

Summary - Digital Radio Controller

Package Prefix	ocpi.core
Name	dig_radio_ctrlr
OpenCPI Release Version	v1.5 (release date 4/2019)

Revision History

Revision	Description of Change	Date
v1.5	Initial Release	4/2019

1 Block Diagrams

Non-parameter Properties: request_config_lock,
 config_locks,
 unlock_config_lock,
 unlock_all,
 data_stream_is_enabled,
 direction_readback,
 tuning_freq_MHz,
 bandwidth_3dB_MHz,
 sampling_rate_Msp,
 samples_are_complex,
 valid_values_tuning_freq_MHz,
 valid_values_bandwidth_3dB_MHz,
 valid_values_sampling_rate_Msp,
 valid_values_samples_are_complex



Parameter Properties: MAX_STRING_LENGTH_p,
 NUM_DATA_STREAM_IDS_p, NUM_DATA_STREAM_IDS_RX_p, NUM_DATA_STREAM_IDS_TX_p,
 DATA_STREAM_IDS_RX_p, DATA_STREAM_IDS_TX_p,
 MAX_NUM_DATA_STREAMS_RX_p, MAX_NUM_DATA_STREAMS_TX_p,
 MIN_ACHIEVABLE_RX_TUNING_FREQ_MHZ_p, MAX_ACHIEVABLE_RX_TUNING_FREQ_MHZ_p,
 MIN_ACHIEVABLE_RX_BANDWIDTH_3DB_MHZ_p, MAX_ACHIEVABLE_RX_BANDWIDTH_3DB_MHZ_p,
 MIN_ACHIEVABLE_RX_SAMPLING_RATE_MSPS_p, MAX_ACHIEVABLE_RX_SAMPLING_RATE_MSPS_p,
 IS_SUPPORTED_RX_SAMPLES_COMPLEX_p, IS_SUPPORTED_RX_SAMPLES_REAL_p,
 IS_SUPPORTED_RX_GAIN_MODE_AUTO_p, IS_SUPPORTED_RX_GAIN_MODE_MANUAL_p,
 MIN_ACHIEVABLE_TX_TUNING_FREQ_MHZ_p, MAX_ACHIEVABLE_TX_TUNING_FREQ_MHZ_p,
 MIN_ACHIEVABLE_TX_BANDWIDTH_3DB_MHZ_p, MAX_ACHIEVABLE_TX_BANDWIDTH_3DB_MHZ_p,
 MIN_ACHIEVABLE_TX_SAMPLING_RATE_MSPS_p, MAX_ACHIEVABLE_TX_SAMPLING_RATE_MSPS_p,
 IS_SUPPORTED_TX_SAMPLES_COMPLEX_p, IS_SUPPORTED_TX_SAMPLES_REAL_p

Digital Radio Controller

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2 Functionality

2.1 Digital Radio Controller Concept and Definition

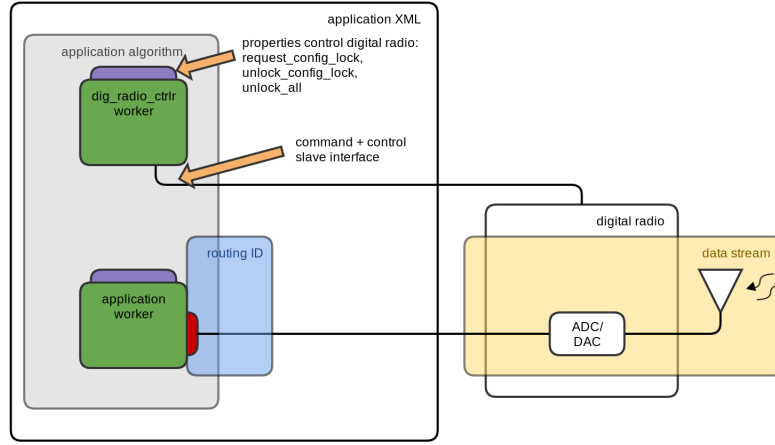


Figure 1: Digital Radio Controller - Major Concepts with Minimal Implementation.

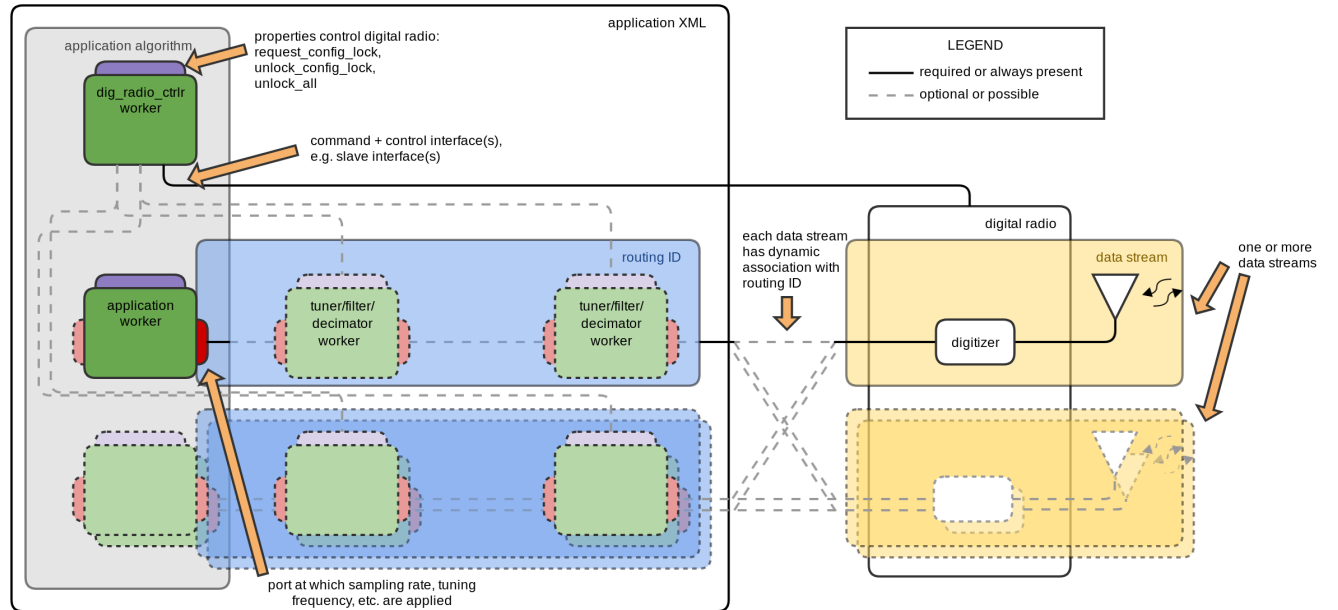


Figure 2: Digital Radio Controller - Major Concepts and Intended Usage.

Each worker implementing this component spec represents a *digital radio controller*. A *digital radio* exposes at least one worker port which streams digitized Radio Frequency (RF) samples within an OpenCPI application. Each port streams samples which were ultimately received (RX) from an ADC or will be transmitted (TX) to a DAC. Each port, including the characteristics of its RF source or destination, is represented as a *data stream*. A *digital radio controller* controls the configurations which characterize the RF source or destination of each *data stream*'s samples, e.g. tuning frequency. Note that a *digital radio controller* does not currently expose the ports which stream digitized samples. A *digital radio controller* controls a single *digital radio* and is capable of locking configurations to guarantee

that their values cannot change. This locking mechanism is useful in guaranteeing that the act of configuring a *data stream* does not corrupt the configuration of another *data stream*. In any given OpenCPI application, a *digital radio controller* provides mechanisms for locking multiple *data streams* of a single *digital radio* at once as well as performing multiple successive locks and unlocks.

2.2 Data Stream Concept and Definition

A *data stream* has the following characteristics.

- It corresponds to an RF data sink or source on the *digital radio*, usually an RF connector.
- It has an associated *data stream ID*, which usually corresponds to the label of the RF connector it represents.
- It can be configured with at least one *data stream type* which can be RX or TX. Workers implementing this spec are allowed to have a *data stream* support both types, e.g. if the radio allows configuring a single RF connector for either RX or TX.
- It has, at a minimum, configurations for tuning frequency, 3dB bandwidth, and sampling rate, where:
 - Tuning frequency is the RF frequency corresponding to 0 Hz in the baseband signal of the OpenCPI worker port which is exposed to the OpenCPI application's algorithm. This includes not only analog or digital tuning within the *digital radio* but also any digital tuning that falls under control of the worker implementation of this component spec.
 - The 3dB bandwidth is the maximum bandwidth for which the passband ripple can be reasonably guaranteed to be less than or equal to 3dB for the combined filter response for all filtering that is applied between the RF spectrum and the OpenCPI worker port which is exposed to the OpenCPI application's algorithm. This includes not only analog or digital filtering within the *digital radio* but also any digital filtering that falls under control of the worker which implements this component spec.
 - The sampling rate is the rate at which the OpenCPI worker port which is exposed to the OpenCPI application's algorithm. This includes any digital upsampling or downsampling that falls under control of a worker which implements this component spec.

2.3 Routing ID Concept and Definition

While a *data stream ID* corresponds to an RF data sink or source, a *routing ID* associates a *data stream ID* with an application-specific stream of OpenCPI workers. Because a *digital radio* can have multiple *data streams* of the same *data stream type*, it is possible that an application contains multiple workers whose connections are available to a given *data stream*. The *routing ID* disambiguates this association. At the moment, the worker implementations of this component define the intended labelling of *routing IDs*. A *routing ID* has the format RXn or TXn, where n is a zero-based index. For example, 'RX0' for a single-channel RX radio controller would always use 'RX0', and a dual-channel RX radio controller would allow 'RX0' or 'RX1'.

2.4 Configuration Lock Request Concept and Definition

Each *digital radio controller* can be issued a *config lock request*, which consists of a *config lock ID* as well as requirements for one or more *data streams*. The requirements for each *data stream* include a *routing ID* and a set of values and tolerances for that stream's configurations. The tolerances are used to determine if a lock was successful or not when applying rounding necessary for hardware configuration. Each *config lock request* is expected to fail if the radio cannot support the requested values within the requested tolerances. When a *config lock request* is successful, it is saved as *config lock* whose values can be queried. Each *config lock* can be unlocked, which requires a reference to its *config lock ID*.

2.5 Detailed Property Description

2.5.1 Parameter Properties

- MAX_STRING_LENGTH_p
 - Length of all string properties.

- NUM_DATA_STREAM_IDS_p
 - Total number of *data stream IDs*.
- NUM_DATA_STREAM_IDS_RX_p, NUM_DATA_STREAM_IDS_TX_p
 - Total number of *data stream* IDs that can be configured for RX or TX streaming. Note this number of *data streams* may not be available for use simultaneously. The purpose of these parameter properties is to provide the ability to enforce the array length of the DATA_STREAM_IDS_RX_p parameter property.
- DATA_STREAM_IDS_RX_p, DATA_STREAM_IDS_TX_p
 - Defines all *data streams* on the radio that can be configured for RX/TX streaming. Note that, of the streams specified in each of these parameter properties, only MAX_NUM_DATA_STREAMS_RX_p/MAX_NUM_DATA_STREAMS_TX_p number of the *data streams* specified in this parameter property's are available for use simultaneously.
- MAX_NUM_DATA_STREAMS_RX_p, MAX_NUM_DATA_STREAMS_TX_p
 - Max number of simultaneously usable RX/TX *data streams* available on radio. The purpose of these parameter properties is to provide the option for an OpenCPI application to use its selection feature[2] to enforce application requirements of number of simultaneously usable RX/TX *data streams* upon worker selection at runtime.
- MIN_ACHIEVABLE_RX_TUNING_FREQ_MHZ_p, MAX_ACHIEVABLE_RX_TUNING_FREQ_MHZ_p,
 MIN_ACHIEVABLE_RX_BANDWIDTH_3DB_MHZ_p, MAX_ACHIEVABLE_RX_BANDWIDTH_3DB_MHZ_p,
 MIN_ACHIEVABLE_RX_SAMPLING_RATE_MSPS_p, MAX_ACHIEVABLE_RX_SAMPLING_RATE_MSPS_p,
 MIN_ACHIEVABLE_TX_TUNING_FREQ_MHZ_p, MAX_ACHIEVABLE_TX_TUNING_FREQ_MHZ_p,
 MIN_ACHIEVABLE_TX_BANDWIDTH_3DB_MHZ_p, MAX_ACHIEVABLE_TX_BANDWIDTH_3DB_MHZ_p,
 MIN_ACHIEVABLE_TX_SAMPLING_RATE_MSPS_p, MAX_ACHIEVABLE_TX_SAMPLING_RATE_MSPS_p
 - Min/Max for all RX/TX *data streams*. The purpose of these parameter properties is to provide the option for an OpenCPI application to use its selection feature[2] to enforce application requirements of number of simultaneously usable RX/TX *data streams* upon worker selection at runtime.
- IS_SUPPORTED_RX_SAMPLES_COMPLEX_p, IS_SUPPORTED_RX_SAMPLES_REAL_p,
 IS_SUPPORTED_RX_GAIN_MODE_AUTO_p, IS_SUPPORTED_RX_GAIN_MODE_MANUAL_p,
 IS_SUPPORTED_TX_SAMPLES_COMPLEX_p, IS_SUPPORTED_TX_SAMPLES_REAL_p
 - True if supported by any RX/TX *data streams*. The purpose of these parameter properties is to provide the option for an OpenCPI application to use its selection feature[2] to enforce application requirements of number of simultaneously usable RX/TX *data streams* upon worker selection at runtime.

2.5.2 Non-Parameter Properties - request_config_lock

The `request_config_lock` property configures radio hardware for requested settings and prevents settings from changing thereafter. Struct members are as follows.

- `config_lock_ID`
 - Each requested *config lock* must have an associated ID which must be a non-empty string. If the request is successful, the locked values along with this ID are appended to the existing locks in the `config_locks` property, and this ID can be used in the future to unlock a specific lock.
- `data_streams`
 - From 1 to (`MAX_NUM_DATA_STREAMS_RX_p` + `MAX_NUM_DATA_STREAMS_TX_p`) data streams can be simultaneously requested to lock. This member is a sequence struct whose struct members are as follows.
 - * `data_stream_type`
 - Set to RX or TX.
 - * `data_stream_ID`
 - Set to an empty string to request *data stream* by type only, otherwise set to one of the values in `DATA_STREAM_IDS_RX_p` or `DATA_STREAM_IDS_TX_p`. Requesting by type only means that any of the available *data streams* which can be used for the given type could be used.
 - * `routing_ID`
 - Usually set to "RXO", "TXO", "TX1", etc...
 - * `tuning_freq_MHz`
 - * `bandwidth_3dB_MHz`
 - * `sampling_rate_Msps`
 - * `samples_are_complex`
 - * `gain_mode`
 - Set to "null", "auto", "manual", or possibly something worker-specific. A value of "null" means that a gain setting is not included (ignored) in the *config lock request* for the given *data stream*, which means that any gain setting which is present in the *data stream* will not be guaranteed. Workers implementing this spec must always accept values of "null", "auto", and "manual", but must fail if requests for "auto" or "manual" are not supported by the *data stream*. In addition, hardware-specific values are allowed to be accepted by the worker.
 - * `gain_dB`
 - If `gain_mode` is "auto" or "null", this value will be ignored, i.e. a lock attempt for `gain_dB` will not occur.
 - * `tolerance_tuning_freq_MHz`
 - Tolerance which will determine lock success.
 - * `tolerance_bandwidth_3dB_MHz`
 - Tolerance which will determine lock success.
 - * `tolerance_sampling_rate_Msps`
 - Tolerance which will determine lock success.
 - * `tolerance_gain_dB`
 - Tolerance which will determine lock success. If `gain_mode` is 'auto' or 'null', this value will be ignored, i.e. a lock attempt for `gain_dB` will not occur.

2.5.3 Non-Parameter Properties - config_locks

The `config_locks` property contains enumerations of currently locked configs for one or more *data streams*. Struct members are as follows.

- `config_lock_ID`
 - ID of successfully requested *config lock*.
- `data_streams`

- This member is a sequence of structs where the struct members are as follows.
 - * `direction_lock`
 - Locked *data stream* type. Value is for the *data stream* specified in `data_stream_ID`.
 - * `data_stream_ID`
 - * `routing_ID`
 - Locked routing ID. Value is for the *data stream* specified in `data_stream_ID`.
 - * `tuning_freq_MHz`
 - Locked tuning frequency. Value is for the *data stream* specified in `data_stream_ID`.
 - * `bandwidth_3dB_MHz`
 - Locked 3dB bandwidth. Value is for the *data stream* specified in `data_stream_ID`.
 - * `sampling_rate_Msps`
 - Locked sampling rate. Value is for the *data stream* specified in `data_stream_ID`.
 - * `samples_are_complex`
 - Locked value. Value is for the *data stream* specified in `data_stream_ID`.
 - * `gain_mode_lock`
 - Locked gain mode. Value is for the *data stream* specified in `data_stream_ID`.
 - * `gain_dB`
 - Locked gain. Value should be ignored for auto gain modes. Note that `gain_mode_lock` may have implementation-specific auto gain modes in addition to the generic 'auto' mode. Value is for the *data stream* specified in `data_stream_ID`.

2.5.4 Non-Parameter Properties - `unlock_config_lock`

The `unlock_config_lock` property unlocks a *config lock* by its ID. Struct members are as follows.

- `config_lock_ID`

2.5.5 Non-Parameter Properties - `unlock_all`

The `unlock_all` property unlocks all existing *config locks*. Write a value of true to this property to perform an unlock.

2.5.6 Non-Parameter Properties - Current Value Reading

The `data_stream_is_enabled`, `direction_readback`, `tuning_freq_MHz`, `bandwidth_3dB_MHz`, `sampling_rate_Msps`, and `samples_are_complex` sequence properties are used to read the current config value (locked or not) for each enabled *data stream*. Each sequence element contains the current config value for an enabled *data stream*. Workers implementing this spec are expected to adjust this property's length such that it includes only enabled *data streams*. If no *data streams* are enabled, the sequence length is expected to be zero.

2.5.7 Non-Parameter Properties - Valid Values Reading

The `valid_values_tuning_freq_MHz`, `valid_values_bandwidth_3dB_MHz`, `valid_values_sampling_rate_Msps`, and `valid_values_samples_are_complex` array properties indicate the current valid ranges of values for all *data streams/data stream type* combinations. Each array element contains the ranges for a single *data stream* for a single *data stream type*. It is expected that *data streams* that can be configured for either RX or TX will have a separate entry for each possible *data stream type*. Once a config is locked, it is intended that its valid ranges will only consist of a single value.

3 Component Spec Property Table(s)

For a detailed property description, see 2.5.

Table 1: Component Spec Properties.

Name	Type	Sequence Length	Array Dimensions	Accessibility	Default	Description
MAX_STRING_LENGTH_p	UShort	-	-	Parameter	128	Length of all string properties.
NUM_DATA_STREAM_IDS_p	UShort	-	-	Parameter	1	Total number of <i>data stream IDs</i> .
NUM_DATA_STREAM_IDS_RX_p	UShort	-	-	Parameter	1	Total number of <i>data stream IDs</i> that can be configured for RX streaming.
NUM_DATA_STREAM_IDS_TX_p	UShort	-	-	Parameter	1	Total number of <i>data stream IDs</i> that can be configured for TX streaming.
DATA_STREAM_IDS_RX_p	String	-	NUM_DATA_STREAM_IDS_RX_p	Parameter	-	Defines all <i>data streams</i> on the radio that can be configured for RX streaming.
DATA_STREAM_IDS_TX_p	String	-	NUM_DATA_STREAM_IDS_TX_p	Parameter	-	Defines all <i>data streams</i> on the radio that can be configured for TX streaming.
MAX_NUM_DATA_STREAMS_RX_p	UShort	-	-	Parameter	1	Max number of simultaneously usable RX <i>data streams</i> available on radio.
MAX_NUM_DATA_STREAMS_TX_p	UShort	-	-	Parameter	1	Max number of simultaneously usable TX <i>data streams</i> available on radio.
MIN_ACHIEVABLE_RX_TUNING_FREQ_MHZ_p	Double	-	-	Parameter	-	Min for all RX <i>data streams</i> .
MAX_ACHIEVABLE_RX_TUNING_FREQ_MHZ_p	Double	-	-	Parameter	-	Max for all RX <i>data streams</i> .
MIN_ACHIEVABLE_RX_BANDWIDTH_3DB_MHZ_p	Double	-	-	Parameter	-	Min for all RX <i>data streams</i> .
MAX_ACHIEVABLE_RX_BANDWIDTH_3DB_MHZ_p	Double	-	-	Parameter	-	Max for all RX <i>data streams</i> .
MIN_ACHIEVABLE_RX_SAMPLING_RATE_MSPS_p	Double	-	-	Parameter	-	Min for all RX <i>data streams</i> .
MAX_ACHIEVABLE_RX_SAMPLING_RATE_MSPS_p	Double	-	-	Parameter	-	Max for all RX <i>data streams</i> .
IS_SUPPORTED_RX_SAMPLES_COMPLEX_p	Bool	-	-	Parameter	-	True if supported by any RX <i>data streams</i> .
IS_SUPPORTED_RX_SAMPLES_REAL_p	Bool	-	-	Parameter	-	True if supported by any RX <i>data streams</i> .
IS_SUPPORTED_RX_GAIN_MODE_AUTO_p	Bool	-	-	Parameter	-	True if supported by any RX <i>data streams</i> .
IS_SUPPORTED_RX_GAIN_MODE_MANUAL_p	Bool	-	-	Parameter	-	True if supported by any RX <i>data streams</i> .
MIN_ACHIEVABLE_TX_TUNING_FREQ_MHZ_p	Double	-	-	Parameter	-	Min for all TX <i>data streams</i> .
MAX_ACHIEVABLE_TX_TUNING_FREQ_MHZ_p	Double	-	-	Parameter	-	Max for all TX <i>data streams</i> .
MIN_ACHIEVABLE_TX_BANDWIDTH_3DB_MHZ_p	Double	-	-	Parameter	-	Min for all TX <i>data streams</i> .
MAX_ACHIEVABLE_TX_BANDWIDTH_3DB_MHZ_p	Double	-	-	Parameter	-	Max for all TX <i>data streams</i> .
MIN_ACHIEVABLE_TX_SAMPLING_RATE_MSPS_p	Double	-	-	Parameter	-	Min for all TX <i>data streams</i> .
MAX_ACHIEVABLE_TX_SAMPLING_RATE_MSPS_p	Double	-	-	Parameter	-	Max for all TX <i>data streams</i> .
IS_SUPPORTED_TX_SAMPLES_COMPLEX_p	Bool	-	-	Parameter	-	True if supported by any TX <i>data streams</i> .
IS_SUPPORTED_TX_SAMPLES_REAL_p	Bool	-	-	Parameter	-	True if supported by any TX <i>data streams</i> .
request_config_lock	Struct (see Table 2)	-	-	Writable	-	Configures radio hardware for requested settings and prevents settings from changing thereafter.
config_locks	Struct (see Table 4)	-	-	Volatile	-	Enumeration of currently locked configs.
unlock_config_lock	Struct (see Table 6)	-	-	Writable	-	Unlocks a <i>config lock</i> by its ID.

unlock_all	Bool	-	-	Writable	-	Unlocks all existing <i>config locks</i> .
data_stream_is_enabled	Struct (see Table 7)	NUM_DATA_STREAM_IDS_p	-	Volatile	-	Used to read enabled status for all <i>data streams</i> .
direction_readback	Struct (see Table 8)	MAX_NUM_DATA_STREAMS_RX_p + MAX_NUM_DATA_STREAMS_TX_p	-	Volatile	-	Used to read current config value (locked or not) for each enabled <i>data stream</i> .
tuning_freq_MHz	Struct (see Table 9)	MAX_NUM_DATA_STREAMS_RX_p + MAX_NUM_DATA_STREAMS_TX_p	-	Volatile	-	Used to read current config value (locked or not) for each enabled <i>data stream</i> .
bandwidth_3dB_MHz	Struct (see Table 10)	MAX_NUM_DATA_STREAMS_RX_p + MAX_NUM_DATA_STREAMS_TX_p	-	Volatile	-	Used to read current config value (locked or not) for each enabled <i>data stream</i> .
sampling_rate_Msps	Struct (see Table 11)	MAX_NUM_DATA_STREAMS_RX_p + MAX_NUM_DATA_STREAMS_TX_p	-	Volatile	-	Used to read current config value (locked or not) for each enabled <i>data stream</i> .
samples_are_complex	Struct (see Table 12)	MAX_NUM_DATA_STREAMS_RX_p + MAX_NUM_DATA_STREAMS_TX_p	-	Volatile	-	Used to read current config value (locked or not) for each enabled <i>data stream</i> .
valid_values_tuning_freq_MHz	Struct (see Table 13)	-	NUM_DATA_STREAM_IDS_RX_p + NUM_DATA_STREAM_IDS_TX_p	Volatile	-	Indicates the current valid ranges of values for all <i>data stream/data stream type</i> combinations.
valid_values_bandwidth_3dB_MHz	Struct (see Table 14)	-	NUM_DATA_STREAM_IDS_RX_p + NUM_DATA_STREAM_IDS_TX_p	Volatile	-	Indicates the current valid ranges of values for all <i>data stream/data stream type</i> combinations.
valid_values_sampling_rate_Msps	Struct (see Table 15)	-	NUM_DATA_STREAM_IDS_RX_p + NUM_DATA_STREAM_IDS_TX_p	Volatile	-	Indicates the current valid ranges of values for all <i>data stream/data stream type</i> combinations.
valid_values_samples_are_complex	Struct (see Table 16)	-	NUM_DATA_STREAM_IDS_RX_p + NUM_DATA_STREAM_IDS_TX_p	Volatile	-	Indicates the current valid ranges of values for all <i>data stream/data stream type</i> combinations.

Table 2: Structure declaration for dig_radio_ctrlr request_config_lock property.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	config_lock_ID	String	-	-	-	Standard	-	ID used for future reference.
Member	data_streams	Struct (see Table 3)	MAX_NUM_DATA_STREAMS_RX_p MAX_NUM_DATA_STREAMS_TX_p	+	-	-	Standard	-

Table 3: Structure declaration for dig_radio_ctrlr request_config_lock property's data_streams member.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	direction	Enum	-	-	-	RX,TX	-	-
Member	data_stream_ID	String	-	-	-	Standard	-	Set to empty or to one of the values in DATA_STREAM_IDS_RX_p or DATA_STREAM_IDS_TX_p.
Member	routing_ID	String	-	-	-	Standard	-	Usually "RXO", "TX0", "TX1", etc...
Member	tuning_freq_MHz	Double	-	-	-	Standard	-	-
Member	bandwidth_3dB_MHz	Double	-	-	-	Standard	-	-
Member	sampling_rate_Msps	Double	-	-	-	Standard	-	-
Member	samples_are_complex	Bool	-	-	-	Standard	-	-
Member	gain_mode	String	-	-	-	Standard	-	Set to "null", "auto", "manual", or possibly something worker-specific.
Member	gain_dB	Double	-	-	-	Standard	-	-
Member	tolerance_tuning_freq_MHz	Double	-	-	-	Standard	-	Tolerance which will determine lock success.
Member	tolerance_bandwidth_3dB_MHz	Double	-	-	-	Standard	-	Tolerance which will determine lock success.
Member	tolerance_sampling_rate_Msps	Double	-	-	-	Standard	-	Tolerance which will determine lock success.
Member	tolerance_gain_dB	Double	-	-	-	Standard	-	Tolerance which will determine lock success.

Table 4: Structure declaration for dig_radio_ctrlr config_locks property.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	config_lock_ID	String	-	-	-	Standard	-	ID of successfully requested <i>config lock</i> .
Member	data_streams	Struct (see Table 5)	MAX_NUM_DATA_STREAMS_RX_p MAX_NUM_DATA_STREAMS_TX_p	+	-	-	Standard	-

Table 5: Structure declaration for dig_radio_ctrlr config_locks property's data_streams member.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	direction_lock	Enum	-	-	-	RX,TX	-	Locked type for <i>data stream</i> specified in <i>data_stream_ID</i> .
Member	data_stream_ID	String	-	-	-	Standard	-	-
Member	routing_ID	String	-	-	-	Standard	-	Locked routing ID for <i>data stream</i> specified in <i>data_stream_ID</i> .
Member	tuning_freq_MHz	Double	-	-	-	Standard	-	Locked tuning frequency for <i>data stream</i> specified in <i>data_stream_ID</i> .
Member	bandwidth_3dB_MHz	Double	-	-	-	Standard	-	Locked 3dB bandwidth for <i>data stream</i> specified in <i>data_stream_ID</i> .
Member	sampling_rate_Msps	Double	-	-	-	Standard	-	Locked sampling rate for <i>data stream</i> specified in <i>data_stream_ID</i> .
Member	samples_are_complex	Bool	-	-	-	Standard	-	Locked value for <i>data stream</i> specified in <i>data_stream_ID</i> .
Member	gain_mode_lock	String	-	-	-	Standard	-	Locked gain mode for <i>data stream</i> specified in <i>data_stream_ID</i> .

Member	gain_dB	Double	-	-	-	Standard	-	Ignore this value if gain_mode_lock is an AGC-related value, e.g. auto.
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Table 6: Structure declaration for dig_radio_ctrlr **unlock_config_lock** property.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	config_lock_ID	String	-	-	-	Standard	-	-

Table 7: Structure declaration for dig_radio_ctrlr **data_stream_is_enabled** property.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	data_stream_ID	String	-	-	-	Standard	-	-
Member	data_stream_is_enabled	Bool	-	-	-	Standard	-	-

Table 8: Structure declaration for dig_radio_ctrlr **direction_readback** property.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	data_stream_ID	String	-	-	-	Standard	-	-
Member	direction_val	Bool	-	-	-	Standard	-	-

Table 9: Structure declaration for dig_radio_ctrlr **tuning_freq_MHz** property.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	data_stream_ID	String	-	-	-	Standard	-	-
Member	tuning_freq_MHz	Double	-	-	-	Standard	-	-

Table 10: Structure declaration for dig_radio_ctrlr **bandwidth_3dB_MHz** property.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	data_stream_ID	String	-	-	-	Standard	-	-
Member	bandwidth_3dB_MHz	Double	-	-	-	Standard	-	-

Table 11: Structure declaration for dig_radio_ctrlr **sampling_rate_Msps** property.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	data_stream_ID	String	-	-	-	Standard	-	-
Member	sampling_rate_Msps	Double	-	-	-	Standard	-	-

Table 12: Structure declaration for dig_radio_ctrlr **samples_are_complex** property.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	data_stream_ID	String	-	-	-	Standard	-	-
Member	samples_are_complex	Bool	-	-	-	Standard	-	-

Table 13: Structure declaration for dig_radio_ctrlr valid_values_tuning_freq_MHz property.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	data_stream_ID	String	-	-	-	Standard	-	-
Member	direction_tuning	Enum	-	-	-	RX,TX	-	-
Member	valid_values	Struct (see Table 17)	32	-	-	Standard	-	-

Table 14: Structure declaration for dig_radio_ctrlr valid_values_bandwidth_3dB_MHz property.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	data_stream_ID	String	-	-	-	Standard	-	-
Member	direction_bandwidth	Enum	-	-	-	RX,TX	-	-
Member	valid_values	Struct (see Table 17)	32	-	-	Standard	-	-

Table 15: Structure declaration for dig_radio_ctrlr valid_values_sampling_rate_Msps property.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	data_stream_ID	String	-	-	-	Standard	-	-
Member	direction_sampling	Enum	-	-	-	RX,TX	-	-
Member	valid_values	Struct (see Table 17)	32	-	-	Standard	-	-

Table 16: Structure declaration for dig_radio_ctrlr valid_values_samples_are_complex property.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	data_stream_ID	String	-	-	-	Standard	-	-
Member	direction_samples_are	Enum	-	-	-	RX,TX	-	-
Member	valid_values	Bool	2	-	-	Standard	-	-

Table 17: Structure declaration for dig_radio_ctrlr valid_values_tuning_freq_MHz, valid_values_bandwidth_3dB, and valid_values_sampling_rate_Msps property's valid_values members.

Type	Name	Type	Sequence Length	Array Dimensions	Accessibility/Advanced	Valid Range	Default	Description
Member	min	Double	-	-	-	Standard	-	-
Member	max	Double	-	-	-	Standard	-	-

References

- [1] FMCOMMS2/3 Digital Radio Controller Worker
- [2] OpenCPI Application Development