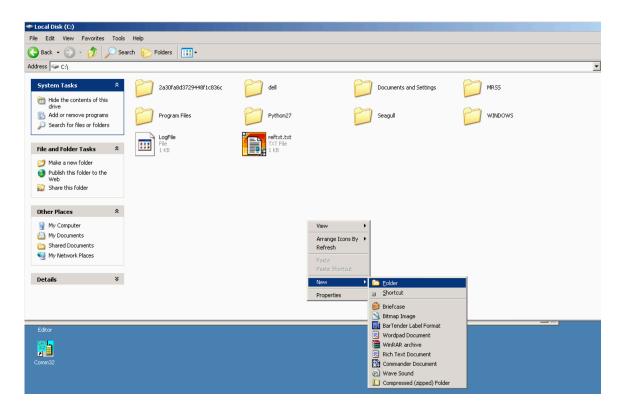
Radio Mobile modeling

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Installing and setup on windows

Setup the program http://www.ve2dbe.com/download/download.html

Make a directory for it on the C:\ root called "Radio-Mobile"



Install the core files

Download the Visual Basic Runtime (Service pack 6) File vbrun	n60sp6.exe from Microsoft.	File Edit View Favorites	r Took	Mala							
Install it on your PC before executing the next steps (you may have	to reheat)	Seck - ⊙ - ⊅ > Search Polders III -									
instant on your PC before executing the next steps (you may have		Address C:\Documents and				is)rmwcore.zip				-	→ 60
Step 2		Folder Tasks	*	2	2	•			-		
	Library	Extract all files		antenna	icon	antenna.png	Cities.dat	colors.dat	colors1.dat	colors2.dat	
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andio-Mobile	(1) History		- 🗆 ×	🔤	–	-	\odot	2	2	<u>_</u>	
File Edit View Favorites Tools Help			.	colors3.dat	colors4.dat	colors5.dat	complete.wav	dot_g.png	dot_r.png	dot_y.png	
🚱 Back 🔹 🕥 👻 🏂 Search 🌔 Folders 🛛 🎹 🕶					•		— 1			E	
Address 🛅 C:\Radio-Mobile		-	🔁 Go		See Inace di	geoStarsLib.dl	Internet dat	Iandhaisht dat	Man Link bet	Radioros dat	
File and Folder Tasks				PIX_D6V_1	Freedinage.cli	geostarsub.di	Incernet.oat	ianu leigi k.uac	hap_cristore	Kaulosys.dat	
😏 Make a new folder											
Publish this folder to the Web				unzip32.dl							
🔛 Share this folder											
Other Places 🛸	Windows Security Warning	×									
Guier Flaces	Are you sure you want to copy or move this folder?										
My Documents	You should only copy or move files from locatio you trust.	ns that									
Carl Shared Documents	Yes	No									
Service Places											
Details ¥											
					R <u>e</u> fresh P	irefox ×					
				•							

Install the English (or whatever language pack)

Step 2				Pile Travel 16.5 Eng.zip File Edit: View Fevorites Tools Heb	×
Create a program directory to plac	e the contents of the following files.			Bitck, - (2) - (2) Search []- Folders []] - Address [] - C:[Documents and Settings/bryani/by: Documents/Downloads/ymw1165eng.zp	▼ → 60
a in the second					
File Edit View Favorites Tools	Help			ng mupdateen mwdtx32.dl mweng.exe mweng.hlp	
🕒 Back 🔹 🕥 🐇 🏂 🔎 Seard	h 😥 Folders 🔢 -				
Address 🗀 C:\Radio-Mobile				🗾 🔁 Go	
File and Folder Tasks *	FreeImage.dl 3.15.1.0 FreeImage library	geoStarsLib.dll	DAT F 2 KB	net.dat	
Copy the selected items Publish the selected items to the Web	Landheight.dat DAT File 1 KB	Map_Link.txt TXT File 2 KB	DAT F 1 KB	sys.dat lie	
 E-mail the selected items Delete the selected items 	unzip32.dl 5.5.2.0 Info-ZIP's UnZip DLL for Win32	antenna	icon		
Other Places	antenna.png 359 × 200 PNG Image	Cities.dat DAT File 116 KB	Colors DAT F 1 KB		
My Documents Shared Documents My Computer	colors1.dat DAT File 1 KB	mupdateengexe VE2DBE	VE2DE	ihang exe SE	
S My Network Places	colors2.dat DAT File 1 KB	rmweng.hlp Help File 42 KB	Radio ME2DE	ng ove Propagation and Virtual FC	
Details ¥	mwdix32.dl	colors3.dat DAT File 1 KB	DAT F 1 KB		
	colors5.dat DAT File 1 KB	complete.wav	dot_g 16 × 1 PNG 1	16	
r.h.,	dot_r.png 16 x 16 DMC Image	dot_y.png 16×16 DMG Image	Fix_EI DAT F	lev_Thr.dat	

Edit maplink.txt to enable the map data

Map_Link.txt - Notepad
File Edit Format View Help
'Radio Mobile restricted merge sources (this line for alternate OSM style server) virtualearth.net
google.com
First read the links below for the terms and conditions of each service, and if you agree to abide by these proceed. For the Radio Mobile program to enable access to each of the servers above, the apostrophes must be removed, and the file saved.
Doing so, you will have access to the services subject to their copyright and usage conditions:
Pour accéder à chacun ce ces serveurs il faut enlever l'apostrophe au début de la ligne. Noter que ce faisant, vous accédez à des services qui sont sujets à des droits d'auteur. Veuillez consulter les liens suivants pour connaître les conditions qui s'appliquent:
Radyo Mobil yazýlýmýnýn menüsündeki (Düzelt>Üste resim ekle) bölümünde, yukarýdaki sunuculardaki haritalarý da kullanabilmeniz için, yukarýda sýralanan adreslerin baþýnda bulunan apostrof (') karakterini silmeniz ve bu dosyayý yine ayný isimle saklamanýz gerekmektedir.
Bu þekilde telif hakký olan bu servislere de eriþme hakkýnýz olacaktýr. Bu iþlemi yaparak sözkonusu verileri kullanmanýz halinde aþagýdaki adreslerde bulunan telif hakký þartlarýný kabul etmiþ olacaksýnýz.
http://www.microsoft.com/maps/product/terms.html http://www.google.com/apis/maps/terms.html

Make a directory C:\Geodata and the following directories under it

📁 Geodata				
	Help			
	arch 😥 Folders 🛄 🗸			
Address 🛅 C:\Geodata				💌 🔁 Go
File and Folder Tasks 🛛 🕆	srtm1	strm3	strmthird	
📺 Rename this folder				
🙀 Move this folder			<u></u>	
Copy this folder	Landcover	OpenStreetMap	Terraserver	
Publish this folder to the Web				
😂 Share this folder	Toporama			
E-mail this folder's files				
🗙 Delete this folder				
Other Places 🕆				
🕁 Local Disk (C:)				
My Documents				
Shared Documents				
😼 My Computer				
🧐 My Network Places				
Details ¥				

Copy the wmap.zip world map definition files to the program directory

Start the program and make a shortcut to it on the desktop. It is rmweng.exe in the program directory.

Configure the base program settings

Select "options" then "internet" and configure the strm1 data, the 1/3 data is more accurate, but not needed for this purpose.

Internet options			×
Proxy Web update SRTM Land cover OpenStreetMap NationalMap Toporama Virtual Earth Google Map	SRTM Download from Internet if a file is not found Download from Internet if a file is not found Use local files only Local files path C:\Geodata\srtm1 Internet ftp directory SRTM - 1 arcsecond - Site 1	·	OK
	http://rmw.recordist.com/srtm1/		

💽 Internet options			X
Proxy Web update SRTM Land cover OpenStreetMap NationalMap Toporama Virtual Earth Google Map	Land cover Download from Internet if a file is not four Download from Internet if a file is not four Use local files only Local files path C:\Geodata\Landcover Internet ftp directory Landcover - Site 1 http://rmw.recordist.com/landcover/	·	ОК

Load Elevation data for the State of Florida

This will make a map of the state and force the downloading of the rather large SRTM elevation data, so you don't have to do this again

File and > Map Properties (f8)

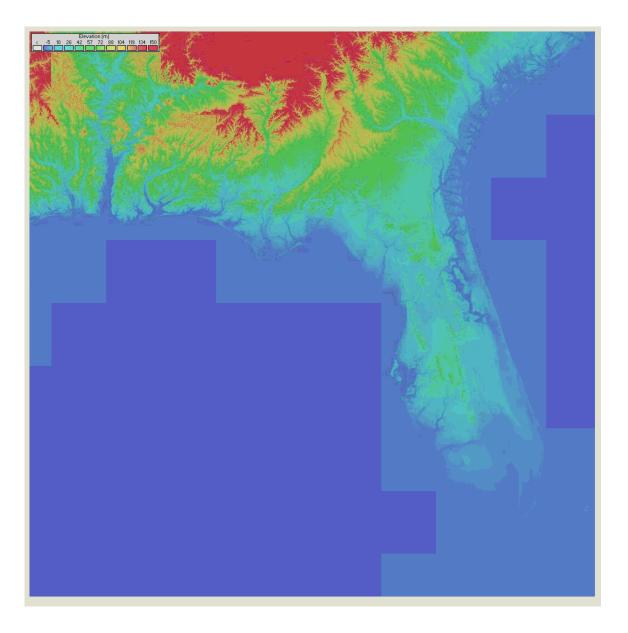
Put in 27.6648° N, -81.5158° W as the center and make it as follows

Properties of\default.map			×
Centre 28°49'49.2''N 084°15'43.2''W EL78UT	Size (pixel) Width(pixels) Hei 1024 102	ight (pixels) 24	Extract
Latitude Longitude 28.83034 -84.262	Size (km) Width(km) Hei	ight (km)	Cancel
Use cursor position		00.00	Top Left 33*19'47''N 089*23'53'W
World map	Elevation data source Drive or path	Top layer	Top Right
Select a city name	None 🔽 C	Browse	33°19'47''N 079°07'33''W
Enter LAT LON or QRA	None 🔽 C	Browse	Bottom Left 24°19'51''N
Select a unit	None 🔽 c	Browse	089*23'53''W
	None 🔽 😋	Browse	Bottom Right 24°19'51''N
Adjust units elevation	SRTM c:\geodata\srtm1	Browse	079°07'33''W
Merge pictures	Ignore missing files	Bottom layer	Resolution 976.6 m/pixel
Force gray scale	Initialize matrix with elevatio	on (m) -2	31.64 arcsecond

This should download the entire state of Florida, about 5000mb of files.

76%

Getting file from internet...N30W084.hgt 44/56



Modeling a repeater in RM

Band	Frequencies	Service Contour	Interference Contour	Adjacent Channel Deratings, if applicable
VHF Low Band		31 dBµ F(50,50)	13 dBµ F(50,10)	There is no adjacent channel protection on 20 KHz users. There are no narrowband channels on these bands.
VHF High Band	144-148 and 219-225 MHz	37 dBµ F(50,50)	19 dBµ F(50,10)	 42 dBμ F(50,10) 15 kHz adjacent channel wide band 44 dBμ F(50,10) 7.5 kHz adjacent channel narrow band to narrow/wide band. 20 KHz channels need no adjacent channel protection wide to wide 10 KHz channels shall not need adjacent channel unless the intended mode is >8 KHz. If so a 25 dBμ F(50,10) value is to be used for this.
UHF	440-450 MHz	39 dBµ F(50,50)		There is no adjacent channel protection on 25 or 12.5 KHz users. It's still advisable to be cognizant of this.
	900 MHz	40 dBµ F(50,50)		There is no adjacent channel protection on 25 or 12.5 KHz users. It's still advisable to be cognizant of this.

Use the following data for the Part 90 Land Mobile signal contours:

The basic concept here is to model the repeater at its coordinates and then define another "mobile" unit with the receiver. This mobile unit doesn't need to be in the coverage area, just defined.

1.83m (6ft) is what the FCC uses, as a standard receive height for this station. The gain of the antenna doesn't matter as we will model for $dB\mu V$ (dBu) which is the absolute field strength in microvolts per meter where 0dbu is 1 microvolt/m. It's this absolute reading which makes field strength useful for comparing difference repeaters coverage area.

This field strength can be converted to dBm if you know the gain of the receive antenna using the formula below: P=E-20log(f)+G-77.2where P is power in dBm E is field strength in dBu f is frequency in MHz G is antenna gain in dBi (2.15 more than dBd)

In RM there are several different settings used to model networks.

Units – Define the locations of radio transmitters/receivers Networks – Define the modeling parameters and group units as members Systems – Define the radio parameters of a unit in a system (ERP, height, etc.)

All three combine to produce a prediction of a given unit's coverage.

Network Properties

We will setup the network properties to match the different frequencies we will be using. Two will be configured for each band, as we have both a primary and interference contour with different modeling parameters. The adjacent channel parameters uses the same as the interference (50% of locations/situations, 10% of the time).

Now setup the network properties, the examples below show a band and then the interference defined for that band.

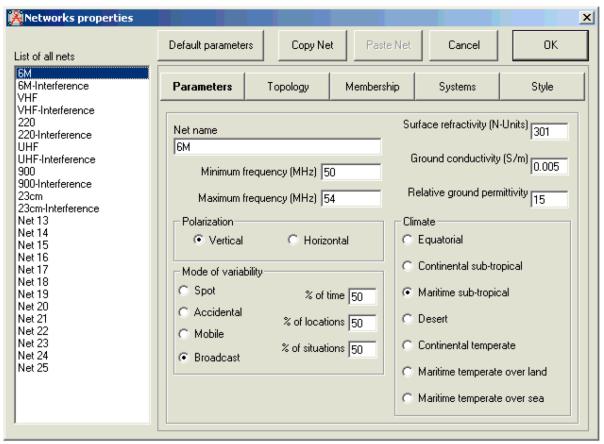


Figure 1 - 6 meter band network properties

🔀 Networks properties					×
List of all nets	Default parameters	Copy Ne	t Paste N	let Cancel	ОК
6M 6M-Interference VHF VHF-Interference 220 220-Interference UHF UHF-Interference 900 900-Interference 23cm 23cm-Interference Net 13 Net 14 Net 15 Net 15 Net 16 Net 17 Net 18 Net 19 Net 20 Net 21 Net 22 Net 22 Net 23 Net 24 Net 25		- -	50 Initial me 10 prins 50	Systems Surface refractivity (N Ground conductivity Relative ground per Climate Continental sub-tropi Maritime sub-tropi Desert Continental temperat Maritime temperat	y (S/m) 0.005 mittivity 15 opical cal erate e over land

Figure 2 - UHF Interference properties

Setting up the Systems

Systems define the radio settings for each transmitter and at least one will need to be changed for each model produced. The first system will define the "mobile" receiver, and the second the currently modeled repeater. The next few can be filled with example repeaters (50w at 50', etc).

Radio Mobile	<u>≥</u>
Do you want to set type PNG	as default type for new picture?
Yes	No

Modeling a repeater

First determine your band and interference criteria

In this example we'll be modeling a UHF, with a 39 dBu service contour and a 21 dBu interference contour.

First Setup a new unit with the lat/lon of the subject unit.

🔆 Units properties		×
NI4C-ST Pete	Name Elevation (m) AG4BV6	ОК
N4PSK-443.9 WB4DT AG4BV	Position 26*54'00.0''N 080*16'12.0''W	Clear
Unit 7 Unit 8 Unit 9	Copy EL96UV Paste	Undo unit
Unit 10 Unit 11 Unit 12	Enter LAT LON or QRA	Move up
Unit 13 Unit 14 Unit 15	Place unit at cursor position	Move down
Unit 16 Unit 17 Unit 18		Export
Unit 19 Unit 20 Unit 21	Place cursor at unit position	Import
Unit 22 Unit 23 Unit 24	Style - Unit 6 Enabled C Left © Centre C Right	Sort
Unit 25 Unit 26 Unit 27	Transparent No label BackColor ForeColor	Apply style
Unit 28 Unit 29 Unit 30	Icon 16x16 pixels	Small font
Unit 31 Unit 32	Show only units that are members of a visible network	

Now draw a new map, with this unit at the center. Note the extents 400x400km, some VHF and Low band may require a larger map to plot the interference area. The "adjust Units elevation" should be checked, as it will use the SRTM data to adjust the base elevation at the unit (ASL height)

Operation of\default.map			×
Centre 26*54'00.0''N 080*16'12.0''W EL96UV		eight (pixels) D24	Extract
Latitude Longitude 26.9 -80.27	- Size (km) Width(km) He	eight (km)	Cancel
Use cursor position		D0.00	Top Left 28*41'59''N
World map	Elevation data source	Top layer	082°17'17'₩ Teo Biekt
Select a city name	None c	Browse	Top Right 28*41'59''N 078*15'07''W
Enter LAT LON or QRA	None 💌 c	Browse	Bottom Left
AG4BV ▼	None 💌 c	Browse	25°06'01''N 082°17'17'W
	None 💌 c	Browse	Bottom Right 25°06'01''N
Adjust units elevation	SRTM c:\geodata\srtm1	Browse	078°15′07'₩
Merge pictures	Ignore missing files	Bottom layer	Resolution 390.6 m/pixel
Force gray scale	Initialize matrix with elevati	on (m) -5	12.65 arcsecond

Now click and extract the map and go to picture properties. Select White as we want a totally white background which will be transparent in the final rendering.

Z	J\default.png properties	×
	Draw mode	
	Gray scaled slope	Draw
	Colored slope (absolute)	
	Colored slope (relative)	Cancel
	○ X-ray	3D picture
	○ X-ray (inverted)	
	Colors	Stereo
	• White	
	Draw objects	Object drive/path
	🕞 Show cities	С
	Font	Browse
	🔽 Transparent	
	Elevation data source: default.map Map statistics: Minimum -3.0 m - Maximum 91.0 m - Average 4.0 m Fits elevation data in memory Width=1024 Pixels Height=1024 Pixels Path:	

You will only have to do this once if you're doing more than one model.

Now setup the network to have the mobile user and the unit in the same network, with the mobile unit have the mobile system, and the subject unit have the "repeater" system.

🔏 Networks properties							×
List of all nets	Default parameters	Copy Net	Paste	e Net	Cancel	ОК	
6M 6M-Interference VHF VHF-Interference 220 220-Interference UHF UHF-Interference 23cm 23cm-Interference 23cm 23cm-Interference Net 13 Net 14 Net 15 Net 15 Net 16 Net 17 Net 18 Net 19 Net 20 Net 21 Net 22 Net 23 Net 24 Net 25	Parameters List of all units NI4C-ST Pete Mobile unit KK4RVS N4PSK-443.9 WB4DT AG4BV Unit Unit	Topology	F S	Member Role of A Comman System Repeat Antenr Oth	AG4BV nd er na height (m) – stem	Style	

Now configure the Repeater system to have the proper ERP and antenna height. The program can calculate this based on the antenna gain (In dBd for our needs!), or preferably you can insert the calculated ERP as the transmitter power output as the ERP in dBm. Note the Line Loss is 0 dB, and the antenna gain is 0 dBd (2.15 dBi). The forces the output power to be whatever there in watts dBd.

If the system uses a different antenna you can select the antenna from the antenna type selection. This can be important with the offset dipole antennas, which have a "D" or offset gain pattern.

😤 Networks properties			×
List of all systems	Default parameters Copy N	et Paste Net Cano	el OK
Mobile Hepester 50W 50' WB4DT/r System 5 System 6 System 7 System 9 System 10 System 12 System 13 System 14 System 15 System 17 System 18 System 20 System 21 System 22 System 23 System 24 System 25	Parameters Topology	Membership System	is Style
	00 💌	Select from VHF UHF	
	System name Transmit power (Watt		(dBm) 55.4
	Receiver threshold (μV	0.1496	(dBm) -123.5
	Line loss (dB		avities+connectors)
	Antenna type Antenna gain (dBi		(dBd) 0
	Antenna height (m	97.54 (Above ground)	
	Additional cable loss (dB/m) 0 (If antenna heigh	t differs)
	Add to Radiosys.dat	Remove from	Radiosys.dat

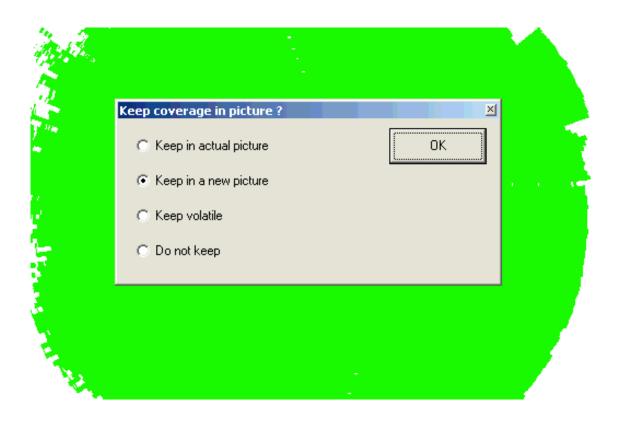
The first model will be the interference model.

Do a single polar model, with the Center Tx – Mobile Rx, which is modeling the received field strength at the mobile unit.

The radial range is typically 200km, but may need to be longer on high elevation systems and/or low band.

Select a color for the interference, and that it should be a solid color, with a fill area. Enter in the value for interference criteria on the threshold and select dBuV/m, which is another way to say dBu.

After this completes it will ask if you want to keep it in a new picture, select this.



Now Save this picture in the C:\PLOTS directory, and create a directory in the format "FREQ CALLSIGN" to save them in.

Save picture					1
Save in	: 🗀 444.400 AG	â4B∨	•	(† 🖻 🗇	•
My Recent					
Documents					
Desktop					
My Documents					
My Computer					
My Network	File name:	444.400 AG4BV	21 dBu Interferen	ce Contour 💌	Save
Places	Save as type:	Picture File (PN)	3)	-	Cance

Save the file, and the next dialog will pop up. Ensure white is transparent and Optimization of color palette is checked. This will make a PNG with only the green area solid.

Save picture - Options		×
✓ White is transparent		ок
Opacity	255	
Optimization of color pallette		

Model the service contour

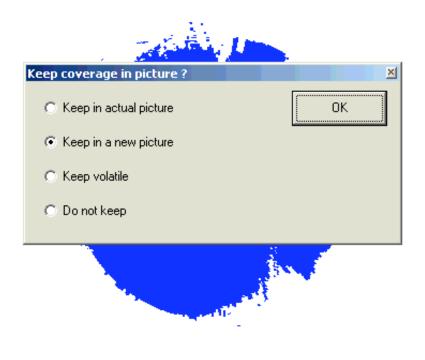
This next step is modeling the service contour and is similar to the prior steps.

First go back to the white picture from the window menu.

Select the single polar radio coverage with the network being the service contour network this time. Change the color and the Threshold to the appropriate threshold.

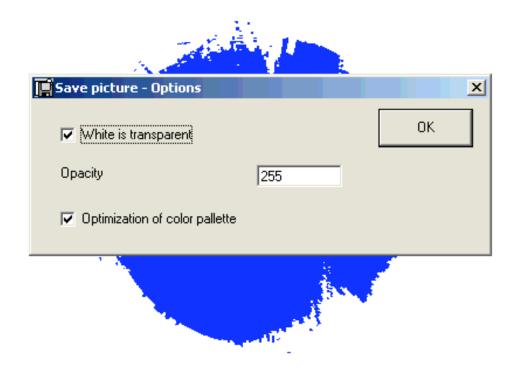
😥 Single polar Radio coverage	×
Centre unit AG4BV	Draw
Mobile unit Mobile unit	
Network UHF	Cancel
Link Direction Centre Tx - Mobile Rx Centre Rx - Mobile Tx Worst case	Radial range (km) Minimum Maximum 0.01 200
Plot Contour line Fill area	Azimuth range (*) Minimum Maximum Step
Solid Network style Rainbow Blur	Antenna pattern
Color	omni.ant
Threshold Auto set O S-Unit From O dBm 39 Ο μV To O dBμV/m 200	View pattern Image: Draw background Image: Draw background Image: Draw background
Save coverage data (TXT)	

Keep in a new picture



Save picture as

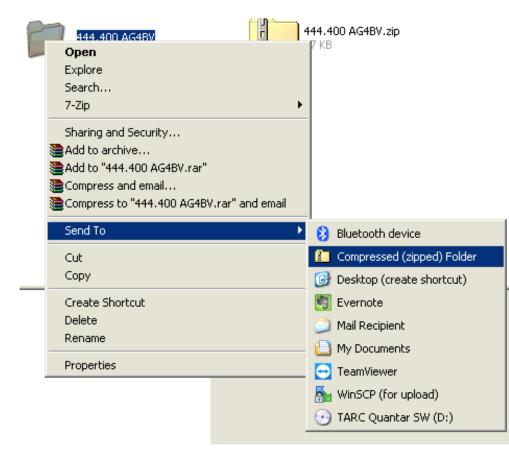
1.10	
New networks	
Open networks	Ctrl+O
Save networks	Ctrl+S
Save networks as	
Networks properties	Ctrl+N
Unit properties	Ctrl+U
Open map	
Save map as	
Map properties	F8
Previous map	
Next map	
New picture	
Open picture	
Save picture as	
Picture properties	Ctrl+I
Print	Ctrl+P
Exit	



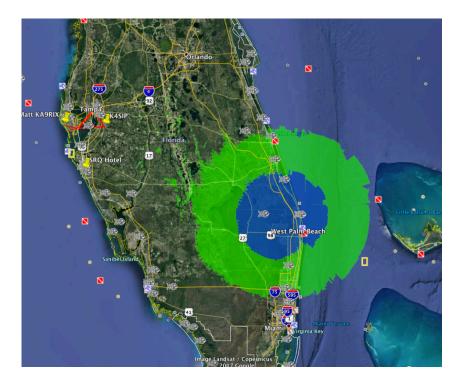
Save picture		? ×
Save in:	: 🔁 444.400 AG4BV 💽 🔶 🖽 🕬 🎟 🗸	
My Recent Documents Desktop My Documents	 ▲ 444.400 AG4BV 21 dBu Interference Contour.png ▲ 444.400 AG4BV 39 dBu Service Contour.png 	
My Network Places	File name: 444.400 AG4BV 39 dBu Service Contour Save as type: Picture File (PNG)	Save Cancel

Evaulating the results in google earth

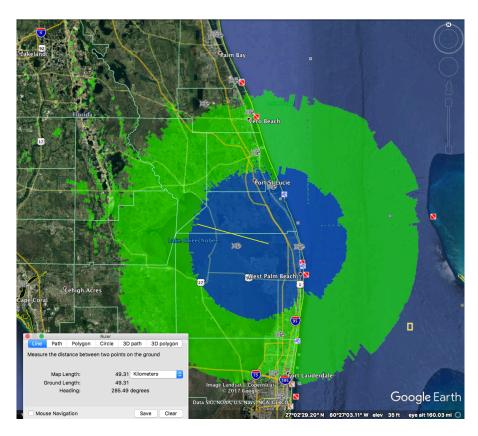
First we need to create a zipfile of the plots and export it to your desktop or if running it in a windows natively, just skip to opening the KML file directly.

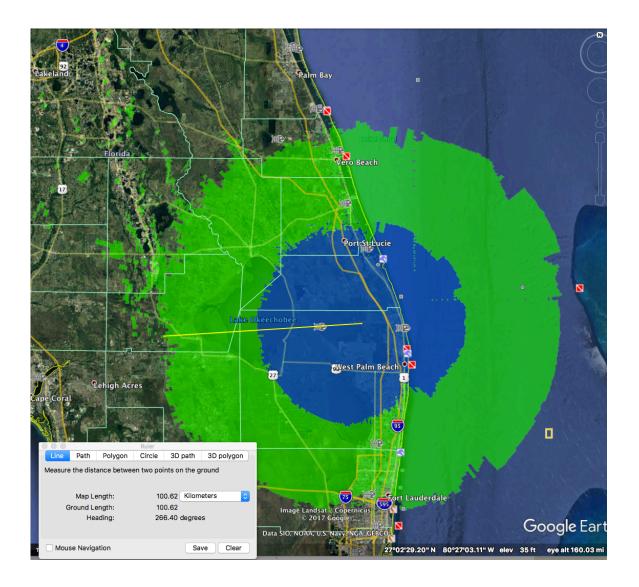


Now transfer that file to your computer and open each kml in google earth.



The average radius of the service contour and the interference contour can be measured and added in the coordination database.



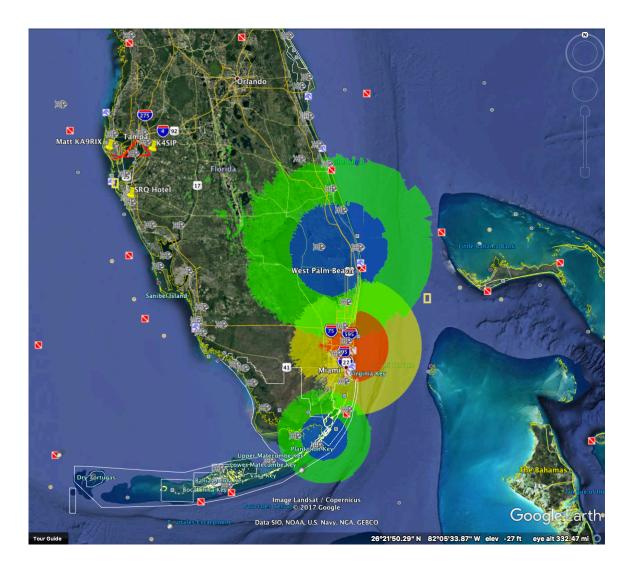


In this case we find the Service radius is about 50km and the interference radius is about 100km. We do not consider the over water part, and are ignoring the parts up on the mid Florida ridge. These contours are only for quick searching in the database for close frequencies. The models will govern the actual use of a frequency by a coordinated system.

Modeling Co-Channel adjacencies

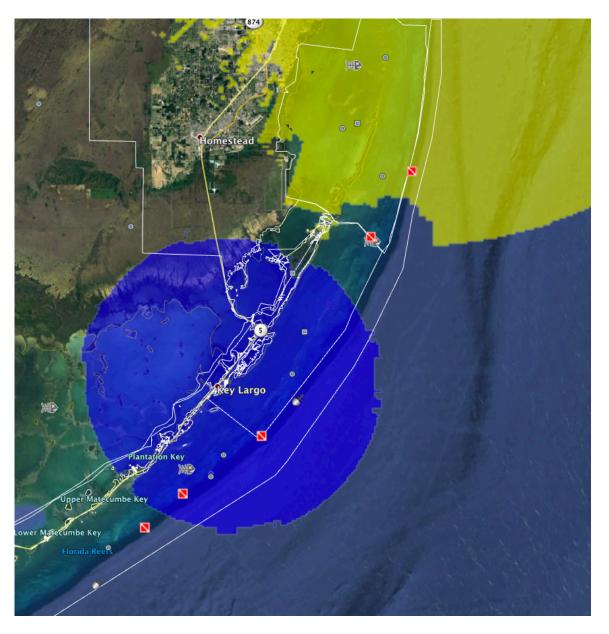
Co channel adjacent systems start as a model of all individual systems, which are then overlaid in Google earth.

Open the appropriate CO-Channel systems in Google earth to evaluate. In this example we are evaluating the middle system in red and yellow against the two existing systems in green and blue.



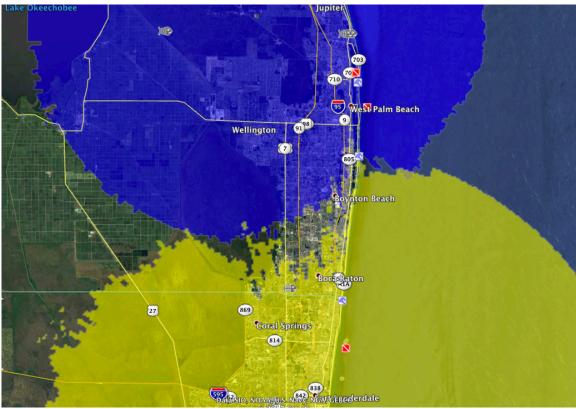
Using the Places dialog, uncheck and check the appropriate images and examine for overlap of the service contour of one and the interference contour of another.

In this case the system in Key Largo is not going to have the proposed interference contour of the Golden Beach system overlap it.



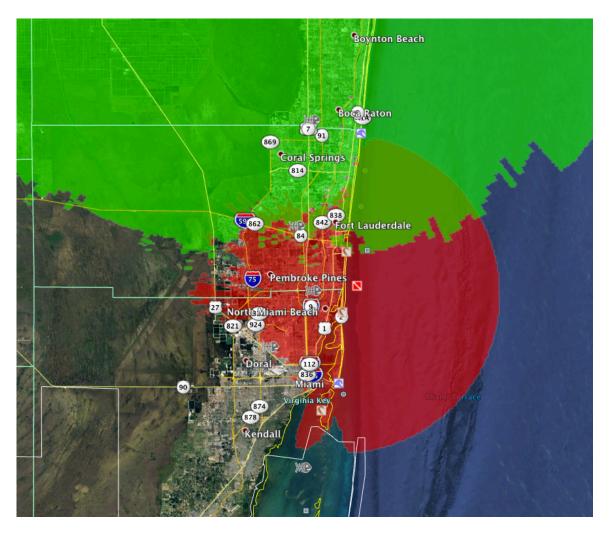
The same is true for the interference contour from Key Largo on the service contour of the proposed system.

Now looking at the incumbent system in Jupiter Farms, it service contour is only slightly overlapped by the interference contour of the proposed system.



This minor overlap is completely acceptable in most amateur radio systems.

Note the overlap of the northern systems interference contour on the proposed system's service contour.



This is typically not acceptable, however most the overlap is over water so this new proposed system should not interfere with the established systems, but the north system may interfere with it.

Modeling Adjacent channels on VHF systems

TBD, basically modeling the adjacent channel with a signal strength of (50,10) 42/44dBu, so that an adjacent channel contour doesn't overlap the service contour of any adjacent channel users. The idea here is the