RATS

1 1990

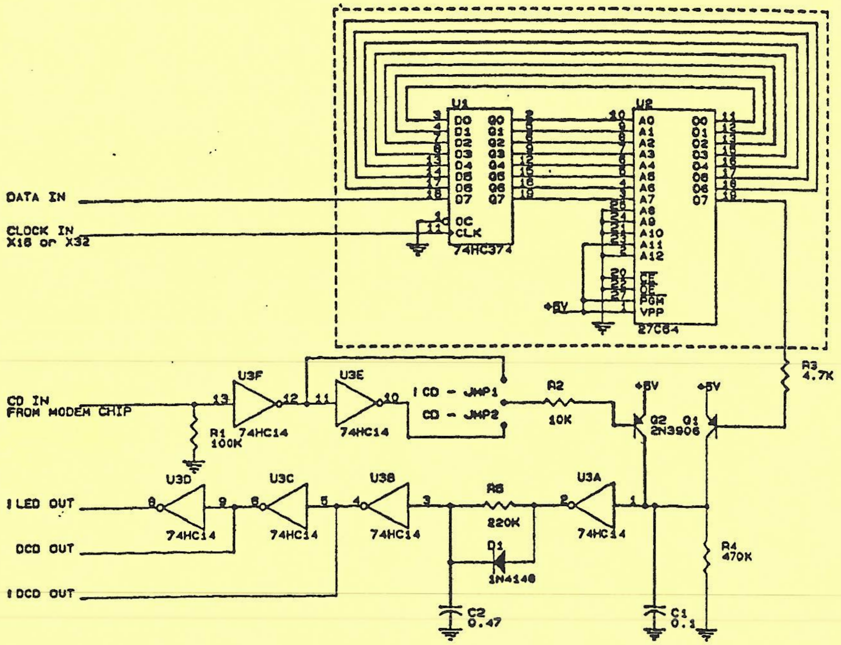

FIGURE 2 - IMPROVED DCD RETROFIT CIRCUIT

Radioamatööritekniikan seura ry:n jäsenlehti 1/90

JULKAISIJA: Radioamatööritekniikan seura r.y.
PL 88
02151 ESPOO

PÄÄTOIMITTAJA: Jari Salminen, OH2BYQ

RATS ilmestyy kuusi kertaa vuodessa. Julkaisu lähetetään kaikille seuran jäsenille sekä maksaneille tilaajille.

Seuran jäsenmaksu vuodelle 1990 päätetään seuran vuosikokouksessa 10.3.1990. Liittymismaksu uusille jäsenille 50 mk. Seuran ulkopuoliset voivat tilata lehden maksamalla tilaushinnan 90,-/vsk seuran tilille PSP 6787 36-9.

Ilmoitushinnat:
1/1 sivu 300,-
1/2 sivu 150,-

Seuraavan numeron stop-date: 28.2.1990

Lehteen tarkoitettua materiaalia ja vinkkejä kiinnostavista aiheista voi lähettää seuran postilokeroon tai suoraan toimihenkilöille, joiden yhteystiedot löytyvät takakannesta. Toimitustyön helpottamiseksi olisi hyvä, jos materiaali olisi valmiiksi tietokoneella luettavassa muodossa PC-levykkeellä.

Radioamatööritekniikan seura ry:n tarkoituksena on edistää uuden teknologian käyttöä radioamatöörien keskuudessa. Tämän toteuttamiseksi yhdistys

- toimii yhteydenpitokanavana jäsenilleen
- järjestää esitelmä- ja luentotilaisuuksia
- ylläpitää radioamatööriasemia OH2NXX ja OH1SIX
- harrastaa julkaisutoimintaa
- pitää yhteyksiä muihin koti- ja ulkomaisiin alan yhteisöihin.

Puheenjohtajalta

Jari Salminen OH2BYQ

Vaikka et saanutkaan lehden numeroa 6/89 niin älä ole huolissasi. Jäsenmaksusi ei ole rästissä eikä sinua ole erotettu seurasta!

Kävi näet niinkuin jo jonkin aikaa on osattu pelätä: jäsenistöltä saapuneen laihan materiaalin sekä aikaisempien aktiivisten kirjoittajien ilmeisten työ- ja joulukiireiden takia ei lehteä yksinkertaisesti saatu kasaan.

Joten jälleen kerran lienee syytä muistuttaa lehden perimmäisestä tarkoituksesta: toimia yhteydenpitokanavana jäsenistölle. Tämä tarkoittaa niin tiedoitusta jäsenille kuin MYÖS JÄSENILTÄ. Tavoitteemme uuden teknologisen tiedon jakamisesta ei onnistu, jos sen tiedon luominen on vain harvojen harteilla. Jokaisella on varmasti takataskussaan ja -raivossaan kiintoisia projekteja/vinkkejä, joille soisi laajempaakin julkisuutta lehden palstoilla.

Tämän lehden numerossa pääaiheena on "ARRL 7th Computer Networking" konferenssin julkaisusta N7CL:n artikkeli pakettiradioiden DCD:n (Data Carrier Detect) käytöstä sekä TNC:iden modifioinnista, joilla saavutetaan selvä tehokkuuden parannus eteenkin ruuhkaisilla alueilla. Kannattaa siis vakavasti harkita modifiointien tekoa!

Vuoden 1990 tapahtumakalenterin onkin jo ehditty avata pakettiradiopäivällä Tampereella hotelli Pinjassa 27.1, joka sujui n. 60 osallistujan voimin oikein mukavasti. Pakettiradion perusteiden lisäksi aiheina oli uusinta uutta Microsat-satelliiteista ja Clusterista, sekä visioita uusista kehitysnäkymistä esim. giga-alueille. Lehden ensi numeroon pyritään kasaamaan esillä olleista aiheista jonkinlainen yhteenveto, joten myös kuulijoiden kommentit ovat tervetulleita.

Seuraavana seuran tapahtumakalenterissa on vuorossa seuran vuosikokous lauantaina 10.3. Tarkempaa tietoa lehden sisäsivuilla.

Ja huomatkaa: aineiston viimeinen jättöpäivä lehden seuraavaan numeroon on 28.2.90. Joten pikaisiin kirjoittelemisiin ...

73 de Jimi

RATS 1/90 sisältö:

CAN WE CONTINUE TO IGNORE LEVEL ONE?

Eric S. Gustafson, N7CL
Lähde: ARRL 7th Computer Networking Conference (Proceedings)

ABSTRACT

For some reason which I cannot fathom, there has been a great reluctance to specify or even to provide guidelines for the various level 1 issues in the amateur packet radio system. This reluctance traces back all the way to the very early days of packet radio development. I find this situation very strange indeed since if level 1 isn't working, all the other levels of the protocol which everyone seems eager to specify down to the last bit position are all irrelevant.

In this paper I will choose one of the most consistently botched and yet most easily corrected level 1 parameters, the modem's data carrier detector. I will show how the performance of our present packet systems can be improved by careful consideration of even just this single level 1 issue.

Data Carrier Detect (DCD) is one of the most important items to consider on any multiple access packet channel. This paper explains why, then describes how to improve the performance of the current generation of amateur packet terminal node controllers (TNC).

INTRODUCTION

It has been six years now since the birth of the AX25 level 2 standard in late 1982. I think that now it is appropriate to ask "What has the ostrich approach to setting level 1 standards gotten us so far?" Well, it has gotten us a number of things:

1. It has gotten us a user base that is almost completely ignorant that there is anything that needs to be considered at level 1. This is too bad since the user is the only one who has any control over what happens there.

2. It has gotten us manufacturers building TNCs with modems that have a number of characteristics which are detrimental to the performance of what was originally touted as a SHARED channel.

3. It has gotten us radio manufacturers who are under zero pressure to provide products which physically interface in a standard manner or even use similar levels for the digital mode audio signals. Manufacturers who are still content for the most part to build radios which are from 3 to 10 (or even more) times as slow as necessary for good packet system performance (NO aspect of voice radio performance must be compromised in order to achieve adequate speed).

4. It has gotten us a protocol specification which so judiciously avoids any provision for any level 1 issue whatsoever that its performance is significantly degraded when used on a channel where the signal propagation is anything less than similar to a land line. This could probably be adequately fixed as an implementation issue but there is NO information available to the implementer warning him of the necessity.

Do I blame the manufacturers of radios or TNCs? No not at all. The manufacturers have no reason to gamble on trying to set up anything in a standard manner unless the standard pre-exists and there is some consumer pressure on all to bring about general conformance. With relatively short product lifetimes and low profit margins in the amateur market nobody could expect them to spend a lot of engineering time to optimize the modems, for example, before getting a product to market. This fact is what drove the formation of groups like TAPR to support the development of the mode in the first place.

However, my purpose here is not to enumerate EVERYTHING that is wrong, but rather to show how relatively easily ONE thing can be done right.

DCD is a "level one" issue, which means that there is no standard document for TNC manufacturers to use as reference for guidance in this aspect of a TNC design. Writers of software for TNCs and other level 2 devices also have no guidelines on what is reasonable to expect from the DCD circuit.

This is unfortunate, because proper DCD operation can make or break a packet channel. I have observed many thousands of unnecessary collisions and retries on VHF and HF packet channels (both amateur service and commercial as well) related to substandard DCD performance. After helping a number of hams drastically improve the operation of their TNCs here in the Tucson LAN, I decided to write this paper and share the results of my work with the Amateur packet community at large.

WHAT DCD SHOULD DO

The purpose of the DCD function in the modem used in a packet radio TNC is to prevent transmission on an occupied channel. If two stations transmit at the same time, we say a collision has occurred. This almost invariably means that both stations will have to resend the corrupted data. This has the effect of increasing the total load on the channel and reducing throughput for everyone sharing the channel.

Ideally, no station would ever step on another's transmission, and all stations would clearly hear all other stations (or no other station except the other one involved in the QSO!). The world is not ideal, however, so the best we can do is tune the protocol to minimize its sensitivity to this fact. This means considering at least some level 1 issues in the protocol specification.

We can also define how a proper DCD circuit should act and then see what we can do to implement such a circuit.

There are four key features that a DCD circuit should possess:

First, the DCD circuit must be able to reliably distinguish a data carrier from noise or other non-packet signals. An open squelch circuit, for example, should not inhibit transmission of packet data. There is no point in not transmitting because of receiver noise in the absence of signals. A DCD circuit which requires the operation of the TNC with audio gated by the typical narrowband FM radio squelch circuit, directly contributes to increased collision frequency. It does this by increasing the "deaf time" of the packet radio system. The TNC has no way of determining that another station has keyed up if this happens to occur during the system "deaf time". The total system deaf time (neglecting the presence of a duplex repeater or regenerator for now) is the sum of:

1. The radio's transmitter keyup delay. That is, the time that elapses between assertion of push-to-talk (PTT) and the appearance of an on-frequency, full power, correctly modulated packet radio signal on the channel. Transmitters commonly used in amateur packet radio service exhibit delays ranging from approximately 60 to over 500 milliseconds for this parameter. Most commercially available synthesized radios are in the 150 to 200 millisecond range.

2. The radio's squelch circuit attack time. This is the time between the appearance of a signal just above the squelch threshold at the receiver input and the appearance of usable audio at the modem input. Radios commonly used in amateur packet radio service exhibit delays ranging from approximately 80 to well over 750 milliseconds (no that is not a misprint!) for this parameter. Most commercially available VHF FM radios currently available fall in the 150 to 300 millisecond range.

3. The modem's DCD attack time. This is the time between the appearance at the minimum usable signal-to-noise ratio (SNR) of decodable packet audio at the input of the demodulator and the assertion of the DCD output. Typical values for this parameter range from approximately 8 to a little more than 30 milliseconds. These numbers are for 1200 baud modems. Phase information DCD circuits which use the recovered data stream to make the DCD determination will have delays which are proportional to the baud rate. Five character periods is typically long enough to produce a DCD circuit with a zero false detection rate when monitoring uncorrelated noise. This is a little over 30 milliseconds at 1200 baud.

As you can see, even the worst case DCD circuit is better than the best of the squelch circuits. If we take the middle of the typical times for the various delays we see that eliminating the squelch delay reduces the "deaf" time from approximately 420 milliseconds to approximately 195 milliseconds. Doesn't seem like much? Then consider that this will reduce the collision frequency by approximately 50 percent on a channel with no hidden terminals. Depending on the DWAIT, FRACK, and RESPTIME settings of the TNCs using the channel, and the amount of traffic on the channel, this can and usually does have a dramatic effect on the the channel throughput.

Second, once a data carrier decision has been correctly made, it is important that the DCD indication remain valid through short fades, collisions, and periods when a signal too marginal to decode is on the channel. This prevents a TNC which is holding off its transmission from transmitting over a station which has a marginal signal, or beginning to transmit over a station which is still transmitting but whose signal received a short multipath hit during the packet. The DCD "hang" time also prevents the phase information based DCD circuits from "piling on" a collision between two other stations on the channel. The appropriate amount of "hang" time will depend on the propagation characteristics of the band being used and the exact type of modem (if other than straight two tone FSK or AFSK). I have been having good success at 300 baud on HF FSK and at 1200 baud on VHF FM AFSK with a hang time of approximately 8 character periods.

Third, it is important that the DCD system NOT be sensitive to audio amplitude variations. It should respond in exactly the same way for any signal that the modem is capable of decoding regardless of absolute input amplitude. This will prevent transmission over a relatively weak station who has keyed up immediately after a much stronger signal has terminated. For this to be fully effective the modem must have a large dynamic range.

Fourth, as can be seen in the above discussion, the modem should not take an unreasonably long time to assert the DCD output signal. An attack time of 5 character periods seems to me to be a reasonable MAXIMUM allowed DCD delay specification.

EXISTING IMPLEMENTATIONS

There are two primary methods of determining the presence of a data carrier in use in most TNCs today. These are phase information based DCD and amplitude information based DCD.

Phase information based DCD circuits look for coherent (phase related) information in the audio presented to the demodulator or in the data stream emerging from the demodulator. The TAPR TNCs use the in-phase carrier detector of the phase locked loop (PLL) in an XR2211 demodulator to look for phase information in the incoming audio. This type of detector directly detects the presence of the data carrier.

It is also possible to design a system which uses information derived from baud period phase relationships of the demodulated data stream to infer the presence of a data carrier. A good example of the use of this type of circuit is the K9NG 9600 bps modem. [1]

Either of these two phase information based methods are demonstrably superior for use in the radio environment than any of the amplitude information based methods with which I am familiar.

Amplitude information based circuits simply look for energy in the modem passband. Any signal is assumed to be a data signal. These circuits are appropriate only for telephone systems which are generally very quiet in the absence of the desired signal. Telephone modems are typically not required to operate in a Carrier Sense Multiple Access (CSMA) environment so their DCD requirements are much less stringent than demanded by our radio environment. Popular single chip modems are usually of this type, including the AMD7910 and TI TCM3105 chips.

Apart from the MFJ-1278, which incorporates the XR2211 improvements shown later in this paper, I am not aware of any Amateur packet TNCs which have modems which are fully optimized for the amateur packet radio environment.

IMPROVING EXISTING DCD CIRCUITS

Much of the following material is either taken from or is based on information found in articles I have previously published in several low circulation newsletters. Some of it had been simply sent as messages in response to questions on the linked packet bulletin board system. Don't be surprised if some of this material looks familiar to you. This is the first time this has all appeared in one place. Some recently discovered errors are corrected in this version. [2],[3],[4],[5]

The information presented here will allow the owner of almost any existing TNC to upgrade the performance of the DCD circuit in his TNCs modem for proper operation on a packet radio CSMA channel. The vast majority of TNCs currently in service are covered. Only units which do not use the popular Exar PLL modem chip set or which don't have an appropriate baud clock signal available for use by an external synchronous modem are not addressed. These units are only a tiny minority of the TNCs currently in use.

It is not particularly difficult to make a DCD circuit which operates in accordance with the points mentioned above. And, making the changes in your station TNC(s) will make a noticeable improvement in operation. At least, it has in the Tucson LAN where many TNCs have been modified for proper DCD circuit operation!

I should mention that the Tucson area is using a duplex audio repeater to eliminate hidden terminals from the system. A duplex regenerator would have the same effect if properly implemented. I believe that eventually it will be seen by everyone involved that all user access to network nodes should be by way of either repeater or regenerator.

XR2211 IMPLEMENTATIONS

Units such as the TAPR TNC 1 and TNC 2 can be easily modified to have dramatically improved DCD performance. Figure 1 is a

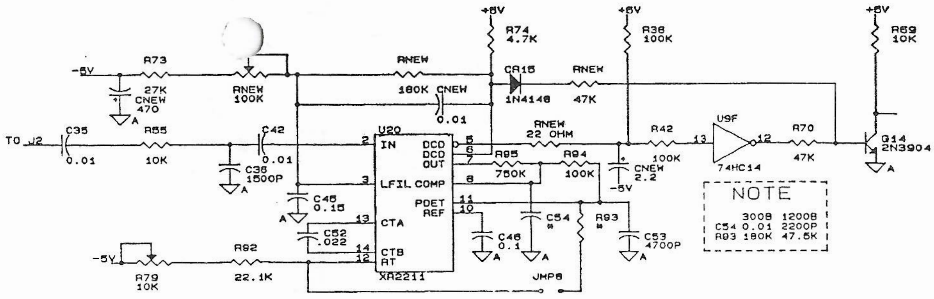

FIGURE 1 - TNC 2 DCD MODIFICATIONS

circuit diagram of a 2211-based demodulator which has the characteristics noted above.

Hysteresis is employed in the DCD decision threshold and "hang" time is added by the 74HC14 circuit following the modem chip.

I have incorporated this circuit in many TNCs and literally hundreds of commercial packet communications controllers. The improvement is very noticeable. Check the schematic diagram of your TNC. You will probably notice different values used in the various feedback resistors and capacitors used. That's because most TNC's 2211 demodulators are based on Exar Applications Notes or Data sheet information which assumes that the chip is to be used to implement a land line modem. The changes presented here have been incorporated in some commercial packet systems designed from the ground up for radio application. The improvement in performance really is noticeable. Try it!

The following modification procedure gives a step by step process to follow for modification of the modem in the TNC-2. The same modifications can be performed on a TNC-1 or beta test TNC-1 board but the part numbers given in the procedure will not apply. Also, it will be necessary to patch a 74HC14 into the wire wrap area of the board to construct the "hang time" generator.

If the complete modification including the variable threshold control is done on a TNC-1 or Beta Board, extreme caution should be exercised to assure that the threshold control is not set to defeat the DCD entirely. Software available for these TNCs has no provision for detecting a DCD fault condition. For this reason it is recommended that if this modification is done to a TNC-1 or Beta Board, you should include hardware gating of the data output from the modem based on the DCD output signal. This will prevent reception when the DCD circuit is disabled and thereby warn the operator that something is wrong.

MODIFICATIONS TO TNC-2 DATA CARRIER DETECTOR (DCD) CIRCUIT

These modifications are to allow correct DCD operation in a TNC-2 modem. Variable DCD decision threshold is included to allow compensation for various audio bandwidths presented to the demodulator when using appropriately narrow filters on HF.

NOTE! For 1200 baud HF linear mode FSK work on 10 meters, the normal 2.4 KHz SSB filter constitutes a "narrow" filter for the demodulator.

There are three objectives to these modifications:

1. Provide threshold control for the DCD circuit. This allows the operator to adjust the demodulator to compensate for the DCD threshold shift which accompanies bandwidth limiting the audio fed to the demodulator when a narrow filter is used in the radio.

2. Add hysteresis to the Data Carrier Detector. This reduces the DCD's sensitivity to noise. It does this WITHOUT DEGRADING DCD ACQUISITION TIME for a valid data carrier.

3. Add DCD hang time on release.

The modifications presented in Appendix A will upgrade the modem in any TNC-2 or clone (including MFJ-1274) which has a 2211 demodulator to the level of DCD performance of the 1278 modem.

OTHER TNCS

Other TNCs may require somewhat more drastic measures. If you have a TNC which uses either the AMD7910 or the TCM3105 single chip modem, or a TNC which uses a modem based on audio filters like the PK-232, you can vastly improve the DCD performance of your modem for packet radio use. The circuit presented in Figure 2

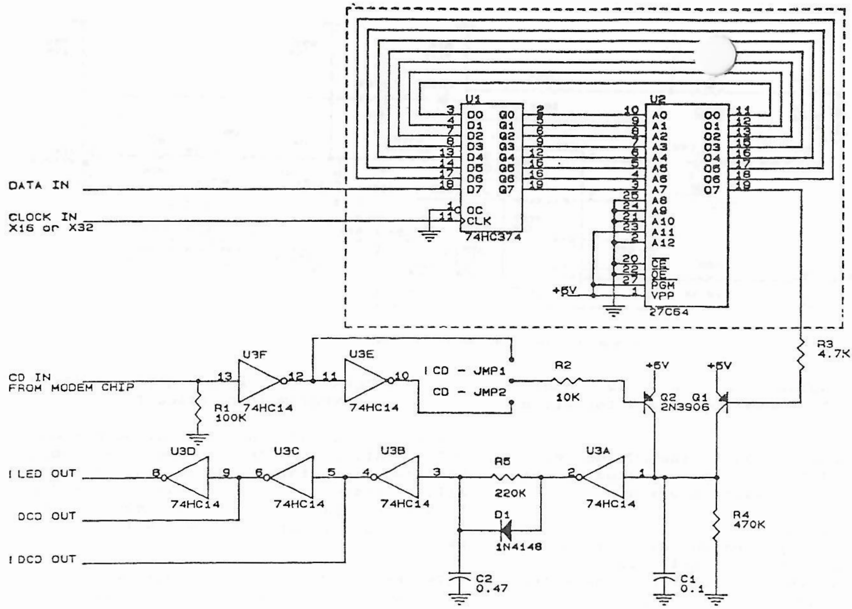

FIGURE 2 - IMPROVED DCD RETROFIT CIRCUIT

will provide a phase information based DCD for these TNCs which currently use amplitude information based DCD circuits.

If your TNC incorporates a TNC-2 style state machine (if it uses a Z80 SIO chip, it may; if it uses an 8530 SCC, it probably doesn't), you can add a phase information based based DCD by using the circuit shown in Figure 2 that is outside the dotted lines. If it doesn't incorporate such a state machine, you need the whole circuit as shown in Figure 2.

HOW IT WORKS

Please refer to Figure 2 for the following discussion.

The DCD circuit presented here is based on the update signals in a Digital Phase Locked Loop (DPLL) which recovers both baud clock and data from an NRZI packet data stream. Its output represents detection of baud clock phase coherence in the data stream.

The circuit consists of the state machine used in the TNC-2 and some delay elements used to make the DCD decision. The state machine is formed from the 74HC374 and the 27C64 chips. The 74HC14 is used as a pair of retriggerable delay elements and for signal inversion and buffering.

The 27C64 with the state machine coc already burned into it can be obtaine directly from TAPR. This same code is i the state machine ROM in any full TNC- clone which uses the 2211 demodulator ar Z80 SIO.

One of the state machine signals (whic was not used in the TNC-2) appears on p: 19 of the 27C64. This signal is the DPI update pulse. As long as the DPLL correctly locked to the incoming data, pulses will appear on this pin. When t: DPLL is not locked to an incoming da stream, there will be a continuous stre of pulses on this pin.

The DPLL update signal is used in th circuit to retrigger the first del element so that it never times out so lo as DPLL update pulses are present. If t pulses disappear, the delay element tim out and generates the DCD signal.

The output from the first delay eleme keeps the second delay element trigger so long as DCD is true. When DCD go false, the second delay element begins time-out sequence which keeps the D output true until the time-out peri expires. This is the source of the D "hang time".

While the circuit presented here primarily intended for 1200 baud VHF operation, it will [illegible] work well for 300 baud HF packet work. If this is your application, the time constants on the delay elements will have to be increased.

The time constant of the "hang" generator (0.47 uF cap) will have to be increased for 300 baud operation to about 2 uF.

The time constant which is optimum for the DCD generator (the 0.1 uF cap in fig. 2) will depend on a number of factors including the bandwidth of the radio used ahead of the modem (You should use a 500 Hz IF filter in ANY radio used on 300 baud HF packet regardless of the presence or absence of audio filtering in the modem!).

You should pick a value for the DCD generator delay capacitor so the DCD circuit produces approximately a 10 percent duty cycle of false DCD "ON" time while monitoring receiver noise on a channel which is ABSOLUTELY free of ANY signals which fall within the demodulator's passband. The DCD generator delay capacitor will probably need to be somewhere in the range of 2 to 4 times the 0.1 uF value used for 1200 baud.

Both negative true and positive true DCD outputs are provided so that you may use the polarity which is required by your TNC. Also, JMP1 and JMP2 allow the DCD circuit to be configured to operate correctly from either a positive or negative true CD output from whichever modem chip is found in your TNC.

TNC SIGNALS

Once you have constructed the DCD circuit, you will have to obtain some signals from your TNC for the new DCD circuit to use. You will also have to arrange for the output of this circuit to be substituted for the normal DCD signal used in the TNC.

The signals required for the DCD circuit operation are:

1. A sample of the data recovered by the demodulator in the modem.

2. A sample of a clock which has a frequency of either 16 or 32 times the baud rate (X16 or X32 baud clock).

3. The intercepted Carrier Detect (CD) signal from the modem. This is the CD generated by the modem based on amplitude of the input audio.

4. A source of + 5 volts. If you use all CMOS parts, the power supply current requirements are minimal. The 74HC14 MUST be a CMOS part for the circuit to work properly.

5. Ground

If your TNC has provision for a TAPR style modem disconnect header, these signals (including the X16 or X32 baud clock) will be easily located and conveniently interfaced at this header. If it doesn't have this header, you will have to fish around in the circuit of your TNC on your own to locate them.

In any case, the DCD signal currently used in your TNC will have to be disconnected and rerouted through the new circuit.

STANDARD HEADER SIGNALS

The signal locations on the TAPR standard modem disconnect header are as follows:

1. Receive Data is obtained from header pin 13.

2. Carrier Detect is obtained from header pin 2.

3. Data Carrier Detect (DCD) is inserted at header pin 1. Jumper from header pin 1 to header pin 2 is removed.

4. The baud clock is obtained from header pin 12. The frequency of this clock will be either 32 times the baud rate or 16 times the baud rate depending on whether you have a TNC-1 or one of two types of TNC-2. No changes are necessary to make use of either clock speed.

AM7910 CONNECTIONS

The signals of interest on the AMD7910 modem chip are:

1. Receive Data output (RD)-----> pin 24

2. Carrier Detect (CD)----------> pin 25
   This signal is negative true for the 7910 chip.

TCM3105 CONNECTIONS

The signals of interest on the TCM3105 modem chip are:

1. Receive Data output (RXD)----> pin 8

2. Carrier Detect (CDT)---------> pin 3
   This signal is positive true for the 3105 chip.

3. In TNCs which use the TCM3105 chip but do not provide another source of baud clock, like the Kantronics KAM, you can use the signal at pin 2 of this chip. This signal is very close to 16 times the baud rate (19.11 KHz instead of 19.2 KHz for 1200 baud).

COMMERCIAL TNC SIGNAL LOCATIONS

The information you need to find the proper signals in several commercially available TNCs is presented in Appendix B. This is not intended to be a complete list by any means. It is simply a list of TNCs which have been successfully modified to include this circuit.

CONCLUSION

This paper outlines desirable characteristics in a TNC's DCD circuit. Modification instructions have been presented to enable owners of existing TNCs to upgrade their units. Hopefully, TNC manufacturers will take time to investigate their TNC DCD implementations and make the minor changes necessary to reduce unneeded retransmissions on our crowded packet frequencies!

[1] Goode, Steve, K9NG, "Modifying the Hamtronics FM-5 for 9600 bps Packet Operation," ARRL Amateur Radio Fourth Computer Networking Conference, pp.45-51.

[2] Gustafson, Eric, N7CL, "HF Modem Performance", Packet Radio Magazine, DEC 1986, p.12.

[3] Gustafson, Eric, N7CL, "HF Modem Performance Comparisons", Packet Radio Magazine, JAN-FEB 1987, pp.21-24.

[4] Gustafson, Eric, N7CL, "Letters To The Editor", Packet Radio Magazine, APR 1987, pp.8, 9, 19.

[5] Gustafson, Eric, N7CL, "Improved Data Carrier Detector (DCD) for 2211", RMPRA>PACKET, AUG 1988, pp.29,30.

APPENDIX A

MODIFICATIONS TO TNC-2 DATA CARRIER DETECTOR (DCD) CIRCUIT

Part numbers referred to are for the original TNC-2 as produced (briefly) by TAPR. I have not reviewed schematics of clones produced by all manufacturers so I cannot be sure that these numbers will be correct in all cases. Since I have seen information on the MFJ series, I can say that the numbers are ok for the 1270, 1270B, and 1274. If you are in doubt about part number correspondence, obtain a schematic of the original TNC-2 as produced by TAPR. Comparison between the TAPR schematic and the schematic of your TNC should resolve any differences. The TNC I used to verify this modification was a 1274 which I use primarily on HF packet. Since the physical layout of the modem area of the 1274 is different than the layout of the original TNC-2 or "pure" unaltered clones, I have avoided giving specific physical location information in the modification procedure.

Any manufacturer of the TNC-2 can feel free to incorporate this change into their hardware if they wish without incurring any obligation to myself or TAPR. I am available to answer any quetions in this area.

NOTE! Do NOT use T firmware earli than version 1.6 with th modification.

Firmware prior to V1.6 has facility for detection of a D fault condition and therefore cann warn you when the threshold contr has been improperly set.

STEP BY STEP MODIFICATION

1. If you have a TNC-2 or clone (exce MFJ-1274), and have not alrea removed the MF-10 filter and associat header parts, do so at this time. T reason for removing the MF-10 is th the operation of this filter circuit the TNC-2 is marginal. This margir condition drastically reduces the mod dynamic range. Simply remove both t MF-10 and the header associated wi the MF-10. Then, under the boar solder a jumper between pins 1 and of the header socket. Removing the M 10 also unloads the negative 5 vc supply, improving its regulation a reducing the noise generated by t charge pump circuit. There ABSOLUTELY NO PERFORMANCE PENALTY f removing this filter. The same filt used in the TNC-1 is NOT marginal a there is NO reason to remove the MF- from a TNC-1 or beta board.

2. Replace C35 and C42 with 0.01 uF cap

3. Remove the 470 K resistor at R73. careful not to damage the circuit bo pads or traces as they will be nee later in the modification.

4. Remove CR13.

5. Replace R70 with a 47 K resistor.

6. Lift the cathode end of CR15 from circuit board. Install a 47 K resis in series with CR15. Solder one of this resistor to the hole vacated CR15's cathode end. Solder the ot end of this resistor to the cathode of CR15 above the circuit board.

7. Replace R74 with a 4.7 K resistor.

8. Form a parallel network consisting 180 K resistor and a 0.01 uF cap. this network as compact as possible it will have to fit underneath circuit board. Solder this networ place under the board. One end goes pin 3 and the other to pin 6 of 2211 socket (U20).

9. Replace R38 with a 100 K resistor.

10. Above the circuit board, using le as short as possible, install a uF, 10 volt rated electroly capacitor between the -5 volt pad the tuning indicator connector hea (J3, pin 1) and ground. Connect

positive lead to ground. Remember that this cap will have to clear the cabinet so position it as near the board as possible.

11. Under the circuit board, solder a 2.2 uF, 16 volt rated electrolytic capacitor from the junction of R38 and R42 to the negative 5 volt supply. The negative end of this cap goes to the negative 5 volt supply.

12. Under the circuit board, solder one end of a 22 ohm resistor to the junction of R38 and R42. The other end goes to pin 5 of the 2211 (U20).

13. On the front panel, mount a miniature 100 K, linear taper potentiometer (yes, there really IS room for this). This will be the DCD threshold control. It will be used to set the DCD trigger point to the proper value.

    If linear mode operation is not contemplated, you can eliminate the 100 K potentiometer and the 27 K fixed series resistor referred to in the next two steps. Instead, install a fixed 180K resistor in place of R73. This is possible because there is not very much difference in the audio bandwidth presented to the demodulator from the various makes of NBFM radios.

14. Solder a wire from the wiper of the 100 K pot to the pad vacated by R73 which connects to C45 and pin 3 of the 2211 (U20).

15. Solder one end of a 27 K resistor into the pad vacated by R73 which connects to the negative 5 volt supply. Solder a wire from the other end of this resistor to one of the 2 remaining leads from the 100 K pot. Use the lead that is set to zero resistance when the shaft of the potentiometer is turned fully CCW.

When operating a TNC with a DCD threshold control, set the control so that the DCD LED on the front panel flashes occasionally when there is no signal present. The "false DCD" duty cycle should be approximately 10 percent.

When operating VHF FM with the radio squelched, the DCD will not false. If you MUST operate with the radio squelched (thus incurring the penalty of the additional delay time of the squelch circuit), set the threshold fully clockwise as described below.

The audio bandwidth of some VHF FM radios is so wide that the DCD will not false regardless of the threshold control setting. This will almost always be true when the audio is obtained ahead of the radio's squelch controlled stage before de-emphasis. For these radios simply turn the control fully clockwise. This sets the DCD to maximum sensitivity. DCD operation will not be impaired.

This completes the TNC-2 modem modification.

APPENDIX B

COMMERCIAL TNC SIGNAL LOCATIONS

AEA PK-87

It is relatively easy to interface this new DCD circuit to the PK-87 because there is no requirement to switch back to the internal DCD circuit once the modification is installed.

The Receive data signal is obtained from the center pin of JP4.

The Carrier Detect signal is obtained from the end of JP5 which connects to the modem chip.

The DCD output signal from the new circuit is inserted at the center pin of JP5. Use the NEGATIVE TRUE output. The jumper originally installed at JP5 is removed. The DCD indicator on the front panel will show the action of the new DCD circuit.

The X32 baud clock signal is obtained from pin 13 of U20 (a 74LS393 divider). Don't be tempted to get this signal from the "clock" line on J4, the external modem connector, as this is a X1 clock.

AEA PK-232

The PK-232 is also relatively easy to interface.

The Receive Data signal is obtained from the center pin of JP4.

The Carrier Detect signal is obtained from the end of JP6 which is NOT connected to pin 3 of the external modem connector.

The X32 baud clock signal is obtained from pin 13 of U8 (also a 74LS393 divider).

The DCD output from the new circuit is inserted at the center pin of JP6. Use the NEGATIVE TRUE output. The jumper originally installed at JP6 is removed.

To use the new DCD circuit with a PK-232 on VHF FM 1200 baud:

1. Set the audio level from the radio so that the tuning indicator "spreads" fully on the station with the lowest transmitted audio level on the channel.

2. The existing DCD threshold control should be set so that the existing DCD indicator LED on the front panel lights up whenever there is ANY signal or noise input to the TNC from the radio.

Be sure that even the station with the lowest amount of audio on the channel lights this LED. This LED should extinguish when there is no audio input from the radio (dead carrier from repeater etc.).

If you wish to observe the action of the DCD signal generated by the new circuit, add a high efficiency LED and 1k series resistor between +5 volts and the LED output of the new DCD circuit. The anode end of the LED should go towards +5 volts.

Pac-Comm TINY-2

The Pac-Comm TINY-2 hooks up as follows:

The X16 baud clock signal is obtained from U10 pin 1.

Receive Data is obtained from J5 pin 17.

Negative true Carrier Detect (CDT) is obtained from J5 pin 2.

NOTE: This is an inverted version of the CD output from the TCM3105 chip itself. Since this is a negative true logic signal, JMP1 on the new DCD circuit will be used instead of JMP2 which would normally be used for a TCM3105.

Negative true DCD from the new circuit is applied to the TNC at J5 pin 1. Remove the connection between J5 pins 2 and 1. The existing DCD indicator LED will not show the action of the new circuit.

If you wish to observe the action of the DCD signal generated by the new circuit, add a high efficiency LED and 1k series resistor between +5 volts and the LED output of the new DCD circuit. The anode end of the LED should go towards +5 volts.

If you wish to observe the action of the new DCD circuit on the existing LED indicator, you will have to do the interface a bit differently. First, you will get the negative true CDT signal from pin 1 of JPD. Then insert the LED output signal from the new circuit at either pin 2 of JPD or pin 2 of J5. Remove the jumper currently installed at JPD on the TINY-2 circuit board. If the new circuit is interfaced in this manner, the "RFDCD" signal can no longer be used. (This is no great loss, however, as it will also no longer be necessary.)

Kantronics KAM

For 1200 baud operation the signal location points of interest in the KAM are as follows:

The Receive Data (RXD) signal is obtained from pin 8 of the TCM3105 modem chip.

The X16 baud clock signal is obtained from pin 2 of the TCM3105.

The POSITIVE TRUE Carrier Detect (CDT) signal from the modem is obtained from pin 3 of the TCM3105. This line from the modem to the CPU is labeled with two numbered pads (7 and 8). These numbered pads represent pin numbers on a 20 pin modem disconnect header which is physically similar but electrically dissimilar to the standard TAPR modem disconnect header. The connection between these 2 locations should be broken. JMP1 on the new DCD circuit will be used.

The DCD output from the new circuit is injected at pin 21 of the 63B03 CPU.

The front panel LED which normally indicates the CDT signal activity will show the action of the new DCD circuit.

How to install the TAPR DCD State Machine Board in an AEA PK-88

Julian Macassey, N6ARE

Assemble the board as per the TAPR instructions. You do not have to insert the ribbon cable. It is better to use shielded cable as will be explained later.

The board will not fit inside the PK-88 case. Find a metal box that will fit the State Machine board. The board can be fixed inside the box with double sticky tape. Wire up the box as follows:

PK-88 to State Machine Interconnection

P1 (State PCB)	PK-88 points	Wire function
1 (Brown)	Cathode D5	Plus 5V
2(Red)	Cathode D4	Ground (Shield)
3(Orange)		Not Used
4(Yellow)		Not Used
5(Green)	JP4 CD center	DCD Out
6(Blue)	IC-20 Pin 13	X16/X32 Clock
7(Violet)	JP4 CD end	DCD In
8(Grey)	JP4 RD center	NRZI Data In

The colors in brackets above refer to the ribbon cable supplied with the kit. If you use this cable, you will have to find a way to feed this out of the case of the PK-88. Should you choose to use a shielded cable to connect between the PK-88 and State Machine PCB, you can feed the cable through hole in the PK-88 box between the DC connector and DB-25 connector. This hole may be marked "INT/EXT SW". When using shielded cable, the shield should carry the ground so connect to position 1 on P1 of the State Machine PCB.

The connections within the PK-88

Owing to the design of the PK-88 box, it is hard to install these mods and have the case easy to open and close. To understand these instructions it helps to have the PK-88 schematic and board layout diagram in front of you.

First you need to connect the power and ground. The power should go to the cathode of D5. This is the output of IC1 the 7805 Voltage Regulator. You will find a better place to do this is at the other end of this trace which is just behind the fuse. The ground should go to the cathode end of D4. This is the ground to IC1. The purpose of keeping these power connections together and as close to the regulator as possible is to reduce noise.

Next the clock connection (P1 6). You can attach either to pin 13 of IC-20 or pin 13 of the DB-25 connector. The source of the clock is pin 13, this should give a better signal.

The tricky bit is the connections across the jumper pins "cd" in the "JP 4" block of jumper pins. JP 4 is three sets of jumpers of 3 pins each. With the board in front of you with the DB-25 connector to your left, the top jumper is "cd". It is marked on the board and diagram, but is hard to read. Connect the "DCD Out" (P1 5) wire to the center pin of the jumper. Connect the "DCD In" (P1 7) wire to the end pin of the same jumper. The end pin is the one furthest from the DB-25 connector.

The final wire is "NRZI Data In" (P1 8). This wire is connected to the center pin of the center jumper. This is the jumper marked "RD" in the drawings, some TAPR documents call this RD or Receive Data as well as NRZI.

Replace the shorting plug on the center (RD) pins of JP4. Discard the jumper of the top (CD) pin of JP4.

You have now installed the State Machine Modification. It will work with standard AX.25 use.

KISS USE

For KISS use with KA9Q TCP/IP you have to make sure that pin 8 of the DB-25 is wired to the computer, also that the jumper JP3 has been moved to the correct position. See Paragraphs 2.8.2 and 2.13.1 of the PK-88 manual. Also it appears that the state mod will only work in KISS when using the May 89 PROM. Earlier versions do not seem to work in KISS. The later PROMS are the ones that go into KISS with a single "KISS ON" command.

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AMSAT news service bulletins, 1/23/90

SUCCESSFUL LAUNCH OF SIX NEW AMATEUR RADIO SATELLITES

After nearly three years of hard work by scores of dedicated AMSAT volunteers, there are finally six new amateur satellites in orbit. At 01:35:31 UTC on January 22, 1990, ESA successfully launched it's V35 mission, an Ariane 4 booster, from its launch facility in Kourou, French Guiana. On board were six amateur radio satellites, two built by the University of Surrey, UO14 and UO15 and four microsats built by AMSAT-NA, AO16, AO17, AO18, AO19. An errant tape recorder on the primary payload, SPOT-2 delayed the launch from January 9th and bad weather in the area brought about a scrub of the launch on January 21. However, the picture perfect launch occured at the beginning of the ten minute launch window Sunday evening local time.

The AMSAT Launch Information Network Service (ALINS) brought the launch "live" to thousand of amateurs and interested on-lookers world wide. Doug Loughmiller, KO5I, President of AMSAT-NA, anchored the net which could be heard on the ham bands covering 160 meters all the way up to AO10 and AO13. Also heard on the ALINS net were a number of the major contributors to this latest effort. Commentary prior to the launch was offered by Tom Clark, W3IWI, Jan King W3GEY, Martin Sweeting, G3YJO, Jeff Ward G0/K8KA, Harold Price NK6K, Dave Cowdin WD0HHU and Bob McGwire N4HY. It was noted that this was also an anniversary for the ALINS net. It was twenty years ago, on January

23, 1970, when the first ALINS net covered the launch of Australius-OSCAR 5.

Doug Loughmiller, watching the ESA video feed of the launch, counted down to ignition and liftoff. AMSAT's Dave Cowdin, who had been at the launch site for over 5 weeks gave updates on the progress of the mission from his position at ESA mission control. At about three minutes into powered flight (during the second stage burn), the launch commentary ceased. For over a minute, neither Dave Cowdin or Tom Clark, who was monitoring the launch from the NASA Goddard Space Flight Center in Greenbelt MD offered any information. This silence had certainly activated the adrenaline glands and stopped the breathing of those who were listening. One voice offered some comfort, explaining that ESA had never had a second stage failure in any of its missions. Finally Dave's voice came through indicating that all systems were "still GO" — and with that message, those listening could begin to breath again. As part of the elation felt by the development team, Harold Price (a member of the software team) indicated his delight in recognizing that the satellites were no longer within the grasp of the hardware team, and that the satellites were "all theirs".

At 20:04 minutes of mission elapsed time, ESA issued a payload separation command to its launch vehicle and UO14 and UO15 were freed. A minute and a half later at 21:29 mission elapsed time, ESA issued two more payload separation commands and AO16, AO17, AO18, AO19 were released. Dave Cowdin reported that the six separation lights were "All Green" indicating confirmation that all six Amateur Satellites had successfully separated from the launch vehicle.

Dave Cowdin indicated that AMSAT was treated in a most professional manner by ESA. Although the primary payload, SPOT-2, (a $100 million observation satellite) was ESA's primary concern, applause from ESA mission control could be heard over the ALINS net as the six satellites were separated from the main launch vehicle.

During the first orbit, AMSAT-LU in Buenos Aires commanded the CW beacon to commence transmitting, and it provided vital temperature and battery voltage information to the satellite command team. Although attempts by N4HY to turn on the PSK telemetry beacons during orbit 1 were unsuccessful, all of the Microsats were transmitting by the end of the last pass (orbit 3) over the west coast, around 0700. Spacecraft engineers Harold Price and Jan King, operating from W6TRW, indicated that the satellites had either responded to ground command or had switched on transmitters automatically in order to prevent battery overcharging. WEBERSAT was succesfully commanded on >from Weber State College in Ogden, Utah during orbit 2. UO-14 and 15 were activated during the first opportunity visible from the University of Surrey on orbit 5.

SPOT-2 / MICROSAT / UOSAT KEPLERIAN ELEMENT SET

The following element, originally provided by ESA as relayed by N4HY has been modified by W2RS to more closely predict observed AOS and LOS times:

Satellite:	SPOT-2, UO-D, E, Microsat-A, B, C, D
Catalog number:	
Epoch time:	90022.0778588
Element set:	Kourou-1
Inclination:	98.73 deg
RA of node:	97.9558 deg
Eccentricity:	0.0013
Arg of perigee:	93.9 deg
Mean anomaly:	302.31 deg
Mean motion	14.28575 rev/day

Decay rate:	1.0e-05 rev/day^2
Epoch rev:	0
Appogee	816.0 km
Perigee	798.1 km

The following element set for PACSAT was provided by RGO via G3AAJ.

Satellite:	AO-16
Catalog number:	
Epoch time:	90022.77211779
Element set:	RGO
Inclination:	98.7092 deg
RA of node:	99.2408 deg
Eccentricity:	0.0003323
Arg of perigee:	185.4669 deg
Mean anomaly:	178.4316 deg
Mean motion:	14.28180195 rev/day
Decay rate	7.9248e-04 rev/day^2
Epoch rev:	10

Whatever element set you are using, allow some tolerance in pass times and antenna pointing until information starts to become available from the standard sources.

MICROSAT AND UOSAT FREQUENCIES AND DEPLOYMENT ORDER

The following are the Microsat and UoSat listening frequencies, data rates, and modes for the first few weeks of operation and check out.

Spacecraft	OSCAR number	Frequency,MHz	Mode
UoSat D	UO-14	435.070	1200 bps AFSK (FM)
UoSAT E	UO-15	435.120	1200 bps AFSK (FM)
PACSAT	AO-16	437.025	1200 bps PSK AX.25
DOVE	AO-17	145.825	1200 bps AFSK AX.25 (FM)
WEBERSAT	AO-18	437.075	1200 bps PSK AX.25
LUSAT	AO-19	437.150	1200 bps PSK AX.25
LUSAT - CW	LUSAT	437.125	12 WPM CW telemetry

Packet transmission from DOVE may be monitored with an unmodified TNC-2 or clone, using an FM receiver. The other microsats (PACSAT, WEBERSAT, and LUSAT) require an SSB receiver and TNC with a 1200 bps PSK demodulator (FO-12 compatible, NOT the 400 bps PSK demodulator used with AO-10 and AO-13). The modulation scheme used by the UoSats is compatible with UO-11.

RATS:N OHJELMAPANKKI 22.1.1990

Vesa Tervo, OH1NWQ

RATS:in ylläpitämään ohjelmapankkiin kerätään eri lähteistä radioamatööritoimintaan ja elektroniikkaan liittyviä Public Domain PC-ohjelmia, joita välitetään seuran jäsenille.

Ohjelmien tilaus tapahtuu lähettämällä seuralle lista haluamistasi ohjelmista, riittävä määrä levykkeitä (muista suojata levykkeet postin käsittelyltä) ja riittävällä postimaksulla varustettu palautuskuori. Levykkeiden on oltava valmiiksi formatoituja käsittelyn nopeuttamiseksi. **Jos näitä ohjeita ei noudateta, hidastuu levykkeiden toimitus ratkaisevasti! Samoin käy suurille (yli 10 levykettä) kerralla pyydetyille ohjelmamäärille.**Ei siis seuraavasti: Lähettäkää kaikki mitä löytyy tai Haluan pakettiradioon liittyviä ohjelmia.

Ohjelmien tilausosoite:

Vesa Tervo OH1NWQ
"RATS PC"
Orivedenkatu 8 G160
33720 TAMPERE

Välitys tapahtuu käytännön syistä IBM PC:n levyformaateilla eli 5.25" (360 kB ja 1.2 MB) sekä 3.5" (720 kB ja 1.44 MB). Käytä mieluiten 720kB tai 360 kB formaattia, koska omassa koneessani on ko. asemat. **HUOM! Kaikki ohjelmat ovat pakatussa muodossa (.ARC)**, joten tarvitset PKUNPAK (eli PKXARC) ohjelma (versio 3.5 tai uudempi). Mikäli sinulla ei ole sitä, niin pyydä se tilauksesi yhteydessä.

Ohjelmalista on pyritty jakamaan aihepiireittäin (pakettiradio, satelliitit,...) ja siinä käytetään seuraavaa rakennetta:

OHJELMAN_NIMI VERSIO (LEVYKKEITÄ)
Kuvaus ohjelmien sisällöstä. VERSIO on ohjelman versionumero tai ohjelmien luontipäivämäärä muodossa PPKKVV (esim. 010490). Suluissa ilmoitetaan tarvittava 360 kB:n levykkeiden määrä (HUOM! 720 kB:n levykkeelle mahtuu 2 kpl, 1.2 MB:n 3 kpl ja 1.44 MB:n 4 kpl 360 kB:n levykettä).

Jotta ohjelmapankki pystyisi palvelemaan monipuolisesti harrastettamme, uusia ohjelmia otetaan mielellään vastaan. Mikäli luulet että joku toinenkin voisi olla kiinnostunut kirjoittamistasi ohjelmista, niin tee lyhyt kuvaus ohjelmastasi ja lähetä se ohjelmapankkiin.

Lisäinfoa saat lähettämällä postia tai soittamalla minulle.

Vesa Tervo OH1NWQ k. (931) 180 690, t. (931) 30 500

PACKET - Pakettiradio

WA7MBL-MAILBOX V5.12 (2)
Toistaiseksi eniten käytetty pakettiradioboxiohjelma. "Varma valinta" boxin pystyttäjälle.

BB V2.6 (1)

AA4RE:n versio pakettiradiopostilaatikko-ohjelmasta. Ohjelma näyttää käyttäjälle hyvin samanlaiselta kuin WA7MBL, mutta sallii mm. useita samanaikaisia yhteyksiä ilman erillisiä moniajo-ohjelmia. Ohjelma osaa toimia myös puhelinmodeemin kanssa. Vaatii toimiakseen W8DED tai TheFirmwaren TNC:ssä. Samalla levykkeellä myös MBBIOS 3.2 keskeytysohjattu konfiguroitavissa oleva sarjaliikenneohjain.

CBBS 6.0 (1)

W0RLI:n ohjelman varhaisempiin versioihin pohjautuva postilaatikko-ohjelma, josta on myös C-kielinen lähdekoodi saatavana.

DIEBOX V1.5c (2)

Saksalaisten kehittämä pakettiradiopostilaatikko-ohjelma. Monta samanaikaista käyttäjää samalla taajuudella. Vaatii toimiakseen TNC:hen uuden prommin, The Firmware 2.1c. Tämän binäärikoodi on mukana levykkeillä. Sisältää Turbo-Pascal:lla tehdyn lähdekoodin.

MSYS V1.05 (1)

Uutta 101089: Postilaatikko-ohjelma PC:lle, joka sallii useita samanaikaisia yhteyksiä. Ohjelma hallitsee myös DX Cluster, KA-NODE ja TCP/IP liikennöinnin. Toimii TNC:n KISS modessa.

W0RLI-PC-MAILBOX V10.04 (1)

Postilaatikko-ohjelma PC:lle. Vaatii toimiakseen joko XT:n V20 CPU:lla tai AT:n.

W0RLI-CPM-MAILBOX V12.0 (1)

Pakettiradiopostilaatikko Z80 assemblerilla CP/M koneille. Vaati koneen BIOS:in muuttamista (ei heikkohermoisille!).

TERMINALS (1)

Terminaaliohjelmia:

1) YAPP V2.0 - Erityisesti pakettiradiota varten suunniteltu.

2) PK232 V1.41 - PK232 TNC:lle, YAPP:n tyylinen, monipuolisempi.

3) ET - YU3FK:n yksikertainen TSR-ohjelma (Turbo Pascal).

KERMIT V2.32/A (1)

Yleiskäyttöinen pääte- ja tiedonsiirto-ohjelma.

TURBOPR V2.5a (1)

Saksalaisten kehittämä pääteohjelma pakettiradiokäyttöön. Osaa mm. pitää automaattisesti lokia QSO:ista, 4 samanaikaista yhteyttä, valmiiksi ohjelmoitavia tekstejä jne. Turbo-Pascal:lla tehty lähdekoodi mukana. Vaatii toimiakseen TNC:hen uuden prommin, The Firmware 2.1c. Tämän koodi on mukana levykkeellä.

KA9Q-TCPIP V890421.1 (2+2)

Ylempien kerrosten yhteyskäytännöt toteuttava ohjelmapaketti. Tämä versio sisältää NET/ROM tuen, finger-komennon sekä "packet driver" ohjaimen käyttömahdollisuuden. Yli satasivuinen käyttöohje levyillä. Itse ohjelma on 2 levykettä ja lähdekoodi (ei välttämätön) 2 levykettä.

ROSE 221088 (2)
X.25 suosituksen mukainen verkko-ohjelmisto TNC:lle. Sisältää lähdekoodin C-kielisenä.

TNC1-SRC (1)
TNC-1:n lähdekoodi (6809 assembler) ja AX.25 pascalilla. Samalla levykkeellä myös KA9Q:n C-kielinen TNC-ohjelmarunko Xerox 820 mikrolle. Hyödyllinen lähinnä AX.25 protokollaan tutustumiseen.

TAPR 310389 (1)
TNC-1 ja TNC-2 suunnittelijan jakamia ohjelmapäivityksiä yms. TNC-2 ohjelmaversio 1.1.6. Versio 1.1.6 sisältää valmiin KISS-toiminnan TCP/IP:tä varten. 7th Computer Networking Conference Proceedings:ssa esitettyjen Carrier Detect parannusten EPROM:ien sisällöt. Beta-test versio "priority ack" protokollamuutoksesta.

THENET V1.1 (1)
Saksalainen NET/ROM klooni, public domain, manuaalit mukana. Vastaa täysin toiminnaltaan NET/ROM 1.3:sta ja toimii yhdessä aidon NET/ROM:n kanssa verkossa. Mukana myös CONVERS verkkonode, jossa monen käyttäjän keskustelumahdollisuus. Ohjelma jaettu kolmeen eri versioon: End-Node (= vanha TheNet), Interlink-Node (rajoitettu käyttöoikeus) ja Convers (keskustelunode).

ARES/DATA V1.0 (1)
Uutta 151089: USA:n PePa-organisaatiolle kehitetty yksinkertainen tietokantaohjelma on-line tiedon keräämiseen esim. loukkaantuneista. Käyttää TNC:n host-modea ja sallii useita samanaikaisia käyttäjiä.

WW-PBBS 291088 (1)
Maailmanlaajuinen pakettiradio boxi- ja digipiitterilista.

MISC-PACKET-1 010889 (1)
Sekalaisia pakettiradio-ohjelmia:

PK-232: uusin ohjelmaversio päivätty 301288.

Netconf: Osa 7th Computer Networking Conference:n teksteistä tiedostoina.

Packet-MS: I2KFX:n ohjelma meteoscatter-yhteyksiin paketilla. Käyttää KISS-modea.

MISC-PACKET-2 010889 (1)
G8BPQ TheNode 3.23: Ohjelma toimii TNC:n KISS-modessa ja tekee siitä Net/Rom protokollaa käyttävän verkkosolmun. Muodostaa useita "virtuaalisia TNC:itä" yhdella laitteella käytettäväksi esimerkiksi postilaatikko-ohjelmissa.

Stats: Ohjelma toimii KISS-modessa ja kerää taajuudella kuuluvista asemista erilaista tilastotietoa (tx/rx määrä, toistot, törmäykset jne.).

NTS12: USA:n NTS-sanomanvälityslomake paketilla. Ideoita Pepa-käyttöön?

SATRA 1.0 (1)
Satelliittien ratalaskentaohjelma graafisella näytöllä. Osaa myös antenniroottorin ohjauksen (ks. RATS 2/89). Vaatii toimiakseen MS-Windows:in.

OH2SN-SAT 101189 (1)
101189 Uusi versio: Satelliittien ratalaskenta, auringon paikan laskeminen.

OH2SN-BOXSAT 101189 (1)
101189 Uusi versio: Boxeille satelliittien ratojenlaskentaohjelma BOXSAT, joka laskee automaattisesti valmiiksi mm. puolentoista vuorokauden suuntatiedot listoiksi, joita voi lukea boxissa normaaleina viesteinä. Mahdollisuus lukea ratatiedot boxiin tulleista viesteistä.

HAMTECH - Radioamatööritekniikka

KOLVIKALLE (1)
Sekalaisia ohjelmia antennimitoituksesta resonanssipiirien laskentaan.

MININEC (1)
MININEC III - antennianalyysi, RC-CAD - sekalaista RC-suunnittelua, **Uutta 011089:** RFCAD - sekalaista RF-suunnittelua, FILTER11 - aktiivisuotimen suunnittelu.

OH2SN-ELEKTRO 101189 (1)
101189 Uusi versio: Suotimien, syöttöjohtoilmiöiden ja kuormien sovitusten laskentaan.

RF-DESIGN 011089 (1)
Uutta 011089: RFTOOLS - RF-kytkentöjen suunnitelua, RFS - FM-asemien antenni yms. laskentaa, INTMOD60 - sekoitustulosten analysointia.

PROPAGATION 011089 (1)
Uutta 011089: MINPROP2 - etenemisennuste, WHATSON - etenemisennuste, WHERITIS - antennisuunnan laskenta.

K2UYH/NTEX_MS (1)
K2UYH:n basicilla tekemiä VHF/UHF toimintaan liittyviä ohjelmia sekä kokoelma mikroaaltosuunnitteluun ja VHF/UHF/SHF workkimiseen liittyviä ohjelmia Texasista.

WORK - Workkiminen (lokit, morse, jne.)

OH2BCV April89 (1)
OH2BCV/OH3UU contestiohjelmat CQ WW DX, ARRL DX ja RS(T)+001 tyyppisille kilpailuille. Sisältää lokinpidon, tulostuksen sekä QSL-tarrat.

OH1AA HF-LOKI 2.0 (1)

OH1MIE:n tekemä lokinpito-ohjelma HF:lle. Toimii pop-up ikkunoilla kuvaruutupohjaisesti. Ei vielä valmis, mutta normaali loki toimii, kilpailuloki ja QSL kirjoittaminen vasta tulossa.

LOKIT 011089 (1)

Uutta 011089: CNLOG140 ja CONTEST - kilpailuloki, LOGBOOK - dBase:lla tehty lokikortisto.

OH2BGN VHF-LOKI v.9 (1)

VHF/UHF/SHF testilokiohjelma, joka laskee sekä etäisyydet että pisteet. Ohjelma tekee kirjoittimelle valmiin lokilehden.

VK3UM EME Planner (1)

EME-workkijan toiveohjelma. Sisältään kuun (ja auringon) suunnan laskennan, lähetysvuoroajastimen, yhteysväliin liittyvää laskentaa jne.

OH2SN-DXCCMAP 101189 (1)

101189 Uusi versio: Näyttää asemapaikan sekä valitun kohteen sijainnin maapallon kartalla, isoympyräkaaren, prefixin, maan nimen sekä ITU- ja CQ-nimen. Lisäksi päivän/yön raja, auringon suunta ja korkeus, nousu- ja laskuaika kohteessa. Graylinesuunnat todettavissa. Extrana LOGIQSL, joka kirjoittaa kahta erilaista QSL-tarraa.

OH2DN 1.0 (1)

Matin ohjelmat DXCC-maataulukointiin ja sähkötyksen opetteluun sekä suomen- että ruotsinkielellä.

MORSE 011089 (1)

Uutta 011089: Kokoelma ohjelmia sähkötyksen opetteluun. Levyllä on AUTOCW, CW, SM207, MORSE24C, MACHINE ja MORSE nimiset ohjelmat.

RTTY/FAX 011089 (1)

Uutta 011089: OH3FG - Kehittynyt RTTY-ohjelma, HAMRTTY - RTTY-ohjelma, AUTOFAX - wefax vastaanotto PC:llä, WEFAX - sääkuvien vastaanotto KAM:n kanssa.

OH7QT 240688 (1)

Kokoelma basic ohjelmia mm. kuun sijainnin määrittelyyn, etäisyyslaskentaan ja antennisuunnitteluun.

OH8NS 311087 (1)

dBASE ja basic ohjelmia mm. kilpailuloki (VHF), lokaattori ja QSL-tarrat.

MISC - Sekalaista

RA-62-88 010889 (1)

Empun, OH2BBF, tekemät PC-File -tiedostot RA:n sisällyksistä v. 1962-88 sekä useilta vuosilta myös mm. Hamradio, Hamradio Today, Radcom, Practical

Wireless ja Dubus lehdistä. Erikseen saatavana myös PC-file (1 levyke) tiedostojen käsittelyyn.

W3IWI_DSP 061288 (HUOM! 4 AT)

Edustava kokoelma signaalinkäsittelyohjelmistoja (DSP, digital signal processing) amatöörikäyttöön. Mukana mm. pakettiradiomodeemeita, wefax-vastaanotto, FIR/IIR suodattimet. Pääasiassa TMS 32010/32020 prosessoreille, jotain myös 56000 sarjalle. Lisäksi DSP-aiheista keskustelua USA:n verkoista. Kokoelman laajuuden vuoksi se toimitetaan AINOASTAAN 1.2 tai 1.44 MB levyillä (4 kpl).

SEKALAISTA 010889 (1)

CCIR: OH1KH:n ohjelma CCIR:n jonokoodin generoimiseen PC:llä. Voidaan käyttää vaikkapa repeaterin ohjaukseen. Mukana lähdekoodi Turbo-Pascal:lla.

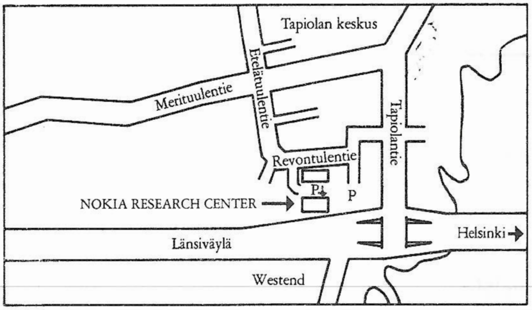
Autolo4: Ohjelma ICOM:n rigien tietokoneohjaukseen ja workkimistietojen keräykseen. **Uutta 011089:** Uusi versio.

Radioamatööritekniikan seuran

VUOSIKOKOUS 10.3.1990 klo 13

Nokian tutkimuskeskus
Revontulentie 8 C
Tapiola, Espoo

Käsiteltävänä sääntömääräiset asiat.
Kokouksen jälkeen illanviettoa saunassa.



Oy. Yleisradio Ab.
Mittausasema
V.K.Lehtoranta

MITTAUSPÖYTÄKIRJA TKVE 164/89

KENTÄNVOIMAKKUUDEN MITTAUKSIA FM ULA-ALUEELLA 13.11.1989

13.11.1989 esiintyi Jokelan mittauksissa erittäin voimakasta radioauroraa alkaen iltapäivällä 12 UTC jälkeen ja jatkuen kuuden tunnin ajan; voimakkaimmillaan radioaurora oli 16-17 UTC (18-19 SA).

Ohessa ULA-spektri mittaus taajuusalueelta 87.5...105.4 MHz. ko. vuorokaudelta maanantaina 13.11.1989.

Rx: R&S ESVP (12 kHz:n IF-kaistalla)
Ant: R&S VHF mittausantenni noin 11 m korkeudella maasta

Mittaus edustaa ULA-alueen nykytilannetta Hyvinkäällä voimakkaan auroran vallitessa vastaanotettuna suhteellisen tehottomalla "ympärisäteilevällä" antennilla.

Miltei jokaisella "ULA-kanavalla" 103.8 MHz:iin saakka näkyy radioaurorasignaaleita, jotka ovat peräisin kaukaisista ULA-asemista, jotka saattavat olla suomalaisia, ruotsalaisia, norjalaisia jne. Voimakkaalla aurorakelillä voi näkyä muitakin.

Suht. hiljaisia taajuuksia: 89.7, 90.4, 95.3, 95.7, 96.1 jne.

103.8 MHz:n yläpuolella ei vielä näy minkäänlaista "liikennettä".

Ohessa myös 30 taajuuden ANRITSU-mittaus samalta päivältä ja siinä vastaanottimena on Anritsu ja antennina sama R&S HE 114.

Vaikka inputjännitteen konvertoinnissa on sama "antennikerroin" (11 dB) esiintyy arvoissa eroja, koska:

a) Anritsu on kalibroitu "EMF"-jännitteelle (6 dB suurempi),
b) vastaanottimen "skannausvauhti" on erilainen eli
   - Anritsu mittaa 30 taajuutta aina 2 sekuntia kerrallaan,
   - ESVP mittaa 204 taajuutta aina 0.5 sekuntia kerrallaan.

ESVP ULA-mittauksissa tulostetut 50% -arvot ovat useita desibelejä pienempiä mutta "pohjat" ilman asemia ovat 3-4 dB suurempia.

* Oy. Yleisradio Ab. B:NEW-13.11S
Measuring Station
R&S ESVP with ND antenna in Jokela
Start date 13-11-1989, repeating period 60 min and length 60 min.
Values of field strength (dB/1uV/m) exceeded for 50 % of time:

MHz.	87.500	87.600	87.700	87.800	87.900	88.000	88.100	88.200	88.300	88.400	88.500	88.600	88.700	88.800	88.900	89.000	89.100	89.200	89.300	89.400	89.500	89.600	89.700	89.800	89.900	90.000	90.100	90.200	90.300	90.400
00:03-01:00	9	9	9	9	9	9	9	9	9	9	9	9	27	9	9	9	9	9	9	9	9	9	9	9	9	10	46	9	9	9
01:00-02:01	9	9	9	9	9	9	9	9	9	9	9	9	27	9	9	9	9	9	9	9	9	9	9	9	9	10	46	9	9	9
02:01-03:00	9	9	9	9	9	9	9	9	9	9	9	9	27	9	9	9	9	9	9	9	9	9	9	9	9	10	46	9	9	9
03:00-04:01	9	9	11	9	62	10	9	9	9	9	31	9	27	9	15	9	9	46	9	9	9	9	9	19	13	10	46	9	9	9
04:01-05:00	9	9	11	9	66	11	9	10	9	9	35	9	19	9	20	9	9	47	9	9	9	9	9	28	19	10	38	9	9	9
05:00-06:00	9	9	11	9	63	11	9	10	9	9	33	9	20	9	20	9	9	45	9	9	9	9	9	26	23	10	38	9	9	9
06:00-07:01	9	9	16	9	65	11	9	10	9	9	34	9	20	9	23	9	9	45	9	9	9	9	9	27	22	10	39	9	9	9
07:01-08:00	9	9	11	9	65	13	9	9	9	9	32	9	21	9	28	9	9	45	9	9	9	9	9	28	21	9	40	9	9	9
08:00-09:01	9	9	11	9	66	21	9	9	9	9	32	9	21	9	27	9	9	46	9	9	9	9	9	27	24	9	40	9	9	9
09:01-10:00	9	9	15	9	65	21	9	9	9	9	33	9	20	9	20	9	9	44	9	9	9	9	9	27	24	9	38	9	9	9
10:00-11:01	9	9	13	9	64	16	9	9	9	9	32	9	20	9	22	9	9	43	9	9	9	9	9	29	22	9	39	9	9	9
11:01-12:01	9	9	11	9	63	13	9	9	9	9	26	10	20	9	18	9	9	40	9	9	9	9	9	24	15	9	39	9	9	9
12:01-13:00	9	10	14	9	66	20	9	11	9	10	34	10	20	9	25	10	10	45	9	9	9	9	9	25	17	9	38	10	9	9
13:00-14:01	9	14	16	10	65	21	11	13	12	11	36	11	21	10	24	10	12	44	10	11	10	10	9	28	14	13	38	11	11	9
14:01-15:00	9	11	12	9	64	19	10	10	11	9	32	10	21	10	18	9	11	44	10	10	9	10	9	24	17	11	39	10	10	9
15:00-16:01	9	13	15	10	65	14	11	12	11	10	35	11	22	11	20	10	11	46	10	11	10	11	9	22	18	12	38	11	11	9
16:01-17:00	9	15	13	10	64	14	11	14	12	11	30	12	27	11	19	10	13	46	11	11	11	11	10	25	14	11	45	12	10	10
17:00-18:00	9	11	12	9	65	13	10	11	10	9	31	10	28	10	14	9	10	45	9	9	10	10	9	25	14	10	45	10	9	9
18:00-19:01	9	9	12	9	66	11	9	10	9	9	32	10	28	9	13	9	9	45	9	9	9	9	9	24	13	9	46	9	9	9
19:01-20:00	9	9	11	9	65	11	10	10	9	9	31	10	28	9	13	9	9	46	9	9	9	9	9	23	13	9	45	9	9	9
20:00-21:01	9	9	11	9	64	11	9	9	9	9	30	9	28	9	15	9	9	46	9	9	9	9	9	28	16	9	45	9	9	9
21:01-22:00	9	9	11	9	66	10	9	9	9	9	35	9	28	9	17	9	9	47	9	9	9	9	9	26	16	9	45	9	9	9
22:00-23:01	9	9	9	9	9	9	9	9	9	9	9	9	28	9	9	9	9	9	9	9	9	9	9	9	9	10	45	9	9	9
23:01-00:00	9	9	9	9	9	9	9	9	9	9	9	9	28	9	9	9	9	9	9	9	9	9	9	9	9	10	45	9	9	9
					E																									

* Oy. Yleisradio Ab. B:NEW-13.11T
Measuring Station
R&S ESVP with ND antenna in Jokela
Start date 13-11-1989, repeating period 60 min and length 60 min.
Values of field strength (dB/1uV/m) exceeded for 50 % of time:

MHz.	90.500	90.600	90.700	90.800	90.900	91.000	91.100	91.200	91.300	91.400	91.500	91.600	91.700	91.800	91.900	92.000	92.100	92.200	92.300	92.400	92.500	92.600	92.700	92.800	92.900	93.000	93.100	93.200	93.300	93.400
00:03-01:00	9	9	9	9	34	9	17	42	9	28	9	9	9	9	61	11	12	9	9	9	11	17	9	29	9	9	31	9	9	9
01:00-02:01	9	9	9	9	34	9	18	42	9	28	9	9	9	9	63	13	13	9	9	9	11	21	9	31	9	9	32	9	9	9
02:01-03:00	9	9	9	9	34	9	17	41	9	29	9	9	9	9	60	11	11	9	9	9	13	20	9	32	9	9	31	9	9	9
03:00-04:01	9	9	28	9	34	9	19	43	9	27	9	9	9	10	61	12	11	9	9	9	14	20	9	28	9	9	31	65	9	9
04:01-05:00	9	9	30	9	34	9	18	45	9	31	9	9	9	9	64	11	17	9	9	9	18	27	9	34	9	9	34	66	9	9
05:00-06:00	10	9	31	9	31	9	18	43	9	32	9	10	9	9	63	11	18	9	9	9	22	23	9	32	9	9	33	64	9	9
06:00-07:01	10	9	28	9	34	9	18	44	9	28	9	11	9	9	64	16	20	9	9	9	24	25	9	33	9	9	35	64	9	9
07:01-08:00	10	9	31	9	34	9	19	40	9	37	9	11	9	9	62	11	22	9	9	9	20	27	9	32	9	9	31	65	9	9
08:00-09:01	11	9	29	9	33	9	19	45	9	35	9	10	9	9	65	12	25	9	9	9	25	25	9	32	9	9	34	66	9	9
09:01-10:00	10	9	25	9	34	9	18	42	9	30	9	9	9	9	63	15	18	9	9	9	23	26	9	32	9	9	33	65	9	9
10:00-11:01	10	9	28	9	32	9	18	41	9	28	9	10	9	9	62	14	21	9	9	9	21	27	9	30	9	9	31	65	9	9
11:01-12:01	9	9	24	9	31	9	19	42	10	29	9	10	9	9	61	12	19	9	9	9	18	26	9	30	9	9	33	63	9	9
12:01-13:00	11	9	23	9	33	10	18	42	10	31	9	10	9	9	62	12	20	10	9	9	17	21	9	31	9	9	31	65	9	9
13:00-14:01	15	10	28	10	31	12	19	43	11	35	12	11	11	11	62	14	21	12	10	12	16	24	11	36	9	11	32	64	11	10
14:01-15:00	11	10	25	9	33	10	18	41	10	31	10	9	10	10	61	11	16	10	9	11	13	21	10	29	9	11	32	63	10	9
15:00-16:01	13	10	30	10	33	11	18	44	11	28	11	10	10	12	63	13	16	11	10	11	18	20	11	33	10	11	33	64	11	10
16:01-17:00	12	11	25	11	32	12	18	43	11	32	12	11	11	10	63	13	16	11	11	12	14	24	11	31	11	11	34	65	12	10
17:00-18:00	10	9	26	9	34	10	20	43	10	31	10	10	10	9	64	12	15	10	10	10	14	24	10	31	9	10	35	65	10	9
18:00-19:01	10	9	23	9	33	9	19	43	9	30	9	10	9	9	64	12	11	9	9	9	13	25	9	32	9	9	34	65	9	9
19:01-20:00	10	9	29	9	30	9	19	44	9	30	9	10	9	9	63	11	12	9	9	9	12	22	9	31	9	9	30	65	9	9
20:00-21:01	9	9	32	9	32	9	18	43	9	28	9	10	9	9	62	11	12	9	9	9	14	28	9	30	9	9	32	63	9	9
21:01-22:00	9	9	32	9	34	9	18	45	9	30	9	10	9	9	61	11	13	9	9	9	14	24	9	32	9	9	32	66	9	9
22:00-23:01	9	9	9	9	38	9	19	45	9	32	9	9	9	9	62	12	11	9	9	9	17	25	9	32	9	9	36	9	9	9
23:01-00:00	9	9	9	9	38	9	18	43	9	32	9	9	9	9	62	14	15	9	9	9	14	25	9	32	9	9	36	9	9	9
															E													L		

E = Espoo
L = Lahti

9 ≙ pohjakohina
12 kHz:n kaistalla

Oy. Yleisradio Ab.   B:NEW-13.11U

Measuring Station

R&S ESVP with ND antenna in Jokela

Start date 13-11-1989, repeating period 60 min and length 60 min.

Values of field strength (dB/1uV/m) exceeded for 50 % of time:

MHz. .kHz	93.500	93.600	93.700	93.800	93.900	94.000	94.100	94.200	94.300	94.400	94.500	94.600	94.700	94.800	94.900	95.000	95.100	95.200	95.300	95.400	95.500	95.600	95.700	95.800	95.900	96.000	96.100	96.200	96.300	96.400
00:03-01:00	9	9	24	9	9	61	9	9	18	9	9	13	26	10	16	9	9	9	9	9	62	9	9	9	9	45	9	12	9	9
01:00-02:01	9	9	24	9	9	62	9	9	22	9	9	12	26	11	16	9	9	9	9	10	62	9	9	9	9	45	9	11	9	9
02:01-03:00	9	9	20	9	9	61	10	9	19	9	9	11	26	10	16	9	9	9	9	10	60	9	9	9	9	44	9	11	9	9
03:00-04:01	9	9	23	9	10	61	10	9	20	9	9	12	26	10	16	9	9	9	9	9	62	9	9	9	9	47	9	12	9	9
04:01-05:00	9	9	27	9	10	62	9	9	27	9	9	19	19	11	11	9	9	9	9	9	64	9	9	9	9	47	9	12	9	9
05:00-06:00	9	9	29	9	10	61	9	9	24	9	9	20	19	11	12	9	9	10	9	9	63	9	9	10	9	46	9	12	9	9
06:00-07:01	9	9	24	9	10	61	9	9	24	9	9	18	19	12	11	9	9	9	9	9	65	9	9	10	9	47	9	12	9	9
07:01-08:00	9	9	28	9	10	66	9	9	28	9	9	24	21	11	14	9	9	9	9	9	62	9	9	10	9	47	9	12	9	9
08:00-09:01	9	9	28	9	10	66	9	9	26	9	9	29	19	11	12	9	9	9	9	9	65	9	9	10	9	48	9	12	9	9
09:01-10:00	9	9	22	9	10	62	9	9	27	9	9	20	18	13	11	9	9	9	9	9	63	9	9	9	9	46	9	12	9	9
10:00-11:01	9	9	26	9	9	63	9	9	27	9	9	23	21	14	11	9	9	9	9	9	61	9	9	9	9	46	9	12	9	9
11:01-12:01	9	9	24	9	10	65	9	9	27	9	9	20	18	12	13	10	9	9	9	9	64	9	9	9	9	47	9	11	9	9
12:01-13:00	9	9	21	9	10	62	9	10	23	9	10	22	18	13	11	10	9	10	9	9	63	10	9	11	9	46	9	12	9	9
13:00-14:01	12	9	25	10	11	63	11	13	23	9	11	22	19	15	12	11	11	11	9	10	63	11	9	14	10	47	9	13	10	9
14:01-15:00	11	9	20	9	10	62	11	10	22	9	9	17	19	11	12	10	10	9	9	10	61	10	9	10	9	47	9	12	9	9
15:00-16:01	12	10	27	10	11	62	11	12	23	9	11	17	19	15	13	10	11	11	9	10	64	11	10	12	10	48	9	13	10	9
16:01-17:00	14	11	22	11	11	63	10	15	24	11	13	18	26	14	13	11	11	12	10	11	63	12	9	12	13	49	10	12	11	11
17:00-18:00	10	9	23	9	10	64	9	11	24	9	10	14	26	12	15	10	9	10	9	9	65	10	9	10	10	48	9	11	9	9
18:00-19:01	9	9	26	9	9	65	9	10	25	9	9	13	26	11	16	10	9	9	9	9	65	9	9	9	9	48	9	14	9	9
19:01-20:00	9	9	27	9	10	62	9	10	23	9	9	14	26	11	16	9	9	9	9	9	63	9	9	9	9	48	9	15	9	9
20:00-21:01	9	9	29	9	9	63	9	9	27	9	9	13	26	11	16	9	9	9	9	9	63	9	9	9	9	47	9	14	9	9
21:01-22:00	9	9	27	9	10	62	9	9	24	9	9	14	26	11	15	9	9	9	9	9	63	9	9	9	9	47	9	15	9	9
22:00-23:01	9	9	27	9	10	65	9	9	25	9	9	13	26	10	15	9	9	9	9	9	63	9	9	9	9	47	9	11	9	9
23:01-00:00	9	9	27	9	9	63	9	10	26	9	9	17	26	11	16	9	9	9	9	9	63	9	9	9	9	49	9	12	9	9
						E															L									

Oy. Yleisradio Ab.   B:NEW-13.11V

Measuring Station

R&S ESVP with ND antenna in Jokela

Start date 13-11-1989, repeating period 60 min and length 60 min.

Values of field strength (dB/1uV/m) exceeded for 50 % of time:

MHz. .kHz	96.500	96.600	96.700	96.800	96.900	97.000	97.100	97.200	97.300	97.400	97.500	97.600	97.700	97.800	97.900	98.000	98.100	98.200	98.300	98.400	98.500	98.600	98.700	98.800	98.900	99.000	99.100	99.200	99.300	99.400
00:03-01:00	9	13	9	18	34	29	9	9	9	9	9	9	9	9	59	9	9	9	9	9	10	9	9	9	9	9	9	9	10	9
01:00-02:01	9	14	9	17	35	29	9	9	9	9	9	9	9	9	61	9	9	9	9	9	10	9	9	9	9	9	9	9	11	9
02:01-03:00	9	13	9	17	37	29	9	9	9	9	9	9	9	9	59	9	9	9	9	9	10	9	9	9	9	9	9	9	12	9
03:00-04:01	9	14	9	17	33	29	9	9	9	9	44	9	9	9	60	9	9	23	9	9	11	9	9	63	9	9	9	9	14	9
04:01-05:00	9	11	9	13	38	30	9	9	9	9	45	9	9	9	61	9	10	28	9	9	12	9	9	62	9	9	9	9	13	9
05:00-06:00	9	11	9	12	38	29	9	9	9	9	45	9	9	9	61	9	10	23	9	9	13	9	9	62	9	9	9	9	21	9
06:00-07:01	9	11	9	12	38	32	9	9	9	9	45	9	9	9	62	9	10	25	9	9	12	9	9	63	9	9	9	9	19	9
07:01-08:00	9	11	9	12	37	33	9	9	9	9	45	9	9	9	61	9	10	34	9	9	14	9	9	64	9	9	9	9	19	9
08:00-09:01	9	11	9	12	36	33	9	9	9	9	46	9	9	9	62	9	10	28	9	9	26	9	9	64	9	9	10	9	20	9
09:01-10:00	9	11	9	12	35	31	9	9	9	9	46	9	9	9	60	9	9	30	9	9	25	9	9	63	9	9	9	9	19	9
10:00-11:01	9	11	9	12	36	32	9	9	9	9	45	9	9	9	60	9	9	29	9	9	19	9	9	63	9	9	9	9	16	9
11:01-12:01	9	10	9	13	35	31	10	9	9	9	43	9	9	9	61	9	11	30	9	9	17	9	9	63	9	9	9	9	17	9
12:01-13:00	9	11	9	11	34	30	10	9	9	9	46	9	9	9	60	9	10	22	9	9	23	10	9	62	9	9	10	9	13	9
13:00-14:01	9	11	11	12	40	30	11	11	10	10	45	10	10	9	60	10	11	25	10	9	24	13	11	63	9	11	12	9	13	9
14:01-15:00	9	11	10	12	36	30	10	10	10	9	45	9	9	9	60	9	10	29	9	9	23	10	10	63	9	10	11	9	14	9
15:00-16:01	10	12	11	13	39	32	11	11	10	10	45	10	10	9	62	10	10	28	9	10	17	11	11	63	10	11	11	9	14	10
16:01-17:00	10	11	12	13	38	33	12	11	11	10	45	11	10	10	62	10	11	24	11	11	16	13	11	62	10	11	12	10	13	10
17:00-18:00	9	11	10	17	38	33	10	9	10	9	45	9	9	9	61	9	9	26	9	9	17	10	10	63	9	10	10	9	11	9
18:00-19:01	9	11	9	17	37	33	9	9	9	9	46	9	9	9	62	9	9	27	9	9	11	9	9	63	9	9	9	9	12	9
19:01-20:00	9	11	9	17	36	31	9	9	9	9	46	9	9	9	61	9	9	23	9	9	11	9	9	61	9	9	9	9	13	9
20:00-21:01	9	13	9	17	35	30	9	9	9	9	45	9	9	9	60	9	9	28	9	9	12	9	9	63	9	9	9	9	12	9
21:01-22:00	9	13	9	17	37	31	9	9	9	9	46	9	9	9	60	9	10	25	9	9	11	9	9	63	9	9	9	9	11	9
22:00-23:01	9	13	9	17	36	34	9	9	9	9	9	9	9	9	61	9	10	9	9	9	12	9	9	9	9	9	9	9	12	9
23:01-00:00	9	13	9	17	37	35	9	9	9	9	9	9	9	9	60	9	9	9	9	9	11	9	9	9	9	9	9	9	13	9
											E				L									E						

Oy. Yleisradio Ab. B:NEW-13.11W
Measuring Station
R&S ESVP with ND antenna in Jokela
Start date 13-11-1989, repeating period 60 min and length 60 min.
Values of field strength (dB/1uV/m) exceeded for 50 % of time:

MHz.	99	99	99	99	99	100	100	100	100	100	100	100	100	100	100	101	101	101	101	101	101	101	101	101	101	102	102	102	102	102
.kHz	.500	.600	.700	.800	.900	.000	.100	.200	.300	.400	.500	.600	.700	.800	.900	.000	.100	.200	.300	.400	.500	.600	.700	.800	.900	.000	.100	.200	.300	.400
00:03-01:00	9	9	32	9	23	9	9	9	19	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
01:00-02:01	9	9	32	9	22	9	9	9	19	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
02:01-03:00	9	9	32	9	21	9	9	9	19	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
03:00-04:01	29	9	32	9	23	9	9	9	19	9	9	64	9	9	9	9	63	9	9	9	9	9	9	9	9	9	27	9	9	9
04:01-05:00	35	9	30	9	27	9	9	9	19	9	9	63	9	9	9	9	64	9	9	9	9	9	9	9	9	9	30	9	9	9
05:00-06:00	34	9	30	9	29	9	9	9	19	9	9	62	9	9	9	9	63	9	9	9	9	9	9	9	9	9	32	9	9	9
06:00-07:01	34	9	30	9	26	9	9	9	19	9	9	63	9	9	9	9	61	9	9	9	9	9	9	9	9	9	28	9	9	9
07:01-08:00	38	9	31	9	30	9	9	10	19	9	9	65	9	9	9	9	66	9	9	9	9	9	9	9	9	9	34	9	9	9
08:00-09:01	34	9	31	9	26	9	9	9	19	9	9	63	9	9	9	9	65	9	9	9	9	9	9	9	9	9	27	9	9	9
09:01-10:00	35	9	31	9	23	9	9	9	19	9	9	64	9	9	9	9	65	9	9	9	9	9	9	9	9	9	27	9	9	9
10:00-11:01	33	9	29	9	25	9	9	9	17	9	9	63	9	9	9	9	62	9	9	9	9	9	9	9	9	9	29	9	9	9
11:01-12:01	32	9	29	9	23	9	9	10	19	9	9	63	9	9	9	9	64	9	9	9	9	9	9	9	9	9	24	9	9	9
12:01-13:00	32	10	29	9	21	9	9	10	19	9	9	63	9	9	9	9	63	9	9	9	9	9	9	9	9	9	25	9	9	9
13:00-14:01	38	11	28	10	24	10	9	11	18	9	11	63	10	10	9	11	63	10	11	10	9	10	9	11	9	10	26	10	11	9
14:01-15:00	34	10	30	9	23	9	9	10	17	9	9	63	9	9	9	10	59	9	9	10	9	9	9	10	9	9	26	9	10	9
15:00-16:01	35	11	30	10	26	10	9	11	19	10	10	63	10	10	9	10	62	10	10	10	9	10	9	11	9	10	27	10	10	9
16:01-17:00	34	13	32	10	24	11	10	11	18	11	10	62	11	11	9	11	63	11	11	10	9	10	9	11	10	10	25	11	10	10
17:00-18:00	34	10	31	9	21	9	9	9	17	9	9	63	10	9	9	10	64	9	9	9	9	9	9	9	9	9	24	9	9	9
18:00-19:01	34	9	30	9	22	9	9	9	15	9	9	63	9	9	9	9	64	9	9	9	9	9	9	9	9	9	23	9	9	9
19:01-20:00	33	9	28	9	25	9	9	9	19	9	9	62	9	9	9	9	62	9	9	9	9	9	9	9	9	9	26	9	9	9
20:00-21:01	32	9	29	9	27	9	9	9	19	9	9	63	9	9	9	9	64	9	9	9	9	9	9	9	9	9	29	9	9	9
21:01-22:00	35	9	31	9	25	9	9	9	20	9	9	63	9	9	9	9	64	9	9	9	9	9	9	9	9	9	29	9	9	9
22:00-23:01	9	9	35	9	28	9	9	9	19	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
23:01-00:00	9	9	36	9	27	9	9	9	20	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9

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Oy. Yleisradio Ab. B:NEW-13.11X
Measuring Station
R&S ESVP with ND antenna in Jokela
Start date 13-11-1989, repeating period 60 min and length 60 min.
Values of field strength (dB/1uV/m) exceeded for 50 % of time:

MHz.	102	102	102	102	102	103	103	103	103	103	103	103	103	103	103	104	104	104	104	104	104	104	104	104	104	105	105	105	105	105
.kHz	.500	.600	.700	.800	.900	.000	.100	.200	.300	.400	.500	.600	.700	.800	.900	.000	.100	.200	.300	.400	.500	.600	.700	.800	.900	.000	.100	.200	.300	.400
00:03-01:00	28	9	9	27	9	9	9	9	9	9	9	9	47	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
01:00-02:01	28	9	9	27	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
02:01-03:00	28	9	9	27	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
03:00-04:01	28	9	9	27	9	12	9	9	9	9	18	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
04:01-05:00	27	9	9	20	9	11	9	9	9	9	16	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
05:00-06:00	26	9	9	21	9	11	9	9	9	9	23	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
06:00-07:01	27	9	9	20	9	14	9	9	9	9	23	9	48	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
07:01-08:00	28	9	9	25	9	12	9	9	9	9	27	9	48	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
08:00-09:01	28	9	9	24	9	11	9	9	9	9	27	9	49	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
09:01-10:00	27	9	9	20	9	13	9	9	9	9	25	9	45	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
10:00-11:01	27	9	9	21	9	15	9	9	9	9	22	9	48	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
11:01-12:01	26	9	9	21	9	12	9	9	9	9	19	9	42	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
12:01-13:00	26	9	9	20	9	12	9	9	9	9	14	9	48	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
13:00-14:01	26	9	11	21	9	13	10	9	11	9	12	10	48	10	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
14:01-15:00	27	9	10	20	9	11	9	9	10	9	12	9	48	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
15:00-16:01	28	9	10	21	9	13	9	9	11	9	13	10	48	10	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
16:01-17:00	28	9	10	22	9	12	10	9	11	9	11	10	49	11	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
17:00-18:00	29	9	9	28	9	11	9	9	9	9	10	9	49	10	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
18:00-19:01	27	9	9	28	9	11	9	9	9	9	12	9	48	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
19:01-20:00	24	9	9	28	9	11	9	9	9	9	17	9	48	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
20:00-21:01	26	9	9	28	9	11	9	9	9	9	15	9	49	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
21:01-22:00	28	9	9	28	9	10	9	9	9	9	16	9	48	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
22:00-23:01	32	9	9	28	9	9	9	9	9	9	9	9	49	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
23:01-00:00	33	9	9	28	9	9	9	9	9	9	9	9	49	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9

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* Oy. Yleisradio Ab.
Measuring Station
2 x ANRITSU + ND(Hor) HE[illegible] UHF antennas (h=10..11 m) at Jokela
Start date 13-11-1989, r[illegible]ng period 60 min and length 60 min.
Values of field strength (dB/1uV/m) exceeded for 10 and 50 % of time for:

	MHz	Station	ant.c.dB		MHz	Station	ant.c.dB
1.	48.2500	Propagation E2	5	16.	103.7000	Espoo 7(test)	11
2.	49.7500	Leningrad R1	7	17.	182.2448	Espoo TV1	12
3.	55.2600	Propagation E3	7	18.	196.2487	Espoo TV2	16
4.	62.2500	Propagation E4	7	19.	203.2513	Lahti TV1	14
5.	93.7000	Tampere 2	11	20.	175.2539	Sippola TV1	12
6.	92.6000	Turku 2	11	21.	223.2600	Tallinn TV	16
7.	92.1000	Mikkeli 2	11	22.	189.2500	Turku TV1	16
8.	92.5000	Jyväskylä 2	11	23.	495.2500	Espoo TV3	31
9.	99.1000	Kerimäki 2	11	24.	623.2500	Lahti TV2	28
10.	88.2000	Lapua 1	11	25.	527.2500	Tallinn TV	31
11.	103.3000	Stockholm P4	11	26.	727.2500	Tampere TV2	30
12.	92.4000	Stockholm P1	11	27.	607.2396	Mikkeli TV2	28
13.	99.2000	Sundsvall P3	11	28.	503.2604	Jyväskylä TV2	32
14.	88.4000	Bollnäs P1	11	29.	567.2500	Eurajoki TV2	28
15.	89.4000	Borlänge P3	11	30.	591.2500	Kuopio TV2	27

Nr.		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
MHz.		48.	49.	55.	62.	93.	92.	92.	92.	99.	88.	103.	92.	99.	88.	89.	103.	182.	196.	203.	175.	223.	189.	495.	623.	527.	727.	607.	503.	567.	591.
.kHz		.250	.750	.260	.250	.700	.600	.100	.500	.100	.200	.300	.400	.200	.400	.400	.700	.245	.249	.251	.254	.260	.250	.250	.250	.250	.250	.240	.260	.250	.250
00:03	10%	3	1	3	1	37	31	25	21	6	7	5	5	5	5	6	57	0	3	2	0	27	4	19	18	19	20	18	20	18	18
01:00	50%	2	1	2	1	33	25	18	16	5	6	4	5	4	4	5	56	-1	3	2	0	25	3	19	18	19	20	18	19	17	18
N= 58																															
01:00	10%	3	1	3	1	35	34	23	22	9	8	9	10	8	5	7	5	0	3	2	0	26	4	19	18	19	20	18	20	18	18
02:00	50%	2	1	2	1	30	29	17	16	6	7	6	8	5	4	6	4	-1	3	2	0	24	3	19	18	19	19	18	20	17	18
N= 59																															
02:00	10%	3	1	3	1	33	33	21	25	8	8	5	5	5	5	6	5	0	3	2	0	28	4	19	18	19	20	19	20	18	18
03:00	50%	2	1	2	1	27	25	16	19	5	6	4	5	4	4	5	4	0	3	2	0	26	3	19	18	19	20	18	20	17	18
N= 60																															
03:00	10%	3	2	3	1	37	36	23	25	9	11	5	6	7	5	7	7	0	4	2	0	30	4	19	18	19	20	19	20	18	18
04:00	50%	2	1	2	1	32	26	16	21	6	7	4	5	6	5	6	5	0	3	2	0	28	3	19	18	19	20	18	20	17	18
N= 59																															
04:00	10%	3	2	3	1	40	41	30	30	13	14	5	6	7	5	6	6	1	3	2	0	29	4	19	18	27	20	18	20	17	18
05:00	50%	2	1	2	1	36	35	24	25	7	9	4	5	5	5	5	5	0	3	2	0	27	3	19	18	19	19	18	20	17	18
N= 60																															
05:00	10%	3	2	3	1	42	37	34	36	16	15	5	6	7	5	6	57	1	3	2	0	28	4	19	18	28	20	18	20	18	18
06:00	50%	2	1	2	1	38	31	26	31	9	10	4	5	6	5	5	7	1	3	2	0	27	3	19	18	26	19	18	20	17	18
N= 59																															
06:00	10%	3	24	3	1	40	38	33	36	15	14	5	6	6	5	6	57	71	65	69	36	26	24	72	66	28	25	25	21	18	18
07:00	50%	2	2	2	1	34	33	28	32	8	10	4	5	5	5	5	57	0	3	2	0	23	4	19	18	25	19	18	20	17	18
N= 60																															
07:00	10%	6	42	3	2	41	39	38	34	16	13	7	7	5	5	6	57	71	66	69	40	27	26	72	67	26	28	34	22	18	18
08:00	50%	3	25	2	1	36	36	31	27	10	9	5	5	5	5	5	57	71	65	68	37	26	21	72	66	24	24	28	20	18	18
N= 59																															
08:00	10%	25	40	3	2	38	41	38	37	17	12	6	7	5	5	6	58	71	66	69	39	27	26	72	66	26	29	38	29	18	18
09:00	50%	20	33	2	1	33	32	33	33	13	8	4	6	4	5	5	57	71	66	68	37	26	22	72	66	24	25	33	24	17	18
N= 59																															
09:00	10%	28	42	3	2	37	42	30	35	14	13	6	7	5	5	6	57	71	66	69	37	27	28	72	67	28	31	40	24	18	18
10:00	50%	13	31	3	1	30	34	26	31	10	8	4	6	5	5	5	56	71	66	68	36	26	22	72	66	26	25	33	20	18	18
N= 60																															
10:00	10%	39	29	3	2	37	42	34	35	15	13	5	6	5	5	6	57	71	66	69	38	27	30	73	69	32	28	32	21	20	18
11:00	50%	29	12	2	1	31	37	28	29	9	9	5	6	4	5	5	57	71	65	68	35	25	21	72	67	30	24	25	20	18	18
N= 59																															
11:00	10%	24	8	3	2	36	40	35	31	11	13	7	7	5	5	6	57	71	66	68	35	26	28	73	69	33	28	29	22	20	19
12:00	50%	7	5	3	1	32	36	25	26	7	8	5	5	5	5	5	51	71	65	68	32	24	20	72	68	30	23	22	21	18	18
N= 60																															
12:00	10%	15	15	14	12	34	38	35	31	19	19	17	17	12	16	17	57	71	67	68	36	27	28	73	69	32	28	25	23	20	19
13:00	50%	7	8	6	5	28	29	30	23	13	14	9	9	8	9	9	57	71	66	68	34	25	22	72	67	29	23	21	21	18	18
N= 59																															
13:00	10%	16	24	20	19	37	38	34	27	21	20	19	20	15	17	19	57	71	67	68	40	30	29	20	69	33	27	24	21	21	18
14:00	50%	13	21	18	16	34	33	29	22	19	18	16	18	9	13	14	57	71	66	68	35	26	25	19	68	28	24	21	21	18	18
N= 60																															
14:00	10%	10	24	19	16	34	39	29	27	18	14	14	18	9	11	12	57	71	67	68	39	32	29	73	69	39	27	27	22	20	18
15:00	50%	7	21	15	12	27	31	22	22	15	12	11	15	6	8	10	57	71	66	68	35	28	24	19	68	31	24	20	20	18	18
N= 59																															
15:00	10%	22	25	23	21	40	36	30	31	23	23	19	21	15	19	19	57	72	67	69	36	30	26	73	68	31	26	25	21	19	18
16:00	50%	14	21	18	17	35	30	23	25	18	19	15	18	11	12	13	57	71	67	68	34	28	22	72	67	27	23	20	20	18	18
N= 59																															
16:00	10%	24	22	22	22	34	39	29	25	22	26	19	24	18	17	20	58	72	67	69	37	29	28	74	68	29	25	23	21	18	18
17:00	50%	17	18	18	14	31	32	24	20	18	19	15	18	13	14	15	57	71	67	68	34	25	23	72	67	26	22	19	20	17	18
N= 60																															
17:00	10%	13	18	14	10	35	37	27	27	14	16	12	14	10	11	12	57	73	67	69	37	27	27	74	68	27	28	21	21	19	18
18:00	50%	9	15	10	8	30	31	22	21	12	14	10	12	8	8	9	57	72	67	68	35	25	22	73	66	25	23	19	20	18	18
N= 59																															
18:00	10%	5	14	10	7	36	36	25	28	12	14	9	10	7	7	8	57	73	67	70	36	26	28	73	68	28	26	24	21	19	18
19:00	50%	4	11	6	4	34	32	17	19	9	11	7	8	6	5	6	57	72	66	69	34	24	24	72	67	26	22	21	20	18	18
N= 60																															
19:00	10%	8	14	8	5	37	35	26	28	12	13	10	12	8	8	9	57	73	67	69	36	26	30	72	67	27	26	27	21	18	18
20:00	50%	4	8	4	3	34	30	20	20	9	10	7	8	6	5	6	57	72	65	69	35	23	24	19	65	25	23	21	20	18	18
N= 59																															
20:00	10%	3	10	3	2	39	40	24	27	10	12	7	7	6	5	7	57	73	67	70	38	25	28	19	67	26	28	23	21	18	18
21:00	50%	2	5	3	1	36	36	19	21	7	9	5	6	5	5	6	57	73	66	69	34	23	23	19	66	24	24	20	20	17	18
N= 59																															
21:00	10%	4	10	3	3	39	37	27	28	12	10	7	7	6	5	8	57	72	66	69	35	28	28	19	67	27	27	22	21	18	18
22:00	50%	3	3	3	2	36	32	20	22	7	8	5	6	5	5	6	57	1	66	19	1	26	5	19	66	24	23	19	20	18	18
N= 60																															
22:00	10%	4	18	4	3	39	38	23	28	11	11	8	8	6	6	8	58	1	4	3	1	27	4	19	19	27	20	18	20	18	18
23:00	50%	3	4	3	2	37	33	16	22	7	9	6	6	5	5	6	57	0	3	2	0	23	4	18	18	24	20	18	20	17	18
N= 59																															
23:00	10%	4	3	3	1	39	39	27	27	12	11	7	10	6	5	7	58	0	4	2	1	27	4	19	19	26	20	19	20	18	18
00:00	50%	2	2	3	1	37	31	23	21	8	8	5	6	5	4	6	57	0	3	2	0	24	3	18	18	22	20	18	19	18	18
N= 60																															

IONOSFÄÄRISTÄ [E2 & R1]
P2-ETENEMISTÄ

RADIOAURORA

Oy. Yleisradio Ab.
Jokela
Mittausasema
V.K.Lehtoranta/Vki

MITTAUSPÖYTÄKIRJA TKVE 161/89

9.11.1989

VHF / UHF RADIOKELIHAVAINTOJA --- LOKAKUU 1989

Yhteenveto lokakuun 1989 sääolosuhteista Uudellamaalla (Hyrylä, Tuusula):

Keskilämpötila oli +5.0° (mikä on 0.2° yli normaalisen). Kuukauden kylmin vaihe sijoittui alkupuolelle ja 7.10 aamulla lämpötila 2 metrin korkeudella oli -3.3° ja maanpinnalla -7.6°. Miinusasteita oli maanpinnalla monenakin aamuna. Sademäärä Hyrylässä oli 43.6 mm eli noin 68%.

Tropo

Erityisiä tropokelejä ei lokakuussa 1989 ole esiintynyt, vaikka lokakuu on marraskuun ohella perinteisesti täällä vuoden potentiaalisin "kovan tropon" kuukausi edellyttäen tietysti, että sopivia säätiloja siunaantuu (lähinnä pysyväluonteisia korkean alueita). Ainoastaan aavistuksen verran kohonneita VHF-kenttiä näkyy esim. 9.10, 18.10, 28.10 sekä 30.10 ja niinä päivinä on jotain korkean tapaista näkyvissä sääkartoilla. Sodankylässä 7.10 oli paras.

Huonon näköiset lievealueiden kelit esim.: 11.10 ja 26.10.

Etenkin Kerimäen, Jyväskylän ja Mikkelin ULA2 -asemien kuukausiarvot olivat lokakuussa 1989 syyskuun arvoja selvästi pienempiä.

F_2

Varsinaiset televisiokanavan E2 (48.2 MHz) F2-kelit näyttävät vähitellen alkaneen 12.10.89 ja jatkuneen 20.10 saakka ja jälleen 25.10 alkaen parantuen lokakuun loppua kohden. Aikavälillä 22-24.10 ei Jokelan E2-kanavamittauksissa näy juuri mitään; silloin vallitsi ionosfäärinen häiriötilanne.

E2-kanavalla näkyi esim. 31.10 Dubai, UAE pitkin päivää 09-13 UTC (d≈4500 km). Idän sektoriin on kanavalla R1 (49.7 MHz) ollut F2-keliä alkaen 13.10 ja etenkin 15.10 (07-10 UTC), samaten 16.10 ja jälleen 31.10 (07-09 UTC).

19.10.89 noin 13 UTC tapahtunut auringonpurkaus eli flare voimakkaine SID-ilmiöineen (Short Wave Fadeout ym.) saavutti televisiohaastattelujen ansiosta Suomessakin huomiota ja purkauksen jälkiseuraukset olivatkin kyllä merkittäviä. HF-kelit olivat jokseenkin lamassa 20.10, 21.10 ja senkin jälkeen. GPS-navigaatiosatelliittien toiminta oli samoina päivinä häiriintynyt. Samaten Loran C -asemien toiminta oli häiriintynyt.

Protonien määrä on ollut tavaton 20.10 ja suuri 1.10 sekä koko ajan 19-26.10.

Myös MF-asemat ovat olleet lamassa 19-22.10; esim. yöllä 20-21.10 ei ionosfääriaaltoja ollut keskiaalloilla oikein lainkaan. Sen sijaan mm. yöllä 8-9.10 ja jälleen 14-15.10 MF-taajuiset ionosfääriaallot olivat voimakkaita.

2-16.10 ionosfääristen kelien voidaan sanoa olleen hyvän; etenkin 6.10 jälkeen.

Aurora

Geomagneettista häiriöisyyttä on ollut etenkin 18.10 jälkeen ja etenkin illalla 20.10 geomagneettiset indeksit ovat olleet korkealla mutta eivät toki ole yltäneet samoihin kuin 13-14.3.1989. Huippurauhallista oli 13-14.10.

Radioauroraa näkyy Jokelan mittauksissa ULA- ja tv I- alueilla:

1.10	aamuyöllä	(Sodankylän max. Q-indeksi = 5-6)
16.10	alkuillasta	(Q = 4-5)
18.10	aamulla ja illalla	(Q = 6-7)
20.10	illalla ja yöllä	(Q = 8-9)
21.10	alku- ja loppuillasta	(Q = 8-9)
22.10	alkuillasta	(Q = 6-7)
28.10	alkuillasta	(Q = 5-6)
31.10	alkuillasta	(Q = 5-6)

20.10 ja eräinä muinakin iltoina radioaurora on ollut häiriötasoon nähden odottamattoman heikkoa.

17.10 illalla ilmeisesti Es-keliä.

Heikompana radioauroraa näkyy mm.: 3.10, 7.10, 12.10, 17.10, 29.10 ja 30.10, yhteensä ainakin saman verran päiviä kuin oli syyskuussa.

Todettuja pilkkulukujen ja "solar fluxin"(2800) kuukausikeskiarvoja

kk	$\bar{R}$	S-flux
7.88	112	153
8.88	111	154
9.88	120	154
10.88	125	169
11.88	125	153
12.88	179	193
1.89	161	228
2.89	165	217
3.89	131	203
4.89	129	191
5.89	138	194
6.89	196	247
7.89	127	188
8.89	167	222
9.89	176	225
10.89	158	208

Vieressä taulukoidut auringon aktiivisuutta kuvaavat indeksit (kuukausikeskiarvot) ovat lokakuussa 1989 varsin kohtuulliset ja nähtäväksi jää, nousevatko ne tulevina kuukausina paljonkin vai ei lainkaan...

FTZ ennustaa tilastollisesti tasoitetuksi maksimi-kuukaudeksi maaliskuuta 1990 ja 12 kk arvoksi R_{12} = 178, joka olisi korkeampi kuin edellinen maksimi joulukuussa 1979 (164) mutta ei niin korkea kuin maaliskuussa 1958 (201).

Review at Significant Solar and Geophysical Data October 1989

Day	Ri	10 cm	Number of Events Xray X	Xray M	opt. Fl.	Radio X	Radio M	SWF X	SWF M	Pro-ton	Geo-mag.	foF2
1	129	198								2600		-3.7
2	143	207		1						70		
3	159	221								12		
4	186	236										
5	209	219										
6	189	219								22		+1.1
7	168	225										
8	166	209										+1.2
9	187	201										+1.5
10	178	195										+1.3
11	191	191										+1.9
12	154	202		1	1							+1.8
13	148	223		2								+2.0
14	159	225		1			3					+1.4
15	189	225		1								+1.3
16	209	236					1					+1.5
17	206	224		1								-2.2
18	184	226		3	1				1		3.1	-2.0
19	159	227	1	1	2	1		1		3200	3.6	
20	140	205		3						73000	5.4	
21	152	206		3						1000	6.5	-2.3
22	158	225	1	3	1		1		1	2800	4.6	-4.3
23	145	211	1	2	1				1	8300	3.3	-3.8
24	131	213	1		1		1			3000		
25	121	188		2	1					4100		
26	109	173		2						1400	3.6	
27	97	177	1	1					2	250	3.1	
28	116	174		2						45		
29	131	174		2	1					20		+1.4
30	156	188								15	3.8	
31	144	206		3			4					
Numb			5	34	9	1	10	1	5	16	9	17
Mean	158.5	207.9										12.1

Explanations:

RI : provisional sunspot number from Sunspot Index Data Center Brussels
10 cm : 10 cm flux Ottawa
Xray : X = >0.1 erg/(cm2*sec), M = 0.01-0.1 erg/(cm2*sec)
opt. Fl. : optical flares of importance >1
Radio : radio bursts (X = >10000 FU., M = 1000-10000 FU.)
SWF : short wave fadeouts observed at Norddeich
: (X = importance 3, M = importance 2)
Proton : proton events (maximum number of particles)
Geomag. : mean value of the k-indices (only >3.0) from Wingst
foF2 : deviation of the foF2 values (St. Peter-Ording) at noon (09-13 UTC) from the monthly median value (only deviations >1.0 MHz)
C : no value available

Sunspot Numbers predicted by FTZ:

November	171	December	173	January	174
February	177	March	178	April	177

Oy. Yleisradio Ab.
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MITTAUSPÖYTÄKIRJA TKVE 178/89

12.12.1989

VHF / UHF RADIOKELIHAVAINTOJA --- MARRASKUU 1989

Yhteenveto marraskuun 1989 sääolosuhteista eteläisessä Suomessa:

Marraskuun alkupuoli oli melko lämmin ja varsinaisesti nollan alapuolelle mentiin vasta kuukauden neljännellä viikolla. Ylin mitattu lämpötila Helsinki-Vantaalla oli +9.1° (12.11) ja alin -19.9° (27.11). Sademäärät olivat Uudellamaalla normaalia pienempiä mutta Varsinais-Suomessa suurempia.

TROPO

Marraskuun tropokelit huipentuivat 17-19.11.89, kun korkean keskus purjehti Itämeren ylitse lännestä itään päin. Lauantaina 18.11 monet VHF- ja UHF-asemat olivat voimakkaita koko vuorokauden ajan (eritoten Ahvenanmaalla). Seuranneella "pakkaskaudella" illalla 28.11 esimerkiksi Tallinnan (ch 28) ja Mikkelin (ch 38) UHF-televisiot olivat Jokelassa erittäin voimakkaita.

Huonot lievealueiden kelit esimerkiksi: 4-5.11, 15.11 sekä 22-23.11.89.

F2

Lokakuun puolivälissä alkaneet F2-kelit jatkuivat tv-kanavalla E2 (48.25 MHz) voimakkaina marraskuun alun aina 13.11 saakka, jonka jälkeen ne olivat kumman vaisuja ja ajoittaisia. Itäänpäin oli R1-kanavalla (49.75 MHz) keliä 15.11 saakka ja sitten merkittävässä määrin vasta (23.11 ja) 29.11.

E2-kanavalla oli nähty 14.10-13.11 välillä mm. DUBAI Arabiemiraateista ja iranilaisia asemia, Maleesia, Espanja sekä Portugali. Etenkin Dubai oli ajoittain tavattoman voimakas (jopa 50 dB(μV/m). F2-keli (ja/tai Es-keli) on 5-7.11 sekä 9.11 näkyvissä myös kanavalla E3 (55.26 MHz).

Englantilainen 28 MHz:n majakka GB3RAL on kello 08-16 UTC välillä sentään ollut kuuluvissa 18.11 lukuunottamatta 25.10 lähtien päivittäin yli viiden viikon ajan (!), saksalainen DL0IGI ei lähestulkoonkaan yhtä usein.

Kuukauden mielenkiintoisin kelipäivä oli 17.11 (perjantai), jolloin kaikkia mahdollisia VHF-etenemisen muotoja esiintyi yhdessä ja erikseen: sellaisia kuin Tropo-, Aurora-, F2-, Aurora Es- ....

AURORA

Geomagneettista häiriöisyyttä oli kuukauden alkupuolella ja sitten voimakkain "rysäys" alkoi illalla 17.11 jatkuen koko yön. Geomagneettisesti rauhallisin vuorokausi oli ylivoimaisesti 25.11; häiriöisin oli 17.11.

Radioauroraa näkyy Jokelan mittauksissa ULA- ja tv I-alueilla selvimmin:

3.11	iltapäivällä ja illalla	(Sodankylän max. Q-indeksi = 5-6)	
13.11	iltapäivällä ja illalla	(13-14 & 16-17 UTC!)	(Q = 6-7)
17.11	iltapäivällä ja illalla	(myös Aurora Es-keliä)	(Q = 8-9)
26.11	illalla	(17-18 UTC!)	(Q = 5-6)
28.11	illalla		(Q = 5-6)
29.11	illalla		(Q = 5-6)
30.11	illalla		(Q = 5-6)

Heikompaa auroraa myös esim.: 2.11, 4.11, 5.11, 7.11, 9.11, 11.11 ja 22.11.89.
Aurora Es-keliä: 17.11 17-19 UTC. "Tavallista" Es-keliä (!) 19.11 08-11 UTC.

Aurinko oli marraskuussa varsin aktiivinen ja suurin päivittäinen pilkkuluku (Ri) oli 262 (22.11). Suurin "solar flux" sattui päivälle 8.11 (oli 271) Marraskuun "solar flux" kuukausikeskiarvo oli korkein sitten kesäkuun 1989.

Varsinkin kuukauden alkupuolella kriittiset foF2-arvot olivat korkeita ja HF-kelit olivat yleensä melko hyvät - poikkeuksena päivät 17.11 ja 18.11.89.

Jatkossa käynee niin, että etenkin yli 30 MHz:n F2-keli tullee seuraavaksi "aukeamaan" vasta kevään koittaessa, ehkä maaliskuussa. Tammikuulle päiväsajaksi ennustetut foF2-arvot ovat pari MHz pienempiä kuin joulukuussa 1989.

Todettuja auringonpilkkulukujen ja solar fluxin kuukausikeskiarvoja

kk	$\overline{R}$	$\overline{flux}$
7.88	112	153
8.88	111	154
9.88	120	154
10.88	125	169
11.88	125	153
12.88	179	193
1.89	161	228
2.89	165	217
3.89	131	203
4.89	129	191
5.89	138	194
6.89	196	247
7.89	127	188
8.89	167	222
9.89	176	228
10.89	158	208
11.89	173	234

FNL YLE TKVE

File:"Anrvu"
NOVEMBER 1989:
No recording due to technical problems (=C):
59 h (8.2%)

MAXIMUM DAILY 1 h MEDIAN FIELD STRENGTH RECORDED AT JOKELA
NOVEMBER 1989

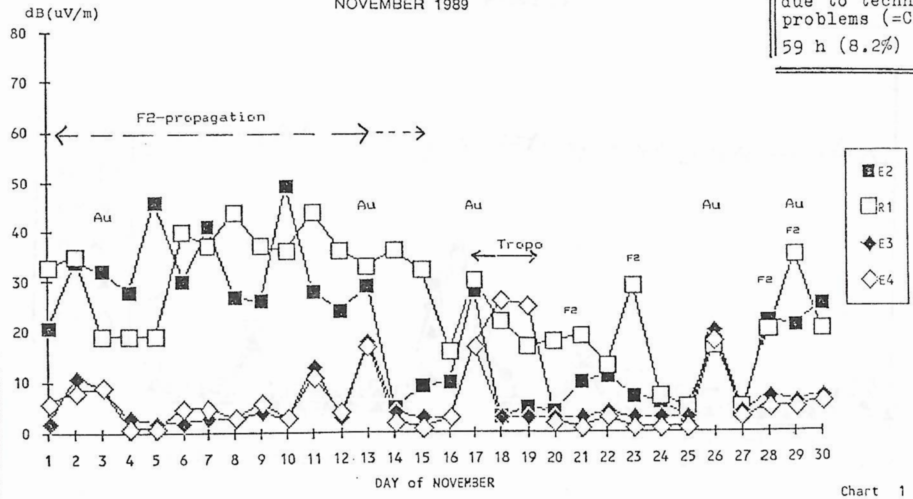


Chart 1

MAXIMUM HOURLY 1 h MEDIAN FIELD STRENGTH RECORDED AT JOKELA
NOVEMBER 1989

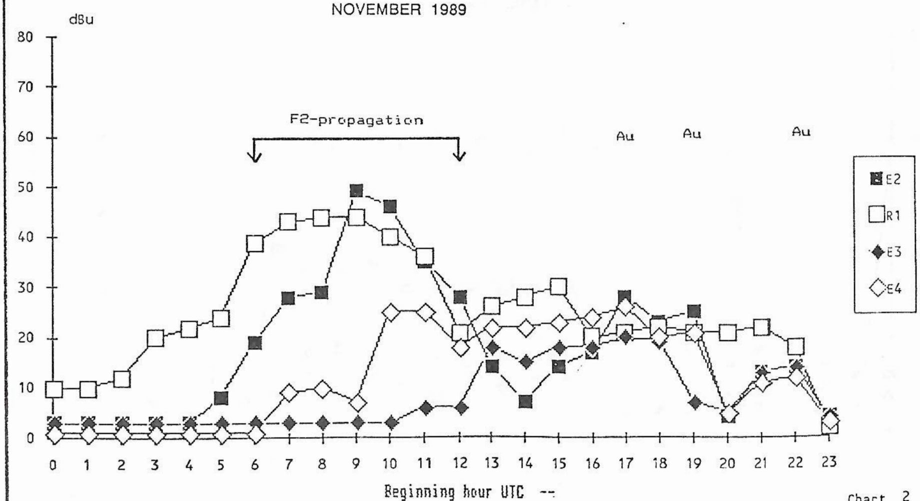


Chart 2

Tr = Tropo, Au = Aurora

4 TV Band I frequencies for Es, F2 & Aurora propagation:

- ch E2 (48.25)
- ch R1 (49.75)
- ch E3 (55.26)
- ch E4 (62.25)

<u>F2-propagation in November</u>:
- 01-13.11 good on E2 (48.25 MHz) and on some days up to 60 MHz !!
- R1 good: 01-15.,(23.)& 29.11.

<u>Aurora</u>: 03.,13.,17.,26.,28-30.11.

<u>Aurora Es</u>: 17.11 (17-19 UTC)
30.11 (19-21 UTC)

- R1 LENINGRAD 49.75 d=302 km
- E4 STOCKHOLM 62.25 d=404 km

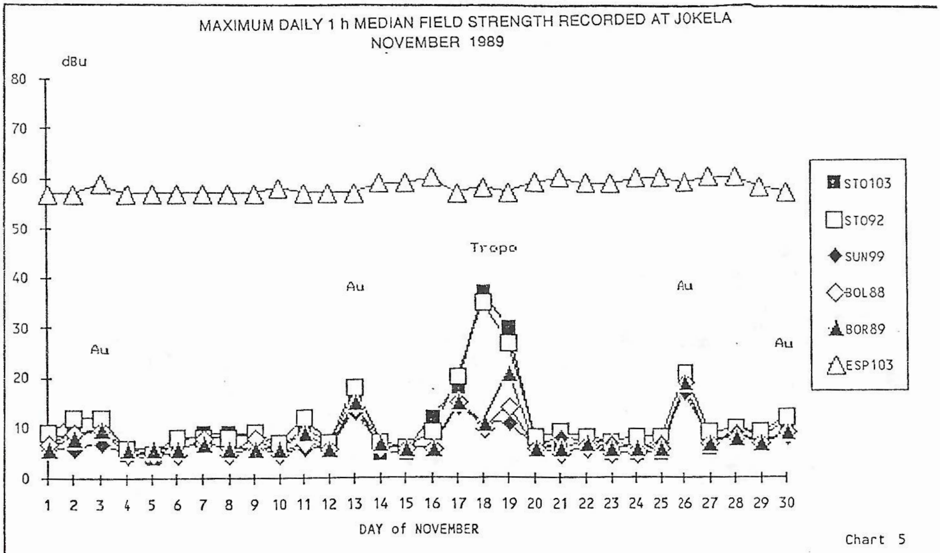


Chart 5

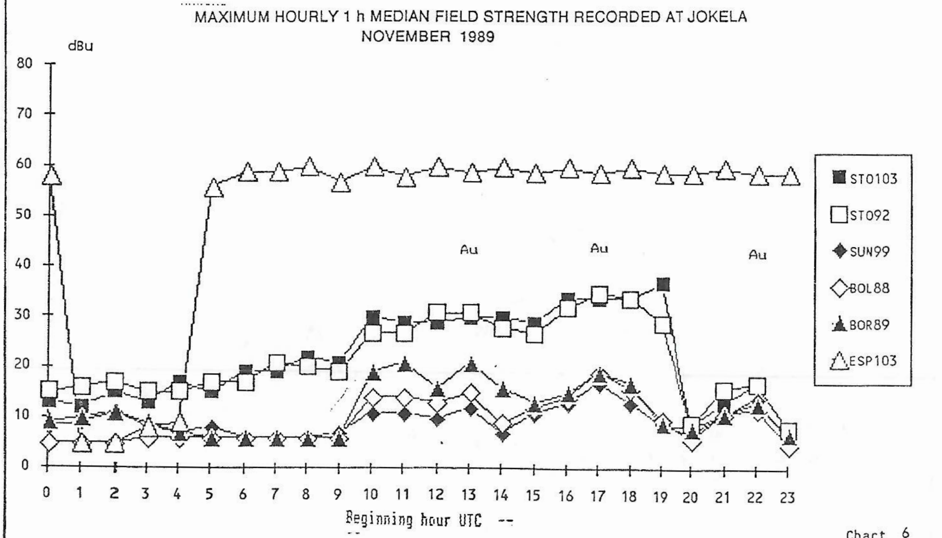


Chart 6

5 long distance FM stations (Swedish) and a local FM for reference:

- STOCKHOLM	103.3	d=404 km
- STOCKHOLM	92.4	d=404 km
- SUNDSVALL	99.2	d=454 km
- BOLLNÄS	88.4	d=483 km
- BORLÄNGE	89.4	d=539 km
- ESPOO	103.7	d= 47 km

- Tropo: good 18.11 & 19.11.
- Aurora: good 13.11 & 26.11.
- Mixed propagation: 17.11 (also Aurora Es).

Oy. Yleisradio
Jokela
Mittausasema
V.K.Lehtoranta/Vki

MITTAUSPÖYTÄKIRJA TKJV 2/90

15.1.1990

VHF/UHF RADIOKELIHAVAINTOJA -- JOULUKUU 1989

Yhteenveto joulukuun 1989 sääolosuhteista Uudellamaalla (Tuusula, Hyrylä):

Keskilämpötila oli -5.4° (mikä on 2.0° normaalia alempi). Alin mitattu lämpötila oli -29.4° (15.12) ja ylin +4.2° (19.12). Sademäärä oli 53 mm, mikä on normaali. Roudan syvyys ja Tuusulanjärven jään paksuus olivat huomattavasti edellistä vuotta (joulukuu 1988) pienempiä.

1-3.12 ulottui Keski-Euroopassa olevasta korkeasta selänne Lounais-Suomeen mutta silti oli lämpöasteita! 27-31.12 oli Baltiassa voimakas korkean keskus mutta pakkasta vain pari astetta. Sodankylässä oli kylmintä 25.2 ja 18.12.

TROPO

Mitään merkittäviä tropokelejä ei joulukuun aikana esiintynyt. Havaittavimmat kohonneet VHF-kentät sattuivat päiville: 9-10.12, 17.12, 21.12 ja 30.12. Kohonneita UHF-kenttiä: 10.12, 12.12, 14-15.12 ja 21.12 eniten aamulla ja iltapäivällä. Ahvenanmaalla oli hyvät VHF/UHF -kelit: 3.12 illalla, 21.12 aamupäivällä sekä 29-31.12 miltei jatkuvasti.

Huonot lievealueiden kelit esimerkiksi: 4-7.12, 13.12, 20.12 sekä 26.12.

F2

Lokakuun puolivälissä alkaneet, nelisen viikkoa kestäneet kunnolliset F2-kelit eivät joulukuun aikana osoittaneet piristymisen oireita. Oikeastaan vain neljänä päivänä näkyy joulukuussa 50% -arvoissa kanavalla E2 (48.25 MHz) melko pysyviä signaaleita osoittavia numeroita: 1.12, 28.12 ja 30-31.12.

Englantilainen 28 MHz:n majakka GB3RAL on kello 09-15 UTC välillä näkynyt jokseenkin jokaisena joulukuun päivänä, heikko se oli vain 31.12.

Joulukuun varmasti mielenkiintoisin kelipäivä oli 30.12, jolloin esiintyi varsin voimakasta tropoa, voimakasta radioauroraa (14-20 UTC) sekä kaiken lisäksi vielä F2-keliäkin kanavalla E2 (48.25 MHz) 06-10 UTC.
21.12 ja 23.12 on ilmeisesti esiintynyt myös "tavallista" Es-keliä.

AURORA

Geomagneettista häiriöisyyttä oli joulukuussa varsin runsaasti. Häiriöisin vrk Sodankylässä oli 1.12 (Ak=80) ja Saksassa 29.12 (Wingst Ak=56).

Radioauroraa näkyy Jokelan mittauksissa ULA- ja tv I-alueilla selvimmin:

4-5.12	illalla ja yöllä	(Sodankylän max. Q-indeksi = 7-8)	
7.12	illalla	(19-20 UTC!)	(Q = 4-5)
14.12	alkuillasta	(15-16 UTC!)	(Q = 5-6)
16.12	alkuillasta	(15-16 UTC!)	(Q = 5-6)
22.12	iltapäivällä ja illalla	(13-14 UTC!)	(Q = 5-6)
24.12	alkuillasta		(Q = 5-6)
27.12	pitkin iltaa	(16-17 UTC!)	(Q = 6-7)
29.12	alkuillasta ja yöllä	(15-16 UTC!)	(Q = 7-8)
30.12	pitkin iltaa	(15-16 UTC!)	(Q = 6-7)
31.12	aamulla sekä illalla		(Q = 6-7 & 4-5)

Heikompaa radioauroraa myös.: 1-2.12, 3.12 sekä 26.12; yöllä 1-2.12 esiintyi Aurora Es -keliä ULA-alueella Englantiin.

Joulukuun puolivälissä auringon aktiivisuus oli melkoisen vaisua mutta loppukuussa etenkin päivittäiset solar flux -arvot olivat korkeita (27.12 oli 285), mikä kyllä näkyy n. 50 MHz:n keleissä. HF-kelit eivät kuukauden alkupuoliskolla - lähinnä geomagneettisesta aktiviteetista johtuen - olleet erityisen hyvät. Kuitenkin, korkeimmat foF2-arvot kirjattiin 1.12 (olivat Saksassa yli 15 MHz !). 50 MHz:n kelit alkanevat jälleen helmikuussa (ainakin Etelä-Afrikan suuntaan)... Auringonpilkkumaksimin (12kk) ajankohdasta ei ole vielä tietoa (lähellä on...).

Todettuja auringonpilkkulukujen ja solar fluxin kuukausikeskiarvoja

kk	$\bar{R}$	$\overline{flux}$
4.88	88.0	123.6
5.88	60.1	117.9
6.88	101.8	143.8
7.88	113.8	157.6
8.88	111.6	158.0
9.88	120.1	154.1
10.88	125.1	168.7
11.88	125.1	152.8
12.88	179.2	193.5
1.89	161.3	227.8
2.89	165.1	217.0
3.89	131.4	203.0
4.89	130.6	190.9
5.89	138.5	194.4
6.89	196.2	247.2
7.89	126.8	187.8
8.89	166.8	222.5
9.89	176.8	228.4
10.89	158.5	207.4
11.89	173.0	233.9
12.89	165.1	213.8

File: "Anrvu"
DECEMBER 1989
Total time of no recording (=C) due to technical problems:

17 h (=2.3%)

FNL YLE TKVE

MAXIMUM RECORDED DAILY 1 h (50%) FIELD STRENGTH AT JOKELA
DECEMBER 1989

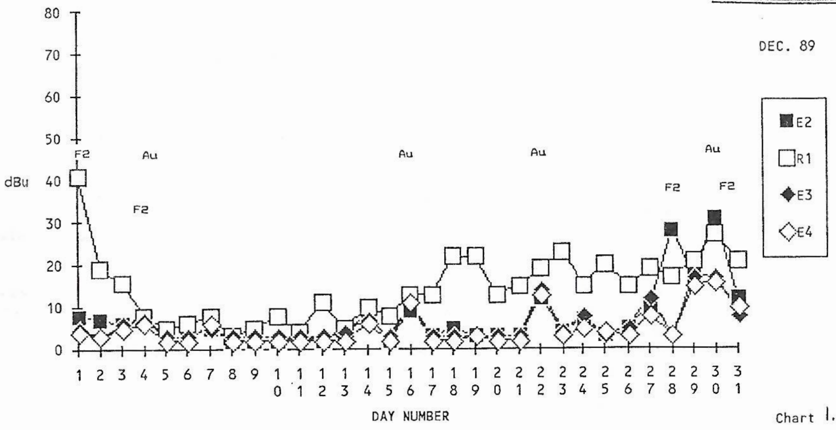


Chart 1.

FNL YLE TKVE

MAXIMUM RECORDED HOURLY 1 h (50%) FIELD STRENGTH AT JOKELA
DECEMBER 1989

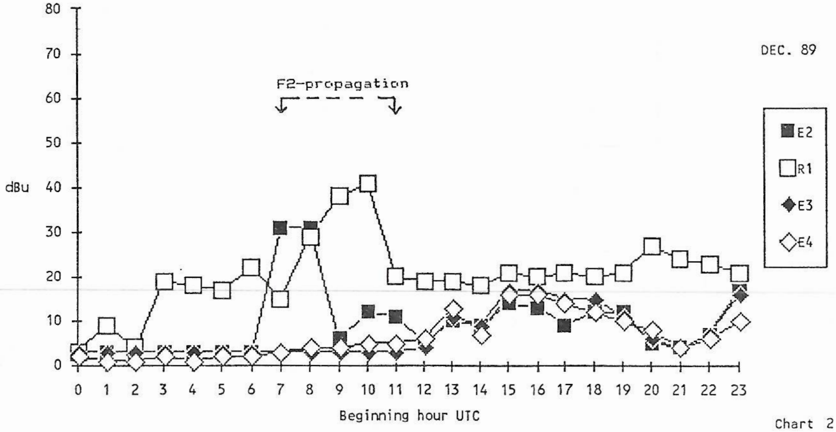


Chart 2

Tr = Tropo, Au = Aurora

4 TV Band I frequencies for Es, F2 & Aurora propagation:

- ch E2 (48.25)
- ch R1 (49.75)
- ch E3 (55.26)
- ch E4 (62.25)

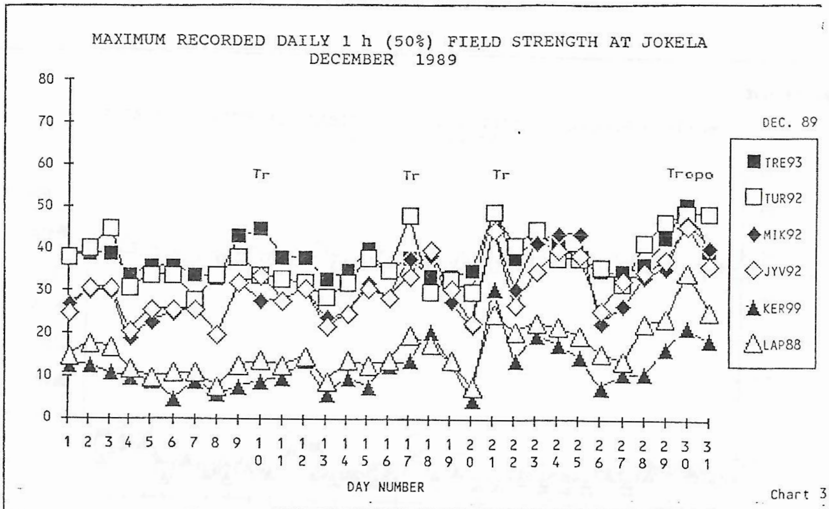
F2-propagation in December:

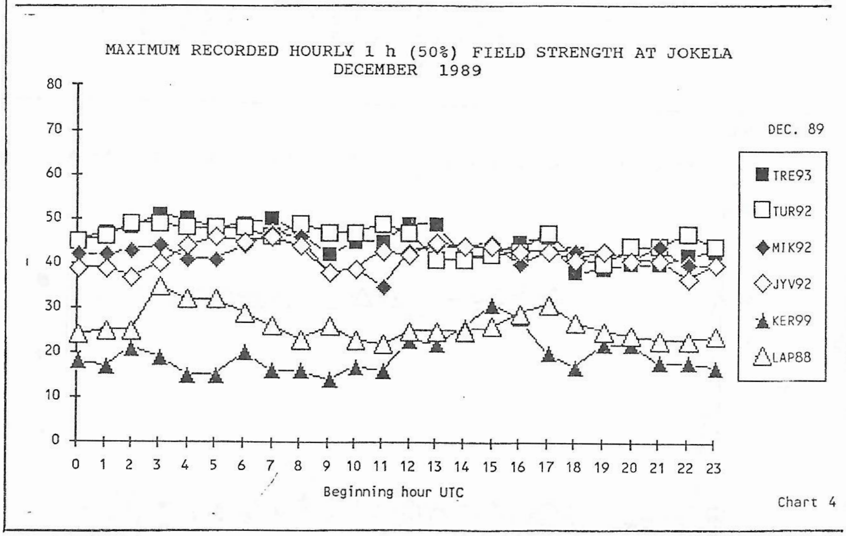
- E2 (48.25): 1.12, 3.12, 4.12, 28.12, 30.12, 31.12;
  weak: 2.12, 7.12, 13.12, 18.12, 20.12.

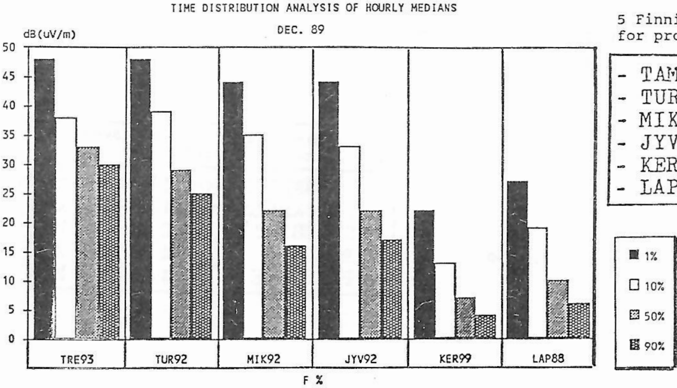
- R1 (49.75): 1.12, 4.12, 20.12.

Aurora: 4.12, 5.12, 16.12, 22.12, 29.12, 30.12;

- R1 LENINGRAD 49.75 d=302 km
- E4 STOCKHOLM 62.25 d=404 km







5 Finnish FM2 stations (24h) (+ 1 FM1) for propagation studies:

- TAMPERE	93.7	d=136 km
- TURKU	92.6	d=147 km
- MIKKELI	92.1	d=177 km
- JYVÄSKYLÄ	92.5	d=185 km
- KERIMÄKI	99.1	d=276 km
- LAPUA	88.2	d=286 km

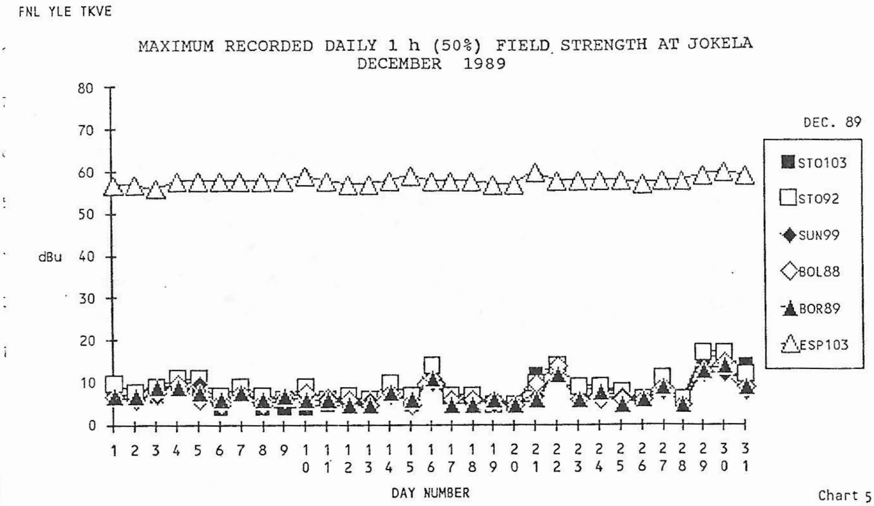


Chart 5

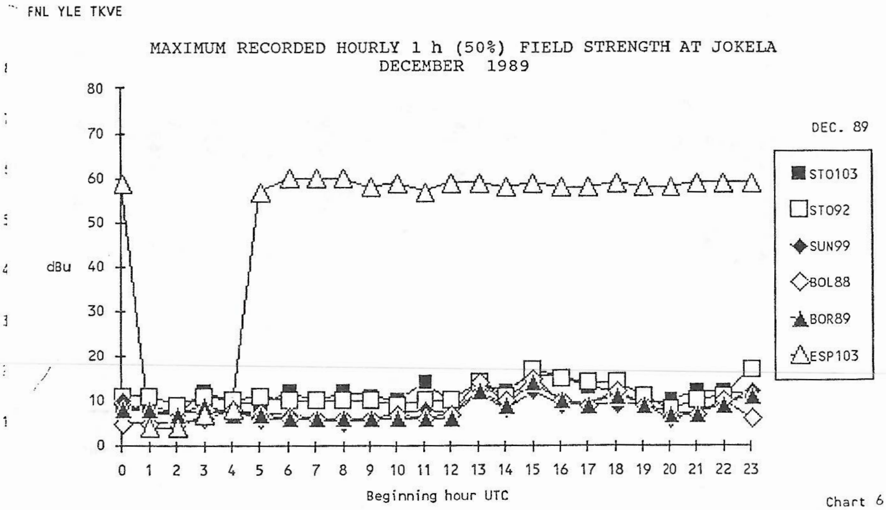


Chart 6

5 long distance FM stations (Swedish) and a local FM for reference:

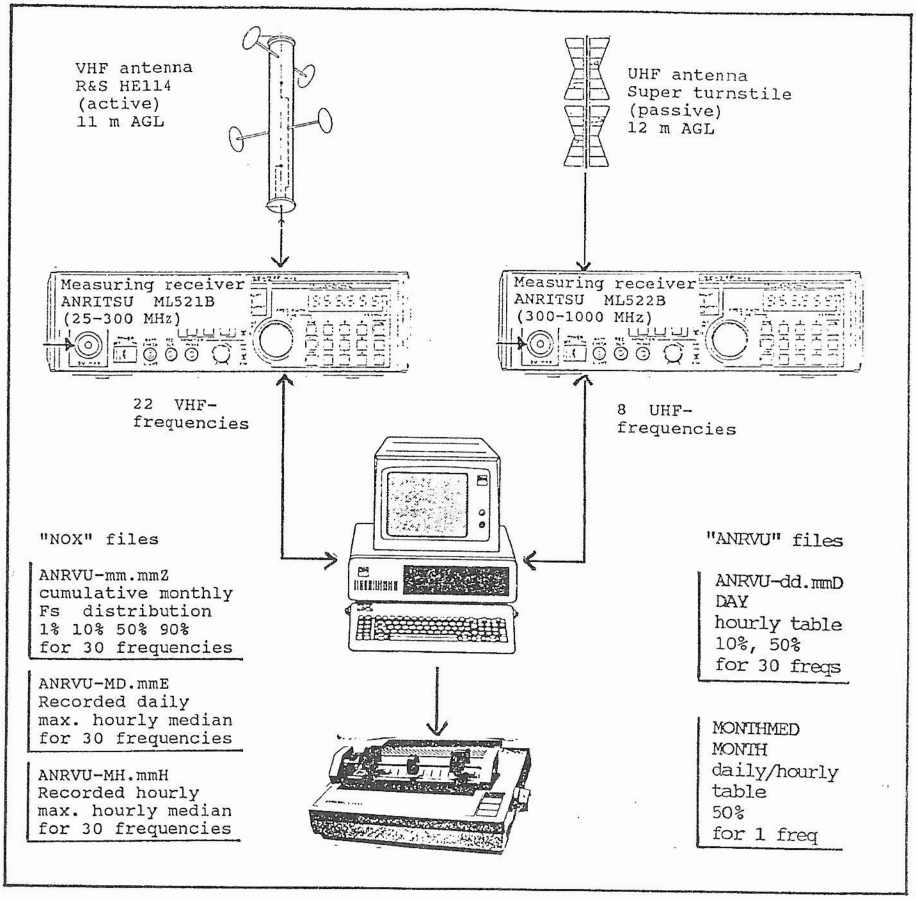
- STOCKHOLM	103.3	d=404 km
- STOCKHOLM	92.4	d=404 km
- SUNDSVALL	99.2	d=454 km
- BOLLNÄS	88.4	d=483 km
- BORLÄNGE	89.4	d=539 km
- ESPOO	103.7	d= 47 km

Aurora: 4.12, 5.12, 16.12, 22.12, 29.12, 30.12;

VHF & UHF FIELD STRENGTH MEASURING AND RECORDING SYSTEM

Oy. Yleisradio Ab.
Measuring station
SF-05400 Jokela
Finland

- Geogr.coordinates:
  60 N 34 25 E 00
- Site elevation:
  72 m MSL



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Tilaukset SUORAAN pankkiirille varustettuna merkillä "RATS PC". Tilausen mukana postimerkillä varustettu palautuskuori suojapahveineen

Pikapaino Paatelainen Oy 1990