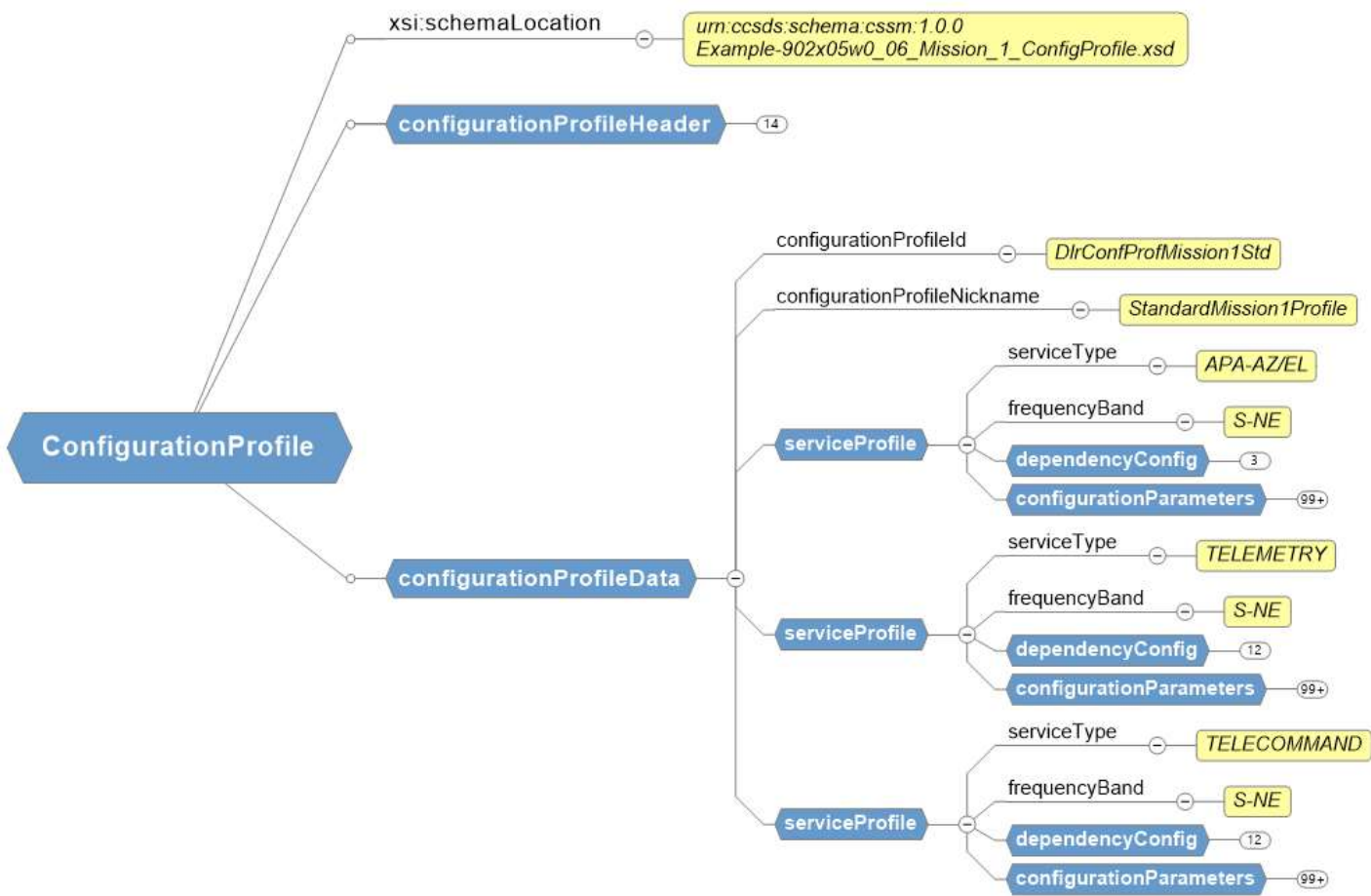


Thoughts on Config Profile

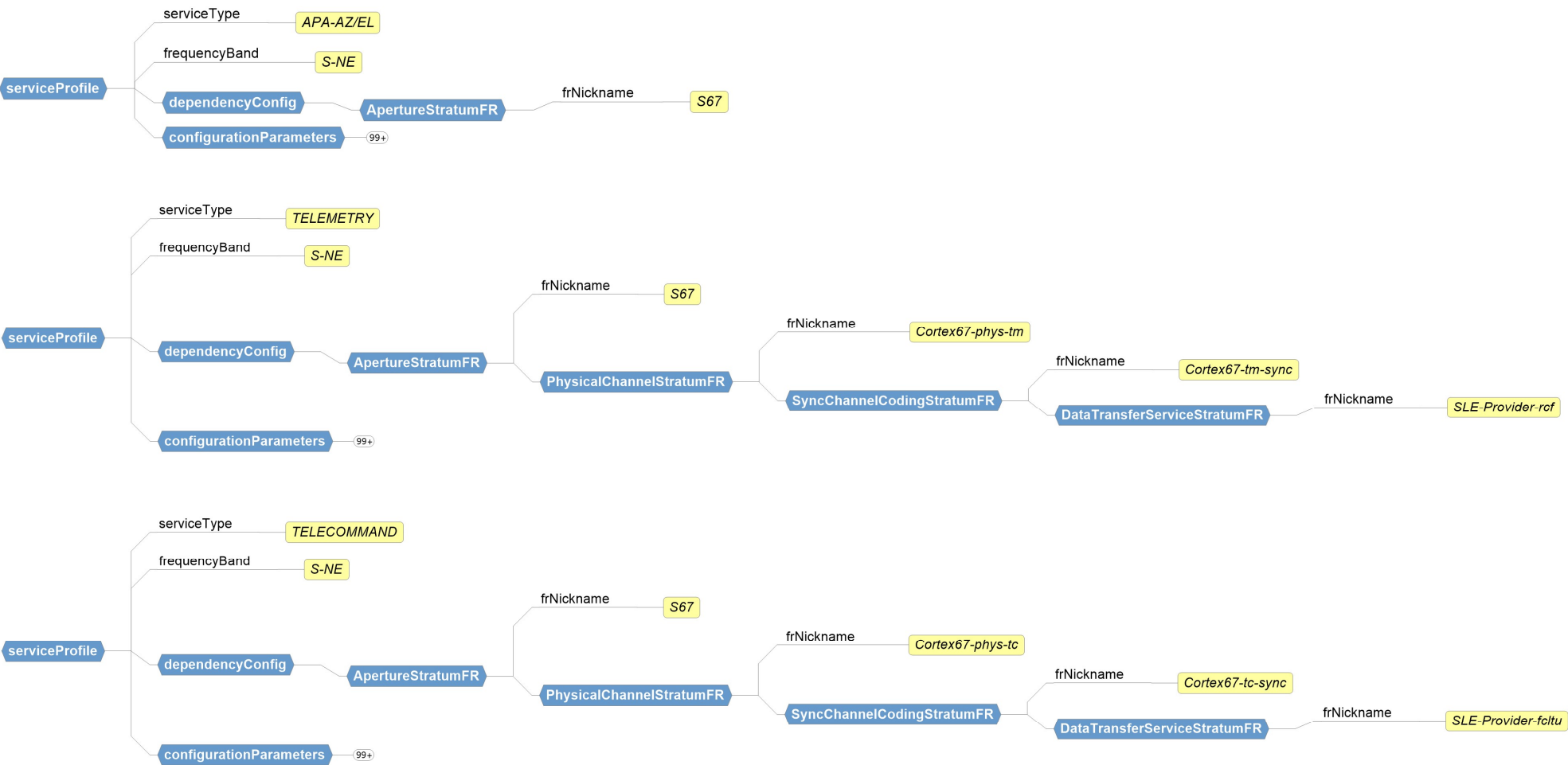
E. Barkley

18 Feb 2022

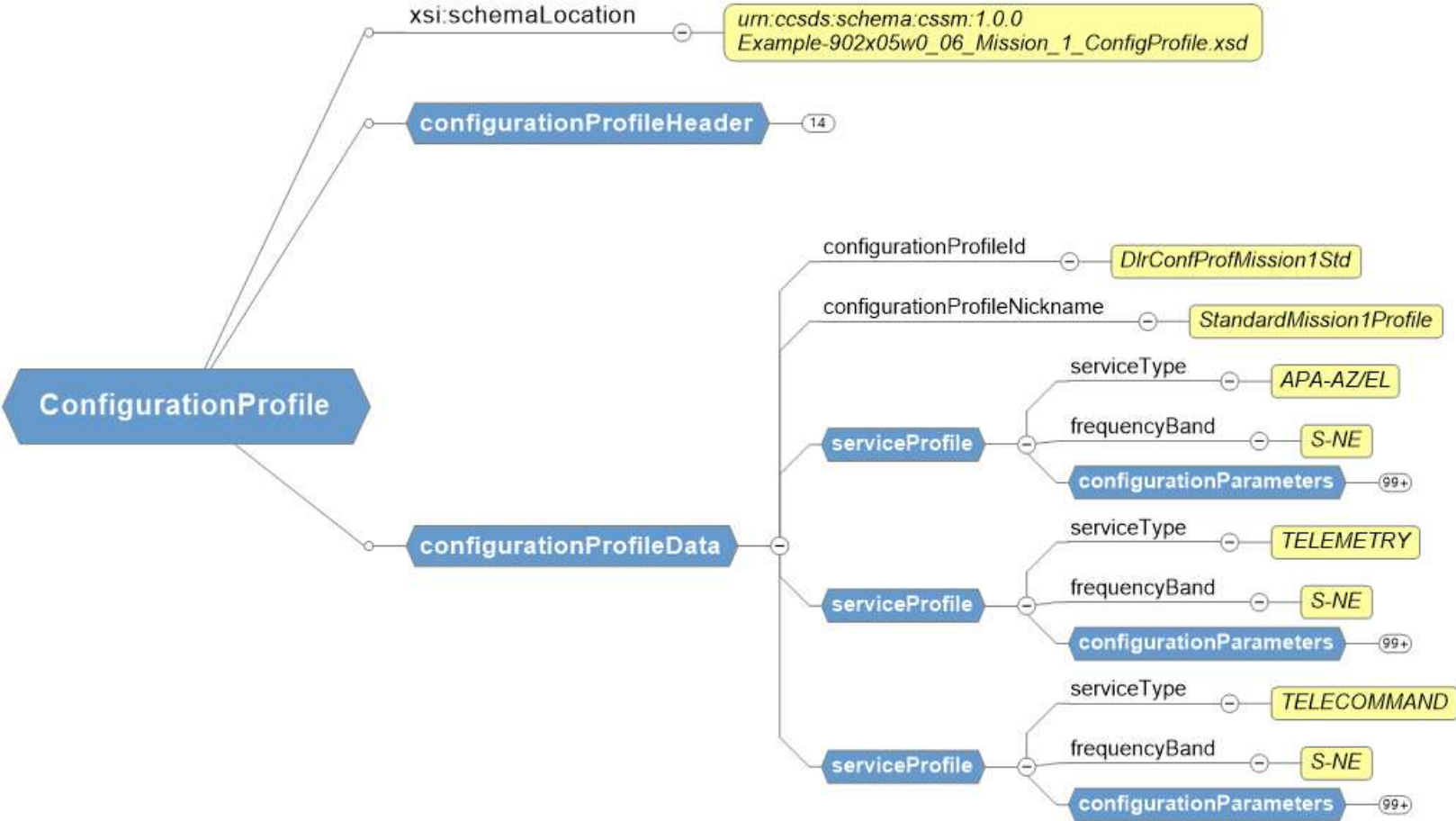
Reference – Overall Structure



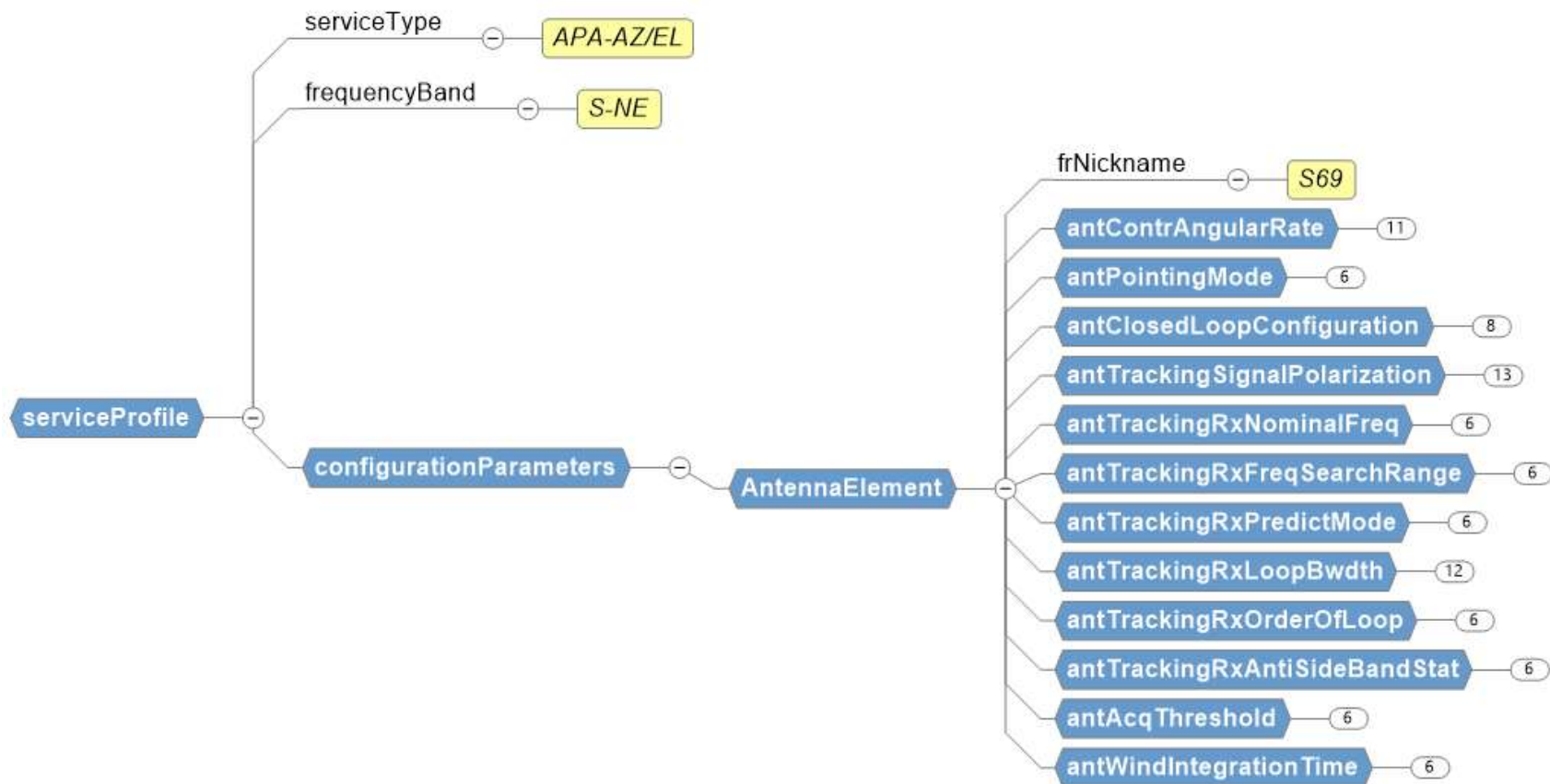
Clarification request: Dependency Config – just to show “wiring”? Really needed for expressing the parameters?



If we remove Dependency Config, its gets more to the point?



All of this would never show up in CSSM CP? Telemetry/Telecommand all presume/require proper antenna management – not really a service exposed in a managed service context? But some parameters could “shift” to a spacecraft perspective? (Next slides)



Antenna Element parameter comments (1/5)

Parameter	Description	Comments
antContrAngularRate	The parameter configures and reports the azimuth and elevation angular rates in 1/1000 degrees per second at which the antenna shall move when antPointingMode is set to 'slew'.	1) We have used milli-radians in other Cross Support recommendations 2) Mission users will never configure this nor command the antenna to slew
antPointingMode	This enumerated parameter configures and reports the pointing mode of the antenna servo system. The values this parameter can take on are: - 'stow': the antenna is in or is moving to its stow position; the angular rates applied in this case are not those specified by the antContrAngularRate parameter, but depend on the specifics of the antenna implementation; - 'halt': the antenna has been stopped in its current position; - 'fixedPosition': the antenna is moving to or has moved to the specified azimuth and elevation; - 'slew': the antenna is moving at commanded angular rates; - 'programTrack': the antenna is pointed in accordance with spacecraft trajectory predicts; - 'closedLoop': the antenna is pointing in closed-loop mode. Antenna implementations will typically support only a subset of the above listed pointing modes.	In a managed service context, missions do not configure this.
antClosedLoopConfiguration	This parameter configures and reports the settings applied to 'closedLoop' antenna pointing mode, either to monopulse tracking or to conical scan tracking. For conical scan the parameter specifies the cone of the conical scan.	1) Conscan and monopulse can affect Doppler readings and knowing if this is occurring can help in producing better validated trajectory determination 2) For CCSDS SM config profile we may want to consider an addition value – something like “providerDiscreation” -- rationale: missions may just want to optimize for telemetry service and how the provider accomplishes this is not really of much concern to the mission (i.e., mission would rather rely on expertise of the ground station operators) 3) This parameter may also show up in the event sequence – part of the mission controlled ground events for the return carrier available state

Antenna Element parameter comments (2/5)

Parameter	Description	Comments
antTrackingSignalPolarization	This enumerated parameter configures and reports the nominal polarization and the the channel(s) that shall be used for tracking purposes. If 'autoHysteresis' is chosen, the parameter specifies how much larger in 1/10 dB the power observed for the currently unselected polarization must be before a switch-over to the polarization with the stronger signal is performed. If 'combining' is chosen, the parameter specifies the bandwidth around the carrier that shall be evaluated to determine the necessary phase rotation and gain setting of the two channels for obtaining the best possible result from the diversity combining. If the same receiver is used for telemetry reception and antenna steering, setting of this parameter is not possible and the value reported by this is a copy of the ccsds401CarrierRcptPolarization parameter or a TBD parameter of the CCSDS 415 Return Channel Reception FR Set.	<div>1) This seems rather complicated to represent in the configuration profile as associated with the antenna. It has dependency on the number of receiver's used, gain settings, depending on overall setting, implies a right-hand and left-hand circular polarization channel (but does not really explicitly state it) among other considerations.</div> <div>2) Suggest that we just go with the RCP vs LCP vs LIN (Linear) values associated with the spacecraft carrier for SM CP -- I.e, we do not want or need this in the SM config profile.</div> <div>3) The "TBD" parameter should be defined</div>
antTrackingRxNominalFreq	This parameter configures and reports the nominal return carrier frequency disregarding any Doppler shift. If the same receiver is used for telemetry reception and antenna steering, setting of this parameter is not possible and the value reported by this is a copy of the ccsds401CarrierRcptNominalFreq parameter or a TBD parameter of the CCSDS 415 Return Channel Reception FR Set.	<div>1) Given the "copy" phrasing, suggesting just going with the nominal carrier frequency stated by ccsds401 parameter</div> <div>2) The "TBD" parameter should be defined</div>
antTrackingRxFreqSearchRange	This parameter configures and reports the bandwidth in Hz centered around the antTrackingRxNominalFreq, possibly corrected for the expected Doppler offset (as configured by the antTrackingRxPredictMode parameter) in which the receiver shall search for the carrier signal. This parameter is also valid in case of a suppressed carrier modulation scheme. If the same receiver is used for telemetry reception and antenna steering, setting of this parameter is not possible and the value reported by this is a copy of the ccsds401CarrierRcptFreqSearchRange parameter or a TBD parameter of the CCSDS 415 Return Channel Reception FR Set.	<div>1) Given the "copy" phrasing, suggesting just going with the ccsds401 parameter</div> <div>2) The "TBD" parameter should be defined</div>

Antenna Element parameter comments (3/5)

Parameter	Description	Comments
antTrackingRxPredictMode	<p>This enumerated parameter configures and reports for which condition the Doppler predicts have been calculated. It can take on four values: - 'none': no information regarding the expected Doppler shift is available and therefore the nominal frequency (see antTrackingRxNominalFreq) is used; - 'oneWay': this mode will be used when the spacecraft is not locked to a forward link signal or while the spacecraft transponder is commanded to non-coherent mode or when the spacecraft receiver is in 'coherency enabled' mode and the forward link carrier frequency is ramped such that the Doppler on the forward link is compensated, i.e., the spacecraft always 'sees' the nominal forward link frequency; in this case it does not matter if the forward link is radiated by the same station as the one that is receiving the return link or a different station; - 'twoWay': this mode is applied when the spacecraft receiver is commanded to 'coherency enabled' mode and the station that is receiving the return link also radiates the forward link, the latter at a constant frequency; - 'threeWay': this mode is applied when the spacecraft receiver is in 'coherency enabled' mode and a station different from the one receiving the return link is radiating the forward link signal at a known constant frequency. If the same receiver is used for telemetry reception and antenna steering, setting of this parameter is not possible and the value reported by this is a copy of the ccstds401CarrierRcptPredictMode parameter or a TBD parameter of the CCSDS 415 Return Channel Reception FR Set.</p>	<p>1) At least for deep space missions at the DSN this is all managed for the mission. The “configuration” is not just a simple setting of these kind of values, but in fact a mathematically modeled set of frequency changes with thousands of data point representing the frequency values as a function of time factoring in all the Doppler inducing components – e.g., earth motion/rotation, spacecraft trajectory, etc. This includes all the information re 1-way, 2-way, etc.</p> <p>2) On very rare occasion, DSN frequency ramping for the forward carrier may be turned off (e.g., radio science measurements) but this is really more about Doppler compensation on/off and not about stating a configuration profile parameter to indicate 1-way, 2-way, etc.</p>

Antenna Element parameter comments (4/5)

Parameter	Description	Comments
antTrackingRxLoopBwdth	This parameter configures and reports the single-sided tracking loop bandwidth in tenth Hz of the receiver. Depending on the mode the tracking receiver operates in, this is either the bandwidth of the PLL tracking the remnant carrier or the frequency range observed for checking spectral symmetry. This parameter also configures and reports the duration in seconds within which the bandwidth reduction to a newly commanded loop bandwidth shall be reached. This gradual change of the loop bandwidth is intended to avoid loss of lock. The duration for the gradual bandwidth change can be set to 'auto' or set to a specific duration. If the duration is set to '0', the newly commanded bandwidth is applied immediately. If the same receiver is used for telemetry reception and antenna steering, setting of this parameter is not possible and the value reported by this is a copy of the ccsds401CarrierRcptTrackingLoopBwdth parameter or a TBD parameter of the CCSDS 415 Return Channel Reception FR Set.	1) For those operations that have a receiver running to help point the antenna, it seems that analysis by the provider on the signal characteristics that the user provides should allow this to be specified. It seems antithetical to a true service provision for the user of the service to have to define all the details of the service?
antTrackingRxOrderOfLoop	This enumerated parameter configures and reports the order of the carrier tracking loop. It can take on the following values: - 'first order': such loop is hardly ever used because it has a static phase error even in case of a constant return link carrier frequency; - 'second order' : this is the most commonly used loop as it has no static phase error for a constant return link carrier frequency; - 'third order' : such configuration may have to be used in case of high Doppler rates, as such loop has no static phase error even when the return link carrier frequency is sweeping, but initial acquisition is more difficult with such loop. If the same receiver is used for telemetry reception and antenna steering, setting of this parameter is not possible and the value reported by this is a copy of the ccsds401CarrierRcptOrderOfLoop parameter or a TBD parameter of the CCSDS 415 Return Channel Reception FR Set	1) Similar to comment immediately above, it seems that this would be something that the service provider determines rather than requiring the service user to supply

Antenna Element parameter comments (5/5)

Parameter	Description	Comments
antTrackingRxAntiSideBandStat	This parameter configures and reports the status of the Anti-Side-Band system of the tracking receiver. The spectrum is expected to be symmetrical around the carrier. In the absence of this symmetry one can conclude that the receiver did not lock on the carrier but on some side band and acquisition will be restarted if the antTrackingRxAntiSideBandStat is 'enabled'. For very weak signals the wide bandwidth required to check the spectral symmetry may prevent signal acquisition due to the reduced sensitivity. Therefore the Anti-Side-Band system can be turned off, i.e., antTrackingRxAntiSideBandStat is set to 'disabled'. If the receiver does not have an Anti-Side-Band system, the reported value shall be 'notApplicable' and configuring of the parameter is prevented by the guard condition.	<div>1) At least for the DSN acquisition aid antennas are used only for launch tracking scenarios – these are pretty much guaranteed to be booming loud signals.</div> <div>2) It seems that this would be adjusted in realtime (SC-CSTS) and not really part of the SM CP?</div>
antAcqThreshold	This parameter configures and reports the SNR threshold of the received signal at which the transition from the antPointingMode from 'fixedPosition' to 'closedLoop' or 'programTrack' shall occur. In case of the transition to 'programTrack' the time offset observed for the signal acquisition is applied when accessing the trajectory predicts. In case of a remnant carrier, the threshold specifies the carrier power to spectral noise density ratio in dBHz. In case of the carrier being suppressed, the threshold specifies the data power to spectral noise density ratio in dBHz. This parameter is used for contingency acquisition, i.e., when the spacecraft trajectory is somewhat uncertain and the spacecraft may be early or late with respect to the time when signal acquisition at the antenna 'fixedPosition' pointing was expected	<div>1) At least for the DSN, missions never set up this kind of transition information and if anything like this occurs it is managed by the DSN on behalf of the mission.</div>
antWindIntegrationTime	This parameter configures and reports the length in seconds of the period during which the wind speed and peak wind speed are observed for the calculation of the antMeanWindSpeed and antPeakWindSpeed parameters.	<div>1) For the DSN, weather data reporting is not something the end user can configure – user just receive the weather data output as part of the DSN's monitor data.</div>