ORIGINAL

ORIGINAL

EX PARTE OR LATE FILED

WILEY, REIN & FIELDING

1776 K STREET, N.W.
WASHINGTON, D.C. 20006
(202) 719-7000

DAVID E. HILLIARD
(202) 719-7058
DHILLIARD@WRF.COM

FACSIMILE
(202) 719-7049

RECEIVED
JUN 8 2001
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

June 8, 2001

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

BY HAND

Re: ***Ex Parte* Notification**
ET Docket No. 98-153
Ultra-Wideband

Dear Ms. Salas:

This is to note that on June 7, 2001, Michal Freedhoff and Paul Withington of Time Domain Corporation, Phillip Inglis, a consultant to Time Domain, and Robert Pettit of this firm and I met with Tom Tycz, John Martin, Rosalee Chiara, Rockie Patterson, and Chris Murphy of the International Bureau We addressed the issues covered in the enclosed presentation pertaining to ultra-wideband.

Should any questions arise concerning this matter, please contact me.

Respectfully,

David E. Hilliard

David E. Hilliard
Counsel for Time Domain Corporation

Enclosure: Presentation
cc: Ms. Chiara, Messrs. Tycz, Martin, Patterson, and Murphy

No. of Copies rec'd 0+1
List A B C D E

TIME DOMAIN

THE PULSE OF THE FUTURE

UWB:
The 50 MHz Limit
&
Noise-likeness

TIME DOMAIN ®

6/7/2001

Discussion Outline

- The 50 MHz Limit as presently proposed
  - What problems are created for the UWB industry by the 20 dB limit
  - Objective of the limit
  - Restrictive 20 dB limit in NPRM
  - Impact on UWB Technology
  - An appropriate peak limit
  - A 41 dB limit is a good balance
- Defining sufficient noise-likeness

Objective of the Peak-to-Average Limit

- The 20 dB peak limit as measured in a 50 MHz bandwidth was proposed as a means of controlling peak level interference
- Limits peak pulse amplitude thereby controlling peak-related interference potential
  - Prevents front-end overload in a victim receiver

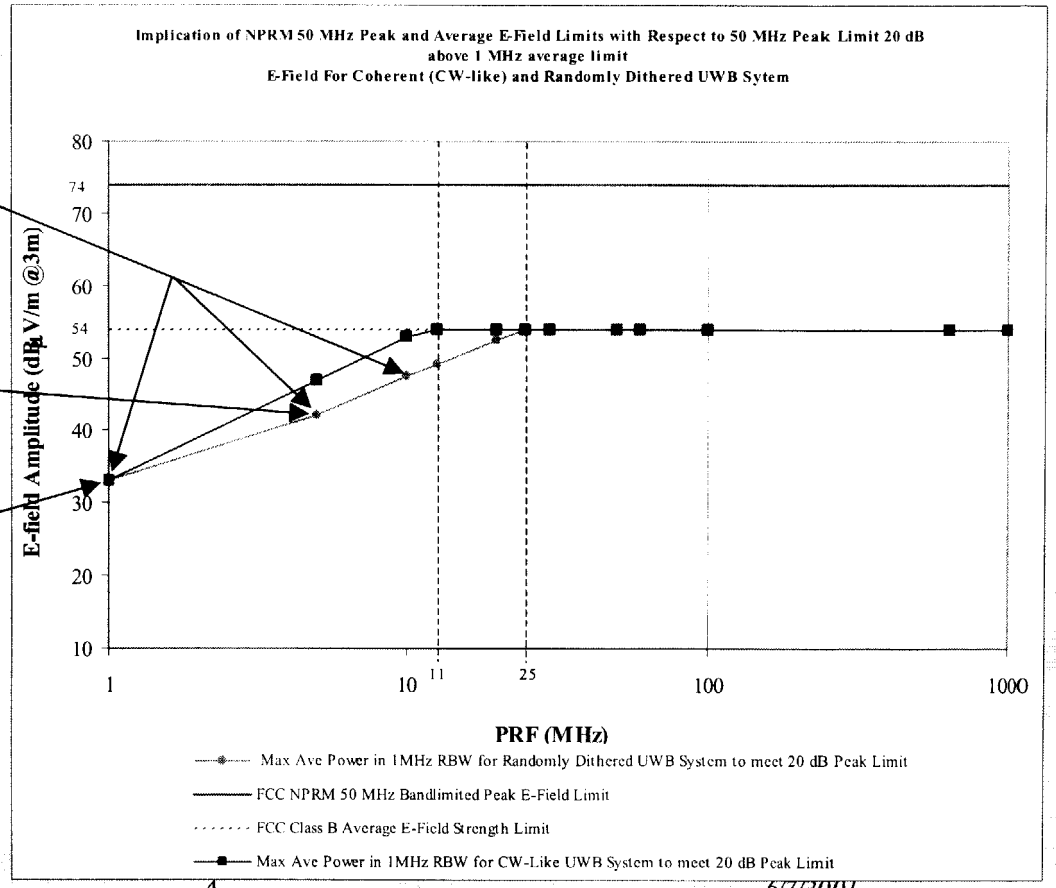
The 50 MHz Limit

- As proposed in the NPRM, the lower the PRF, the lower the reduction in average power has to be

TM-UWB Emitter PRFs Used for Texas GPS Testing

TDC Through-Wall Radar PRF & PRF of Emitter Used by TDC for Its GPS Test

Typical GPR PRF & Used in Texas Testing



Impact of the 20 dB limit on UWB Technology

- Using NTIA's Pulse Response Formulas, average power reductions can be calculated.
  - For dithered UWB technology, PRFs below 23-25 MHz are affected. For example, a 1 MHz PRF system would require a 21 dB reduction in average power.
  - For non-dithered technologies, PRFs below 11 MHz are affected. For example, a 1 MHz PRF system would require a 21 dB reduction in average power.

20 dB Value on 50 MHz Peak Limit is Problematic

- Restricts use of lower PRF systems
- Radar Applications – most are precluded
  - TDC's radar vision - (e.g., through-wall sensing)
    - Requires lower PRF for maximum range
    - Severe average power reduction is required
  - GPR in general has similar problems
- Applications also constrained
  - TDC's tracking system
  - Inventory monitoring
  - Medical communication & tracking applications

Problems (cont'd)

- Restricting UWB applications to high PRFs may increase potential impact on GPS
  - GPS studies conclude that pulse-like signals (where PRF is smaller than RBW) are less of a problem for GPS than white noise or noise-like UWB signals.
  - Lower PRFs are more pulse-like than higher PRFs

Derivation of an Appropriate Peak Limit

- NTIA did not account for the proposed 20 dB peak to average limit and its effect on average power in its non-GPS report.
- NTIA did not reduce the average powers of the UWB systems tested, and as a result, the 1 MHz PRF systems actually had peak power levels that were 41 dB above the average limit.
- For 1 MHz PRF systems, dithered and non-dithered UWB signals evoke the same response level in a 50 MHz measurement bandwidth.

Comments on NTIA's Average Power Analysis

- NTIA analyzed 15 non-GPS systems in the 1-6 GHz range for average UWB power susceptibility.
- PRFs below 1 MHz generally showed a 10 dB higher interference potential
  - A 10 dB/decade reduction in average power for UWB PRFs below 1 MHz will equalize average power interference potential for PRFs over the 0.001 MHz to 500 MHz range.
  - A 41 dB peak limit forces this 10 dB/decade reduction in average power below 1 MHz PRFs, negating the 10 dB higher interference potential noted by NTIA.

NTIA Criteria Not Exceeded Using a 41 dB Limit

- Implementing an average power reduction for low PRF systems based on a 41 dB peak to average ratio, and incorporating an additional path loss figure, shows that UWB devices operating at – 41.3 dBm EIRP power levels will not exceed the protection criteria NTIA used in its analysis.

Comments on NTIA's Peak Power Analysis

- Of the 15 non-GPS systems examined by NTIA, 2 communications systems were further analyzed based on UWB peak power susceptibility.
- NTIA used a 1 dB increase in the system noise floor as its criterion for harmful interference in lieu of the the industry standard C/I ratio criterion.
  - For the SARSAT station, NTIA calculated a minimum separation distance of 11.3 km for a 1 MHz PRF UWB power level of -41.3 dBm
  - For the FSS Earth Station (5° elevation), NTIA calculated a minimum separation distance of 10.1 km for a 1 MHz PRF UWB power level of -41.3 dBm

Peak Power Analysis for SARSAT and FSS Using the Industry C/I Ratio

- First, calculate the path loss:
  - Lp=C/I-C+Pt+Gt+Gr-Ls-Lr-FDR
  - Source: NTIA Report 94-313 "Analysis of electromagnetic compatibility between radar stations and 4 GHz fixed-satellite Earth stations", July 1994
- Then, solve for D, the minimum separation distance, using the Hata model for urban environments
  - Lp=32.4+20logF+20logD
- When parameters for SARSAT and FSS systems given in NTIA reports and FCC proposed limits for UWB power levels for a 1 MHz system are used, the required separation distance is only 5 meters for SARSAT and 26 meters for FSS!

Peak-Related Interference Results Comparison

NTIA non-GPS Criterion	Industry Standard Criterion
SARSAT – 11.3 km	SARSAT – 5 m
FSS – 10.1 km	FSS – 26 m

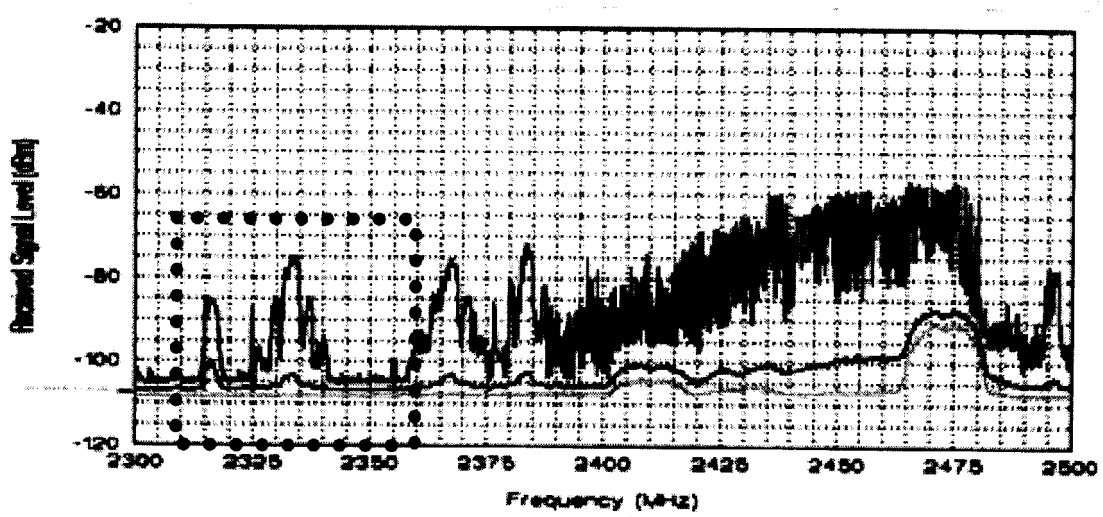
- NTIA'S analysis used incorrect performance criterion (raising noise floor by 1 dB vs. industry standard C/I ratio).
- NTIA Report 94-313 related to radar interference did use the industry standard approach

Other Factors That Further Reduce the Impact of UWB

- Worst-case calculation by NTIA that led to the 10.2 and 11.3 km distances assumed an undithered UWB signal.
- Worst-case calculation by NTIA that led to the 10.2 and 11.3 km distances assumed UWB height of 30m – this only makes sense if the UWB device were indoors, which adds further attenuation.
- NTIA assumed that the SARSAT and FSS antennas were aimed at the UWB source – no correction for off-axis antenna alignment.
- At low elevation angles, FSS systems would also detect radar signals that would likely be at higher powers than UWB is proposed to be.

Consumer Satellite Services in the 2 TO 2.5 GHZ Band

- NTIA Technical Memorandum 92-154 shows emissions in the 2310 to 2360 MHz band
  - Radars
  - Microwave ovens
  - ISM-band industrial equipment
- "Above 2350 MHz, the probability is high that the BSS receiver will detect microwave oven pulses consistently above its threshold in any of its intended operating environments."
- "Below 2350 MHz, pulse amplitudes are lower, but still above the threshold at short distance in a home or between apartments."



Source: NTIA Broadband Survey of San Diego, CA

TIME DOMAIN ®

Emissions from Microwave Ovens

- Another NTIA report emphasizes the noise level in the 2310 to 2360 MHz band

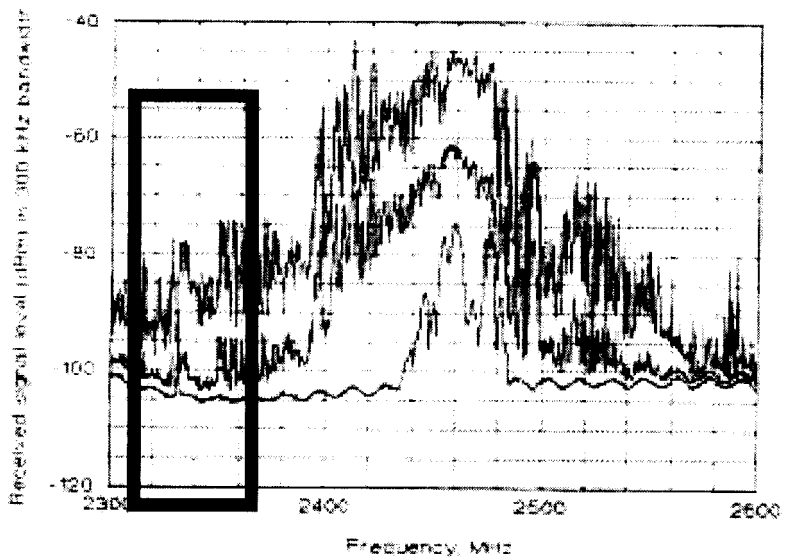


Figure 3-11. Aggregate emission spectrum outside apartment complex 4:30 -7:30 PM weekday

Source: NTIA Technical Memorandum 92-154

Noise-likeness

- Time Domain believes that a test for UWB noise-likeness makes sense.
- A properly designed UWB signal is like, but not identical to, white noise.
- Using too narrow an RBW favors high PRF systems

Conclusion

- A 41 dB peak to average limit poses no interference threat, and allows for the deployment of a wide range of UWB applications.
- Peak power effects reported by NTIA for SARSAT and FSS are incorrect and overstated.
- A test for noise-likeness should be applied carefully.