CBSD Antenna Pattern Database Technical Specification

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CBSD Antenna Pattern Database Technical Specification

1 Introduction and Scope

The Enhanced Antenna Pattern feature ([n.1], Annex 5) allows a SAS to calculate and use the CBSD enhanced antenna pattern in interference calculation and estimate the interference caused by CBSDs more accurately than Release 1 SAS operation. To support the Enhanced Antenna Pattern feature, one method is to establish a CBSD Antenna Pattern Database so that the SAS can calculate CBSD antenna gains according to the corresponding antenna patterns specified in the Database. This specification defines the accessibility, schema and use of the CBSD Antenna Pattern Database.

2 Keywords or Requirements Language

In this document, “SAS Administrators” and “SASs” refer to SASs supporting the Enhanced Antenna Pattern feature unless otherwise specified. “Database” refers to the CBSD Antenna Pattern Database unless otherwise specified.

The key words "required", "shall", "shall not", "should", "should not", "recommended", "may", and "optional" in this document are to be interpreted as described in RFC-2119 [n.2]. In addition, the key word “conditional” shall be interpreted to mean that the definition is an absolute requirement of this specification only if the stated condition is met.

3 References

3.1 Normative references

[n.1] WINNF-TS-1001, “CBRS Operational and Functional Requirements (Release 2)”, Wireless Innovation Forum

[n.2] RFC-2119, “Key words for use in RFCs to Indicate Requirement Levels”, March 1997.

[n.3] WINNF-SSC-0011, “Spectrum Sharing Committee Policy and Procedure SSC Abbreviations and Definitions”, Wireless Innovation Forum

[n.4] WINNF-TS-3002, “Signaling Protocols and Procedures for Citizens Broadband Radio Service (CBRS): Extensions to Spectrum Access System (SAS) - Citizens Broadband Radio Service Device (CBSD) Interface Technical Specification (Release 2)”, Wireless Innovation Forum

[n.5] RFC-7159, "The JavaScript Object Notation (JSON) Data Interchange Format", March 2014

[n.6] RFC-3339, "Date and Time on the Internet: Timestamps", July 2002

[n.7] WINNF-SSC-0013, "Signaling Protocols and Procedures for Citizens Broadband Radio Service (CBRS): WInnForum Registry of CBRS Vendor/Admin IDs for Third-Party Proprietary Feature Prefixes", Wireless Innovation Forum

4 Definitions and Abbreviations

Any previously undefined terms and abbreviations first used in the current version of this document are defined below. All previously defined terms and abbreviations are available at [n.3].

4.1 Definitions

CBSD Antenna Pattern Database: The database that records CBSD antenna patterns that can be used by SAS in CBSD antenna gain calculation.

5 Descriptions of the CBSD Antenna Pattern Database

5.1 General

This section specifies the following items concerning the CBSD Antenna Pattern Database.

- Access rights and security measures
- Recorded information
- Record creation and update
- Use of the Database

Use of the Database is only required for SASs operationally supporting the Enhanced Antenna Pattern feature ([n.1], Annex 5).

5.2 Accessibility of the Database

The Database shall have no read access control so that the records in the Database are available to general public. Upon making requests to the WInnForum, SAS Administrators, CBSD manufacturers, and CBSD users shall also have write access to create new records in the Database. Once a record is created in the Database, only the record creator shall be permitted to update or delete the record in the Database. If a record is updated or deleted, the old record shall be archived for traceability purposes.

Write access to the Database by unauthorized entities shall be prohibited. If the need for write access to the Database by entities other than SAS Administrators, CBSD manufacturers and CBSD users is deemed necessary, a request shall be made to the WInnForum, which upon review may grant access to other parties.

5.3 Use of the Database

In the CBSD registration process with the SAS, a CBSD or a CBSD registrant (e.g., CPI) can indicate its antenna pattern by setting the value of *antennaModel* in [n.4] to the value of *recordCreatorId*:*antennaPatternId* of its antenna pattern record in the Database, where *recordCreatorId* and *antennaPatternId* are defined in Table 1 and 2 respectively. If the managing SAS finds that a CBSD operationally supports the Enhanced Antenna Pattern feature and *antennaModel* indicated in the CBSD registration is identical to *recordCreatorId*:*antennaPatternId* of a record in the Database, the managing SAS shall find the corresponding CBSD antenna pattern from the matching record in the Database and use the antenna pattern to calculate the antenna gain toward a receiver as specified in [n.1].

In a record of the Database, either the azimuth radiation pattern or the two-dimensional radiation pattern shall be specified. When the azimuth radiation pattern is specified in a record, the elevation radiation pattern may be optionally specified to allow SAS calculation of the enhanced antenna pattern. Based on available information in CBSD registration and the Database, a SAS shall select one method to calculate CBSD antenna gains according to REL2-R3-SGN-52102 in [n.1].

6 Definition of the CBSD Antenna Pattern Database

The Database is composed of three types of csv files: one record creators csv file, one CBSD antenna pattern records file per record creator, and one or multiple radiation pattern files per antenna pattern record. The record creators file contains all record creator IDs and links to the antenna pattern record files managed by the corresponding record creators. Each row in the record creators file has two columns with header values defined in the following table. R/O/C in Table 1 and 2 implies whether the value of a column of a csv file must be fulfilled (Required), must be fulfilled when the specified condition is met (Conditional), or may be fulfilled (Optional).

Table 1: Definition of the Record Creators File

Column Name	R/O/C	Column Information
recordCreatorId	Required	This field specifies the system-wide unique ID of the record creator of the record. A record creator is a SAS Administrator, a CBSD manufacturer or a CBSD user.
antennaPatternRecords	Required	The location (managed by WInnForum) of the file containing CBSD antenna pattern records managed by the record creator.

A CBSD antenna pattern records file, with header values defined in Table 2, contains one or multiple antenna pattern records created by the corresponding record creator. Each record in the CBSD antenna pattern records file shall include the antenna pattern of a specified antenna model, identified by an antenna model ID. The CBSD antenna pattern records file is provided as a csv file, where a record is a row in the file.

Table 2: Definition of the CBSD Antenna Pattern Records File

Column Name	R/O/C	Column Information
antennaPatternId	Required	This field is a case insensitive record ID assigned by the record creator. The record creator and the Database administrator shall ensure that every record in the record creator's CBSD antenna pattern record file has a unique *antennaPatternId*.
antennaManufacturer	Required	A string to identify the antenna manufacturer
antennaManufacturerPartId	Required	An identification of the antenna model created by the antenna manufacturer
antennaDescription	Optional	Free text to include additional antenna manufacturer information, antenna model information, URL of antenna specifications, etc.
peakAntennaGain	Optional	Peak antenna gain in dBi. This parameter is added to the Database for completeness. SAS shall use the antenna gain provided by the CBSD or CPI in CBSD registration as described in TS-3002 [n.4]. This field is used for external purposes only and is not used by SAS in any way.
azimuthRadiationPattern	Conditional	The location (managed by WInnForum) of a file containing the radiation pattern in the azimuth plane relative to the boresight direction. The pattern shall cover every degree from -180 to 179 degrees inclusive. This field shall be included if *twoDimRadiationPattern* is not specified in the record.

Column Name	R/O/C	Column Information
elevationRadiationPattern	Optional	The location (managed by WInnForum) of a file containing the radiation pattern in the elevation plane relative to the boresight direction. The pattern shall cover every degree from -180 to 179 degrees inclusive.
twoDimRadiationPattern	Conditional	The location (managed by WInnForum) of a file containing radiation gains with granularity for at least every 5 degree from -180 to 179 degrees for the azimuth angle, at least every one degree from -10 to 10 degrees for the elevation angle, and at least every 5 degrees for the elevation angle from -90 to -10 degrees and from 10 to 90 degrees. This field shall be included if *azimuthRadiationPattern* is not specified in the record.
recordTimeStamp	Required	This parameter represents the time when the record is last created or revised. This parameter shall be updated if any parameter or radiation pattern of the antenna pattern record is revised. It is expressed in UTC using the format, YYYY-MM-DDThh:mm:ssZ, as defined in [n.6].

Note: The weighting factors used to calculate the CBSD antenna gain from *azimuthRadiationPattern* and *elevationRadiationPattern* according to REL2-R3-SGN-52100-d-iii in [n.1] shall be 1 when the Database is used.

The radiation pattern file at the location specified in *azimuthRadiationPattern* shall have two columns expressed in the csv format without a header. The first column is the azimuth radiation angle in degrees relative to the boresight of the antenna, as seen from above. The value of the azimuth radiation angle is an integer between -180 and 179 inclusive. The second column is the radiation gain relative to the peak antenna gain in dB in the direction of the azimuth radiation angle specified in the first column, where the peak antenna gain is from antennaGain [n.4]. The value of the radiation gain is an integer or a floating-point number with a value between -127.0 and +128.0 (dB). It will typically be a negative value when antennaGain reflects the peak antenna gain.

The radiation pattern file at the location specified in *elevationRadiationPattern* shall have two columns expressed in the csv format without a header. The first column is the elevation radiation angle in degrees relative to the boresight of the antenna. The value of the elevation radiation angle is an integer between -180 and 179 inclusive. Radiation below the antenna boresight has a positive elevation angle and radiation above the antenna boresight has a negative elevation angle. The second column is the radiation gain relative to the peak antenna gain in dB in the direction of the elevation radiation angle specified in the first column, where the peak antenna gain is from antennaGain [n.4]. The value of the radiation gain is an integer or a floating-point number with a value between -127.0 and +128.0 (dB). It will typically be a negative value when antennaGain reflects the peak antenna gain.

The radiation pattern file at the location specified in *twoDimRadiationPattern* shall have three columns expressed in the csv format without a header. The first column is the azimuth radiation angle in degrees relative to the boresight of the antenna, as seen from above. The value of the azimuth radiation angle is an integer between -180 and 179 inclusive. The second column is the elevation radiation angle in degrees relative to the boresight of the antenna. The value of the elevation radiation angle is an integer between -90 and 90 inclusive. Radiation below the antenna boresight has a positive elevation angle and radiation above the antenna boresight has a negative elevation angle. The third column is the radiation gain relative to the peak antenna gain in dB in the direction of the azimuth and elevation radiation angles specified in the first two columns, where the peak antenna gain is from antennaGain [n.4]. The value of the radiation gain is an integer or a floating-point number with a value between -127.0 and +128.0 (dB). It will typically be a negative value when antennaGain reflects the peak antenna gain.

Annex A (Informative) Document History

Document history		
V1.0.0	29 Sep 2020	Initial Document Approved
V1.1.0	5 April 2021	Technical revision
V1.2.0	23 August 2021	Technical revision