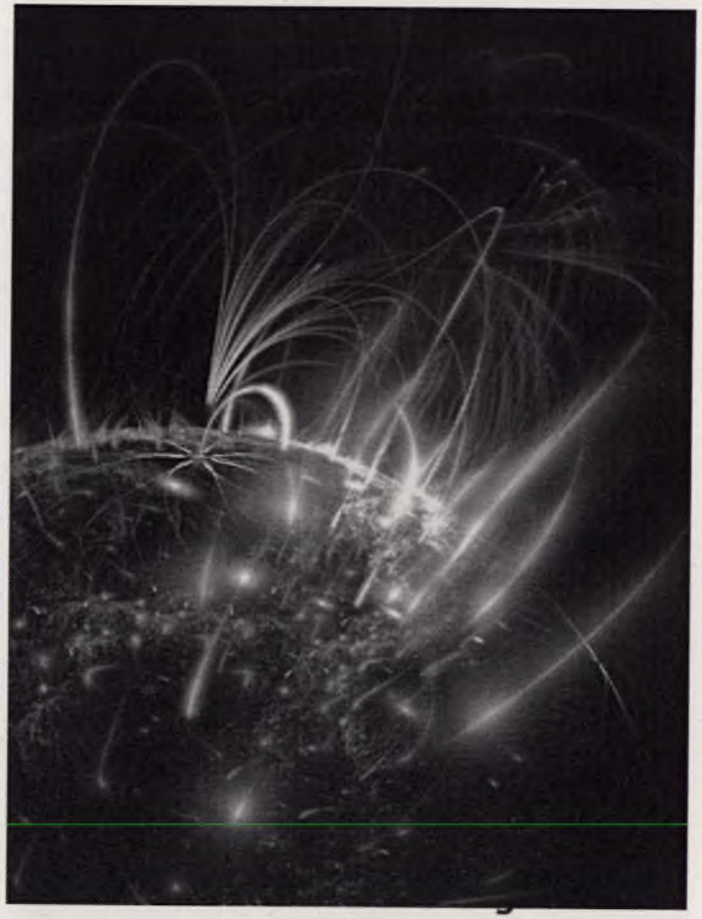
- The ionosphere is composed of layers of ionised gas caused by cosmic and UV radiation from the sun. These layers tend to bend or refract the EM wave and can cause it to return back to earth rather than be lost in space. The amount of refraction depends on:

- **Frequency of signal**

- **Degree of ionisation** - this depends on the time of day and month of year

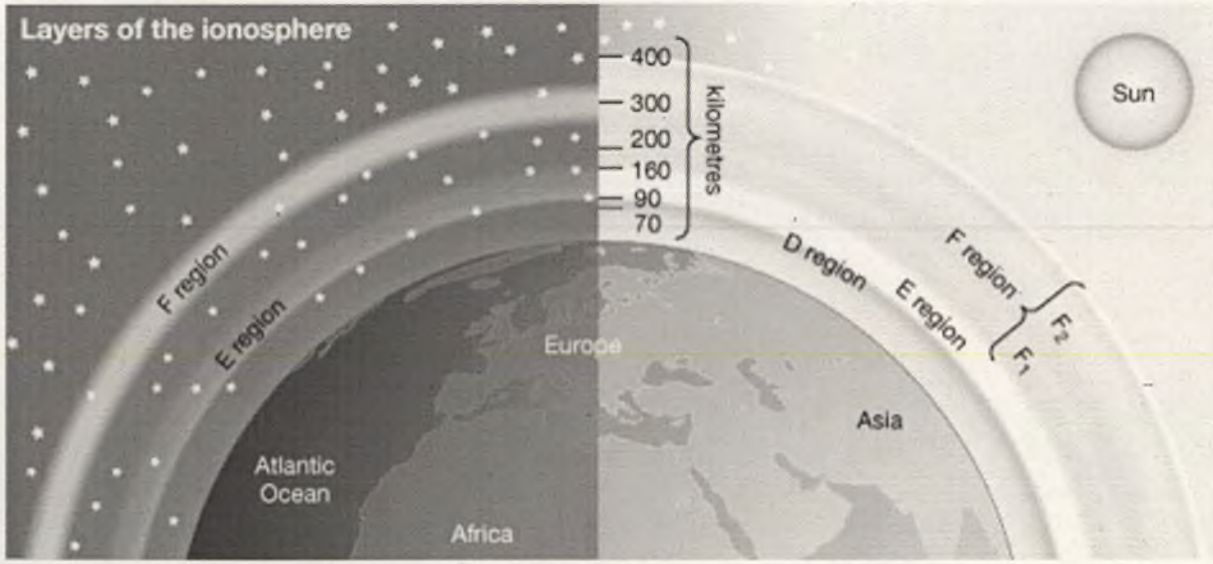
Problems with Sky Wave

- **Interference Fading.** This is fading due to the relative phase of the signals received by ground and sky waves being such that they cancel each other.
- **Selective Fading**. Part of the sideband components of the signal are sometimes lost, causing distortion and fading of the signal.
- **Sunspots, Solar Flares, Ionospheric Storms**. The ionisation of the ionosphere increases during sunspot activity and can cause severe attenuation of the signal.
- **Magnetic Storms, Meteorites** etc. These have a similar effect on the ionosphere as sunspots



Ionosphere Structure

- **The D-layer** extends from 50 to 100 km above the earth's surface. This layer occurs only during daylight hours and is of low ionisation density. Radio waves suffer considerable attenuation in passing through this region but are not bent appreciably.
- **The E-layer** extends from 100 to 150 km and remains weakly ionised during the night.
- **The F-layer** extends from 150 to 500 km and forms a single layer at night. This splits into 2 during daylight to form F1 layer at about 200 km and an F2 layer at about 400-km during summer. The F2 layer is the most highly ionised and shows considerably more variation than the others.



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Frequency band characteristics

Frequency Band	Characteristics	
10 to 100 kHz (VLF and Lower LF)	Reliable communications up to 1000 km using ground wave.	Communication over 1000 km by sky wave and therefore better at night. Sky wave refracted (bent) by E layer.
100 to 500 kHz (LF and Lower MF)	As the frequency increases, the surface wave is attenuated rapidly, range up to 500 km.	Ionospheric losses are high in daytime but low at night when the D layer is absent.
500 to 1600 kHz (MF)	Complete sky wave absorption occurs during daytime and communication is therefore only possible (up to several hundred miles) by the ground wave.	This band is mainly used by broadcast radio.

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Frequency band characteristics

Frequency Band	Characteristics	
1.6 to 30 MHz (High MF and HF)	Rapid surface wave attenuation occurs and therefore all long-range communications are via the sky wave. Surface wave extends typically to 30 or 50 km.	Critical frequency is the highest frequency which, when propagated directly at the ionosphere, does not penetrate it.
	Maximum Usable Frequency (MUF) is the highest frequency that can be used between 2 points employing sky wave propagation.	Optimum working frequency is approximately 80% MUF.
	Critical angle is the smallest angle of incidence at which the signal can strike the ionosphere and still be reflected.	Skip distance is the shortest distance possible between receiver and transmitter using sky waves.
	Dead space is the area in which neither surface nor sky waves can be received from a particular transmitter.	Solar disturbances produce ionospheric disturbances which can interrupt communication for long periods.

Frequency band characteristics

Frequency Band	Characteristics	
above 30 MHz (VHF and Higher)	Radio waves are seldom refracted from the ionosphere at frequencies above 30 MHz	Range is limited to 'line of sight'. Air-to-air and ground-to-air range being larger than ground-to-ground range
	Aerial systems of reasonable size and beamwidth are easily made.	Signals are liable to be reflected off large objects and buildings

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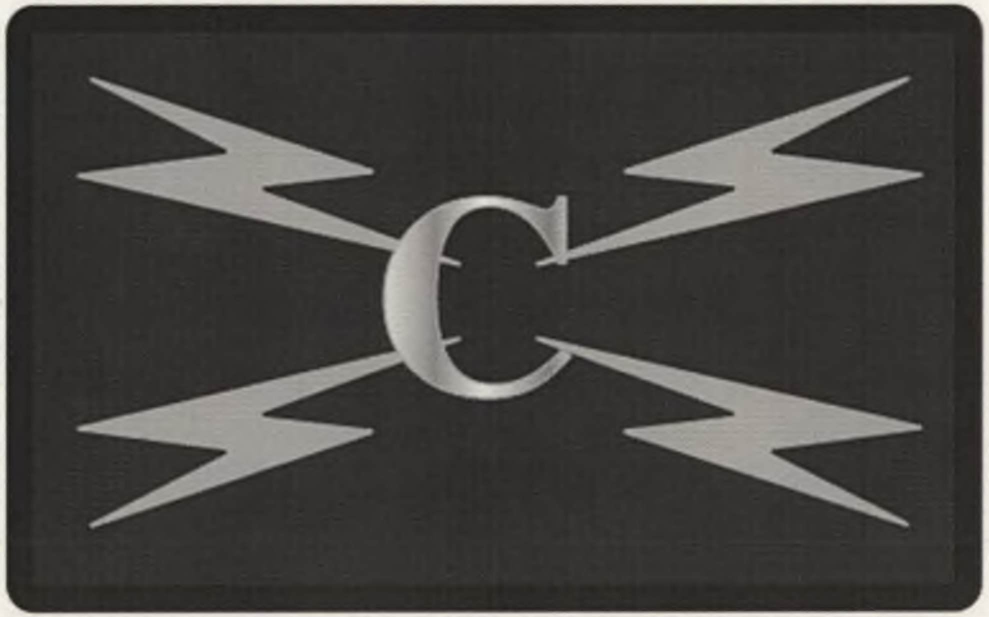
Foundation Radio Licence – Day 2

Silver Badge Module



Proposed Timetable - Sunday

- **08.30**
  - Licence conditions & parameters
  - Operating practice
- **Break 09.30**
  - EM Compatibility
  - Safety
  - ATC and amateur practice
- **Break 10.30**
  - HF Practical Assessment
- **Lunch 12.00**
  - HF Practical Assessment (continued if necessary).
- **Break 14.30**
  - Exam

Amateur Radio (Foundation) Licence

What you earn if you pass!

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About the licence

- You CAN use the station to self-train
- You CANNOT use the station for commercial purposes
  - NO advertising!
- You MUST know that there are other licences and what effect each has on callsigns.
- You MUST notify Ofcom is you move address before operating from it.
- The station WILL only be operated by the Licensee
  - At the main station address
  - At an alternative address
  - At a temporary location
  - When mobile

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More about the licence

- You MUST use the appropriate regional secondary locator after the UK callsign prefix
  - i.e. after the “G”, “M” or “2”
- You MAY permit operation of the Radio Equipment by a person who holds a current United Kingdom Amateur Radio Licence as long as they comply with the restrictions of your licence.
- You CANNOT transfer your licence to another
- You MUST immediately notify Ofcom if you:
  - Change main station address or name
- You MUST confirm your licence details within 5 years of issue or after date of last change.

Identification

- You will be given your own callsign when you register for your licence!

- You SHOULD transmit your callsign:
  - If someone calls "CQ"
  - At the beginning of communication with a licenced amateur
  - As often as practicable during a conversation
  - At the beginning of transmission on a new frequency (whenever it is changed)

Amateurs tend to give their callsigns more frequently but not always on every 'over'

Locations: Temporary and Mobile

- At a Temporary Location
  - Use the suffix "/P" with his call sign and give the location of the Station every 30 minutes to an accuracy of at least 5km by a generally used identifier

- When Mobile
  - Use the suffix"/M“

Inspection and Close Down

- You SHALL permit a person authorised by the Secretary of State:
  - to have access to the Station
  - to inspect the Licence and Log
  - to inspect the apparatus of the Station
- In accordance with directions given, you WILL immediately restrict the operation of, or close down your station if, in the opinion of the Secretary of State:
  - The Licensee is in breach of the Licence; and
  - The breach justifies immediate restriction or close down,

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Allowed Frequencies

- You need to understand there's a schedule to the licence
- You have allowed frequencies, types and modes of transmission, including power limits.

Foundation Licence Parameters

Frequency Bands (in MHz)	Status of allocations in UK to the Amateur Service	Status of allocations in UK to the Amateur Satellite Service	Maximum Peak Envelope Power level in Watts (and dB relative to 1 Watt)
0.1357-0.1378	Secondary. Available on the basis of non-interference to other services inside or outside the UK.	Not allocated	1W (0 dBW) e.r.p.
1.810-1.830	Primary. Available on the basis of non-interference to other services outside the UK.	Not allocated	10W (10 dBW)
1.830-1.850	Primary	Not allocated	10W (10 dBW)
1.850-2.000	Secondary. Available on the basis of non-interference to other services inside or outside the UK.	Not allocated	10W (10 dBW)
3.500-3.800	Primary. Shared with other services	Not allocated	10W (10 dBW)

Messages

- You SHALL address Messages only to other licensed amateurs or `the stations of licensed amateurs and shall send only:
  - Messages relating to technical investigations or remarks of a personal character; or
  - Signals (not enciphered) which form part of, or relate to, the transmission of Messages.
- You MAY use codes and abbreviations for communications as long as they do not hide the nature and help communication.

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Messages

- You SHOULD send messages to individual amateurs and not generally broadcast to all except:
  - For initial calls
  - To groups of amateurs after first establishing contact with one licenced amateur in that group
  - When operating group as an established net
  - Transmitting messages via a mailbox or bulletin board for all amateurs able to receive RTTY or data transmissions.

SUMMARY:

You MAY NOT broadcast to anyone who just happens to be listening, apart from CQ calls all other traffic must be with a specific station. In a net contact must first be established with one of the stations in the group

The Log Book

Although log keeping is no longer a requirement unless requested from an officer from Ofcom it is recommended that a log be kept both for your own information on contacts made, it is always useful if an interference complaint is made by a neighbour.

If operating from a Military Property, and that includes any RAFAC premises then a log book is to be maintained."

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Operating Practices

How to be an Amateur

The Amateur Radio Log Book

What	Detail
Date/Time.	Use the 24-Hour Clock in co-ordinated universal time (UTC) ie, GMT.
Frequency band of transmission	It can be helpful to note the actual frequency rather than just the band.
Class of emission	this is no longer "AM. FM. or SSB". The correct format features a scheme encompassing many other types and modes of transmission. For example, SSB speech is J3E.
Power	The maximum power level for the Foundation licence is limited to 10 Watts (which is also described as 10 dBW).
Initial calls	(CQ Calls) whether they are answered or not. They are entered in the 'Remarks' column.
Details of any tests	Frequency calibration, Harmonic suppression, etc.
Location	when operating from a temporary location (/P for Portable operation).
Any additional information required by the Secretay of State or their agent.	

Signal reports

- These are given as readability and strength for voice calls, and readability, tone and strength for Morse contacts.
  - **Readability** is given as a number from 1 to 5, 1 being virtually unreadable and 5 being very good.
  - **Strength** is given as a number from 1 to 9, 1 being very weak and 9 being very strong. Many receivers have an S meter indicating signal strength which can be used as he basis for a report.
  - **Tone** refers to the quality of the modulated tone in Morse transmissions. It is not commonly used these days except in CW contest operation. It varies from bell-like clarity (T9) to harsh or rasping and almost indecipherable.

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Call Signs

- G0 G1 G2 G3 G4 G6 G7 G8 England Full Licence
- M0 M1 M5 England Full Licence
- M3 M6 England Foundation Licence
- 2E0 2E1 England Intermediate/Novice Licence

- The following regional locators are added after the UK prefix.

Country	Personal	Club
Isle of Man	D	T
Northern Ireland	I	I
Jersey	J	J
Scorland	M	S
Guernsey	U	P
Wales	W	C
England		X

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Be back in 5 minutes

TIME FOR A BREAK

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Electromagnetic Compatibility (EMC)

Interference and things…

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European Conformance

- Particular standard relating to interference.
  - No piece of equipment should cause or suffer from interference from nearby equipment

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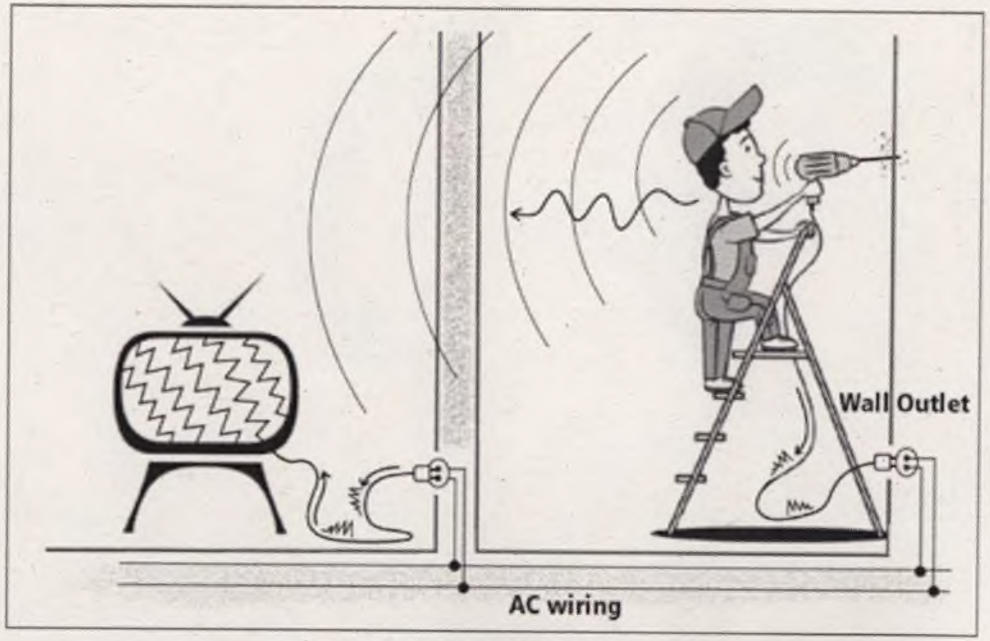
Sources of Interference

- What causes interference?
  - Any equipment which features things which make sparks:
    - such as thermostats
    - car ignition systems
    - drills
    - razors
  - Other sources of interference can be transmitters and even receivers



How to tell it's interference

- What does it look like?
  - Spots, patterning or colour distortion on TV screens or buzzes, whines or clicks on TV or radio.
  - Voice breaking through on TV sound or broadcast radio.

- Although such problems could be the fault of the transmitter, they often occur because the radio or TV is receiving something that it isn't designed to receive (particularly in older sets).

How to reduce problems

- Keep your aerial feeder cables away from house wiring, telephone and television cables.
- ALL Screened cable should be of good quality, otherwise signals may leak out
- Make sure that your transmitter is correctly matched to your aerial.
- Avoid certain types of aerial
- Use a mains filter to prevent transmitted signals getting into the house wiring.
- Use only enough power necessary to make the contact
- Plug in a suitable filter at the aerial socket.

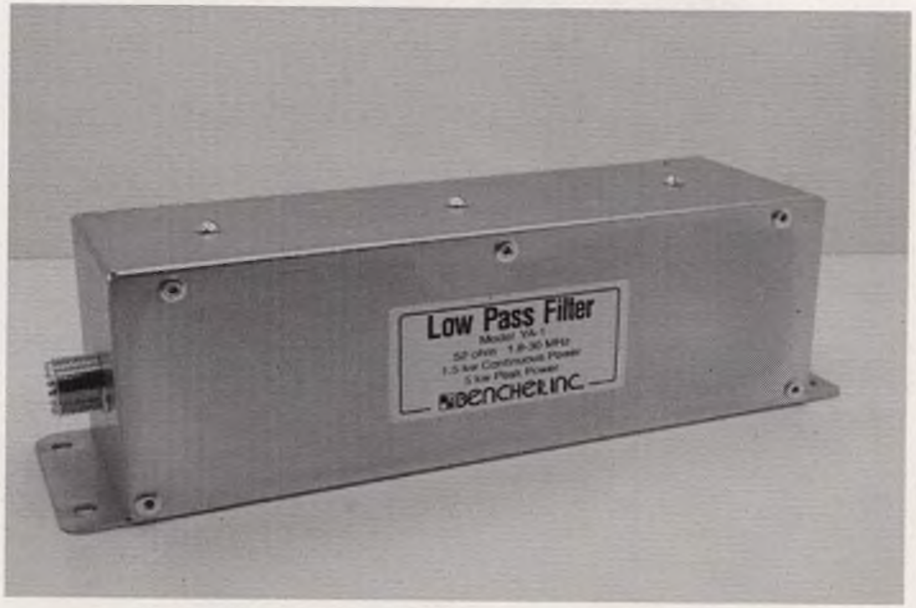
Being a good neighbour

- If a neighbour complained of any sort of interference you would need to help.
- Check with the neighbour just exactly WHEN he suffered the interference and to which station.
- Checking your log-book would show if you were ‘on air’ at the time.
- In many cases interference to a local Television or Radio installation has been traced to a deficiency in that installation. In these cases remedial work to the installation and the addition of filters can cure the problem.

Low pass filters

- Designed to remove any harmonic content from your transmitter.

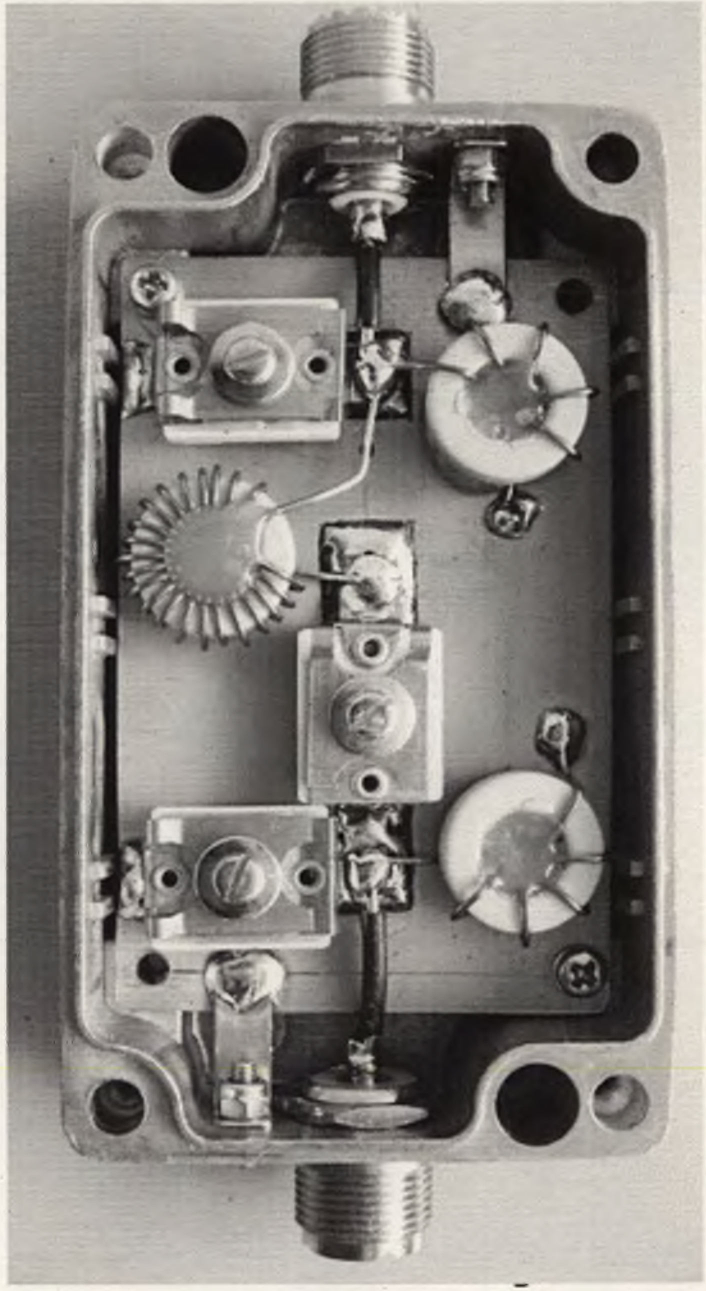
- This cuts off the interfering harmonics ABOVE the working frequency.



Band pass filters

- These filters are designed to pass a band of frequencies.

- When a transmitter uses frequency multiplication stages to produce a vhf/uhf signal (this is because it is easier to produce a more stable oscillator at low frequency), the output can contain the fundamental plus unwanted multiples; these filters are designed to remove these unwanted products.



High pass filters

- High pass filters are designed to be fitted to equipment to protect it from interference from nearby transmissions at a lower frequency than the equipment is receiving.

- An example is the type used on a TV, where the only the TV band signals may pass. Everything else is attenuated.

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Ferrite Rings

- These filters are made by winding coax cable through rings made of a ferrite material, the number of turns being dependent on the frequency involved.

- Their effect is to produce a high impedance to any RF signal picked up by the feeder. They can be installed on microphone leads, speaker wires and TV aerials.

Safety

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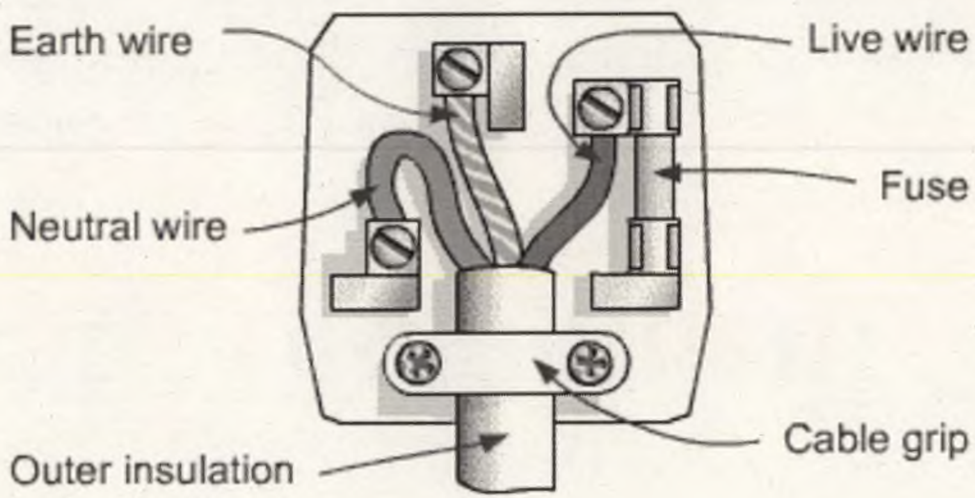
Remember… DON'T LICK THE BATTERY!

Electricity – domestic mains

- Domestic Mains
  - Frayed insulation
  - Exposed wires
  - Loose or unconnected earth wires
  - Trailing leads (trip hazard)
  - Damaged mains plugs and connectors.
  - Always make sure that you use the correct fuse



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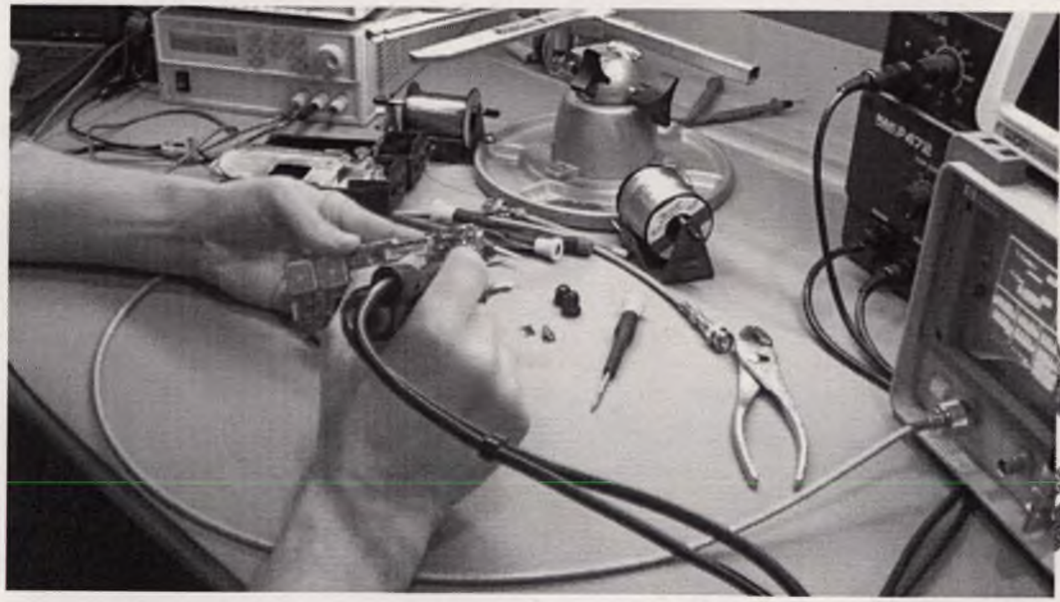
Electricity - equipment

- Whilst most radio sets use low voltage to power them, usually 12 volts but sometimes 24 volts, voltages within them, particularly very old equipment which may contain valves, can be very high.

- You should avoid opening the case.
  - Leave this to a more experienced person who is competent and trained to do this.



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Electricity - current

- High currents can cause
  - heating
  - risk of fire
  - burns
- Domestic mains voltage is 230 volts at 50 Hertz (Hz).

- Remember: Voltages above 30 volts AC and 70 volts DC are enough to put your life in danger.

Best practice is to have a way of turning off all your equipment of in one go, in case of an emergency.
Installing a Domestic Mains Isolating Switch at the entrance to the Radio Room is the best option and this should be clearly marked.

Radio Frequencies

- Non-Ionising Radiations in the form of Radio Frequencies are generated every time you transmit.

- This RF is transmitted to the Aerial (often called Antenna) by means of coaxial cable or open feeder wires.

- Open wire feeders do not have insulation and therefore, should you touch this, you will receive an RF burn.

- These are very painful and can take a long time to heal. In the same way you can receive an RF burn from the Aerial itself; very high voltages exist at the ends of an Aer

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Batteries

- **NEVER**
  - Charge lead acid batteries in a confined space
  - Carry loose batteries in pockets or bags
  - Short the terminals together
- **ALWAYS**
  - Cover battery terminals in transit or when not in use
  - Keep lead acid batteries upright
  - Charge with the correct type of charger

Headphones

- It is very easy to cause damage to your hearing.
- The ear is a very sensitive organ and should be treated with respect.
- Setting the volume to make a channel comfortable to listen to is very simple
-
- When changing a channel start by reducing the volume to counteract possible loud noise on the new channel.

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The radio room

- Generic risk assessments may be in place for using radio equipment
- Be aware of other hazards in your environment
  - Trailing wires
  - Overhead cables
  - Unstable masts…
- React to the hazard in an appropriate manner
  - Remove/reduce hazard yourself
  - Report to supervising staff

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Converting from ATC to Amateur

There are some noticeable differences!!

ROYAL AIR FORCE AIR CADETS
the next generation

The Radio Check - Readability

Cadet	Amateur	Means
Loud Clear	R 5	Very good readability
Readable	R 5	No problem
Unreadable	R 4 - 3	Almost no problem
	R 2 - 1	There's a voice – but that's it

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The Radio Check - Strength

Cadet	Amateur	Means
Loud	S 8 – 9	No background noise
Good	S 7 – 8	Little background noise
Weak	S 3 – 4	Lots of background noise
Very Weak	S 1 – 2	Nearly pure noise
Fading	QSB	Signal strength fluctuates

Tone

This is used in CW or Morse to indicate the quality of the transmitted tone
Again this is on a scale of 1 to 9.
S9 being a pure tone.

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Message content

- Within RAFAC Communications all messages are structured to minimize transmission time with a strong emphasis on comsec (communications security).
- The amateur world does not have the same constraints, but having said that the disciplined approach to message handling is appreciated by the majority of amateurs.
- It is normal to use your first name and give an approximate location of your station (Be wary of giving to much personal detail out over the air as the interceptor is ever present and may be interested in more than just radio).

In Amateur Radio you'll not be informing people of BEADWINDOW for information sharing!

Contact Crib

- To help you with your first few contacts here are a few ideas to work with.
- After making the initial contact and exchanging call signs you may like to exchange the following information. (Change to your own details):
- My name is..............................*Dave*
- Your signal report is..................5 and 9
- I am located near.......................*Portsmouth*
- The equipment here is..............*Icom 706 running 10 watts*
- The Aerial is...........................*di-pole*.............
- I am on a licence course for.......*foundation licence*..........
- My other interests are...............*computing, music, air cadets*....
- Were you ever in the Air Cadets/RAF...........?

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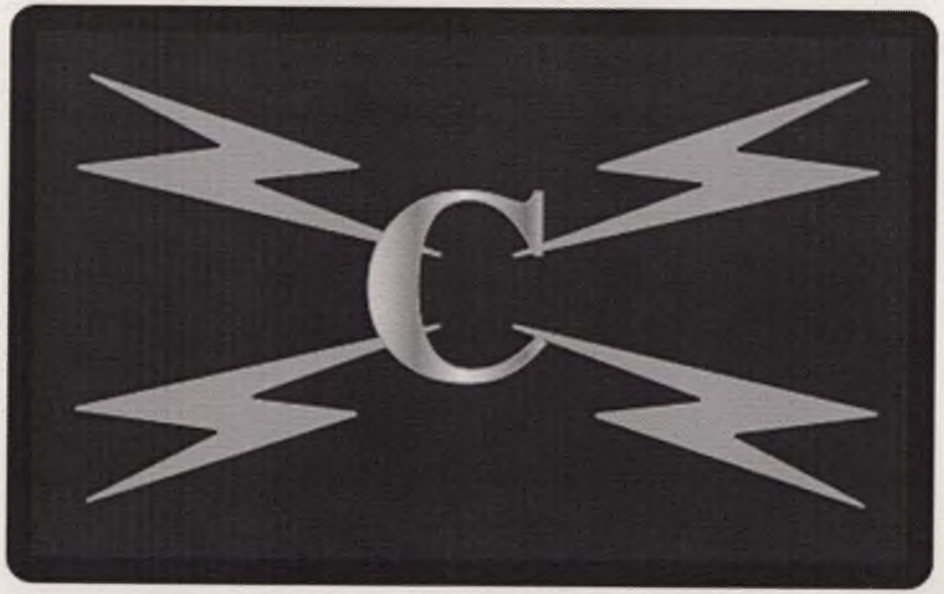
the next generation

HF Practical

Hands on time!

End of
Foundation Radio
Licence
Module



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AIR FORCE
AIR CADETS
the next generation

ANNEX B.

[redacted]
Joint Spectrum Authority

Information Systems and Services
Blumlien Building, Blandford Camp
Blandford Forum, Dorset, DT11 8RH

Military Network: [redacted]
Telephone: [redacted]
Email: [redacted]

[redacted]

JSA Reference:

Date: 30th October 2017

JSA AUTHORITY TO RADIATE – AIR Cadets VHF & UHF

30th October 17 – 30th October 2022

Reference: Email Air 38 Gp dated 30th October 2017

1. The frequencies detailed in Appendix 1 have been assigned for the location, emission and power output as requested.

2. You must observe the restrictions that have been placed on you by the JSA;

- This letter constitutes authority to radiate on the frequencies in Table1 from a spectrum management perspective and is subject to compliance with other applicable UK, MOD and local site regulations. These may include:
    - Radio Frequency Hazards (RADHAZ) to Personal, Flammable Gases or Fuels, or Explosives.
    - High Intensity Radiation Transmission Areas (HIRTA)
    - Security

3. The Authority to radiate expiry dates are detailed on the attached at Appendix 1.

4. After the expiry date you are not authorised to radiate under the terms of this letter. If continued use of this Spectrum is required beyond the date given above, you MUST submit a further application to the Joint Spectrum Authority for authority. Unauthorised use of this Spectrum may result in conflict with other assigned users beyond this date.

5. **Any changes** in the operating parameters or contact details during the period of assignment should be notified to the JSA for our records to be updated. If significant changes to the parameters under which the assignment was originally authorised are required, then a new application will be necessary.

6. You are requested to contact the JSA 6 months before the expiry of this assignment, to confirm your requirement for continuing to use this assignment beyond the expiry date. You will be requested to notify the JSA of any changes from the original application in equipment or system operating parameters and contact details. It should be noted that if the JSA cannot contact you, or has been notified of any replacement contact, then the assignment will be deemed to have expired at the expiry date, and **you will no longer be authorised to use the assignment.**

7. In some instances, there may be a requirement for local co-ordination in the use of the allocated frequencies. **It is the user's responsibility to carry out this local co-ordination.**

8. Please contact the JSA quoting the assignment numbers if you require any further information.

[redacted]

Joint Spectrum Authority
Joint Forces Command
Information Systems and Services
Blandford Camp
Dorset
DT11 8RH

Appendix 1 to
30th October 17

Table 1: Frequencies issued to the Air Cadets

JSA DB Ref	Frequency (MHz)	Use	Tx Location	Rx Location	Emission Designator	Max EIRP (Watts)	Expiry Date	Notes
G:JSA:AS: 0100002418	36.800	VHF	Scotland Only	Scotland Only	25K0F3E	50	30th October 2022	
G:JSA:AS: 0100002418	37.300	VHF	UK Wide**	UK Wide**	25K0F3E	50	30th October 2022	** Not N.Ireland
G:JSA:AS: 0100002418	38.100	VHF	UK Wide***	UK Wide***	25K0F3E	50	30th October 2022	***Not Wales
G:JSA:AS: 0100002418	40.200	VHF	Wales Only	Wales Only	25K0F3E	50	30th October 2022	
G:JSA:AS: 0100002418	78.100 79.350 149.275 149.3375 149.400 149.4125 153.6875 153.800 153.925	VHF	UK Wide	UK Wide	25K0F3E	50	30th October 2022	

Appendix 1 to
30th October 17

JSA DB Ref	Frequency (MHz)	Use	Tx Location	Rx Location	Emission Designator	Max EIRP (Watts)	Expiry Date	Notes
G:JSA:AS: 0100001398	73.8375	VHF Repeater	UK Wide	UK Wide	25K0A3E	50	30th October 2022	
G:JSA:AS: 0100002418	271.500 273.000 434.4125 439.550	UHF	UK Wide	UK Wide	25K0A3E	20	30th October 2022	
G:JSA:AS: 311409	435.625	UHF	UK Wide	UK Wide	25K0A3E	20	30th October 2022	
G:JSA:AS: 304312	435.725	UHF	UK Wide	UK Wide	25K0A3E	20	30th October 2022	
G:JSA:AS: 304313	435.750	UHF	UK Wide	UK Wide	25K0A3E	20	30th October 2022	