Mich-A-Con RF

Iron Mountain, Michigan **April 2010**

In This Issue:

Words from the President

Tom, W8JWN

First of all, I'd like to remark on the excellent attendance at our meetings. We have, on an average, of 15-20 members, or visitors at each meeting. Bravo! I'm very pleased that more of you are interested in the business of the club. May be it's the program that draws you out on the second Tuesday of the month. HI!

Speaking of programs, thanks to Art, Burt, and Bob for their excellent presentations. Also, you will note in the minutes, that future programs have been suggested. If anyone would like to present a ham radio related program, please let me know. If you need any assistance, or material, feel free to ask any member for guidance.

Hopefully, our increased membership and interest will carry over to Field Day. We need operators! You don't even need a license to operate the GOTA station. This is an excellent opportunity for a beginner to get his/her feet wet. Contact Terry if interested.

We need new blood. Also, I might add, young blood. The average age of a ham worldwide is 60+. I recently received a batch of QSL cards from the 8th bureau. Enclosed were three of my cards stamped, "SK" (Silent Key). Of course, people die at any age but it was a shock to see those cards returned. In one of the RTTY contests, age

is given as the exchange. The majority of my contacts were with 60-70 year old hams. No more than a dozen were in the 20-30 group.

Field day is a wonderful opportunity to introduce younger people to the hobby. Bring one of your children, a friend's child, a niece or nephew, or a neighbor kid.

See you at the next meeting.

AM – FM – and Single Side Band (SSB), How they work

By Gary Schafer K4FMX (4/25/2010)

Ever wonder how the modulation actually works on our transmitters?

Here is an attempt to show how each works and the advantage of each.

FM:

Let's start with FM. FM stands for "frequency modulation". It means that we vary the frequency of the main signal (carrier) in order to put information on it.

This can be done in two ways. One method is direct FM and the other is "phase modulation". FM and phase modulation are related and give very similar results at the receiving end but are a little different in the generation.

With FM the carrier frequency is directly varied by the modulation, usually our voice.

To accomplish this we must start with a variable frequency oscillator in the transmitter that is not crystal controlled. It can be an oscillator that is stabilized by a phase locked loop which is referenced to a crystal oscillator but the crystal oscillator itself can not be directly frequency modulated. The variable oscillator is usually modulated with a voltage variable capacitor (varicap) which is fed with the modulating signal audio. This causes the capacitance to change at the same rate as the modulation frequency applied. This changing capacitance causes the variable frequency oscillator to change its frequency at the same rate.

The frequency of the modulating signal causes the carrier frequency to shift at the same rate or frequency as the modulating signal. The LEVEL of the modulating signal determines how far or how much deviation there is of the carrier. The carrier frequency swings back and forth above and below the mean frequency (with no modulation). A 5 KHz deviation signal will swing higher in frequency by 5 KHz at maximum modulation level and also down 5 KHz by the same 5 KHz amount.

The rate at which it swings up and down is determined by the frequency of the modulation signal. If the modulation signal was a 1000 Hz tone then the carrier would swing up and down in frequency 1000 times per second.

PHASE MODULATION:

Phase modulation is almost the same as FM except that during modulation the phase of the carrier is changed rather than directly changing the frequency with modulation. Phase modulation ultimately results in a frequency shift but over a much smaller range.

A crystal oscillator can be phase modulated and that is how all of the older radios were modulated. They were referred to as FM transmitter as they got the same job done and on the receive end you can't tell the difference.

Being that you can only change the frequency a small fraction of what can be done with direct FM, the phase modulation system has to start out at a rather low frequency and be multiplied up. A typical 2 meter transmitter would start out with a 12 MHz crystal and multiply that up to 2 meters. Every time you double the frequency you double the deviation. So the 2 meter transmitter started out at 12 MHz with around .4 KHz deviation. .4 X 12 = 4.8 KHz of deviation at 2 meters.

The other difference in phase modulation is that as the modulating frequency increases, so does the deviation in direct proportion. In other words if a 1 KHz modulating tone causes 2 KHz of deviation then a 2 KHz modulating tone will cause 4 KHz of deviation if both tones were at the same level.

So in phase modulation the amount of deviation is determined by both audio level and audio frequency.

We could use a de-emphasis circuit to roll off the high frequency modulating signal levels by the same amount as the phase modulation causes the increase in deviation due to audio frequency and it would then sound just like a direct FM signal.

But there is actually an advantage to modulating the higher frequencies more than the low audio frequencies in the transmitter and rolling off the response in the receiver instead. It gives better noise reduction in the receiver. This is what is typically done.

So if a direct FM transmitter is used in the same system, the pre-emphasis is applied to the direct FM transmitter so that it matches that of a phase modulated transmitter and then the receiver at the other end can not tell the difference between the two and it benefits from some noise reduction.

In an FM or PM signal the level of the carrier changes with modulation. Side bands are created at the frequency of the modulation and those levels depend on the frequency and amplitude of the modulation.

There are theoretically an infinite number of side bands created but the level falls off rather quickly as they get farther away from the carrier. The receiver bandwidth must be wide enough to accommodate the major side bands.

The energy for these side bands comes from the carrier. As the total energy in the side bands increases, the power in the carrier decreases. But the average level of the whole signal remains constant.

AM:

AM is generated by a mixing process. With a plate modulated transmitter, the modulated stage must be a class C stage which is a non linear device. Audio is applied to the plate circuit usually by transformer coupling the audio in series with the DC plate voltage. The DC plate voltage is used to generate the carrier. As the audio voltage swings positive it adds to the DC plate voltage. As is swings negative it subtracts form the DC plate voltage.

100% modulation is when the audio voltage equals the DC plate voltage. This doubles the plate voltage on the positive peak and makes the plate voltage go to zero on negative peaks. On positive peaks when the plate voltage doubles, the plate current also doubles. This increases the plate power by 4 times what it was with just the carrier. This 4 times power increase is for the duration of the audio cycle being used to modulate the transmitter. This is called the “peak envelope power” of the transmitter or PEP. Yes AM transmitters have peak envelope power just like single side band transmitters.

The AM signal is actually composed of 3 different signals. One is the carrier and the other two are the two side bands, one above the carrier and one below the carrier, which represent the audio signal that was used to modulate the transmitter.

When a carrier at 3900 KHz is modulated with a 1000 Hz tone the transmitter puts out the 3900 KHz carrier and the upper side band at 3901 KHz and the lower side band at 3899 KHz. It appears that the audio signal just ads and subtracts from the carrier frequency but it really gets multiplied and when you get done with the math it comes out to the same frequency as if you just added and subtracted.

What we have done is convert the audio frequencies of the modulation to an RF frequency. The 1000 Hz tone has been converted to 3901 and 3899 KHz.

In an AM signal the carrier level and its frequency does not change at all. It remains completely independent of the side band signals.

If we look at the envelope pattern of an AM signal on an oscilloscope it appears that the carrier goes to zero and up to twice the amplitude of the carrier with full modulation. But what we are looking at in this case is the sum and difference of the modulation voltage and that of the carrier at one time.

The envelope is what is used in the AM detector in the receiver. It acts similar to a rectifier in that its output only gives us half the envelope.

Although the detector operates as a rectifier it is actually also a mixer itself. It lets us recover the original audio by mixing the carrier with the two side bands which are now at RF frequencies, back down to audio frequencies that we can hear.

Remember above we converted the 1000 Hz tone to 3901 KHz and 3899 KHz. Now we are converting them back down to audio again in the receiver in its detector circuit.

In any mixer circuit we always get four signals out of it when we put two signals into it.

In the case of modulation as above we put in 3900 KHz and 1000 Hz. The output is the sum and difference of each: 3901 KHz the sum, 3899 the difference, and the two original signals, the 3900 KHz carrier and the 1000 Hz audio signal. Yes the 1000 Hz audio signal is in the output but it gets attenuated in the output tank circuit and bypassed to ground as we don't need it for anything.

In the receiver the mixer (detector) gives us the original signals back. We put in the carrier and two side bands. They mix with the carrier and the resultant output is again four signals. One is the original carrier that gets filtered out as we no longer need it once the mixing process is done. Then we get two audio signals out from the two side bands but since they both contain the same frequency and amplitude information and they are coherent with one another they add together and give us twice the output that one side band would give us. The fourth output is DC from the rectified carrier.

The carrier is necessary for proper demodulation of the side bands as its frequency and phase must be exact with the side bands in order for there to be no distortion and for the side band energy of each to add together. This is the only reason for transmitting the carrier along with the side bands. It makes the receiver detection process very simple.

SINGLE SIDE BAND (SSB)

Single side band signals usually start out as AM signals. They are usually generated at very low level stages rather than at high level stages as is common with AM. However AM can be generated at low level stages and amplified just like an SSB signal.

The start of an SSB signal usually involves what is called a balanced modulator. It is exactly the same as a balanced mixer. A balanced modulator (mixer) operates like a normal simple mixer like we discussed above except that one of the input signals does not appear in the output while the other signals do. In this case the carrier and audio signal is fed in and mixing takes place generating the upper and lower side bands just as it does with a regular mixer. However in this case only the two side band frequencies appear in the output. The carrier is canceled in the output stage so we are left with double side band with no carrier.

We could amplify this double side band signal and transmit it and receive it on our receiver. We would need to generate a local carrier in the receiver to mix with the two side bands in our detector to recover the audio just like we did with the regular AM signal that had the carrier and two side bands.

That local carrier in the receiver is generated by what we call a BFO or beat frequency oscillator. It is normally generated at the IF frequency and fed directly into the detector along with the side band signal. Although the local carrier could be generated at the same frequency as the side bands are received on and go thru the whole receiver amplifier chain along with the side bands.

The local carrier (BFO) must be on exactly the same frequency and phase in relation to the side bands as the original carrier was. If it is not severe distortion will result when receiving both side bands.

Now we go a step further with our double side band signal after the balanced modulator. We pass it thru a narrow filter that cuts off one of the side bands and leaves the other. We now have a single side band signal with no carrier.

At the receiver it is much easier to demodulate the single side band signal than it was the double side band signal. We again insert a local carrier with the BFO but now it does not have to be exactly on frequency and the phase does not have to be exact either with a single side band signal.

With the double side band signal if the BFO was not exactly in phase, the recovered audio from one side band would try and cancel the other rather than them adding together as they would do with the carrier in exact phase. This would cause distortion.

With only one side band to deal with now there is no cancellation to take place if the phase is not exact. The only notice will be a slight shift in recovered audio frequency by the amount of frequency error between the BFO signal frequency and where it should be in relation the single side band frequency.

THE PRODUCT DETECTOR

In an SSB receiver we use what is called a product detector rather than a simple diode detector that is used for AM. When receiving SSB with a diode detector the BFO signal has to be many times the strength of the strength of the SSB signal to avoid distortion in the detector. The diode detector is easily overloaded and will handle

only a very narrow range of signal levels. It will also mix together any incoming signals in addition to the wanted side band signal.

The product detector is a much better mixer. The BFO is fed to it along with the side band signal and only the "product" of the BFO and the side band signal appear in the output as audio. The product of other unwanted signals and the BFO also appear in the output but other signals do not mix with each other to produce unwanted responses like the diode detector does. Any output must be the result of mixing only with the BFO signal.

BENEFITS OF EACH:

FM is quieter with a strong signal. Simple receiver.

AM will work in a higher noise level. Weaker signal can be heard. Simple receiver.

SSB will work best in high noise weak signal conditions. More complex receiver, transmitter and difficult to tune.

All of the power in an FM transmitters side bands comes from the carrier. The total power output of the FM transmitter remains constant.

Power output of an AM signal contains 2/3 the power in the carrier and 1/3 power in each side band. A 100 watt output AM transmitter will have 100 watts in the carrier and 25 watts in each side band.

The AM transmitters power output increases with modulation. The extra power comes from the modulator. The carrier remains constant.

The carrier conveys no information other than the frequency and phase reference for the detector to demodulate the side bands.

An SSB transmitter has all of its power in one side band.

In order to amplify an AM signal with a linear amplifier the amplifier must be capable of 4 times the carrier power of the AM transmitter as the peak envelope power of the AM transmitter is 4 times its carrier power. The amplifier must be tuned up at the PEP level.

Amplifying an SSB signal is more efficient than AM as all the power is in the one side band so the amplifier doesn't need to amplify any unneeded carrier power or a second side band. All the power is in the information carrying side band.

73

Gary K4FMX

Mich-A-Con ARC Activities for May 2010

Sun	Mon	Tue	Wed	Thur	Fri	Sat
						1
2	3	4	5	6 ARIES	7	8
9	10	11 MEETING	12	13 ARIES	14	15 BREAKFAST
16	17	18	19	20 ARIES	21	22
23	24	25	26	27 ARIES	28	29
30	31					

Club Activities

ARES Nets are conducted at 6:30 PM Central Time every Thursday on our 2-meter repeater (146.850 MHz.)

Meeting: The Mich-A-Con Club meets the second Tuesday of the month at the Dickinson County Library at 7:00 PM. Visitors and Prospective Members are always welcome.

Our Saturday Morning Breakfast is held on the 3rd Saturday of every month at 9:00 AM at the Holiday Kitchen Restaurant on Stephenson Ave (US-2) in Iron Mountain.

Mich-A-Con Amateur Radio Club
Minutes of the April 13, 2010 Meeting

President Tom Martin called the meeting to order at 7:01 p.m.

Secretary Report
The minutes of the March 9 meeting were read and approved.

Treasurer Report
Balances as of April 13, 2010:
Checking - $295.24
Regular Savings - $2,942.04, $1,406.91of which is in the Trailer Fund.
Repeater Savings - $912.80
Petty Cash - $0.00.
We have 29 paid members as of this meeting.
A motion was made and carried to pay Bob Meyers for the purchase of coax connectors.

Repeater Report
Bob Meyers reported that he and Mike Bray have rerouted coax cables and installed lightning arrestors on the repeaters and packet equipment and readied the building for warm weather. The MIIMT packet radio was found to be off frequency. It was reset to 147.420 and is now back in operation. Bob found additional parts for the new 440 repeater, but we still need to locate two missing circuit boards. LeRoy Anderson will loan us his EPROM burner so we can program the TNC chips for the Crivitz packet nodes.

ARES
The ARES Net has been active. Pete Schlitt passed out ID cards to new ARES members.

Pete Schlitt reported that a final list of equipment for the EOC is being prepared for ordering. Tom Martin has checked out the space in the EOC where the equipment will be installed.

Storm Spotter training will be held on April 26th at 6:30 pm CDT at Fornetti Hall of Bay College West.

Old Business
Field Day 2010 –
Contact Terry to sign up. We will have a meeting at the Red Brick Inn when we get closer to Field Day.

Club Programs Scheduled –
May – Tom Martin Traffic Handling
June or July – Gary Schafer AM, FM, SSB.
Other programs under consideration are:
QSLing
Radials & Grounding
Logging
Packet

New Business
None

Adjournment
The meeting was adjourned at 7:55 p.m.

Roundtable Introductions
Attendees introduced themselves to the group.

Club Program
Bob Meyers made a presentation on repeater auto-patch procedures and repeater control codes

Submitted by Mike Bray

Attendees
Mike Bray, K8DDB---Secretary
Adam Hull, KD8LQK
Art Costa, KD8GLO
Skip Caswell, KE9L
Michael Byers
David Thomas, KG9Y
Terry Moriarity, K9TRY
Burt Armbrust, WB8EBS---Treasurer
Scott Jarmusch, KA8TFF---Vice President
Randy Zandt, KB9ZES
Bob Meyers, WA8FXQ
Nate Mieras, KD8GLP
Barry Perron, KC9NFT
Joe Komblevicz, KB8ETK
Paul Schultz, KD8KUF
Tom Martin, W8JWN---President
Al Poquette, K9ECG
LeRoy Anderson, N8WQG
Pete Schlitt, KC8JRH

Wanted:

YOUR ARTICLES, IDEAS AND INPUT! SEND THEM IN NOW TO: kd8ccp@arrl.net

Club Repeaters:

The club maintains two repeaters, which are located on Pine Mountain (elevation 1,650 feet) in Iron Mountain, with tower and facilities provided by the Wisconsin Electric Power Co.

The range of the 2 meter repeater is about 40 miles under normal conditions, depending upon terrain. The 440 MHz repeater has a range of about 25 miles.

OUTPUT	OFFSET	PLTONE	CALLSIGN
146.850	Minus	-	WA8FXQ
444.850	Plus	100 Hz	WA8FXQ

Repeater Specifications:

The 146.85 repeater is a Melco Hi Pro (built from a kit in the 1970s) with 25 watts output.

The 444.85 repeater is a GE Master Pro with 30 watts output.
The repeaters share a Diamond dual band antenna at a tower height of 125 feet.

To use the Auto Patch, key your mic and dial the Auto Patch ON code and let up on your mic. You will then hear a dial tone. Key your mic and dial your number. The phone should then ring. When you complete your call, key your mic and dial the Auto Patch OFF code and the phone call will terminate. Club members will be given Auto Patch codes on request.

V.E. TESTING:

07/10 **Houghton**: 8:30am eastern time, V.E. Exams at Michigan Tech. University in Houghton, MI will be held in the ballroom of DHH (Douglass Houghton Hall at Michigan Tech). Free Parking in Lot #14, front of DHH, across from Wadsworth Residence Hall. Use door #9 on the South-East side of DHH. Contact Glenn Ekdahl, WA8QNF at (906) 482-7743 if you have questions.

7/10 **Gladstone**: Sponsor: Delta County Amateur Radio Society Time:10:00 AM (Walk-ins welcome) Contact: Howard St. John (906) 428-9476 email: hsj99@charter.net
Vec: ARRL/VECLocation: Gladstone City Hall Main Meeting Room 1100 Delta Ave Gladstone, Mi. 49837.

05/01**Iron Mountain**: 9:00am central time, (arrive by 8:30am) Dickinson County Library(conference room), contact Mark J. Lewis N8UKD, (906) 776-1553. 412 Fairmount St. Kingsford, Mi 49802.

06/12 **Marquette**: 8:30am eastern time, (arrive by 8:00am) Marquette County Health Dept. Bldg,U.S. 41 just east of the Michigan State Police Post. Contact Rich Schwenke, N8GBA at 906 249-3837or e-mail: n8gba@chartermi.net.

Please arrive one-half hour early for test sessions to give time to process applications.

Testing applicants should bring the following items with them:
Two pieces of I.D. one being a photo I.D., Original license and one clear copy of their license if applicable, Completed form 605 (one will be provided if you don't have one), pencils, calculator and the test fee of $15.00.

Please have the correct fee as examiners do not carry change. Please contact the individual(s) listed to confirm date(s), location(s), etc.

Note: If you have been assigned a FRN from the FCC you must use it on all forms rather than your SSN.

Links

ARRL WEB PAGE: http://www.arrl.org

ARRL MICHIGAN: http://www.arrl-mi.org/

US REPEATERS: http://www.usrepeaters.com

MICH-A-CON : http://www.qsl.net/ka1ddb

Tropospheric Ducting Forecasts:
http://www.dxinfocentre.com/tropo.html

FCC Universal Licensing System: http://wireless.fcc.gov/uls/

QTH.COM: http://www.qth.com/

QRZ.COM: http://www.qrz.com/

Ehamnet.com: http://www.eham.net/

U.P. Skywarn: http://kcra-mi.net/skywarn/

Please remit dues to :

Burt Armbrust WB8EBS
693 Cliff St.
Quinnesec, Mi. 49876

Name: _____
Address:_____
City, State, Zip _____
Call Sign: _____
Email Address: _____
Phone: _____
ARRL Member? Yes_____ No ____

Annual dues are due in January.
Please make check payable to Mich-A-Con ARC
Annual dues for Full Membership - Single $20 __* Family $30 __ Repeater Only $10 __**

If family membership, please list additional names and call signs:_____
*** The dues for NEW members are prorated - you only pay for the remainder of the year! Please remit $1.67 per month for a Single membership or $2.50 per month for a Family membership.**

Club Patches are available from:

Burt Armbrust WB8EBS
693 Cliff St.
Quinnesec, Mi. 49876

The patches are 3 inches in diameter and sell for $3 ea.

If ordering by mail please include a SASE along with your payment.

ARRL SIGNS MOU WITH RED CROSS

FROM:

The ARRES E-Letter for April 21,2010

On Thursday, March 25, ARRL President Kay Craigie, N3KN, signed a new *Memorandum of Understanding* (*MoU*) with the American Red Cross at ARC National Headquarters in Washington, DC. The *MoU*, which replaces an earlier *Statement of Understanding* that expired in 2007, provides a "broad framework for cooperation" between the ARRL and the ARC "in preparing for and responding to disaster relief situations at all levels in rendering assistance and service to victims of disaster, as well...

On Thursday, March 25, ARRL President Kay Craigie, N3KN, signed a new *Memorandum of Understanding* (*MoU*) with the American Red Cross (ARC) at ARC National Headquarters in Washington, DC. The *MoU*, which replaces an earlier *Statement of Understanding* that expired in 2007, provides a "broad framework for cooperation" between the ARRL and the ARC "in preparing for and responding to disaster relief situations at all levels in rendering assistance and service to victims of disaster, as well as other services for which cooperation may be mutually beneficial."

The ARRL Board of Directors approved the signing of the *MoU* at its January 2010 meeting following the completion of negotiations. The Red Cross requires the completion of a criminal background check to participate in Red Cross activities and provides a process by which a volunteer may have a criminal background check performed at no cost to the volunteer. In the case of ARRL volunteers, the Red Cross has agreed to accept an alternative process: ARRL volunteers may arrange, at their own initiative and expense, to have the criminal background check performed by a state or local law enforcement agency.

The Red Cross also has agreed that ARRL volunteers shall not be asked or required to consent to credit checks, mode of living investigations or investigative consumer reports in order to provide a communications function.

The ARRL and the Red Cross encourage interested volunteers in their respective organizations to become members and to participate in the activities of the other organization. ARRL volunteers should be aware that if they wish to become Red Cross volunteers, they may be required to consent to additional background checks in accordance with Red Cross policy that may include credit checks, mode of living investigations or investigative consumer reports.

Per the *MoU*, "both ARRL volunteers and ARC workers will work cooperatively at the scene of a disaster and in the disaster recovery, within the scope of their respective roles and duties as recommended." During a Red Cross Disaster Relief Operation (DRO) and depending on their training and qualifications, ARRL volunteers may perform in one or more of several roles, including Amateur Radio Liaison, Communication Equipment Operator, Communication Equipment Installation/Repair and Disaster Assessment. ARRL volunteers who are assigned roles by the Red Cross during a DRO will be provided with Red Cross credentials as required by the role, consistent with Red Cross policy.

"Because of the importance of emergency communications, we are happy to be able to continue the League's long-standing relationship with the American Red Cross," said ARRL President Kay Craigie, N3KN. "The ARC and other served agencies give Amateur Radio operators the worthwhile missions in our communities that allow us to thank America for the privilege of being hams."

Club Meetings:

The Mich-A-Con Amateur Radio Club meets on the second Tuesday of the month in the Dickinson County Library at 7:00 PM. Visitors and prospective members are always welcome!

The URL for the Mich-A-Con ARC web site is:
http://www.qsl.net/ka1ddb/

Previous editions of Mich-A-Con RF can be accessed by a link on the news page.

The ARRL DX Bulletin on the Upcoming Activities page is updated each Thursday and the contests section is updated on a monthly basis.

Club Officers:

President:
Tom Martin, W8JWN
(906) 774-5463
tmartin@chartermi.net

Vice President:
Scott Jarmusch KA8TFF
s_jarmusch@yahoo.com

Secretary:
Mike Bray, K8DDB
(906) 563-7020
mikebray@chartermi.net

Treasurer:
Burt Armbrust WB8EBS
(906) 774-8383
wb8ebs@yahoo.com

Reminders:

Club dues for the year 2010 were payable on January 1st. Please use the Membership Application - Renewal form when paying your dues. Checks should be made payable to : Mich-A-Con Arc and sent to our Treasurer, Burt Armbrust WB8EBS at the address listed on the form. Thank-you for supporting your club!

The March Mich-A-Con Meeting will be held on Tue May 11th 2010. It will be held in the Dickinson County Library at 7 PM

MICH-A-CON RF

Mich-A-Con ARC
c/o Stephen Skauge
213 South Angeline
Ishpeming, Mi 49849