



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	01237 422833	Email: fisheralan@btinternet.com
Chairman	Terry Adams	G4CHD		
Vice Chairman	Mike Hammond	G3PGA		
Secretary	Alan Fisher	M6CCH		
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		

January, 2015

EDITORIAL

Welcome to another Club 5&9 Newsletter - the first of 2015.

I trust everyone had a very good Christmas and on behalf of your Committee may I wish you all a Very Happy New Year.

Now that the new year is with us, our thoughts (or at least your Committee's) must prepare for the **Club AGM at our March Meeting**. To that end, we had a Committee Meeting on Wednesday January 14th at which various possible recipients for the Jim McFee Cup were discussed as well as whether each Committee member was willing to stand for re election at the AGM.

Accordingly, the **following members are willing to stand for re election**:-

Terry (G4CHD) - Chairman - would be willing to step down but continue to edit the 5&9 Newsletter.
Mike (G3PGA) - Vice Chairman - is willing to stand and remain as Examiner
Alan (M6CCH) - Secretary - is willing to stand as Secretary
Mike (G4KXQ) - Treasurer - is willing to stand as Treasurer
John (G3JKL) - is willing to stand and continue as Web Master, QSL Manager, and Exam Secretary.
Laurence (G4XHK) - wishes to step down and take a 'sabbatical year out' due to family commitments
Graham (G1ZTJ) - is willing to stand
This will result in at least one possible vacancy on the Committee so nominations please. As always, it is you the membership who have the last say so make a note to attend the AGM in March.
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.

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

For further information, contact Alan (M6CCH)

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/>

REPORT ON THE DECEMBER MEETING

CLUB CHRISTMAS PARTY

It fell this year to me (Mike - G3PGA) to organise and run the Christmas Party.

First on the list of things to do was to visit Morrison's to pre-order the goodies needed.

On the Monday late afternoon the pickup and purchase of the salad stuff went reasonably well. I only barked a couple of times.

Velma and I arrived at the clubhouse and were met by Dave G0PGK and set to work laying out the food table.

Graham G1ZTJ arrived and helped to set up the Raffle Prize table which turned into a great raffle enjoyed by all.

Coffee was free for the event with the food very quickly disappearing.

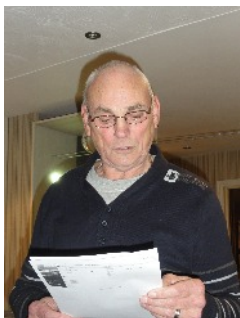
Dave G0PGK's quiz went down very well. I can't remember who won the prize??? (See ecstatic Mike below!)

I hope every one enjoyed themselves

and my thanks go to the following without whose help I would have fallen at the first sausage roll :-

Laurence (G4HXX) for help at Morrison's with the buying, Dave (G0PGK) for early opening + the

coffee shop + the Quiz, Graham (G1ZTJ) in help setting up the raffle table, and Christine (Terry's xyl) for selling the



raffle tickets. My thanks also to John (G3JKL) for the music, Jim (M3VJM) and Terry (G4CHD) for the photos and Terry (G4CHD) for providing the crackers. Also a big thank you to all those who donated for the raffle and auction.

Last but not least to Velma, my xyl, for the catering.

Overall the event went very well with a small profit of £30 towards club funds.

Mike (G3PGA)

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.**

Terry (G4CHD)

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

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

CROSSWORD

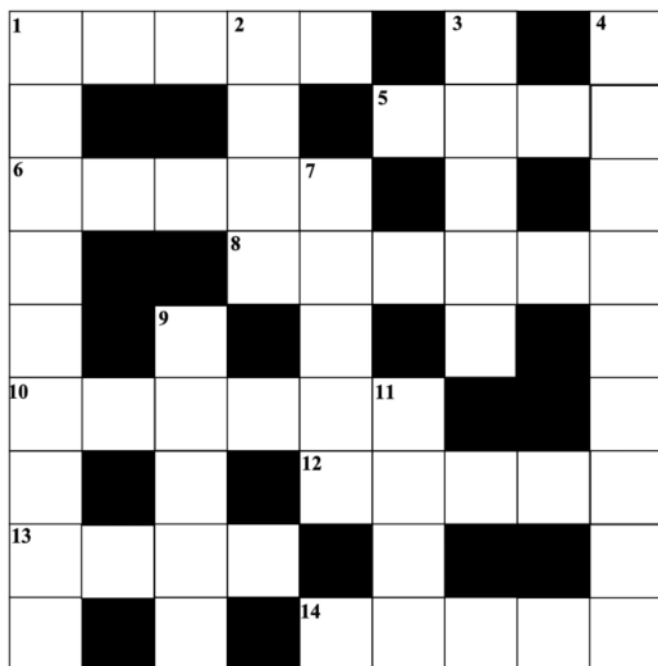
This month's Crossword is by Stuart (M1FWD).
The answers will be published in the next month's Newsletter. Good luck !

Clues Across

- 1) In Buddhism and Hinduism, the sum of a person's actions in previous states of existence (5)
- 5) The second-brightest star in a constellation (4)
- 6) Metric unit of capacity equal to 1000 cubic centimetres (5)
- 8) In computing, a linear sequence of characters, records or data (6)
- 10) Charlie Echo Zero island (6)
- 12) The distance between a camera and the subject to be photographed (5)
- 13) To shape (an object) on a lathe (4)
- 14) County in the state of Oklahoma, USA - county town Pawhuska (5)

Clues Down

- 1) A measure of frequency equivalent to 1000 cycles per second (9)
- 2) Fourth rock from the sun (4)
- 3) Tango Yankee land (5)
- 4) A grey brittle metallic transition element used with steel to make alloys (9)
- 7) A medium through which electromagnetic waves were formerly thought to be transmitted (5)
- 9) Prefix for terms relating to outer space (5)
- 11) Straight lines in which radiation travels to given points (4)



Last month's answers :-

Across 5) receivers 7) Turkey 9) cut-off 12) Norwegian

Down 1) Eritrean 2) SCART 3) nine 4) New 6) stuffing
8) sonic 10) User 11) erg

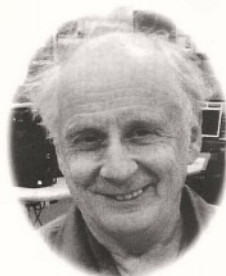
Stuart (M1FWD)

TREVOR G0ERX – A PERSONAL APPRECIATION

by Stuart (M1FWD)

Trevor Michael Balment

24th January 1947 - 14th December 2014



When we moved back to North Devon in 2004 (we had lived here for five years in the early 1970's) our home in Pilton wasn't ready, so my wife (Mags) and I lived with friends in North Molton for a month.

One day, we were sitting in their garden and my Icom handheld was monitoring

GB3DN, when a voice came over the airwaves.

"What a wonderful accent!" Mags exclaimed.

Little did we know then that both the voice and the accent were to become a delightful part of our lives in the following ten years.

We were just a five-minute walk from Trevor and Daphne in Pilton. Many a Sunday afternoon was spent with the four of us rag-chewing in our conservatory and testing out Mags' home-made wine. On one occasion, I even introduced Trevor to the intricacies of EchoLink, before he had his own computer.

I remember one New Year's Eve in particular – they came up the hill to our place and stayed for eight hours. At midnight we alternated between standing in the garden watching the town fireworks and transmitting silly things on the repeater!

If anyone had a question about broadcast station frequencies or locations, then Trevor was the man with the answers. His knowledge of such matters was nothing less than encyclopaedic.

When my Kenwood TS2000 went down the pan and had to go away for repair, who should be standing on the doorstep with his brand-new Alinco DX70-TH, insisting that I borrow it for the duration? You guessed it. Thanks, Trev. Unfortunately, we spoke to each other less frequently in later years. Let's just say that we went our separate ways to some extent as far as conversation topics were concerned. Now, of course, I wish we hadn't.

However, I do have a lovely memory which is going to last for a very long time. A few days before Trevor 'passed over' (that was a favourite phrase of his) the afternoon net closed at five o'clock as usual, but Trevor and I carried on, with a glorious 20-minute QSO about one of our mutual loves – local railway history. Trevor's knowledge of the old lines (and of old Barnstaple itself) was amazing.

I'm so glad we had that final contact – we were planning on a lot more. I treasure that one.

The next day I sent him some railway photos from my collection, including one of the Barnstaple locomotive shed, circa 1963 (now Tesco car park). He replied immediately, saying how much he enjoyed the loco shed photo because, "We used to sneak into the station from behind that shed to go train-spotting!" Avoidance of platform tickets by any chance, Trev?

Like me, he adored *Dad's Army*. Stupid boy!

Trevor's humour was puckish and mischievous, and he

loved to include snippets of CB lingo in QSO's, usually followed by gales of laughter and his legendary phrase, "Oh dear, oh dear, what can one say?"
So, Trev, we're going to cut you loose now, good buddy. A pound in your pocket and off like a rocket
Sleep well, mate. 73.

Stuart (M1FWD)

CHANGES TO THE AMATEUR RADIO LICENSE FROM JANUARY 2015

The following article is from the Essex Ham Web Site which is dedicated to supporting amateur radio in Essex. The web address for the article is :-

<http://www.essexham.co.uk/news/ofcom-licence-changes-consultation-results.html>

The article was posted on Dec 5th 2014 by Pete (M0PSX) and summarises the results of the Ofcom Public Consultation on proposed Amateur Radio License changes.

Ofcom Consultation - Sept 2014

Towards the end of 2013, Ofcom announced plans to change the amateur radio licence. This resulted in an Ofcom Public Consultation, and much discussion within the amateur radio community. Ofcom has today (Dec 5th 2014) published the results of the public consultation, and what they propose to change.

Around 2000 replies were received, and here is a summary of what Ofcom is set to change to the amateur radio licence from January 2015:-

What's being changed :-

1. Make the 470kHz and 5MHz bands available to Full licence holders without the need for an NoV
2. Make changes to allow a club to keep its callsign if the licence-holder leaves that club
3. Allow a licence to be revoked if the holder has been convicted of an offence under the Wireless Telegraphy Act
4. Changes to how often a callsign has to be given
5. Allow encryption, if requested by a User Service or when assisting with communications at a time of emergency
6. Some other minor wording changes

What's not being changed :-

The most controversial proposed change is now not going ahead. The proposal was to make the Regional Secondary Locator reflect the Main Station Address - not the place of operation. Currently, the station M6ABC when in Wales would use MW6ABC – but had the proposal gone through, the "W" would no longer be mandatory. In response to overwhelming feedback, Ofcom will not be making changes, and things stay as they are – a great relief for most amateurs, and well done to Ofcom for supporting the majority view

Use of callsigns :-

For us, this is the interesting one. Ofcom's proposal was for the 'identify every 15 minutes' rule to be dropped and replaced with:

"the station be clearly identifiable at all times and that the call sign be transmitted as frequently as is practicable during transmissions."

Only 330 agreed to relaxing the 15 minute rule, and 1350 disagreed with the proposal. Ofcom's decided to make the change anyway, and it looks like the 15 minute requirement is set to be removed from January.

As a concession, a note will be added to the guidance notes advising that best practice is "every 15 minutes" when operating voice or Morse code – at least that gives some guidance for those of us involved with training.

The Document and Comments :-

Ofcom's statement can be found here :-

<http://stakeholders.ofcom.org.uk/consultations/amateur-radio-licence/statement>

This contains a list of amateurs who responded and had no objection to their names being published.

Next Steps :-

Notices will be sent to existing amateurs about the changes in January 2015, with a period of one month for objections. This is followed by a month for Ofcom to review representations, before a final announcement is made on the Ofcom website and the new licence made available.

New licences issues from January 2015 will have the changes built-in.

Since I wrote this article, I have just received a letter from Ofcom together with full details of any proposed changes and this is included at the end of this Newsletter for your perusal.

However, I noticed that my callsign was given as GE4 Which took me by surprise. A quick Google revealed the following :-

From the RSGB Website

As you will be aware, Ofcom is required to give all licensed radio amateurs notice that it intends to vary licences in line with its decisions following last year's consultation. That process has now begun and letters are being sent out.

It has been brought to the RSGB's attention that some amateurs have received a letter suggesting that their callsign now includes the RSL "E". Ofcom have confirmed that this is an error and not a change in policy. Further details will be published on the Ofcom website.

<http://rsgb.org/main/blog/news/gb2rs...ion-proposals/>

OFCOM CONSULTATION DOCUMENT RE CLOSING EXISTING INTERFERING INSTALLATIONS

Many thanks to both Mike (G3PGA) and Dave (M0JAP for bringing another Ofcom consultation document to my attention for inclusion in the 5&9.

This document sets out Ofcom's consultation on draft regulations for new wireless telegraphy legislation, intended to keep pace with technological advances to control interference.

Electrical and electronic apparatus are capable of emitting electromagnetic energy. In most cases, this is minimal and has no noticeable negative effects. However, in some cases the level of energy emitted from apparatus can cause interference to wireless communications.

Ofcom has powers to take enforcement action in instances where some types of electrical or electronic apparatus causes undue interference to wireless communications.

The proposed regulations are intended to be more resilient to technical developments.

The deadline for responses to this consultation is

16th February 2015.

The full document can be found at :-

<http://stakeholders.ofcom.org.uk/consultations/undueinterference/>

Mike also forwarded details of a Yahoo forum in which you can find comments on this Consultation document :-

rsbtech@yahoogroups.com Digest Number 2383

AMATEUR TIMING AND AN ECONOMICAL Rpi TIME SERVER - PART 2 (of 2) by Dave James (M0JAP)

This can be found on the next 5 pages. Many thanks Dave for such a stimulating article.

NEW SCAM - BEWARE

Thanks to John (G0UNB) for bringing the following to my attention :-

There is a new and clever credit card scam. Please circulate this. Someone it happened to says it works like this:

Wednesday a week ago, I had a phone call from someone who said that he was from some outfit called: "Express Couriers" asking if I was going to be home because there was a package for me, and the caller said that the delivery would arrive at my home in roughly an hour. And sure enough, about an hour later, a uniformed delivery man turned up with a beautiful basket of flowers and wine. I was very surprised since it did not involve any special occasion or holiday, and I certainly didn't expect anything like it. Intrigued about who would send me such a gift, I inquired as to who the sender is. The deliveryman's reply was, he was only delivering the gift package, but allegedly a card

was being sent separately; (the card has never arrived!). There was also a consignment note with the gift.

He then went on to explain that because the gift contained alcohol, there was a £3.50 "delivery charge" as proof that he had actually delivered the package to an adult, and not just left it on the doorstep where it could be stolen or taken by anyone.

This sounded logical and I offered to pay him cash. He then said that the company required the payment to be by credit or debit card only so that everything is properly accounted for.

My husband, who by this time was standing beside me, pulled his wallet out of his pocket with the credit/debit card, and 'John', the "delivery man", asked my husband to swipe the card on the small mobile card machine which had a small screen and keypad where Frank was also asked to enter the card's PIN and security number. A receipt was printed out and given to us.

To our horror, between Thursday and the following Monday, £4000 had been withdrawn from our account at various ATM machines.

It appeared that somehow the "mobile credit card machine" which the deliveryman carried now had all the info necessary to create a "dummy" card with all our card details after my husband swiped our card and entered the requested PIN and security number.

Upon finding out about the illegal transactions on our card, we immediately notified the bank which issued us the card, and our account was closed.

We also personally went to the Police, where it was confirmed that it is definitely a scam because several households had been similarly hit.

WARNING: Be wary of accepting any "surprise gift or package", which you neither expected nor personally ordered, especially if it involves any kind of payment as a condition of receiving the gift or package. Also, never accept anything if you do not personally know or there is no proper identification of who the sender is.

Above all, the only time you should give out any personal credit/debit card information is when you yourself initiated the purchase or transaction!

If you pass this on, it may just prevent someone else from being swindled.....!

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. This is particularly relevant as my article on Frequency Modulation in the October 5&9 did not raise a single comment suggesting that perhaps such articles are not required.

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

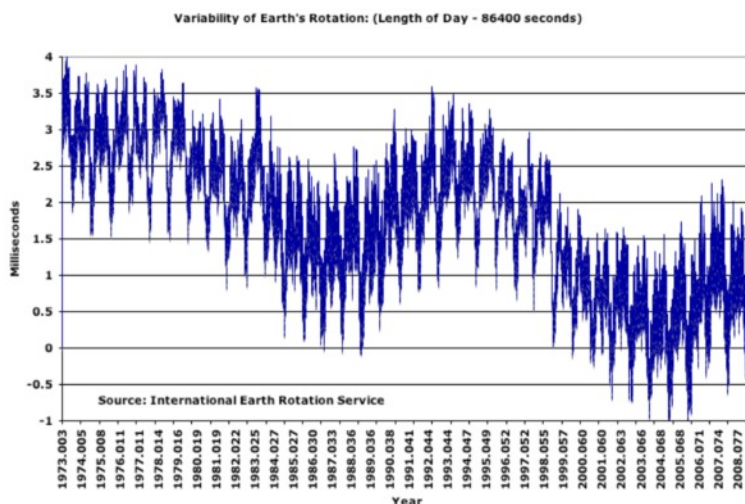
Terry (G4CHD)

Introduction

Following last month's Part 1, which introduced some of the reasons why I find this subject area so fascinating, we now round off with a few details of the Raspberry Pi (RPi) stratum 1 NTP time server and discuss a few related topics. First I explain a couple of typos that went uncorrected in Part 1. Under the Windows and Linux header, and between the two screen dump figures (and later in the same section) there was mention of a stratum 1 server in the Netherlands. As spotted by some dozens of readers it is, of course, a German server, the clue being the 'de' in the address ptbtime2.ptb.de ! Secondly under the header So how is UTC actually determined? the text at the end of para 1 stated that the "leap seconds number is currently 16, and we know that there will be no leap second introduced Dec 31 2014". That should have been 35s and not 16s that TAI is ahead of UTC, as spotted by even more readers. In fact in the New Year, since Part 1, the competent body (the IERS) announced that there will indeed now be a leap second added to UTC this year i.e. at the end of June 30, 2015. Just to be absolutely clear then, currently (January 2015) we note that:

TAI	is ahead of UTC	by 35s	
TAI	is ahead of GPS	by 19s	always
GPS time	is ahead of UTC	by 16s	

The epoch (notional start) for GPS time is Jan. 06 1980. We will address GPS later, but for now we simply note that GPS time is always behind TAI by exactly 19s, not adjusted for leap seconds - although the system propagates a warning (flag) and the leap second data regularly and well ahead of the potential half-yearly dates. The physical reason for the need for leap seconds arises from changes in the rotation of the Earth. Although there is a definite long term slowing, in detail this behaviour is irregular and unpredictable. The primary mechanisms are tidal friction (~2.3 ms/century); changes in the crust relative to core; changes in mantle convection; earthquakes; and upward movement of land mass and mantle material (post-glacial period rebound). This figure shows how much and how fast this changes (left scale is ms, bottom scale shows one tick per year):



In fact for astronomical purposes, there are several other time systems formally defined and employed, and it soon gets quite complicated. We will not go into detail here, but the first point to note is that for an earth-centric viewpoint a Geocentric Co-ordinate Time may be defined with spatial origin at the centre of mass of the Earth. But if we are involved in astrophysics, or especially the necessary astrometry, it's more useful - in fact essential - to work with Barycentric Coordinate Time having its spatial origin at the solar system barycentre (centre of mass). And for each co-ordinate system account must be taken of all relativistic effects in space-time. So for interplanetary and deep-space spacecraft navigation, calculations must utilise 4-dimensional space-time transformations, not just 3-dimensional, and this involves generalisations of the special relativistic Lorentz transformations. I warned you that this subject can be tricky ! Just to get a glimpse of all this, the November 2014 issue of ADARC's 5&9+ newsletter also carried a little article which explained the effect of elevation on the time read from a portable atomic clock.

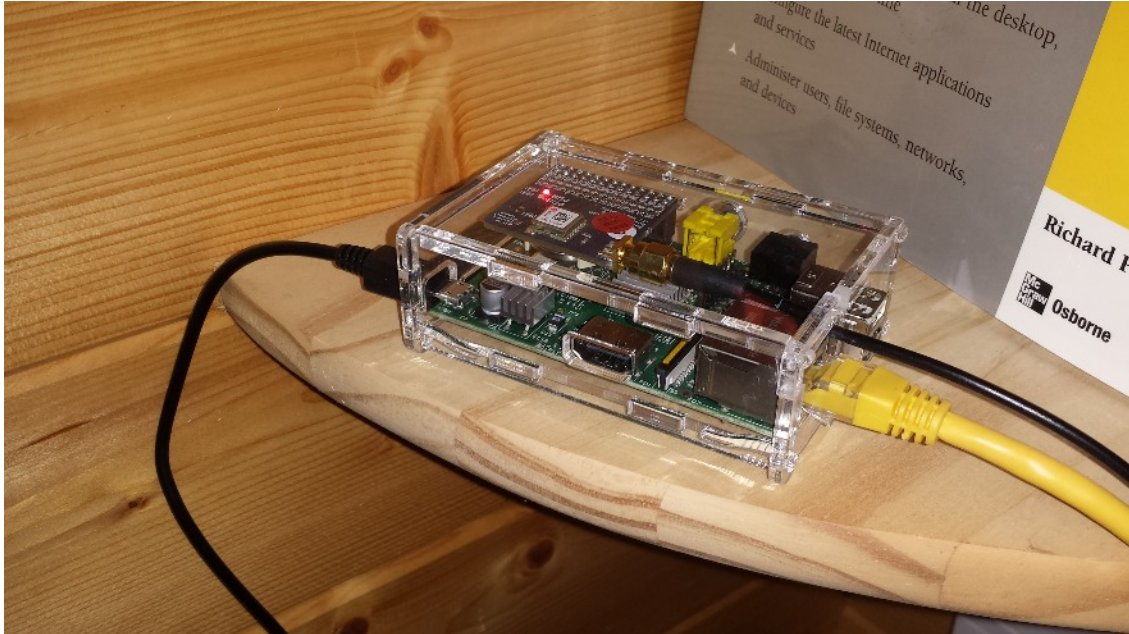
Why leap seconds are of concern

It is essential for many critical systems, especially where safety and much money are involved, that the networks involved are adequately synchronised. At the last leap second change unfortunately some time servers internationally failed to properly introduce the extra one second step, and this confused the NTP server-selection algorithms used in the time distribution. One result was a serious disruption in one of the very largest global airline reservation and scheduling networks; the various servers had software that just could not properly verify timing integrity and shut down - with huge consequences. There are many other examples, and much work is underway to try to avoid this sort of thing next time (this June).

The RPi NTP server

The accuracy, precision and coverage of the GPS is equalled only by the audacity of its original designers and its pervasive utility. It is a truly remarkable technological achievement, and for its funding and ongoing refinement we must be grateful to the US taxpayer alone. Further the May 2000 removal of SA, by Presidential decree, had both immediate technical (accuracy) and commercial benefit, and has spawned a huge global industry and acceptance of GPS as a basic tool for navigation and timing. In parallel with the emergence and improvement of GPS, the internet and world wide web have grown from nothing to the ubiquitous and effective tool we all use today.

So, how to get the low-cost NTP time server mentioned in Part 1 ? It's pretty easy, and these two photos show my finished server together with the outside antenna mounted atop the gable finial on my garden office (yep, it's hard to see the antenna puck):



You need one RPi (B or B+, makes no difference); a suitable flash card; an active antenna (watch the voltage level) and GPS add-on board (see photos in Part 1); and a suitable case. The GPS module used in the add-on board is a u-Blox MAX-7Q, and the RPi-compatible add-on board is available here:

http://ava.upuaut.net/store/index.php?route=product/product&path=59_60&product_id=95.

There is an RTC included, for which you need a CR2032 button cell fitted to support. This module is not a timing grade module, but as explained in Part 1, is capable of delivering a useful level of UTC accuracy at $\sim 1 \mu\text{s}$. You don't need to worry about leap seconds or any special settings, and you don't even need to use a soldering iron ! But you may need a knife or file and/or small pliers; depending on the protective boot on the antenna SMA connector, and depending on whether the RPi is a model B or model B+, the back of the case and/or this boot may need a small but careful adjustment. Other than this, just fit the battery, plug the add-on board onto the RPi interface header (or end of the now longer header on the B+ model) and start to prepare the flash card. Leave the antenna SMA connection off initially.

There are two ways to go here: the (seemingly) easier use of a user mode software arrangement, or use of a proper kernel mode arrangement. Until recently there was no suitable RPi kernel for NTP based on a GPS module serving 1 pps (PPS) inputs, but there is now. (At one point I moved to using a Beagle Bone because of this, but there is no need any more, and the RPi ecosystem is much bigger than that for other 'hobbyist' SBCs like the Beagle Bone – and now the Banana Pi and its flavours). In the first case (user mode), you can start with a normal RPi complete OS system (Debian 'wheezy') flash card and follow the guidance provided by the ever-helpful David Taylor here:

<http://www.satsignal.eu/ntp/Raspberry-Pi-NTP.html>

I normally use a laptop that is network-connected to the RPi using PuTTY. You will need to follow the guidance quite carefully, and it is certainly not a 5 minute job ! You will notice that what we are doing here is not only extracting the UTC time from the NMEA serial mode data output stream from the GPS module (GPIO 14, 15), but also getting much better accuracy in the kernel mode case by using the leading edge of the PPS (pulse per second) ticks presented on one of the interface pins (GPIO 18).

For the better kernel level approach, the same basic principle is used, except that we use a specially written gpsd kernel instead of the ntpd one normally supplied in the Debian distro (which cannot properly exploit the presence of the PPS signal). This means that it is not for the faint-hearted. As an example, early in the process of setting this up I did not even have a ping command line function, so had to install this via the command: `sudo apt-get install iputils-ping`. This approach means that you have to do it all in Linux command line mode, no GUI – unless you are familiar with Linux. To start with you need to download and install a minimalist image based on Raspbian 'wheezy' but importantly including ntpd and a proper PPS-enabled kernel, available here: <http://ntpi.openchaos.org/downloads/>. Then use these commands:

```
sudo apt-get update
sudo apt-get install raspi-config          (and use raspi-config to resize fs)
sudo apt-get upgrade
sudo apt-get install gpsd-clients
```

Care is needed to ensure that this kernel is not over-written at any stage. The absence of a graphical desktop environment is unnerving, and when I tried to install one to aid me I get into such difficulty I had to restart the whole process from scratch.

You will also have to assign a suitable LAN IP address in either case, so that you can use this as a stratum 1 NTP server on your internal LAN, e.g. 192.168.10.1. For the ntp.conf file you must choose a suitable set of back-up NTP servers (I chose a stratum 1 in the Netherlands, a stratum 2 from my ISP and the UK NTP pool's automatically random-assigned set of four stratum 2s). If, like me, you'd like to make the time server available outside your LAN (internet rather than intranet), you need to check that your site router allows external access on port 123 for the specific address you have chosen for your new time server.

If you wish to do much monitoring, you can install SNMP and use the Meinberg Monitor program (see Part 1) remotely on a Windows machine to examine the loopstats files on the Rpi

(see: <http://www.satsignal.eu/ntp/Raspberry-Pi-NTP.html>).

Otherwise you can check how your stratum 1 server is progressing by using the `ntpq -c rv`, `ntpq -p`, and `ntpq -pn` commands as shown in these examples:

```
Last login: Tue Jan 13 15:16:37 2015 from 192.168.1.103
pi@ntppone ~ $ ntpq -c rv
associd=0 status=01ld leap_none, sync_pps, 1 event, kern,
version="ntpd 4.2.7p364@1.2483-o Fri Apr 12 02:52:48 UTC 2013 (1)",
processor="armv6l", system="Linux/3.6.11-pps-g4642dff-dirty", leap=00,
stratum=1, precision=-19, rootdelay=0.000, rootdisp=1.045, refid=HCO,
reftime=d85fc0fb.31db7264 Tue, Jan 13 2015 16:06:19.194,
clock=d85fc0fe.dfffa2d2 Tue, Jan 13 2015 16:06:22.874, peer=49605, tc=4,
mintc=3, offset=0.002124, frequency=-40.406, sys_jitter=0.001907,
clk_jitter=0.000, clk_wander=0.000
pi@ntppone ~ $ cat /sys/class/thermal/thermal_zone0/temp
43850

pi@ntppone ~ $ ntpq -p
remote refid st t when poll reach delay offset jitter
-----
oPPS(0) .HCO. 0 l 9 16 377 0.000 0.000 0.002
*SEM(0) .GPSD. 3 l 11 16 377 0.000 -3.697 0.510
+ntpl.nl.uu.net .PPS. 1 u 17 64 377 47.969 4.999 4.137
-212.159.6.10 (c 195.66.241.10 2 u 11 64 377 37.731 4.599 3.071
-li621-69.member 77.246.126.132 2 u 54 128 377 38.786 4.014 2.269
+y.ns.gin.ntt.ne 145.238.203.14 2 u 14 128 377 49.577 1.350 1.215
-ntp.fundamental 81.2.117.235 2 u 110 128 377 47.381 4.368 2.951
-rigel.retrosnub 195.66.241.2 2 u 47 128 377 38.113 4.286 1.472
pi@ntppone ~ $
```



```

pi@ntpione ~ $ ntpq -pn
remote          refid          st t when poll reach  delay  offset  jitter
-----
o127.127.22.0    .HCO.           0 1   10   16   377    0.000    0.000    0.002
*127.127.28.0    .GPSD.          3 1   12   16   377    0.000   -2.079    1.707
+193.79.237.14   .PPS.           1 u    -   64   377   47.969    4.999    4.266
-212.159.6.10    195.66.241.10   2 u    60   64   377   37.731    4.599    3.071
-212.71.248.69   77.246.126.132  2 u   103  128   377   38.786    4.014    2.269
+129.250.35.251  145.238.203.14  2 u    62  128   377   49.577    1.350    1.215
-217.169.26.196  193.67.79.202   2 u    27  128   377   47.381    4.368    2.898
-178.18.118.13   195.66.241.2    2 u    96  128   377   38.113    4.286    1.472
pi@ntpione ~ $

```

It will be seen that at the last two instances the reported offset from UTC was 0 μ s (0.000 ms, top row, penultimate column in the last two dumps). The third line shows the stratum 1 server in the Netherlands, the fourth the stratum 2 server at PlusNet, my ISP. HCO stands for Harold Clayton Observatory (mine) and the GPS module effectively constitutes a stratum 0 source via the precise PPS pulses and the NMEA time data serial stream i.e. the finished RPi server is seen as stratum 1 to other devices connected to it via Ethernet.

Next steps, and further thoughts

Distributing time and its integral, frequency, on a local basis and moreover very precisely, is non-trivial. As mentioned in Part 1, one can use PTP rather than NTP on a fast LAN, but we are still nowhere close to being within the ns area. Today GPS is the best approach together with account taken of propagation delays in all cables and electronics. Remember that a coaxial cable with typical dielectric constant will have a delay of some 1.5 ns per foot (using nicely mixed units !) In large radio astronomy receivers, the RF cables are 'interrogated' automatically and regularly for variations in delays due to temperature drifts, to preserve the overall calibration of the delays. To do this calibration signals are sent back and forth along the same cables in a band outside the receiver frequency band. Each RF focal point is now measurable to within a few mm, due to advances in metrology, astrometry and GPS technology. Recently a Topcon/Leica survey unit was used at my observatory to determine the position of my second dish, as shown here:



In this breed of GPS field instruments, an ultimate accuracy of less than 0.5 cm is easily and quickly achievable, but to do this the antenna and GPS electronics are far more involved than that describes above or as used in a smartphone. Timing GPS modules are far more expensive than normal navigation ones, and these surveying instruments use both GPS channels, use carrier phase determination, GPRS-distributed (cellular mobile) corrections and offsets derived from a DGPS national network run by Leica and the OS (including a base station in Appledore), and even additional ionospheric propagation corrections supplied by a recently installed augmentation satellite system (EGNOS). Cost is very high.

For the measurement and synchronisation of electronics systems and for the correct frequencies within RF receivers and transmitters, we still use quartz oscillators. Many TCXOs are now almost as good as OCXOs a generation or so ago. These days much instrumentation – and networks, and especially cellular mobile base stations – are designed to take advantage of distribution from a 'house' frequency/time standard, usually PPS tick and sine or square wave 10 MHz signals derived from GPS and a suitably coupled oscillator. Traditionally these oscillators have been quartz OCXO or even DOCXO type. Nowadays compact Rubidium atomic clocks are often used, and like the quartz oscillator these provide good short-term stability. As most requirements cannot justify a cesium or hydrogen clock, GPS can now supply the excellent longer term stability. I am evaluating several designs of GPS-disciplined arrangements using quartz and Rubidium oscillators and different GPS timing modules for my radio astronomy. In the first instance I am setting up a 'house' frequency and UTC standard source, and then hope to extend this to each RA dish. I discovered recently, by the way, that the Chinese do not refer to GNSS 'disciplining' of their oscillators, just 'taming' them ;-)

Summary

As part of my adventures in time and frequency, I have accumulated quite a few high stability frequency sources, including atomic clocks; a number of GPS-disciplined arrangements for both frequency and UTC; and more measuring equipment including time interval counters (to 40 ps) and frequency counters. So if you need a check on or adjustment of a frequency source, or help in timing applications, please send me an e-mail.

If you want a simple way to occasionally or regularly **step-synchronise** your Windows machine to UTC, use one of the software programs listed in Part 1.

If you'd like to **discipline** your machine's system clock through NTP, use the Meinberg port of the NTP daemon in Linux – and the associated Monitor – as also explained in Part 1. I've placed a little file with some help on doing this in this permanent dropbox location:

<https://dl.dropboxusercontent.com/u/5266466/ADARC/NTP%20Win%20Meinb%20ADARC%20dsj%20rA.pdf>

If you encounter difficulties at some point in gaining access to the configuration file, read carefully the help given under Addendum/Troubleshooting here:

<http://www.meinbergglobal.com/english/sw/readme-ntpinstaller.htm#accessrights>.

There is also help on settings etc. on that same page.

If you'd like to **make** a RPi-based UTC server, either user mode or kernel mode, use the outline of the necessary steps as given above. If you get stuck doing this, ask me for a copy of the RPi image (kernel mode) on a flash card. If you'd like to just **use** my NTPIONE RPi server via the internet to help you for NTP, just use address 212.159.76.48 in the configuration file (paste exactly this new line: “server 212.159.76.48 minpoll 5 maxpoll 5 iburst # my NTPIONE at HCO via internet”, whether in Raspbian or Windows OS).

May your times be interesting ... !

dave@greenover.net



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Tel: 020 7981 3700
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12 January 2015

**SCHEDULE 1, PARAGRAPH 7 OF THE WIRELESS TELEGRAPHY ACT 2006 –
NOTICE OF PROPOSAL TO VARY A WIRELESS TELEGRAPHY ACT LICENCE**

Licensee name	
Licence No	
Call sign	
Licence type	Amateur Full Radio Licence

1. In accordance with paragraph 7 of Schedule 1 to the Wireless Telegraphy Act 2006 (as amended - "the Act") and Clause 4(3) of your Amateur Radio licence(s), the details of which are given above ("the Licence(s)"), we are writing to notify you that we propose to vary the Licence(s), as described below.
2. If Ofcom wishes to vary a wireless telegraphy licence, it must:
 - notify you of the reasons for which we propose to vary your licence;
 - specify a period in which you may make representations;
 - decide whether or not to vary the licence within one month of the end of that period; and
 - notify you of its decision within a week of making it.
3. On 7th April 2014, Ofcom published a Statement, *Public Sector Spectrum Release* ("the PSSR Statement") setting out its decisions to remove certain frequency bands from all Amateur Radio Licences. The PSSR Statement followed a Consultation ("the PSSR Consultation") that was published on 11th June 2013. The PSSR Consultation and PSSR Statement can be found at <http://stakeholders.ofcom.org.uk/consultations/public-sector-spectrum-release/?a=0>.
4. On 5th December 2014 Ofcom published a Statement, *Updating the Amateur Radio Licence*, ("the Amateur Radio Statement"), setting out Ofcom's decisions further to update the Amateur Radio Licence. The Amateur Radio Statement followed a Consultation ("the Amateur Radio Consultation") that we published on 9th September 2014. The Amateur Radio Consultation and Amateur Radio Statement can be found at <http://stakeholders.ofcom.org.uk/consultations/amateur-radio-licence>.
5. Ofcom now proposes to vary the Amateur Radio Licence as set out in Annex A to this

Notice. You can view a full version of the draft Licence with the proposed changes here: <http://stakeholders.ofcom.org.uk/consultations/amateur-radio-licence>. If you wish to request a paper copy of the draft Licence, please contact us using the details below.

6. The reason that Ofcom proposes to vary the Amateur Radio Licence is to give effect to the policy decisions set out in the PSSR Statement and in the Amateur Radio Statement.
7. Further, in relation to the decision in the PSSR Statement to vary Tables B and C of the Licence, Ofcom also proposes to vary the Table in Schedule 2 (Additional restrictions which apply to the Unattended Operation of Beacons) by removing access to the 2350 to 2390 and 3410 to 3475 MHz frequency bands. This is to ensure consistency across the Licence and to facilitate public sector spectrum release by the Ministry of Defence, as set out in the PSSR Consultation and in the PSSR Statement.
8. You have one month from tomorrow's date, in which to make representations on Ofcom's proposals to vary the Amateur Radio Licence.
9. Representations should be sent to Ofcom at either of the following addresses:
 - a. by e-mail to ARL2015@ofcom.org.uk; or
 - b. to Ofcom's postal address at:

Spectrum Licensing
Ofcom
Riverside House
2a Southwark Bridge Road
London
SE1 9HA.

10. Ofcom will consider any representations that you may make before coming to its decision and will, in accordance with Clause 4(3) of the Licence, notify you of that decision by publishing a general notice on our website at <http://licensing.ofcom.org.uk/radiocommunication-licences/amateur-radio/licensing-updates>.
11. If we have an e-mail address for you, we shall send any varied Amateur Radio Licence to you by e-mail. Otherwise, we shall send any varied Amateur Radio Licence to you by post.

If you wish to provide your current email address, please use our online E-communications form. This can be found at:

<https://licensing.ofcom.org.uk/radiocommunication-licences/e-comms>

Or via this QR case using your smartphone:



Annex A Changes to the Amateur Radio Licence

In accordance with this Notice of Proposal to Vary a Wireless Telegraphy Licence, Ofcom is proposing the following changes to the Amateur Radio Licence document:

Page, Clause or provision	Nature of change
Section 1 Page 1	For the Full (Club) licence, Ofcom proposes to add to the 'Licensee's Name' the words "insofar as he/she represents [the name of the club]".
Section 1 Page 2	In the trilingual text, Ofcom proposes to update the references to licence Clauses that refer to CEPT Recommendation T/R 61-01, following the further changes proposed below.
Clause 2(1)	Ofcom proposes to amalgamate current Clauses 2(1), 9(3) and 16(1). The revised wording is intended to appear in Clause 2.1 as follows: "2(1) The Licensee may only operate the Radio Equipment in the United Kingdom (including its territorial seas) subject to sub-clauses (a) – (c): (a) Where this Licence is a Full Licence only, and unless it is a Full (Club) or Temporary Licence, the Licensee may operate the Radio Equipment from a Maritime Mobile location; (b) Where this Licence is a Full Licence only, and unless it is a Full (Club) or Temporary Licence, the Licensee may operate the Radio Equipment in countries which have implemented CEPT Recommendation T/R 61-01. (c) The Radio Equipment may not be established or used in any Aircraft or Airborne Vehicle."
Clause 4	Ofcom proposes to introduce two new grounds for revocation. These provisions are intended to appear as new Clauses 4(2)(g) and (h) respectively, as set out below: "(g) where this is a Full (Club) Licence, Ofcom is satisfied that the Licensee no longer represents the club; or (h) where the Licensee has been convicted of an offence under the Wireless Telegraphy Acts."
Clause 4	Ofcom proposes to remove the word 'automatically' from Clause 4(5) which makes provision for Ofcom to revoke the licence on the grounds that the licensee has failed to revalidate the licence. The revised wording of Clause 4(5) is intended to appear as: "4(5) Ofcom may revoke this Licence five years after the later of: (a) the date on which the Licensee last notifies Ofcom that the Licensee wishes to amend any of the details set out in Section 1 of the Licence; or (b) the date on which the Licensee last confirms to Ofcom that the details set out in Section 1 of the Licence are still valid."
Clause 4	Ofcom proposes to introduce a provision enabling it to vary the Licence with respect to frequencies in the 2300 MHz and 3400 MHz bands. This change is intended to appear as a new Clause 4(6): "4(6) In relation to the following bands: (a) 2310 to 2350 MHz; (b) 2390 to 2400 MHz; and (c) 3400 to 3410 MHz. Ofcom may vary this licence for reasons related to interference management after first giving reasonable notice of three months."

Page, Clause or provision	Nature of change
Clause 9	As stated above, Ofcom proposes to remove the existing Clause 9(3) and amalgamate the substance of this into the new Clause 2(1). The remaining provisions in Clause 9 are intended, as a consequence, to be re-numbered.
Clause 11	Ofcom proposes to amend Clause 11(2) to enable those supporting User Services and/or in times of emergency or disaster in the UK to address messages to non-Amateurs and to encrypt messages. The revised wording of Clause 11(2) is intended to appear as: "11(2) Unless the Radio Equipment is being used for the purposes of clauses 1(2) or 1(3) in the UK: (a) Messages sent from the station shall only be addressed to other Amateurs or to the stations of those Amateurs; (b) Messages sent from the station shall not be encrypted for the purposes of rendering the Message unintelligible to other radio spectrum users."
Clause 13	Ofcom proposes to simplify Clause 13(1) with respect to ensuring that Amateur radio stations are clearly identifiable at all times; the Callsign is transmitted as frequently as practicable; and that the Callsign is given in voice or other appropriate format. The revised wording is intended to appear as: "13(1) The Licensee, or, if this Licence is a Full Licence, then any other authorised person who uses the Radio Equipment, shall ensure that: (a) the station is clearly identifiable at all times; (b) the Callsign is transmitted as frequently as is practicable during transmissions, unless the specific requirements of Note (g) ¹ to the Notes to Schedule 1 of this Licence apply; and (c) the Callsign is given in voice or other appropriate format consistent with the mode of operation."
Clause 15	Ofcom proposes to amend the reference to fees, so that it is consistent with comparable references in other types of licences. The revised wording is intended to appear as: "The Licensee shall pay to Ofcom the relevant sums as provided in section 12 of the Wireless Telegraphy Act 2006 and the regulations made thereunder."
Clause 16	As stated above, Ofcom proposes to remove the existing Clause 16(1) and amalgamate the substance of this into the new Clause 2(1). The remaining provisions and cross-references in Clause 16 are intended, as a consequence, to be re-numbered.
Clause 17 (Interpretation)	Ofcom proposes to remove two definitions from this Clause. These are: 1. Clause 17(1)(e) defining 'At Sea'; and 2. Clause 17(1)(kk) defining 'Tidal Water'.
Schedules 1 and 2	Ofcom proposes to: 1. Remove from Schedule 1, Tables B and C (Intermediate and Full Licence Parameters) and from the table in Schedule 2 (Additional restrictions which apply to the Unattended Operation of Beacons), the following frequency bands:

¹ NB. A new Note (g) is intended to be inserted into the Notes to Schedule 1 of the licence and will apply when radio equipment is being operated in the 5 MHz spectrum band.

Page, Clause or provision	Nature of change
	<p>(iv) The Licensee must not cause interference to the use made of the 5 MHz band by the Ministry of Defence ("MoD") and must close down any apparatus that operates in the 5 MHz band if he or she becomes aware that such use is causing undue interference to the MoD's use of the band;</p> <p>(v) The Licensee must close down the Radio Equipment if he or she becomes aware that such use is causing undue interference to the MoD's use of the 5 MHz band;</p> <p>(vi) Communication may be established with military or military cadet organisations by transmitting and receiving only in the 5 MHz band;</p> <p>(vii) Particular care must be taken to ensure radiation does not take place outside the specified frequencies within the 5 MHz band;</p> <p>(viii) Where the Licensee intends to operate within a "net" (a network), the Licensee shall observe the following requirements in relation to the transmission of his or her Callsign:</p> <p>(a) The Licensee shall transmit the station Callsign when he first joins the net and on leaving it;</p> <p>(b) subject to sub-clause (c) below, whilst participating in the net, the Licensee shall not be required to transmit the station Callsign when making contact with other participants;</p> <p>(c) where the Licensee's transmissions have been other than in speech mode for at least fifteen minutes, the Licensee shall transmit his call sign when next he transmits speech.</p> <p>(vi) The Licensee shall operate the Station only at the Main Station Address or at a Temporary Location within the United Kingdom.</p> <p>(vii) At a Temporary Location within the UK, the Licensee shall give the location of the Station every 30 minutes to an accuracy of at least 5km by a generally used identifier as indicated in Note (c) to the "Notes to the licence".</p> <p>(viii) The Licensee shall only operate the Station to the extent that the Licensee can be contacted on a telephone which is located in close proximity to the Station.</p> <p>(ix) In this footnote, "the 5 MHz band" means the radio spectrum between 5.2585 MHz and 5.4065 MHz."</p> <p>3. Update the status of the allocations of the following frequency bands to reflect changes made at the World Radio Conference 2012:</p> <ol style="list-style-type: none"> 0.472 MHz to 0.479 MHz designated as a secondary allocation; 7.100 MHz to 7.200 MHz changed from secondary to primary allocation; and 7.5875 MHz to 7.6000 MHz changed from primary to secondary allocation. <p>4. Update the reference to the "Health Protection Agency" in Note (e) to Schedule 1, where the revised wording is intended to read:</p> <p>"Public Health England and corresponding agencies in other parts of the United Kingdom."</p>

Page, Clause or provision	Nature of change
	<ol style="list-style-type: none"> 2350 – 2390 MHz; and 3410 – 3475 MHz. <p>2. Add frequencies to Schedule 1, Table C (Full Licence Parameters) in the 472 kHz and 5 MHz frequency bands, on the basis of the conditions which are intended to appear as new Notes "r" and "g" to Schedule 1 to the licence. In particular:</p> <ol style="list-style-type: none"> In relation to the use of frequencies in the 472 kHz frequency band, Ofcom proposes to introduce conditions which are intended to appear as a new Note "r" as follows: <p>"(f) Where Radio Equipment is being used in the 0.472 – 0.479 MHz band, the following specific terms and conditions will also apply:</p> <ol style="list-style-type: none"> Where the Equipment is used within 800 kilometres of any border of any of the countries listed below, the maximum power level must not exceed 1 Watt eirp: <p>Algeria, Saudi Arabia, Azerbaijan, Bahrain, Belarus, China, Comoros, Djibouti, Egypt, United Arab Emirates, the Russian Federation, Iran (Islamic Republic of), Iraq, Jordan, Kazakhstan, Kuwait, Lebanon, Libya, Morocco, Mauritania, Oman, Uzbekistan, Qatar, Syrian Arab Republic, Kyrgyzstan, Somalia, Sudan, Tunisia, Ukraine and Yemen</p> <ol style="list-style-type: none"> Any use of the Station in another country is subject to the laws of that country; The Station must not cause interference to and may not claim protection from other wireless telegraphy or electronic equipment; In particular, the Radio Equipment must not cause interference to stations operating in the aeronautical radio - navigation service or on 490 kHz in the Maritime Mobile service; If the Licensee is notified that the Radio Equipment is causing interference to the services described in (iv) above, the Licensee must close down the Equipment and not use it until it can be used without causing such interference. <p>ii. In relation to the use of frequencies in the 5 MHz frequency band, Ofcom proposes to introduce conditions which are intended to appear as a new Note 'g' as follows:</p> <p>"(g) Where Radio Equipment is being used in the 5 MHz band, the following specific terms and conditions will also apply:</p> <ol style="list-style-type: none"> When operating double sideband, the maximum bandwidth shall not exceed 6kHz; Notwithstanding the maximum peak envelope power expressed in the table, above, the maximum radiated power must not exceed 200 Watts eirp; The antenna height shall not exceed 20 metres above ground level;