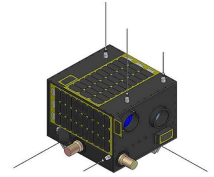


Rattlegram

via Satelit Radio Amatir IO-86



Yono Adisoemarta

YD0NXX / N5SNN

21 Oktober 2023

Jadwal Satelit IO-86

- Twitter (X), IG, FB:
 - pr_teksat
 - amsat-id.org

 **BRIN**
Badan Riset Inovasi Nasional

Jadwal Misi Satelit LAPAN-A2/IO-86
Pusat Riset Teknologi Satelit - BRIN

Date	Time UTC		Time WIB		Mission
	Start	Stop	Start	Stop	
19-Oct	22:28	0:28	5:28	7:28	APRS
	1:56	2:15	8:56	9:15	Attitude Control
	3:41	3:59	10:41	10:59	Image Acquisition
	5:25	5:43	12:25	12:43	Data Transmission : Image
	7:09	7:28	14:09	14:28	Data Transmission : Image
	12:23	14:23	19:23	21:23	APRS (India-Indonesia)
20-Oct	22:50	0:50	5:50	7:50	APRS
	0:34	0:52	7:34	7:52	Attitude Control
	2:18	2:36	9:18	9:36	Image Acquisition
	4:03	4:21	11:03	11:21	Data Transmission : Image
	5:47	6:05	12:47	13:05	Data Transmission : Image
	7:31	7:56	14:31	14:56	VR JOTA 2023 - SSTV
	9:16	9:41	16:16	16:41	VR JOTA 2023 - ROLLCALL
	12:45	13:10	19:45	20:10	VR HT Only
	14:30	16:30	21:30	23:30	APRS (India-Indonesia)
21-Oct	21:27	23:27	4:27	6:27	APRS
	2:40	3:05	9:40	10:05	VR JOTA 2023 - GAMES 1
	4:24	4:49	11:24	11:49	VR JOTA 2023 - GAMES 2
	6:09	6:34	13:09	13:34	VR JOTA 2023 - GAMES 3
	7:53	8:18	14:53	15:18	VR Bimtek BARF
	11:22	11:47	18:22	18:47	VR Newcomers Only
	13:07	15:07	20:07	22:07	APRS (India-Indonesia)
	17:28	17:53	0:28	0:53	Voice Repeater (Brazil)
	21:49	23:49	4:49	6:49	APRS
22-Oct	3:02	3:27	10:02	10:27	VR JOTA 2023 - ROLLCALL
	4:46	5:11	11:46	12:11	VR JOTA 2023 - SSTV
	8:15	8:40	15:15	15:40	VR Newcomers Only
	9:55	10:25	16:55	17:25	VR HT Only (India-Indonesia)
	13:29	15:29	20:29	22:29	APRS (India-Indonesia)
	17:50	18:15	0:50	1:15	Voice Repeater (Brazil)
	22:11	0:11	5:11	7:11	APRS

Disclaimer: This schedule may change due to technical reason, follow our social media for updates.

Pusat Riset Teknologi Satelit

Jadwal JOTA di Satelit



AMSAT-ID
Amateur Radio Satellite Indonesia



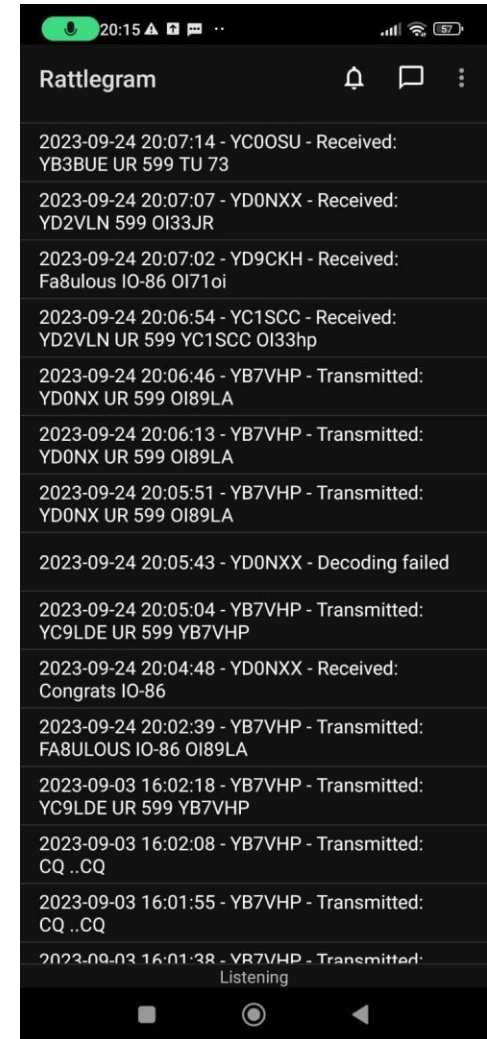
RSI
Radio Scouting Indonesia

Lampiran :

NO	HARI	WAKTU (UTC+7)	AGENDA	STASIUN	ELEVASI SATELIT	
					NCS	
					BARAT	TIMUR
1	JUMAT 20 Oktober 2023	14:31 WIB	SSTV	YH0S	52.0 OI33kp	70.4 PJ21nk
		16:16 WIB	VR JOTA YH0S ROLLCALL	YH0S	36.0 OI33kp	80.0 PJ21nk
2	SABTU 21 Oktober 2023	09:40 WIB	JOTA GAMES RATTLEGRAM	YH0S	84.1 OI33kp	45.0 OI89Ia
		11:24 WIB	JOTA GAMES MORSE / CW	YH0S	79.2 OI33kp	53.1 OI89Ia
		13:09 WIB	JOTA GAMES SSTV	YH0S	61.5 OI33kp	58.3 PJ21nk
3	MINGGU 22 Oktober 2023	10:02 WIB	VR JOTA YH0S ROLLCALL	YH0S	73.1 OI33kp	36.7 PJ21nk
		11:46 WIB	SSTV	YH0S	71.0 OI33kp	48.6 PJ21nk

Rattlegram

- Mode komunikasi yang:
 - Menggunakan bandwidth kecil (bisa lewat satelit)
 - Mengirimkan berita teks (seperti SMS)



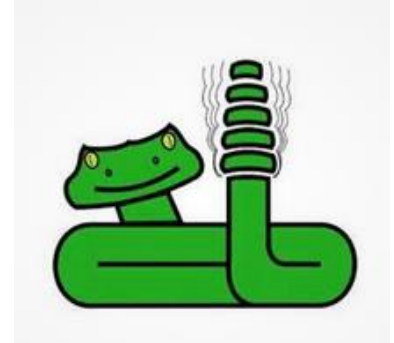
Contoh pesan yang diterima melalui IO-86

Peralatan

- Decoder / Encoder:
 - Software di smartphone (*Rattlegram* di Android)
- Radio: pengirim dan penerima
- Antena: sebaiknya pengarah

Latihan Rattlegram

- Install software Rattlegram
 - Hanya ada di Android
 - Untuk iOS harus di developers mode
- Test terima:
 - Arahkan antenna ke satelit
 - Silakan mendekat ke loudspeaker untuk mendapatkan pesan-pesan dengan baik
 - Jangan ada yang berbicara
- Games:
 - Ada pesan2 dari satelit
 - Upload di: <https://jota.amsat-id.org/home.html>

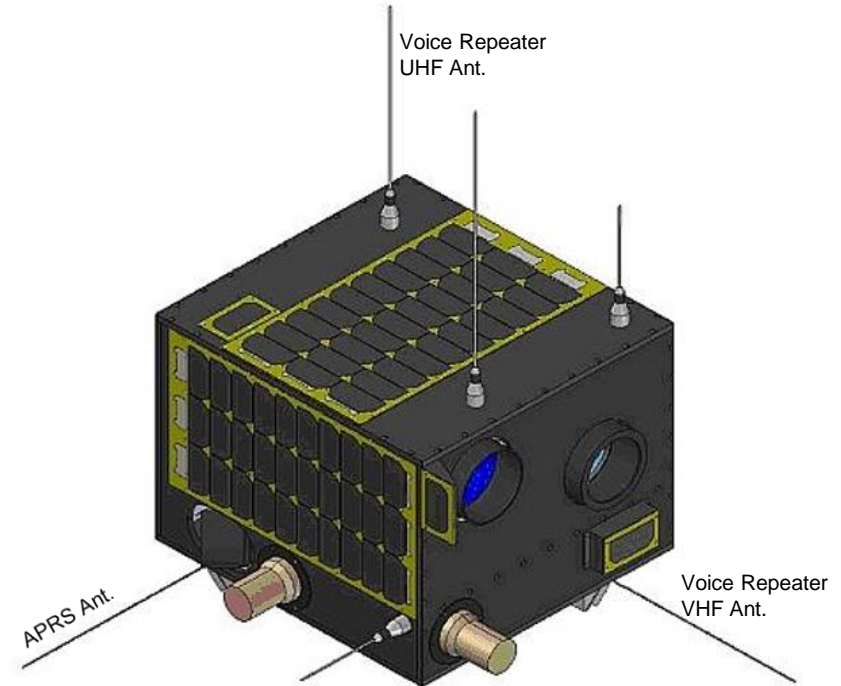


Bagian 2

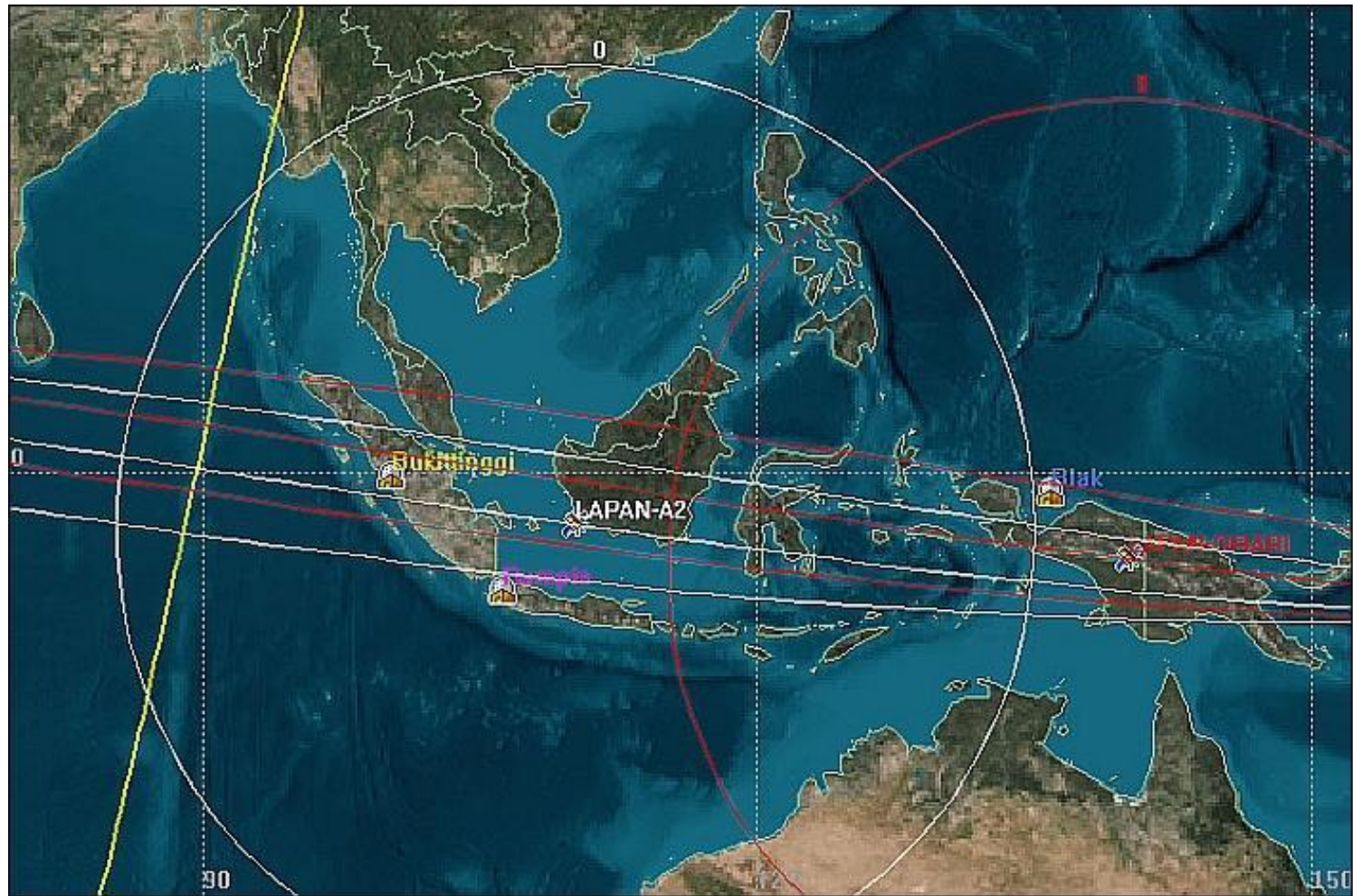
- Satelit
- Penjejakan Satelit

Satelit IO-86 (LAPAN-A2/ORARI)

- LEO: Low Earth Orbit
- Inklinalasi: ~6 deg
- Durasi: ~11 menit
- Interval: ~100 menit
- Coverage:
 - Seluruh Indonesia
- High power: 5 watt (terbesar)
 - Bisa monitor dengan HT saja



Lintasan IO-86



IO (Indonesia Oscar) - 86

- Muatan Radio Amatir di Satelit LAPAN A2/ORARI
 - APRS (Automatic Packet Reporting System) Digipeater
 - Up/Down: 145.825 MHz
 - Voice Repeater (UHF/VHF)
 - Down Link 435.880 MHz
 - Up Link 145.880 MHz + Tone

Teknik Operasi Satelit

- Beberapa komponen untuk menggunakan Satelit Amatir Radio:
 1. Peralatan: Radio, Antena, laptop / HP, voice recorder
 2. Sked: online atau offline
 3. Tracking

Radio dan Antena

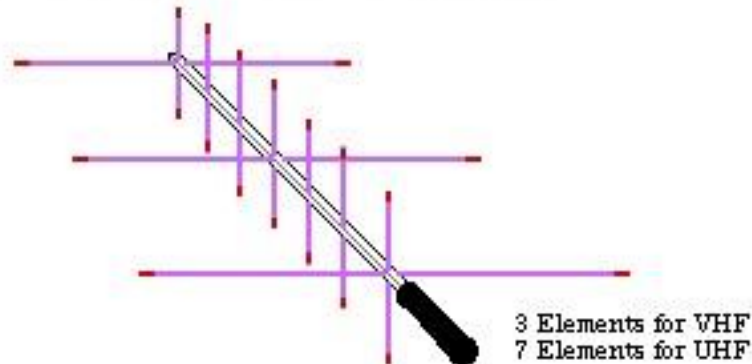
- Karena karakteristik muatan satelit yang cross-band, maka:
 - Perlu 2 antena (atau dual-band antenna)
 - Portable: Arrow / Elk / IOio
 - Mobile: SG-7500
 - Fix station: M2 (cross polarization)
 - Perlu radio yang dual-band (atau 2 buah radio single-band)
 - Perlu tracking (manual atau rotator)

Antena Portable

- Arrow:
 - Dual yagi (VHF dan UHF) cross-line
 - Perlu duplexer

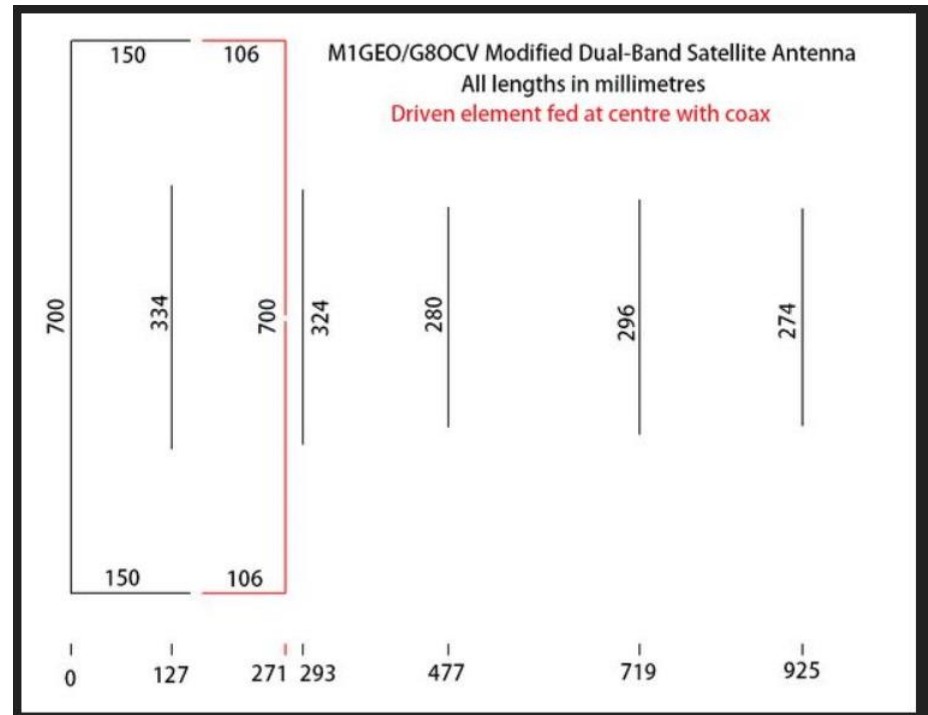
Arrow II Satellite Antenna

Work a Satellite with an HT



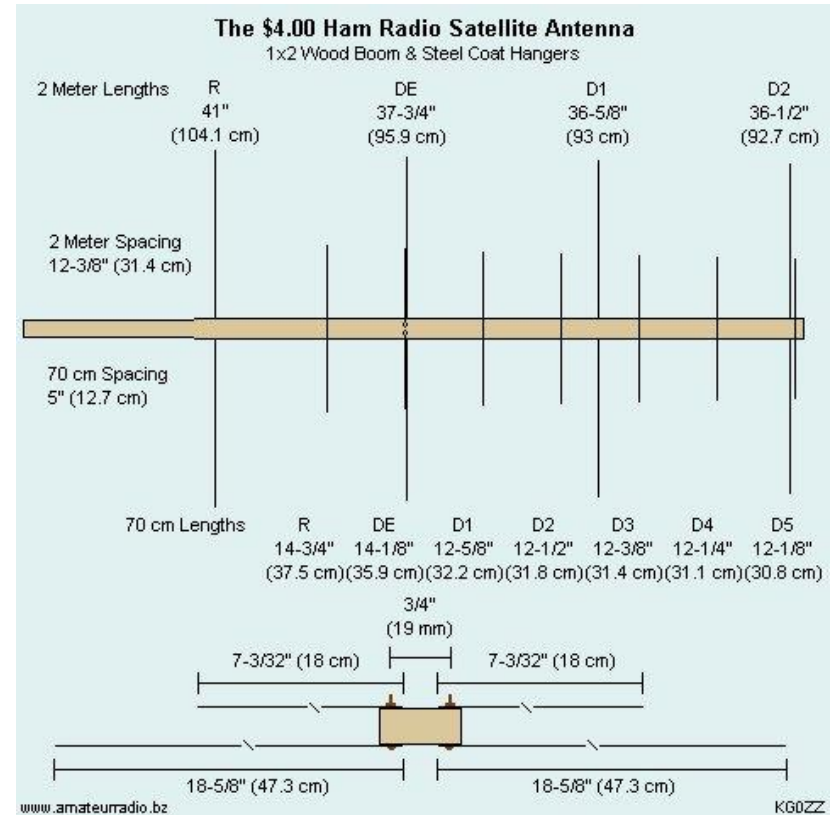
Antena Portable (2)

- Moxon:
 - Dual-band
 - Tanpa duplexer



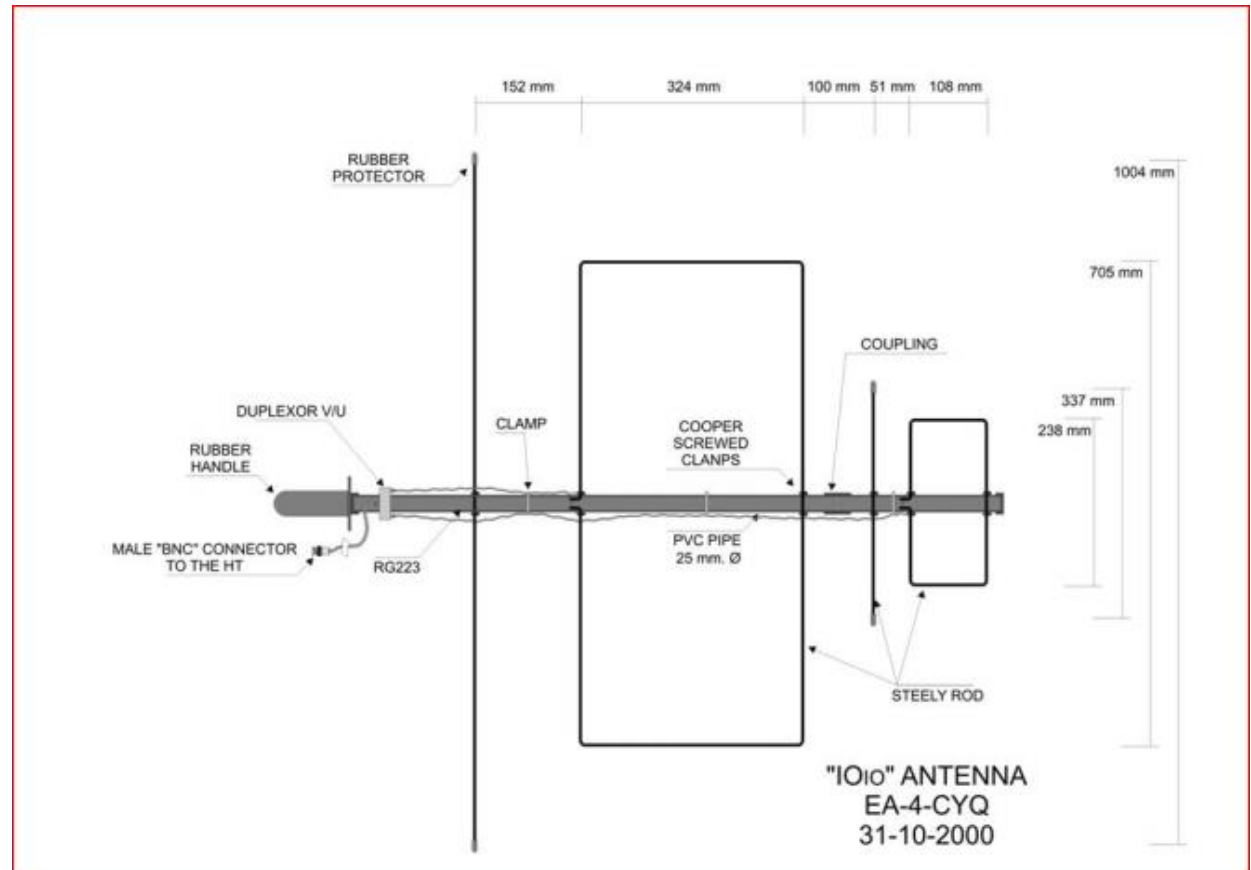
Antena Portable (3)

- Yagi:
 - Dual yagi in-line



Antena Portable (4)

- IOio:
 - Dual yagi
 - in-line



Antena Rumah

- QFH:
 - Single-band
 - Omni
- Yagi:
 - Perlu rotator



Sked (Schedule)

Untuk mengetahui kapan satelit akan lewat diatas kita dan arahnya

Online & Komputer

- Online / Web:
 - [Heavens Above](#)
 - [N2YO](#)
 - [NASA](#)
 - [AMSAT-NA](#)
 - [AMSAT-LU](#)
- Komputer:
 - [Orbitron](#) – free
 - [Nova for Windows](#) - \$60
 - [MacDoppler](#) - \$80-100
 - [SatPC32](#) - \$45-50
 - [GPREDICT](#) - Linux/Mac/ more – free
 - [SimpleSat Look Down](#) - Windows

Offline (SmartPhone)

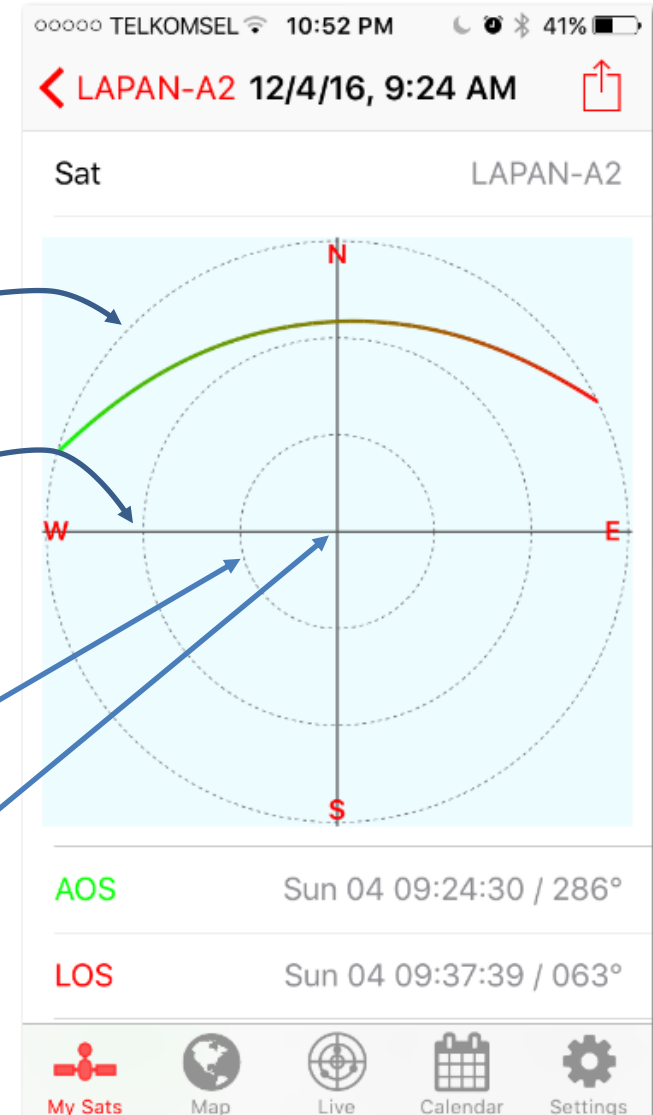
- [PocketSat+ for Palm, Pocket PC](#) - \$25
- [PocketSat3 - 'droid and iOS](#) - \$25
- [GoSatWatch](#) - iOS devices - \$10
- [Satellite Explorer Pro - iOS 6.1+](#)
- [SatSat](#) – iOS – Free
- [HamSatDROID](#) - now [AmsatDroid FREE](#)
- [Heavens-Above](#) – Android – free
- [ISS Detector](#) – Android – free

Tracking

- Satelit akan bergerak dengan cepat diatas kita (umumnya 10 menit dari muncul diatas horison sampai terbenam kembali)
- Memerlukan keahlian untuk mengikuti pergerakan satelit sewaktu melakukan QSO
- Manual: menggunakan tangan untuk mengatur arah antena
- Otomatis: komputer yang mengontrol rotator

Contoh Tracking

- Gunakan kompas untuk mengatur arah
- Lingkaran terluar adalah horison
- Lingkaran tengah 30deg elevasi
- Lingkaran dalam 60 deg elevasi
- Titik ditengah 90 deg

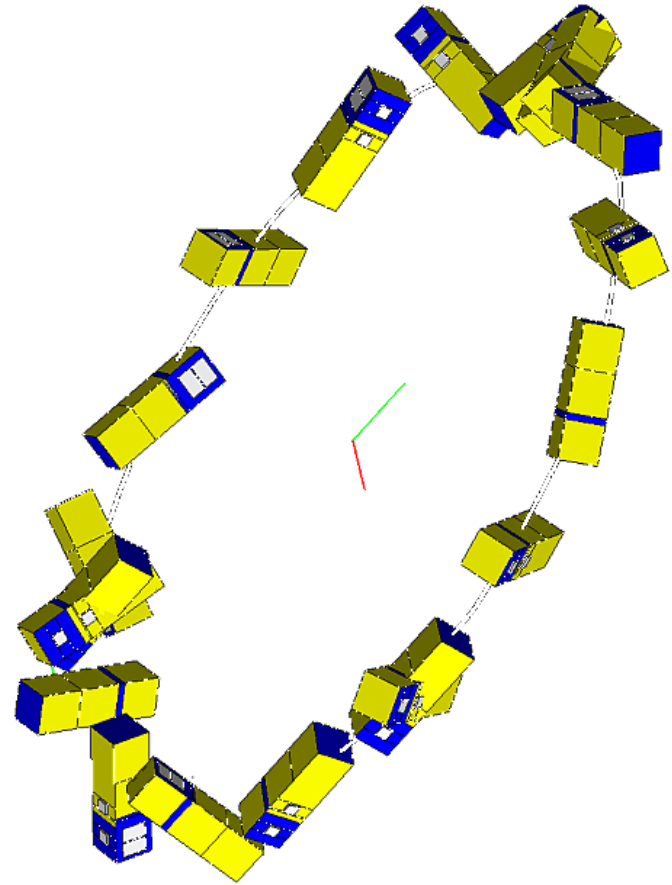


Doppler

- Pergeseran frekuensi karena perbedaan kecepatan dua benda
 - Bunyi kereta api yang berbeda saat mendekati dan menjauhi kita
- Efek Doppler kecil di 144 MHz tetapi besar di 440 MHz
- TX bisa tetap di 145.880 MHz (FM capture effect)
- RX harus bergeser ± 10 kHz dari nominal (435.880 MHz)

Tumbling

- Efek sisa dari peluncuran adalah satelit akan berguling (tumbling)
- Antena tidak selalu menghadap bumi
- Efeknya adalah polarisasi yang terus berubah, membuat fading (QSB)
- Harus selalu memuntir antena untuk mendapatkan sinyal terbaik



Prosedur QSO (Voice)

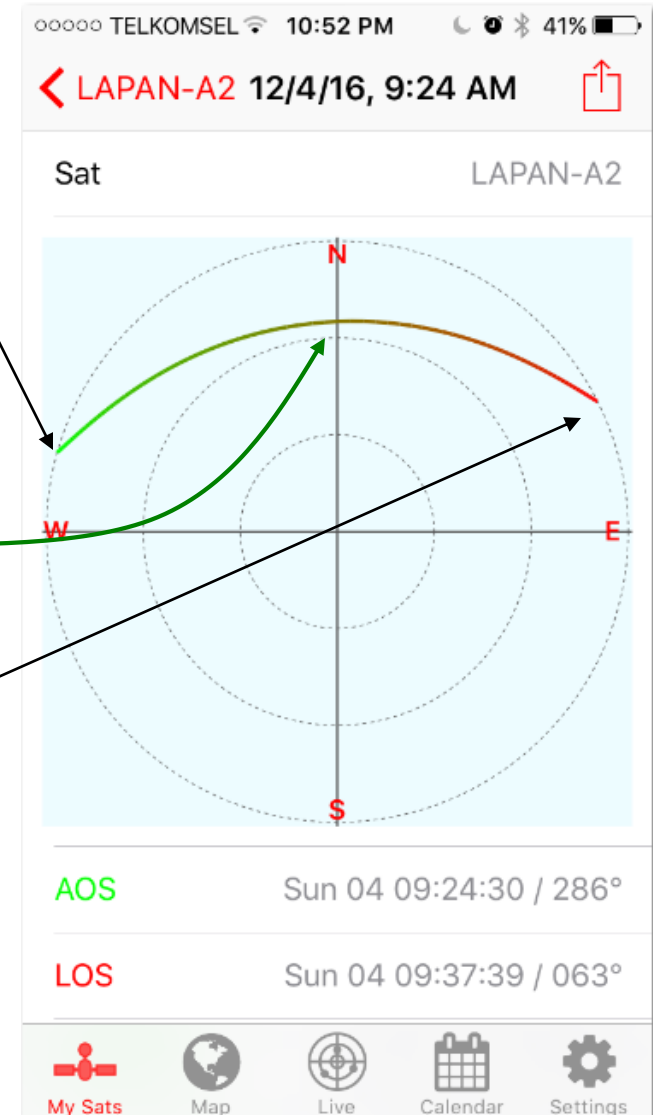
- Pastikan clock di komputer sudah akurat
- Tentukan jam passing
- Gambar di lantai track satelit
- Set radio pada:
 - TX: 145.880 MHz + Tone
 - Downlink: 435.880 MH +- Doppler
- Pastikan sudah bisa mendengar downlink
- Sewaktu sudah kosong tekan PTT dan sebut “ This is <Callsign> via IO-86” (jangan pakai CQ CQ CQ)

Prosedur QSO (Voice) – 2

- Jangan menggunakan CQ berulang-ulang, Karena satelit yang selalu berguling, akan terjadi QSB (fading)
- Pencet PTT dan sebut callsign phonetically
- Untuk menjawab: “<callsign1> this is <callsign 2> your are 59 via <satelit> QSL?”
- Terakhir: “<callsign1> QSL, good luck”
- Ingat:
 - Waktu satelit itu terbatas, QSO dibuat sesingkat mungkin supaya banyak teman bisa melakukan QSO dalam passing ini
 - Banyak spurious, jangan putus asa

Rangkuman QSO

- Atur arah antenna
- AOS: atur freq nominal + 10 kHz
 - qso
- AOS + 2 menit: Freq + 5 kHz
 - qso
- TCA: Freq nominal
 - qso
- TCA + 2 min : Frq – 5 kHz
 - qso
- LOS: freq – 10 kHz
 - selesai



Akrobat Komunikasi Satelit

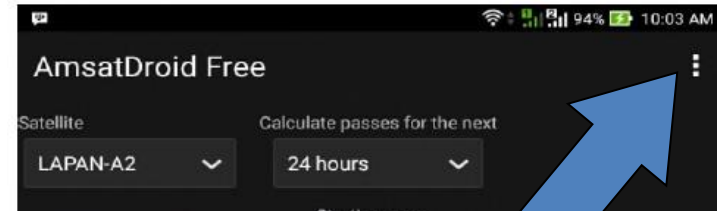
- Dalam waktu 10 menit
 - Penjejukan arah: AOS → TCA → LOS
 - Mengatur frekuensi: +10 kHz → nominal → - 10 kHz
 - Mengatur sikap (attitude) antena:
 - Vertikal ↔ horizontal
 - Melakukan QSO
 - Panggil, jawab, selesai (jangan pakai CQ CQ CQ)
 - Mencatat setiap QSO

Latihan

- Install aplikasi:
 - Amsatdroid free (Android)
 - SatSat (iOS)
 - Orbitron (PC)
- Atur lokasi (QTH)
- Update Keps / TLE (Two Line Element, yaitu Keplerian Data dari satelit)
- Pilih IO-86 (LAPAN-A2)
- Lihat pass track
- Latihan tangan tracking path satelit

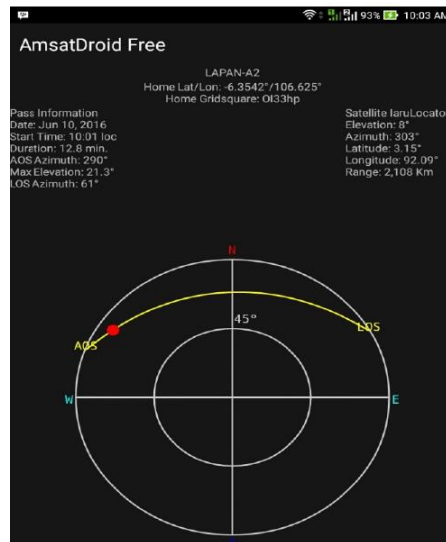
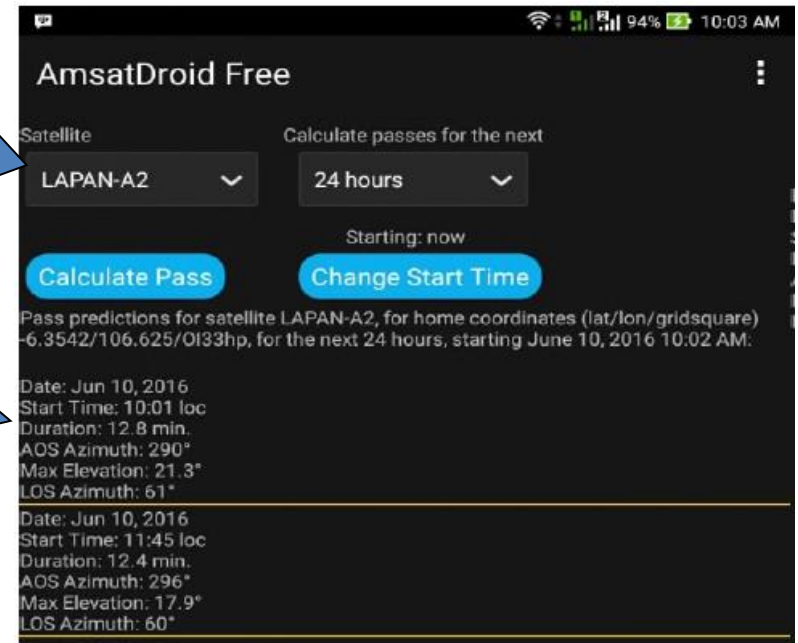
Instalasi AMSATDROID

1. Install Amsatdroid dari Google Play
2. Atur lokasi
 - Tekan 3 dot
 - Pilih "Set Location"
 - Pilih "Use GPS"
 - Atau locator "OI33jt"
3. Lakukan update Keps:
 - Tekan 3 dot kembali
 - Pilih "Update Keps"
 - Pilih Amsat
 - Pilih amsat.org



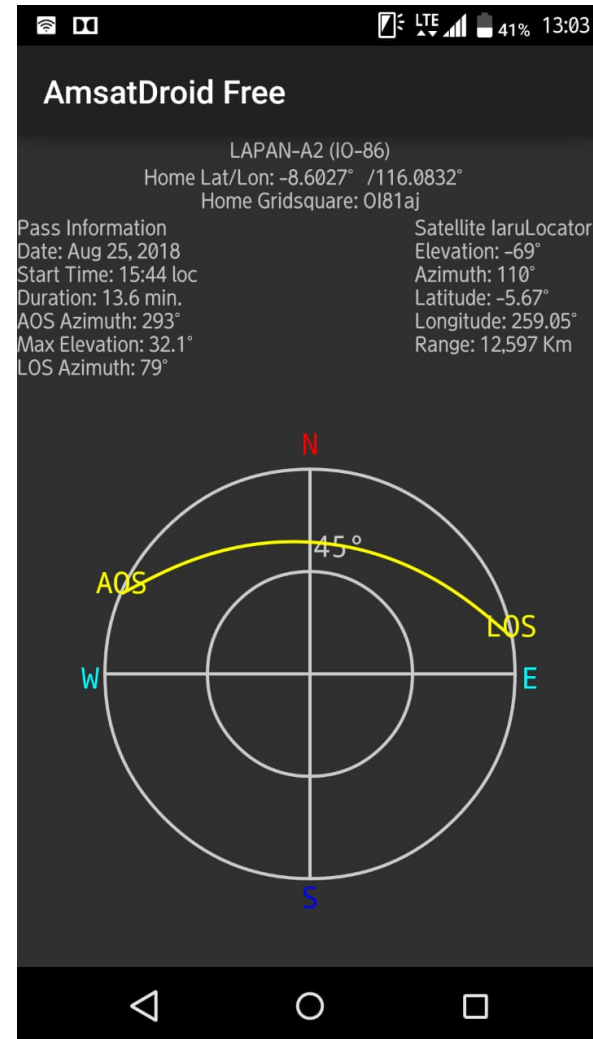
AMSATDROID Free

- Pilih LAPAN-A2
- Pencet salah satu baris
- Lihat track



Latihan Tracking

- Gambar arah mata-angin Utara-Selatan, Barat-Timur di lantai / rumput
- Berdiri dengan mata kearah utara
- Putar badan ke kiri (barat)
- AOS (Acquisition of Signal): awal satelit muncul di horizon sebelah barat
- Badan berputar ke utara sambil antena arahkan naik sampai elevasi 30 derajat
- Terus berputar kekanan sambil antena turun ke horizon, sampai LOS (Loss of Signal)



Jadwal IO-86

UTC			WITA			
18-Oct	2:02	2:22	APRS	10:02	10:22	APRS
	3:46	3:59	AIS Acquisition	11:46	11:59	AIS Acquisition
	5:30	5:43	AIS Acquisition	13:30	13:43	AIS Acquisition
	7:15	7:28	Image Acquisition	15:15	15:28	Image Acquisition
	8:59	9:12	Image Acquisition	16:59	17:12	Image Acquisition
	10:40	11:00	APRS (India-Indonesia)	18:40	19:00	APRS (India-Indonesia)
	12:32	12:46	Voice Repeater (Emergency Communication for Palu & Donggala Earthquake & Tsunami Only...!!)	20:32	20:46	Voice Repeater (Emergency Communication for Palu & Donggala Earthquake & Tsunami Only...!!)
19-Oct	14:13	14:26	Attitude Control	22:13	22:26	Attitude Control
	0:40	1:00	APRS	8:40	9:00	APRS
	2:24	2:37	Imaging	10:24	10:37	Imaging
	4:09	4:22	AIS Acquisition	12:09	12:22	AIS Acquisition
	5:53	6:06	AIS Acquisition	13:53	14:06	AIS Acquisition
	7:37	7:50	Image Acquisition	15:37	15:50	Image Acquisition
	9:22	9:35	Image Acquisition	17:22	17:35	Image Acquisition
20-Oct	11:02	11:22	APRS (India-Indonesia)	19:02	19:22	APRS (India-Indonesia)
	12:54	13:08	Voice Repeater (Emergency Communication for Palu & Donggala Earthquake & Tsunami Only...!!)	20:54	21:08	Voice Repeater (Emergency Communication for Palu & Donggala Earthquake & Tsunami Only...!!)
	14:35	14:48	Attitude Control	22:35	22:48	Attitude Control
	0:58	1:18	APRS (India-Indonesia)	8:58	9:18	APRS (India-Indonesia)
	2:47	3:00	Attitude Control	10:47	11:00	Attitude Control
	4:31	4:51	Voice Repeater for JOTA	12:31	12:51	Voice Repeater for JOTA
	7:59	8:19	Voice Repeater for JOTA	15:59	16:19	Voice Repeater for JOTA
21-Oct	11:32	11:46	Voice Repeater (Emergency Communication for Palu & Donggala Earthquake & Tsunami Only...!!)	19:32	19:46	Voice Repeater (Emergency Communication for Palu & Donggala Earthquake & Tsunami Only...!!)
	13:13	13:33	SSTV for JOTA	21:13	21:33	SSTV for JOTA
	17:32	17:57	Voice Repeater (Brazil)	1:32	1:57	Voice Repeater (Brazil)
	1:21	1:41	APRS (India-Indonesia)	9:21	9:41	APRS (India-Indonesia)
	3:10	3:30	Voice Repeater for JOTA	11:10	11:30	Voice Repeater for JOTA
	4:53	5:13	Voice Repeater for JOTA	12:53	13:13	Voice Repeater for JOTA
	6:38	6:58	Voice Repeater for JOTA	14:38	14:58	Voice Repeater for JOTA
21-Oct	11:55	12:09	Voice Repeater (Emergency Communication for Palu & Donggala Earthquake & Tsunami Only...!!)	19:55	20:09	Voice Repeater (Emergency Communication for Palu & Donggala Earthquake & Tsunami Only...!!)

Satelit IO-86 akan kembali 90 menit setelah LOS

Spesifikasi



LAPAN-A2/LAPAN-ORARI

Indonesian Microsatellite for Amateur Communication, Maritime Traffic monitoring and High Performance Surveillance System

Satellite Technical Specification

- Dimension : 500X470X380 mm
- Weight : 74 kg
- Orbit : ~ 6 inclination (Equatorial)
- Altitude : 630 KM

Power System :

- 4 GaAs Solar Array, 465X262 mm, 30 cells in series, Max 30W(EOS)
- 4 Lithium-ion Batteries, 15V nominal Voltage 6.1 Ah

Communication Data Handling:

- 2 TT&C UHF 1200 bps, FFSK modulation, 5W output
- S-Band payload Communications , 3.5 W RF Output
- OBDH 32 bit RISC Processor, 128/256 byte internal, 1 Mbyte RAM and 1 Mbyte Flash Memory External,

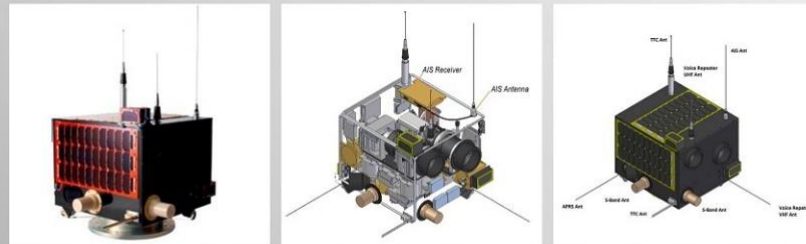
Attitude Control System

- 3 Wheel/Fibre Optic Laser Gyros in Orthogonal Axis
- 2 CCD Star Sensor, Magnetic Coil, 6 Single Solar
- Cell for Sun Sensor and 3 Axis magnetic Field sensor

Payload

- Camera-1
 - Digital Space Camera 1000 mm Lens 2000X2000 Pixel
 - Ground Resolution 3.5m, Swath 7 Km
- Camera-2
 - Color CCD 1000mm Lens, 352X582 Pixel
 - Ground Resolution 5 m , Swath 3.5 Km

Satellite Structure and Sub System



Multi Missions Satellite System

- The LAPAN-A2/LAPAN-ORARI for cover entire Indonesia region. In this particular purposes, the satellite will be flown in Near Equatorial Orbit at ~ 6 deg with near circular orbit. This orbit makes satellite able to pass over the Indonesia 14 times/day.
- The LAPAN-A2/LAPAN-ORARI especially for support 3 (three) main missions:
 - Monitoring of Shipping Traffic from Space using Automatic Identification System (AIS-ASR100) because the coastal station - based system has a very important restriction. It is not suitable for monitoring the traffic on huge ocean areas.
 - Establish the communication among the Indonesian amateur radio communities (ORARI) using amateur radio frequency for disaster mitigation .
 - High performance surveillance system for monitoring earth surface of Indonesia archipelago. This surveillance system applied 2 (two) high resolution cameras with 3.5 and 5 m ground resolution

Pre-Launch Functional Test



Terima Kasih

- Pertanyaan ?