DPA KML Files with Embedded Data
KML File Version: 1.0.4

May 29th 2018

Purpose

This document proposes incorporating all information needed by a SAS about Dynamic Protection Areas (DPAs) into two KML files:

- A file describing sites activated by ESC (hereafter E-DPAs). This file contains coastal DPAs and any inland DPAs that are ESC-monitored.
- A file describing sites activated by portal (hereafter P-DPAs).

These files would be created, posted, and updated by the government, and retrieved on a predetermined schedule by SASs.[1]

Data Elements

The DPAs are specified by some or all of the following data elements depending on DPA type. Not all of these data elements are required for each type of DPA. The appendices contain more information on the data elements and sample KML code.

1. Name of DPA.

   a. For E-DPAs, this is the DPA name.

   b. For P-DPAs, this is the DPA name, and the data element is needed by the informing incumbent portal as the "building" to which individual CBRS channels ("conference rooms") are assigned for this DPA.

2. Placemark

   a. Typically a polygon defining an area

   b. May also be a point (single lat/lon)

   c. May be multiples or combinations of above using MultiGeometry

3. For P-DPAs, the name of an informing incumbent portal organization to which the DPA belongs. Multiple organizations can be listed. This establishes the authorization for portal users under the listed organization(s) to be allowed to "book" conference rooms

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[1] Posting or updating of a file is not related to DPA activation. Activation is only by way of an ESC or portal.

(channels) belonging to this building (DPA). If no organizations are listed, only portal administrators will be able to activate any channels in this DPA.

4. The frequency range(s) over which operations in the DPA are authorized. For P-DPAs, this is used by the portal to determine the CBRS channels that may be activated by this DPA. For both E-DPAs and P-DPAs, these ranges will also be used by the SAS in pre-computing move lists.

5. Interference protection criterion for the DPA, expressed as a maximum aggregate power level in dBm per 10 MHz.

6. Reference height to be used for interference calculations.

7. Azimuth range requiring protection.

8. Beamwidth of incumbent receiver antenna.

9. Whether operations within the DPA are federal government (authorized in the GMF) or not government (experimental license issued by FCC). This data element will determine the precedence with which interference protection will be implemented. The data format specification does not imply any protection policy regarding protection of non-federal sites.

10. The DPA neighborhood distances for Category A and B, as well as Out-Of-Band Category A and B.

11. A GMF serial number for federal government sites, or an FCC call sign for non-government sites.

Data elements 1 and 2 already exist in standard KML files. The remaining data elements can be inserted as user-defined data fields, a feature that is supported by the KML standard under the <ExtendedData> tag. The data elements, including any data for non-federal sites, would be incorporated in the KML by DoD and could be read by the SAS (or portal admin) when importing the DPA KML.

Appendix A: Notes on Data Elements

- <Document><name>
  - Name of kml document.
  - Format: string
  - Examples:
    - E-DPAs
    - P-DPAs
  - Acceptable values for error checking: Any

- <Document><ExtendedData><Data name="version">
  - File format version number
  - Format: float
  - Examples:
    - 1.0.1
    - 2.1.2
  - Acceptable values for error checking: Corresponds to a defined version number. The description in this document is 1.0.4

- <Document><ExtendedData><Data name="creationDate">
  - The ISO 8601 formatted date the file was created
  - Format: string. YYYY-MM-DD
  - Example:
    - 2018-05-10
  - Acceptable values for error checking: Any valid date on or after Jan 1, 2018.

- <Document><ExtendedData><Data name="Disclaimer">
  - Any required disclaimer.
  - Format: string
  - Acceptable values for error checking: Any.

- <Placemark><name>
  - Name of DPA
  - Format: string
  - Examples:
    - East1
    - BARKING SANDS
  - Acceptable values for error checking: Any

- <Placemark><ExtendedData><Data name="portalOrg">
  - If this DPA is managed by portal, this field contains the name of the portal organization which is authorized to activate this DPA.
  - More than one value may be provided if multiple portal organizations have permission to activate the DPA.

- ○ The portalOrg field is not needed for E-DPAs, and will be ignored.
  - ○ Example:
    - ■ BARKING SANDS
  - ○ Format: string
  - ○ Acceptable values for error checking: Any ASCII string.

- ● <Placemark><ExtendedData><Data name="freqRangeMHz">
  - ○ Frequency range over which DPA can be active
  - ○ Must be multiples of 10 MHz (i.e., consistent with nominal CBRS channel definitions)
  - ○ Can have multiple ranges specified for one DPA. Each will be specified by its own freqRangeMHz entry.
  - ○ Each value consists of two frequencies in MHz, separated by a dash
  - ○ Format: A string consisting of a pair of four-digit integers separated by a dash
  - ○ Example:
    - ■ 3550-3650
  - ○ Acceptable values for error checking: Frequencies must be one of the following: 3500, 3510, 3520, …, 3700, and the first frequency must be less than the second frequency. No comma is used in the numbers (e.g. "3,500" is not an acceptable variant of "3500").

- ● <Placemark><ExtendedData><Data name="federalOp">
  - ○ Required for P-DPAs only
  - ○ Indicator if this is a federally-operated DPA. Value is either True or False.
  - ○ Format: boolean
  - ○ Examples:
    - ■ True
    - ■ False
  - ○ Acceptable values for error checking: True, False
  - ○ gmfSerialNumber must be present if True
  - ○ fccCallSign must be present if False.

- ● <Placemark><ExtendedData><Data name="gmfSerialNumber">

NOTE: this item is not part of current P-DPA. May be dropped.
  - ○ Government Master File (GMF) serial number for federally-operated P-DPAs
  - ○ Required for P-DPAs if federalOp==True
  - ○ Not used for E-DPAs
  - ○ Uses standard GMF serial number format (c.f. NTIA Manual, §9.8.2.1 on p. 9-12)
  - ○ Format: string
  - ○ Examples:
    - ■ `N   157325`
    - ■ `MC  126543`
  - ○ Acceptable values for error checking: ≤4-character string, followed by 6-digit number

- <Placemark><ExtendedData><Data name="fccCallSign">

NOTE: this item is not part of current P-DPA. May be dropped.
  - FCC-issued call sign for non-federally-operated P-DPAs
  - Required for P-DPAs if federalOp==False
  - Not used for E-DPAs
  - Uses standard FCC call sign format
  - Format: string
  - Example:
    - WI2XNS
  - Acceptable values for error checking: Valid FCC callsign as verified by relevant FCC database (ELS, ULS, etc.)

- <Placemark><ExtendedData><Data name="protectionCritDbmPer10MHz">
  - Protection criterion in dBm per 10 MHz
  - Required for P-DPAs
  - Required for E-DPAs if protection criterion differs from pre-established criterion of -144
  - Format: integer or floating point
  - Example:
    - -125
  - Acceptable values for error checking: >= -144

- <Placemark><ExtendedData><Data name="refHeightMeters">
  - Height of isotropic antenna at which protection criterion must be met
  - Required for P-DPAs
  - Optional for E-DPAs, otherwise 50 m is used
  - Format: integer or floating point
  - Example:
    - 26.3
  - Acceptable values for error checking: <= 50

- <Placemark><ExtendedData><Data name="antennaBeamwidthDeg">
  - Beamwidth of receive antenna that is being protected in deg
  - Required P-DPAs
  - Optional for E-DPAs (default is 3 deg)
  - Format: integer or floating point
  - Example:
    - 2.5
  - Acceptable values for error checking: (0, 360]

- <Placemark><ExtendedData><Data name="minAzimuthDeg">
  - If the receive antenna sweeps over a limited azimuth, this is the minimum azimuth

- ○ Optional for both E-DPAs and P-DPAs
- ○ Default = 0 if not specified
- ○ For fixed-azimuth systems, set minAzimuthDeg = maxAzimithDeg
- ○ Format: integer or floating point
- ○ Example:
  - ■ 90
- ○ Acceptable values for error checking: [0, 360), and minAzimuthDeg <= maxAzimuthDeg

- ● <Placemark><ExtendedData><Data name="maxAzimuthDeg">
  - ○ If the receive antenna sweeps over a limited azimuth, this is the maximum azimuth
  - ○ Optional for both E-DPAs and P-DPAs
  - ○ Default = 360 if not specified
  - ○ For fixed-azimuth systems, set maxAzimuthDeg = minAzimithDeg
  - ○ Format: integer or floating point
  - ○ Example:
    - ■ 270
  - ○ Acceptable values for error checking: (0, 360], and maxAzimuthDeg >= minAzimuthDeg

- ● <Placemark><ExtendedData><Data name="catBNeighborhoodDistanceKm">
  - ○ Neighborhood distance (in km) over which Category B CBSDs must be included in the DPA move list calculation
  - ○ Default value: Mandatory
  - ○ Format: integer or floating point
  - ○ Example:
    - ■ 221
  - ○ Acceptable values for error checking: (0, 500]

- ● <Placemark><ExtendedData><Data name="catANeighborhoodDistanceKm">
  - ○ Neighborhood distance (in km) over which Category A CBSDs must be included in the DPA move list calculation
  - ○ Default value: 150km (optional field).
  - ○ Format: integer or floating point
  - ○ Example:
    - ■ 160
  - ○ Acceptable values for error checking: (0, 500]

- ● <Placemark><ExtendedData><Data name="catBOOBNeighborhoodDistanceKm">
  - ○ Neighborhood distance (in km) over which Category B CBSDs must be included in the DPA move list calculation for Out-of-Band channels (within 3500 to 3550 MHz).
  - ○ Default value: 25 km (optional field).

- ○ Format: integer or floating point
- ○ Example:
  - ■ 30
- ○ Acceptable values for error checking: (0, 500]

- ● <Placemark><ExtendedData><Data name="catAOOBNeighborhoodDistanceKm">
  - ○ Neighborhood distance (in km) over which Category A CBSDs must be included in the DPA move list calculation for Out-of-Band channels (within 3500 to 3550 MHz)
  - ○ Default value: 0 km (optional field).
  - ○ Format: integer or floating point
  - ○ Example:
    - ■ 10
  - ○ Acceptable values for error checking: (0, 500]

Other placemark data follow the standard KML placemark schema.

Appendix B: Sample P-DPA KML

Note: Data are for example only. Not intended to represent any real DPAs.

```xml
<kml xmlns="http://www.opengis.net/kml/2.2">
<Document>
  <name>P-DPAs</name>
  <ExtendedData>
    <Data name="version">
      <value>1.0</value>
    </Data>
    <Data name="creationDate">
      <value>2018-05-01</value>
    </Data>
  </ExtendedData>
    <Placemark> <!-- Federal area protection example using portal-->
      <name>China Lake</name>
        <ExtendedData>
          <Data name="portalOrg">
            <value>China Lake</value>
          </Data>
          <Data name="portalOrg">
            <value>White Sands</value>
            <!-- White Sands org also has permission to activate this DPA -->
          </Data>
          <Data name="freqRangeMHz">
            <value>3550-3580</value>
          </Data>
          <Data name="freqRangeMHz">
            <value>3600-3640</value>
            <!--More than one frequency range can be specified-->
          </Data>
          <Data name="federalOp">
            <value>True</value>
          </Data>
          <Data name="protectionCritDbmPer10MHz">
            <value>-139</value>
          </Data>
          <Data name="refHeightMeters">
            <value>30</value>
          </Data>
          <Data name="antennaBeamwidthDeg">
            <value>2.5</value>
          </Data>
          <Data name="minAzimuthDeg">
            <value>0</value>
          </Data>
```

```xml
<Data name="maxAzimuthDeg">
  <value>120</value>
</Data>
<Data name="catBNeighborhoodDistanceKm">
  <value>200</value>
</Data>
<Data name="catANeighborhoodDistanceKm">
  <value>150</value>
</Data>
<Data name="catBOOBNeighborhoodDistanceKm">
  <value>25</value>
</Data>
<Data name="catAOOBNeighborhoodDistanceKm">
  <value>0</value>
</Data>
</ExtendedData>
<Polygon>
  <!--These are fake data. Not intended to represent reality.-->
  <outerBoundaryIs>
    <LinearRing>
      <coordinates>
        -106.25345,33.84911,0
        -106.25466,33.84972,0
        [...]
      </coordinates>
    </LinearRing>
  </outerBoundaryIs>
</Polygon>
</Placemark>
<Placemark> <!-- Non-federal area protection example, requires portal-->
  <name>Lockheed Martin Radar Systems</name> <!-- Made-up example -->
  <ExtendedData>
    <Data name="portalOrg">
      <value>Fort Dix</value>
    </Data>
    <Data name="freqRangeMHz">
      <value>3550-3600</value>
    </Data>
    <Data name="federalOp">
      <value>False</value>
    </Data>
    <Data name="protectionCritDbmPer10MHz">
      <value>-129</value>
    </Data>
    <Data name="refHeightMeters">
      <value>1.5</value>
    </Data>
    <Data name="catBbNeighborhoodDistanceKm">
```

```
            <value>200</value>
          </Data>
          <Data name="catANeighborhoodDistanceKm">
            <value>150</value>
          </Data>
          <Data name="catBOOBNeighborhoodDistanceKm">
            <value>25</value>
          </Data>
          <Data name="catAOOBNeighborhoodDistanceKm">
            <value>0</value>
          </Data>
        </ExtendedData>
        <Polygon>
          <!--These are fake data. Not intended to represent reality.-->
          <outerBoundaryIs>
            <LinearRing>
              <coordinates>
                -77.746450,39.684281,1.5
                -77.523563,39.671765,1.5
                [...]
              </coordinates>
            </LinearRing>
          </outerBoundaryIs>
        </Polygon>
      </Placemark>
  </Document>
</kml>
```

Appendix C: Sample E-DPA KML

Note: Data are for example only. Not intended to represent any real DPAs.

```xml
<kml xmlns="http://www.opengis.net/kml/2.2">
<Document>
  <name>E-DPAs 20180501</name>
  <ExtendedData>
    <Data name="version">
      <value>1.0</value>
    </Data>
    <Data name="creationDate">
      <value>2018-05-01</value>
    </Data>
  </ExtendedData>
    <Placemark>
      <name>East1</name>
        <ExtendedData>
          <Data name="catBNeighborhoodDistanceKm">
            <value>220</value>
          </Data>
          <Data name="catANeighborhoodDistanceKm">
            <value>150</value>
          </Data>
          <Data name="catBOOBNeighborhoodDistanceKm">
            <value>25</value>
          </Data>
          <Data name="catAOOBNeighborhoodDistanceKm">
            <value>0</value>
          </Data>
          <Data name="freqRangeMHz">
            <value>3550-3650</value>
          </Data>
          <Data name="protectionCritDbmPer10MHz">
            <value>-144</value>
          </Data>
          <Data name="refHeightMeters">
            <value>50</value>
          </Data>
          <Data name="antennaBeamwidthDeg">
            <value>3</value>
          </Data>
          <Data name="minAzimuthDeg">
            <value>0</value>
          </Data>
          <Data name="maxAzimuthDeg">
            <value>360</value>
```

```
        </Data>
      </ExtendedData>
      <Polygon>
        <!--These are fake data. Not intended to represent reality.-->
        <outerBoundaryIs>
          <LinearRing>
            <coordinates>
              -78.25345,38.84911,0
              -78.25466,38.84972,0
              [...]
            </coordinates>
          </LinearRing>
        </outerBoundaryIs>
      </Polygon>
    </Placemark>
    <Placemark>
      <name>east_dpa_2</name>
      ...
</Document>
</kml>
```