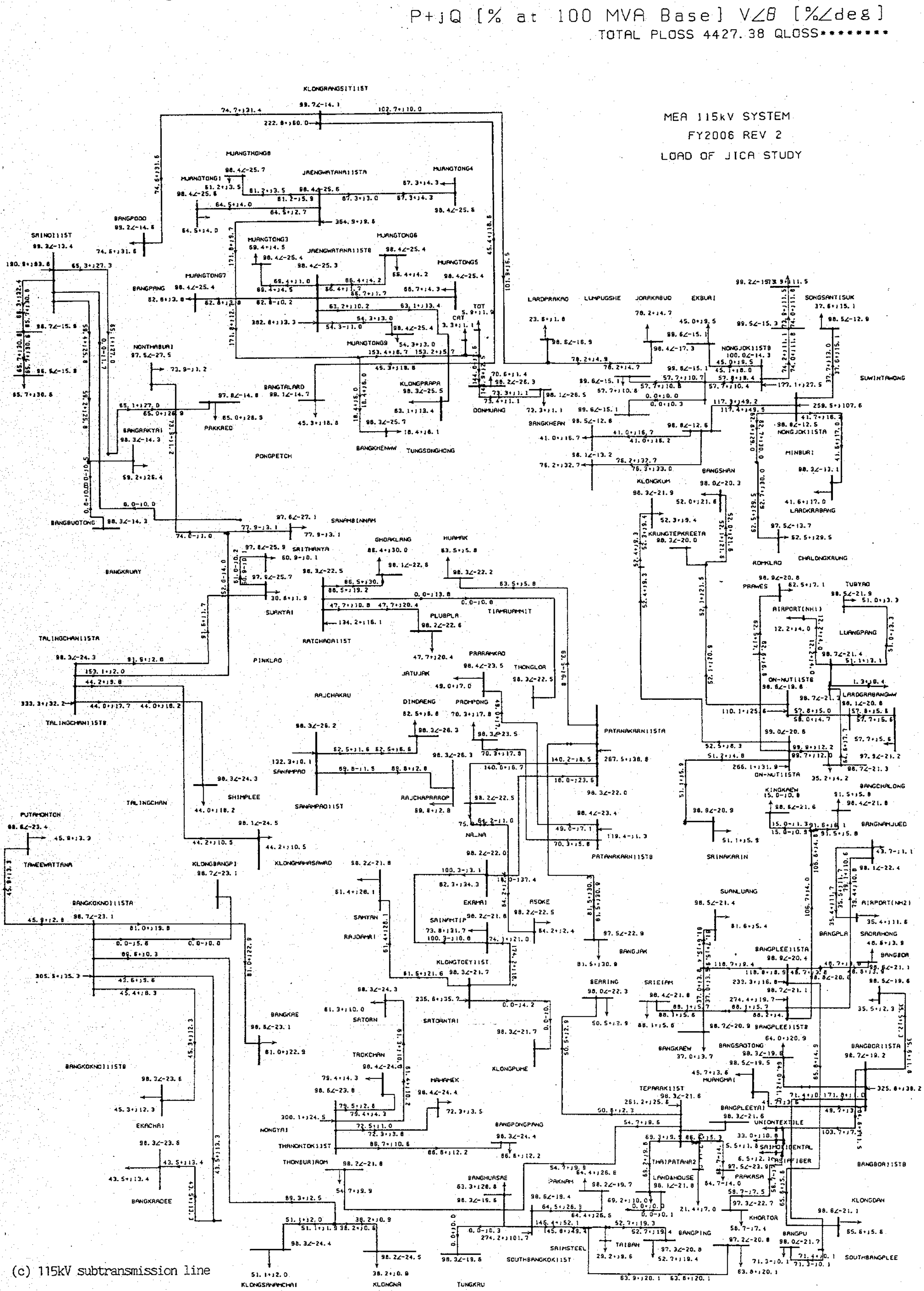
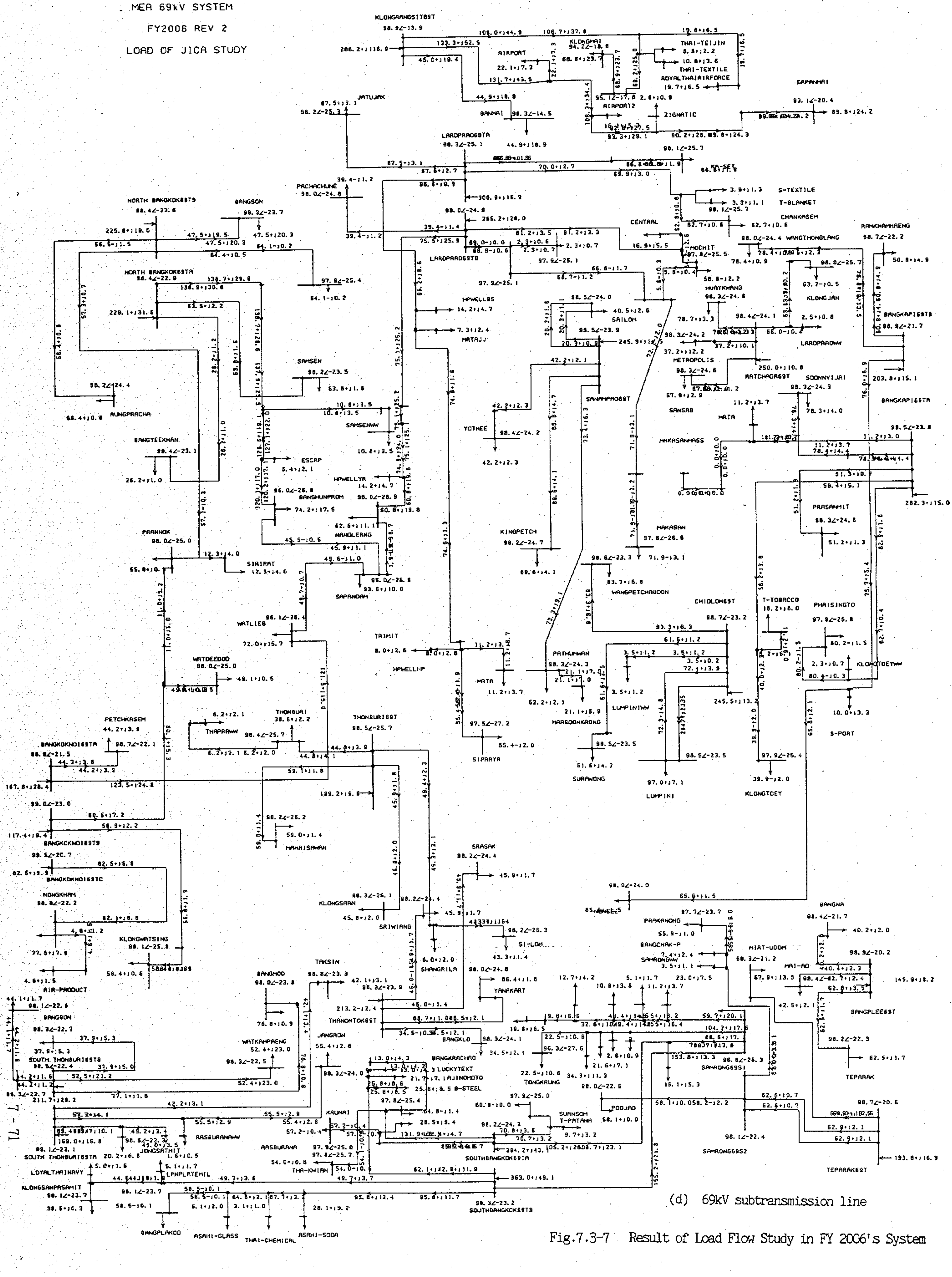


(c) 115kV subtransmission line

Fig.7.3-7 Result of Load Flow Study in FY 2006's System

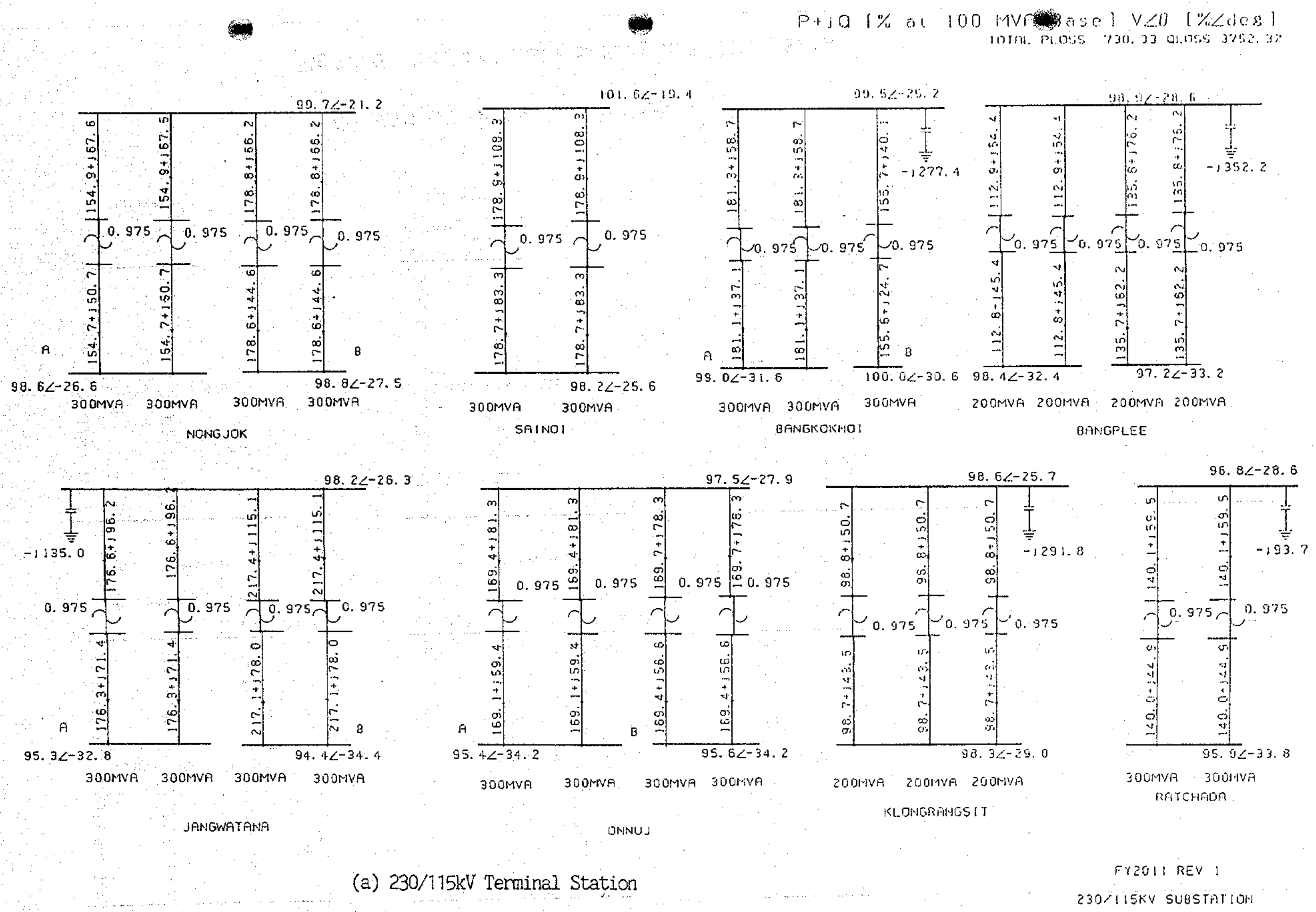
P+jQ [% at 100 MVA Base] V∠θ [%∠deg]
TOTAL PLOSS 4427. 38 QLOSS********

MEA 69kV SYSTEM
FY2006 REV 2
LOAD OF JICA STUDY



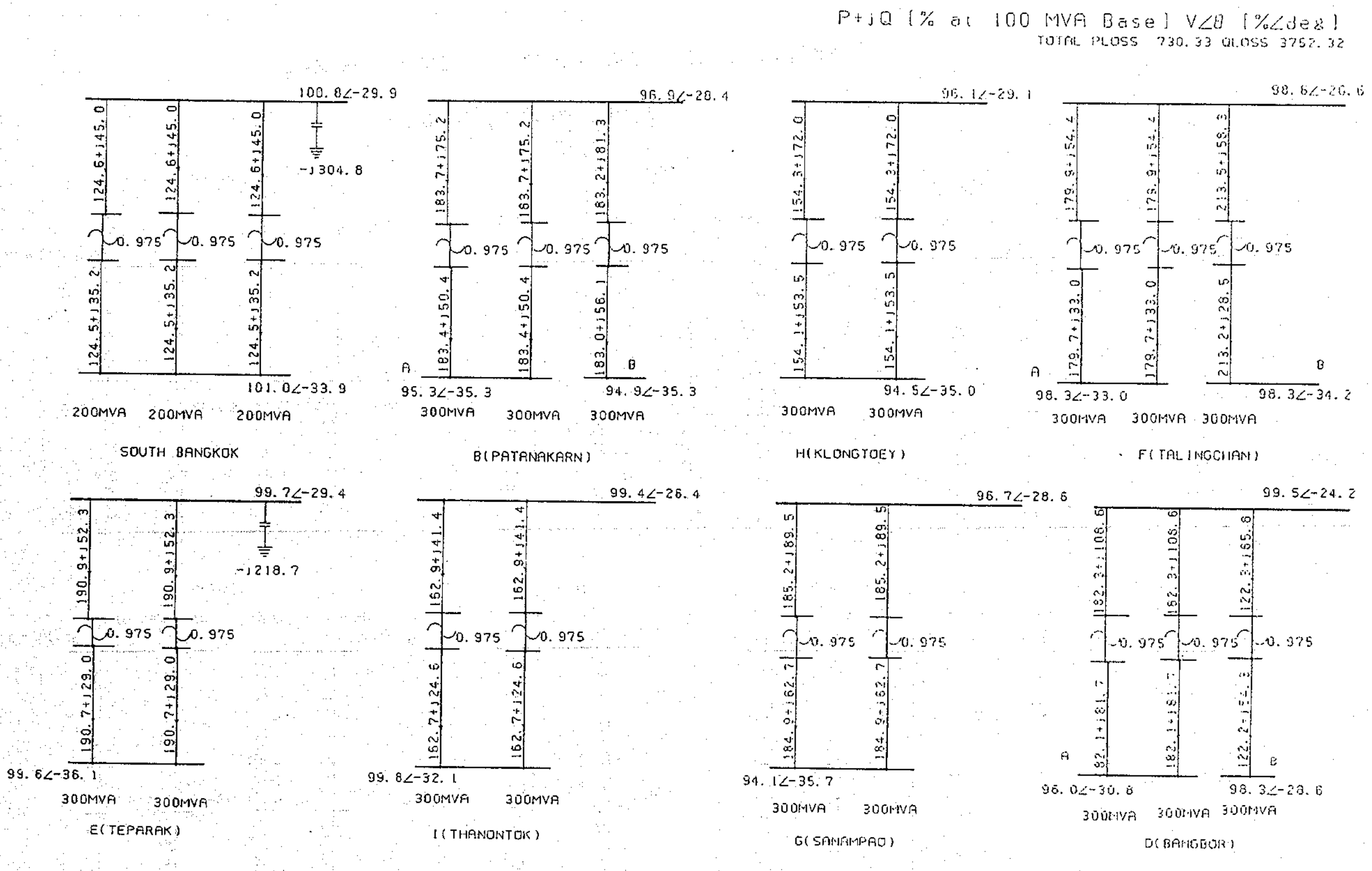
(d) 69kV subtransmission line

Fig.7.3-7 Result of Load Flow Study in FY 2006's System



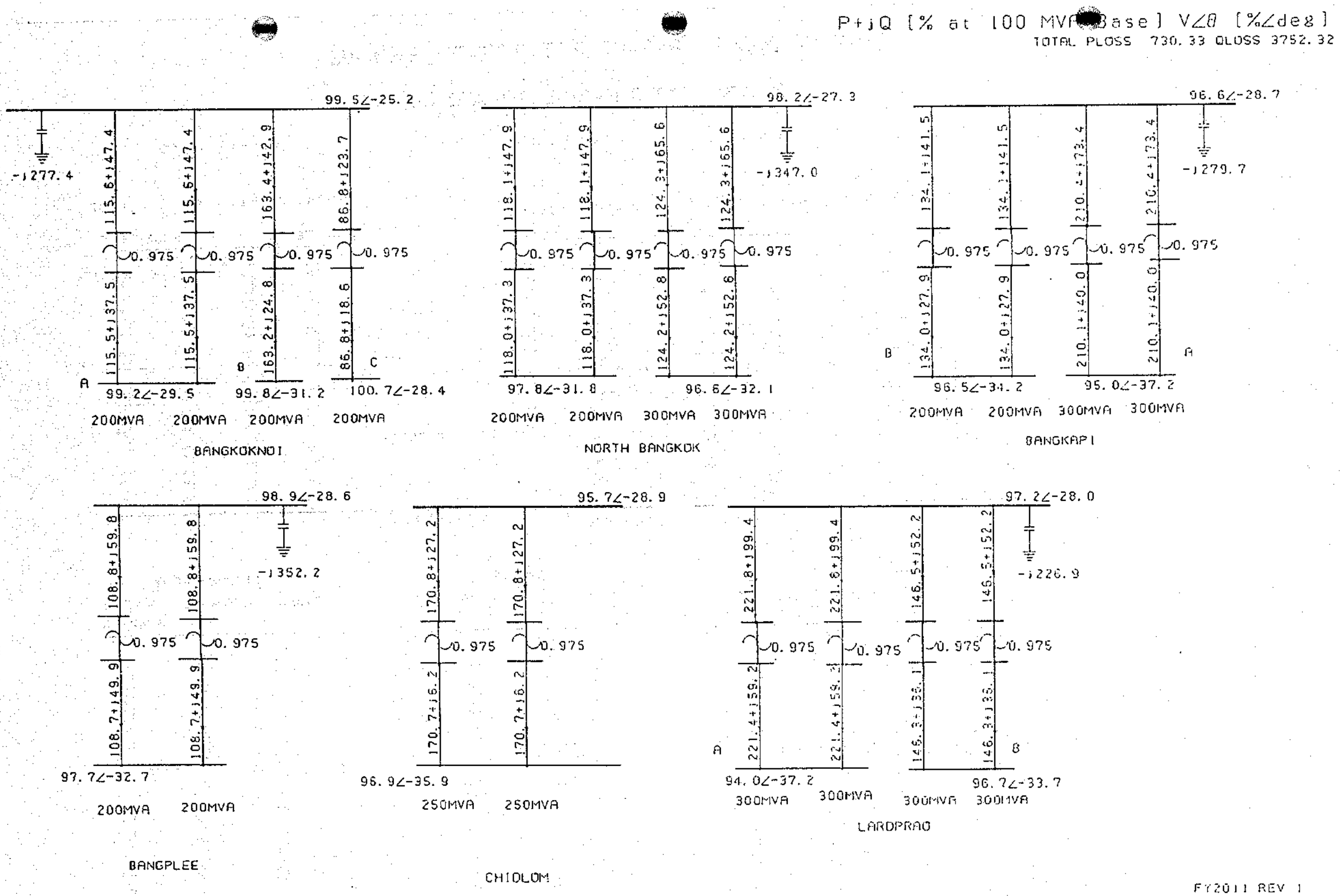
(a) 230/115kV Terminal Station

Fig.7.3-8 Result of Load Flow Study in FY 2011's System



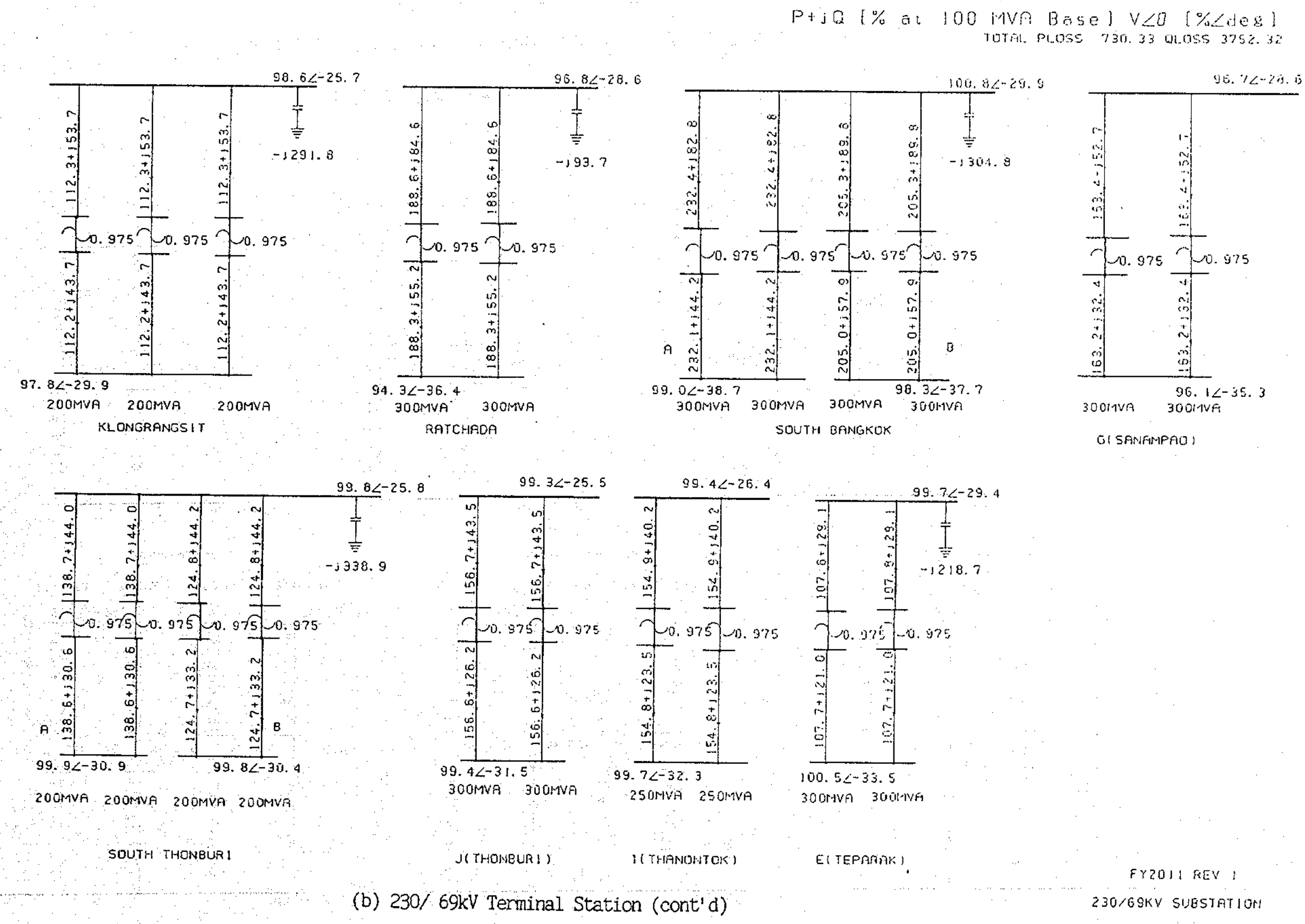
(a) 230/115kV Terminal Station (cont'd)

Fig.7.3-8 Result of Load Flow Study in FY 2011's System



(b) 230/ 69kV Terminal Station

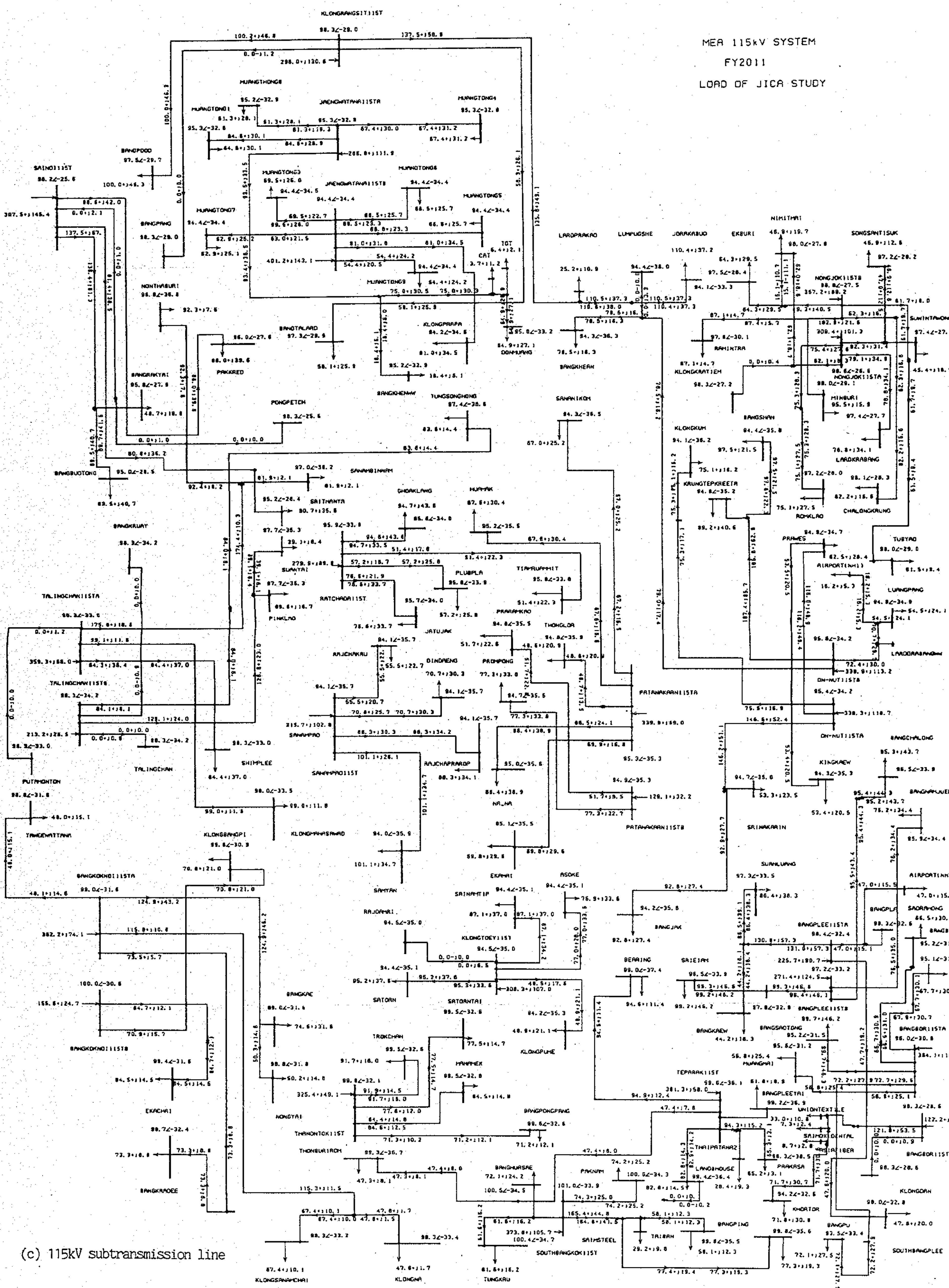
Fig.7.3-8 Result of Load Flow Study in FY 2011's System



(b) 230/ 69kV Terminal Station (cont'd)

Fig.7.3-8 Result of Load Flow Study in FY 2011's System

P+jQ [% at 100 MVA Base] V∠θ [%∠deg]
TOTAL PLOSS 730.33 QLOSS 3752.32

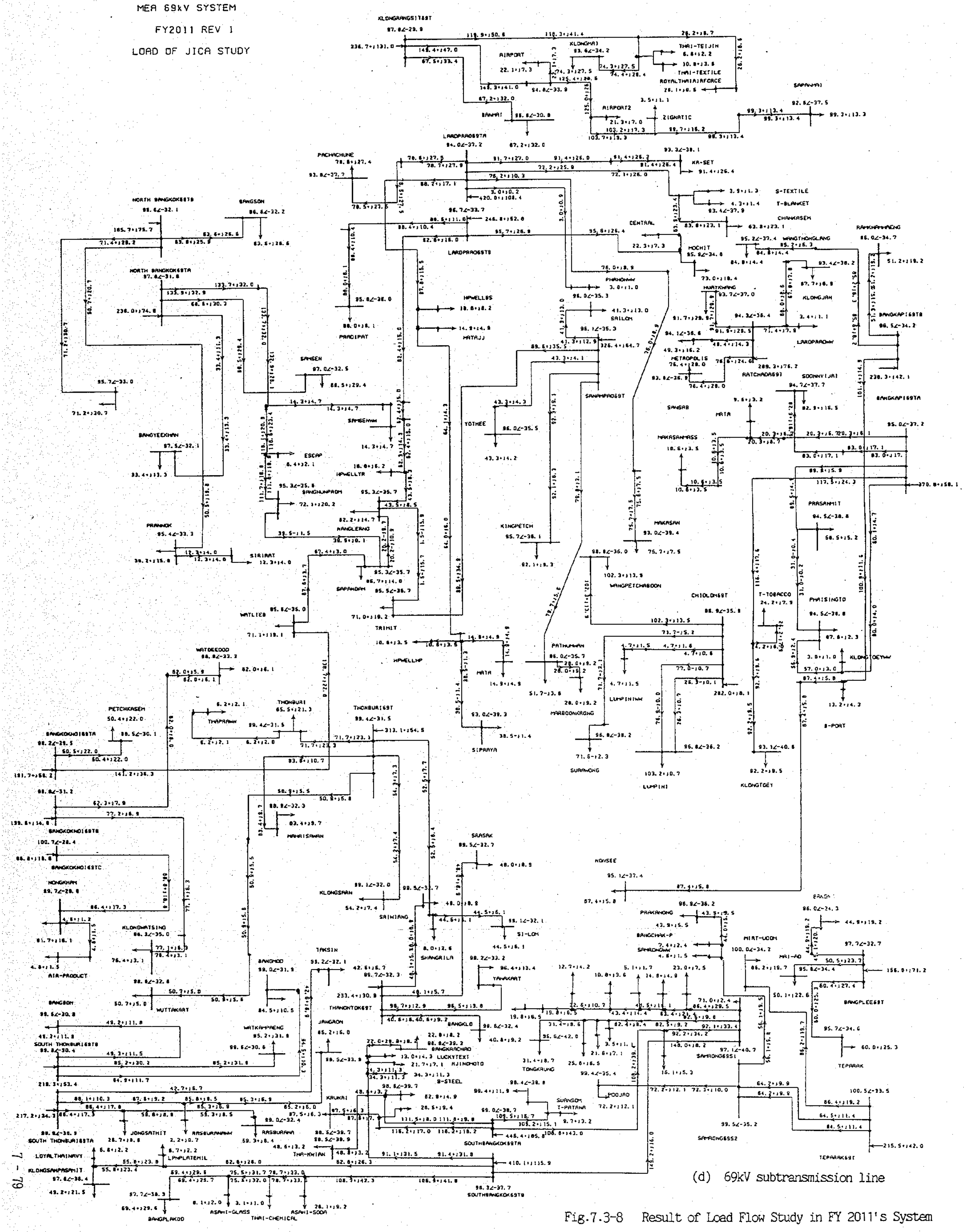


(c) 115kV subtransmission line

Fig.7.3-8 Result of Load Flow Study in FY 2011's System

P+jQ [% at 100 MVA Base] V∠θ [%∠deg]
TOTAL PLOSS 730.33 QLOSS 3752.32

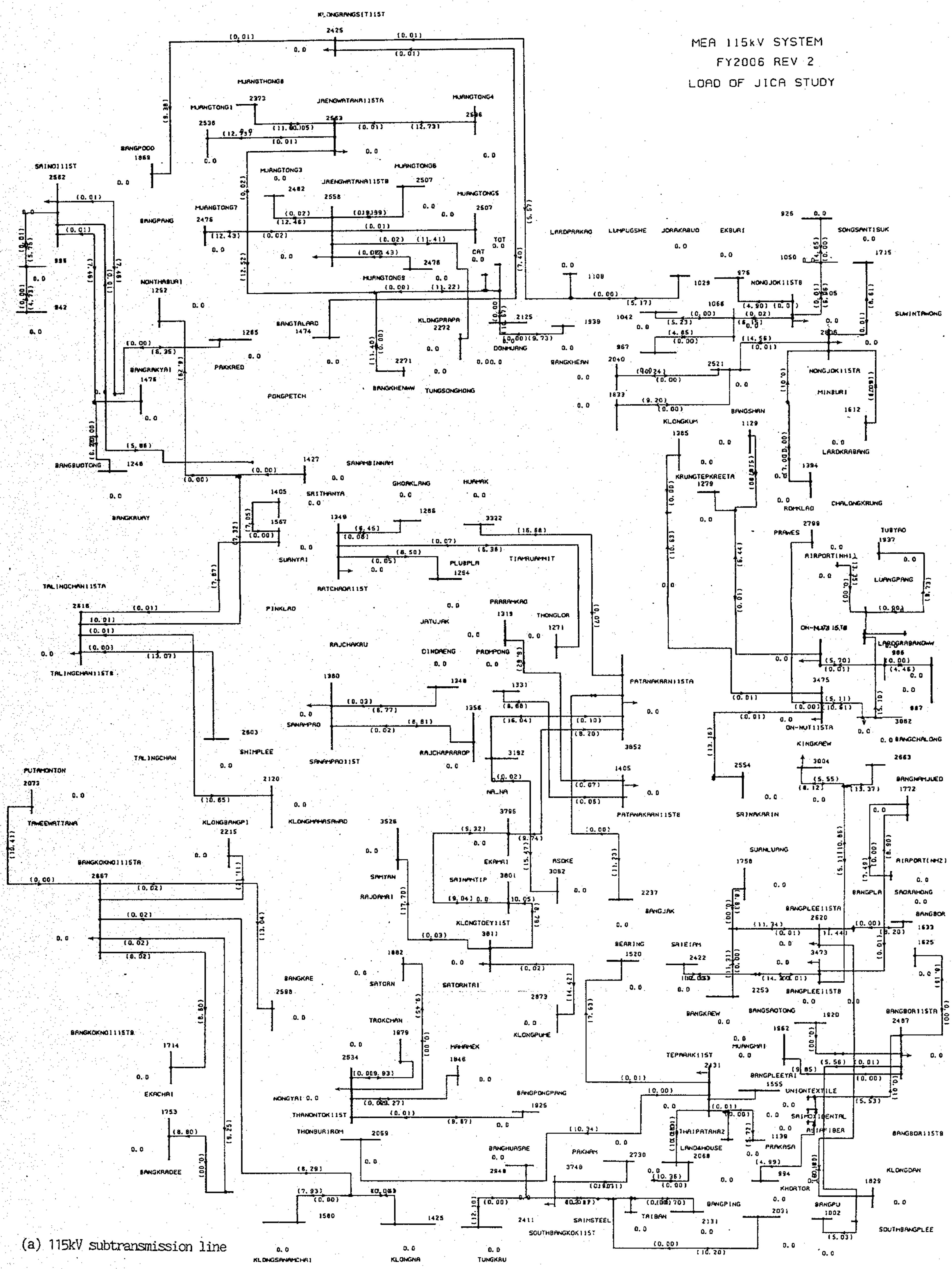
MEA 69kV SYSTEM
FY2011 REV 1
LOAD OF JICA STUDY



(d) 69kV subtransmission line

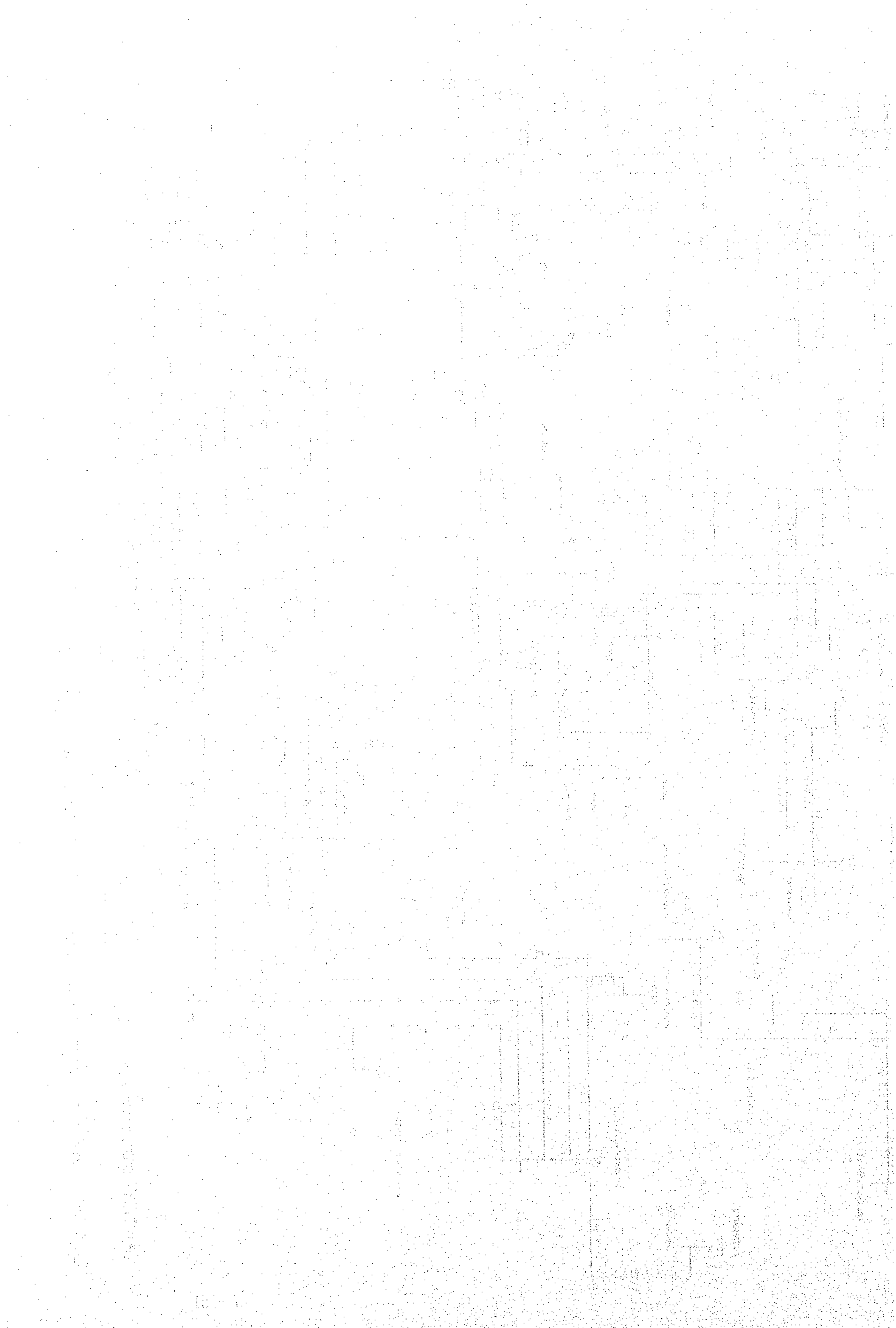
Fig.7.3-8 Result of Load Flow Study in FY 2011's System

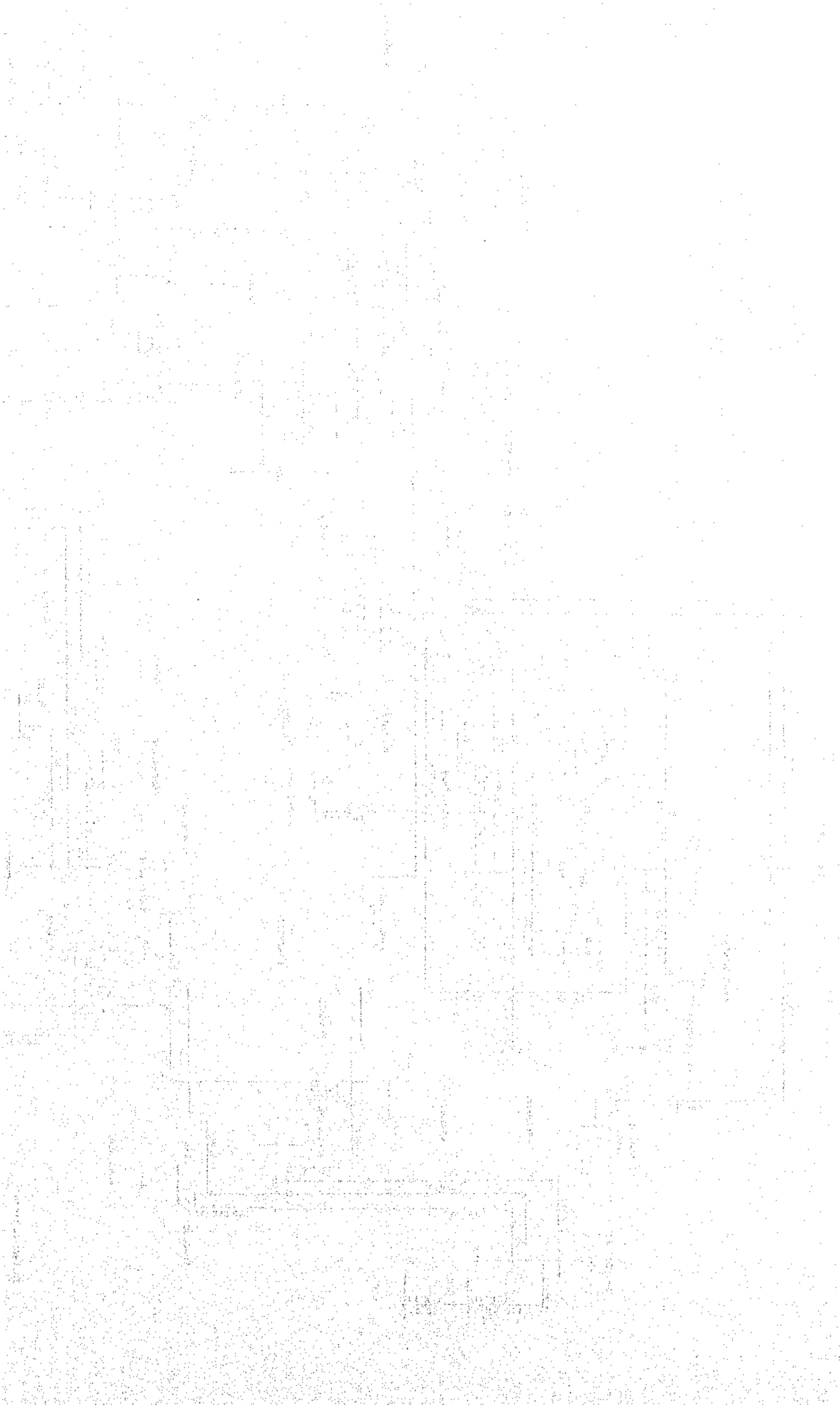
MVA (KA)



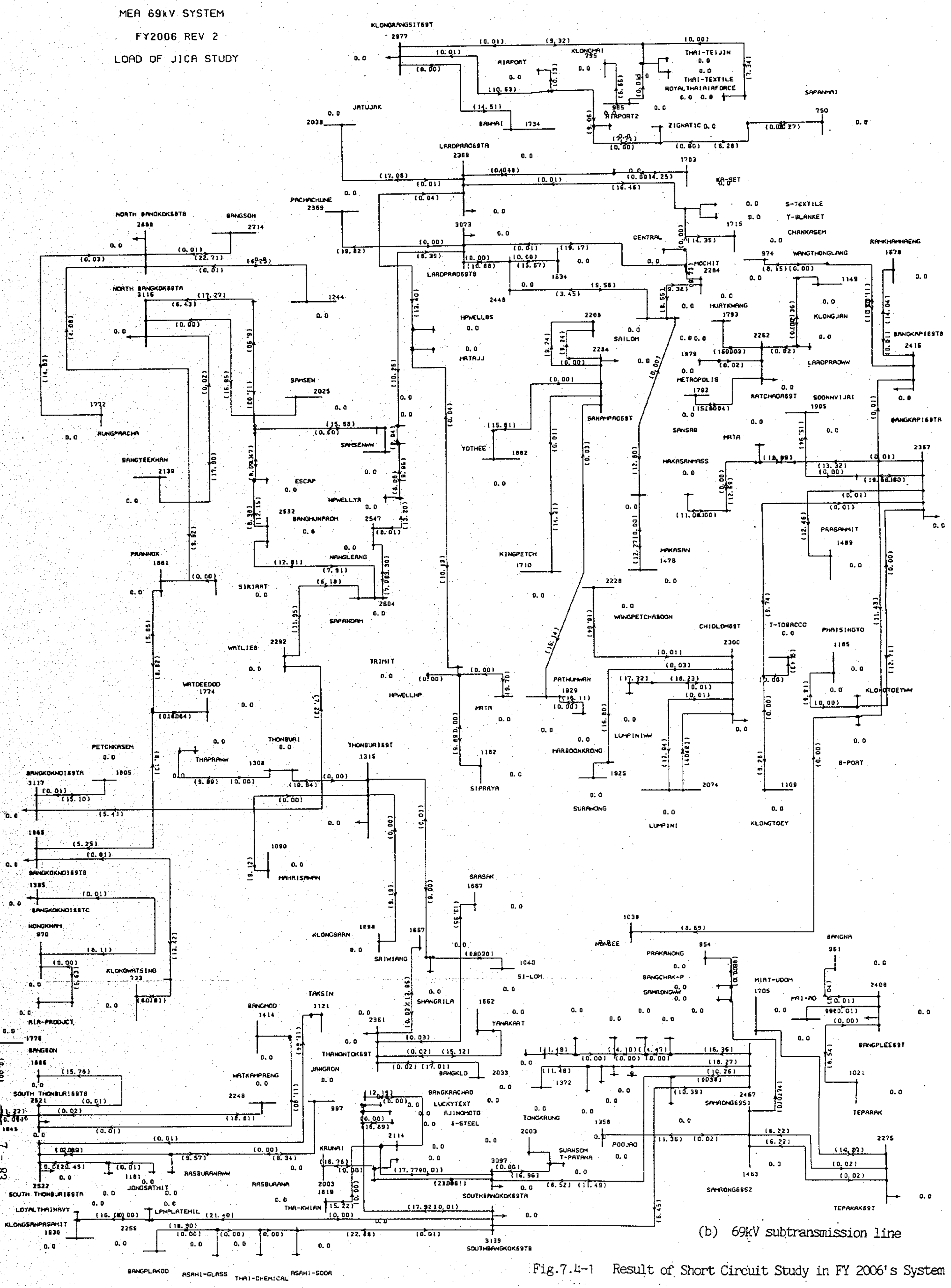
(a) 115kV subtransmission line

Fig.7.4-1 Result of Short Circuit Study in FY 2006's System



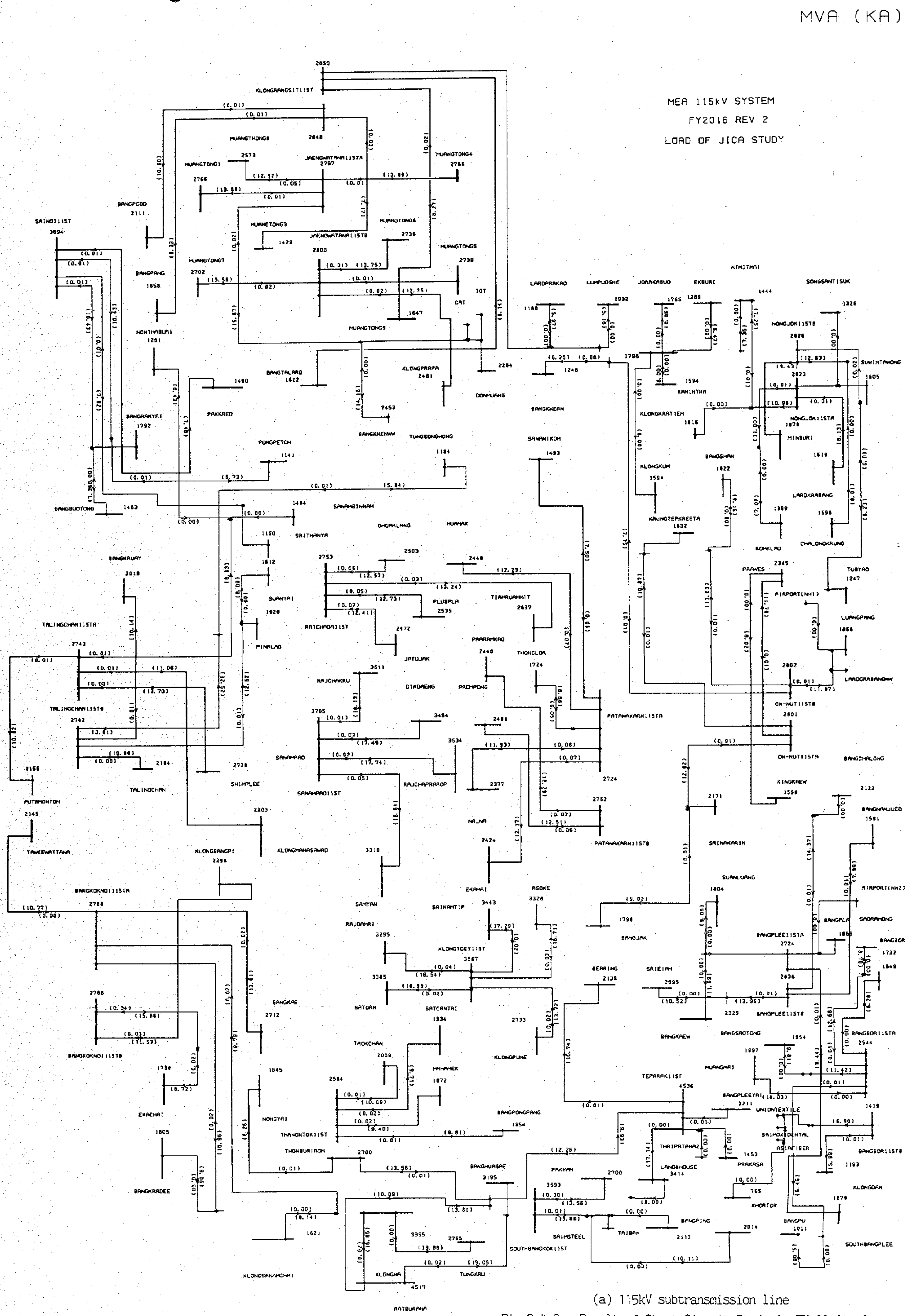


MVA (KA)



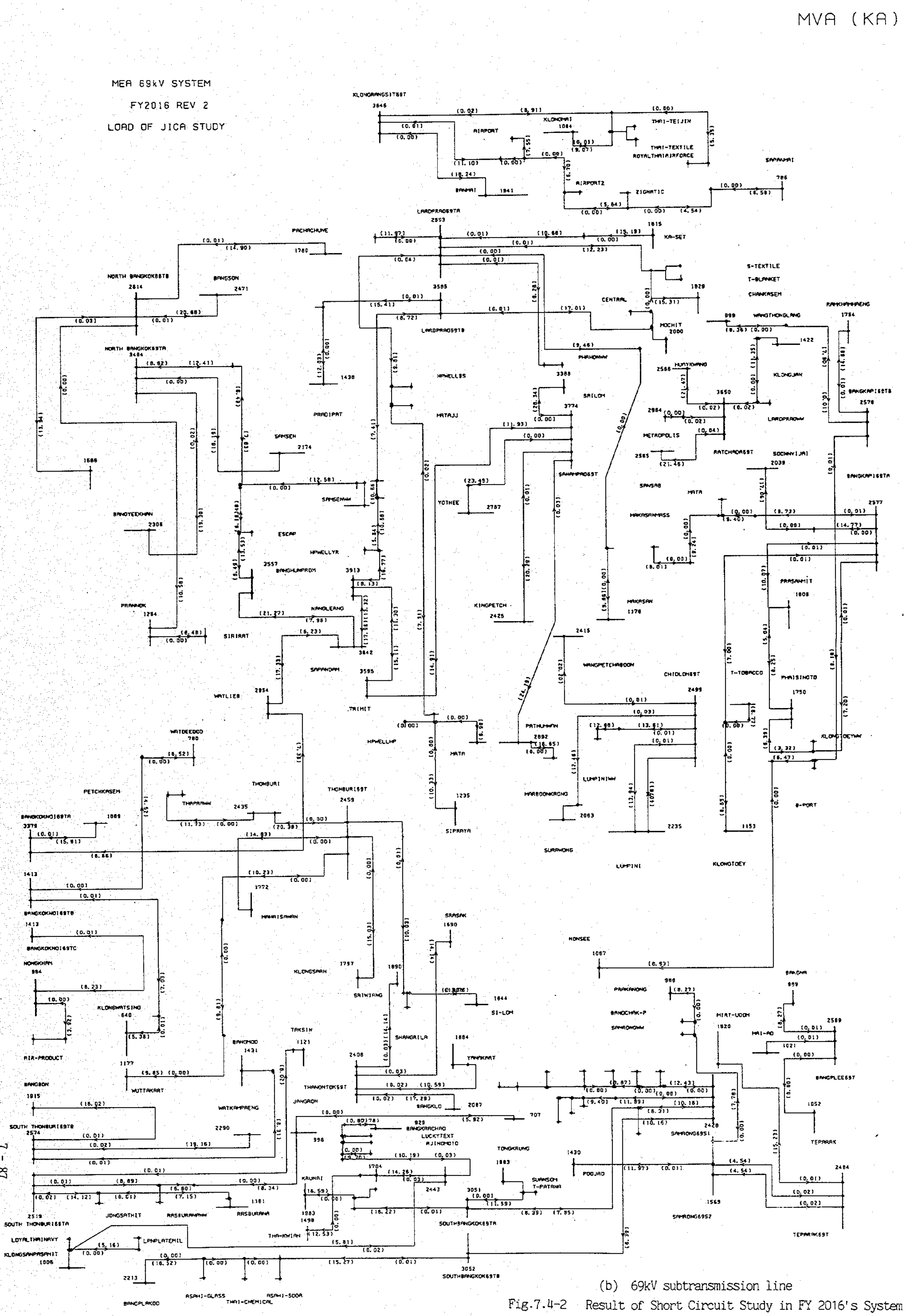
(b) 69kV subtransmission line

Fig.7.4-1 Result of Short Circuit Study in FY 2006's System



(a) 115kV subtransmission line

Fig.7.4-2 Result of Short Circuit Study in FY 2016's System



(b) 69kV subtransmission line

Fig.7.4-2 Result of Short Circuit Study in FY 2016's System

Table 7.5-1 Result of SLG Study in FY 2006's System

MEA SLG FAULT CURRENT AT FY2006

Bus	Fault(KA)
NGJK15TA	5.5
NGJK15TB	3.0
SAINO15T	3.6
BKKN15TA	10.1
BPLE15TA	16.9
BPLE15TB	20.9
JWTAN15A	17.3
JWTAN15B	19.0
ON_NUJB1	12.4
ON_NUJB2	7.1
KRST15T	8.1
RCHDA15T	9.3
SBKK15T	18.4
PTKAR15A	24.7
PTKAR15B	8.2
KTOEY15T	23.8
TLIN15TA	16.2
TPRAK15T	11.3
TNTOK15T	16.2
SNPAO15T	9.4
BNBR15TA	8.8
BKKNO6TA	27.4
BKKNO6TB	14.3
BKKNO6TC	13.4
NORBK6TA	11.9
NORBK6TB	22.5
BAKAP6TB	10.0
BAKAP6TA	23.3
BAPLE69T	23.3
CIDLO69T	17.3
LAPRA6TA	17.7
LAPRA6TB	27.7
KLRST69T	31.2
RATCD69T	24.0
SOUBK6TA	30.3
SOUBK6TB	28.7
SNPAO69T	21.8
STBUR6TA	7.2
STBUR6TB	26.3
TOBURI69	7.8
TNOTO69T	13.6
TEPRA69T	22.9
WTLIEBB1	12.4
SSPDAMB1	16.5
BKUPOMB1	13.9
NLERNGB1	17.4

Table 7.5-2 Result of SLG Study in FY 2016's System

Bus	Fault(KA)
NGJK15TA	17.8
NGJK15TB	16.8
SAINO15T	24.3
BKKN15TA	18.4
BKKN15TB	17.4
BPLE15TA	17.2
BPLE15TB	17.8
JWTAN15A	18.5
JWTAN15B	18.4
ON_NUJB1	18.1
ON_NUJB2	17.0
KRST15TA	17.8
KRST15TB	17.6
RCHDA15T	17.7
SBKK15T	23.7
PTKAR15A	18.1
PTKAR15B	17.3
KTOEY15T	23.6
TLIN15TA	18.5
TLIN15TB	17.9
TPRAK15T	27.3
TNTOK15T	17.5
SNPAO15T	24.6
BNBR15TA	16.8
BNBR15TB	9.0

Bus	Fault(KA)
BKKNO6TA	37.3
BKKNO6TB	17.4
BKKNO6TC	14.0
NORBK6TA	33.7
NORBK6TB	29.6
BAKAP6TB	27.2
BAKAP6TA	27.1
BAPLE69T	26.6
CIDLO69T	27.0
LAPRA6TA	27.6
LAPRA6TB	34.0
KLRST69T	37.2
RATCD69T	37.9
RATUB69A	25.8
SOUBK6TA	30.9
SOUBK6TB	29.8
SNPAO69T	40.0
STBUR6TA	27.0
STBUR6TB	28.2
TOBURI69	27.5
TNOTO69T	13.2
TEPRA69T	25.4
RAMTR15A	13.5
RATUB15A	27.0
WTLIEBB1	22.7
SSPDAMB1	35.3
BKUPOMB1	33.7
NLERNGB1	33.0
TRIMITB1	27.0

CHAPTER 8

PRELIMINARY STUDY OF ENVIRONMENTAL IMPACT ASSESSMENT

CHAPTER 8 PRELIMINARY STUDY OF ENVIRONMENTAL IMPACT ASSESSMENT

8.1 General

8.1.1 Countermeasures for Enhancement and Conservation of Environment in Thailand

The "Enhancement and Conservation of National Environmental Quality Act B.E. 2535" was promulgated in 1992, for the conservation of environmental quality inThailand, and previous miscellaneous standards and regulations concerned were abrogated.

According to this act, the environmental quality standards will be notified by the National Environment Board with regard to the following items (Section 32 of the Act):

(1) Water quality standards for river, canal, swamp, marsh, lake, reservoir and other public inland water sources according to their use classifications in each river basin or water catchment.

(2) Water quality standards for coastal and estuary water areas.

(3) Groundwater quality standards.

(4) Atmospheric ambient air standards.

(5) Ambient standards for noise and vibration.

(6) Environmental quality standards for other matters.

For the purpose of promotion and conservation of environmental quality, moreover, the Minister (Science, Technology and Environment Minister) has the power to specify the types and sizes of projects or activities likely to have environmental impact, and any enterprise, etc. promoting any specified project are required to submit an environmental impact assessment report (Section 46 of the Act). The procedures for preparation and submittal of environmental impact assessment report, etc. are prescribed (Sections 47 and 48 of the Act).

At the stage of the First Field Investigation by JICA, however, any notification for enforcing this act had not been published in the Government Gazette subsequent to promulgation of the Act. Therefore, the MEA need to provide special proceedings and study.

On the other hand, there are increasing demands for adopting underground transmission and distribution lines in some parts of urbanizing areas from the point of view of preserving the sceneries. MEA is planning improvement of environment by specifying three areas for underground transmission lines in its Revised 7th Plan.

8.1.2 Environmental Impact on Transmission Line and Substation Facilities

The impacts of transmission line and substation equipment upon environment are deemed to be caused by noises (transformer and equipment operation noise), static and electromagnetic induction interference, exhaust heat, damage to scenery and radio wave interference as well as noise, vibration, pollution of groundwater, outflow of soil and sand, fire and other accidents during construction work.
The transmission line, distribution line and substation shall be designed taking into account the following major items:

(1) Noise

Considerations should be given in advance at the design stage to keep the transformer noise level within the noise control standards.

(2) Prevention of electrical shock

Necessary measures should be taken by providing sufficient aboveground height of energized part of structures and adopting such a construction as to prohibit entry to the premises of substation, after studying whether there is any danger of electrical shock from steel fence and other metal structures due to static and electromagnetic induction interference.

(3) Impact upon existing infrastructures

Studies should be made as to whether there is any danger of interferences with transmission route of microwave channels, radio and television receiving as well as any possibility of restricting the traffic in the crossing sections of roads and rivers, and necessary countermeasures should be taken on the basis of the results of such studies.

(4) Effect upon land utilization

After studying on the possible reduction of the availability for use of the land under power lines and around tower sites, necessary measures should be taken according to the results of such studies.

(5) Harmony with ambient environment and scenery

Power facilities should be so designed as to ensure coordination with the development and scenery of streets, and not to give any adverse effect of waste heat from power facilities upon the surrounding environment.

(6) Effect of installation of power facilities upon historical and cultural assets

Any site of power facility should be so selected and routed as not to cause any damage to important historical and cultural assets.

(7) Environmental impact during construction work

(a) Any land to be leased for temporary and other work should be confirmed to be restored to initial conditions after completion of the work.

(b) Countermeasures for preventing traffic obstruction

Sufficient measures should be taken to prevent traffic obstruction during excavation of roads, cable laying and other work.

Furthermore, the overhead line work should be carried out by raising and tensioning the line up to a specified height, so that prevention of troubles to the traffic and safety of work can be confirmed.

(c) Water pollution due to foundation, underground cable duct and other work

Adequacy of treatment of muddy water should be ascertained.

Cares should also be taken on land subsidence caused by drawing of groundwater.

(d) Countermeasures for reducing noise and vibration

For reducing noise and vibration during the work, countermeasures should be taken into account adoption of low noise work method, restriction of nighttime work and so forth.

The impact of interferences of static and electromagnetic induction upon human body, and countermeasures for environment with substations are presented herein below.

8.2 Environment Impact Assessment Study Pertaining to Overhead Subtransmission Line

8.2.1 Environment Impact Pertaining to Overhead Subtransmission Line in MEA

Since the majority of subtransmission lines are located in city areas and along roads, any house located under or on the side of subtransmission lines is susceptible to interferences of electrostatic induction, electromagnetic induction and so forth. Among these, the interference due to electrostatic induction is caused by instantaneous discharge current when any person has touched a charged body exposed to electrostatic induction and is said to cause any danger to human body. Although the house, fence, bow window and other structures can possibly be charged, it is possible to prevent charging by providing an earth system.

The environmental problems caused by overhead subtransmission lines of MEA are as described below:

(1) Wind howling sound

Although the aboveground height of overhead subtransmission line ranges from 8 to 20m and there are houses adjacent thereto, there is few complaints about wind noise at normal wind velocity so that any problem has not been raised.

(2) Corona noise

Because of the transmission voltages of 69 kV and 115 kV, any problem has not been raised except in the section using particularly small size conductor.

(3) Electrostatic induction interference

In case the aboveground height of subtransmission line is 8 m or over, the electrostatic induction interference does not cause any particular problem. As the results of measuring the electrostatic induction voltage to existing power facilities are presented in the table below, there will be no particular problem.

Fig. 8.2-1 to 8.2-4 show the results of electrostatic induction analysis.

Measurement of electrostatic induction voltage
(aboveground 1m point)

(Unit: kV/m)

Voltage (kV)	Number of Circuits	Phasing Arrangement*	Aboveground Height (m)		
			6	8	10
69	1	———	0.9～1.4	0.5～0.9	0.4～0.6
	2	Superbundle	1.5～2.3	1.0～1.5	0.7～1.0
115	1	———	1.7～2.5	1.0～1.6	0.7～1.1
	2	Superbundle	2.8～4.0	1.9～2.6	1.4～1.9

Note: * Phasing arrangements for double-circuit line are classified into the following two types, which were excepted from "EPRI Transmission Line Reference Book 345kV and Above/ Second Edition".

A o o A
B o o B "Superbundle "
C o o C

A o o C
B o o B "Low Reactance"
C o o A

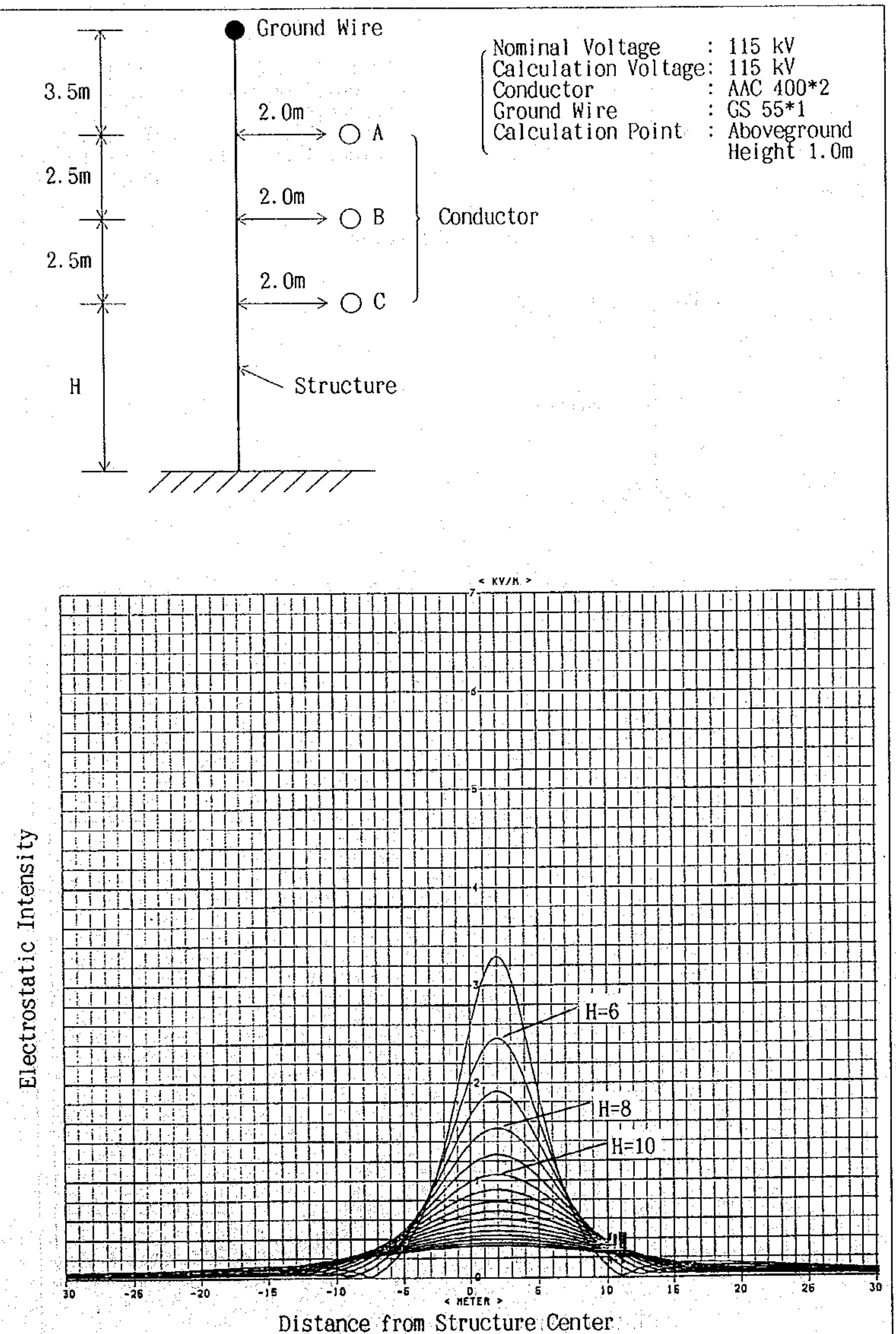


Fig. 8.2-1 Electrostatic Induction Analysis of Overhead Transmission Line (115kV 1ckt)

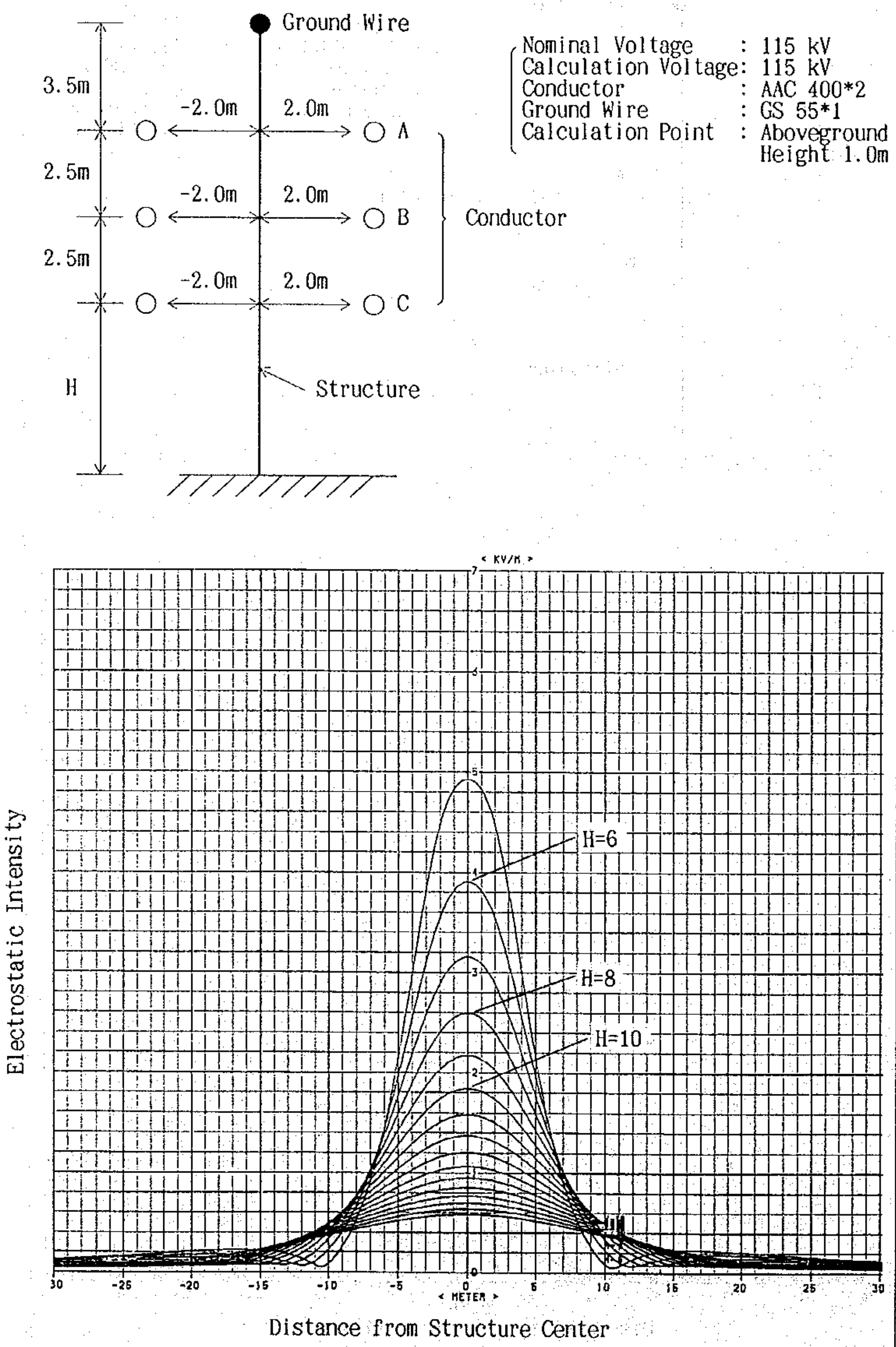


Fig. 8.2-2 Electrostatic Induction Analysis of Overhead Transmission Line (115kV 2ckt)

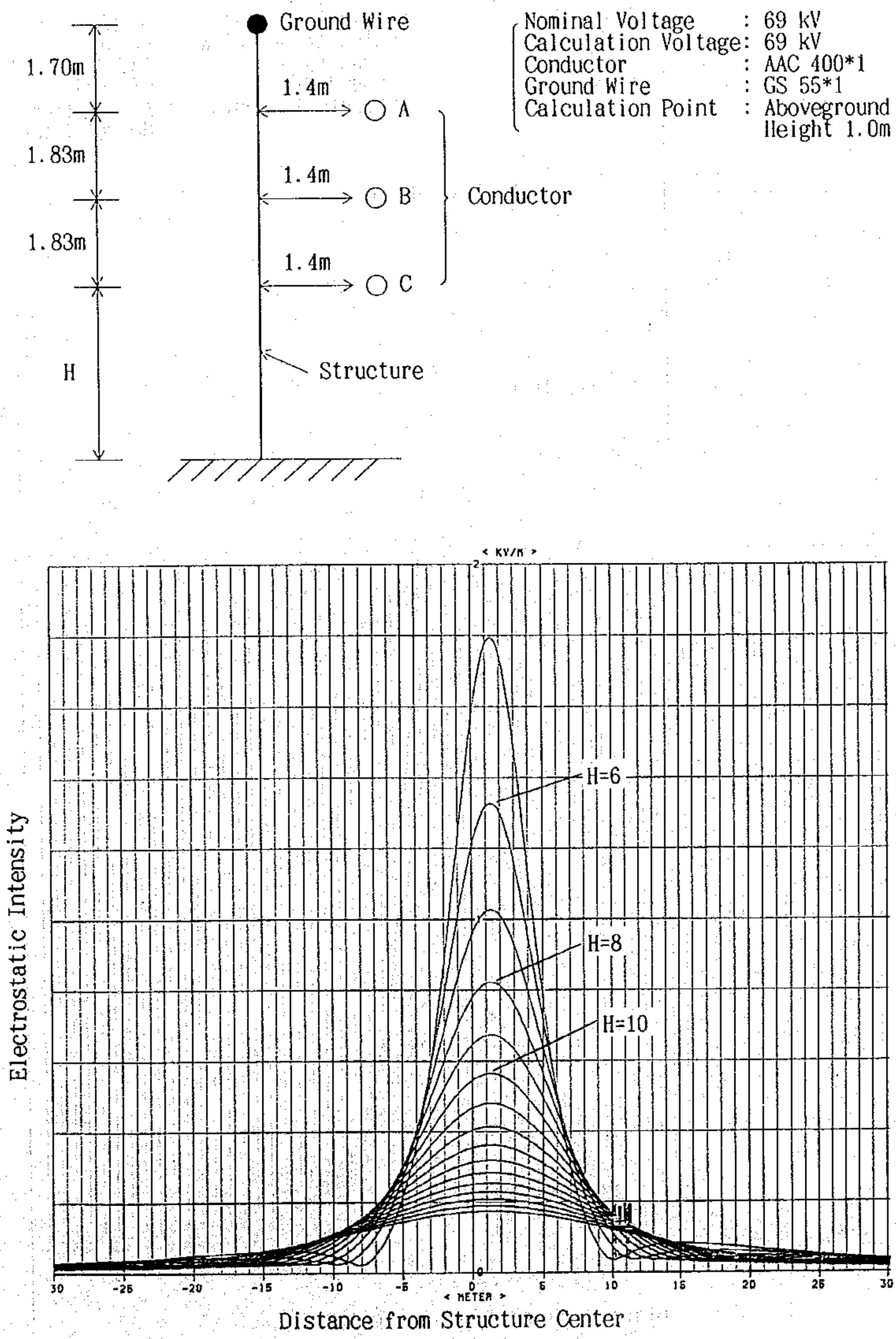


Fig. 8.2-3 Electrostatic Induction Analysis of Overhead Transmission Line

(69kV 1ckt)

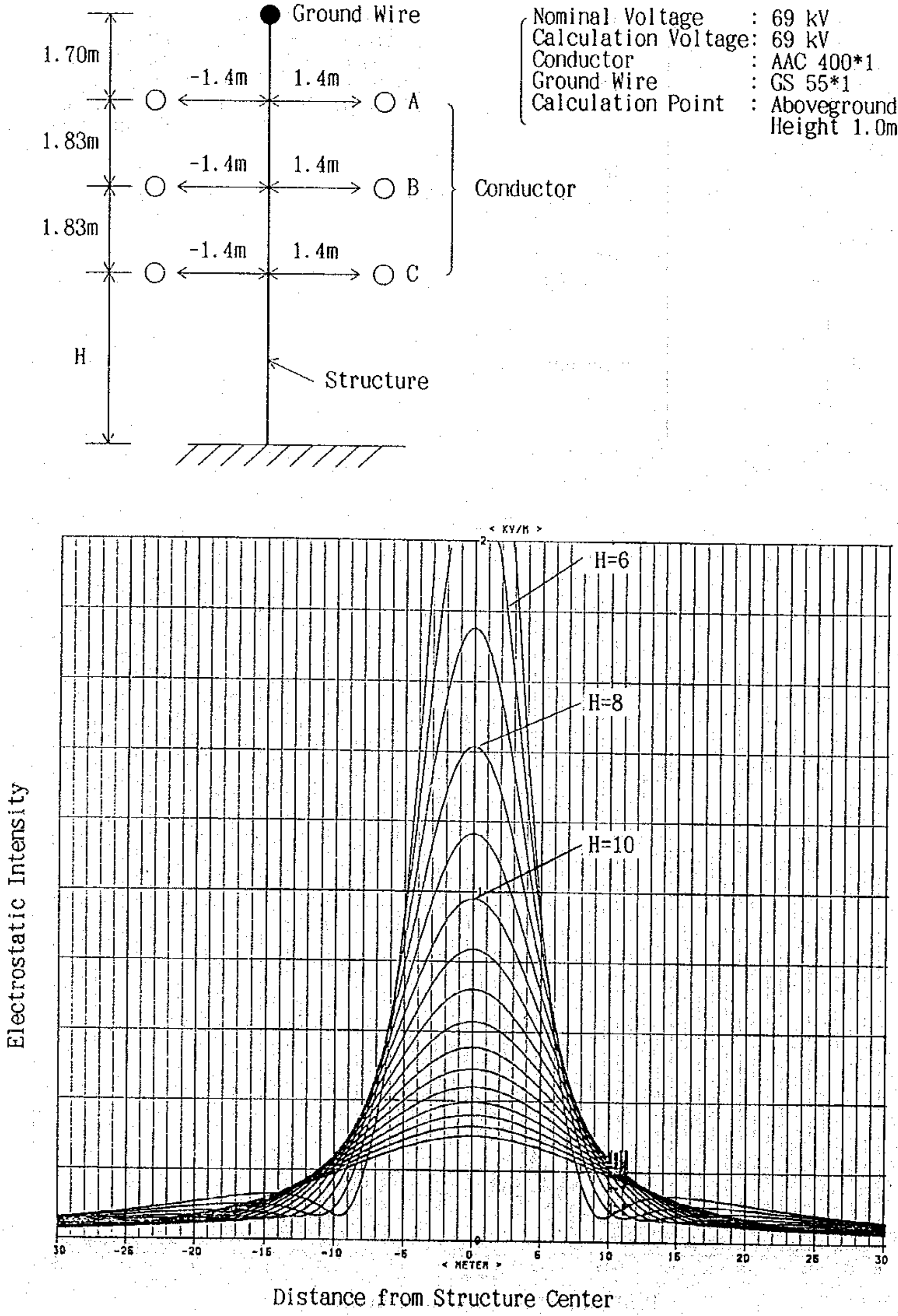


Fig. 8.2-4 Electrostatic Induction Analysis of Overhead Transmission Line (69kV 2ckt)

(4) Electromagnetic induction interference

The electromagnetic induction interference is apt to occur in case 115 kV, 69 kV subtransmission line, primary line, secondary line which are solidly grounded line are installed together on the same support. However, any particular claim has not been raised so far regarding electromagnetic induction interference.

(5) EMF (Electromagnetic induction)

Regarding the EMF, the voltage is so low that there will be no particular problem.

(6) Safe Clearance from Overhead Subtransmission Line

Under this Study, the minimum safe clearance from overhead subtransmission line is recommended for the MEA's 69 kV, 115 kV and 230 kV systems in view of the impact upon human body, electrostatic induction, electromagnetic wave and so forth as listed follows:

(Unit: m)

Other Works	Conductor Temperature (℃)	Voltage (kV)			Remarks
		69	115	230	
Aboveground height (city area)	75	8.5	9.0	9.5	
Aboveground height (other areas)	75	7.5	8.0	8.5	
Aboveground height of highway	75	10.5	11.0	11.5	
Aboveground height of general road	75	8.5	9.0	9.5	
Aboveground height of railway	75	10.5	11.0	11.5	
Height from river water level	75	16.0	17.0	18.0	
Height from canal water level	75	10.5	11.0	11.5	
Separation from primary line	75	3.0	3.5	5.0	
Separation from secondary line	75	3.0	3.5	5.0	
Separation from telecommunication line	75	3.5	4.0	5.0	
Separation from trees	75	3.5	4.0	5.0	
Separation from buildings	75	5.5	6.0	6.5	

8.2.2 Present Situations of Environmental Impact Assessment Study Pertaining to Overhead Subtransmission Line in Japan

Although the impact of subtransmission line upon the environment thereunder has been studied by the World Health Organization and International Commission on Radiological Protection (IRPA), the research results concluded so far on electrostatic induction, electromagnetic wave and other interferences are as described below.

(1) Electrostatic Induction

The phenomenon of electrostatic induction under subtransmission line refers to that wherein static electricity flows when a person has come into contact with metal under the line, and the larger the value, the more uncomfortable.

The occurrence source of static electricity is largely classified into the electric field existing in the natural world and the artificial electric field arising from subtransmission line, etc.

(a) The scale of electric field existing in the natural world is as follows:

Classification	Source of Electric Field	Electrostatic intensity (kV/m)	Sources
Natural	Ground surface at fine weather	0.1	[1]
	Ground surface at lightning and cloudy weather	3 - 20	[1]
Artificial	City area under the line	0.1 - 3	[2]

Source: [1] WHO (World Health Organization of the United Nations) Report

[2] Situations of subtransmission line facilities in Japan (Situations of facilities of the respective power companies)

(b) The limit values related to subtransmission line is as follows:

Categories	Source of Electric Field	Electrostatic intensity (kV/m)	Sources
Japan	City area Mountainous area	3 5	[1]
Other countries	City area Mountainous area	5 - 6 9	[1]
WHO's environmental health standard		10	[2]
Tentative guideline of IRPA	Worker Public	10 5	[3]

Source: [1] Situations of subtransmission line facilities in Japan

(Situations of facilities of the respective power companies)

[2] WHO Report

[3] IPRA Report

(2) Electromagnetic Field (EMF)

(a) The scale of the electromagnetic field existing in the natural world is as follows:

Classification	Source of Electromagnetic Field	Electromagnetic Intensity (gauss)	Sources
Natural	Natural electromagnetic field of globe	0.3	[1]
Artificial	Hair dryer Vacuum cleaner TV set Under the line	0.02 - 0.5 0.02 - 0.2 0.01 - 0.02 0.001 - 0.2	[2] [3] [3] [4]

Source: [1] Ground surface

[2] 3cm measurement position in the Report of the Agency of Natural Resources and Energy

[3] 30cm measurement position in the Report of the Agency of Natural Resources and Energy

[4] Ground surface;

Situations of subtransmission line facilities in Japan

(Situations of facilities of the respective power companies)

(b) The limit values related to subtransmission line is as follows:

Categories	Source of Electromagnetic Field	Electromagnetic Intensity (gauss)	Remarks
Japan	City area Mountainous area	0.2	[1]
Other countries	City area Mountainous area	- -	
WHO's environmental health standard (WHO Report)		50 5	[2] [3]
Tentative guideline of IRPA (IRPA Report)		5 1	[4] [5]

Note: [1] Situations of subtransmission line facilities in Japan (Situations of facilities of the respective power companies)

[2] Free from harmful biological impact

[3] Free from any biological impact

[4] Value for employee under continuous conditions

[5] Value for general people under continuous conditions

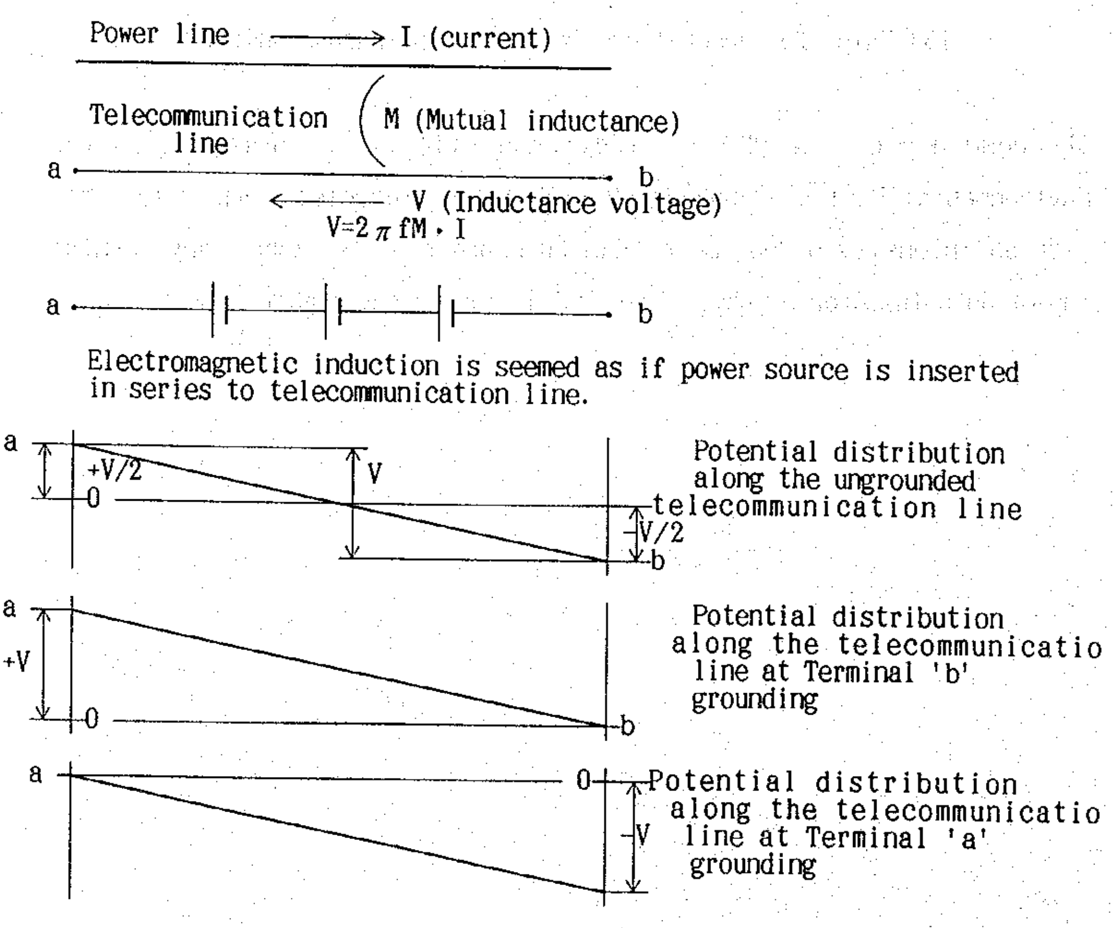
The comments of the WHO on electromagnetic field indicates in the Environmental Health Standards 69 (1987) that the electromagnetic field with an intensity of not more than 50 gauss does not cause any harmful impact upon the growth, physiology and action of any higher animal.

8.3 Electromagnetic Induction

(1) General

When there is any telecommunication line adjacent to a power line, the magnetic flux generated by the current flowing in the power line will intersect with the telecommunication line and cause induction of voltage. The induced voltage is changed depending on the number of magnetic fluxes intersecting with the telecommunication line, namely, the mutual inductance between both of the lines, current and frequency in the power line.

The electromagnetic induction voltage is generated in such a form as the voltage is applied in a longitudinal direction of the telecommunication line and causes a danger to telecommunication line worker and equipment. Moreover, such induction voltage causes a noise problem when the electrical balance between the telecommunication line and ground.



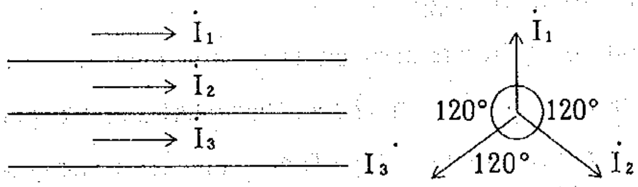
Concept of electromagnetic induction

(2) Electromagnetic induction to telecommunication line from subtransmission line

(a) Mechanism of electromagnetic induction

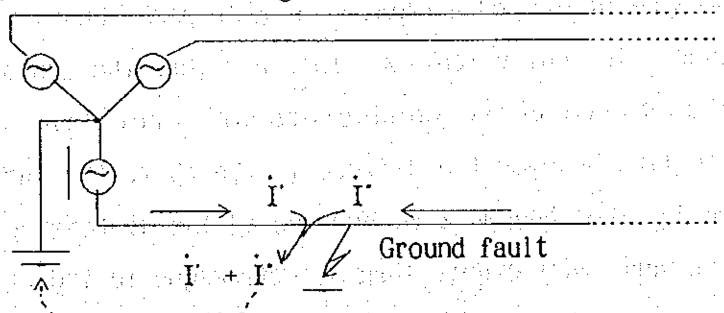
The phenomena of electromagnetic induction to telecommunication line from subtransmission line are illustrated in the figure as follows:

1) Induction due to normal load current



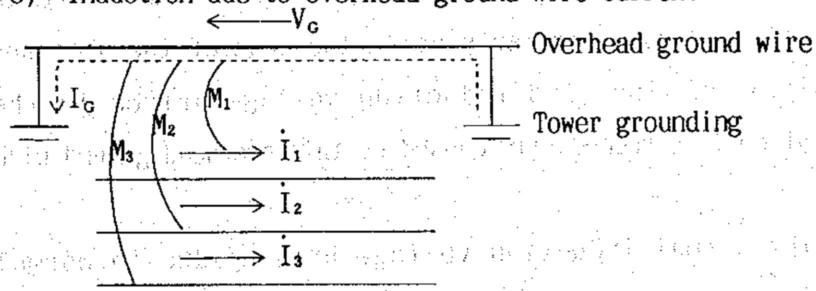
Since $\dot{I}_1 + \dot{I}_2 + \dot{I}_3 \fallingdotseq 0$ no induction occurs.

2) Induction due to ground fault current



In the case of solidly grounding system, one circuit will be short-circuited due to ground fault and extremely large current flows.

3) Induction due to overhead ground wire current



$$\dot{V}_G = \omega M_1 \dot{I}_1 + \omega M_2 \dot{I}_2 + \omega M_3 \dot{I}_3$$

$$\dot{I}_G = \dot{V}_G \,/\, \text{(Ground return circuit impedance in overhead ground wire)}$$

where $\dot{I}_G$ Inducing current

<u>Electromagnetic induction due to subtransmission line</u>

(b) Electromagnetic induction voltage

1) Normal induction noise voltage

This is a kind of noise interference with telecommunication line arising when the harmonics component contained in subtransmission line phase current has been induced. This interference is caused by inverter load, fluorescent lamp, electric railway, chemical plant and other DC loads, transformer charge current and so forth.

2) Normal induction longitudinal voltage

During normal conditions of subtransmission line, the currents in the respective phase conductors remain in three-phase balanced circuit, and its vector sum is nearly zero. Therefore, any electromagnetic induction will not take place under normal conditions. Where the telecommunication line is located extremely close to power line as in the case of attached telecommunication line, however, the distance between the respective phase conductors of power line and telecommunication line becomes too different. So that, the three-phase vector sum does not become zero because of the difference in mutual inductance, and considerably large electromagnetic induction voltage arises even under normal conditions. In the case of subtransmission line with overhead ground wires, moreover, the ground return circuit current flows in the overhead ground wire due to induction voltage caused similarly as in the case of the attached telecommunication line, and induction voltage arises in the telecommunication line secondarily caused by this overhead ground wire current.

Although this normal induction voltage arising due to normal subtransmission line load current is not so large as to cause a danger to equipment and human body, it causes noise generation when the equilibrium of telecommunication line is low.

3) Abnormal longitudinal induction voltage

When a ground fault has occurred in subtransmission line, then a ground return circuit current will flows to the fault point from power station and substation, and a voltage is induced to telecommunication line. The ground return circuit current at the time of fault in subtransmission line is comparatively small in the case of high resistance grounded neutral system and reactor grounded neutral system. At the time of ground fault in the solidly grounding system, however, an extremely large ground fault current will flow and cause generation of high induction voltage in telecommunication line normally for about 0.06 - 2 sec. until the circuit breakers in power station and substation have been operated.

This abnormal longitudinal induction voltage is so high as to cause a danger of damage to telecommunication line workers, burning of telecommunication line, dielectric breakdown and other troubles in some cases.

(3) Limit value of induction voltage

In many cases, the limit value of induction voltage is determined according to the extent of danger to human body caused by the voltage induced into telecommunication line mainly at the time of faults in transmission line, etc. Currently, the limit values are studied by such international organizations as the CCITT (renamed on March 1, 1993 to " ITU-TS: International Telecommunication Union Telecommunication Standardization Sector), CIGRE (Inter-national on Large Electric Systems) and so forth. Moreover, the criteria for determining and evaluating the danger to human body of voltage induced into telecommunication line were reported in IEC479-1 (1984), etc.

The present limit values of electromagnetic induction voltage in major countries are as presented in Table 8.3-1.

(4) Countermeasures for eliminating electromagnetic induction interference

(a) Countermeasures on the subtransmission line side

The overhead ground wire of subtransmission line is effective for reducing the electromagnetic induction interference called a shielding effect contrarily in the case of normal induction, and the higher the conductivity of material, the more effective. In the case of extra-high voltage (EHV) transmission line, therefore, two high conductivity overhead ground wires are provided for reducing the induction interference. Thereby, roughly 50% of reduction effect can be attained.

(b) Countermeasures on the telecommunication line side

Generally, the countermeasures on the telecommunication line side are largely classified into a shielding system through adoption of aluminum sheathed cable (ALS) and underground cable (metal conduit), change of line route, installation of shielding coil, and an arrester system through installation of arresters on telecommunication lines.

Although the shielding system is effective for reducing induction not only at the time of fault but also that at normal conditions (elimination of noise), this system is higher in cost than the arrester system. Whereas, although the countermeasure based on the arrester system is lower in cost than the shielding system, this system is not effective for normal induction.

Table 8.3-1 Present limit values of electromagnetic induction voltage in major countries

		Japan	Belgium, Germany, UK, Sweden, Spain, Hungary, former Czechoslovakia	1) Australia 2) Poland
Present situations	Limit value	1) 430V, 0.1sec. 2) 650V, 0.06sec.	650V, 0.2sec. (Max. 0.5 sec.)	1)1,500V, 0.35sec. 2)1,000V, 0.3sec.
	Counter-measures	Shielding system (Screened conductor cable, metal conduit, etc. are used)	Arrester system (Shielding system is used partly in Belgium, Germany and Hungary)	Arrester system (Shielding system is used partly in Poland)
	Set year	1)1961, 2)1993	1954	1)1975, 2)1984
	Remarks		The recommended values of CCITT are accepted.	

8.4 Environmental Countermeasures Pertaining to Substation

(1) Noise countermeasures

In Thailand, any concrete noise level control value does not seem to have been established based on the Noise Control Act. In the case of construction or expansion of substations in the near future, however, it will be required to take appropriate countermeasures for lowering the substation noise level to not higher than the noise control standards in the corresponding area according to the Noise Control Act to be set forth. Since the substation equipment and facilities excluding transformers are installed indoor according to the present design criteria of MEA, it is possible to restrict propagation of noise to outside. However, countermeasures should be taken for reducing the noise level from transformers installed outdoors. The noise level from distribution substation transformers is specified to be not higher than 77dB (OFAF base). Although this value is roughly equal to that designated in the international standards for transformers, but differs from the specification for so-called low noise transformer. In the case of TEPCO, for reference, the noise levels from outdoor and indoor distribution transformers are specified to be not higher than 50dB and 60dB, respectively. Therefore, the substation noise level has been lowered by adopting low noise transformers equipped with sound insulation tank and low noise cooling equipment.

(2) Vibration countermeasures

Similarly as in the case of noise problem, any vibration control value does not seem to have been specified based on the Vibration Control Act in Thailand. In preparation for construction or expansion of substation when the Vibration Control Act is set forth, it will be required to take countermeasures as appropriate to lower the vibration level of substation equipment to not higher than te standard control value in the corresponding area.

(3) Harmony with environment

In studying construction or expansion of substations, it will be important to promote conservation of surrounding natural environment by gardening, tree-planting, construction of retarding basin and regulation pond and promote coordination with regional society by sufficiently taking into account the right of light, improvement of natural beauty and living environment, prevention of electromagnetic wave interference and so forth.