Wiley Rein & Fielding LLP

1776 K STREET NW
WASHINGTON, DC 20006
PHONE 202.719.7000
FAX 202.719.7049

Virginia Office
7925 JONES BRANCH DRIVE
SUITE 6200
McLEAN, VA 22102
PHONE 703.905.2800
FAX 703.905.2820

www.wrf.com

September 16, 2004

David E. Hilliard
202.719.7058
dhilliard@wrf.com

VIA ELECTRONIC FILING

Marlene H. Dortch, Esq.
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Re: ET Docket No. 04-37 – ***Ex Parte Notice***

Dear Ms. Dortch:

On September 15, 2004, Brian Gaffney, Joel Fox, and Timothy Russell of Aeronautical Radio Incorporated (ARINC), John Bartlett of this firm, and I met with Bruce Franca, Ron Repasi, Alan Scrime, and Ahn Wride of the Office of Engineering and Technology to discuss the concerns that ARINC raised in its Comments and Reply Comments in this proceeding regarding the possibility for interference to aeronautical air traffic control and operational control communications from broadband over power line systems operating on the Aeronautical Mobile(R) high frequencies. Copies of the materials supplied during the meeting are attached.

Respectfully,

David E. Hilliard

David E. Hilliard
Counsel for ARINC

Attachments
cc: Messrs. Franca, Repasi, and Scrime; Ms. Wride

ARINC Air/Ground International LDOC HF Radio Service

What Is Air/Ground International?

ARINC's Air/Ground International radio service provides high frequency (HF) single side band aeronautical operational control (AOC) voice communications for aircraft flying over the Atlantic and Pacific Oceans, Caribbean, Gulf of Mexico, and Central and South America. ARINC connects far-reaching corners of the world to one of two HF Long Distance Operational Control (LDOC) Facilities located in New York and San Francisco. The New York facility extends coverage east toward Europe and Africa and south toward Central and South America. The San Francisco facility provides coverage north to Alaska, west to Russia, and south to Australia and South America.

Very high frequency (VHF) voice communications are also available at oceanic gateways along the east, west, and Gulf coasts and Hawaii. They are used to augment the HF service until the aircraft is no longer in range of the VHF ground stations.

Service Benefits

The ARINC Air/Ground International Service offers an array of benefits including:

- No start-up fee to join the service
- Around-the-clock availability
- Current weather and forecast data, available for virtually any location

The Air/Ground International service can be used to:

- Make ground arrangements. Corporate jets can use a phone patch to contact a fixed-base operator to make arrival arrangements such as aircraft servicing and equipment needs.
- Coordinate flight and ground activities. Airlines use the service to help control and track arrival times so that ground operations can be handled expeditiously.
- React quickly to changes. Dispatch can divert an aircraft from its flight plan to pick up unscheduled passengers/freight.
- Handle irregular operations. Pilots use the service to resolve fuel situations with dispatch when the aircraft experiences weather-induced irregular operations.

COMMUNICATIONS IN FIRs

ARINC also provides air traffic control radio communications services for aircraft flying in United States flight information regions (FIRs). ARINC's Communications Centers relay ATC flight movement messages for the Federal Aviation Administration (FAA) while the aircraft is flying in oceanic regions under FAA jurisdiction. In addition, ARINC can transmit the same messages to customer designations to ensure the company is advised for flight-following purposes. ARINC provides the only HF communications link to the FAA in those international areas for which the FAA has control.

ARINC Communications Centers Provide Global Coverage

- Stay in touch while aloft. When in U.S. FIRs, aircraft can be contacted by ARINC radio operators and advised to activate an LDOC frequency. This eliminates the need for aircrews to monitor LDOC frequencies.
- Inform dispatch of important events.
- Provide emergency communications.

Message Delivery Options

ARINC offers many ways to deliver messages to meet individual needs. Air/Ground International radio operators can:

- Send transcribed messages to any ARINC Data Network Service (ADNS) teletype subscriber or any International Civil Aviation Organization (ICAO) address worldwide.
- Deliver messages by telephone.
- Provide a phone patch to any phone number while the aircraft is en route.
- Deliver ground-originated calls to the aircraft.
- Signal the aircraft's Selective Calling System (SELCAL), if equipped, that a message is incoming so the pilot need not monitor the frequency.

ARINC maintains a 30-day tape recording of all conversations should an after-the-fact analysis be required.

Contact Frequencies

ARINC Station Location and Call Sign	HF SSB LDOC Facilities Frequencies Guarded (kHz)								
	3013	3494	6640	8933	11342	13330	13348	17925	21964
San Francisco	X		X		X		X	X	X
New York		X	X	X	X	X		X	

LDOC frequencies are monitored 24 hours a day

Unparalleled Quality

ARINC has established stringent performance goals for all of its services. Performance is continually measured on all systems against those goals, and the results are published regularly. These reports are readily available to all ARINC customers.

ARINC's demanding quality control program ensures that the Air/Ground International Service meets and exceeds stringent Federal communications regulations. The entire system is monitored 24 hours per day from each Communications Center to ensure all equipment is functioning properly. In addition, ARINC strives for zero operational errors. These significant goals ensure that messages are delivered on time and error free.

ARINC's Experience

ARINC was founded in 1929 to provide reliable and efficient aeronautical radio communications and first began offering HF voice communications services for the aviation community in 1938. Today, ARINC handles the communications needs of all aircraft from the smallest business aircraft to the largest commercial air transport aircraft.

Air/Ground International's experienced radio operators are the industry's only operators who routinely handle air traffic control messages for the FAA. This staff of 120 operators handles an average of 210,000 routine and special situation messages each month from the ARINC Communications Centers, with capacity to handle many more.

ARINC

2551 Riva Road
Annapolis, Maryland 21401 USA
tel: +1 410 266 4180
fax: +1 410 266 2329
e-mail: arincmkt@arinc.com
Web site: www.arinc.com

ARINC develops and operates communications and information processing systems for the aviation and travel industries and provides systems engineering and integration solutions to the government and industry. Founded in 1929 to provide reliable and efficient radio communications for the airlines, ARINC is headquartered in Annapolis, Maryland, USA, and has over 50 locations worldwide, including San Francisco, London, Bangkok, and Beijing.

99-205134M-1

ARINC

AIR/GROUND DOMESTIC RADIO SERVICE

ARINC's Air/Ground Domestic radio service is the aeronautical industry's air/ground voice communications link for aeronautical operational control (AOC) messages. With a network of 122 remote VHF radio sites in the United States, Canada, and Mexico, Air/Ground Domestic supplies complete en route coverage, which many of our customers require for Federal Aviation Regulation (FAR) Part 121 compliance.

ARINC's Air/Ground Domestic networks are controlled from ARINC Communications Centers, where radio operators monitor the VHF frequencies, receive calls, transcribe messages, and route calls as customers request, 24 hours per day. An ongoing network modernization program provides for automated routing, Voice over Frame message transmission, and two-way direct dialing, which ensures the continued high performance of the existing service and establishes ARINC as the premier service provider of next-generation voice communications.

ARINC provides aircrews and their ground parties with immediate communications for:

- Exchange of operational control and flight information
- Aircraft malfunctions and emergencies
- In-flight medical assistance

- Weather and destination airport information
- Arranging diversions

Coverage

Air/Ground Domestic coverage is continuous above 20,000 feet within the continental U.S. and along the coastal regions of western Canada and Alaska. ARINC also has VHF coverage in Mexico with stations installed at major airports in Mexico. Air/Ground Domestic supports the major flight routes in the U.S. and offers rapid and reliable access for dispatchers and flight followers. In addition, coverage at lower altitudes and on the ground is available at 77 airports in the U.S. and 14 airports in Mexico. Coverage charts are available from ARINC at customer request.

DIRECT PILOT-TO-GROUND COMMUNICATIONS — WITH OR WITHOUT RADIO OPERATOR ASSISTANCE

Message Delivery

ARINC offers many ways to deliver messages; radio operators can:

- Send transcribed messages by AviNet℠ to any International Civil Aviation Organization (ICAO) address worldwide
- Deliver messages by telephone
- Establish a phone patch between aircraft and any ground facility
- Deliver ground-originated calls to aircraft anywhere in the coverage area
- Signal the aircraft's Selective Calling System (SELCAL) that a message is incoming so the pilot need not monitor the frequency for calls

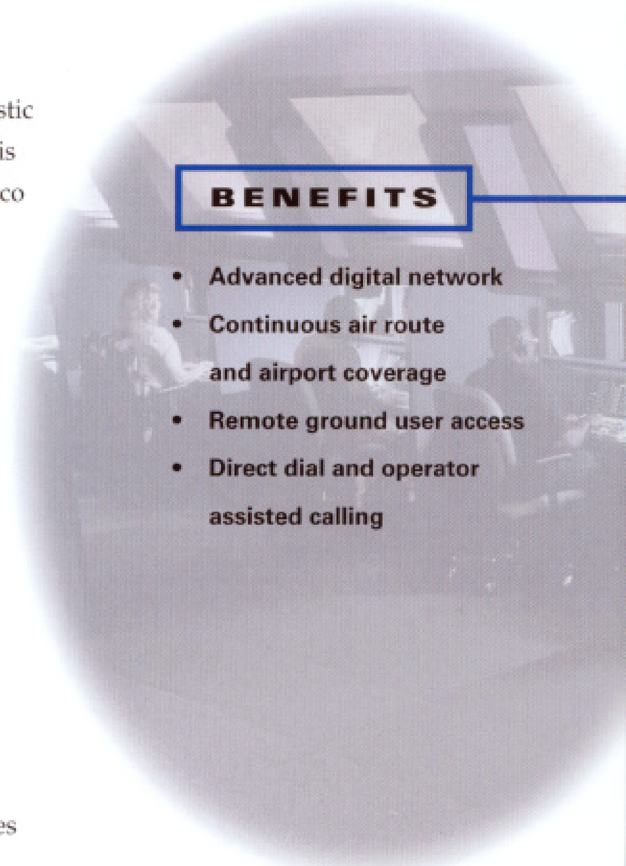
In addition, ARINC recently installed the VHF Dial Access system, which allows a ground party to contact its aircraft using any desktop dual-tone multifrequency (DTMF) telephone without radio operator involvement. This tool, when used in conjunction with ARINC's WebASDSM service, provides dispatch centers convenient, self-serve use of Air/Ground Domestic networks.

VHF Domestic Service Quality

Demanding quality control measures ensure that Air/Ground Domestic meets stringent Federal Aviation Administration and Federal Communications Commission communications regulations for air carriers. ARINC maintains greater than 99.70 percent availability of the Air/Ground Domestic network system. The entire network is monitored from ARINC's San Francisco Communications Center to ensure all stations are working properly. Moreover, ARINC-designated employees routinely ride in cockpit jumpseats and visit stations to monitor quality and check network performance. If problems occur, ARINC's staff of on-call technicians located throughout the U.S. can be dispatched quickly to repair radios and restore service.

Enhancements

The Air/Ground Domestic Service is currently undergoing several upgrades that will allow for better quality communications and additional self-serve use features for customers to contact their own aircraft. Air/Ground Domestic will soon support DTMF call routing from the cockpit, and radio operator assistance on demand. Air/Ground Domestic is the next generation in voice communications.



BENEFITS

- **Advanced digital network**
- **Continuous air route and airport coverage**
- **Remote ground user access**
- **Direct dial and operator assisted calling**

2551 Riva Road, Annapolis, MD 21401-7465 USA • AT&T Country Access + 800 633 6882 • Fax: +1 410 573 3300 • www.arinc.com

Summary of ARINC's Broadband Over Power Lines Modeling and Interference Analysis

Prepared by: Joel Fox
ARINC
Staff Principal Engineer
Electromagnetic Programs
410-266-4924
jfox@arinc.com

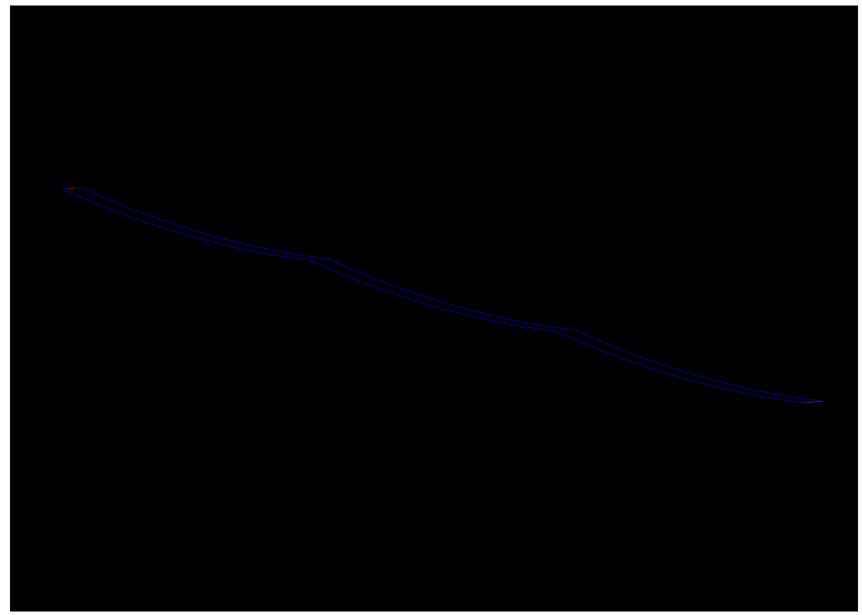
ARINC
Engineering Services, LLC
YOU WON'T BELIEVE WHAT WE CAN DO.™

ARINC BPL Modeling

- This model attempts to predict the interfering signal strengths presented at various distances from a single BPL radiator at a fixed height above ground of 100 [ft] in the frequency range of 3 – to 20 MHz.
- Modeling software: method-of-moments analysis program Numerical Electromagnetic_Code, Version 4.1 (NEC),

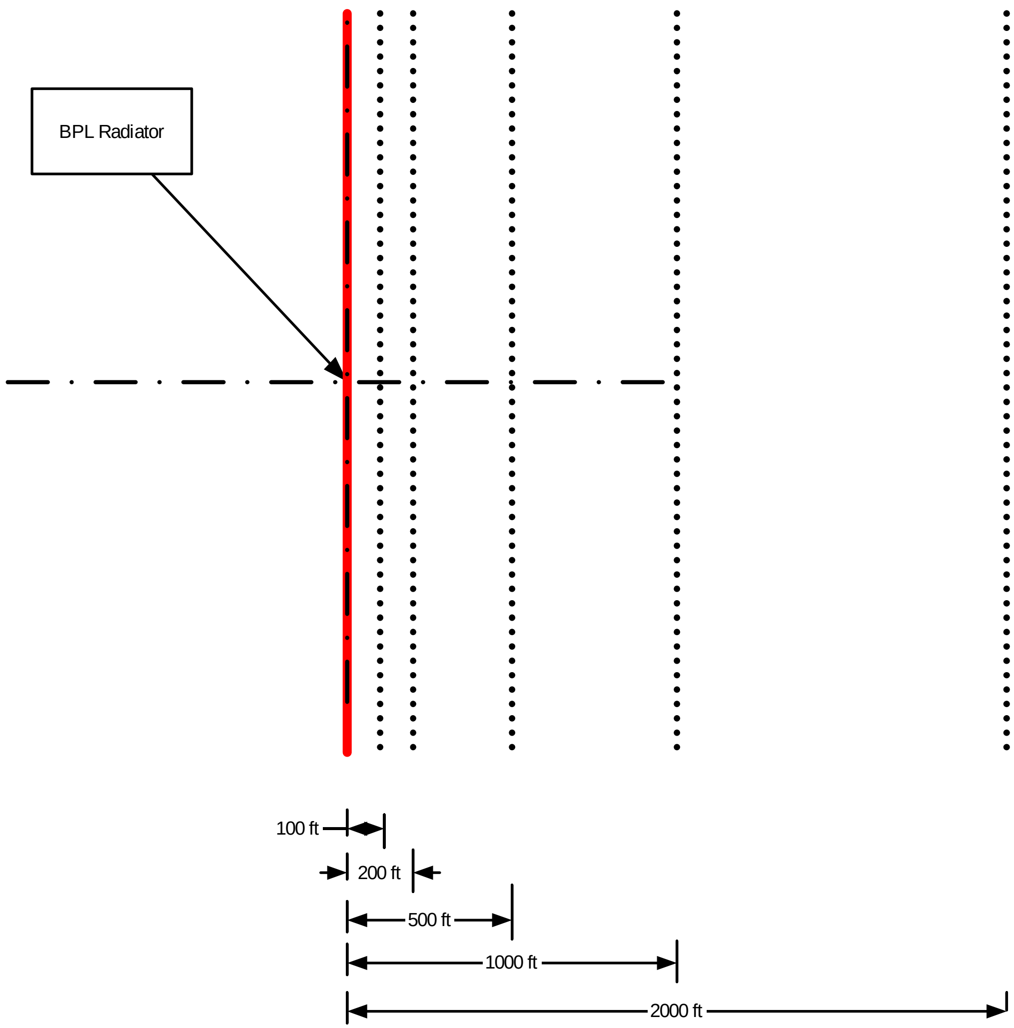
ARINC BPL Modeling Parameters

- Parameters
  - 2000 ft span 12 sections 3 ft sag (figure depicts only 3 sections)
  - Zload = R +j0
    - R = 6.25, 12.5, 25,50,100,200,400,1000
  - P_{input} = 1mW
  - Excitation voltage was varied with input impedance to produce 1mW input power.
  - 6 ft spacing between parallel sections
  - 40ft above ground
  - Differentially Fed Excitation
  - Used Avg Ground parameters (conductivity=.005 dielectric = 13)
  - Analyzed f = 3,5,10,15,20 Mhz

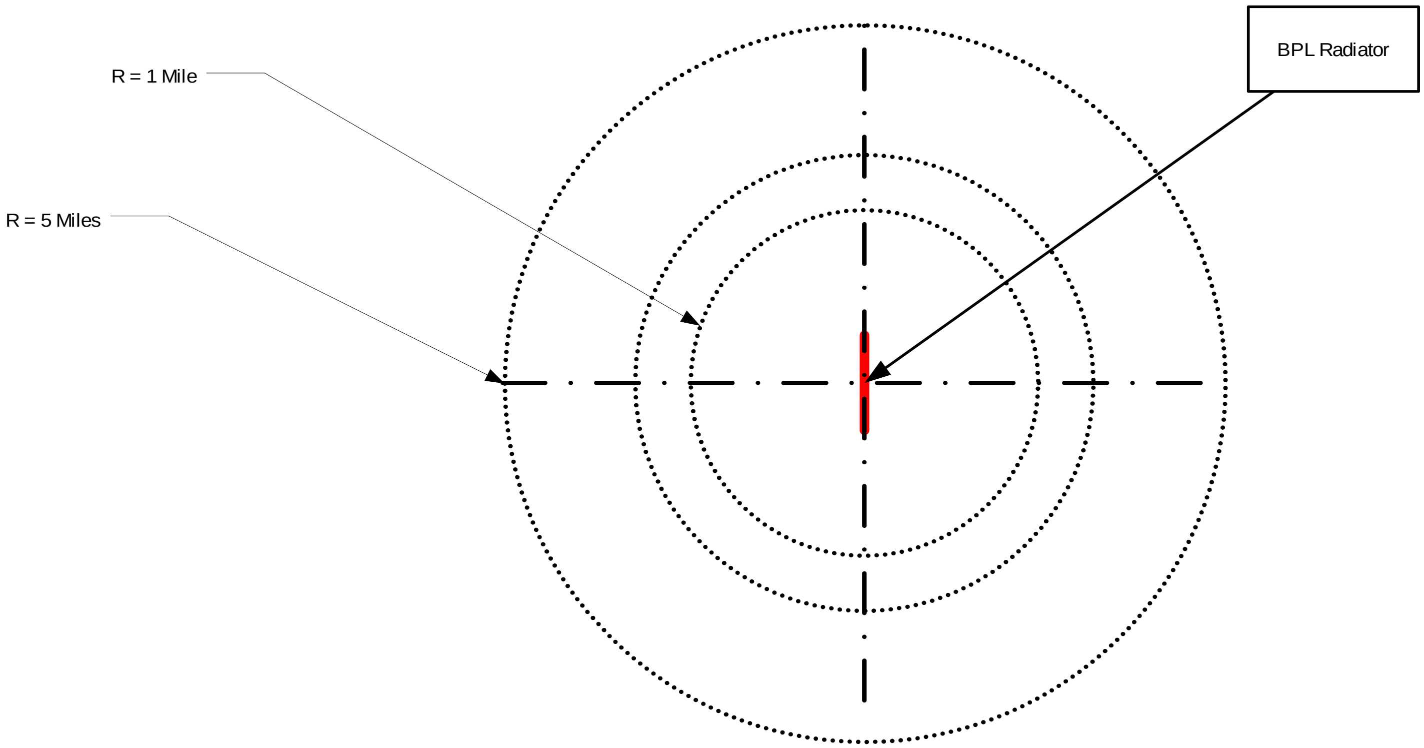


BPL Analysis Approach

- Assumed horizontally polarized ground side receive antenna.
- Distances analyzed from BPL antenna D= 100ft,200ft, 500ft,1000ft ,2000ft,1mi, 2mi and 5mi
- At distances (D = y) of 1000ft and less, the analyses looked at 1000 points between -1000ft = x = 1000ft at a height of 100ft above ground parallel to the BPL radiator.
- At distances of 2000 ft and greater, the analysis looked at 360 points (phi) around the BPL antenna at a fixed receive antenna height of 100 ft.
- Antenna Height above ground was assumed fixed at (z) = 100ft for all analysis
- |E| near field horizontal signal strength was calculated at each point and sorted for maximum in dBuV/m
- Far Field pattern was analyzed reporting maximum power gain [dBi] and take off angle.



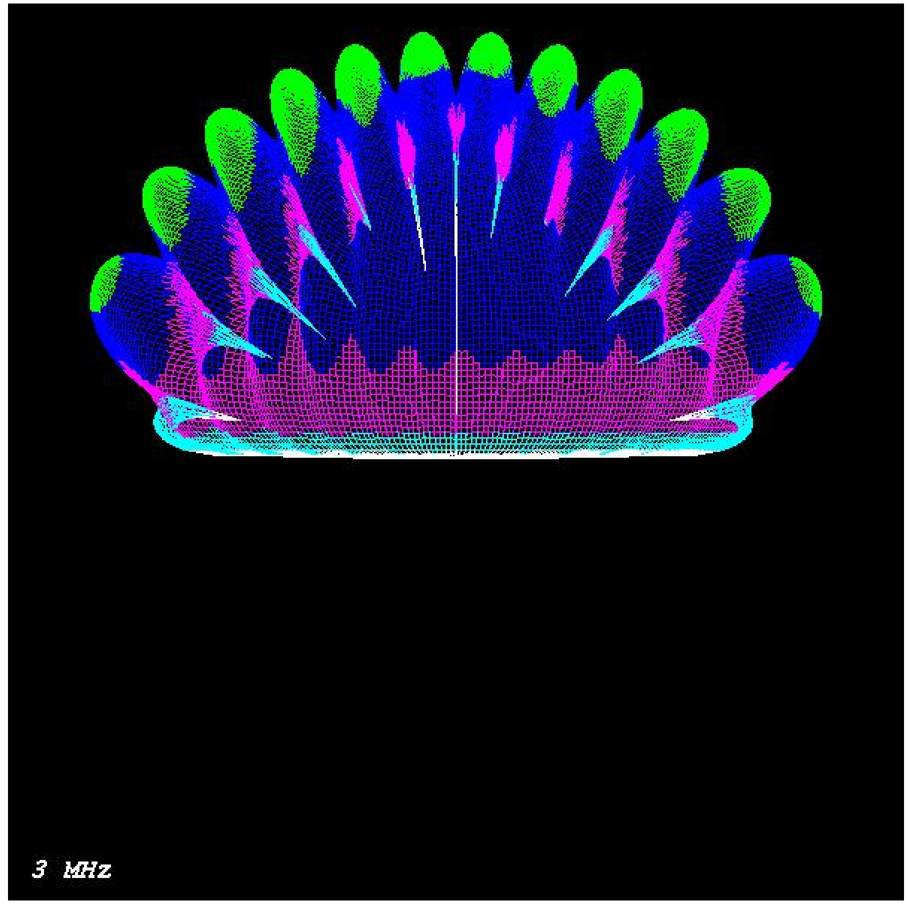
Points analyzed at 100 ft above ground every 2 ft parallel to 2000 ft BPL radiator at distances
D = 100ft,200 ft, 500 ft, 1000 ft and 2000 ft



Points analyzed at 100 ft above ground every 1 degree
for PHI = 0 -360 for Distances R = 1mi, 2mi, 5mi

Radiation Pattern Plots Explained

- Horizontal Gain is Depicted
- Patterns are color coded based on their power gain:
  - Red > 0 dBi
  - Yellow 0 to – 10 dBi
  - Green -10 to -20 dBi
  - Blue -20 to -30 dBi
  - Magenta -30 to -40 dBi
  - Cyan -40 to -50 dBi
  - White <-50 dBi

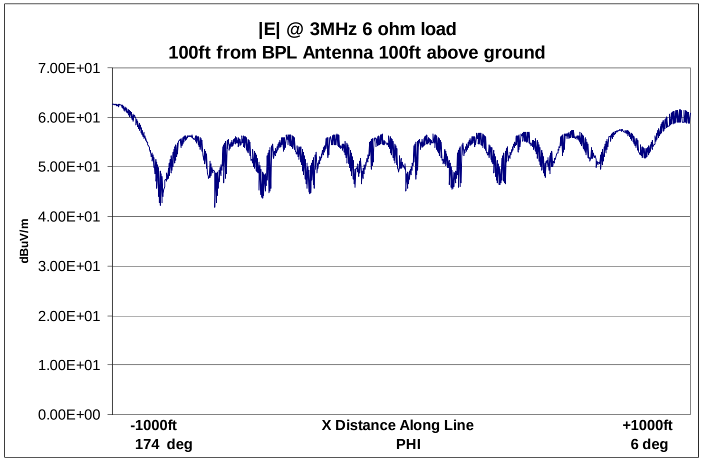


BPL Power Gain [dBi] Summary

Freq [MHz]	R Load [ohms]	Theta	Phi	MAX Gain dBi
3	6.25	5	0	-7.7
3	12.5	5	0	-9.5
3	25	5	0	-11.7
3	50	5	3	-14.2
3	100	5	0	-16.9
3	200	5	0	-19.7
3	400	4	172	-22.2
3	1000	6	0	-24.1
5	6.25	3	0	-4.9
5	12.5	3	0	-6.3
5	25	3	0	-8.2
5	50	3	0	-10.5
5	100	9	0	-12.9
5	200	9	0	-15.2
5	400	4	0	-16.7
5	1000	4	0	-16.9
10	6.25	52	0	1.8
10	12.5	52	0	0.9
10	25	57	177	-0.4
10	50	57	176	-2.3
10	100	57	176	-4.6
10	200	57	177	-7.1
10	400	56	0	-9.6
10	1000	68	65	-9.5

Freq [MHz]	R Load [ohms]	Theta	Phi	MAX Gain dBi
15	6.25	67	0	6
15	12.5	67	1	5.1
15	25	67	1	3.7
15	50	67	1	1.8
15	100	67	0	-0.5
15	200	67	0	-3
15	400	67	0	-5.4
15	1000	74	52	-5.3
20	6.25	64	142	5.6
20	12.5	64	142	4.9
20	25	64	142	3.8
20	50	64	142	2.1
20	100	61	36	0
20	200	60	35	-1.6
20	400	60	35	-2.6
20	1000	60	35	-2.5

BPL Interference Summary @ 3Mhz



BPL Input power of 1mW

Receive Antenna Fixed Height 100ft

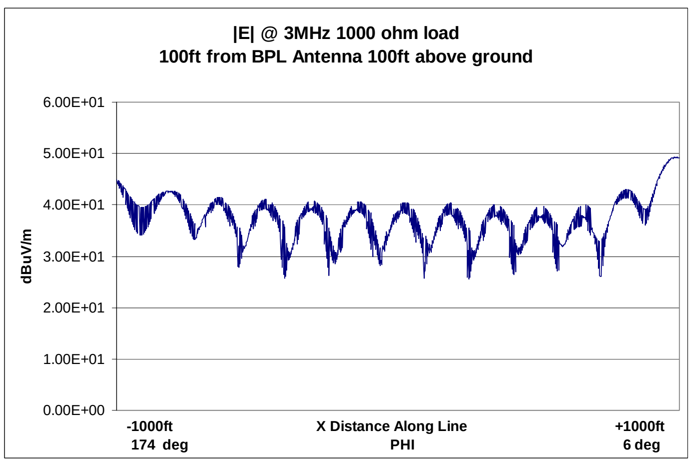
Maximum predicted interference @ 3MHz 100ft from BPL antenna is 63dBuV/m = 1412.538 uV/m

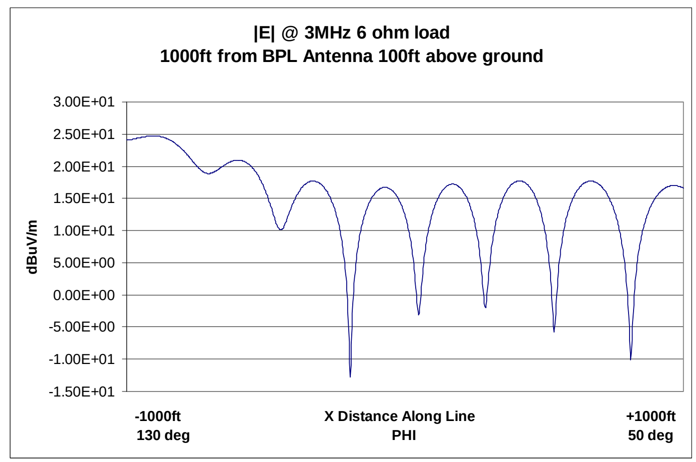
Interference level exhibits 15-20dB swings with various loads

Highest interference at either end of BPL radiator.

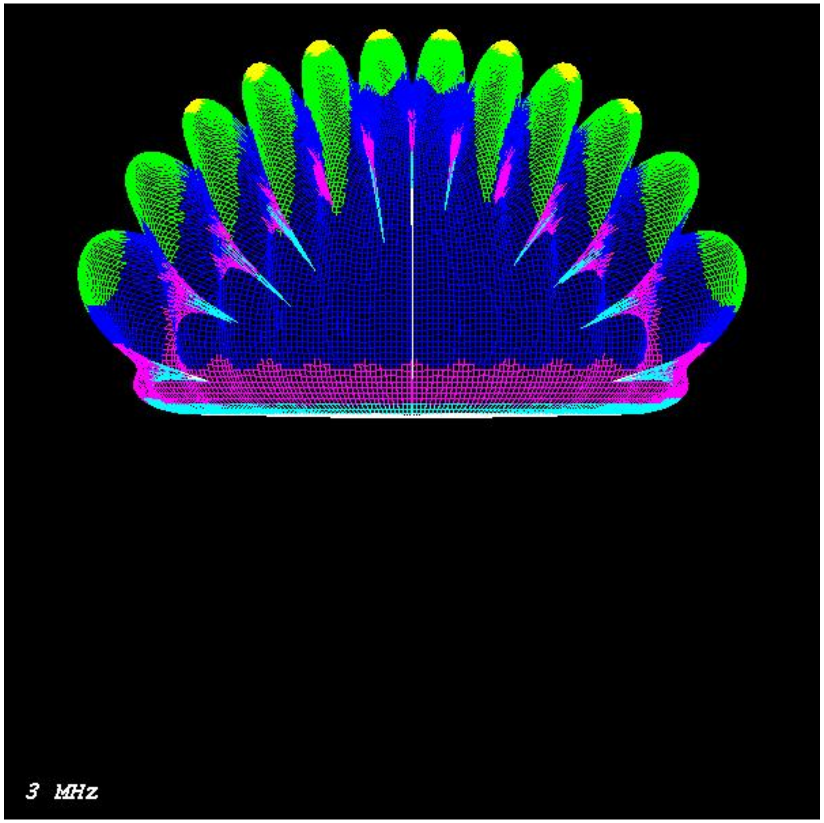
Approximate 40dB/decade roll off @ 3MHz

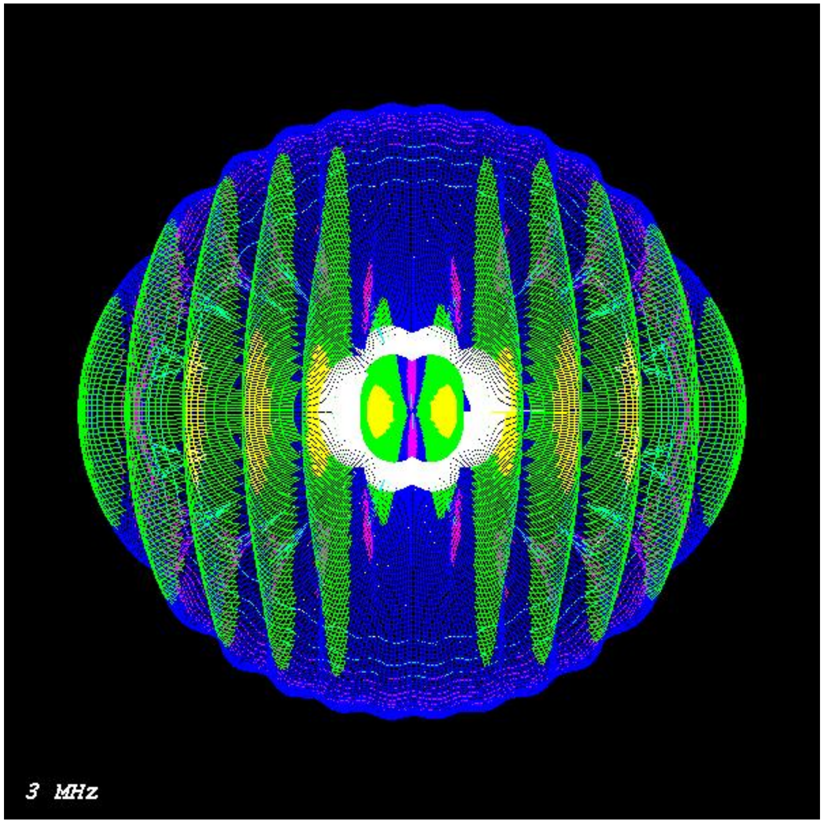
Interference will increase as BPL radiation angle increases. High site installations will be subject to more interference.





BPL Zload = 6.25 +j0 Zin = 24+j577 f = 3.0 MHz



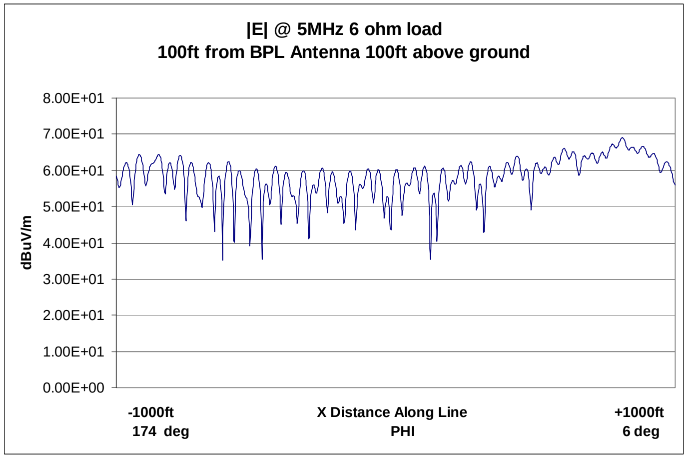


>0 | 0 to -10 | -10 to -20 | -20 to -30 | -30 to -40 | -50 to -60 | -50 to -60

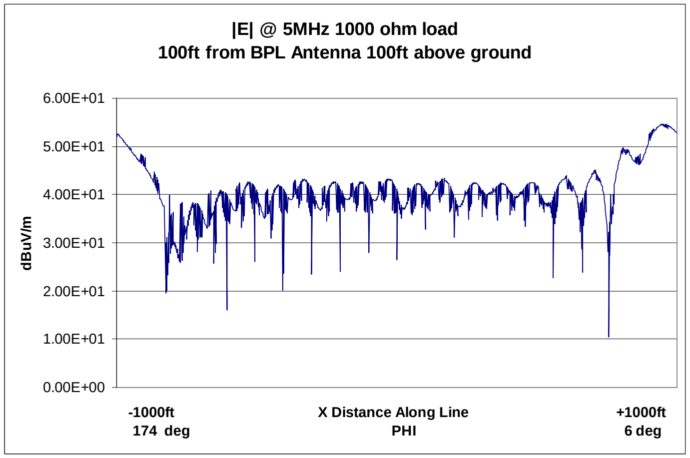
L3M6_3hpa

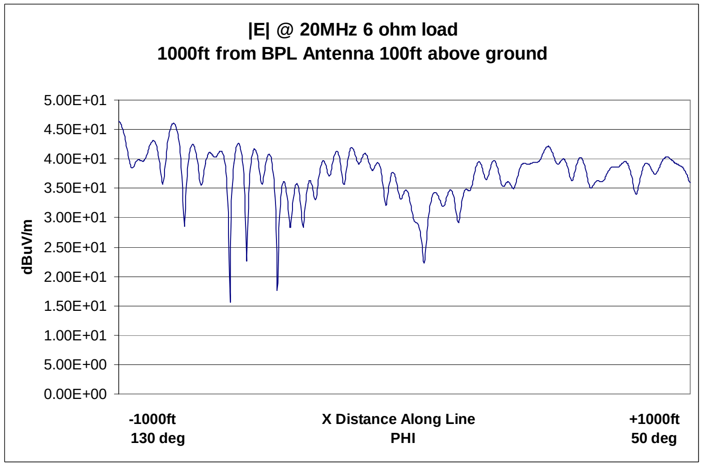
L3M6_3hpb

BPL Interference Summary @ 5Mhz

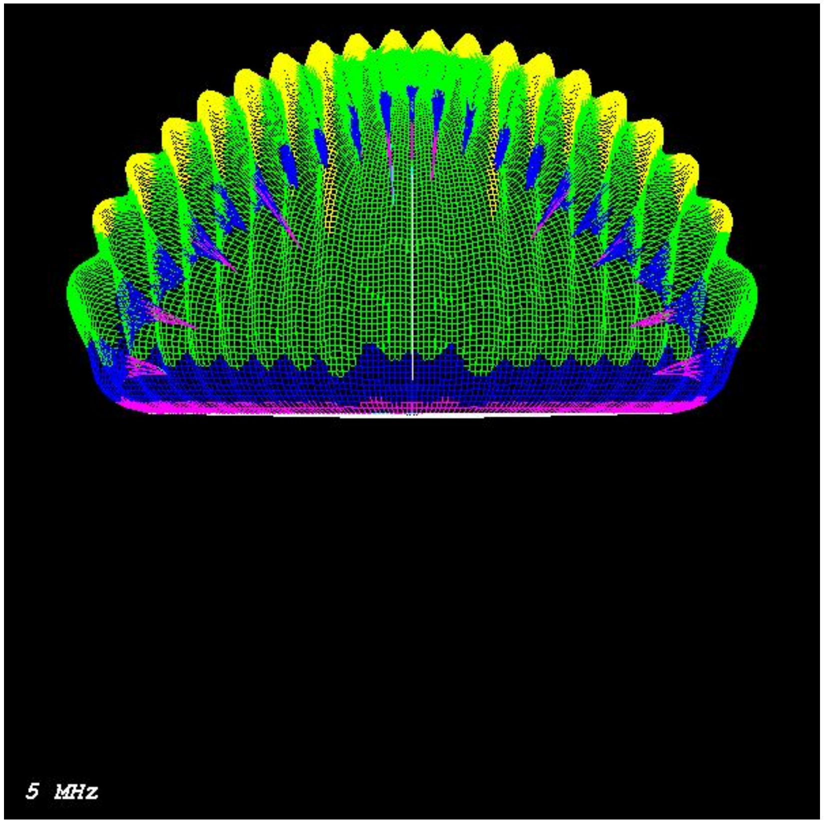


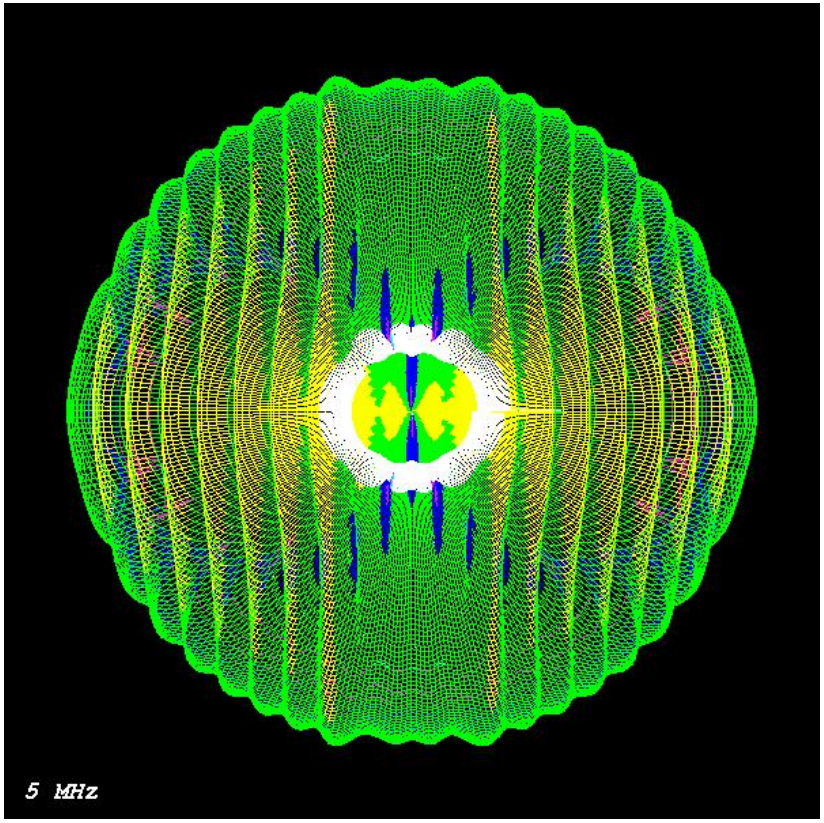
- **BPL Input power of 1mW**
- **Receive Antenna Fixed Height 100ft**
- **Maximum predicted interference @ 5MHz 100ft from BPL antenna is 69dBuV/m = 2818.38 uV/m**
- **Interference level exhibits 15-20dB swings with various loads**
- **Highest interference at either end of BPL radiator**
- **Approximate 20dB/decade roll off @ 5MHz**
- **Interference will increase as BPL radiation angle increases. High site installations will be subject to more interference.**

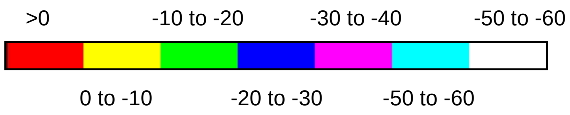




BPL Zload = 6.25 +j0 Zin = 202+j2001 f = 5.0 MHz







L5M6_5hpa

L5M6_5hpb

BPL Interference Summary @ 10Mhz

BPL Input power of 1mW

Receive Antenna Fixed Height 100ft

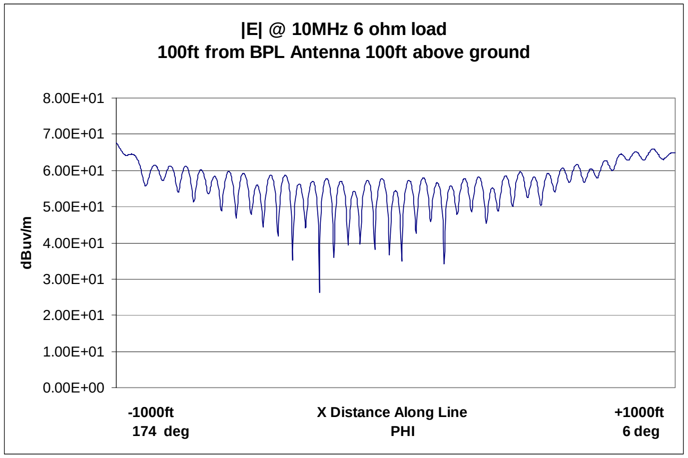
Maximum predicted interference @ 10 MHz 100ft from BPL antenna is 67.7dBuV/m = 2426.6 uV/m

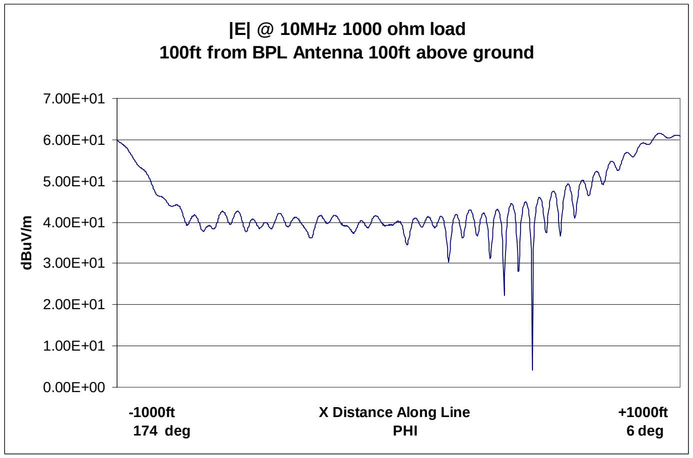
Interference level exhibits approximate 10dB swings with various loads

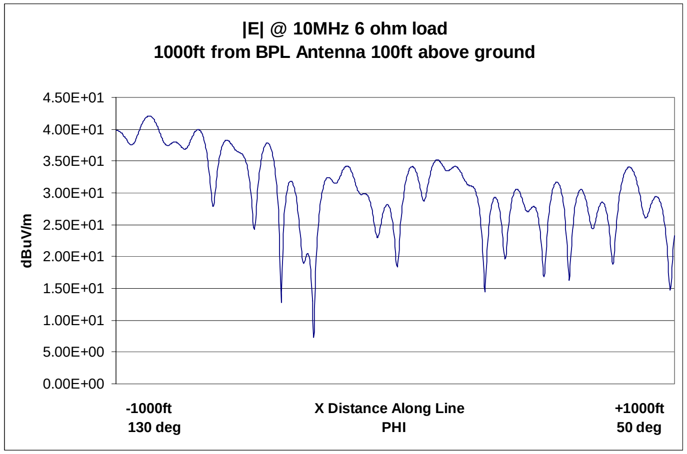
Highest interference at either end of BPL radiator

Approximate 20 dB/decade roll off @ 10MHz

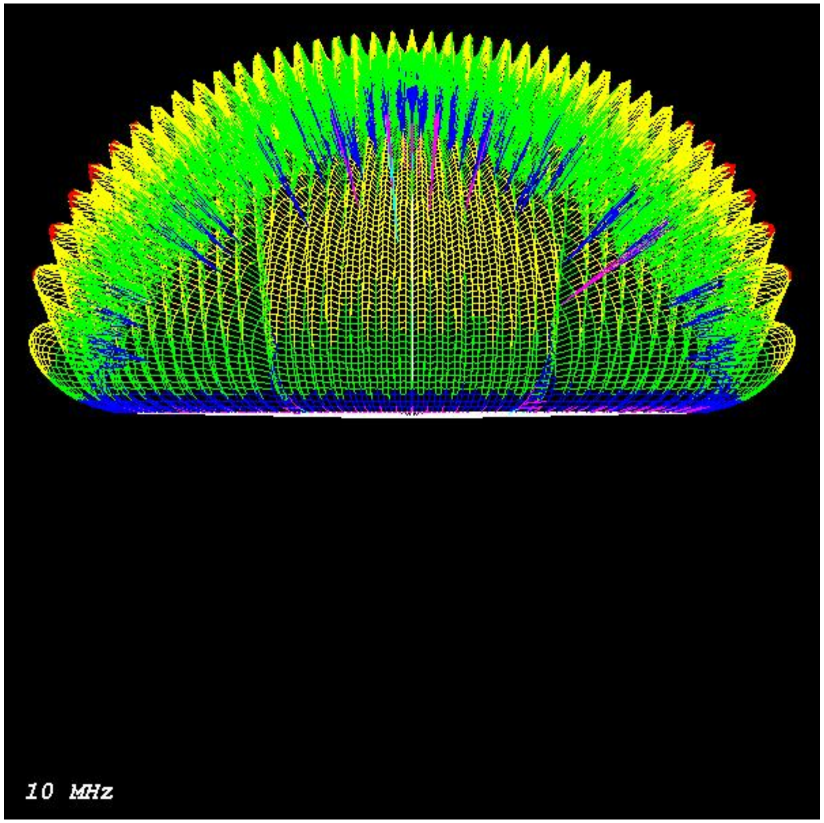
Interference will increase as BPL radiation angle increases. High site installations will be subject to more interference.

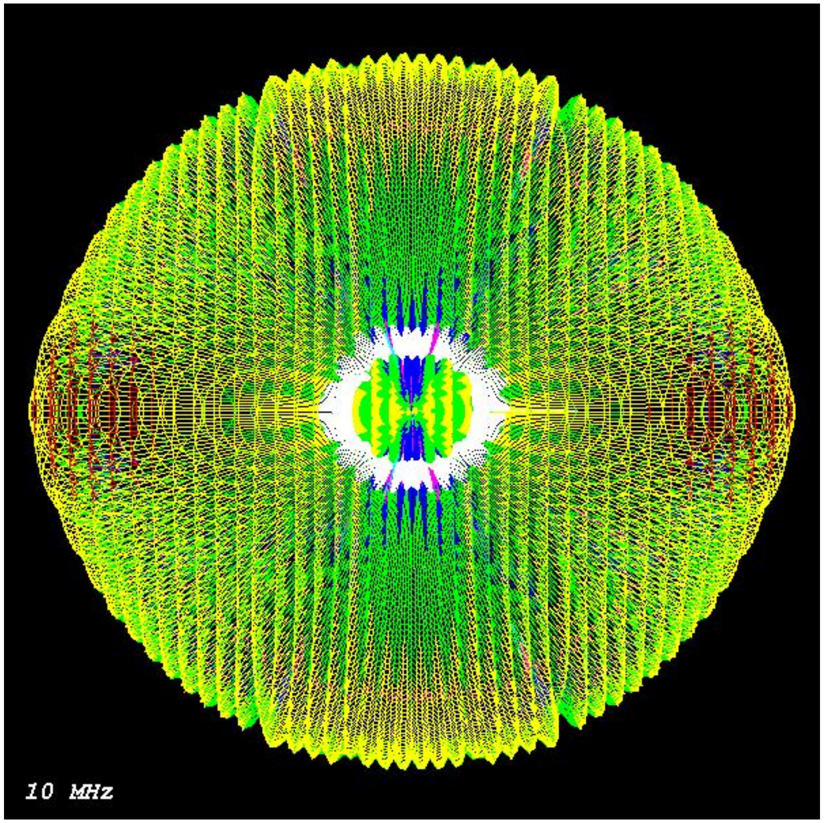


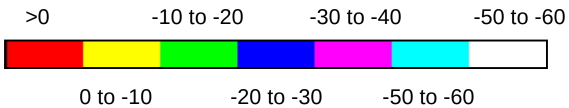




BPL Zload = 6.25 +j0 Zin = 40-j430 f = 10.0 MHz



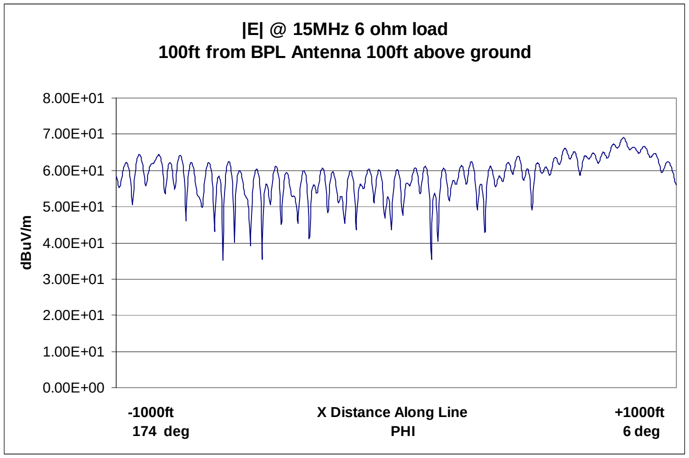




L10M6_10hpa

L10M6_10hpb

BPL Interference Summary @ 15Mhz



BPL Input power of 1mW

Receive Antenna Fixed Height 100ft

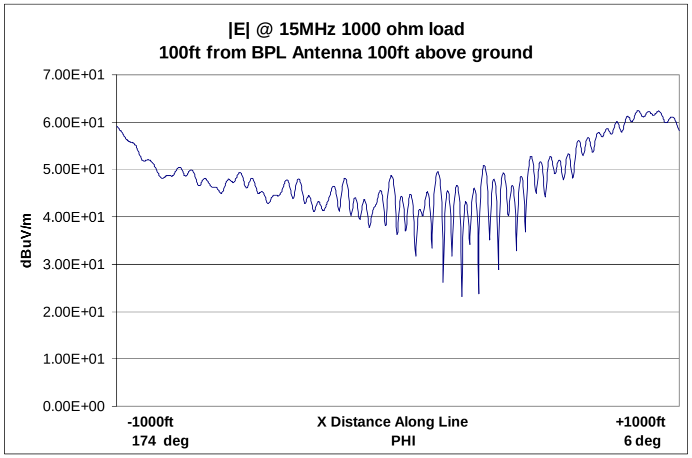
Maximum predicted interference @ 20 MHz100ft from BPL antenna is 69dBuV/m = 2818.38 uV/m

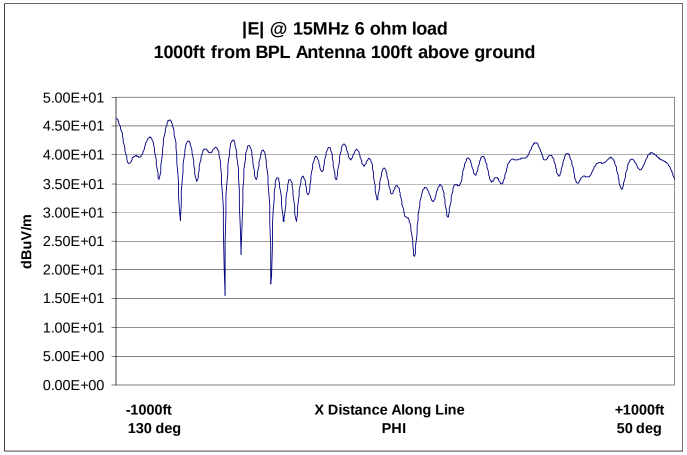
Interference level exhibits approximate 10dB swings with various loads

Highest interference at either end of BPL radiator

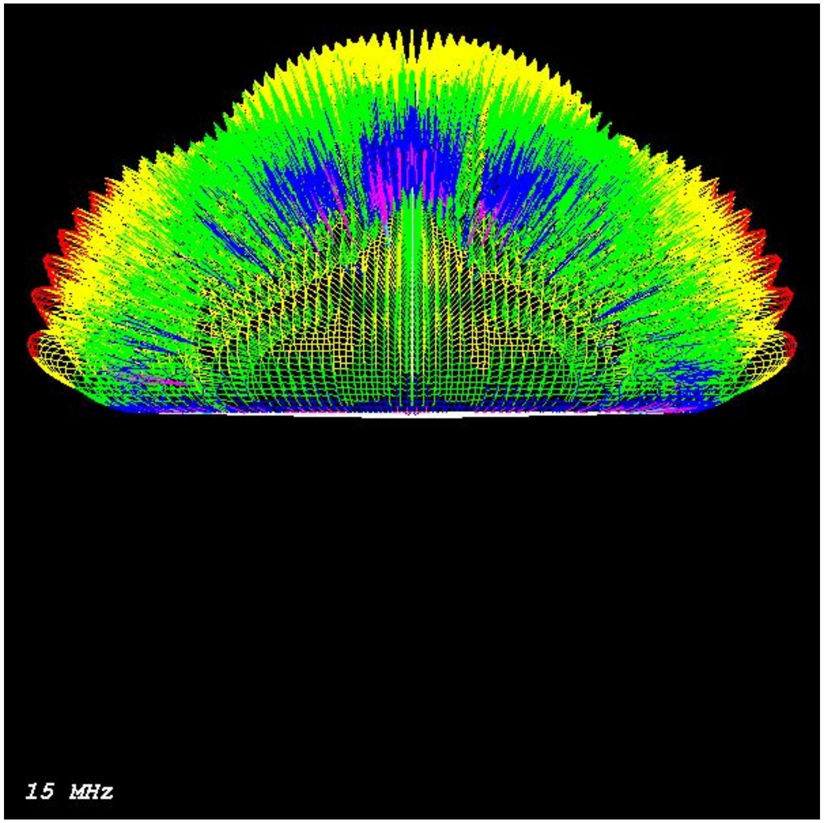
Approximate 20 dB/decade roll off @ 15MHz

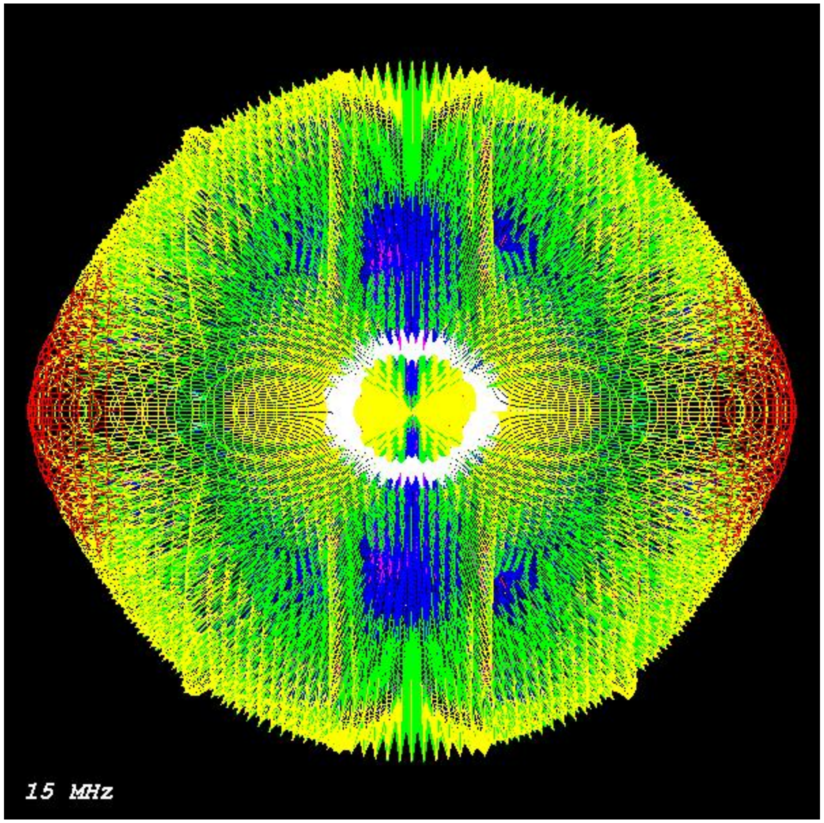
Interference will increase as BPL radiation angle increases. High site installations will be subject to more interference.





BPL Zload = 6.25 +j0 Zin = 43+j428 f = 15.0 MHz





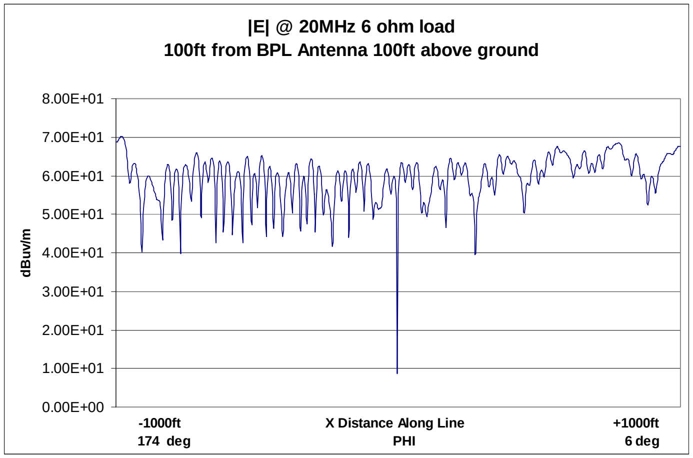
>0 | -10 to -20 | -30 to -40 | -50 to -60

0 to -10 | -20 to -30 | -50 to -60

L15M6_15hpa

L15M6_15hpb

BPL Interference Summary @ 20Mhz



BPL Input power of 1mW

Receive Antenna Fixed Height 100ft

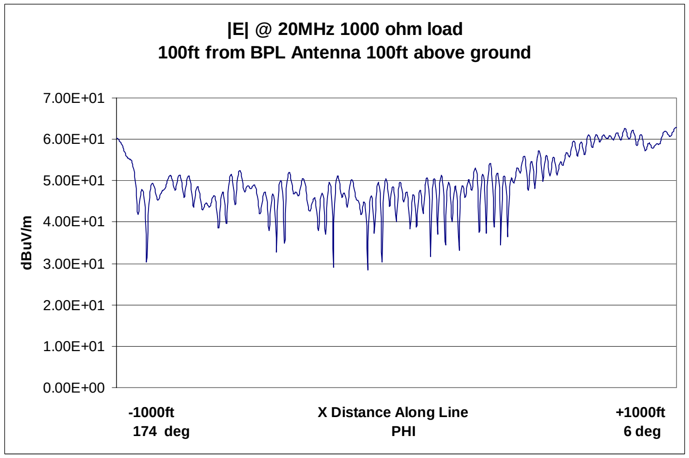
Maximum predicted interference @ 20 MHz 100ft from BPL antenna is 70.2 dBuV/m = 3235.94 uV/m

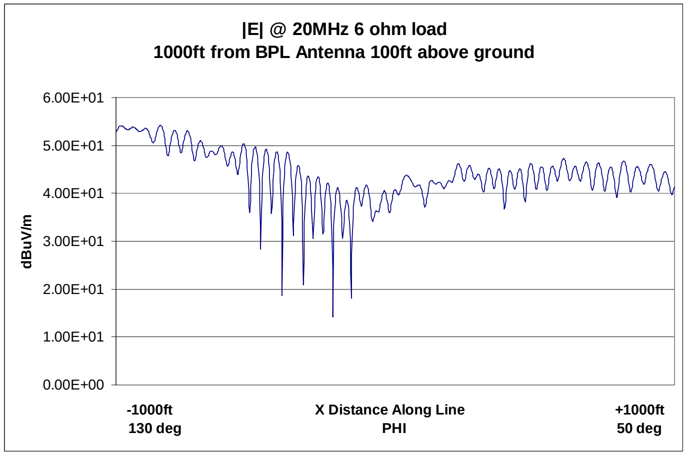
Interference level exhibits approximate 10dB swings with various loads

Highest interference at either end of BPL radiator

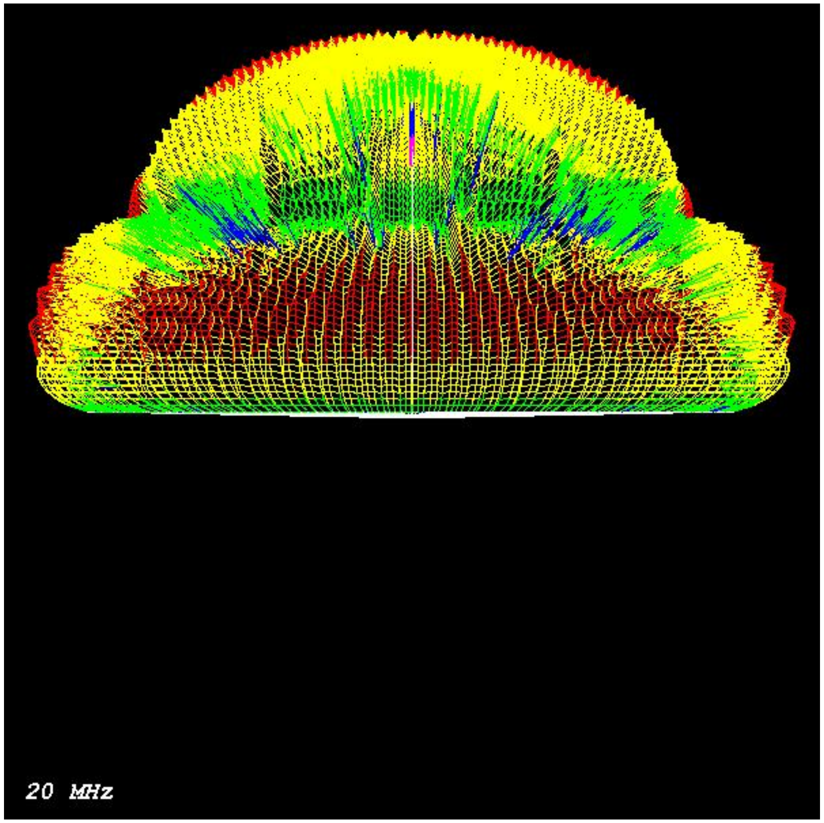
Approximate 20 dB/decade roll off @ 20MHz

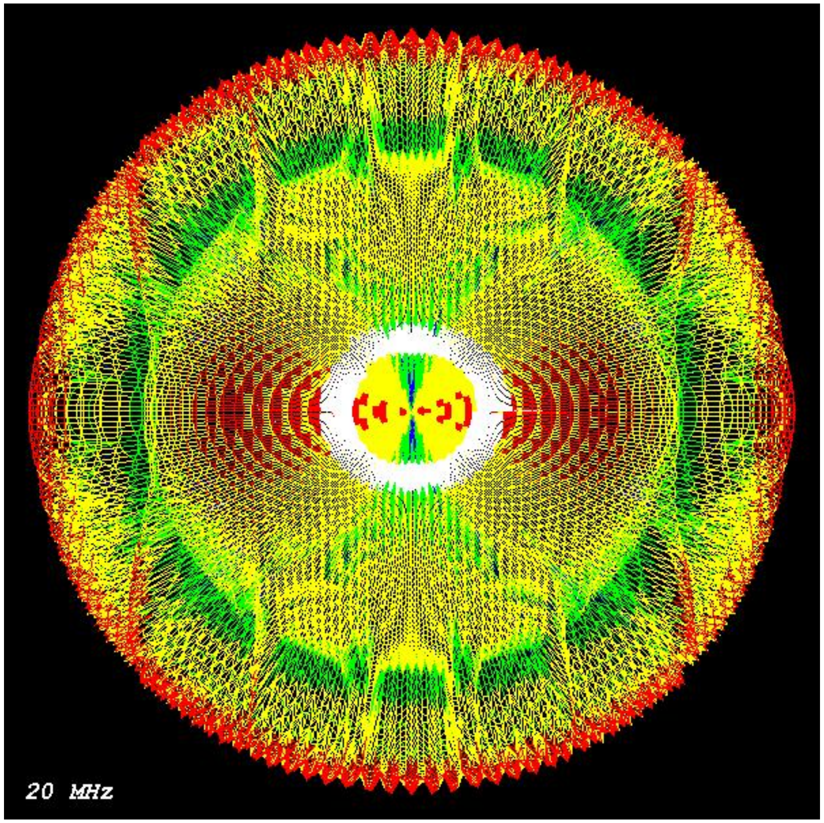
Interference will increase as BPL radiation angle increases. High site installations will be subject to more interference.





BPL Zload = 6.25 +j0 Zin = 253-j1399 f = 20.0 MHz





>0	0 to -10	-10 to -20	-20 to -30	-30 to -40	-50 to -60	-50 to -60

L20M6_20hpa

L20M6_20hpb

Conclusions

- The Part 15 40dB/decade factor is over optimistic by approximately +20dB. A more realistic extrapolation factor may be 15 to 20 dB/decade. This assumes you are measuring a point along the radiator which provides a maximum field strength which is highly unlikely.

- The pattern data shows a significant variation in received interference signal level as you move along the radiator. Swings of approximately 30dB or more are typical. It can be concluded that taking a small number of field point measurements (in the near field) and extrapolating to predict signal strengths farther away from the antenna produces a very low degree of confidence in establishing the real received BPL signal strengths.

- Although this simplified model may not represent the BPL system in full, the predictions presented provide estimates that predict significant departures from part 15 30uV/m limits.

- This analysis considered a ground side receive site situated on perfectly flat ground with a receive antenna of 100ft. Real world installations will provide receive sites that have a significantly higher look angle from the BPL noise source than those investigated here. The BPL radiator exhibits it's highest gain at these higher elevation angles. As a result interference to high sites will be even higher than those predicted here.

Conclusions Continued

- Significant increase in gain is seen off the ends of the BPL radiator. For distances less than 2000 ft in this analysis the receive site was examined parallel to the BPL radiator. An increase in interference level will be observed in installations that fall within this region.

- Multiple BPL radiators were not considered in this analysis. Combined signal strengths from multiple BPL sources could dramatically increase the received interference level.

- Skywave propagation was not considered here, but may be significant depending on ionoshperic conditions due to the high angle radiation pattern exhibited by the BPL radiator. Combined signal strengths from multiple BPL sources could dramatically increase the received interference level and should be considered.

MEMO

To: Brian Gaffney
ARINC - RF Engineering Technical Director

From: Tim Russell
ARINC - Principal Engineer

Date: 14 September 2004

Re: Interference signals at the HMB and PYE sites

The interference signals that have been measured at the above mentioned sites have been shown to have a very high likelihood of originating from PLC devices. The reasoning for this conclusion has come from the measurement of like devices in the ARINC lab, obtaining frequencies of usage as well as spectral signatures as measured on spectrum analyzers. The radiated signals from some of these units can be rather large in amplitude due in part to the RF power used by the unit to pass the information to the intended receiver unit. For example ARINC has a PLC telephone extension device pair manufactured by PhonexBroadband (model PX-441) that has an output power level of +20 dBm (100 milliwatts) centered at 3305 kHz. Signal levels of this magnitude, injected into the power lines of a home or office, are bound to cause interference to radio communications equipment, where a normal receiver sensitivity is less than 1 micro-volt (1 µV), for a radius of many miles, even with a poor antenna system at the PLC site.

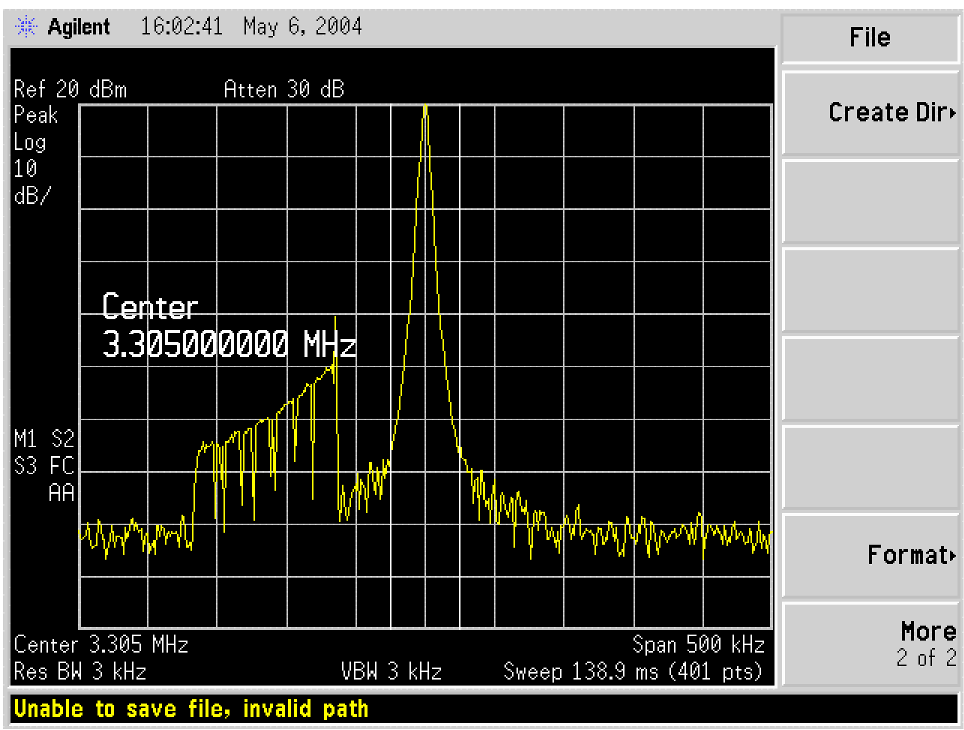


Figure 1 – PhonexBroadband Output Power Level

The first scientific measurements of these signals in the field was performed over the days of 28 April and 29 April 2004 at ARINC's Half Moon Bay (HMB) receiver site. Standard DF equipment was utilized to first detect interfering signals at the receive site and then track the signals to their respective sources. On that trip three (3) signals were tracked to homes within the city limits of the town of Half Moon Bay, approximately 5.5 miles from the HMB receiver site. With two of the homes the signal was tracked to a particular area/room of the home. *It can not be over stressed that these signals were received at the HMB site and tracked to their respective sources over 5 miles away*. During this trip multiple signals were detected, and over a period of many hours it was observed that the signals were not constant in amplitude but varied as the apparent propagation method for each signal changed its parameters.

During the week of 16 August 2004 ARINC documented the interference signals and noise floors of its West Coast receive sites Half Moon Bay (HMB) and Point Reyes (PYE). On 17 August 2004 at the HMB site a 3019.8 kHz signal was measured and Figure 2 below depicts the measured signal level as seen on the Agilent 8562EC spectrum analyzer.

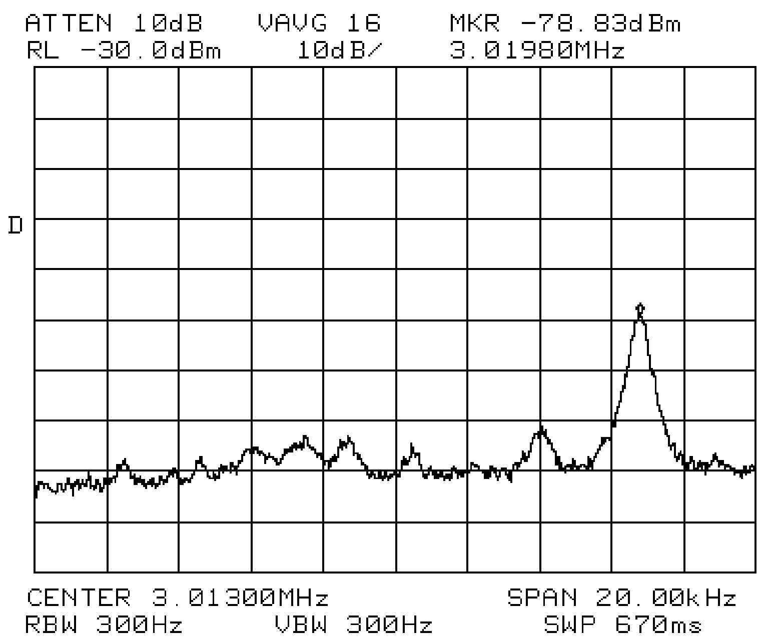


Figure 2 – Interference Signal at Half Moon Bay

It can be seen from the graphic that the level of the interfering signal at that time was -78.83 dBm. To further identify the signal source the horizontal resolution of the spectrum analyzer was brought to 30 Hz (zoomed in) and the spectral signature of the signal of interest was observed. The signal exhibited the typical slowly drifting (in frequency) carrier signal with 60 Hz (minor) and 120 Hz (major) sideband lobes. This is the typical spectral signature that all PLC devices intended for phone extension applications that have been measured at the ARINC labs have exhibited. During this measurement session it was observed that the signal drifted over 1 kHz in frequency over roughly a 15 minute period. Again, typical of PLC devices. It should also be noted that even though the carrier frequency of these devices are outside the bandwidth of the 3013.0 to 3016.0 kHz bandwidth of ARINC's receivers, when these signals are modulated with information their bandwidth can be as much as 50 kHz wide which will cause, and have caused, considerable interference to ARINC's receivers. During times of reception of the weaker aircraft signals communications with aircraft over oceanic waters can, and have been, completely blocked. To compound the nature of the problem, interference at the sites have been intermittent in nature, coming and going away as the devices are activated and deactivated by their users, further denoting the high probability of PLC devices.

That same day but during the evening, measurements were taken at the PYE receive site. The graphic in Figure 3 below depicts the measurement taken that night. During this measurement session another suspected PLC device was measured, this time at 3025.1 kHz. Though the signal level was measured at -88 dBm, this signal was over 10 dB above the noise floor for that evening. That evening at the lower frequency bands (below roughly 10 MHz) was present a period of high noise floor due to static "crashes". During this time lightning storms were present over the Sierra mountain range and was a poor night for reception of signals.

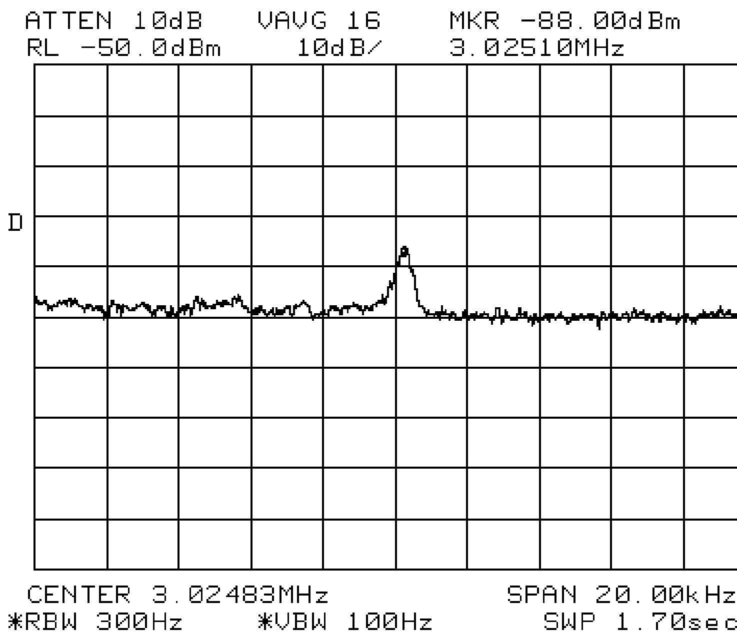


Figure 3 – Interference Signal at Point Reyes (night)

Figure 4 depicts the measured noise floor and the same interfering signal (center frequency of the plot now 3013 kHz rather than 3019 kHz), but with the measurement taken at roughly 10AM the next morning. As can be seen, the interference signal is still present and at approximately the same amplitude, -88 dBm. Also to be noted is the noise floor. With the static crashes no longer present the noise floor dropped to roughly -125 dBm. These two plots show a typical variation of the noise floor with HF propagation. The noise can be high due to atmospheric conditions, and it can be quite low during time of low solar K index readings and the absence of noise generating lightning storms. If noise floors of the level of those measured in the evening are used as the basis for allowable BPL noise, the times of quiet noise floors will be gone and HF communications capabilities will be forever diminished.

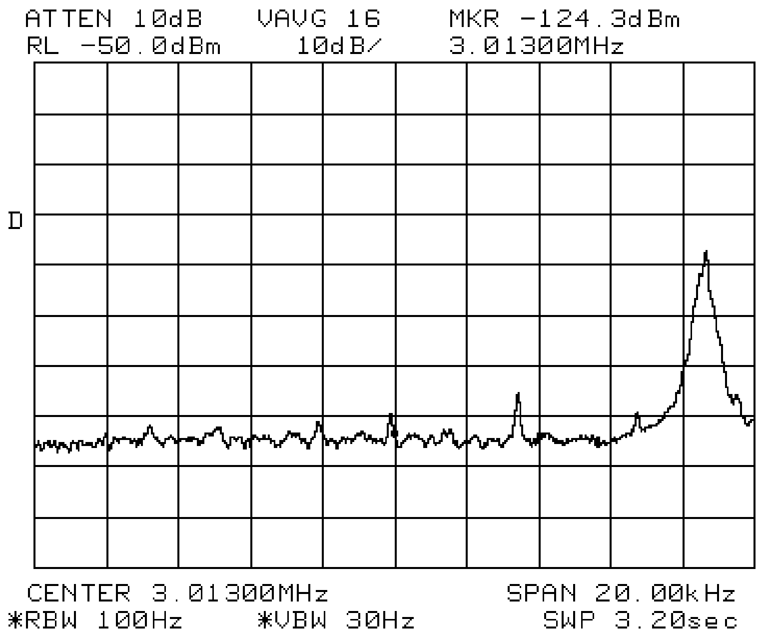


Figure 4 – Interference Signal at Point Reyes (day)