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July 29, 2004

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, SW
Room TW-B204
Washington, DC 20554

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

Dear Ms. Dortch:

Pursuant to Section 1.1206(b) of the Commission's rules, I am writing on behalf of Lucent Technologies Inc. ("Lucent") to notify you of an *ex parte* communication that occurred on July 14, 2004 between Safwan Zaheer of the Wireless Standards Development Group of Lucent, and Ahmed Lahjouji and Ron Chase of the Commission's Office of Engineering and Technology. Specifically, Mr. Zaheer emailed the attached document to Mr. Lahjouji and Mr. Chase.

An original and one copy of the letter are being submitted for inclusion in the proceeding record.

Best regards,

Phil Marchesiello

cc: Charles Mathias, Lucent
Ahmed Lahjouji, OET, FCC
Ron Chase, OET, FCC

Lucent Technologies
Bell Labs Innovations

Comments on FCC's USTG 1/8-57 "Analysis of Ultra-Wideband Interference into the 1850-1910 MHz and 1930-1990 MHz Frequency Bands"

DATE: **July 21, 2004**

FROM: **Lucent Technologies**

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Introduction:

This document provides comments on FCC's USTG 1/8-57, "Analysis of Ultra-Wideband Interference into the 1850-1910 MHz and 1930-1990 MHz Frequency Bands", and proposes slight modifications to the paper in order to appropriately determine the minimum separation required between the Ultra-Wideband (UWB) systems and the Personal Communications Systems (PCS), operational in the United States of America.

Discussion:

The analytical approach employed in the FCC paper to determine the minimum separation distance between the UWB devices and the IS-95 PCS handsets, for compatible operation between the two systems, is an appropriate methodology. However, the reference points (i.e. the PCS mobile receive antenna input and line output), used in the analysis are misplaced, resulting in smaller separation distance between the two devices. Following are our recommended parameter values to determine the minimum separation distance between the two devices for compatible operation:

(The recommended changes are highlighted in blue, for ease of reference)

Parameter	Value	Equation
Frequency	1900 MHz	F
Receiver antenna gain	-4.6 dBi[1]	AG
PCS receiver line loss	-2 dB[1]	LL
Desired signal level at the receive antenna input	-112.6 dBm/MHz	DSL

[1]Per the comments filed by Sprint and Qualcomm in response to "ET Docket No. 98-153, First Report and Order, Potential Interference to PCS from UWB Transmitters Based on Analysis from Qualcomm Incorporated".

Received desired signal level at the receive line output	-119.2 dBm/MHz	S = DSL + AG + LL
Processing gain (corresponding to a voice data rate of 14.4kbps)	19.4 dB	PG
Minimum required Eb/Nt	6.2 dB[2]	Eb/Nt
Maximum (N+I) at the receive line output in absence of outside noise sources	-106 dBm/MHz	MaxNI = S + PG –Eb/Nt
Maximum (N+I) at the receive line output (including received PCS internal interference and thermal noise)[3]	-99 dBm/MHz	**$MaxNI_1$**
Received desired signal level at the receive line output in the presence of in-cell and other-cell interference	-112.2 dBm	S_1 = **$MaxNI_1$** + Eb/Nt -PG
Maximum UWB emission level at the receive line output	-109 dBm/MHz	IR = $MaxNI_1$ – 10
Maximum UWB emission level at the PCS handset antenna input	-102.4 dBm/MHz	I = IR –AG - LL
UWB emission limit	-53.3 dBm/MHz	E
Required path loss	49.1 dB	PL = E – I
Minimum separation distance Required	**3.6 meters**	20 log (D) = PL – 20log(F) + 27.56

As noted, in the first paragraph of FCC USTG 1/8-57 (under the discussion section), the thermal threshold of an IS-95 PCS mobile receiver is -106 dBm/MHz. However, this value should be referenced at the PCS receive line output. In the absence of outside noise sources, the operational sensitivity level or the desired signal level at the PCS receive line output is then calculated to be –119.2 dBm/MHz [-106 dBm/MHz (noise floor) + 6.2 dB (Eb/Nt) - 19.4 dB (processing gain)]. Therefore, the desired signal level at the PCS receive antenna input is then –112.6 dBm/MHz (-119.2 dBm/MHz – (-6.6) dB (antenna gain & line losses). The next step is to determine the maximum noise plus interference level (N+I) that can be tolerated by the PCS mobile receiver.

The maximum (N+I) at the PCS receive line output is –106 dBm/MHz in the absence of outside noise, which increases to –99 dBm/ MHz in the presence of outside noise sources, as specified by Sprint PCS in its petition to the FCC. The –99 dBm/MHz is the

[2] As per the comments filed by Sprint and Qualcomm in response to "ET Docket No. 98-153, First Report and Order, Potential Interference to PCS from UWB Transmitters Based on Analysis from Qualcomm Incorporated".

[3] Sprint's petition indicated that the handset received in-cell and other-cell interference plus the thermal noise is in the order of -99 dBm/ MHz.

maximum noise plus interference level (including the in-cell and outer-cell noise) that the PCS mobile receiver can tolerate. For a non-harmful/ non-interference operation of an IS-95 PCS system the maximum allowable non-IS-95 interference at the PCS mobile receive line output should not exceed –109 dBm/MHz (10dB down from the –99 dBm/MHz noise plus interference level). This level then becomes the maximum allowable UWB emission level that the PCS mobile receiver can tolerate. If this level is maintained at the PCS mobile receiver, the PCS receiver Eb/Nt will be degraded by 0.4 dB. Using the FCC proposed UWB emission level of –53.3 dBm/ MHz (for indoor UWB systems), this level of protection can only be achieved, if the UWB devices and the PCS mobile receiver handset are, at least, 3.6 m (~ 12 ft.) apart.

The maximum UWB emission level of –101.7 dBm/MHz at the PCS mobile receive line output, as per the FCC USTG 1/8-57, will degrade the PCS receiver Eb/Nt by 1.9 dB. This unacceptable level of interference will either cause an increase in the Frame Error Rate (FER) of the voice channel (increasing the level of interference in the PCS cellular system) or cause degradation in the voice call quality. Therefore, it is suggested that the maximum UWB emission level should not exceed –102.4 dBm/MHz at the PCS mobile receiver input, or consequently, -109 dBm/MHz at the PCS mobile receive line output (i.e., 10 dB below the maximum (N+I) at the PCS receive line output). This will then result in an Eb/Nt degradation of 0.4 dB, which is an acceptable and a tolerable level of interference.

UWB Emissions into CDMA2000-1X System:

CDMA2000-1X is one of the several radio interfaces that is identified by the ITU, as an IMT-2000 system. CDMA2000-1X is an evolution of the IS-95 CDMA system, and is ubiquitously deployed in the USA, in particular, in the PCS and cellular bands. Therefore, it is essential to study the impact UWB devices will have on such a system.

Employing a similar analytical approach, as is used in the rest of the paper, and using a typical Mobile Station (MS) receiver antenna gain and line loss of 0dBi (for CDMA2000-1X and IS-95), and a processing gain of 21dB (corresponding to a voice data rate of 9.6kbps), we arrive at the following results:

Parameters	Value
Maximum (N+I) at the receive line output (including received PCS internal interference and thermal noise	-99 dBm/MHz
Maximum UWB emission level at the receive line output	-109 dBm/MHz
Maximum UWB emission level at the CDMA2000-1X Receive Antenna Input	-109 dBm/MHz
UWB Emission Level	-53.3 dBm/MHz

Required Path Loss	55.7 dB
Minimum Separation Distance Required	**7.7 m (~ 25 ft.)**

The results of the above table also apply to IS-95 PCS receivers, having a typical effective antenna gain (including the antenna gain and line loss) of 0dBi.

Conclusion:

This contribution examines an analytical approach to determine the minimum separation distance between the UWB devices, and the IS-95 PCS, and the CDMA2000-1X handsets operating in the USA. It is suggested that the maximum UWB emission level at the PCS receiver input not exceed –109 dBm/MHz. If the current, proposed, FCC UWB emission level of –53.3 dBm/MHz is considered, then the required level of protection is achieved if the two devices are separated by, at least, **7.7 meters (25 ft.)** having a typical effective mobile antenna gain of 0 dBi. This level of separation may not be guaranteed, in an indoor environment, for the safe operation of the two devices. ***It is, further, noted that the UWB emission level in the 1990-3100 MHz band is –51.3 dBm/MHz (2dB higher than the level studied in this paper).***

Therefore, FCC is requested to re-consider the proposed UWB emission limits (for indoor UWB systems), so that the two systems can co-exist with each other with acceptable and tolerable interference level. This will, then, enable the users of the two technologies, to efficiently utilize the benefits offered by the two technologies.