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Club newsletter



January 2021

Editor: Richard, G3ZIY

Club Covid-19 lockdown nets

Sunday mornings from 1030 local on 28.430±kHz USB

Most Wednesday evening from 2000 on GB3MH

Pacemaker Wearers!

It might be in your interests to look at this page:

<https://www.eenewseurope.com/news/pacemaker-risk-latest-iphone>

M0TZZ and Christmas HQP Contests

Hi all. I would not count myself as a contester although I regularly give away some points during contests but normally only to work some exotic countries not worked before, being a bit of a DX'er. I've dabbled in a couple but not seriously, such as the Practical Wireless 70MHz contest. Nor do I have a particular penchant for spending the best part of 48 hours in the shack (especially in winter!) but the HQP (Hope) contest series attracted me, each session was only 1½ hours, and they were all operated during the day.

I was particularly interested in the FT4 legs (there are also SSB, CW and RTTY legs) since I work a lot of Marmite mode (as I call it). I know there is a lot of anti FT4/8 feeling but I don't understand that since it is not so different from RTTY which has been around for donkeys' years. I am not talking about the technical side, more that you need a PC to do both and they are both RF end to end. They are also a little technically challenging to set up and use well which is also an attraction to me.

I first got interested in digi modes (or MGM as they call them nowadays) on my first visit to CARC (9 years ago) when Rob Barter showed me Digital Master 780 in action, working PSK31 so it is all his fault... With an M6 licence I found I could work some DX on my 10 watts that I couldn't work SSB. So the bug was caught and I've been working just about all of the digi modes ever since, with the odd bit of voice. My favourite pastime is chasing new DX countries (224 in the log so far) and lately most of these have been using FT8 as it can hear stations that you physically cannot (especially with my dodgy hearing).

Anyway, fast forward to last year. The RSGB set up a 6-week HQP contest, SSB, CW, RTTY and FT4 in the spring and summer, nice short sprints and I thought I would have a go on FT4 at some of them. These are HF (well 80/40/20/15 & 10m). You get one point

for each contact, you can work the same station on multiple bands, there are double points for each contact in a different continent and a further double bonus for contacts on 15 and 10m. You don't have to contact stations that are contesting, anyone will do. To my surprise I came second in the May contest (in my group, UK High Power) without trying too hard which encouraged me to enter some more. There are other groups for 100 watts and also QRP.

Thus encouraged, I had a go at the 2m contest which is not part of the HQP series – these are a bit tougher, a whole 2 hours and of course I only have 100 watts on that band while I can go up to the legal limit on HF. I came second in that too. I was pipped at the post in both by just a few points.

So, before the Christmas HQP HF series I had a bit of a think about what I could do to improve my operating conditions. In the HF one where I came second, I had

some IT problems which caused me to miss a vital 5 minutes at the beginning while I sorted it out so better preparation needed! Also I was busy chasing multipliers on 10 and 15 which did give me some extra points, but sometimes I had to call them 2 or 3 times before I got an answer so that needed re-thinking – with only 90 minutes, every second counts.

For the Xmas legs I made sure that everything was well prepared and working. For those that know, I was using WSJT-X software for FT8, coupled with JT-Alert set to only alert me if I had already worked stations that day – on one of the contests I had a dupe rejected and we don't want that – it's time wasted! I also had my rotator set to automatically point at the station I am working – important then not to work one to the East followed by one to the West! A sweep works best. I can't run more than the legal limit (anyway about 300W will get anywhere that could hear you) and I can't improve my antenna without going to a SteppIR (and major expense which would upset the wife).

Subject of which, my HF station is:

Flex 6400 – SDR with no knobs at all, completely PC controlled

Expert 1K-FA linear, also PC controlled for band following etc. Auto switches antenna for the band and has a built-in auto ATU (very good and handy). Getting on a bit (like me) and the next item for upgrade in the shack when I win the lottery!

Cushcraft MA5B 3 ele beam which works on 10/12/15/17 and 20m (thanks again Rob!)

65ft longwire for under 20m.

Yaesu rotator on top of a 12m mast (for which I have planning permission – it's not so difficult to get as long as you don't have stroppy neighbours).

Software – WSJT-X with JT Alert, PST Rotator and Log4OM (auto logging is a MUST), SmartSDR to run the rig.



The most important thing was to keep up the contact rate and make sure that I was calling strong stations (to maximise the chance of a quick reply) and if there were mults I would try, but only once.

FT4 transmit/receive sequences are only 6 seconds long with a 2 second gap at the end – a typical exchange (with me calling DL5ABC) looks like this:

DL5ABC M0TZZ JO01 (me calling with my locator)

M0TZZ DL5ABC +10 (him replying with signal report +10)

DL5ABC M0TZZ -01 (I give him his signal report)

M0TZZ DL5ABC RR73 (he acknowledges the exchange – RR and says 73)

DL5ABC M0TZZ 73 (I say 73 back to him)

So you can see it only takes $5 \times 8 = 40$ seconds for a complete QSO.

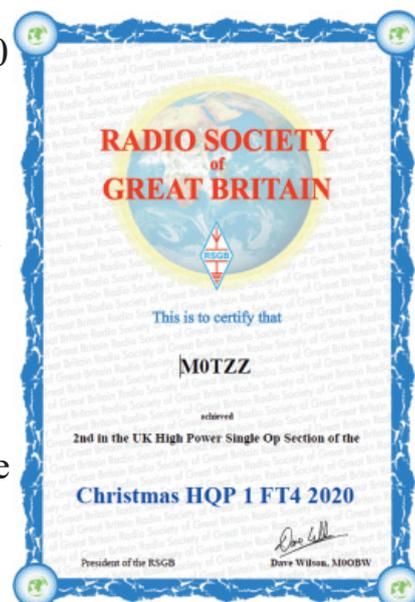
There were two legs before Christmas and two legs afterwards, naturally I entered all four.

On 22nd December things started well at 11:00, I began on 20m (where most of the FT4 activity always is) and immediately worked Italy (always easy) followed by an Asiatic Russian station (Mult!). Then I worked many EU stations, then got Venezuela, more EU than Puerto Rico. After 29 QSO's I dropped down to 30m but only found one UK station (still a point) and then down to 40m. Here I got only 5, all EU. Had another look at 15m, livened up a bit but only 4 Russian/Ukraine stations but double band bubble anyway. I went back to 20m and got a further 14, all EU except one Kazakhstan. Suddenly it was 12:30 and I had 53 in the log, best DX being the Venezuelan station at just under 7,500 kms. 53 in 90 mins is only a QSO per 1.7 minutes – must try harder! Others mentioned that conditions were a bit flat, so maybe that explains the lack of DX. It was also just before the rise in SFI we had just before and over Christmas.

On 31st December conditions were greatly improved due to the spike in SFI, and the start time of 14:00 helped with transatlantic contacts. There was a lot of US activity on 20m, so I started there (multipliers my boy!). Within 13 minutes I had worked 8 US/Canadian stations, on a roll! I ran out of US, so swung the beam to EU and worked 12 EU stations, then pointed back at the US to see if there was anything new. There was! I worked 10 US stations back to back. 14:45 and half way through, 30 in the log so better than last time and with a lot of double points. 6 more EU, then down to 40m, untried in the last one. Here I got 6 more EU and an Asiatic Russia and including MM91 who is one of my competitors, this was a bit remiss... 15m and 10m were showing no activity in JT Alert so back to 20m to work 10 EU, a US and a Canada and then it was all over once again. A total of 55, not much better than before but more points for the DX. Cracking first half, but it tailed off in the second half as there were less new stations to work – I'd already worked most of the stations on the waterfall. Best DX was WB8FVB in Texas at just over 7,900 kms.

Nevertheless (and to my surprise) I came second in group across those two legs:

I bet you're getting bored with seeing these now... One more to go!



And so to 2021, after working a lot of new countries on the 1st and 2nd (some of us at the Club have a little challenge to work as many countries or entities as possible in any year), the 6th January test started at 12:30 and just before that there was a lot of activity showing on 20m and quite a bit on 40 but alas nothing on 15 and 10 so I started on 20m. The SFI had by now returned to a more usual figure, but everyone would have the same problem. This time I concentrated on quantity, rather than quality. I worked 60 stations back-to-back in the first hour and a quarter, there certainly was a huge amount of activity including a lot of foreign stations participating in the test. Among those 60 were only 12 inter-continental QSO's. I dropped down to 40m (finding nobody new to work on 20) and worked another 14 EU stations before the end giving me 74 contacts – that's more like it! Best DX was PT2JC in Brazil, 8,700 kms.

The results were announced a few days later and I had won the leg in my group, but also submitted more QSO's than anyone else so I was very pleased with that!

The final leg was on my birthday, 11th January (65, no bus pass or state pension yet!), starting at 09:30 so there wouldn't be much US to be had that day, they will all still be in bed...

Started on 20m as usual, and just before there was quite a lot of JA on band so I beamed that way expectantly. I had a run of 21 QSO's which included 7 JA's and 4 other inter-continent contacts. Running out of people again I dropped to 40m and got 15 EU's before returning to 20 to see if there were any new ones. Here I got 9 EU's and 2 more JA's. Half an hour to go so I dropped down to 80m which was busy for the band/time – here I got 13 EU's, about half of which were G's but I was careful to avoid my arch enemies! Went back to 40m and worked another 11 including GU which gave me a 2021 new one. Total 71 QSO's so we seem to be getting the hang of it now. Best DX JA2ODB at 9,700 kms.

A couple of days wait for the results, and I won the leg in my group, again submitted more QSO's (by a whisker) than anyone else and won the title across the two legs too.

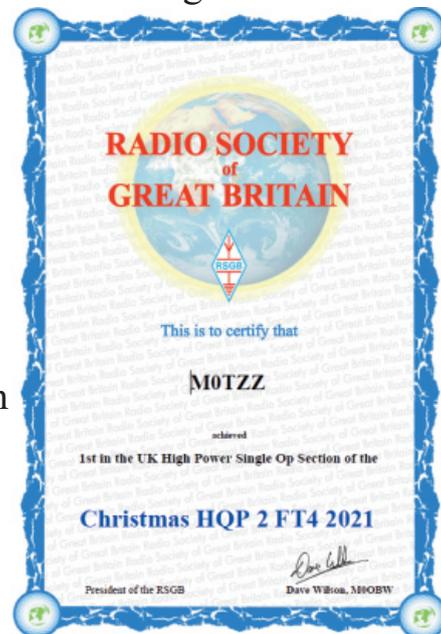
So all in all, I enjoyed the challenge, had a bit of fun and got some certificates to hang on the shack wall quite apart from having a break from painting and decorating. I watched "Who wants to be a millionaire" last night, and they start with a "fastest finger first" round and that accurately describes FT4 contesting – you have to be mightily fast with the mouse if you want to be competitive although that's not compulsory in these contests.

It has certainly given me a little contesting practice, so I'll certainly have a go at the upcoming RSGB ones, and possibly international ones too. I guess there may be some more HQP tests organised if the lockdown carries on.

If anyone fancies having a go at FT4/8 contesting, or just want to have a go at these digimodes and are not sure where to start, just get in touch, I'll be happy to help. Since it all happens on-screen (in my shack at least) I could even share a session with you on Zoom.

Stay safe and healthy!

73 Phil M0TZZ



Is your Linear linear?

I was reminded recently, after hearing some of the 'big guns' who always seem to appear just during contests, how bad some of the transmissions are on the bands. Clipped audio, wide splattery transmissions, and even one lower sideband signal at the top of 40m who's upper sideband was so poorly suppressed that he was also transmitting above 7.2MHz!

All amplifiers generate unwanted signals, however slight, and the art is reducing these products to as low a level as possible. One (very wasteful) way to do this is to use, for example, a 1kW amplifier but just run it at 400W. But the more sensible way is to make sure it is well engineered and operated within its designed parameters.

Some stations spend lots of money on their rig, and scrimp on buying a solid power supply (PSU). On peaks of modulation, the PSU output voltage sags with the sudden demand for current from the amplifier, and the output power also sags which causes clipping and wide signals. If you notice this effect, and your PSU is a bit old, check out the big electrolytic capacitors in it, are any of them bulging at the top? May be a sign they have dried out, and time for them to be replaced. It's these capacitors that take the brunt of supplying the surge demands of current demanded by the amplifier.

How to test for problems (apart from complaints from other amateurs!). Many rigs have a spectrum display built in which should show the transmitter output. Or you could use a software defined radio (SDR) to see your signal. At a push one of the webSDRs could be used. You could just tune across the frequency with another receiver in narrow CW mode, but you would have to ensure it is not being overloaded by the proximity of your transmitter.

The usual way RF amplifiers are checked for linearity is by putting a two tone test signal into them. In a perfect world, the amplifier should just output two tones at a higher level. In the real world this is not usually the case however! If you look at Fig. 1, it shows a typical spectrum of a 10m two-tone signal with two 50W nominal output level tones. The suppressed carrier frequency was 28.43MHz and the audio tones input to the

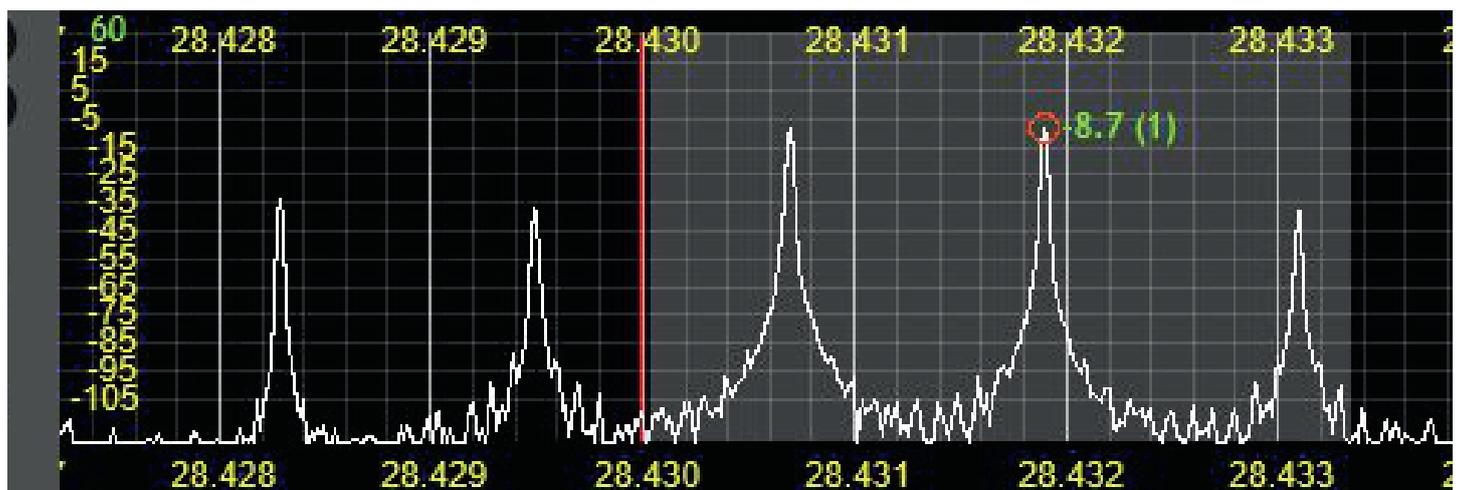


Fig. 1

rig were 700 and 1900Hz. The wanted signals are thus at 28.4307 and 29.4319 MHz respectively. The other signals evenly spaced each side have been generated in the amplifier. The two wanted signals are both at -8.7dB, and the unwanted ones at -35dB or so. The difference is -26.3dB; which on 50W nominal is a power of 117mW. Many QRP

stations only run that sort of power! So any stations in adjacent channels to this transmission are likely to suffer some interference. Although my image doesn't show it, these unwanted products extend for some way either side of the nominal frequency, but the transmitter filtering would have removed the further ones.

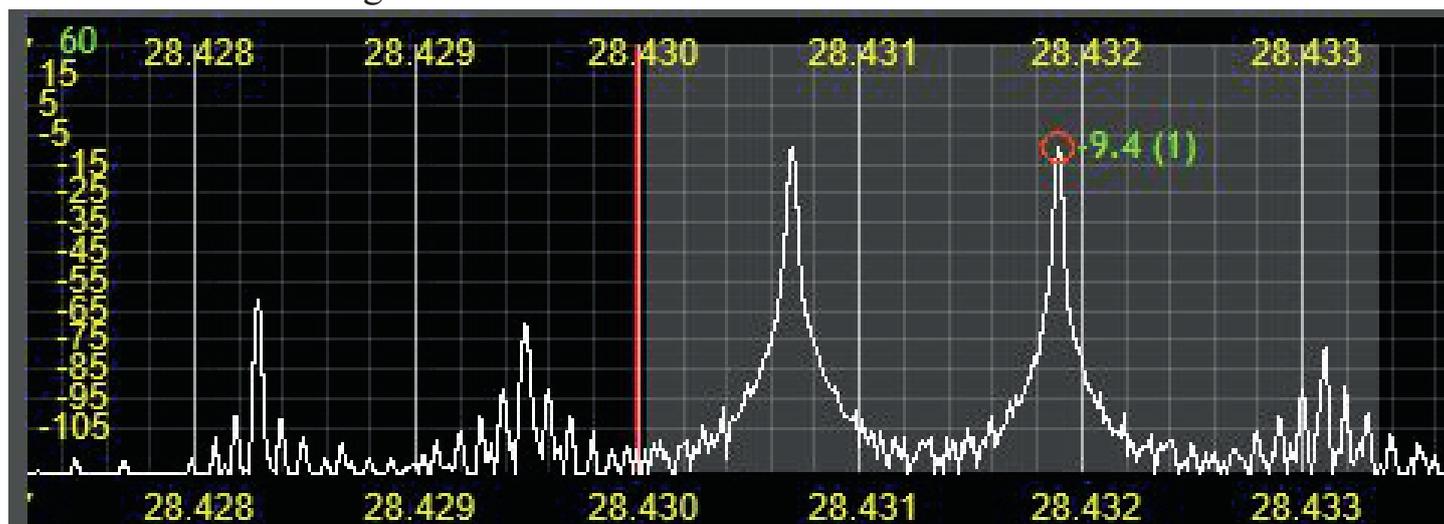


Fig. 2

So how to mitigate this problem? Initially by good design, or clever electronics. The manufacturer of this particular radio incorporated a circuit which pre-distorts the input signal in the opposite sense to the PA distortion, and the results are very evident (Fig. 2). Now the difference between wanted and unwanted is -65.8dB . With a nominal wanted signal of 50W , the unwanted signal is now only $13.15\mu\text{W}$!

We can see how this is being achieved in Fig. 3 which shows the amplifier inputs plotted against the output. The circuitry has altered the gain of the amplifier at various input levels to equalise the output level. The blue trace shows the power amplifier's gain, and it can be seen that it varies between 0.7 and 1.2 over the input signal level range. So the circuitry alters the gain in a reciprocal manner (red trace) and the end result is that the gain is constant throughout all the power range.

Some transceivers have built in two tone test signal generators, but for those that don't, free audio software can generate the two required audio frequencies (see <http://www.ko4bb.com/getsimple/index.php?id=tone-generator> for example). The chosen frequencies are not critical, except that they must not be harmonically related, hence the choice of 700 and 1900Hz. Then feed the signal into the line input to your rig, and adjust the audio level to get the nominal output power without any ALC showing on your rig. If your transmitted signal looks like Fig. 2, then that's just fine. If it's more like Fig. 1, then the rig maybe could do with a bit of attention. Amateur rigs should be better than -30dBC (unwanted products down on the wanted product), but the specifications may show they cannot achieve this value (if indeed the manufacturer even specifies it!). So the rig above actually fails to achieve the desired performance without the pre-distortion circuitry enabled.

So do check your rigs and see if they are reasonably linear; your fellow amateurs will thank you!

Richard, G3ZII

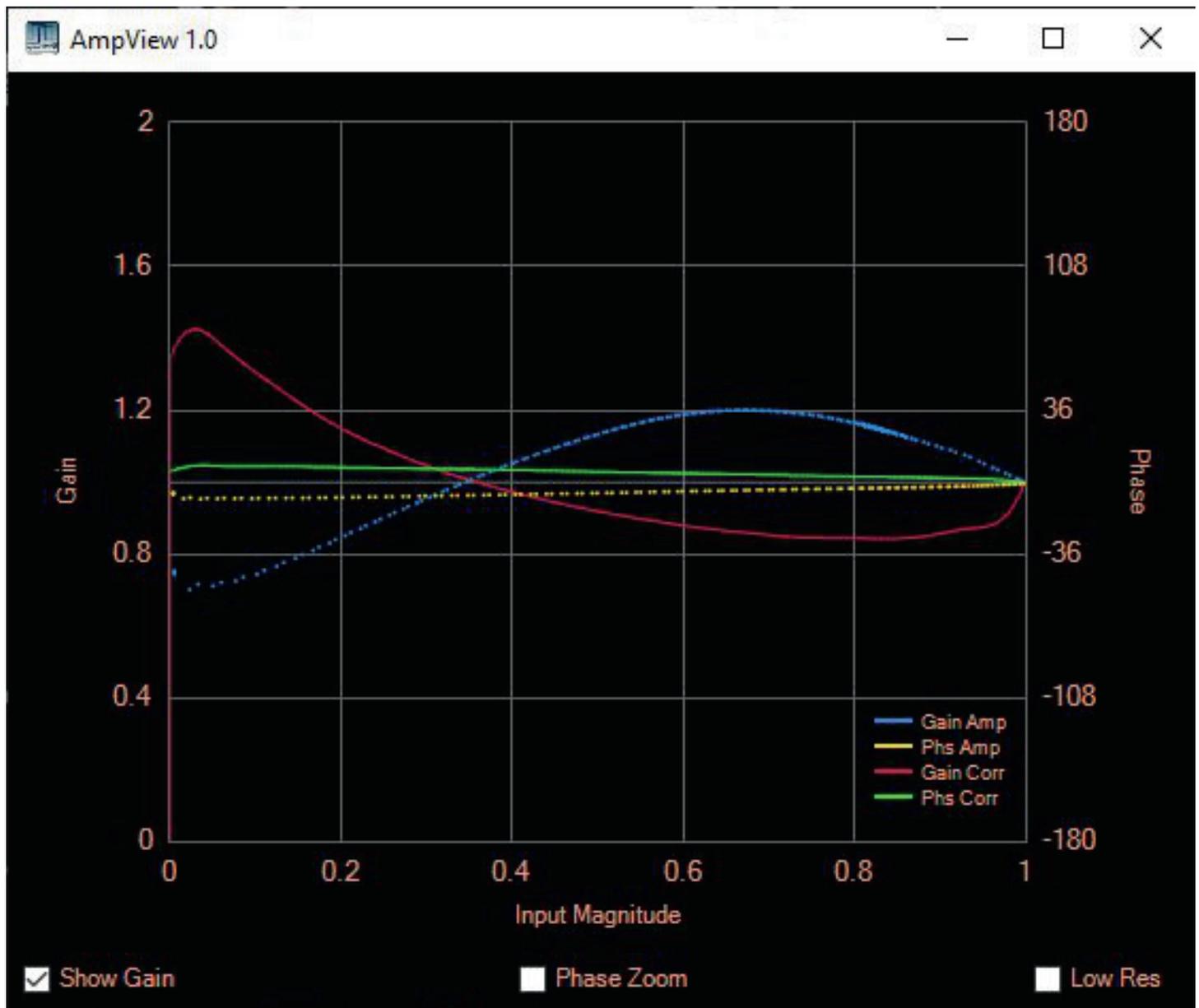


Fig. 3

Now That's What I Call QRP!

Very low frequency enthusiast Joe, VO1NA reports that Stefan, DK7FC copied his 50-character EbNaut message transmitted from Newfoundland on 8.271kHz, with a radiated power of 10mW. We believe this is a new record for amateur transatlantic VLF. Joe's tower supports a VLF rotated L, which is 10 metre average height and 100 metres long.

RSGB EMC Committee publishes EMF calculator

The RSGB's EMC Committee (EMCC) has updated the EMF web page which contains information on the new licence requirement to assess EM Fields.

Most notably, as agreed with Ofcom last month, the EMCC has published its calculator, which incorporates the Ofcom calculator but adds a front end specifically for radio amateurs. This calculator will be updated if Ofcom publishes any updates to its own calculator.

The calculator is currently an evaluation version and the EMCC welcomes feedback to help it move towards a final one. Please email your comments to Board Director and EMCC Chair John Rogers, M0JAV: m0jav@rsgb.org.uk



Three RSGB VIPs at the annual dinner and dance of Crawley ARC on 8 May. From left: John Allaway, G3FKM, Executive Vice-President; John Brown, G3DVV, Honorary Treasurer; Cyril Parsons, GW8NP, President. (Photo by courtesy of G3FRV and G8IBE)

Archive image from *Radio Communication*, July 1975

Low cost Auto Tuner

A few months ago Stewart G3YSX alerted me to the availability of some low cost ATU kits from Aliexpress.

The kits are based around a design by N7DDC. All details, schematics and part lists are available from his github site <https://github.com/Dfinitiski/N7DDC-ATU-100-mini-and-extended-boards>.

The kits are based around the extended design providing switching of 7 inductors and 7 capacitors, with maximum power handling of 100W.

At the time of writing the kits are available at a cost of around £20 including delivery. These versions have the SMD parts already soldered on the PCB. The version I have required the SMD parts to be soldered on, which I find therapeutic, but if I was to order another I would probably pay the additional £2 to have them soldered on already.

The firmware has also been revised since I obtained my kit. I have version 3.0, the latest is version 3.2, and it would be wise to make sure the version you order is the latest. Firmware can be updated if you have a Pickit programmer.

Aluminium extruded cases are available with all cut outs etc. made and a choice of connectors (SO239, SMA, BNC) and switches for around £16, but I have not got one of those so cannot comment on them. I will probably use a plastic food container from

Sainsbury's. There is also a design for a 3D printed case.

Specifications

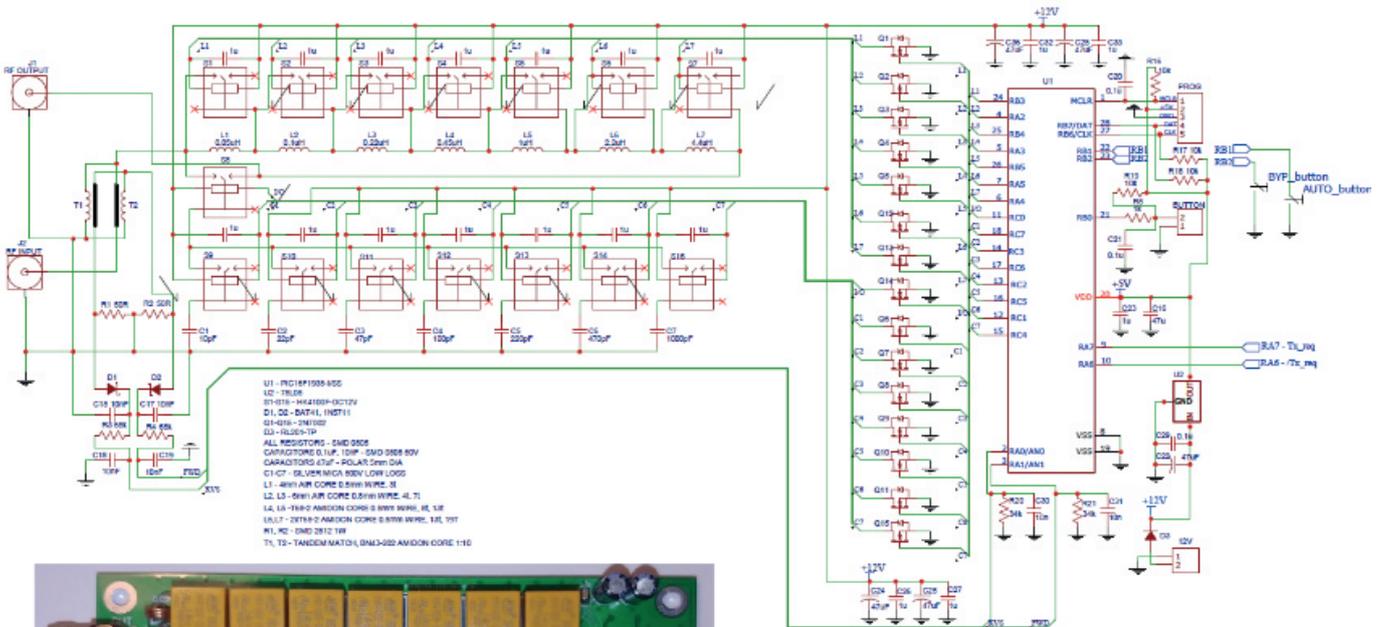
- Power supply range: 10 - 15 VDC
- Max current : 450mA
- Max working power: 100 watts
- Max measured power: 150 watts
- Minimum power for tuning start: 1 watt
- Recommended maximum power while tuning not above 30 watts. (after tuning you can set 100 watts and work on this power)
- Minimum measured power: 0.1 watt
- Step for measurement on powers under 10 watts: 0.1 watt
- Step for measurement on powers above 10 watts: 1 watt
- Power measurement accuracy: 10%
- Maximum inductance set: 8.5 μ H
- Minimal step for setting inductance: 0.1 μ H
- Maximum installed capacity: 1870 pF
- Minimal step for setting capacity: 10 pF



100 Watts tuner, 7x7 (7 capacitors x 7 coils) based on PIC 16F1938.

Dimension – 120 mm x 62 mm.

The design uses a tandem match directional coupler to provide forward and reverse power readings to a PIC microcontroller. When the tune button is pressed (or autotune is selected and the SWR is > 1.2) the PIC runs through a very rapid sequence of switching



TITLE:	ATU-100 (EXTended board) by N7DDC	REV: 2.0
Date:	29-07-2020	Sheet: 1/1
EASYEDA V5.8.20	Drawn By: D. Farnitz	

inductors and capacitors in/out to determine the best combination for minimum SWR. Tuning should not be initiated if the power is more than 30W. Tuning takes less than 1 second. The tuner can be set to auto tune, manual tune or can be bypassed.

If you want to handle more power, then take a look at the github page referenced above where there is a video showing a 1000W version – note that is homebrew – not a kit, but using the same firmware. If you want to use just QRP, then the turns on the tandem match can be adjusted to give better results, and the firmware updated. There is also a video showing how this is done and the changes needed in the firmware.

Assembly

The tuner was delivered in less than 2 weeks and was well packaged in a rather nice reclosable type cardboard box.

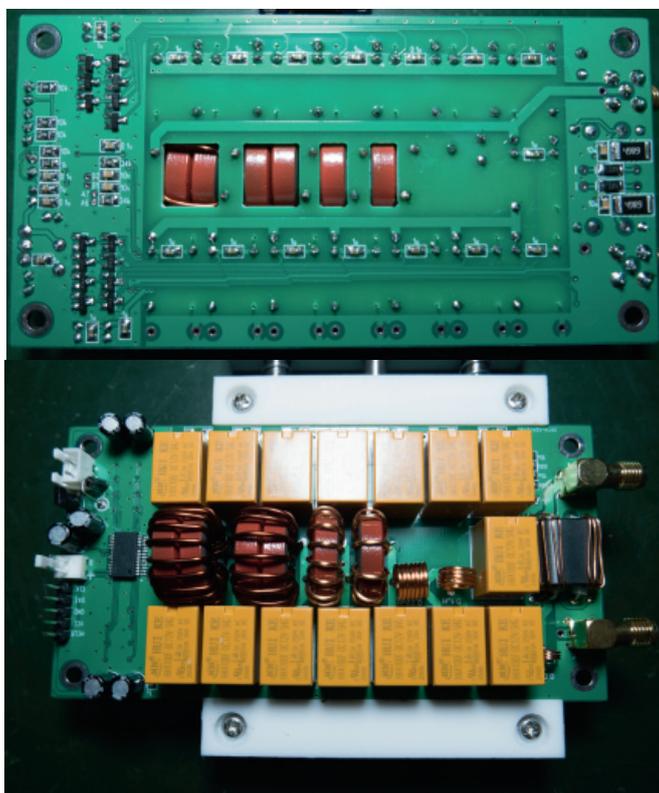
My version came with no parts soldered to the PCB. Most versions come with all the SMD parts already soldered on the PCB.

There are no instructions, but the PCB is well marked, the components well identified and a component list provided.

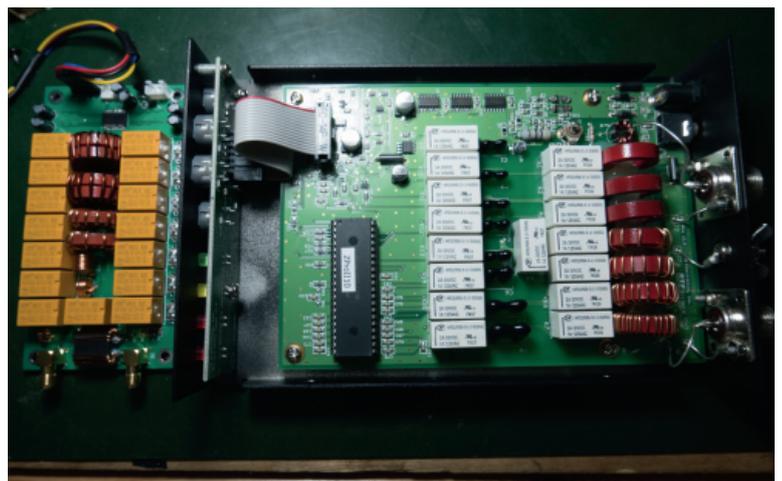
The only problems were determining how to wind the tandem match – a quick look at the photos of the built versions cleared that up, and the length of wire supplied for winding the inductors was about 2.54 times too short! I know G3VHH who also built one, his kit with parts already soldered came with the correct length of wire.

Soldering the SMD parts proved to be no problem, apart from not being able to locate the solder wick in my shack to fix a bridge on two of the PIC pins. The solder wick has still not turned up! Some coax braid was used instead.

My finished board:



And a comparison with my other Auto ATU – the LDG Z-11 PRO II on the right:



The LDG also has 7 inductors to choose from, but adds another capacitor value. The capacitors on the LDG unit are much larger devices, and the directional coupler is a

different design.

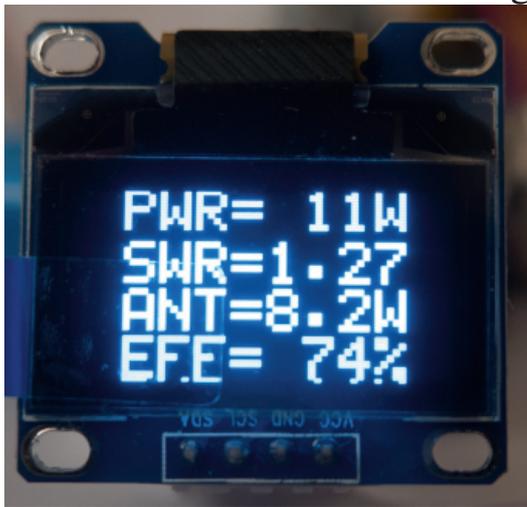
In use

I have only tested with my Carolina Windom (half wave on 80m), but the N7DDC

ATU provides an adequate match on all bands (except 160m), similar to the LDG Z-11 PRO II. Neither will get a perfect match unless you are lucky as they can only create inductor and capacitance values based on combining the fixed values. The N7DDC uses the combination that gives the best match, and sometimes this is better than the LDG which seems stop when the match is better than 1.2. On 160m the N7DDC managed to get the SWR down to 3, the LDG fails to tune.

The LDG includes a frequency counter that the firmware uses to go directly to the setting previously used for that frequency. This feature is not present in the N7DDC unit, however the tuning process is very much faster so this is not an issue in practice.

The N7DDC has the advantage of the OLED display and much smaller size.



When transmitting the display is as above, when there is no input power the display shows the capacitance and inductance chosen.

Tuning is very fast. I prefer the tune on demand option. My LDG has a tendency to start tuning itself midway through a QSO, perhaps when the wind blows a nearby tree and changes the SWR slightly. Tuning at full power could be very bad news for finals and relays.

The power and SWR correspond reasonably well with my homebrew power meter at higher powers (over around 5 watts) – at lower powers the reported SWR is better than reported on my homebrew meter, possibly due to the diode forward voltage in the power detectors.

The relays in the LDG are latching, so once the tune is done the power consumed is very low. The N7DDC requires power for the relays all the time, which is a shame if you are portable. If power is lost the tuning parts are bypassed. The LDG relays are rated at 2A, the N7DDC relays at 3A. I have run it at just over 100W with no issues observed and nothing getting warm. The caps are (or at least are supposed to be!) mica type but are very small.

Summary

I think this is quite a good ATU for portable use due to its very small size and simple operation. My example works fine from a 9V PP3 and represents amazing value for money.

For use in the field I would not fit the SMA connectors and chose the aluminium case with BNC connectors; for the shack where disconnection/reconnection is rare then SMA is ideal, or you could fit N type if you really want. As noted in the latest Radcom, PL259 should be made obsolete! [*SMA for RG174 etc., connectors can only withstand 500v RMS at HF, so if the aerial is a really high impedance they could flash over. Ed*]

If you want a perfect match and high reliability then use a continuously variable inductor and capacitor type tuner and tune by hand (or design your own with stepper motors).

This could be a good base for an ATU to include in a homebrew transceiver.

Dave Wilde, M0WID

Things heard on the Amateur bands / The dangers of online examinations

A newly qualified Full Licencee said that his brand new £1500 Yaesu wasn't switching on – after a brief chat with the supplier, it transpired that he had attached the DC power leads to a 3 pin 240V mains plug, and after the initial 'pop and puff of smoke' it no longer worked... When it was explained that the radio requires 13.8V from a PSU, he said that this wasn't pointed out to him at the time of purchase and he wanted it replaced under warranty as he held the retailer responsible...

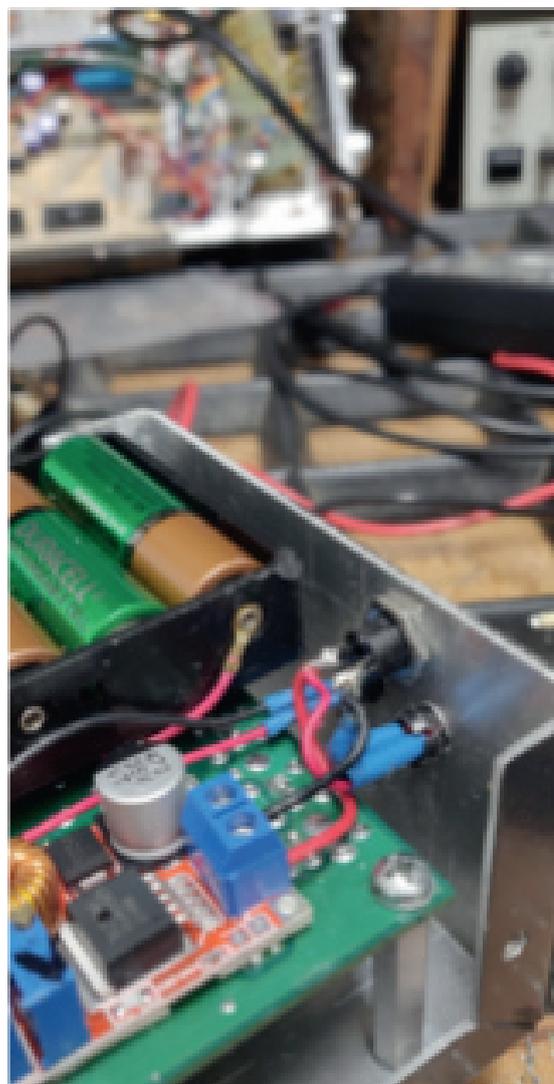
On another occasion a newly licenced full licence callsign speaking to a retailer in the Midlands - "Could you explain what I need to talk to people on the radio?" When it was explained the equipment required - he simply said that sounds like a real faff and bloody expensive, so I won't be bothering, oh and who do I contact about getting my money back for these three exams?

MFJ Antenna Analyser

I decided to fit some rechargeable batteries to my MFJ-259B, so I purchased ten 2500 mAH NiMH Duracell cells, probably a bit of an overkill.

Problem was that the internal charging circuit was only specified at about 15mA; mine was even less than that at 10mA and would take for ever to fully charge and apparently not recommended for NiMH batteries.

So I decided to build another charger with higher current and I initially looked for a smart charger but was unable to find one that met all the criteria, so I selected a simple voltage/current regulator that would fit inside the MFJ. I found it hard to get a definitive answer as to what to set the voltage and current to, so decided in the end to use 14 V and 1 A but easy to readjust if required.



I used an old laptop power supply rated at 18.5 Volts but this was not critical as the regulator is rated at up to 30 volts, and current was not a problem as they are mostly rated at several amps.

I fitted two LEDs to the back panel; one illuminates when power is connected and the other when the batteries are fully charged i.e., at 14 volts it switches off. This LED was originally a SMD on the regulator board so I removed it and fitted a panel mount LED to the back panel.

I was originally going to use the power connector on the front panel but doing this shorts out the current sense resistor which results in unlimited charge current.

I also fitted some stick on feet so that the power connector and LEDs prevented it wobbling when stood on end.

If anyone is interested in building this I'll do a follow-up article with more details and schematics etc.

Richard G4ANN

1968 RAE Brain-Teaser

To keep you from wondering what to do during lockdown, I dug out this old RAE paper from 1968 (the exam I actually took) and present a couple of questions for you to have a go at. I have included the 'rules' as well (and how many of you can still use a slide rule – or even own one?). Yes, the parchment is a bit yellow after 50+ years. 😊

This paper contains ten questions: answer EIGHT questions as follows: both questions in Part I (which are compulsory) and SIX questions in Part II. Failure in either part will carry with it failure in the examination as a whole.

You should have the following for this examination:

One answer book, which includes squared paper (inches and tenth).

Mathematical tables (you may use a slide rule).

6. Describe THREE methods of coupling two tuned radio frequency circuits. Explain with the aid of sketch curves how the degree of coupling affects the frequency response.

Why is a band-pass characteristic desirable in the case of i.f. transformers in superheterodyne sound receivers?

8. What is meant by:

(a) amplitude modulated double sideband telephony (A3),

(b) amplitude modulated single sideband suppressed carrier telephony (A3J)?

With the aid of a circuit diagram describe one method of amplitude modulation used in an amateur sound transmitter.

Errata

In the November edition, due to your editor not double checking his sources of information, it was erroneously stated that Mr. Juha Sipilä was the Prime Minister of Finland. He no longer holds this position; the current Prime Minister is Sanna Marin.



Adverts

Tesla referral code. If any of you are thinking of buying a new Tesla car, please consider using my referral code <https://ts.la/richard59094> which will get you and me both a free 1000 miles worth of supercharger electricity.

Richard, G3ZIIY.

Mitsubishi Outlander hybrid 4x4 for sale, 11500 miles September 2018 model GX4h. In very good condition. Contact Richardg3ziy@gmail.com

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