LWA Station-Level Metadata
Ver. 3

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Contents

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1 Introduction

This memo documents the format of station-level metadata for the LWA-1 initial operational capability (IOC) monitoring and control system (MCS). The metadata described in this document consists of "station static" and "station dynamic" information, which is distinct from the observation-related metadata described in [1].

2 Format of a Station Static MIB Initialization File

Initialization files for the station static MIB is a human-readable text files. See the example provided in Appendix A. These files consist of lines, with each line having one of the following structures:

- *keyword data* `#` *comment*
- `#` *comment*
- empty line

where

- *keyword* is a keyword, identifying a parameter. Internal whitespace not allowed.
- *data* is data intended to be assigned to the parameter. Only printable non-whitespace characters are allowed, with the exception that the "`#`" character is not allowed. The data field is interpreted to begin with the first non-whitespace character following *keyword*, and end with the last non-whitespace character preceding either a "`#`" character, or the end of the line.
- *comment* text is preceded by the character "`#`" and may include only printable non-whitespace characters, with the exception that spaces are allowed.

A line may be up to 4096 characters long. Empty lines are allowed, ignored, and encouraged as a way to improve the readability.

The following is a list of defined parameters, in the order in which it is recommended that they appear in the file. For each parameter, the identifying keyword is given, followed by a definition and information on valid values.

- `FORMAT_VERSION`: An integer equal to the version number of this document. Included to account for the possibility of format modifications over time.
- `STATION_ID`: Station Identification. This is a two-letter code intended to enable concise, unambiguous identification of the station.
- `GEO_N`: WGS84 latitude of the origin of the station's local coordinate system. Decimal degrees, with North and South being indicated as "+" and "−", respectively. This position is an arbitrarily-selected reference point and may not necessarily correspond to the location of the phase center of the station during an observation.
- `GEO_E`: WGS84 longitude of the origin of the station's local coordinate system. Decimal degrees, with East and West being indicated as "+" and "−", respectively. This position is an arbitrarily-selected reference point and may not necessarily correspond to the location of the phase center of the station during an observation.
- `GEO_EL`: Elevation (above mean sea level) of the origin of the station's local coordinate system, meters. This position is an arbitrarily-selected reference point and may not necessarily correspond to the location of the phase center of the station during an observation.
- `N_STD`: Maximum number of stands; expected to be 260.
- `STD_LX[`n`]`: x coordinate [m] of the feedpoints of stand n ($1 \leq n \leq$`N_STD`) in the local coordinate system. The $+x$ points East.
- `STD_LY[`n`]`: y coordinate [m] of feedpoints of stand n ($1 \leq n \leq$`N_STD`) in the local coordinate system. The $+y$ points North.
- `STD_LZ[`n`]`: z coordinate [m] of feedpoints of stand n ($1 \leq n \leq$`N_STD`) in the local coordinate system. The $+z$ points to the Zenith.

- `ANT_STD[`n`]`: The stand on which antenna n ($1 \leq n \leq 2\times$`N_STD`) is mounted. This will be set to `floor`$((n-1)/2)+1$ if not otherwise specified.
- `ANT_ORIE[`n`]`: The intended orientation (polarization) of antenna n ($1 \leq n \leq 2\times$`N_STD`); 0 = "intended to be North-South"; 1 = "intended to be East-West". This will be set to $(n-1)$ `mod` 2 if not otherwise specified.
- `ANT_STAT[`n`]`: The status of antenna n ($1 \leq n \leq 2\times$`N_STD`). See Note 1. This will be set to 3 ("OK") if not otherwise specified.
- `ANT_THETA[`n`]`: The undesired rotation [deg] of the North or East arm of antenna n ($1 \leq n \leq 2\times$`N_STD`) in the elevation plane, relative to nominal (0°). Positive sign means increasing angle with respect to the $+z$-axis of the local coordinate system, in the direction of the $z = 0$ plane. Will be set to 0.0 (no error) if not otherwise specified.
- `ANT_PHI[`n`]`: The undesired rotation [deg] of the North or East arm of antenna n ($1 \leq n \leq 2\times$`N_STD`) in the azimuth plane, relative to nominal (0°). Positive sign means increasing angle with respect to the $+x$-axis of the local coordinate system in the direction of the $+y$ axis. Will be set to 0.0 (no error) if not otherwise specified.
- `ANT_DESI[`n`]`: An integer code which identifies the design of antenna n ($1 \leq n \leq 2\times$`N_STD`). See Note 2. Design information expected to be indexed by this code includes the mechanical specification (specific design/manufacture/model), complex vector effective length vs. frequency and pattern direction, and self-impedance vs. frequency. This will be set to "1" unless otherwise specified. Use "0" to indicate a different but unknown/undocumented design. "`ANT_DESI`" (without "`[`n`]`") will result in `ANT_DESI[`n`]` being set to `ANT_DESI` for *all* n; although subsequent uses of `ANT_DESI[`n`]` can override this for selected n.
- `N_FEE`: Number of FEEs to be described in this file.
- `FEE_ID[`m`]`: Label or serial number which unambiguously identifies FEE m ($1 \leq m \leq$`N_FEE`).
- `FEE_STAT[`m`]`: The status of FEE m ($1 \leq m \leq$`N_FEE`). See Note 1. This will be set to 3 ("OK") unless otherwise specified.
- `FEE_DESI[`m`]`: An integer code which identifies the design of FEE m ($1 \leq m \leq$`N_FEE`). See Note 2. Design information expected to be indexed by this code includes electrical and mechanical descriptions and frequency-domain transfer function described as (a) coefficients in a polynomial fit (representative of all FEEs with this design code) and (b) measurements of a representative FEE. This will be set to "1" unless otherwise specified. Use "0" to indicate a different but unknown/undocumented design. "`FEE_DESI`" (without "`[`n`]`") will result in `FEE_DESI[`n`]` being set to `FEE_DESI` for *all* n; although subsequent uses of `FEE_DESI[`n`]` can override this for selected n.
- `FEE_GAI1[`m`]`: Gain [dB] of FEE m ($1 \leq m \leq$`N_FEE`) port 1, assuming nominal input and output terminations, at the reference frequency of 38 MHz. This will be set to 35.7 unless otherwise specified. "`FEE_GAI1`" (without "`[`n`]`") will result in `FEE_GAI1[`n`]` being set to `FEE_GAI1` for *all* n; although subsequent uses of `FEE_GAI1[`n`]` can override this for selected n.
- `FEE_GAI2[`m`]`: Gain [dB] of FEE m ($1 \leq m \leq$`N_FEE`) port 2, assuming nominal input and output terminations, at the reference frequency of 38 MHz. If this FEE has only one port, then this should be -200. This will be set to 35.7 unless otherwise specified. "`FEE_GAI2`" (without "`[`n`]`") will result in `FEE_GAI2[`n`]` being set to `FEE_GAI2` for *all* n; although subsequent uses of `FEE_GAI2[`n`]` can override this for selected n.
- `FEE_ANT1[`m`]`: Antenna to which port 1 of FEE m ($1 \leq m \leq$`N_FEE`) is connected. Normally in the range 1 to $2\times$`N_STD`. A value of 0 means the FEE input is open-circuited. If not specified, then `FEE_ANT1[1]` will be 1, `FEE_ANT2[1]` will be 2, `FEE_ANT1[2]` will be 3, `FEE_ANT2[2]` will be 4, and so on.

- FEE_ANT2[m]: Antenna to which port 2 of FEE m ($1 \leq m \leq$N_FEE) is connected. Normally in the range 1 to 2×N_STD. A value of 0 means the FEE input is open-circuited or has only one port. See FEE_ANT1[m] (above) for default ordering.

- FEE_RACK[m]: From the perspective of SHL, this is the rack (1-6) in which the power supply powering this FEE is located. A value of 0 means this parameter is unknown. This parameter is used in conjunction with FEE_PORT[m] to identify the power source for this FEE.

- FEE_PORT[m]: From the perspective of SHL, this is the power port corresponding to the power supply powering this FEE. A value of 0 means this parameter is unknown. This parameter is used in conjunction with FEE_RACK[m] to identify the power source for this FEE.

- N_RPD: Maximum number of cables connecting to FEEs to SEP; typically 520.

- RPD_ID[m]: Label or tag which unambiguously identifies cable m ($1 \leq m \leq$N_RPD). Set to "UNK" unless otherwise specified.

- RPD_STAT[m]: The status of cable m ($1 \leq m \leq$N_RPD). See Note 1. Set to 3 ("OK") unless otherwise specified.

- RPD_LENG[m]: Length [m] of cable m ($1 \leq m \leq$N_RPD). Set to 0.0 unless otherwise specified.

- RPD_VF[m]: Velocity factor [%] of cable m ($1 \leq m \leq$N_RPD) at the reference frequency of 10 MHz. Set to 83 unless specified otherwise. "RPD_VF" (without "[n]") will result in RPD_VF[n] being set to RPD_VF for *all* n; although subsequent uses of RPD_VF[n] can override this for selected n.

- RPD_DD[m]: Dispersive delay [ns] of cable m ($1 \leq m \leq$N_RPD) at the reference frequency of 10 MHz and reference length of 100 m. This is the additional propagation time (beyond that expected by dividing length by (velocity factor × the speed of light in free space)) due to cable dispersion. Set to 2.4 unless specified otherwise. "RPD_DD" (without "[n]") will result in RPD_DD[n] being set to RPD_DD for *all* n; although subsequent uses of RPD_DD[n] can override this for selected n.

- RPD_DESI[m]: An integer code which identifies the design of cable m ($1 \leq m \leq$N_RPD). See Note 2. Design information expected to be indexed by this code includes cable type, electrical and mechanical descriptions, frequency-domain transfer function described as coefficients in a polynomial fit (representative of all cables with this design code). Set to "1" unless otherwise specified. Use "0" to indicate that design is unknown or undocumented. *The value "2" has been used for the (primarily) LMR-400 runs to Stand 258.* "RPD_DESI" (without "[n]") will result in RPD_DESI[n] being set to RPD_DESI for *all* n; although subsequent uses of RPD_DESI[n] can override this for selected n.

- RPD_A0[m]: α_0 [m^{-1}] of cable m ($1 \leq m \leq$N_RPD) at the reference frequency RPD_FREF[m]. This is used to calculate cable gain given length and frequency via the Memo 170 model. Set to 0.00428 unless otherwise specified. "RPD_A0" (without "[n]") will result in RPD_A0[n] being set to RPD_A0 for *all* n; although subsequent uses of RPD_A0[n] can override this for selected n.

- RPD_A1[m]: α_1 [m^{-1}] of cable m ($1 \leq m \leq$N_RPD) at the reference frequency RPD_FREF[m]. This is an additional parameter included to improve accuracy, but is not implemented in the Memo 170 model as of Version 3. Set to 0.0 unless otherwise specified. "RPD_A1" (without "[n]") will result in RPD_A1[n] being set to RPD_A1 for *all* n; although subsequent uses of RPD_A1[n] can override this for selected n.

- RPD_FREF[m]: Frequency [Hz] at which the parameters RPD_A0[m] and RPD_A0[m] of cable m ($1 \leq m \leq$N_RPD) are specified. Set to 10.0e+6 (10 MHz) unless otherwise specified. "RPD_FREF" (without "[n]") will result in RPD_FREF[n] being set to RPD_FREF for *all* n; although subsequent uses of RPD_FREF[n] can override this for selected n.

- RPD_STR[m]: "Coefficient of stretching" [unitless] for cable m ($1 \leq m \leq$N_RPD). RPD_LENG[m] is multiplied by this prior to computation of cable gain or delay. Set to 1.0 unless otherwise specified. "RPD_STR" (without "[n]") will result in RPD_STR[n] being set to RPD_STR for *all* n; although subsequent uses of RPD_STR[n] can override this for selected n.

- RPD_ANT[m]: Antenna to which cable m ($1 \leq m \leq$N_RPD) is ultimately connected. Normally in the range 1 to 2×N_STD. A negative value means the cable is connected at its input, but not at its output. A value of 0 means this cable is disconnected at both ends, or that its connections are unknown. Will be set to m unless otherwise specified.

- N_SEP: Maximum number of ports through SEP; typically 520. Note that a "SEP port" is defined as the path from the jack on the outside of the shelter, to the end of the cable that connects to the ASP input.

- SEP_ID[m]: Label which unambiguously identifies SEP port m ($1 \leq m \leq$N_SEP) on the SEP panel. Set to "UNK" unless otherwise specified.

- SEP_STAT[m]: The status of SEP port m ($1 \leq m \leq$N_RPD). See Note 1. Will be set to 3 ("OK") unless otherwise specified.

- SEP_CABL[m]: Label or tag which unambiguously identifies the cable that connects the SEP panel to the ASP input. Set to "UNK" unless otherwise specified.

- SEP_LENG[m]: Length [m] of the cable that connects the SEP panel to the ASP input. Will be set to 0 unless otherwise specified. "SEP_LENG" (without "[n]") will result in SEP_LENG[n] being set to SEP_LENG for *all* n; although subsequent uses of SEP_LENG[n] can override this for selected n.

- SEP_DESI[m]: An integer code which identifies the design of SEP port m ($1 \leq m \leq$N_RPD), including the cable to ASP. See Note 2. Design information expected to be indexed by this code includes cable type, electrical and mechanical descriptions, frequency-domain transfer function described as coefficients in a polynomial fit (representative of all cables with this design code). Will be set to "1" unless otherwise specified. Use "0" to indicate that design is unknown or undocumented. "SEP_DESI" (without "[n]") will result in SEP_DESI[n] being set to SEP_DESI for *all* n; although subsequent uses of SEP_DESI[n] can override this for selected n.

- SEP_GAIN[m]: Gain [dB] of SEP port m ($1 \leq m \leq$N_RPD) including the cable to ASP, at the reference frequency of 38 MHz. Since cables are passive and lossy, this will always be negative. Will be set to 0 unless otherwise specified. "SEP_GAIN" (without "[n]") will result in SEP_GAIN[n] being set to SEP_GAIN for *all* n; although subsequent uses of SEP_GAIN[n] can override this for selected n.

- SEP_ANT[m]: Antenna to which SEP port m ($1 \leq m \leq$N_RPD) is ultimately connected. Normally in the range 1 to 2×N_STD. A negative value means the SEP port is connected at its input, but not at its output. A value of 0 means this SEP port is disconnected at both ends, or that its connections are unknown. Will be set to m unless otherwise specified.

- N_ARB: Maximum number of ARX boards.

- N_ARBCH: Maximum number of channels per ARX board; expected to be 16.

- ARB_ID[m]: Label or serial number which unambiguously identifies ARX board m ($1 \leq m \leq$N_ARB). Will be set to "UNK" unless otherwise specified.

- ARB_SLOT[m]: Unambiguous identification of the slot of the ASP chassis in which ARX board m ($1 \leq m \leq$N_ARB) is installed. Will be set to 0 unless otherwise specified.

- ARB_DESI[m]: An integer code which identifies the design of ARX board m ($1 \leq m \leq$N_ARB). See Note 2. Design information expected to be indexed by this code includes board revision number, electrical and/or mechanical descriptions, frequency-domain transfer function described as coefficients in a polynomial fit (representative of all ARX board channels with this design code). Will be set to "1" unless otherwise specified. Use "0" to indicate that design is unknown or undocumented. *Currently the value "1" is taken to mean "of the same design as the first four ARX boards installed in the station" and the value "2" is taken to mean "of the same design as the generation of ARX boards following the first four".* "ARB_DESI" (without "[n]") will result in ARB_DESI[n] being set to ARB_DESI for *all* n; although subsequent uses of ARB_DESI[n] can override this for selected n.

- ARB_RACK[m]: From the perspective of SHL, this is the rack (1-6) in which the power supply powering this ARX board is located. A value of 0 means this parameter is unknown. This parameter is used in conjunction with ARB_PORT[m] to identify the power source for this ARX board. Will be set to 0 unless otherwise specified.

- ARB_PORT[m]: From the perspective of SHL, this is the power port corresponding to the power supply powering this ARX board. A value of 0 means this parameter is unknown. This parameter is used in conjunction with ARB_RACK[m] to identify the power source for this ARX board. Will be set to 0 unless otherwise specified.

- ARB_STAT[m][p]: The status of channel p ($1 \leq p \leq$N_ARBCH) of ARX board m ($1 \leq m \leq$N_RPD). See Note 1. This will be set to 3 ("OK") unless otherwise specified.

- ARB_GAIN[m][p]: Maximum gain [dB] of channel p ($1 \leq p \leq$N_ARBCH) of ARX board m ($1 \leq m \leq$N_ARB), at the reference frequency of 38 MHz in full-bandwidth mode. "Maximum gain" means gain when programmable attenuation is minimum. Will be set to 67.0 unless otherwise specified. "ARB_GAIN" (without "[m][p]") will result in ARB_GAIN[m][p] being set to ARB_GAIN for *all* n; although subsequent uses of ARB_GAIN[m][p] can override this for the selected m and p.

- ARB_ANT[m][p]: Antenna that channel p ($1 \leq p \leq$N_ARBCH) of ARX board m ($1 \leq m \leq$N_ARB) is ultimately connected to. A negative value means the channel is connected at its input, but not at its output. A value of 0 means this channel is disconnected at both ends, or that its connections are unknown. If not indicated otherwise, ARB_ANT[1][1] will be set to 1, ARB_ANT[1][2] will be set to 2, and so on.

- ARB_IN[m][p]: Label unambiguously identifying the input connector to channel p ($1 \leq p \leq$N_ARBCH) of ARX board m ($1 \leq m \leq$N_ARB) on the ASP rack. Will be set to "UNK" unless otherwise specified.

- ARB_OUT[m][p]: Label unambiguously identifying the output connector from channel p ($1 \leq p \leq$N_ARBCH) of ARX board m ($1 \leq m \leq$N_ARB) on the ASP rack. Will be set to "UNK" unless otherwise specified.

- N_DP1: Maximum number of DP1 boards. Expected to be 26.

- N_DP1CH: Number of channels per DP1 board. Expected to be 20, where 1 & 2 are a stand, 3 & 4 are a stand, and so on.

- DP1_ID[m]: Label or serial number which unambiguously identifies DP1 board m ($1 \leq m \leq$N_DP1). Will be set to "UNK" unless otherwise specified.

- DP1_SLOT[m]: Unambiguous identification of the slot of the DP chassis in which DP1 board m ($1 \leq m \leq$N_ARB) is installed. Will be set to 0 unless otherwise specified.

- DP1_DESI[m]: An integer code which identifies the design of DP1 board m ($1 \leq m \leq$N_DP1). See Note 2. Design information expected to be indexed by this code includes board revision

number, firmware version, TBN bandpasses described as coefficients in a polynomial fit. Will be set to "1" unless otherwise specified. Use "0" to indicate unknown/undocumented design.

- DP1_STAT[m][p]: The status of channel p ($1 \leq p \leq$N_DP1CH) of DP1 board m ($1 \leq m \leq$N_RPD). See Note 1. Will be set to 3 ("OK") unless otherwise specified.
- DP1_INR[m][p]: Label unambiguously identifying the *rack* input connector for channel p ($1 \leq p \leq$N_DP1CH) of DP1 board m ($1 \leq m \leq$N_DP1) on the DP rack. Will be set to "UNK" unless otherwise specified.
- DP1_INC[m][p]: Label unambiguously identifying the *chassis* (i.e., inside the *rack*) input connector for channel p ($1 \leq p \leq$N_DP1CH) of DP1 board m ($1 \leq m \leq$N_DP1) on the DP rack. Will be set to "UNK" unless otherwise specified.
- DP1_ANT[m][p]: Antenna that channel p ($1 \leq p \leq$N_ARBCH) of DP1 board m ($1 \leq m \leq$N_DP1) is ultimately connected to. A value of 0 means this channel is not connected, or that its connection is unknown. If not specified otherwise, DP1_ANT[1][1] will be set to 1, DP1_ANT[1][2] will be set to 2, etc.
- N_DP2: Maximum number of DP2 boards. Expected to be 2.
- DP2_ID[m]: Label or serial number which unambiguously identifies DP2 board m ($1 \leq m \leq$N_DP2). Will be set to "UNK" unless otherwise specified.
- DP2_SLOT[m]: Unambiguous identification of the slot of the DP chassis in which DP2 board m ($1 \leq m \leq$N_DP2) is installed. Will be set to 0 unless otherwise specified.
- DP2_STAT[m]: The status of DP2 board m ($1 \leq m \leq$N_DP2). See Note 1. Will be set to 3 ("OK") unless otherwise specified.
- DP2_DESI[m]: An integer code which identifies the design of DP2 board m ($1 \leq m \leq$N_DP2). See Note 2. Design information expected to be indexed by this code includes board revision number, firmware version, DRX bandpasses described as coefficients in a polynomial fit. Will be set to 1 unless otherwise specified. Use 0 to indicated design is unknown or undocumented.
- N_DR: Maximum number of MCS-DR subsystems. Expected to be 5.
- DR_STAT[m]: The status of MCS-DR m ($1 \leq m \leq$N_MDR). See Note 1. Will be set to 3 ("OK") unless otherwise specified.
- DR_ID[m]: Serial number which unambiguously identifies MCS-DR m ($1 \leq m \leq$N_MDR). Will be set to "UNK" unless otherwise specified.
- DR_SHLF[m]: Unambiguous identification of the shelf in the MCS-DR chassis in which this MCS-DR PC is installed. Will be set to 0 unless otherwise specified.
- DR_PC[m]: The model of this MCS-DR PC. Will be set to "UNK" unless otherwise specified. *Values currently in use are "XPS435" and "T1500".*
- DR_DP[m]: Which DP output this MCS-DR is connected to. Values are 1-4 for beam outputs, and 5 for TBN/TBW. Will be set to 0 (not connected) unless otherwise specified.
- N_PWR_RACK: Maximum number of racks, from the perspective of SHL. Expected to be 6 at IOC.
- N_PWR_PORT[m]: Maximum number of power ports in rack m ($1 \leq m \leq$N_PWR_RACK), from the perspective of SHL. Will be set to 0 (no ports) unless otherwise specified.
- PWR_SS[m][p]: Subsystem that receives power from port p ($1 \leq p \leq$N_PWR_PORT) of rack m ($1 \leq m \leq$N_PWR_RACK). Valid values are SHL, ASP, DP_, MCS, DR1, DR2, DR3, DR4, and DR5. A value of UNK means this port is not connected, or that its connection is unknown.

- PWR_NAME[m][p]: Specific item that receives power from port p ($1 \leq p \leq$N_PWR_PORT) of rack m ($1 \leq m \leq$N_PWR_RACK). A value of UNK means this port is not connected, or that its connection is unknown. Valid values are:
  - For PWR_SS[m][p] = SHL, valid values are MCS, *others TBD*
  - For PWR_SS[m][p] = ASP, valid values are MCS, FEE, ARX, FAN.
  - For PWR_SS[m][p] = DP_, valid values are MCS, *others TBD*
  - For PWR_SS[m][p] = MCS, valid values are SCH (Scheduler), EXE (Executive), TP (Task Processor), CH (Command Hub), and GW (Gateway).
  - For PWR_SS[m][p] = DR1, DR2, DR3, DR4, and DR5, valid values are PC, DS1 (DRSU 1), and DS2 (DRSU 2)

  It should be noted that while this information is largely (but not exactly) redundant with respect to the the "_RACK" and "_PORT" parameters for subsystems, the former is intended primarily as an aid to operators and maintainers. MCS may use either for actionable control decisions, so it is important that they be consistent.

- MCS_CRA: "Configuration request authority" policy to be used by MCS when processing requests to set FEE and ASP parameters (which obviously apply station-wide) in session definition files. "0" means that MCS sets FEE and ASP parameters according to the information in the SSMIF, and any requests for changes are ignored. "1" means that the FEE and ASP parameters set by the SSMIF are treated as defaults, and that a session may be able to change them. See the discussion of the SESSION_CRA keyword in MCS0030 for additional details.

Note 1: For status ("_STAT") entries, 3 = "OK", 2 = "Suspect; possibly bad (If used, provide warning)", 1 = "Bad (Don't use)", 0 = "Not Installed".

Note 2: The details of the use of "_DESI" parameters has not yet been worked out.

3 Format of the Station Dynamic MIB

The station dynamic MIB is a Gnu dbm ("gdbm") database, consisting of the files `station_dynamic.pag` and `station_dynamic.dir`. For information about dbm databases generally, suggested starting points are [2] and [3]. It might also be of interest to know that dbm is supported by Python [4].

The record structure for the station dynamic MIB database can be defined in the form of a C language code segment, as follows:

```
#include <sys/time.h>
char ssm_keyword[32];         /* the keyword; also, the key for the dbm database */
struct ssm_record {
  char val[1024];             /* parameter value; always stored as char. */
  char format[6];             /* used to identify actual data format; see below */
  struct timeval last_change; /* time this value was last changed */
                              /* .tv_sec is seconds into current epoch */
                              /* .tv_usec is fractional remainder in microseconds */
  };
```

In this is code segment, the field `format[]` is a "\0"-terminated string indicating how the data in the field `val` should be interpreted. `format` has one of the following values, with the associated interpretation of `val`:

"s*n*": character string, *n* bytes (exclusive of terminating characters), right-padded with "\0" characters.

In all cases, data is left-justified in the `val` field, and the values of any leftover bytes are undefined. The time given in `last_change` is expressed as a Linux/C "`timeval`"; for those not familiar with this a useful starting point is [5].

The following is a list of defined keywords with corresponding formats (indicated in square brackets) and corresponding values. We begin with parameters which are analogous to parameters appearing in the subsystem MIBs defined in the MCS Common ICD:

- `SUMMARY`: [s7] Summary state of station. Valid values are as follows:
  - `NORMAL`
  - `WARNING` (issue(s) found, but still fully operational)
  - `ERROR` (problems found which limit or prevent proper operation)
  - `BOOTING` (initializing system; not yet fully operational)
  - `SHUTDWN` (shutting down system; not ready for operation)

  Note that this is analogous to MCS Common ICD MIB entry 1.1, except it refers to the entire station. `SUMMARY` is determined by MCS using (among other things) the subsystem `SUMMARY` values.
- `INFO`: [s256] When `SUMMARY` is `WARNING` or `ERROR`, this value begins with a list of MIB keywords, separated by single spaces, and terminated by the character ! (exclamation mark). The MIB keywords will be those containing values indicating the problem condition. A human-readable text string which provides further explanation may be included following the character !. A non-blank value when `SUMMARY` is not `WARNING` or `ERROR` is not specified, but is not prohibited.

The following parameters indicate the summary status of defined level-1 subsystems, and are nominally equal to the "`SUMMARY`" and "`INFO`" entries of the associated subsystem MIBs. There will be a latency, typically on the order of seconds, between the time the subsystem MIB entries are updated and the time the associated parameters (below) are updated.

- SHL_SUMMARY: [s7] The current value of SUMMARY in the SHL MIB.
- SHL_INFO: [s256] The current value of INFO in the SHL MIB.
- ASP_SUMMARY: [s7] The current value of SUMMARY in the ASP MIB.
- ASP_INFO: [s256] The current value of INFO in the ASP MIB.
- DP__SUMMARY (note: two underscores): [s7] The current value of SUMMARY in the DP MIB.
- DP__INFO (note: two underscores): [s256] The current value of INFO in the DP MIB.
- DRn_SUMMARY: [s7] The current value of SUMMARY in the DRn MIB, $1 \leq n \leq$N_DR.
- DRn_INFO: [s256] The current value of INFO in the DRn MIB, $1 \leq n \leq$N_DR.

The following "_STAT" parameters are analogous to similarly-named parameters appearing in the station static MIB. As in the station static MIB, 3 = "OK", 2 = "Suspect; possibly bad", 1 = "Bad", 0 = "Not Installed". The integer value of this parameter can only be equal to or less than the value of the same parameter in the station static MIB. When this value is less than the value appearing in the station static MIB, it is either because (1) MCS demoted it, perhaps as a result of a diagnostic; or (2) an operator demoted it. N_STD, N_DP1, N_DP2, and N_DR are defined in the station static MIB. Note that for parameters other than ANT_STAT[], a unit will not appear in the station dynamic MIB unless it is indicated in the station static MIB as being associated with an antenna. In other words, if the station static MIB says it isn't associated with an antenna, then it doesn't appear in the station dynamic MIB.

- ANT_STAT[n]: [s1] Current status of antenna n ($1 \leq n \leq 2\times$N_STD).
- FEE_STAT[n]: [s1] Current status of the FEE channel connected to antenna n ($1 \leq n \leq 2\times$N_STD).
- RPD_STAT[n]: [s1] Current status of the cable associated with antenna n ($1 \leq n \leq 2\times$N_STD). See
- SEP_STAT[n]: [s1] Current status of the SEP port associated with antenna n ($1 \leq n \leq 2\times$N_STD). See
- ARX_STAT[n]: [s1] Current status of the ARX channel associated with antenna n ($1 \leq n \leq 2\times$N_STD).
- DP1_STAT[n]: [s1] Current status of the DP1 channel (including digitizer and per-antenna processing located on a DP1 board) associated with antenna n ($1 \leq n \leq 2\times$N_DP1).
- DP2_STAT[m]: [s1] The status of DP2 board m ($1 \leq m \leq$N_DP2).
- DR_STAT[p]: [s1] The status of MCS-DR p ($1 \leq p \leq$N_DR).

Additional parameters:

- FORMAT_VERSION: [s3] An integer equal to the version number of this document. Included to account for the possibility of format modifications over time.

A Example of a Station Static MIB Initialization File

To appear in a future version of this document.

B Document History

- Version 3 (Feb 27, 2011):
  - `GEO_EL` field added.
  - `RPD_GAIN[`m`]` deprecated; replaced by `RPD_A0[`m`]`, `RPD_A1[`m`]`, `RPD_FREF[`m`]`, and `RPD_STR[`m`]`.
  - For many indexed parameters, added ability to define the default value. The default value is indicated using the parameter without an index or square brackets.
  - `MCS_CRA` field added.
- Version 1 (June 16, 2010): First version.

References

[1] S. Ellingson, "LWA Station-Level Observing Procedure and Associated Metadata," Ver. 1, LWA Engineering Memo MCS0030, June 15, 2010.

[2] `http://en.wikipedia.org/wiki/Dbm`.

[3] N. Matthew and R. Stones, *Beginning Linux Programming*, 4th Ed. Wrox Press, 2008. See Chapter 7.

[4] `http://docs.python.org/library/dbm.html`.

[5] `http://linux.die.net/man/2/gettimeofday`