founded 1970

THE BULLSHEET

Official News Bulletin of the

Texas DX Society

An ARRL Affiliated Club

April, 1987
Volume XI
Number 4

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TDXS Officers

President:	K5TU Kim Carr
V. President:	K5GN Dave McCarty
Secretary:	KE5IV Ken Grabenstein
Treasurer:	KG5U Dale Martin

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ANNOUNCEMENT

MEETING NOTICE- The Texas DX Society meets the second Friday of each month except when changed by the Board of Directors. The April regular meeting will be on Friday, April 10, 1987 at the new Demontrond Motorhome Sales at 6015 Hillcroft where Jay Marks Mazda used to be. Directions can be obtained on 147.36. We may be a little short on chairs so bring one if you can.

LEE NORMAN

As you have probably heard, Lee Norman has recently undergone a very serious operation to remove a tumor from his lung. He developed pneumonia while in intensive care after the operation and has had a very tough time. We are happy to report that Lee is now out of intensive care and beginning to slowly regain strength. He is in the Southeast Memorial Hospital, room no. 346 and his phone number is 929-4346. Calls should be kept brief for the next week or so. I can speak for the entire club in saying we are greatly relieved to see Lee getting better and we send our best wishes for a speedy recovery.

CONTESTS

With contest season almt over only the results and an occasional "odd" contest remain for the next few months.

Up coming contests:

April 11-12	North American QSO Party (SSB)
April 25-26	Helvetia Contest (Swiss, but not cheese) work HB9s give RST+Nr.
May 2-3	County Hunters SSB-Work mobiles at:3.870-80, 7.235-45 & 14.265-75
May 9	CQ-M USSR contest-2100 May 9th to 2100 May 10th both modes 3.5 -10 meters. Work stations once per band regardless of mode. Single band entries OK. Give RST+Nr. All the UA countries will be on. Be sure to send in a log as UAs only get credit for verified QSOs.
May 30	QRP ARCI Hootowl Sprint (This could be big!)
May 30-31	CQ WW WPX (CW)

Results and rumors:

Official:

ARRL 160 Contest

K5LZO	Single Op.	167 x 50 = 16,700		1st S. Tx.
KN5H	Single Op.	69 x 30 = 4,140		In 3 hours!
NR5M	Multi Op.	706 x 78 = 117,156		1st S. Tx.
K5NA	Single Op.	1084 x 111 = 300,588		1st & new record!

Rumors:

ARRL DX (CW)

NR5M	Multi-2	2600 x 347	
XE2FU	Multi-2	5600 x 330	
W5ASP			

ARRL DX (Phone)

KE5FI	Single- 10	189 x 40	
NR5M	Multi-Multi		1st Multi-Multi
K5GN	Single Op.	25 x 15	
K5RVK	Multi-Sing.		

CQ WW WPX (Phone)

KE5FI	Single Op.	1240 x 555
KG5U	Single Op.	1095 x 520
K2TNO	Multi-Sing.	
NR5M	Multi-Multi	2400 x 780
WV5K(K5LZO)	Multi-M	

North American QSO Party (CW)

NR5M (K5GN)	Single Op.	490 x 167
KG5U	Single Op.	441 x 147
K5LZO	Multi Op.	981 x 210

Get the Multi-Multi plans going for CQ WW WPX (CW)!

MADISON SPRING FLING

New rigs and old favorites, plus the best essential accessories for the amateur.

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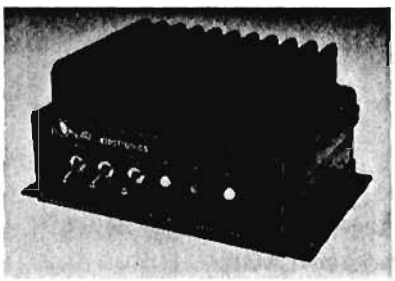
1-713-520-7300 OR
1-713-520-0550
TEXAS ORDERS CALL COLLECT

ALL ITEMS ARE GUARANTEED OR SALES PRICE REFUNDED

EQUIPMENT

Kenwood TH205AT	Trade in your old HT
Kenwood TS 440	Call for trade
Icom R7000 25-2000 MHz	949.00
Icom IC735	849.00
Ten-Tec 2510 (Easy OSCAR)	439.00
KOK FM 240 NT	279.00
Milago Amps	15% OFF
Tokyo Hy-Power HL1K AMP No. 4CX250B	699.00



Lunar 2M4-40P	109.00

ACCESSORIES

B&W VIEWSTAR ANTENNA TUNER	89.95
Heil HC3/HC4/HC5	Stock
Heil BM10 Boom Mike headset	CALL
Tri-H 5000A Remote Phone	$189.00
Triplett 3360 VOM (same as FLUKE 77)	69 00
Daiwa NS660A 30/300/3000 watts	135.00
Alinco ELH 230D- Excellent buy	88 00
Nye MB5-A (for the big boys!)	529.00
Shure 444D	54.95
Ameco PT-2	84.95
New Tokyo HC 200A	115 00
Nel-Tech Labs Digital Voice Keyer DVK 100	335 00
Astatic SilverEagle & Base	66.00

BELDEN

9913 low loss, solid center, foil/braid shield	51c/ft.
8214 RG8 Foam	45c/ft.
8237 RG8	39c/ft.
8267 RG213	55c/ft.
8000 14 Ga stranded copper ant. wire	13c/ft.
8448 8 conductor rotor cable	33c/ft.
9405 Heavy duty 2-16 Ga 6-18 Ga	56c/ft.
9258 RG8x	20c/ft.
9269 RG-62A/U	16c/ft.
8403 Mic Cable, 3 condctr & shield	45c/ft.
100 feet 8214 w/ends installed	54.00
8669 7/16" tinned copper braid	1.00/ft.

AMPHENOL

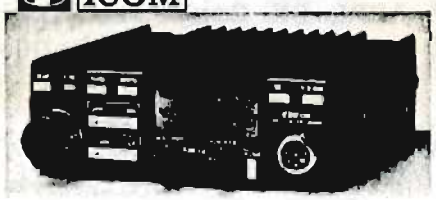
831SP-PL259 Silverplate	1.25
UG176 reducer RG8X	.30
831J Double Female UHF	2 00
82-61 N Male	3.00
82-97 N Female Bulkhead	3.00
82-63 Inline Female N	4.00
82-98 N elbow	9.00
31-212 BNC-RG59	1.50
31-216 UG201 A/U N Male-BNC Female	2.00
31-2 BNC-RG58	1.50
34025 N Male, RG58	3 00
34125 N Female UHF male	9.00
3128 BNC Female-PL259	3 00
4400 N Male-50 239	7.00

PACKET POWER

AEA PK-232	299 00
Kantronics KPC 2400	299.00
Kantronics 2400	139.00
Kantronics Packet II	149.00
MFJ 1270	125.00
AEA PM-1	149.00
New AEA UDC-232 Firmware, No modem, List 279.00	249.00
New Kantronics KAM	299.00

See you at Dayton Flea Market, Spaces 2435-37.

ICOM



IC28A	List 429	Your Cost 369.00

ANTENNAS

Isopole 144 MHz	44 95
AOP-1, Complete Oscar Antenna	149 95
Butternut HF6V, 80-10 vertical	125 00
HF2V, 80 & 40 vertical	119.00
HF4B	189.00
Hustler G7-144	119 95
Hustler 6BTV	139 00
KLM HF World Class Series Antennas	Call Don
Alpha Delta Twin Sloper	49 00
Coax Seal	2.00/roll
B&W Dipoles	Less 10%
KLM KT-34A	399.00
W2AU, W2DU	Now Available
NEW KLM 1.2-44LBX	129 00
1296 Power Divider	Soon
Orion CD-78 + BS 80 75/80 rotatable dipole	299.00
GSRV	44.00

OTHER ANTENNAS

Diamond D-130 Discone 25-1300 MHz	79 00
Larsen Kulduck	17 00
Larsen 2M ¼wave telescope ant	25 00
Avanti AP151.3G on Glass Antenna	36 00
Anteco 2M, 5/8, Mag. Mount, Comp	25.00
Orion 2M 1/2 wave Handy Antenna	19 00
Van Gordon SLA-1 160-80-40 Sloper	44 00
Valor AB 5 Mobile	79 95
Stoner DA100 D Active Rx Antenna	190 00
DC Tenna Hitch 3/8-24 Thread Fits 3/4" trailer hitches	29 95

KEYS

Bencher & Vibroplex	Less 10%
Bencher is now improved. Screws & springs, all stainless steel and extra hand polishing	
Nye ESK-001 Keyer	58 00

TUBES

Collins & Drake Replacement tubes	Stock
GE 6146B	12.95
3-500Z	109.95
GE Industrial Tubes	Call
GE 12BY7A	7 00
GE 6JS6C	12 95
GE 8950	16 00
12JB6 Sylvania	6 00
Hard to find Tubes 50-90% off list	
6JB6A	9.95
6JE6C/6LQ6	9 95
572B	69.00

BOOKS

We stock SAMS, TAB, ARRL, RSGB, Ameco Radio Pubs	Call
New 1987 Radio Database Book - International SW plus reviews	12 95

PARTS

1.5 Amp/400V full wave bridge rectifier	1.95
2.5A/1000PIV Epoxy diode	29 each or 19.00/100
.0015/10KV or .001/20KV	1.95 each
3N201	.95
4 inch ferrite rod	1 95
365pF cap	1 95
Sanyo AAA,AA Nicads w/tabs	2.00
2,4,5,6,8 pin mic plugs	3.00
1/8, 1/4, watt carbon resistors	.05 each
Meters 0-3000 VDC 2½" Square 0-1 Amp DC	9.95
Drake--Collins mike plug	2.00
Thousands of panel meters	3.95 up CALL
MICA Cap .0004/3KV	5.00 others CALL
Close out on rigs & accessories. All the time	Call
We may have what you're looking for.	
Diodes 3A/1000 PIV	.29
Duracell 9 Volt Battery - 2 Pak MN1604	3.49
DC Fan 3½" Sq. x 1"	9.95
CINCH 12 pin conn fitz (Drake etc.) female	3.00

SERVICES

Complete KWM 2 Rotube	179.00
Flat tee Collins rebuild	Call

USED EQUIPMENT

All equipment, used, clean, with 90 day warranty and 30 day trial. Six months full trade against new equipment. Sale price refunded if not satisfied.

KWM 380/2CW
ETO/ALPHA 77, Clean
ICOM IC 745
TenTec 505 Argonaut
YAESU FT 101E
YAESU FT 901 DM/CW
Kenwood TS-830S/CW
TS-430S/acc
TS-520S
Drake TR4cw, clean

Call for latest used gear list (800) 231-3057

TOWER ACCESSORIES

1/4" E H S Guy cable, Rohn US, 1000 ft	250 00
3/16" E H S cable, Rohn US, 1000 ft.	210 00
1/4" Guy Cable, 6100 #7 x 7 strand, import	18c/ft
3/16" Guy Cable, 3700 #7 x 7 strand, import	15c/ft.
3/8" x 6 E&J Turnbuckle	7 95
3/16" Wire Rope Clips	40
1/4" wire clips	50
1/4 Thimbles	45
Porcelain 500D Guy Insulator (3/16)	1.99
Porcelain 502 Guy Insulators (1/4)	3.39

POLICIES

Minimum order $10.00. Mastercard, VISA, or C.O.D. All prices FOB Houston, except as noted. Prices subject to change without notice. Items subject to prior sale. Call anytime to check the status of your order. Texas residents add sales tax. All items full factory warranty plus Madison warranty.

NEW AMPLIFIER LINE

Coming soon. How to buy a portable transceiver. The factors in order are: size, features, reliability, parts availability outside USA. Call for information.

BIRD

STOCK ITEMS CALL

Power Range	Frequency Bands (MHz) 2-30	21-60	50-125	100-250	200-500	400-1000
5 watts	—	5A	5B	5C	5D	5E
10 watts	—	10A	10B	10C	10D	10E
25 watts	—	25A	25B	25C	25D	25E
50 watts	50H	50A	50B	50C	50D	50E
100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
1000 watts	1000H	1000A	1000B	1000C	1000D	1000E
2500 watts	2500H					
5000 watts	5000H					

MADISON
Electronics Supply
3621 FANNIN
HOUSTON, TEXAS 77004
1-713-520-7300 OR 1-713-520-0550

Now ICOM. Call on the IC-μ2AT, IC-38A, IC-03AT

CONTEST QUIZ
(de KN5H, K2VV & NCJ)

Now that the 1987 ARRL DX Contests are over, here is a quiz you can take to see if you learned anything.

1. The loudest station calling you in the pileup will:

   a. be a dupe
   b. send the slowest
   c. want the rules explained to him
   d. want a phone patch to Miami

2. The station you spend 10 minutes trying to pull out of the noise on 160 meters will:

   a. be a dupe
   b. be a KA8 that wants to know your county
   c. be a WD6 running 2 watts who wants your QSL for WAS
   d. be a spur from that Multi-Multi across town

3. A new multiplier calling you at the end of the contest will:

   a. sign his call two different ways and then disappear
   b. give you his name, address, rig, weather and sister's phone number
   c. be followed by two different stations from the same country
   d. say he's not in the contest but you're loud in Maputo

4. A rare station calling CQ test will:

   a. QSY when more than three people call him at once
   b. be called by his QSL manager and start a long QSO
   c. start going by call areas and QRT after 107 W4's
   d. change bands with the first Multi-Multi who calls him

5. During that great European opening:

   a. anyone 20 db over S9 will repeat everything 3 times at 10 WPM
   b. anyone weaker than S3 will send your report once at 40 WPM and immediately QSY
   c. the rarest station will send your call 3 times and fade into the noise
   d. you wont get an answer to any CQ's but when the ZF2 calls CQ on your freq., the whole world calls him

6. During the contest:

   a. at least three rare stations will call you on 20 and compliment you on your 160 meter signal - too bad you did not hear them
   b. the multiplier you really need on 10 will only have a 20 meter dipole
   c. a rare multiplier will show up on the transmit freq. of another rare one who is smart enough to operate split
   d. you will call and call that rare one on 160 only to find that the guy operating before you was using the dupe sheet as a floor mat

7. Your 20 meter beam:

   a. will always be pointed 180 degrees away from the multiplier you just found
   b. will be pointed at ZL when the rotor breaks
   c. will develop an intermittent at sunset
   d. will not work on 80 even though you been trying to work people with it for 10 minutes.

8. If you say "only the station with Juliet in the call:"

   a. all the JA's will stop calling you
   b. all the Europeans will keep calling you
   c. the Italians will turn up their processors
   d. a WD9 from a small town outside Chicago will attempt to become your penpal

9. The rarest DX-pedition of the contest will:

   a. not get on until the last hour of the contest and only concentrate on 160
   b. give his QSL manager after every QSO
   c. call 3 CQ's after every QSO
   d. give his call every 20 minutes and then say he is still maritime mobile

10. At the end of the contest you will:

   a. find that you never worked a LU on 10
   b. find your 20 meter rotor control box needed an additional 30 degrees added to it's readout before the contest started
   c. find that the reason you never got those last 3 multipliers on 40 was because you were still on USB
   d. smell something very distressing and its coming from that brand new amplifier you borrowed

DX Report
(de WI5P)

COUNTRY - CALL - ZULU - FREQ

ALAND IS. - APRIL 17-25 - ALL BAND
KAMPUCHEA - XU1SS - 0100 - 7.088
BENIN - 3X0HSH/TY - 2100 - 14.160
LIBYA - 5A0A - 1845 - 14.006
BRUNEI - V85AA - 1400-1600 - 40CW
MALAWI - 7Q7LW - 0400 - 7.005
C. AFRICA - TL8NW - APRIL -
MAURITIUS - 3B8CF - 0130 - 3.506
CHATHAM - ZL7DE - 1400 - 3.506
MELLISH - VK0MW - AUGUST
CHRISTMAS - KH6GDR/T32 - 0200 - 14.178
SENEGAL - DK7PE/6W - 160 M
CHILE - 3G87PAX - APRIL 1-19 - ALL BAND
SOMALIA - T52JL - 1800 - 14.188
CHINA(Z23)- BY0AA - 0030-0200 - 14.024
SRI LANKA - 4S7RO - 1200 - 7.006
CROZET - FT8WA - 1330 - 7.006
SUDAN - ON7IP/ST2 - 2100 - 14.160
DESECHEO- NP4TB/KP5 - April 17-19
SVALBARD - SP5EXA/JW - JUNE - AUGUST
EGYPT - SU1ER - 1800 - 14.227
TANZANIA - 5H3ZR - 2030 - 14.002
(FJL)UA - UA1ODX - 2300 - 20 CW
- 0100 - 40 CW
ISLE OF MAN - APRIL 11-23 - ALL BAND
TOKELAU - ZK3PM - 0200 - 14.309
JOHNSTON - KN4BPL/KH3 - 0600 - 1.846
TURKEY - TA4A - 0300 - 3.505
TROMELIN - FR5AI/T- APRIL

WHAT'S WHAT DEPT. - Work some strange prefixes? Wonder where they are? Maybe the listing below will help you. We are right in the middle of the DX contest season and perhaps this listing will help you to identify some multipliers.

This update incorporates the last comprehensive listing I published some time ago plus everything I have come up with since that time. A number of you commented that you have posted the last listing at your operating position, so I have conveniently printed this one all on one page.

A8.....same as.....EL
AZ1.....same as.....LU
AD5.....same as.....EA5
BA.....same as.....BY
BT.....same as.....BY
CN11....same as.....CN8
CQ.....same as.....CT1
CR.....same as.....CT1
CR9.....same as.....CT3
CS.....same as.....CT1
CU1-0...same as.....CT2
CV0.....used to be..CX
DV.....same as.....DU
EB.....same as.....EA
ED.....same as.....EA
EE.....same as.....EA
EF1.....same as.....EA1
EF0.....same as.....EA1
EH1.....same as.....EA
EH9.....same as.....EA9
EJ.....same as.....EI
FB.....used to be..F
FD.....used to be..F
FE.....used to be..F
FF.....used to be..F
FT8.....used to be..FB8
GV.....same as.....G
GV4.....same as.....GU4
HJ0.....same as.....HK0
HJ3.....same as.....HK3
HL.....same as.....6S
J2.....used to be..VP2G
J4.....same as.....SV
J42.....same as.....SV1
J6.....used to be..VP2L
J7.....used to be..VP2D
J8.....used to be..VP2S
JV.....same as.....JT
JV.....same as.....JF
LF2.....same as.....LA2
LY4.....same as.....UA4
OT.....same as.....ON
P4.....used to be..PJ3
P40.....same as.....PJ2
RT7.....same as.....UB5
RT0.....same as.....UB5
S0.....same as.....SM
SO.....same as.....SP
SW2.....same as.....SV2
SW3.....same as.....SV1
SX..... same as.....SV
SZ.....same as.....SV
T4.....same as.....CO
T5.....used to be..60
T7.....used to be..MI/9A1
TE.....same as.....TI
TK.....used to be..FC
TV.....same as.....F
TV.....same as.....F
V2A.....used to be..VP2A
V3.....used to be..VP1
V4A.....used to be..VP2K
V8.....used to be..VS5
VI.....same as.....VK
VX6.....same as.....VE6
XJ.....same as.....VE
XP1.....same as.....XQ1
XQ.....same as.....ZD
XQ.....same as.....CE
YQ0Z....same as.....CE0Z
YS.....same as.....BY
XX9.....used to be..CR9
ZX0.....same as.....CE9
1Z.....same as.....XZ
3G.....same as.....CE
3H.....same as.....BY
4C.....same as.....XE
4J5.....same as.....UB
4Z7.....same as.....4X4
5I.....same as.....ZC
5K.....same as.....HK
5L.....same as.....EL
5F2.....same as.....XE
5K.....same as.....HL
5V1.....same as.....5W8
7J.....same as.....JA
7J1.....same as.....JA1
7J6.....same as.....JA6
7S.....same as.....SM
8A.....same as.....YB
8J.....same as.....JA
8D.....same as.....AP
8P2.....same as.....8P6

Reprinted from the FRC Newsletter

The NOAA Space Environment Laboratory

The Space Environment Laboratory (SEL) is unique within the US Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), Environmental Research Laboratories in providing both real time services to meet national needs, and research and support activities to improve these services. SEL , through the Space Environment Service Center (SESC) is a national center for providing around-the-clock forecasts and warnings of solar and space disturbances, an activity which requires a substantial fraction of its resources. The rest of its efforts are devoted to studying and analyzing solar and terrestrial disturbances, and to developing systems to improve monitoring, understanding, forecasting, and analysis of disturbances.

The genesis of the mission of SEL is traceable to activities of the U.S. Government during the Second World War, when the Interservice Radio Propagation Laboratory (IRPL) was formed in the National Bureau of Standards (NBS). At that time there was a strong requirement to support ionospherically propagated communications to the European Theatre, which could be severely disrupted during times of solar and geomagnetic disturbances. In 1946, the Central Radio Propagation Laboratory (CRPL) was formed in NBS to place the work of IRPL on a permanent basis. In the early 1950's, CRPL moved to the new NBS facilities in Boulder. From these beginnings, the radio propagation work moved to the Environmental Science and Services Administration, and still later the space environment services and research activities moved to NOAA when it was established.

The modern era of providing space environment services dates from 1965, when SEL (then the Space Disturbances Laboratory) established a real-time forecast and warnings center. The needs for these services have grown and diversified, extending well beyond ionospheric communications to include such problems as radiation hazards to astronauts, increased drag on navigation satellites during magnetic disturbances, upsets of geostationary satellite electronics and other systems, induced currents in long lines, and the impact of geomagnetic activity on geophysical exploration by air-borne magnetometers.

Major terrestrial space disturbances are traceable to three different types of solar activity: large solar flares, coronal mass ejections (some of which are associated with eruptive filaments), and high speed solar wind streams emanating from coronal holes. The time required for disturbances to reach the earth ranges from the immediate effects of X-rays associated with flares, to 10's of minutes to hours for energetic solar protons from major flares, to 1 to 5 days for shock waves and plasma clouds from solar flares and the solar wind disturbances which are a result of coronal mass ejections. Disturbances associated with a given high speed solar wind stream tend to affect the earth every 27 days, as the stream overtakes the earth due to solar rotation. Only the flare X-rays reach the earth unperturbed by the intervening medium. The propagation of both the energetic particles, and the shock waves and mass ejections can be profoundly influenced by the solar wind and its magnetic fields.

The terrestrial impacts of solar activity of concern to users include:

* radiation hazards to astronauts and high flying aircraft (energetic solar protons)
* surface charging and deep charging of satellites (enhanced plasma environment and energetic solar protons)
* disturbed ionospheric communications (solar X-rays, solar protons, magnetospheric particle precipitation)
* disturbances of the external geomagnetic field (ionospheric currents associated with particle precipitation, ring current in the inner magnetosphere)
* induced currents in long lines (temporal variations of the magnetic fields from ionospheric currents)
* upper atmosphere heating (joule heating by ionospheric currents).

(The sources of the problems are given parenthetically.)

The forecasts, warnings, real-time data, and summary information provided by SEL's Space Environment Services Center are generic products designed to serve the entire set of users concerned with these problems. Several methods of distributing these products are used, including commerical satellite broadcasts. The thrust of research activities within SEL is to increase man's understanding of solar activity and consequent disturbances at the earth, and to develop techniques for improving man's capablities to monitor, forecast, and analyze solar-terrestrial disturbances.

PROPAGATION
(de Chuck, KE5FI)

The solar flux continues to show signs of increasing in the new solar cycle. (Even though a certain KH6 disagrees!) The average flux for March was 74.0, right on the money according to the chart published in this column in February. The April average is predicted at 75.

Propagation will be a bit wishy-washy this month with sporadically good openings on 20 meters when the A index is low. There may be some reasonable 15 meter openings between April 6 - 10 and 19 - 26th when the flux will probably climb above 75. I doubt we will see any other days above a flux of 75. What we need is some new activity to liven things up! Of course it was less than a year ago when we were wishing for 70...

ANTENNAS

2 meter mobile	2 M squared for SSB	45.00
	MM-1041 Mag Mount 5/8	25.00
	AP151.3G on glass mount	36.00
	Larson	Call
	Untenna CR2A 2m Magmount	40.00
220 mobile	Larson antennas	Call
	Untenna CR3A 220MHz Magmount	39.00
70 CM	Larson	Call
	Untenna CR4A 440MHz Magmount	36.00
Dual-band 144/70cm	Diamond 5/8both	39.95
Base	AEA Isopole 144	49.95
	Ringo Ranger II 2M	39.95
	AEA Isopole 440	48.30
	Diamond Dual 6DB 144/8DB 440	104.95
	Diamond Dual 4.5db 144/ 7.2db 440	79.95
HF mobile	Bugcatcher 80m 250w	34.00
	80m 1kw	48.50
	40m 250w	28.50
	40m 1kw	34.00
	Valor AB5	85.00
	AB3	43.00
	Stainless steel mast 3/8 2'	9.95
	3/8 3'	10.95
	3/8 4'	11.95
HF	TET Beams (CLOSE OUT) 3F 350H	175.00
	3F 370H	295.00
	Butternut HF4V (prepaid)	222.00
	Butternut HF6V (prepaid)	128.00
	Butternut HF2V (prepaid)	128.00
	Other Butternut,VHF,scanner	Call
	Cushcraft A4	310.00
	Cushcraft A3	230.00
	Cushcraft A743/A744 30/40m kit	79.00
	Spi-Ro Dipoles	
	D32-20,15,10m	54.95 PPD
	D42-40,20,15,10m	59.95 PPD
	D52-80,40,20,15,10	64.95 PPD
	D162-160,80m	79.95 PPD
	Spi-Ro Vertical or Slopers	
	VS-31 20,15,10m	42.95 PPD
	VS-41 40,20,15,10m	44.94 PPD
	VS-53 80,40,20, 15,10m	69.96 PPD
	VS-64 160,80,40, 20,15,10,	89.95 PPD
	Untenna HI-Rizer Low Profile	
	CR4010A 40-10m	117.00

Smiley Antennas for HT's:
"The Hand Tuned Performance System"

2m	from	12.95
220MHz	from	12.95
440MHz	from	17.95

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Living With Lightning

What it is, what to do about it and where to go to avoid it!

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It's the leading cause of weather related deaths in the United States. It's the leading destroyer of personal property and the least understood atmospheric phenomenon. It's managed to keep pace with technology matching every advance in electronics with it's destructive power. Until about 230 years ago no one really knew what it was. Benjamin Franklin finally identified it with his famous kite and key experiments and it's still unclear how he managed to avoid getting fried in the process. It's caused by dust and we call it lightning.

Yes, I said it's caused by dust. Don't believe that? Here's how.

You may have noticed like Ben did that lightning is the by-product of an atmospheric activity called thunderstorms. Thunderstorms are formed by convective action in the atmosphere. This means that cool air causes warmer, moist air to rise to the cooler upper atmosphere. (I can guarantee it's cooler in the upper atmosphere. I'm writing this while freezing to death in an airliner cruising at 35,000 feet.) The cooling action then causes condensation to form on small dust particles (I told you so) and the result is clouds (no clouds, no lightning-usually.) The cooler dry air surrounding the clouds is then forced to migrate downward. This up and down action can get quite intense at times. Airplane drivers know all about it-they call it turbulence. It also helps maintain the burp bag industry.

The exact way cloud electrification takes place is not completely understood. Not only that, there are varying opinions on the subject. It is known, however, that a separation of electrical charges occurs causing positive and negative pockets within a cloud. As this action continues the cloud assumes a net negative charge with respect to the earth and upper portions of itself. Further action causes a potential for point discharge to be reached. Picture the whole situation as a giant capacitor. The charged bodies (earth and cloud) are the plates and the atmosphere is the dielectric. When the potential exceeds the dielectric's voltage rating. Zap! Lightning. Sometimes it discharges to other clouds, sometimes within the cloud and of greater interest to us earthlings, sometimes to the ground.

Before the discharge takes place an intense field develops between the cloud and ground. As the field intensity increases, corona discharge or "St. Elmo's Fire" can form on conductive bodies (I've seen this happen on tall towers.) Further intensification causes the air between cloud and ground to

ionize. Pockets of ionized air form and are shifted around by the wind. These pockets are more conductive than the surrounding atmosphere and form irregular conductive paths of increased current flow.

When a flash finally lets go it typically follows these stages during discharge: (1) Charge configuration of the thunderstorm cell prior to flash; (2) local discharge between the small P region at the cloud base and its N region; (3) free electrons start downward from the cloud in 150 foot steps; (4) a leader stroke moves downward, neutralizing the positive ion pockets; (5) as the negative stepped leader nears the earth, positive point discharge currents strain upward; (6) several streamers may reach upward; (7) a positive return stroke rises upward; (8) a return stroke makes the trip from earth to ground at near the speed of light and thousands of amperes of current flow down the channel to earth.

Impresssive? If you happen to be on the receiving end of the thousands of amperes of current not only will you be impressed, you'll have big problems.

So what happens if your number is up and you happen to be on the receiving end of a big bolt. Frankly, there's not much that most of us can do to prevent being hit but at least we can minimize the effect.

A lot of people think lightning rods will prevent a strike. Not always so. Lightning rods can help decrease the intensity of the charge on an object but their biggest asset is to "direct" the point discharge. In other words, don't depend on not being hit if you have lightning rods. Just be aware that the strike will probably occur at a rod rather than somewhere else. Incidently, a tower is a great lightning rod and affords a "zone of protection" to nearby bodies. Some describe this zone as a 45 degree cone extending downward from the tip of structure but recent data indicates that it is more like a concave hyperbolic shape somewhat smaller than a 45 degree cone.

Since we can't completely prevent getting hit then the logical thing to do is figure out how to handle the current from a strike. This is where the lightning conductor comes into play. What's a lightning conductor? It's nothing more than a dedicated path for stroke currents and could be part of a building's steel framework or the framework of a tower, either of which is capable of carrying very high current.

Ordinarily when we think of high current capacity conductors something large comes to mind. For example, the battery and starter cables in an automobile where hundreds of amperes are needed for cranking an engine. But a lightning conductor's size is not as important as we might think. Here's why: A lightning current waveform has a risetime on the order of 1 microsecond. Additionally, current of 200,000 amperes is not uncommon with an

average stroke being in the 20,000 to 30,000 ampere range. Inductance plays an important part in the performance of any conductor, especially when dealing with current that has a step function such as lightning. During the fast risetime of the current the inductance is responsible for most of the voltage drop in the conductor. As the current goes into its slower decay the resistive voltage drop is a larger part of the total. Here's an example by formulation of how that works:

Voltage drop through a lightning conductor: E = IR + L(di/dt)
Where: I = current in amperes
R = conductor dc resistance in ohms
L = conductor inductance in henries
di= change of current in amperes
dt= change of time in seconds (risetime)

If we assume:
conductor length = 10 meters
conductor material: copper
conductor size = #6 AWG
total DC resistance = .013 ohms
total inductance = 10 microhenries
current = 1,000 amperes
risetime = 1 microsecond

Then:
E = (1000 X .013) + .000010 (1000/.000001)
E = 13 + 10,000
E = 10013 volts

As you can see the resistive voltage drop is only 13 volts but the reactive drop is 10,000 volts. It's obvious that conductor length is much more important than size; the longer the conductor, the higher the reactive voltage drop. But don't get fooled into thinking that a piece of #30 hookup wire will work as a good lightning conductor. It won't so don't try it. If you calculate power (I2R) in the above example you'll find that it equals 13,000 watts. #30 hookup wire would vanish into the next dimension under that kind of smoke.

For maximum protection multiple down conductors are the best idea. It's better to have three smaller diameter conductors than one large one. Chances are that a strike could take out one conductor but wouldn't damage all three. Multiple paths also lower the surge impedance of the entire system providing a better path to ground.

So what happens to all that current after it gets safely from the cloud and down your tower? Believe me, it's still got to go somewhere and that somewhere is good old mother earth. Good grounding is as important to lightning safety as effective down conductors and must be done as the last link in the chain.

Grounding can be accomplished in a number of ways. Driven rods, buried electrodes, counterpoise systems and underground mats are among the most effective. The exact way it's done will depend on the soil conditions at your paricular site. A combination of methods can be even more effective.

Lightning current entering a ground rod will radiate equally in all directions. As this current passes through resistive soil a voltage gradient is established that will decrease in strength with distance. Ground rods also exhibit an impedance similar to that of conductors which reduces the effectiveness of deeper portions of the rod.

Installing a number of ground rods a reasonable distance apart establishes a more effective system by dividing the currents between them. The greater the distance between rods (within reason) the less overlap of individual voltage gradients and the better overall grounding. Rods in combination with a counterpoise system provide an extremely effective ground if installed properly.

But alas, perfection can't always be achieved. There's no such thing as a 10 in grounding. The result of imperfection can be manifested in several ways, most of them somewhat nasty. Some of the common problems that develop in less than perfect systems (most of them are less than perfect) are:

Touch Voltages: Injury to a person or animal in contact with a conductive body energized by lightning current.

Step Voltages: A voltage divider is formed between the earth and a grounding electrode during discharge. Someone standing on the ground could be injured due to potential difference between different parts of their body.

Sideflash: A secondary lightning flash to a grounded body from high voltage on a lightning conductor.

The secret to dealing with the above mentioned nasties is bonding. Bonding is a step that we all should practice in every installation either inside the shack or on the tower. It is simply the act of equalizing the potential difference between conductive bodies through metallic connections.

As a start, lets examine the tower structure. Vertical tower elements must be electrically contiguous (Aggie word for touching.) If they're not, copper or aluminum downconductors must be used. At the base a suitable grounding system-counterpoise, rods or both-should be utilized. Unless it's a series fed vertical (insulated from ground) each guy cable should be bonded to the tower. Don't rely on friction contact or thimbles to do the job. At the earth end of each guy cable it should be connected to a minimum of one ground rod and preferably

a ground rod array. If a counterpoise is used guy cables should be connected to it. If no counterpoise system is used a bonding conductor should be connected between the ground array at each guy anchor and the base of the tower. This arrangement will help minimize step voltages at or near the base of the tower.

Antennas should be electrically bonded to the tower at their mounting points. Notice I said electrically-some antennas have floating feedpoints but can be dc grounded without harming their rf feed point impedances. All transmission lines should be bonded to the tower at 50 foot (do not exceed 100 feet if possible) intervals. Any supporting structures such as transmission line bridges should also be well bonded to both the tower and the shack.

Bonding requirements for series fed towers are somewhat different. Towers that are active radiators can use spark gaps at the base as a discharge path for lightning currents. In addition, a choke coil or stub can provide a path for static charges to bleed off to ground.

As I mentioned a few paragraphs back, there are no perfect 10's in lightning protection or grounding. It's also not possible to cover every aspect of protection or grounding in an article such as this. The goal should be to minimize the effect of getting struck. When the bolts start popping probably the safest thing to do is disconnect everything from the antenna, pull the wall plugs and leave for Antarctica where there is very little dust. Or maybe we should all buy ourselves a kite and a key.

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