US .... United States

EU .... European Union

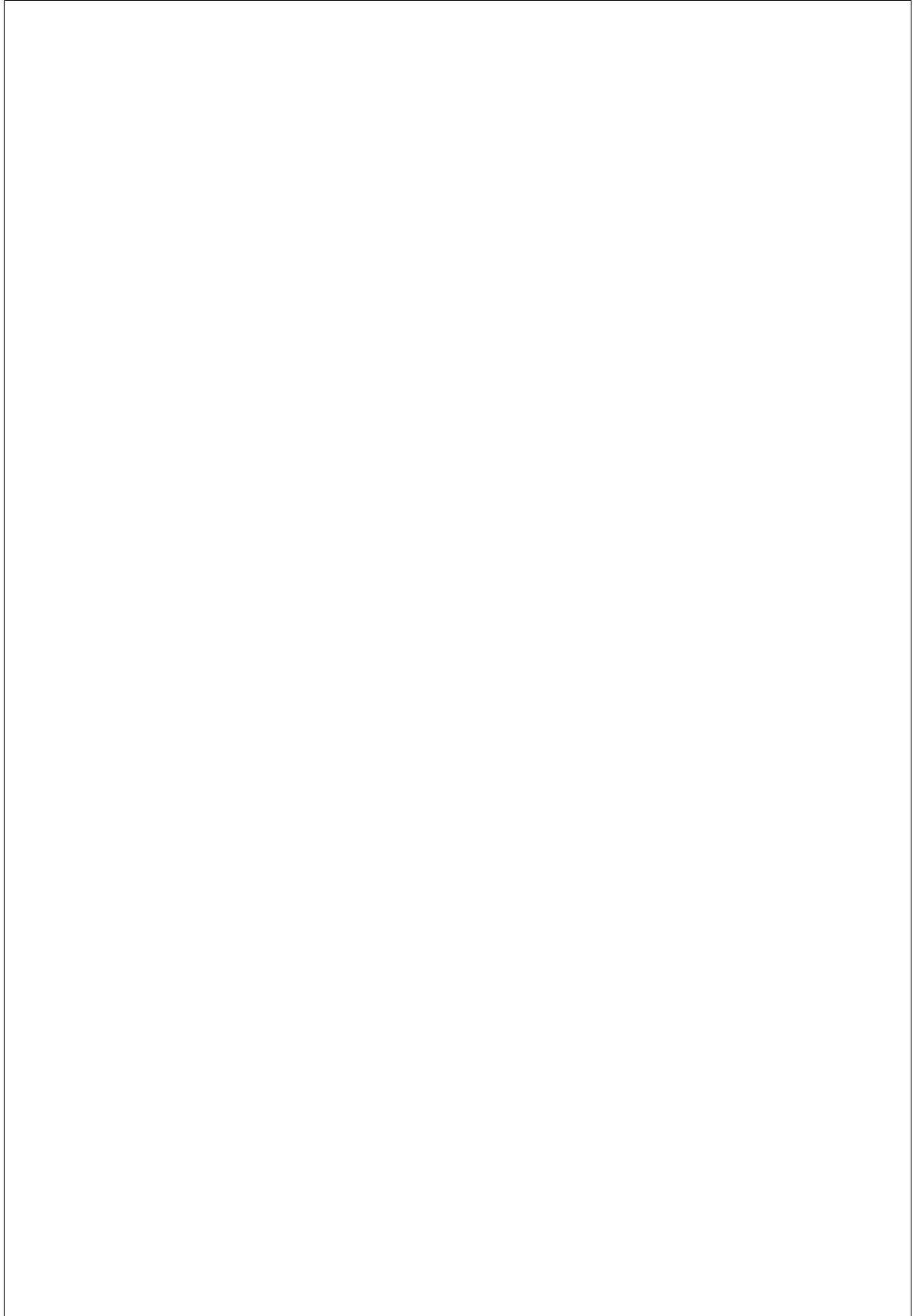**Gvmt** .... Government

Final thesis

Test Data Post-Processing and Analysis of LA & HARQ

by

Paul Nedstrand & Razmus Lindgren

LITH-IDA-EX-2015/THESISNUMBER

October 28, 2014

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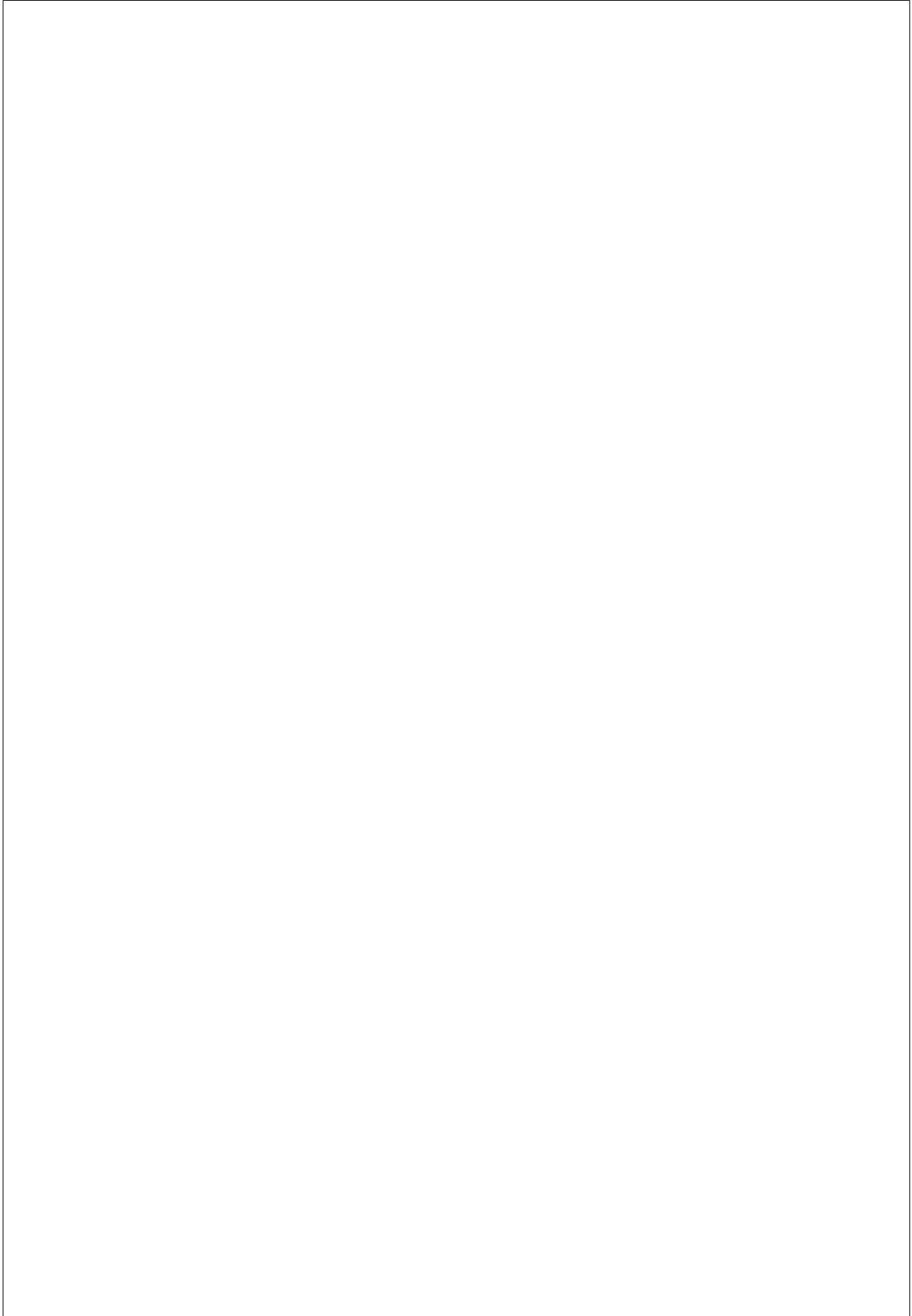
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October 28, 2014

Supervisor: Ola Leifler

Examiner: EXAMINER

Abstract

§ This Master thesis involves developing a lightweight analyser that produce statistics from the communication between a cell phone and a E-UTRAN base station. The analyser tool will produce graphs with information about the correlation between a signal throughput and the interference in the channel that the signal is sent through. From the statistics produced by the analyser tool, the testing personal at Ericsson can more easily deduce where the interference in signals arises from.

Contents

Chapter 1
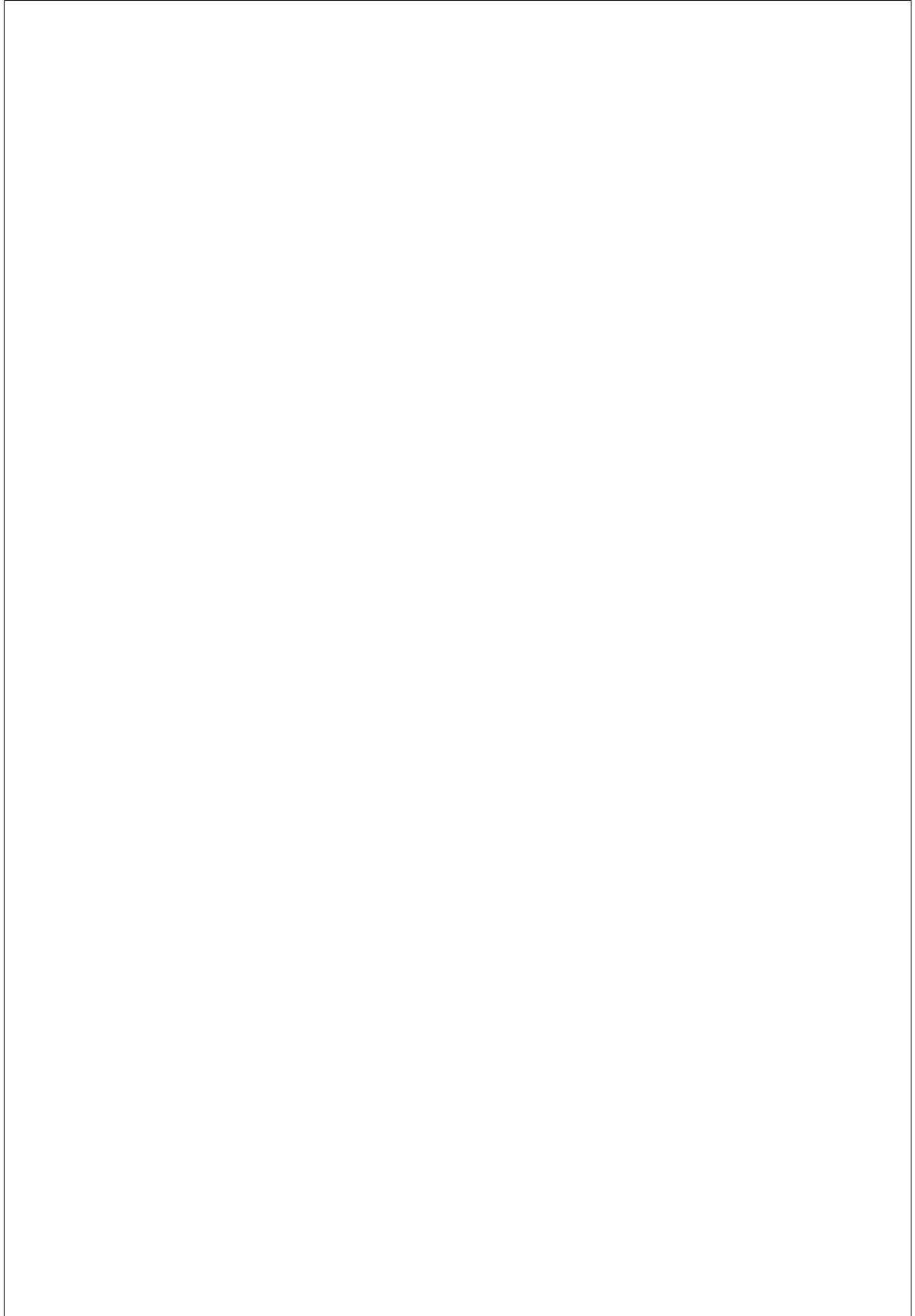
Introduction

1.1   background and Motivation

The purpose with this master thesis is to help Long Term Evolution Interoperability Development Testing (LTE IODT) Data analysis. LTE IODT wants to automatically generate analysis of Link Adaptation (LA) and Hybrid Automatic Repeat Request (HARQ) tests where we sweep through Signal to Interference plus Noise Ratio (SINR) for different channel models. The LTE IODT lab test logs gives a unique opportunity to look into detailed behaviour of link and rank adaptation for both downlink and uplink.

Ericsson needed a tool for allowing the testers to better analyse the performance in UE-to-eNodeB implementations. The performance in this sense is whether Ericsson and/or their customer had implemented their system according to the minimum criterion of the specification for said implementation or not. To be able to judge where in the implementation the loss of performance had occurred, Ericsson needed a tool to plot the values of signal-variables that are most affected by HARQ and LA, so that their own personnel could use that information to further analyse the algorithms. To be able to plot relevant values for debugging we first had to gain vast knowledge about how LTE, HARQ and LA.

The visualization tool which we used in this project was an Ericsson internal project called Logtool. We implemented our program as a plugin project to Logtool. The Logtool project is built upon the eclipse framework and we also developed the plugin in eclipse development enviroment in Java.

1.2   problem formulation

The purpose of this master thesis is to help LTE IODT Data Analysis to see how well the LTE system is performing when the HARQ (Hybrid Automatic

Repeat Request)and LA (Link Adaptation) is activated. To perform such an analysis we needed to gather vast knowledge regarding how signals are treated in LTE and how the protocols implemented are constructed.

TODO: write about all web pages and libraries which contained information about LTE

The output should be recorded and automatically compared with the recommended minimum requirements of the 3GPP standards and Ericsson Research.

1.3 Goals and Methodology

Our task from Ericsson was to develop a lightweight analyzer tool that:

- simply produces statistics

- Handle multiple input sources

We also had the following criteria:

- Study and understand the 3GPP standards and Ericsson Research

- Analyze the data from processing for the final graph

- Evaluate a suitable tool for the processing of data, e.g. MATLAB or other tools

- Capability to correlate the graph to logs in order to facilitate troubleshooting

TODO: write about why and how we did a focus group

1.4 Thesis Outline

This thesis is divided into the following Parts

- part 1 we planned stuff here

- part 2 we implemented stuff here

- part 3 we reviewed stuff here

Chapter 2

Body

Are you sure that that I shouldnt me realize that the end of the wash cycle is a treasured moment for most people?

.. One FISHWICH coming up!!

Is it because of your life that you say one fishwich coming up?

If I am elected, the concrete barriers around the WHITE HOUSE will be replaced by tasteful foam replicas of ANN MARGARET!

I dont understand.

You mean you dont want to watch WRESTLING from ATLANTA?

Do you really think I might want not want to watch wrestling?

Is this TERMINAL fun?

Is it because of the people you hang around with that you are going through all this?

Its a lot of fun being alive... I wonder if my bed is made?!?

What makes you think you wonder if your bed is made?

...PENGUINS are floating by...

Earlier you said I would like not want to watch wrestling?

Hey, LOOK!! A pair of SIZE 9 CAPRI PANTS!! They probably belong to SAMMY DAVIS, JR.!!

How do you reconcile problems at school?

BARRY.. That was the most HEART-WARMING rendition of "I DID IT MY WAY Ive ever heard!!

Is it because was the most heart warming rendition of you did it your way you have ever heard that you came to me?

I know how to get the hostesses released! Give them their own television series!

Is it because of any hobbies you have that you say give them their own television series?

In order to make PLANS for the WEEKEND...so that we can read RESTAU-RANT REVIEWS and decide to GO to that restaurant & then NEVER GO...so we can meet a FRIEND after work in a BAR and COMPLAIN

about Interior Secty JAMES WATT until the SUBJECT is changed to NU-CLEAR BLACKMAIL...and so our RELATIVES can FORCE us to listen to HOCKEY STATISTICS while we wait for them to LEAVE on the 7:48....
Does it bother you that you can read restaurant reviews and decide to go to that restaurant then not ever go so you can meet a friend after work in a bar and complain about interior secty james watt until the subject is changed to nuclear blackmail and so your relatives can force us to listen to hockey statistics while you wait for them to leave on the 7 48?
Is this the line for the latest whimsical YUGOSLAVIAN drama which also makes you want to CRY and reconsider the VIETNAM WAR?
How does it feel to want?

2.1 Mainline

2.2 Qwadratica

A slightly tegelsten liknande sida. A slightly tegelsten

liknande sida. A slightly tegelsten liknande sida.

A slightly tegelsten liknande sida. A slightly tegelsten liknande sida.

Chapter 3

Closing

Lets all show human CONCERN for REVEREND MOONs legal difficulties!!
You mentioned that I would like not want to watch wrestling?
.. the MYSTERIANS are in here with my CORDUROY SOAP DISH!!
Perhaps this has something to do with your sex life?
Here I am at the flea market but nobody is buying my urine sample bottles..
When did you first know that nobody is buying your urine sample bottles?
I was in EXCRUCIATING PAIN until I started reading JACK AND JILL
Magazine!!
Possibly you should consult a doctor of medicine, I am a psychiatrist.
HUGH BEAUMONT died in 1982!!
This is not a healthy way of thinking.
Yow! And then we could sit on the hoods of cars at stop lights!
Maybe hangups you have are related to this.
I HAVE a towel.
Why do you say was the most heart warming rendition of you did it your
way you have ever heard?
Excuse me, but didnt I tell you theres NO HOPE for the survival of OFFSET
PRINTING?
Is the fact that didnt you tell me theres no hope for the survival of offset
printing the real reason?
Ive read SEVEN MILLION books!!
Is it because of your inhibitions that you are going through all this?
.. Like I always say – nothing can beat the BRATWURST here in DUS-
SELDORF!!
Are you afraid of that?
I havent been married in over six years, but we had sexual counseling every
day from Oral Roberts!!
Does the fact that you had sexual counseling every day from oral roberts
explain anything else?
Are you selling NYLON OIL WELLS?? If so, we can use TWO DOZEN!!

Earlier you said you can read restaurant reviews and decide to go to that restaurant then not ever go so you can meet a friend after work in a bar and complain about interior secty james watt until the subject is changed to nuclear blackmail and so your relatives can force us to listen to hockey statistics while you wait for them to leave on the 7 48?
Im having a BIG BANG THEORY!!
How do you reconcile some problems in your childhood?
I want to kill everyone here with a cute colorful Hydrogen Bomb!!
Why should you get to kill everyone?
Civilization is fun! Anyway, it keeps me busy!!
Have you been sure it keeps you busy?
Eisenhower!! Your mimeograph machine upsets my stomach!!
You have your mind on machines, it seems.
Did YOU find a DIGITAL WATCH in YOUR box of VELVEETA?
What makes you believe that?
Hmmm.. A hash-singer and a cross-eyed guy were SLEEPING on a deserted island, when...
Do you use hash often?
Yow! Now we can become alcoholics!
You mentioned that I would like to cry?
Im having a tax-deductible experience! I need an energy crunch!!
When did you first desire to have an energy?
Everywhere I look I see NEGATIVITY and ASPHALT...
Perhaps this is related to some problems at home?
YOW!!! I am having fun!!!
Are you sure that you are having fun?
So this is what it feels like to be potato salad

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Titel
Title

TITLEBIBPAGE

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Sammanfattning
Abstract

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