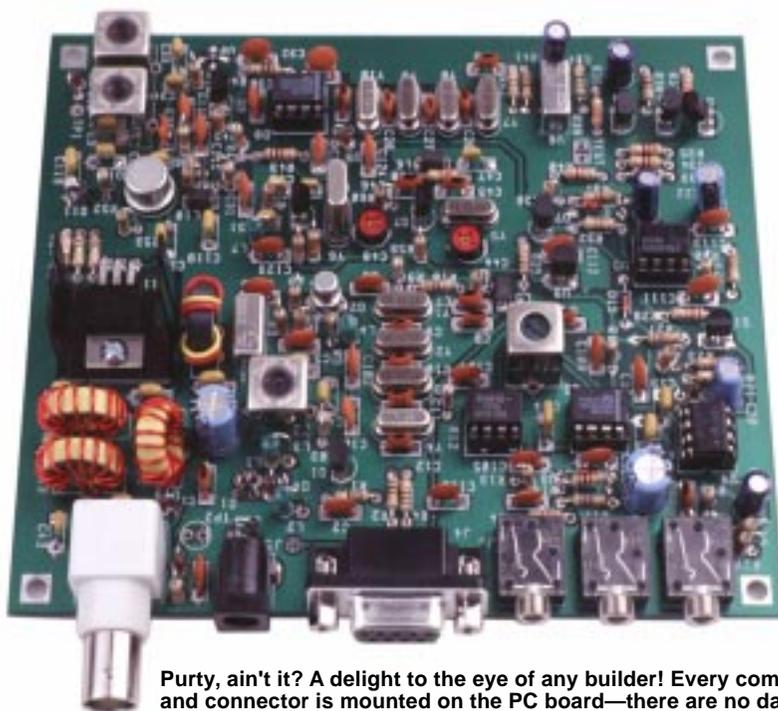


A Panoramic Transceiving System for PSK31

Combine an inexpensive transceiver, some *free* software and you're on PSK31 at a rock-bottom price! Add to that the fun and pride of building the transceiver and you've got an *irresistible* package!

PSK31 is a relatively new digital mode, created by Peter Martinez, G3PLX, and covered in detail in *QEX*.¹ Because of its narrow bandwidth requirements and the Viterbi decoding built into the mode by Peter, PSK31 is ideally suited to Amateur Radio digital communications using low power. However, the narrow bandwidth of the PSK31 signal—31.25 Hz—makes tuning PSK31 signals somewhat more difficult than tuning SSB and CW signals, because accurate tuning to within only a few hertz is necessary for proper decoding. This requirement has resulted in several attempts to make tuning easier, such as the PSK31 tuning aid described by Don Urbytes, W8GLV,² and the phase scope and waterfall display Peter included in his popular introductory software for PSK31. It was during an e-mail exchange with Peter that I hit on the idea of eliminating the need for tuning altogether! The concept of the Panoramic Transceiving System for PSK31 was born.

¹Notes appear on page 37.



Purty, ain't it? A delight to the eye of any builder! Every component and connector is mounted on the PC board—there are no danglers.

As Steve Ford, WB8IMY, put it so well in his article, "PSK31—Has RTTY's Replacement Arrived?,"³ PSK31 signals don't *deedle-deedle* like RTTY signals, or *chirp* like the TOR modes, they *warble*, sounding like high-pitched, warbling carriers as you tune across them. If several PSK31 stations are operating close together, they sound like a bunch of caterwauling alley cats! It is virtually impossible to separate the individual stations by ear, as the human hearing cannot distinguish between different tones very close together in pitch, so some other technique must be used to separate stations and the best way to do it is *visually*!

Software—The Visual Solution

PSK31 stations are received just like CW or SSB stations, by beating the incoming carrier with another carrier produced by

the receiver, creating a beat note, which, in the case of CW, is an on/off tone. For SSB, it's a whole series of tones that represent the human voice. Just as it is possible to hear many CW stations at one time as a collection of on/off tones of different pitch, it is possible for many PSK31 stations to also be heard at one time as a collection of warbles. Each station on a slightly different frequency produces a slightly different warbling tone, just as each CW station produces a different keyed tone. By scanning the audio spectrum containing these warbling tones and displaying the tones graphically as on a spectrum analyzer, each PSK31 station can be seen apart from the others. This task is accomplished by the software part of the system; a program called *DigiPan*, for *digital panoramic* tuning. *DigiPan* has been released for general



Figure 1—A sample of *DigiPan*'s PSK31 signal display. At the bottom half of the screen, the bar with the diamond-shaped cursor in it (the large bar at the left) is a strong PSK31 station. (Incoming signals scroll from top to bottom; the newest signals are at the top of the display.) The ongoing chatter—complete with typos—is readable in the top half of the screen above the waterfall display.

use, and is reviewed in detail by Steve in his PSK31 update article.⁴

DigiPan employs digital signal processing (DSP) techniques to decode the PSK31 warbles and present them as characters on a computer display. A portion of a typical *DigiPan* spectrum window is shown in Figure 1. The bright yellow bars represent the signals within the passband. The left-most signal with the diamond-shaped cursor in it is a strong PSK31 station to which the receiver is tuned. Time is displayed on the Y axis, progressing from top (most recent) to bottom (past).

To tune in and receive any of these stations, all you have to do is use the computer's mouse to point to the station's signal and click! The diamond-shaped cursor jumps immediately to the center of the station signal and the chosen station's trans-

mitted information appears on screen in a receive window.

Other sections of the *DigiPan* screen are devoted to buttons to control the functions of *DigiPan*, the receive window and a window for typing outgoing text. You can download a copy of *DigiPan* free on the web at <http://members.home.com/hteller/digipan/>.

The Transceiver

For *DigiPan* to provide a panoramic display with point-and-click tuning of stations, it is necessary for the transceiver to provide panoramic reception *and* transmission, which means the transceiver must be a special *wideband* design, capable of receiving many PSK31 stations at one time. Therefore, the second important element of the Panoramic Transceiving System is the transceiver itself.

There are characteristics of PSK31 communication that dictate (and to some extent simplify) the transceiver design. The narrow width of a PSK31 signal demands a very low-drift design, typically less than

5 Hz over the course of a QSO. However, the narrow signal width also means lots of stations fit into a very narrow slice of spectrum! The fortunate result is that it is possible to make a simple, low-drift, crystal-controlled receiver and transmitter and let the software perform the tasks of displaying the signals on the band and tuning them in. The TR switching requirements prove to be quite simple. Unlike CW, there is no need for perfectly shaped keying or fast break-in, and the transmit/receive function need be no more complicated than throwing a switch. To ensure the most reliable TR switching, we elected to use a standard RS-232 signal (RTS or DTR) available at the computer's serial port to control the TR changeover.

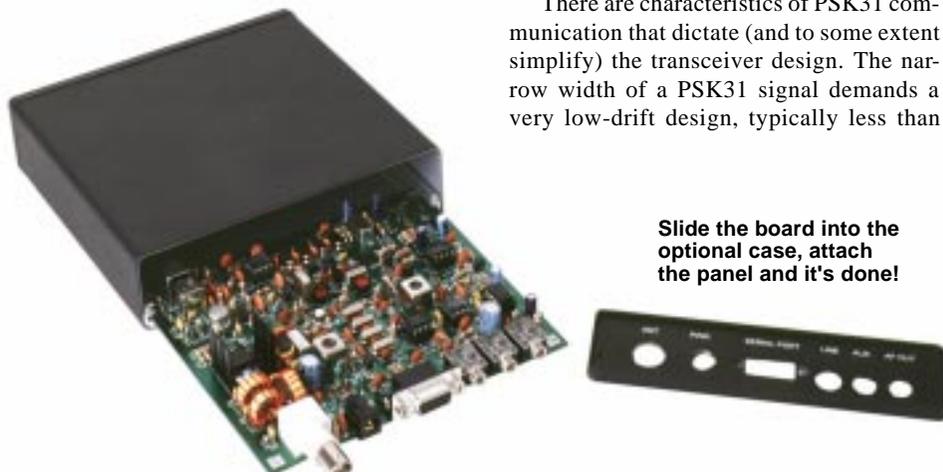
To properly transmit and receive a PSK31 signal, it is necessary that the transmitter and receiver be operated linearly. Although it is still possible to overdrive the transmitter or otherwise operate in a non-linear range and have the signal decoded successfully at the receiving end, you won't win any friends on nearby frequencies! The spectrum of an overdriven transmitter signal extends well beyond the normal narrowband signature. With the panoramic display, your signal spectrum is displayed for all to see, and you're sure to get meaningful feedback from the stations you're in QSO with or who are on nearby frequencies!

Circuit Description

Dave: When Skip contacted me regarding the use of an existing linear SSB design for a PSK31 transceiver,⁵ I was naturally curious as to the modifications necessary to yield reliable operation. Those amounted to extensive changes to improve the LO stability, as discussed later, and a new TR switching mechanism. Skip had developed a small outrigger board that contained the necessary PSK31 circuit functions, but the additional modifications to the existing board didn't lend themselves readily to ease of reproduction. To eliminate the need for the hand wiring and modifying an existing SSB transceiver, I agreed to incorporate the changes into a clean new layout. The result of this collaboration is shown in the schematic of Figure 2. The following discussion highlights the changes with respect to that earlier design.

Transmitter Section

TR switching is controlled by an RS-232-level signal (RTS)⁶ directly from the computer. Comparator U5A responds to a positive voltage input by turning on the transmitter bias supply (**V_{sw}**) through U5B. The components between those two comparator sections provide a time delay necessary for TR sequencing. Catch diode D7 ensures rapid turnoff of **V_{sw}** when switch-



Slide the board into the optional case, attach the panel and it's done!

ing back to receive—this suppresses an otherwise-sizeable transient at the transmission tail end.

Audio drive to the transmitter is provided by the computer sound-card's **LINE OUT** jack to J2. Q4 provides an effective means of muting this input during receive (more on this later). When Q4 is turned off, the following amplifier stage also has no bias and is quite effectively turned off as well. Q6 is an emitter-follower providing a nominal 50- Ω source impedance to U6. This doubly balanced diode-ring mixer normally passes little of the LO signal generated by the 9-MHz oscillator (Q7 and associated components). On transmit, audio modulation applied via Q4-Q6 forms a 9-MHz DSB signal at U6 pin 1. The IF filter (Y7-Y10 and associated components) passes only the lower sideband to yield a 9-MHz SSB signal. U7, a doubly balanced active mixer, converts the 9-MHz SSB signal to 14 MHz. The second LO (Q8 and associated components) runs at approximately 5.073 MHz. Note that both of the LOs use L-network matching to the mixers; this eliminates having to deal with those annoying multifilar toroid windings!

Emitter-follower stage Q9 buffers the high output impedance of U9; its output feeds amplifier U8, an MMIC selected for its small footprint and good stability. L8, L9 and associated components form a 14-MHz band-pass filter that eliminates unwanted images and spurs. The following two amplifiers (Q10 and Q11) are virtual cut-and-pastes of my earlier work except that matching between those two stages is done with another L network (L10, C38) that eliminates another multiple-winding toroid. L10 and all succeeding inductors need to be self-shielded types (such as toroids).

D13, D14 and associated components serve as a convenient test point for tune-up purposes. If desired, an LED may be connected to TP2 to function as an RF-output indicator. The output of this circuit is a dc signal, so the LED may be remotely located on an enclosure's front panel. This reduces the risk of RF feedback/coupling problems caused by the proximity of wiring harnesses to circuit components. When the transmitter is properly adjusted, the LED flickers noticeably, and with a little practice, serves as a rough guide to setting up the sound card output level.

Receiver Section

The receiver retains the low-gain preamplifier and diode-ring mixer of my April 1997 *QST* design (see [Note 5](#)). Although high in component count, it maintains the relatively high immunity from overloading (IMD) of that earlier work. The matching between the first mixer post-amp and receive crystal filter was changed to an L-

network configuration to accommodate the high crystal-filter impedance.

Because the host computer provides either a speaker-drive capability or an AF output intended for use with amplified speakers, there's no need for the receiver to provide significant audio-output power. Audio amplifier stage U4BA uses a garden-variety op amp to provide the necessary gain. The remaining half (U4A) of that dual device is pressed into service as a follower for a peak detector (D5, D6 and associated components). That circuit delivers AGC to prevent strong signals from overloading the product detector (U3) or the computer's sound-card channel.

Crystal Oscillator and IF Filter Design

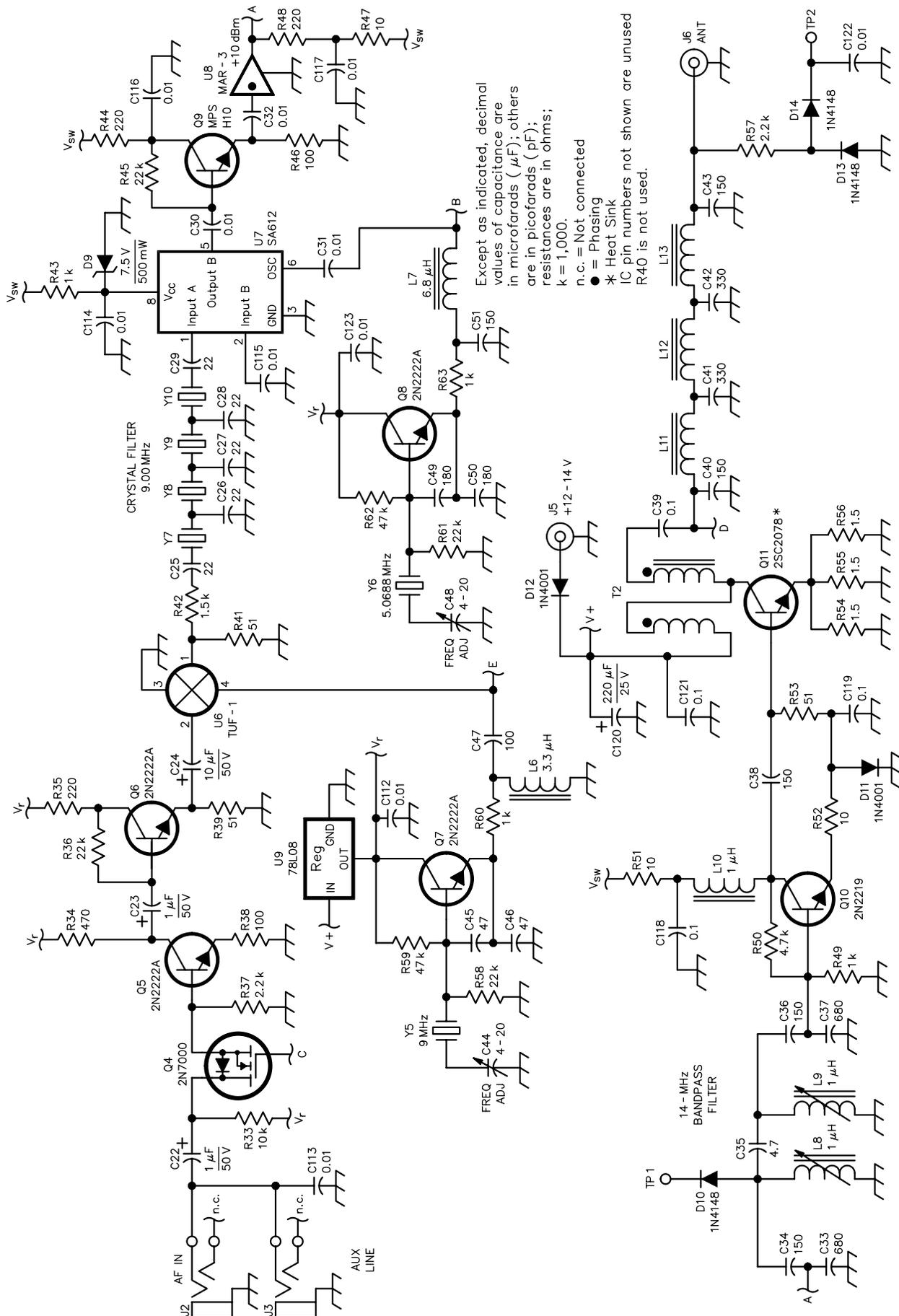
Skip: Because PSK31 reception and transmission requires a highly stable frequency

control, we established a goal for drift performance of less than 5 Hz over the course of a QSO (roughly 10 minutes). Ordinary VFOs weren't considered because they aren't stable enough, and PLL and DDS designs were deemed too expensive and complicated. Even commonly used VXO circuits produce too much drift. Finally, I found a combination of low-cost computer crystals that made it possible to use a simple crystal oscillator with minimum pulling and, therefore, with very low drift.

A 9-MHz Cohn filter is used for the IF and a 5.0688-MHz computer crystal employed in the first-conversion oscillator. By adding a small value of capacitance in series with the crystal, it was made to oscillate at 5.0695 MHz, above its marked frequency. To bring the IF-filter and the conversion-oscillator frequencies closer to those desired

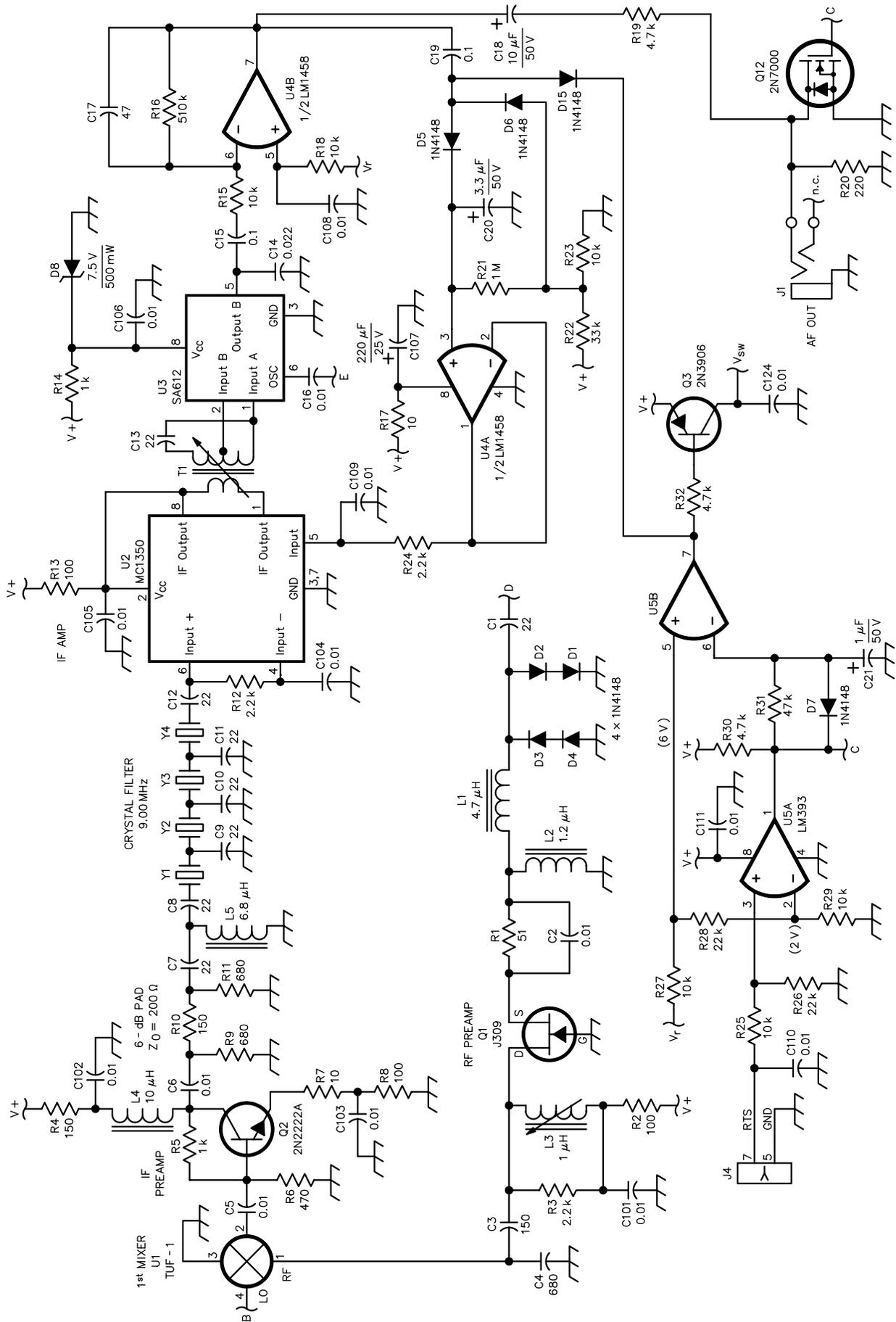
Figure 2 (see next page)—Schematic of the PSK31 transceiver circuit. Unless otherwise specified, resistors are 1/4-W, 5%-tolerance carbon-composition or metal-film units. All small-value capacitors are NP0/COG types; do not substitute. Unless otherwise noted, equivalent parts can be substituted; n.c. indicates no connection. Parts identified by NJ are available from the New Jersey QRP Club. Send an SASE to George Heron, N2APB, 2419 Feather Mae Ct, Forest Hill, MD 21050 for a price list. Proceeds benefit that club's activities. Other parts are available from Digi-Key Corp, 701 Brooks Ave S, Thief River Falls, MN 56701-0677; tel 800-344-4539, 218-681-6674, fax 218-681-3380; <http://www.digikey.com> and Mouser Electronics, 958 N Main St, Mansfield, TX 76063-4827; tel 800-346-6873, 817-483-4422, fax 817-483-0931; sales@mouser.com; <http://www.mouser.com>.

C1, C7-C13, C25-C29—22 pF
 C2, C5, C6, C16, C30-C32, C101-C106, C108-C117, C122-C124—0.01 μ F
 C3, C34, C36, C38, C40, C43, C51—150 pF
 C4, C33, C37—680 pF
 C14—0.022 μ F
 C15, C19, C39, C118, C119, C121—0.1 μ F monolithic cap
 C17, C45, C46—47 pF
 C18, C24—10 μ F, 50 V aluminum electrolytic
 C20—3.3 μ F, 50 V aluminum electrolytic
 C21-C23—1 μ F, 50 V aluminum electrolytic
 C35—4.7 pF
 C41, C42—330 pF
 C44, C48—4-20 pF, 6-mm trimmer cap (Mouser 242-4220)
 C47—100 pF
 C49, C50—180 pF
 C52-C100—Not used.
 C107, C120—220 μ F, 25 V electrolytic
 D1-D7, D10, D13-D15—1N4148/1N914
 D8, D9—7.5 V, 500 mW Zener diode, 1N5236
 D11, D12—1N4001 power diode
 J1-J3—Three-circuit, 1/8-inch PC-mount phone jack
 J4—DB9 chassis-mount female connector
 J5—PC mount dc connector
 J6—BNC PC-mount female connector
 L1—4.7 μ H, 5%-tolerance RF choke (Mouser 43LS series)
 L2—1.2 μ H 5%-tolerance RF choke (Mouser 43LS series)
 L3, L8, L9—1 μ H, Toko TK1411 (Digi-Key TK1411)
 L4—10 μ H 5%-tolerance RF choke (Mouser 43LS series)
 L5—6.8 μ H self-shielded SMT inductor (Digi-Key DN1122CT)
 L6—3.3 μ H self-shielded SMT inductor (Digi-Key DN1118CT)
 L7—6.8 μ H 5%-tolerance RF choke (Mouser 43LS series)
 L10—1 μ H self-shielded SMT inductor (Digi-Key DN1112CT)
 L11, L13—13 turns #24 enameled wire wound on a T-50-6 core (NJ)
 L12—14 turns #24 enameled wire wound on a T-50-6 core (NJ)
 Q1—J309 or J310 JFET (NJ)
 Q3—2N3906 PNP transistor
 Q4, Q12—2N7000 MOSFET (NJ)
 Q2, Q5-Q8—2N2222A or 2N4401 NPN
 Q9—MPSH10 NPN transistor (Digi-Key MPSH10)
 Q10—2N2219A NPN transistor
 Q11—2SC2078 NPN transistor; heat sink (NJ)
 T1—10.7 MHz IF transformer (Mouser 42IF123)
 T2—4 bifilar turns #24 enameled wire on an FT50-43 core (NJ)
 U1, U6—TUF-1 diode-ring mixer (NJ)
 U2—MC1350P IF amplifier
 U3, U7—SA612AN mixer IC (NJ)
 U4—LM1458 dual op amp
 U5—LM393 dual comparator
 U8—MAR-3SM MMIC (NJ)
 U9—78L08 8 V, 100 mA positive voltage regulator
 Y1-Y5, Y7-Y10—9.00 MHz crystal, HC-49/US holder (Digi-Key X419); Note: All 9-MHz crystals *must be within a 200-Hz frequency grouping*.
 Y6—5.0688 MHz crystal, HC-49/U holder (Digi-Key X052)
 Misc: IC sockets, TO-220 heat sink, inductor-tuning wand (Digi-Key TK9003), hardware, enclosure, PC board (see [Note 6](#)).



Except as indicated, decimal values of capacitance are in microfarads (μF); others are in picofarads (pF); resistances are in ohms; k = 1,000.

- n.c. = Not connected
- = Phasing
- * Heat Sink
- IC pin numbers not shown are unused
- R40 is not used.



and to reduce the need for pulling the first-conversion-oscillator crystal, I selected series-resonant crystals for the filter, but use a *parallel*-resonant crystal for the first-conversion oscillator. In order to achieve panoramic operation, the crystal filter in the IF needs to be almost 4000 Hz wide. That is accomplished by using small values of capacitance and high termination impedances for the filters. The resulting filters have a center frequency of 9.0015 MHz, with -6 -dB bandwidth points around 8999.5 MHz and 9003.5 MHz.

This choice of crystal characteristics makes it possible to use off-the-shelf crystals to yield a transceiver design with a zero-beat frequency of 14.073 MHz located at the high end of the PSK31 activity. This bit of serendipity made the design of a dedicated PSK31 rig irresistible!

The filters exhibit asymmetrical skirt characteristics, so the BFO injection oscillator is set to the high side of the filter passband to take advantage of the superior roll-off characteristics there. This results in improved rejection of opposite sideband energy. This also results in LSB operation, nonstandard on 20 meters. This proves to be no handicap, however, because the *DigiPan* software simply compensates by displaying the panoramic spectrum in consistent left-to-right fashion regardless of whether upper or lower sideband is specified. A signal arriving at 14.072 MHz, for instance, results in a beat note or tone, of 1000 Hz. Similarly, an incoming signal at 14.071 MHz produces a tone of 2000 Hz. The receiver frequency remains fixed at a zero beat frequency of 14.073 MHz, and tuning in any particular signal is only a matter of instructing *DigiPan* to decode the signal at a particular tone frequency by pointing to it with the mouse and clicking.

Muting Considerations

Dave: It is not practical to disable the sound-card microphone input during transmit through software control. Because the sound card has high gain from the microphone input to card output, it's also necessary to disable the receiver output during transmit. Without this provision, the receiver output would wrap back into the

sound-card input, and appear along with the transmit audio in the sound-card output, causing unwanted modulation distortion or even oscillation. Q12 provides an effective low-resistance path to ground that shuts off the receiver audio output during transmit to prevent this problem. Similarly, the sound card's **LINE OUT** signal is present at all times. Unless effectively muted before it gets to the continuously functioning first transmit mixer, U6, that mixer will generate 9-MHz DSB signals. These are, in turn, audible in the receiver because of its high sensitivity, with the same potential for unwanted oscillation. The two-stage muting circuit (Q4, Q5) described earlier provides the needed muting function.

Construction

Kits are available to ensure quick and easy assembly.^{7,8} If you decide to build this transceiver from scratch, "ugly" or ground-plane construction is the most convenient (if not aesthetically pleasing) way to go. The resulting performance with this construction method is good, because the plentiful ground-plane surface largely ensures freedom from ground-path problems. Keep all component lead lengths to a minimum. I find it useful to add additional bypass capacitors on long wire runs for dc and audio signals—they help keep unwanted-signal pickup to a minimum. The added capacitors can also serve as convenient standoffs for other components. Where a bypass capacitor would disturb the circuit function when used as a support, a high-value resistor (1 M Ω or more) or low-value capacitor (5 pF) can often serve the same function.

Scratch builders should purchase a few more 9-MHz filter crystals (about 50% more) than specified and group them within a 200-Hz spread using a test oscillator and frequency counter or general-coverage receiver. Where NP0 (C0G) capacitors are called for, don't substitute a lesser type! The latter are typically high-density types and are notably lossy at RF. The performance difference between the two capacitor types in critical areas (such as the transmit band-pass filter) is appreciable: I've seen an incurred loss as great as 4 to 5 dB. Such attention to detail can make or

break a construction project.

The tuned circuits used in this project use shielded (can-style) variable inductors. For experienced builders, part substitutions should pose no difficulty. Retain the component values shown in the schematic as much as possible, since dramatic departures will affect performance.

Transceiver Adjustment

Alignment is quite straightforward. Attach a 50- Ω dummy load to the rig's antenna jack (J6). Connect a 12 to 14 V dc supply to the transceiver at J5 and interconnect the computer's sound-card microphone jack to the rig's **AF OUT** jack (J1). Run the installed *DigiPan* software to bring up the panoramic display. Some adjustment of the microphone gain setting on the sound-card mixer recording control window may be needed as explained in *DigiPan*'s on-line Help. The correct microphone gain setting yields a speckled blue background across much of the panoramic display. Plug a speaker into the **AUXILIARY LINE** jack (J3), adjust L3 and T1 for maximum volume, and then readjust the microphone gain setting as needed. Set trimmer capacitor C44 so that the background noise on the display is centered within the 4-kHz panoramic passband.

Set the sound-card output level to half-scale (click the speaker icon in the *Windows* taskbar tray). Now click on the *DigiPan* **TX** button. Measure the dc voltage at test point TP1, adjusting L8 for maximum reading. Move the voltmeter to test point TP2, adjust L9 for a maximum meter reading, and then readjust L8 for maximum.

Frequency Alignment

The easiest way to perform this one-time procedure is to calibrate the transceiver frequency against a known amateur signal. Set the *DigiPan* **View Frequency Display** selection to **LSB** and the **Configure Start Frequency** to **14073000**. Transmit a CW signal on 14071000 Hz and adjust C48 until the CW signal's signature (a single bright line on the display) is directly under the 14071 tick mark on the panoramic display.

Operational Adjustment

Click on the *DigiPan* **TX** menu button and adjust the **speaker VOLUME** slider on the *Windows* taskbar tray for an output-power reading of 1.5 W. As you type and transmit text, the meter will flicker to higher power readings and should peak at approximately 3 W at the tail end of the transmission.

Sending Pictures

Although slow compared to other picture-transmission techniques such as SSTV, it is possible to send small color pictures



Rear panel or front panel, call it what you may, it's the business end of the box—nothing need be mounted on the other end panel. At this stage, it's truly plug and play!

during the course of a PSK31 QSO. Perhaps the operator on the other end would want to get a better idea of what you look like. Because PSK31 is such a robust mode, you can send a postage-stamp color photograph of yourself or an electronic 16-color QSL card about four times larger than a postage stamp in about eight minutes.

The process involves encoding the picture as text, transmitting the text, and then decoding the text into a picture at the receiving end. A public domain utility, *BINHEX.EXE*, which can be downloaded from the Internet at <http://members.home.com/hteller/binhex.exe>, can be used for encoding and decoding. The *DigiPan* help file contains full details about sending pictures by PSK31.

Results

Skip: Peter's excellent work in making PSK31 an ideal QRP digital communication mode has really proven itself. My very first PSK31 QSO, using an output power of only 1 W and an inverted-V antenna in the attic, was with Valery, UT4UO in Kiev, followed by many contacts with Scandinavian, German, Italian, Australian, North African and South American stations. I regularly work stateside stations every day using only 1 W and my simple dipole antennas, with typical signal reports ranging from 559 to 579. My signal isn't as strong as many others, but in the absence of QRM or extreme fading, copy is almost always solid! I never sign as a QRP station. If I don't mention the transmitter power output, everyone seems to think mine is a typical 50-W PEP station, only my signal's a little weaker than expected. When I disclose the fact that I'm running only 1 W, everybody stands amazed!

The most significant thing I have learned from this little experience is that PSK31 produces almost perfect copy—even down to the noise level. That's what amazes others and me the most. I was also pleasantly surprised one day (after I had sent Dave a PSK31-specific modification of his own SSB QRP transceiver) when Dave heard me sign with another station and called me using the same rig I had just sent him! For the first time, I was in QSO with another QRP station also running only 1 W!

Some Thoughts

With the wideband IF needed for the convenience of panoramic operation, unwanted signals can get through the IF filter along with the desired ones. Occasionally, a very strong signal can either desense the receiver and affect weak-signal reception, or overload the receiver or the sound card. AGC can reduce such overloading, but is subject to pumping, particularly by strong nearby PACTOR stations. The ultimate solution to the unwanted strong-station

problem during panoramic reception is to attenuate the signal *before the AGC point* by switching in a narrow, tunable passband filter at the reception frequency, or a tunable notch filter at the frequency of the strong interfering station. Both such solutions are beyond the scope of this project, but remain considerations for the future. Fortunately, the enormous convenience of panoramic display and point-and-click tuning far outweighs the occasional problems caused by very strong unwanted signals.

Acknowledgements

Our thanks to Peter Martinez, G3PLX, for his invaluable contribution of PSK31 to the Amateur Radio community, and to Nick Fedoseev, UT2UZ, who generously gave hundreds of hours of his time coding the *DigiPan* freeware to support the panoramic transceiver. Nick is also developing a greatly enhanced shareware version of *DigiPan* called *MIXW32 V2.0* which has advanced logging and contesting features, a beam-heading indicator, an active world map, CW keyboarding and decoding, RTTY, SSB, and a unique feature called Speedscan, which makes *MIXW32* the *fastest* PSK31 and RTTY contesting program in the world! *MIXW32* can be downloaded at <http://users.nais.com/~jaffejim/mixwpage.htm>.

Thanks also to the author of *Spectrogram*, Richard Horne, (<http://www.mnsinc.com/rshorne/gramdl.html>) for providing an inspirational program for the *DigiPan* spectral display, and to Nick's assistant, Denis Nechitailov, UU9JDR, for his help in coding the programmable buttons and several other important user-friendly features of *DigiPan*. *DigiPan* certainly represents the combined best efforts of hams from all over the world!

Notes

¹Peter Martinez, G3PLX, "PSK31: A New Radio-Teletype Mode," *QEX*, July/August 1999, pp 3-9 (reprinted from *RadCom*, Dec 1998 and Jan 1999 issues).

²Don Urbytes, W8LGV, "A PSK31 Tuning Aid," *QST*, Dec 1999, pp 35-37.

³Steve Ford, WB8IMY, "PSK31—Has RTTY's Replacement Arrived?," *QST*, May 1999, pp 41-44.

⁴Steve Ford, WB8IMY, "PSK31 2000," *QST*, May 2000, p 42.

⁵Dave Benson, NN1G, "A Single-Board QRP SSB Transceiver for 20 or 75 Meters," *QST*, Apr 1997, pp 29-33.

⁶*DigiPan* Version 1.1 also allows use of the RS-232 DTR for users with pre-existing hardware interconnects.

⁷A kit for this project includes a double-sided PC board, all on-board components, all connectors and an assembly manual. Price: \$95 in the US and Canada, \$100 elsewhere, (including shipping). A black-anodized extrusion enclosure with a custom-punched and silk-screened rear panel is also available for \$30 in the US and Canada, \$35 elsewhere. Make checks and money orders payable to: Small Wonder Labs, 80 E Robbins Ave, Newington, CT 06111.

⁸Specialty parts (denoted by NJ in the [Figure](#)

[2 caption](#)) are available from the NJ QRP Club. Send an SASE to George Heron, N2APB, 2419 Feather Mae Ct, Forest Hill, MD 21050 for a price list. Proceeds benefit that club's activities.

Dave Benson, NN1G, has published a number of articles in QST. Well known in the QRP community, he was inducted into the QRP Hall of Fame in 1999. Dave earned his BS in electrical engineering from the University of Connecticut in 1976. Following graduation, he worked in a variety of aerospace engineering programs. Dave has been happily self-employed since 1996. An enthusiastic (if out-of-shape) outdoorsman, he enjoys camping and can occasionally be found on the air operating by flashlight from a tent site. In addition to other interests, Dave spends a week in Appalachia each summer as a team leader on volunteer home-repair projects. You can contact Dave at 80 E Robbins Ave, Newington, CT 06111; nn1g@earthlink.net.

Howard ("Skip") Teller, KH6TY, was first licensed in 1954, received his commercial First Class Radiotelephone license in 1959 and worked his way through college as chief engineer of several radio stations. He holds a BS degree in electrical engineering from the University of South Carolina and is retired from running a factory in Taiwan where he manufactured the weather alert radio that he originated in 1974 and is still sold by RadioShack. Skip enjoys working PSK31 with his homebrew one-watt transceiver and developing simpler ways to build HF equipment. You can contact Skip at 335 Plantation View Ln, Mt Pleasant, SC 29464; hteller@home.com. 

NEW PRODUCTS

RIG CONTROL SOFTWARE FOR ICOM HF MARINE TRANSCEIVERS

◇ Creative Services Software announces *MRC* version 1.0, a 32-bit radio control program for the ICOM IC-M700, 'M710 and 'M710-R HF marine SSB transceivers. These ICOM models are popular choices for both mariners and ocean-going amateurs.

The new software will allow the operator to control these radios from their computers, making tuning around the bands as easy as using a VFO on a conventional amateur transceiver. The program allows you to vary transmit and receive frequencies, change the operating mode and tune the antenna on the fly. *MRC* will run under *Windows 95*, *Windows 98*, *Windows NT* or *Windows 2000*.

MRC retails for \$49.95 and includes a cable that connects between a PC and the NMEA interface connector on the ICOM radios. Free upgrades will be offered for any subsequent 1.x software releases.

A limited capability demo version is available for download from the *CSS* Web site.

For additional information contact Creative Services Software, 503 W State St, Suite 4, Muscle Shoals, AL 35661; tel 256-767-3739; fax 256-381-6121; info@cssincorp.com; <http://www.cssincorp.com>. 
Next New Product

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N

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