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North American Broadcasters Association (NABA)

COMMENTS ON THE WORKING DOCUMENT TOWARDS DRAFT CPM TEXT ON WRC-12 AGENDA ITEM 1.19

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 ITU-R Study Groups, 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. NABA supports the view that the introduction of new technologies such as Software Defined Radio (SDR) and Cognitive Radio Systems (CRS) technologies may lead to more efficient use of radio frequency spectrum. NABA, however, believes that sound technical studies and testing are the only practical ways to ensure orderly sharing of the spectrum and the establishment of effective criteria to protect all radiocommunication services.

In this context, NABA fully supports the concerns and views of the broadcasting service expressed in the draft CPM text contained in Annex 7 to Document 1B/210. NABA shares these concerns relative to the introduction of SDR and CRS technologies being utilized in bands allocated to the broadcasting service in the Radio Regulations; especially, the bands used for TV broadcasting. These concerns include:

1. Since the broadcasting service is often planned on a noise-limited basis, it may be difficult for SDR and CRS technologies to be applied in those frequency bands allocated to the broadcasting service without introducing interference.
2. Broadcast receivers are particularly vulnerable to interference from signals in adjacent, multiple adjacent, local oscillator, and image channels. Legacy broadcast receivers numbering in hundreds of millions or more throughout the world represents a major challenge for spectrum sharing without interference.
3. Although new technologies have been introduced into broadcast receivers for consumers, the economics have been such that improvements in the technical specifications have not been realized.

The following sections address each of these concerns citing specific measurement programs and studies.

1 Demonstration showing CRS technologies in the TV Bands

Since the broadcasting service is often planned on a noise-limited basis, it may be difficult for SDR and CRS technologies to be applied in those frequency bands allocated to the broadcasting service without introducing interference. This difficulty has been borne out in a measurement study performed and reported by the United States. The FCC undertook a measurement study of CRS spectrum sensing and transmitting functions 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 considered two aspects for sharing spectrum. One consideration was whether a WSD is capable of the technique to “detect and avoid” or “listen before talk” in order to avoid causing interference. This cognitive approach would use “spectrum sensing” techniques that listen for the signals of TV stations, wireless microphones and other incumbent services licensed to utilized the spectrum. Since the Broadcasting Service is a noise-limited service, the study attempted to determine whether the spectrum sensing capability of the devices should be able to detect signals lower than −116 dBm over a 6 MHz bandwidth (the minimum signal level considered for TV and wireless microphone reception). The FCC study also evaluated the potential for WSDs to interfere with TV reception and wireless microphone operations.

1.1 CRS technology fails to detect signals in the TV bands and can cause interference to TV reception

Two devices were evaluated in the study. Both devices had the capability of spectrum sensing. Only one device, however, was capable of transmitting and was used to evaluate potential interference. The FCC performed both laboratory and field testing of the devices. The conclusion reached by the FCC states:

“… the sample prototype White Space Devices submitted to the Commission for initial evaluation do not consistently sense or detect TV broadcast or wireless microphone signals. Our tests also found that the transmitter in the prototype device is capable of causing interference to TV broadcasting and wireless microphones …”

One WSD failed to meet even the WSD proponent’s −116 dBm sensing threshold by about 20 dB. The second WSD could detect the presence of an occupied DTV channel at −114 dBm. However, two-signal tests showed that the detection reliability was degraded by the introduction of a second DTV signal on a nearby channel.

The FCC also evaluated the interference potential of a WSD to over-the-air TV reception. Their tests demonstrated "that interference can occur at significant distances from a victim DTV receiver, even under favorable DTV reception conditions (i.e., received signal significantly above TOV). This was seen to be particularly true for co-channel interactions that may occur as a result of unreliable detection of occupied channels."

1.2 CRS technology unable to detect wireless microphones

Low power wireless microphones are also licensed to use the TV bands and are commonly employed at sporting and theatrical venues as well as news events. As with the DTV sensing the first WSD "was generally unable to sense wireless microphones". The performance of the second WSD "was mixed when tested in a variety of situations and conditions. This device was found to be able to sense wireless microphone signals located in the center of a TV channel in all scans at a signal level as low as −120 dBm. However, on some scans it also incorrectly indicated the presence of a microphone …"

1.3 Further sensing studies shows false detection of occupied TV channels

Further studies are continuing with four additional WSDs submitted to the FCC. Initially the testing utilized ideal laboratory conditions where measurements were made with equipment directly connected by cable to the signal source and with the WSD tuned to a single channel. However, recent tests were conducted using the antenna supplied by the manufacturer. One device, when turned on, indicated in the laboratory that all channels were occupied including 608 to 614 MHz which is allocated in the Radio Regulations to radio astronomy in Region 2. This device also indicated that seven channels were occupied when the antenna was removed and the connection terminated. This same device, when operated outdoors, indicated that all channels were occupied with the antenna connected and that 16 channels were occupied with the antenna connection terminated. Similar results have been observed for three additional WSDs including the false detection of occupied channels when the WSD was isolated within an anechoic chamber.

2 Legacy Issues must be considered in the deployment of CRS

Although cognitive radio system technologies are being proposed to facilitate sharing of the spectrum, there are some radiocommunication services that have such a large installed base of legacy equipment that it may be impossible to accommodate sharing of frequency bands without major interference and disruption of service. Broadcast receivers are particularly vulnerable to interference from signals in adjacent, multiple adjacent, local oscillator, and image channels. Legacy broadcast receivers numbering in hundreds of millions or more throughout the world represents a major challenge for spectrum sharing without interference.

Even though the United States has completed its transition to digital television on 12 June 2009, receiver specifications were not imposed which would accommodate sharing. The "Coupon Program for Digital-to-Analog Converter Boxes" funded through the National Telecommunications and Information Administration in the United States Department of Commerce did provide receiver specifications for a receiver intended for over-the-air reception. These specifications (see Attachment 2) are based on the same planning factors used to allocate TV channels throughout the United States. The installed base of converter boxes purchased through the NTIA program is 35 million. Even with the NTIA "specifications", tests by the United States Federal Communications Commission found that 11 percent of the converter boxes failed to meet the requirements for immunity from adjacent and taboo channel interference (see Attachment 3).

In view of these results, it is imperative that adequate studies and measurements be made before introducing cognitive technologies as a means to control the utilization of spectrum.

3 Improvements through new technologies may not be realized

Although new technologies are being introduced into broadcast receivers for consumers, the economics are such that improvements in the technical specifications have not been realized. As an example, the transition from “canned” tuners to “silicon” tuners has resulted in smaller and lighter devices that are more suited for mobile and handheld applications. Unfortunately, as illustrated in Document 6A/361, “Studies on the compatibility between LTE and DVB-T systems in co- and adjacent-channel configuration”, the newer technology (e.g., silicon tuners) may not provide improved performance. The document states:

Quote

... the “can tuners” have up to 4 dB better PRs (Protection Ratios) than the silicon tuners in the adjacent channels N±1. In the adjacent channels N+2 to N+8, the “can tuner” PR values are 12 dB to 28 dB better than the ones for silicon tuners. At the image frequency in channel N+9 the “can tuner” receivers have still an advantage of about 4 dB versus the silicon tuners.

Unquote.

Consequently, expectations that performance improvements will be realized through new technologies must be confirmed with test measurements and rigorous analysis before CRS technology is applied to the management of the RF spectrum.

Conclusions

1. Technical analysis and sharing studies must be completed prior to the introduction of CRS technology into radiocommunication systems. These analysis and studies must consider all ITU-R Recommendations that provide protection and planning criteria. The application of CRS technology must respect the provisions of the Radio Regulations. In addition, all Regional Agreements and associated plans and their technical basis must be considered and respected.
2. Broadcast receivers are particularly vulnerable to interference from signals in adjacent, multiple adjacent, local oscillator, and image channels. The introduction of CRS technology into the bands utilized by the broadcasting service must include studies and consideration for the installed base of legacy devices and limitations on spectrum sharing while minimizing the impact of interference.
3. The introduction of CRS technology in the bands utilized by the broadcasting service must consider a realistic transition of new technologies into broadcast devices. Although new technologies have been introduced into broadcast receivers for consumers, the economics have been such that improvements in the technical specifications have not been realized

NABA agrees with Working Party 6A that the application of CRS technologies needs to be supported by a solid guarantee, backed by detailed, independently conducted technical studies by recognized research institutions, ensuring that interference or service degradation will not occur.

Attachment 1

"Initial Evaluation of the Performance of Prototype TV-Band White Space Devices", Office of Engineering and Technology, Federal Communications Commission (USA), OET Report FCC/OET 07-TR-1006, 31 July 2007.

FCC OET
07-TR-1006.pdf

Attachment 2

"United States Code of Federal Regulations, 47 CFR 301 Technical Appendix 1, "NTIA Coupon-Eligible Converter Box (CECB) Required Minimum Performance Specifications and Features".

NTIA Converter Box
Specifications

Attachment 3

"DTV Converter Box Test Program - Results and Lessons Learned", Office of Engineering and Technology, Federal Communications Commission (USA), OET Report FCC/OET 09-TR-1003, 9 October 2009.

FCC OET
09-TR-1003

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