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Interference and Noise troubleshooting

Presentation to SASTAR Group on April 19, 2021



Agenda

- 1. Current general station set-up
- 2. Interference during transmit
- 3. Noise mitigation – Small example

Current station set-up

- 5 HF antennas and dummy load on the roof,
- Switching by IP based device located on the tower powered via Power over Ethernet – only 2 HF coax cables come down from the roof,
- 1 vertical VHF/UHF antenna,
- The shack is in the basement,
- 1 HF radio, 1 handheld VHF/UHF radiom, 1 Amplifier, 1 Manual antenna tuner,
- All coax cables come down to the basement through an unused gas furnace vent along with other wires (240V wires to solar panel inverters, Cat6 cables, rotator cable, etc.),
- Station room is fed via 15AMP breaker (shared between many devices within the same room),
- The low voltage devices are fed by a single 35AMP ferrite core transformer,
- Amplifier has its own 2 x 20AMP circuit.

Current station set-up



Current station set-up



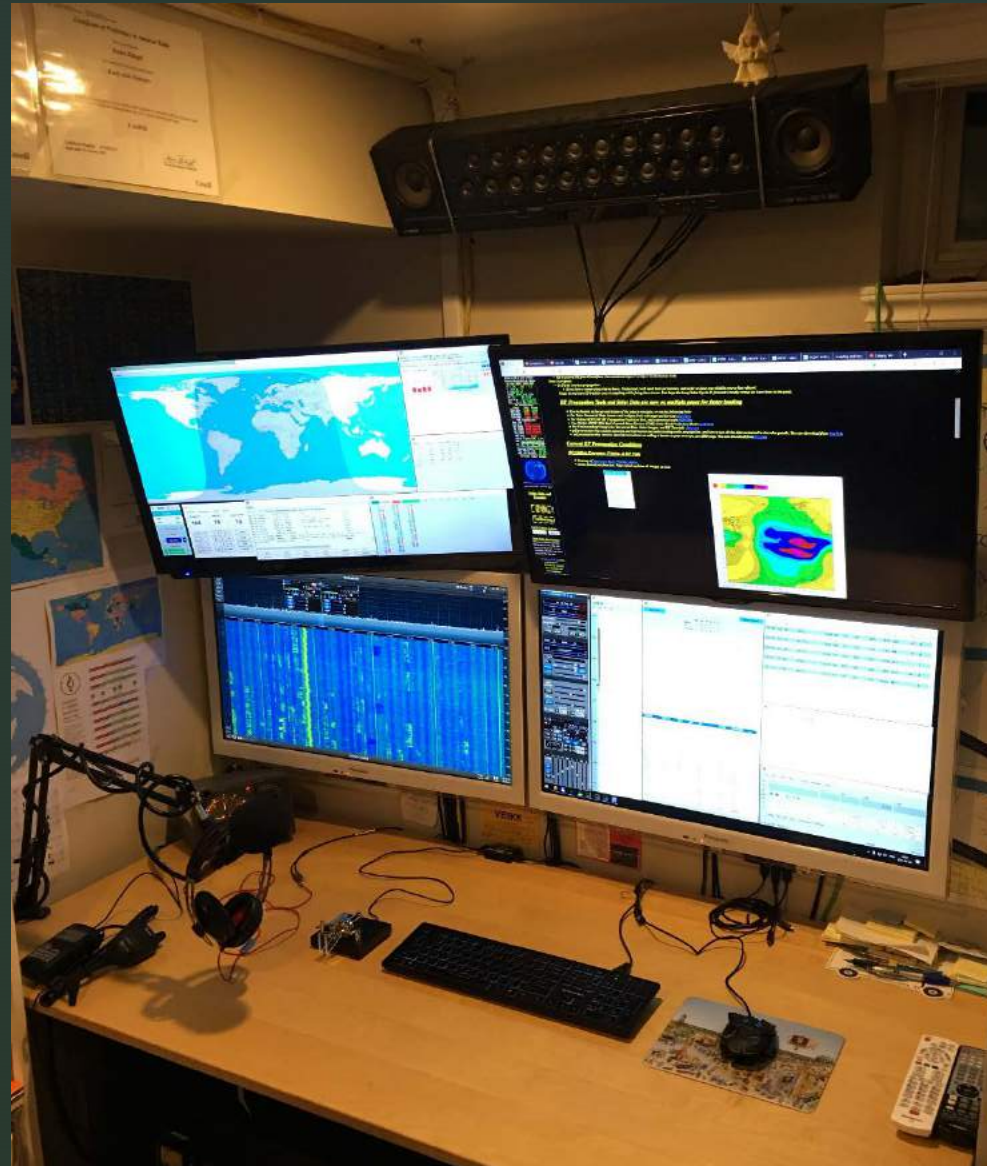
Current station set-up



Current station set-up



Current station set-up



Interference during transmit – Power <100Watt

- Radio (IP based) kept on loosing connection with computer during transmit even as low as 40Watts
- Same bands were not possible to use depending on the angle of the Hexbeam on the roof, e.g. 15m to Europe was not possible – the radiation elements were dead above the antenna switch box on the tower,
- Loosing internet connection in the house while transmitting – connection returned after 10-15sec from end of transmit – typically on 20 and 15m bands even at 80 to 100Watts,
- Interference in the house with sound systems – typically on 40m even at 80Watts,
- USB tabletop speaker reliably crashed during 80m transmits at 80 Watts,
- Interference with dishwasher – only on 160m already at 80Watts,
- Rotator USB controller failed on pretty much anytime transmitting above 80Watts,
- Rotation needle slightly moved during transmitting above 80Watts,

Interference during transmit – Power >100Watts

- Failing computer keyboard and mouse at around 150 to 250Watts on 40 and 20m bands,
- Antenna switch (IP based) disconnect and directing power into dummy load – typically around 200 – 400Watts on any band randomly,
- Computer display shutdown (only 1 of the 4) – typically on 80m only around 300Watts transmit power,
- Computer shutdown at around 200-300Watts on 20m and around 400Watts on 40m,
- Problems with some bathroom appliances using touch technology,
- Not sure how the neighbors were impacted...

Interference during transmit – Action taken #1

- Installed Chokes on each antenna feedline as close as it was possible to the radiating element – The small coax beads were useless



Interference during transmit – Action taken #1



Interference during transmit – Action taken #1



Interference during transmit – Action taken #2

- Installed ferrite rings onto low voltage cables – Got flat Ethernet cables



Interference during transmit – Action taken #2

- Installed ferrite rings onto wires going into computer



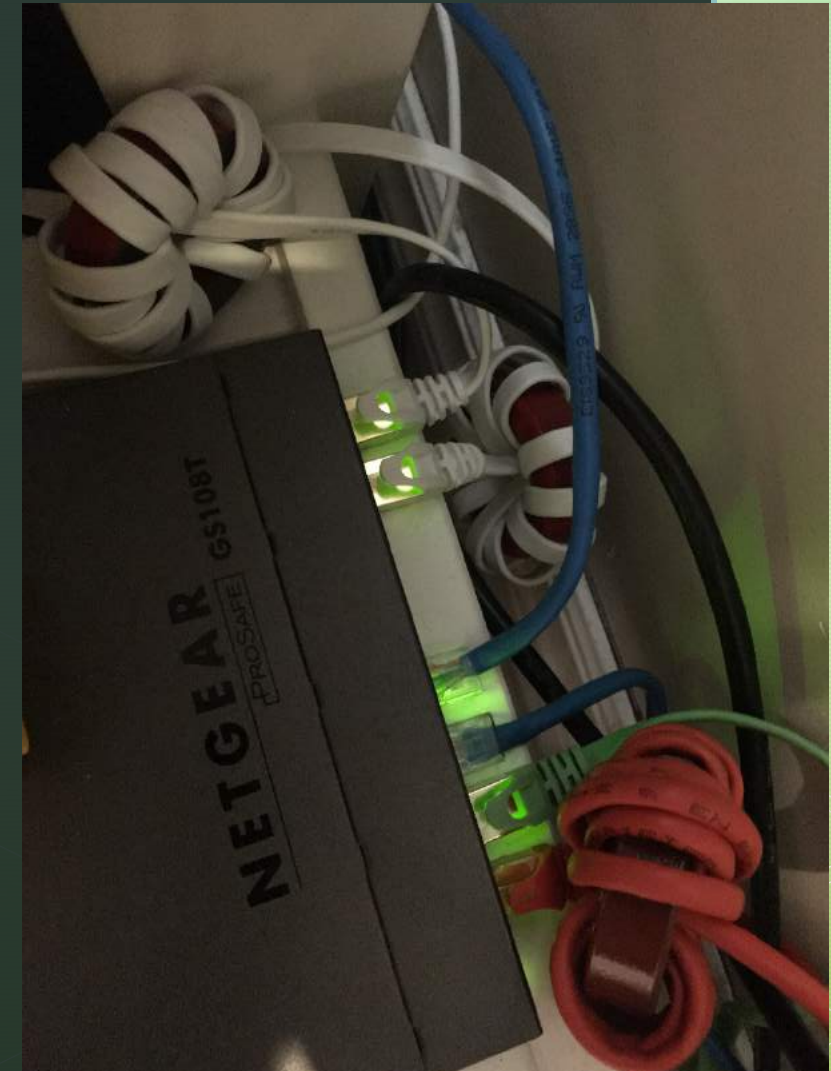
Interference during transmit – Action taken #2

- Installed ferrite rings onto some wires going into the radio including the power cable



Interference during transmit – Action taken #2

- Installed ferrite rings onto Ethernet cables and the switch in the room



Interference during transmit – Action taken #2

- Installed ferrite rings onto the rotator control cable – the cable was too short to put on more



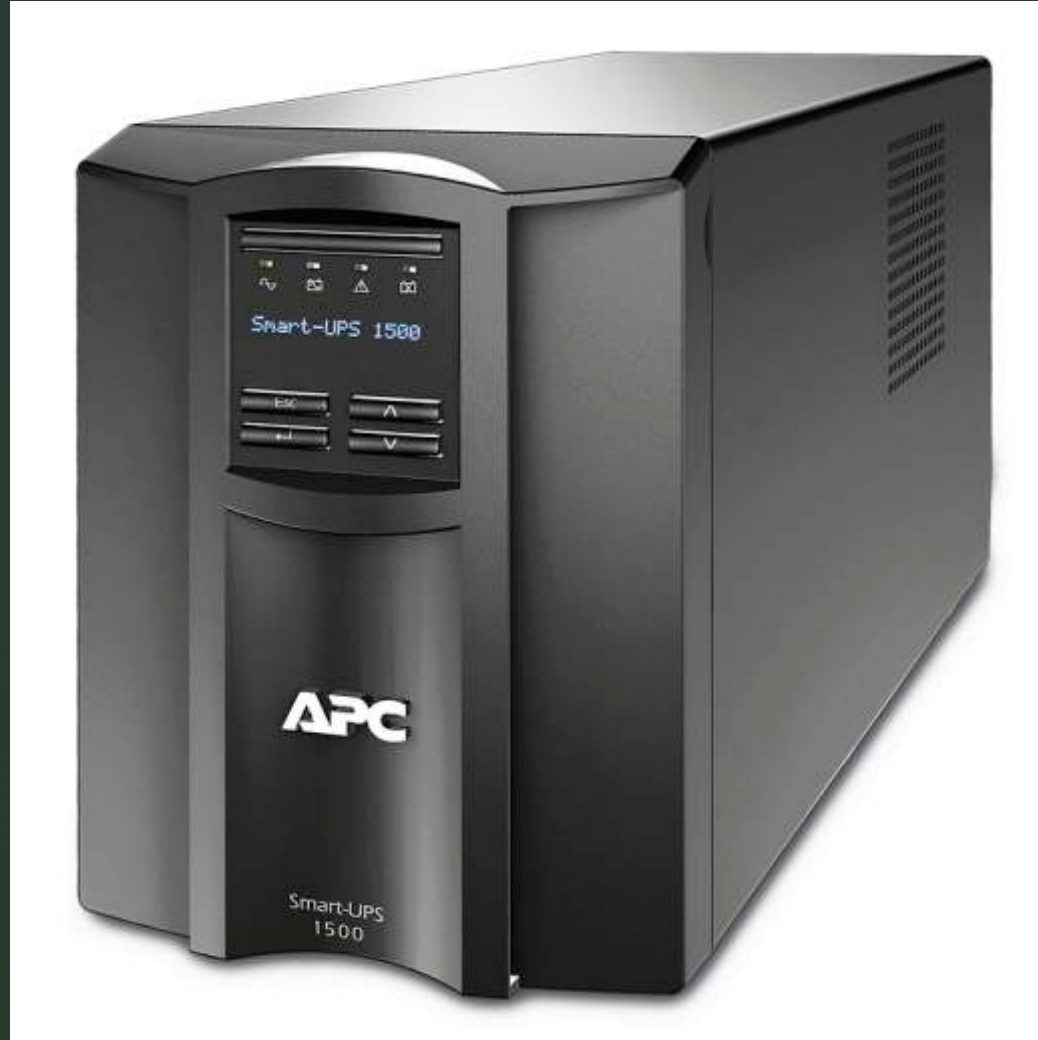
Interference during transmit – Action taken #3

- Installed copper tape shield inside the antenna switch also on the PoE separator



Interference during transmit – Action taken #4

- Got a second hand UPS for the Station - also good for noise filtering and back-up in case the fuse blows



Interference during transmit – Results of the action

- No more interference on the home network during transmit,
- The rotator and its controller does not indicate false directions during transmit (now it is only ± 5 degrees instead of shutting down),
- No more computer shutdown due to interference,
- Significantly reduced noise on the sound amplifiers in the house,
- MORE CONFIDENT IN OPERATING
knowing that the system is more reliable

Interference during transmit – Results of the action

- The dishwasher is still not happy (older Electrolux model with touch panel)
Breaker is shutdown prior to high power transmit → The plan is to place ferrite rings on its feedline



Interference during transmit – If I could re-build

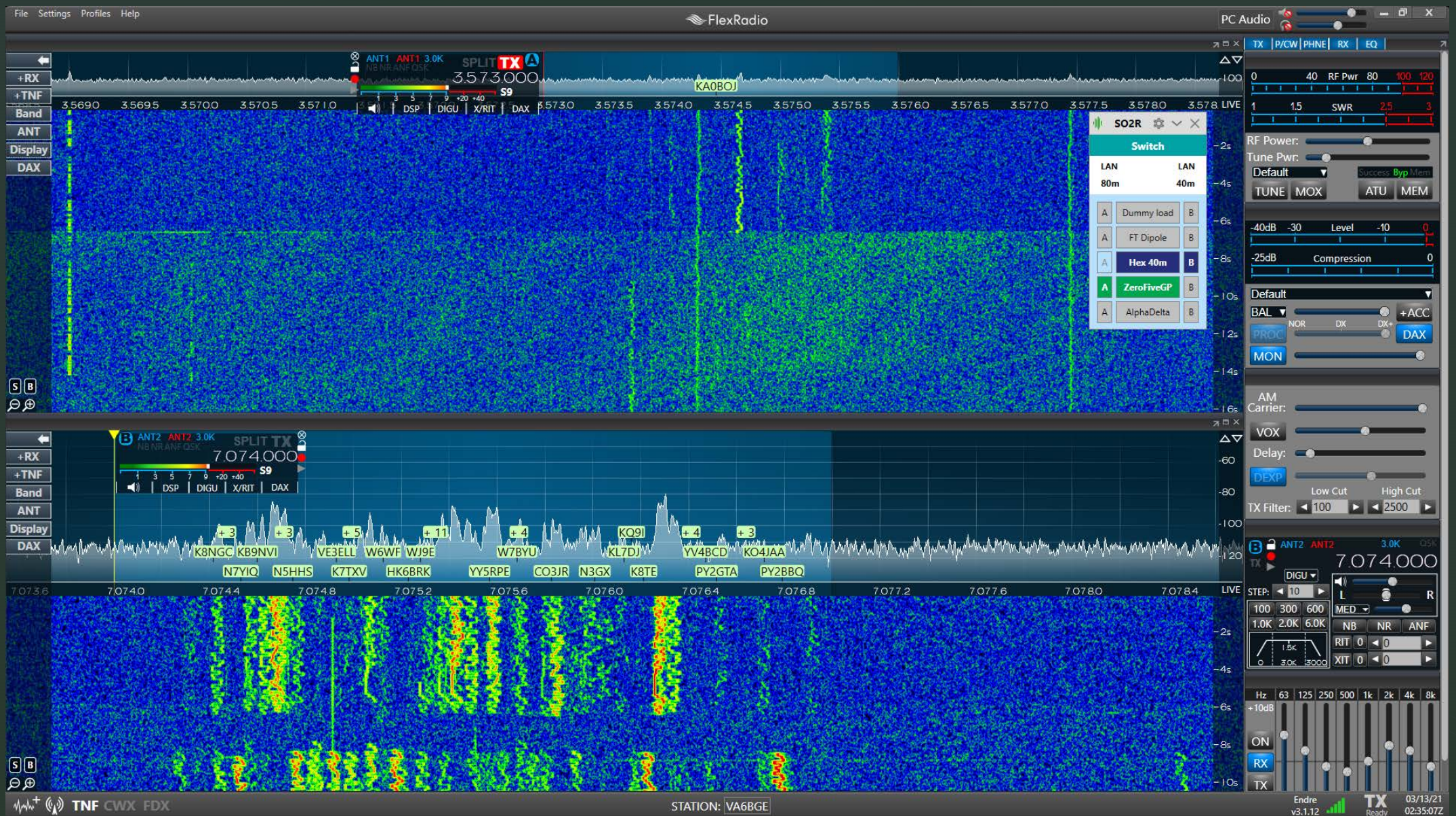
- • Use good quality shielded low voltage wires
 - CAT6 STP or better,
 - Good quality wires into the stereos (on the input side at least),
- Leave extra length at both ends of the cables – it is useful for installing ferrite rings or for splicing if the plug needs to be replaced,
- Don't save on chokes – the beads may not be sufficient,
- Run wires on the shortest possible route to the shacks and try not to put them next to other wires – a separate conduit is a good idea,
- Have a separate breaker for the radio itself,
- Properly tuned antenna shall cause less RFI trouble particularly on high power.

Noise mitigation – The problem

- Experienced serious interference slightly on 40m (1 S unit), but significantly on 80 and on 160m when the fairy lights were on outside the house (up to 3 S units)
 - Approx. 1,000ft of fairy lights all over the shrubs
 - They work like a large radiating antenna
 - Fed by 8AMP 12Volt cheap switching power supply



Noise mitigation – The problem

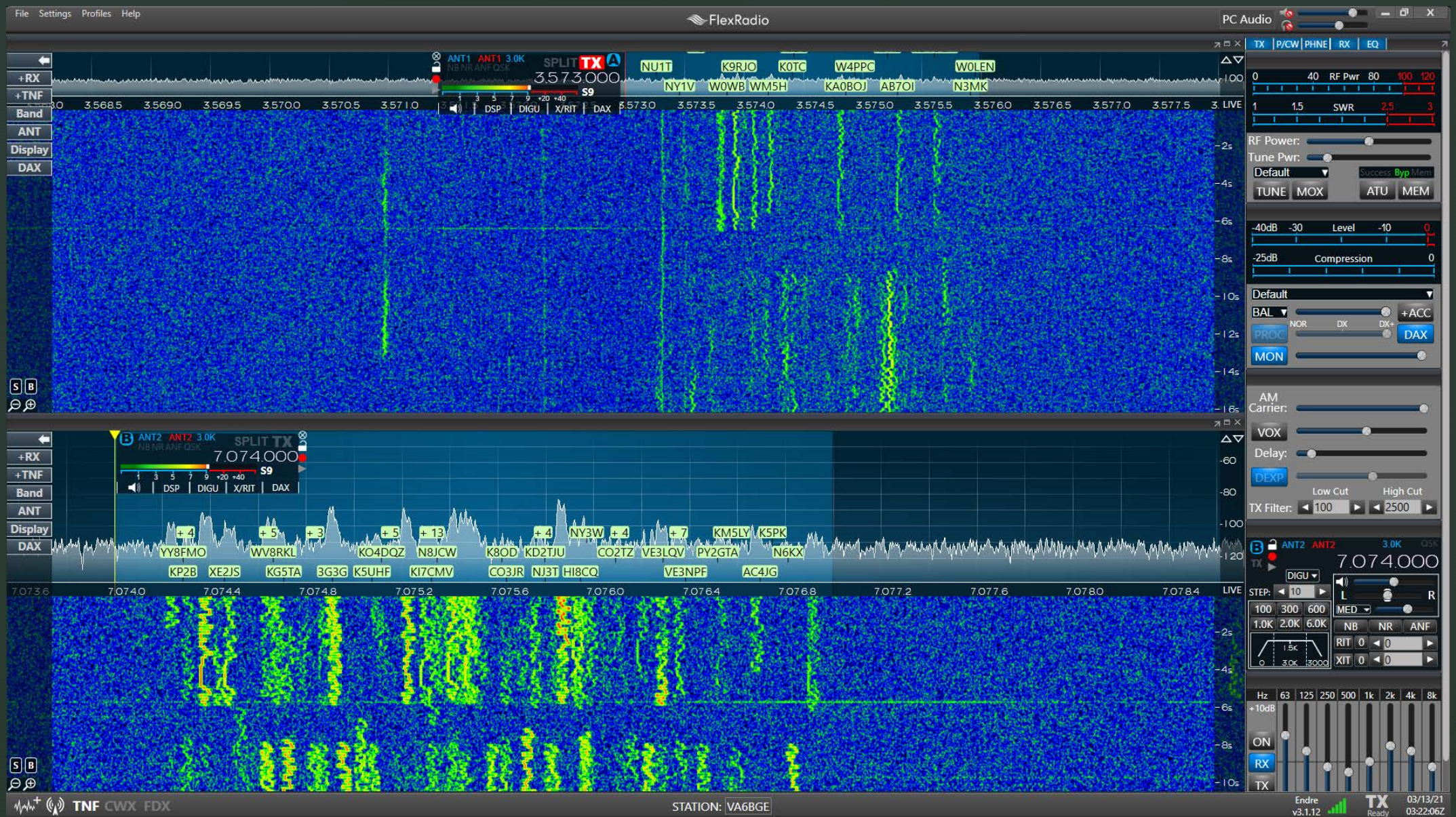


Noise mitigation – The solution

- Go for ferrite core transformer – the old way is the quieter way!



Noise mitigation – The result

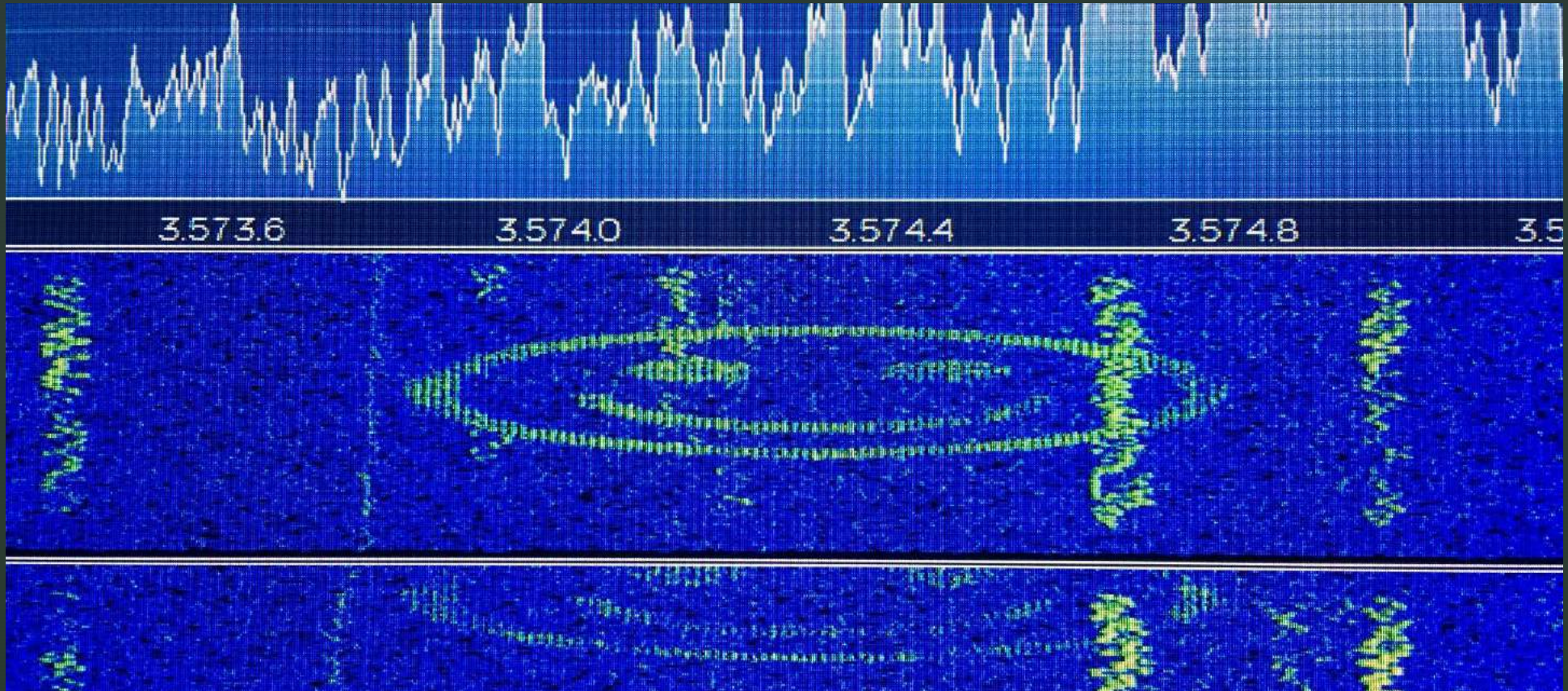


Noise mitigation – Further actions

- Eliminating switching power supplies from the household – e.g. cheap phone chargers, have a central charging location – at least not to leave them plugged in when not in use,
- Always check on the waterfall if a new device is causing any further noise and take corrective actions as necessary or return the product,
- The chokes on the coax cables also helped to reduce some noise,
- Some noise cannot be cut, but therefore there are some smart tools to reduce them.

Noise mitigation – Further actions

- Sometime the noise is intentional indeed...



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