IREDELL WIRELESS

W4SNC

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By the Iredell County Amateur Radio Society (ICARS)
P.O. Box 142 Statesville NC 28687

ICARS WEBSITE www.icarsonline.org

MAY 2004

*The Iredell County Amateur Radio Society will meet at Julia's Tally House Thursday **MAY 13**, 2004.*
Come and eat at 6:00pm. The meeting starts at 7:00pm.
Bring the family. Everyone welcome!

	2 Meter FM		SSB Net
	Wednesday		Saturday
DATE	146.685 at 9:00 PM	DATE	28.468 at 9:00 PM
05/12/04	KC4MJC	05/15/04	W4DON
05/19/04	KG4YVZ	05/22/04	KE4ERH
05/26/04	KE4NUN	05/29/04	AG4AU
06/02/04	KG4DKN	06/05/04	W4UFO
06/09/04	KE4NUN	06/12/04	N1GC
06/16/04	KG4DKN	06/19/04	W4RTW
06/23/04	WA6KWW	06/26/04	N4ACF
06/30/04	WD4LXC	07/03/04	KC4MJC

April 8 2004 Iredell County Amateur Radio Society
Meeting Minutes

The Iredell County Amateur Radio Society met at Julia's Tally House for the monthly meeting. There were 8 members and 4 guests present. President Larry Earle WD4LXC called the meeting to order at 7:00 PM. Larry first asked if everyone received their copy of the Iredell Wireless newsletter. Larry then asked for a motion to approve the minutes of last month's meeting , as printed in the newsletter. The motion was made, seconded and approved. Next Larry asked for the Treasurers report. John Lamson WB4WRY, Treasurer reported a beginning balance of $ 615.13. One check written to Tim Misenheimer, KC4MJC for $37.00 to pay newsletter postage. The next check was also to Tim to pay for the chip he ordered for the Hamtronics (old 147.045) repeater. $25.00. ICARS had one deposit of dues of $15.00. Leaving an ending balance of $568.13. President Earle, asked for a motion to approve the report John gave. A motion was made. The motion was then seconded and then approved. Larry then asked for any new business. Tim, KC4MJC reported that he installed the 6803 IC chip in the Hamtronics repeater. The repeater still would not operate. He said he did not try anything else because he did not want to mess anything else up. Mike Bryan WA6KWW was next. He thanked everyone who turned up for the March-of-Dimes walkathon. He reported the Balloon Rally was coming up on June 4th, 5th and 6th. He next asked if anyone wanted to attend the Morganton Hamfest. The floor was then turned over to our Vice-President, Margie Persons KE4YWO who reminded everyone that Tim Slay N4IB will be here next month
(May 13) with his test equipment to test you're 2 meter rigs. Margie then introduced Lee Dalhan KD4TQZ. Lee had a very interesting program on APRS.
After the program the meeting was adjourned.

Respectfully Submitted
Tim Misenheimer KC4MJC, Secretary

If you have a 2 meter rig you wish to have checked, see the sheet on the back page of this newsletter.
Bring those rigs in so we can get everyone sounding their best!!

FREQUENCY MODULATION (FM)

A brief discussion of FM transmitter modulation parameters
by W4DON
May 2004

Prior to 1946, most all radio broadcast stations employed amplitude modulation as means of placing intelligence on the radio carrier wave. In 1939 the FCC permitted the first use of FM for commercial broadcasting. After WWII ended FM was accepted as a major development in broadcasting. In television the sound portion of transmission is FM. Also FM has replaced AM in non-broadcast, point-to-point radio communications.

MODULATION

In radio, the term modulation means varying some property of a radio carrier wave in accordance with the intelligence to be carried by that wave. If the amplitude of the carrier wave is varied, the process is known as AMPLITUDE MODULATION. If the frequency of the carrier wave is varied, the process is known as FREQUENCY MODULATION.

Frequency modulation means frequency variation. When a radio carrier wave is frequency modulated it is made to "swing" both higher and lower in frequency than the un-modulated carrier frequency.

How is FM produced. It can be produced by varying either the inductance or capacitance in an oscillator circuit. An oscillator is nothing more than an AC voltage generator. It's oscillating frequency therefore can be modulated by varying either the inductance or capacitance of components in the oscillator circuit by one of several methods with the audio frequencies that are to be transmitted..

Center frequency, also known as resting frequency or idling frequency is the frequency of an UN-MODULATED FM carrier wave. This is the assigned or selected frequency of a FM station, be it a broadcast or point-to-point station.

How audio level affects the FM carrier

When a carrier is frequency modulated by a high level audio tone or tones, a high percentage of modulation is produced, meaning a high frequency swing results when a high AF level is used to modulate the carrier. On the other hand, if the carrier is modulated by a low level audio tone, a low percentage of modulation is produced, meaning a low frequency swing results when a low AF level is used to modulate the carrier. In summary audio level determines percentage of modulation in a properly adjusted FM transmitter.

Example 1: A 100,000,000 hertz (100 mHz) carrier of a 5 kHz narrow band FM transmitter is modulated 100 % by a 3000 hertz audio frequency signal. The carrier wave will swing up to 100,002,500 hertz and down to 99,997,500 hertz, or +/- 2500 hertz. On the other hand if the carrier is modulated only 50% by the 3000 hertz AF signal the carrier wave will swing up to only 100,001,250 hertz and down to 99,998,750 hertz, or +/- 1250 hertz. This amount of carrier swing is also known as "deviation".

How audio frequency affects the FM carrier

The audio frequency determines rate of frequency swing. In other words, the rate of the carrier frequency swing is determined by the pitch (frequency) of the audio tone or tones that modulates the transmitter carrier.

Example 2: In Example 1 above a tone of 3000 Hz was used to modulate a narrow band FM transmitter. That 3000 Hz tone will cause the carrier frequency to swing up and down at a rate of 3000 times per second. If the tone is 256 Hz the carrier frequency swing rate would be 256 times per second. Thus it can be seen that a complex audio signal, such as speech or music, will cause a complex rate of swing in a FM transmitter carrier when modulated.

Continued on next page

Sidebands in FM

Yes, FM does produce sidebands but unlike AM which produces only two sidebands, upper and lower, FM produces sideband pairs, both upper and lower, in great abundance. The first pair of sidebands is called the FIRST ORDER (same as in AM,) second pair is called SECOND ORDER, third pair is called THIRD ORDER, and so on.

Example 3: In Example 1 above, where the modulating tone was 3000 Hz, the FIRST ORDER sideband will be 3000 Hz above and below the center frequency, the SECOND ORDER will occur at 6000 Hz, the THIRD ORDER will occur at 9000 Hz, and so on.

Under certain conditions the power radiated in the form of sidebands above the first order is negligible and need not be considered, but under other conditions the number of significant sidebands rises to the eighth order and even higher.

Modulation Index

The number of significant sidebands are determined by a factor known as MODULATION INDEX. Modulation index is the RATIO of carrier swing TO the frequency of the audio tone or tones which produces the swing during the modulation process. The modulation index determines how many orders of sidebands will be produced.

Modulation Index = RF swing / audio frequency

Another term for "frequency swing" is FREQUENCY DEVIATION. And a special type of the modulation index is called the DEVIATION RATIO. Deviation ratio may be defined as the RATIO of the frequency swing to audio frequency produced at 100 percent modulation.

Deviation Ratio = maximum RF swing / maximum audio frequency

FM broadcast stations, which have a modulated bandwidth of 150,000 Hz (+/- 75000 Hz), are required to be capable of transmitting audio frequencies as high as 15,000 Hz. The deviation ratio for a FM broadcast station is the ratio of 750,000 to 15,000. That is, the deviation ratio is 5.

Since the modulation index determines how many order of sidebands will be produced, a modulation index of 0.5 or less will cause most of the sideband power to be in the first order pair of sidebands. That is, when the modulation index is 0.5, the power radiated in the second and higher order sidebands is negligible and need not be considered as a possible source of interference on adjacent channels. Since the bandwidth of an FM signal with a 0.5 modulation index is the same as the bandwidth would be if AM were used, a FM signal with a 0.5 modulation index is know as NARROW BAND FM. Actually, all FM transmissions in channels not wider that 40 kHz are referred to by the FCC as narrow band FM. Amateur stations using FM must limit their transmissions to a bandwidth no greater than that necessary for an AM signal when the same modulating frequencies are used. Narrow band FM is always used in point-to-point communication but is not used by FM broadcast stations.

Over modulation in FM

In FM the amplitude of the carrier is not affected by modulation. Remember, it is the frequency of the carrier, not amplitude, which is modulated. Excessive modulation level will cause an excessive frequency swing and a larger modulation index, generating additional order of sideband frequencies which may fall into adjacent channels causing interference. Excessive modulation will also cause your 2-meter transmitter FM signal to exceed the bandwidth of another 2-meter receiver's front end, such as our 2-meter repeater receiver. Hence, if you're on the fringe, shouting into your microphone will only make matters worse.

In summary, frequency deviation (swing), audio level (percentage of modulation) and frequency of the carrier wave are very important parameters in any FM transmitter. At the next ICARS meeting N4IB, Tim, will conduct a "clinic" for the month of May program. Tim will have a "Service Monitor" on hand and offer to check these parameters on each members FM transceiver, including the sensitivity of the receiver (threshold or 12 db SINAD). Each member must supply their own power supplies, RF and AF cables. ONE TRANSCEIVER PER MEMBER PLEASE. Bring and record your parameters on Form found in the April or May 2004 Newsletters. No adjustments will be made due to the time element. AR de W4DON

ICARS CLINIC
Thursday - May 13, 2004
Transceiver Measurement Report

Guidelines and Instructions:

1. Only measurements will be taken on your transceiver. No adjustments will be made.
2. No adjustments will be made to your transceiver due to time element, etc..
3. Your HT batteries should be fully charged.
4. You will provide power supply for fixed and mobile type transceivers.
4. Maximum of one repeater pair will be measured. Example: 146.085/685 mHz
5. You must supply necessary cables:
    a. from antenna jack to service monitor including any adapters needed.
    b. from audio out jack to service monitor if SINAD test is desired.
        1. otherwise only threshold sensitivity measurement will be made.
6. Do not disturb Technician(s) while measurements are being made.
7. Only one transceiver per person UNLESS time permits more.
8. Use this form to register your transceiver and record measurements..

Name:

Date:	Callsign:	
Make:	Model:	S/N:

Receiver Frequency and Sensitivity Measurements (Choose one)

THRESHOLD: Squelch set to just quiet receiver. RX Frequency _____ mHz Sensitivity _____ microvolt(s)	**12db SINAD**: Audio out required. Squelch set maximum CCW or open. RX Frequency _____ mHz Sensitivity _____ microvolt(s)

Transmitter Power, Frequency and Modulation Deviation Measurements

TX Pout: _____ Watts	TX Freq: _____ mHz	TX Speech Dev._____ kHz 5 . 0 kHz Maximum	TX TTPad Dev. _____ kHz 3 . 5 kHz Maximum

Comments _____

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File: MeasurementReport