Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems	)	ET Docket 98-153

REPORT OF V-COMM, L.L.C.

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1. Executive Summary

In regard to the FCC's consideration of new Ultra-Wideband (UWB) systems, V-COMM strongly advocates the need for additional compatibility testing with existing wireless systems, prior to the broad acceptance of UWB systems. Additional testing requires joint company participation to ensure the compatibility of existing wireless systems with the proposed UWB systems.

Joint testing should be conducted, in a cooperative effort with interested parties, to include the UWB vendors, wireless service providers and independent engineering expertise in the industry. To promote this cooperative testing, the FCC should *require* all UWB vendors make available pre-commercial versions of their systems, for wireless service providers and other experts in the industry to sufficiently test its compatibility with existing systems. This should take place prior to the adoption of FCC rules and regulations for UWB systems, and prior to the commercialization and proliferation of UWB systems.

2. Introduction

V-COMM is a wireless engineering consulting firm. We have over 25 years of in-depth experience in wireless telecommunications engineering. We have provided our expertise to wireless operators in system design, network engineering, implementation, network expansion, system performance and optimization. V-COMM's technical expertise includes assisting wireless operators in the evaluation and integration of new technology into their networks. We have considerable engineering experience in mitigating interference between adjacent band operators and collocating wireless systems. We have experience in all wireless technologies, including CDMA, TDMA, GSM and AMPS technologies, in Cellular, PCS, ESMR, Fixed Wireless, and Broadband Wireless Industries.

Currently, V-COMM is testing the compatibility of the AirCell technology with existing digital and analog cellular systems. V-COMM is conducting tests in-market, in a cooperative effort with interested parties, which includes industry experts, vendors and wireless service providers. Test results will be shared with the FCC and other wireless industry experts to determine the potential impact of the AirCell system co-existing with existing cellular systems.

Similar cooperation and coordination of wireless industry representatives should be organized for UWB system compatibility testing. With operating bandwidths extending through the Ultra-High Frequency (UHF) and Super-High Frequency (SHF) bands, UWB systems pose significant potential for interference to many existing wireless systems.

3. Joint Company, Comprehensive Testing Needed

Currently, UWB vendors have little incentive to participate in joint testing or provide equipment to interested parties, at this time or in the future. In most cases, these vendors have completed internal tests, submitted test results to the FCC, and are representing that their technology can co-exist with existing wireless systems.

But such internal testing is not reliable, because these vendors do not operate wireless systems and cannot know how best to design and carry out tests. Thus, the FCC should *require* all UWB vendors make available pre-commercial or other available versions of their systems to wireless service providers and other experts in the industry, such as V-COMM, to perform joint company compatibility tests to better understand the risks of interference to existing wireless carriers.

Wireless operating companies would be able to offer significantly more experience, with internal and external engineering groups specialized in their technology, to fully understand the systems, develop test methods & engineering controls, and evaluate test results. In this manner, the impact to the performance of the wireless systems can be directly measured and evaluated, in “controlled tests” performed within a wireless carrier’s network.

UWB systems utilize unconventional and proprietary pulse transmissions that are not well understood by the wireless operating companies and industry engineering firms. Cooperative, joint testing would afford the wireless operators and other parties the opportunity to evaluate its impact to existing carrier-based wireless systems.

4. Wireless Networks Deploying New Technology

To meet market demands, competitive offerings and FCC service requirements, wireless operators continually enhance and deploy new wireless technology into their networks, with new operating characteristics. Two examples include Enhanced 911 Phase 2 Location Determination and Third Generation Wireless Service. These new technologies are being deployed today, and both utilize signals that are lower in signal strength and closer to the system noise floor. As a result, these technologies are more susceptible to outside-system interference and any increase in the operating noise floor.

Future compatibility testing is required as new technologies are deployed within the wireless networks. Wireless companies should be afforded the opportunity to conduct on-going tests to protect the integrity of existing and future wireless technologies.

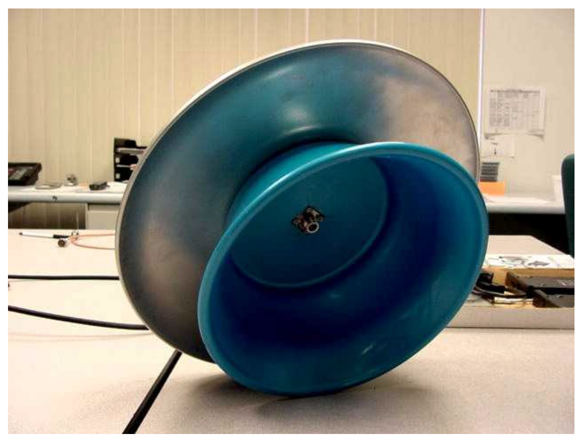
5. UWB Antenna Systems and Antenna Isolation Test

UWB antenna systems with high-frequency operating bandwidths require compatibility testing with existing wireless systems at frequencies within and *outside* the operating bandwidth of the antenna. RF leakage can occur at frequencies outside the operating bandwidth of the antenna. Without using additional filtering, UWB antenna systems offer limited protection and isolation to existing wireless operations at lower frequencies.

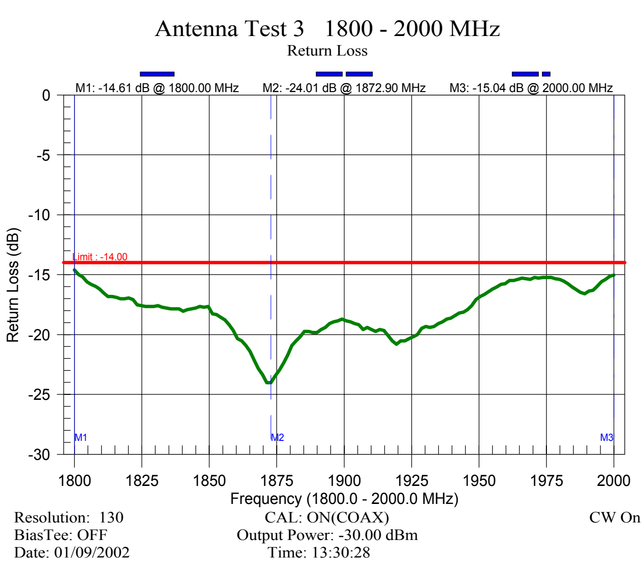
To demonstrate this, V-COMM performed the following antenna test to show the out-of-band RF leakage characteristics of three high-frequency antennas. In these tests, the antenna isolation was excellent (infinite) for some frequencies, but as low as 12 dB, for others. This level of isolation is very poor, in comparison to typical band pass filters in the range of 60 dB. Without additional filtering, compatibility testing should include frequencies above and below the operating bandwidth of the UWB antenna system.

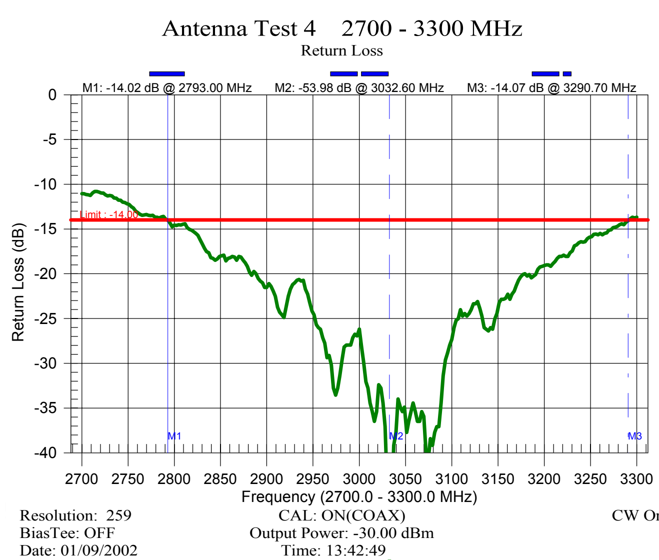
V-COMM tested three antennas with “tuned” operating frequency bands of 1900 MHz, 3000 MHz and 6000 MHz. Pictures of the antenna with ground plane, test setup and the return loss plots for the “tuned” bandwidths of the antennas are provided below.

Antenna Test Setup



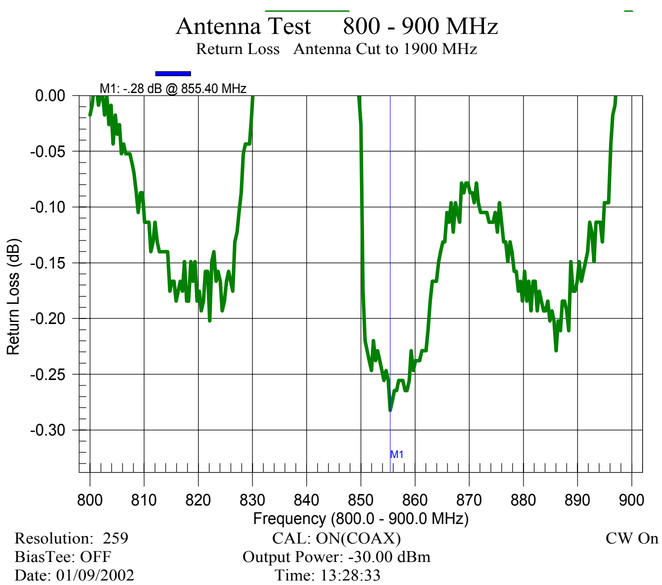
Bottom View



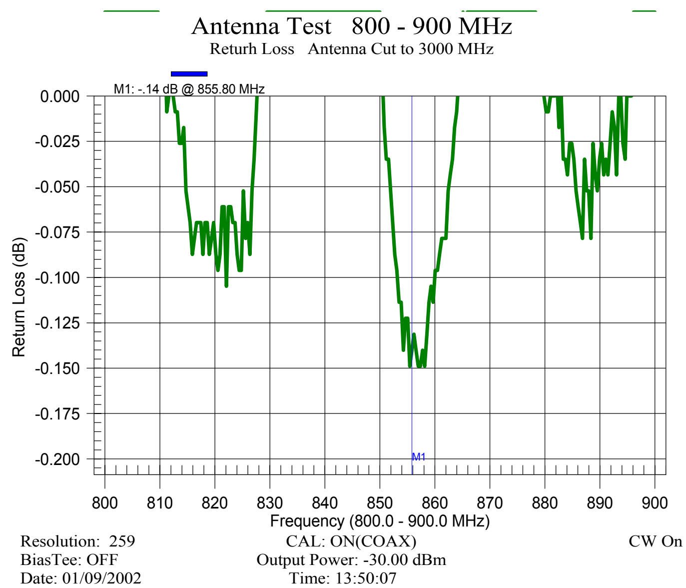


The antenna was cut

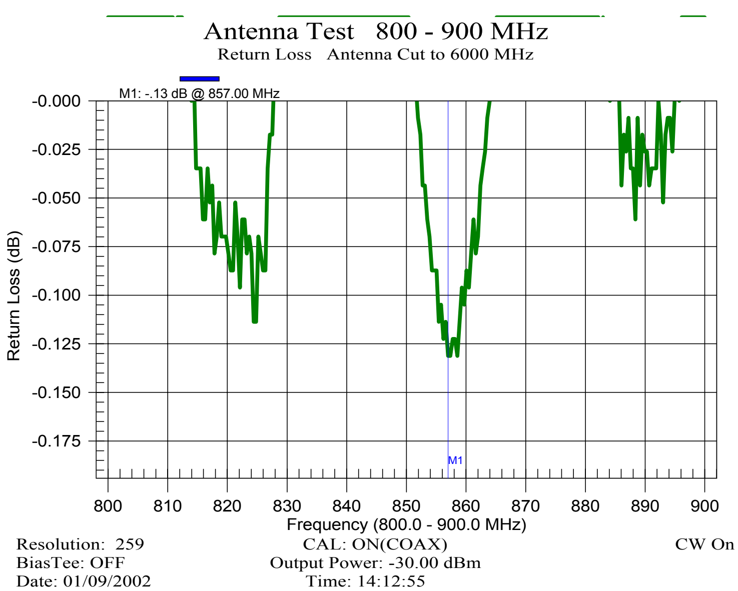
The 1900 MHz, 3000 MHz and 6000 MHz antennas exhibited the following return loss characteristics in the 800 to 900 MHz frequency ranges.



1900 MHz Antenna



3000 MHz Antenna



6000 MHz Antenna

The worst-case antenna isolation is represented by the maximum return loss (furthest from zero). The table below summarizes the maximum return loss and corresponding antenna reflected power, radiated power and isolation for RF emissions in the 800-900 MHz frequency band. These antennas are "tuned" to operating frequency bands of 1900 MHz, 3000 MHz and 6000 MHz.

Antenna's Operating Frequency	Return Loss in 800-900 MHz Band	Reflected Power in 800-900 MHz Band	Radiated Power in 800-900 MHz Band	RF Emissions in 800-900 MHz Band (Isolation)
1900 MHz	0.28 dB	93.8%	6.2%	-12.0 dB
3000 MHz	0.14 dB	96.8%	3.2%	-15.0 dB
6000 MHz	0.13 dB	97.1%	2.9%	-15.3 dB

The measurements were recorded using an Anritsu Site Master model # 332B, with the Anritsu phase stable cable (3 ft. in length). The antennas were cut to equivalent ¼ wavelength isotropic reference with a ground plane, to maintain 50 Ohm impedance. The ground plane was connected to a bulkhead flange-mount N-type female connector, with a solid copper wire antenna element soldered to the center pin of the N-type connector. The measurements were made within open free-space, in the middle of a large room (approx. 20 ft. by 20 ft.), with the antenna ground plane elevated approximately 8 inches above the table. The antennas were tested for the antenna's tuned frequency band, using an acceptable operating resonant bandwidth equal to or better than VSWR 1.5:1, or 14 dB Return Loss. The antennas' worst-case reflective and isolation characteristics in the 800-900 MHz frequency range are listed in the table above.

Our test results indicate that the antenna isolation provided by the three high-frequency antennas are in the 12 to 15 dB range, for the 800-900 MHz frequency band, in the worst-case. These values do not offer wireless operators sufficient protection from potential interference to their frequency bands. Unless additional band pass filters are used, compatibility testing is also needed for wireless operators outside the operating frequency band of the UWB antenna system. This assumes the UWB pulse transmitter is generating signals within the 800-900 MHz frequency range, and the only source of isolation is the antenna's operating frequency characteristics.

The isolation provided by an UWB antenna system will vary depending on the type of antenna used and other possible radiating elements within the device that could affect the matching impedance and antenna's reflective characteristics.

The operating bandwidth and emission characteristics of the UWB antenna system should be measured, for frequency ranges above and below its operating range, to determine the extent of any RF leakage observed. This level will assist in determining the compatibility of these devices to systems outside the operating frequency range of the UWB antenna system.

6. Power Levels of UWB Systems

UWB systems operating at the FCC Part 15 power limits, have the potential for interfering with existing wireless networks. At these levels, they are comparable to the lower emission levels of existing commercial wireless mobile phones.

Provided below are examples of commercial wireless phone transmit power levels:

Technology	**Phone Transmit Power – Upper Level**	**Phone Transmit Power – Lower Level**
AMPS	600 mwatts (27.8 dBm)	6.3 mwatts (8 dBm)
NAMPS	600 mwatts (27.8 dBm)	400 uwatts (-4 dBm)
TDMA	600 mwatts (27.8 dBm)	400 uwatts (-4 dBm)
GSM (U.S. Version)	1000 mwatts (30 dBm)	1000 uwatts (0 dBm)
CDMA (IS95)	200 mwatts (23 dBm)	6.3 nanowatts (-52 dBm)

The wireless access technologies listed above are: Advanced Mobile Phone System (AMPS), Narrow-band AMPS (NAMPS), Time Domain Multiple Access (TDMA), Global System for Mobile Communications (GSM), and Code Domain Multiple Access (CDMA). These technologies utilize mobile phone transmit power levels in the ranges above, and achieve the lower levels when line-of-sight conditions are present and the units are close to their serving cell site. Also, it is achieved with indoor applications using microcells or re-radiators.

CDMA technology has the lowest transmit power levels, of all the technologies listed above. Consequently, it is very sensitive to any increase in the operating noise floor. Within the New Jersey and Philadelphia area, V-COMM observed CDMA phones typically in the microwatt range (below 0 dBm, or 1 mwatt), and as low as –52 dBm, at 0.1 miles away from its serving cell site.

Many UWB systems are proposing to use transmit power levels above the lower limits used by today's Cellular and Personal Communications Systems (PCS). At these levels, they have the potential to interfere with the low levels received by close-by wireless base stations and mobile phones.

Most digital wireless systems today have the ability to maintain a target quality threshold by increasing transmit power to overcome additional interference, however this comes at the expense of a reduction in system capacity, system performance and system coverage. Increased dropped calls and failed access attempts can be observed with an increase in the operating noise floor, above the equipment's system noise floor. These parameters should be closely monitored as UWB compatibility tests are performed.

7. Conclusion

UWB transmission systems potentially hold promise for many new and exciting wireless applications, from collision avoidance systems, to motion detection & radar systems, to Wireless Local Area Networks (WAN), and high-speed internet access for home and business users. The general public stands to derive great benefit from the proliferation of the proposed Part 15 devices. There are many examples of great public benefit from the proliferation of Part 15 devices, e.g. cordless phones, wireless baby monitors, 802.11 Wi-Fi devices, etc. Further, with well over 100 million wireless phones in the U.S. alone, the proliferation of these devices have generated great benefits to the general public as well. As each of these mass market devices continue to penetrate the U.S. market, the probability of them being in close proximity increases significantly, especially when considering the consumer profile for each of these devices is nearly identical. If all of these devices can co-exist and offer value to the general public, we believe the FCC has achieved its vision.

However, to ensure UWB systems are compatible with existing wireless systems, comprehensive and joint company testing is needed. The Commission should require that UWB vendors make available their products for such testing, as part of their operating requirements. Due to the inherent wide-band characteristics of UWB systems and antennas operating at high frequency bands, compatibility testing is required with existing systems at frequencies within and outside the operating bandwidth of the UWB antenna system.

With the anticipated proliferation of UWB devices, it will be difficult for the Commission, or other parties, to ensure proper controls will be maintained throughout the product life cycle. In addition, wireless service providers continue to deploy new technologies into their networks, with new operating characteristics. These technologies generally offer increased spectral efficiency, operate at lower power levels, and are more sensitive to increases in the operating noise floor. For these reasons, the existing wireless operators should be afforded the opportunity to complete on-going and future tests to ensure the future compatibility of UWB systems with existing wireless operators.