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April 26, 2002

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

Re: ET Docket No. 98-42, RF Lighting
Ex Parte Communication

Dear Ms. Dortch:

Pursuant to Section 1.1206(a)(2) of the Commission's Rules, I am filing this letter electronically to report an oral ex parte communication in the above-referenced proceeding.

Yesterday, a group of companies supporting the robust development of Part 15 technologies and services met with Julius P. Knapp, Karen Rackley, Hugh L. van Tuyl, and Neal McNeil of the Commission staff. The Part 15 representatives consisted of Damon C. Ladson of Harris, Wiltshire & Grannis, LLP representing Apple, Inc., Cisco Systems, Inc., and VoiceStream Wireless Corporation; Robert C. Calaff of VoiceStream Wireless Corporation; David A. Case of Cisco Systems, Inc.; Carl Stevenson behalf of of Agere Systems and IEEE 802; John K. Boidock of Texas Instruments Corporation; James Zyren of Intersil Corporation; and the undersigned on behalf of Intersil Corporation and Symbol Technologies, Inc.

This group supports prior filings by those interested in the continued success of Part 15 interests that proposed the following in-band limits for RF lighting devices in the 2.4 GHz band:

2400 - 2460 MHz	10 mV/m @ 3m
2460 - 2480 MHz	330 mV/m @ 3m
2480 - 2500 MHz	10 mV/m @ 3m

We urged the Commission to apply these limits using the measurement standards and procedures presently set out in Part 15 of the Commission's Rules, including Section 15.35 on measurement bandwidth.

We noted that consumers, businesses, and educators have enthusiastically embraced unlicensed applications in the 2.4 GHz band, including IEEE 802.11 (such as Wi-Fi) and Bluetooth.

We presented the results of calculations and simulations showing that RF lights will cause serious interference to Part 15 devices over hundreds of meters, absent appropriate limits (*e.g.*, an emissions mask such as that outlined above). RF lights conforming to the mask will still cut 802.11b throughput by a third or more. (See the attached presentation.) But we are willing to accept that interference as a compromise that lets RF lighting technology go forward.

We explained how minor and inexpensive changes to the RF lighting power supply and magnetron will go a long way toward reducing interference.

We reported that Fusion Lighting has refused to participate in joint testing with us, and has refused to make available a specimen lamp for testing of our own, despite indications in the record that they have offered to test with the DARS proponents. (See the ex parte filing by Fusion Lighting on April 9, 2002.)

In short, we argued that the public interest requires the Commission to balance the potentially disabling interference to Part 15 users from unlimited RF lighting emissions against the relatively minor costs of compliance with the compromise proposal set out above.

Copies of our presentation outline and test data on half-wave rectified power supplies are attached.

If there are questions about this submission, please call me at the number above.

Respectfully submitted,

Mitchell Lazarus

cc: Meeting participants
Peter A. Tenhula, Chairman Powell's Office
Bryan Tramont, Comm'r Abernathy's Office
Paul Margie, Comm'r Copps's Office
Samuel Feder, Comm'r Martin's Office

Impact of RF Lights on IEEE 802.11b

Part 15 Interests

Thursday, April 25, 2002

Impact of RF Lights

- Significant Interference Threat to Part 15
  - Disruption of both Bluetooth and 802.11 services
  - Economic impact on Part 15 vendors and consumers

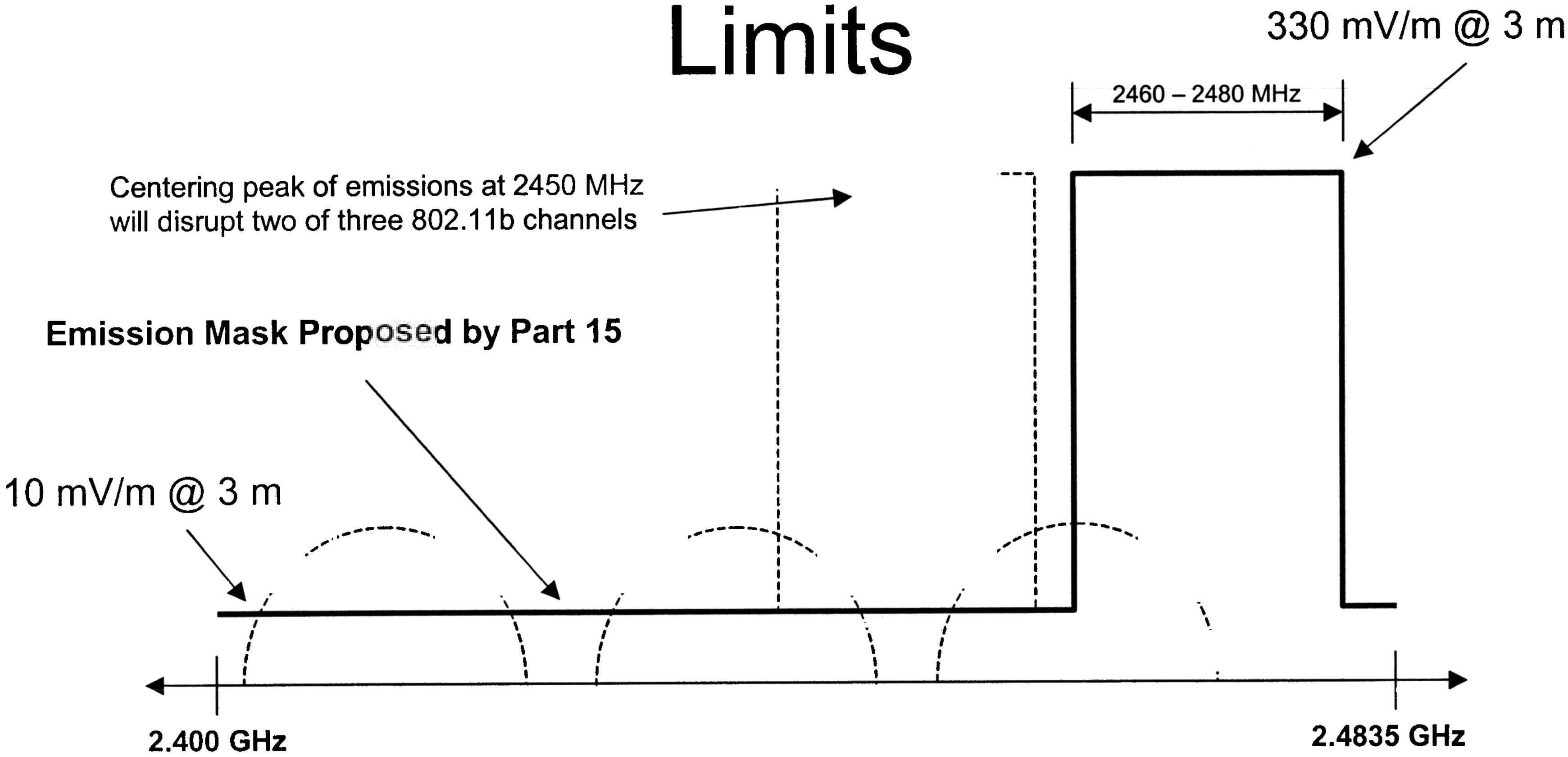
- Affected Parties
  - **Consumers:** IEEE 802.11b is a popular home networking technology, promoting adoption of broadband services
  - **Education & Small Business:** Classrooms & offices easily networked without expense of pulling wires
  - **Enterprise & Healthcare:** Worker mobility & productivity enhanced by wireless networking

Factors Affecting Interference

- Device Characteristics
  - Duty cycle of lamp (e.g. 60 Hz half-wave rectification)
  - Intensity of emission
  - Time-frequency signature (splatter)

- Usage Factors
  - Always on (continuous usage)
  - Outdoor use (possibly mast-mounted)
  - Multiple units in close proximity (e.g. stadium lights)
  - Distance from Lamp

Proposed RF Light In-Band Limits



In band limits(1):	2400 – 2460 MHz	10 mV/m @ 3m
	2460 – 2480 MHz	330 mV/m @ 3m
	2480 -2500 MHz	10 mV/m @ 3m

Note 1: measured over 1 MHz bandwidth, per 47 CFR 15.35(b)

Can Interference be Mitigated?

- Need for In-Band limits
    - Reasonable limits on emissions
    - Suitable measurement techniques
- Shift interference to one end of band
    - Affect only one 802.11b channel
- Improve power supply
    - Full-wave rectification (plus minimal AC filtering) greatly reduces spectrum splatter
        - Incurs negligible additional cost
- Other important avenues
    - Lower limit across band
        - Specify low limit across band
    - Combination of approaches

Effects of Interference

- Can we predict effects of interference?

  Depends on MANY factors
  - Jammer strength and bandwidth
  - 802.11b signal strength
  - 802.11b receiver separation from RF light
  - Indoor/outdoor scenarios
- Best Approach is Actual Testing
  - But Fusion has refused to participate in joint testing with Part 15 (although Fusion has offered to test with DARS)
- Simulations show a very high probability of interference under conservative assumptions
- Some estimates
  - Following slides based on assumptions described on following page

Effects of Power Supply

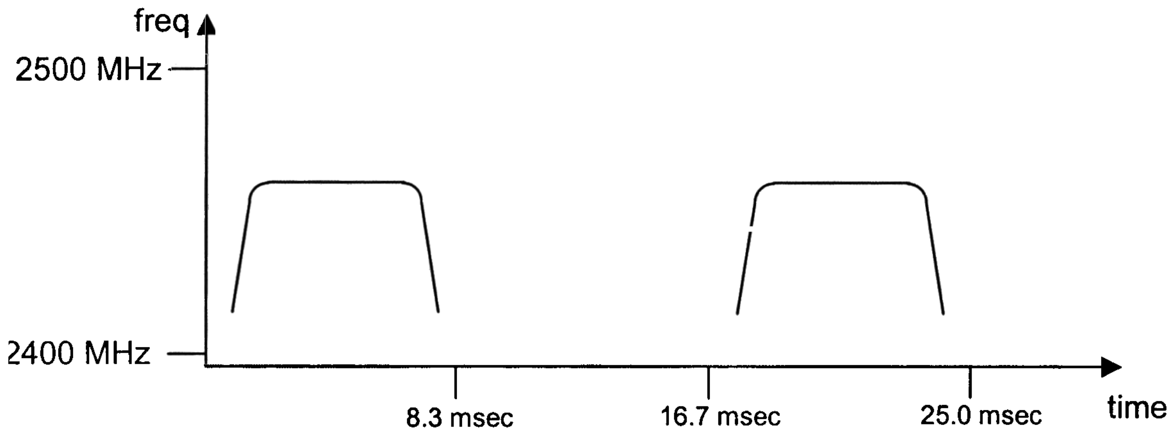


Fig 1a Effects of Half Wave Rectification: Frequency Transients

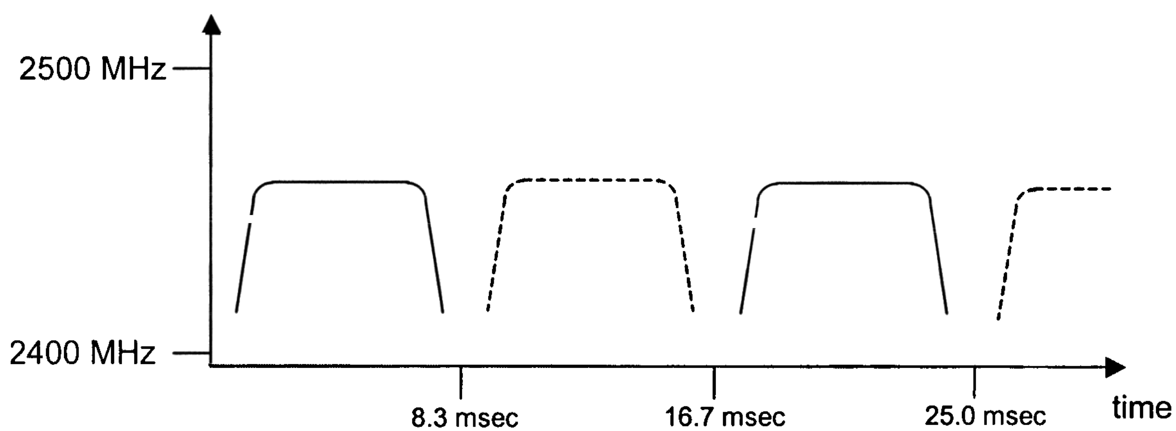
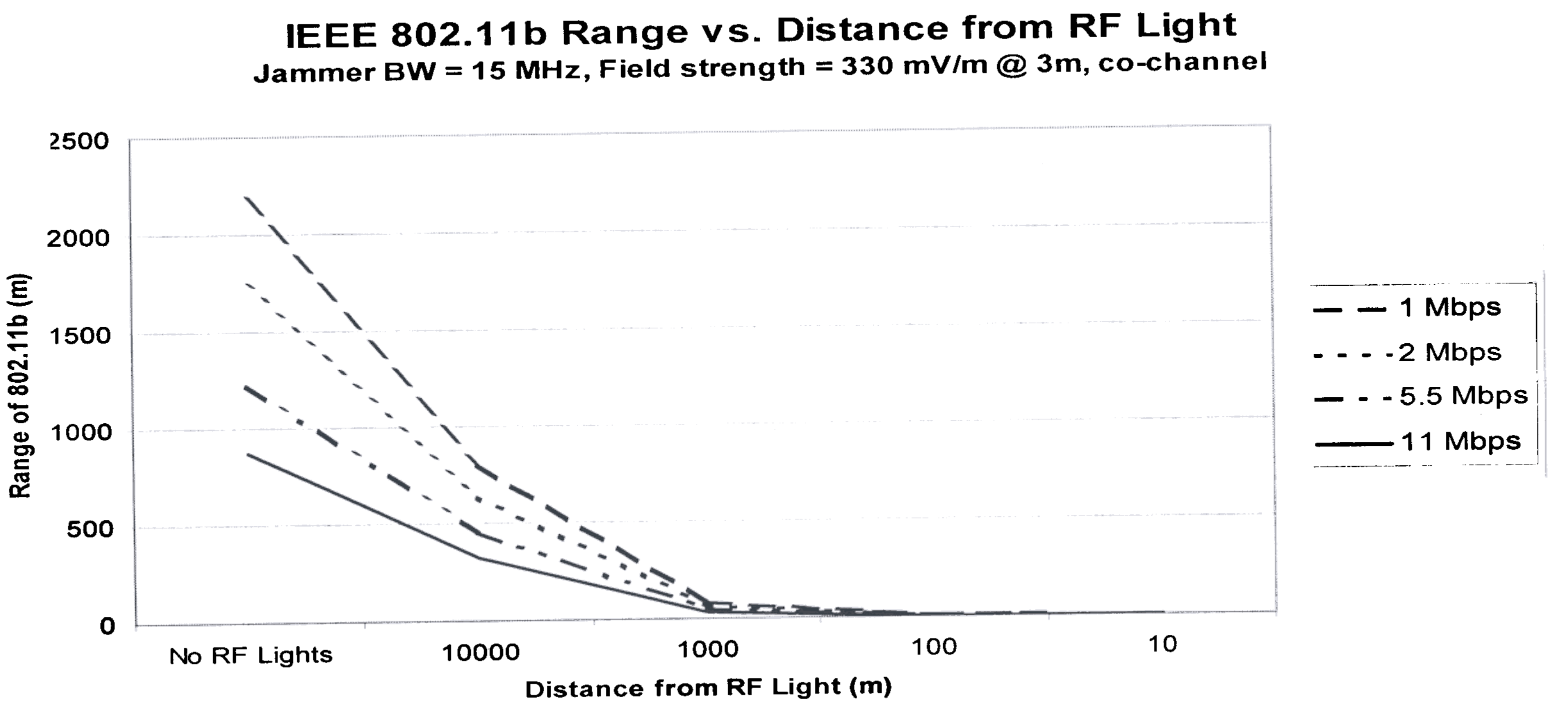


Fig 1b Multiple Lights on Alternating Cycles Results in Continuous Broadband Jamming

Assumptions

- **Propagation**
  - Outdoor (RF light and 802.11b BOTH outdoors)
    - Range squared (r^2) losses
    - Applied to both signal and jammer
    - Line-of-sight among all devices
  - Indoor (RF light and 802.11b BOTH indoors)
    - Range squared for first meter, range cubed (r^3) thereafter
    - Applied to both signal and jammer
- **Interference**
    - 330 mV/m @ 3m
    - Analysis BW of 1 MHz
    - 100% duty cycle for light
    - Analyzed separately for Broadband (15 MHz) and Narrowband (1 MHz) Jammer
- **Antennas**
    - Omni directional

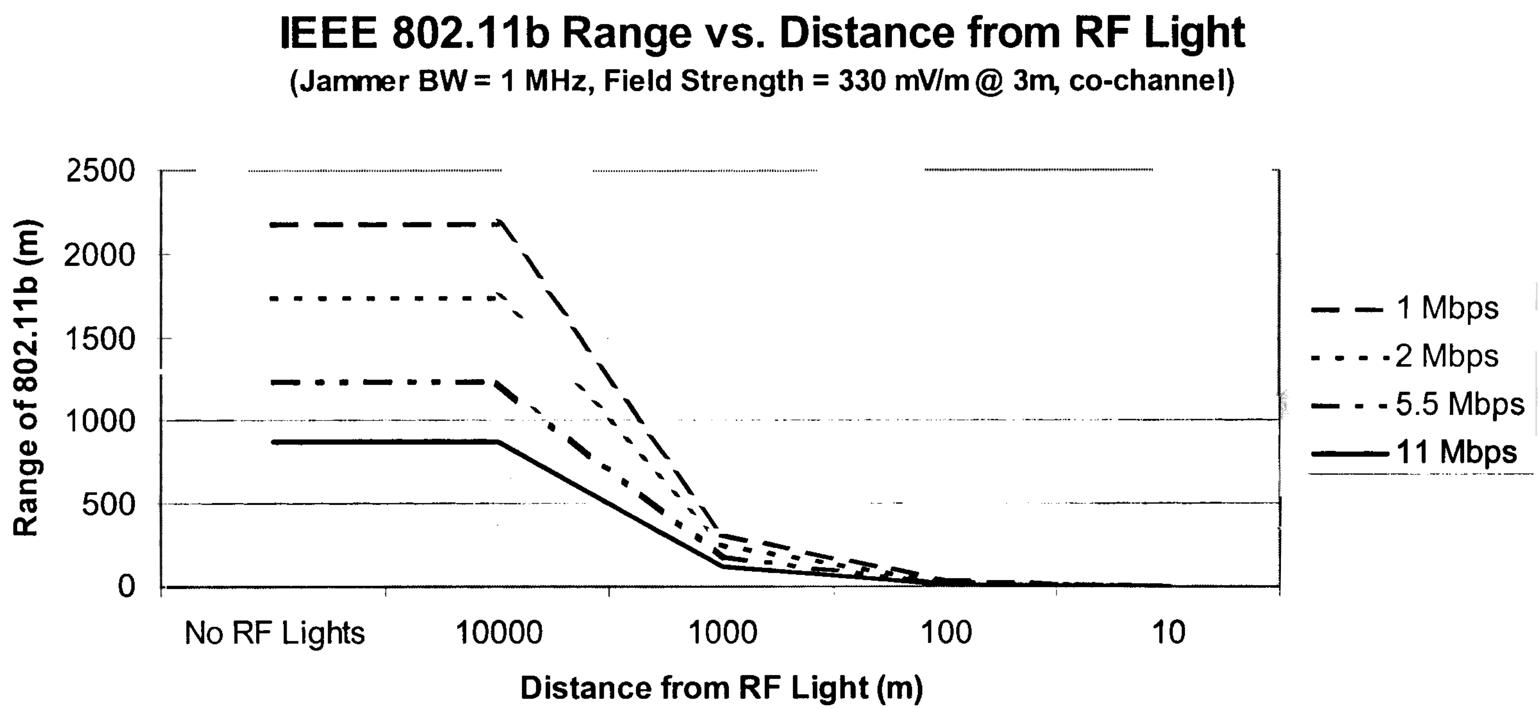
Outdoor RF Light, Outdoor 802.11b Broadband Jammer



Outdoor operation within 1-2 kilometers of an RF light drastically impairs service. Interference free range for 802.11b >850 meters at 11 Mbps and >2000 meters at 1 Mbps.

Note: Jammer BW is 15 MHz. Results in a total jammer power of 500 mW

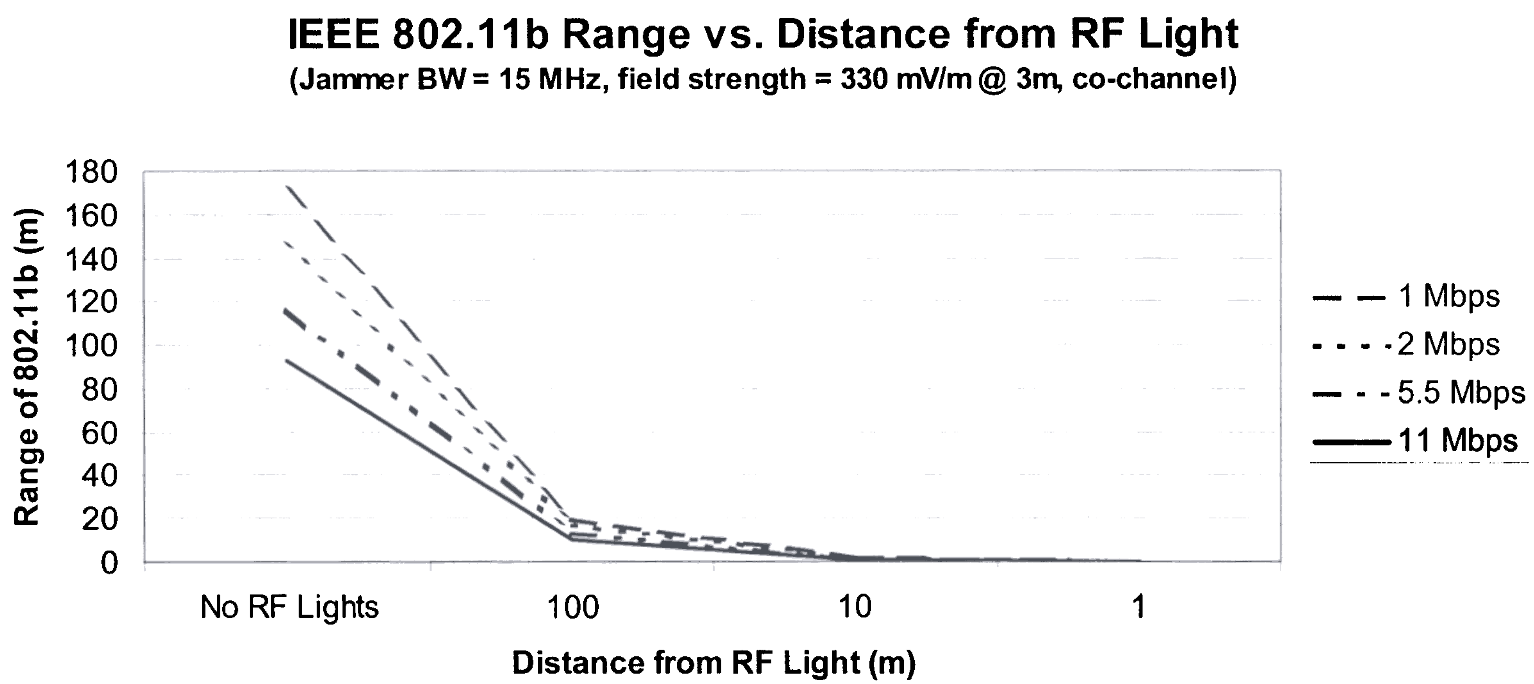
Outdoor RF Light, Outdoor 802.11b Narrowband Jammer



Outdoor operation within 1-2 kilometers of an RF light drastically impairs service. Interference free range for 802.11b >850 meters at 11 Mbps and >2000 meters at 1 Mbps.

Note: Jammer BW is 1 MHz. Results in a total jammer power of approximately 32 mW

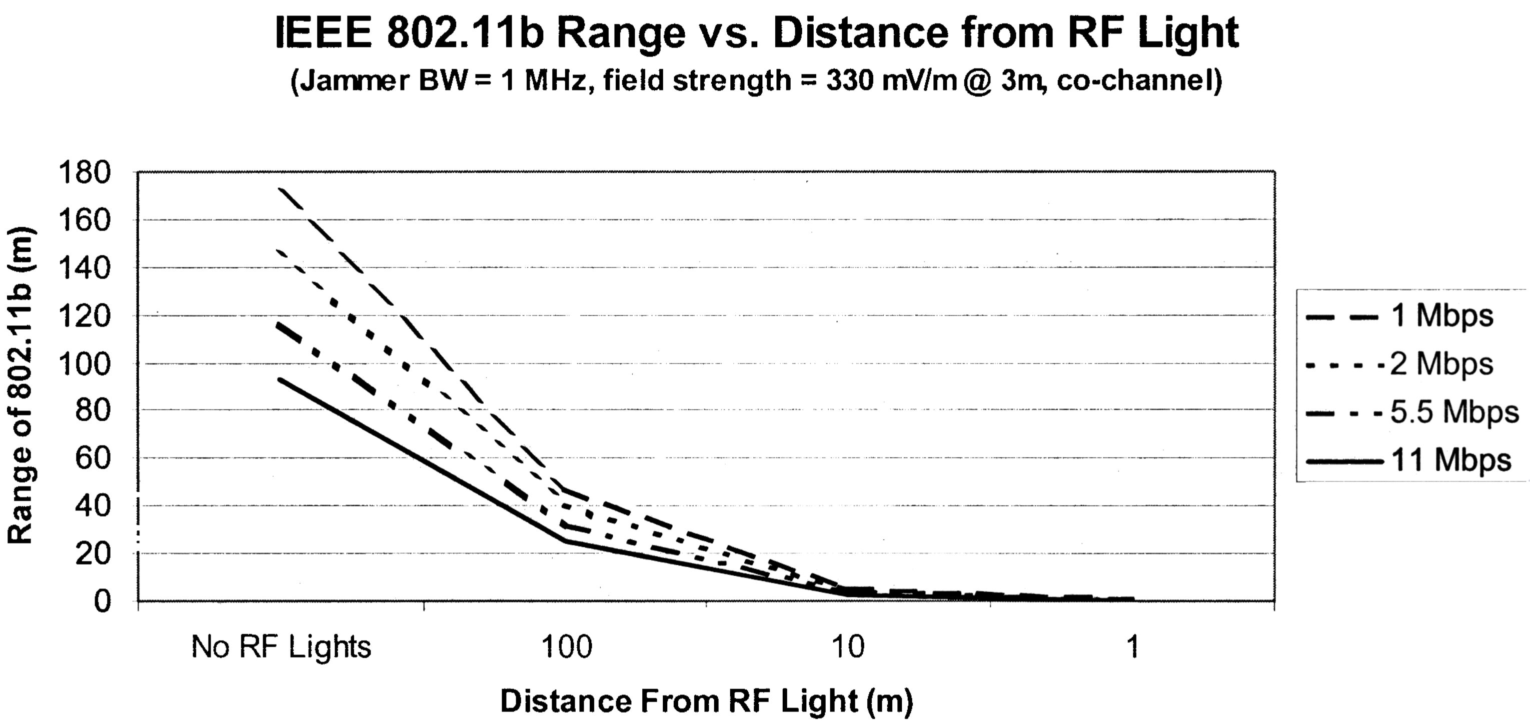
Indoor RF Light, Indoor 802.11b Broadband Jammer



Indoor operation within 100 – 200 meters of an RF light drastically impairs service. Interference free range for 802.11b >80 meters at 11 Mbps and >160 meters at 1 Mbps.

Note: Jammer BW is 15 MHz. Results in a total jammer power of approximately 500 mW

Indoor RF Indoor 802.11b



Indoor operation within 100 – 200 meters of an RF light drastically impairs service. Interference free range for 802.11b >80 meters at 11 Mbps and >160 meters at 1 Mbps.

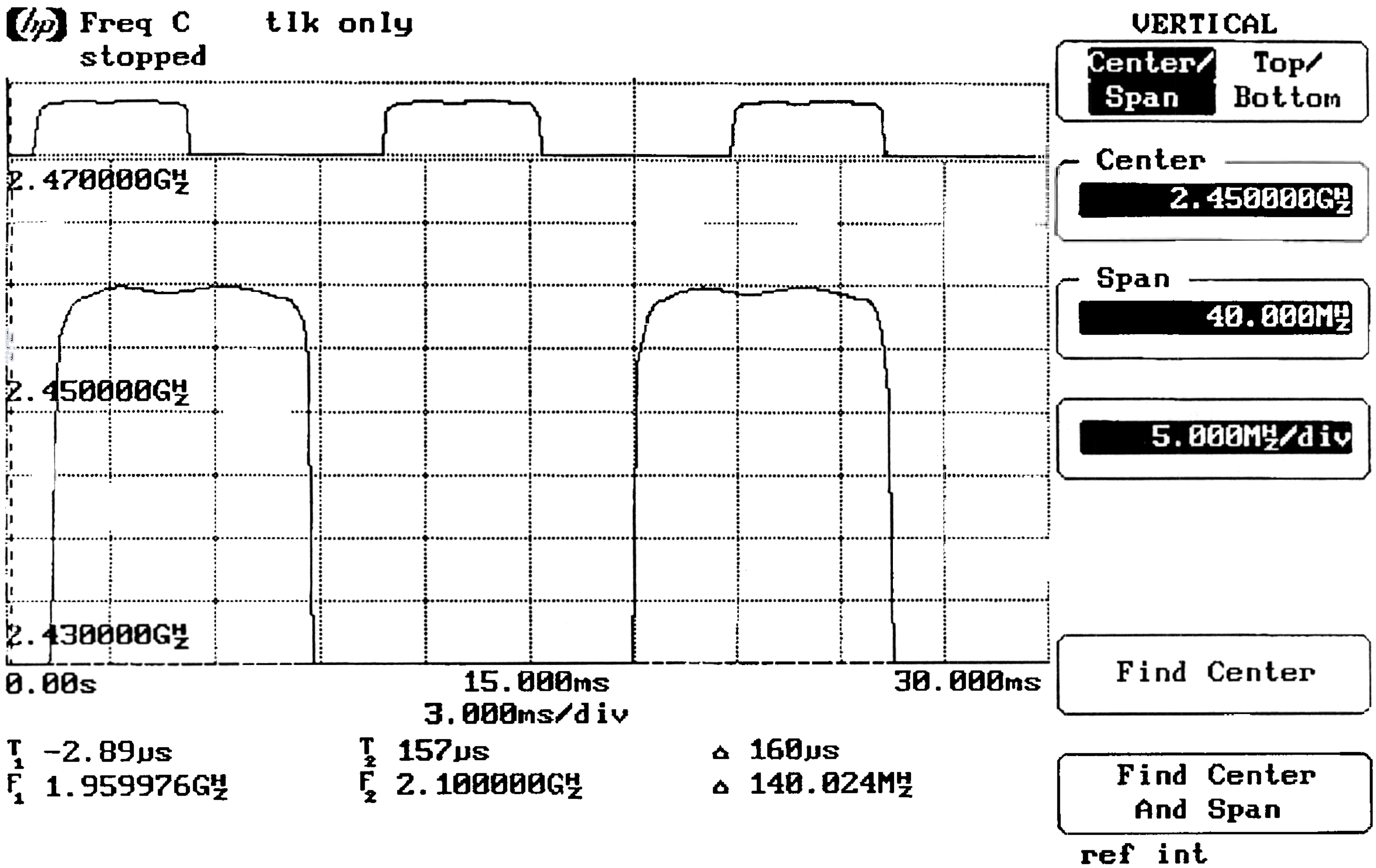
Note: Jammer BW is 1 MHz. Results in a total jammer power of approximately 32 mW

Conclusions

- RF Lights are a Serious Threat to Part 15
  - Part 15 operation disrupted
    - Estimates demonstrate severity of threat
    - Actual testing with RF Lights highly desirable

- Suitable limits are essential to protect consumers of BOTH products
  - In-band limits
    Measurement techniques suited to RF lights

- Reasonable limits will help BOTH applications
  - Part 15 communications services will not be threatened
  - RF lights will not encounter market resistance because of interference threat


Freq C
tlk only
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VERTICAL
Center/ Span
Top/ Bottom
Center
2.450000GHz
Span
40.000MHz
5.000MHz/div
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2.450000GHz
2.430000GHz
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15.000ms
30.000ms
3.000ms/div
Find Center
Find Center And Span
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F1 1.959976GHz
T2 157µs
F2 2.100000GHz
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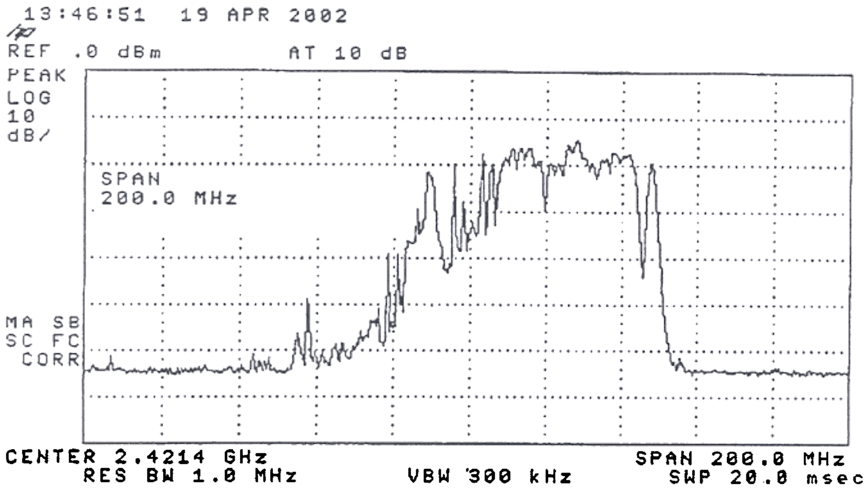
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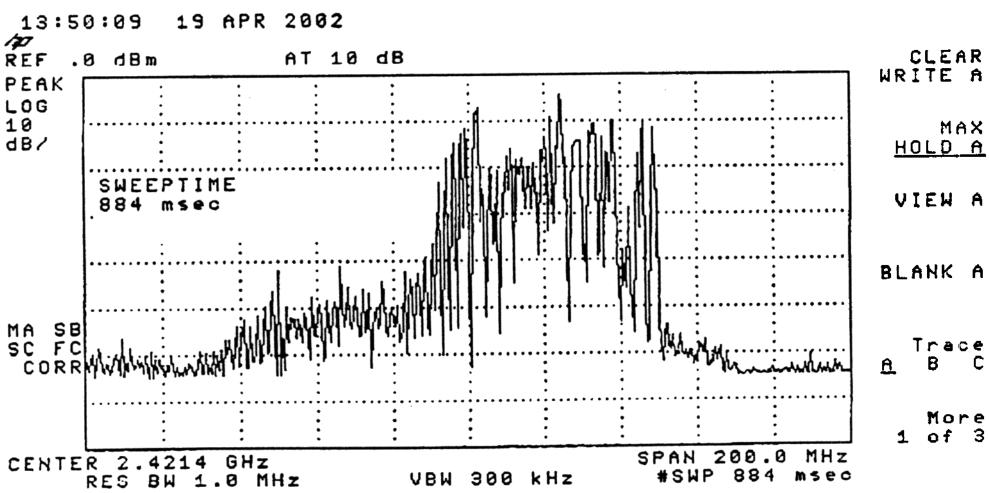
More
1 of 3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1 of 3