

# **R-390A - IF Filtering**

Collins Mechanical Filters versus Curry Longwave Filters

An Empirical Study

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## Background

My 1967 EAC R-390A began erratically exhibiting severe AGC problems a few months ago. If the radio was changed to manual AGC and I continuously adjusted the gain control, it functioned well enough to allow me to delay dealing with the issue until I had the time.

If the radio was turned on cold, it would function correctly for up to an hour and then begin intermittently overloading on loud signals and then finally overload continuously when set at a full RF gain setting.

Once I got the receiver on to the lab bench, I traced a low resistance path to ground (~22K Ohms) in the AGC circuitry into the bowels of the IF deck, indicating a short to ground on the far side of one of the series resistors in the AGC circuit.

After some head scratching and consulting with the schematic, I discovered that one side of the output of each of the four mechanical filters was tied to the AGC line, with the other side of each going to the bandwidth switch.

The problem had to be one of the mechanical filters, but I was reluctant to dig down into the tight underside of the IF deck to detach each filter from the others to check it.

I had been considering obtaining one of the Dave Curry Longwave mechanical filters ( <http://www.75a4.com> ) to improve my R-390A's performance on CW anyway.

Rick Mish ( <http://www.dxing.com/r390/mish.htm> ) was the magician who had resurrected and remanufactured this particular R-390A for me in 1998. It had performed flawlessly in nearly continuous 24 hours a day 7 days a week operation since then.

A quick E-mail to Rick confirmed my suspicions – he said the filters do short to the case often enough to be a known problem and there is no way to repair one short of replacement. That did it! These filters seem to be failing at a more frequent rate all the time, and I decided it was time to take steps to avoid future problems in this area.

The thought of working with my trifocal glasses in the close quarters of the IF deck convinced me that it was time to let someone else replace the mechanical filters with improved filter designs and bandwidths more to my liking.

Rick agreed to replace my faulty filter and a couple of it's siblings with Dave Curry's latest offerings. I immediately placed an order with the Electric Radio Magazine store ( <http://ermag.com> ), where Ray Osterwald promptly shipped me Dave Curry's 6KC, 2.5KC and .5KC models for my R-390A.

Meanwhile, I set up my lab equipment to measure the frequency response of the IF deck with the original Collins mechanical filters before I shipped it off.

I also wanted to establish a benchmark for repeating the measurements upon the IF deck's return, so I could empirically compare performance in addition to describing my "listening/operating" experiences.

## Test Setup

See Figure 1 - Test Configuration.

A HP 3585A spectrum analyzer's tracking generator output was routed via a 50Ω step attenuator to an adapter cable plugged in to J513 on the IF deck. The 3585A generator output level was set to its lowest value.

The secondary IF output from the IF deck present at J116 on the radio's rear panel was connected through a 6 DB 50Ω pad to the 50Ω input on the HP3585A.

The step attenuator was set to 30 DB and the radio adjusted to MVC. The RF gain was adjusted to display a signal 20 DB below a noticeable compression point at the peak of the pass band.

From this point forward, only the center frequency and span of the spectrum analyzer were changed as measurements were taken for each of the IF bandwidths.

## Results

Detailed data collected for each of the existing filters at appropriate and consistent frequency intervals resulted in the normalized frequency response graphs shown in Figure 2 through Figure 5.

Once the data measurements were completed, the IF deck was shipped off to Rick Mish for replacement of the 2,4 and 8 KC filters with the .5, 2.5 and 6 KC Curry filters respectively.

When the IF strip returned, an identical test setup was used and the results of a second series of tests, this time with the Curry filters installed, was conducted. These data results are shown in the normalized frequency response graphs of Figure 6 through Figure 8.

Upon hearing that I was replacing the stock filters, several people have asked me to compare the two sets of filters. Pair-wise data comparisons of the filters are shown in the normalized frequency response graphs of Figure 9 through Figure 14.

Until I can find a way to warm each of the removed filters to a nominal operating temperature to determine which one has the shorted terminal, looking at the graphs only provides a tantalizing clue or two as to the culprit.

Closely examining the graphs, I have a feeling that perhaps the 8KC filter was the cause. Something there just isn't right - look at the anomaly on the lower side of the oddly shaped pass band. I also note the 6 DB bandwidth seems to be a rather narrow for this filter.

However, data is only numbers – how does the radio really sound? I am happy to say I am delighted with the radio's new performance and capabilities.

The 1KC and .1KC filters in the radio were marginal for continuous use at best and the new .5KC filter is a distinct pleasure to listen to. I can always switch to the narrower bandwidths if I actually need to.

The 2.5 KC filter is perfect for listening to SSB and for picking off one sideband of an AM station in a tight situation on 40 meters in the evenings.

The 6KC filter is great for AM listening, and on a quiet band, I can always switch over to the original 16KC filter if I truly want 'high fidelity' audio, provided I feed an external audio system from the diode load terminal.

The most frequent inquiry is always – “was it *really* worth putting more than \$600 into a nearly 40 year old radio?”

This radio is the one R-390A that I'm keeping. For me, the answer is unquestionably - Yes!

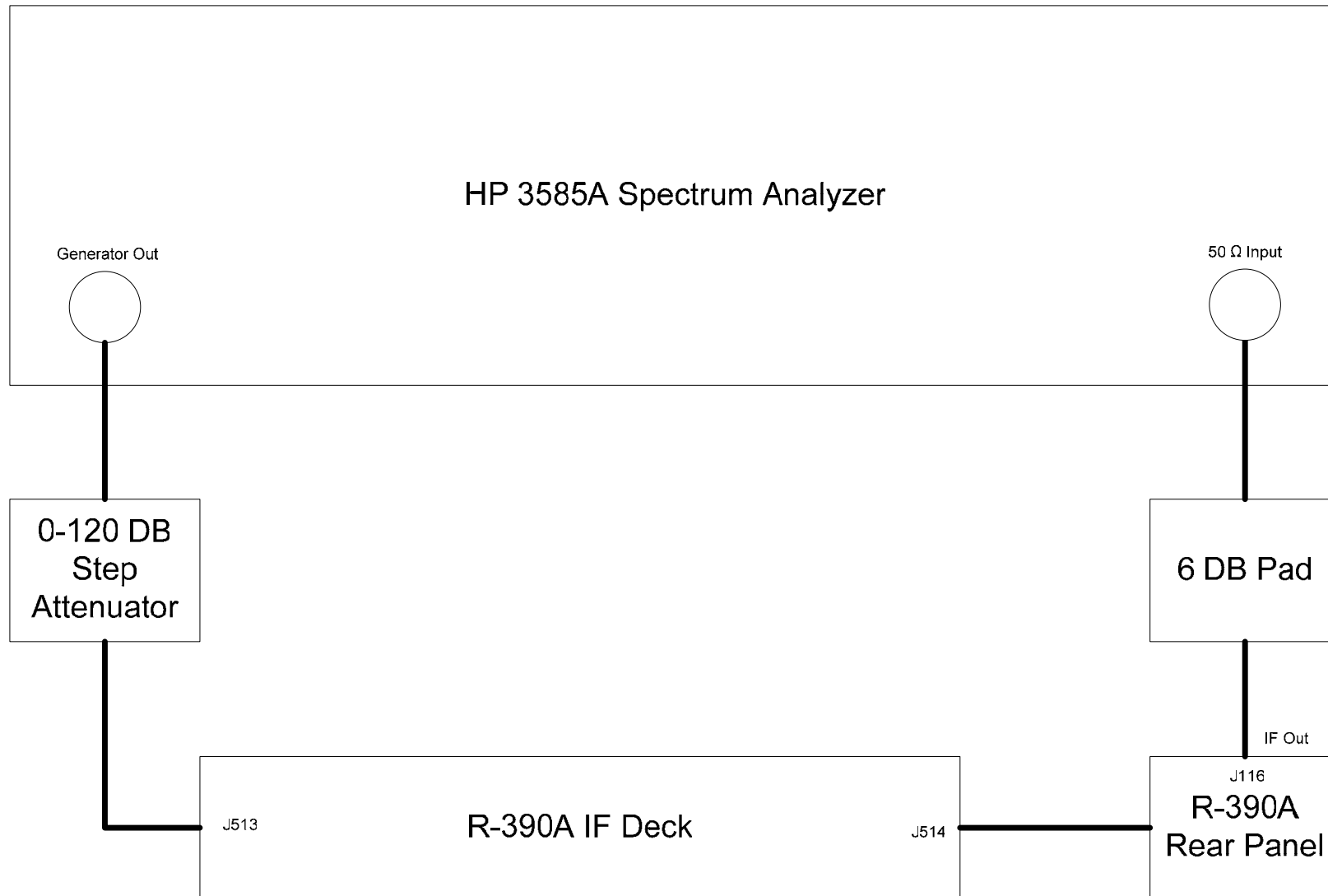


Figure 1 - Test Configuration

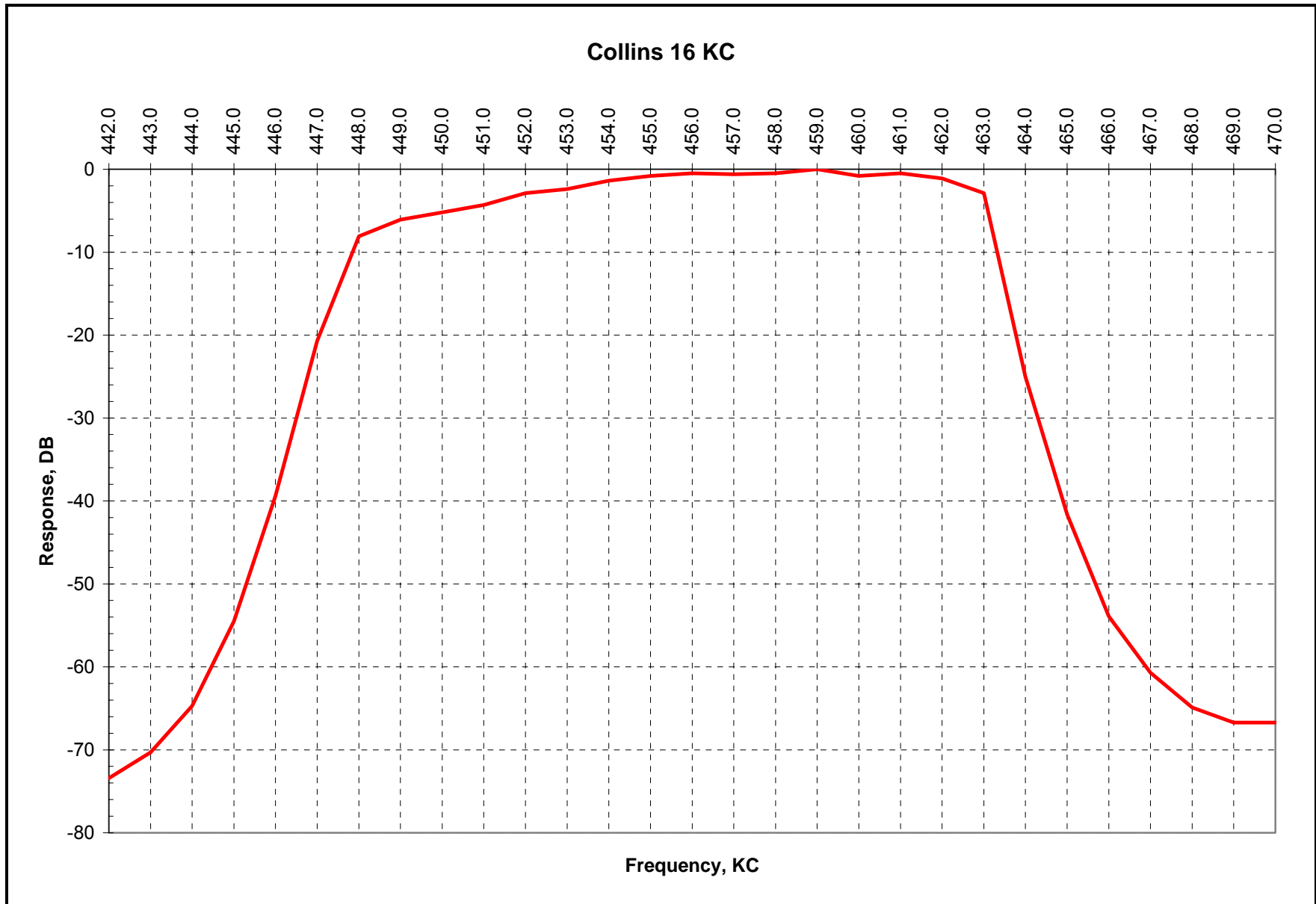


Figure 2 - The Collins 16 KC Filter

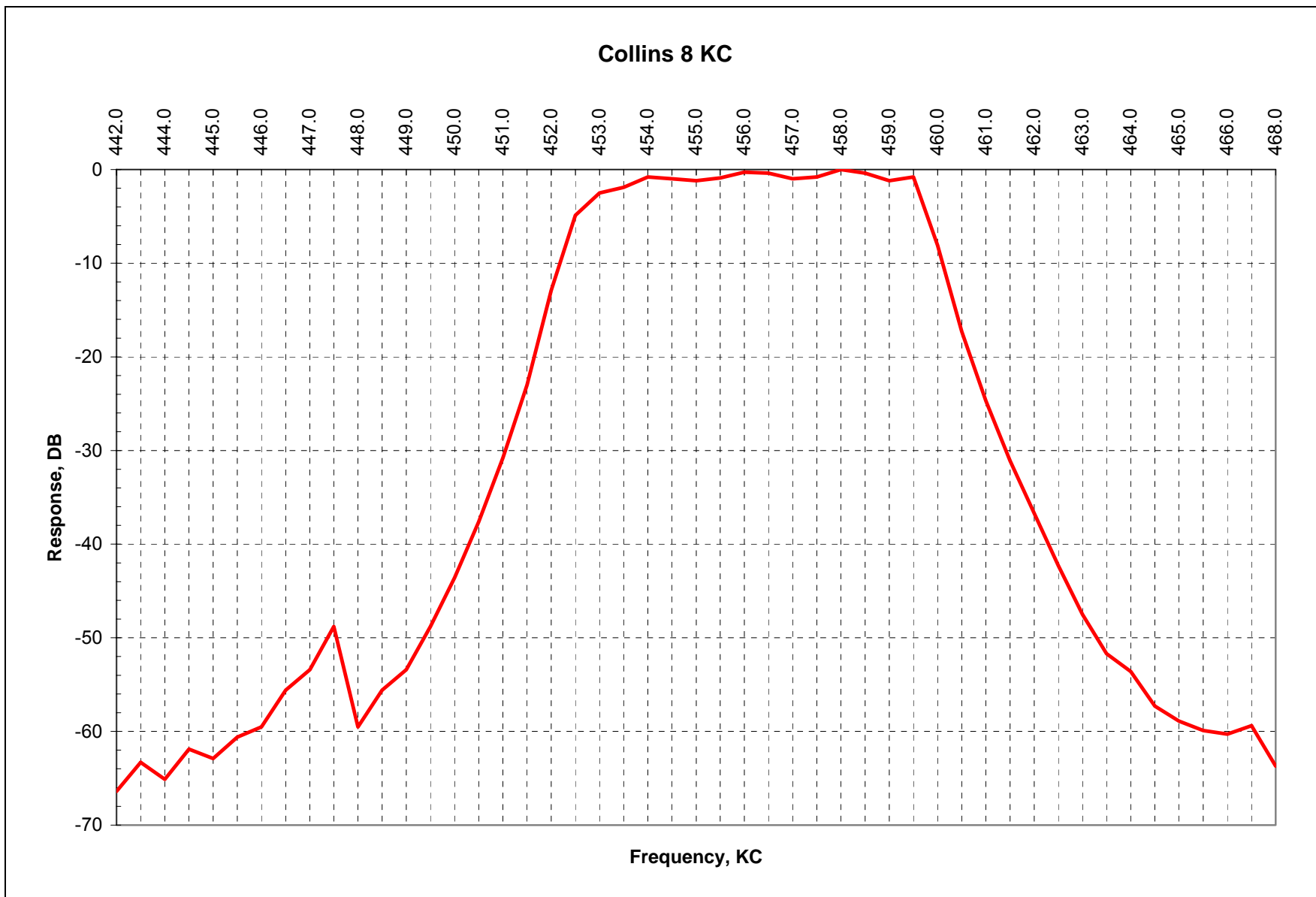


Figure 3 - The Collins 8 KC Filter

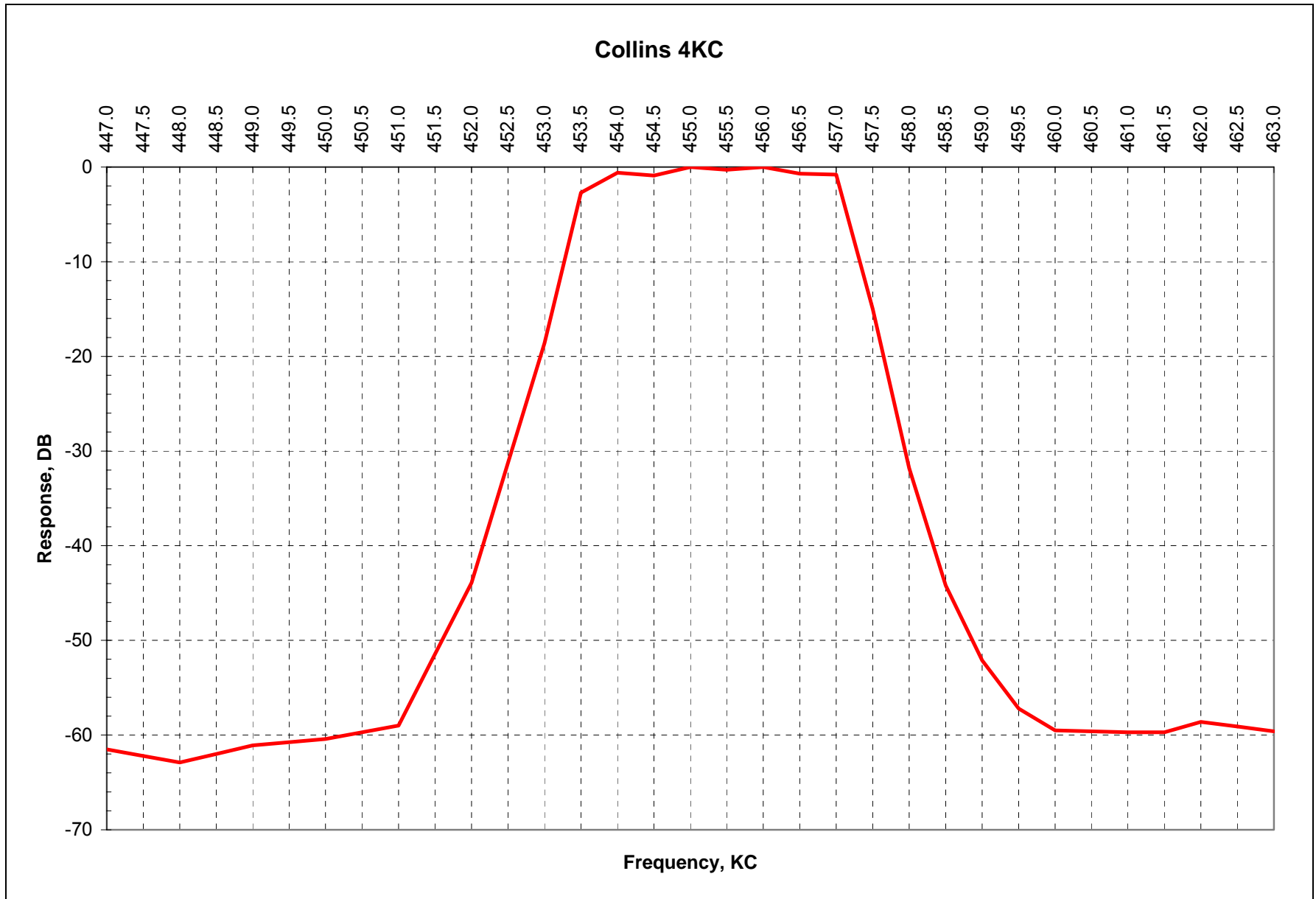


Figure 4 - The Collins 4 KC Filter



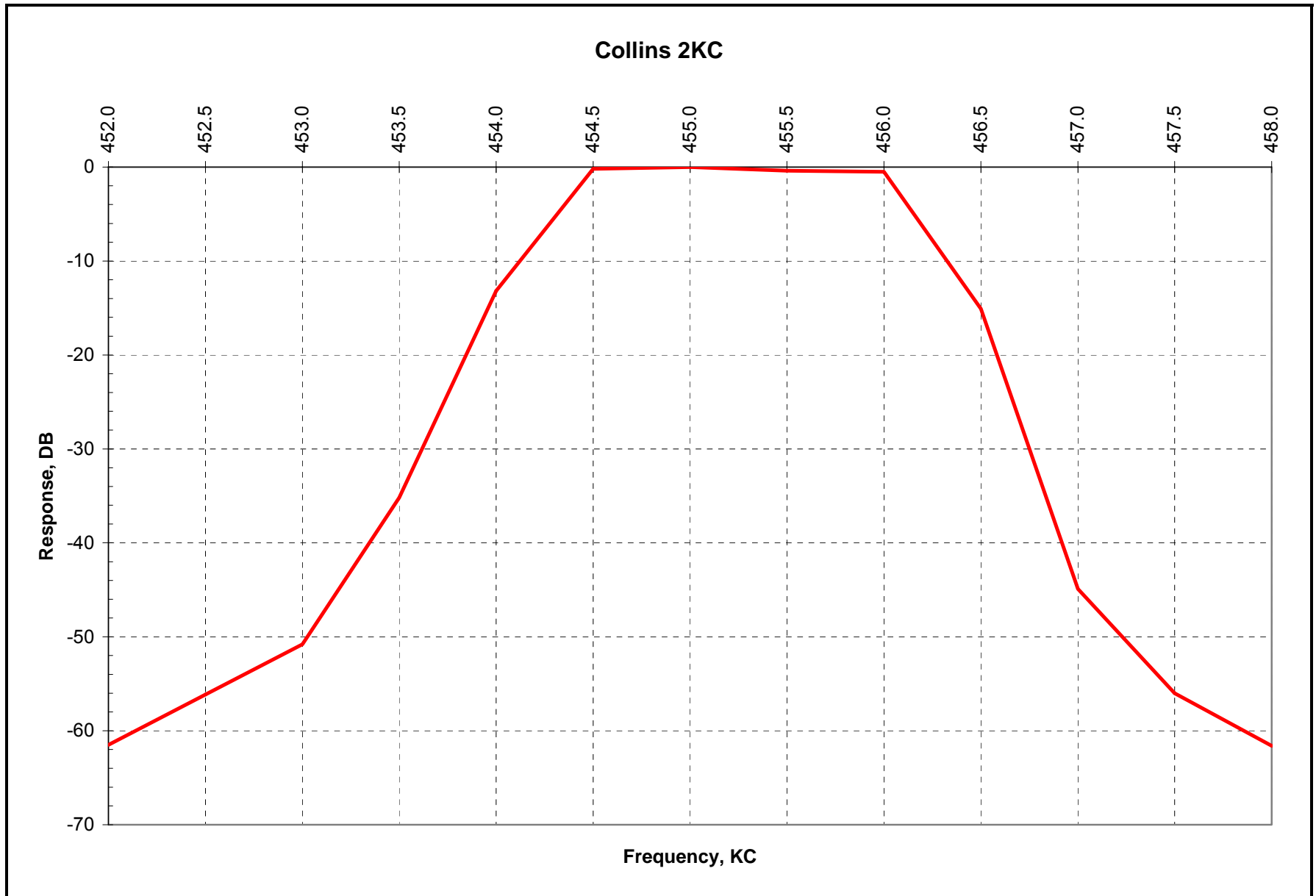


Figure 5 - The Collins 2 KC Filter

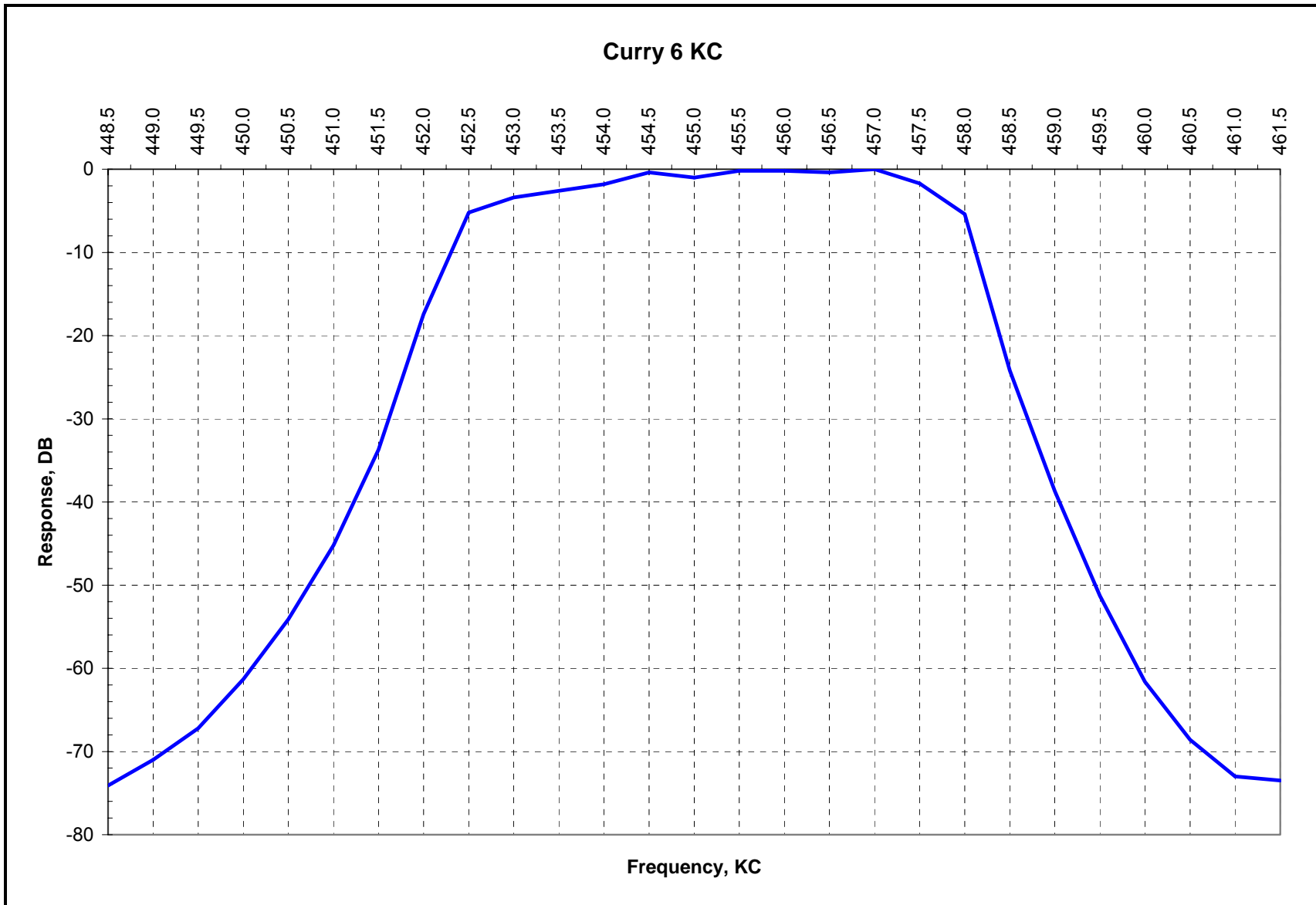


Figure 6 - The Curry Longwave 6KC Filter

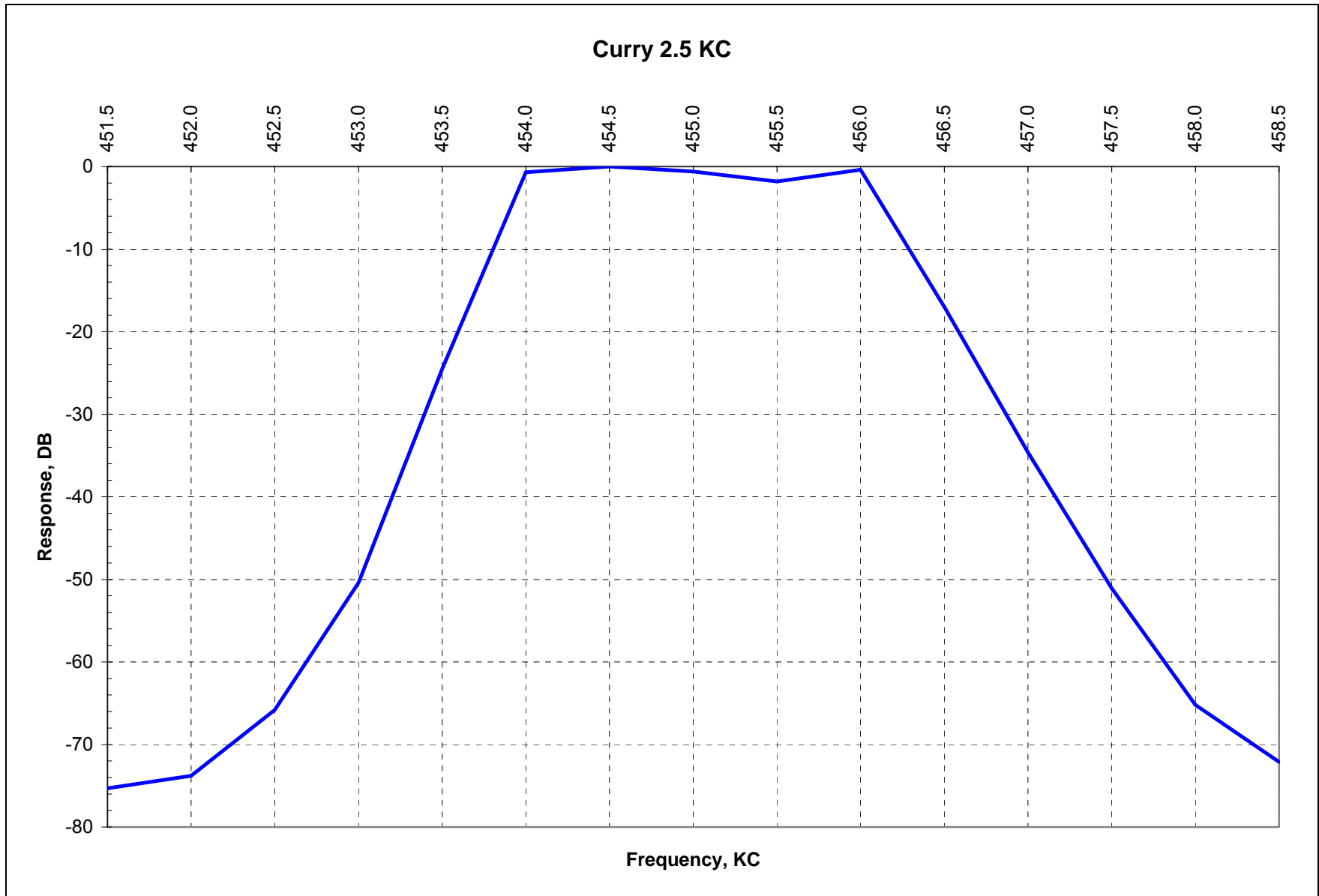


Figure 7 - The Curry Longwave 2.5 KC Filter

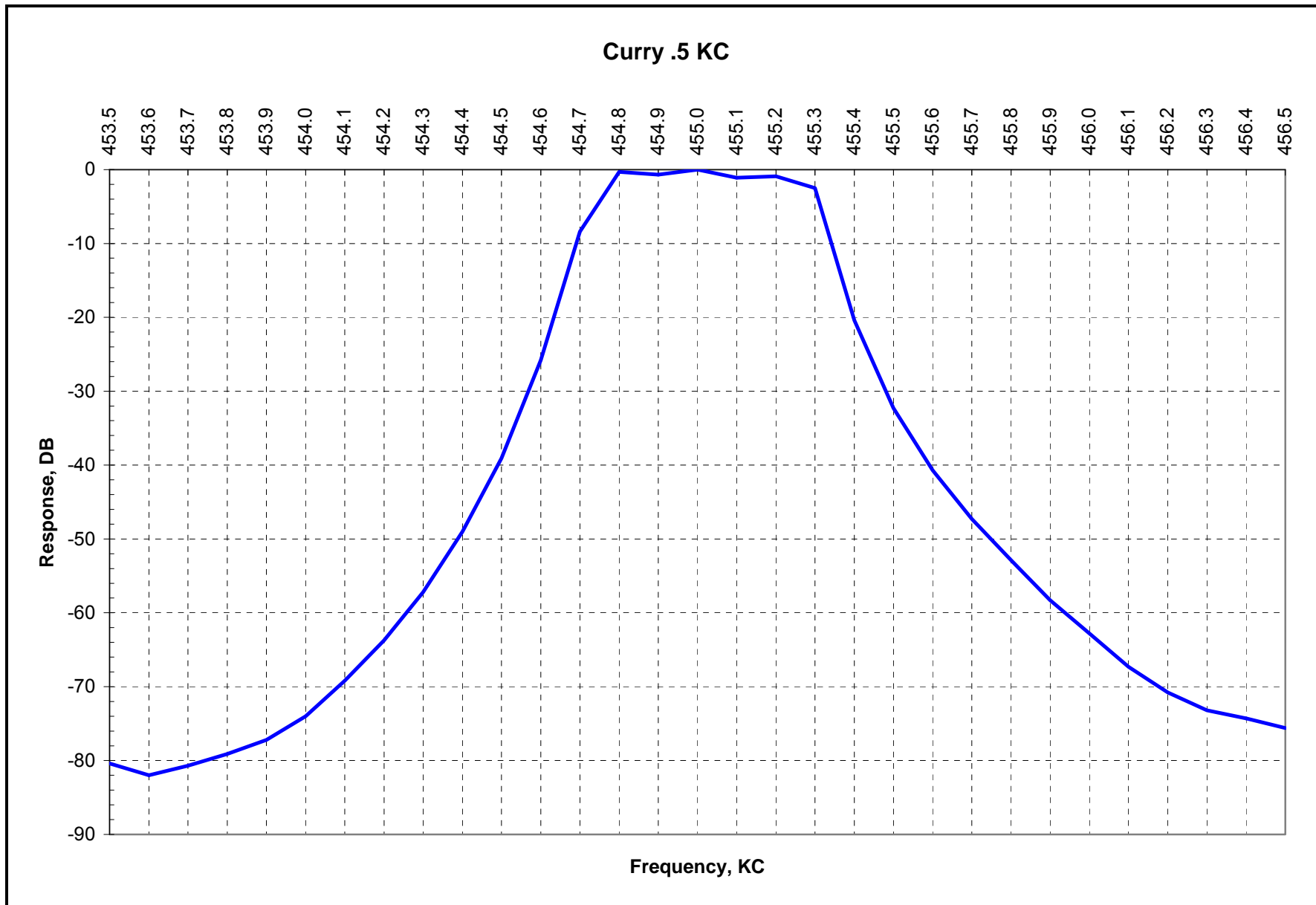


Figure 8 - The Curry Longwave .5 KC Filter

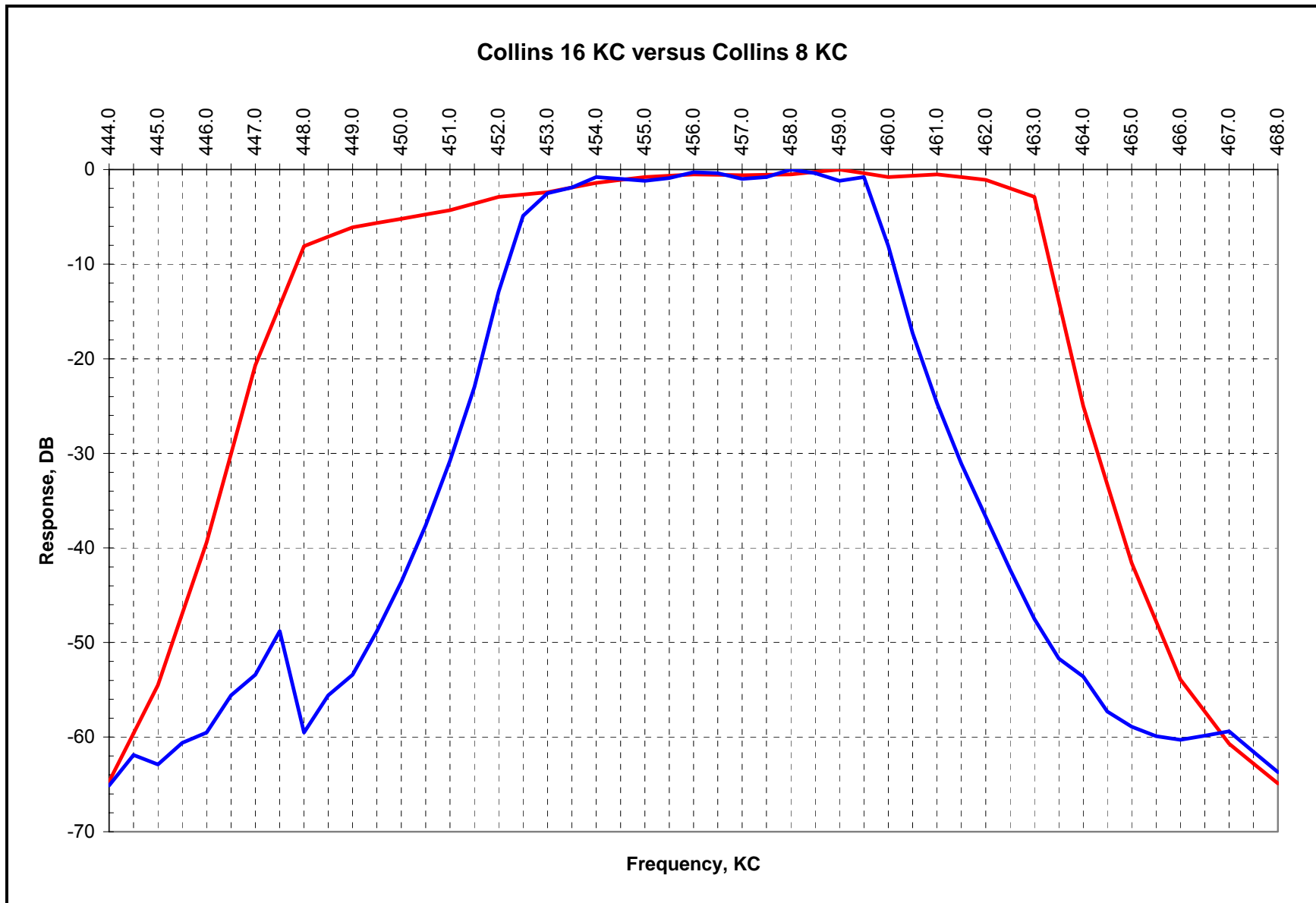


Figure 9 - Collins 16 KC Filter versus Collins 8 KC Filter

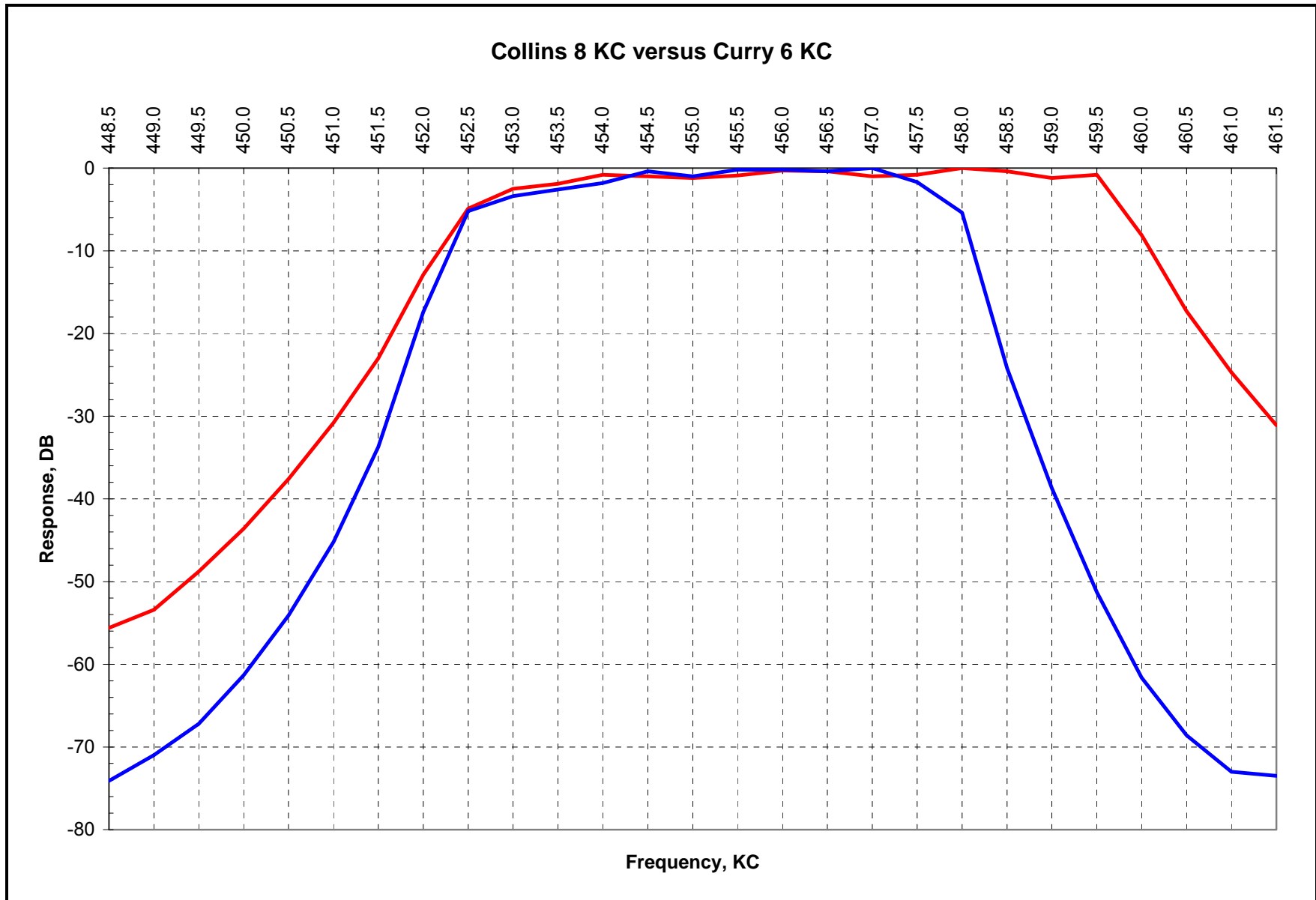


Figure 10 - Collins 8 KC Filter versus Curry 6 KC Filter

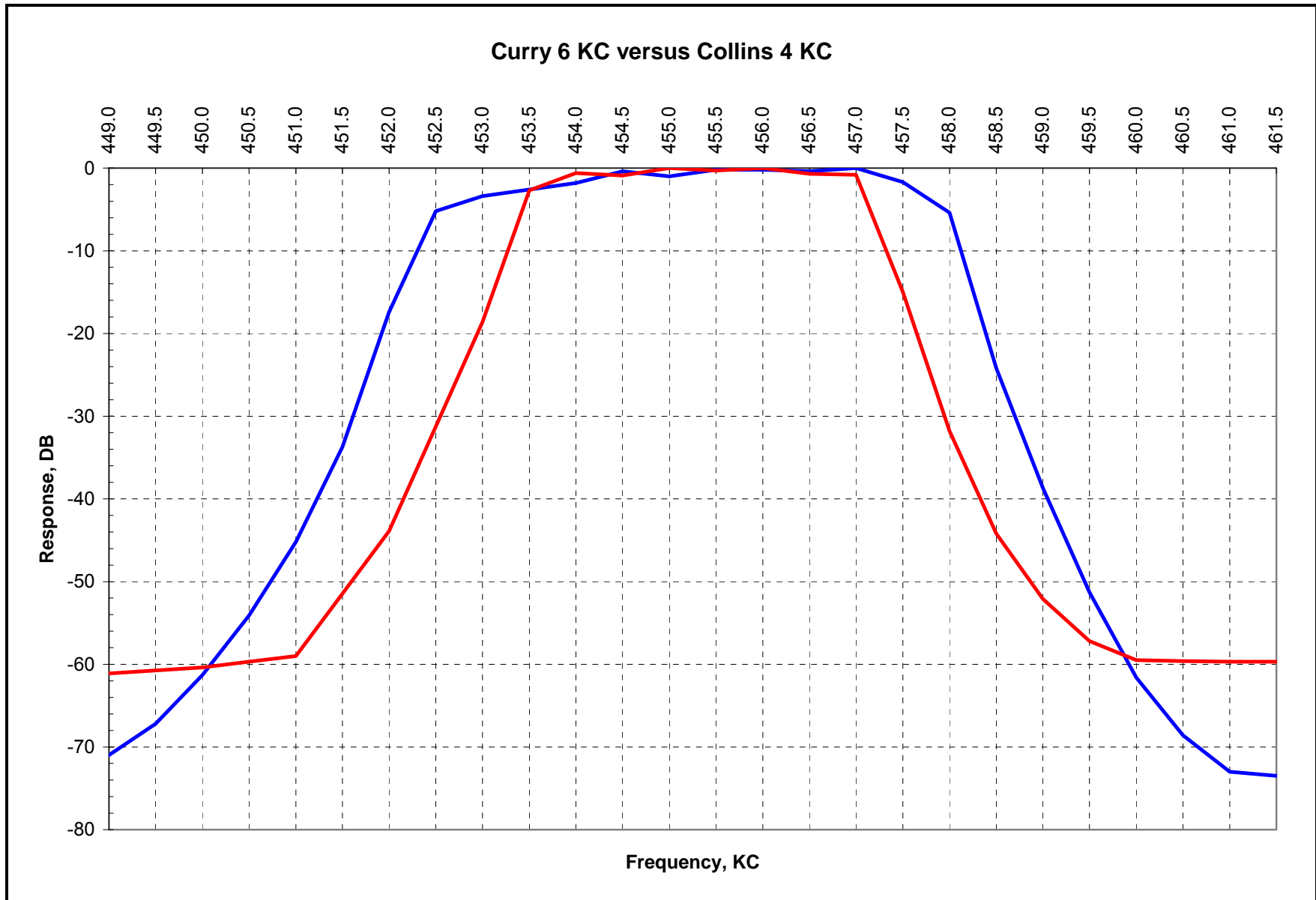


Figure 11 - Curry 6 KC Filter versus Collins 4KC Filter

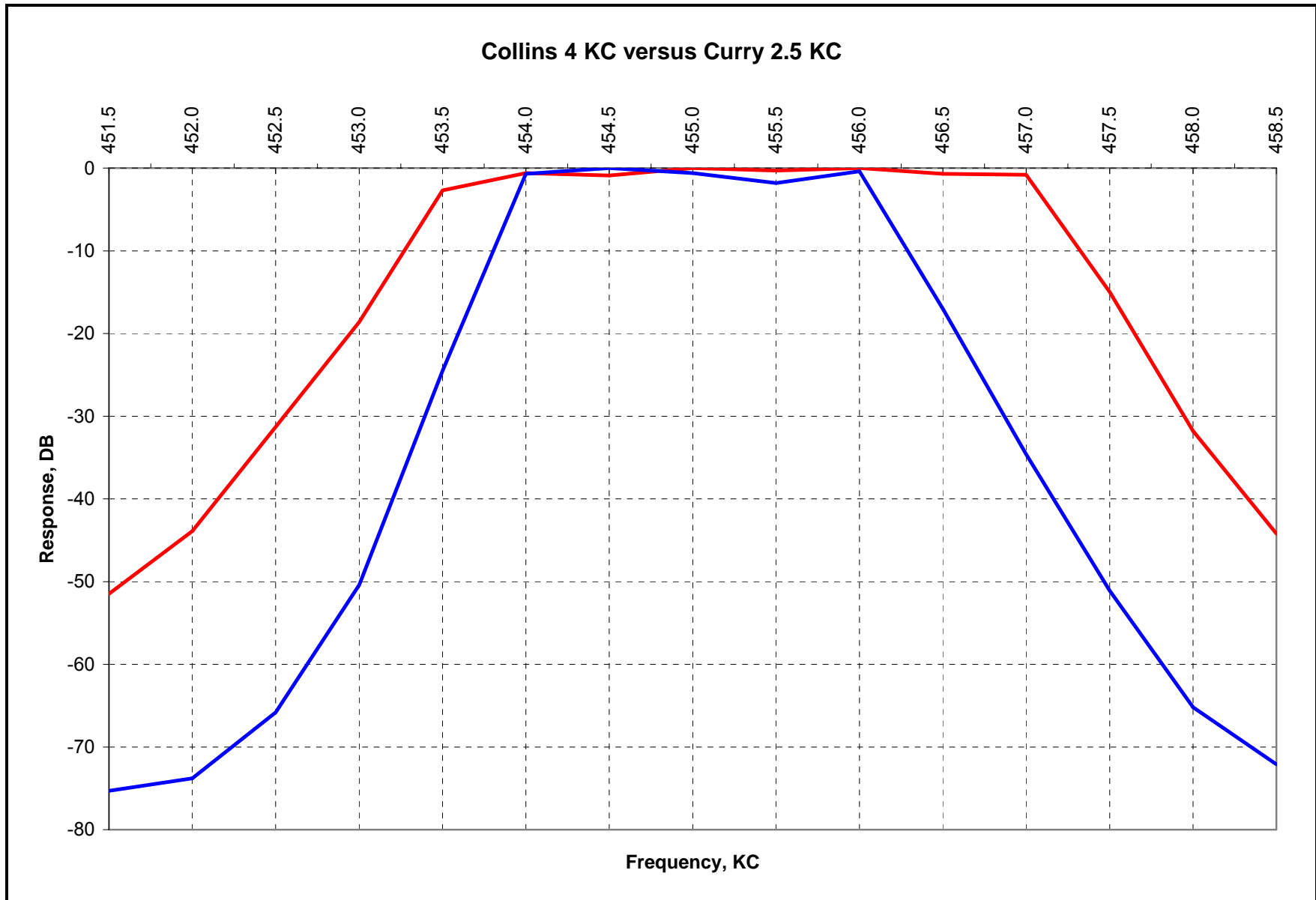


Figure 12 - Collins 4 KC Filter versus Curry 2.5 KC Filter



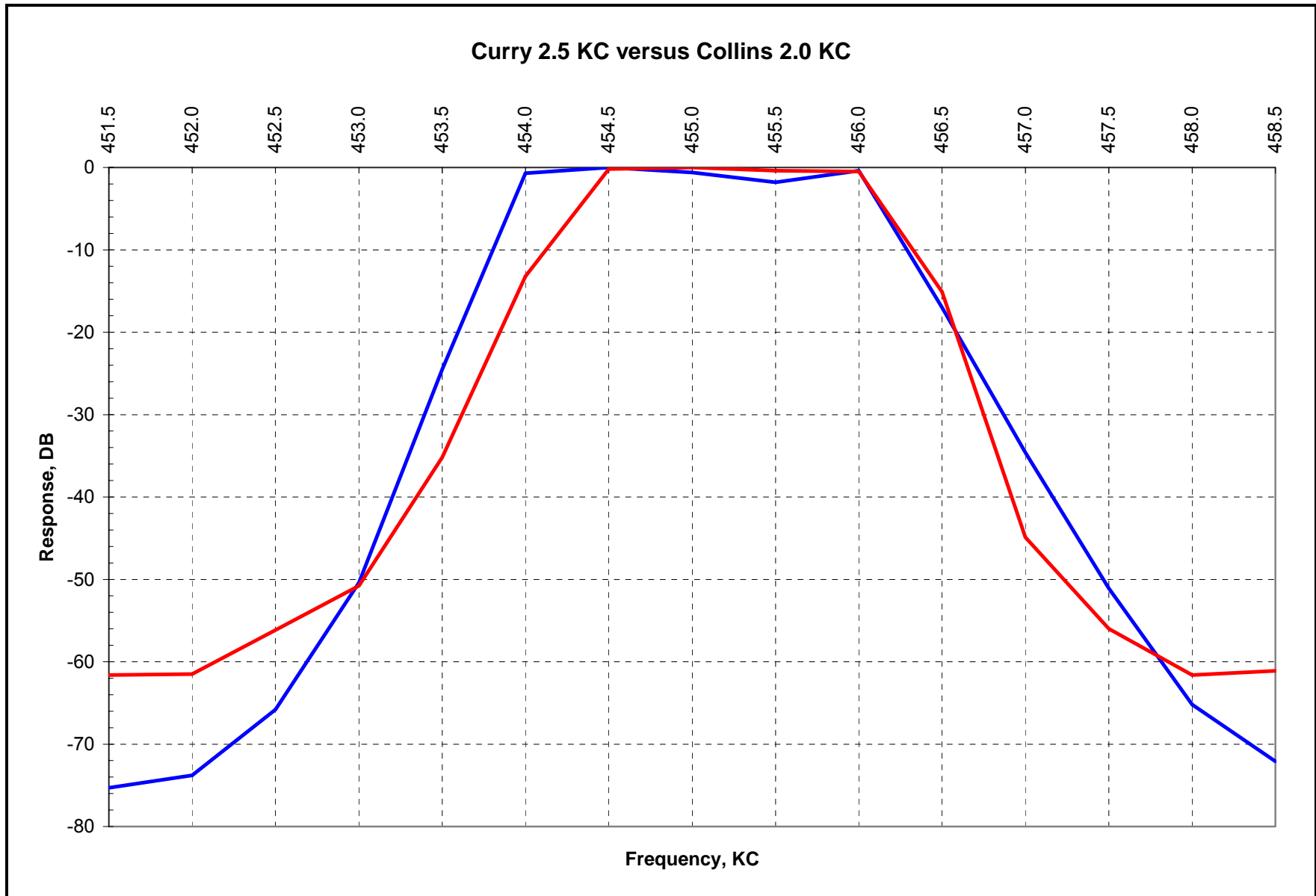


Figure 13 - Curry 2.5 KC Filter versus Collins 2 KC Filter

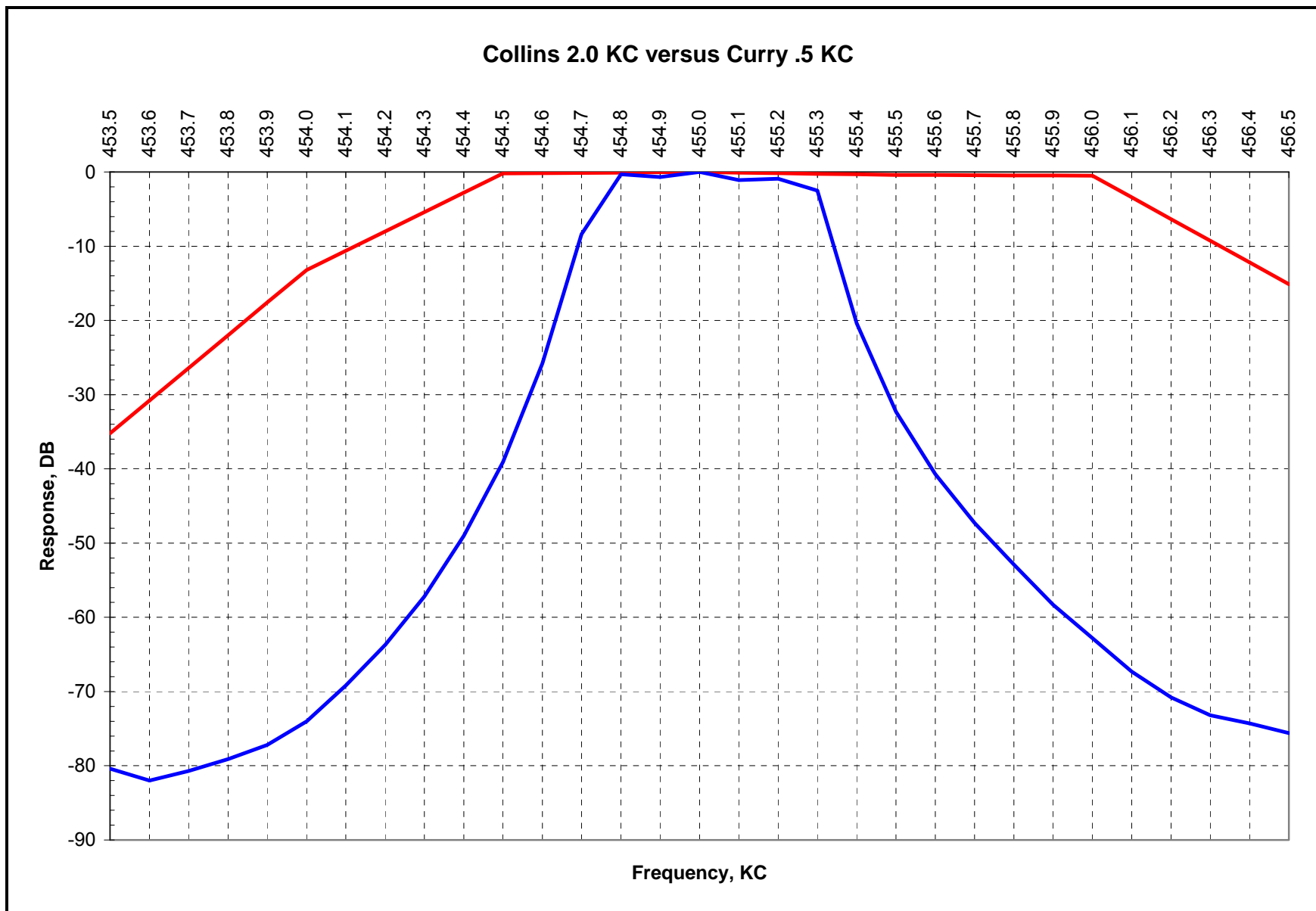


Figure 14 - Collins 2 KC Filter versus Curry .5 KC Filter

## References

1. Dave Curry's Longwave Products Web Page ( <http://www.75a-4.com> ) has filter information.
2. Ray Osterwald's article on page 2 of Electric Radio #147 (August 2001) describes installation of the Curry Longwave filters. The Curry filters are reviewed in the February 2001 issue of Electric Radio magazine.
3. Electric Radio Magazine's Web Page ( <http://www.ermag.com> ) has ordering information for the Curry filters.
4. Rick Mish's Miltronix R-390 Web Page ( <http://www.dxing.com/r390/mish.htm> ) offers radio repairs.
5. Chuck Rippel's Web Page ( <http://www.r390a.com/html/Curry.html> ) has a review of the Dave Curry products and offers radio repairs.
6. The R-390A FAQ Web Page ( <http://www.r-390a.net/faq-refs.htm> ) has R-390A manuals and schematics.

## Notes

1. The intrinsic insertion loss of the Collins or of the Curry filters was not empirically measured. This would involve the building of test fixtures that are outside the scope of this effort.
2. No attempt was made to quantify the differences in IF gain achieved by the use of either set of filters. All measurements were 'normalized' to the peak of the pass band and left at that.
3. Once a filter was observed to be at its 'floor', no measurements were taken further from the center frequency unless a response anomaly was present.
4. The accuracy of the measurements is within plus-or-minus 1 DB or so, which is close enough to ensure a good understanding of the filter response. Additional precision would only arguably result in better accuracy, due to alignment variances, gain settings, etc.
5. No measurements or comparisons were made for the 1.0 and 0.1 KC bandwidth positions of the R-390A. The functionality remains even after the .5KC filter was installed.
6. The 9KC Curry Longwave filter is not available in the R-390A form factor, so no comparison with it is possible.
7. Additional research involving the measurement and comparison of more 'before' and 'after' examples of Curry replacements of Collins filters in R-390A IF decks would add immeasurably to the R-390A body of knowledge.