A CHECK PROCEDURE TO TEST

THE EVN VLBI STATIONS

G. Tuccari
S. Buttaccio

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INTRODUCTION

Reliability became a strong requirement for EVN VLBI stations. Money investment and human efforts spent into the network observations put a more serious demand in producing good data. Uniformity in good quality is also fundamental, because bad recorded data coming from few stations affect the achievable quality. The 1995's TWG meeting held in Dwingeloo found all friends sensitive in this direction and a common way was chosen to produce a test procedure to check the equipment involved in the observations. The checklist and the check procedure presented in this report are this first attempt to standardize inside the EVN the testing operations.

The following pages will show a form that should be filled before the start of a VLBI session and in any case periodically between sessions. Every test is strictly related to the receiver that should be used, while the aim is to test the full acquisition rack in despite to the observation mode. Few checks are also dedicated to more marginal equipment such as the meteorological station. It is included a list of rules to follow when the tests are performed in order to define what to look at and what to accept.

The final acceptance for the equipment is responsibility of the Technical Friend and the knowledge of not good performances should act as stimulus to correct the problem more then stopping an observation.

A more easy way to collect data has been developed in a second moment as Internet hypertextual form. This page can be filled in the appropriate boxes and a file is produced including session and station information. The present version is located in the Noto Web server "http://freccia/checklist/checklist.html". A centralized version of the produced files is expected in the JIVE Web.

We should like to thank all the people who helped us to produce this checklist and we invite everybody to furnish comments in order to obtain a better and more useful version of it.

_____ STATION CHECK FORM

Date Time

RECEIVERS

#1 Band(s) ..... cm

#2 Local oscillator frequency ..... MHz

#3 Local oscillator amplitude ..... dBm

#4 Vacuum .....

#5 Cryogenic temperature ..... K

#6 Polarisation .....

#7 Tsys on BBC (obs. freq.) ....
....

#8 Tsys on IFD (a,b,c,d) ....

#9 Band plot visual check .....(OK/KO)

#10 Cal signal amplitude (USB tracks) I
....
....
....

Cal signal amplitude (LSB tracks) II
....
....
....

#11 Cal signal phase (USB tracks) .... Ia
....
....
....

Cal signal phase (LSB tracks) .... IIa
....
....
....

Cal signal phase (USB tracks) .... Ib
....
....
....

Cal signal phase (LSB tracks) .... IIb
....
....
....\ ....

Notes:

_____ STATION CHECK FORM

Date Time

POINTING

#12 Subreflector position (if fixed) X ....., Y .....

Z1 ....., Z2 ....., Z3 .....

#13 Fivpt(one point) source ....., az ....., el .....

daz ....., del .....

Notes:

TIME & FREQUENCY

#14 Clock offset .....

#15 Station 1PPS - DAR 1PPS .....

#16 5 MHz presence ..... (OK/KO)

#17 Coherence test ..... (OK/KO)

Notes:

METEO STATION

#18 Temperature - temp. calibrator ....

#19 Humidity - hum. calibrator ....

#20 Pressure - pres. calibrator ....

Notes:

DAR

#21 BBC lock status (OK/KO) ....

....

#22 BBC signal level ....

....

_____ STATION CHECK FORM

Date Time

#23 Formatter Time - UT .... (s)

#24 FS Time - UT .... (s)

#25 Patch panel check .... (OK/KO)

#26 Recorder Vacuum ....

#27 Tracks' bandwidth (OK/KO)
....
....
....
....

#28 FWD-REV shift ..... microns

#29 270-135 speed shift .....(F)microns .....(R)microns

#30 LVDT scale calibration ....

#31 Parity errors FWD
....
....
....
....

#32 Parity errors REV
....
....
....
....

#33 Nitrogen flow .... lt/m

#34 Internal Rec. humidity .... %

#35 External Rec. humidity .... %

Notes:

Check List Compilation Notes

#1 Band(s)

What is to be indicated: the receiver band to be tested.

How to perform this test: check whether the receiver connected to the DAR is what your schedule file requires.

What to accept: The scheduled receiver.

#2 Local oscillator frequency

What is to be indicated: the frequency to be used as LO in the receiver synthesiser.

How to perform this test: it strongly depends on the receiver itself (read the remote synthesiser frequency set, look from external connector using a counter, etc.).

What to accept: Your station specific value.

Notes: If more than one LO is used check for proper values of all.

#3 Local oscillator amplitude

What is to be indicated: the amplitude to be used as LO in the receiver synthesiser.

How to perform this test: it strongly depends on the receiver itself (read the remote synthesiser amplitude set, look from external connector using a spectrum analyser, etc.).

What to accept: Your station specific value.

Notes: If more than one LO is used check for proper values of all.

#4 Vacuum

What is to be indicated: the vacuum if the receiver is cooled

How to perform this test: it strongly depends on the receiver itself (read remotely the value, look at the external gauge, etc.).

What to accept: Your station specific value.

Notes: If more than one receiver is involved check for proper values of all.

#5 Cryogenic temperature

What is to be indicated: If the receiver is cooled the cryogenic temperature.

How to perform this test: it strongly depends on the receiver itself (read remotely the value, look at the external gauge, etc.).

What to accept: Your station specific value.

Notes: If more than one receiver is involved check for proper values of all.

#6 Polarisation(s)

What is to be indicated: the receiver circular polarisation.

How to perform this test: check whether the receiver polarisation channel connected to the DAR is what your schedule file requires.

What to accept: The scheduled polarisation.

Notes: If you have a more direct way to perform a real check please indicate.

#7 Tsys on BBC

What is to be indicated: the system temperature determined using the videoconverter total power indication at the observation frequencies.

How to perform this test: use your standard procedure to produce Tsys measurements using the videoconverters in the DAR (noise diode, cal signal, etc.)

What to accept: The typical system temperature related to the receiver should be uniform all over the band or in any case should be what you normally have (a plot for all the bands is to be kept as reference).

Notes: write comments, if interferences affect the measurement.

#8 Tsys on IFD

What is to be indicated: the temperature system determined using the IFD total power indication at full band.

How to perform this test: use your standard procedure to produce Tsys measurements using the IF distributor in the DAR (noise diode, cal signal, etc.)

What to accept: The typical system temperature related to the receiver.

Notes: write comments, if interferences affect the measurement.

#9 Band plot visual check

What is to be indicated: whether the receiver band is OK or KO.

How to perform this test: perform a visual check using the spectrum analyser and comparing with a typical plot of the receiver.

What to accept: The receiver band is consistent in

during the antenna tracking.

What to accept: the parameters required by your specific station set.

Notes: If no subreflector is present does not apply.

#13 Fivpt

What is to be indicated: azimuth and elevation pointing errors, source azimuth and elevation at test time.

How to perform this test: use FS fivpt command with a source at about 45 degree in elevation.

What to accept: pointing errors less than 0.1 beamwidth in both axis or in any case in the limit you accept (to indicate).

#14 Clock offset

What is to be indicated: the formal clock offset.

How to perform this test: getting the value from your T&F station display or using GPS reading.

What to accept: the time offset should be monitored every day in order to check maser operation. The value should be in agreement with the known clock rate. An upper limit of 10 microsec can be accepted to allow fringe search to be quick.

#15 Station 1PPS - DAR 1PPS:

What is to be indicated: the difference in time between the station 1PPS and DAR 1PPS.

How to perform this test: for the VLBA formatter use a two channel oscilloscope and monitor the rising edge of the station 1PPS and the resynchronised 1PPS (SYNC) in the DAR. In the MKIIIa formatter an error indication is in the front panel. Check if its set is correct.

What to accept: the time difference in the VLBA formatter should be about 420 ns (362+-20ns + delay between positive edge of station 1PPS and the following rising edge of 5 MHz). In the MKIIIa formatter no error indication.

#16 5 MHz presence

What is to be indicated: whether or not station 5 MHz is present at DAR and receiver

How to perform this test: use an oscilloscope and a counter to monitor.

What to accept: amplitude as defined at your station (usually 13 dBm).

#17 Coherence test

	amplitude and frequency range to the typical plot (a plot for all the bands is to be kept as reference).
#10 Cal signal amplitude	
What is to be indicated:	cal signal amplitude as read in the 28 recording tracks.
How to perform this test:	cal signal is injected in the RF and it appears in the USB setting the videoconverter frequencies as XX.99. A tape is recorded in mode A in any pass # and then read back and signal amplitude detected with DQA (VLBA) or running PCALR (MKIIIa). The same is done for LSB setting the videoconverter frequencies as XX.01.
What to accept:	In the first case the amplitude of the cal signal should be present only in the tracks associated with the USB, in the second case should be detected in the LSB tracks. The amplitude has to be a few percent of the Tsys and approximately constant for all detections. Dqa prodedure for VLBA terminals in FS should produce values in voltage percentage in the range 3-10%
#11 Cal signal phase	
What is to be indicated:	cal signal phase as read in the 28 recording tracks.
How to perform this test:	cal signal is injected in the RF and it appears in the USB, setting the frequency of videoconverters XX.99. A tape is recorded in mode A in any pass # and then read back and signal phase detected with DQA (VLBA) or running PCALR (MKIIIa). The same is done for the LSB, setting the frequency of videoconverters XX.01. Two readings should be done in order to check the phase stability in both circumstances.
What to accept:	In the first case the phase of the cal signal should be constant or slowly varying only in the tracks associated with the USB, in the second case should be constant or slowly varying in the tracks associated with the LSB channels. In any case the variation depends on the receiver frequency and the signal amplitude. It may change from track to track.
#12 Subreflector position	
What is to be indicated:	subreflector position in X,Y,Z1,Z2,Z3 axis.
How to perform this test:	check the position to be used if the subreflector is fixed or the parameter file if it is moved

What is to be indicated: whether or not the maser is working properly.

How to perform this test: connect a separate 5 MHz to your phase cal reference input. Separate means coming from a different atomic clock such as a rubidium or cesium. Look at the 10 KHz phase cal signal on a scope triggering with the frame sync output of the formatter.

What to accept: the signal might drift slowly, but should be stable. The test detects a useless maser and data will already be very poor, before the test can detect a problem but it's a way to get the feeling of maser operation.

Notes: the test is possible only a secondary atomic clock is present.

#18 Temperature - temp. calibrator

What is to be indicated: external temperature coming from your meteorological station and temperature as read from a calibration thermometer.

How to perform this test: read from your meteorological station and calibrator.

What to accept: difference smaller than few degree.

Notes: the test is particularly important if the station is involved in geodinamic observations.

#19 Humidity - hum. calibrator

What is to be indicated: external humidity coming from your meteorological station and humidity as read from a calibration gauge.

How to perform this test: read from your meteorological station and calibrator.

What to accept: difference smaller than 10 %.

Notes: the test is particularly important if the station is involved in geodinamic observations.

#20 Pressure - temp. calibrator

What is to be indicated: external pressure coming from your meteorological station and pressure as read from a calibration gauge.

How to perform this test: read from your meteorological station and calibrator.

What to accept: difference smaller than few mbar.

Notes: the test is particularly important if the station is involved in geodinamic observations.

#21 BBC lock status

What is to be indicated: if videoconverters are locked in their operative range.

How to perform this test: using FS set three frequency values (low, medium, high) and check whether or not the LO is locked.

What to accept: lock in the three points.

Notes: when using reduced band number of point can be reduced.

#22 BBC signal level

What is to be indicated: total power level coming out from the USB and LSB.

How to perform this test: remove input signal and read zero levels, then using FS set the observation frequencies and read the total power detected. Then set the same frequency and read the total power.

What to accept: at zero level counts not greater than 500, with normal input signal values in the range 10 K - 20 K (16-bit conversion).

Notes: if a different measurement is used, normalize in the range 0-65535.

#23 Formatter time - UT

What is to be indicated: difference between formatter time and UT

How to perform this test: read the formatter time and compare with your UT clock.

What to accept: 0 sec.

#24 FS time - UT

What is to be indicated: difference between FS time and UT.

How to perform this test: read the FS time and compare with your UT clock.

What to accept: 0 sec.

#25 Patch panel check

What is to be indicated: if the patch panel configuration is right (only MKIIIa).

How to perform this test: compare your patch panel configuration with the configuration related to the observation mode.

What to accept: the configuration of the observation mode of the schedule file.

#26 Recorder vacuum

What is to be indicated: vacuum level of recorder.

How to perform this test: load a tick tape and look at the vacuum gauge of the recorder.

What to accept: near 10 (inch of water)

#27 Tracks' bandwidth and eye pattern

What is to be indicated: if bandwidth coming from the playback is OK or not for the 28 recording tracks.

How to perform this test: look at the signal coming out from the monitor of the read electronics using an oscilloscope and a spectrum analyser reproducing a signal recorded in mode A with 2MHz bandwidth. Check all the tracks.

What to accept: in the oscilloscope the 'eye' pattern should be well defined (keep an example of good and bad type) bandwidth should appear flat up to 2MHz with a level of about -25 dBm.

#28 FWD-REV shift

What is to be indicated: the shift in tape position between a track recorded in forward and then in reverse direction.

How to perform this test: record a track in forward and in reverse direction and using the FS peak command determine the difference in the position.

What to accept: values less than 50 microns.

#29 270-135 speed shift

What is to be indicated: the shift in tape position between a track recorded at 270 inches/s and then at 135 inches/s.

How to perform this test: record a track in forward at 270 in/s and then at 135 in/s. Reproduce and using the FS peak command determine the difference in the position. Repeat in reverse.

What to accept: values less than 20 microns.

#30 LVDT scale calibration

What is to be indicated: position track adjacent to tr#15 on both sides.

How to perform this test: record the tracks 14, 15 and 16 at zero calibrated position and then playback using track 15 in the position -698.5 and 698.5. Determine the peak position.

What to accept: errors less than 10 microns.

#31 Parity errors FWD

What is to be indicated: the parity errors of a forward recording.

How to perform this test: record in mode A in forward and use the check2a1 procedure to get parity errors of the 28 tracks.

What to accept: typical result of a good recording status is 0. The limit is 600. Values greater than 600 indicate a head to look at carefully to evaluate its performances.

#32 Parity errors REV

What is to be indicated: the parity errors of a reverse recording.

How to perform this test: record in mode A in reverse and use the check2a2 procedure to get parity errors of the 28 tracks.

What to accept: typical result of a good recording status is 0. The limit is 600.Values greater than 600 indicate a head to look at carefully to evaluate its performances.

#33 Nitrogen flow

What is to be indicated: nitrogen or dry air flow coming to the recording heads.

How to perform this test: read the flowmeter placed in the recorder.

What to accept: values between 5 and 10 l/min are typical.

#34 Internal rec. humidity

What is to be indicated: humidity read inside the tape cabinet of the recorder.

How to perform this test: check the value using a humidity gauge placed near the headstack.

What to accept: values under 40 %, typical values should be between 30 and 40 %.

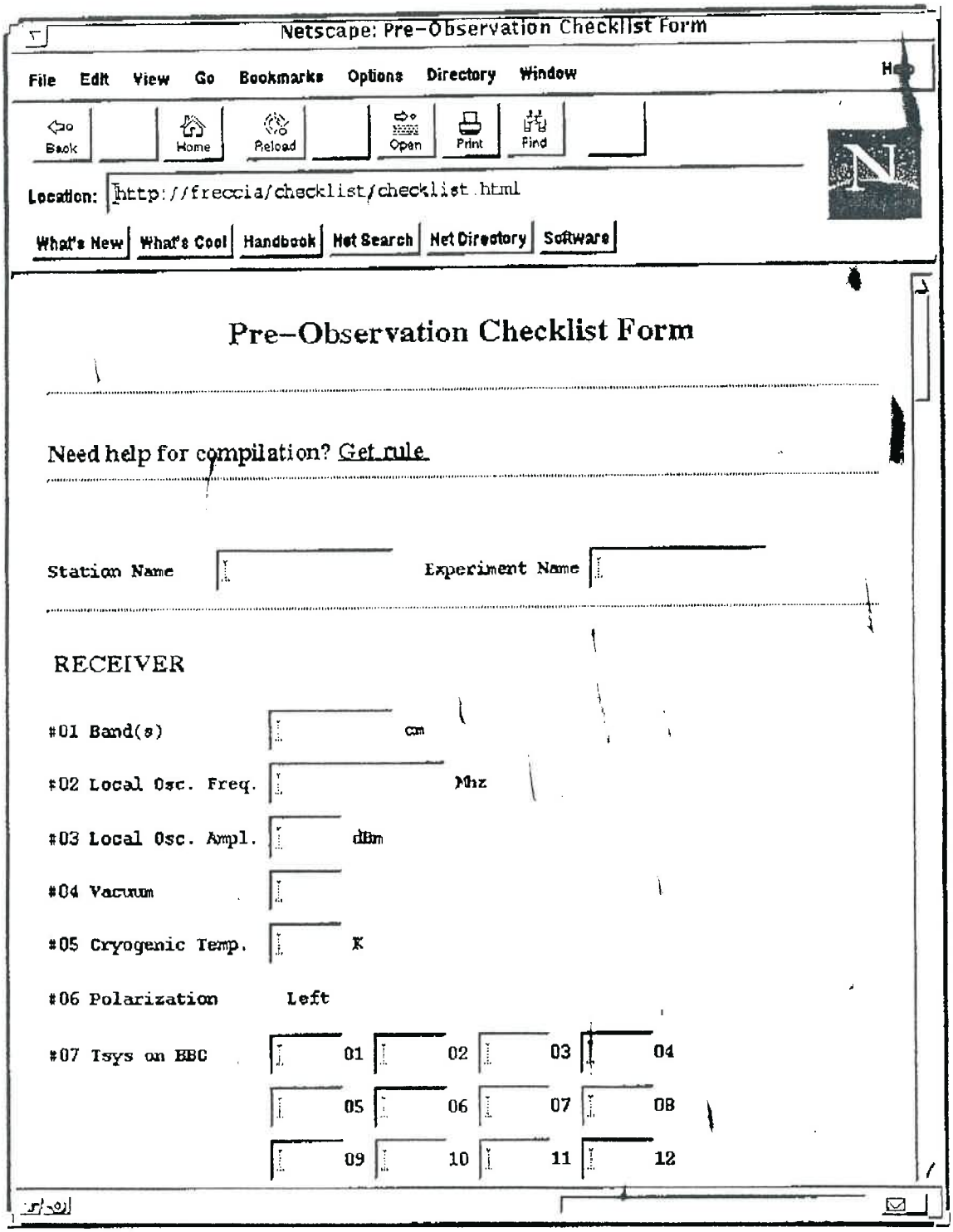
#35 External rec. humidity

What is to be indicated: humidity as read outside the tape cabinet of the recorder.

How to perform this test: check the humidity value in the room where the recorder is placed.

What to accept: values under 40 %.

Notes: the external humidity value is to be controlled because is 'source' for the humidity inside the recorder.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#03 Local Osc. Ampl. dBm
#04 Vacuum
#05 Cryogenic Temp. K
#06 Polarization Left
#07 Tsys on BBC 01 02 03 04
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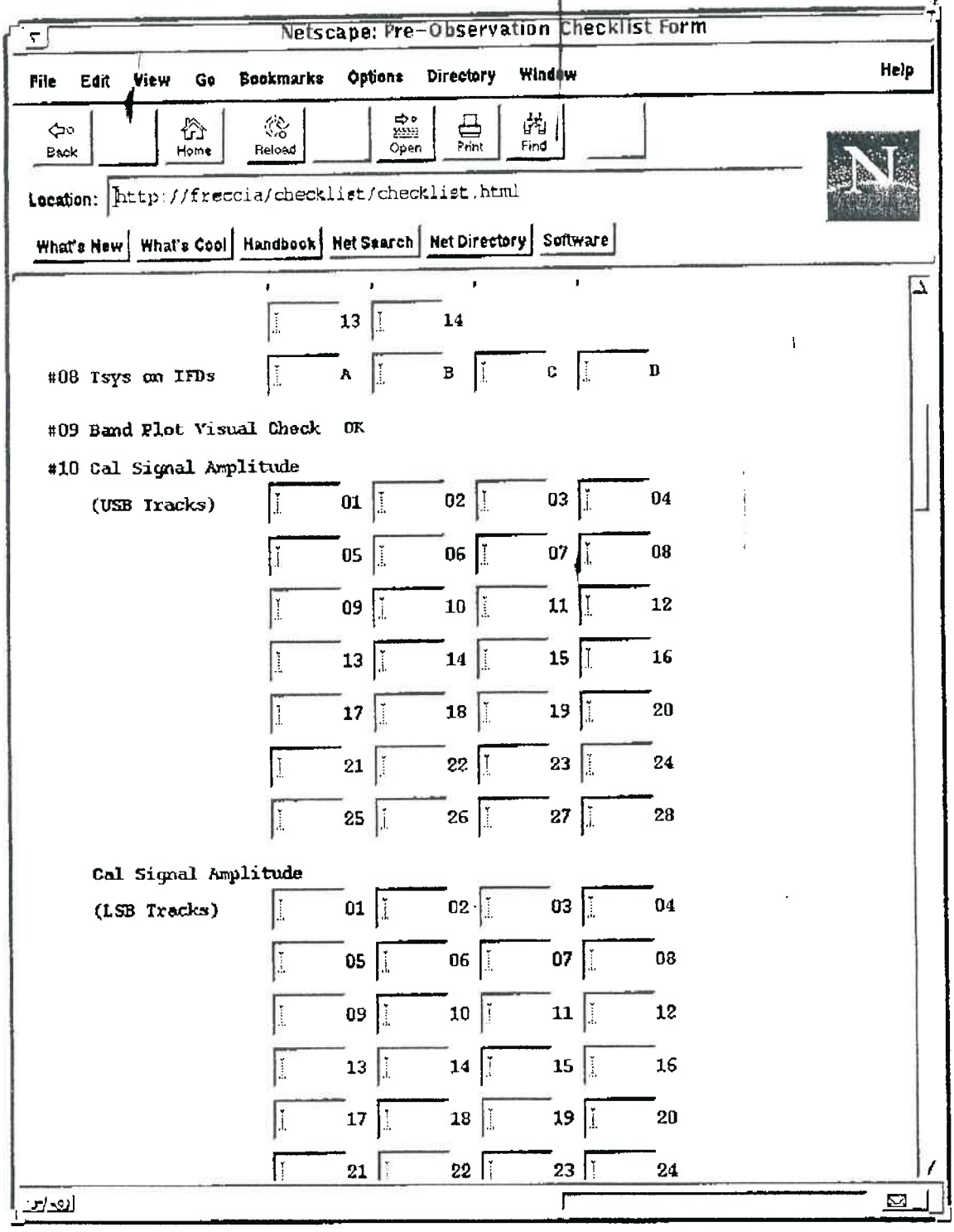
09 10 11 12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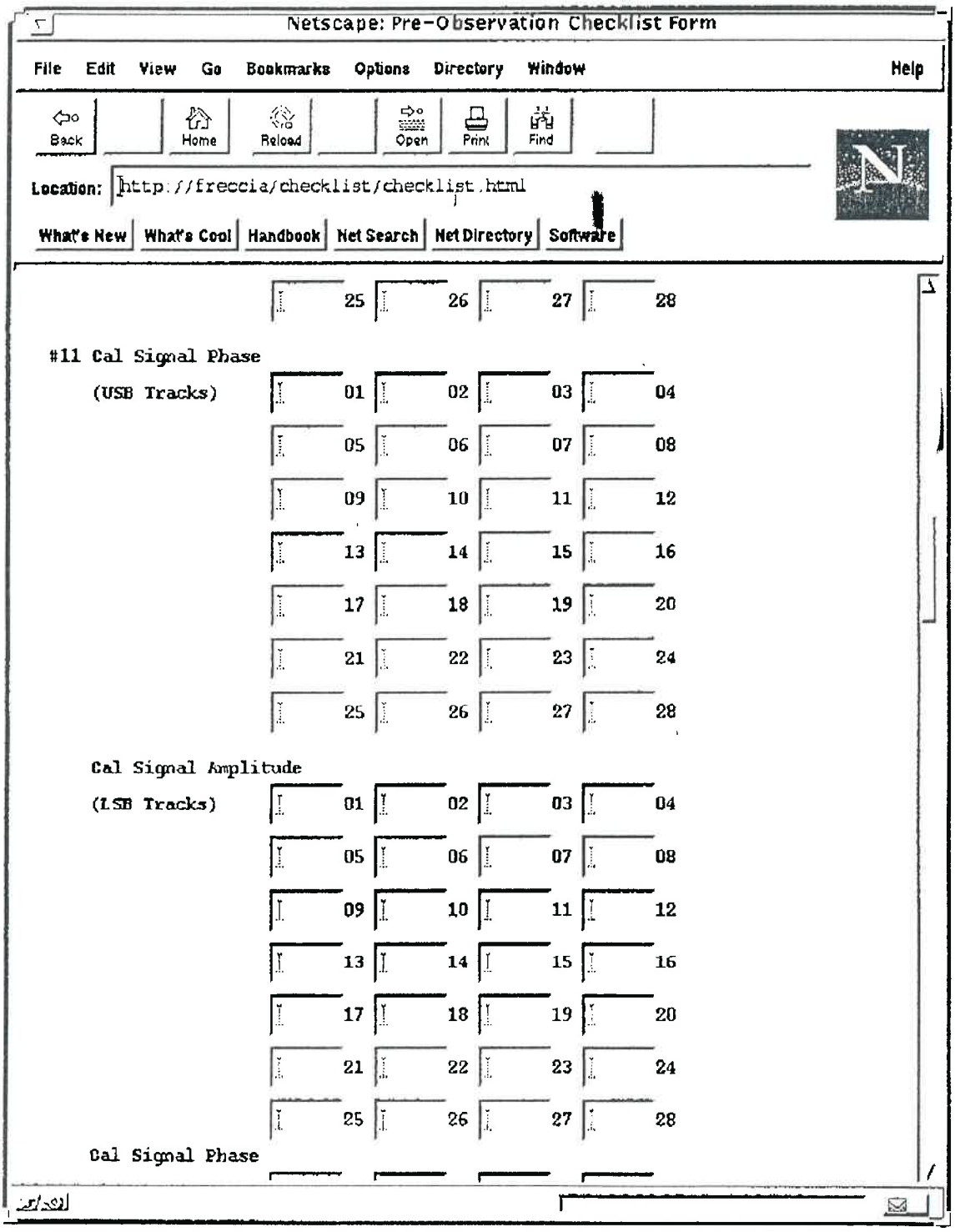
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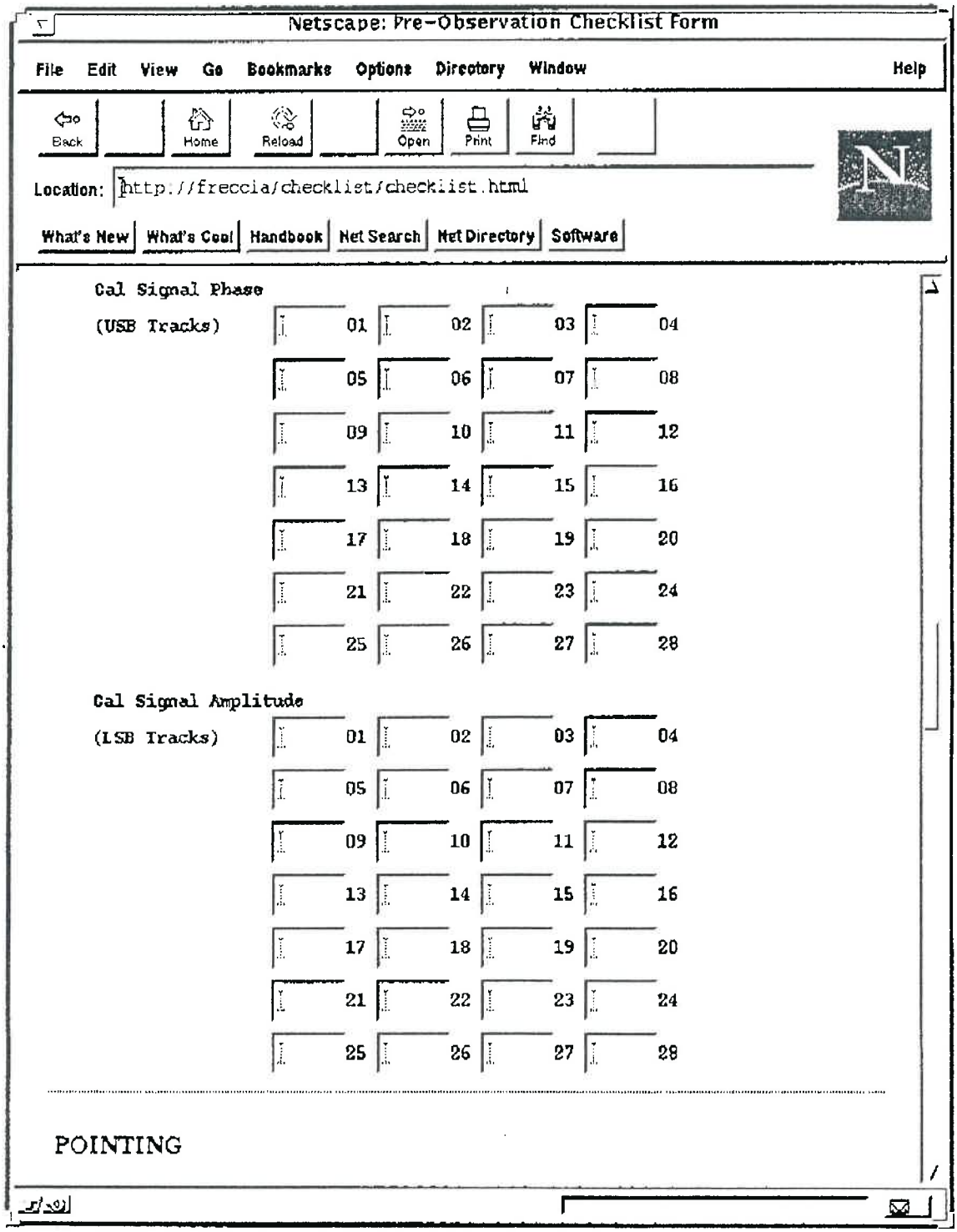
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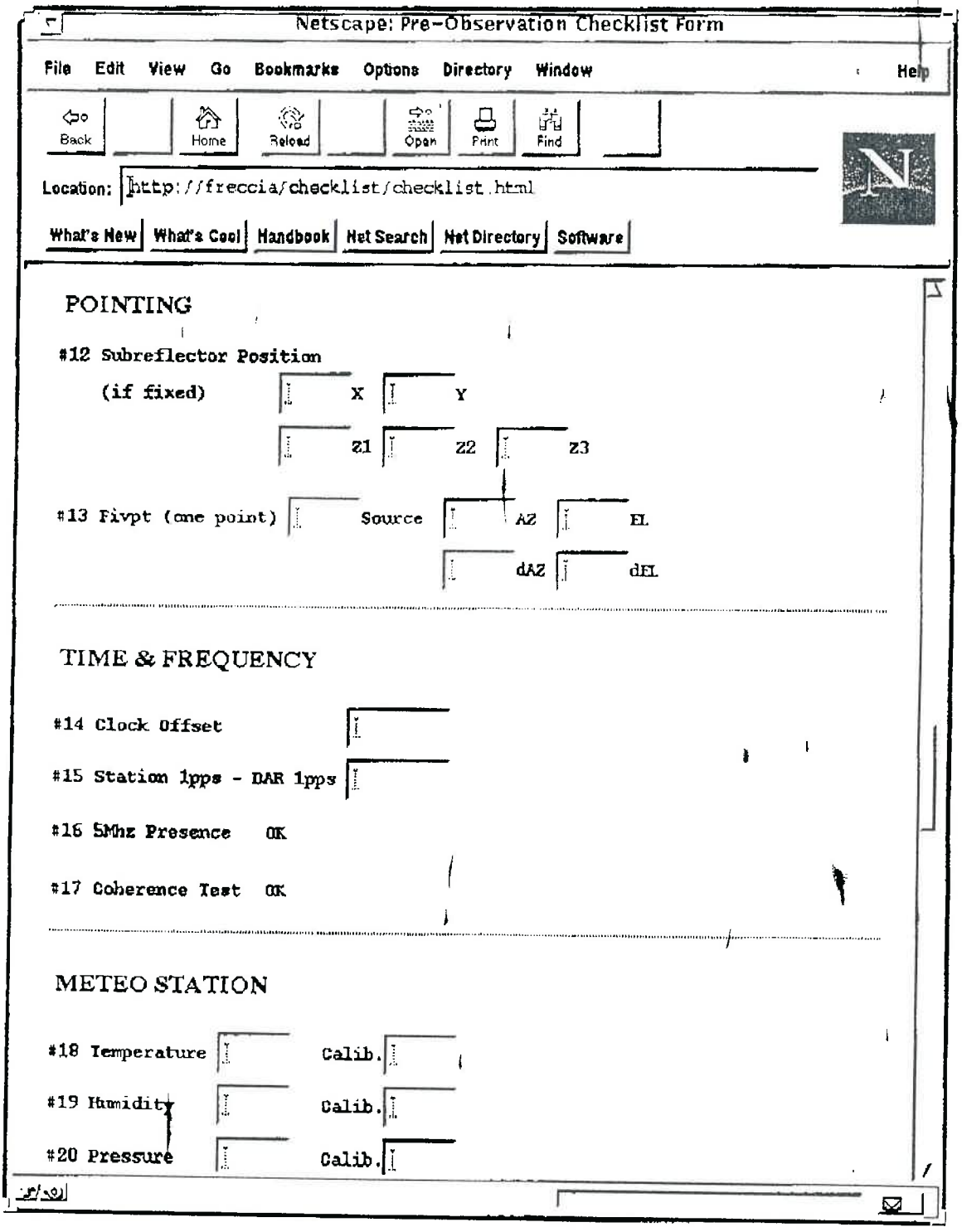
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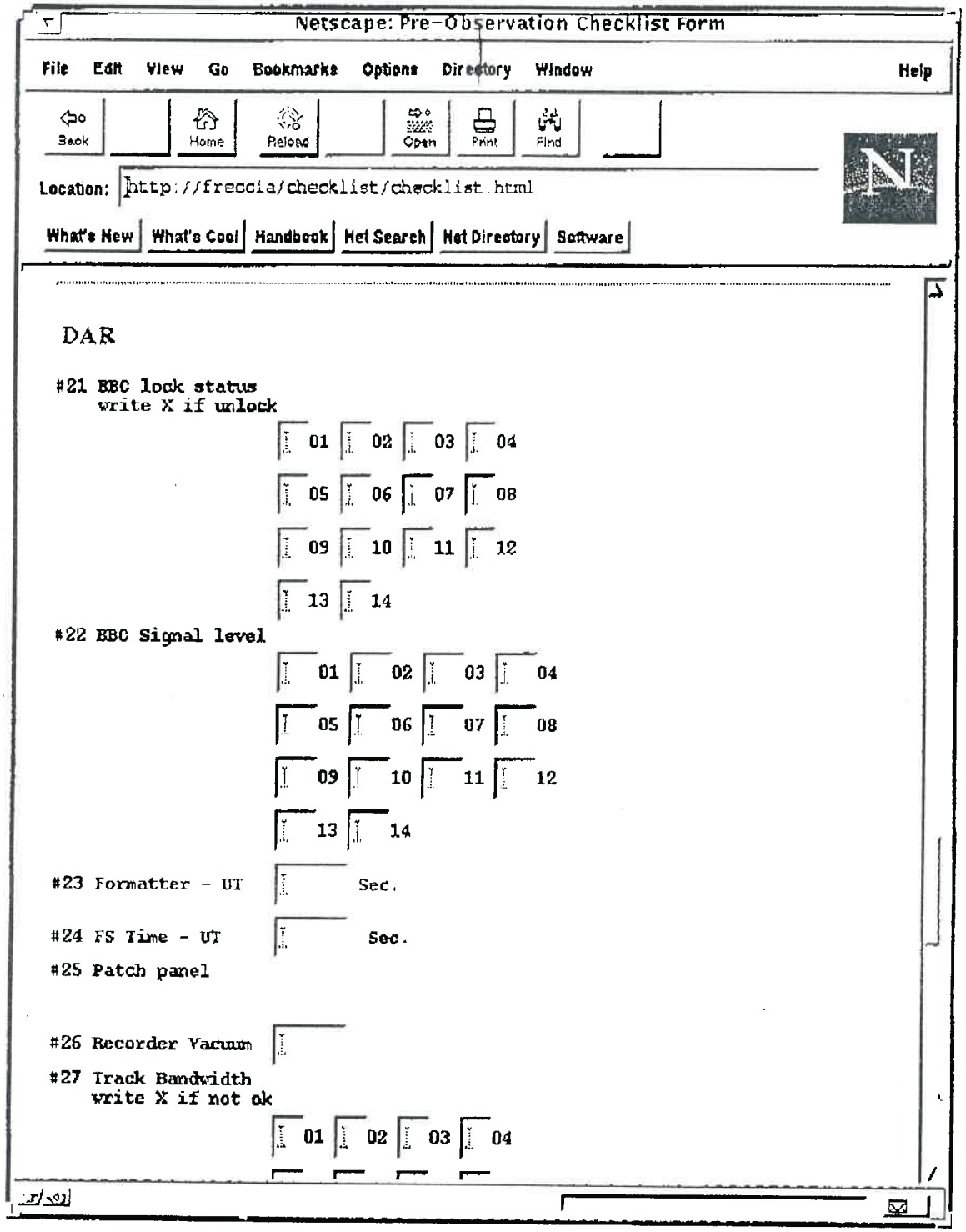
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write X if unlock
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05 06 07 08
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13 14
#22 BBC Signal level
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05 06 07 08
09 10 11 12
13 14
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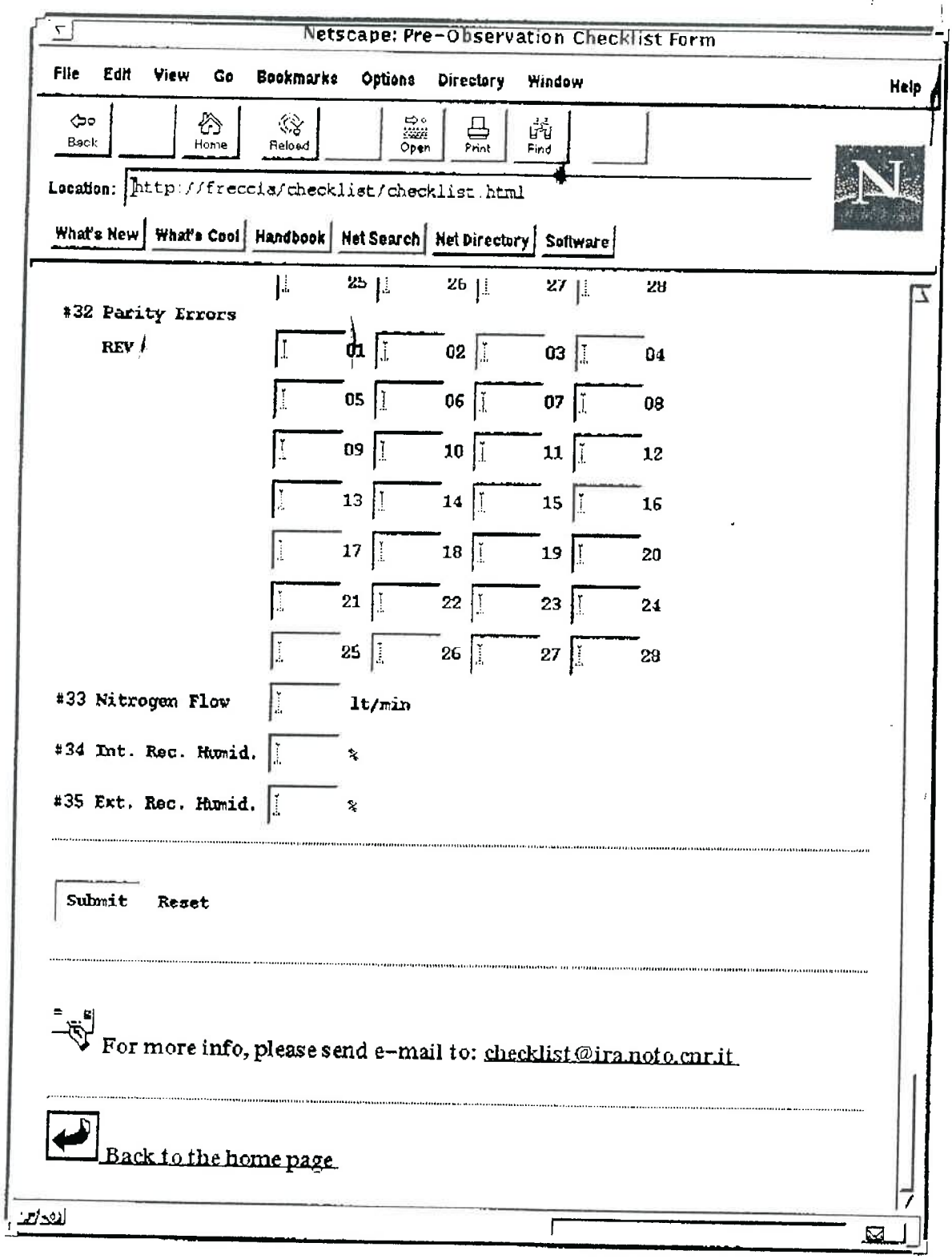
Sec.
#24 FS Time - UT
Sec.
#25 Patch panel
#26 Recorder Vacuum
#27 Track Bandwidth
write X if not ok
01 02 03 04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#34 Int. Rec. Humid. %
#35 Ext. Rec. Humid. %
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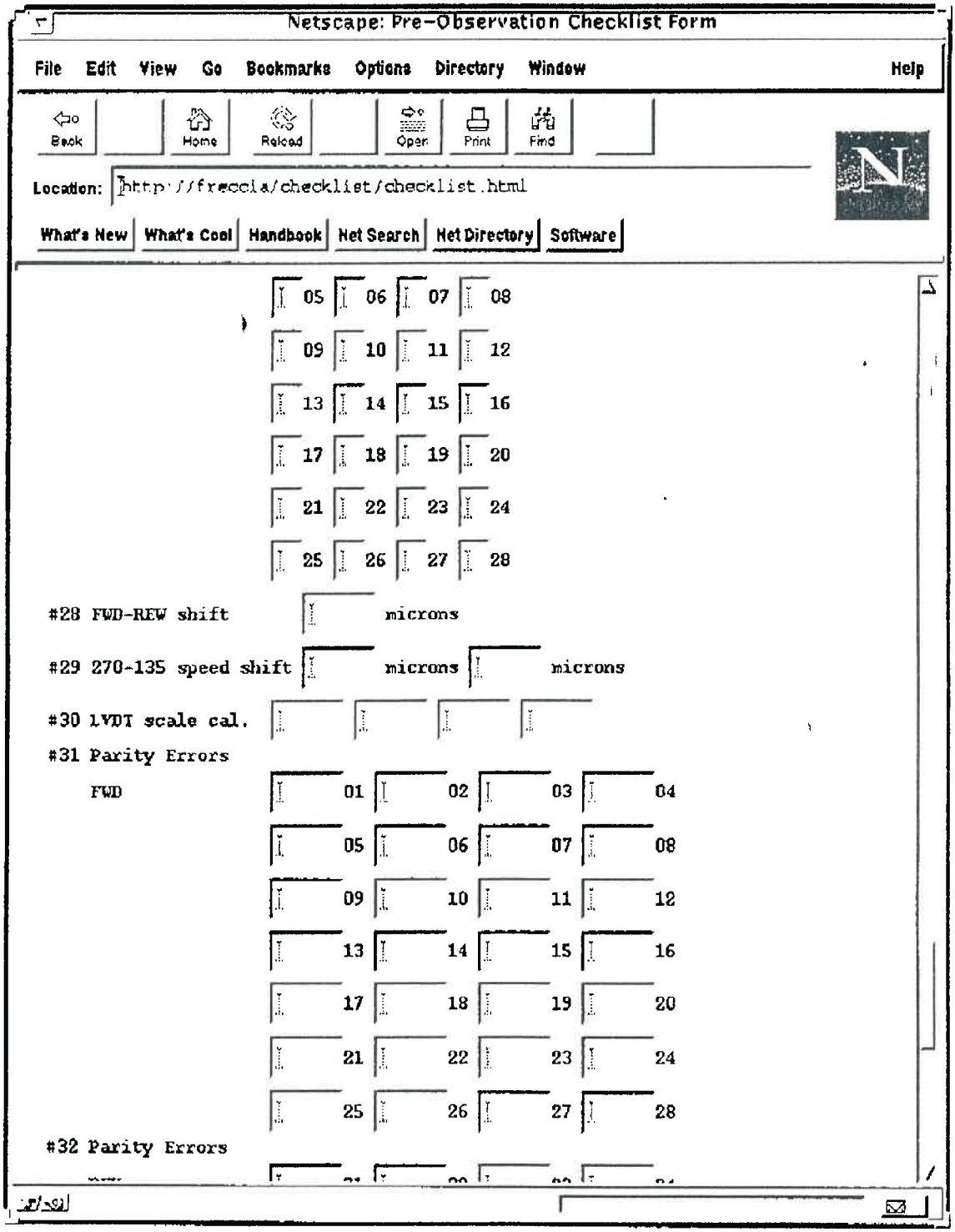
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