The INSPIRE Journal

Volume 5 Number 1
November 1996

INSPIRE Celebrates Anniversaries!

Fall 1996 marks several milestones in the history of INSPIRE.

7th Anniversary of student involvement in space physics research. It was in the fall of 1989 that the planning for the ACTIVE Project was begun. That project featured monitoring transmissions from a Soviet satellite.

5th Anniversary of the formation of INSPIRE. In November of 1991, The INSPIRE Project, Inc., was formed as a scientific/educational nonprofit California corporation. INSPIRE has been granted tax exempt status by both federal and state agencies. The purpose of The INSPIRE Project is to promote the involvement of students in scientific research.

4th Anniversary of *The INSPIRE Journal.* The *Journal* was first published to report the results of the space shuttle based SEPAC operations. The *Journal* has continued and grown as the projects supported by INSPIRE have changed and grown.

We look forward to many more exciting years with The INSPIRE Project.

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The INSPIRE Journal is a publication of The INSPIRE Project, Inc., a nonprofit educational/scientific corporation of the State of California. The purpose of the INSPIRE Project, Inc., is to promote and support the involvement of students in space science research. All officers and directors of the corporation serve as volunteers with no financial compensation. The INSPIRE Project, Inc., has received both federal and state tax-exempt status (FEIN 95-4418628). The *Journal* is published two times per year: November 1 and April 1. Submission deadlines: October 1 and March 1

Contributions to the *Journal* may be sent to:

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Subscription Update

This issue marks the expiration of all subscriptions to *The INSPIRE Journal*.. I hope you plan to continue subscribing. Please use a copy of the order form found on the last page of this issue to order your renewal. Please take care to print your address information and make a special note of any changes. The following conditions will apply to all subscriptions in the future.

1. The one year (two issues) subscription rate will be: $ 6 US, Canada, Mexico; $10 Overseas rate

2. All subscriptions will expire each year after the November *Journal* issue.

Field Observation "Loaners" Available

We have had several INSPIRE participants take advantage of the field setups available from INSPIRE. The setups include an RS4 receiver with antenna, a cassette recorder with headphones and microphone, an audio tape and connecting cable. All you need to provide is a ground rod. (A 3/4" metal pipe or EMT conduit is recommended.)

You may borrow a field setup for 1-2 months and use it as often as you want. You will have only three obligations:

1. Provide return postage (about $5) and return the equipment when done.
2. Record an audio tape of one or more of your field observation sessions and return the tape with the equipment.
3. Write a short (1-2 pages) note for the *Journal* about your experiences.

This is a way to find out if you want to build a kit for yourself. If you have a field setup already, this can provide you with a second field station to allow you to check out your components. If you would like to borrow a field setup, send your request to Bill Pine at the address shown on Page 2 (USMail, email or fax).

New INSPIRE Receiver Coming Soon!

This fall a prototype of the new INSPIRE IR2 receiver was field tested and approved by the officers of INSPIRE. An order has been placed with John Kohus of Laboratory Services in South Barre. MA. Delivery is expected in a few weeks. After that the assembly instructions will have to be written and tested. A pricing decision will be made that is consistent with the policy of INSPIRE: we will sell the kit for the smallest amount which covers all costs. An announcement will be made in the April 1997 issue of *The INSPIRE Journal*. An article reporting on the performance of the new receiver as tested against the RS4 and the ACTIVE B-field receiver will also appear at that time. I can tell you that the new receiver performed better that the other two.

INSPIRE Is Now on World Wide Web:

URL: http://www.gsfc.nasa.gov/education/inspire/inspire.html

INSPIRE Workshop

The next INSPIRE Workshop has been scheduled for Saturday, February 8, 1997, at Gallaudet University in Washington, DC. Everyone is invited. If you would like details about this workshop, contact Bill Pine and he will get the information to you as soon as it is available.

email Address and Fax for INSPIRE

email: pine@nssdca.gsfc.nasa.gov
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RS4 Receiver Kits and Assembled Receivers Available Now

INSPIRE RS4 receiver kits and assembled receivers are now in stock and available for immediate delivery. These items are available on a "while supplies last" basis. Please use the INSPIRE order form on the last page of the *Journal.*

The price for an assembled receiver is $70.

INTMINS-November/96 Operations Schedule

By Bill Taylor, Washington, DC
Stas Klimov, Moscow, Russia
Bill Pine, Ontario, CA

The November 1996 INTMINS Operations schedule has been determined. Operations will occur on the last two weekends: November 23-24 and November 30-Deember 1. Data gathered will be analyzed and reported on in the April 1997 issue of *The INSPIRE Journal.*

Gathering Data:

IMPORTANT NOTE: Data gathering procedures will remain the same as those used in April 1996.

In order to allow more flexibility dealing with orbital changes by MIR between now and when the operations occur, the following data gathering schedule will be followed:

Step 0: Completely check out all equipment. A good method is to set up everything in your living room. All you will hear is household 60 Hz, but you will know the equipment is working. This is also a good time to fill out the log cover sheet (see page 57 of the *Journal*).

Step 1: Define "T-time" as the starting time for operation of ISTOCHNIK.
Convert the UT time to local time.
Arrive at your site with time to spare.

Step 2: Start data recording at T minus 12 minutes.
Prior to this time place a brief voice introduction on the tape identifying the observers and the operation number.

Step 3: Place time marks on the tape at: T-12, T-10, T-5, T, T+3, T+8, T+13, and near the end of the tape. Use UTC times only. Note that this schedule brackets the scheduled time of operation of ISTOCHNIK with time marks. Use 60 minute tapes and place one operation per side.

Step 4: Keep a written log (see page 58 of the *Journal*) of time marks and descriptions of everything you hear.

Step 5: Review your tapes and revise your logs if necessary.

Step 6: Mail your tapes and logs to Bill Pine at the address shown on Page 2.
Your tapes will be returned to you.
Send in copies of your logs since they will not be returned.
You will receive a copy of the spectrographs made from your data.
With your next issue of the *Journal* you will receive a copy of the complete data set from all participants.
Your data will be incorporated in the data analysis report article in the *Journal.*

Mode of Operation:

The two instruments on MIR are Ariel and ISTOCHNIK. Ariel is a plasma generator and operates for 5 minutes, alternating between axes. ISTOCHNIK is a modulated electron gun that accelerates a beam of electrons and emits them into space. The electron beam is turned on and off at frequencies of either 10 hertz or 1000 hertz (1 kHz), which should cause the radiation of electromagnetic waves in the VLF range at those two frequencies. ISTOCHNIK operates for a total of 2 minutes on the following schedule:

ISTOCHNIK mode:	10 seconds modulate at 10 Hz
	10 seconds modulate at 1000 Hz
	10 seconds modulate at 10 Hz
	10 seconds modulate at 1000 Hz
	repeat for 2 minutes of operation

On each pass, Ariel will either operate first or last, whichever gives the most coverage over INTMINS observers. Since the signal from ISTOCHNIK is more powerful, it is the one most likely to be detected. For that reason, the schedule emphasizes the operation of ISTOCHNIK.

INTMINS Schedule

In order to obtain the most reliable schedule for INTMINS operations, determination of the scheduled is delayed as long as possible. Having the smallest possible time between requesting the schedule from the Russian Space Agency (represented by Stas Klimov) and the actual operations minimizes the adjustments that may have to be made later due to changes in the orbit of MIR. For this reason, the schedule is not determined until after the *Journal* goes to the printer. The INTMINS schedule has been included as a separate supplement to this issue. This is the procedure that will be followed in the future.

Recording Alone:

Learning From Experiences Recording INTMINS Sessions

Mike F. Aiello
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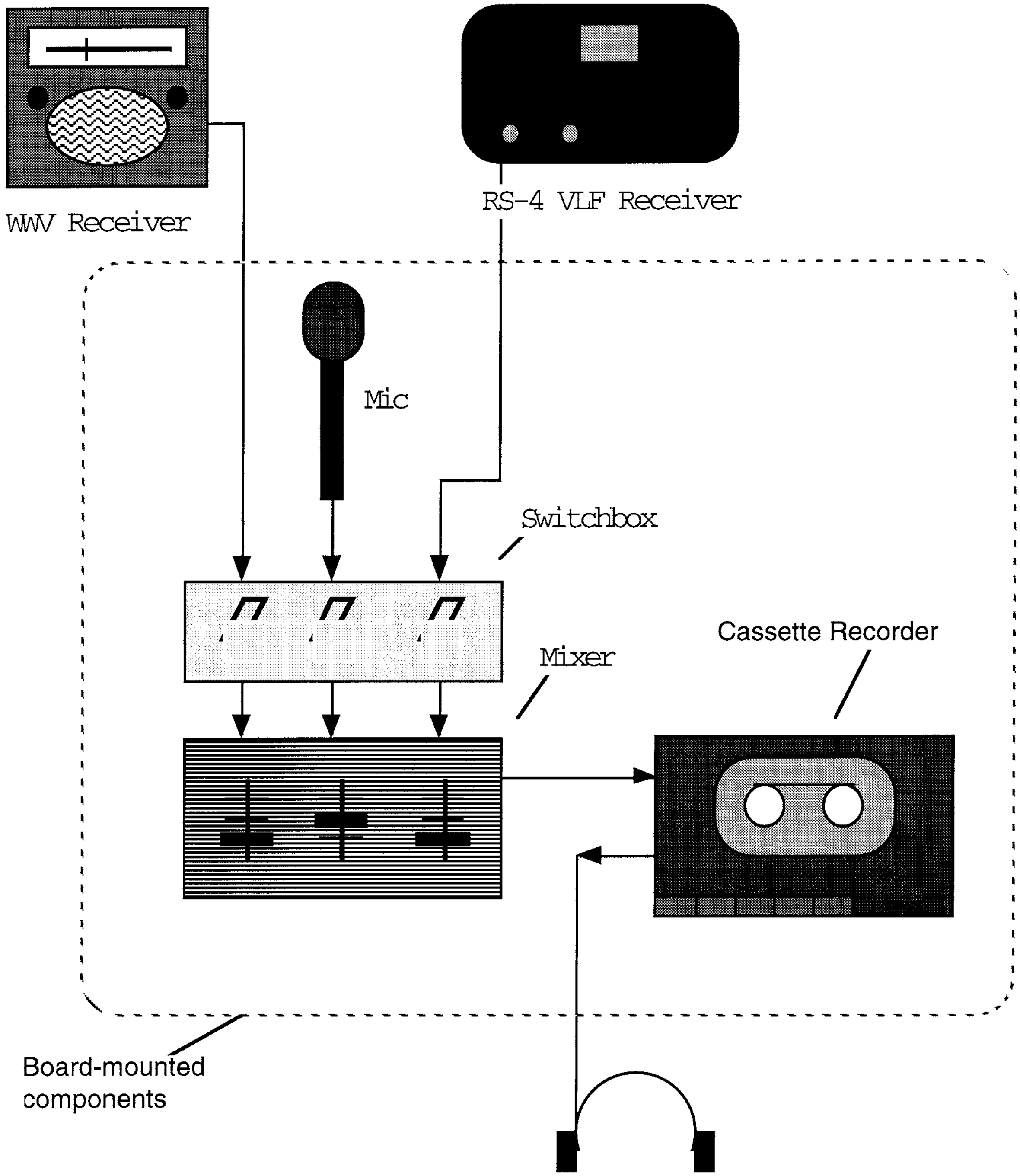
Croton, NY 10520
e-mail: n2htt@bestweb.net

Since my first experience as one of many ground observers in the SEPAC experiments, I have found participating in an organized effort to collect scientific data both exciting and rewarding. There is a challenge to meeting a schedule, in the field, working with a fairly complex assortment of gear and a time-dependent protocol. This challenge is especially keen when you are working in pitch darkness, outdoors, in below freezing temperatures, alone, and at 2:03 AM local time on a weekday. (For some reason, these seem to be the only passes I can cover here on the East Coast...)

Not that VLF data collection is that difficult a process, but with at least four main components, (radio, VLF receiver, microphone , and cassette recorder), the need to set up antennas, make voice announcements on cue, etc., there is enough going on to make the whole process easy prey to Murphy, or just plain late night befuddlement. This is not to mention the 2n interconnections that must be made correctly, with good contact. And then there are batteries...

After many on-site mishaps and nearly missed schedules, I came up with two improvements for my recording sessions: one involving the hardware, and one involving t he process. These are both simple ideas, but I thought they were worth sharing, because the improvement in field operation that resulted was dramatic. You may already be doing similar things; I would welcome any correspondence on ideas you've developed in the field. The key to the hardware improvement was to eliminate poor/incorrect interconnections by making most of them permanent. Now the equipment I use for VLF recording has other responsibilities in real life, so a hard-wired, permanent fixture wouldn't do. Instead, I found a medium sized composition drawing board at a local art supply store, and came up with secure, but removable, means of mounting my recording equipment on the board. Large pieces of equipment are attached using lengths of bungie cord passed through holes in the board and knotted behind. The smaller items are affixed with self-adhesive Velcro™ patches. The board itself had a convenient handle hole, making the whole affair easily portable. The board contains four items attached to it: the cassette recorder, a four-channel mixer, a home-made switch box for three audio channels, and a gooseneck which holds my microphone for voice announcements. There are only three off-board connections that must be made on-site: audio from the WWV receiver, audio from the VLF receiver, and my headphones. All other connections are made on the board beforehand, and are as short as possible. There is no possibility of tangles, dislodged or loose connections between the on-board components. You can see this layout in the accompanying block diagram.

VLF Field Recording Station Block Diagram



The switch box is an extra convenience that I added to facilitate night work. Each switch is paired with an indicator LED which lights when that channel is enabled. Not only is this visual cue very handy, but the switches allow me to add in and drop out WWV and the microphone without changing the pre-set recording levels determined before the session. The whole audio mixing board is very secure and easy to transport and use. There's even a spot to clip a digital clock displaying UT.

The process improvement took the form of a comprehensive set of checklists that record every setting, and every connection necessary to complete the session. The settings include switch settings on the VLF receiver, and recording levels on the mixer and the cassette recorder. The WWV frequency, and radio volume and tone are also included. The interconnection checklist covers all the connection points in the system, including those on the board. You can see samples of the checklists at the end of the article. I use the checklists at two points in the recording session. Well before the start of the session, I set recording levels and select the WWV frequency I'll use. I record this information on the checklist at the appropriate places. After I have made all the necessary settings, I make all the connections between the board and the other components, and the VLF receiver and the antenna system. Just before the start of the session, I run over the checklist one last time, verifying each connection or setting. If I follow this procedure faithfully, I am set and ready when the recording start time arrives.

The audio board had its pilot run during the November 1995 INTMINS series. I only managed one session, and although the board components functioned well, I had battery trouble (figures...) and nearly missed the schedule. In the April session, I added the checklists and fresh batteries, and the session came off flawlessly. It was a warm, sunny late afternoon recording session, but I'm sure that had nothing at all to do with the successful run. In any event, by organizing the connections, and the set-up process, fortune has to be smiling just a little bit more on my recording efforts in the field.

VLF Recording Session Checklist 1 of 2

Board Hookups

- [ ] **WWV:** Radio(Tape Out) --> Mixer(Channel 1 Mic)
- [ ] **Mic:** --> Mixer(Channel 2 Mic)
- [ ] **VLF:** RS-4(Rcvr Out) --> Mixer(Channel 3 Mic)
- [ ] **Phones:** --> CTR(Phones)
- [ ] **Audio:** Mixer(Left Out) --> CTR(Mic In)
- [ ] **Clock:** Clip to board

RS-4 Hookups

- [ ] **Ant:** RS-4(Ant. In) --> Antenna Pigtail
- [ ] **Gnd:** RS-4(Gnd. In) --> Ground Strap (to car)

RS-4 Settings

- [ ] **Level:** 1 2 3 4 5 6
- [ ] **Antenna:** ___ Whip / ___ Long Wire
- [ ] **Output:** ___ Rcvr / ___ Mic
- [ ] **Filter:** ___ In / ___ Out
- [ ] **Power:** ___ On / Off

VLF Recording Session Checklist 2 of 2

CTR Settings

☐ **Level:** 1 2 3 4 5 6 7 8 9 10

☐ **Tone:** 1 2 3 4 5 6 7 8 9 10

☐ **Vox:** ___ Out / ___ Lo / ___ Hi

☐ **ALC:** ___ Out / ___ In

☐ **Counter:** 000

Mixer Settings

☐ **WWV:** Channel <u>1</u> 2 3 Level 1 2 3 4 5 6 7 8 9 10

☐ **Mic:** Channel 1 <u>2</u> 3 Level 1 2 3 4 5 6 7 8 9 10

☐ **VLF:** Channel 1 2 <u>3</u> Level 1 2 3 4 5 6 7 8 9 10

☐ **Output:** ___ Mono / Stereo

☐ **Power:** ___ On / Off

WWV Radio Settings

☐ **Freq:** ___ 5000 / ___ 10000 / ___ 15000 / ___ 20000 kHz

☐ **Base:** ___ 0 (Neutral)

☐ **Treble:** ___ 0 (Neutral)

☐ **Volume:** ___ 0 (Off)

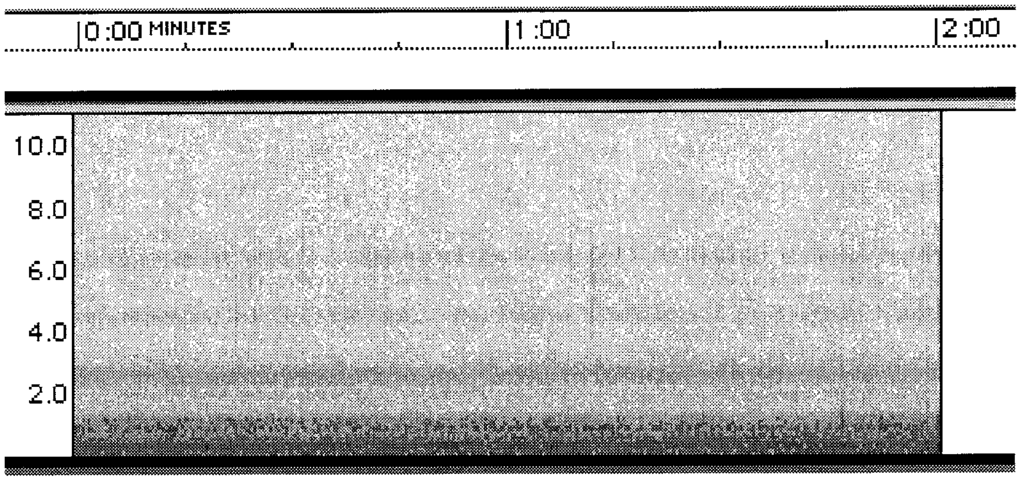
☐ **Mode:** ___ AM / FM / SSB

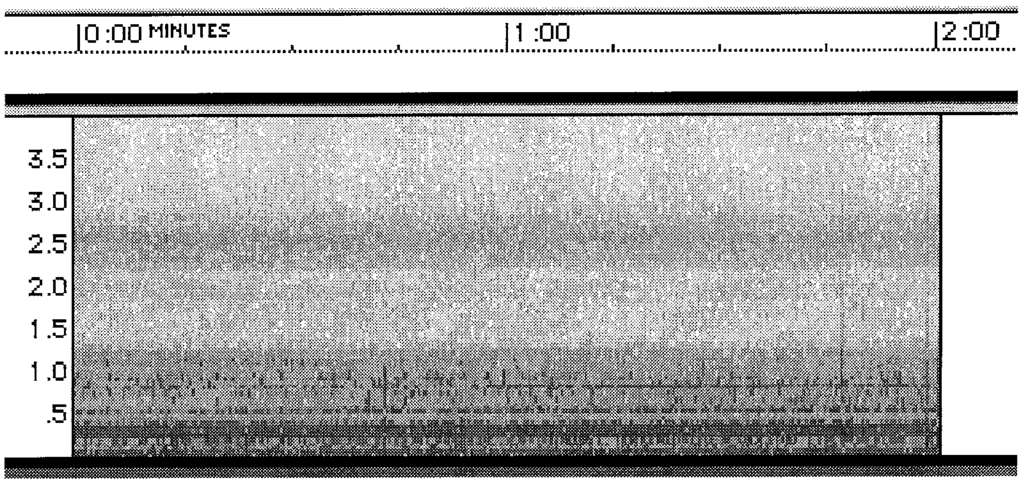
☐ **Power:** ___ On / Off

Some More Italian VLF/ELF Activity

by Flavio Gori
INSPIRE European Coordinator
Florence, Italy

The winter of 95/96 was spent in various MIR/INSPIRE operations. It was really fine to work with the Russian people and many INSPIRE groups (Italians, too) cooperated in a very good way. You can read about this work elsewhere in the *Journal*. I would like to talk about my recording as it appears in the sonograms by Bill Pine (below). You can easily see the very big noise in the area under 1 kilohertz. It is really a puzzle how it is possible that the noise can grow so strong in three years while I do not see any more electric lines now than then.





Anyway, this is what happened and I don't really know where to look for a more quiet site (remember that I have to drive 3/4 hour from my house to arrive there!). The Italian towns (small or big) are much too close together now and the electrical noise is everywhere - at least in the vicinity of my home and not so far from roads. As you can understand, it is not so easy to walk for an hour in the evening or night to get away from power lines. I'll try again.

I also looked at my tape using some software we have developed here. We are still unable to print these with the right resolution, but I can see on the video screen some features. Some signs we can read as tweeks and there seems to also be a bip of noise at about the same time. This is the problem: with the software we use a sound card to record the tape in a file and then we watch the recording session on the PC screen. We cannot hear the tape and see the video at the same time. So I wonder how many of us can really say "this is this"?

I have also read about people that hear the tape many times and when they *believe* they hear something interesting, they record that part of the tape and analyze it by computer. I agree with Bill Taylor when he wrote in these pages some months ago: it's not really easy to understand with *just* the ear what the tape contains. We have to use the tools we have and can afford. Otherwise we risk not hearing something and then not processing that part of the tape, losing a potentially interesting part.

In the summer of 96 I was in the Dolomiti mountains again with my family and I took along my WR3 receiver and my portable recorder, hoping to finally find a very quiet site to listen to my favorite Natural Radio sounds. It was really so. At about 1800 meters above sea level in the Seiliar Plateau National Park, we experienced the quiet site we usually dream about. The receiver did work well and led me to think about the necessity or not to purchase another WR3 with some filters that are able to cut off at least some of the hum. I am not convinced that filters can give better performance since sometimes I think that they would also cut off part of the signals we are interested in and want to detect. So maybe it is better to detect all we can and look for a quiet site. This is not really easy for me.

During the July 26, 1996, recording session starting at 1430 UTC I heard sferics and some small tweeks. I was suddenly surprised to hear, almost hidden in the sferics, a beep-beep sound just like the ones the Time Signal Station emits. The beep sound amplitude was really low and sometimes I could not hear it. My attempts to record it were completely unsuccessful. I then began a series of changes in positions between the WR3 and the recorder looking for the best coupling of receiver and recorder and tape. After a series of changes that I could not control in real time (since the headphones contribute some noise, too) I finally found a combination that would permit me to record the beep-beep signal and see it with the software. I am thinking of shipping this tape to Bill Pine (if he is agreeable [he is! - ed.]) to let him monitor this recording with his Mac and maybe he can explain all of this. I don't believe the radio clock can be so low in frequency and so fast in transmission. This is something like the CW I recorded in the winter of 1993 during the coordinated recording session with Jim Mandaville who was in the Saudi Arabian desert while I was in the Maldives Islands early in the morning, about 3:00 AM. Monitoring my tape with his Mac, Jim did determine that is was an Indian CW transmission. Who can say why it was detectable in VLF? This could be the case with the latest recording tape. By checking with my Swatch watch, the interval between the two beeps is not perfectly 10", but 09" or so. Are you thinking that this instrument is not the highest technology available? Maybe you are right, but the same pattern appears to be true when I listen to a real time signal like DCF77 in Germany or MSF in the United Kingdom.

I describe all of this to show how interesting Natural Radio is and how long we have to work to arrive at an understanding of what is going on.

As I have organized since 1992, during the August San Lorenzo meteor shower, we went looking for possible connections between meteor activity and VLF/ELF signals. I went to my usual recording field station and *finally* discovered how to shield the noise from the recording tape: put the recording machine in the car and close the car door. In this way I found a very good iron box to shield all the noise made by the recorder. It was not so hard to have tried this earlier, but what would you do if you had to go a distance from the car to record?

Anyway, some trials with the recorder in and out of the car gave the evidence. Sometimes it is far better to stay close to the car and the (weak) electric lines than to go away from the car and the lines and be unable to make a good connection. Also, the walking stick I made for field recording of ELF sessions was not as good as the simple car as a *ground*. You have to think about it.

I believe that a very interesting job would be to organize the creation of a worldwide recording net to define the knowledge of the natural background noise, both in quiet times and when perturbed. Of course, it should be a job where professional and amateur scientists would work for 24 hours a day and for a very long time, I think not less than 5 years. The first 3 years would be just to record all the signals arriving. Then we could begin to discover a pattern where we could design some software able to record only the signals that are not part of the supposed normalcy. The fourth and fifth years would be used for cross referencing between what we consider the normal and what appears to be out of the ordinary. At the end we could be able to understand more about the background noise and other VLF/ELF phenomena. I believe that the results of this study might be useful for many fields and not just for Natural Radio Research.

While I believe that the very low frequency part of the radio spectrum is the more promising for detecting natural phenomena, I have to admit that other parts of the radio spectrum are useful to determine some anomalies that may be correlated with natural or manmade events. In the past years we have seen some interesting clues about the connections between our planet (the solid body and its surrounding space) and what is on the planet - plants, animals and humans. All of us might be able to hear about how living things respond at the time of a particular event such as lightning or earthquake. The magnetic field of the earth is used by animals to find their way. Plants not only use electromagnetic waves with chlorophyll to acquire energy, but are also able to serve as an antenna in some VLF/ELF reception. Sometimes it seems to me that all living things on earth and the earth itself are exchanging information between each other using the very low frequency radio spectrum and probably by other means, too.

Anyway, it is clear to me that in the VLF range we can find a lot of information on natural events. Sometimes we can use manmade signals within the natural parts of the planet to get information in the VLF range. An example is the work on the Space Shuttle when its transient signals remained in the ionosphere for some while. This appeared in some wonderful work by some USA scientists such as J. Dea, W. Boemer, W. Van Bise and F. Rauscher. I would also like to take this opportunity to thank Dr. Jack Dea of NOSC in San Diego, CA, for kindly shipping me some of their work in this area and in the field of seismic precursors.

In this last field some important evidence is reported worldwide about some more high frequency work. Here in Italy also we have groups of scientists working in this range and the LF range in particular. In Europe a part of the LF region is used for broadcasting such as the station that broadcasts from the Principality of Monaco on the *Cote Azure*, Radio Monte Carlo (RMC) at 216 kHz.

Researchers at the Universities of LA SAPIENZA, III and Tor Vergata (all in Rome) and the University of Bari have recorded electromagnetic and seismoacoustic emissions from the Amare Cave on the southern slope of the Gran Sasso chain. They also analyzed the RMC radio signals. To do this, the researchers put a portable receiver (supplied by a 12 volt battery located near the mouth of the cave and connected to a solar electric module) near the bottom of the cave. To detect the electric signals the receiver was connected to a steel rectilinear antenna, 2 metres high and 1.5 centimeters in diameter. The magnetic signals were detected by a loop antenna 80 centimeters in diameter. The seismoacoustic signals were detected by three geophones (two piezoelectric and one moving coil type). Since they also wanted to keep track of the atmospheric pressure and temperature they used a pressure transducer accurate to 0.5 hPa and a temperature sensor accurate to 0.1 °C. All of the data were recorded at 10 minute intervals. The electric signals, the magnetic signals, the RMC signals and the atmospheric data were all recorded as voltages in the output of an integration module. The acoustic signals were recorded on a counting module as the number of pulses over a threshold value. The magnetic signals were filtered in two frequency bands: 0.3 - 3.0 kHz and 3-30 kHz. The electric and acoustic signals were filtered in those two bands plus 30-300 kHz.

In 1992 a similar receiver was installed inside the Cervo Cave, located in another karst area, 50 kilometres southwest of the Amare Cave. The signals were recorded in the same way by the same instruments and recorded in digital form every 10 minutes.

In the two caves, the data collected seem to identify two different states: quiet and perturbed. In the quiet state only electric and magnetic signals of the highest frequency range appear, probably connected to the lightning activity of our planet. In the perturbed state the research team detected the sudden appearance of siesmoacoustic signals coupled with the electric and magnetic ones. This phenomenology is connected to local weather processes like rainfall, atmospheric pressure variations and some thermal effects. The Italian researchers propose a model to account for these observations: micromovements of the limestone blocks that constitute the roof of the caves are invoked for the production of the seismoacoustic signals, while the electrification generated by these movements is invoked for the production of the electric and magnetic signals.

On August 25, 1992, an earthquake with magnitude 3.9 occurred in the Gran Sasso area and on June 4, 1993, a 4.5 earthquake occurred in the Umbria region, 100 kilometres north of the Amare cave. Before these events, the signals recorded in the caves showed anomalies from a few hundred hertz to several hundred kilohertz!

As everybody knows, the low frequency (LF) range is easier to investigate than the very low frequency (VLF) range since we do not have to go outside away from power lines with all of the problems associated with that. At home we can use our best recorder, computer and the like, without all of the limitations involved in operations *in the field.*

Some of these scientists are talking to me about creating an amateur network able to record the Radio Monte Carlo (RMC) emissions all around Italy. The University would supply the receivers and the recording tools which would use an EPROM (Erasable, Programmable Read Only Memory) unit which we would have to change every 28 days or so. Then we would ship the EPROM to Rome, where the professional researchers would analyze our recording comparing it with their recording in the caves in order to look for any kind of propagation anomalies. The project should start in the first months of 1997.

The network is growing. I contacted the people who usually work with me for the INSPIRE operations and some more friends who are serious listeners involved in BCL. The people who respond by confirming at the end of August 1996 will be part of the Net. Our *Natural Radio Research* group is starting its job and I am happy to say that we are able to cover from north to south in Italy.

I will keep the readers of *The INSPIRE Journal* informed in my next articles. I think it is a very important thing to find a topic where the traditional Natural Radio Researchers and the BCL can meet each other on common ground where everybody can bring his experiences in radio science. Some have thought that Natural Radio would only interest a very small part of the radio amateurs, but I think we can find ways to get more and more "aficionados" and all of these groups can bring some important contributions to our hobby and our research. Now, here in Europe and Italy in particular, we have many people interested in Natural Radio Research, both amateur and professional. The best news appears to be the willingness on the part of the professional researchers to work with the amateurs and share their knowledge and experience. Not only that, but some of them seem to be interested in our research and results, too.

So we have the great opportunity to exchange our experiences in the field with the professionals. This collaboration is at the beginning, but I can affirm that it is a very important step for research in all fields. I am glad to say that the very first step was done by the creation if The INSPIRE Project which, to my knowledge, was the very first to propose this kind of agreement.

INTMINS OBSERVERS

Roster Update

By Bill Pine
Ontario, CA

In previous issues of *The INSPIRE Journal*, INTMINS observer teams were profiled. In order to avoid repetition of those descriptions, the same team numbers will be retained permanently by those teams and descriptions of new teams will be added.

North American observers:

Team #	Observer	Location
1	John Lamb, Jr. East Texas State University	Commerce, TX
2	Stephen G. Davis	Fort Edwards, NY
3	Don Shockey	Oklahoma City, OK
4	Mike Aiello	Croton, NY
5	Jean-Claude Touzin	St. Vital, QC, CANADA
6	Bill Pine Chaffey High School	Ontario, CA
7	Dean Knight Sonoma Valley High School	Sonoma, CA
8	Mike Dormann	Seattle, WA
9	Robert Moloch Eastern Elementary School	Greentown, IN
10	Bill Taylor INSPIRE	Washington, DC

European observers:

(European team numbers are denoted with an “E” in the designation.)

Team #	Observer	Location
E1	Flavio Gori	Florence, IT
E2	Silvio Bernocco	Vaccera, IT
E3	Fabio Courmoz	Aosta, IT
E4	Joe Banks	London, UK
E5	Renato Romero	Cumiana, IT

Additions to the roster of INTMINS Observers:

New INTMINS teams, with their permanent team numbers and descriptions are shown below. INTMINS observers are described in the following format:

X. (team number) Name of observer — Location

Team Name
Longitude: of observation site
Latitude: of observation site
Description of observation site
Receiver: description of receiver used
Recorder: description of recorder used
Antenna: antenna type and description
WWV: WWV radio used (if any)
File code: used for naming data files for storage

North American Teams:

11 Mark Mueller — Brown Deer, WI

Brown Deer High School
Longitude: 87° 56' W
Latitude: 43° 10' N
Receiver: INSPIRE RS-4
Recorder: Realistic CTR-80
Antenna: 2 m whip
WWV:
File code: Mueller WI

12 Jon Wallace — Litchfield, CT

Longitude: 73° 15' W
Latitude: 41° 45' N
Wheeler Road
Receiver: INSPIRE RS-4
Recorder:
Antenna:
WWV:
File code: Wallace CT

13 Bill Combs — Crawfordsville, IN

Longitude: 86° 59' W
Latitude: 40° 4' N
soybean field
Receiver: INSPIRE RS-4
Recorder: Radio shack VSC 2002
Antenna: Marine 2 m whip
WWV: Radio shack
File code: Combs IN

14 John Barry — West Lebanon, IN

Seeger High School

Longitude:	87° 22' W
Latitude:	40° 18' N

Open field, near a barn

Receiver:	INSPIRE RS-4
Recorder:	Audiotronics
Antenna:	whip
WWV:	
File code:	Barry IN

15 Robert Bennett — Las Cruces, NM

Longitude:	106° 44' W
Latitude:	32° 36' N

Desert floor between two mountain ranges; Elevation about 4000 feet

Receiver:	INSPIRE RS-4
Recorder:	Marantz PMD 439
Antenna:	10 foot whip or 100 foot long wire
WWV:	Yupiteru Model MVT-7100
File code:	Bennett NM

16 Leonard Marraccini — Finleyville, PA

Longitude:	80° 00' W
Latitude:	40° 16' N

County park, fields, rolling wooded hills; nearest electric line 1 mile away

Receiver:	INSPIRE RS-4
Recorder:	Sears cassette
Antenna:	vertical "CB" whip
WWV:	Realistic DX440
File code:	Marraccini PA

17 Kent Gardner — Fullerton, CA

Longitude:	117° 48' 30" W
Latitude:	34° 12' 13" N

Horse Canyon Saddle; 3500 ft. elev.; 2.5 miles east of San Gabriel Dam, 4.5 miles north of Glendora, CA

Receiver:	INSPIRE RS-4
Recorder:	Marantz PMD 200
Antenna:	50 foot long wire 6 feet off the ground, horizontal
WWV:	Realistic DX160
File code:	Gardner CA

European teams:

E6 Marco Ibridi — Finale E., IT

Longitude:	11° 17' E
Latitude:	44° 50' N
Receiver:	ELIRCA2 (home brew)
Recorder:	
Antenna:	Vertical 1.5 m
WWV:	
File code:	Ibridi IT

E7 Alessandro Arrighi — Firenze, IT

Longitude:	10° 57' 50" E
Latitude:	43° 43' 21" N

500 meters above sea level

Receiver:	
Recorder:	
Antenna:	
WWV:	
File code:	Arrighi IT

E8 Zeljko Andreic — Zagreb, Croatia

Rudjer Boskovic Institute

Longitude:	
Latitude:	
Receiver:	
Recorder:	
Antenna:	
WWV:	
File code:	Andreic CROATIA

INTMINS-April/96 Data Analysis Report

by Bill Pine
Chaffey High School
Ontario, CA

The third session in an ongoing series of INTMINS operations was conducted in April 1996. Instruments were operated on board the MIR Space Station in accordance with the schedule published and distributed as a supplement to *The INSPIRE Journal*. INSPIRE observers attempted to record the VLF radio signal emitted by ISTOCHNIK, the modulated electron gun carried on MIR.

The modulation frequencies of ISTOCHNIK are 10 herts and 1000 hertz (1 kHz). Since the 10 hertz signal is outside the design band of the RS4 receiver and usually obscured by manmade hum, the 1000 hertz signal is the one we are attempting to detect. ISTOCHNIK is operated for 10 seconds at 10 hertz then 10 seconds at 1000 hertz, alternating between these two frequencies each 10 seconds for two minutes.

Analysis of the spectrograms from the data tapes submitted has failed to yield evidence of the 1000 hertz signal. Spreadsheet analysis of the sound files created from the data tapes is ongoing and may yield definitive results. At this point we can state that we have not been able to detect the signal from ISTOCHNIK ... yet.

The question arises: is the signal detectable at the surface of the earth? The answer to this question is not known. The power level of ISTOCHNIK is consistent with a signal at the earth's surface that is theoretically detectable under ideal conditions. Ideal conditions include a cooperative atmosphere and ionosphere and receiving equipment that is operating perfectly. Even under these conditions, it is very unlikely that an observer will be able to hear the 1000 hertz tone. A tone that is too weak to be audible might be found using computer analysis of the spectrogram. An even weaker signal might be found using spreadsheet analysis of the sound file.

It should be pointed out that the answer to the question posed in the previous paragraph (is the signal detectable?) just might be NO! The end result of the INTMINS operations may be a definitive statement that a signal of that power cannot be detected. Even though we hope to detect the signal, that negative result would be a valuable scientifically. That result would tell us that if we hope to do VLF experiments using electron guns or VLF transmitters from orbiting platforms, the power of the device must be higher that that of ISTOCHNIK. Meanwhile, we can all keep improving our field techniques and equipment and keep on trying! It is very apparent to this analyst that the data gathering efforts of the past have led to improved data quality now and that quality keeps improving.

Data Analysis Procedure

Analysis of data tapes consisted of making a 2-minute sound file coniciding with the scheduled operation time of ISTOCHNIK. This involved listening to the tape and following the log and time marks until the appropriate time, then recording the sound file on computer. The file was then used to create a frequency-time graph, or spectrogram. Using a screen-grab utility, images of the spectrograms were then transferred to Word files for storage, analysis and printing. A common sequence of spectrogram images was:

1. A picture of the entire 2-minute time starting with the time mark placed at the time of ISTOCHNIK operation start. The initial frequency range is 0 - 11.025 kHz. This range uses half the CD sampling rate and includes the lowest OMEGA frequency (10.4 kHz). At this scale, the ISTOCHNIK signal should appear as an intermittent dash (10 seconds ON, 10 seconds OFF) at 1000 Hz.

2. The first minute of the file was then cropped and enlarged.

3. The first 30 seconds of the file was cropped and enlarged.

4. Spectrograms of the above three time intervals were then made using a frequency range of 0-4 kHz. This reduced frequency range was chosen to make the 1 kHz frequency and the next couple of harmonics more easily visible.

INTMINS-April/96 Operations Summary

(NOTE: All times are UT on the date indicated.)

European Passes

Pass	ISTOCHNIK Start Time	Path during ISTOCHNIK Firing	Number of Observers Recording Data
4/21 1537	1537	Sardinia, North-central Italy	6
4/21 1711	1711	North of Spain, Northern France	3
4/28 1315	1315	Northern Italy,	5

North American Passes

Pass	ISTOCHNIK Start Time	Path during ISTOCHNIK Firing	Number of Observers Recording Data
19-1	2204	VA, MD, DC, NJ, DE, NY	2
19-2	2230	Northern Baja, Southeast CA, AZ	3
19-3	0107 (4/20)	West of CA/OR border, OR	4
19-5	0426 (4/20)	West Central MN, Southeast WI	2
19-6	0603 (4/20)	OK panhandle, Eatern TX	1
20-1	2106	Northern NC, VA, DC, East of DE	1
20-2	2239	West central KS, Northeast IA	1
20-3	0011 (4/21)	West of CA, Northern CA, NV	2
26-1	1845	Eastern VA, DC, MD, East of NY	1
26-2	2020	Southwest WI, Sudbury ON Canada	3
26-3	2149	West of CA, Bay Area, Western NV	3
26-4	2334	Western ON, Eastern QC Canada	2
26-6	0240 (4/27)	Southern BC Canada	2
27-2	1920	Southwest TX, Central OK	2
27-3	2054	South Central CA, East Central NV	5
27-6	0153 (4/28)	Central IL, KY, TN, GA/SC Coast	2
27-7	0322 (4/28)	West of OR, OR/ID/NV border	2

Summary of Passes Recorded

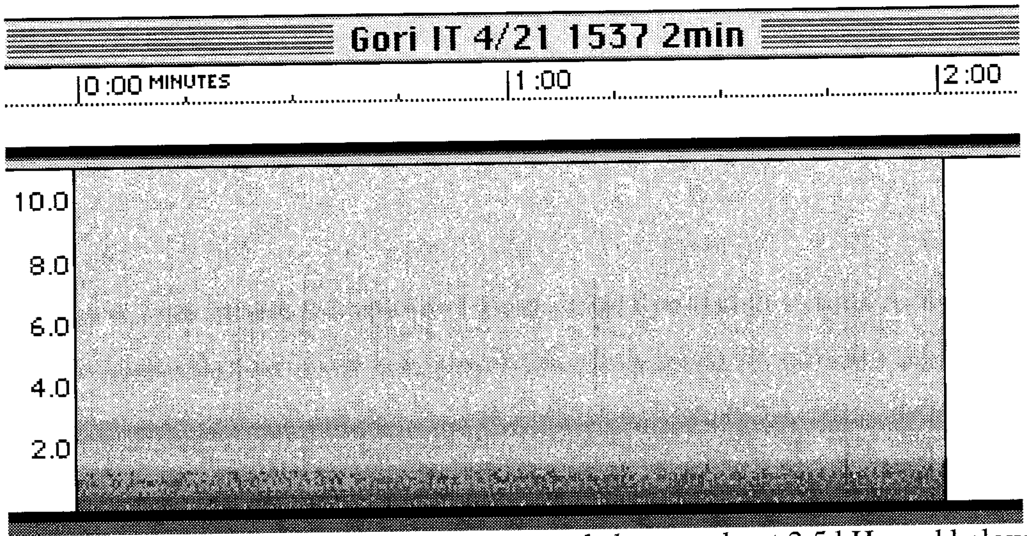
Pass	4/21	4/21	4/28
Team	1537	1711	1315
E1	X	X	X
E2	X	X	X
E5	X	X	X
E6	X		X
E7	X		X
E8	X		

Pass	4/19					4/20			4/26					4/27			
Team	1	2	3	5	6	1	2	3	1	2	3	4	6	2	3	6	7
1		x								x							
2	x								x								
5												x					
6		x	x								x				x		
7			x					x			x				x		
8								x							x		x
11				x													
12									x								
13						x	x			x							
14									x	x	x	x	x	x	x	x	
15			x		x	x							x	x	x	x	x
16	x																
17		x	x														

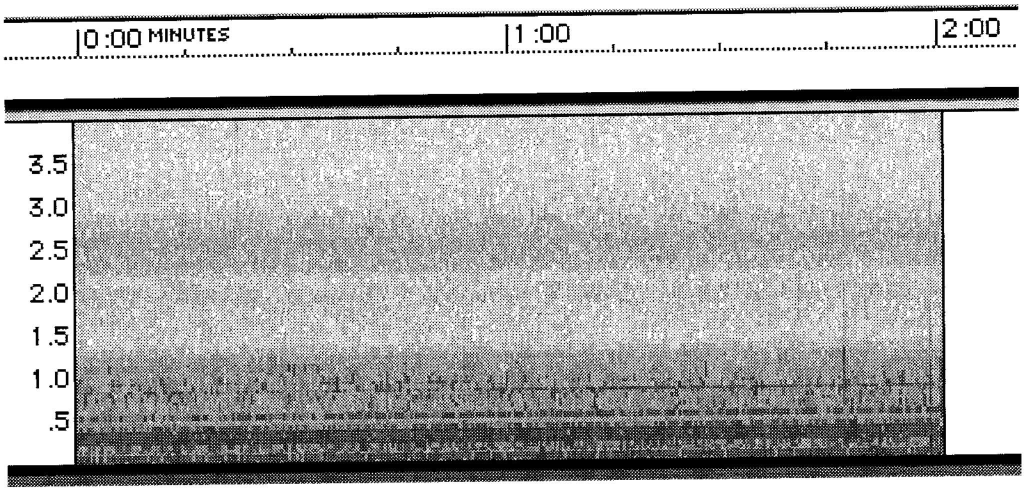
INTMINS Data

The following spectrograms are taken from the data tapes submitted by INSPIRE observers. The first view shown will be that of the entire two-minute interval analyzed. This first view will contain the file name identifying the observer. Subsequent views will be of parts of the interval or with a reduced frequency range. Refer to the time scale at the top of the spectrogram and the frequency scale to the left to determine the parameters for that view.

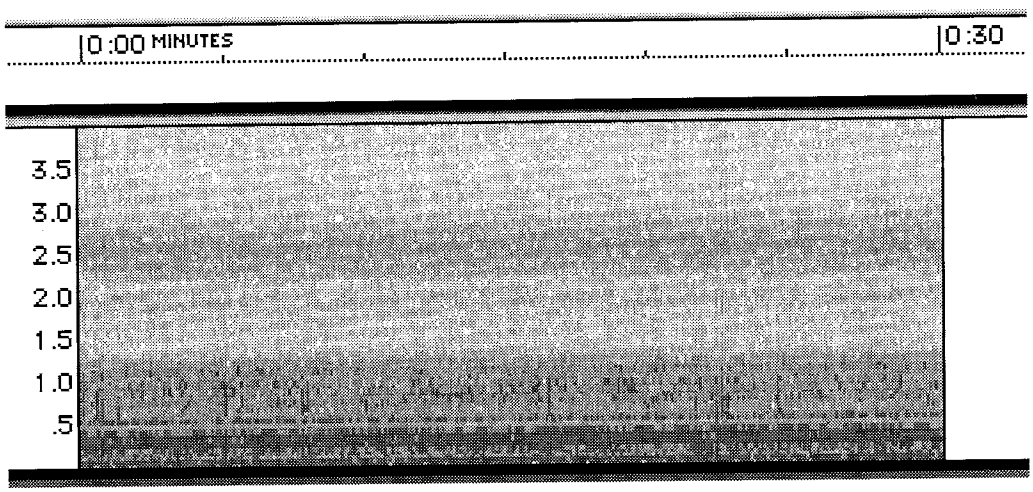
4/21 1537 UT



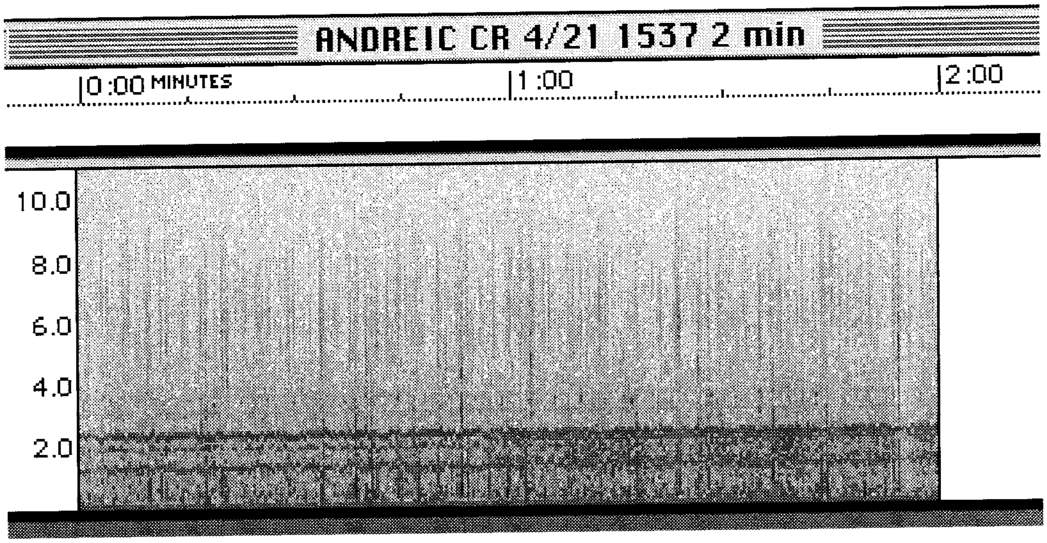
Flavio Gori, Florence, IT   Very quiet, some manmade hum at about 2.5 kHz and below 2 kHz.



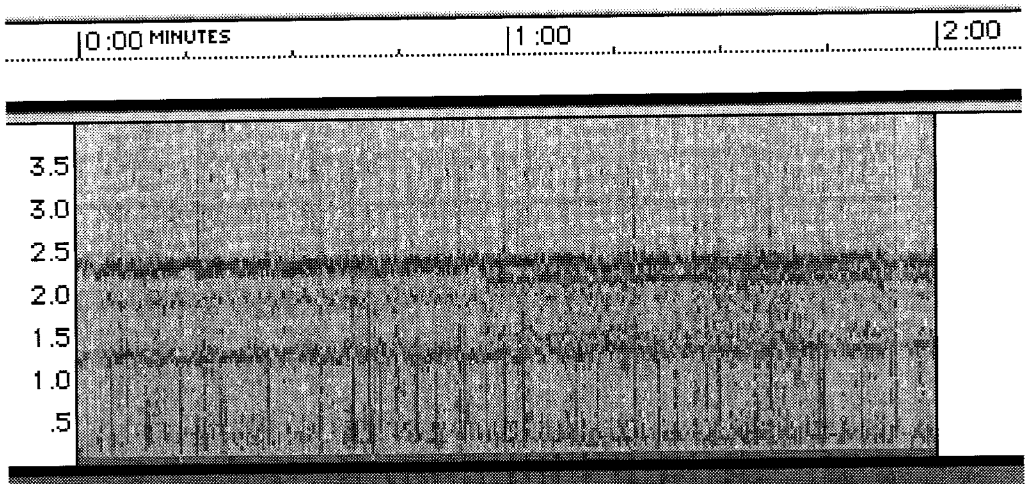
0-4 kHz



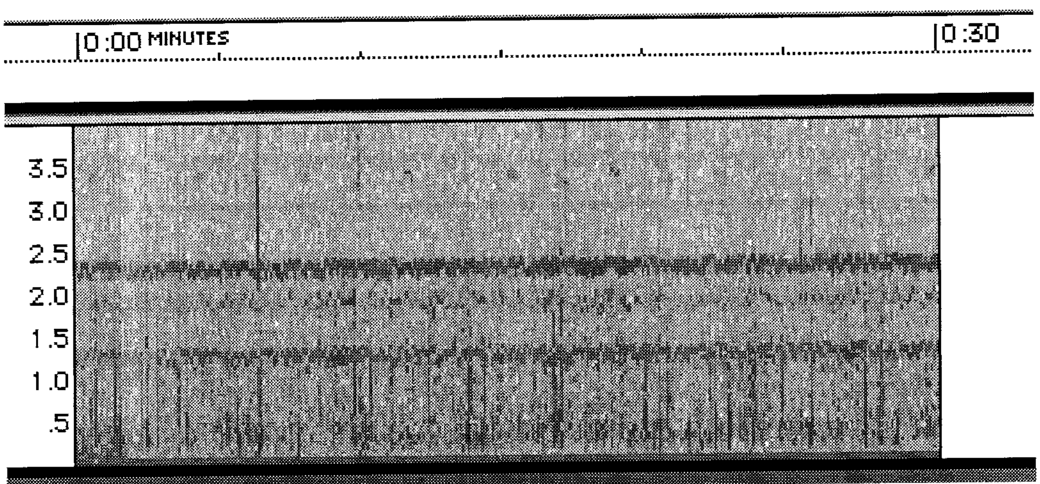
First 30 seconds; 0-4 kHz.   Nothing appears at 1 kHz



Zeljko Andreic, Zagreb, Croatia   Good sferics, no OMEGA, some manmade hum.

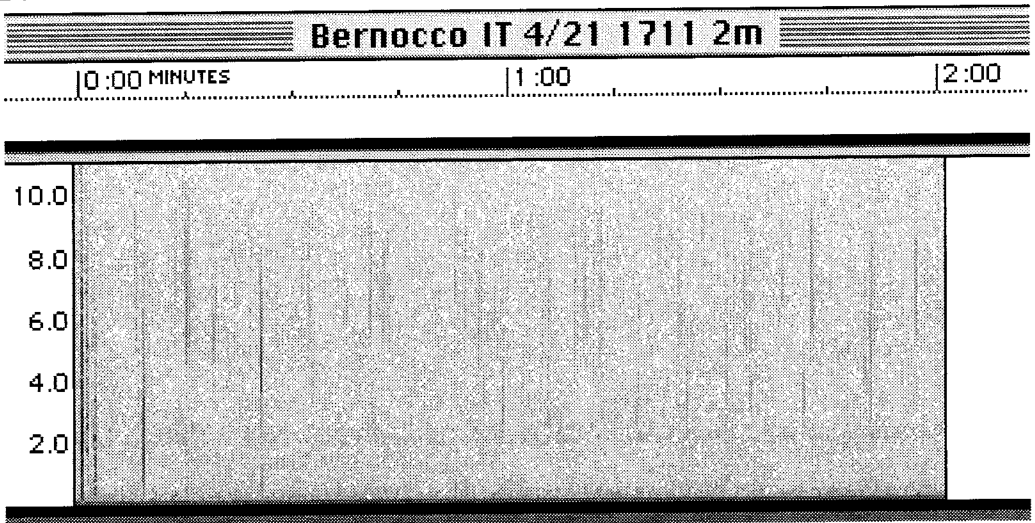


Note that there is no hum at 1 kHz. No intermittent signal, either.

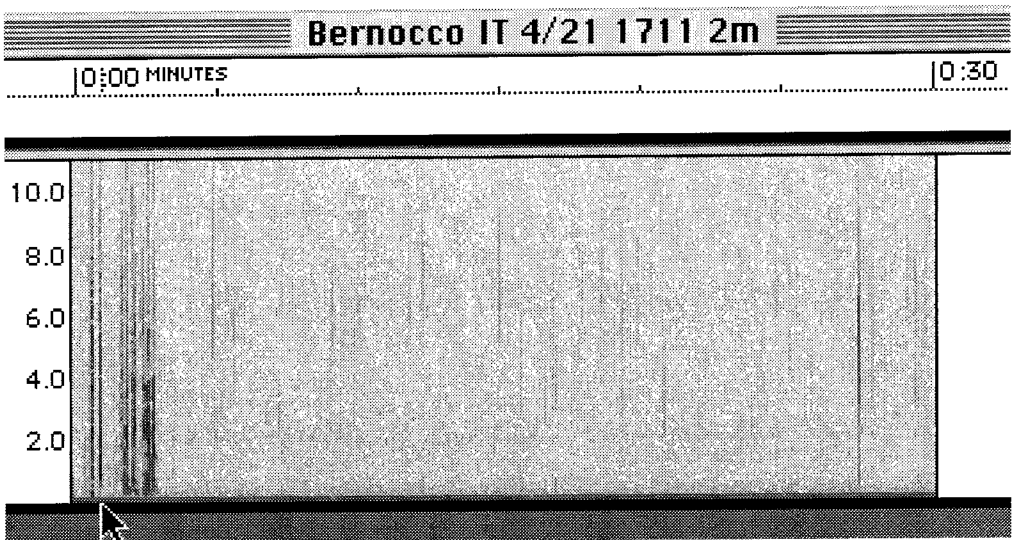


First 30 seconds. No 1 kHz signal. Notice the periodic signal at about 3.4 kHz. This might be a radar sweeping across the VLF antenna.

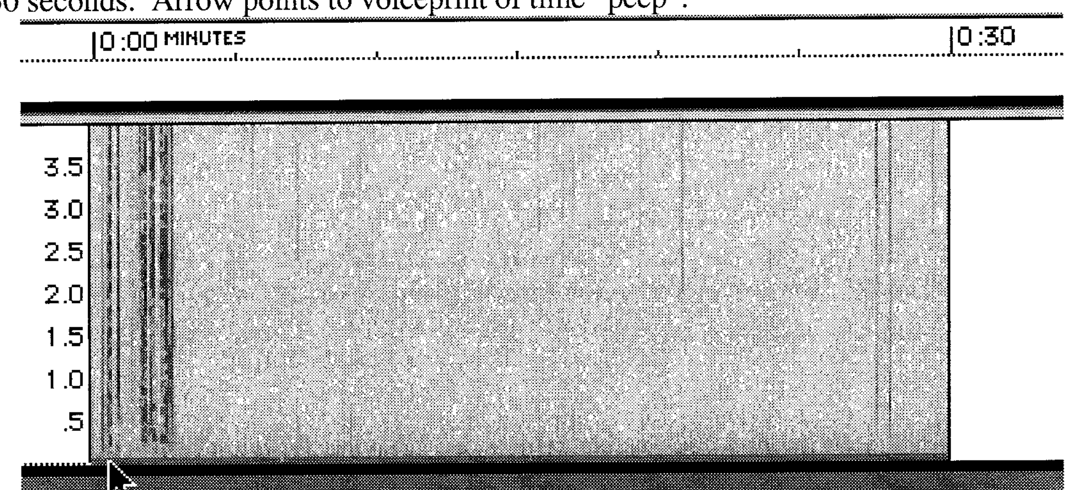
4/21 1711



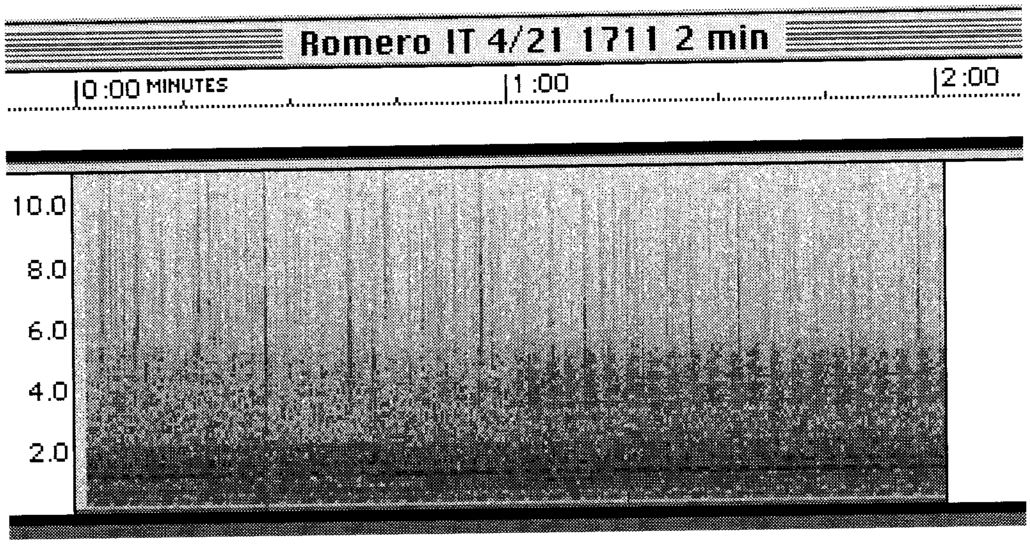
Silvio Bernocco, Vaccera, IT   Low density sferics, but some are strong.



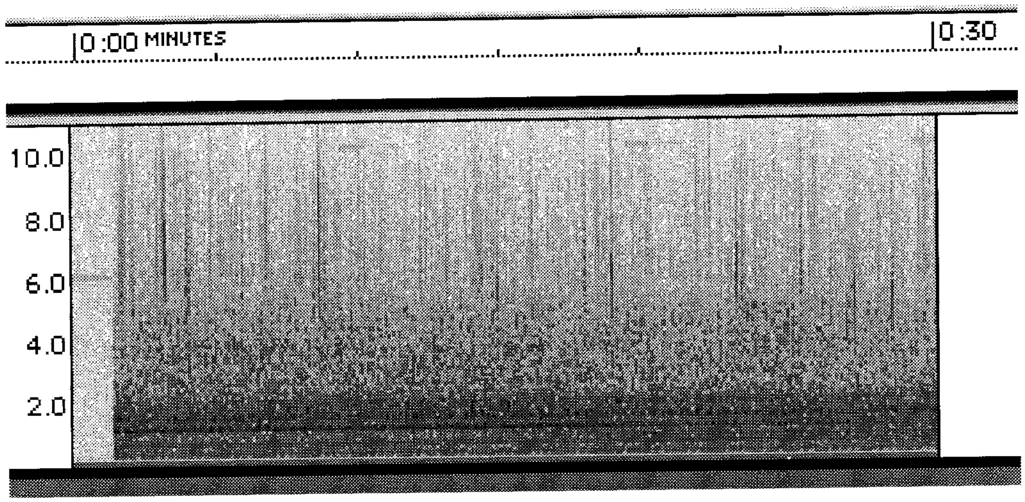
First 30 seconds. Arrow points to voiceprint of time "peep".



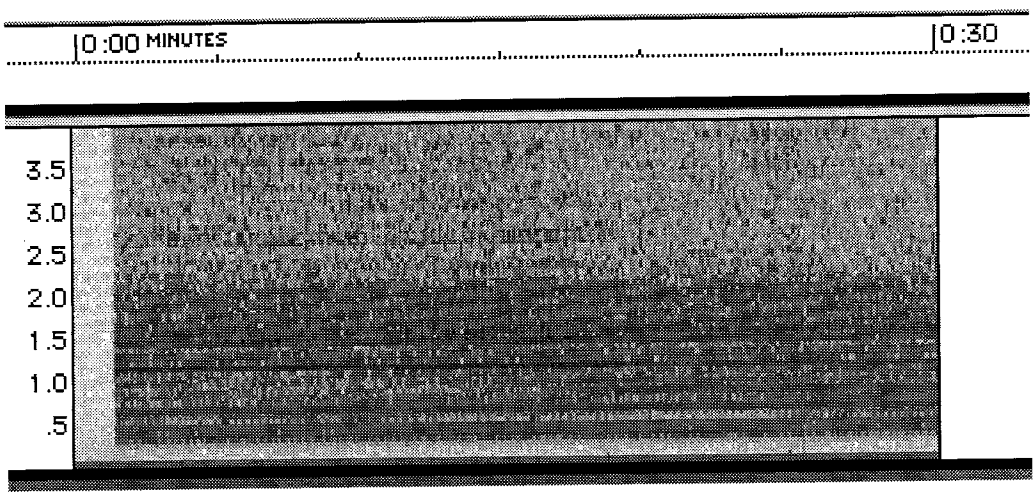
0-4 kHz, first 30 seconds. Arrow points to time mark.



Renato Romero, Cumiana, IT   OMEGA present at 10.4 kHz, some sferics, much manmade hum.

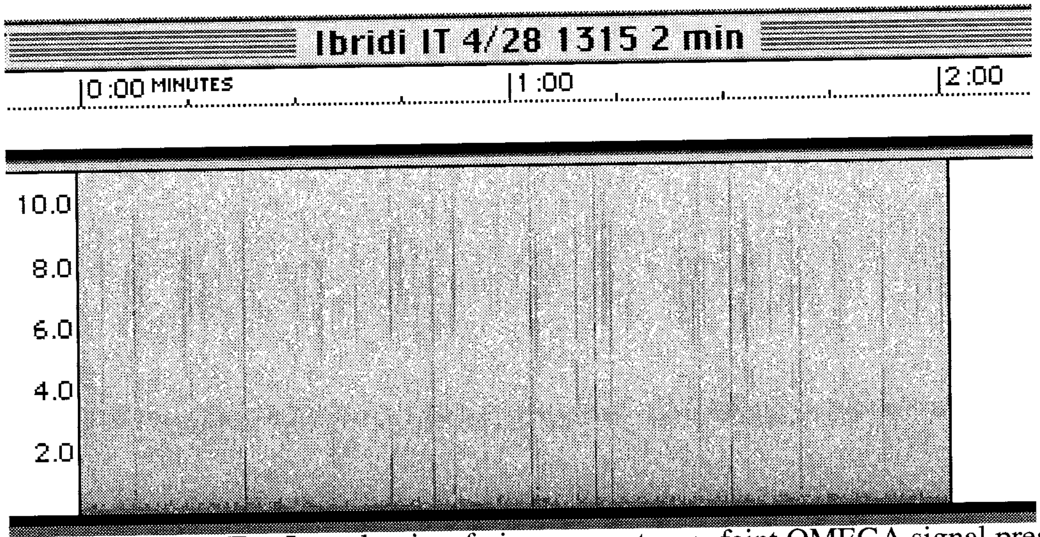


First 30 seconds. Two OMEGA stations - probably Norway and Liberia. Strong hum.

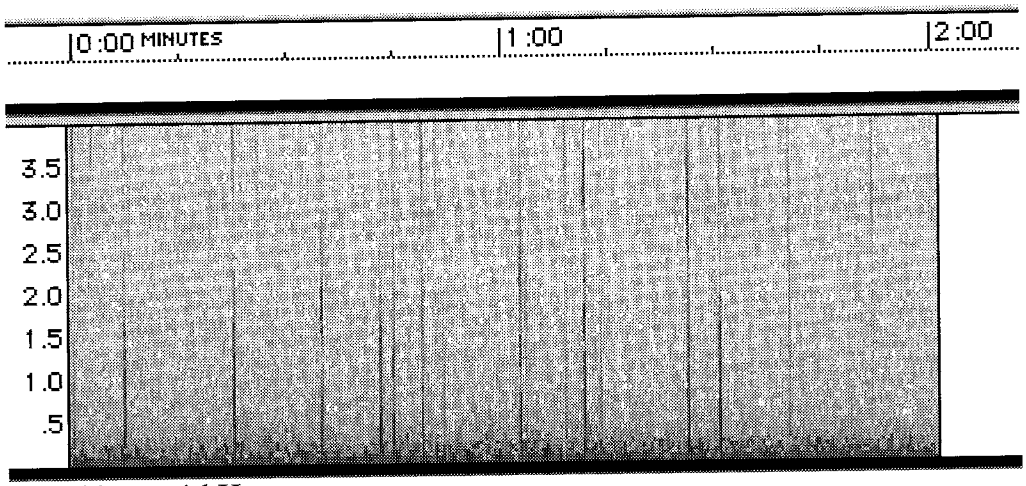


0-4 kHz. Note the pronounced hum bands from powerlines.

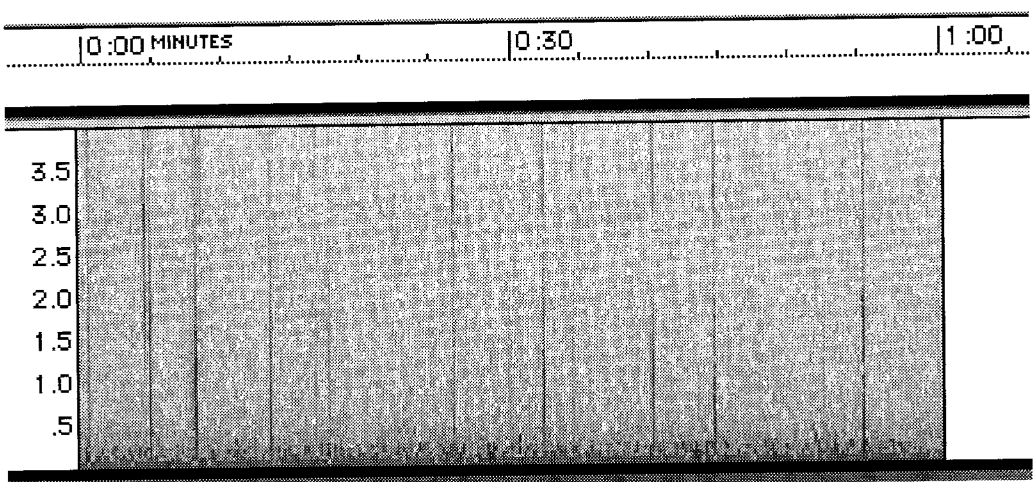
4/28 1315



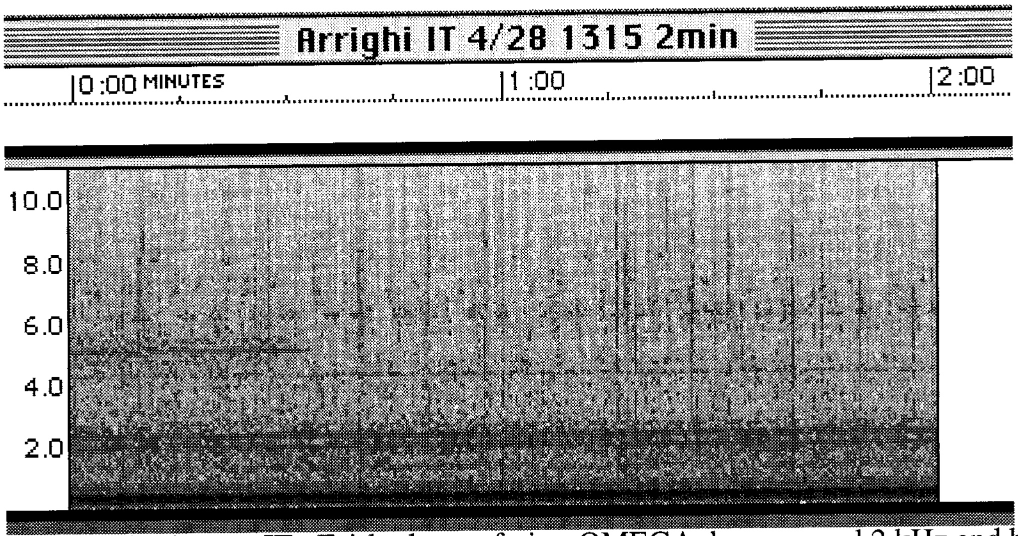
Marco Ibridi, Finale E., IT Low density sferics, some strong, faint OMEGA signal present.



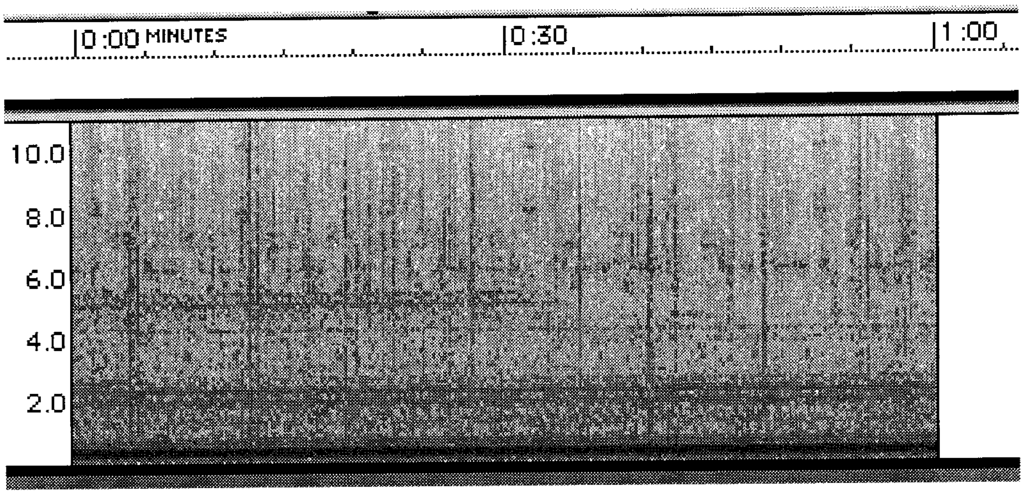
0-4 kHz. Nothing at 1 kHz.



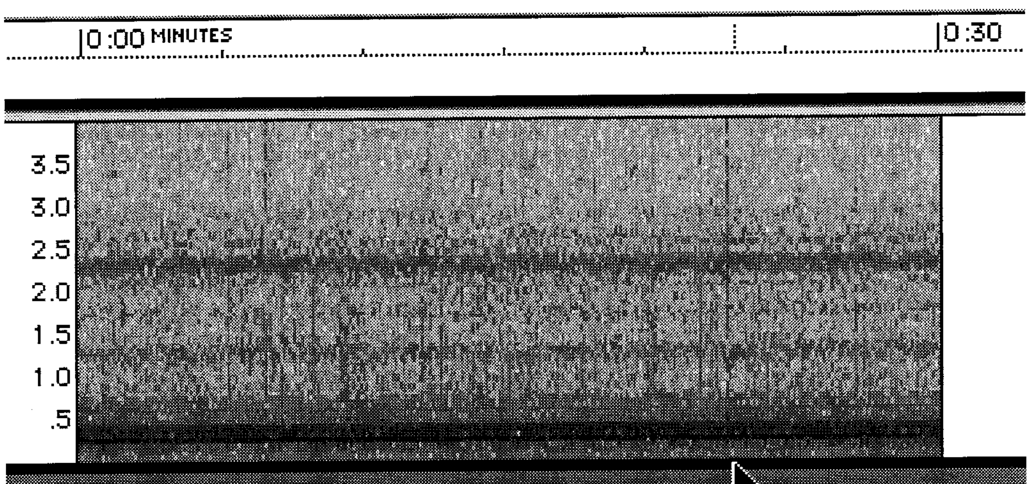
First minute. No signal at 1 kHz.



Alessandro Arrighi, Firenze, IT   Fairly dense sferics, OMEGA, hum around 2 kHz and below 1 kHz, something intermittent appears just above 6 kHz.

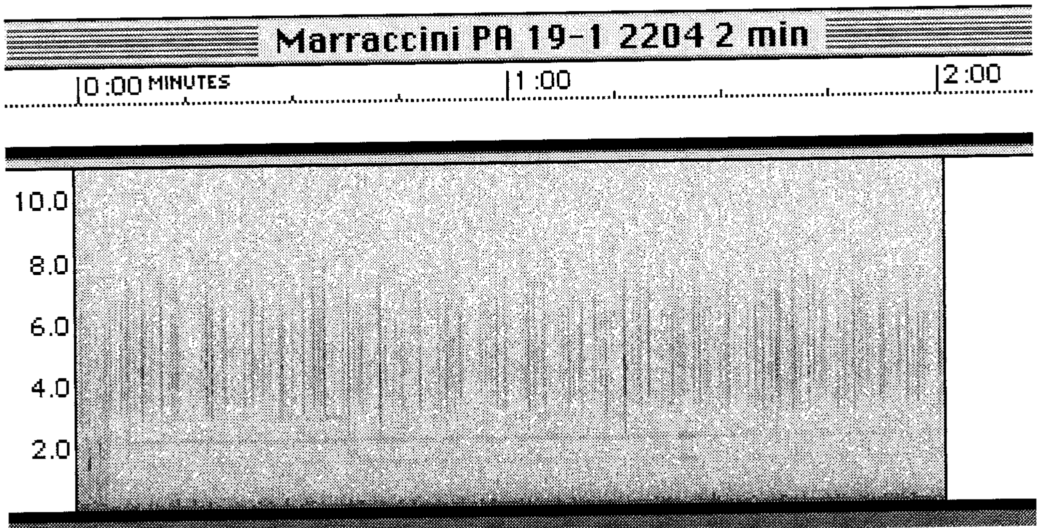


First minute.

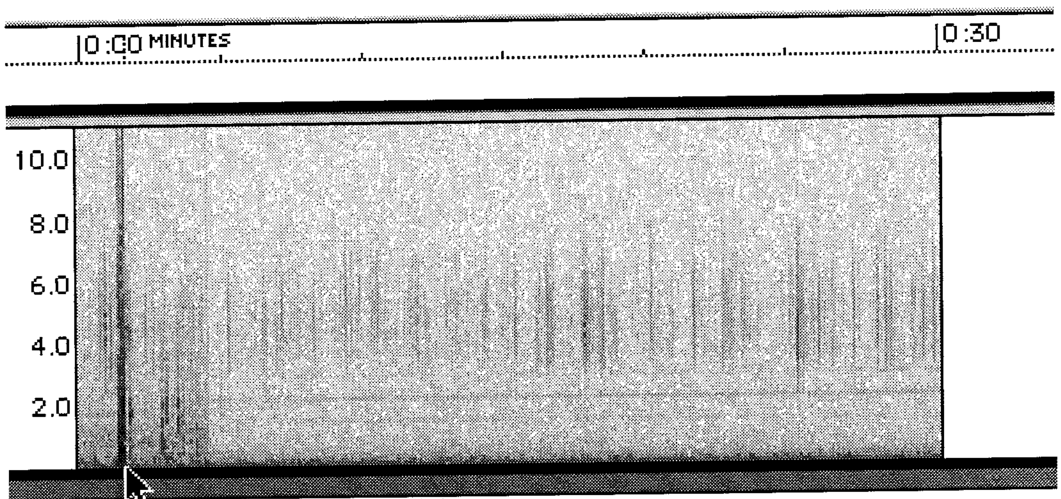


First 30 seconds; 0-4 kHz. Nothing at 1 kHz with correct pattern.

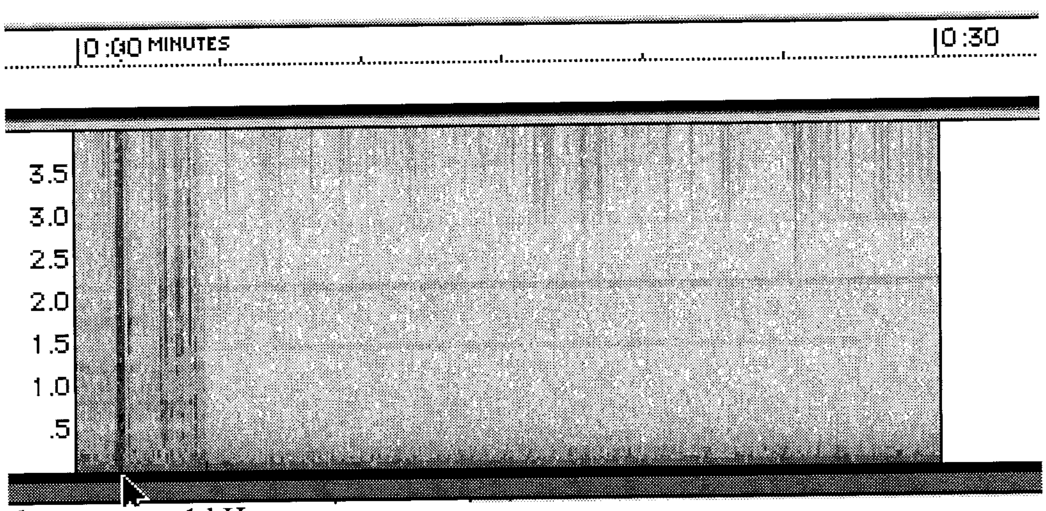
19-1



Leonard Marraccini, Finleyville, PA   Sferics, no AC hum.

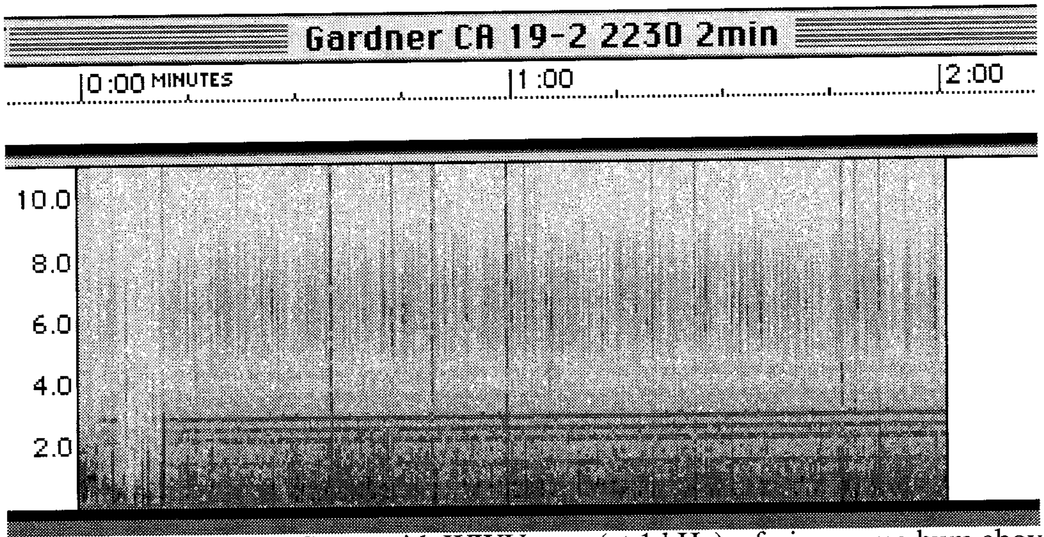


First 30 seconds. Arrow points to "Mark".

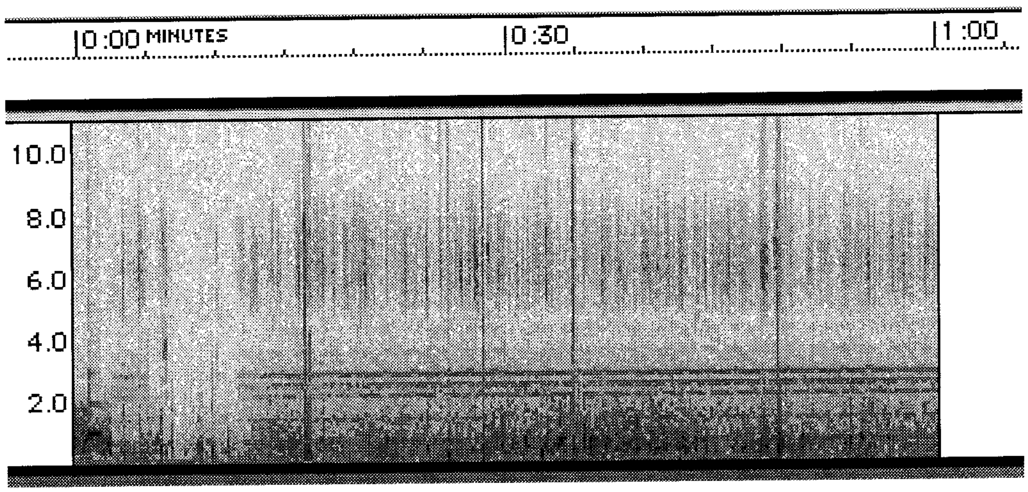


No signal apparent at 1 kHz.

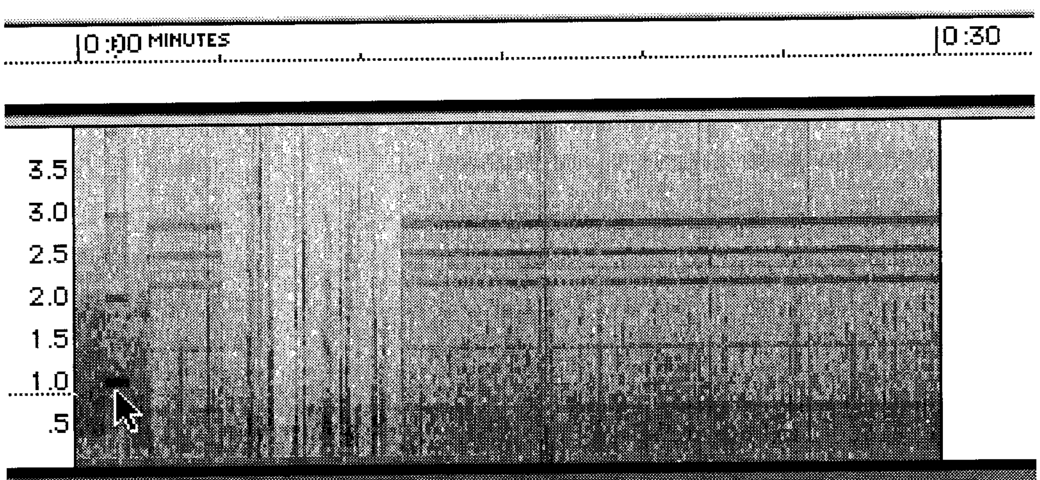
19-2



Kent Gardner, Fullerton, CA   Starts with WWV tone (at 1 kHz); sferics, some hum above 2 kHz.



First minute.



First 30 seconds. Arrow points to 1 kHz WWV tone. Nothing else at 1 kHz.