# Letters to the Editor

**An Effective 80 and 40 Meter SSB/CW Receiver (Jan/Feb 2005)**

***Gentlemen,***

Careful examination of the article by Dave Lyndon, AK4AA, seems to indicate to me that if you reference the oscillator board schematic, Figure 4, there is a missing coupling capacitor that should be in the circuit between T202 and T203 to dc isolate the collector of Q206 from the rest of the circuit.

Can you please confirm this? I do not know if this has been seen by other readers. — *Thank you, Paul Parker, WB6DHH,* **pjldparker@juno.com**

***Hi,***

Yes, there should be a coupling capacitor as Paul's sharp eye reveals. I checked the actual physical circuit, and there is a 0.1 µF disc ceramic capacitor from the junction of the T202 primary and secondary connection to the junction of C220 and the "Q" side of T203. It's important that this be a value much larger than C220.

Sorry for the omission in the schematic, and thanks to WB6DHH for spotting it. [The corrected portion of the schematic is printed here as Figure 1. — *Ed.*] — *73, Dave Lyndon, AK4AA,* **dlyndon@hughes.net**

**In Search of New Receiver Performance Paradigms (Empirical Outlook, May/Jun 2006)**

***Hi Doug,***

I think it's fair to say that third-order intercept point (TOIP) has never been an exact scientific parameter of receiver performance comparison. It's a useful (sometimes!) performance parameter for components, but for the receiver as a whole, it has enormous "ifs and buts."

Let's go back a few (40!) years. HF marine receivers here in the UK had an intermodulation performance requirement that a signal at +80 dBµV would produce an IMD product at no more than +30 dBµV. From memory, the spacings were 50 and 100 kHz. Those receivers were adequate, if not particularly good — the intercept point works out at about –2 dBm, and most were about +5 dBm. At that time, they had tuned front ends.

In the early 1980s, an "advanced design" receiver appeared. (I won't say which company, but they were international and no longer exist.) It used 1-bit sampling at 500 MHz, and then resampled at progressively higher bit resolutions and lower frequencies, and it passed all the type-approval tests. Installed on a ship, it proved such a disaster that according to reports, having set sail from Holland on the first fitting, they stopped in the UK for a conventional receiver to be fitted! But it met the specification.

TOIP is not a very good indicator of overall IMD performance because it doesn't take into account the front-end bandwidth that is handling all the unwanted signals. It has some use when designing for comparing parts; but even then, quoting intercept points in dBm is capable of leading to great problems because of what I call "The Great 50-ohm Scam." Everybody happily talks of levels in dBm; but once you're away from 50 Ω, it gets more than a bit meaningless. I see this in my work (advanced systems design of RF CMOS integrated circuits for low power applications such as transceivers in pacemakers, endoscopes and the like) where you have to work in µV of intercept. Impedances are such that dBm requires multiple calculations as you go from one impedance to another.

Incidentally, RF sub-micron CMOS devices are pretty good at following the cube law, right up to where they hit gain compression. The usual rule of thumb that "TOIP is 10 to 15 dB above 1-dB gain compression" doesn't apply very well with RF CMOS.

So we can confidently say that a receiver with a narrowband tuned front end on 7 MHz (such as the old National HRO) and a receiver with a wide band (sub-octave filter, up-conversion) can have TOIPs that favor the up-conversion receiver and still not work as well as the HRO.

I've seen it written somewhere (I can't remember where) that classical two-signal IMD tests do not give representative results when used on a receiver with early digitization and DSP filters. I didn't see an explanation (Cynicism suggests it's because the results come out badly!) but in reality, the measurements require multiple signals. The best measurement would be done at varying input levels of very wideband noise, with a notch at the receive frequency, measuring the SNR degradation of a signal at the 10-dB SNR level. Such a measurement is, regrettably, impracticable.

More to the point would be to have a standard level at which the intermodulation ratio is measured, probably somewhere around 60 mV (–10 dBm). A +20 dBm IP receiver would then show IMD signals at –70 dBm. A better approach would be to use mV EMF, which takes out the anomaly of dBm in that they represent the power that would be delivered if the load were 50 Ω. Historically, the US used µV PD (potential difference) at the antenna terminals, while Europe used the EMF. That gave a 6 dB advantage in the US for the marketing department to exploit, while EMF is a better parameter to represent practice. The dBm comparison crawled in from the radar/ECM field, but is so misleading in receiver design that far too often, it is, in reality, as much use as teats on a bull!

TOIP and IMD measurements are only

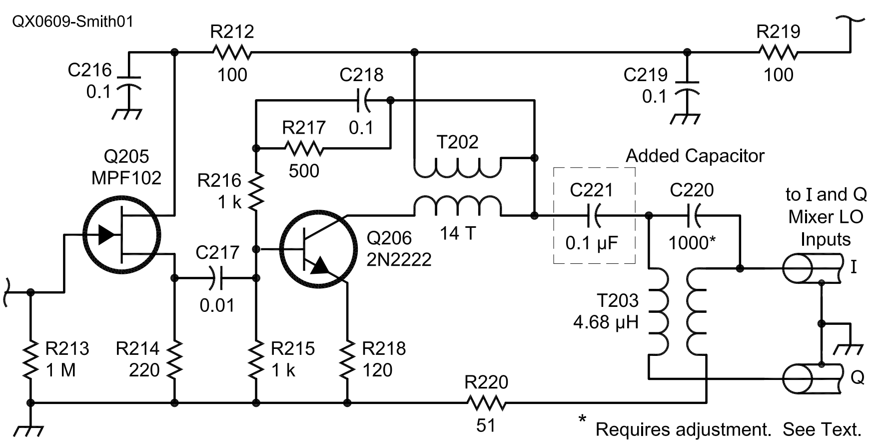


**Figure 1 — This schematic diagram shows a corrected portion of the Oscillator Board, Figure 4 from "An Effective 80 and 40 Meter SSB/CW Receiver" by Dave Lyndon, AK4AA in the January/February 2005 issue of *QEX*. A 0.1 µF capacitor is added between T202 and T203.**

a little part of the receiver performance story, though, and as I showed in my *QEX* article some four years ago, phase noise can be far more limiting.[1]

*— 73, Peter E. Chadwick, G3RZP,*
**g3rzp@g3rzp.wanadoo.co.uk**

***Hi Peter,***

Good to hear from you again. To get right to the point: You and the others I'm talking to seem to agree that a fixed input level is the right way to go for IMD3 measurement in receivers. The only thing is that those who operate near the noise floor have one criterion and those who contest may have another. It's unclear to me how we can avoid measuring IMD3 performance at several levels when units don't obey a cube law.

What's bound to be puzzling to readers is that many published IP3 measurements don't comply with the traditional definition of IP3. That is while heavy emphasis is being placed on receiver IP3 performance by those marketing departments you mentioned. You're right that complex systems don't necessarily play by rules applicable to component parts but equipment reviewers also emphasize IP3, even regardless of their own admissions of its invalidity. Something has to give. Readers deserve a fair shot at comparing old data with new.

It's also true that units with early digitization — and even some with late digitization — do no behave at all like cube law. We do have some studies of how they do behave coming here in *QEX*. At least one of our friends there in Europe is intensely examining the situation.

*— 73, Doug Smith, KF6DX,* QEX *Editor,*
**kf6dx@arrl.org**

**I-V Curve Tracing With a PC (Jul/Aug 2006)**

***Doug,***

What is with the reprinting of *QEX* articles in lightly edited form with slightly different titles in *QST* (or is it the other way around)? Most recently, WB9LVI's curve tracer write-up was published in both magazines in the same month. I seem to recall one other similar situation.

I subscribe to both magazines and expect to get unique content in return for the unique checks that I send in for each publication. I seem to remember from my limited experience as an author, that one of the first questions that I was asked was, "Has this been submitted anywhere else?" It was considered a cardinal sin to do so without notifying the publishers of each magazine. As *QEX* and *QST* are both ARRL products and the other publication was referenced in the footnotes in both articles, the cross-publication must have been an overt act by ARRL management, rather than by the author.

You have done a stunningly good job of improving *QEX*, and I salute you for doing that. There really is no need to pad the publication with reprints from the sister magazine.

*— 73, Ted Gisske, K9IMM,*
**gisske@offex.com**

***Dear Ted,***

Thanks for writing and giving me the chance to explain. The situation is this: Sometimes we feel a project deserves exposure in both publications and we leave the heavy technical content out of the *QST* companion piece. WB9LVI's article was accepted in basically the form you see it for *QEX*, then *QST* decided to run a slightly less technical version of it. We don't do that often but we have a selfish motive: to steer ARRL members to *QEX* and to steer non-members to *QST*.

As I think you know, *QST* has a circulation of over 140,000 and *QEX* is under 10,000. We'd like to see *QEX* grow, and we're of the impression that many ARRL members don't read *QEX* because they don't realize what they are missing. We'd like to improve that situation.

Thanks for your kind words. As our silver anniversary approaches, I'm particularly proud to be part of *QEX*. It would be easy for me to take the credit but you writers are the real heroes of this forum.

*— 73, Doug Smith, KF6DX, QEX Editor,*
**kf6dx@arrl.org**

***Hello Larry and Doug,***

I just opened my issue of *QEX*, went to read my article and saw that Equation 1 on page 4 was incomplete. This is very strange as it was okay in the PDF proof that you sent me. I'm wondering if it is a printer's error, or do I have a bad copy of *QEX*?

If the printer goofed then I think the correct equation should be printed in the next issue as it will help readers in following the derivation. By the way Larry, Equations 2 and 3 that you fixed came out just right!

*— Best wishes, George Steber, WB9LVI,*
**steber@execpc.com**

***Hi George,***

That error was apparently caused by a bug in our layout software. It's happened before — in one of my articles! It happens sometimes when the final file is created to send to the printer, but no one is sure why. Unfortunately, it's tough to catch after everybody has signed off on the proofs. The complete equation appears here.

$$\frac{V_2}{V_1} = G_1(s) = \frac{R_1 C_1 s}{R_1 C_1 s + 1} \quad \text{(Eq 1)}$$

*— 73, Doug Smith, KF6DX, QEX Editor,*
**kf6dx@arrl.org**

[1]P. Chadwick, G3RZP, "HF Receiver Dynamic Range: How Much Do We Need?" *QEX*, May/June 2002, pp 36 – 41.


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