European Network of
Transmission System Operators
for Electricity

ACCOUNTING AND FINANCIAL SETTLEMENT OF KF, ACE AND RAMPING PERIOD (FSKAR) IMPLEMENTATION GUIDE

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APPROVED DOCUMENT
VERSION 1.0

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NOTE CONCERNING WORDING USED IN THIS DOCUMENT

The force of the following words is modified by the requirement level of the document in which they are used.

- SHALL: This word, or the terms “REQUIRED” or “MUST”, means that the definition is an absolute requirement of the specification.
- SHALL NOT: This phrase, or the phrase “MUST NOT”, means that the definition is an absolute prohibition of the specification.
- SHOULD: This word, or the adjective “RECOMMENDED”, means that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- SHOULD NOT: This phrase, or the phrase “NOT RECOMMENDED”, means that there may exist valid reasons in particular circumstances when the particular behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.
- MAY: This word, or the adjective “OPTIONAL”, means that an item is truly optional.

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Revision History

Version	Release	Date	Paragraph	Comments
0	1	2020-09-15		First draft of the accounting & FSKAR Implementation guide.
0	2	2020-10-15		Comments from CIM EG members were considered.
1	0	2020-11-04		Approved by MC.

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1 Scope

The objective of this Accounting & FSKAR implementation guide is to make it possible for IT developers to develop an IT application for System Operators and Coordination Centre Operators to exchange cross border meter measurement as well as accounting and settlement information relative for the RGCE Accounting & Settlement process according to the SAFA annex 3, policy on accounting and settlement.

Please note that the first release of this IG will only deal with part of the accounting process not related to establish accounting data (SOVA) and the settlement process of FSKAR.

The implementation guide is one of the building blocks for using UML (Unified Modelling Language) based techniques in defining processes and messages for interchange between actors in the electrical industry in Europe.

This guide provides a standard for enabling a uniform layout for the transmission of data between TSOs to establish and calculate the accounting point data and also to issue the financial settlement results within a Synchronous Area. The implementation guide is developed for the harmonisation of the underlying data exchange process. The implementation guide refers to information models based on the European style market profile (ESMP), IEC 62325-351. In particular, the IEC 62325-450 methodology was applied to develop the contextual and assembly models.

2 References

2.1 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- IEC 62325-301:2018, Framework for energy market communications – Part 301: Common information model (CIM) extensions for markets;
- IEC 62325-351:2016, Framework for energy market communications – Part 351: CIM European market model exchange profile;
- IEC 62325-450:2013, Framework for energy market communications – Part 450: Profile and context modelling rules;
- IEC 62325-451-1:2017, Framework for energy market communications – Part 451-1: Acknowledgement business process and contextual model for CIM European market;
- IEC 62325-451-2:2014, Framework for energy market communications - Part 451-2: Scheduling business process and contextual model for CIM European market

2.2 Other references

- The Harmonised Electricity Market Role Model;
- Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing (EB GL).
    - AII continental European TSOs' proposal for Common settlement rules for intended exchanges of energy as a result of the frequency containment process and ramping period in accordance with the Article 50(3) of Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing.
    - AII continental European TSOs' proposal for Common settlement rules for all unintended exchanges of energy in accordance with the Article 51(1) of

Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing.

- Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (SO GL)
- Reporting Information Document UML Model and Schema
- Financial Settlement Report Document UML Model and Schema
- UCTE Accounting and Settlement Process IG (Only for the accounting part)
- FSKAR Transparency Reporting v1.0 IG

3 Terms and definitions

Accounting data (Eex): The value Eex is the exchanged energy between two LFC areas/blocks as reflected in the accounting data. The accounting data also includes the exchanges per virtual tie-lines (VTL). This VTL exchanges may include but are not limited to aFRR exchanges and imbalance netting.

Aggregated Netted External Schedules (ANES): A schedule representing the netted aggregation of all external TSO schedules and external commercial trade schedules between two scheduling areas or between a scheduling area and a group of other scheduling areas. [1]

Day-Ahead Market Prices (DAMP): Day-Ahead Market Prices for each LFC block or area provided by each corresponding LFC Operator in €.

External commercial trade schedule: It means a schedule representing the commercial exchange of electricity between market participants in different scheduling areas.[1]

External TSO schedule: It means a schedule representing the exchange of electricity between TSOs in different scheduling areas. [1]

Frequency Containment Process (FCP): Means a process that aims at stabilising the system frequency by compensating imbalances by means of appropriate reserves.[1]

Frequency Containment Process Energy (FCPE or E_{FCP}): The energy resulting from the frequency containment process. It is equal to the product of the notified K-factor with the average frequency deviation for each TSO-TSO settlement period and each LFC area.

$$E_{FCP} = -k * \Delta f * \frac{1}{4} h$$

Frequency deviation (Delta f): The difference between the actual and the nominal frequency of the synchronous area which can be negative or positive [1].

Intended Energy Exchange (E_{ie}): This means the intended cross-border energy exchanges according to EBGL Art. 50. This includes the ANES, the cross-border exchanges over virtual tie-lines, the cross-border energy exchanged as a result of the frequency containment process and the cross-border energy exchanged as a result of the ramping periods.

K-factor: K-factor represents the assumed reaction of an LFC area/block to a frequency deviation. Defined in the SOGL as a value expressed in megawatts per hertz ('MW/Hz'), which is as close as practical to, or greater than the sum of the auto-control of generation, self-regulation of load and of the contribution of frequency containment reserve relative to the maximum steady-state frequency deviation.[1]

LFC Operator: Responsible for the load frequency control for its LFC Area or LFC Block.

Ramping period: It is a period of time defined by a fixed starting point and a length of time during which the input and/or output of active power will be increased or decreased. 1 For CE, the ramping period is set at 10 minutes

Ramping Period Energy (E_{RP}): Energy exchanged as a result of ramping between different ANES values ($ANES_{n-1}$ and $ANES_n$, where n and n-1 refer to adjacent TSO-TSO settlement periods). The RP energy is the difference between a step change and a ramped change, where the ramp is linear starting 5 minutes before the change and ending 5 minutes after the change.

$$E_{RP} = \frac{(ANES_{n-1} - ANES_n)/2}{2} * \frac{5}{60} h + \frac{(ANES_{n+1} - ANES_n)/2}{2} * \frac{5}{60} h$$

[1] SO GL Network Code

Scheduled energy exchanges ($Esch$): It refers to the energy corresponding to the sum of the ANES for each LFC area/block, as obtained by the co-ordination centres from the Verification Platform.

TSO-TSO Settlement period: The TSO-TSO-Settlement period is a parameter of the process representing the time resolution on which the accounting data and energy exchanges are determined. According to the currently approved version of the FSKAR methodologies, the TSO-TSO settlement period shall be equal to 15 minutes.

System Operator Accounting data Matching (SOAM): Calculated accounting data on interconnection.

System Operator Measurement Alignment (SOMA): Metered measurement data on interconnection.

System Operator Validated Accounting (SOVA): Bilaterally validated calculated accounting data on interconnection.

System Operator Validated Measurements (SOVM): Bilaterally validated metered measurement data on interconnection.

Unintended Exchange (UE or E_{ue}): This means the unintended cross-border exchange of energy according to EBGL Art. 51. It is equal to the difference between the metered exchanges on physical tie-lines as reflected in the accounting data and the sum of the ANES, the VTL exchanges, the FCP energy and the RP energy. The unintended exchange is calculated as shown below.

$$E_{ue} = E_{ex} - E_{sch} - E_{VTL} - E_{FCP} - E_{RP}$$

Virtual Tie-Line (VTL): The energy exchanged through virtual tie lines can be manual frequency restoration reserves, automatic frequency restoration reserves or imbalance netting. Moreover, there might be other processes that use virtual tie-lines for the exchange of energy. Virtual tie-line exchanges are recorded in the accounting data.

Working Day: The Working Day is the calendar day except Saturdays, Sundays and 4 holidays: Christmas day (25th of December), New Year's Day (1st of January), Easter Monday and Ascension Day.

4 The Accounting and Financial Settlement Business Process

4.1 General Introduction to Accounting process related to established accounting data

For this version of the Accounting and FSKAR IG, accounting process related to establish accounting data is not tackled.

Current SOVA formats will continue being used. Please refer to the currently used IG "UCTE Accounting and Settlement Process IG" for information about the Accounting process and the data format.

The process of agreement on establishing accounting data between TSOs and submission to CCs is already in place today and is currently known as accounting process. This accounting process will remain the same with the introduction of FSKAR.
This accounting process is the validation of the metered data (usually located at an interconnecting tie-line of a TSO) and of the resulting accounting data. In order to perform the accounting process in a correct manner the TSOs of a common border have to prepare a bilateral accounting agreement. Within this documents TSOs agree on the list of common (physical and virtual) tie-lines to be included in the accounting process and rules of calculation of accounting values based on meter measurements for each tie-line, including the consideration of line losses. Actual preparation of bilateral agreement is out of scope of this document.

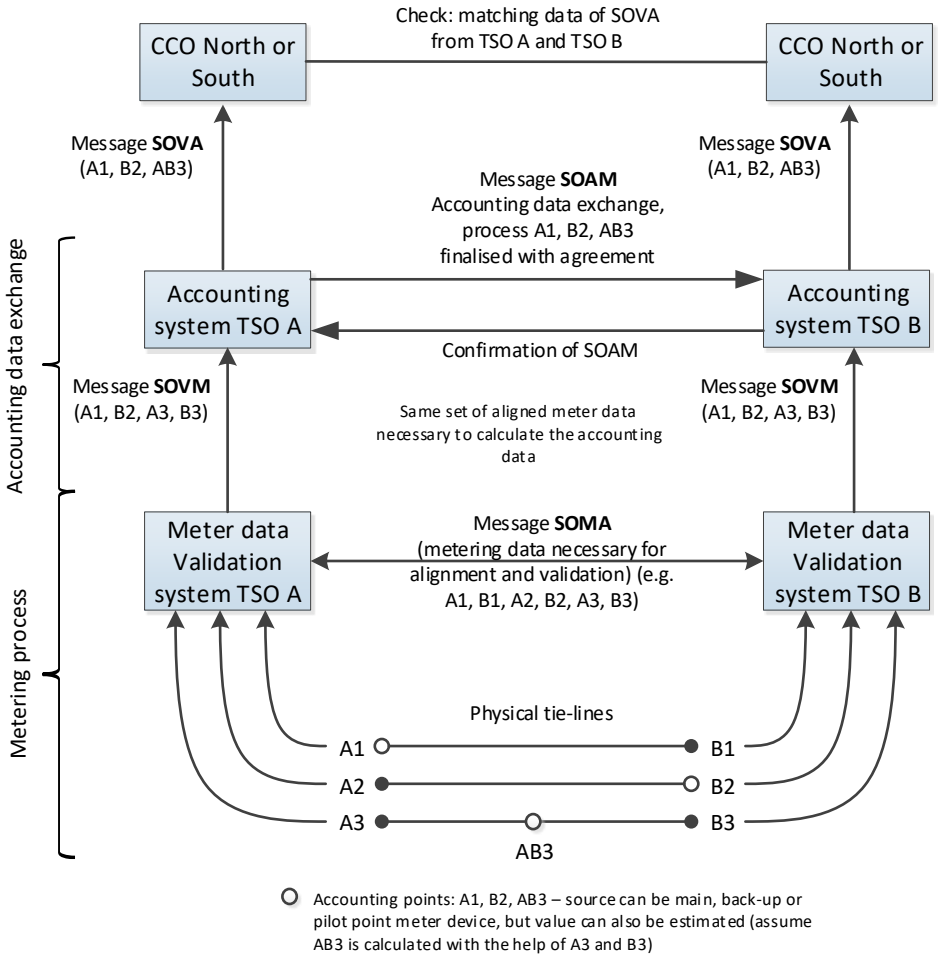

Figure 1 - Accounting process related to establishing accounting data description

This accounting process begins with collection of metered measurement data for each common tie-line on both sides of the border. Each TSO assembles and sends his meter measurement data document "System Operator Meter Alignment" (SOMA) to his adjacent/neighbouring TSO.

Every TSO validates the contents of the SOMA document. The TSOs inform each other about the result of validation.
In case of unsuccessful validation both TSO follow the predefined troubleshooting procedures within bilateral accounting agreement until successful validation is reached. In case of successful validation, the metered measurement data document “System Operator Validated Measurements” (SOVM) is assembled and sent to the accounting data system of the TSO in order to calculate the accounting data (e.g. consideration of losses).

Based on agreed rules from bilateral accounting agreement and using the validated meter measurement data, the accounting data is calculated and assembled into a document “System Operator Accounting data Matching” (SOAM). SOAM is sent from TSO A to TSO B. TSO B is requested to validate this data. Which TSO assumes the sending and validating role is defined for each border in the bilateral agreement. In case of unsuccessful matching, both TSOs follow the predefined troubleshooting procedures within bilateral accounting agreement until successful matching is reached. After successful matching, both TSOs assemble document “System Operator Validated Accounting” (SOVA) and send it to the related CCO.

The CCOs match the respective SOVA, meaning they should receive from both TSOs the same data in the SOVA files. In case of non-successful matching, involved TSOs are notified about the result and are required to send the corrected SOVA. In case of successful matching the accounting process is complete.

The daily accounting process is usually finished on the first working day after energy delivery. It starts with the initial exchange of metered data between neighbouring TSOs, continues with the establishment of the accounting data, and the transmission of the resulting data up to the CCO (and in some cases LFC block Operators) and finishes with the exchange of the accounting data between the CCO.

If accounting data is based on substitute metered measurement data, the two involved TSO have time to adjust the data during the final monthly accounting process. If data is not adjusted by the TSO and they match, this data is considered as final.

4.2 General Introduction to FSKAR process

Due to the physical nature of an interconnected network, there are unavoidably deviations between the intended exchange (scheduled exchange + FCP + RP) and the actual physical flows. These deviations are referred to as unintended Exchange. The EBGL in the Art. 50(3) and 51(1) requires that the settlement of the unintended exchange, the FCP and RP shall be done financially.

The deviations are determined as the difference between the physical exchanges (as determined by metered data, agreed upon by neighbouring TSOs) and the scheduled exchanges (this includes the ANES and the exchanges realized over VTL), per each LFC area or block and for a given settlement period. These deviations capture three different components.

- Frequency containment process energy (FCP energy) results from the activation of FCR across the synchronous area and is an intended component.
- Ramping period energy (RPE) results from the application of ramps to the scheduled exchanges and is also an intended component.
- The third component, corresponding to the residual amount, is the actual unintended exchange.

The aim of the FSKAR process is to perform the accounting and settlement of these three components with a price. The accounting consists of capturing the FCP energy, RP energy and unintended exchange for all LFC blocks and areas. Settlement corresponds to the calculation of a price for each of the three components, and the resulting TSO invoicing. The agreement between RGCE TSOs is to settle FCP energy and unintended exchange at the same price, established based on day-ahead market prices, and the RP energy at a zero price.

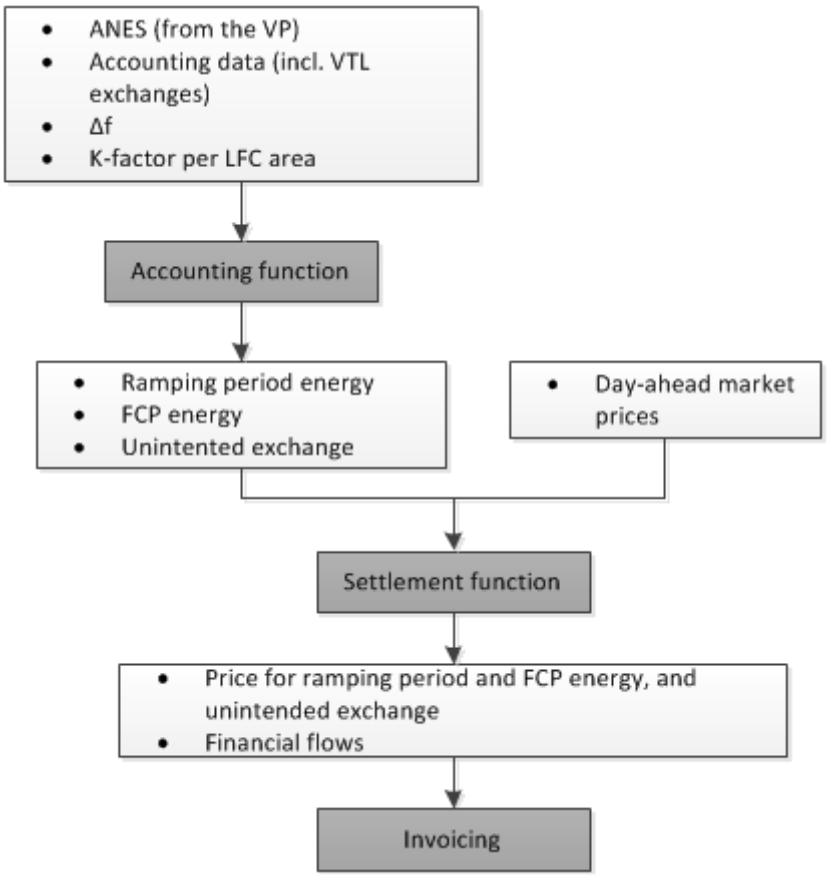

Figure 2 - Data flow and setup of Accounting and Settlement functions of FSKAR

4.2.1 Accounting process: determination of energy exchanges

When the process of establishing accounting metering devices data is complete, the sum of the accounting data from the LFC areas is compared to the sum of the LFC Areas schedules (ANES - Aggregated netted external schedules) for the settlement period in order to determine the exchanged FCP energy, RP energy and UE.

The input parameters are the scheduled energy exchange E_{SCH}, the exchanged energy between the LFC areas/blocks E_{ex} as reflected in the accounting data, the frequency deviation Δf and the K-factor.
ENTSO-E (SG SF) determines yearly K-factors for all TSOs in the synchronous area, which are used by the CCs. TSOs participating in the FCR cooperation additionally update these K-factors on a daily basis with 4h-resolution, and these TSOs therefore are required to additionally send the updated K-factors to the CCs

The energy exchange is calculated as follows:

$$E_{ex} = E_{ie} + E_{ue}$$

$$E_{ie} = E_{VTL} + E_{sch} + E_{FCP} + E_{RP}$$

$$E_{FCP} = -K * \Delta f * \frac{1}{4} h$$

$$E_{ue} = E_{ex} - E_{sch} - E_{VTL} - E_{FCP} - E_{RP}$$

The parameters in the calculations refer to the cross-border energy exchange that is intended (E_{ie}) and unintended Energy (Eue).

Eie is the sum of virtual tie lines (E_{VTL}), schedules (Esch), FCP (E_{FCP}) and ramping period processes (E_{RP}).

Unintended exchangeE_{ue} is equal to the remaining energy exchanges, which are not included or due to the verified ANES, the virtual tie-line exchanges, the delivery of FCR (FCP energy) or the realization of ramps in the control programs (RP energy).

The unintentional deviation E_{UD} is broken down into three different components (E_{RP}, E_{FCP} and E_{ue}) in the new FSKAR process and is thus not used by itself anymore.

The outputs of the accounting function are E_{FCP}, E_{RP} and E_{ue}.

E_{RP} is the difference between a step change and a ramped change, where the ramp is linear starting 5 minutes before the change and 5 minutes after the change.

4.2.2 Settlement process: determination of Prices

The input parameters to calculate the settlement price for each settlement period (15 min.) are the day-ahead market prices (DAMP), E_{ue} and E_{FCP} for each LFC area/block and Δf.
The DAMP are send every day to the CC by the LFC Operator

Frequency – independent component is calculated as follows:

$$Price_{ref}(t) = \frac{\sum_m DAMP_m(t) * (|E_{ue} + E_{FCP}|)_m(t)}{\sum_m (|E_{ue} + E_{FCP}|)_m(t)}$$

Frequency – dependent component calculated as follows:

$$Price_{UE,FCP}(t) = \begin{cases} Price_{ref}(t) - 2\,€/mHz * (-100\,mHz + 20\,mHz) & \Delta f(t) < -100\,mHz \\ Price_{ref}(t) - 2\,€/mHz * (\Delta f(t) + 20\,mHz) & -100\,mHz \le \Delta f(t) < -20\,mHz \\ Price_{ref}(t) & -20\,mHz \le \Delta f(t) \le 20\,mHz \\ Price_{ref}(t) - 2\,€/mHz * (\Delta f(t) - 20\,mHz) & 20\,mHz < \Delta f(t) \le 100\,mHz \\ Price_{ref}(t) - 2\,€/mHz * (100\,mHz - 20\,mHz) & \Delta f(t) > 100\,mHz \end{cases}$$

The outputs consist of cash flows for each LFC area for each settlement period. Sum of cash flows must be zero over each settlement period.

4.2.3 Invoicing (Out of scope)

The detailed process for the invoicing is out of scope of this IG.

The CCs provide the TSOs with settlement reports according to the results of the settlement. The invoicing entity is provided with the resulting settlement values once per month.

4.2.4 Transparency reporting (Out of scope)

The Transparency Platform (TP) receives settlement report according to the results of the settlement process. As the invoicing process, this is out of scope of this IG and is defined in the FSKAR Transparency IG referenced in the beginning of the document

4.3 Use cases

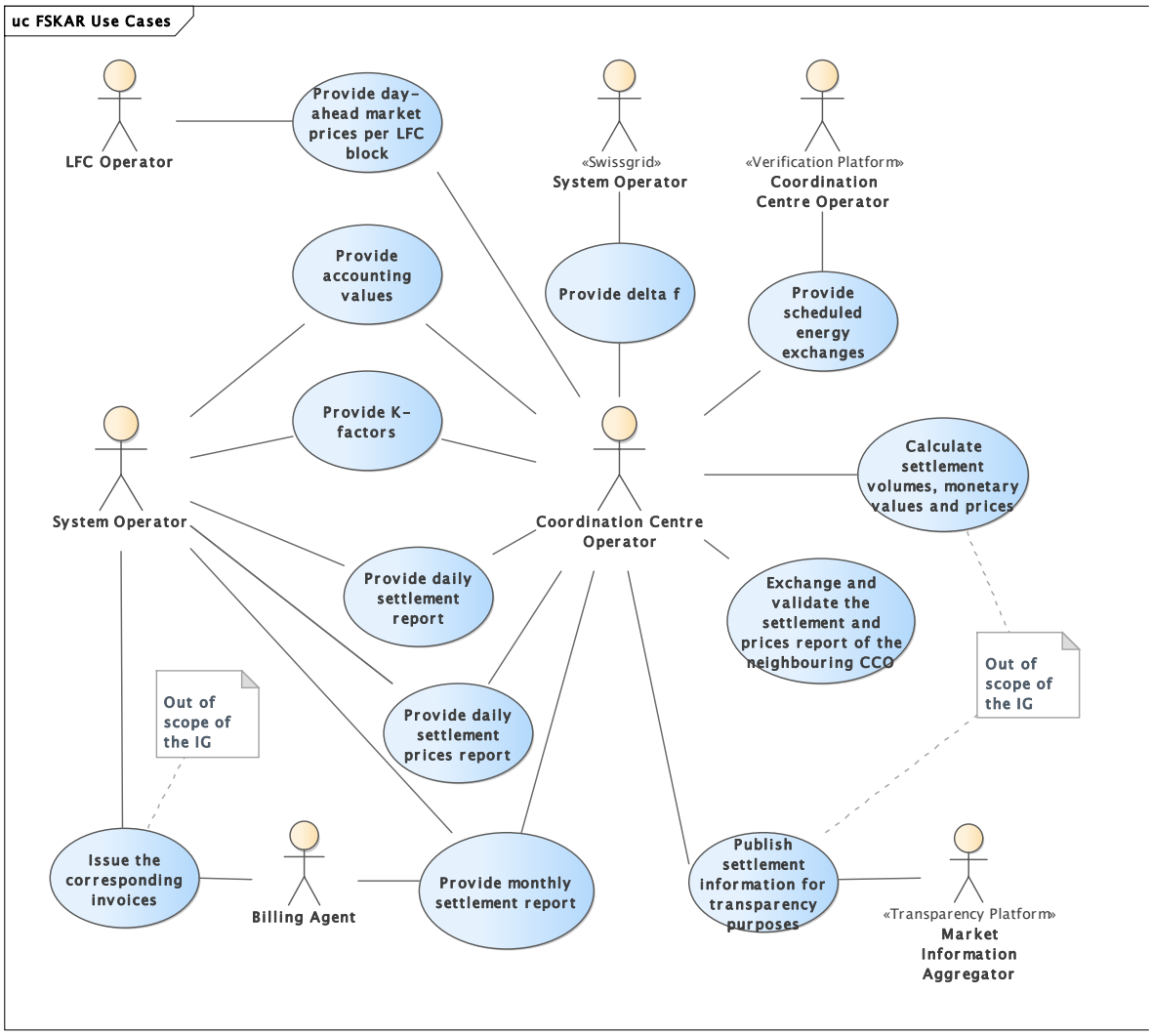

Figure 3 - Use Case diagram

Table 1 gives a list of roles involved in the FSKAR business process.

Table 1 - Role labels and descriptions

Role Label	Role Description
Billing Agent	A Billing Agent is the role that acts as an intermediate between SOs for invoicing purposes.
Coordination Centre Operator (CCO)	The CCO coordinates the data received from the SOs of its Coordination Centre Zone and performs business check with the other(s) CCO. It then calculates the physical and financial settlement for each SOs of its Coordination Centre Zone. It is the one responsible for the publication of data to the MIA and the SOs of its Coordination Centre Zone. Note: in the FSKAR process, the Verification Platform sending the ANES is considered as part of the CCO role
Market Information Aggregator (MIA)	The MIA receives and publishes all submitted information by the Coordination Centre Operator. Note: in the FSKAR process, the MIA role is played by Transparency Platform.

Role Label	Role Description
System Operator (SO)	Within the FSKAR process, the SOs must provide the accounting (measurement data) values in SOVA files to the CCO. Additionally, SOs participating in the FCR cooperation must submit the updated K-factors to the CCOs. The SOs will then receive settlement information from the CCO that they will have to validate, and potential associated invoice they will have to settle. Note: The SO "Swissgrid" has also the responsibility of sharing the delta f value with the CCOs.
LFC Operator	LFC Operator is in charge of providing the Day-Ahead Market Prices per LFC block/Area

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374 Table 2 gives a list of use cases for the FSKAR Transparency reporting.
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376 **Table 2 - FSKAR use cases**

Use case label	Roles involved	Action descriptions and assertions
Provide accounting values	SO, CCO	The SO sends to their CCO the System Operator Validated Measurements (SOVA). The SOVA corresponds to relevant interconnections accounting data established and validated by both SOs. (In phase 1 of the IG, does not change)
Provide K-factors	SO, CCO	Each SO sends their K-factors to their CCO. Yearly for most SOs: determined centrally by ENTSO-E SG SF. 4h-resolution for SOs in FCR cooperation.
Provide Day-ahead market prices (DAMP) per LFC block/Area	LFC Operator, CCO	All LFC operators send their DAMP per LFC block/Area to their CCO. DAMP is submitted per default on LFC block level, but for LFC blocks for multiple LFC areas, DAMP can be submitted per LFC area, if agreed with the CCO.
Provide delta f (Δf)	SO, CCO	System Operator (Swissgrid) sends the delta f to the CCO.
Provide scheduled energy exchanges (ANES)	CCO	The Verification Platform (Controlled by CCO) provides the scheduled exchanges to the CCOs. The ANES describe agreed energy flow on interconnections.
Calculate settlement volumes, monetary values and prices	CCO	Based on the SOs input, the CCO calculates the settlement volumes and its monetary values for each LFC area, as well as the prices for these exchanges Frequency Containment Process Energy, Ramping Energy Unintended Exchanges
Provide Daily Settlement Report (DSR)	CCO, SO	The CCO calculates the settlement volumes for each SO and provides to the SO the relevant information: settlements volumes, K-factor, accounting data, ANES and delta f.
Provide Daily Settlement Prices Report (DSPR)	CCO, SO	Once all SO have sent their DAMP to the CCO, the CCO calculates and sends the daily settlement prices and monetary values, as well as the SO settlement volumes. It also send back the SO DAMP prices that were used for the calculation.

Use case label	Roles involved	Action descriptions and assertions
Provide Monthly Settlement Report (MSR)	CCO, SO, Billing agent, MIA	After the deadline for problem reporting has expired for all days of the month and all problems have been closed, the CCO establishes the MSR (volumes, monetary values and prices) which are send to the SOs. The SOs are asked to validate the MSRs within 4 working days. Once all the MSRs have been validated for the month, the CCO sends the MSRs to the Billing Agent (validated settlement volumes, prices and monetary values)
Exchange and validate the settlement and prices report of the neighbouring CCO	CCO	Prior to the settlement prices determination, the CCOs exchange the settlement volumes and DAMP of the SOs of their CCZ Following determination of the settlement prices, the CCOs confirmed between themselves that they calculated the same data.
Publish settlement information for transparency purposes	CCO, MIA	CCO sends monthly validated settlement data (volumes, monetary values and prices of frequency containment process energy, ramping energy and unintended exchanges) to MIA for transparency purposes, ensuring SOs have access to all settlement data.
Issue the corresponding invoices	Billing Agent, SO	Billing Agent acts as a financial intermediary for billing.

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4.4 Activity diagram

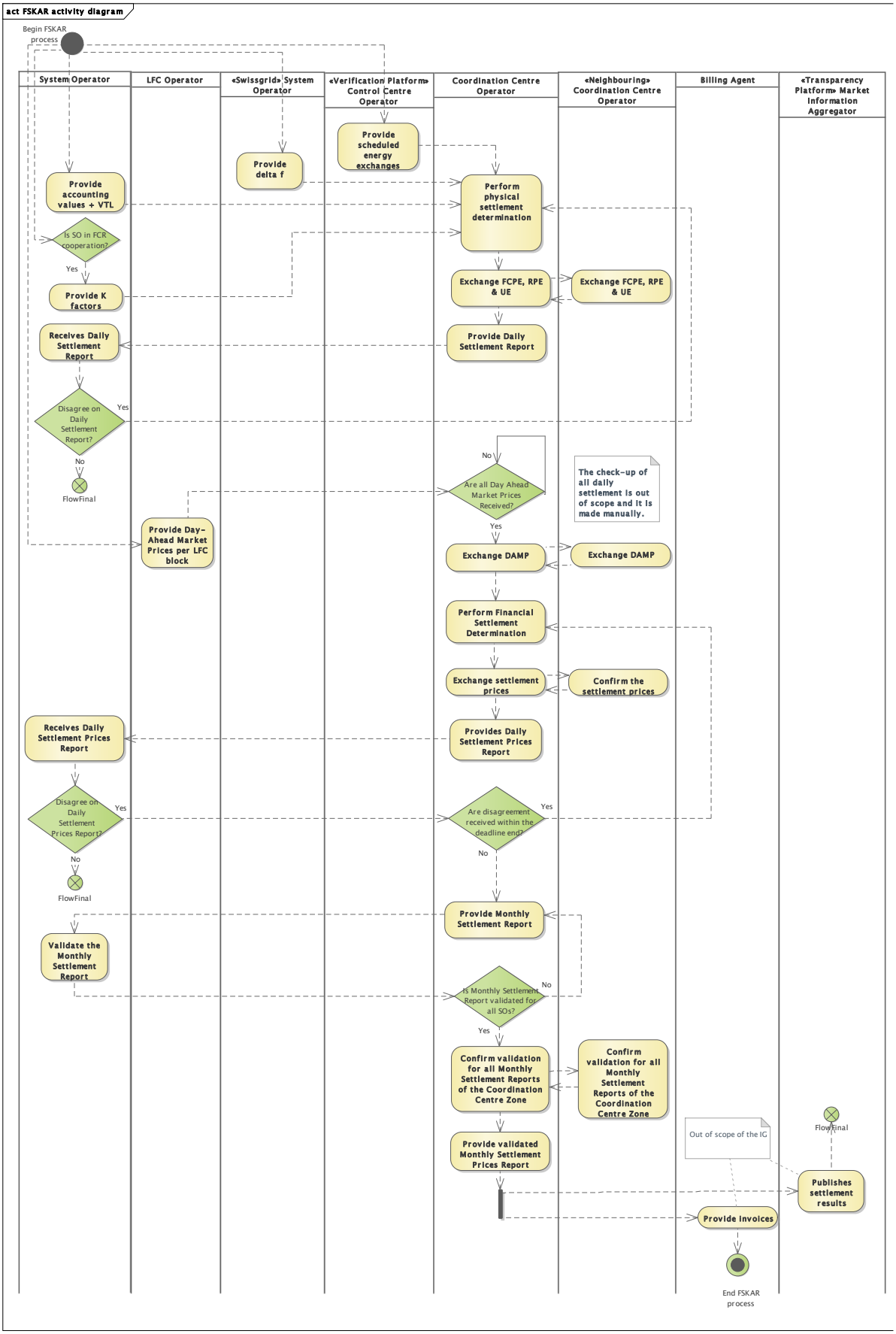

Figure 4 - Activity diagram

If you seek precision regarding the accounting process, please refer to current IG “RG CE accounting-guide-v2r0”

As soon as data are available for a given day, SOs are supposed to send to their respective CCO the following relevant information:

- The bilaterally agreed data on interconnector (SOVA), which details all physical Tie - Line, plus the Virtual Tie Line
- The K-factor. ENTSO-E (SG SF) determines yearly K-factors for all SOs in the synchronous area, which are used by the CCs. This exchange is not detailed in the IG. SOs participating in the FCR cooperation additionally update these K-factors on a daily basis with 4h-resolution, and these SOs therefore are required to additionally send the updated K-factors to the CCs. This is the exchange detailed in the IG

The CCOs also need the delta f, which will be send by the Swiss SO **Swissgrid** for the whole Synchronous Area

Finally, the CCOs will extract from the Verification Platform the scheduled energy exchanges.

Once all the information have been gathered, CCOs can calculate the settlement volumes:

- Frequency Containment Process Energy,
- Ramping Energy
- Unintended Exchanges

The CCO then exchange between themselves the result of their calculation and send back to each SO the daily settlement report. The daily settlement report contains for the concerned SO its settlement volumes, K-factor, ANES and SOVA, as well as the delta f or the Synchronous Area.
If he wants to, the SO can, thanks to this information, check that the data used by the CCO were correct, and also redo the calculation. In case of disagreement, within 4 working days, the SO can reach out the CCO accounting office. If necessary, CCO (re)sends an updated daily settlement report to the SO(s).

In parallel of the daily settlement process, LFC operators are supposed to send the DAMP of each LFC block/Area to the CCO. As the DAMP are originally per Bidding zone and not LFC block/Area, calculation may be done by the SOs part of the same LFC block in order to have a common DAMP. For more detail, please refer to the business description in the reference.

Once all DAMP prices have been sent, all the CCOs calculated the settlement prices, namely;

- Frequency Containment Process Energy prices,
- Ramping Energy prices
- Unintended Exchanges prices

In order to do so, the CCO have to exchange between themselves the DAMP of their respective LFC block. After the calculation, one CCO will send its result to the other(s), which have to confirm the result.

When all CCOs agree and the 4 days deadline is over, the CCO sends the daily settlement prices report to the SOs. The daily settlement prices report contains the settlements volumes and the associated monetary values of the SO, as well as the settlements prices, which are the same for the whole Synchronous Area.
It also contains the SO DAMP prices that were used for the calculation

The SO has four (4) workings days to perform business check on the data received. In case of disagreement, the SO can reach out the helpdesk of its CCO. If necessary, updated daily settlement report, or daily settlement prices report will be send to the SO(s)

Once, for all day of the month, all mismatch have been cleared and the deadline are over, the CCOs send the monthly settlement report to the SOs. The monthly settlement report contains the settlement volumes and monetary values of the SO, as well as the settlement prices of the Synchronous Area, for the whole month

The SOs have four (4) workings day to confirm whether or not they accept the result.
To confirm, the Confirmation Document will be used with the header and a reason code indicating whether the monthly settlement report was accepted or rejected. In case of rejection the SO has to explain the reason of disagreement directly with the accounting office of the CCO.

When all the SOs have confirmed the monthly settlement report, CCO confirms the validation for all Monthly Settlement Reports of its Coordination Centre Zone (via email), that the reports have been confirmed.

Once this is completed, one designated CCO sends to the billing agent and the MIA the validated monthly settlement report of all SOs. This report contains the settlements volumes and monetary values of all SO, as well as the settlement prices of the Synchronous Area.

4.5 Document exchange processes

4.5.1 General overview

Next figure shows a general sequence diagram of the document exchange processes.

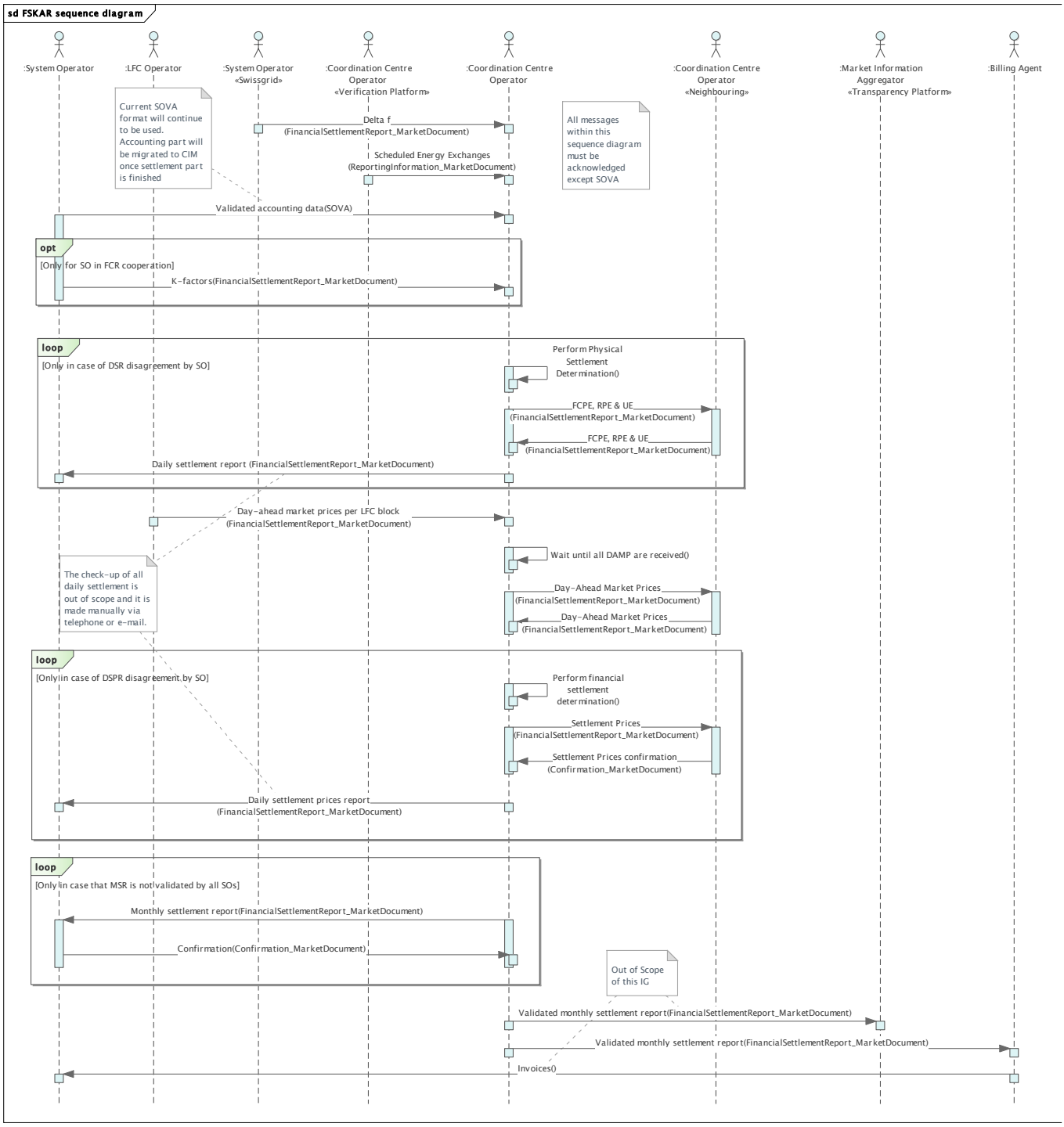

Figure 5 - Sequence diagram

The use cases are supported by the following document exchanges:

4.5.1.1 Acknowledgement – Acknowledgement_MarketDocument

All received documents except SOVA must be acknowledged with an acknowledgment document, IEC 62325-451-1, in a syntactic and business/semantic way by the different parties.

4.5.1.2 Validated accounting data – SOVA

SO provides all its accounting data to the CCO using the current SOVA files. The accounting data includes the validated metered measurements for each physical tie-line and should also reflect the exchanges per virtual tie-lines. This VTL exchanges may include but are not limited to aFRR exchanges and imbalance netting.

The process for submitting the SOVA files is already implemented and will be translated into CIM ESMP for the next release of this IG.

4.5.1.3 Delta f – FinancialSettlementReport_MarketDocument

The frequency deviation is one of the inputs for the financial settlement process and represents the simple average value of the frequency deviations in the Synchronous Area per TSO-TSO settlement period. Swissgrid (SO) is the only party in charge of providing the delta f to the CCOs.

4.5.1.4 Scheduled Energy Exchanges – ReportingInformation_MarketDocument.

Refers to the energy corresponding to the sum of the ANES for each LFC area/block, as obtained from the Verification Platform by the CCOs.

4.5.1.5 K-factors – FinancialSettlementReport_MarketDocument

It represents the assumed reaction of an LFC area/block to a frequency deviation. There are SOs which have a yearly K-factor, while the SOs cooperating in the FCR cooperation have a time resolution of K-factors equal to 4 hours. The current working assumption is:

- Yearly K-factors are configurated manually once a year, when the SG SF defines them for the SA CE. (Out of scope of the IG)
- SOs in the FCR cooperation send the K-factors for each 4h-period to the CCs. These are then updated for those SOs.

4.5.1.6 FCPE, RPE and UE exchange – FinancialSettlementReport_MarketDocument

Once the physical settlement determination is performed, CCOs must exchange the settlement volumes: FCP energy, RP energy and Unintended exchange for each LFC area/block. This data exchange allows CCOs to be aligned.

4.5.1.7 Daily settlement report (DSR) – FinancialSettlementReport_MarketDocument

The daily settlement report includes ANES, K factor, delta f, and settlement volumes (FCPE, RPE and UE) previously calculated during the physical settlement determination phase. DSRs also contains metered flows for each tie-line.

In case that SO agrees with the DSR no more actions are required from SO side. In case of disagreement, the SO must coordinate with the CCO. The check-up of all daily settlement is out of scope and it is made manually via telephone or email within 4 days. In case of DSR disagreement, the physical settlement determination must be run again and consequently SOs should exchange FCPE, RPE and UE again and provide a new DSR to the SO.

4.5.1.8 Day-Ahead Market Prices (DAMP) – FinancialSettlementReport_MarketDocument

The price determination is also known as the financial settlement function and is carried out by the CCOs. The main inputs for the financial settlement are the volumes calculated during the physical settlement determination and the Day-Ahead Market Prices (DAMP). DAMP for each LFC block/Area is provided by each corresponding LFC operator in €. DAMP is submitted per default on LFC block level, but for LFC blocks for multiple LFC areas, DAMP can be submitted per LFC area, if agreed with the CCO.

CCOs must exchange the received DAMP from their associated LFC Operators. This way all CCOs have all the prices from all the LFC blocks within the Synchronous Area.

4.5.1.9 Settlement prices exchange – FinancialSettlementReport_MarketDocument; Confirmation_MarketDocument

Once the financial settlement determination process has finished, CCO exchange with the neighbouring CCO the settlement prices for FCPE, RPE and UE. The neighbouring CCO checks if the received prices are in line with the ones calculated on its side. Neighbouring CCO answers confirming if the prices are fine or there are discrepancies using Confirmation document.

4.5.1.10 Daily settlement prices report (DSPR) – FinancialSettlementReport_MarketDocument

Once the settlement prices have been confirmed and 4 days deadline of DSR is over, CCO delivers the DSPR to their associated SOs. This report includes daily settlement prices (FCPE, RPE and UE) to the SO, as well as the settlement volumes (FCPE, RPE and UE) and monetary values.

This report also contains the SO DAMP prices that were used for the calculation

In case that SO agrees with the DSPR no more actions are required from SO side. In case of disagreement, the SO must coordinate with the CCO. The check-up of all daily settlement is out of scope and it is made manually via telephone or email within 4 days. In case of DSPR disagreement, the financial settlement determination must be run again and consequently SOs should exchange settlement prices again and provide a new DSPR or DSR to the SO.

4.5.1.11 Monthly settlement report (MSR) – FinancialSettlementReport_MarketDocument, Confirmation_MarketDocument

After the deadline for problem reporting has expired for all days of the month and all problems have been closed, the CCO establishes the monthly settlement results (volumes, monetary values and prices) which are sent to the SOs for validation. SO confirms if the report is fine or there are discrepancies using Confirmation document within 4 days.

Once the MSR has been validates for all SOs, then it can be submitted to Market Information Aggregator (TP) for publication (Out of scope) and to the Billing Agent to issue the corresponding invoices.

4.6 Documents overview

The document exchange processes of FSKAR described in the previous chapter require sending and receiving various ESMP documents. The information to be exchanged is:

- Acknowledgement_MarketDocument v8.1 based on IEC 62325-451-1:2017 Ed2;
- Confirmation_MarketDocument v5.1 based on IEC 62325-451-2:2014;
- FinancialSettlementReport_MarketDocument v1.0;
- ReportingInformation_MarketDocument v2.1;
- SOVA (Current SOVA format will continue to be used. Accounting part will be migrated to CIM once settlement part is finished)

4.7 FinancialSettlementReport_MarketDocument

Following table shows a description of the different attributes in FinancialSettlementReport_MarketDocument v1.0 to be used in this business process

4.7.1 FinancialSettlementReport_MarketDocument Dependendency Table

Table 3 - FinancialSettlementReport_MarketDocument Dependency Table 1/2

FinancialSettlementReport_MarketDocument						
Class	**Attribute**	**Delta f**	**K-factors**	**DAMP (Between LFC operator and CCO)**	**DAMP (CCO Coordination)**	**FCPE, RPE & UE (CCO Coordination)**
Financial Settlement Report_ Market Document	mRID	Used	Used	Used		Used
	revisionNumber	Used	Used	Used		Used
	type	B43: Settlement coordination document	B42: K-factor document	A44: Price document	B43: Settlement coordination document	B43: Settlement coordination document
	process.processType	A57: FSKAR settlement	A57: FSKAR settlement	A57: FSKAR settlement		A57: FSKAR settlement
	sender.mRID	Used	Used	Used		Used
	sender.roleType	A04: System Operator	A04: System Operator	A48: LFC Operator	A16: Coordination Centre Operator	A16: Coordination Centre Operator
	receiver.mRID	Used	Used	Used		Used
	receiver.roleType	A16: Coordination Centre Operator	A16: Coordination Centre Operator	A16: Coordination Centre Operator		A16: Coordination Centre Operator
	createdDateTime	Used	Used	Used		Used
	period.timeInterval	Used. Daily Period	Used. Daily Period	Used. Daily Period		Used. Daily Period

FinancialSettlementReport_MarketDocument						
Class	**Attribute**	**Delta f**	**K-factors**	**DAMP (Between LFC operator and CCO)**	**DAMP (CCO Coordination)**	**FCPE, RPE & UE (CCO Coordination)**
	domain.mRID	EIC code of the Synchronous Area. Coding Scheme: A01	EIC code of the Synchronous Area. Coding Scheme: A01	EIC code of the LFC block or Area. Coding Scheme: A01		EIC code of the Synchronous Area. Coding Scheme: A01
	docstatus	Not used	Not used	Not used		Not used
Timeseries	mRID	Used	Used	Used		Used
	businessType	C38: Frequency Deviation	C25: K-factor	C39: Day-Ahead Market Price		C34: Frequency Containment Process Energy C36: Ramping Period Energy A21: Unintended Energy
	product	8716867000016: Active power	8716867000016: Active power	8716867000016: Active power		8716867000016: Active power
	curveType	A01: Sequential Fixed Block A03: Variable Fixed Block	A01: Sequential Fixed Block A03: Variable Fixed Block	A01: Sequential Fixed Block A03: Variable Fixed Block		A01: Sequential Fixed Block A03: Variable Fixed Block
	measurement_Unit.name	MTZ: Millihertz	E08: Megawatt per Hertz	MWH: megawatt hours		MWH: megawatt hours
	currency_Unit.name	Not used	Not used	EUR: EURO		Not used

FinancialSettlementReport_MarketDocument						
Class	**Attribute**	**Delta f**	**K-factors**	**DAMP (Between LFC operator and CCO)**	**DAMP (CCO Coordination)**	**FCPE, RPE & UE (CCO Coordination)**
	in_Domain	Not used	EIC code of the LFC area/block. Coding Scheme: A01 **Note**: Same EIC code in in & out domain	EIC code of the LFC block/Area. Coding Scheme: A01 **Note**: Same EIC code in in & out domain		EIC code of the importer LFC area/ block or Synchronous area. Coding Scheme: A01
	out_Domain	Not used	EIC code of the LFC area/block. Coding Scheme: A01 **Note**: Same EIC code in in & out domain	EIC code of the LFC block/Area Coding Scheme: A01 **Note**: Same EIC code in in & out domain		EIC code of the exporter LFC area/block or Synchronous area. Coding Scheme: A01
	connectingLine_ RegisteredResource	Not used	Not used	Not used		Not used
Series_Period	timeInterval	Used	Used	Used		Used
	resolution	PT15M	PT1H	PT15M		PT15M
Point	position	Used	Used	Used		Used
	quantity	Used	Used	Used		Used (Volume quantity)
	monetaryValue_Quantity.quantity	Not used	Not used	Not used		Not used

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563 **Table 4 - FinancialSettlementReport_MarketDocument Dependency Table 2/2**

FinancialSettlementReport_MarketDocument					
Class	**Attribute**	**Settlement prices exchange (CCO Coordination)**	**Daily Settlement Report (DSR)**	**Daily Settlement Prices Report (DSPR)**	**Monthly Settlement Report (MSR)**
Financial Settlement Report_ Market Document	mRID	Used	Used	Used	Used
	revisionNumber	Used	Used	Used	Used
	type	B43: Settlement coordination document	B38: Settlement document	B44: Financial settlement document	B44: Financial settlement document
	process. processType	A57: FSKAR settlement	A57: FSKAR settlement	A57: FSKAR settlement	A57: FSKAR settlement
	sender.mRID	Used	Used	Used	Used
	sender.roleType	A16: Coordination Centre Operator	A16: Coordination Centre Operator	A16: Coordination Centre Operator	A16: Coordination Centre Operator
	receiver.mRID	Used	Used	Used	Used
	receiver.roleType	A16: Coordination Centre Operator	A04: System Operator	A04: System Operator	A04: System Operator A10: Billing Agent
	createdDateTime	Used	Used	Used	Used
	period.timeInterval	Used. Daily Period	Used. Daily Period	Used. Daily Period	Used. Monthly Period
	domain.mRID	EIC code of the Synchronous Area. Coding Scheme: A01	EIC code of the Synchronous Area. Coding Scheme: A01	EIC code of the Synchronous Area. Coding Scheme: A01	EIC code of the Synchronous Area. Coding Scheme: A01

FinancialSettlementReport_MarketDocument					
Class	**Attribute**	**Settlement prices exchange (CCO Coordination)**	**Daily Settlement Report (DSR)**	**Daily Settlement Prices Report (DSPR)**	**Monthly Settlement Report (MSR)**
	docstatus	Not used	A13: Withdrawn Only used in case a document has been submitted by mistake	A13: Withdrawn Only used in case a document has been submitted by mistake	A13: Withdrawn Only used in case a document has been submitted by mistake
Timeseries	mRID	Used	Used	Used	Used

	businessType	C35: FCPE price C37: RPE price C33: UE price	B63: Aggregated netted external schedule (ANES) C34: Frequency Containment Process Energy C36: Ramping Period Energy A21: Unintended Energy C25: K-factor C38: Frequency deviation A66: Energy Flow (Metered Tie-Line flows for each Tie-Line A67: Powerplant energy schedule (Intended energy exchange for each Virtual Tie-Line A44: Compensation Program (Temporary)	C34: Frequency Containment Process Energy C36: Ramping Period Energy A21: Unintended Energy C35: FCPE price C37: RPE price C33: UE price C39: Day-Ahead Market Price	C34: Frequency Containment Process Energy C36: Ramping Period Energy A21: Unintended Energy C35: FCPE price C37: RPE price C33: UE price
	product	8716867000016: Active power	8716867000016: Active power	8716867000016: Active power	8716867000016: Active power

FinancialSettlementReport_MarketDocument					
Class	**Attribute**	**Settlement prices exchange (CCO Coordination)**	**Daily Settlement Report (DSR)**	**Daily Settlement Prices Report (DSPR)**	**Monthly Settlement Report (MSR)**
	curveType	A01: Sequential Fixed Block A03: Variable Fixed Block	A01: Sequential Fixed Block A03: Variable Fixed Block	A01: Sequential Fixed Block A03: Variable Fixed Block	A01: Sequential Fixed Block A03: Variable Fixed Block
	measurement _Unit.name	MWH: megawatt hours	MTZ: Millihertz (Only for Frequency Deviation) E08: Megawatt per Hertz (Only for K-factor) MWH: megawatt hours (For all except Frequency Deviation and K-factor)	MWH: megawatt hours	MWH: megawatt hours
	currency _Unit.name	EUR: EURO	Not used	EUR: EURO	EUR: EURO

FinancialSettlementReport_MarketDocument					
Class	**Attribute**	**Settlement prices exchange (CCO Coordination)**	**Daily Settlement Report (DSR)**	**Daily Settlement Prices Report (DSPR)**	**Monthly Settlement Report (MSR)**
	in_Domain	Not used (Synchronous area code already in header)	EIC code of the importer LFC area/block or Synchronous area. Coding Scheme: A01	For FCPE price, RPE price and UE price : Not used (Synchronous area code already in header) For DAMP: EIC code of the LFC block/Area. (Same in both in-and out domain attributes) For the rest EIC code of the importer LFC area/block or Synchronous area. Coding Scheme: A01	For FCPE price, RPE price and UE price: Not used (Synchronous area code already in header) For the rest: EIC code of the importer LFC area/block or Synchronous area. Coding Scheme: A01

FinancialSettlementReport_MarketDocument					
Class	**Attribute**	**Settlement prices exchange (CCO Coordination)**	**Daily Settlement Report (DSR)**	**Daily Settlement Prices Report (DSPR)**	**Monthly Settlement Report (MSR)**
	out_Domain	Not used (Synchronous area code already in header)	For FCPE price, RPE price and UE price: Not used (Synchronous area code already in header) For the rest: EIC code of the exporter LFC area/block or Synchronous Area. Coding Scheme: A01	For FCPE price, RPE price and UE price: Not used (Synchronous area code already in header) For DAMP: EIC code of the LFC block/Area. (Same in both in-and out domain attributes) For the rest: EIC code of the exporter LFC area/block or Synchronous Area. Coding Scheme: A01	For FCPE price, RPE price and UE price: Not used (Synchronous area code already in header) For the rest: EIC code of the exporter LFC area/block or Synchronous Area. Coding Scheme: A01
	connectingLine_ RegisteredResource	Not used	EIC code of the tie-line. Coding Scheme: A01 Note: Used only with businessType codes A66 and A67	Not used	Not used
	timeInterval	Used	Used	Used	Used

FinancialSettlementReport_MarketDocument					
Class	**Attribute**	**Settlement prices exchange (CCO Coordination)**	**Daily Settlement Report (DSR)**	**Daily Settlement Prices Report (DSPR)**	**Monthly Settlement Report (MSR)**
Series_Period	resolution	PT15M	PT1H (Only for K-factors) PT15M (For the rest)	PT15M	PT15M
Point	position	Used	Used	Used	Used
	quantity	Used	Used Volume quantity for FCPE, RPE and UE businessType codes	Used Volume or price depending on the chosen businessType code	Used Volume or price depending on the chosen businessType code
	monetaryValue_Quantity.quantity	Not used	Not used	Used only with businessType codes C34, C36 and A21 Monetary value	Used only with businessType codes C34, C36 and A21 Monetary value

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565 Note: Volumes and monetary values of energy are always netted. If for a given 15-minute time
566 interval and In and Out domain couple there are non-zero values, then only a zero can be
567 provided for the opposite In and Out domain couple and the same 15-minute time interval.

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570 ## 4.8 ReportingInformation_MarketDocument

571 Following table shows a description of the different attributes in
572 ReportingInformation_MarketDocument v2.1 to be used in this business process

573 ### 4.8.1 ReportingInformation_MarketDocument Dependency Table

574 **Table 5 - ReportingInformation_MarketDocument Dependency Table**

ReportingInformation_MarketDocument		
Class	**Attribute**	**Values**
Reporting Information_ Market Document	mRID	Used
	revisionNumber	Used
	type	B26: Aggregated netted external schedule document
	process.processType	A57: FSKAR settlement
	sender.mRID	EIC code of Verification Platform 10V000000000009D
	sender.roleType	A32 = Market information aggregator
	receiver.mRID	EIC code of Coordination Centre Operator
	receiver.roleType	A16: Coordination Centre Operator
	createdDateTime	Used
	time_Period.timeInterval	Used. Daily Period
	domain.mRID	EIC code of the Coordination Centre Zone. Coding Scheme: A01
	dataset_marketDocument .mRID	Not used
	dataset_marketDocument. revisionNumber	Not used
	docstatus	Not used
	referenced_DateAndOrTime. date	Not used
	referenced_DateAndOrTime. time	Not used
Timeseries	mRID	Used
	businessType	B63: Aggregated netted external schedule (ANES)
	product	8716867000016: Active power
	in_Domain	EIC code of the importer LFC area/block. Coding Scheme: A01
	out_Domain	EIC code of the exporter LFC area/block. Coding Scheme: A01
	connectingLine_ RegisteredResource	Not used
	measurement_Unit.name	MAW: megawatt

ReportingInformation_MarketDocument		
Class	**Attribute**	**Values**
	curveType	A01: Sequential Fixed Block A03: Variable Fixed Block
	marketObjectStatus.status	Not used
Series_Period	timeInterval	Used
	resolution	PT15M
Point	position	Used
	quantity	Used
	posFR_Quantity.quantity	Not used
	negFR_Quantity.quantity	Not used

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577 4.9 Confirmation_MarketDocument

578 Following table shows a description of the different attributes in Confirmation_MarketDocument
579 v5.1 to be used in this business process.
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581 **Table 8 - Confirmation_MarketDocument Dependency Table**

Confirmation_MarketDocument		
Class	**Attribute**	**Values**
Confirmation_MarketDocument	mRID	Used
	type	A18: Confirmation Report
	createdDateTime	Used
	sender_MarketParticipant.mRID	EIC code of SO
	sender_MarketParticipant.marketRole.type	A04: System Operator for MSR confirmation or A16: Coordination Centre Operator for CCO confirmation
	receiver_MarketParticipant.mRID	EIC code of Coordination Centre Operator
	receiver_MarketParticipant.marketRole.type	A16: Coordination Centre Operator
	schedule_Period.timeInterval	Monthly Period
	confirmed_MarketDocument.mRID	Confirmed MSR mRID for MSR confirmation Confirmed settlement prices between CCO document mRID for CCO confirmation
	confirmed_MarketDocument.revisionNumber	Confirmed MSR revision number for MSR confirmation Confirmed settlement prices between CCO document revision number for CCO confirmation
	domain.mRID	EIC code of the Synchronous Area. **Coding Scheme: A01**
	Subject_MarketParticipant.mRID	Not used
	Subject_MarketParticipant.marketRole.type	Not used
	process.processType	Not used

Confirmation_MarketDocument		
Class	**Attribute**	**Values**
	Reason (Linked to Confirmation_MarketDocument class)	A01 if the SO/CCO confirm the data A02 if the SO/CCO disagrees and wants to trigger the contestation procedure
	Imposed_TimeSeries	Not used
	Confirmed_TimeSeries	Not used

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583 # 5 Communication channel

584 For all details in respect to the communication channel used for the message exchanges defined
585 in this Implementation Guide please refer to 'SAFA for RGCE – Annex 03 – Policy on Accounting
586 and Settlement'.
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