FIVE AND NINE PLUS

THE OFFICIAL NEWSLETTER OF THE APPLEDORE AND DISTRICT AMATEUR RADIO CLUB

Club Callsigns: G2FKO and GX2FKO
Web Site : www.adarc.co.uk

CLUB'S OFFICERS

President	John Jeffers	G0UNB			
Chairman	Terry Adams	G4CHD			
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Treasurer	Mike Wogden	G4KXQ			
Committee	Laurence Soutter	G4XHK			
	John Lovell	G3JKL			
	Graham Bailey	G1ZTJ			
QSL Manager	John Lovell	G3JKL			
Web Master	John Lovell	G3JKL			
Exam Secretary	John Lovell	G3JKL			
Editor	Terry Adams	G4CHD			

October, 2014

EDITORIAL

Welcome to another Club 5&9 Newsletter. After last month's excellent talk by Peter Christie, this October's meeting also offers members another very interesting talk - on the **History of Policing Terrorism** by our Club Secretary Alan. This will be Alan's first talk for us and with such an interesting title - I'm sure that many members will want to attend.

Therefore any help in setting out the chairs etc prior to the talk would be much appreciated.

Your **Committee** held another **Meeting** on Wednesday, October 8th at which it was agreed to help the Bratten Fleming Scouts on **Wednesday, November 19th** to achieve their communications badge. A 2m vhf transmitting station will be used and so **please listen out** for GX2FKO on the night between 6 - 7.30pm on the club frequency of 145.450MHz to enable the Scouts to get their necerssary number of contacts. An HF RX station will also be used to enable the Scouts to practice their tuning skills and callsign recognition using the NATO alphabet.

The **Club Christmas Party** was also discussed and will follow a similar pattern to last Xmas - ie entry will be **free**, with food, coffee/tea provided. Seasonal music - possibly live (!) will be played - and hopefully Dave will offer his customary enjoyable light hearted quiz. The customary Raffle will be held with the Club providing some tasty prizes but **members are also asked to bring a raffle prize** to make the draw a good one to end the night on.

As always, other halves are very welcome.

Enjoy the Newsletter Terry (G4CHD)

CLUB MEETINGS

Unless otherwise stated, Meetings are held at the Appledore Football Social Club starting at 7.30pm for 8.00pm. Visitors are always welcome.
For further information, contact Alan (M6CCH)

October 20th	Brief History of Policing Terrorism' by Alan (M6CCH)
November 17th	A Light Hearted Radio Quiz - by John (G3JKL)
December 15th	Club Christmas Party
January 19th	"Contests - Beauty or a Beast?" by Terry (G4CHD) & Mike (G3PGA)
February 16th	"Whisper & WebSDRs" by Mike (G4KXQ)
March 16th	Club AGM
April 20th	TBA

REMINDER NOTICE

HOLSWORTHY AMATEUR RADIO RALLY

Sunday, October 19th
at the

HOLSWORTHY COMMUNITY COLLEGE, VICTORIA HILL, HOLSWORTHY EX22 6JD

REPORT ON THE SEPTEMBER MEETING

HISTORY OF RADIO IN NORTH DEVON
by Peter Christie

My thanks to our President John for standing in for me at the meeting and sending me the following report.
The meeting was well attended and Peter Christie was in fine form introducing his talk as being 'The Advance of Technology from the Beginning of the Nineteenth Century', he began describing the various ways that water was harnessed to drive mills, the use of steam including pictures of various vehicles using it for propulsion– two and four wheel. The introduction of gas lighting and later electricity. He drew our attention to Barnstaple being in some cases the first to try out new ideas in England for example the use of Ether as an anaesthetic and a photograph of the device used to administer it. The advance of newspaper production and the manufacture in Barnstaple of the complicated machinery necessary for printing and production. He mentioned the introduction of the telegraph and also how the telephone gradually made itself felt in the area and the design of the first working computer by Thomas Fowler, the then Great Torrington treasurer for the poor law union in 1840 (yes before Babbage – his never worked anyway) – as a mechanical aid for calculating establishment charges from each Parish. This machine was designed using the Ternary (or Trinary) numeral system, something which brought some discussion from the members. Most of the objects, buildings and machinery were clearly shown on screen despite their age which made the talk even more interesting thanks to Dave (M0JAP) being able solve what seemed a very difficult problem of matching Peter's data with the computer.

John G0UNB

LOCAL SKEDS

Zepp Net: **Mon, Tues, Thurs :**
145.450 MHz Wed
via GB3DN 1600 local time

6m Net: **Wednesday, 8pm, 51.480 MHz FM**

HF Net: **Friday** at **1500** local time
7.145 MHz ± qrm

Slow Morse: Run by **Dave (G3YGJ)** every **Tuesday and Thursday, 7pm clock time on 145.250 mode FM.**

70cm Net: **Sunday, via GB3ND, 1100 - noon local time.**
Available on Echolink node 221334

LOCAL REPEATERS

70cm Handy Cross Repeater/Echolink (#221334) Gateway (GB3ND)
User: Listen 433.35MHz– Transmit 434.95MHz
Access 1750Hz Tone (Timeout 4.25 mins)/ 77Hz CTCSS
Repeater keeper is Jeff (G4SOF)

2m Stibb Cross Repeater (GB3DN)
http://www.g0rql.co.uk/gb3dn.htm
User: Listen 145.6375MHz - Transmit 145.0375 MHz.
Access 1750 Hz Tone or 77 Hz CTCSS Repeater keeper is Tony (G1BHM).
Yahoo users group for general chat and banter at :-
http://groups.yahoo.com/group/GB3DN/

SUDOKU PUZZLE

The aim is to enter a number into each cell so that **any column, or any row, or any block of cells contains all numbers from 1 to 9**.

	6					7	4	
					8			
5			4	2			8	6
		2			6	9		
1	4					2	7	
7					2			3
	3	8	5	1		4		
					7			
9	1						5	

Terry (G4CHD)

BIT OF NOSTALGIA

My first HF rig was the Yaesu FT200 - brings back memories!

CROSSWORD

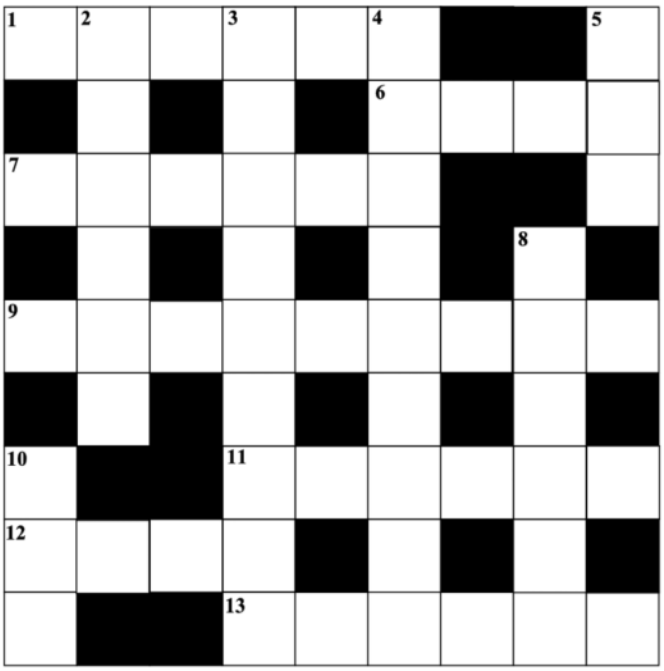
This month's Crossword is by Stuart (M1FWD).
The answers will be published in the next month's Newsletter. Good luck !

Clues Across

1) A large dung-beetle regarded as sacred in ancient Sierra Uniform land (6)
6) U.S. State, capital city Des Moines (4)
7) The fifth largest city in California (6)
9) To break up, as in a radio signal (9)
11) U.S. State, capital city Salem (6)
12) Sixty minutes (4)
13) A long pin to hold a kebab together (for example) whilst cooking (6)

Clues Down

2) Prefix for terms relating to the heart (6)
3) Devices which impede the passage of an electrical current (9)
4) The regions of our planet's crust and atmosphere occupied by living organisms (9)
5) ? actor, a semiconductor diode with a capacitance dependent on the applied voltage (3)
8) Functionless; serving no practical purpose (6)
10) The reciprocal of an ohm, a former unit of conductance (3)



Last month's answers :-

Across 1) leukaemia 6) drawn 7) aria 9) Aisne 10) Lent 12) Faroe 13) Ascension

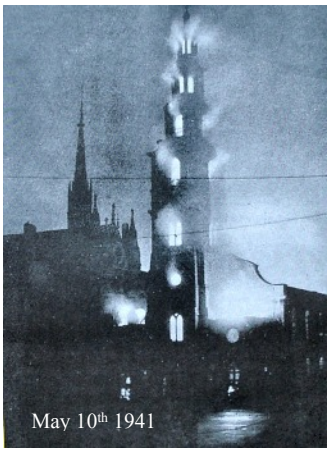
Down 2) ecru 3) Kuwait 4) metre 5) aural 7) annals 8) llama 9) antic 11) mono

Stuart (M1FWD)

MISSING RAF SCULPTURE

The following interesting article was sent to me by John, our President, who is also asking for help in locating and retrieving a stolen sculpture - the importance of which is explained in the article.

St Clement Danes is an Anglican church in the City of Westminster, London. It is situated outside the Royal Courts of Justice on the Strand. Although the first church on the site was reputedly founded in the 9th century by the Danes, the current building was completed in 1682 by Sir Christopher Wren. Wren's building was gutted during the Blitz. Shortly after WW2, those in the RAF contributed, voluntarily to its renovation and made it the RAF's Church. Every squadron in the war has its badge emblazoned in a tile in the floor - there are 400 of them! Each was paid for by squadron members, and there is a book containing the names of those who lost their lives during the conflict.



It is worth a visit if you are in London with an hour to spare.
The church is sometimes claimed to be the one featured in the nursery rhyme Oranges and Lemons and the bells do indeed play that tune.

However, on a more serious note -
the picture opposite is that of a **sculpture stolen** from the Church. It is about a foot tall and was stolen a month or so ago. 'Friends of the Church' (I'm one) have been asked to publish this picture by e mail so that it can be spread by all recipients to others in the hope that someone has seen it and so inform the Church of its whereabouts. So if anyone can help - please contact me.

John (G0UNB)

A Basic intro to FM follows - hopefully interesting reading for some.

Well that's it for another month, enjoy the read.

If any member has written an article that they feel would be of interest to Club members, please send it in to me and it will make your Club Newsletter all the more interesting.

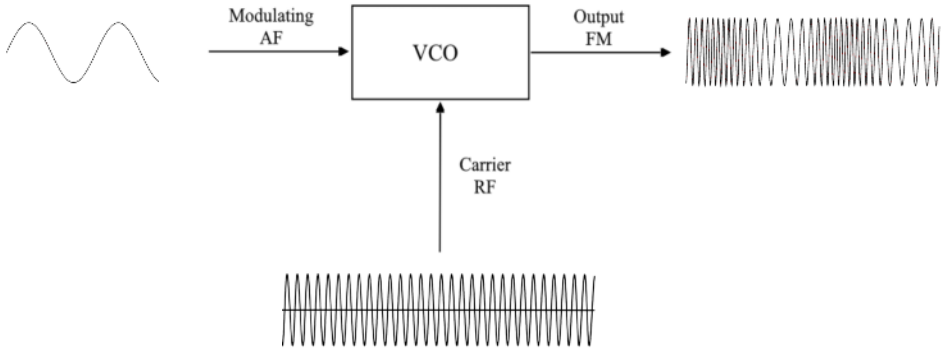
Terry (G4CHD)

BASIC INTRODUCTION TO FREQUENCY MODULATION (FM)

When I first came across FM, I found it one of the hardest things to get my head around. This article makes no attempt to be complicated and over mathematical (although some maths inevitably appears) and hopefully will be useful to any members who still find the subject a little bewildering.

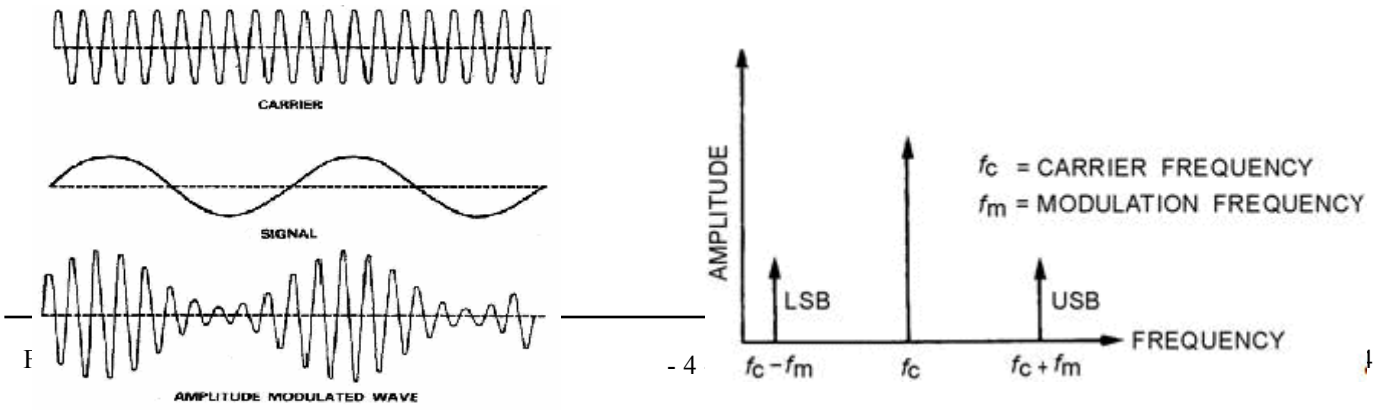
MODULATION

HF radio frequency (RF) waves can travel vast distances using sky wave propagation by 'bouncing' off the ionised layers in the upper atmosphere. Hence, if one wishes to transmit audio frequency (AF) signals eg voice communication over similar vast distances, then this can be achieved by 'piggy backing' the AF voice signal on the back of a RF carrier signal. This process is termed modulation and involves making a chosen property of the RF carrier wave (eg its amplitude or its frequency) vary in sympathy with the amplitude of the modulating AF voice wave. In FM it is the frequency of the RF carrier wave which varies in sympathy with the amplitude variations of the modulating AF voice wave which is accomplished using an FM Modulator.
Edward Howard Armstrong (1890-1954) presented his paper, "A Method of Reducing Disturbances in Radio Signalling by a System of Frequency Modulation", (which first described FM radio) before the New York section of the Institute of Radio Engineers on November 6th, 1935. The paper was published in 1936. So the principle has been around for some time.
A simple method (but not necessarily the best for carrier frequency instability reasons) of producing an FM signal is to use a Voltage Controlled Oscillator (VCO) which produces an output signal with a frequency proportional to the input signal amplitude :-
It must be stressed that it is the **amplitude** of the AF signal which controls the **frequency** of the FM signal.
The frequency of the AF signal only dictates how quickly the frequency of the FM signal changes.
It is also worth pointing out that when demodulating the FM signal, only its frequency is important and amplitude variations in the signal are irrelevant.



FREQUENCY SPECTRUM AND BANDWIDTH

Consider an **Amplitude Modulated (AM)** signal - its frequency spectrum and hence its bandwidth are easily determined (providing the modulator is not overdriven). The following diagram shows that the frequency spectrum consists of only the carrier and upper (USB) and lower (LSB) sideband signals - the latter being spaced above and below the carrier frequency by the modulating frequency.
This resultant bandwidth is thus twice the modulating frequency for any depth of modulation up to 100%.



Now **consider an FM signal** - the frequency spectrum is far more complex involving some tricky mathematics using Bessel Functions.

First, a number of definitions :-

Frequency Deviation (Δf) :- this is the difference at any instant between the FM signal frequency and the carrier frequency. Its value is determined solely by the amplitude of the modulating signal at that instant. The Maximum Frequency Deviation occurs therefore when the modulating signal is at its peak amplitude.
Consider a 100 kHz carrier modulated by an audio frequency (AF) signal from a microphone :-
When not speaking into the microphone, there is no AF signal and hence no frequency deviation results. The output signal is simply at the carrier frequency - known as the centre frequency.
If one speaks into the microphone, the amplitude of the AF signal increases from zero causing the frequency of the carrier to deviate above and below its centre frequency. It will be assumed that this results in a peak carrier deviation of 50 kHz. The FM signal frequency now varies between 950 - 1050 kHz.
Speaking twice as loud (or doubling the microphone gain) now produces double the carrier frequency deviation ie 100 kHz, causing the FM signal frequency to vary bewteen 900 - 1100 kHz.
Note that the frequency of the modulating signal has no influence upon the frequency deviation and hence any audio frequency signal of the SAME amplitude will produce the same frequency deviation in the FM signal.

Modulation Index (m) :- this is the ratio of the Peak Frequency Deviation (Δf) to the maximum modulating frequency (fm) ie

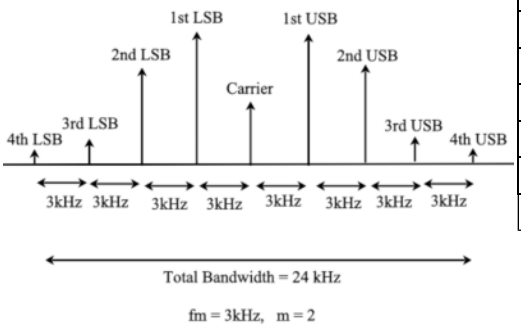
$$m = \Delta f / fm$$

eg in amateur radio, it is accepted that the modulating signal from the microphone be limited to a frequency range of 300 Hz - 3 kHz. This arose historically in order that an AF signal with an upper limit of 3kHz would result in an AM signal with a bandwidth of 6kHz. The lower limit of 300 Hz reduces base frequencies to compensate for the loss of frequencies above 3kHz.
Hence, if a 7.1 MHz carrier which is frequency modulated by a 300Hz - 3kHz AF signal to produce a peak frequency deviation of 6 kHz, then the modulation index = 6kHz/3kHz = 2.

FM Frequency Spectrum :-
Unlike an AM signal which has only one upper and one lower sideband, an FM signal has theoretically an infinite number of sidebands placed at fm, 2fm, 3fm, 4fm etc above and below the carrier.
Hence theoretically, an FM signal has an infinite bandwidth.

However, in practice, the amplitudes of these sidebands vary according to Bessel Functions and the modulation index as shown in the Table opposite.

For the example where **m = 2**, only the first 4 sidebands spaced every 3 kHz have a significant amplitude giving a total bandwidth of 24 kHz
(ie 2 x (4 x 3kHz))



		Sideband									
m	**Carrier**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	1										
0.25	0.98	0.12									
0.5	0.94	0.24	0.03								
1	0.77	0.44	0.11	0.02							
1.5	0.51	0.56	0.23	0.06	0.01						
2	**0.22**	**0.58**	**0.35**	**0.13**	**0.03**						
2.41	0	0.52	0.43	0.2	0.06	0.02					
2.5	0.05	0.50	0.45	0.22	0.07	0.02	0.01				
3	0.26	0.34	0.49	0.31	0.13	0.04	0.01				
4	0.4	0.07	0.36	0.43	0.28	0.13	0.05	0.02			
5	0.18	0.33	0.05	0.36	0.39	0.26	0.13	0.05	0.02		
5.53	0	0.34	0.13	0.25	0.04	0.32	0.19	0.09	0.03	0.01	
6	0.15	0.28	0.24	0.11	0.36	0.36	0.25	0.13	0.06	0.02	
7	0.3	0	0.3	0.17	0.16	0.35	0.34	0.23	0.13	0.06	0.02
8	0.17	0.23	0.11	0.29	0.1	0.19	0.34	0.32	0.22	0.13	0.06

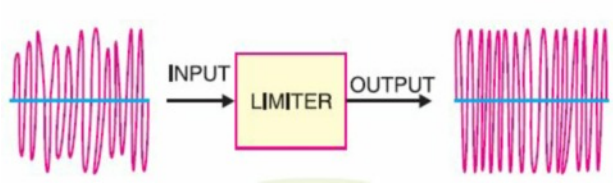
Such a bandwidth would be totally unacceptable on the 2m vhf band where a 'channel' spacing of 12.5 kHz is used.
As a result, Narrow Band FM (**NBFM)** is used in which only one sideband is significant.
Using the Table on the previous page implies that a modulation index of m = 1 is needed to limit the FM signal to a single upper and lower sideband..

Carson's Rule :-
This gives an approximation of the Bandwidth of an FM signal according to the formula :-

Bandwidth, BW = 2 (Δf + fm)

ie bandwidth approximates to twice the sum of the Peak Frequency Deviation plus the maximum modulating frequency.
Since the modulation index m = Δf/fm then rearranging gives Δf = m * fm
Substituting this in the bandwidth formula gives **BW = 2 (m + 1) fm**
ie bandwidth approximates to twice the maximum modulating frequency times the modulation index plus 1.
Consider the previous example where **fm = 3 kHz and m = 2**. BW = 2 * (2+1) * 3kHz = **18 kHz**.
Compare this with the previous bandwidth obtained using Bessel Functions of **24 kHz**.
The tendency for the formula to give a smaller bandwidth is why Carson's Rule is not used for spectrum/bandwidth planning. This is exemplified when **NBFM** is used. eg for **fm = 3 kHz and m = 1**, then according to Carson's Rule, a bandwidth of 2 * (1+1) * 3 kHz = **12 kHz** results instead of a BW of **6 kHz** as derived using Bessel Functions!

Intrinsic Noise reduction Properties of an FM signal :-
Electrical noise manifests itself as amplitude variations in the signal. When an AM signal is demodulated, these amplitude variations appear in the output signal as noise.
However, when an FM signal is demodulated, only the frequency changes in the carrier produce an output which is thus relatively noise free.
However, not all FM Demodulators are perfect in totally ignoring amplitude variations, and hence the Demodulator is normally preceded by a limiter amplifier which amplifies to such a large extent that its output becomes an FM signal having flattened peaks. The diagram below shows an input FM signal which is also amplitude modulated by noise. The output of the Limiter Amplifier is pure FM and thus is free of noise.



Since the limiter amplifier has to have a very high gain in order to amplify even relatively weak signals to saturation, then a squelch control is invariably used to deaden the receiver in the absence of any signal or if the input signal is too weak.