

ASGARD

Balloons for science

VTS-SNW ASGARD VI experiment
“High Altitude Ionospheric
Propagation Investigation on HF
bands”.

Organised by

SNW Clubvergadering 2 oktober 2015



St-pieterscollege
Jette



ESERO
Belgium



Royal
Meteorological
Institute



Planetarium
Brussels



Solar Terrestrial
Center of
Excellence



Royal Observatory
Of Belgium



Euro Space
Society



Belgian Institute
for Space Aeronomy



Agenda:

- ASGARD VI Handleiding
- VTS/SNW experiment
- Propagatie Simulatie 28/4/2016
 - HAMCap en DxAtlas2
- Besluit
 - Aanbeveling voor het WSPR baken & Ballon antenne.



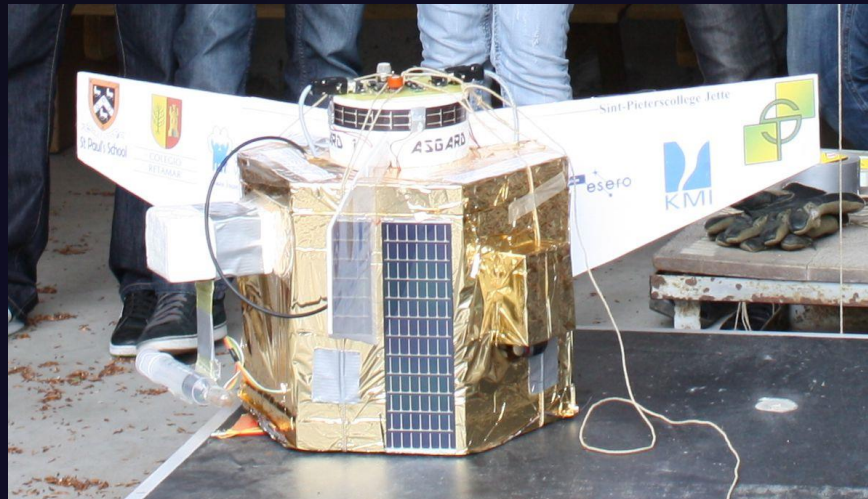
ASGARD VI HANDLEIDING



ASGARD VI Handleiding

Schooljaar 2015/2016:

- Meevliegen met KMI ballon op 28 april 2016.
- WSPR baken (20m/30m/40m; 1W)
- http://www.esero.be/_WP/?page_id=190

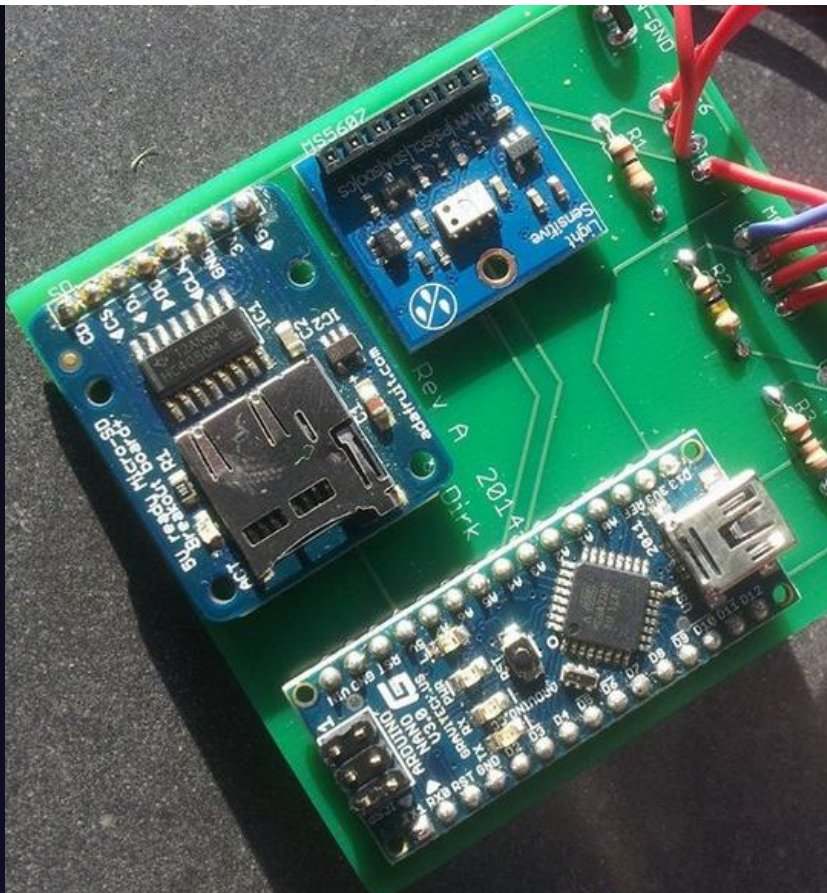


ASGARD VI Handleiding

ASGARD V

Leerlingen doen aan RUIMTEVAART

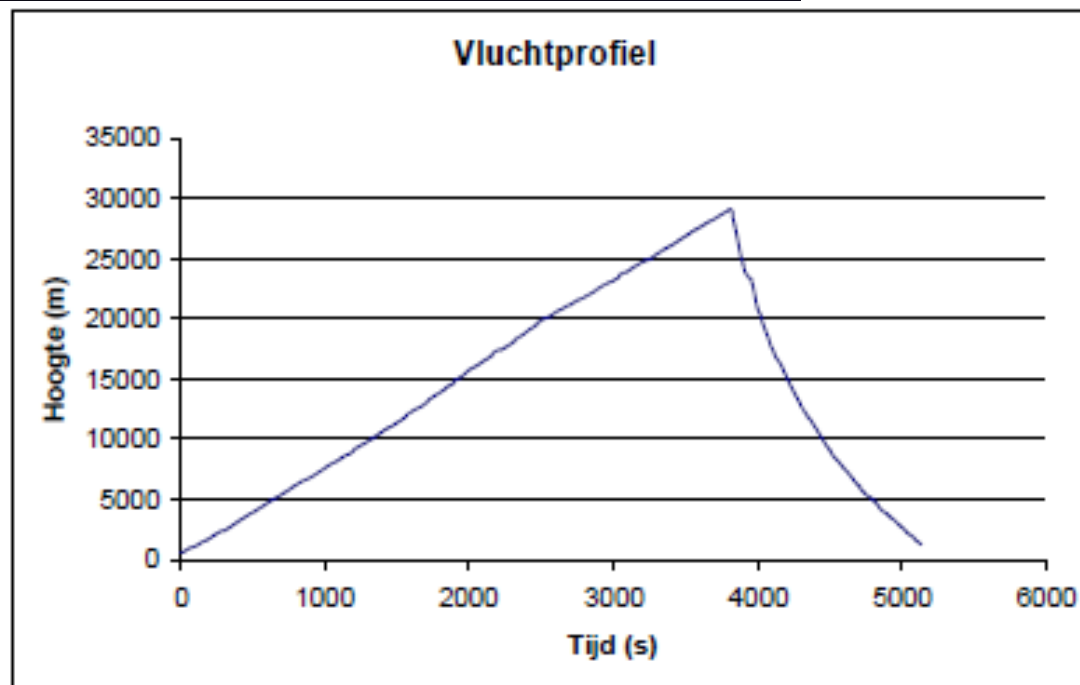
Stuur een zelfbedacht experiment mee met een stratosfeerballon



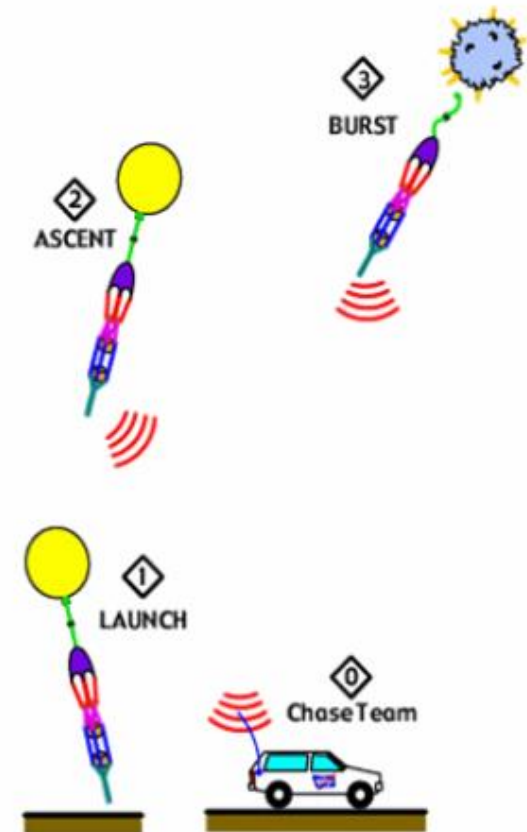
- Moederbord met:
 - Arduino nano
 - Osc: Si5351
 - GPS: UBLOX7
 - Voeding: SPV1040 & LiPo
 - Logger: SD card

ASGARD VI Handleiding

- Fase I: Stijgen;
- Fase II: Dalen;
- Fase III: Gondola terughalen;



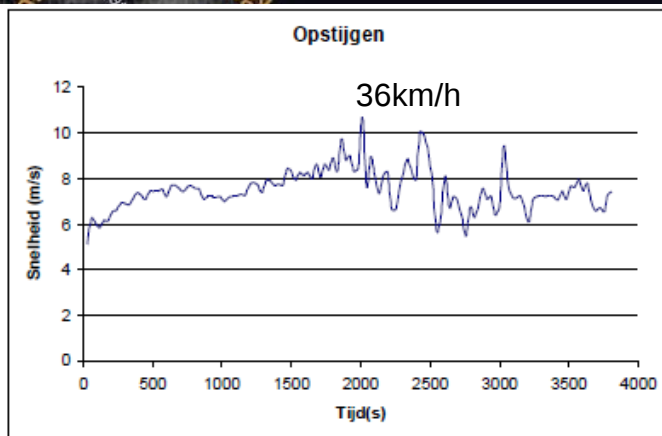
Afbeelding 4: Vluchtprofiel



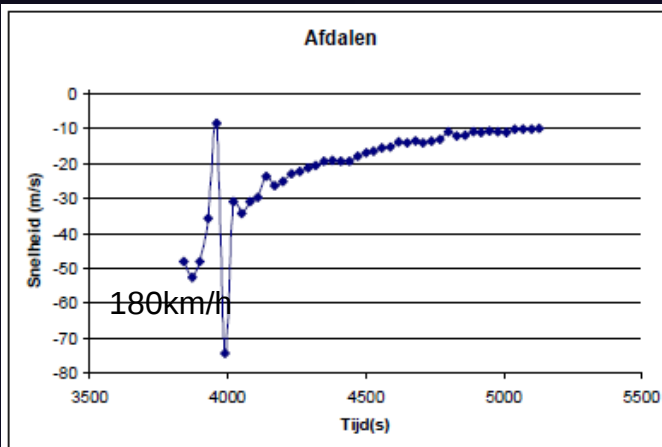
Afbeelding 3: Vluchtfasen



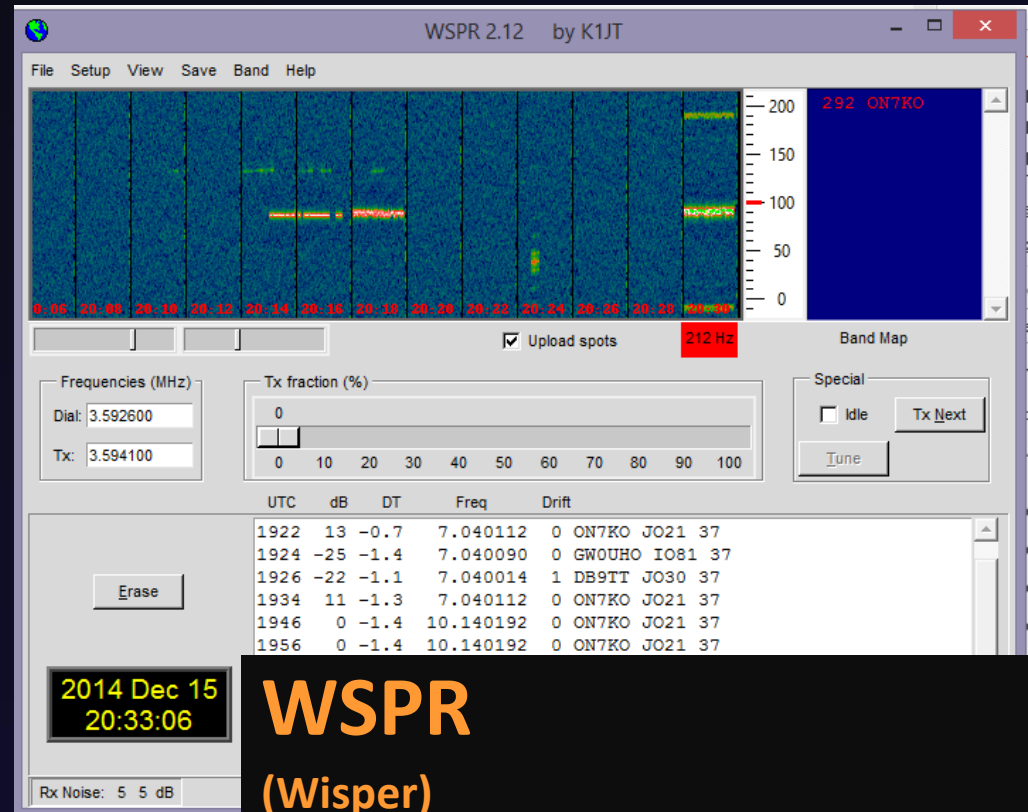
ASGARD VI Handleiding



Afbeelding 5: Stijgsnelheid i.b.v. de tijd



Afbeelding 6: Afdaalsnelheid i.b.v. de tijd

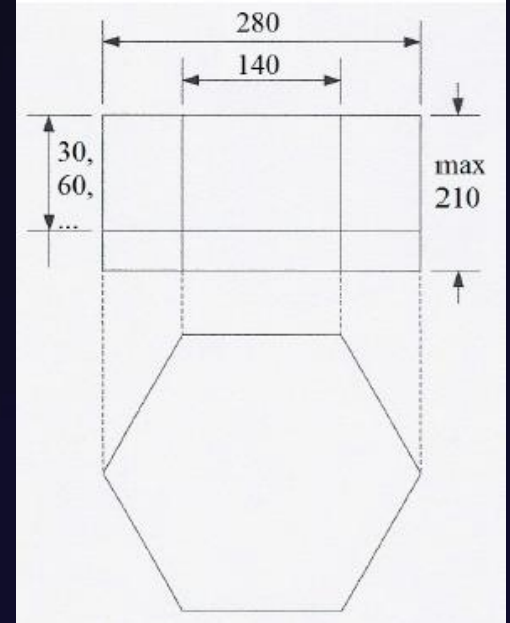
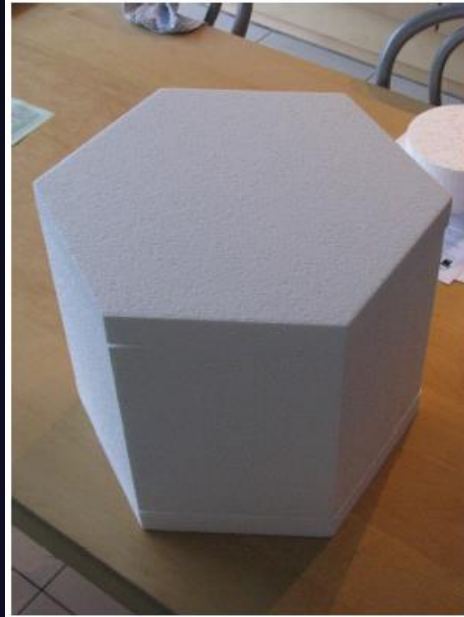


WSPR

(Wisper)

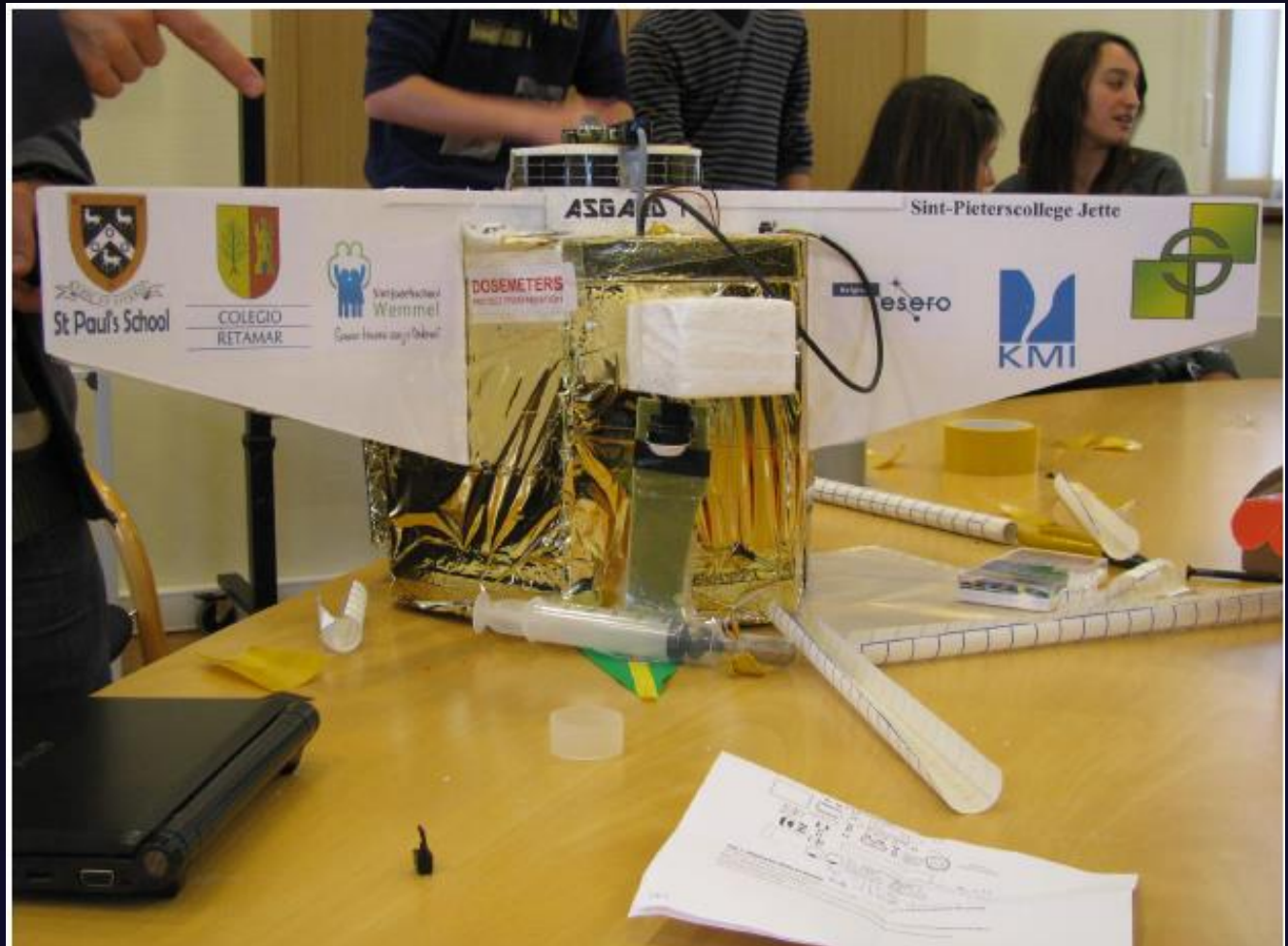
- 4-FSK, tone separation 1.4648 Hz.
- Occupied bandwidth: about 6Hz
- Standard message: callsign + 4-digit locator + dBm

ASGARD VI Handleiding





ASGARD VI Handleiding

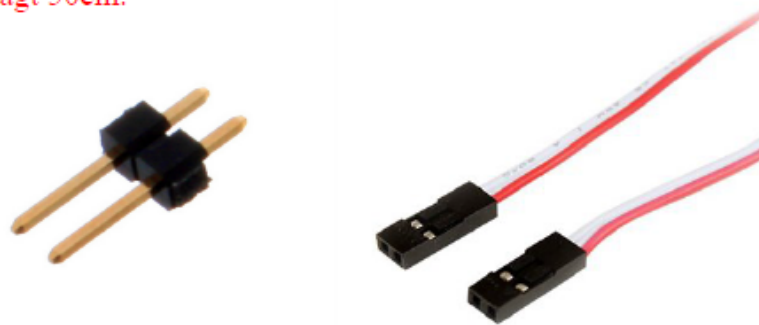


Afbeelding 11: Logo's van scholen en partners op de gondola van Asgard-1



ASGARD VI Handleiding

Experimenten die geen eigen stroombron hebben krijgen **9V DC** ter beschikking op hun experimentenplatform. Aansluiting gebeurt via een 2-pin header en dito kabel (zie Afbeelding 14). De kabellengte bedraagt 50cm.



Afbeelding 14: Elektrisch interface

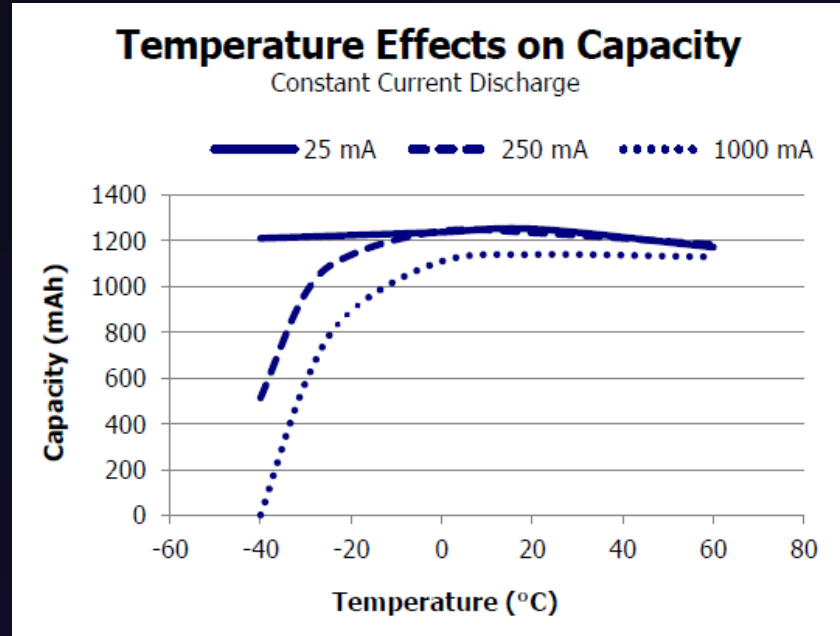
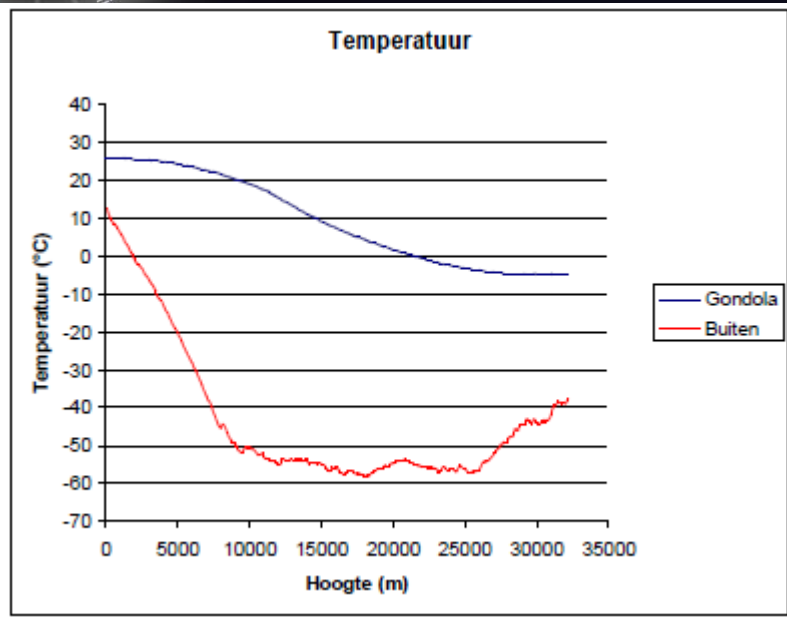
5.5.1 Electrische functies

Het boordcomputer-platform bevat een stroombron ten behoeve van de experimenten. De karakteristieken van de nominale stroombron (varianties zijn mogelijk) zijn gegeven in Tabel 4.

Batterijtype	AA Lithium/Ijzerdisulfide (Li/FeS ₂)
Aantal	6
Nominale spanning	6x1,5V
Werkings temperatuur	-40 tot +60°C
Massa	6x14,5g
Max stroom	2,0A(continu)
Max inverse stroom	2μA
Inwendige weerstand	100-250mΩ
Capaciteit	6x3000mAh



ASGARD VI Handleiding



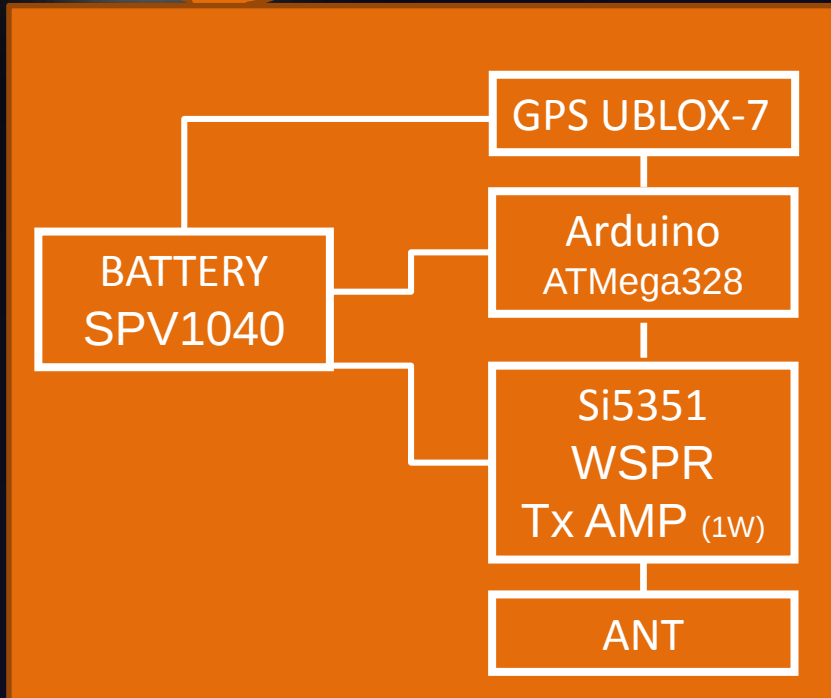
Opmerking1: Het is toegelaten een experiment uit te rusten met een eigen stroombron. In dat geval moet de batterij in staat zijn het experiment minimum 3 uur continu van stroom te voorzien!

Opmerking2: Voor de veiligheid moeten alle stroomdraden geïsoleerd zijn.

ASGARD VI

ASGARD VI Handleiding

VTS HW



Tijd & Locatie

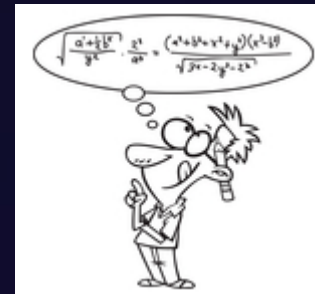
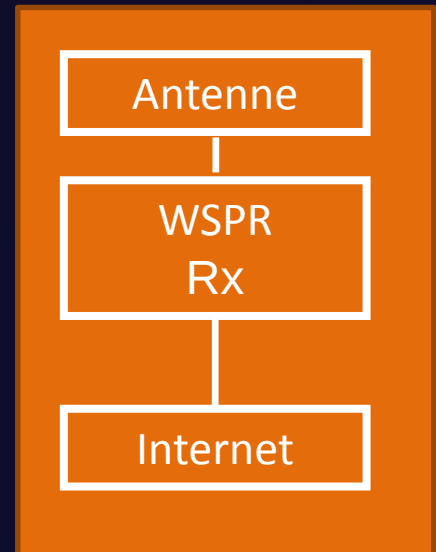
Power control
WSPR
Si5351

TCXO
Uitgangstrap

2x2m antenne
of 4m en
radialen

WSPR grondstations:
(Hoe meer, hoe beter.)

- Ukkel
- VTS-Sint-Niklaas
- ...





VTS/SNW EXPERIMENT

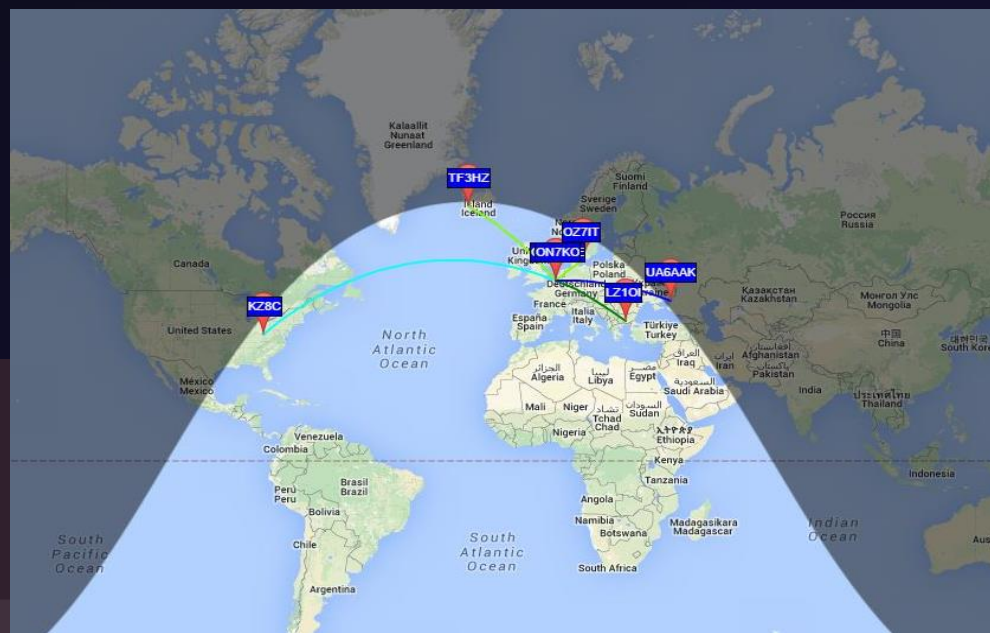
ONDERZOEK VAN DE IONOSFEER



ASGARD VI (28 April 2016)

Ionosfeer onderzoek vanuit de stratosfeer d.m.v. “Weak Signal Propagation” (WSPR)

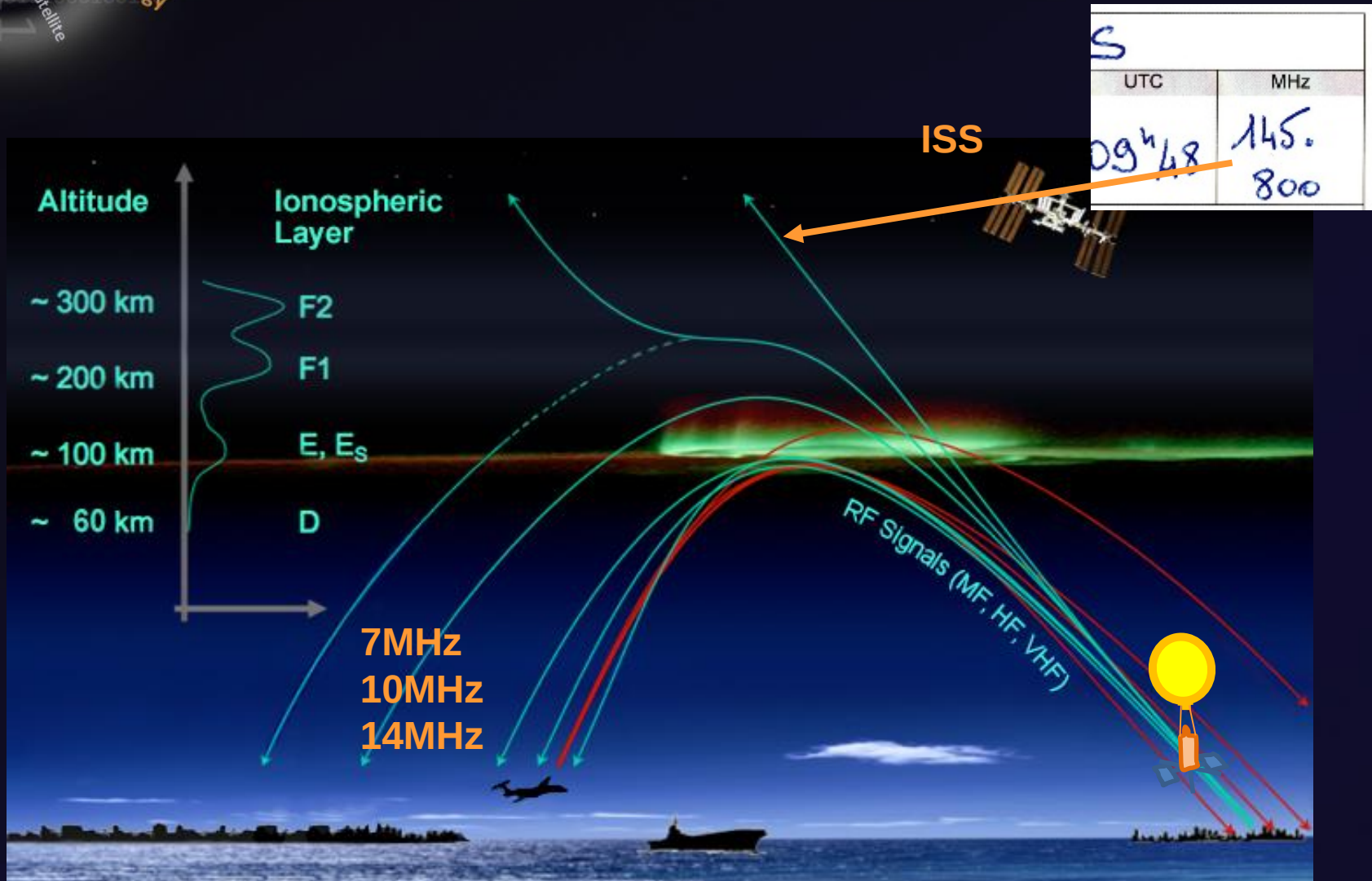
Search for call:
 Show spots heard by:
 Sort by: ☐ Reverse order ☐
 Find unique calls ☐ Find unique reporters ☐



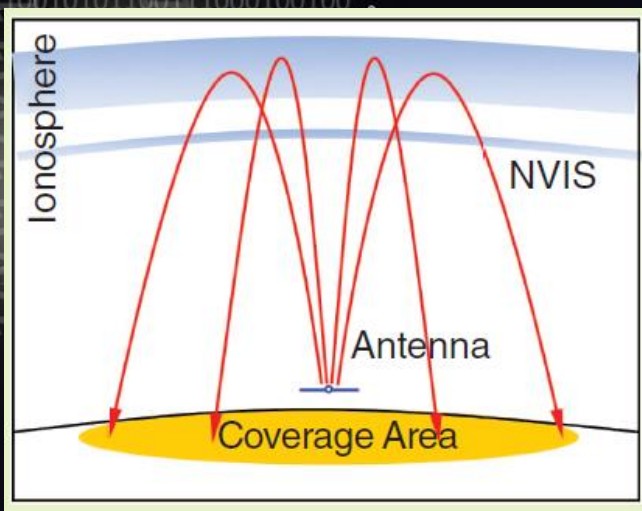
Date	Call	Frequency	SNR	Drift	Grid	Power		Reported		Distance	
						dBm	W	by	loc	km	mi
2015-01-24 08:20	VK3YT	10.140294	-26	0	QD98	+10	0.010	ON7KO	J021ce	18270	11352
2015-01-24 08:10	VK3YT	14.097116	-26	0	QD98	+10	0.010	ON7KO	J021ce	18270	11352



Gedrag van de Ionosfeer

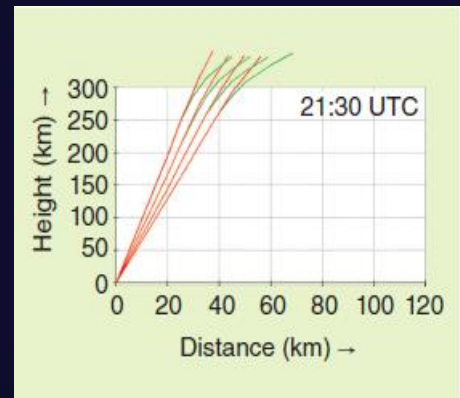
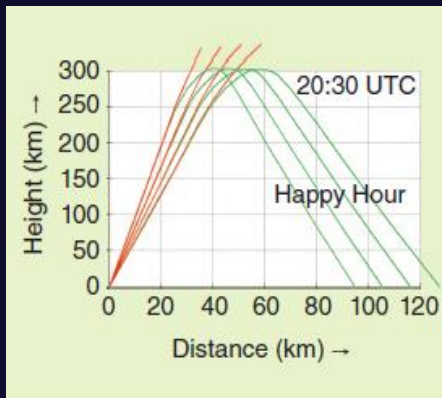
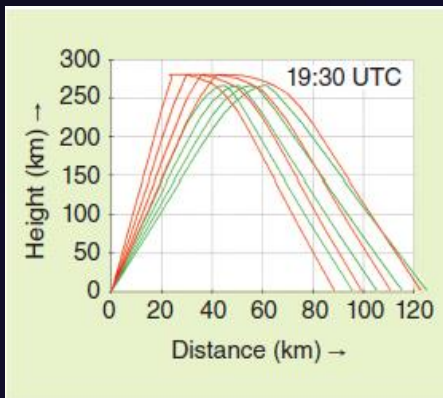
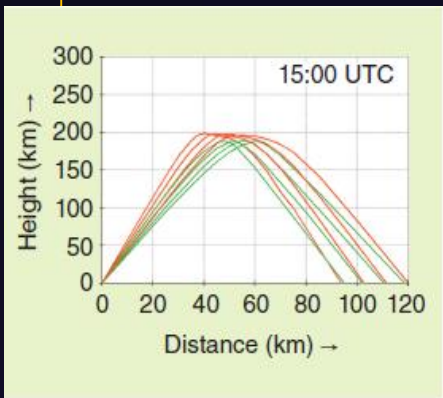
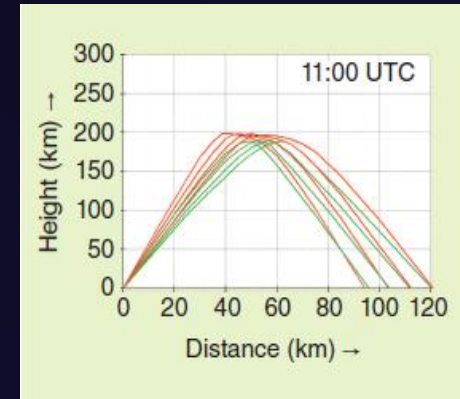
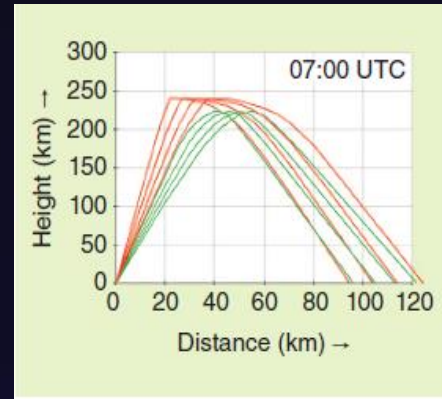
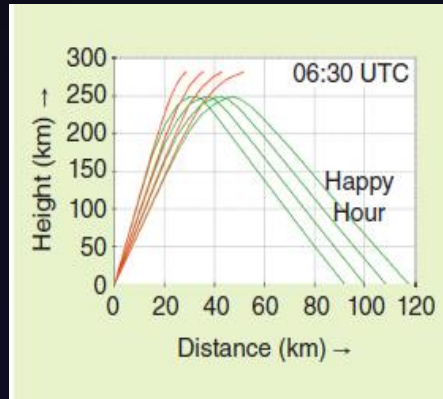
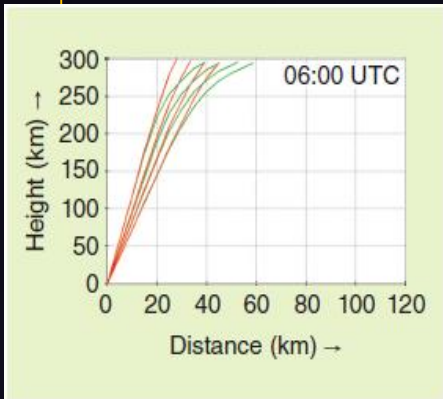


110010101100111000100100



Near Vertical Incidence Skywave

NVIS op de 7MHz



Near Vertical Incidence Skywave

- Pad lengte hangt af van de opstralingshoek.

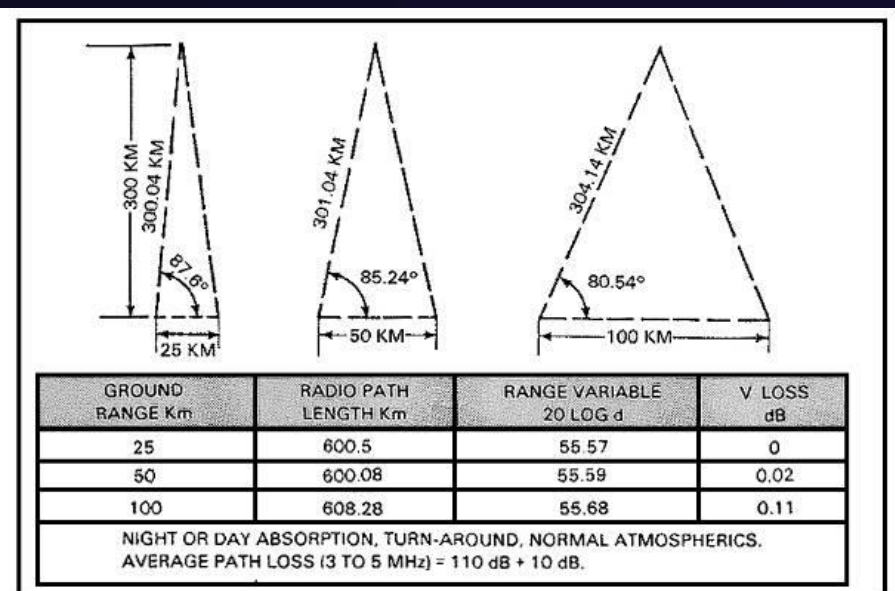
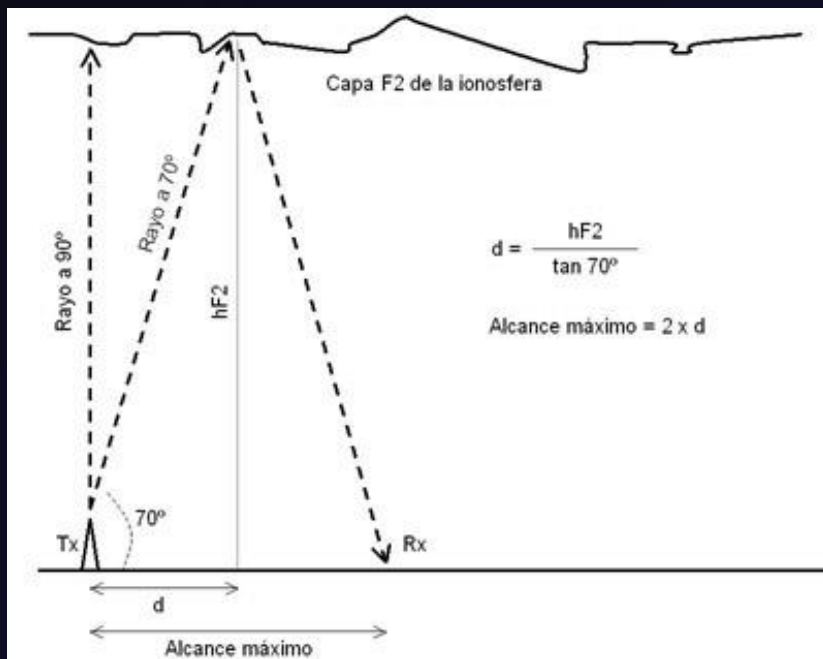
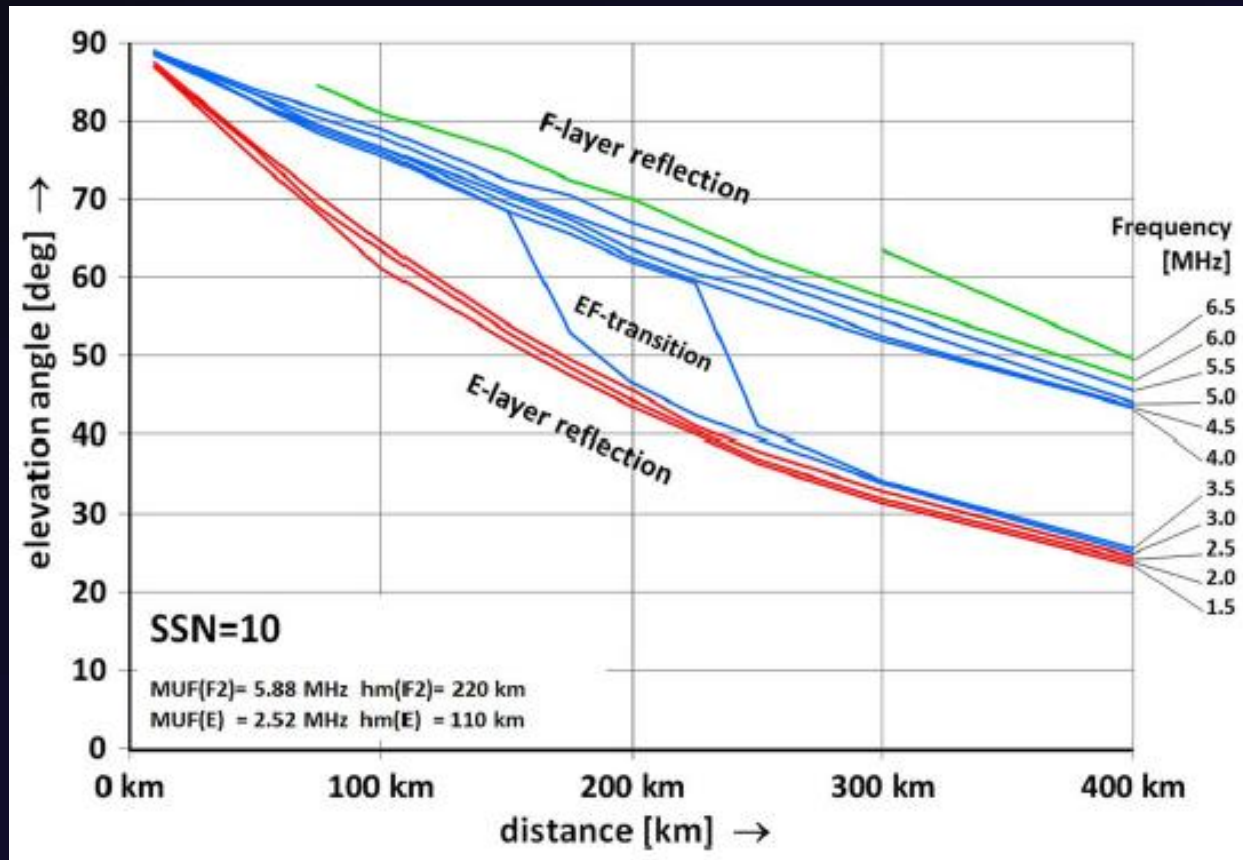


Figure M-3. Path length and incident angle (near-vertical incidence sky-wave mode).



Near Vertical Incidence Skywave

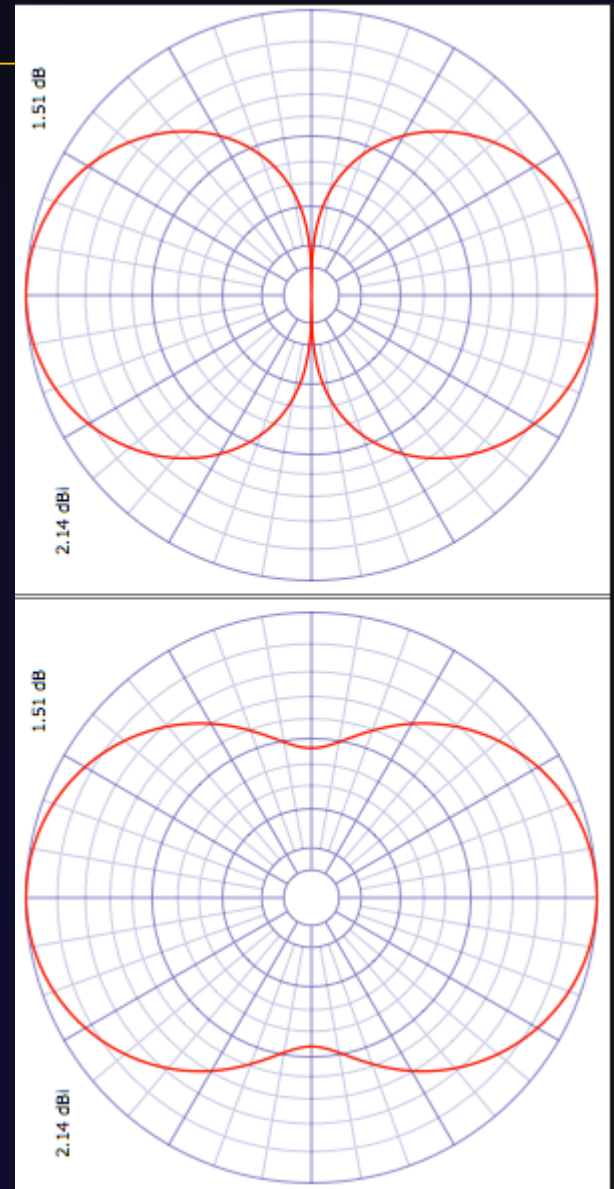
- Pad lengte hangt af van de opstralingshoek en de reflectie laag.





Near Vertical Incidence Skywave

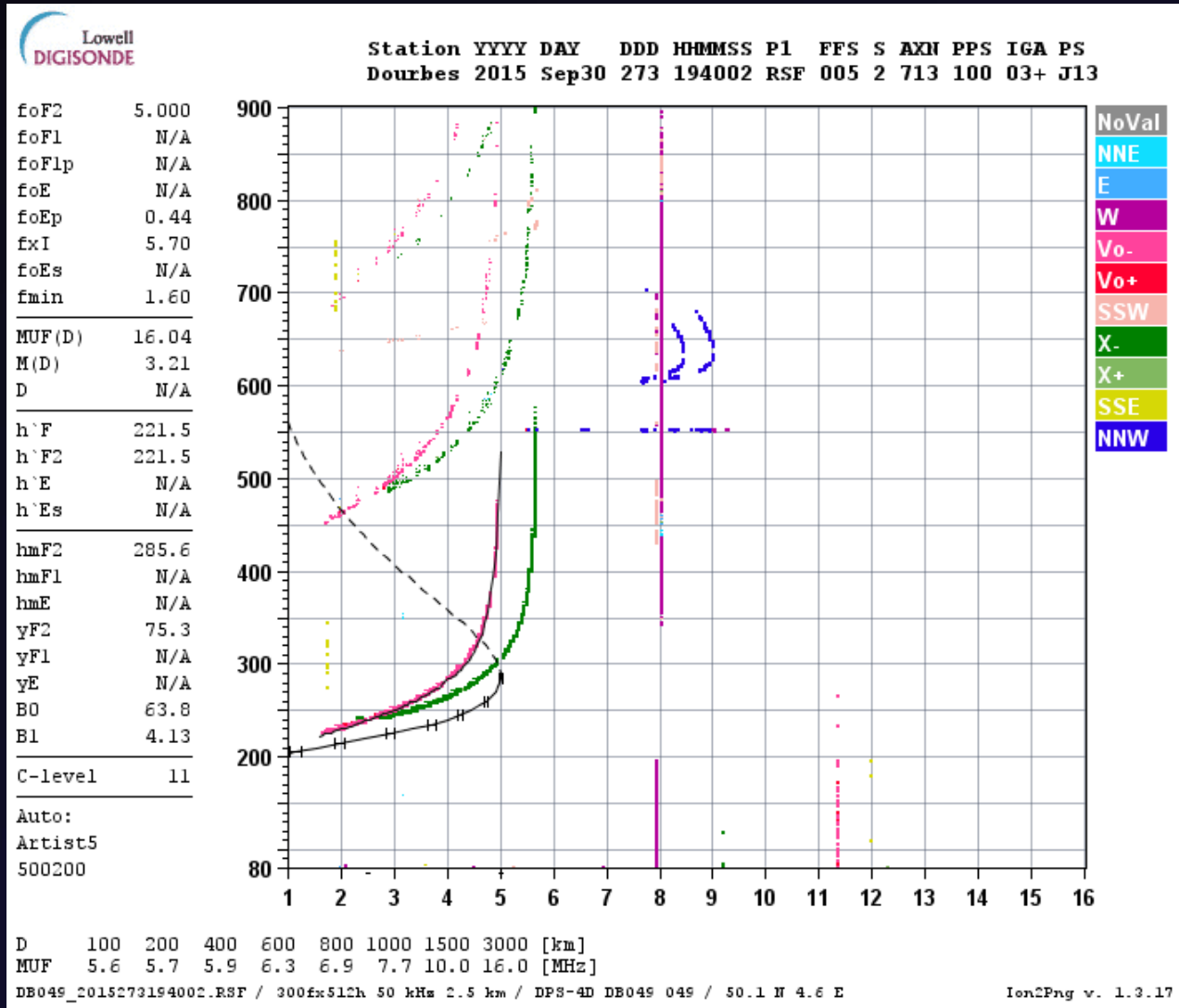
- We hebben verticale afstraling nodig maar onze antenne hangt verticaal.
 - Oplossing voor onze banden van 20m, 30m en 40m: gebruik maken van een verkorte dipool bv 2x2m





Ionogram

<http://digisonde.oma.be/>



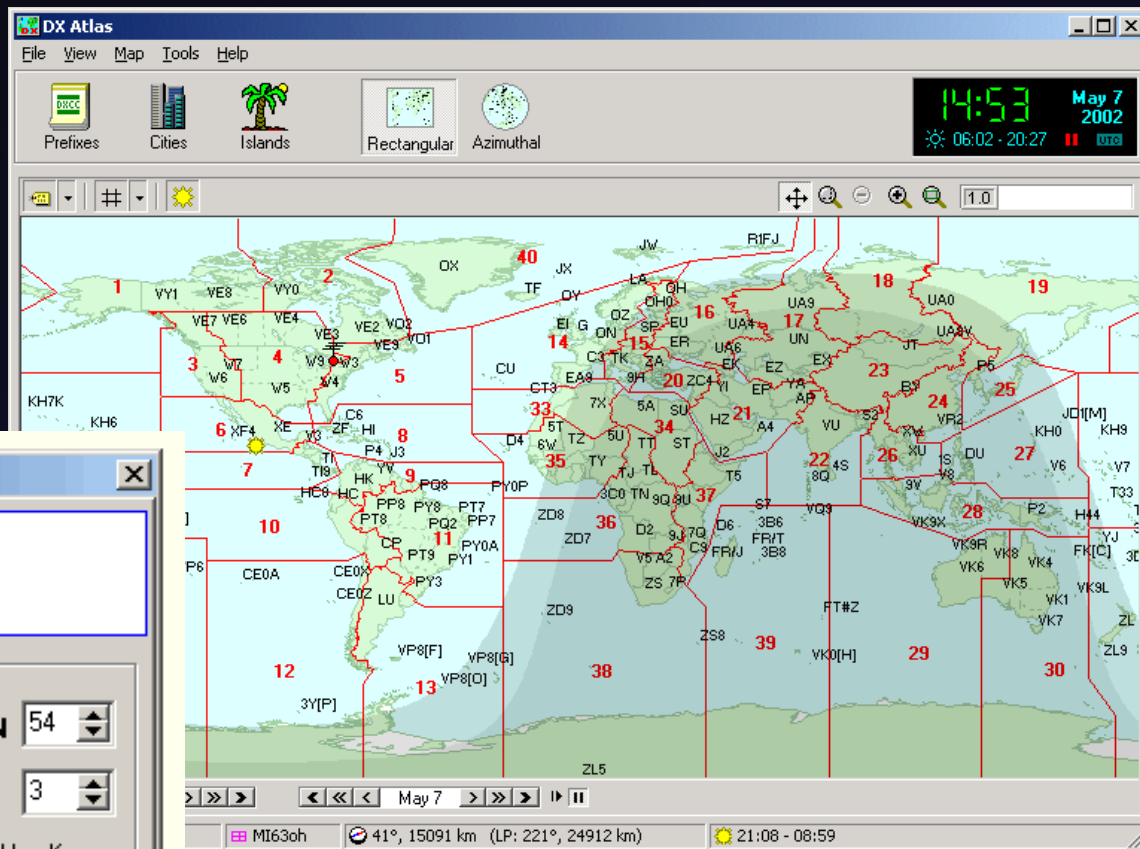


PROPAGATIE SIMULATIE 28/4/2016



Propagatie Simulatie 28/4/2016

<http://www.dxatlas.com/hamcap/>



HamCAP 1.0

Ham CAP 1.0
Propagation prediction tool by VE3NEA

Input parameters:

DX QTH: 50° N 143° E SSN: 54

DX Call: UA0F Kp: 3

Month: Feb 2004 Use Kp: ☐

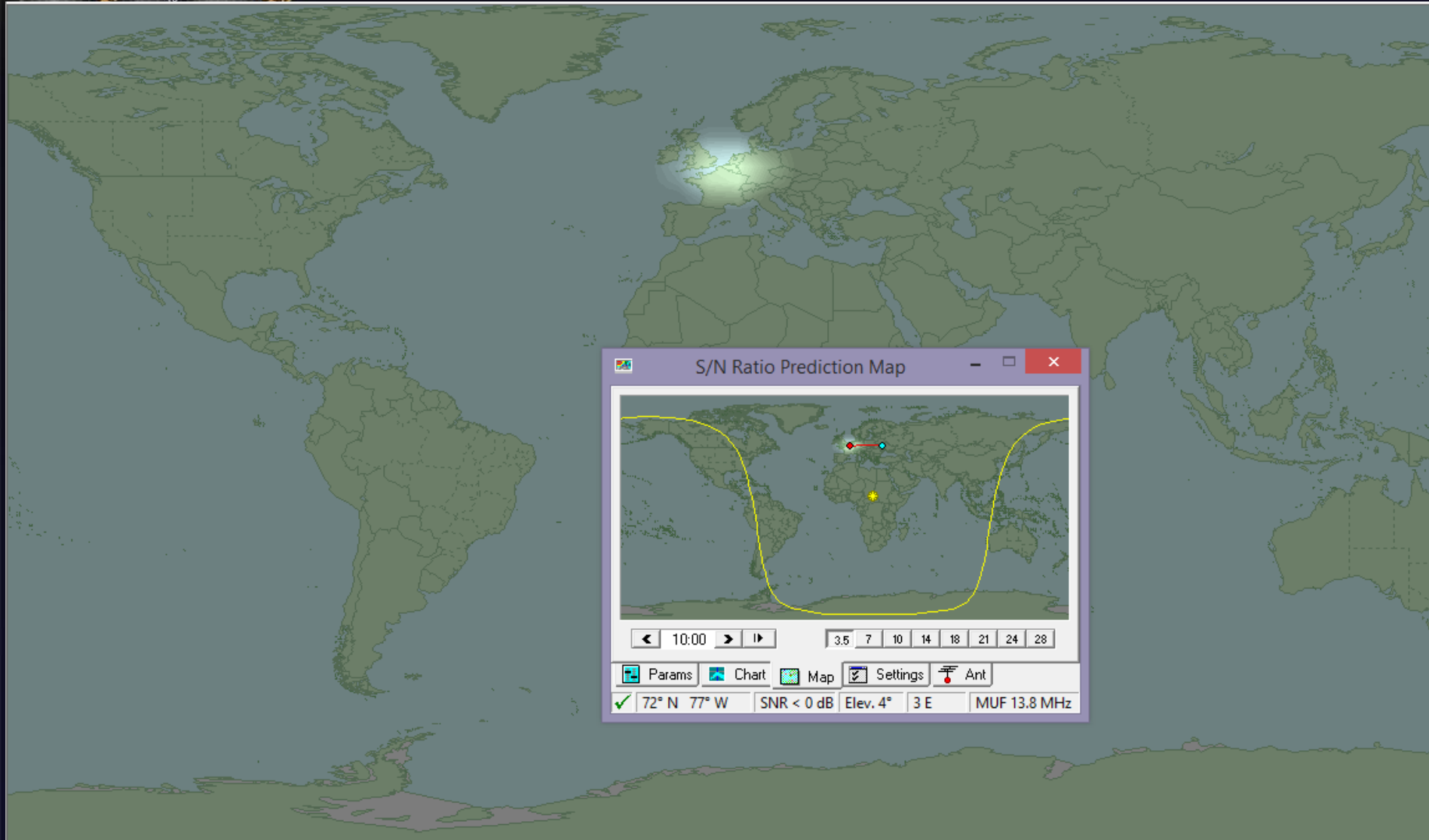
Path: ☒ Short ☐ Long Power: 100

Params Chart Map Settings Ant



Propagatie Simulatie 28/4/2016

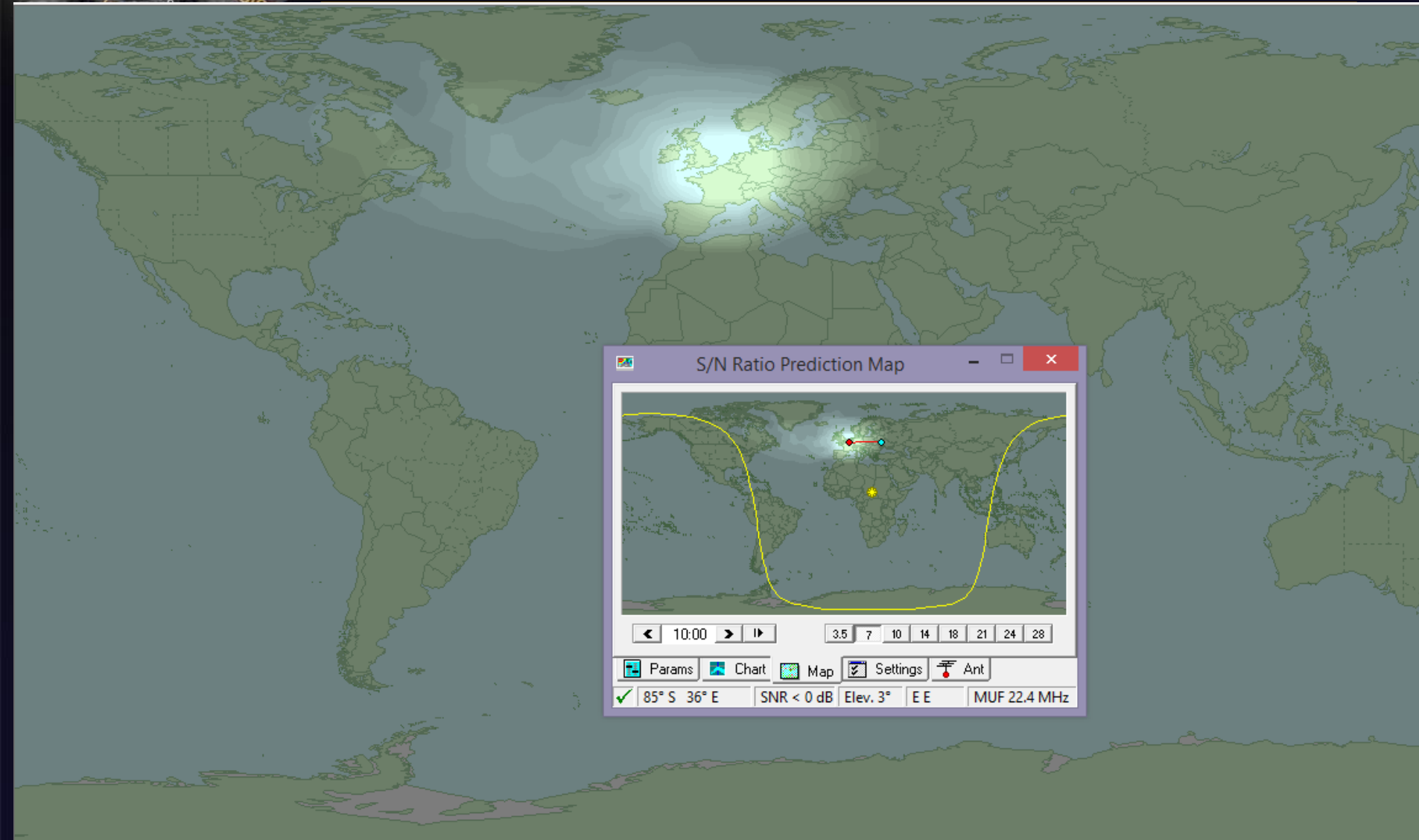
80m om 12h





Propagatie Simulatie 28/4/2016

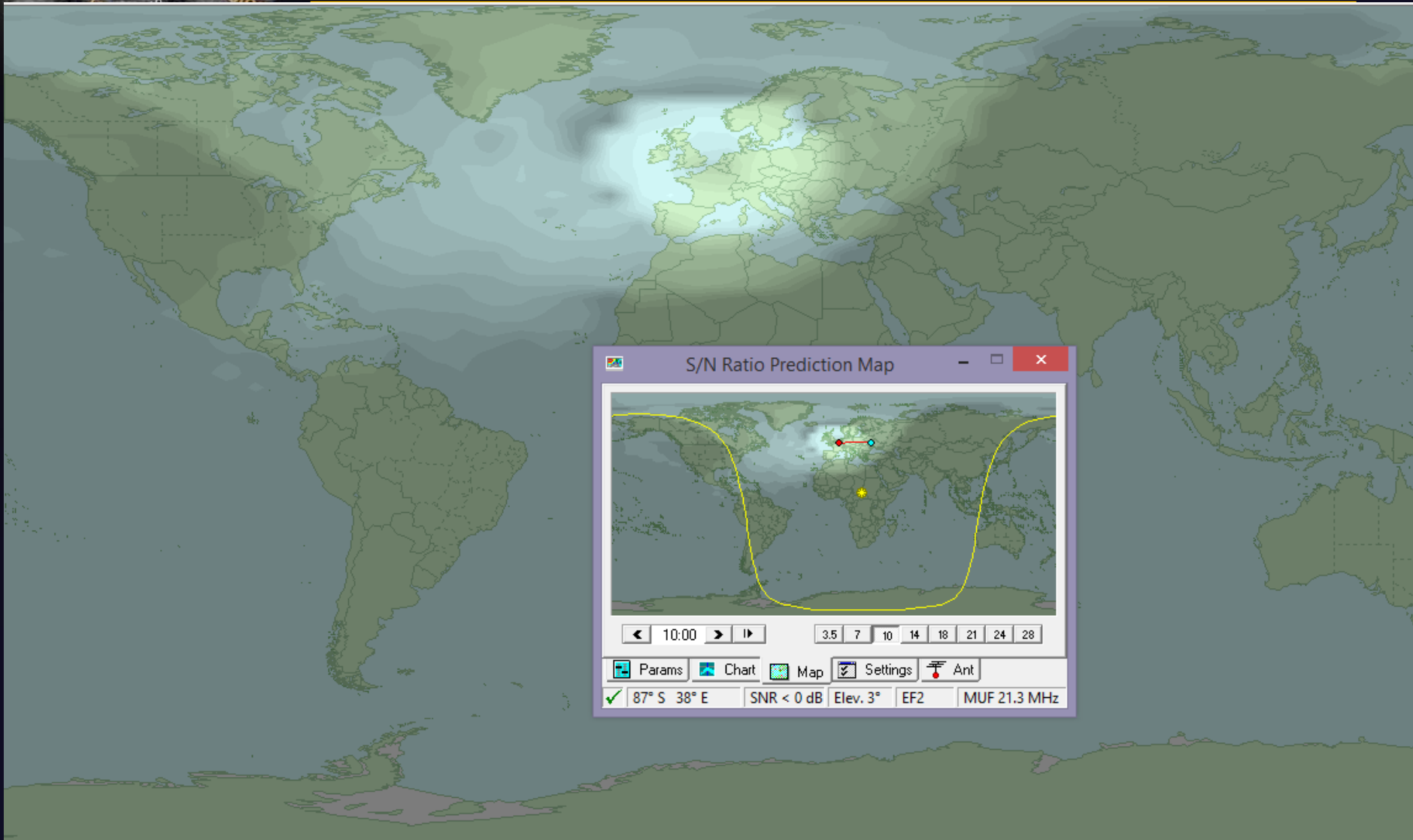
40m om 12h





Propagatie Simulatie 28/4/2016

30m om 12h





Propagatie Simulatie 28/4/2016

20m om 12h

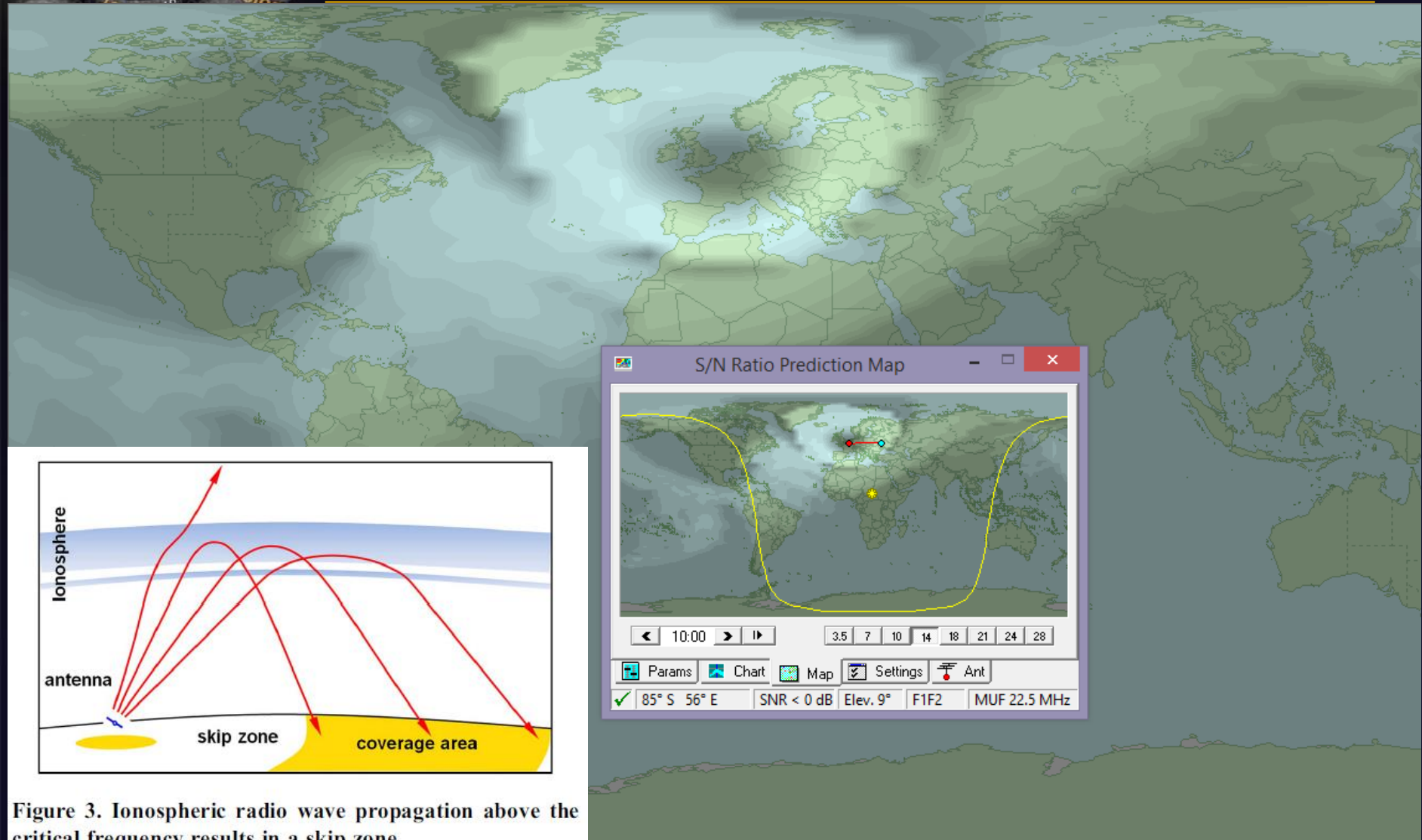
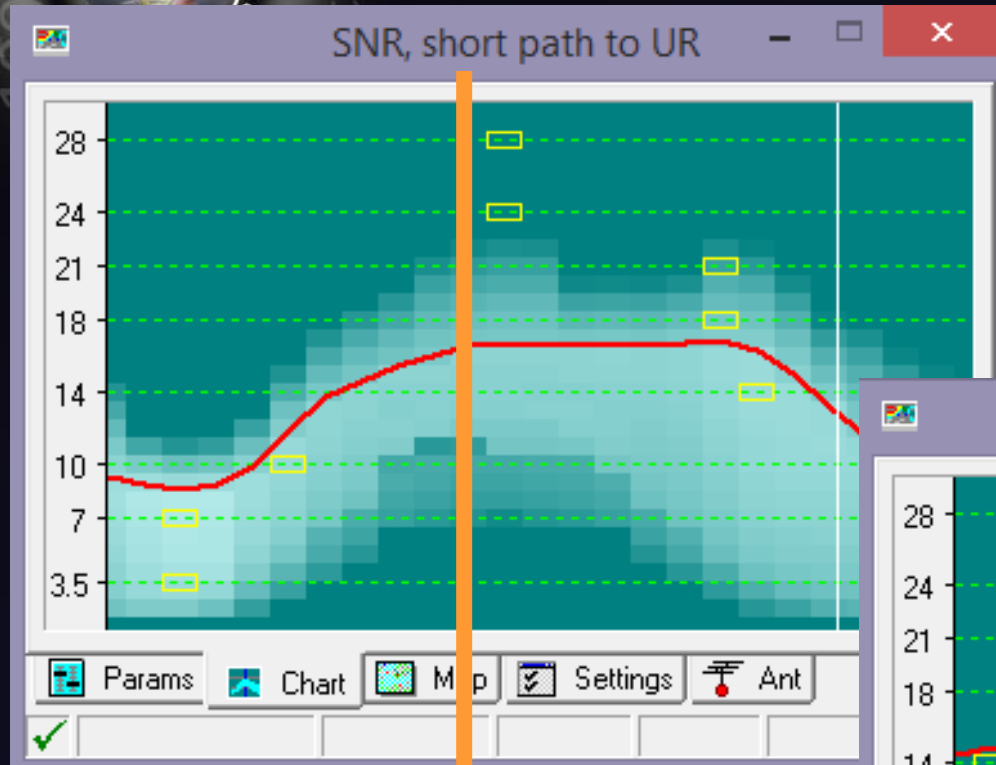


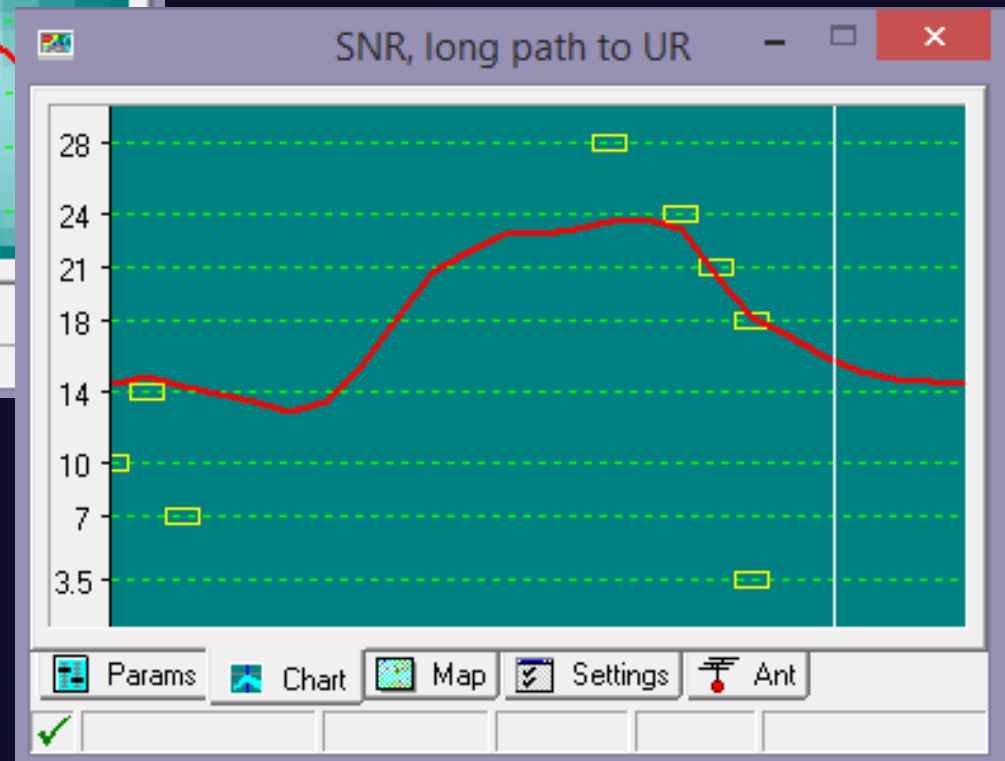
Figure 3. Ionospheric radio wave propagation above the critical frequency results in a skip zone.

Propagatie Simulatie

28/4/2016



12h





BESLUIT

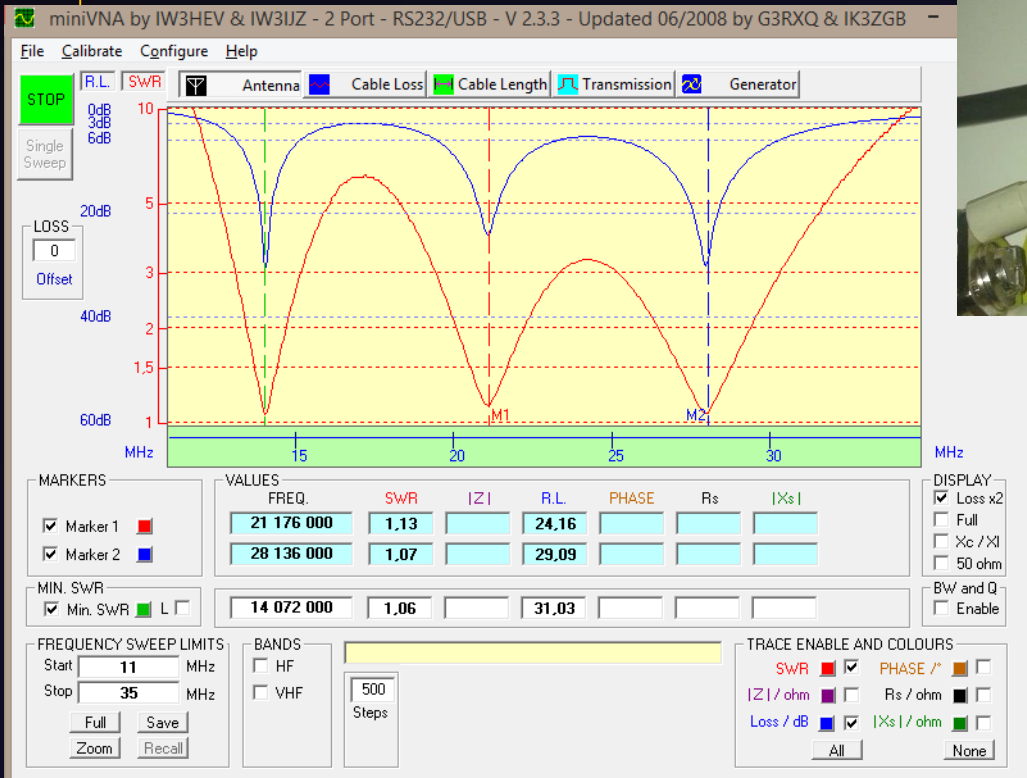


Besluit.

- Interessant om de propagatie in de 40m, 30m en 20m band te vergelijken.
- Om dit mogelijk te maken de kans op verbinding verhogen door:
 - 2x2m antenne
 - We hebben verticale afstraling nodig voor 7MHz.
 - 1W te gebruiken i.p.v. 10mW
 - De volle tijd te gebruiken om uit te zenden.
Dus in de 3 banden gelijktijdig uitzenden.
 - Nodig: isolator (Zie ON7KO zijn filter op volgende pagina).



Conclusie van de simulaties.







ASGARD VI Project Realisering:

- **Communicatie met SNW:**

Clubvergadering: elke eerste vrijdag van de maand om 20:00 uur.

Labo: elke derde vrijdag van de maand om 20:00 uur.

Parochiaal Centrum "Huize De Meerleer" - lokaal de "Nieuwe Pluim"

Hofstraat 7

9100 Sint-Niklaas

- **Yahoo group:**

https://groups.yahoo.com/neo/groups/VTSS_NW_Ballonproject/info



APPENDIX

Near Vertical Incidence Skywave Propagation: Elevation Angles and Optimum Antenna Height for Horizontal Dipole Antennas

Ben A. Witvliet^{1,2}, Erik van Maanen², George J. Petersen², Albert J. Westenberg², Mark J. Bentum¹, Cornelis H. Slump¹, and Roel Schiphorst¹

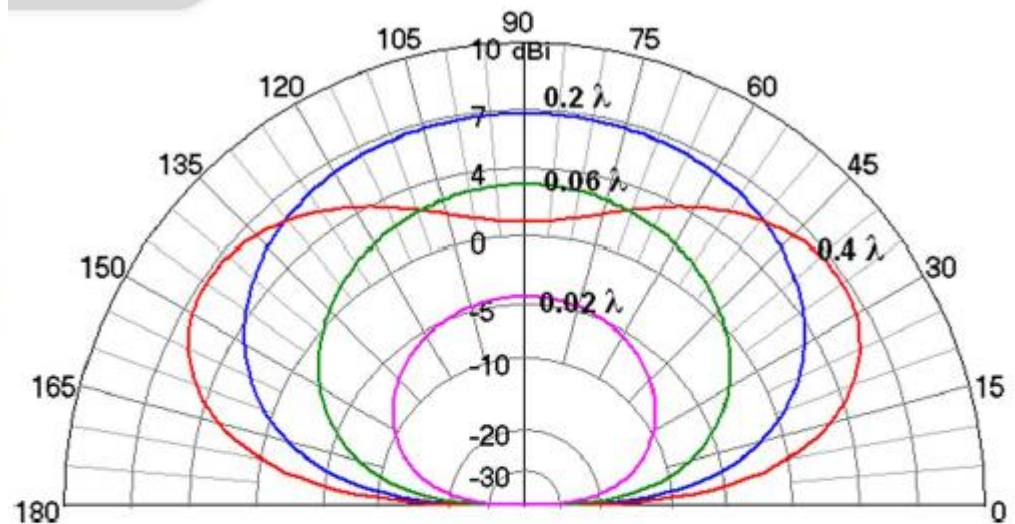
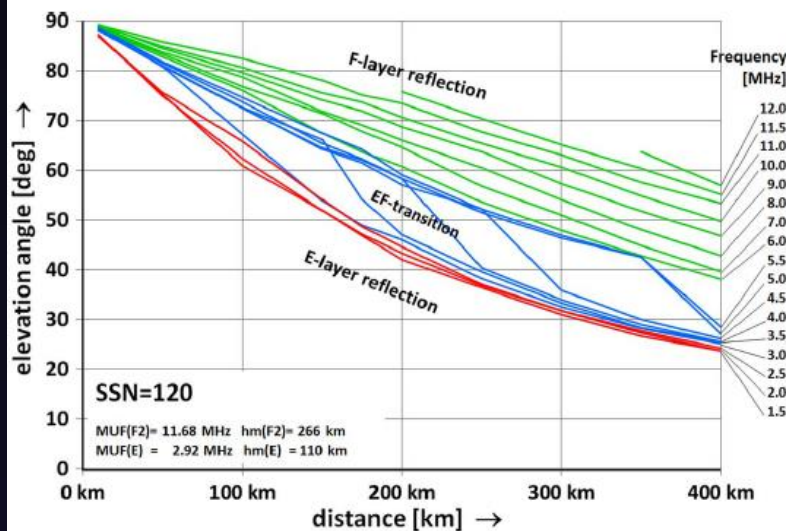


Figure 14. Vertical radiation pattern of a horizontal half-wave dipole antenna 0.02λ , 0.06λ , 0.20λ , and 0.40λ above farmland soil at 5.39 MHz. Intensity axis shows antenna gain in decibels over an isotropic radiator (dBi).



- **Ionosfeer Tutorial:**
 - <http://www.amateur-radio-wiki.net/index.php?title=Propagation>
 - <http://www.astrosurf.com/luxorion/qs1-hf-tutorial-nm7m4.htm>
 - http://www.ukssdc.ac.uk/ionosondes/ionogram_interpretation.html
- **Simulatie software:**
 - HFprop (F-layer model) <http://www.astrosurf.com/luxorion/qs1-soft-hfprop.htm>
 - HAMCap (VOACAP model) : <http://www.dxatlas.com/hamcap/>
- **Effectieve SSNe:**
 - <http://spawx.nwra.com/spawx/ssne24.html>
- **Ionogram sources:**
 - <http://giro.uml.edu/didbase/scaled.php>
 - <http://digisonde.oma.be/>
 - Ionosondes locations Europe: <http://www.dk5ya.de/iono.htm>
- **Ionosphere modelling:**
 - ITU: <http://www.itu.int/rec/R-REC-P/e>
 - <http://www.ngdc.noaa.gov/stp/iono/ionohome.html>
 - [http://www.researchgate.net/publication/228810307_28_Ionospheric_Models_for_Radio_Propagation Studies](http://www.researchgate.net/publication/228810307_28_Ionospheric_Models_for_Radio_Propagation_Studies)
 - <http://www.g0lfp.com/ionograms/index.php>



- WSPR:
 - <http://www.amateur-radio-wiki.net/index.php?title=WSPR>
 - <http://physics.princeton.edu/pulsar/K1JT/>
 - <http://wsprnet.org/drupal/>
 - <http://wsprnet.org/drupal/node/2043>
- WSPR C-code voor Arduino:
 - <http://www.knology.net/~gmarcus/>
- WSPR ontvanger:
 - [Soft Rock RX Ensemble III HF Receiver Kit](#)
 - <http://www.websdr.org/> in combinatie met VB-cable (<http://vb-audio.pagesperso-orange.fr/Cable/index.htm>) en WSPR ontvangst SW.
- Skin effect:
 - <http://chemandy.com/calculators/skin-effect-calculator.htm>



- **Ballonprojecten:**

- <http://www.arhab.org/index.php>
- http://en.wikipedia.org/wiki/Amateur_Radio_High_Altitude_Ballooning
- <http://amsat-uk.org/tag/high-altitude-balloon/>
- <http://www.leobodnar.com/balloons/>
- <http://ukhas.org.uk/>
- <http://habhub.org/zeusbot/>
- <http://www.google.com/loon/>
- <https://plus.google.com/+ProjectLoon/videos>
- <http://ava.upuaut.net/?p=448>
- <https://kt5tk.wordpress.com/>
- <http://www.mike-stirling.com/2014/06/tiny-balloon-tracker/>
- <http://www.qrp-labs.com/ultimate3/ve3kcl-balloons/ve3kcl-s1.html>