VHF 101 and
VHF Contesting
A First Look at Weak Signal
VHF and Up

Loosely speaking, Amateur Radio is divided into two large pieces.

- The High Frequencies (HF)
- The VHF Frequencies and above.
  - We often call this VHF/UHF.
  - Or sometimes we use VHF+ to make certain that the reader understands that we are talking about the VHF frequencies and everything above.

The High Frequencies(HF)

- Strictly speaking, HF is from 3 MHz to 30 MHz. However, we normally include our 160M band, which is actually a Medium Frequency (MF) band
- In General, the HF bands tend to be
    - LONG RANGE BANDS

The HF Bands used for Contesting

- 160M - 1.8 MHz to 2.0 MHz
- 80M - 3.5 MHz to 4.0 MHz
- 40M - 7.0 MHz to 7.3 MHz
- 20M - 14.0 MHz to 14.35 MHz
- 15M - 21.0 MHz to 21.450 MHz
- 10M - 28.0 MHz to 29.7 MHz
  - Novice/Technician CW Sub-Band 28.0 to 28.3
  - Novice/Technician SSB Sub-Band 28.3 to 28.5

The Bands not used for Contesting

- 60M - Our only channelized band--5 channels, USB Only, 100 watts ERP, very specialized band
- WARC – World Administrative Radio Conference
  - 30M, 17M and 12M

WARC Bands

- 30M - 10.100 MHz to 10.150 MHz--200W MAX Power--CW and Digital ONLY
- 17M - 18.068 MHz to 18.168 MHz--CW Sub-band 18.068-18.110
- 12M - 24.890 MHz to 24.990 MHz--CW Sub-band 24.890-24.930 MHz

The VHF Frequencies(and UP)

In General, the VHF+ bands tend to be SHORT RANGE BANDS

THE BIG THREE:

- Six Meters (6M) – 50 MHz to 54 MHz (The Magic Band)
- Two Meters (2M) – 144 MHz to 148 MHz
- The 70cm Band – 420 MHz to 450 MHz (also just called 432)
- If you cover the Big Three, you probably have 98% of all of VHF

The VHF Frequencies

Six Meters (6M)

50 MHz to 54 MHz (The Magic Band)

- The Weak Signal part of the band is 50.0 MHz to about 50.5 MHz
- CW ONLY from 50.0 MHz to 50.1 MHz
- DX Window from 50.1 to 50.125 MHz--DX ONLY here
- SSB Calling Frequency is 50.125 MHz
- RANGE--This band can be very long range, sometimes thousands of miles. This band is called the Magic Band because it exhibits all the propagation modes that are seen on the HF bands AND all the modes seen on the VHF bands.

The VHF Frequencies

Two Meters (2M) – 144 MHz to 148 MHz

- The Weak Signal part of the band is 144.0 MHz to about 144.5 MHz
- CW ONLY from 144.0 MHz to 144.1 MHz
- SSB Calling Frequency is 144.200 MHz
- RANGE– Modest station 150 – 200 miles. Contest quality station 400 + miles on a daily basis
- FM Ops Please Note: 2M signals do not stop at 30 miles

The VHF Frequencies
222

The last VHF band

The 222 MHz band – 222 MHz to 225 MHz

- 222 is a great band. It is a quiet band and normally, you can work about as far on 222 as you can on 2M
- Calling Frequency is 222.100 MHz, both CW and SSB

The VHF Frequencies (and UP)

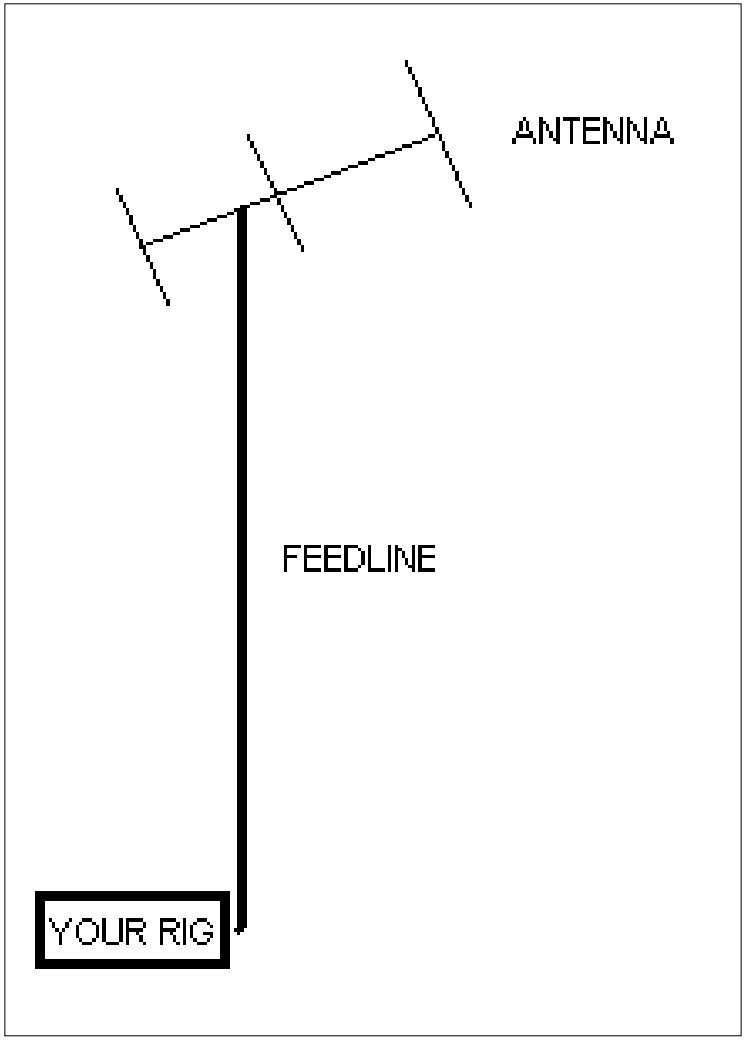
The 70cm Band – 420 MHz to 450 MHz (also just called 432)

- Most weak signal @ 432.000 – 432.200 MHz
- Call Frequency 432.100 both CW and SSB
- Range slightly less than 2M band with equal equipment

The Microwave bands

- The 902 MHz band
- The 1296 MHz band -- The most popular Microwave band
- The 2304 MHz band
- The 3456 MHz band
- The 5760 MHz band
- The 10 GHZ band
- Even Higher Bands

A Simple VHF Station v1.0



A Simple VHF Station v1.0

LMR-400 Coax

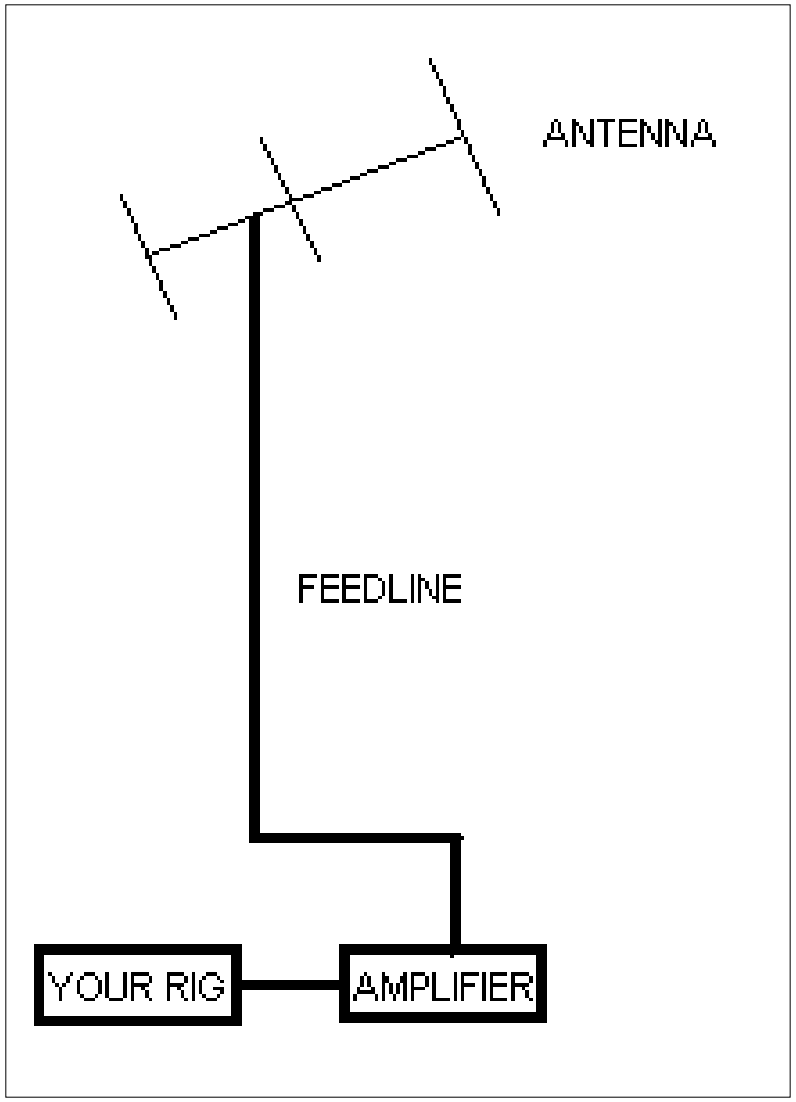
VHF Transceiver

VHF Horizontal Loop

or

VHF Yagi Antenna

A Simple VHF Station v1.1



A Simple VHF Station 1.1

VHF Yagi Antenna

LMR-400 Coax

VHF SWR Meter

Coax Jumper

VHF Transceiver

Coax Jumper

Power Amplifier

A Simple VHF Station

The Rig:

Single Band Rigs

Icom 551 and 551D -- 6M only rigs(not currently made)

Icom 251 and 251H -- 2M only rigs(not currently made)

Icom 271 and 271H -- 432 only rigs(not currently made)

Others

Multi-band Rigs:

Icom IC706MK2G -- HF + 6M + 2M + 432(Semi-Obsolete)

Icom IC7000 -- HF + 6M + 2M + 432

Yaesu FT100D -- HF + 6M + 2M + 432(Obsolete hard to find)

Yaesu FT736R -- 2M + 432 + two options (6M, 222, 1296)

Yaesu FT857D -- HF + 6M + 2M + 432

Yaesu FT897D -- HF + 6M + 2M + 432

Kenwood TS2000 -- HF + 6M + 2M + 432 + 1296(Optional)

Icom 746 & 746Pro -- HF + 6M + 2M(not currently made)

Icom 9100 – HF + 6M + 2M + 432 + 1296(optional)--Very expensive

A Simple VHF Station

The Antenna:

ALL Weak Signal work uses Horizontal Antennas

- **The Dipole:** Just two lengths of wire, OK for 6M, especially portable type use
- **The Loop antenna:** Basically a dipole bent into a circular shape, OK for 6M, 2M, and 432. A good mobile antenna
- **Beam Antennas:** Normally a Yagi, but could be a Quad. VHF/UHF beams are lightweight and much smaller than HF beams. This is good!

A Simple VHF Station

The Feedline:

- Carries the signal from the antenna to the receiver on RX
  Carries the RF from the transmitter to the antenna on TX
- Feedline LOSS is your enemy. The less LOSS the better
- In General, the smaller diameter the coax, the more loss. Larger diameter coax is better
- RG-58 -- Small coax, very lossy, can be used for short jumpers
- RG-8X -- A bit larger, still fairly lossy, good for jumpers
- RG-8 -- Approximately 1/2", now obsolete
- LMR-400 -- Approximately 1/2", lowest loss of that size
- Heliax -- Lowest loss of all coaxial cables. Common sizes are
- 1/2", 7/8", and 1 5/8". Requires special connectors

THE BIGGEST MISTAKE MADE BY VHF ROOKIES IS USING CRAPPY COAX

VHF Contesting and Contests

4 MAJOR CONTESTS IN THE US

ARRL January VHF Contest
ARRL June VHF Contest
CQ WW VHF Contest in July
ARRL September VHF Contest

Minor US Contests
Spring and Fall sprints
UHF Contest
EME Contest
10GHz and up Contest

VHF Contesting and Contests

Scoring is QSO points X Multipliers(except rovers). The Multiplier is unique grids—so EM13 worked on 6M, 2M, and 432 counts as 3 unique grids. If you work 100 stations in your grid on 6M, you have 100 points. If you work 100 stations in 100 unique grids, you have 10,000 points. DO THE MATH!

QSO Points:

Band	6M	2M	222+432	902+1296	2304 and up
Jan	1	1	2	4	8
June	1	1	2	3	4
CQ	1	2	Only 6M and 2M used in the CQ WW Contest		
Sept	1	1	2	3	4

VHF Contesting and Contests

OPERATOR CLASSES in the ARRL Contests

Multi-Multi – All bands, multi-operator, high power

Limited Multi – 6M+2M+222+432, multi-operator, high power

Single Operator(High Power)

Single Operator(Low Power)

Single Operator(Portable)--10W or less

Single Operator(Three Band)--6M + 2M + 432

Single Operator(FM Only)

Limited Rover—Lowest 4 bands only

Classic Rover

Unlimited Rover

Lots of Wallpaper goes begging here

VHF Contesting and Contests

ARRL Contests

The ARRL has NO Assisted Classes in VHF Contesting. We are trying to change this. CQ has much better rules in this regard.

Currently, Multi-Op stations may LOOK at the Internet, but cannot post anything there.

Single Op Stations may not even LOOK at the Internet.

BEGIN RANT BY PRESENTER

These ARRL rules are hurting VHF contesting and should be changed. Please help us do so.

END RANT

VHF Contesting and Contests

The CQ WW VHF Contest

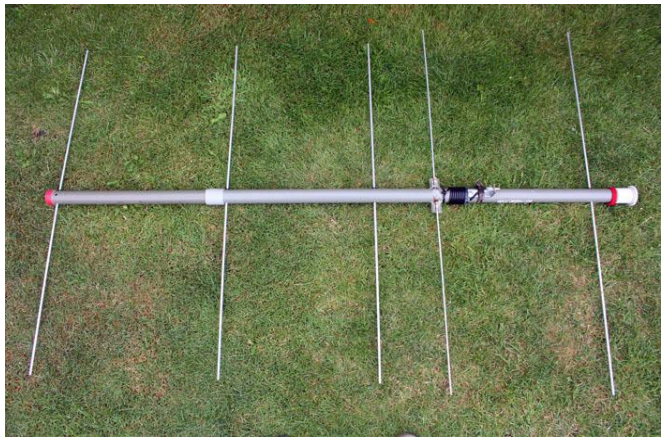
Only 6M and 2M may be used. This is truly an International contest as all nations have 6M and 2M. Thailand turns in thousands of QSOs each year on 2M—and they have a 10W power limit!!

CQ has much better rules concerning Assistance. ALL stations may LOOK at the Internet resources.

CQ permits digital meteor scatter and digital EME stations to post their Call, Frequency, and Sequence ONLY to Internet resources. They call this Active Assistance.

In my opinion, the CQ WW is the best VHF contest that we currently have.

VHF Fixed or Mountaintop Station:



Rovers-Put Your Station in Your Vehicle

Rovers are rare in HF contesting, but are very important in VHF contesting

The Simple Rover

- Simple Rovers rigs cover 6M, 2M, and 432. Others optional.

Antennas: are normally whips, loops, or small yagi's

- 6M Whip antenna -- 5/8th wave 2M FM antenna is perfect for 6M
- 2M Loop antennas -- There are several different choices here
  - M2 HO loop -- www.m2inc.com
  - KU4AB loop -- www.ku4ab.com
  - KB6KQ loop -- www.loopsnmore.com
  - Delbert loop -- www.delbertloops.com
- 432 Loop antennas -- Same manufacturers as above
- Dual 2M + 432 loop: E-Factor loop by WT4E www.efactorantennas.com
- Cheap Yagi's by WA5VJB: www.wa5vjb.com/yagi-pdf/cheapyagi.pdf
- These are superb small yagis for rover operations.

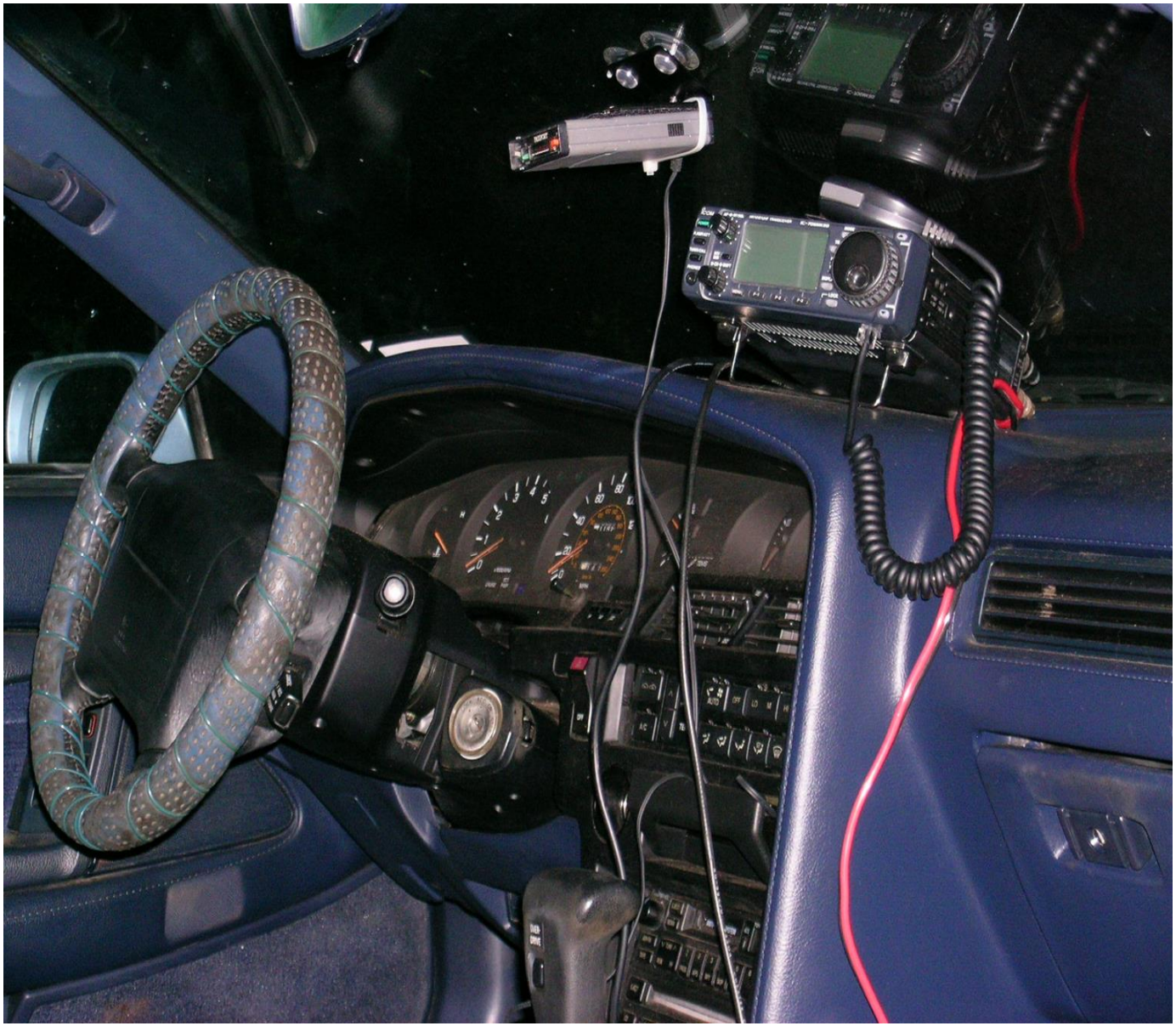
The Limited Rover Class in Contests:

- Limited Rover Class for contests is the "Lowest 4 bands" allowed
- January, June, and September contests = 6M, 2M, 222, and 432 MHz
- August UHF contest = 222, 432, 902/903, and 1296 MHz
- There are power limitations, so read the rules carefully
- There are NO limitations on antennas (be innovative)

Mag Mount 6, 2 and 432 on Simple Rover #1

Mag Mount 144/432 MHz on Simple Rover #2

Inside Simple Rover #1



Rovers--Put Your Station in Your Vehicle

Simple Rovers:

- As stated, these rovers are “quick and easy” to set up.
- They are a good way to introduce roving fun to those that have never done roving.
- This is a quick way to add some points and maybe a multiplier or two to you score.
- Great for pumping up your Club Score

Rovers-Put Your Station in Your Vehicle

More Complex Rovers:

More complex rovers primarily are about having more bands. Sometimes, a LOT more bands!!

Common Configurations:

- 6M, 2M, 222, and 432(The Limited Rover Class)
- Some people call these bands the "Low Bands"
- 6M, 2M, 222, 432, 902/903, and 1296
- So this is the Low Bands + the first two microwave bands 902 MHz and 1296 MHz
- Some parts of the country use 903MHz rather than 902MHz

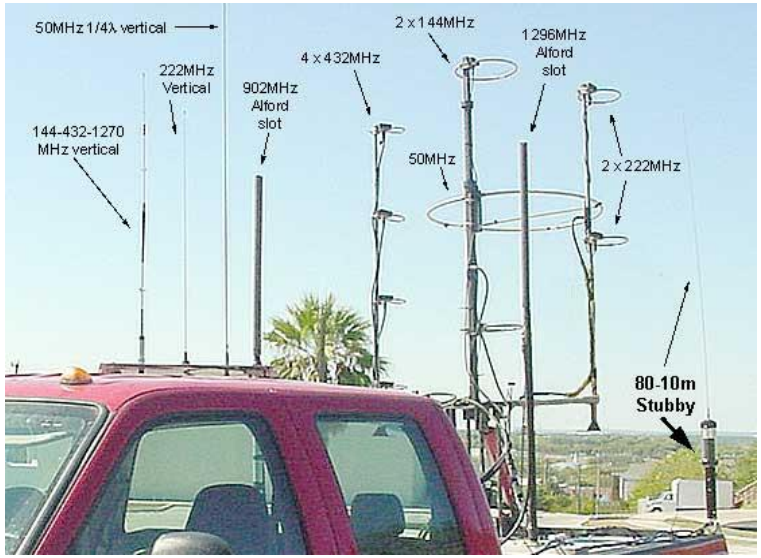
Rovers--Put Your Station in Your Vehicle

More Complex Rovers means more bands in the vehicle:

Adding the higher microwave bands

- 2304, 3456, 5760, 10GHz, and higher
- Not for VHF Rookies
- Expensive--requires special equipment and antennas

Complex Rovers—Some on steroids, I think



Complex Rovers:

Complex Rovers

Steve & Sandra

From DEMI

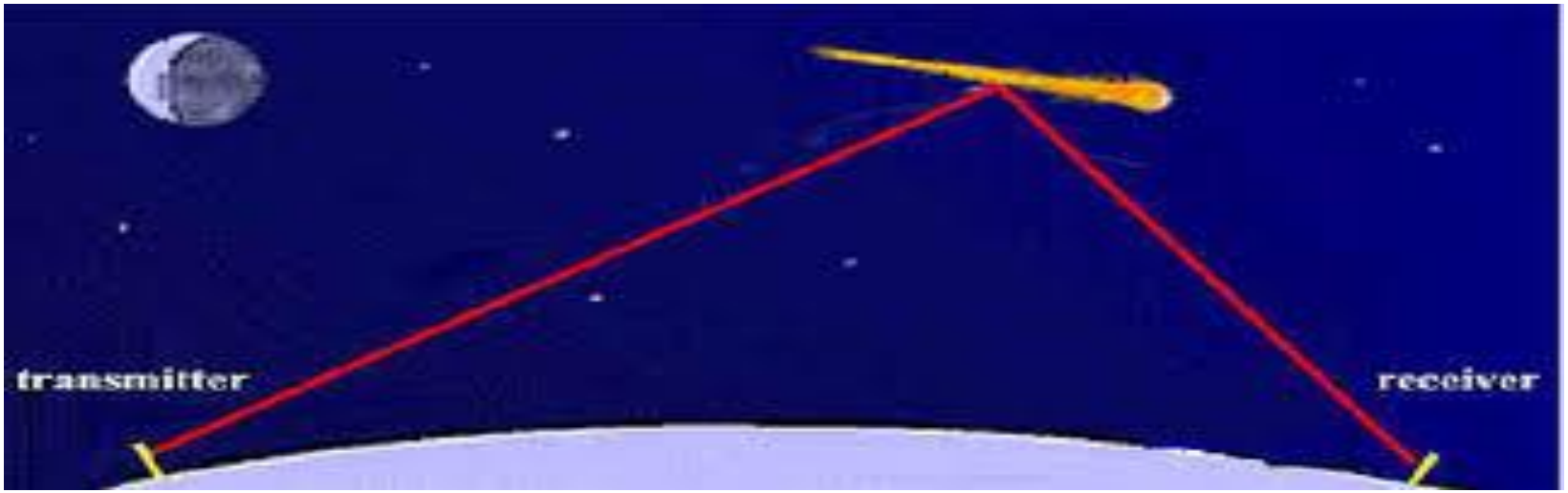
FUN MODES USED IN VHF CONTESTING AND EVERYDAY USE TOO

METEOR SCATTER—Bouncing your signal off meteor trails in the atmosphere

Moonbounce(EME)—Bouncing your signal off the moon.

These modes are not seen in HF contesting but they are a lot of fun and can put a lot of “rare” grids in the logs.

METEOR SCATTER



Meteor Scatter signals are often quite strong, but they are essentially random in time. You never know when a burn will occur.

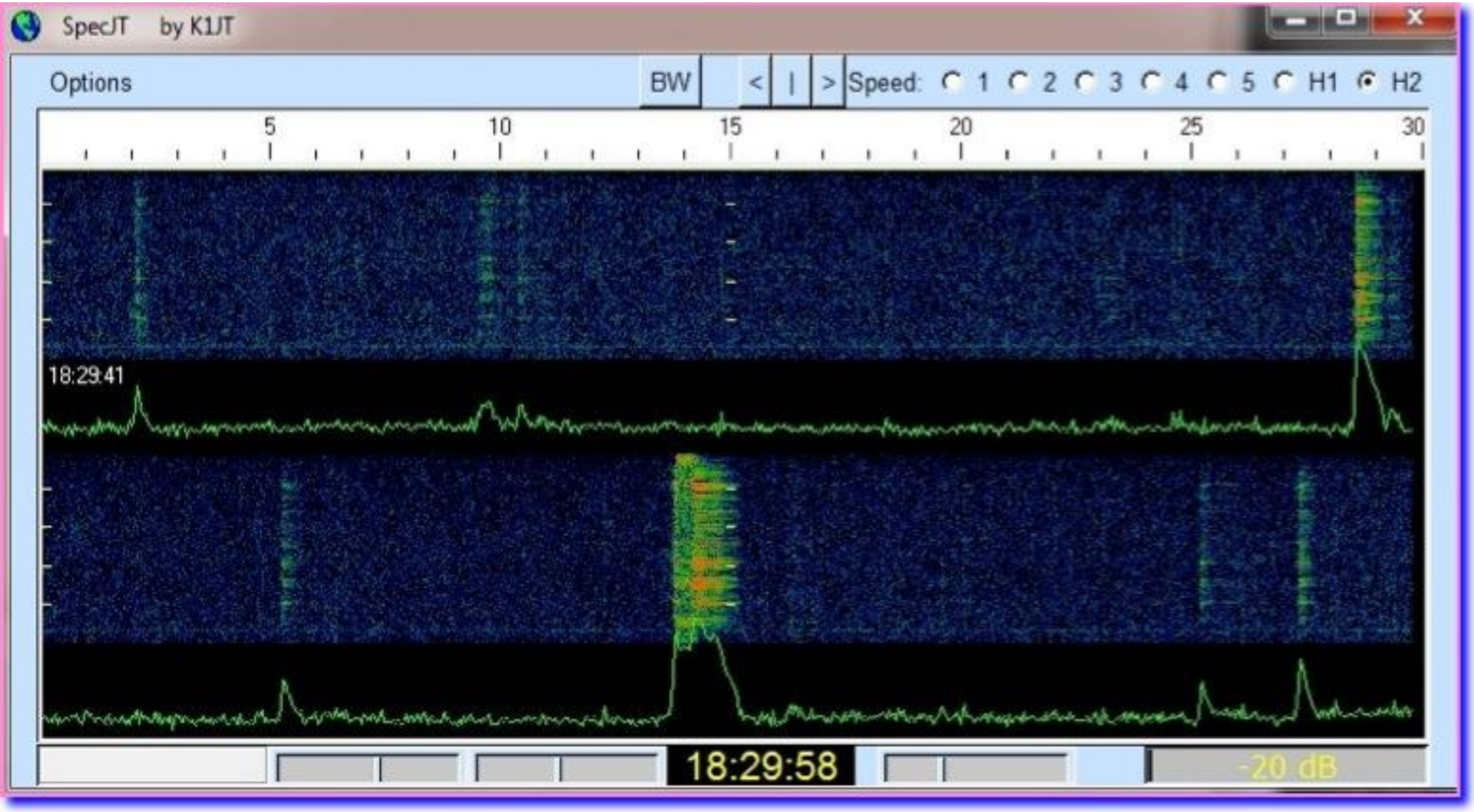
FUN MODES USED IN VHF CONTESTING AND EVERYDAY USE TOO

METEOR SCATTER—Software used is WSJT using the FSK441 mode. It is optimized for "bursty" type propagation.

What a burn that must have been!!

Meteor Pings seen in the SpecJT Waterfall

These are fairly small meteor burns but will make an easy QSO. Most will carry a full set of calls.



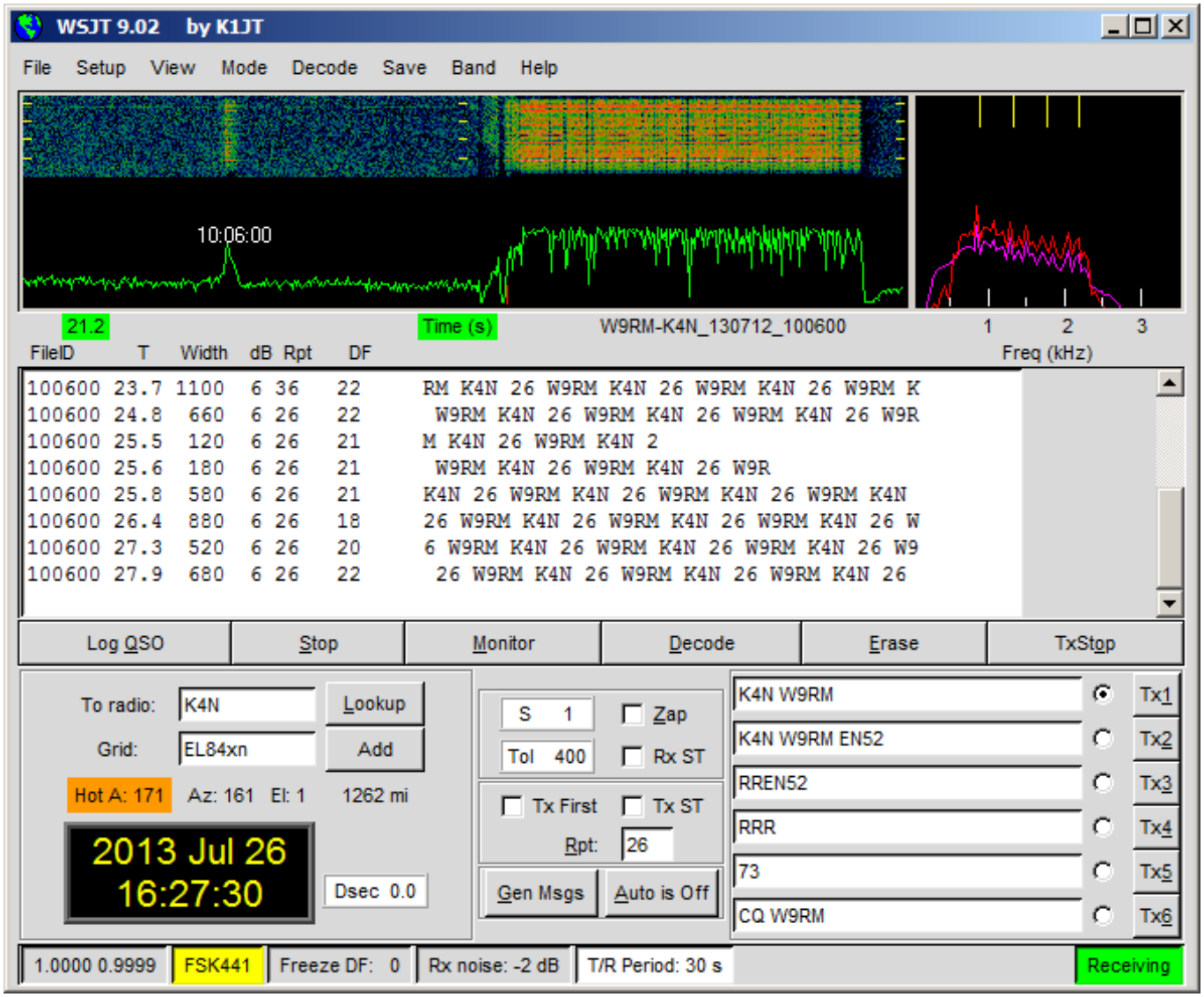
Here is a Recording of the Sound of a 2M FSK441 Meteor Scatter Signal

This signal was from our DXpedition to EL84 off the FL Keys. From EL84xn to EN52rc is 1265 miles.

This was done with a single M2 2M12 and 300W off the boat in EL84 on a “plain jane” day in July, 2013.

It does not get any better than that...what a burn!!

K4N to W9RM on 2 Meters



STATION REQUIREMENTS FOR METEOR SCATTER

6M—The easiest band for meteor scatter(MS)

- **Small Station—3el beam and 100W. You can work a lot of stuff with this station, but of course, more is better.**
- **Medium Station—5el beam and 200-300W**
- **Big Gun Station—7el beam / stacked 5el and 1000W**
- **Don't put the antenna up too high. 30-40ft is optimum for most contacts. Only for very long distance contacts(>1200 miles) should the antenna be up high.**
- **Good for 30-40 extra grid multipliers at night in a contest**
- **Contacts from 500-1000 miles are fairly easy**
- **Contacts up to 1400 miles are possible in a good shower**

STATION REQUIREMENTS FOR METEOR SCATTER

2M—Harder than 6M but still quite workable

- **Small Station—5 or 7el beam and 50W**
- **Medium Station—9 or 12el beam and 200-300W**
- **Big Gun Station—Stacked 12el or long yagis and 1000W**
- **Don't put the antenna up too high. 30-40ft is optimum for most contacts. Only for very long distance contacts(>1200 miles) should the antenna be up high.**
- **Good for 15-20 extra grid multipliers at night in a contest**
- **Contacts from 500-1000 miles are fairly easy**
- **Contacts up to 1400 miles are possible in a good shower**

EME IN CONTESTS

You can work 50-60 EU stations on 2M using EME. Nothing beats putting 50+ grids in the log from Germany, The Netherlands, Russia, Italy and so on. This is an advanced technique, but well worth the effort in a contest. We routinely average 50 unique grids via EME.

4 x 12el and 1000W will work anything in the world

Software is WSJT using the JT65 protocols

- **JT65A for 6M**
- **JT65B for 2M, 222, and 432**
- **JT65C for 1296**

IT HELPS TO HAVE ONE OF THESE.....

Questions?

Thank You!