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Spectrum and Telecommunications Management

Broadcasting Procedures and Rules

Part 5:
Application Procedures and Rules for Digital Radio Broadcasting (DRB) Undertakings

Contains the following amendments:

Canada

Aussi disponible en français - RPR, partie 5

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SECTION A - INTERNATIONAL AGREEMENTS

A-1 INTERNATIONAL COORDINATION — ITU RESOLUTION NO. 528 (WARC-92)

The frequency band 1452-1492 MHz was allocated at WARC-92 to the Broadcasting Service and the Broadcasting Satellite Service, limited to digital audio broadcasting, on a primary basis worldwide (except the USA) and subject to the provisions of **Resolution 528** (WARC-92). However, this frequency band is also allocated internationally to other services, notably:

- Fixed
- Mobile

Resolution 528, *inter-alia*, resolves that a competent conference be held for planning the broadcasting-satellite service (sound) and the development of procedures for the coordinated use of the broadcasting service in this band. In the interim period, the terrestrial DRB service may be introduced subject to coordination with administrations whose services may be affected. Such coordination will be carried out in accordance with relevant ITU-R Recommendations as agreed to by administrations concerned as a result of **Resolution 703** (Rev. WARC-92) or otherwise.

A-2 BILATERAL COORDINATION WITH THE USA

The 1452-1492 MHz band is allocated within the USA to the Fixed Service and the Mobile Service on a primary basis. This band is being used by Mobile Aeronautical Telemetry (MAT) systems at various locations within the USA for the monitoring and control of vehicles undergoing flight testing. According to ITU **Resolution 528** (WARC-92), it will be necessary to coordinate between assignments in the Broadcasting (DRB) Service and existing or planned MAT systems. Bilateral discussions are underway to determine criteria and procedures for coordination between assignments in the DRB Service and MAT systems.

SECTION B - DIGITAL RADIO BROADCASTING (DRB) - GENERAL

DRB ensembles operate according to the Eureka 147 (DAB) system specifications of the European Telecommunications Standards Institute (ETSI) ETS 300 401. The Eureka system uses digital techniques to remove redundancy and perceptually irrelevant information from the audio source signal, then it applies closely-controlled redundancy to the transmitted signal for error correction. Efficient spectrum utilization is achieved by interleaving multiple programme signals and by permitting a special feature of frequency re-use.

B-1 DEFINITIONS

B-1.1 Allocation

The International Telecommunications Union (ITU) uses the word 'allocation' in reference to the provision of a frequency band for a particular service.

B-1.2 Allotment

An 'allotment' is the provision of a specific channel for a Digital Service Area (DSA), as defined in the allotment plan. A list of current DRB allotments is published by the Department in the *Allotment Plan for Digital Radio Broadcasting*.

B-1.3 Ensemble

A Digital Radio Broadcasting (DRB) ensemble is a network of co-channel transmitters which transmits a common multiplex (i.e. carries a distinct group of programmes and ancillary services).

B-1.4 Assignment

An 'assignment' is the authorized use of an allotment by a DRB ensemble.

B-1.5 Groups

A group is a set of up to five broadcasting programmes plus ancillary services, sharing the same channel in a DRB ensemble.

B-1.6 Digital Service Area (DSA)

The Digital Service Area (DSA), which is defined for each DRB allotment, represents the geographical area within which DRB service is intended to be provided. The DSA is derived from the coverage areas of the AM and/or FM undertakings comprising the group.

B-1.7 Coverage

Coverage is the area delimited by the contour(s) at which DRB reception is predicted for a specified percentage of locations and time. The Allotment Plan used as a coverage objective mobile reception to 90% of locations for 90% of time based on a minimum usable signal strength (i.e. reception threshold) of 44 dBμV/m.

B-1.8 Frequency Re-Use Contour (FRC)

The Frequency Re-Use Contour(s) (FRC) of a DSA defines the area within which unacceptable level of interference would occur to another DSA if assigned the same channel (i.e. co-channel assignment). The FRC contours are based on a field strength of 42 dBμV/m to be exceeded for 10% of locations for 10% of the time.

B-1.9 Channels

The plan provides 23 DRB channels in the 40 MHz of available spectrum with a nominal channel bandwidth of 1.536 MHz and a basic data rate of 2,304 Kbits/sec. This channelization raster results in an inter-channel guard band of 208 kHz and a guard band at the edges of 48 kHz. It should be noted that a DRB channel can accommodate up to five broadcasting services plus ancillary services. A list is presented in **Table 1**.

TABLE 1

DRB Centre Channel Frequencies
(1,452-1,492 MHz)

Channel No.	Centre Frequency (MHz)	Channel No.	Centre Frequency (MHz)
1	1452.816	13	1473.744
2	1454.56	14	1475.488
3	1456.304	15	1477.232
4	1458.048	16	1478.976
5	1459.792	17	1480.72
6	1461.536	18	1482.464
7	1463.28	19	1484.208
8	1465.024	20	1485.952
9	1466.768	21	1487.696
10	1468.512	22	1489.44

11	**1470.256**	**23**	**1491.184**
12	**1472**		

B-1.10 Transmitter Characteristics

An ensemble can comprise a single transmitter or multiple co-channel transmitters deployed in a fashion to achieve the desirable coverage. The multiple co-channel transmitters can comprise a mix of synchronous transmitters operating as a Single Frequency Network (SFN) and non-synchronous transmitters operating as gap fillers and coverage extenders. Transmitters shall be identified as originating transmitters or repeaters.

B-1.11 Effective Isotropic Radiated Power (EIRP)

The Effective Isotropic Radiated Power (EIRP) is the product of the transmitter output power, the transmission line (and combiner) efficiency and the maximum power gain of the antenna relative to an isotropic radiator.

B-1.12 Gap Filler

A DRB gap filler is a repeater (non-synchronous co-channel) designed to provide coverage within holes in the coverage area.

B-1.13 Coverage Extender

A DRB coverage extender is a repeater (non-synchronous co-channel) designed to extend coverage beyond the edge of coverage of the originating transmitters.

B-1.14 Single Frequency Network

A Single Frequency Network (SFN) is a network of co-channel synchronous transmitters designed to achieve a large coverage area. However, a separate distribution network is required to feed the programming to each of the synchronous transmitters in the network.

B-2 ALLOTMENT PRINCIPLES

To the extent possible, the following principles were taken into account in the development of the *Allotment Plan for Digital Radio Broadcasting*.

- DRB to be introduced as a replacement service to AM and FM services;

- for FM undertakings, the plan to accommodate DRB facilities which will provide for replacement of their existing coverage and have the potential to expand to the highest class of FM undertaking in the community;

- for wide-coverage AM undertakings, the plan to accommodate stereophonic DRB facilities equivalent to the highest Class of FM undertaking in the community. For limited coverage AM undertakings, the plan to permit replacement of existing coverage, with potential to expand to the highest class FM undertaking in the community;

- provision to be made for additional DRB services;

- provision to be made for ancillary services;

- provision to be made for a satellite component.

B-3 CHANGES TO THE DRB ALLOTMENT PLAN

The current allotment plan may be amended in the future as technology evolves and experience is gained in the implementation.

B-4 PROTECTION OF FIXED SERVICES [1]

The 1,452-1,492 MHz frequency band is presently used by fixed services. DRB ensemble channel allotments were planned to minimize interference to existing in-band fixed services. In order to evaluate the interference from a DRB ensemble into fixed systems, the channel emission mask of **Fig. 1**, **Appendix 5** was adopted.

[1] The coordination guidelines are in development.

SECTION C - PREPARATION OF TECHNICAL SUBMISSIONS SUPPORTING APPLICATIONS FOR DIGITAL RADIO BROADCASTING (DRB) ENSEMBLES

C-1 APPLICATION REQUIREMENTS

C-1.1 Application or Notification

C- 1.1.1 An application is required for:

(a) the construction of a new DRB ensemble,

(b) modification to an existing ensemble that impacts on its coverage such as the addition of transmitters, changes to EIRP, antenna height or antenna pattern.

C- 1.1.2 The holder of a Broadcasting Certificate for a DRB ensemble shall notify the Department of each addition of programmes/ancillary services to an existing ensemble.

C-1.2 Forms and Documents

C-1.2.1 A complete technical submission shall include the following:

(a) Two copies of the appropriate **Form IC-2646** or **IC-2647.** An application for a Broadcasting Certificate for a new DRB ensemble shall be made on departmental **Form IC-2646** ***"Application for a Broadcasting Certificate Digital Radio (DRB) - New Undertaking."*** An application for changes to an existing ensemble requires the submission of **Form IC-2647** ***"Application for a Broadcasting Certificate Digital Radio (DRB) - Change of Facilities."***

(b) Two copies of the departmental **Form IC-2374** ***"Notice of Retention of Broadcasting Engineering Consultant"*** (refer to **BPR-1, Section 1.2**).

(c) One copy of the departmental **Form IC-2586** ***"Preliminary Environmental Information, Municipal/Land-Use Consultation and Aeronautical Site Clearance Attestation"*** reproduced in **BPR-1, Appendix 3**.

(d) One copy of Transport Canada **Form 26-0427** ***"Aeronautical Obstruction Clearance Form."***

(e) Five copies of an engineering brief in suitable loose-leaf binders with identifying labels. The brief shall include all the detailed technical information as outlined in **Section C-2**.

(f) Reproducible copy of maps showing the estimated coverage contours, frequency re-use contours and, where applicable, maps of comparative contours for change of facilities.

C-1.2.2 All necessary forms may be obtained from any departmental regional office (Vancouver, Winnipeg, Toronto, Montreal, Moncton) or from departmental headquarters in Ottawa. All addresses are provided in **Appendix 1** of **BPR-1**. Also, applicants may obtain forms and submit applications at any local office of the Department.

C-2 ENGINEERING BRIEF

The order of material presented in the engineering brief shall be maintained as listed below to simplify processing in the Department. The metric system known as SI (Système International) shall be used throughout the engineering brief.

C-2.1 Title Page

The title page shall include the submission title, project or reference number, date, name and address of the applicant, name of the consultant.

C-2.2 Table of Contents

The table of contents shall cross-reference pages and sections of the brief.

C-2.3 Summary Sheet

A summary sheet as per **Appendix 1** shall be prepared for each proposed transmitter site and each antenna on that site.

C-2.4 Main Section of Brief

C-2.4.1 Introduction - A general statement shall address the purpose of the brief in relation to the application, including the principal centre(s) to be served, and the design considerations to accomplish the applicant's objectives.

C-2.4.2 Sources of Information - List sources of information used in compiling the engineering brief.

C-2.4.3 Transmitters - Specify make, type and output power. For the purposes of this provisional procedure, a TAC (Technical Acceptance Certificate) is not required.

C-2.4.4 Description of Antenna System - The following details are required:

Antenna - Manufacturer, type, number of sections (if applicable), power gain, vertical and horizontal radiation patterns.

Transmission Line - Manufacturer, type, length in metres and efficiency.

Combiner - Name of manufacturer and operational characteristics, including return loss and loss.

Polarization - Only vertical polarization shall be employed.

C-2.4.5 Radiated Emissions - Radiated emissions shall meet the mask in **Figure 1** of **Appendix 2.**

Note: *The emission mask specified herein is an interim mask pending the completion of studies on emission mask requirements. If the results of these studies indicate a need to tighten the limits of the emission mask then, if necessary, existing licensees will be required to take the necessary steps to meet the amended emission mask.*

C-2.4.6 Determination of coverage - The applicant shall provide an estimate of proposed coverage according to the method described in **Appendix 3**.

C-2.4.7 Frequency Re-Use Contours (FRC) - The applicant shall prepare this analysis according to the method described in **Appendix 4**.

C-2.4.8 Special Analysis and Commitments Relative to Interference to Other Broadcasting Undertakings - Analysis shall be submitted with appropriate commitments made in regard to all potential interference situations with other broadcasting undertakings as a result of the operation of the proposed DRB facility. The following are some examples of interference possibilities with other broadcasting services which shall be explored for each proposal:

(a) Ghost reflections of television signals from the new DRB antenna structure (refer to **BPR-4, Section C-7**);

(b) Distortion of AM radiation patterns by the new DRB tower located in the vicinity of an AM antenna array.

C-2.4.9 RF Exposure Analysis - The applicant shall provide a RF exposure analysis (refer to **BPR-1, Section 8.2**).

C-2.4.10 Environmental Assessment - The applicant shall comply with the requirements of the environmental assessment procedure of **BPR-1, Section 8.1**.

C-2.4.11 Notification to Municipalities/Land-Use Authorities - The applicant shall notify the municipalities/land-use authorities as per **Section C-3**. The applicant shall submit a completed copy of the ***"Preliminary Environmental Information, Municipal/Land-Use Consultation and Aeronautical Site Clearance Attestation"*** reproduced in **BPR-1, Appendix 3.** The applicant shall also submit a

completed copy of Transport Canada **Form 26-0427 *"Aeronautical Obstruction Clearance Form."***

C-2.5 Diagrams

An elevation diagram of each structure and transmitting antenna as per **Figure 1** of **Appendix 1** and a block diagram of major components of the transmitting system are to be included in the engineering brief.

C-2.6 Radiation Patterns

C-2.6.1 Radiation Patterns - Horizontal and vertical radiation patterns shall be submitted for each antenna in the ensemble.

C-2.6.2 Radiation Patterns Data - For each antenna, the applicant shall provide vertical and horizontal pattern data in the following formats.

(a) Hard copy (plots) and,

(b) Electronic format (ASCII comma delimited).

For the vertical and horizontal patterns, data shall be taken relative to maximum gain (boresight). For the vertical and horizontal pattern, a sufficient number of points shall be selected to provide an accuracy of ±0.5 dB in the main beam of the antenna (0 to -10 dB range from maximum) and an accuracy of 1 dB in all other directions.

An electronic file must be prepared for each panel of the antenna system. The file shall contains two sections. The first specifies the horizontal pattern. The second section, which begins with the string VERTICAL_PATTERN, specifies the vertical pattern. The first line of each section gives the number of data pairs (azimuth, gain) describing the pattern. The azimuth relative to the boresight must cover the full range of azimuths. The elevation angle relative to the boresight must cover the range from 0^0 to 90^0 (assuming a symmetrical pattern in the 0^0 to -90^0 range). The gain for each panel is specified in dB relative to maximum (i.e. boresight) gain. An example of antenna pattern file is presented in **Table 2**.

While in the example, degree increments are evenly spaced at 10^0, this need not be the case. Both the degree and dBi values can be up to four decimals.

TABLE 2

Example of antenna pattern file

```
18
0,     0
20,   0
40,   0
60,   -0.5
80,   -4
100, -15
120, -20
140, -35
160, -35
180, -35
200, -35
220, -35
240, -20
260, -15
280, -4
300, -0.5
320, 0
340, 0
VERTICAL_PATTERN
10
0,    0
10, -2
20, -2
30, -2
40, -3
50, -5
60, -15
70, -15
80, -15
90, -15
```

C-2.6.3 Antenna Boresight Azimuth - Antenna boresight azimuth shall be indicated in degrees clockwise from North.

C-2.6.4 Beam Tilt - Beam tilt shall be indicated in degrees below (positive) or above (negative) horizontal plane. The horizontal plane may be different from the visual horizon.

C-2.7 Maps

C-2.7.1 The applicant shall provide map(s) (scale 1:50,000) locating each proposed antenna site with geographical co-ordinates (latitude and longitude).

C-2.7.2 The following maps shall be provided in hard copy and MapInfo MID/MIF electronic file format.

(a) a map showing the proposed coverage area;

(b) a comparative map showing the reference FRC as per the Allotment Plan vs the proposed/revised FRC;

(c) a comparative map showing the reference DSA as per the Allotment Plan vs the proposed/revised coverage area;

(d) a comparative map showing the proposed coverage vs the already authorized analog coverage and the proposed/revised DSA, if applicable.

For the purpose of this procedure, proposed DSA or FRC's that exceed the reference published in the Allotment Plan are called revised DSA's or FRC's.

C-3 NOTIFICATION TO MUNICIPALITIES/LAND-USE AUTHORITIES

C-3.1 An applicant for a new DRB ensemble or for changes to an existing ensemble shall submit a notice to the local municipality(ies) where transmitters are located stating his or her intention to operate a DRB ensemble in the area. The purpose of this notice is to provide the municipal authority with an opportunity to consider the implication of the proposed antenna structure and site. The municipal authority may file a written objection to the proposed facilities with the appropriate departmental district office. The applicant and the municipal authority shall resolve all municipal problems and objections. Failing this, the Department will consider all factors pertaining to the application, as well as the municipal comments, and render a final decision.

C-3.2 The notice shall include the following information:

(a) a statement to indicate that a DRB ensemble is planned for the municipality and that, if approved, the operation of the ensemble would be subject to federal regulations for which a broadcasting licence from the CRTC and a broadcasting certificate from the Department are required;

(b) a map showing each transmitter site.

C-3.3 The notice is to be filed with each municipal authority with sufficient lead time to permit it to consider the impact of the proposal. Insufficient lead time could delay the processing of the application by the Department and may also cause the CRTC to reschedule this item for a later Public Hearing. A copy of the **"*Preliminary Environmental Information, Municipal/Land-Use Consultation and Aeronautical Site Clearance* Attestation",** reproduced in **BPR-1, Appendix 3** is to be filed with the Department's headquarters office.

A copy of Transport Canada **Form 26-0427 *"Aeronautical Obstruction Clearance Form"*** is also to be filed with the Department's headquarters office.

C-4 ON-AIR TESTING PROCEDURES

C-4.1 When the construction of the authorized facilities is complete, notice of on-air testing shall be given to the Director, Broadcasting Application Engineering at least three weeks (unless otherwise specified in the letter of authority) prior to transmission tests, with a copy to the pertinent district office. Departmental permission from the Director, Broadcasting Application Engineering is required for testing.

C-4.2 The required scope and duration of such on-air emission tests will depend to a large extent on the potential for interference that might be caused to existing broadcasting undertakings or other radio services. Such details of the testing shall be agreed upon with the Director, Broadcasting Application Engineering shortly before on-air testing begins.

C-4.3 Following successful on-air tests, the applicant's consultant shall certify to the Department that the T-DRB ensemble is ready to commence operation in accordance with the approved technical submission and request permission to commence normal broadcasting schedule.

C-5 POLICY ON PROVIDING NON-BROADCASTING SERVICES

The applicant wishing to use a DRB installation to provide non-broadcasting services should consult the following documents for guidance:

- Spectrum Policy **SP-1452** entitled ***"Spectrum Policy Provisions to Permit the Use of Digital Radio Broadcasting Installations to Provide Non-Broadcasting Services"***, dated September 26, 1997, and available at http://strategis.ic.gc.ca/spectrum.

- Public Notice CRTC **1995-184** entitled ***"A Policy to Govern the Introduction of Digital Radio"*** published on October 29, 1995, and available at http://www.crtc.gc.ca/.

- Client Procedures Circular **CPC-2-1-03** entitled ***"Licensing Radiocommunication Systems Using FM Subsidiary Communication Multiplex Operation (FM/SCMO) or Digital Radio Broadcasting (DRB) Installations"*** published on December 27, 1997, and available at http://strategis.ic.gc.ca/spectrum.

APPENDIX 1

SUMMARY SHEETS

IF USING MULTIPLE PANELS, PLEASE PREPARE ONE SUMMARY PER PANEL

APPLICANT:_____

ENSEMBLE **NEW** ☐ **CHANGE** ☐

ENSEMBLE LOCATION:_____

ALLOTMENT PLAN IDENTIFICATION:_____
(According to *Allotment Plan for Digital Radio Broadcasting*)

CHANNEL NUMBER:_____

ORIGINATING TRANSMITTER ☐ **REPEATER** ☐

NAME OF TRANSMITTER/REPEATER LOCATION:

_____

FOR A REPEATER, ADD THE NAME OF THE MAIN TRANSMITTER:

_____

SITE CO-ORDINATES **N. LAT.** ' "

W. LONG. ' "

ANTENNA TYPE **DIRECTIONAL** ☐ **OMNIDIRECTIONAL** ☐

TRANSMITTER POWER INTO PANEL: _____ W **COMBINER and LINE LOSS: _____ dB**

EIRP: _____ W (Vertical Polarization) at **BEAM TILT _____ Degrees below Horizontal**

MAXIMUM ANTENNA GAIN :_____ dBi **AZIMUTH: _____ Degrees**

AMOUNT OF ADDITIONAL DELAY _____ (µsec)

RELATIVE TO _____(Name of Originating Transmitter)

RCAG: _____ **METRES**

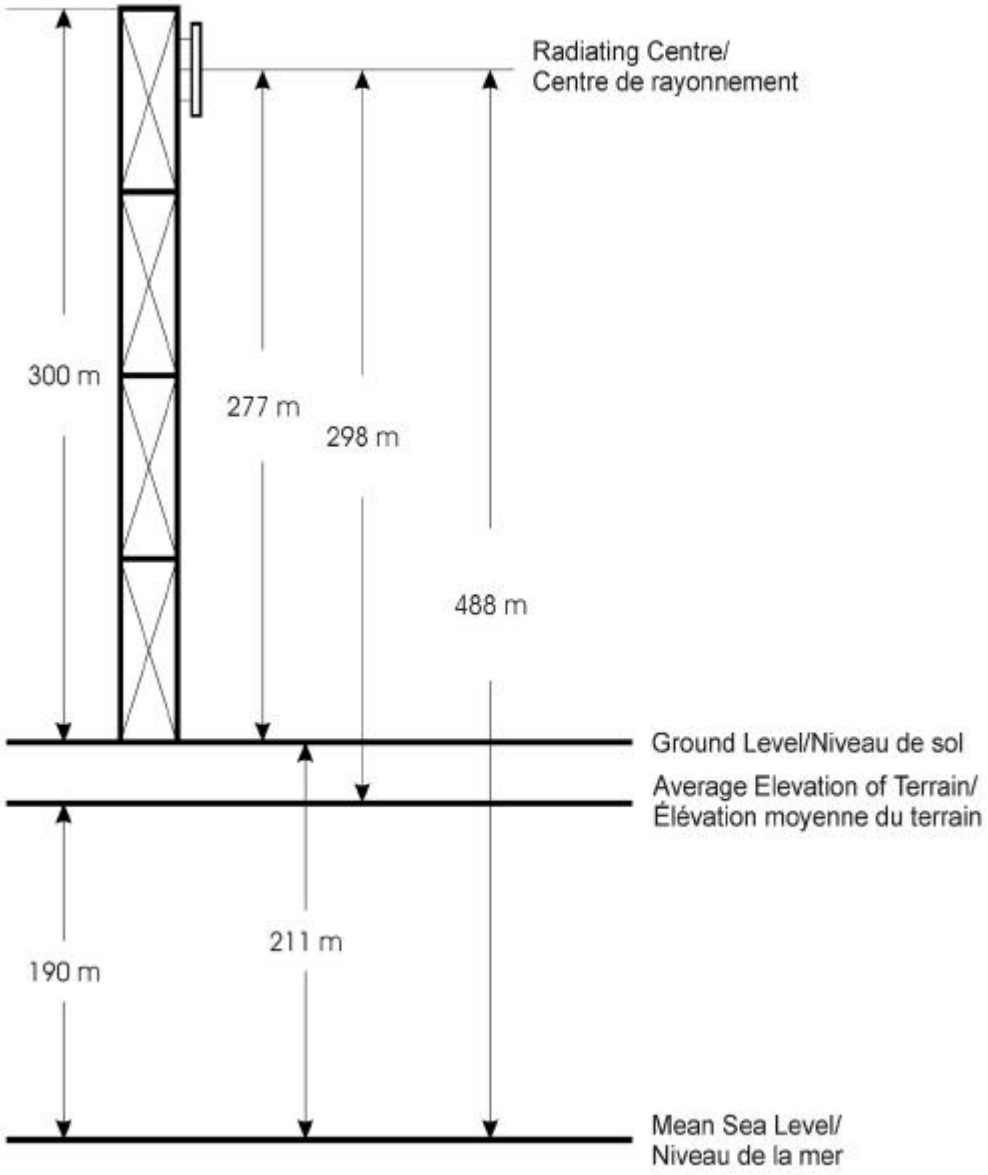
RCAMSL: _____ **METRES**

GROUND LEVEL: _____ **METRES**

APPENDIX 1

Figure 1

ELEVATION DIAGRAM OF TYPICAL TOWER AND TRANSMITTING ANTENNA



APPENDIX 2

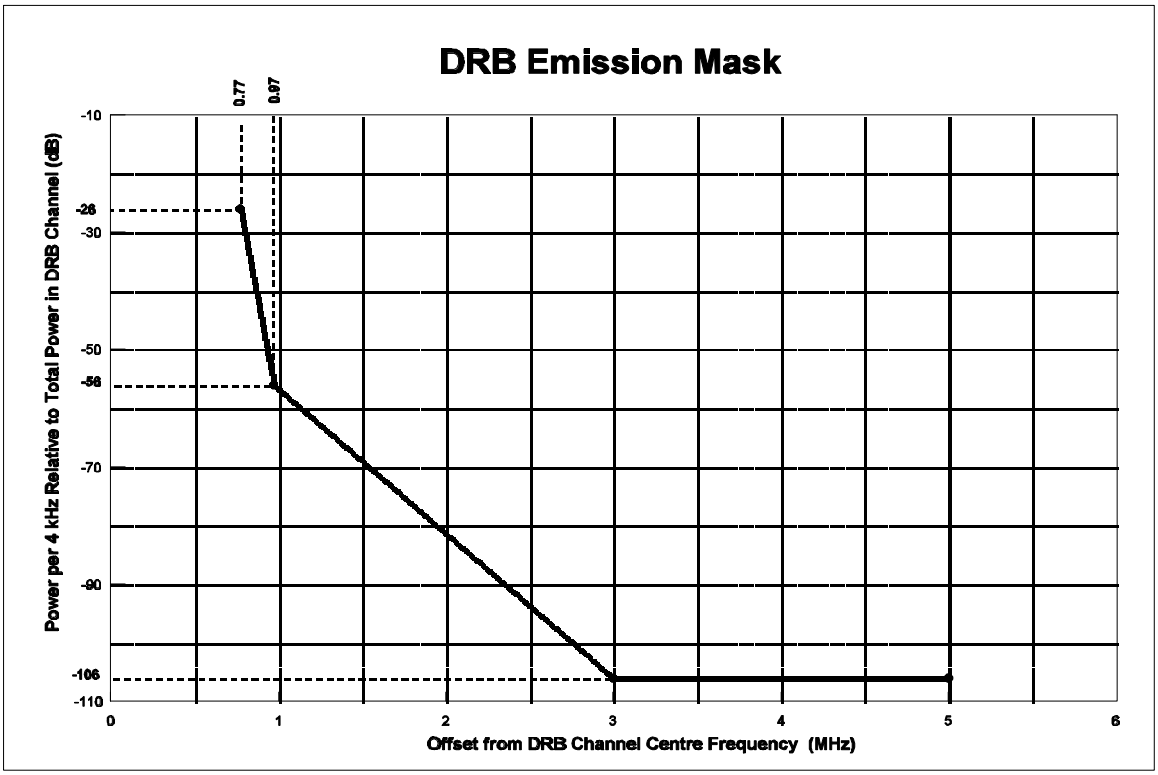
DRB CHANNEL EMISSION MASK

The following formula gives the theoretical unfiltered spectrum power density for the Eureka-147 (DAB) system. **Figure 1** gives the required DRB emission mask, including necessary filtering.

$$P(f) = \sum_{k=1}^{384} \left[\frac{Sin\ (\pi(f - f_k)T_s}{\Pi(f - f_k)T_s} \right]^2$$

where: f_k; centre frequency of sub-carrier k (k = 1, 2, 3 ...., 384)
T_s; Symbol period (312 µS)

Figure 1



APPENDIX 3

DETERMINATION OF COVERAGE

General

This appendix describes a software program called DRBLITE™ [2] available for estimating the coverage obtainable for a specified DRB ensemble configuration. A DRB ensemble can range from a simple configuration consisting of a single transmitter to a complex multiple transmitter configuration operating in a synchronous fashion (i.e. Single Frequency Network) or a non-synchronous fashion (i.e. main transmitter feeding off-air an ensemble of gap fillers and coverage extenders operating on the same frequency) or a combination of both synchronous and non-synchronous transmitters.

Definition of Coverage

Coverage is defined as the percentage of a pre-defined area where DRB service is intended to be provided, referred to in the DRB Allotment Plan as the Digital Service Area (DSA), where DRB reception is predicted for a given percentage of locations and time. More specifically, coverage is defined as locations where reception in vehicles is possible assuming an omni-directional receive antenna at 1.5 metre above ground. Since reception is statistical in nature, varying both in location and time, these parameters need to be defined when specifying coverage. In the development of the Allotment Plan the values assumed for service coverage were 90% of locations and 90% of the time. However, these percentage values can be varied if, for example, improved coverage is desired when implementing the service.

The software is capable of generating contours delineating the areas where a specified margin above reception threshold is predicted to exist for a specified percentage of locations and time.

Methodology for Prediction of Coverage

To estimate coverage expected for a given DRB ensemble configuration that can consist of multiple transmitters and considering the abrupt failure characteristics exhibited in digital systems (i.e. a range of only a few dB in receive signal level to go from excellent reception to failure) requires very complex analysis involving prediction of many parameters such as, path loss over complex terrain, addition of multiple receive signals that are randomly varying in level as well as relative time delay, receiver performance in the presence of rapidly changing multipath, etc. Software has been developed to predict coverage based on the following methodology and assumptions:

[2] DRBLITE™ licence may be obtained from the Technology Transfer Office, Communications Research Centre, 3701 Carling Avenue, P.O. Box 11490, Station H, Ottawa, Ontario, K2H 8S2, Canada.

- path loss prediction based on the PREDICT[3] propagation model

- detailed terrain elevation data where available used to estimate path losses (500 metre or DTED)

- multipath signals being received at a particular location resulting from multiple co-channel transmitters forming a DRB ensemble are considered to be constructive (i.e. improves the received Carrier-to-Noise [C/N]) if the differential delays between the multiple signals do not exceed the guard interval[4]; conversely, multipath signals whose differential delay with respect to the received reference signal exceeds the guard interval are considered as destructive (i.e. intersymbol interference). The received reference signal is determined by the method assumed for receiver synchronization.

The software essentially predicts reception by determining the received (C/N) at a specified number of locations within the designated DSA, defined as points on a grid, using the assumptions described above. Based on this point information, the software plots coverage contours which correspond to a C/N margin above reception threshold of 0 dB, and estimates the percentage coverage for the area within the DSA.

The resultant coverage depends on the values of a number of parameters which must be specified as input parameters when using the software. The screen parameters are given in a file called “offsets”. The file is available at http://strategis.ic.gc.ca/spectrum. The following table identifies these input parameters. Asterisked parameters indicate the values used for the parameters when generating the coverages for the strawman DRB ensembles synthesized in the process of developing the Allotment Plan. However, the most appropriate values specific to the DRB ensemble being analysed, such as transmitter configurations, antenna characteristics, etc., and the most current value for the DRB system parameters, should be used in generating the predicted coverage.

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[3] PREDICT is a licensed software propagation model developed by the Communications Research Centre (CRC).

[4] The guard interval employed in the Eureka-147 system is defined as a percentage of the symbol (nominally 20% of the symbol period) and is located at the beginning of the symbol. The guard interval portion is not considered (i.e. ignored) in the reception of the received reference symbol. This effectively eliminates intersymbol interference with adjacent overlapping symbols so long as the differential time delay between the signals received does not exceed the guard interval.

DRBLITE™ Input Parameters

Parameter	Description	Default Value
Longitude	Reference point (screen parameter)	No default value[1]
Latitude	Reference point (screen parameter)	No default value[1]
Screen Width	Horizontal screen width (screen parameter)	No default value[1]
Offset X	Position of reference point (screen parameter)	No default value[1]
Offset Y	Position of reference point (screen parameter)	No default value[1]
Frequency	Operating frequency of DRB channel	1472.0* MHz
Rx Ant. Height	Height of receiver antenna above ground	1.5* metre
Figure of Merit	Receiver Figure-of-Merit (G/T)	-27.35* dBK^{-1}
Rx Gain	Receiver antenna gain (optional)	0* dB
Rx Ant. Noise Temp	Effective Noise at Rx antenna output(optional)	105*K
Rx Front End Loss	Losses between Rx ant and LNA(optional)	1.0* dB
Rx Noise Figure	Noise Figure of LNA (optional)	3.0* dB
% Time	Percentage of time service available	90%*
% Locations	Percentage of locations service available	90%*
Bandwidth	DRB channel bandwidth	1536* kHz
Symbol Rate	Rate of useful modulated information	1152* kbauds/s
Code Rate	Ratio of useful information rate to total bit rate[2]	0.5* R
E_b/N_0	Minimum Energy/Bit to Noise Density	12* dB
System Margin	Margins for Inter & Intra system Interference	2* dB
System Mode	Operational Mode (Modes 1, 2, 3, 4)[3]	2*
Rx Synchronization	First echo or optimal	First echo*
Topo Data Base	Options: 500 m; DTED[4]; None	500 m*
Signal Summation	Options: Simple; Statistical	Simple*
Grid Precision	Options: 40 x 40, 80 x 80, 160 x 160	40 x 40*
Output	Margin (above threshold); Field Strength	Margin*
Transmitter Parameters [a]		
Name	Name of Tx site location	No default value
Location	Antenna location (Latitude; Longitude)	No default value
Site Elevation	-1 (not Provided) or value 0	-1
Antenna Height	Height above ground level	No default value
EIRP	Maximum value (W)	No default value
Horiz. Ant. Pattern	Option: Omni directional; Custom	Omni
Antenna Azimuth	Option: 0 (Omni); Value if directional	0
Vert. Ant. Pattern	Option: None or Custom	None
Ant Physical Tilt	Option: 0 (None) or Value in Deg	0
Tx Mode	SFN or re-transmitter	SFN
Tx Feed	Only specified for re-transmitters[5]	No default value
Additional Delay	Specified only if SFN transmitter[6]	0 µSec

[a] These parameters must be provided for each transmitter in the ensemble

(1) If the FRC is to be generated at the same time as coverage, then the screen limits should be applicable for the FRC generation (see **Appendix 4** for additional details);

(2) The code rate is linked to the useful information rate and the spectrum efficiency. The higher the code rate, the higher the useful information rate, the higher the spectrum efficiency;

(3) The system mode, symbol period and guard interval are inter-related. Only Modes 2, 3 & 4 are applicable for L-Band operation;

(4) If available 500 metre data base is recommended as it includes ground clutter;

(5) Tx feed parameter identifies from which transmitter the re-transmitter is being fed off-air;

(6) The additional delay parameter permits the adjustment of the Guard Interval Zone in the case of SFN operation and should only be used in SFN applications.

* Asterisked parameters indicate the values used for the parameters when generating the coverages for the strawman DRB ensembles synthesized in the process of developing the Allotment Plan.

APPENDIX 4

DETERMINATION OF FREQUENCY RE-USE CONTOURS

General

The FRC identifies the amount of interference from a DRB ensemble (i.e. network) comprising a single transmitter or an ensemble of transmitters operating at a specific frequency into other nearby DRB ensembles operating on the same frequency (i.e. co-channel ensemble). Each DRB Service area in the DRB Allotment Plan has an unique FRC associated with it. Normally, at the time of implementation, the FRC generated from an ensemble of DRB transmitters used to obtain the desired coverage shall not exceed the FRC specified in the Allotment Plan for that specific DRB service area. Furthermore to insure compatible results, the methodology used for the generation of the FRC shall be identical to that used in generating the FRCs in the Allotment Plan (i.e. same topographical data base, propagation model and assumptions relating to certain critical system parameters). To insure this compatibility a software application package called DRBLITE™ [5], including the necessary data bases, is available from the Department for applicants to determine the FRC for their particular DRB ensembles.

Definition of FRC

The FRC is the contour(s) representing a composite field strength level of 42 dBµV/m to be exceeded for 10% of locations and 10% of the time. In a DRB ensemble comprising multiple transmitters the field strengths from the individual transmitters are summed in a statistical manner to obtain the FRC for the ensemble. Since the contours represent a specific value of field strength and are generated using 500 metre terrain topography, in most cases the FRC consists of multiple contours with a large main contour and a number of smaller contours outside the main contour. The criteria for acceptable level of interference of a DRB ensemble into another co-channel DRB Service Area(DSA) is that the total area of the interfering DRB ensemble FRC encompassed within the interfered with DSA shall be less than one percent of the DSA.

FRC Generation

The FRC is generated on the basis of estimating the individual field strengths of each of the DRB transmitters comprising the DRB ensemble on a pre-defined 40 x 40 grid (i.e. 1600 points) that encompasses the whole area of the FRC. In order to provide a FRC estimate that can be compared to the FRC specified in the Allotment Plan for the particular DSA this pre-defined grid area shall be identical to that specified in the Allotment Plan. The required information is provided in a file called “offsets” available at http://strategis.ic.gc.ca/spectrum, in terms of specifying the geographical coordinates of a reference point, the vertical and horizontal off-set of the reference point and the horizontal span of the grid (the vertical to horizontal span ratio is fixed at 0.7). To estimate the field strengths from the individual transmitters at each of the grid points, a version of

[5] DRBLITE™ licence may be obtained from the Technology Transfer Office, Communications Research Centre, 3701 Carling Avenue, P.O. Box 11490, Station H, Ottawa, Ontario, K2H 8S2, Canada.

the CRC propagation model PREDICT[6] is used along with 500 metre terrain elevation data that includes ground clutter. Also other parameters specific to the particular DRB ensemble must be provided. Some of these parameters have default values specified. Those default values flagged with an asterisk in the table below shall be used as these were the values used in determining the reference FRCs in the Allotment Plan. The other default parameters, related mainly to the transmitter parameters, should correspond to the characteristics of the particular ensemble being analysed.

DRBLITE™ Input Parameters

Parameter	Description	Default Value
Longitude	Reference point (screen parameter)	No default value
Latitude	Reference point (screen parameter)	No default value
Screen Width	Horizontal screen width (screen parameter)	No default value
Offset X	Position of reference point (screen parameter)	No default value
Offset Y	Position of reference point (screen parameter)	No default value
Frequency	Operating frequency of DRB channel	1472.0* MHz
Rx Ant. Height	Height of receiver antenna above ground	1.5* metre
% Time	Percentage of time signal is above threshold	10%*
% Locations	Percentage of locations signal is above threshold	10%*
Topo Data Base	Options: 500 m; DTED; None	500 m*
EM Field Summation	Options: Simple; Statistical	Simple*
Grid Precision	Options: 40 x 40, 80 x 80, 160 x 160	40 x 40*
Output	Margin (above threshold); Field Strength	dBµV/m*
Transmitter Parameters [a]		
Name	Name of Tx site location	No default value
Location	Antenna location (Latitude; Longitude)	No default value
Site Elevation	-1 (not Provided) or value 0	-1
Antenna Height	Height above ground level	No default value
EIRP	Maximum value (W)	No default value
Horiz. Ant. Pattern	Option: Omni directional; Custom	Omni
Antenna Azimuth	Option: 0 (Omni); Value if directional	0
Vert. Ant. Pattern	Option: None or Custom	None
Ant Physical Tilt	Option: 0 (None) or Value in Deg	0

[a] These parameters must be provided for each transmitter in the ensemble

* Default values flagged with an asterisk shall be used as these were the values used in determining the reference FRCs in the Allotment Plan.

Criteria for Acceptable FRC

Once the FRC has been calculated it can be compared to the reference FRC specified in the Allotment Plan for that particular DSA to see whether it exceeds the limits. If it does not exceed the limits then the proposed implementation meets the technical requirements with respect to allowable interference

6 PREDICT is a licensed software propagation model developed by the Communications Research Centre (CRC).

into other DSAs in the Allotment Plan. If the calculated FRC exceeds the limits of the reference FRC in the Allotment Plan then a further check will be required to see whether the proposed ensemble exceeds the interference criteria on which the plan is based. This involves verifying whether the FRC spillover into other **co-channel** DSAs exceeds 1% of the area of the respective DSAs. Provision has been made in the software to do this verification, if necessary.

APPENDIX 5

Figure 1

PROTECTION ALLOWANCE FOR FIXED SERVICES