REPORT ON
THE EVALUATION OF INTERFERENCE
TO CBLA-FM FROM 2ND ADJACENT FM TEST STATION CARN
AND
EVALUATION OF CARN SIGNAL QUALITY

TORONTO, ONTARIO

Prepared for:

MR FITZROY GORDON
2901 Bayview Avenue
Toronto ON M2K 2Y6

Prepared by:

D.E.M. ALLEN & ASSOCIATES LTD.
130 Cree Crescent
Winnipeg, MB R3J 3W1

PROJECT #56701

JUNE 25, 2010

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1.0 Introduction:

D.E.M. Allen & Associates Ltd. has been retained by Mr Fitzroy Gordon to carry out second adjacent channel testing between a test station on 98.7 MHz in Toronto, ON and CBLA-FM on 99.1 MHz in Toronto, ON.

2.0 Background

In 2005, A. Fitzroy Gordon, OBCI (now known as Caribbean African Radio Network or CARN) made applications to Industry Canada and the Canadian Radio-television and Telecommunications Commission (CRTC) for permission to establish a new FM broadcasting station in Toronto, ON.

In Broadcasting Decision CRTC 2006-135, CARN was approved in part by the CRTC, conditional upon submission of an application proposing the use of an FM frequency and technical parameters acceptable to the CRTC and Industry Canada.

The Honourable Tony Clement, P.C., M.P., Minister of Industry, wrote a letter dated June 17, 2009, to CARN informing of his decision that experimental authorization could be issued to CARN to allow testing on the proposed frequency of 98.7 MHz. Mr. Clement indicated that the objective of the authorization "is to allow CARN to conduct tests that will assess the quality of service to your targeted audience while at the same time not causing objectionable interference to incumbent stations."

Hahn Broadcast Engineering prepared and submitted to Industry Canada a Technical Brief dated March 2, 2010 for a new FM station on Channel 254B1 (98.7 MHz) operating at a maximum ERP of 1 kW (H&V) and average ERP of 0.446 kW, and an EHAAT of 276.8 metres. This document is hereafter referred to as the CARN Technical Brief and the station proposed in the Brief is referred to as CARN.

D.E.M. Allen & Associates Ltd. Prepared a Test Plan dated March 8, 2010 Project # 56701 that was also submitted to Industry Canada. This document is hereafter referred to as the Test Plan.

2.0 Background: (Cont'd.)

On March 23, 2010, Industry Canada (IC File 6206-8495) provided authority for testing of the facility proposed in the Hahn Brief dated March 2, 2010.

CARN has constructed the facility detailed in the Hahn Engineering Brief.

On May 11, 2010 CARN received authority from Industry Canada to commence testing for a three week period starting on May 31, 2010. Testing of the CARN facility began at approximately 10:00 a.m. on May 31, 2010 as authorized. Industry Canada was present for the start of testing and carried out the normal testing for IMP's and spurious emissions. Industry Canada reported that no problems with the CARN facility were found.

D.E.M. Allen & Associates Ltd. carried out testing in accordance with the Test Plan over the period of May 31 to June 7, 2010. This report provides the results of the testing.

Because the Test Plan provided specific details on the testing and the reasoning behind the methodology of testing, this information is not repeated in this report.

3.0 Discussion:

3.1 Intent and Goals of Testing

The goal of the testing is twofold. The first goal is to determine if CBLA-FM receives objectionable interference from the CARN FM station. The second goal is to determine if the proposed CARN station can serve its intended audience in the Toronto region.

These tests are not intended to be a set of tests on the feasibility of second adjacent channel FM stations in general, but are intended to be a set of tests that are applicable to this specific case.

3.2 Industry Canada Rules on Second Adjacent FM Stations

Industry Canada's second adjacent channel protection rules and ratios included in Broadcasting Procedures and Rules Part 3 (BPR-3) do not allow a station to be implemented within the protected contour of a second adjacent channel incumbent station. The present rules require that a proposed new second adjacent channel station be located outside the protected contour of the incumbent station. Therefore, the proposed CARN station does not meet Industry Canada's rules and is technically short spaced to CBLA-FM.

3.0 Discussion:

3.2 Industry Canada Rules on Second Adjacent FM Stations (Cont'd.)

Industry Canada has no specific rules for assessing interference for the case of co-sited second adjacent channel FM stations. It should be noted that the -26 dB D/UD protection ratio listed in BPR-3 for second adjacent channel stations was developed for the purposes of providing protection to a radio receiver located at the 54 dBu protected contour. Receiver tests have shown that for most receivers, increasing the desired signal level reduces the radio's ability to reject a second adjacent channel frequency.

3.3 CBC's Involvement and Participation in Testing

The Test Plan proposed the participation of the CBC in the testing. The CBC was unable to participate in the testing over the week of May 31 to June 7. The Test Plan also requested that the CBC provide results of past testing related to the use of 98.7 MHz. In a conference call on June 1 2010, the CBC stated that any results of prior tests on 98.7 MHz are the property of the CBC and would not be released.

3.4 98.7 MHz Transmitting Facility

The 98.7 MHz transmitting facility was constructed as per the CARN Technical Brief. In general, the facility was constructed with the intent of becoming the permanent transmitting facility of CARN, and as such, the construction, installation and installed equipment were of a high standard. The CARN transmitting facility included redundant transmitters, modern processing equipment, and full remote control of the site.

The audio during the test period consisted primarily of music with spoken word announcements. The test audio material was stored on an IPod and fed in to the system. CARN audio modulation levels were set for a maximum deviation of +/- 75 kHz. During testing, the transmitter was operated at the power listed in the CARN Technical Brief.

3.0 Discussion: (Con't.d)

3.5 Comments on CBC and CARN Facilities

The CARN site was built at First Canadian Place in Downtown Toronto and as such is co-sited with CBLA-FM. A comparison of the two facilities is as follows

	CBLA-FM	**CARN**
Frequency	99.1 MHz	98.7 MHz
Channel / Class	256C1	254B1
Antenna	Directional	Directional
Antenna Polarization	Circular	Circular
Transmitter Coordinates	43-38-56 N 79-22-54 W	43-38-56 N 79-22-54 W
Mode of Operation	Mono	Stereo
Maximum ERP	98 kW	1 kW
EHAAT	303.7 m	276.8 m

CARN and CBLA-FM are located on separate towers on the rooftop of First Canadian Place but their proximity is such that they are essentially co-located.

Both CBLA and CARN operate with circular polarization. The directional radiation patterns are very similar.

In general CBLA-FM's signal was very robust throughout the test area. This is attributable to the fact that CBLA-FM is mono and is therefore less prone to multipath distortion, and the test points were largely within the CBLA-FM 3 mV/m contour. Furthermore, CBLA-FM uses conservative modulation levels, and in general has a very "clean" sound consisting mostly of spoken word. This proved to be helpful to the listening tests as it was felt that any interference to CBLA-FM would be more noticeable than if the station had highly processed audio that might mask adjacent channel distortion. Furthermore, the CBLA-FM mono operation reduced the amount of multipath interference on CBLA-FM and contributed to the clean CBLA-FM signal.

4.0 Testing and Results:

4.1 General

The tests were carried out as per the Test Plan with only minor differences as detailed in this section.

4.2 Mobile Field Strength Measurements

4.2.1 Discussion

Mobile field strength measurements were taken for the following reasons:

- Compare the measured coverage of CARN to the coverage estimated in the Technical Brief filed with Industry Canada.

- Determine the D/UD ratio of the field strength of CBLA-FM to the field strength of CARN. While the measured ratios of the field strength are not a direct indicator of interference, they can be compared to the measured performance of receivers. Furthermore, the ratio of field strengths between two stations (and hence the D/UD) is not consistent over a large urban area and the measured levels provides an indication of the variability of the D/UD over the area.

All measurements were taken using the Audemat-Aztec FM-MC4 FM field strength meter, serial number 00140. This meter is capable of measuring up to 99 stations simultaneously by using a calibrated receiver and antenna. The meter records a GPS position and determines the field strength at each measurement point, in dBuV/m, for all the programmed stations.

The Audemat-Aztec FM-MC4 mobile field strength meter was set up in a vehicle. The receiving antenna and GPS antenna were placed on the roof of the vehicle. The receiving antenna was set at a vertical position and was at a height of 2.0 m above ground level. A laptop computer was connected to the Audemat Aztec meter to record the geographical coordinates and the field strength measurements. The mobile field strength measurements were taken over the span of approximately three days.

Mobile measurements were carried out using the Audemat-Aztec measuring equipment and software by programming in the desired frequencies. A field strength measurement was programmed to be taken every 15 seconds while driving along the routes. At a speed of 50 kilometres/hour, a measurement was taken at a spacing of approximately 210 metres along the road. At a speed of 100 kilometres/hour, a measurement of every station was taken at a spacing of approximately 417 metres along the road.

4.0 Testing and Results:

4.2 Mobile Field Strength Measurements

4.2.1 Discussion (Cont'd.)

The following frequencies were measured:

Station	Frequency	Comment
CHFI-FM	98.1 MHz	CHFI-FM is third Adjacent Channel to CARN
CARN	98.7 MHz	CARN
N/A	98.9 MHz	Lower First Adjacent Channel to CBLA-FM
CBLA-FM	99.1 MHz	CBLA-FM CBC Radio One English Service
N/A	99.3 MHz	Upper First Adjacent Channel to CBLA-FM

Mobile field strength measurements were carried out throughout and slightly beyond the CARN estimated 54 dBu contour shown in the CARN Technical Brief.

Figures 1 and 2 are maps of the measured CARN field strengths at 2.0 metres above ground.

Figures 3 and 4 are maps of the measured CBLA-FM field strengths at 2.0 metres above ground.

Figures 5 and 6 are maps of the ratio (in dB) of the CBLA/CARN measured field strengths at 2.0 metres above ground.

4.2.2 Comparison of Measured CARN Field Strengths to Theoretical 54 dBu Service Contour

The CARN field strengths measured at a height at 2.0 metres AGL are hereafter referred to as the measured field strengths. The 54 dBu service contour shown in the Technical Brief and estimated at a height of 9.1 metres determined using the HAAT's, ERP's and F(50,50) curves is hereafter referred to as the theoretical contour.

The measured field strengths in the vicinity of the theoretical contour are lower than 54 dBu mostly because of the difference in height between the theoretical contour and the measured field strengths.

The program CRC Predict 2.08v2 was used to estimate the difference between the field strength at 2 metres above ground and the field strength at 9.1 metres above ground at six locations along the CARN theoretical contour. This height factor varied between 7 and 15 dB depending on the location. Adding a height factor to the measured field strength shows that the height-factored measured field strengths correspond within reasonable and practical limits to the theoretical contour shown in the Technical Brief.

4.0 Testing and Results: (Cont'd.)

4.2.3 Results of CBLA to CARN Comparative Field Strengths

Comparative mobile field strength measurements were taken at approximately 3319 locations.

The average D/UD (CBLA-FM / CARN) ratio of all the mobile field strength measurements was approximately 23 dB. The variations in the measured D/UD ratios throughout the measurement area are listed in the following table:

D/UD CBLA-FM/CARN (dB)	Number of Measurement Locations	% of Measurement Locations
< 13	281	8.5%
>= 13 & < 20	709	21.4%
>= 20 & < 26	1142	34.4%
>= 26 & < 32	856	25.8%
>= 32	331	10.0%
Total	3319	100%

Out of the 3319 locations measured, 9 isolated measurement points had a D/UD ratio of less than 0 dB, meaning that the CARN field strength was higher than the field strength of CBLA-FM at those points.

FM receiver tests were carried out by Industry Canada in 2001 and 2002 and test results were summarized in a paper prepared by Wayne A. Stacey dated June 3, 2002 and submitted to a BTAC Sub-committee for the Broadcasting Technical Advisory Committee. These tests showed that for situations with a single second adjacent channel interfering station, that the threshold to second adjacent interference depends upon the receiver under test, and the level of the incoming desired signal. The receivers were broadly categorized according to cost and type. The median thresholds for each receiver category were calculated for three different incoming signal levels. These median D/UD thresholds varied from -11 dB to -63 dB.

Given that:

- The average measured D/UD ratio of CBLA/CARN throughout the measurement area is 23 dB;
- The measured D/UD at 99.73% of the locations was above 0 dB;
- 0 dB D/UD is still 11 dB above the poorest median second adjacent interference threshold noted in the receiver tests.

4.0 Testing and Results:

4.2.3 Results of CBLA to CARN Comparative Field Strengths

Therefore, the CBLA/CARN D/UD field intensity ratios measured throughout the Toronto area are well above the median values of second adjacent channel threshold as measured during Industry Canada's receiver performance measurements referenced above.

This demonstrates that the CBLA/CARN D/UD levels measured in the CARN theoretical service contour are unlikely to cause second adjacent channel interference to CBLA.

4.3 Mobile Listening Tests

4.3.1 Discussion

The mobile field strength measurements provided an opportunity to carry out listening tests on both CBLA-FM and CARN over a large area. These mobile listening tests were carried out on a car radio while taking the mobile field strength measurements.

Using Industry Canada's methods and procedures, the CARN Technical Brief predicts large areas of co-channel and first adjacent channel interference to CARN. It was felt that a car radio's high sensitivity, good audio quality, and its use of an external antenna, make it a good indicator of co-channel interference.

A present day car radio typically has very good adjacent channel rejection and of all available consumer radios is the least likely to receive adjacent channel interference.

These tests are not formally documented but the results of the mobile listening tests and the fixed listening tests were used to derive the estimated co-channel interference area to CARN.

It is well known that propagation characteristics in the Toronto area vary depending upon the season and the weather conditions. It is fully expected that interference will vary throughout the year. The listening tests were carried out during periods of very warm weather when some of these conditions are known to occur. Long term monitoring would be the only way to characterize the interference to CARN under all conditions.

4.0 Testing and Results: (Cont'd.)

4.3.2 Results of Mobile Listening Tests

Based on the mobile listening tests (as well as the fixed location listening tests), the areas of co-channel interference to CARN are substantially less than predicted in the Technical Brief. The areas of co-channel interference as determined by the listening tests are shown on Figure 10. The areas where co-channel interference to CARN exceeding 3 on the ITU scale (slightly annoying) are shaded.

No adjacent channel interference to CARN was noted in the mobile listening tests.

It can be concluded that over the time of the test period, the co-channel interference to CARN was found to be substantially less than that predicted in the Technical Brief.

4.4 Fixed Listening Tests

4.4.1 Discussion

Fixed listening tests were carried out at approximately 100 locations over the period of May 31 to June 7 using the methodology established in the Test Plan. Tests were carried out by two persons for the first four days and by one person for the last three days.

The locations of the fixed listening tests are shown in Figures 7, 8 and 9.

Listening tests included the use of the following radios:

- Radio in Kia Sorento rental vehicle digitally tuned with outside antenna (no model number on radio)**
- Sony Model ICF-C218 analog tuned clock radio**
- Tivoli SongBook digitally tuned tabletop alarm clock radio **
- RCA MC4304BK FM radio / MP3 player with earphones**
- Realistic Model 12-636 analog tuned small portable radio**
- A variety of display radios located in retail stores
- Miscellaneous radios were borrowed and used at several points. These listening tests are not formally documented in this report.

** Radios used at the majority of locations

A table of the results of the fixed listening tests are attached to this report in Appendix 1.

4.0 Testing and Results:

4.4 Fixed Listening Tests

4.4.1 Discussion (Cont;d.)

A portion of the FM band was scanned using the Audemat Aztec at locations where an outdoor listening test was carried out. These band scans are included in Appendix 2.

Listening tests on CARN and CBLA-FM were also carried out on a number of radios in at least five retail stores. These retail stores were in malls which characteristically have high RF noise levels and significant attenuation through the building structure. These listening tests were not formally documented in this report but the results contributed to the conclusions in this report.

Listening tests were made at a variety of locations, including in-car, out of car, in public and private buildings (shopping malls, hotels, office buildings, restaurants, an arena, a library), etc. The listening tests had few tests in private residences due to the difficulty and time consuming nature of coordinating and obtaining permission to enter a private residence. However; it is felt that the tests as carried out are sufficient to establish the conclusions in this report.

In some locations of high background acoustic noise, headphones were used with those radios that have a headphone jack to reduce the background noise and to take advantage of the improved audio quality of the headphones.

The fact that the listening tests were primarily within the 3 mV/m of CBLA-FM, CBLA operates in mono, and CBLA has very “clean” audio with large “talk” content resulted in a situation where it was felt that any audible interference to CBLA would be very evident.

At several fixed locations where artifacts or high background noise were heard in CBLA’s audio, the CARN transmitter was shut off to determine if CARN was causing any interference to CBLA-FM. In no instances did these artifacts or background change when CARN was taken off the air and then turned on again.

4.0 Testing and Results:

4.4 Fixed Listening Tests (Cont'd.)

4.4.2 Results and Conclusions of Listening Tests

Interference from CARN to CBLA-FM

No second adjacent channel interference was detected from CARN to CBLA-FM at any of the listening point locations using the receivers listed in this report. It is our opinion that the receivers used, and the locations selected, are sufficient to demonstrate that a station operating at the parameters of the CARN test station will not cause second adjacent channel interference to CBLA-FM.

Interference from CARN to CHFI-FM

No third adjacent channel interference from CARN to CHFI-FM was detected at any of the listening point locations using the receivers listed in this report. It is our opinion that the receivers used, and the locations selected, are sufficient to demonstrate that a station operating at the parameters of the CARN test station will not cause third adjacent channel interference to CHFI-FM.

Interference to CARN from CBLA-FM

The following was noted from the listening tests on CARN:

Tuning in CARN on a low cost analog tuned radio was difficult and in many locations simply not possible due to the second adjacent CBLA-FM and to a lesser extent the third adjacent CHFI. Given that the persons carrying out the tests had difficulty tuning in CARN it is assumed the average consumer would most certainly have difficulty. Many factors may be the cause of this situation, and the analysis and identification of the factors is not of importance to this study. Within its coverage area, the CARN signal may not be receivable on certain radios, and in particular low quality analog tuned radios.

Except for the interference areas shown on Figure 10, it was possible to tune CARN in and listen to CARN on the high quality Tivoli radio assuming field strengths were sufficient, and background RF noise was not excessive**. This means that listeners outside the identified interference areas who want to hear CARN and are willing to invest in a quality radio will be able to hear the station within the coverage area.

** Even the high quality radio had difficulty tuning in a reliable CARN signal in very shadow limited areas or in some indoor locations with high background RF noise. This is normal to all FM stations and is not unique to the CARN case.

5.0 Conclusions:

No second adjacent channel interference was detected from CARN to CBLA-FM at any of the listening point locations using the receivers listed in this report. The receivers used for the tests, and the locations selected, are sufficient to demonstrate that a station operating at the parameters of the CARN test station does not cause second adjacent channel interference to CBLA-FM.

Over the time of the test period, the co-channel interference to CARN was found to be substantially less than that predicted in the Technical Brief. Measurements show that the 54 dBu contour of CARN is within practical limits, equal to that estimated in the Technical Brief. This results in the coverage of CARN being, in general, better than that estimated in the Technical Brief.

Listeners using low quality and / or analog tuned radios may not be able to receive CARN within the interference free areas in the CARN 54 dBu due to the comparatively strong second adjacent channel station CBLA-FM. However, the second adjacent effects of CBLA are not problematic on a higher quality radio.

6.0 Signatures and Seal:

The undersigned is responsible for the preparation of this Report. Robert Kowalchuk, C.E.T. assisted in carrying out the field measurements and listening tests. Wojciech Kobylinski, P. Eng assisted in the preparation of maps for this report. The qualifications of K.A. Pelser, who is responsible for this submission, are known to Industry Canada, Ottawa.

K.A. Pelser, P. Eng.
Member of the Canadian
Association of Broadcast Consultants