Give new life to analogue repeaters!
By Peter Lindquist SM5GXQ

Many clubs in our country have over the years invested both money and diligent work in their repeaters. Therefore, it can of course feel a little melancholy, that many of these repeaters do not come to much use. One by one, repeats are re-made into one of the digital modes (DMR, D-star or C4FM). But there is another way out, which means that the analog repeaters can survive. This article will be about SvxLink.

If you can somehow expand the repeater's footprint area, then you can also increase the chance of QSO. In digital networks, there is of course this possibility, as they can be connected to different networks via the Internet. The downside is that many users then need to acquire new radio stations, if they do not already have a radio that is prepared for digital traffic. The ideal would be if one could continue to use existing analogue radio stations, but still be able to reach out further in Sweden and the world.

Must be comprehensible.
Not everyone may neither have the interest nor the ability that is often required, for to familiarize themselves with how these digital modes of transport work. If we're going to be really honest, these modes do add a wealth of capabilities – which unfortunately comes at the expense of the fact that they are not entirely easy to understand. Technology may be advanced and complicated, but it must be easy to use. Sound quality on DMR also cannot compete with the one achieved with analog FM.

Similar systems
With other systems – such as EchoLink, IRLP, FRN, etc – it has since long been possible to reach other analogue repeaters.

But now there is a better way, where you can combine analogue radio with reflectors and talk groups. The best of both worlds!

Another possibility is to connect repeaters is via analogue radio. This can be done using a simplex link on a frequency band other than the repeater's. It also helps to increase accessibility – as the strength of amateur radio tends to highlight the fact that our systems are independent from both mobile and fixed telecommunications networks – or the Internet. Here, of course, you can also use Amprnet as a carrier.
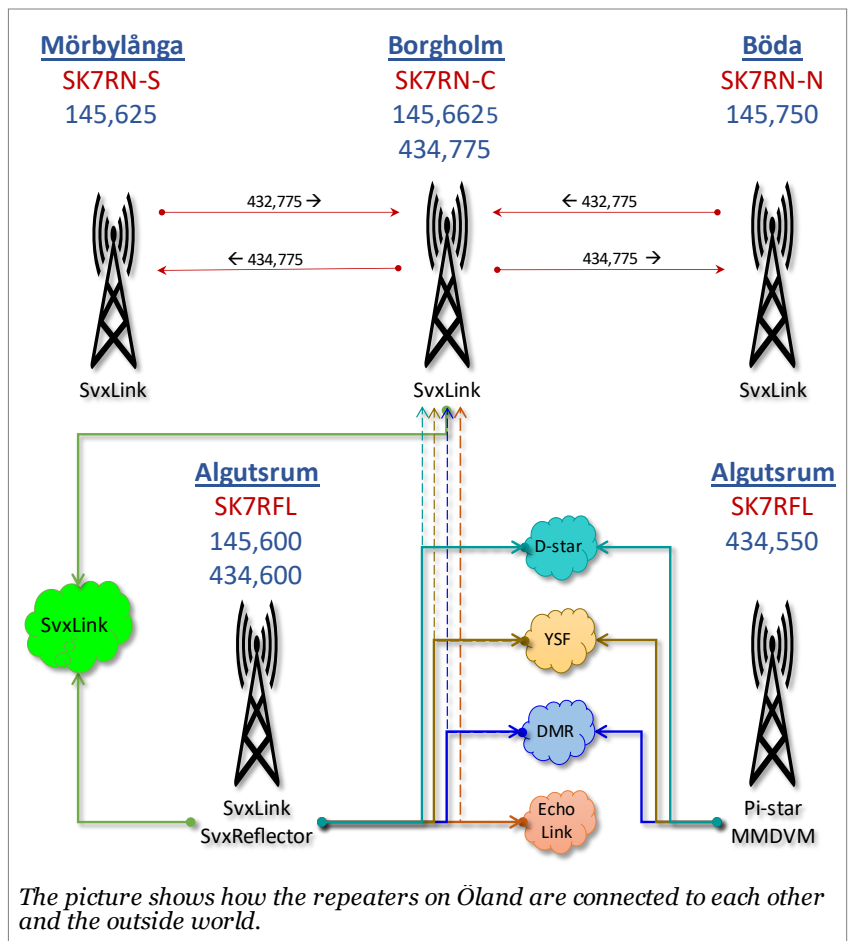
Öland's repeater network
As an example, we can tell the story of the repeater network on the island of Öland, where Sweden's third repeater SK7RFL started back in 1972. It covers virtually all of Öland, as well as large parts of Kalmar County, as well as parts of Blekinge. It sits with separated transmitter and receiver antennas high up in Öland's highest radio tower.

In recent years, no less than three repeaters have been added – all with the signal SK7RN. For many years, that club has dreamed of being able to connect these three repeaters, in order to cover the whole of Öland and thus also a large part of the mainland. Since there have been agreements with the municipalities on the island

for a few years now to conduct emergency communications, such interconnection cannot take place with dependence on mobile networks or the Internet. The only then remaining option was analog links of 70 cm. But the problem has been that the repeater logic that the club has used in the past has not really been able to achieve this.

EchoLink
At the same time, SK7RFL needed a new solution for connecting to EchoLink. Quite easily, we were able to create a solution, which however run as a regular user into the repeater. Such a solution has several disadvantages, such as poor audio quality. And without squelch signaling, VOX must be used. But in the autumn of 2019,

Mörbylånga	Borgholm	Böda
SK7RN-S	SK7RN-C	SK7RN-N
145,625	145,6625	145,750
	434,775	

432,775 → ← 432,775
← 434,775 434,775 →

SvxLink   SvxLink   SvxLink

Algutsrum	Algutsrum
SK7RFL	SK7RFL
145,600	434,550
434,600	

SvxLink

D-star
YSF
DMR
Echo Link

SvxLink
SvxReflector

Pi-star
MMDVM

The picture shows how the repeaters on Öland are connected to each other and the outside world.

we were able to deploy this solution – with the help of SvxLink. But even then, we had a dream of integrating EchoLink, and thus SvxLink, into the repeater itself.

Yes, it was actually as recently as summer 2019, that I first heard about SvxLink. SvxLink – yes, it is called that because it has been developed by SM0SVX Tobias – cannot simply provide connectivity to EchoLink. It's actually a full-fledged repeater logic. There you can configure several logics (Simplex-, Repeater- or Reflector-as wellas hang on various modules – such as EchoLink, FRN, Weather, Parrot, Recorder or Voice mail. One can also have "remote" Rx/Tx. Everything is built together as "building blocks".

Connection to reflector
Another possibility that already existed at the time was to connect SvxLink to a reflector – using for example mobile Internet. In the summer of 2019, we learned that there were trials conducted along the northeast coast of Sweden with a new version of this reflector – which now supports talk groups!

SvxLink runs under Linux, which also means that it can be inserted into a cheap single board computer, such as the Raspberry Pi. It is also very stable. All the problems we encountered during the summer have actually been due to hardware failures in either antenna systems or power supplies – the repeater logic has not stalled a single time!

Right from the start, we had realized that SvxLink could also be the solution to SK7RN's linking problems. Concurrently with SK7RFL's EchoLink, SvxLink was installed on the "central" SK7RN repeater in Borgholm. Now this repeater could serve as a link between the other two – which are located in Böda and Mörbylånga.

But the solution was still not completely stable, and the links broke down at fairly uneven intervals. The reason was that the other two repeaters were still not upgraded.

Simulator
During the winter, therefore, four new repeater logics were completed, all based on SvxLink. They could be run "on bench", where all traffic cases could be simulated in real time. In autumn 2019 came the new version of SvxLink, which now also supports talk

groups. A fifth logic was developed for SK5BN in Norrköping.

Now we would also be integrating EchoLink and SvxLink in the heart of SK7RFL. In parallel with this, we had an idea that even build a DMR Repeater at SK7RFL. As antennas, the same ones that already existed for 70cm are used – where we use a Combiner and a splitter, which can run up to 4 repeaters on the same antenna system! Early the question of being able to connect analogue FM with DMR had come up. But that vision then seemed rather distant. – even though we already knew at that time that there were things like HBLINK, MMDVM bridge and Analog bridge. But it sounded complicated.

6 repeaters!
Upon arrival at my summer QTH in Färjestaden in the spring of 2020, no less than 6 repeater frequencies would now be deployed. 5 analogue ones with SvxLink and one digital with Pi-Star. The first installation consisted of replacing an SD card on the repeater in Borgholm.

Sk7RFL's analogue repeater has a single repeater logic with two transmitters and two receivers running parallel. *ReflectorLogic* is then needed to connect to the national reflector.

SK7RN - 3 repeaters
SK7RN's three repeaters each have their own logic, which is why they actually behave like three separate repeater stations – with the big difference being that they are connected to a fourth repeater on 70cm. Only this repeater in Borgholm has the connection to the repeater network, with links to Böda and Mörbylånga.

In addition to the repeater logic itself, simplex logic(s) are then needed for the links – as well as reflector logic towards the reflector network. All three, on the other hand, have mobile broadband, which is primarily used for remote administration.

"East Coast Link"
So from the week after Midsummer 2020, all the repeaters on Öland became interconnected. They are then also connected to the national repeater network, which then was commonly referred to as the "East Coast Link". There are more than 70 repeaters

and simplex nodes connected at the time of writing. New repeaters are being connected at a steady pace.

Talk groups
As we have previously described, this network is now also based on talk groups – which have numbers that are confusingly similar to those used on DMR. However, there is no 1-to-1 bridging between SvxLink's and DMR's talk groups.

Talk groups can be selected either with DTMF commands or different CTCSS tones. Each repeater-owner can choose which talk groups their repeater should "listen" to, and which talk group to activate by default. For example, all connected repeaters in Sweden listen to talk group 240. But there are also district-specific talk groups, just as on DMR. In addition to these, there are a number of cluster talk groups, e.g. 24021 for the "Kalix line" and not least 24078 for the repeaters on the island of Öland.

There is also a QSY function, where the reflector automatically transfers only the repeaters involved to its own and more "private" talk group.
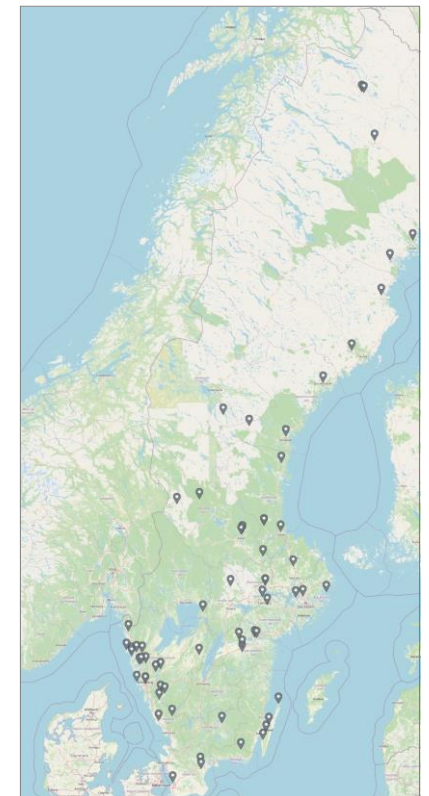
The Svx Portal has, among other things, a map where you can see all connected repeaters and its status in real time.

DMR Bridge

In the latter half of the summer 2020, the now deployed MMDVM repeater could be supplemented with a DMR bridge. It connects SvxLink talk group 24078 with DMR talk group 240721.

During the summer of 2023, we have also extended this digital bridge to YSF as well as D-star. The user can now select any talk group or reflector, using DTMF commands.

In order to prevent feedback through the different systems, we have introduced different barriers – so that it is normally not possible to combine EchoLink, DMR with the SvxLink's national repeater network. Therefore, incoming connections over DMR and EchoLink to SK7RFL are limited to the 4 repeaters on Öland.

SSA Bulletin

But there is one big exception. The SSA bulletin is read all over our system, every Sunday at 09:00. However, all 6 frequencies on Öland are interconnected.

At the same time, it is possible to connect:

- via EchoLink to SK7RFL-R,
- via DMR on talk group 240721,
- via C4FM to reflector YSF24078 (SE-SK7RF),
- via D-star to reflector DCS010, module X,
- via SvxLink by enabling the talk group 24070 from another connected node, or
- locally via DMR at SK7RFL, talk group 6/TS1.

Most of this will happen completely automatically, even the bulletin mode is time controlled. Users, without neither DTMF nor CTCSS in their radio, can continue to use our 5 analog repeater frequencies in the same way they always have.

Of course, you can also reply to calls that come from DMR|YSF|D-star, EchoLink or other SvxLink nodes – simply by pressing your PTT and speak.

The linking between the repeaters and with DMR|YSF|D-star is completely automatic.

But those who so desire can learn more about how the system works – and make exciting new connections from their analogue radio.

For outgoing connection via EchoLink to other Swedish repeaters, there is even an "abbreviated number list".

Big boost

All this has meant a big boost for the 2m and 70cm traffic on the island of Öland and the surrounding area. New and long-distance contacts have been made, while allowing amateurs with previous connections to the area to keep in touch with their old amateur buddies.

But in our hobby, exciting new opportunities must come – to keep the flame alive!

Everything's business-as-usual

At the same time, we have always cherished our old faithful users – no development should be at the expense of, that those who originally used the repeater may now think it has become too advanced and put the radio aside. That simply can't happen – we can't afford to lose multiple users of our repeater systems!

Nor has it been at the expense of sound quality – which is actually better than before we started rebuilding the systems. We've even made DMR (!) sound great through the bridge, using AGC and an Equalizer.

Swedish experts at SvxLink

As I see it, there are currently three major players within SvxLink: SM0SVX Tobias, SM3SGP Gunnar and SA2BLV Peter.

What I have done is apply these already existing tools, to create a robust – but above all easy to use – repeater network on the island of Öland, with several possibilities for connectivity.

Another useful lesson has been that no software in the world can solve problems in the repeater hardware. During the summer of 2023, we have replaced all existing radio and interface hardware on all four repeater sites.

During my long stays on Öland, there have therefore been countless visits to the 4 repeater sites – where cavity filters have been trimmed, cables replaced and various power supply problems fixed.

It has also meant that the undersigned has learned completely new things, such as using a NanoVNA!

Further reading

For those of you who are curious to read up on, both about how to use these systems, or even convert and connect their own club's repeater – well then there are many good sites on the web to visit.

One such is actually the now well-visited site sk7rfl.se, i.e. the repeater's own website. There is also the "repeater school", which was started in the summer of 2020. There you will find both user tips and technical information on how to build a repeater.

If you want to see how the system works in real time, you must not miss visiting the Swedish Svx portal created by SA2BLV Peter.

And last but not least, Tobias' own website for SvxLink.

References

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