

BAB V

KESIMPULAN

1. Penggunaan jalur frekwensi untuk 3,5 Ghz pada komunikasi *radio link* telah memenuhi persyaratan yang ditetapkan Dirjen Postel.
2. Hasil *Fresnel Zone* untuk 3,5 Ghz menunjukan tingkat LOS yang lebih baik.
3. Besarnya daya penerimaan (*receive signal level*) yang diterima lebih besar batas minimum daya penerimaan (*Power Threshold*) yang dipersyaratkan sebesar -88dBm, maka sinyal yang diterima lebih baik.
4. Kualitas dari sistem sangat baik karena pada BER 10^{-6} besarnya *Eb/No* standar untuk modulasi 4 QAM adalah 10,6 dB maka untuk *Eb/No* 29,427 dB quantities BER akan lebih kecil.
5. Nilai probabilitas putus hubungan (*outage*) yang telah analisis lebih kecil dari yang di persyaratan yaitu sebesar 0,01 %, maka kehandalan sistem lebih baik dari yang diharapkan.
6. Untuk mentransmisikan Bit Rate dengan kecepatan 2×2 Mbps diperlukan *Bandwidth* sebesar 2,05Mhz dari hasil analisis.
7. Pada sistem PCM dengan nilai BER 10^{-6} untuk sistem modulasi digital 4 - QAM diperoleh hasil analisis untuk S/N sebesar 24,1 dB. Hasil tersebut lebih besar dari signal carrier to noise 13,6 dB (diambil dari tabel performansi modulasi untuk BER 10^{-6}) sehingga signal yang diperoleh lebih baik

DAFTAR PUSTAKA

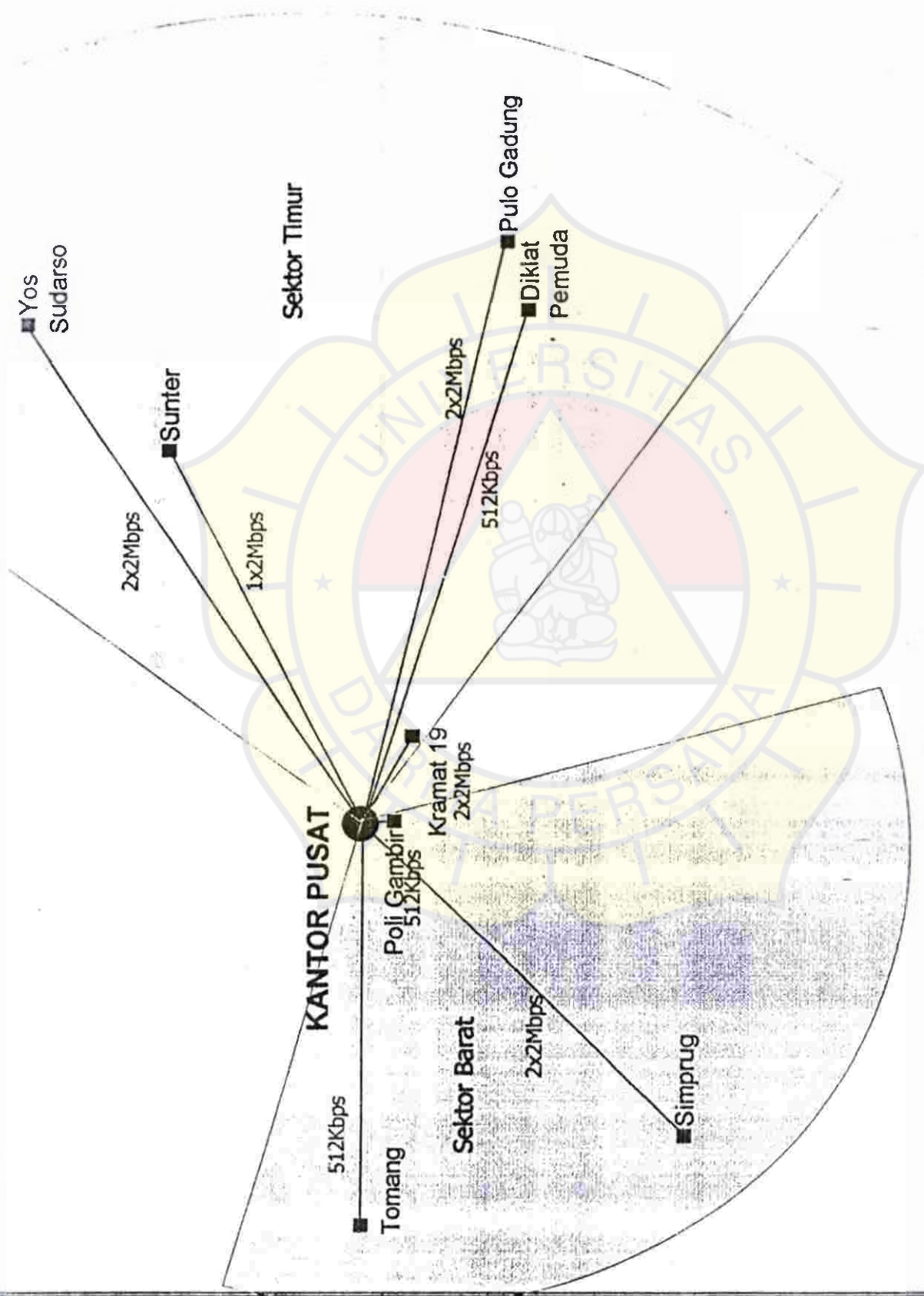
1. Tomasi Wayne, "Advanced Electronic Communication System" third edition, Prentice Hall, 1994
2. Freeman Roger L, "Telecommunication Transmission Hard Book" third edition, Jhon Wiley & Son, 1996
3. Freeman Roger L, "Telecommunication System Engineering Analog and Digital Network Design" third edition, Jhon Wiley & Son, 1996
4. Gouzali Saydam Drs, BC, TT, "Prinsip Dasar Teknologi Jaringan Telekomunikasi", Angkasa, Bandung, 1997
5. Suhana Ir, "Buku Pegangan Teknik Telekomunikasi", PT Pradnya Paramitha, Jakarta, 1991
6. Mischa Schwartz, "Transmisi Informasi, Modulasi dan Bising", Penerbit Erlangga, Jakarta, 1986
7. NEC Corp, "Instruction Manual Pasolink Digital Radio yatem", 2001

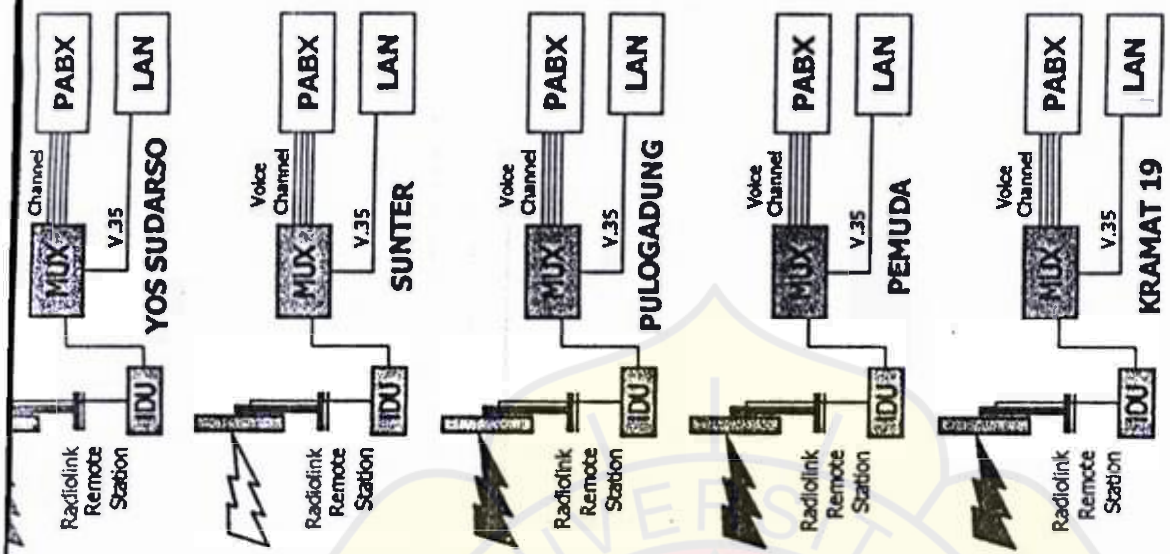
LAMPIRANI



LAMPIRAN II



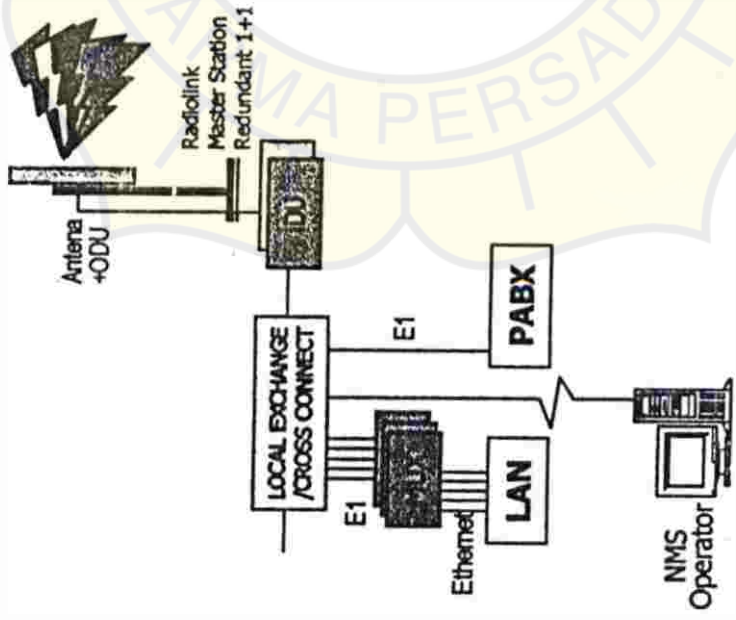




Bandwidth @ :

- 2x2Mbps
- 1x2Mbps
- 2x2Mbps
- 512Kbps
- 2x2Mbps

Sektor Timur



LAMPIRAN III



SECTOR ANTENNA

Directional

Vertical Polarization

SEC 35-90-16 V

High Gain Series

Patented Model

16 dBi
3.4-3.6 GHz

RFS Vertical Sector High Gain Antennas are cost-effective products for wireless telecommunications in many systems. (WLL applications)

SEC 35-90-16 V is the designation for sectorial antennas in 3.4 - 3.6 GHz frequency range single vertically polarised.

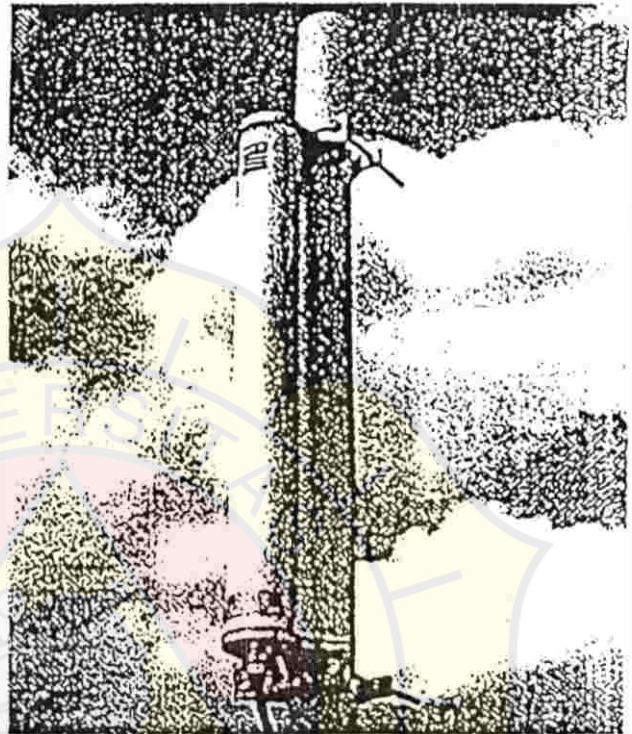
Offers advantageous radioelectrical characteristics in 3.4-3.6 GHz band :

- Azimuth sector size (-3dB) 90°.
- Gain 16 dBi.
- Good rear protection
- Low VSWR

This antenna is totally protected by a plastic enclosure, guaranteeing correct operation in the harshest conditions.

The metal parts of the antenna including the mounting are DC grounded.

The size and its lighthness insure very fast and easy installation on standard tubes from 48 to 114 mm.



Electrical Specifications

Frequency range	3.4 to 3.6 GHz
Return loss (return loss)	< 1.5 (14dB)
Gain	> 16 dBi
Polarization	Vertical
Azimuth sector size (-3 dB)	90° (± 5°)
Half beamwidth (-3 dB)	6.5°
Front-to-back ratio	30 dB
Isolation discrimination	20 dB
Power rating	50 W
Connector (standard)	N-Female

Mechanical Specifications

Material of the antenna	Aluminium alloy
Material of the mount	Hot Galvanized Steel
Material of the radiating element	Printed circuit
Height of the antenna	570 mm
Antenna weight	3.5 kg
Wind in operation	165 km/h
Survival wind (with 30 mm radial ice)	250 km/h
Operating temperature	-40 to +60°C
Standard colour	White
Standard mount	48 to 114 mm

Options

- Termination 7-16 Female: Ref. 35-01
- Mechanical fit: Ref. 35-02

Technical Data Sheet ; SEC 35-90-16 V

Catalog: 3.5 GHz

Issue : 1.0

France

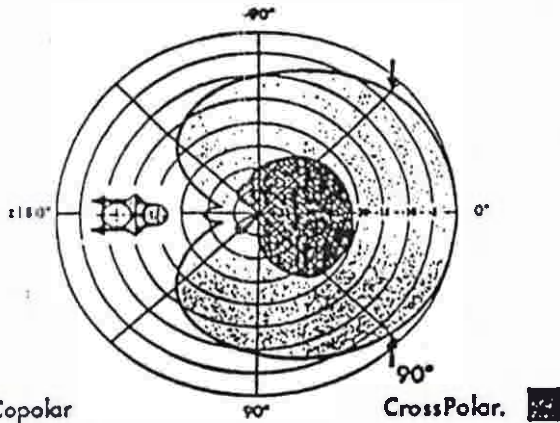
FREQUENCY SYSTEMS France

95871 BEZONS Cedex Tel: 01.34.23.62.00 Fax : 01.34.23.63.24
95871 BEZONS Cedex Tel: 02.40.45.93.45 Fax: 02.40.90.41.43

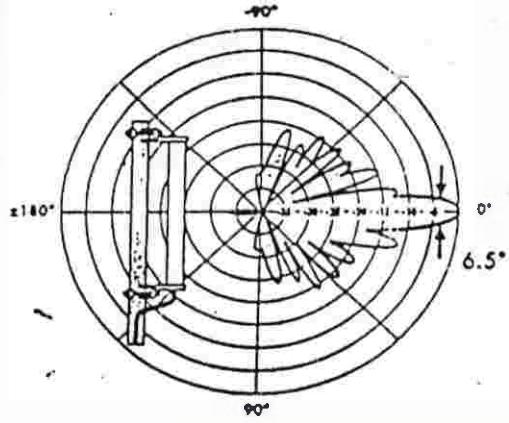


P.T. JASNIKOV. GENP

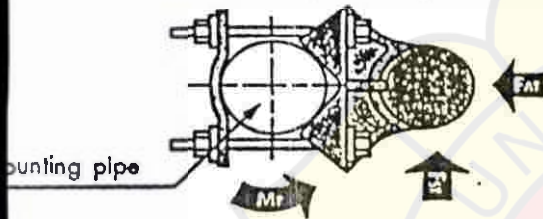
SEC 35-90-16 V Azimuth Radiation Pattern



SEC 35-90-16 V Vertical Radiation Pattern

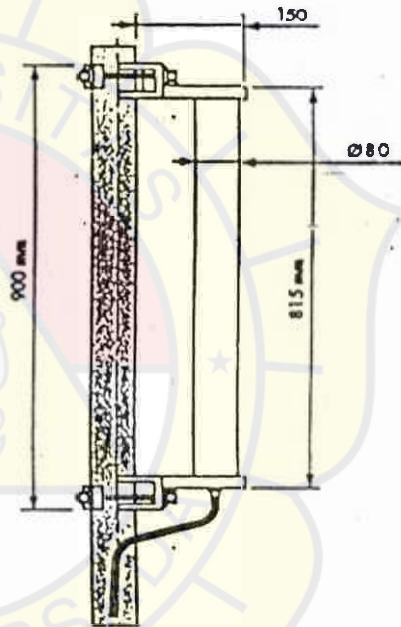


SEC 35-90-16 V Forces & twisting moment due to wind



Calculation Forces & twisting Moment results				
Pipe diameter (mm)	Ø 48		Ø 114	
Wind velocity (km/h)	110	200	110	200
Wind velocity (m/s)	31	56	31	56
Max. FAT (N)	28	93	28	93
Max. Ft (N)	28	93	28	93
Max. Mt (Nm)	3	10	4	14

SEC 35-90-16 V (side view) Mounting interface & external dimensions

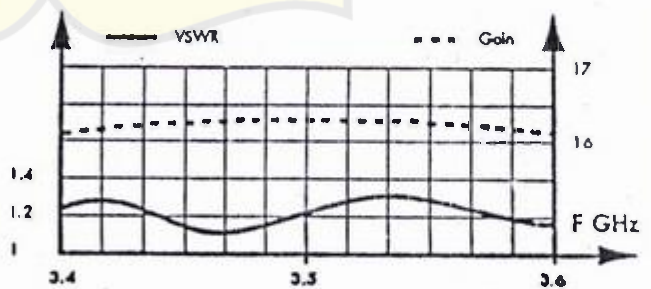


Shipping (standard) 1 antenna

Shipping mode	Reinforced cardboard
Individual shipping	: 92 x 17 x 17 cm (LxWxH)
Volume	: 0.03 m ³
Gross weight*	: 4.0/4.7 kg Net weight : 3.5/4.2 kg
Export packing	: On request

* weight standard / weight with 100 option

Typical Gain & VSWR Curves



France

FREQUENCY SYSTEMS France
 Lez-Jaurès BP 20 95871 BEZONS Cedex Tel: 01.34.23.62.00 Fax: 01.34.23.63.24
 Le Trignac: rue Maréchal 44570 TRIGNAC Tel: 02.40.45.95.45 Fax: 02.40.90.41.43



PT. JASNIKOM, GEMANUS.A



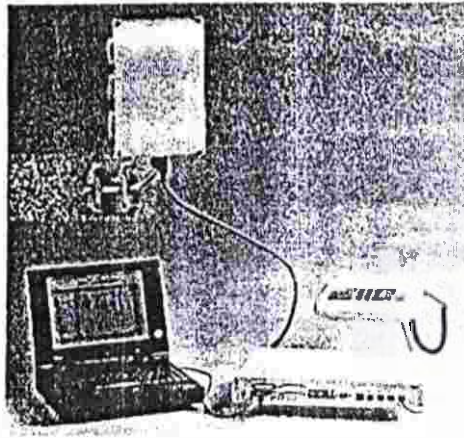
LAMPIRAN IV



M Broadband Radio

Main Applications

- Access network for residential and business users
- ATS to BSC connection
- LAN Extension/Distribution
- PABX interconnection
- Wireless backup of existing data network



TECHNICAL SPECIFICATIONS

Multiple access scheme	TDM/TDMA				
Duplex scheme	FDD				
Frequency bands (GHz)	2.2(*)	2.4	3.5	10	25
TX/RX duplex frequencies (MHz)	17.5	94 or 73	100 or 50	350	1008
Channel spacing	3.5 MHz to 7MHz per channel				
Capacity	16xE1 per Cell				
Number of subscribers per MRU	up to 480				
Output power	up to +29 dBm				
Modulation	4QAM with FEC				
Receiver sensitivity @10 ⁻⁶	down to -94 dBm → 1F-L				
Maximum input level	-30 dBm → R-L				
Frequency stability	better than ± 2 ppm				
Signalling	V.5, 1, V.5, 2, CAS				

↳ 3.5 + 100 = 3.6 GHz

MASTER RADIO UNIT

Network Interfaces	2Mbit/s, G.703, G.704 (framed/unframed), 10 BaseT, V35/V36, 2W analogue
Protection scheme	1+1 hot stand-by
Power consumption	max 120 W
Power supply	3.6 + 72VDC
ODU-ODU interconnection	E2 (8448 kbit/s); maximum cable length: 200 m
Mechanical dimensions (W x H x D)	ODU 350x418x300 mm IDU 448x249x260 mm

PERIPHERAL RADIO UNIT

Available User Interfaces (*)	POTS, ISDN, E1, Nx E1, Nx64 kbit/s, 64 kbit/s G.703
Available User Interfaces (**)	V.35/V.36, V.24/V.28, 10 BaseT
Power consumption	7 +25 W
Power supply	18 + 45 VDC or 25 + 72 VDC
Mechanical dimensions (W x H x D)	184x286x98 mm

Full indoor version only
Full outdoor PRU
Split PRU

CE



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LAMPIRAN V



CROWAVE DIGITAL RADIO PATH CALCULATION

Customer:	Pertamina	Project:	Interoffice
Equipment Type:	SM	Capacity:	2x2 Mbps
Configuration:	PMP Broadband Radio	Mid Freq:	3,5 GHz
Transmit Power:	27 dBm	Rx Threshold	-88,0 dBm (at BER 1E-6)
Names:	Kantor Pusat Pertamina	-	Kantor Bid. Perkapalan Yos Sudarso
Latitude: (S)	06° 10' 31" dms		06° 07' 27" dms
Longitude: (E)	106° 49' 55" dms		106° 53' 34" dms
Bearing:	- Deg.		- Deg.
Path Length:			8,67 Km
Antenna elevation:	3 mtr		1 mtr
Antenna height:	105 mtr		47 mtr
Free Space Att.:		-122,09 dB	} 125,65
Absorption Loss:		0,06 dB	
Diff. Terrain Loss:		1,0 dB	
C.U. Loss:		2,5 dB	
Antenna Types:		Belden	Belden
Antenna Att./100m:		36,40 dB ✓ +2,1	36,40 dB ✓
Antenna Length:		1,5 mtr + 1,50 m	1,5 mtr ✓ + 30 mtr
Antenna Att.:		0,55 dB ✓	0,55 dB ✓
Coil & Conn. Loss:		0,5 dB ✓	0,5 dB ✓
Accessories Loss:		1,0 dB	
Antenna Size:		90° mtr	integrated mtr
Antenna Gain:		15,00 dBi ✓	14,00 dBi ✓
Total Gain:		56 dB	
Total Loss:		128,75 dB	
Received Signal Level:		-72,75 dBm	
Threshold Level:		-88,0 dBm	
Sustained Fade Margin:		15,25 dB	
Form factor:		0,5	
Rain factor:		1,0	
Sustained Outage:		2,04E-05	
Outage objective :		1,00E-04	99,99 % = min.value
Min Fade margin required:		-8,4 dB	
Signed Margin (Calc.-Min.value):		-6,9 dB	
Reliability Non-diversity:		<u>99,99795913</u> % <-----	Good
Outage Time Non-Diversity in sen/yr:		-643,6	

100 = ...

 PT. JASNIKOM.GEMANUSA

LAMPIRAN VI



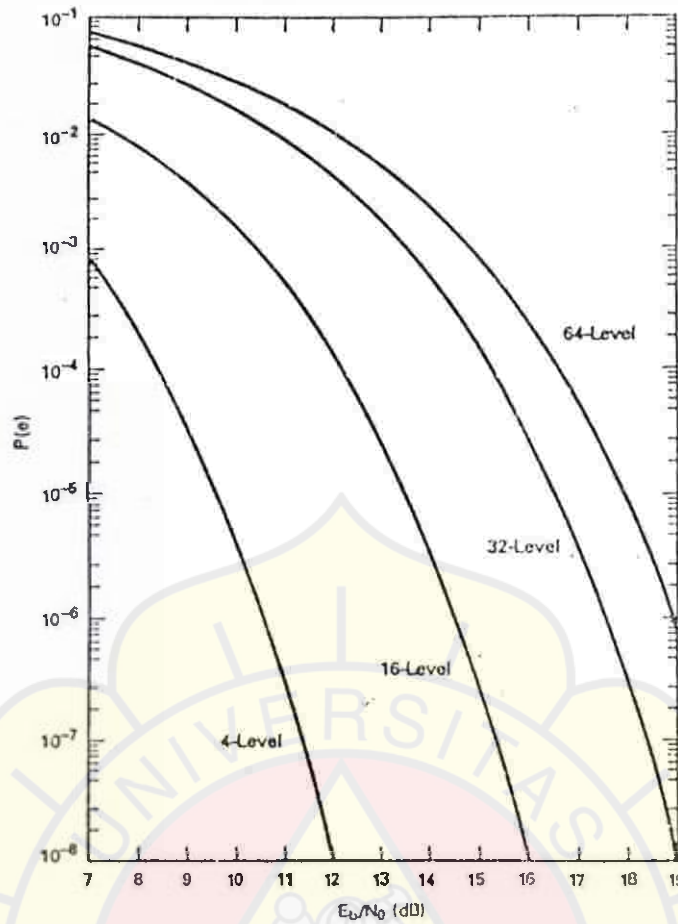


Figure 1-43 Error rates of QAM modulation systems.

The probability of error for coherent FSK is

$$P(e) = e^{-\frac{E_b}{N_0}} \quad (1-26)$$

TABLE 1-3 PERFORMANCE COMPARISON OF VARIOUS DIGITAL MODULATION SCHEMES (BER = 10^{-6})

Modulation technique	C/N ratio (dB)	E_b/N_0 ratio (dB)
BPSK	10.6	10.6
QPSK	13.6	10.6
4-QAM	13.6	10.6
8-QAM	17.6	10.6
8-PSK	18.5	14
16-PSK	24.3	18.3
16-QAM	20.5	14.5
32-QAM	24.4	17.4
64-QAM	26.6	18.8



MEMORANDUM

Kepada : Sesuai Distribusi
Dari : Manajer Senior Teknologi Informasi
Direktorat Pengembangan

No.: 416/100300/2001- S0

Jakarta, 19 Oktober 2001

Lampiran : 1 (satu) berkas
Perihal : Hasil Pembahasan Telsus dan Penataan Frekuensi PERTAMINA

Bersama ini disampaikan hasil pembahasan Telekomunikasi Khusus (Telsus) dan Penataan Frekuensi antara PERTAMINA dengan Ditjen. Posel yang dilaksanakan di Bandung pada tanggal 28 September s/d 4 Oktober 2001 dengan hasil antara lain sebagai berikut :

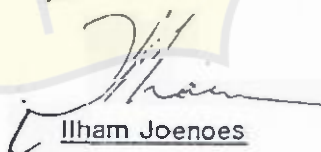
1. Kesepakatan hasil inventarisasi dan klarifikasi sistem Telekomunikasi Khusus PERTAMINA dan 11 KPS
2. Kesepakatan hasil inventarisasi dan klarifikasi penggunaan frekuensi radio di PERTAMINA dan 11 KPS
3. Rekomendasi tindak lanjut bagi Penyelenggaraan Telekomunikasi Khusus dan Perijinan Frekuensi.

Mengacu pada Berita Acara yang telah ditanda tangani (terlampir) oleh pihak Ditjen. Posel dan PERTAMINA, selanjutnya TI PERTAMINA Pusat sebagai pembina fungsi TI wilayah/unit PERTAMINA dan KPS, yang bertanggung jawab atas implementasi pelaksanaan ketentuan perundang-undangan sesuai UU Telekomunikasi No. 36 tahun 1999, mewajibkan kepada seluruh pengguna perangkat Telekomunikasi di wilayah/unit operasi PERTAMINA dan KPS agar hasil tersebut diatas digunakan sebagai pedoman/acuan dalam setiap pengoperasian, perencanaan penyelenggaraan jaringan Telekomunikasi PERTAMINA/KPS.

Dalam hal masih memerlukan kejelasan dan konfirmasi dapat menghubungi TI PERTAMINA Pusat.

Demikian disampaikan dan atas perhatiannya diucapkan terima kasih.

Manajer Senior Teknologi Informasi


Ilham Joenoes

Jembusan:

1. Direktur Pengembangan (sebagai laporan)
2. Manajer Pengelolaan TI
3. Manajer Pengembangan TI
4. Manajer Perencanaan TI
5. Manajer Pengendalian TI
6. Manajer Kelompok Konsultan TI

LAMPIRAN VIII



PERUSAHAAN PERTAMBANGAN MINYAK DAN GAS BUMI NEGARA
(PERTAMINA)

Projek Pertamina Interoffice Radio Link

BER Test Perwira -Yos Sudarso

SunSet E8 - S/N : 100484
Printed At : 2004-05-27 15:18:36
Version 1.03

YOS-STR-PT
RECORD : 0015
START TIME:2004-05-26 14:52:47
END TIME :2004-05-27 15:11:46

ET: 024:18:39 RT: CONTINU
FRM : UNFRM CLK SR:INTERN
RCV : 2047 XMT :2047
INPUT: TERM TEST R:2.048M
LINE 1 - SUMMARY
CODE: 0 RATE : 0.0E-12
CRC : N/A RATE : N/A
FE : N/A RATE : N/A
MFE : N/A RATE : N/A
BIT : 0 BER : 0.0E-12
EBIT: 0 EBER :
+RXLVL:-2.5 dB -RXLVL:-2.4 dB
Rx CLK:2048000 HZ/PPM: -0.0

ET: 024:18:39 RT: CONTINU
FRM : UNFRM CLK SR:INTERN
RCV : N/A XMT :N/A
INPUT: TERM TEST R:2.048M
LINE 2 - SUMMARY
CODE: 0 RATE :
CRC : N/A RATE : N/A
FE : N/A RATE : N/A
MFE : N/A RATE : N/A
BIT : N/A BER : N/A
EBIT: N/A EBER : N/A
+RXLVL:N/A -RXLVL:N/A
Rx CLK:N/A

ET: 024:18:39 RT: CONTINU
FRM: UNFRM COD: HDB3

LINE 1 - FREQUENCY
NEG 0 POS
NO LINE 2 REF SIGNAL

RCV/hz: 2048000 CKSLIP: N/A
MAX/hz: 2048000 +WANDR: N/A
MIN/hz: 2047999 -WANDR: N/A

ET: 024:18:39 RT: CONTINU
FRM: UNFRM COD: HDB3
RCV: 2047 XMT: 2047