NETEX Program

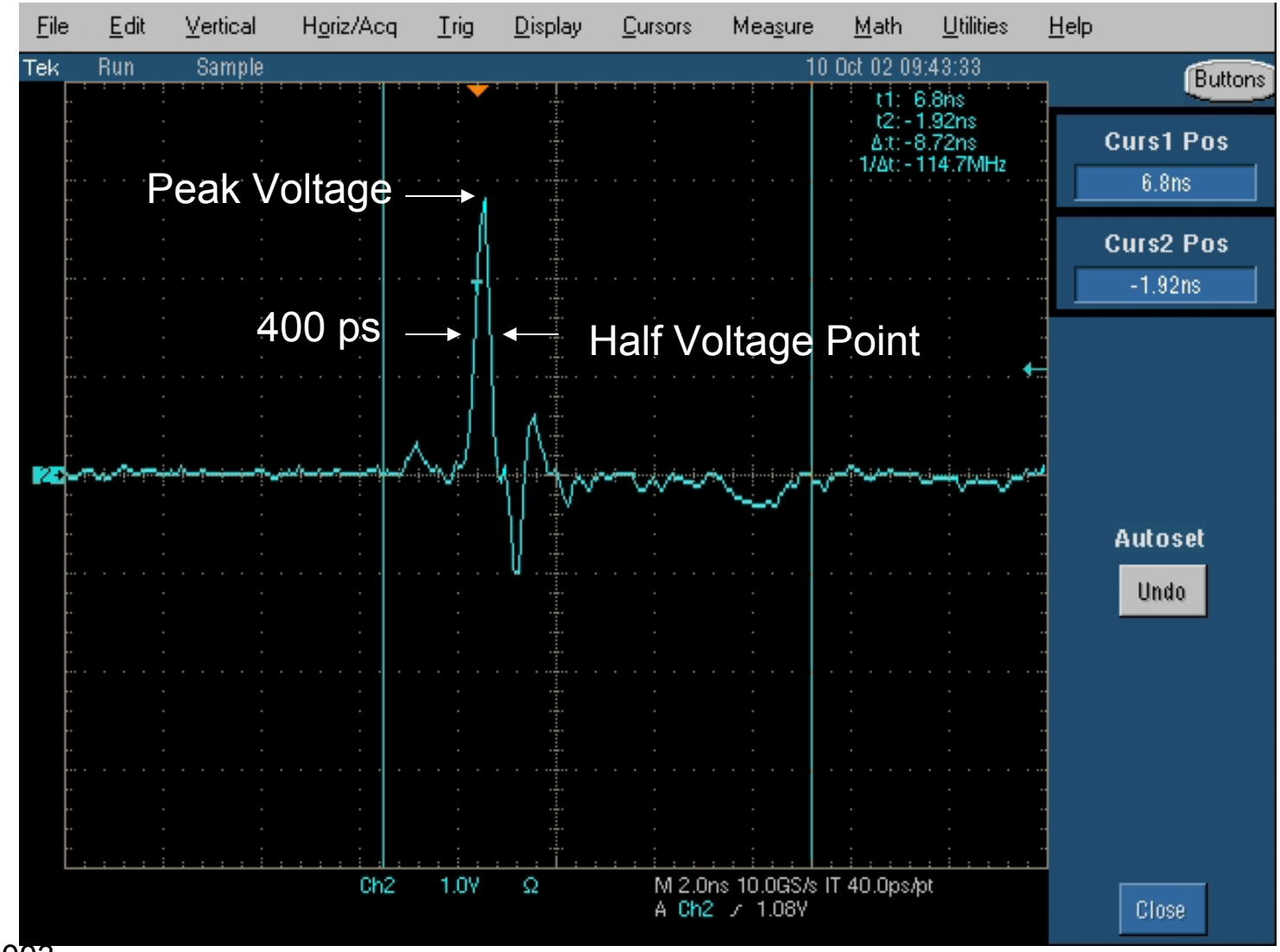
Networking in Extreme Environments

Electromagnetic Interference Effects of
Ultra Wideband Emissions on Selected Military Receivers

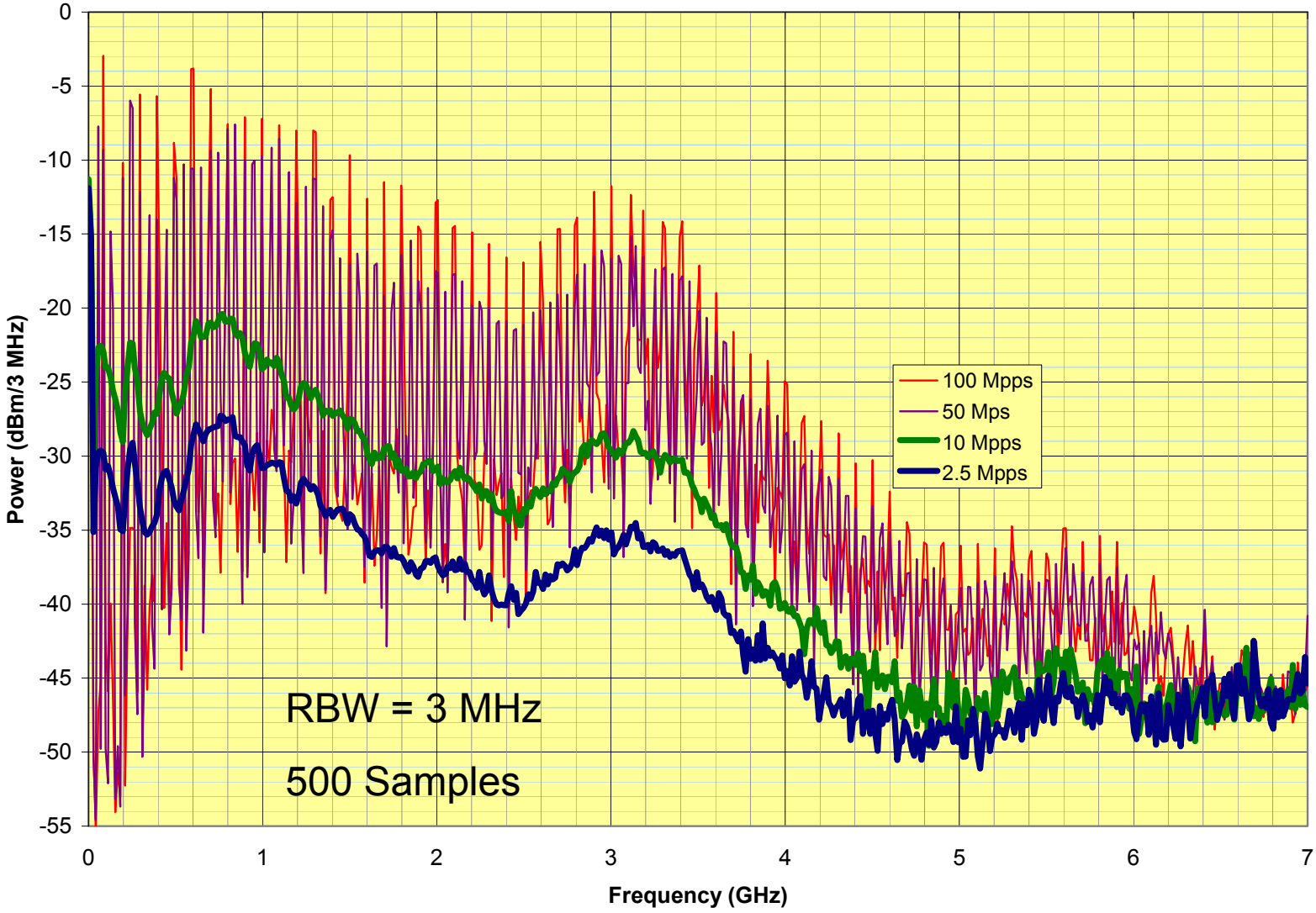
7 April Industry Day Workshop

A. H. Light

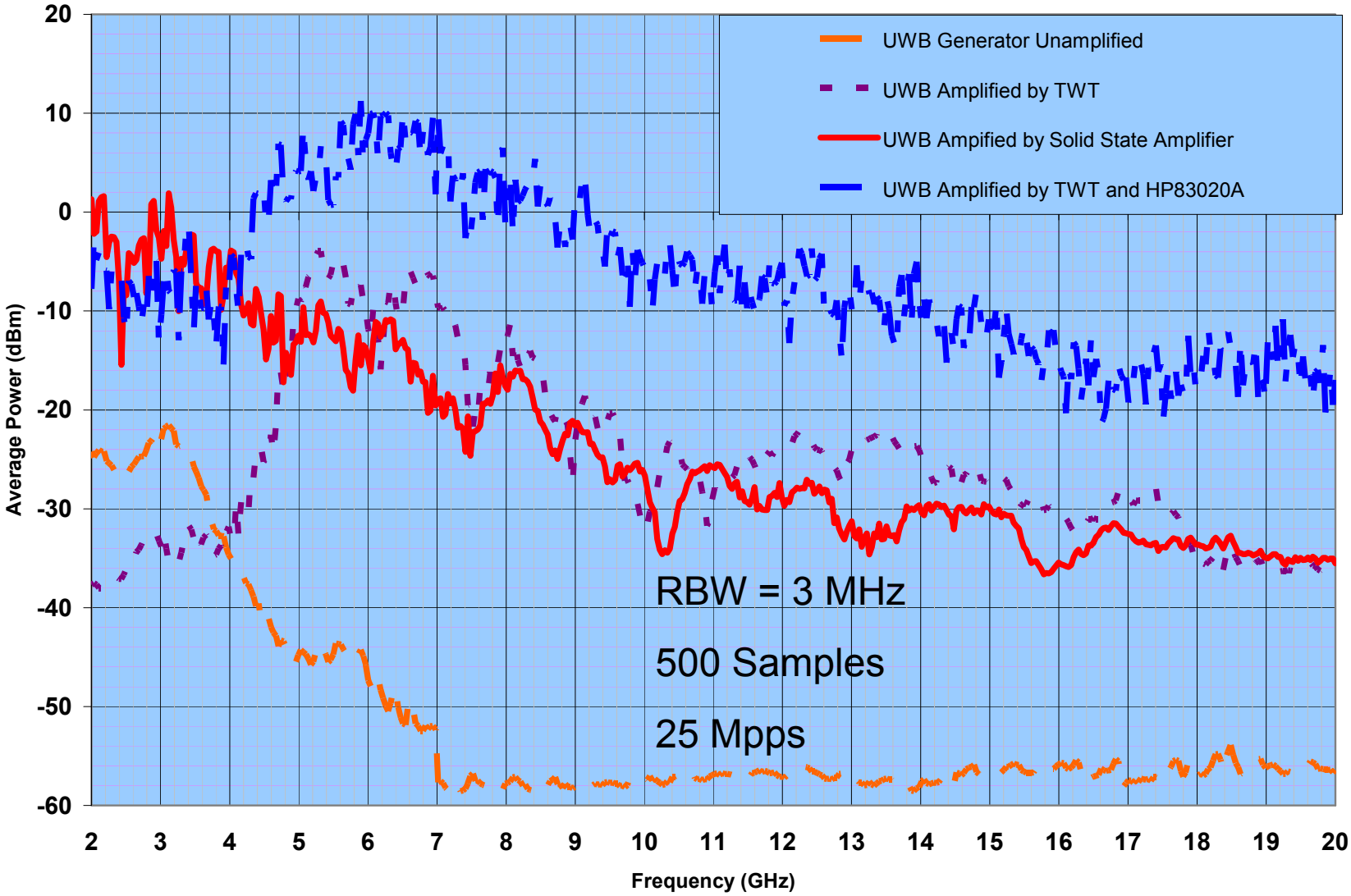
UWB Test Pulse



UWB Output 0 – 7 GHz



Amplified UWB Output 2 – 20 GHz



Test Process

- Select Test Frequencies
  - Three (3) per Band
    - One each in bottom 10%, middle 10%, and top 10%
- Select Test Modes
  - All Available
- Suite of Tests
  - Conducted at Each Frequency and in Each Mode

Test Process (cont)

- Suite of Tests (cont)
  - System Sensitivity to Desired Signal (DS)
    - Compare to System Specified Sensitivity
    - Measure both level at which DS quality achieved (AT) and lost (UT)
  - Susceptibility to Broadband Gaussian White Noise (BGWN)
    - Inject DS at AT + 6 db
    - Measure both level at which DS quality lost (WNUT) and reachieved (WNRT)
    - If DS and Noise Source have sufficient margin test at high level
      - Inject BGWN at WNUT + 20 db
      - Measure both level at which DS quality reachieved (WNHLRT) and lost (WNHLUT)

Test Process (cont)

- Suite of Tests (cont)
  - Susceptibility to UWB Test Waveforms (TWs)
    - Repeated for each UWB TW
    - Inject DS at AT + 6 db
    - Measure both level at which DS quality lost (UWBUT) and reachieved (UWBRT)
    - If DS and UWB have sufficient margin test at high level
      - Inject UWB TW at UWBUT + 20 db
      - Measure both level at which DS quality reachieved (UWBHLRT) and lost (UWBHLUT)

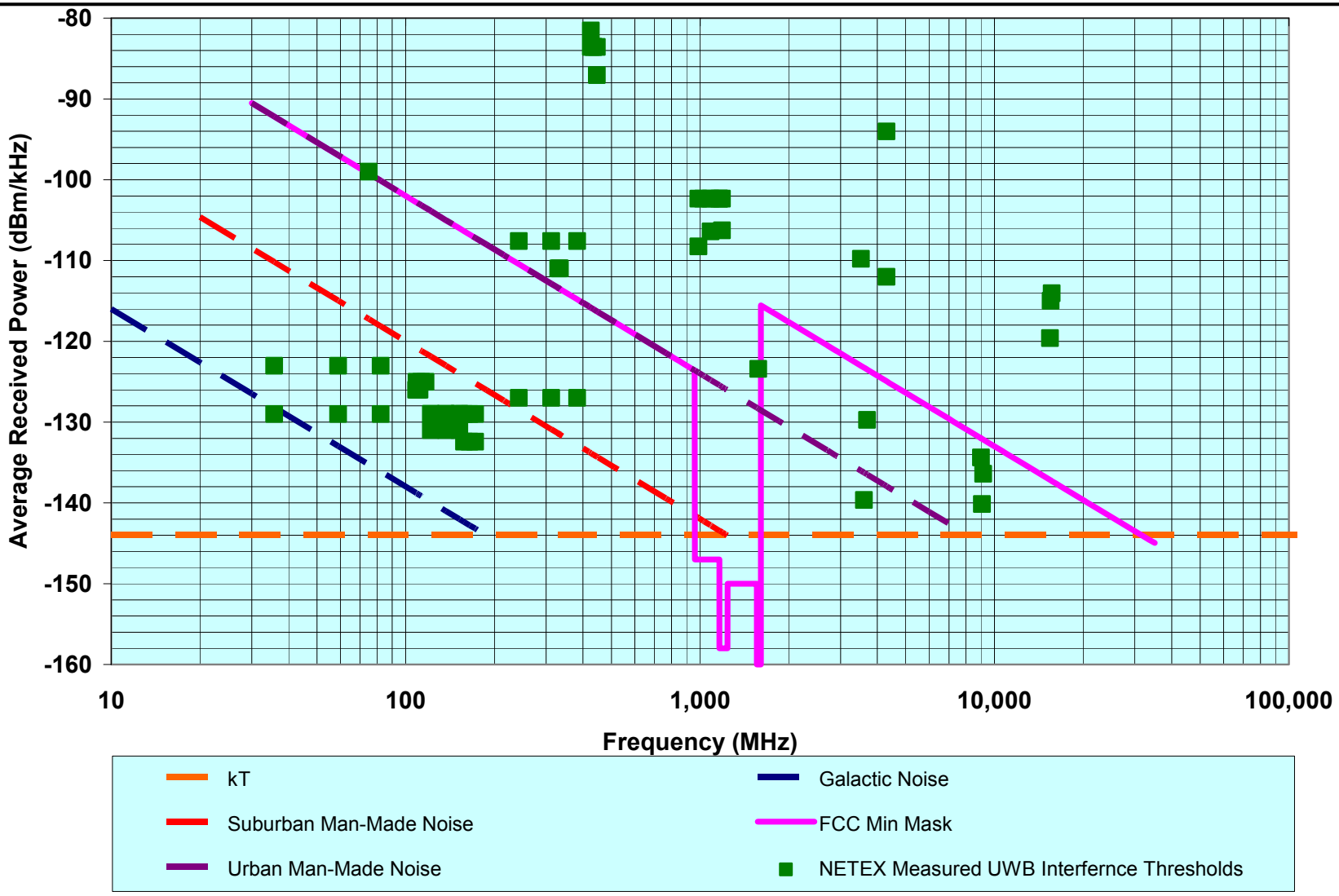
UWB Test Waveforms

Test Waveform (TW)	Pulse Repetition Frequency (PRF)	Modulation of PRF	Interference Characterization
1	Test Frequency (TF)/n	Not Applicable (N/A)	Single spectral line at tuned frequency of Victim – CW-like Interference
2	TF/m ($m \geq n$)	Dithered at greatest available percentage (%) which was less than the full receiver RBW.	Frequency Modulated (FM) signal within receiver passband
3	RBW	1% Dither	Frequency Modulated (FM) signal within receiver passband
4	RBW	Swept FM; 1,0; PN PPM	Maximal Effect Interference
5	RBW/10	N/A	10 Spectral Lines in Receiver Pass Band – High Rate interference Bursts
6	RBW*10	N/A	Variable Effect : 1.Similar to TW1 if TF = 10*n*RBW 2.Lesser Effect to NO Effect if TF ≠ 10*n*RBW
7	RBW/100	N/A	100 Spectral Lines in Receiver Pass Band – Low Rate interference Bursts

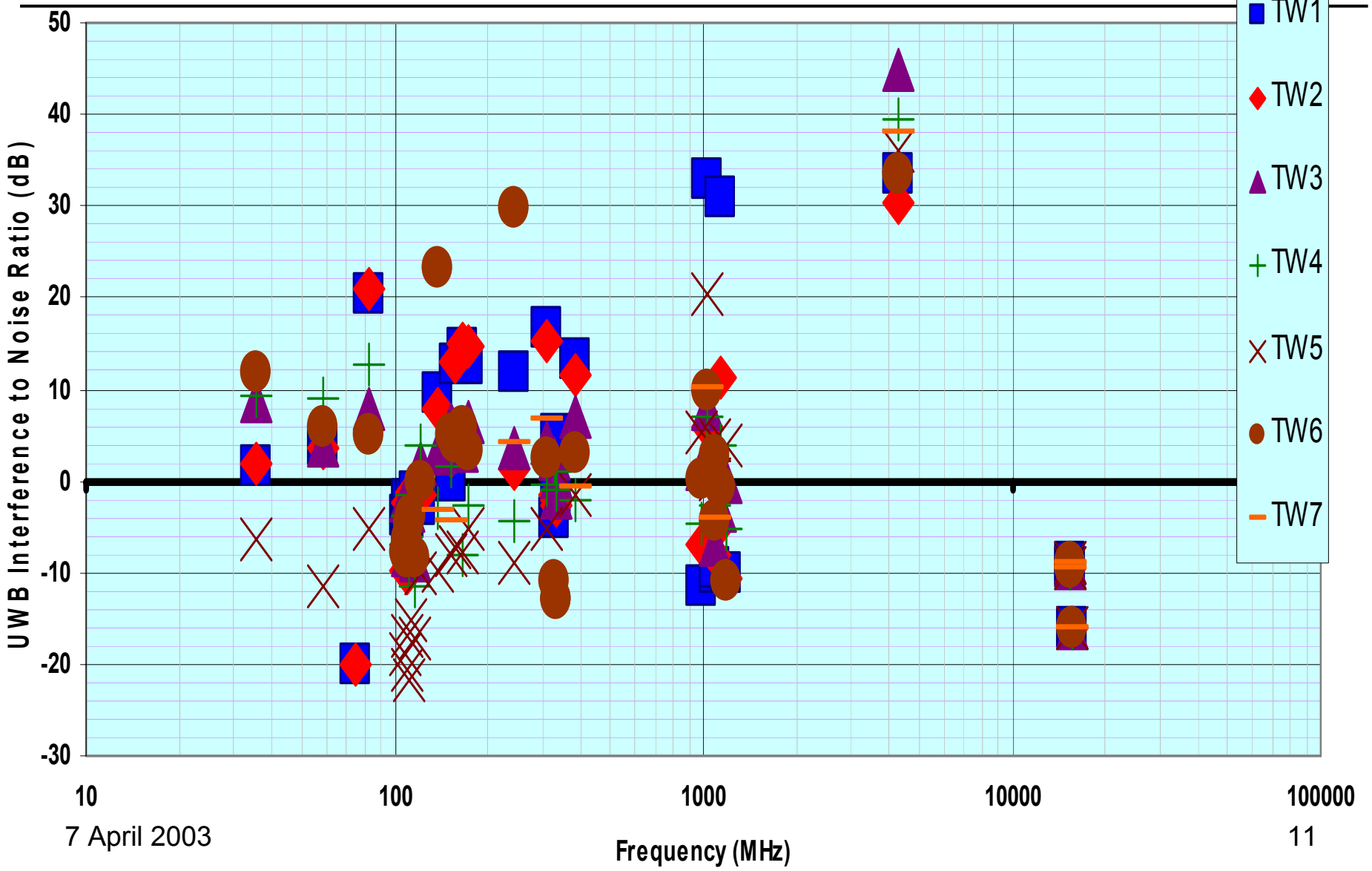
Military Systems Tested

TOTALS			
16 SYSTEMS	**39 MODES**	**65 FREQUENCIES + 5 FREQUENCY HOP SETS**	**1616 TESTS**

UWB vs Noise and the FCC Mask



UWB vs BWGN


50
40
30
20
10
0
-10
-20
-30
UWB Interference to Noise Ratio (dB)
10
100
1000
10000
100000
Frequency (MHz)
TW1
TW2
TW3
TW4
TW5
TW6
TW7