SSTV

via Satelit Amatir Radio IO-86

Yono Adisoemarta

YD0NXX / N5SNN

SSTV

- Slow Scan Television
- Mode komunikasi yang:
  - Menggunakan bandwith kecil (bisa lewat satelit)
  - Mengirimkan gambar diam
  - Memerlukan waktu beberapa detik-menit untuk mengirim gambar
  - Dapat digunakan untuk mengirim gambar dari daerah bencana yang tidak ada komunikasi teresterial

Contoh gambar yang diterima via SSTV melalui IO-86

SSTV (2)

- Satelit dengan mode SSTV:
  - ISS
  - IO-86
  - FO-99
- Mode:
  - Robot (24, 36, 72)
  - PD (60, **90**, 120, 240)
  - Martin
  - Scottie
  - MP / ML / MR
  - KG-STV

Peralatan

- Kamera
  - Digital camera atau *Smartphone*
- Encoder:
  - Software di komputer atau smartphone
- Radio: pengirim dan penerima
  - Dengan atau tanpa kabel *interface*
- Decoder (software)
- Peralatan presentasi

Software SSTV

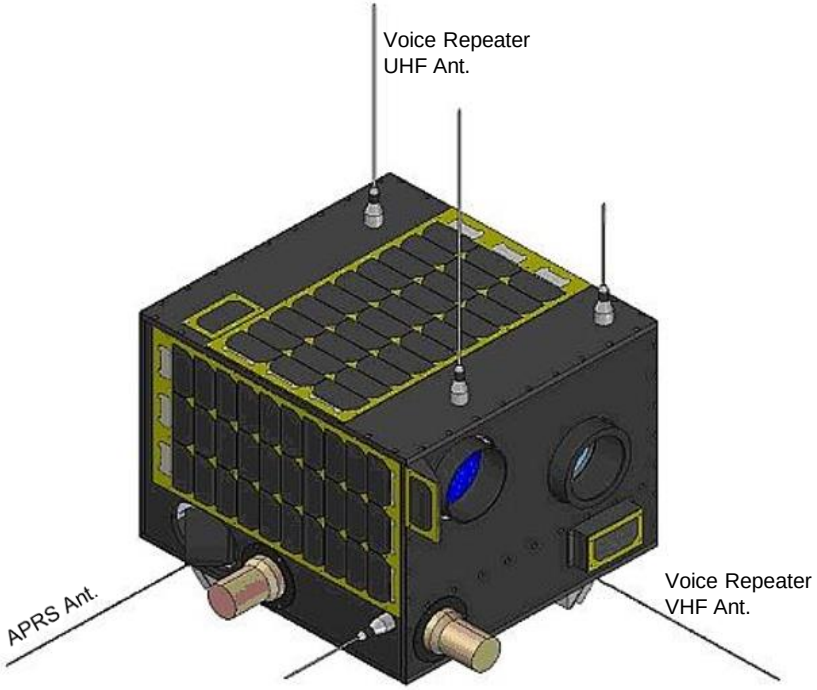
- Komputer / Laptop:
  - MMSSTV / RXSSTV (PC)
  - Multiscan 3B (Mac OS)
  - QSSTV (Linux)
- Smartphone:
  - SSTV for iPhone / iPad
  - Robot36 (Android)
  - DroidSSTV (Android)

Latihan SSTV

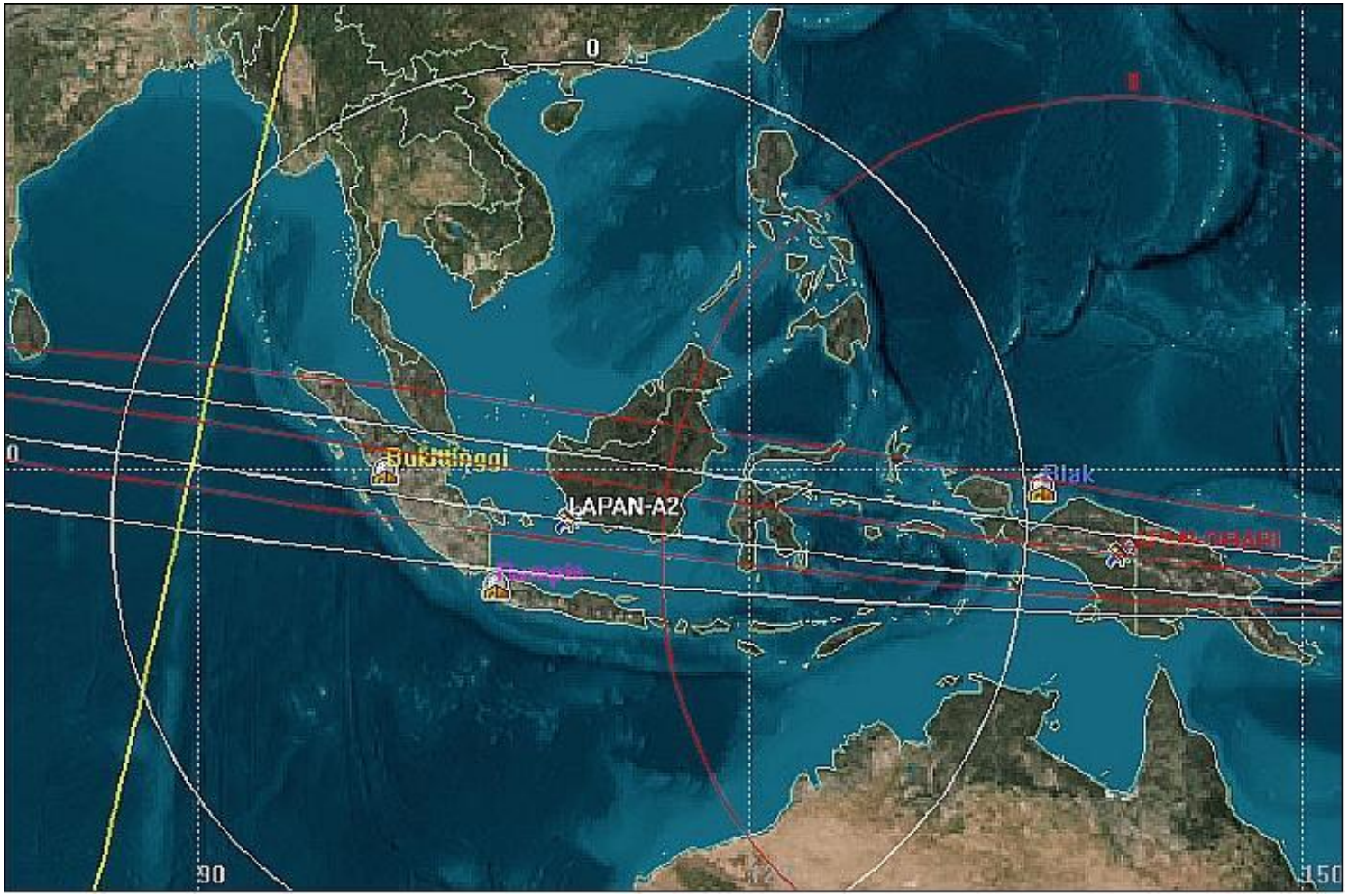
- Install software SSTV
  - Download sesuai dengan platform
  - Setup jika diperlukan (soundcard dll)
- Siapkan gambar
  - Ambil foto dan tuliskan callsign / informasi yang diperlukan
- Test terima:
  - Silakan mendekat ke loudspeaker untuk mendapatkan gambar yang bersih (tidak ada noise)
- Test kirim:
  - Pilih gambar lalu TX
  - Dengarkan suara yang keluar
  - Dekatkan dengan microphone (jika tidak ada *interface*)

Satelit IO-86 (LAPAN-A2/ORARI)

- LEO: Low Earth Orbit
- Inklinasi: ~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

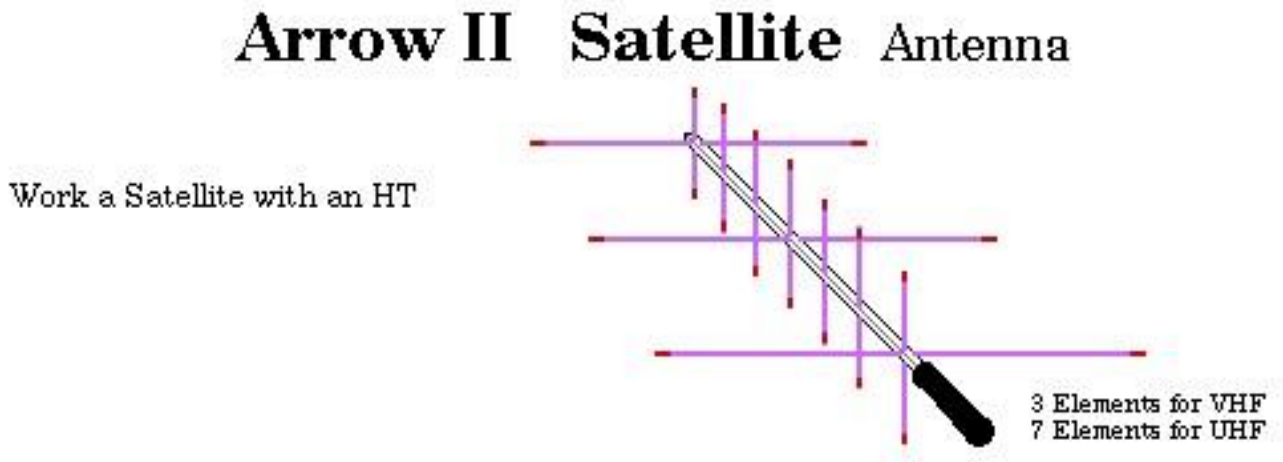
- Beberapa komponen untuk menggunakan Satelit Amatir Radio:
  1. Peralatan: Radio, Antena, laptop / HP, voice recorder
  2. Sked: online atau offline
  3. Tracking

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)

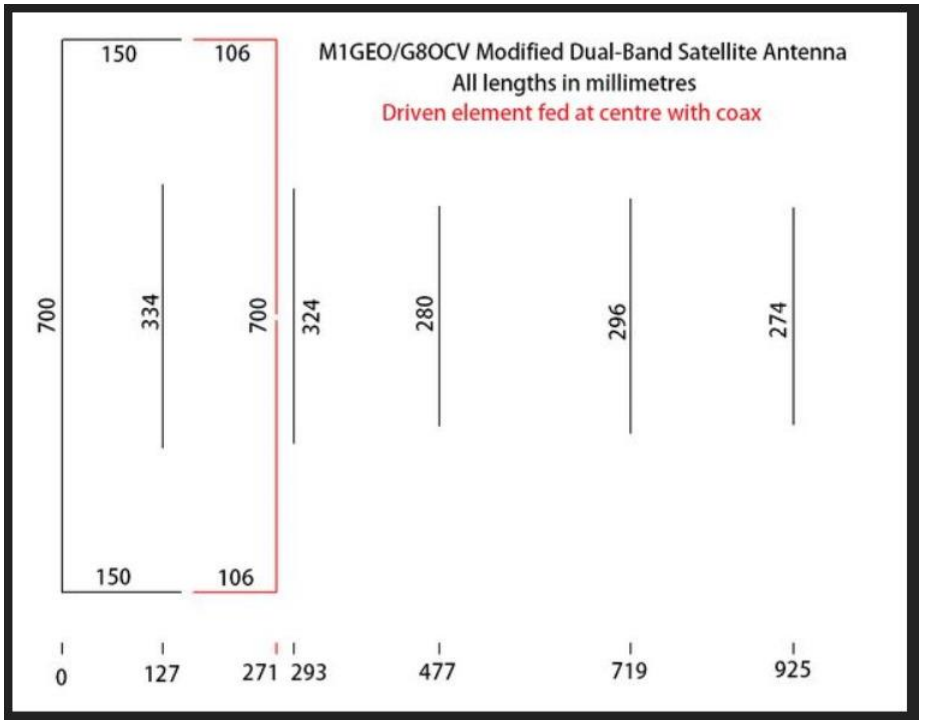
Antena Portable

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



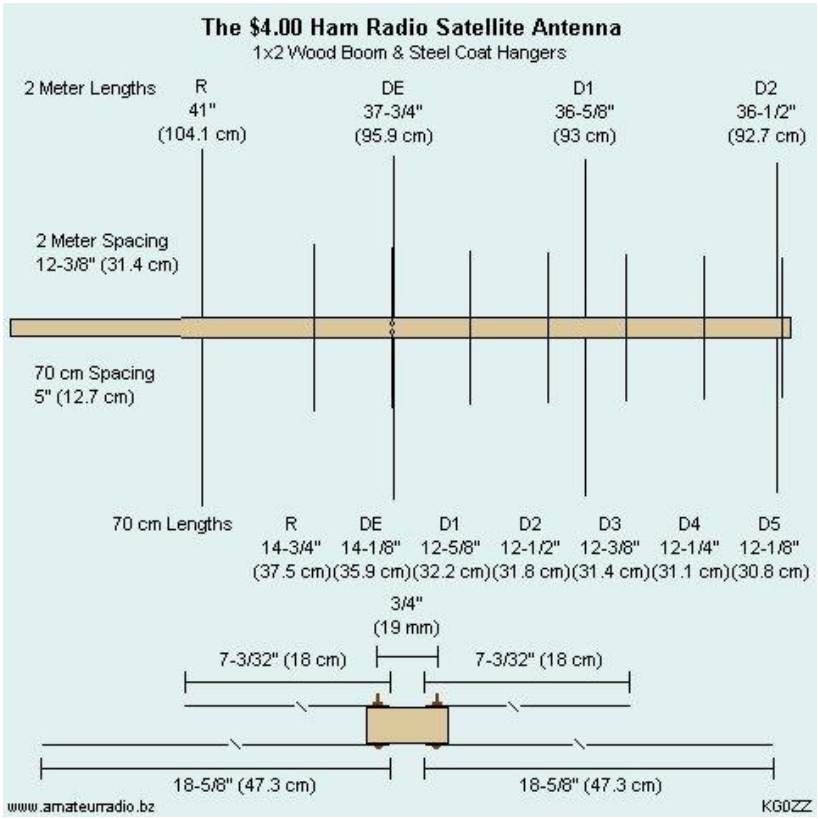
Antena Portable (2)

- Moxon:
  - Dual-band
  - Tanpa duplexer



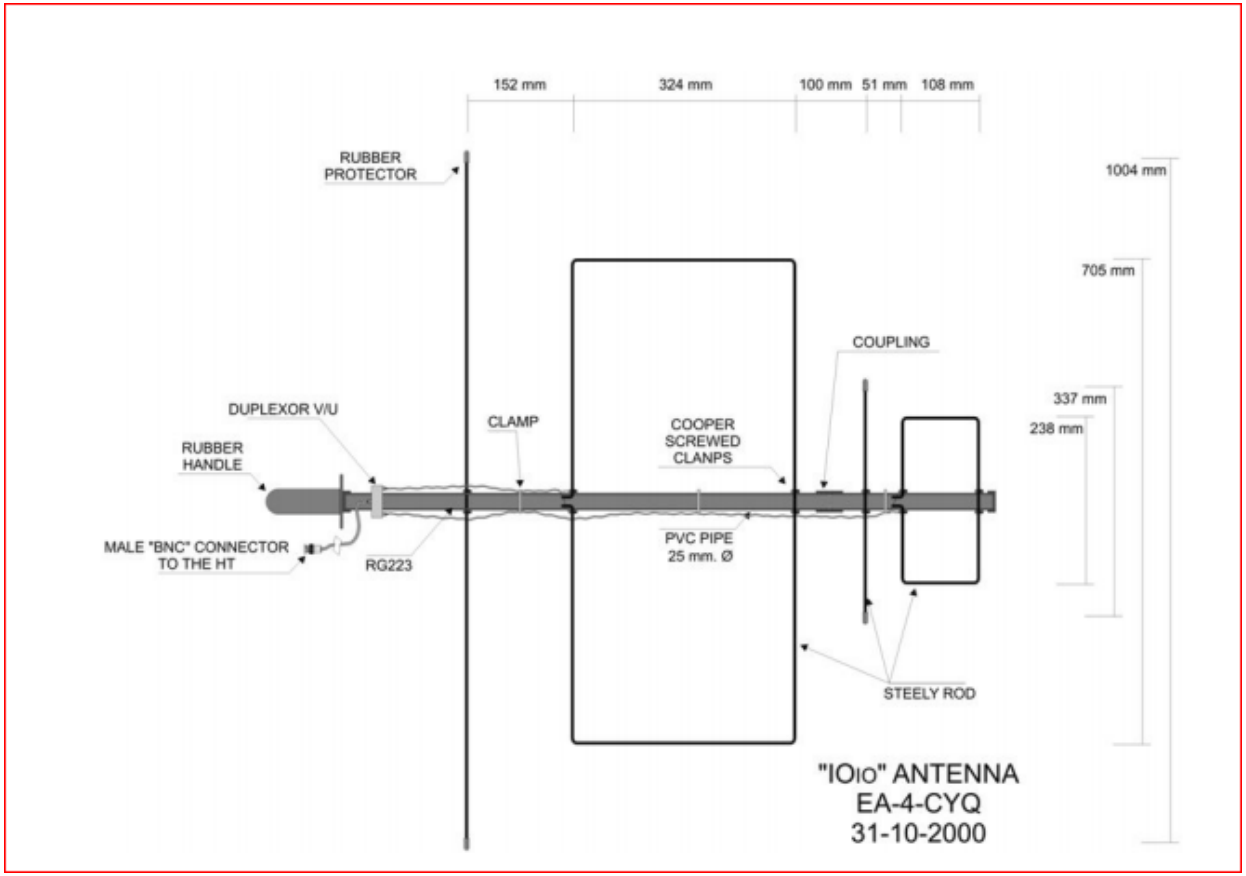
Antena Portable (3)

- 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)

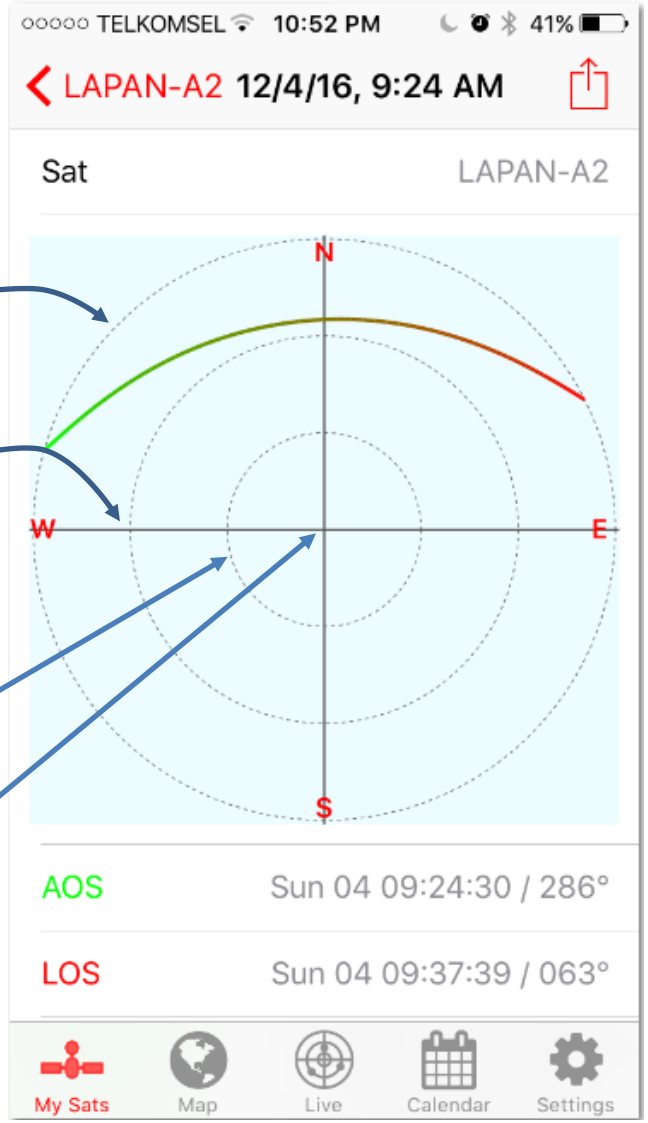
- PocketSat+ for Palm, Pocket PC - $25
- PocketSat3 - ‘droid and iOS - $25
- GoSatWatch - iOS devices - $10
- Satellite Explorer Pro - iOS 6.1+
- SatSat – iOS – Free
- HamSatDROID - now AmsatDroid FREE
- Heavens-Above – Android – free
- ISS Detector – Android – free

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

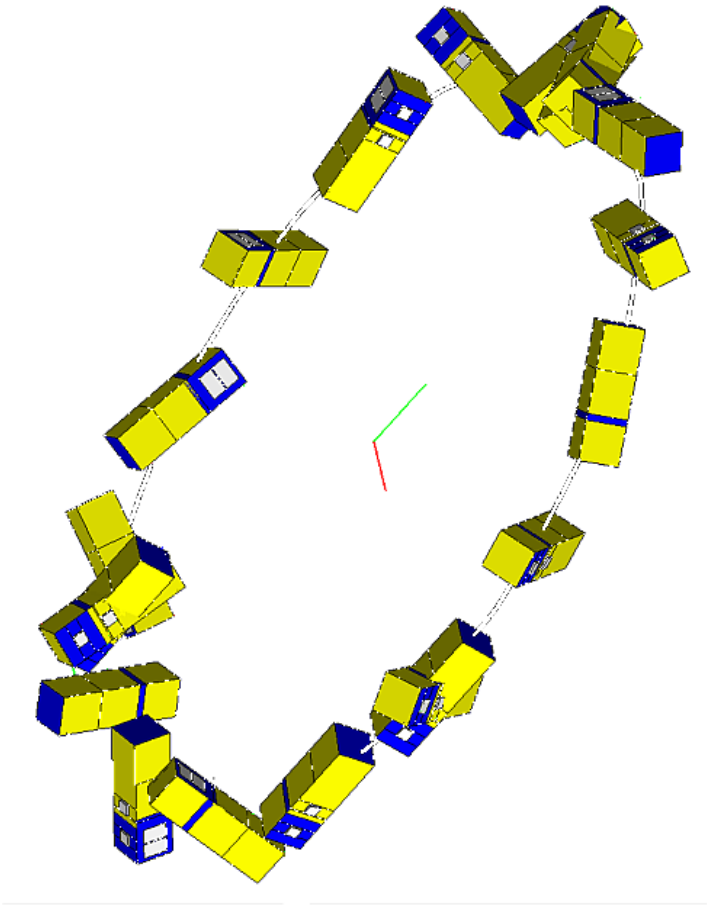


Doppler

- 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)

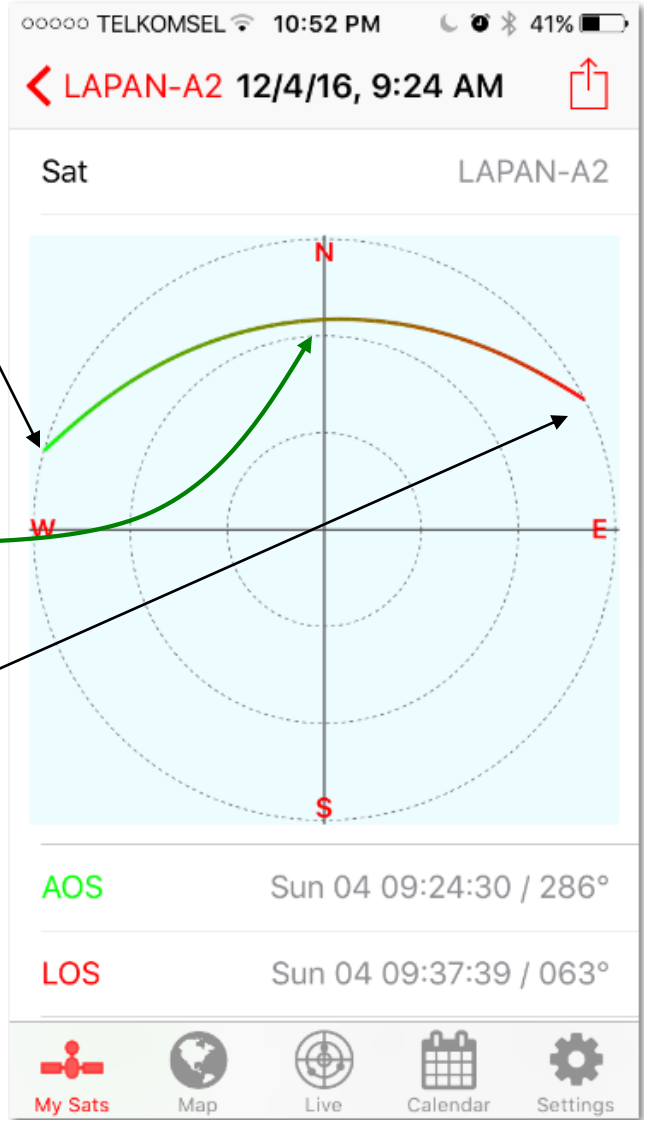
- Pastikan clock di komputer sudah akurat
- Tentukan jam passing
- Gambar di lantai track satelit
- Set radio pada:
  - TX: 145.880 MHz + Tone
  - Downlink: 435.880 MH +- Doppler
- Pastikan sudah bisa mendengar downlink
- Sewaktu sudah kosong tekan PTT dan sebut “ This is <Callsign> via IO-86” (jangan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

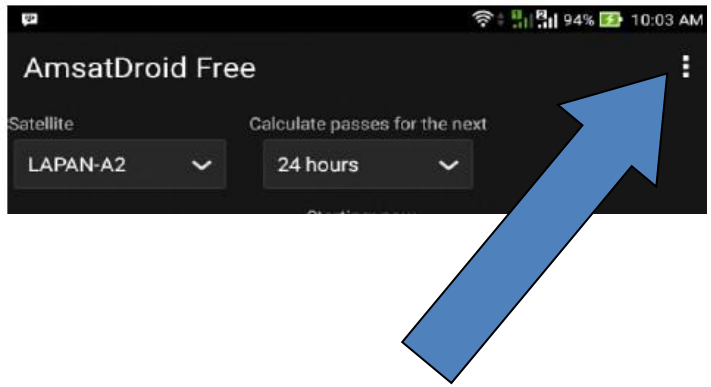
- Dalam waktu 10 menit
  - Penjejakan arah: AOS → TCA → LOS
  - Mengatur frekuensi: +10 kHz → nominal → - 10 kHz
  - Mengatur sikap (attitude) antena:
    - Vertikal ←→ horizontal
  - Melakukan QSO
    - Panggil, jawab, selesai (jangan pakai CQ CQ CQ)
  - Mencatat setiap QSO

Latihan

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

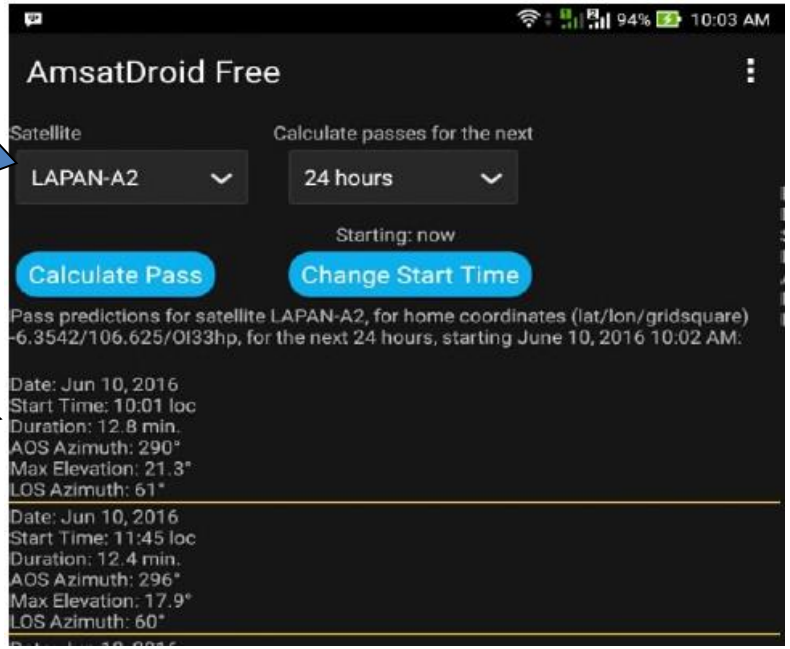
Instalasi AMSATDROID

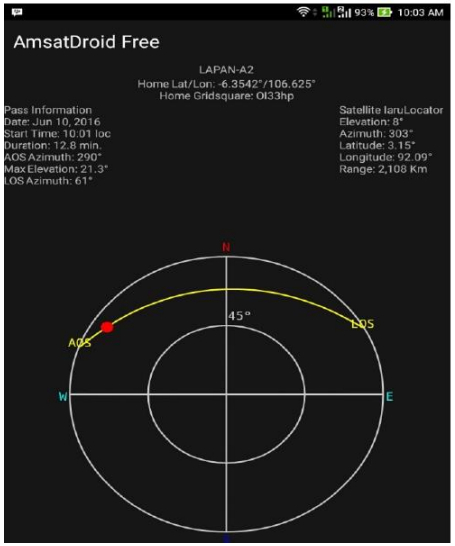
1. Install Amsatdroid dari Google Play
2. Atur lokasi
   - Tekan 3 dot
   - Pilih “Set Location”
   - Pilih “Use GPS”
   - Atau locator “OI33jt”
3. Lakukan update Keps:
   - Tekan 3 dot kembali
   - Pilih “Update Keps”
   - Pilih Amsat
   - Pilih amsat.org



AMSATDROID Free

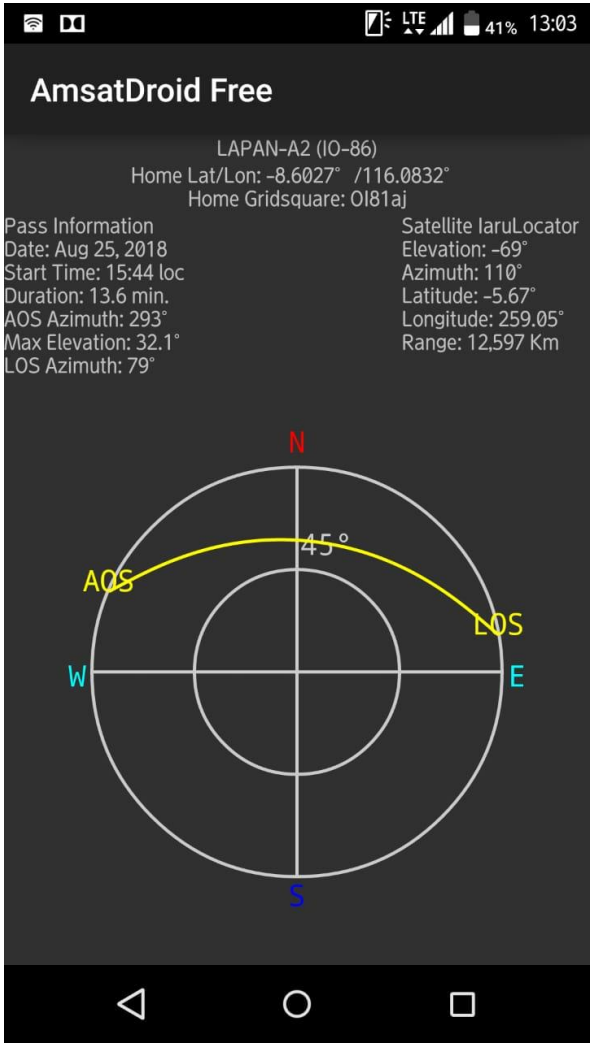
- Pilih LAPAN-A2
- Pencet salah satu baris
- Lihat track





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	18-Oct	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...!!)	
	14:13	14:26	Attitude Control		22:13	22:26	Attitude Control	
19-Oct	0:40	1:00	APRS	19-Oct	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	
	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	
20-Oct	0:58	1:18	APRS (India-Indonesia)	20-Oct	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	
	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)	21-Oct	1:32	1:57	Voice Repeater (Brazil)	Brazil
21-Oct	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	
	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

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

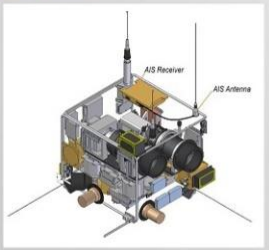
Power System :
- 4 GaAs Solar Array, 465X262 mm, 30 cells in series, Max 30W(EOS)
- 4 Lithium-ion Batteries, 15V nominal Voltage 6.1 Ah

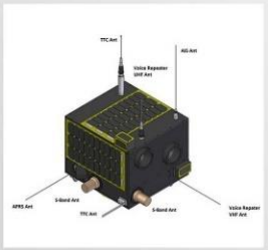
Communication Data Handling:
- 2 TT&C UHF 1200 bps, FFSK modulation, 5W output
- S-Band payload Communications , 3.5 W RF Output
- OBDH 32 bit RISC Processor, 128/256 byte internal, 1 Mbyte RAM and 1 Mbyte Fash Memory External,

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
- Camerra-1
  - Digital Space Camera 1000 mm Lens 2000X2000 Pixel Ground Resolution 3.5m, Swath 7 Km
- Camerra-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 ?