

Ryhmä C

## SDR Projekti Laivojen paikannus

Tiedonsiirtotekniikka

2025



Kaakkois-Suomen  
ammattikorkeakoulu

## **SISÄLLYS**

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## 1 TOTEUTUS

Löydettiin githubista tuommoisen AIS-catcher ohjelmisto. Asennettiin se alla olevalla skriptillä:

```
sudo bash -c "$(curl -fsSL https://raw.githubusercontent.com/jvde-github/AIS-catcher/main/scripts/aiscatcher-install)"
```

asennettiin myös graafinen käyttöliittymä, tosin sillä ei kyllä tehty mitään:

```
sudo bash -c "$(curl -fsSL https://raw.githubusercontent.com/jvde-github/AIS-catcher-control/main/install_ais_catcher_control.sh)"
```

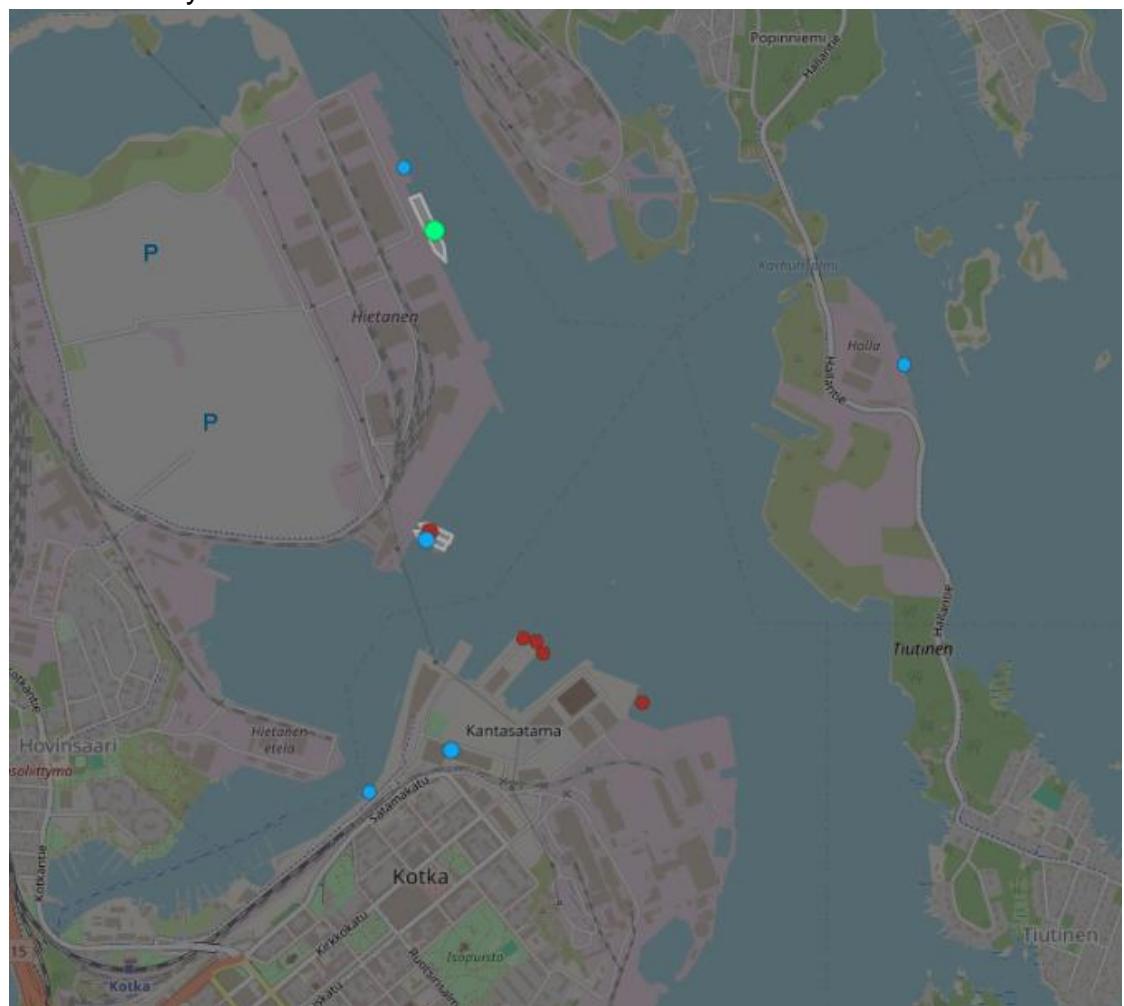
Laitettiin se aluksi keräämään tietoja kymmenen sekunnin välein.

AIS-catcher -v 10

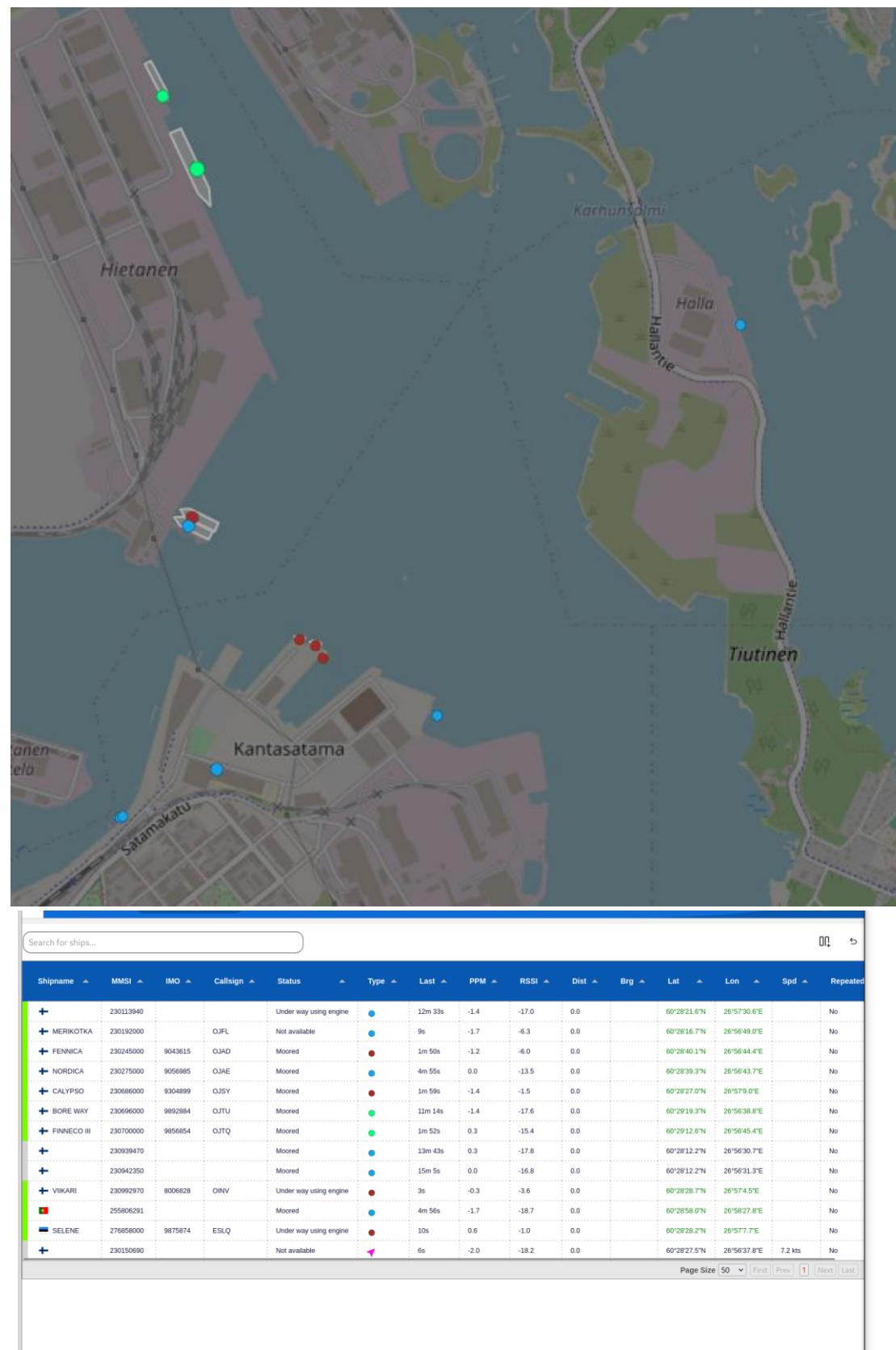
Sitten suljettiin se ja avattiin uudelleen web viewerin kanssa

AIS-catcher -N 8100

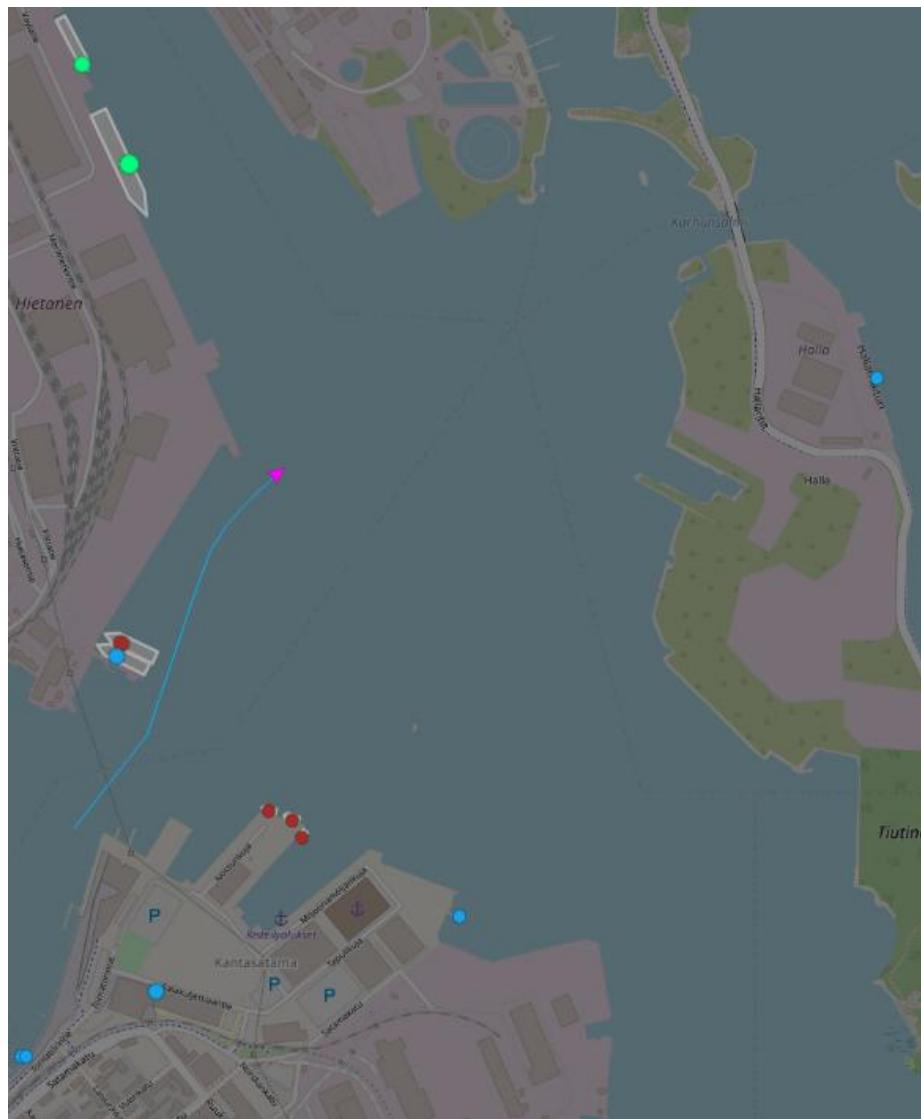
Ja siellä näky botkit.



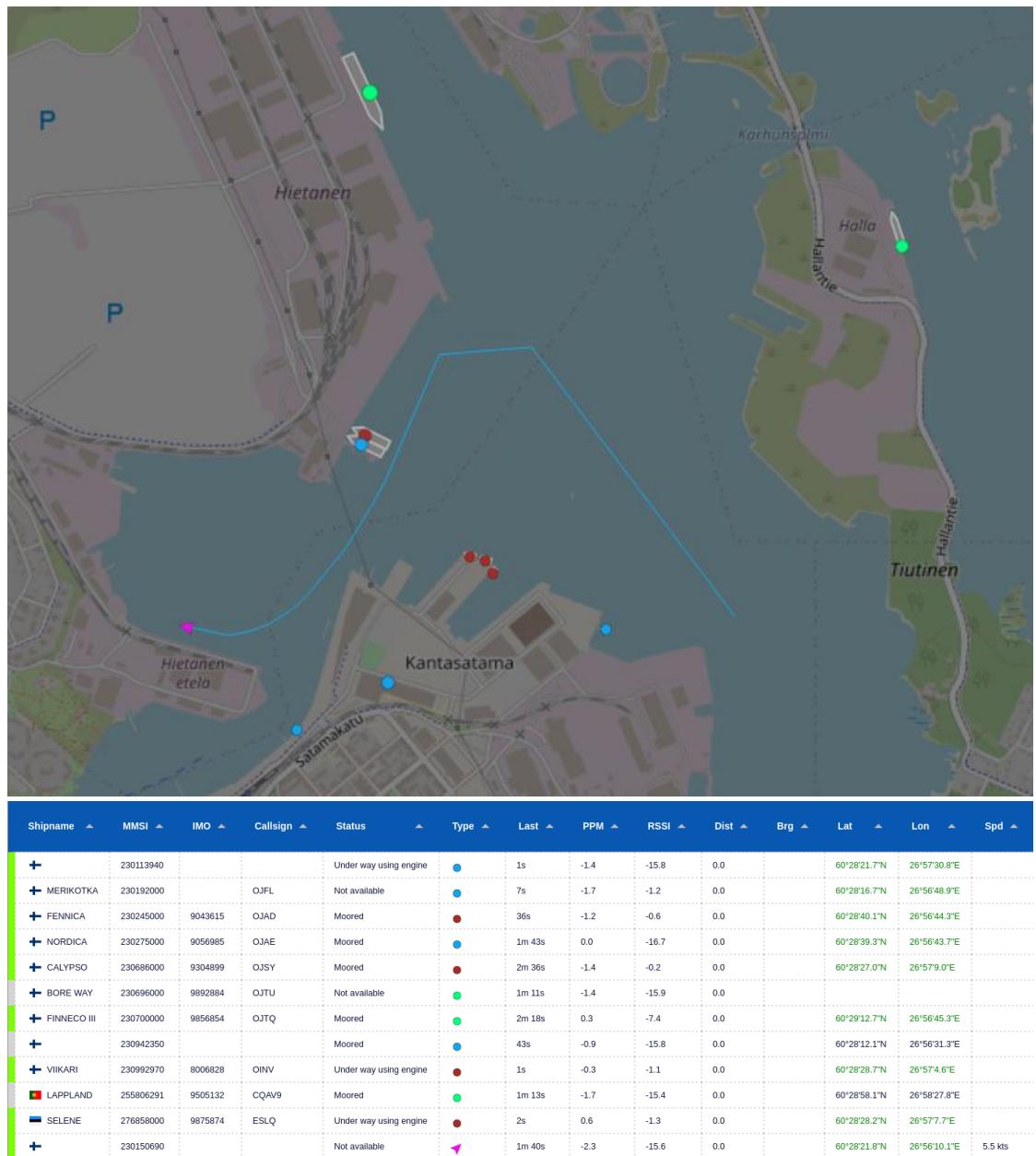
Hieman säädin asetuksia, mutta ei löytänyt enempää laivoja.



Nähtiin jopa pieni vene vauhdissa

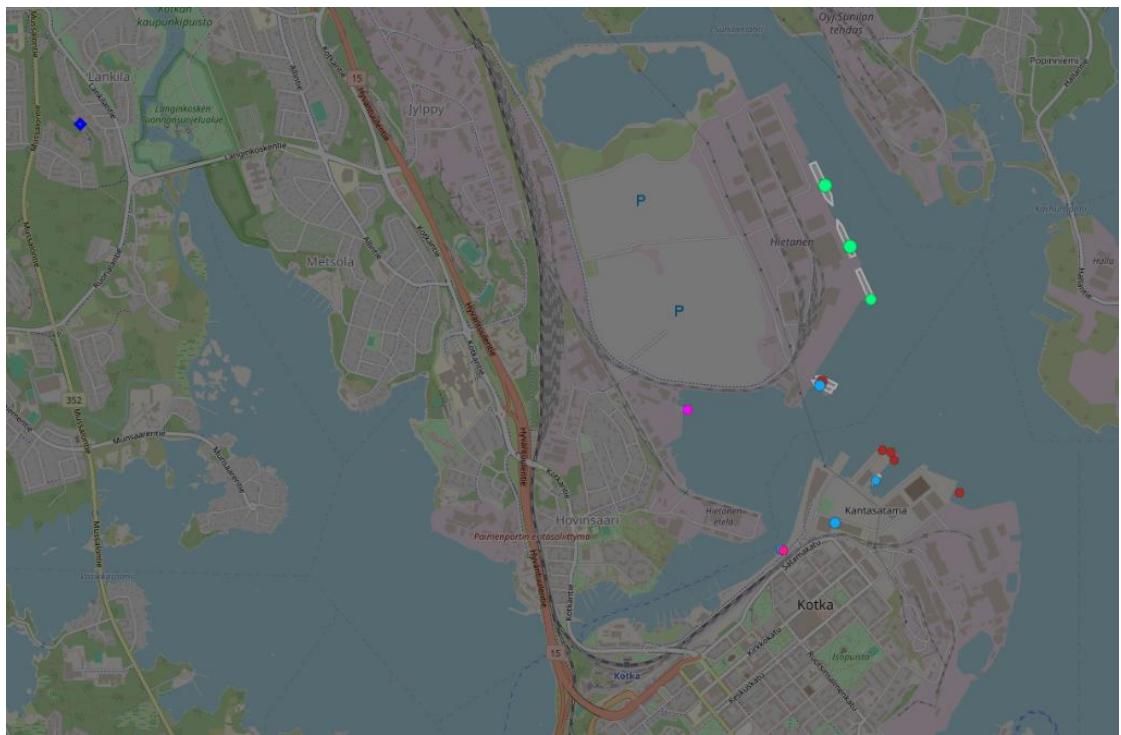


Saatiin vielä sama rannikkovartioston alus kiinni paluumatkalla

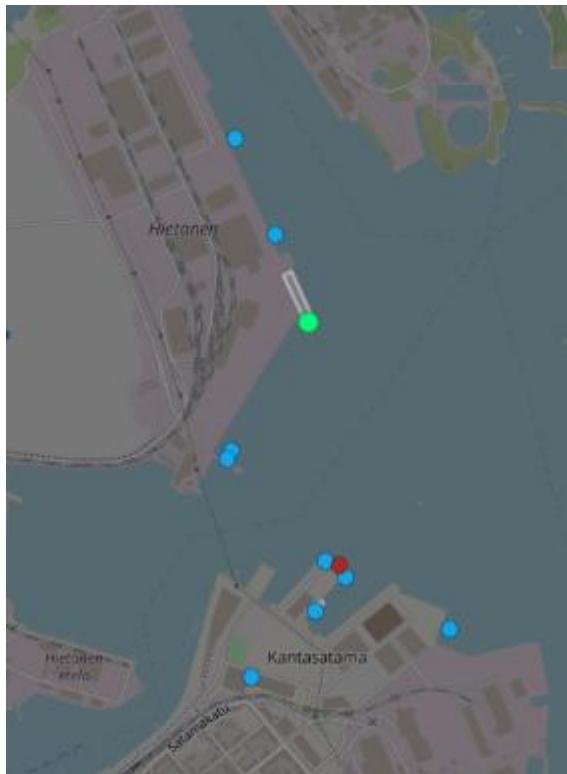


Uudella antennilla sisällä vielä testatessa löytyi ainakin





Testattiin vielä perus dipoliantennilla, näkee paljon vähemmän



Sitte yritetään pistää tämä toimimaan läppärillä kali live tikun avulla.  
Ei saatu mitään asennettua, kun oli certtejä vanhentunut. Piti hakea uudet certit.  
`wget https://http.kali.org/kali/pool/main/k/kali-archive-keyring/kali-archive-keyring_2018.1_all.deb`

```
apt install ./kali-archive-keyring_2018.1_all.deb  
Sitten päivitetään mikäliennee  
apt-get update
```

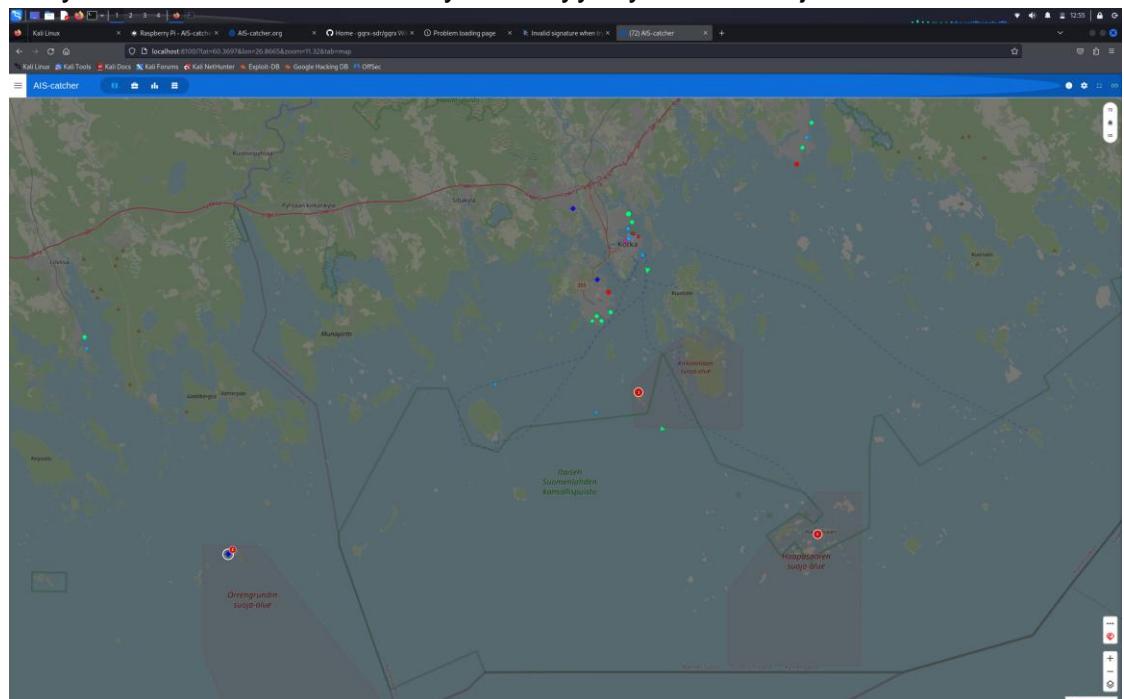
Ja itse asennukseen.

```
sudo bash -c "$(curl -fsSL https://raw.githubusercontent.com/jvde-github/AIS-catcher/main/scripts/aiscatcher-install)"
```

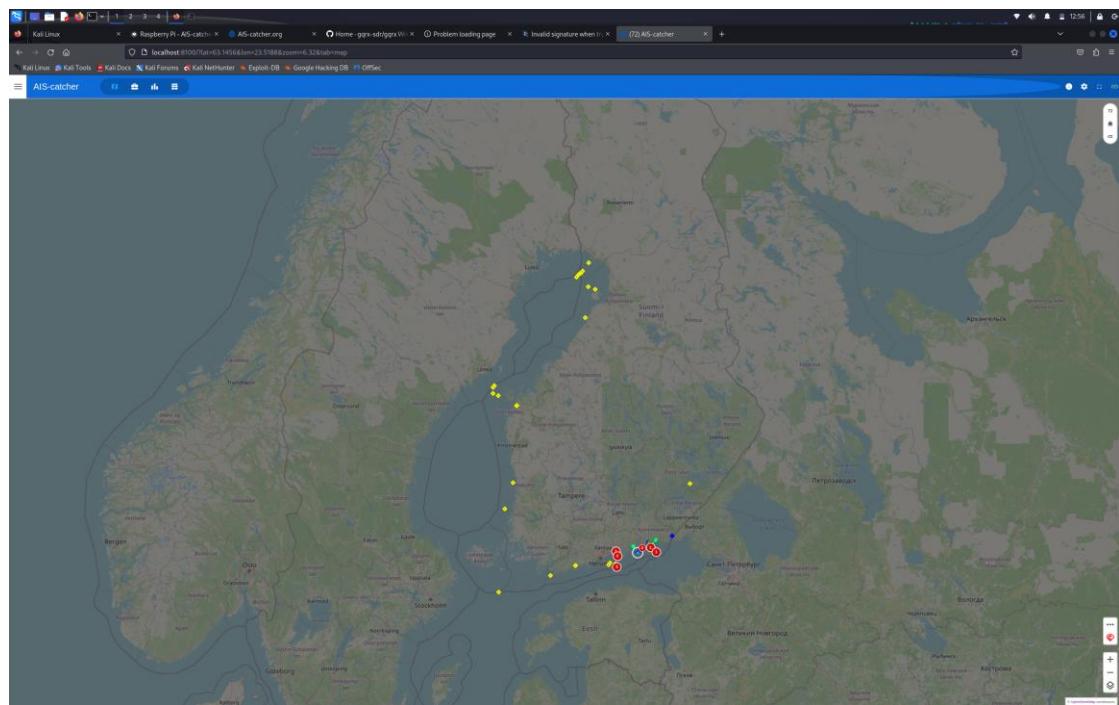
Tässä meni ikuisuus. Livetikku hidasti hommia aika paljon.

Testattiin sitten kampuksen katolta.

Kotkan suuntaan osoittelemalla sai yllättävän hyvin laivoja. Kauimmat laivat näkyvät Loviisassa asti. Aika hyvin näkyy myös merelle ja Haminaan.



Ouluun asti näkyy joitain merimerkkejä, mutta ne taitavat pingata toistensa kautta eteenpäin signaalejaan. Ei sentään ihan niin kaukaa nappaa meidän antennimme.



Alla vielä listattuna kaikki laivat ja muut, jotka antenni havaitti. Näkyy zoomaamalla.

Shipname	MMSI	IMO	Callsign	Status	Type	Last	PPM	RSSI	Dst	Brg	Lat	Lon	Spd	Repeated
+	2300048			Not available	◆	7s	-2.6	-33.5	0.0		60°37'3.6"	20°39'3.3"	N/A	
+	2300057			Not available	◆	4s	-2.6	-14.2	0.0 (R)		60°32'47.4"	20°29'2.1"	Yes	
+	2300063			Not available	◆	5m 16s	-2.4	-27.5	0.0		60°30'0.2"	20°30'1.2"	N/A	
+	2300018			Not available	◆	7s	-2.4	1.0	0.0		60°29'22.5"	20°52'34.4"E	N/A	
+	2300027			Not available	◆	4s	-2.9	-36.0	0.0		60°28'40.9"	20°54'0.2"	N/A	
+	232367000	9022011	EMB1G2	Moved	●	2s	-4.3	-6.0	0.0		60°21'33.3"	20°54'10.1"	N/A	
+	231905722	9000949	CZBH2	Moved	●	3m 32s	-2.0	-8.8	0.0		60°21'39.7"	20°53'0.7"	N/A	
+	230000770		CHE133	Not available	●	1m 21s	0.8	-5.9	0.0		60°24'40.7"	20°57'13.5"	N/A	
+	230004893			Moved	●	2m 22s	0.8	-14.8	0.0		60°23'11.4"	20°33'5.7"	N/A	
+	230000390			Not available	●	3m 20s	2.3	-38.3	0.0		60°23'11.4"	20°29'44.2"	N/A	
+	2312065	230112086	QX70L	Under way using engine	●	7s	-4.9	8.4	0.0		60°27'41.6"	20°57'48.7"E	N/A	
+	230129480	00101940	OD-E01	Under way using engine	●	7s	-1.7	0.6	0.0		60°23'11.4"	20°57'30.8"E	Yes	
+	230100506	230100506	CH4008	Not available	●	3m 10s	1.2	-35.3	0.0					N/A
+	230100008		OPFL	Not available	●	1s	-2.3	1.5	0.0		60°28'38.7"	20°56'0.8"	N/A	
+	230246000	904815	ODAQ	Moved	●	1m 32s	-2.4	0.8	0.0		60°24'40.7"	20°54'45.5"	N/A	
+	230275000	9050485	QAE	Moved	●	2m 26s	-0.6	1.4	0.0		60°23'09.7"	20°56'4.7"	N/A	
+	230002000	9048080	OTM	Moved	●	5s	-2.8	1.8	0.0		60°23'11.4"	20°57'2.7"	N/A	
+	230000000	9034599	QD2Y	Moved	●	1m 50s	2.0	1.5	0.0		60°23'07.0"	20°57'32.2"	N/A	
+	230000000	9056300	QD7D	Moved	●	2m 38s	0.3	0.5	0.0		60°23'11.4"	20°56'45.8"	N/A	
+	230904670	230904670	ODN4E	Moved	●	1m 38s	0.0	0.0	0.0		60°23'11.4"	20°50'30.7"	N/A	
+	230402850		QDQD	Moved	●	25s	-3.4	1.5	0.0		60°23'12.4"	20°56'3.4"	N/A	
+	230902840	9072081	ODQJ	Moved	●	1m 2s	-1.2	0.5	0.0		60°23'07.0"	20°57'40.7"	N/A	
+	230902528		ODR	Under way using engine	●	5s	-2.6	-1.8	0.0		60°23'08.4"	20°57'50.1"	N/A	
+	230902090			Moved	●	5m 20s	-2.8	-19.1	0.0		60°23'03.7"	20°53'40.2"	N/A	
+	230000970	9008428	ODRV	Under way using engine	●	8s	-0.8	-1.4	0.0		60°23'08.6"	20°57'44.6"	N/A	
+	244504000	9321359	PHKA	Under way using engine	●	5s	0.3	-4.0	0.0		60°25'22.0"	20°54'1.1"E	N/A	
+	244502000	9007358	PHFL	Under way using engine	●	7s	0.0	0.1	0.0		60°25'46.9"	20°51'1.1"E	12.5 kHz	N/A
+	245460000			Moved	●	1m 42s	-0.3	-17.7	0.0		60°23'2.1"	20°57'39.1"	N/A	
+	233200000	9052088	LXES	Under way using engine	●	4s	-4.1	-2.9	0.0		60°23'24.6"	20°47'34.2"	12.0 kHz	N/A
+	230800120	9031294	CQAB	Moved	●	3m 56s	-2.9	-19.7	0.0		60°24'36.0"	20°53'34.8"	N/A	
+	235814000	9057587	CQUR	Moved	●	8s	0.3	1.5	0.0		60°25'03.4"	20°57'1.0"E	N/A	
+	235800000			Under way using engine	▲	44s	-1.4	-18.7	0.0		60°24'40.6"	20°52'2.4"	12.7 kHz	N/A
+	2300019075			Moved	▲	Am 50s	-1.4	-17.8	0.0		60°22'37.9"	20°57'45.9"	N/A	

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Kali Linux   Raspberry Pi - AIS-catcher   AIS-catcher.org   Home - gpxsdrigps Wi-Fi   Problem loading page   R: Invalid signature when tr...   (78) AIS-catcher   Screenshots taken   View image

localhost:8007/Satellite26.89144,Lovisan7.32467nbsps

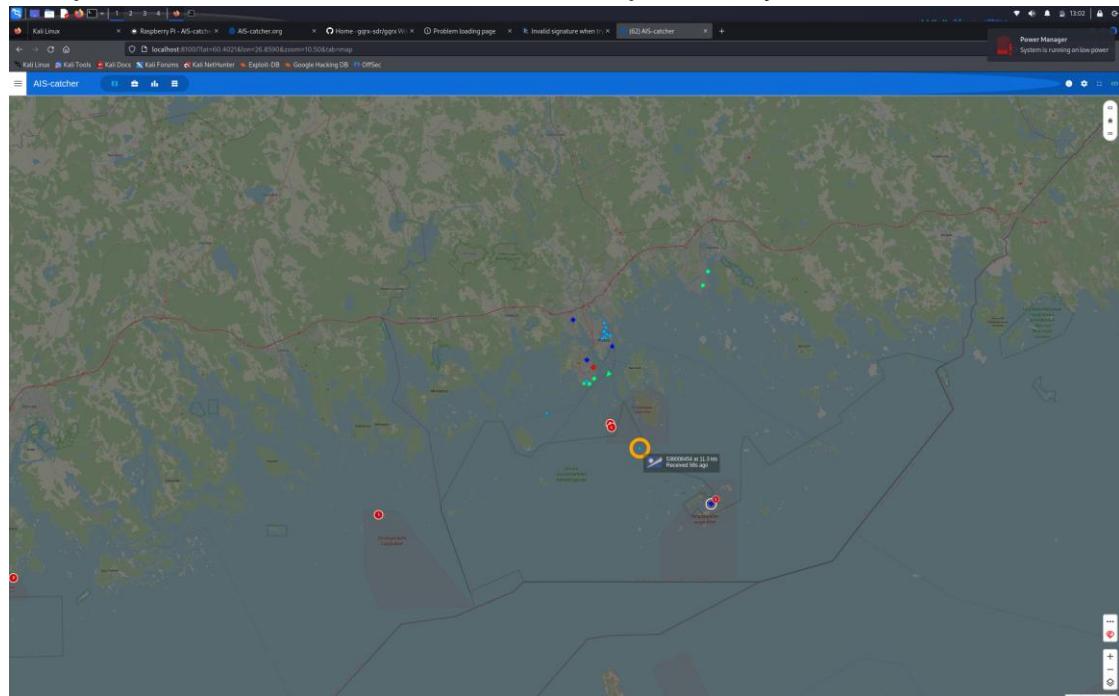
AIS-catcher

Search for ships...

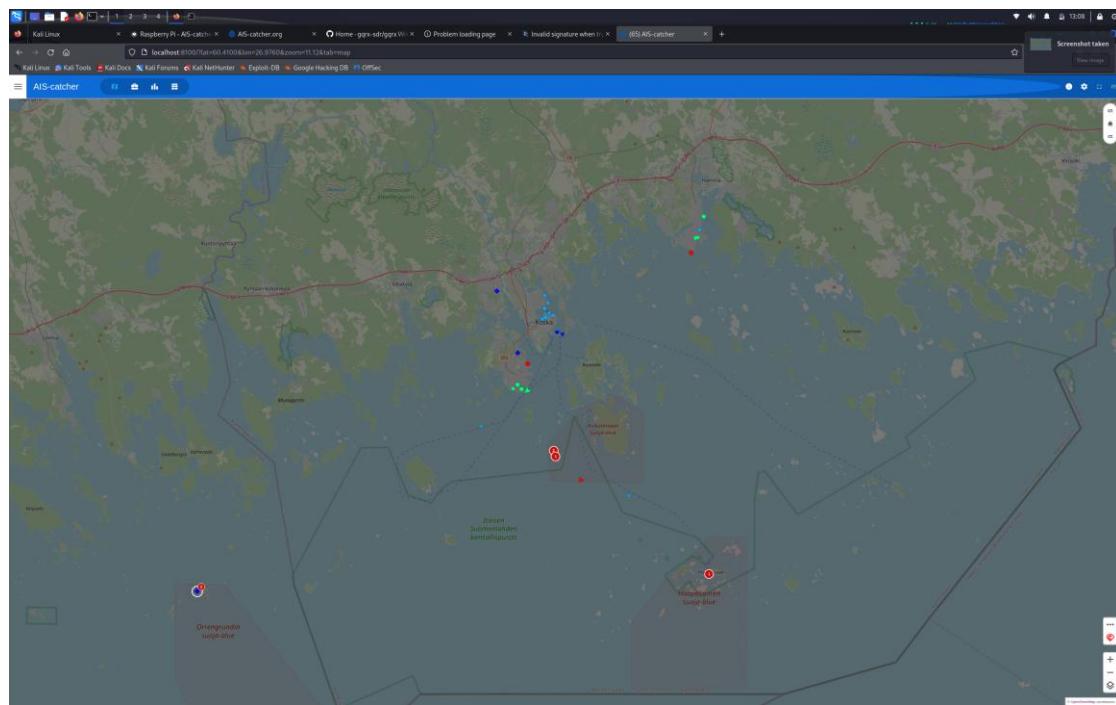
Shipname	MMSI	IMO	Callsign	Status	Type	Last	PPM	RSSI	Dst	Brg	Lat	Lon	Spd	Repeated
CALIFIA	230040000	9000000	ES07	Moved	■	201400	-0.0	2.2	0.0	00°00'00.0N	00°21'45.0E	N/A		
FINNECO 1	230640000	895830	OTD7	Moved	●	2m 38s	0.3	0.5	0.0	00°09'12.0N	20°59'45.0E	N/A		
IGOR	230904070		03H68	Moved	●	1m 38s	0.0	0.0	0.0	00°09'11.0N	20°59'45.0E	N/A		
HANNE	230402250		OQ00	Moved	●	25s	-1.4	1.5	0.0	00°09'32.0N	20°57'45.0E	N/A		
OTMAR	230840840	9702061	OQ01	Moved	●	1m 3s	-1.2	0.5	0.0	00°09'37.0N	20°57'45.0E	N/A		
TELEA 1	230502528		OTR9	Under way using engine	●	9s	-2.6	-1.8	0.0	00°09'28.0N	20°57'30.0E	N/A		
				Moved	●	9m 10s	-0.8	-0.1	0.0	00°09'20.0N	20°57'30.0E	N/A		
VIRGO	230400970	8000420	CRV	Under way using engine	●	9s	-0.9	-1.4	0.0	00°09'04.0N	20°57'45.0E	N/A		
ANIE	244504000	9331250	PW84	Under way using engine	●	5s	0.3	-4.0	0.0	00°09'22.0N	20°57'30.0E	N/A		
TINCA	244502000	9307358	PWFL	Under way using engine	●	7s	0.0	0.1	0.0	00°09'46.0N	20°57'30.0E	11.0 Kts	N/A	
				Moved	●	1m 41s	-0.3	-17.7	0.0	00°09'23.0N	20°57'30.0E	N/A		
ESTEMAR	253202000	9523668	LXES	Under way using engine	●	4s	-4.1	-2.9	0.0	00°07'24.0N	20°47'45.0E	11.0 Kts	N/A	
RIX MUNTE	205800120	9031354	CQAS	Moved	●	1m 56s	-2.9	-10.7	0.0	00°09'36.0N	20°57'30.0E	N/A		
CORONA SEA	205814000	9057597	CQCR	Moved	●	9s	0.3	1.5	0.0	00°09'53.0N	20°57'30.0E	N/A		
				Under way using engine	▲	44s	-1.4	-17.7	0.0	00°09'24.0N	20°57'30.0E	22.7 Kts	N/A	
				Moved	●	4m 58s	-1.4	-17.9	0.0	00°09'23.0N	20°57'30.0E	N/A		
BUDVA	202000000	9683001	KOCQ	Moved	●	1m 19s	-1.7	-8.4	0.0	00°07'40.0N	20°57'30.0E	N/A		
SELDENE	276800000	9678374	ESLQ	Under way using engine	●	2s	0.0	1.3	0.0	00°09'28.0N	20°57'30.0E	N/A		
AKLIER	004200000	9038340	V3WF2	Moved	●	40s	0.9	-12.4	0.0	00°09'05.0N	20°57'30.0E	N/A		
WILSON DAWINGER	014100000	9300111	APB02	Moved	●	1m 12s	-3.2	-14.4	0.0	00°09'42.0N	20°57'30.0E	N/A		
PRATICORUS	530800940	9470356	VTA2325	Under way using engine	●	7s	-4.7	-8.4	0.0	00°07'47.0N	20°59'30.0E	11.4 Kts	N/A	
LIBERTY BAY	530800962	9522993	V744840	Moved	●	2m 26s	-2.0	-10.0	0.0	00°09'51.0N	20°59'30.0E	N/A		
CHED COBALT	038019290	9747710	DETK3	Moved	●	1m 18s	-0.3	-10.4	0.0	00°09'38.0N	20°57'30.0E	N/A		
TUNDHAL	038005033	9493305	DETG3	Moved	●	7s	-1.1	-4.3	0.0	00°09'23.0N	20°57'30.0E	N/A		
SUDOMI LEXINA	092304001		Not available		●	10s	-1.1	-13.5	0.0 (P)	00°09'21.0N	20°49'45.0E	Yes		
KALLJOMITALA	092304002		Not available		●	14s	-2.6	-14.8	0.0 (P)	01°01'40.0N	20°39'31.0E	Yes		
REIN II (M)	993200000		Not available		●	13s	-2.6	-12.0	0.0 (P)	01°01'37.0N	20°39'31.0E	Yes		
REIN II (M)	992300005		Not available		●	13s	-2.6	-10.9	0.0 (P)	01°01'47.0N	20°39'31.0E	Yes		
REIN II (M)	992300006		Not available		●	12s	-2.9	-10.2	0.0 (P)	01°01'47.0N	20°39'31.0E	Yes		
REIN II (M)	992300007		Not available		●	12s	-2.6	-11.4	0.0 (P)	01°01'38.0N	20°39'31.0E	Yes		
LYT (M)	992300008		Not available		●	12s	-2.6	-12.8	0.0 (P)	01°01'37.0N	20°39'31.0E	Yes		
LYT (M)	992300009		Not available		●	12s	-2.6	-10.7	0.0 (P)	01°01'37.0N	20°39'31.0E	Yes		
LYT (M)	992300010		Not available		●	10s	-2.6	-13.5	0.0 (P)	01°01'47.0N	20°39'31.0E	Yes		
REIN II (M)	992300013		Not available		●	10s	-2.6	-13.5	0.0 (P)	01°01'47.0N	20°39'31.0E	Yes		

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Testattiin pikku dipoliantenttia, joka otti samalta kohdalta katolta yllättävän hyvin. Kuitenkin ei huomannut signaaleja ihan niin kauaa kuin meidän antennimme. Esimerkiksi Loviisan laivoja se ei huomannut, eikä kaikkia Haminan laivoja. Yksi merellä matkustavista laivoista jäi siltä myös huomaamatta.



Haminan suuntaan osoittaessa antenni huomasi yhden laivan lisää Haminan satamasta, mutta muuten tulokset olivat aika samanlaisia verrattuna siihen, kun Kotkan länsipuolelle osoitteli. Loviisan laivoja ei toki näkynyt.



Alla vielä lista laivoista, jotka näkyivät Haminaan osoittaessa.

AIS-catcher																
Search for ships...																
Shipname	MMSI	IMO	CallSign	Status	Type	Last	FPM	RSSI	Dst	Brg	Lat	Lon	Spd	Repeated		
+ TEKLA I	339962508		DRW	Under way using engine	■	3t	-2.6	0.1	0.0	002738.97N	205750.1E		No			
■ 27M58000				Under way using engine	■	1s	0.0	1.4	0.0	002825.27N	205757.6E		No			
■ HEINRICH ESSIG	251890000	9639144	CQH2	Under way using engine	■	3s	-5.4	-17.6	0.0	002115.07N	205712.8E	12.0 Km	No			
+ ■				Not available	■	2s	-1.4	0.5	0.0	002923.97N	205754.3E		No			
+ MERIKOTKA	230182000		CJPL	Not available	■	1s	-2.3	0.7	0.0	002818.77N	205749.8E		No			
+ OTIAK	330942845	8707091	CJPL	Under way using engine	▼	9s	-2.2	0.5	0.0	002735.07N	205738.0E	20.4 Km	No			
■ ANKIE	244545000	9323559	PHKA	Under way using engine	■	10s	0.3	-14.2	0.0	002912.27N	205454.2E		No			
■ ■	246546000			Moved	■	1m 10s	-0.9	-10.1	0.0	002923.27N	205433.1E		No			
■ ■	530000004			Under way using engine	▲	1s	-0.0	-11.1	0.0	002913.07N	205413.8E	11.3 Km	No			
+ ■	2320110			Not available	■	3s	-1.7	-24.4	0.0	002923.27N	205201.2E		No			
+ ■	230111000			Under way using engine	■	7s	-0.9	-0.2	0.0	002745.77N	205740.8E		No			
+ ■	230111040			Under way using engine	■	9s	-2.0	0.0	0.0	002812.87N	205738.7E		No			
+ ■	230111040		CJPL05	Moved	■	1m 46s	-0.0	6.0	0.0	002912.27N	205738.7E		No			
+ ■	23000408			Not available	■	4s	-2.8	-18.8	0.0	002810.17N	205730.8E		No			
+ ■	2300057			Not available	■	6s	-2.6	-17.6	0.0(0)	002812.47N	205726.5E		Yes			
+ ■	2300137			Not available	■	2s	-2.6	-21.5	0.0	002812.97N	205434.2E		No			
■ ■ MSC YOSHINO	211210700	9022011	MBI02	Moved	■	1m 46s	-4.6	-2.4	0.0	002913.07N	205441.2E		No			
■ ■ TERN ISLAND	212020722	9005459	CQHZ2	Moved	■	3m	-2.0	0.7	0.0	002743.27N	205729.7E		No			
■ ■ MTS208	23000770	9048115	CHL833	Not available	■	52s	0.8	-4.8	0.0	002740.87N	205741.6E		No			
■ ■ FENICA	230245000	9048115	CQHD	Moved	■	1m	1.7	3.6	0.0	002740.87N	205644.8E		No			
■ ■ NORDICA	230275000	9024695	CQAE	Moved	■	1m 57s	-0.6	5.9	0.0	002828.37N	205643.3E		No			
+ ■	23030000			Moved	■	27s	-3.3	7.0	0.0	002923.37N	205717.7E		No			
+ ■	23036000			Moved	■	1m 20s	-5.7	5.3	0.0	002827.07N	205750.8E		No			
+ ■	23040000			Moved	■	2m 6s	0.3	4.3	0.0	002923.97N	205645.5E		No			
+ ■	23041200			Moved	■	2m 58s	-1.8	-0.8	0.0	002812.07N	205613.3E		No			
+ ■	23090270	8008428	DRW	Under way using engine	■	2s	-0.9	1.2	0.0	002812.17N	205747.8E	1.2 Km	No			
■ ■ TRICA	246521000	8007356	PHFL	Under way using engine	■	6s	0.0	-6.5	0.0	002913.07N	205619.7E	22.0 Km	No			
■ ■ 251036000				Under way using engine	▼	1s	-4.1	-10.4	0.0	002737.07N	205113.8E	12.2 Km	No			
■ ■ 250314000				Moved	■	2m 20s	0.3	2.8	0.0	002813.57N	205707.6E		No			
■ ■ 25151625				Moved	■	1m 24s	-5.4	-1.9	0.0	002742.77N	205125.8E		No			
■ ■ BULVA	26200000	9669551	DOCQ	Moved	■	49s	-1.7	0.6	0.0	002812.97N	205719.3E		No			
■ ■ ALUER	30420000	9038461	VZRF2	Moved	■	9s	-0.9	-0.8	0.0	002810.77N	205710.8E		No			
■ ■ BH SIN DAEGURO	31410000	9001111	AER-01	Moved	■	47s	-1.5	-4.6	0.0	002810.77N	205110.8E		No			

AIS-catcher																
Search for ships...																
Shipname	MMSI	IMO	Callsign	Status	Type	Last	PPM	RSSI	Dst	Brg	Lat	Lon	Spd	Repeated		
TELEFONICA	230000000	90000000	WAGA900	Avalon	●	24	-0.6	-0.0	0.0	00°28'22.4"	12°30'41.4"	N/A				
MTS108	230000070		CW1003	Not available	●	544	0.8	-4.9	0.0	00°27'40.0"	20°57'42.8"	N/A				
FENICA	230240000	9003415	QAD	Mooned	●	1m 2s	-0.7	3.6	0.0	00°28'00.0"	20°56'42.5"	N/A				
NORDICA	230270000	9050485	QAD	Mooned	●	1m 50s	-0.6	5.9	0.0	00°28'38.7"	20°56'42.7"	N/A				
+	230300000			Mooned	●	29s	-2.3	7.0	0.0	00°28'21.5"	20°57'27.7"	N/A				
+	230400000			Mooned	●	1m 22s	-1.7	5.3	0.0	00°28'27.0"	20°57'42.8"	N/A				
+	230400000			Mooned	●	2m 8s	0.3	4.3	0.0	00°28'22.6"	20°56'42.5"	N/A				
+	230400000			Mooned	●	2m 50s	-1.4	-1.9	0.0	00°28'13.0"	20°56'42.8"	N/A				
VIRGILI	230500070	8000020	ORVY	Under way using engine	●	4s	-0.9	1.2	0.0	00°28'20.0"	20°57'42.8"	1.3 Km	N/A			
TINCA	244520000	9007358	PWFL	Under way using engine	●	8s	0.0	-4.5	0.0	00°28'33.7"	20°56'42.7"	12.8 Km	N/A			
+	251000000			Under way using engine	●	15s	-4.1	-10.4	0.0	00°28'35.0"	20°56'42.8"	12.2 Km	N/A			
+	255814000			Mooned	●	2m 40s	0.3	2.8	0.0	00°28'23.5"	20°57'42.8"	N/A				
+	260810620			Mooned	●	1m 26s	-1.4	-1.9	0.0	00°28'22.7"	20°57'42.8"	N/A				
BLUDOK	260000000	9003001	400Q	Mooned	●	91s	-1.7	0.6	0.0	00°28'40.0%"	20°57'42.8"	N/A				
KUER	944220000	9008400	Y2W92	Mooned	●	12s	-0.9	-0.6	0.0	00°28'26.7"	21°07'30.0"	N/A				
WILSON DAWINGER	954100000	8000111	WPB02	Mooned	●	44s	-0.9	-4.8	0.0	00°28'40.0"	21°07'42.8"	N/A				
LIBERTY BAY	330000062	0022393	VT44840	Not available	●	2m 50s	-2.0	-12.3	0.0	00°28'17.0"	20°56'42.8"	N/A				
CHIEF COBALT	030010209	9147170	DTK13	Mooned	●	48s	-0.3	-4.0	0.0	00°28'17.0"	20°56'42.8"	N/A				
TUNDHAL	030020553	9429195	DSQ23	Mooned	●	21s	-3.8	-6.3	0.0	00°28'23.0%"	20°56'42.8"	N/A				
SUDOMEN LEXINA	902300001			Not available	●	2m 38s	-2.6	-12.1	0.0 (R)	00°28'21.4%"	20°48'42.2%"	Yes				
KALLIOKITALA	903300002			Not available	●	2m 42s	-1.7	-24.3	0.0 (R)	00°28'40.0%"	20°33'13.2%"	Yes				
REIN 8 [N]	992500000			Not available	●	2m 40s	-2.6	-16.6	0.0 (R)	00°28'42.7%"	21°03'13.2%"	Yes				
REIN 7 [N]	992600000			Not available	●	2m 42s	-1.7	-12.3	0.0 (R)	00°28'34.7%"	21°03'13.2%"	Yes				
REIN 14 [N]	992600008			Not available	●	40s	-1.4	-18.4	0.0 (R)	00°28'37.7%"	21°03'13.2%"	Yes				
L71 [T]	992500008			Not available	●	2m 42s	-2.6	-12.9	0.0 (R)	00°28'37.7%"	21°03'13.2%"	Yes				
L71 [D]	992500003			Not available	●	2m 42s	-2.6	-15.8	0.0 (R)	00°28'58.7%"	21°33'13.2%"	Yes				
REIN 17 [N]	992500013			Not available	●	2m 40s	-2.6	-19.3	0.0 (R)	00°28'57.7%"	21°33'13.2%"	Yes				
WITHDRAWN KE Z...	902300002			Not available	●	2m 42s	-1.7	-21.2	0.0 (R)	00°28'07.0%"	21°03'22.2%"	Yes				
WITHDRAWN KE L...	992300031			Not available	●	2m 40s	-1.6	-12.8	0.0 (R)	00°28'23.5%"	24°23'23.2%"	Yes				
WITHDRAWN O...	992300032			Not available	●	2m 40s	-2.6	-17.1	0.0 (R)	00°28'15.7%"	23°57'42.8%"	Yes				
WITHDRAWN G...	992300033			Not available	●	2m 40s	-2.6	-14.9	0.0 (R)	00°28'05.7%"	20°48'42.2%"	Yes				
WITHDRAWN NO...	992300034			Not available	●	2m 38s	-3.2	-13.4	0.0 (R)	00°28'04.2%"	20°38'42.8%"	Yes				
NESTERBAK-KM	992300059			Not available	●	41s	-1.7	-17.9	0.0 (R)	00°28'20.4%"	21°24'13.2%"	Yes				

## 2 ANTENNI

Rakennettiin oma yagi antenni taajuudelle 162 MHz. Antennin käsi tehtii muoviputkesta ja putken läpi porattiin porakoneella. Käytettiin rullamittaa reflektorin, dipolin ja directorin rakentamisessa. Leikattiin rullamitasta oikean koisot osiot alhaalla tarkat mitat, mutta tehtiin noin:

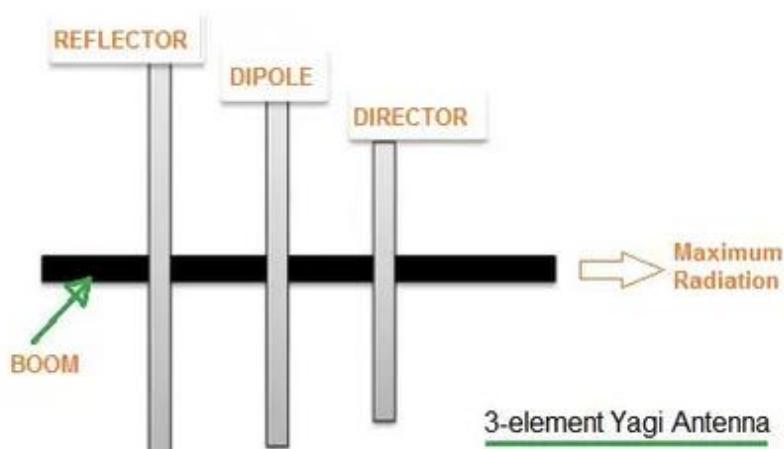
Reflektorin Pituus: 92 cm

Dipolin Pituus: 87,5 cm

Directorin Pituus: 81 cm

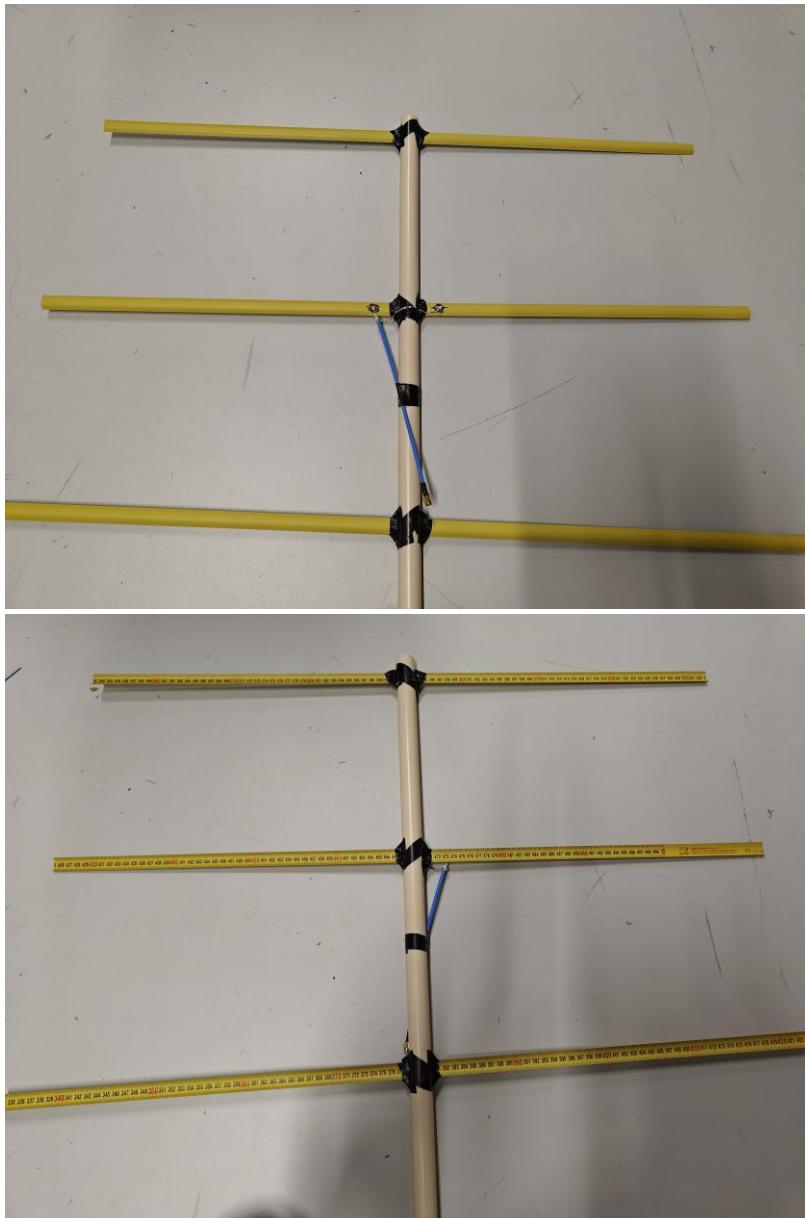
Reflektorin ja Dipolin väli: 23 cm

Dipolin ja Directorin väli: 23 cm

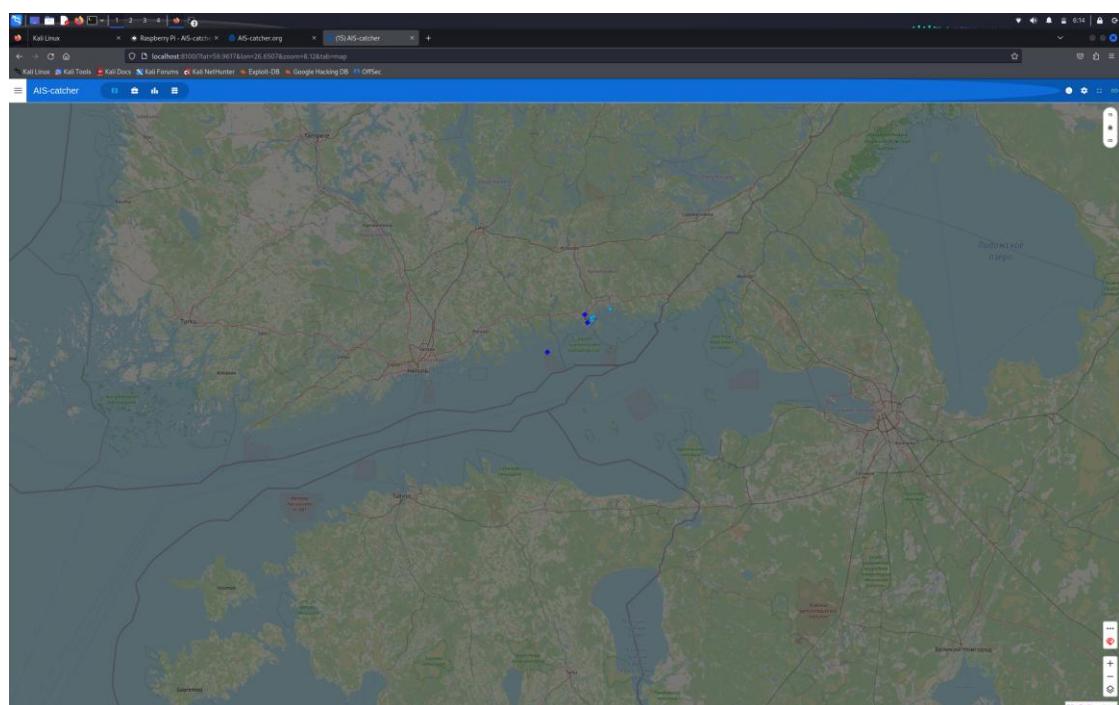
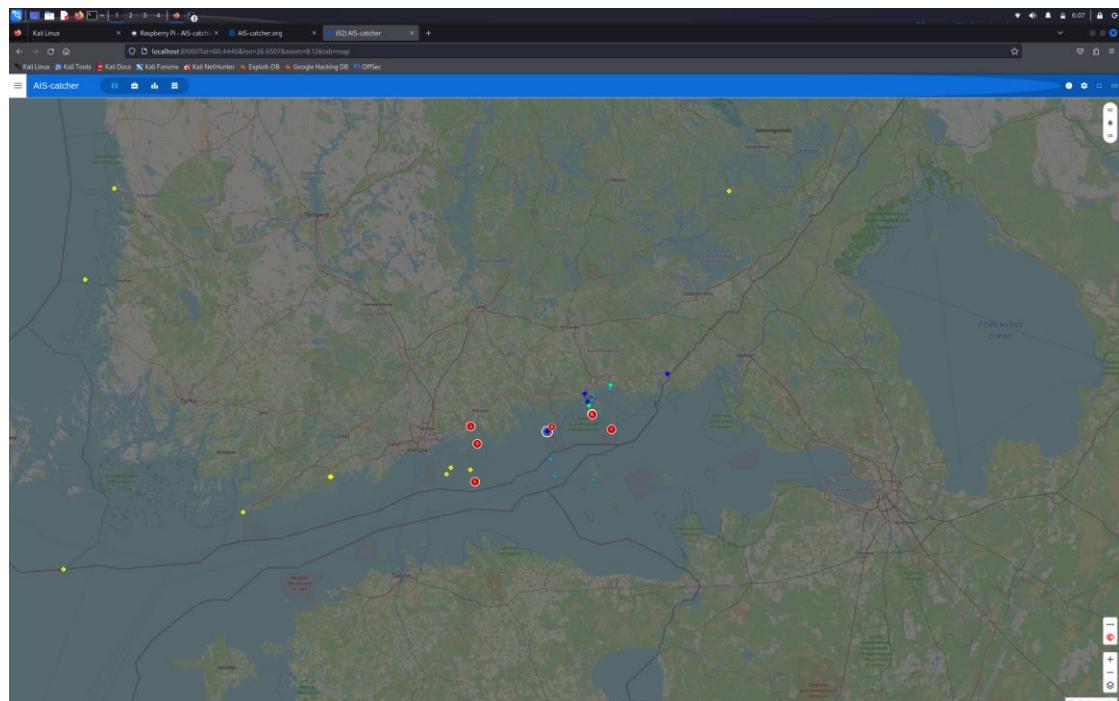


Inputs		Clear Input
Operating Frequency in MHz	162	<input type="button" value="▼"/>
Outputs		
Reflector Length	0.9166666666666666	<input type="button" value="▼"/>
Dipole Length	0.8759259259259259	<input type="button" value="▼"/>
Director length	0.8148148148148148	<input type="button" value="▼"/>
Reflector to Dipole Spacing	0.23148148148148148	<input type="button" value="▼"/>
Dipole to Director Spacing	0.23148148148148148	<input type="button" value="▼"/>

Mitta katkaistiin puoliksi dipolissa ja yhdistettiin se sähköteipillä, että se sillä ole yhteyttä toiselle puolelle. Tinattiin antennijohto dipolin vasemmalle ja oikealle puolelle, että saadaan positiivinen ja negatiivinen puoli. Kuva miltä antenni näyttää:



Myöhemmin testattiin myös Ruotsinsalmen majakassa. Antennilla nähtiin majakalta yllättävän pitkälle ja testasimme siellä myös pienemällä antennilla ja antennien ero oli huomattava.



**LÄHTEET**

<https://docs.aiscatcher.org/installation/ubuntu-debian/>

<https://github.com/jvde-github/AIS-catcher>

<https://unix.stackexchange.com/questions/421985/invalid-signature-when-trying-to-apt-get-update-on-kali>