



# **CBSD Antenna Pattern Database Technical Specification**

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## Contributors

The following individuals made significant contributions to this document:

- Yi Hsuan (Google)

# 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 Information in the Database

Each record in the Database shall include the antenna pattern of a specified antenna model, identified by an antenna model ID. A record can include the information listed in Table 1.

**Table 1: List of Recorded Information in the CBSD Antenna Pattern Database**

Field	Description
Record Creator ID	A unique ID for the creator of a record in the Database.  A record creator is a SAS administrator, a CBSD manufacturer, a CBSD user, or other entities authorized by the WinForum.
Antenna Pattern ID	A system-wide unique Antenna Pattern ID created by the Record Creator to identify the record. The creator and the Database administrator shall ensure that every record in the Database has a unique Antenna Pattern ID.
Antenna Manufacturer	A string to identify the antenna manufacturer
Antenna Manufacturer Part ID	An identification of the antenna model created by the antenna manufacturer
Antenna Description	Free text to include antenna manufacturer information, antenna model information, URL of antenna specifications, etc.
Azimuth Radiation Pattern	This field specifies the radiation pattern in the azimuth plane, relative to the boresight direction.
Elevation Radiation Pattern	This field specifies the radiation pattern in the elevation plane relative to the boresight direction.
Two-Dimensional Radiation Pattern	This field specifies the two-dimensional radiation pattern of the antenna model relative to the boresight direction.
Record Time Stamp	This is used to reflect the day and time a particular entry was first created in the Database. It shall be updated if the record is revised after creation.

### 5.4 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 *antennaPatternId* of its antenna pattern record in the Database, as defined in Table 3. 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 defined in the following table. R/O/C in Table 2 and 3 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 2: Definition of the Record Creators File**

Column Name	R/O/C	Column Information
<i>recordCreatorId</i>	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.
<i>antennaPatternRecords</i>	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 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 3: Definition of the CBSD Antenna Pattern Records File**

<b>Column Name</b>	<b>R/O/C</b>	<b>Column Information</b>
<i>antennaPatternId</i>	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 <i>antennaPatternId</i> .
<i>antennaManufacturer</i>	Required	A string to identify the antenna manufacturer
<i>antennaManufacturerPartId</i>	Required	An identification of the antenna model created by the antenna manufacturer
<i>antennaDescription</i>	Optional	Free text to include additional antenna manufacturer information, antenna model information, URL of antenna specifications, etc.
<i>azimuthRadiationPattern</i>	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 <i>twoDimRadiationPattern</i> is not specified in the record.
<i>elevationRadiationPattern</i>	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.

Column Name	R/O/C	Column Information
<i>twoDimRadiationPattern</i>	Conditional	The location (managed by WinForum) 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 <i>azimuthRadiationPattern</i> is not specified in the record.
<i>recordTimeStamp</i>	Required	This parameter represents the time when the record is last created or 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. 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. 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. 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

<b>Document history</b>		
V1.0.0	29 Sep 2020	Initial Document Approved
V1.1.0	5 April 2021	Technical revision