Radiocommunication Study Groups

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North American Broadcasters Association (NABA)

FURTHER TESTS ON PROTECTION REQUIREMENTS FOR BROADCAST SYSTEMS AGAINST INTERFERENCE FROM RADIO DEVICES UTILIZING THE TV BANDS

The North American Broadcasters Association (NABA, *www.nabanet.com*) is an association of broadcasters in Canada, Mexico, and the United States, and the NABA Technical Committee is its standing technical body. NABA is thus in a position to present the technical viewpoints of the most authoritative association of professional North American Broadcasters in television and sound programme production, post-production, and distribution for terrestrial, satellite, and cable broadcasting.

NABA is a Sector Member of ITU-R and a long-time participant in Study Groups ITU-R, Working Parties, Task Groups, Rapporteur groups, etc. NABA numbers among its members Chairmen, Vice-Chairmen and members of the above groups. NABA also participates widely in the ITU work on radio, television and multimedia services and has a strong interest in spectrum management studies including spectrum engineering techniques, spectrum management fundamentals, spectrum monitoring, and inter-service sharing, interference and compatibility.

In this context, NABA has noted in its contribution, Document 6A/28, that there is an interest in permitting the use of devices which would operate within the spectrum allocated in the ITU Radio Regulations to the broadcasting service. In particular, unlicensed devices, without an allocation in the RR, are proposed which would use frequencies within the TV bands that are temporally and/or geographically underutilized. These frequencies are being referred to as “white spaces”.

Although NABA recognizes the need to share the valuable resources of the RF spectrum, this should be done such that the interference levels permit a quality of service no lower than the one currently afforded by the Radio Regulations.

Thus, NABA submitted Document 6A/80 to this SG 6 block meeting including additional information on various “white space” tests that have been conducted in the interval since the last SG 6 block meeting. Since the submission of Document 6A/80 at this SG 6 block meeting, new FCC test data has just been released, and this NABA Contribution to Study Group 6 adds important new information that was unavailable for inclusion in NABA Document 6A/80.

Performance of TV-band white space devices

NABA notes that the Federal Communications Commission (FCC) in the United States has continued its testing of the performance of prototype unlicensed low-power radio transmitting devices (i.e., "white space devices" or WSDs) that would operate on frequencies allocated to the broadcasting service. The study report can be found in Attachment 1.

The study recently involved the field testing of five devices to determine their cognitive ability for "spectrum sensing" in both indoor and outdoor environments. The results of the study clearly showed the inability of WSDs to reliably detect the status (occupied or vacant) of a TV channel. The FCC test results showed that the WSDs could not "sense" the presence or absence of a TV channel 30 percent of the time.

In addition, two of the WSDs were tested to see if they could detect the presence of wireless microphones in a sports venue and in a theatre venue. Wireless microphones are licensed in the United States to operate within the TV bands on a non-interference basis. The FCC test results showed that, in the sports venue, the WSDs could not "sense" the presence of a wireless microphone 36 percent of the time. Although the executive summary of the report fails to mention it, the performance of the WSDs at the theatre venue was a 100 percent total failure.

Direct-pickup interference to television receivers

NABA notes that the FCC investigated a concern that TV receivers with a direct connection to a cable TV system may also be susceptible to interference from wireless network devices operating within the TV broadcast spectrum on locally unused broadcast channels (TV white spaces). A cable TV system is likely to have fewer unused TV channels (if any) since the planning constraints are not as severe as over-the-air TV systems. The FCC study investigated the potential for ingress into the cable TV system at the TV receiver. The study report can be found in Attachment 2.

The study used three digital TV receivers that were available in 2005 and were used in a previous FCC study. The cable TV signals, connected directly to the TV receiver, were typical 256-QAM signals set at a minimum signal level specified for the "input terminals of the first device located on the subscriber's premises." The interfering signal was an OFDM signal with a 4.8 MHz bandwidth located with the cable TV channel to which the victim TV receiver was tuned. The OFDM signal is typically used for wireless network systems especially in portable applications. In each test, the power of the interfering signal applied to an antenna was adjusted to determine the minimum power level that caused interference to the operation of the TV connected to the cable TV system. The tests evaluated the interferer separated from the victim receiver by distances of two and ten meters. These distances are typical for wireless networks operating in the same residence and adjacent residences, respectively. In most cases, the tests included separation of the interferer and the victim TV by a wall emulating multiple rooms or apartments.

It should be noted that the FCC used high quality "quad-shielded" coaxial cable for interconnections between the cable TV system and the victim receivers. That level of shielding is much more than is typically installed in the average home. It is not uncommon to find installed coaxial cable with only 50 to 80 percent shielding. The potential is thus greater for interference to occur at even lower power levels than reported in this study.

The FCC results clearly demonstrate that cable TV systems are adversely affected by wireless networks operating in the TV bands. Furthermore, the interference occurs at power levels significantly below the levels proposed by the United States. The proposal permits fixed devices to operate at EIRP levels up to 36 dBm and portable devices to operate at 26 dBm. For the case where the interferer was two meters from the victim TV receiver, the minimum EIRP interference level with and without a wall was measured at 6.3 dBm. This scenario is typical if a wireless network is

operating in the same room as a TV receiver or on the other side of a wall. Thus the proposed power levels are nearly 1 000 times higher for fixed wireless devices and 100 times higher for portable wireless devices than the level necessary to ensure protection of the cable TV system.

For the case where the interferer was ten meters from the victim TV receiver, the minimum EIRP interference level with a wall was measured at 15.3 dBm. This scenario is typical of a wireless network being operated in an apartment building or townhouse. For this situation the proposed power levels that are over 100 times higher for fixed wireless devices and over 10 times higher for portable devices than is necessary to ensure protection to the cable TV system.

The National Cable & Telecommunications Association (NCTA) in the United States has completed an extensive evaluation of the impact of WSDs[1]. There are two principal concerns. The first being the possible interference to TV interface devices such as VCRs, DVDs, and cable set top boxes that operate on or adjacent to TV channels in the low VHF band from 47 MHz to 72 MHz. NCTA asks that WSDs not be allowed to operate in the low VHF band. The second concern is the possible interference to cable headend reception of over-the-air broadcast signals. Although some cable operations have direct links to television stations, many cable systems receive terrestrial broadcast signals through tower-mounted, high gain directional terrestrial antennas, particularly in the rural and fringe areas. In order to mitigate the potential for interference, NCTA asks that WSD operation be restricted to only fixed devices, that no co-channel or adjacent channel WSD operation be permitted in the service area of the TV station, and that co-channel and adjacent channel WSD operation be restricted beyond the service area by a "line-of-sight" distance.

Further study by the NCTA[2], found in Attachment 3, finds that in addition to the low VHF band, WSDs should also be prohibited from the high VHF TV band, 174 MHz to 234 MHz. In addition, WSDs operating in the UHF band and in fixed locations should be limited in their proximity to residential buildings. NCTA also suggests that spectrum coordination is required before portable WSDs are operated on channels adjacent to those being received at a cable TV headend. As seen above, the inability of WSDs to automatically determine the availability of a TV channel, leads NCTA to recommend that auto-location (e.g., GPS or equivalent) be used in combination with regular access to a reliable database containing geographically-indexed lists of available channels. These techniques would provide the flexibility and reliability required to protect TV broadcast reception without unnecessarily restricting the operation of WSDs.

Consumer TV receiver performance

There is concern that consumer TV receivers may not be adequate to avoid interference from co-channel and adjacent channel emissions of wireless network devices. A study[3] by the Federal Communications Commission (FCC) in the United States demonstrated the limited performance of DTV receivers in the presence over-the-air interference in both co-channel and adjacent channel

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[1] "The potential adverse effects of unlicensed operation of new devices in TV broadcast bands on cable customers' reception of cable service" Appendix 1 of NCTA comments in the matter of unlicensed operation in the TV broadcast bands, dated 31 January 2007, see http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6518724319 and Appendix 2 see http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6518724320.

[2] NCTA *ex parte* filing dated 10 September 2008, see http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6520066607.

[3] "Tests of ATSC 8-VSB reception performance of consumer digital television receivers available in 2005", Office of Engineering and Technology, Federal Communications Commission (USA), OET Report FCC/OET 05-TR-1017, 2 November 2005.

situations. The study report can be found in Attachment 4. The study demonstrated that wireless network devices should not be operated on co-channel and adjacent channels occupied by TV broadcasting services.

A more recent study[4] by the FCC revealed additional interference mechanisms that can arise on a desired channel N from multiple signals on channels N+K and N+2K where K is an integer. The study report can be found in Attachment 5. The study also revealed that signals on channel N+7 could cause interference to the reception of digital television signals on channel N. Subsequent to the FCC revelations, the interference mechanisms have been studied extensively and reported by Rhodes[5]. The analysis shows that the introduction of non-broadcasting transmitters in the TV bands could cause further interference. Significant analysis and planning, specific to the operating location, must occur in order to ensure that WSDs will not cause interference.

Conclusion

Various studies and tests extending over the past three years clearly show that devices operating in the frequency bands allocated the broadcasting service are unable to reliably sense broadcasting signal and will cause interference. Study Group 6 is the ITU-R group recognized for its responsibility to ensure the protection and quality of the broadcasting service. As such, Study Group 6 should proceed expeditiously to develop suitable requirements as Recommendations that will ensure the protection of the broadcasting service in the presence of emissions from non-broadcasting radiocommunication devices with applications (e.g., "white space devices", wireless networks, etc.) not having a corresponding frequency allocation in the RR.

Attachment 1

"Evaluation of the performance of prototype TV-band white space devices, Phase II", Office of Engineering and Technology, Federal Communications Commission (USA), OET Report FCC/OET 08-TR-1005, 15 October 2008.[6]

FCC OET
07-TR-1005.pdf

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4 "Interference rejection thresholds of consumer digital television receivers available in 2005 and 2006", Office of Engineering and Technology, Federal Communications Commission (USA), OET Report FCC/OET-07-TR-1003, 30 March 2007.

5 C. W. Rhodes, "More examples of interference from unlicensed devices", TV Technology, 21 February 2007.

6 Appendices to Report FCC/OET 07-TR-1005 can be found at URLs: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-08-2243A4.doc through DA-08-2243A10.doc.

Attachment 2

"Direct-pickup interference test of three consumer digital cable television receivers", Office of Engineering and Technology, Federal Communications Commission (USA), OET Report FCC/OET 07-TR-1005, 31 July 2007.

FCC OET
07-TR-1005.pdf

Attachment 3

"Summary of NCTA's technical parameters for unlicensed TV band devices", *Ex Parte* filing in ET Docket No. 04-186, 10 September 2008.

NCTA 10 September
2008.pdf

Attachment 4

"Tests of ATSC 8-VSB reception performance of consumer digital television receivers available in 2005", Office of Engineering and Technology, Federal Communications Commission (USA), OET Report FCC/OET 05-TR-1017, 2 November 2005.

FCC OET
05-TR-1017.pdf

Attachment 5

"Interference rejection thresholds of consumer digital television receivers available in 2005 and 2006", Office of Engineering and Technology, Federal Communications Commission (USA), OET Report FCC/OET-07-TR-1003, 30 March 2007.

FCC OET
07-TR-1003.pdf