



**Chapter 24, Inc.
Madison, Wisconsin**

Society of Broadcast Engineers November 2002

Next Meeting:

**Thursday,
November 21, 2002**

Category 5e/6 Cable

**Dutch Treat Dinner
at 5:30 PM
at Perkins
1410 Damon Road**

**Meeting and Program
at 7:00 PM**

**at Wisconsin Public
Broadcasting Center
3319 W. Beltline Hwy**

ORIGIN OF SPREAD SPECTRUM

By Vicki W. Kipp

Can you think of any applications in your daily life that rely on spread spectrum technology? Consider cellular phones, pagers, wireless internet, garage door openers, traffic signals, and cordless phones, just to name a few. The concept of spread spectrum may seem like a new development, but it has actually existed for more than 60 years. Do you know where it originated? Would you believe that spread spectrum technology is credited to a glamorous Hollywood star and an experimental music pioneer? This is the true history of spread spectrum.

Born November 9, 1914 in Austria, Hedy Lamarr was a bright and beautiful woman. She married leading arms manufacturer Fritz Mandl. Mr. Mandl wanted his wife by his side constantly, even during his business meetings. Lamarr silently noted the pre-World War II military technology discussions that she heard while with Mandl. Although she didn't have formal instruction in military technology, the highly intelligent young woman was able to comprehend the dialogues. Mandl was researching the design of remote controlled torpedoes using radio waves.

Torpedoes were a key military weapon, but they were difficult to aim properly. Hitting a target usually required launching several torpedoes. Once launched, torpedoes could veer off target because of unpredictable ocean currents or because the target moved out of its path. The military had no way to alter the course of a torpedo once launched, and needed a means of controlling the weapon post-launch. One proposed solution involved controlling torpedoes by extremely long wires. The problem was that the wires sometimes broke, leaving the torpedo to run its own path. Another potential solution was to steer launched torpedoes via radio waves. This system was never produced because it was too vulnerable to disruption by enemy signal jamming.

(continued on page 4)

In This Issue:

| | |
|------------------------|--------|
| Minutes | page 2 |
| Short Circuits | page 2 |
| Amateur Radio News ... | page 3 |
| Local Legals | page 5 |
| FCC Rulemakings | page 6 |

NATIONAL COMES TO MADISON IN 2003

By Vicki W. Kipp

The SBE Board of Directors has decided to hold the next National SBE meeting in Madison, in conjunction with the WBA Broadcast Clinic on October 14-16, 2003. The National SBE attendance at the 2003 Broadcast Clinic will add energy and excitement to the conference.

When the National SBE came to the 1999 Broadcast Clinic, they sold reference books and SBE certification pins at their booth. The presence of the National SBE at the 2003 Broadcast Clinic will draw additional attendees to

the conference including the National SBE Staff, board members, committee chairpersons, and SBE award winners.

The National SBE Awards Banquet will be held in place of the Upper Midwest Regional SBE Meeting on Wednesday night, October 15, 2003. The Awards Banquet dinner will include a guest speaker selected by the National SBE.

The National SBE will hold a contest to award one lucky person a trip to and registration for the 2003 WBA Broadcast Clinic and National SBE Meeting.

DTV STATIONS ON THE AIR

As of November 5th, there are 562 DTV stations in 158 markets providing programming. Over 92% of all US homes are in markets with at least one DTV signal on the air. In Wisconsin there are 18 DTV stations currently on air.

The National Association of Broadcasters maintains a list of DTV stations that are in operation. This can be found at the NAB web site (www.nab.org) in the DTV update section.

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October Business Meeting Minutes

Chapter 24 of the Society of Broadcast Engineers hosted the Upper Midwest Regional SBE meeting on Wednesday, October 16 2002 at the Marriot West in Madison, Wisconsin for the chapter's monthly meeting. There were 42 members in attendance, 29 of whom were certified, and 4 guests. SBE Chapters 28 (Milwaukee), 80 (Green Bay), 112 (Western Wisconsin), 24 (Madison), 55 (St. Louis), and 5 (Atlanta) were represented.

The meeting was called to order at 7:10 PM by chairman Tom Smith.

Chairman Tom Smith announced that there would be an open house at Resonance Research in Baraboo on October 19.

Newsletter editor Mike Norton announced the deadline for articles for the November issue will be due at midnight, Friday, November 1st. The folding party will be held Wednesday, November 6 at 5:30 PM at WKOW-TV.

There was no old business.

The meeting adjourned at 7:14 PM.

Part of this month's program was the unveiling of the Chapter 24 Wisconsin Digital TV website (www.widigital.tv) and was presented by Steve Paugh and Jason Mielke of the DTV web committee.

A second program was a presentation on the Wisconsin Amber Alert System by Gary Timm, Wisconsin EAS Chairman and Co-Chair of the Wisconsin Amber Committee (www.amberalertwisconsin.org).

Submitted by Jim Magee, Secretary

SBE Short Circuits – November 2002

*By John L. Poray, CAE
SBE Executive Director*

BOARD APPROVES 2003 BUDGET, DUES INCREASE

The SBE Board of Directors, meeting on October 16 in Phoenix as part of the SBE 2002 National Meeting, approved the national organization's budget for 2003. Citing increasing costs, the Board unanimously approved an increase in membership dues for Regular, Senior, Associate and Student Members, effective January 1, 2003.

"After eleven years of maintaining dues at the same level for the vast majority of members, the Board, agreeing with a recommendation from the Finance and Executive Committees, determined an increase was necessary at this time to keep SBE on a firm financial footing," said SBE President, Troy Pennington. Pennington went on to say, "SBE has operated with a deficit budget in both 2001 and 2002, using cash from reserves to make up the difference. Expenses have been kept as low as possible while still providing the resources to carry out the programs and services of the Society."

(continued on next page)

Short Circuits (continued)

The rate for Regular, Senior and Associate members will rise \$5 to \$60 per year. This is the first dues increase for these membership categories since April 1992. Dues for Student Members will rise \$3 to \$18 per year, which will be the first increase for this member category since 1996.

The new rates will apply to new members that join on or after January 1, 2003 and for current members who are due to renew April 1, 2003. Membership dues for Youth Members will remain at \$10 while dues for Sustaining Members will stay at \$550 per year.

Chapters will also share in the increased revenues from the dues increase. Rebates to qualifying chapters will go up since they are determined by the amount of dues paid by Regular, Senior and Associate members. The overall increase will bring the total rebates earned by qualifying chapters to more than \$36,000 beginning in 2003.

SBE TO HOST PSIP REMAILER

At the request and suggestion of several members, SBE will establish and host an e-mail remailer for those interested in the subject of PSIP. To subscribe to the list, go to <http://www.broadcast.net/mailman/listinfo/sbe-psip> and follow the instructions to subscribe to the list. Tom Weber, CPBE of WISH-TV in Indianapolis will be initial moderator for the list.

2002-2003 CHAPTER LIAISONS ANNOUNCED

To help facilitate communication between SBE chapters and the national Board of Directors, each chapter is assigned a Board member who will serve as that chapter's liaison with the Board. Though chapters are free to contact any Board member at any time, the assigned liaison provides the chapter someone specifically on the Board they can contact with questions, problems or concerns. The complete list of liaison assignments will be in the December issue of The SBE SIGNAL and will be posted on the SBE web site, www.sbe.org around November 15.

AMATEUR RADIO NEWS

By Tom Weeden, WJ9H

- The American Radio Relay League has asked the FCC to deny a petition, filed by a Virginia amateur, that would set aside eight channels in the 70-cm band on which visitors from Europe and the United Kingdom would be permitted to use their Personal Mobile Radio (PMR 446) transceivers while in the US. PMR 446 is similar to the US Family Radio Service (FRS), which uses frequencies in the 462-467 MHz range.

The FCC put the Petition for Rule Making from Dr Michael Trahos, KB4PGC, on public notice in August. Trahos said his proposal would help to promote international goodwill. The General-class licensee asked the FCC to amend its Amateur Service "and/or" Family Radio Service rules to allow "visiting/transient/tourist non-amateur non-United States resident foreign nationals" unlicensed access to certain frequencies between 446.0 and 446.1 MHz at up to a half watt PEP output. Trahos also asserted that existing Part 97 Amateur Service rules precluding the use of PMR 446 radios in the US were "essentially unenforceable" and that granting his petition would have minimal impact on existing amateur operations. The ARRL contended, however, that there are "obvious" enforcement problems associated with the petition and that putting the unlicensed users on a ham band was "a formula for serious interference."

The ARRL band plan for 70 cm designates 446.0 MHz as a national calling channel. Other frequencies in the segment are for simplex or repeater use. In the US, government radiolocation services are primary and amateur radio is secondary on that portion of the 70-cm band.

- A new web site featuring "the bleeding edge of Amateur Radio technology" has hit the internet. Chris Karpinsky, AA1VL, recently developed the <neoamateur.org> site to identify and encourage technological development in amateur radio. He wants the site to become a reference point for all the latest advances in the various ham radio niches including software-defined radios (SDRs), digital modes, and networking.

In an interview, Chris commented, "A problem I have found in the past is that I've stumbled across (by accident) many great projects people have done..." So, he thought it would be a good thing to develop a Slashdot-type news site just for amateur radio technology scoop. (The Slashdot site bills itself as the web site of "News for Nerds. Stuff that matters.")

Like the Slashdot site, neoamateur features synopses of the latest news with links that permit you read the whole story. Chris says <neoamateur.org> is a collaborative place where the site visitors develop much of the site content.

(Excerpts from "The ARRL Letter" and the www.arrl.org web site)



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ORIGIN OF SPREAD SPECTRUM (continued from page 1)

Hedy Lamarr later divorced Fritz Mandl. She subsequently met film mogul Louis B Mayer in London. Mayer brought her to Hollywood to make films for MGM. Lamarr became famous for the movies she made in the 1930s and 1940s. Despite her film success, Hedy soon became concerned with the impending war. The eyes of the world were on Europe as World War II began in 1939.

Hedy became acquainted with musician George Antheil in 1940. Antheil established the player piano as an accepted instrument for composed music. Sharing a common view on WWII, Lamarr and Antheil were both strongly opposed to the Nazis. Realizing that whichever country controlled the Atlantic Ocean would win the war, they vowed to collaborate on an effective radio-controlled torpedo.

Inspiration struck when Hedy and George were sitting at a piano bench playing together. George played the keys and Hedy followed him on a different octave. Hedy exclaimed, "Hey, look, we're talking to each other and changing all the time." Hedy developed her insight into a plan to disperse a torpedo guidance radio signal over numerous frequencies to avoid enemy interception or jamming.

She envisioned sending information in a random pattern over multiple frequencies. Just like the number of keys on a piano, the communications system was designed to use eighty-eight frequencies. The signal would move across the spectrum so quickly that anyone monitoring a particular frequency would only hear a blip. The challenge remaining was how to keep the transmitter and receiver synchronized as they moved through the frequencies.

Hoping that Antheil could help resolve the synchronization quandary, Hedy Lamarr shared her idea with him. Drawing on his player piano expertise, Antheil proposed that two paper rolls – perforated with the same pseudo-random pattern to define the frequency path – be installed at the launch point transmitter and launched torpedo receiver. The rolls must start simultaneously. The rolls could maintain synchronization right up until the torpedo hit the ship, if the motors driving them had good rotary stability.

Realizing that their idea could help the US war effort, Lamarr and Antheil submitted their invention to the National Inventors Council. They were advised to patent the simple continuous wave frequency hopping system, and their secret communications system received US Patent Number 2,292,386 on August 11, 1942. They gave their patent to the government for the war effort instead of exploiting it commercially. Neither Lamarr nor Antheil ever received a dime for their invention. Unfortunately, the government chose not to use the secret communications system for World War II due to cost and their skepticism. It wasn't until 1962 that the US Navy finally installed spread spectrum technology aboard their ships. Hedy Lamarr and George Antheil were at last recognized for their contribution when they received the Pioneer Award from the Electronic Frontier Foundation in 1997. George Antheil died in 1959, and Hedy Lamarr in 2000. In 2002, Lamarr was inducted to the *Electronic Design* magazine Engineering Hall of Fame for her landmark achievement.

THEORY

Spread spectrum technology is popular because it resists jamming, has a low probability of intercept, is so

inconspicuous that it can be considered transparent, is unlikely to interfere with other business and consumer use signals, and is a highly efficient way to use the frequency spectrum. Spread spectrum technology increases capacity and reduces cost of the crowded spectrum by enabling multiple users to share radio frequencies concurrently, without interfering with each other.

Spread spectrum signal bandwidth is purposely designed to be much wider than the information carried. Spread spectrum requires a wider signal bandwidth in exchange for an improved signal-to-noise ratio. Noise-like spread spectrum signals are hard to detect with narrowband equipment because the signal's energy is spread over a bandwidth of many times the information bandwidth. For a signal to be considered spread spectrum, a signal's resultant transmitted bandwidth must be determined by some function other than the information being transmitted. A typical spread spectrum RF signal bandwidth is 20 to 254 times the information bandwidth, although the RF bandwidth can be up to 1000 times the information bandwidth.

Spread spectrum and narrow band signals can share the same band without causing interference to each other. Although spread spectrum and narrow band are both transmitted at similar power levels, spread spectrum signals are so wide that they transmit at a much lower spectral power density.

All types of spread spectrum transmit signals rely on pseudo noise code techniques. Spread spectrum receivers de-spread with a locally produced replica pseudo noise code and a receiver correlator to detect only
(continued on next page)



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SPREAD SPECTRUM (continued)

the desired coded information from all possible signals. De-spreading is the process used by a correlator to recover narrowband information from a spread spectrum signal. A correlator is a specialized matched filter that demodulates a spread spectrum signal. It responds only to signals that are encoded with identical matched signal characteristics and with a pseudo noise code that matches its own code. By changing its local code, a correlator can be "tuned" to different codes. A correlator does not respond to manmade, natural, or artificial noise or interference.

Spread spectrum comes in two varieties: direct sequence (figure 1) and frequency hopping (figure 2). Direct sequence spread spectrum modulates its carrier with a high-speed code sequence, along with information being sent. With frequency hopping spread spectrum, the transmission hops from frequency to frequency over a wide band. Code sequence determines the order in which the frequencies are occupied. The information rate determines the frequency hopping rate.

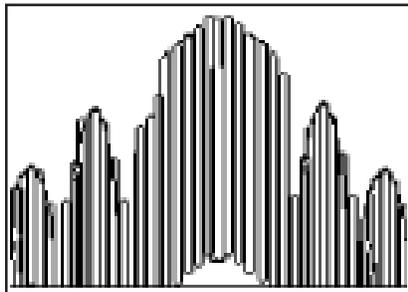


Figure 1. Illustration of direct sequence spread spectrum signal.

APPLICATIONS

Spread spectrum technology is widely implemented today in wireless LANs, radio modem barcode scanners for warehousing, digital dispatch, digital cellular CDMA (Code Division Multiple Access) communications, and newer commercial satellites. In frequency-congested metropolitan areas, broadcasters use spread spectrum microwave equipment for RPU, ICR, and STL transmission. Spread spectrum technology spares broadcasters the expense of buying a dedicated connection to transmit a signal from one location to another and the task of frequency coordination. Plus, the robust modulation scheme protects their signal from interference. Future applications of spread spectrum are likely to include helmet-based communications, military defense satellites, and battlefield combat identification systems.

Information for this article came from the following sources: www.sss-mag.com/ss.html, www.hoxie.org/news99/senior99/hedy8.html, www.hedylamarr.at, www.sirius.be/lamarr.htm.

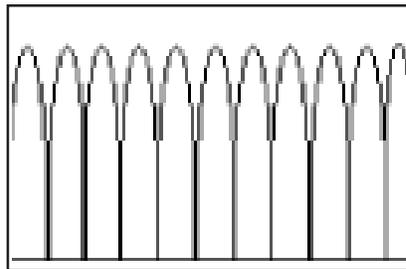


Figure 2. Illustration of frequency hop spread spectrum signal (as viewed over time).

Thanks to WISC-TV for maintaining the web server for the Chapter 24 Web page!

Thanks to WKOW-TV for providing copying and folding facilities for the Chapter 24 newsletter!

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LOCAL LEGALS

Compiled by Tom Smith

PROPOSED

WHIT-FM 93.1 MHz, DeForest, WI

Great Dane Broadcasters, Inc. wish to modify their construction permit by moving the location of their transmitter site. The proposed site would be at the coordinates of 43-09-34 north / 89-12-55 west and operate with a power of 6 kW at 98 meters above average terrain and 94.5 meters above ground. The proposed site is the current site of WNWC-AM. This notice was released on October 4, 2002.

WDRB (AM) 1400 KHz, WBDL (FM) 102.9 MHz, WNFM (FM) 104.9 MHz, Reedsburg, WI

Marathon Media Group, LLC seeks permission to transfer their licenses to Newradio Group, LLC. Other area stations included in the transfer are WDLB (AM) 1450 KHz and WLJY (FM) Marshfield, WOSQ (FM) in Spencer, translators W290AL (FM) 105.9 MHz, Baraboo and W277AC (FM) 103.3 Watertown. Other Wisconsin stations are WOBT (AM) and WRHN (FM) Rhinelander, WATK (AM), WRLO (FM) and WACD (FM) Antigo and WYTE (FM) Whiting. Seven stations in Illinois are also included in the transaction. This notice was released on October 22, 2002.

New FM 89.3 MHz, Richland Center, WI

Richland Center Fellowship wishes to amend its application for
 (continued on page 7)

Token Creek
MOBILE TELEVISION
incorporated

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 **FCC Rulemakings**

Compiled by Tom Smith

FINAL RULEMAKINGS

**MM Docket 99-325
Digital Audio Broadcasting Systems
And Their Impact on the Terrestrial
Radio Broadcast Service.**

The FCC has approved the use on an In-Band On-Channel (IBOC) system for digital transmission of broadcast Audio in the AM and FM Bands. They also selected as a standard the IBOC system developed by iBiquity Digital Corporation. In this rulemaking the FCC rejected the use of either TV channel 6 or the use of L-band frequencies of 1452-1492 MHz for digital only systems such as Eureka 147. They noted the difficulty in the clearing of both bands and the expected analog operation of TV broadcasts beyond 2006.

The FCC issued a number of rules for the interim basis. The FCC will issue rules for a formal setting of standards and licensing procedures in the future. In the interim rules, FM stations must operate through the existing antenna. FM stations will not be allowed to use a separate antenna for digital transmission.

AM stations are required to follow even more restrictions including limiting audio response on the analog

part of the signal to 5 KHz, no stereo operation, and limiting the use of the IBOC signal to daytime operations with additional use during pre and post sunrise periods which is 6 AM to sunrise and sunset to 6 PM..

No station is required to transmit an IBOC signal, and the FCC did not set a date for ceasing analog operation. The FCC did acknowledge that the system can be converted to a digital only system.

The FCC released a 42 page iBiquity standards paper for FM and a 32 page standards paper for AM. These papers list the system specs and standards, and are published by iBiquity.

This notice was adopted on October 10th and released on October 11th.

**DA-02-2751
Wireless Telecommunications
Bureau seeks to Verify ITFS, MDS
And MMDS License Status and
Pending Applications.**

**DA 02-2752
Wireless Telecommunications
Bureau seeks to Verify ITFS, MDS
And MMDS Pending Legal Matters**

The FCC has moved responsibility of all Instructional Television Fixed Service (ITFS), Multipoint Distribution Service (MDS) and Multichannel Multipoint Distribution Service (MMDS)

from the old Mass Media Bureau, which is now the Media Bureau, to the Wireless Telecommunications Bureau.

As the Wireless Telecommunications Bureau moves the data about these licenses from the Broadband Licensing System to the Universal Licensing System, they are reviewing all the information on the licenses in these services. They are asking all licenses to go to an FCC web site to check if their license information matches the FCC information.

The FCC is requesting that licenses send in all corrections of FCC data that does not agree with their paperwork. The FCC is seeking copies of licenses from stations that are operating and whose information is missing from the FCC database, and wants stations that have ceased operation to turn in their licenses. The website for license and application information is <http://wireless.fcc.gov/services/itfs&mids/licensing/inventory.html>.

Those stations with legal actions pending should check the appendix attached to the notice. This action is similar to what broadcasters were required to do when the FCC transferred Part 74 broadcast licenses to the ULS database.

The notice was released on October 18th and the responses from the licensees are due on December 17, 2002.

From FCC Notices (www.fcc.gov)

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Thanks to Special Events Coordinator Lonnie Cooks and volunteers Leonard Charles, Bill Fletcher, Jim Hermanson, Allan Johnson, Denise Maney, Steve Paugh, Tom Smith, Fred Sperry, and Paul Stoffel for their involvement with the SBE Chapter 24 booth at the Broadcast Clinic.



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Local Legals (continued from page 5)

a new FM. The transmitter is to be located at the coordinates of 43-18-51 north / 90-23-03 west, which is one half mile South of Richland Center. The transmitter would operate with a radiated power of 19 kW at 120 meters above average terrain and 138 meters above ground. This application was filed on October 22, 2002 and the notice was released on October 25, 2002.

WSUM (FM) 91.7 MHz, Madison, WI

The Board of Regents of the University of Wisconsin seeks permission to modify the license of WSUM. They are asking to change to another directional antenna which requires a change in the direction it is mounted on the tower. They also request a reduction in radiated power from 5.6 kW to 4.9 kW. This notice was released on October 29, 2002.

GRANTED

New LPFM , 105.7 MHz, Watertown, WI

The FCC has granted the dismissal of the application for a new low power FM by the St. John Radio Association. There was an informal objection filed on September 27, 2001 and letter from the applicant dated December 4, 2001 requesting dismissal. The FCC acted on this request on October 10, 2002 and released the notice on October 17, 2002.

New FM 106.7 MHz, Mount Horeb, WI

The FCC has granted a construction permit to David and Lynn Magnum for a new FM for Mount Horeb, WI. The transmitter will be located at the coordinates of 43-0-26 north / 89-

54-05 west, and operate with a radiated power of 2.9 kW at 146 meters above average terrain and 102 meters above ground. The transmitter site is just South of US 151 at Barneveld. The Magnums own 8 stations in Wisconsin which are located in Tomah, Wisconsin Dells, Portage, Kewaunee, and Sturgeon Bay. Action was taken on October 3, 2002 and announced on October 17, 2002.

New FM, 106.7 MHz, Mount Horeb, WI

The FCC has dismissed the applications of Dodge Point Broadcasting Co. Inc. and First Congregational Services for a new FM station in Mount Horeb. These actions were made in conjunction with the granting of the construction permit for 106.7 MHz in Mount Horeb to the Magnums. Action was taken on October 3, 2002 and announced on October 17, 2002.

K53HX (LPTV) Channel 53, Viroqua, WI

Charlotte Mills was granted a construction permit to construct a low power TV station in Viroqua. The station will operate with the radiated power of 999 watts at the coordinates of 43-33-41 north / 90-52-38 west.

WVRE (FM) 101.1 MHz, Dickyville, WI

The FCC has granted Radio Dubuque, Inc. permission to modify their construction permit to locate their transmitter at the coordinates of 42-31-44 north / 90-36-58 west with the antenna at 129 meters above average terrain and 101.2 meters above ground and operating with a radiated power of 3.7 kW. This notice was issued on October 24, 2002.

From FCC Releases (www.fcc.gov)



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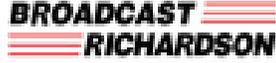
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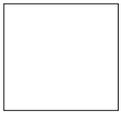


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FIRST CLASS MAIL

Newsletter edited on Pagemaker 7.0 by: Mike Norton
 Contributors this month: Vicki W. Kipp, Jim Magee, Tom Smith, and Tom Weeden.
 Thanks to Leonard Charles for his work on the Chapter 24 WWW page.

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NOVEMBER MEETING and PROGRAM



**Society of Broadcast Engineers
CHAPTER 24 MADISON, WISCONSIN
Thursday, November 21, 2002**

CATEGORY 5e/6 CABLE

Here's your chance to learn more about unshielded twisted pair cable. Can you use Category 5 or enhanced versions (5e, "6") to carry analog and digital audio? Or analog and digital video? Of course you can! Find out how at this month's program. Easy to use 'Category' cables to be discussed, including hands-on RJ45 termination. Join us for this joint presentation by Belden and Panduit representatives.

**Dutch Treat Dinner at 5:30 PM
at Perkins Restaurant
1410 Damon Road
(near Fish Hatchery Road and the Beltline)**

**Meeting and Program
at 7:00 PM
at Wisconsin Public Broadcasting Center
3319 W. Beltline Highway**

Visitors and guests are welcome at all of our SBE meetings!

2002/2003 UPCOMING MEETING/PROGRAM DATES:

| <u>Day</u> | <u>Date</u> | <u>Program</u> |
|------------|-------------------|----------------|
| Tuesday | December 17 | T. B. A. |
| Wednesday | January 15, 2003 | T. B. A. |
| Thursday | February 20, 2003 | T. B. A. |

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|--------------------|--------------------------|-------------------------|-------------------------|-----------------------------|
| Program Committee: | Denise Maney 277-8001 | Steve Paugh 277-5139 | Fred Sperry 264-9806 | Steve Zimmerman 274-1234 |
|--------------------|--------------------------|-------------------------|-------------------------|-----------------------------|