Boulder Amateur Television Club
TV Repeater's REPEATER

February, 2020

Jim Andrews, KH6HTV, editor - kh6htv@arrl.net www.kh6htv.com

Future Newsletters: This newsletter is not just for Boulder ATVers, but ATVers throughout the USA. If you have contributions for future newsletters, please send them to me. We love to also include news from other ATV groups, both in the USA & world-wide. You will be finding more & more news from other ATV groups here as evidenced by this issue of our newsletter. We have contributions from Ohio, Missouri, Minnesota, and California in this issue. We also encourage you to forward this newsletter on to other ham friends in your clubs.

Jim Andrews, KH6HTV, email = kh6htv@arrl.net

Feedback on 23cm RFI:

From Art, WA8RMC, APCO -- We had our repeater output at 1250 MHz and the FCC made us move because we interfered with GLONASS GPS operation from the Russian satellites. GLONASS operates in the bottom of the amateur 23 cm band in all parts of the USA. I don't know if it's active in Boulder but it is in Ohio and also in California for surveying purposes. (editor's note: From *gssc.exa.int* the L2 GLONASS center frequencies are 1242.9375 to 1248.625, ± 0.511 MHz)

As to GLONASS, the FCC didn't actually shut us down, as they didn't want to get involved, but asked if we would work with the Ohio Department of Transportation about it and come to an agreement. Our repeater output was interfering with their surveying equipment. We moved our ATV repeater's signal up to 1288 and they were happy. If your repeater output is not in the 23cm band, I see no problems. I only mention it because the GLONASS signal is becoming more popular and at some point it may be an issue for other ATV groups.

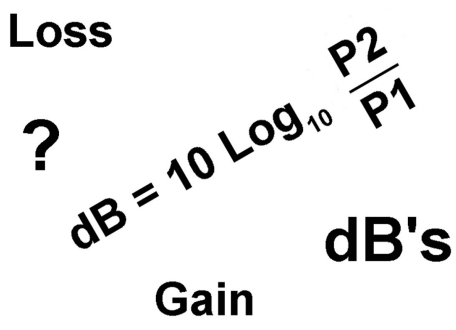
From Mike, WA6SVT, ATN: Great newsletter Jim! The radar and the dual peaks -- Most of the FAA/DOD long range air search radars use dual frequency to help improve the radar display due to QRM if only one channel is used. Also helps with jamming too. Typically one channel is in the low 1300 MHz and the other is in the 1.2 GHz band. Looks like you have both channels in the 1.2 GHz band. Each channel has a receiver bandwidth of about 3 MHz.

We have RADAR at 1280 MHz from San Pedro Hill on the Palos Verdes Peninsula, 1247.75 MHz San Clemente Island 60 miles off the southern Orange County coastline. These two are FAA/DOD and a DOD only RADAR on 1291 MHz on San Nicholus island off the coastline near the LA and Ventura border. This has caused us to not be able to use the 1276-1282 MHz ATV channel, the 1288-1294 MHz ATV channel and 1240-1246 MHz channel in most of Southern California. We have been able to use the lower 4 MHz of the 1240-1246 MHz channel at Snow Peak. and low power on the 1288-1294 MHz channel at Santa Barbara because Santa Cruz Island is in the path between San Nicholas Island and Santa Barbara.

DENVER FAA RADAR: Colin, WA2YUN, has done some research on the radar that has been causing us RFI on the 23cm band. The radar is called a CARSR which stands for Common Air Route Surveillance Radar. It is a long range L-band radar with a range of 200 nautical miles. The various radars operate from 1.2 to 1.4 GHz with 50 kW peak power. The antenna rotation speed is 5 rpm, i.e. once every 12 seconds. The offending radar for us is located near Parker, Colorado. Here is the link Colin found:
http://www.fortwiki.com/Parker_FAA_Radar_Site

Decibel Math – Throw-Out the Calculator

--Roger Paskavan, WA0IUJ --



We all want to know how many dB of gain that antenna modification made. Yet, most amateur operators dread the thought of doing logarithmic calculations to try and get to the bottom of a gain or loss problem. There is another way of looking at decibels and only requires knowledge of simple arithmetic. In fact it is so easy that you don't even need a calculator. It can be done all in your head. So let's look into this not so new form of Ham magic. There is a non-calculator way to solve decibel-log problems in seconds without

using charts, tables or calculators. There is no need to involve algebra, just some addition and multiplication of simple numbers. First, here is some background on the "dB"..

The word Decibel dates to the late 1800's of Alexander Graham Bell and his research on the famous telephone. Alexander had a lot to do with measurements of audio and signal intensities in his work so he created a term called the "Bel." (One L intentionally missing). The problem with the Bel was its numerical size. It was a huge unit probably derived from the large signals needed in those days to operate the crude telephone equipment. With the modernization and efficiency of components, the same telephone services are now achieved with much lower signal levels. In honor of its inventor, the logical thing to do was to keep the unit of measure and apply the metric system to the Bel. So, the Bel was divided by 10 and prefixed with the word deci (meaning 1/10 in metric). This became the root of the word, deci-bel, later termed db. We now had a common way of expressing gain or loss in the form of a ratio between power, voltage or current. The B is only capitalized since it refers to Alexander's last name.

A decibel expresses the ratio between two values with the same dimensions. The quantities compared may be two power levels, two voltages, two sound pressure levels, and so on. Since the quantities in the ratio always have the common same dimension units, the dimensions cancel out; the decibel itself is dimensionless. But, dB measurements must be made between identical impedances to be accurate. For example, two power measurements must be on two 50 Ohm lines or 600 ohm line, etc. for the numbers to work.

Decibels can be used to express gain or loss between any number of antennas, amplifiers or two measurements. They can be utilized to show the input/output differences between two amplifiers or two antennas thus providing meaningful gain figures, etc. This article will deal with power measurement.

So now that I've defined some basics, let's look at a method of finding dB's without doing those painful logarithmic calculations. To begin understanding this method, you need to memorize three **key** numbers and their associated dB figures with a multiplier. **10 dB = 10 x, 6 dB = 4 x and 3 dB = 2x.** (x= times)
The Key number is telling you what to do with the power value when its related dB figure is used.

For **10 dB**, the key number is **10.** This means that for an increase or a +10 dB change, our power level would be multiplied by 10. For a decrease or a -10 dB change, we would divide by 10.

For **6 dB**, the key number is 4. This means that for an increase or a +6 dB change, our power level would be multiplied by 4. For a decrease or a -6 dB change, we would divide by 4.

For 3 dB, the key number is **2**. This means that for an increase or a +3 dB change, our power level would be multiplied by 2. For a decrease or a -3 dB change, we would divide by 2.

While it is quite easy to visualize 3 dBs as doubling the power, larger numbers follow the

same logic but it may not seem that way. It is more difficult to realize that an LNB with 57 dB of gain will have doubled the power of a 54 dB gain LNB. Anyway, you cut it, 3 dB is double your power. Remember, the power is doubled for every 3 dB and halved for every 3-dB loss. In my original example, we had to double the power 18 times to get to 54 dB's and then double once more to get to 57 dB. Remember, if you increase a 500 Watt linear amplifier to 1000 Watts that is still only a 3 dB gain even though the numbers are big.

By way of another example, a dish antenna with a 30 dB gain delivers one-tenth (1/10) the signal power of a larger dish having a 40 dB gain. The signal power at the dish focal point is multiplied by 10, four times to obtain **+40 dB** of gain. In 30 dB example, the dish antenna signal power was multiplied by 10, three times to get to a gain of 30 dB. (The difference is 10 dB or 1/10 the gain for the smaller dish.

A resistive power splitter loses 6 dB per port. What does this mean? With 6 dB gain or loss, the multiplier/ divider is four. This means that for a given signal power at the input, each output port will have a 6-dB loss because of splitting the signal. Since 6 dB is four times and this is a loss situation, the input power is divided by four at each port. Referring to signal power, if the RF drive signal input is 10 milliwatts, each port would measure 2.5 mW.

So, let's go through some worked examples of combining the key numbers, 3, 6 a 10 to figure dB's in your head and throw away the calculator.

Example 1: A UHF amplifier boasts a gain of 13 dB. If you put 4 watts of drive into this amplifier, what will be the power output? First, increase the level by 10 dB of the 13 dB (to 40 Watts). That's 4 watts times 10, then increase the 40 watts by the remaining 3 dB, which is 2x (double the 40 W). The answer becomes 80 watts output and no calculator.

Example 2: Your new UHF beam antenna has a gain of 7 dB. If we feed it with 4 Watts, what will be the radiated power? First, increase the level by 10 dB which is 40 W, then subtract 3 dB by dividing 40 by 2. You are now at 7 dBs gain and the answer is 20 Watts ERP.

Example 3: If you feed 10 Watts drive into an amplifier and you measure 25 watts output, how many dB gain is that? In your mind, run through combinations of dB equivalents. Utilizing the 10 W input power, figure the permutations that make 25 watts. The combination that worked was add 10 dB which is (10x) then subtract 6 dB (which is divide by 4) and the answer is 4 dB. (10 dB – 6 dB = 4 dB of gain.)

Example 4: You replace your old antenna with a new 9 dB VHF beam. If you feed in 1 KW, what will be your ERP output? Figure combinations that make 9 dB. Use 6 dB and 3 dB to make this work. (6dB + 3 dB =9dB) Six dB is a 4x multiplier and then add 3 dB which is a 2x multiplier. Your astonishing answer is 8000 Watts ERP. (1000 x 4 = 4000 then times 2 = 8000W) Scary!

Example 5: This one is wild, an LNB for an 13 cm satellite dish is stamped 43 dB gain. How many times is the input signal from space multiplied before it arrives at your receiver? First, use 10dB and 3 dB to figure this problem. Make the initial calculation 40 dB, then add 3 dB to get your final answer. 40 dB is 10db + 10dB

+10dB +10dB. Since its key number is 10, we multiply 10 x 10 x 10 x10 = 10,000 times, then you add 3 dB by multiplying the 10,000 x 2 = 20,000 times, which is your answer. That is a whole lot of gain in any device. (43 dB is a gain of 20,000 times)

As you can see **3, 6** and **10 dB** are fixed given ratios of power. By combining these three numbers in any number of combinations, most dB problems can be resolved without logs or a calculator. Keep in mind that for positive dB gain you multiply the ratios. For negative gain (loss) you divide the ratios.

If a fixed *numerical reference* is used in place of one of the ratios, then the Decibel becomes a measure of signal against some referenced standard which is called 0 dB. (Similar to par in a golf game)

For electronic calculations of power, the commonly used 0 dB references are:
0 dBm = 1 milliwatt (0.001 Watts) and 0 dBW = 1 Watt

This means that all gains or losses are above or below the given reference value. In this context, 20 dBm is 100mw (1mW x 10 x10) and 50 dBm would be 100 watts. (1mW x 10 x 10 x 10 x 10 x10) To make sense of this measurement, the reference must always be given. In this system, gain or loss utilizes the reference (0 dB) as one of the ratios. So your answers are numbers above or below that given reference.

dB measurements can also be used for voltages, sound pressure and current measurement but that is a topic for a future article. Hope the 2020 New Year brings you a new way of thinking about the age-old mystery, the decibel. 73 de Roger, WA9IUJ

Roger Paskvan WA0IUJ was licensed at age 15 in 1961 and has been a Ham for 58 years under the same call sign. He holds a B.S. degree in Industrial electronics, A Masters degree in Education and is employed as a 42 year professor at Bemidji State University, Bemidji, MN. He has taught engineering classes in broadcast radio and television for the past 42 years. Roger is a broadcast maintenance engineer and owns a number of AM and FM radio stations. Working in broadcast television, he also enjoys 20m SSTV and dabbles in fast scan 13 cm Ham TV. Roger enjoys reading about DVB-S2 transmissions and would like to build a DVB repeater. Waiting for a USA version of QO-100 that would really build DVB interest. He is a VE and offers ham classes, being responsible for hundreds of new licensed hams over the years. Roger can be contacted at: rogerp@paulbunyan.net

St. Louis ATV Repeater: The SLATS ATV repeater is a 70cm in-band, DVB-T repeater. They are using 4 MHz bandwidth, 16 QAM. Input is 440 MHz and the output is 426 MHz, vertical polarization. The output power is 15 Watts. Their antenna is on the top of an 80 ft. tower. They hold a weekly ATV net on Tuesday nights at 8pm local time. Their 2 meter intercom frequency is 144.34 MHz simplex. They are affiliated with ATN. For more info, check out their web site at: http://www.slatsatn.net/

SLATS W0ATN-TVR view from antenna and equipment rack

Ron, KO0Z - John, W0NZG - Gary, N0GL - Earle, WD0FCH

SLATS at WinterFest / ARRL Midwest Convention

The St. Louis ATV club had a display booth at the recent convention. They had three DVB-t demo stations running. They also displayed a new NPR-70 packet radio and the SM-1000 FreeDV/Codec2, HF digital voice adapter. Mel, K0PFX, gave a talk on digital ATV in a forum. Mel's comments were: "We attracted some attention. I believe I will l see a few new folks show up at the next SLATS meeting. Our web site is new this year and we have improved the repeater so this has helped. I did meet two TV broadcasters both engineers/hams and one is "Director of Technology." One offered what he called a

"high location" for a repeater which I presume is one of their towers." The offer of space on a high tower is BIG News !

SAN DIEGO ATV NEWS: Our two, new DATV repeaters that were installed in the City of San Diego over looking the bay [R1] and the twin unit installed in Oceanside [R2] in Febuary 2019 will both be a year old next month. We have had no issues with interference, operations, linking or remote access control. We are now upgrading our VR-Link Mobile/Portable cross-band repeater. We are getting it ready for our March field mobile exercise in San Diego County. We will be deploying four teams of three along the coast from Point Loma and one team up to Dana Point.

73 de Mario, KD6ILO

EQUIPMENT RECCOMENDATIONS
from Werner, WB6RAW

Item-1 A 300-500MHz 30dB Directional Coupler

This is a GREAT product for hams wishing to see a sample of their 70cm ATV signal with their spectrum analyzer, local TV, or measure it's power with a precision power meter like an HP 435 or HP436. The insertion loss is less than 0.2dB and the 30dB coupling value is very accurate across the whole specified band of 300-500MHz. It can handle up to 150watts and comes standard with Type-N connectors. Price is $150.

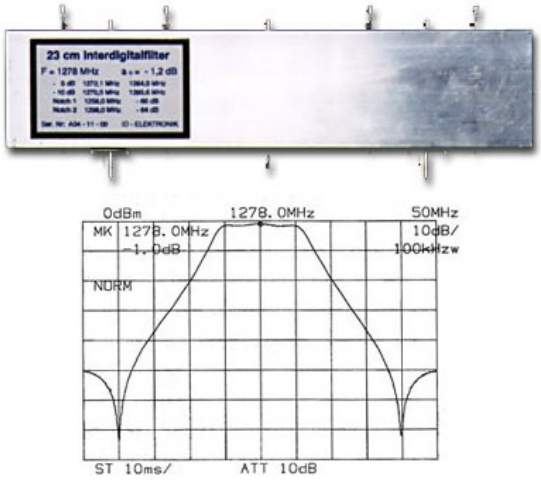
Item-2 A 350-2700MHz, 10dB Directional Coupler

This is another GREAT product for hams wishing to see a sample of their 70cm, 23cm or 13cm ATV signal with their spectrum analyzer, local TV, or a precision power meter like an HP 435 or HP436. I use an additional 30dB pad at the coupling port because this coupling value is so low at 10dB. Note: They also have other coupling values. The insertion loss for this unit is less than 0.9dB and the 10dB coupling value is very accurate across the whole specified band of 350-2700MHz. It can handle up to 300 watts

and comes standard with Type-N connectors. Price is $210. Both couplers are from the CSG company in India (www.csgnets.com)

Item-3 A Low cost 4-port HDMI & 2 port Audio switcher with special effects -- I recently ran across this great little NEW item on the internet and I was so intrigued with it that I ordered one. It comes with 4 HDMI input ports for video and one HDMI output port. It also has two audio input ports. The switcher can be used "stand-alone" to switch audio and video, but it also comes with free software that can be used for MAC, PC or Linux machines that offers chroma keying, titling and much more.The stand-alone video switching can do cuts, fades, pushes, FTB, FTW, PIP and much more. Not bad for under $300. No additional hardware is needed. This is amazing little product that runs on 12V and performs just as specified. I love it! It's a super GREAT value for $295. More details here at: https://www.blackmagicdesign.com/products/atemmini

23cm & 13cm BPFs & Duplexers



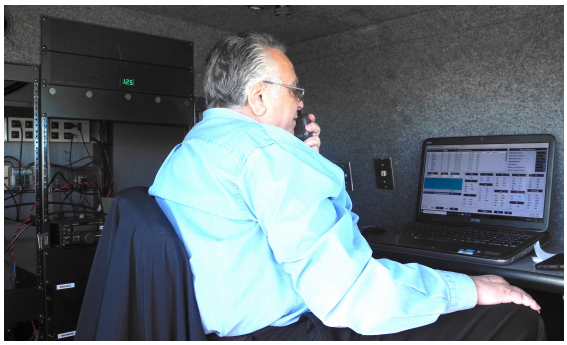
While reading the latest issue of the BATC's CQ-TV newsletter — I came across a mention of filters & duplexers from a firm I had never heard of before. Called ID-Elektronik Gmbh - in Karlsruhe, Germany. While I can not vouch personally for them -- they do have some interesting band-pass filters & duplexers for 23cm & 13cm bands. Also at pretty low cost at 80 & 130 Euros. Their web site is at: http://www.id-elektronik.de/en/

Are you wondering what to do with your old, obsolete, computers ? Well, check this out.

MOTHER - BOARD HOUSE ! ! !

Thanks - Larry, K0PYX

KG0EW Mobile Ham Van



Jack, WM0G, working the 20m pile-up
(Jack is our ARRL-Colorado section manger)

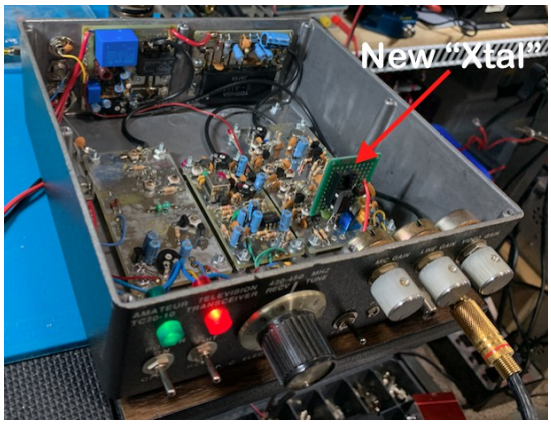
BARC WINTER FIELD DAY: Dave, KG0EW, did a bang-up job organizing the Winter Field operation for BARC. The operation used Dave's "new", actually a well used, surplus, TV station mobile van. Dave has converted it into his mobile HF rig. He had a great site in the 20 acre pasture of Roger & Naomi's, K0IHX & KD0PDZ, QTH on the top of Davidson Mesa. Totally flat land, high elevation and great take-off angle. The van's telescoping mast held a hex beam on a rotator for 20m and also supported 40m & 80m dipoles. The HF rig was an Elecraft K-2 putting out a whopping 15 Watts. From the great location and high beam antenna, the BARC station, W0DK, was able to command and hold a frequency on 20 meters and sit back and let the "Pile-Ups" call us. No hunt-n-pounce required.

When it was all over, W0DK's total score for the 24 hour Field Day was 8,357. This broke down as follows: 363 SSB contacts, 94 CW, 39 states, 54 ARL sections (6 in Canada), plus 3 DX (Germany, France, N. Ireland). Operation bonus points were: 1.5K - not on commercial power (used a battery), 1.5K for outdoors operation, & 1.5K for operating away from home out in the field.

Roger, K0IHX, video taped the Field Day operation and has put together a very nice, short, video. He played it for the last Boulder ATV net. He also plans to show it at the next BARC monthly meeting.

XTAL REPLACEMENT

Ever since International Crystal closed shop, hams have had grief finding crystals for their old rigs. Dave, AH2AR, has found a suitable replacement for 100MHz crystals for old P.C. Electronics ATV rigs. Here is what Dave has written: "I have finished up a small project that provides a solution for the unobtainable crystals for PC Electronics ATV transceivers. This



specifically resolved an issue for Ken, KC8EAT, since the transceiver he will be using did not have a 109.8125. MHz crystal installed. I'm surprised it works so well. No visible artifacts while transmitting and it's right on frequency.

The active component to the circuit is what WB8LGA recommended, obtained from DigiKey. It is a **TTL, programmable crystal oscillator model SGR-8002DC-PTC**. When ordering, you have to specify the desired frequency as DigiKey programs them.

The photo shows the board standing on end, inside the transceiver, right where the xtals normally plug in. It's getting its power source from an on-board 5 volt regulator that's energized only when power is supplied to the exciter. Cost is a low $6 including a 5 V regulator, capacitor and a trimmer cap.

I am very surprised it works so well. As a test, I installed one of these oscillators on the TC-70's second channel where the first channel had the original crystal on 109.8125 MHz. Switching quickly back and forth by flipping the frequency switch shows nearly no spectral differences (on the spectrum analyzer) when comparing the oscillator to the crystal, and unbelievably, the oscillator seems to provide better looking video by examination of the video coming out of a line sampler. It is also spot-on frequency with no perceptible signs of jitter or other artifacts, either on the spectrum analyzer or the received video. I put a 10-30 pF trimmer across the oscillator's output and ground, and a single 0.001 μF disc cap across the regulated 5Vdc that runs the oscillator, and that was all that was needed to get these results. — four parts total— TTL oscillator, 78L05 regulator, capacitor and trimmer. I built two, and both provided the same results. Quite remarkable..."

73 de Dave, AH2AR