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June 18, 2001

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

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

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

Dear Ms. Salas:

On June 15, 2001, Jeff Ross and Dr. Michal Freedhoff of Time Domain Corporation and Richard Wiley and I of this office met with Donald Abelson, Tom Tycz, and Larry W. Olson of the International Bureau. We discussed Time Domain's position in this proceeding as reflected in the enclosed materials.

In accordance with the Commission's rules, an original and one copy of this notification are being filed. If you have any questions or would like any further information, please let me know.

Sincerely,

Robert L. Pettit
Counsel for Time Domain Corporation

Enclosure

cc: Donald Abelson
Tom Tycz
Larry W. Olson

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List A B C D E

TIME DOMAIN

THE PULSE OF THE FUTURE

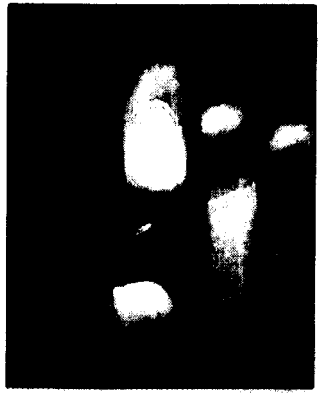
Ultra-Wide Band

Presented to
International Bureau, FCC

June 2001

What is Time Domain?

- Developers of first and only UWB commercial chipset – "PulsON"
- Uses special form of UWB – Time Modulated (TM-UWB)
- 180 employees
- 220 patents – granted or pending
- Worked with FCC since 1989 to secure regulatory approval



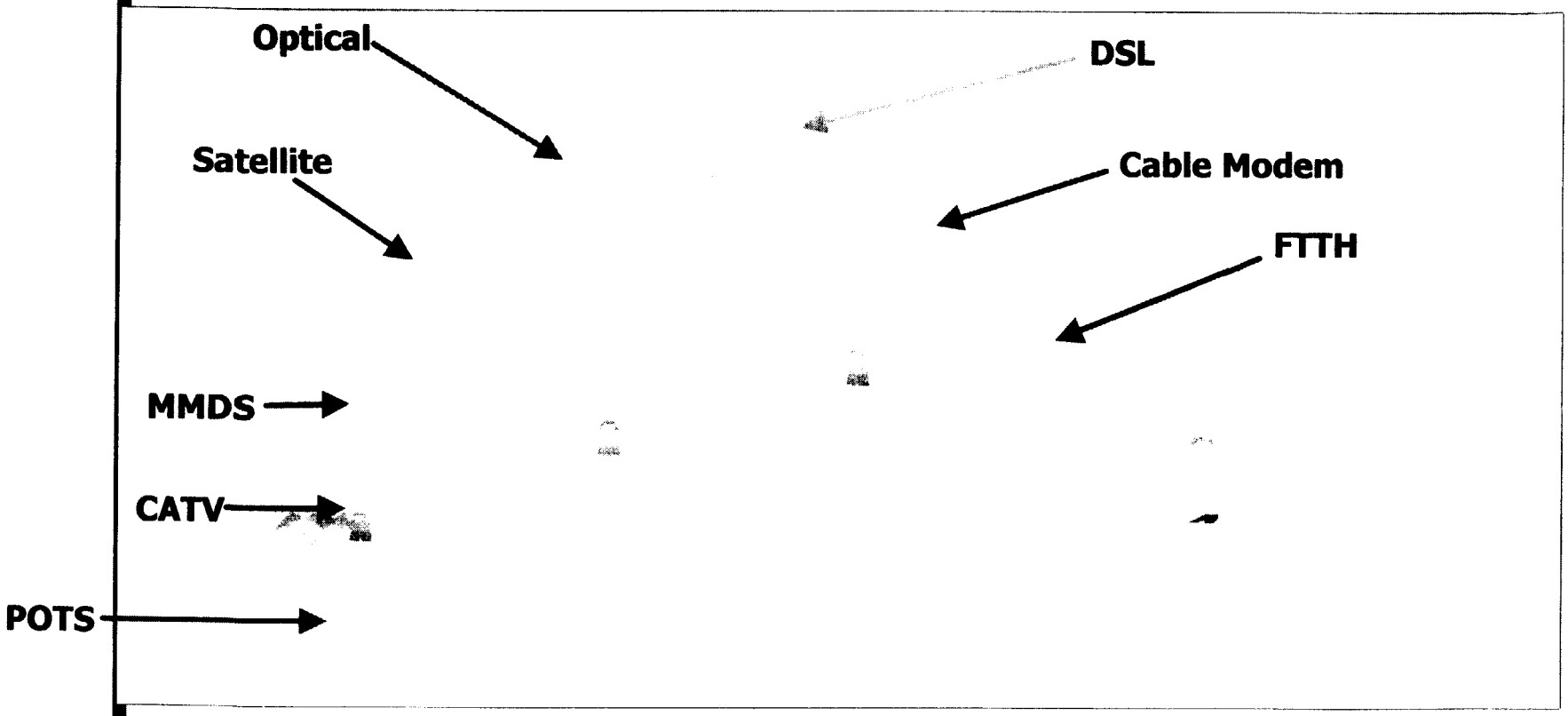
PulsON,
A Chip Based Solution

What is Ultra Wideband?

Ultra Wideband is a new wireless technology that delivers megabits of data across a wide swath of spectrum using ultra low power so as not to interfere with existing users of the spectrum.

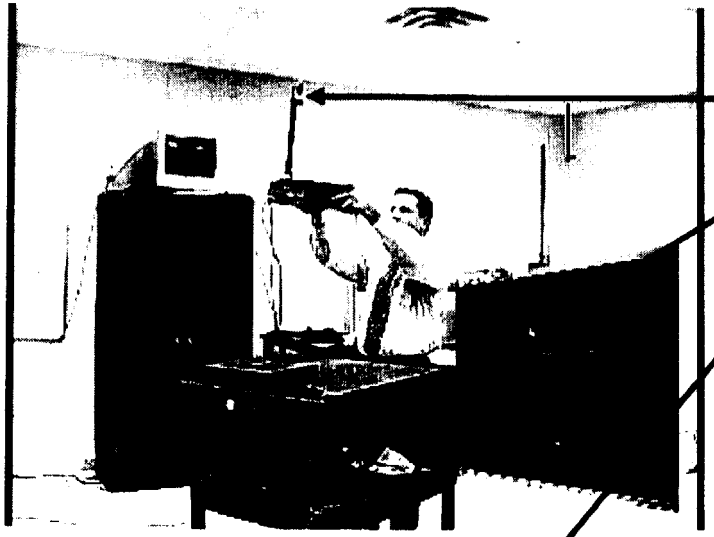
What is UWB's Role in the Future of Broadband Wireless

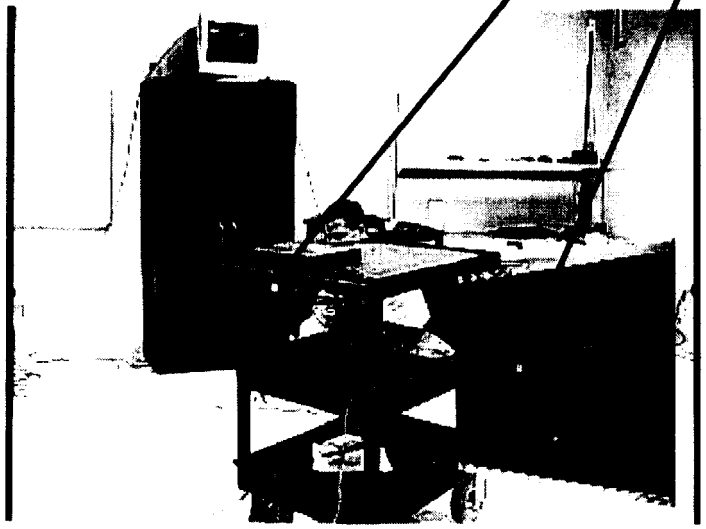
Broadband To The Home...



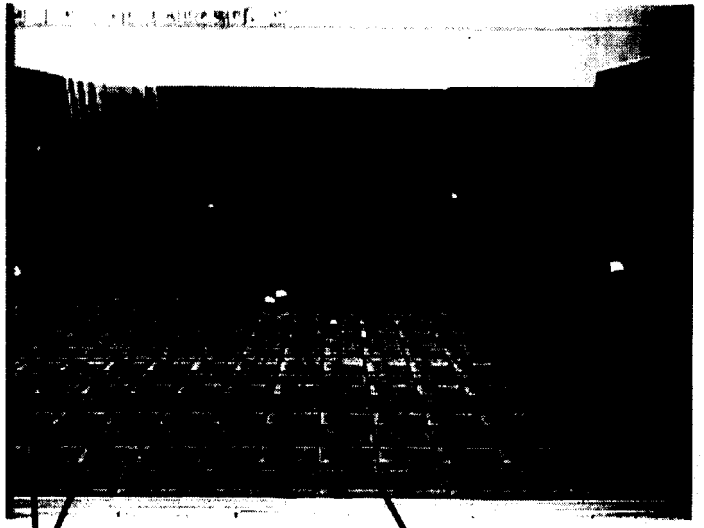
The Challenge: "Broadband Thru The Home"

Precision Location Tracking





real-time 3-D tracking
with cm accuracy



sensors

tracked
object

TIME
DOMAIN®

Radar Prototype

- Through wall motion sensing for law enforcement
- SAR imaging demonstrations

Part 15

- "Part 15" allows low-powered wireless devices to operate on a shared or non-interfering basis with existing spectrum users.
- Characteristics of Part 15 operations:
  - Unlicensed operations
  - Low power devices - less than 50 billionths of a watt of power
  - Interference protection for licensed services
  - Strict power limits - e.g. -71 dBW/MHz (about 50 billionths of a watt) is most strict limit
  - FCC authorization, certification, enforcement
- Billions of Part 15 and Part 18 ISM devices already in operation:
  - Personal computers and accessories
  - Personal digital assistants
  - Spread spectrum network systems
  - High definition DTV receivers
  - Microwave ovens
  - Cordless phone receivers

NTIA's Peak Power Analysis

- Of the 15 non-GPS systems examined by NTIA, 2 satellite 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

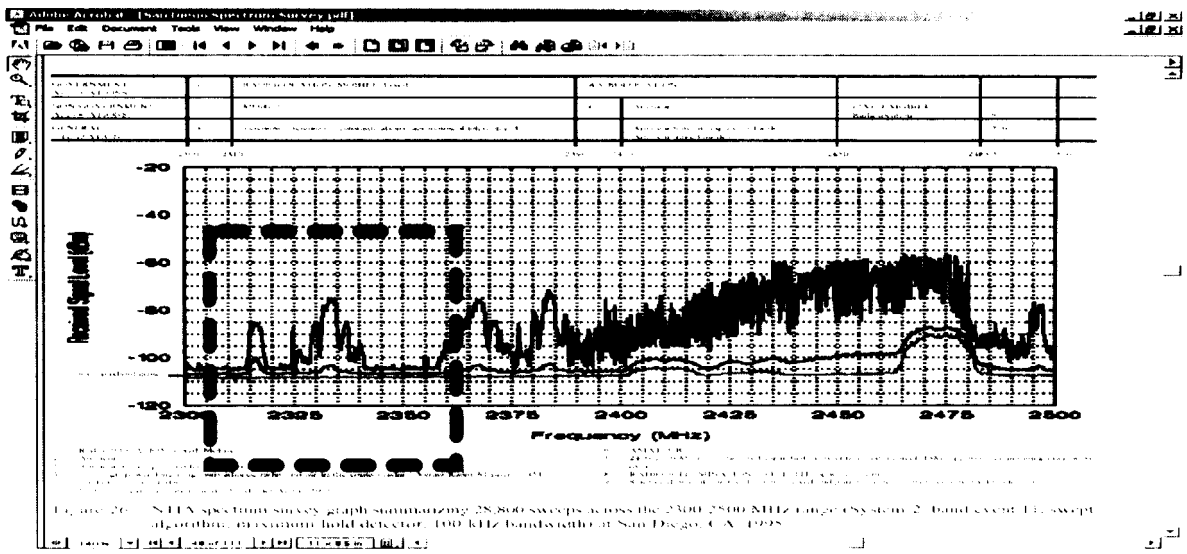
Peak-Related Interference Results Comparison

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

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."



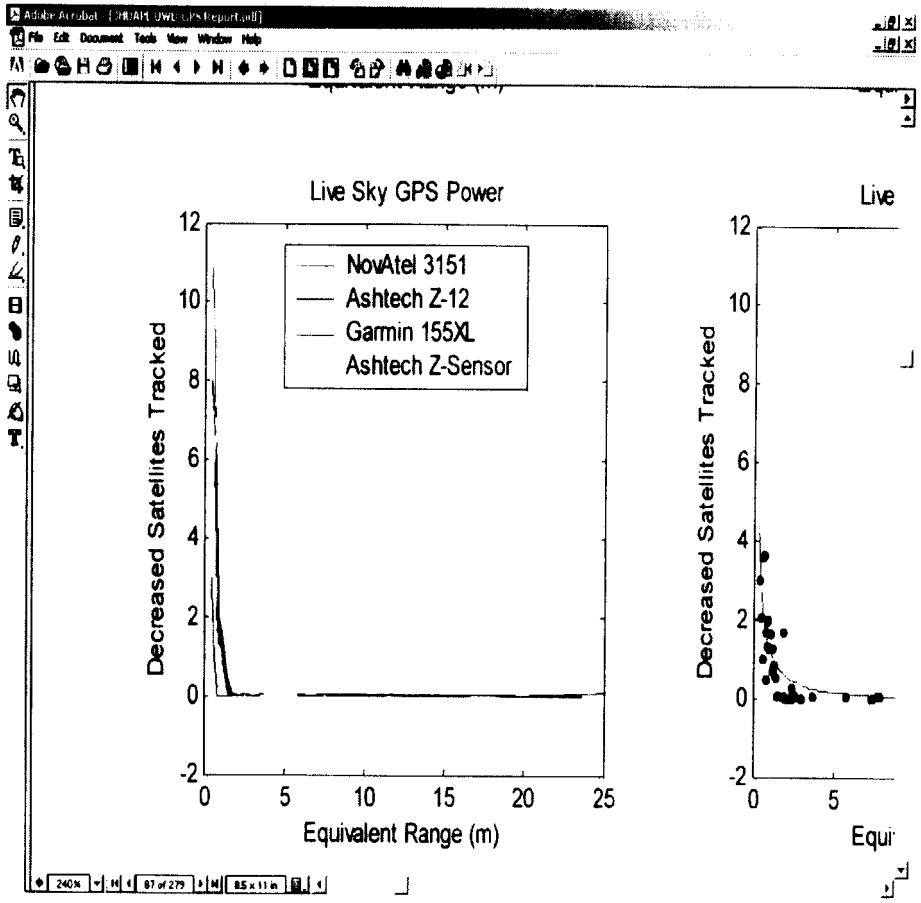
Source: NTIA Broadband Survey of San Diego, CA

TIME DOMAIN®

GPS Coexistence Testing

- Johns Hopkins Applied Physics Laboratory
  - Sponsored by Time Domain
  - Analyzed data taken by Applied Research Laboratory, University of Texas (ARL:UT)
  - Comprehensive testing produced 20 GB of data including conducted and radiated testing of multiple receiver types and UWB modes as well as other digital devices operating at Part 15 power
  - Developed 12 measures of GPS receiver performance related to number of satellites, position accuracy, and reacquisition time

An Example Graph from JHUAPL Report



Asymptotic curve with noticeable effects starting at 3 meters

JHUAPL Analytic Results

- TM-UWB emissions are white noise-like signals that can be modeled as average power
- Multiple TM-UWB emissions add as average power
- TM-UWB emissions resemble emissions from devices operating at Part 15 power levels– un-keyed walkie-talkie
- Developed theoretical model that accurately predicted both ARL:UT and other experimental data
- DoD Joint Spectrum Center recently showed that NTIA and UT/JHU data largely say the same thing. TDC performed similar analysis.

FCC Has Seen This Before - 1

GEN Docket No. 98-68: Amendment of Parts 2, 25 and 68 of the FCC Rules to Further Streamline the Equipment Authorization Process for Radio Frequency Equipment, Modify the Equipment Authorization Process for Telephone Terminal Equipment, Implement Mutual Recognition Agreements and Begin Implementation of the Global Mobile Personal Communications by Satellite Arrangements

GPS Position: "Preliminary analysis of the potential interference into GPS receivers from GMPCS terminals operating at the power levels proposed in the NPRM *(see attached Declaration of Stanford University professor Per Enge)* shows that GPS receivers could be subject to unacceptable levels of interference from GMPCS terminals."

and from an affidavit provided in this filing by Stanford University Professor Per Enge: "Based on my theoretical evaluation of the interference situation, the FCC's proposal to permit mobile earth terminals to produce emissions in the GPS operating band at levels of –70 dBW/MHz, even on an interim basis, could subject certain GPS receivers to significant levels of interference."

FCC Decision: A report and order was issued December 23, 1998, affirming the –70 dBW/MHz standard proposed by the FCC.

FCC Has Seen This Before -2

WT Docket No. 96-86: the Development of Operational, technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Agency Communication Requirements through the Year 2010

GPS Position: In this filing, the GPSIC, the Air Transport Association, American Airlines, the General Aviation Manufacturers Association, Outreach, *Stanford University (the GPS Research Program),* and United Airlines were collectively referred to as GPS Commenters. "The answer the GPS Commenters provided is that the proposed standard is not sufficient. They showed that the public safety service uses proposed by Motorola and other commenters at 794-806 MHz would endanger a GPS system that is dynamic, growing and critical (in both a public safety and an infrastructure context), and that the –70 dBW/MHz out-of-band emission level that is unidentified as sufficient to protect GPS operations is woefully deficient."

FCC Decision: The Third Memorandum Opinion and Order was issued October 10, 2000. The FCC adopted the out-of-band limits of –70 dBW/MHz for wideband emissions and the –80 dBW/MHz limit for narrowband emissions falling within the 1559 –1610 MHz band.

FCC Has Seen This Before - 3

WT Docket 99-168: Service Rules for the 746-764 and 776-794 MHz Bands, and Revision to Part 27 of the Commission's Rules

GPS Position: "In these Reply Comments, the Council emphasizes that it has demonstrated that the –70 dBW/MHz/-80 dBW/MHz standards do not adequately or universally protect GPS… The Council also emphasizes that, based on actual studies and demonstrations, the only default level that can safely be established at this point to protect GPS receivers is a wideband OOBE threshold limit of –100 dBW/MHz."

FCC Decision: In its First Report and Order issued January 7, 2000, the Commission adopted the –70 dBW/MHz (wideband) and –80 dBW/MHz (narrowband) out-of-band emissions limits for signals falling into the 1559 – 1610 MHz band. These limits were designed to protect against the second harmonics of certain 700 MHz transmitters. These limits are premised on protecting aviation GPS use at a distance of about 30 meters.