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## SSB Retuning Automations - User Guide



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## Technical User Guide — SSB Retuning Automations

### 1 Tool overview

**SSB Retuning Automations** is an automation platform for SSB retuning projects that can run in GUI or CLI mode or through a Web Interface (using a server/client infrastructure) and orchestrates five functional modules:

- **Module 0:** Update Network Frequencies.
- **Module 1:** Configuration Audit & Logs Parser.
- **Module 2:** Consistency Check (manual Pre/Post).
- **Module 3:** Consistency Check Bulk (automatic Pre/Post detection by market).
- **Module 4:** Final Clean-Up.

The main execution lives in "src/SSB\_RetuningAutomations.py", where CLI arguments, GUI, configuration persistence, input resolution (folders/ZIP), per-module execution, and artifact versioning are managed.

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## 2 Repository technical architecture

### 2.1 Main files

#### 2.1.1 Orchestration core

- "src/SSB\_RetuningAutomations.py": entry point, CLI/GUI parsing, module routing, batch/bulk execution, and versioning.

#### 2.1.2 Main modules files

- "src/modules/ConfigurationAudit/ConfigurationAudit.py": log parsing and audit workbook construction (Excel + PPT).
- "src/modules/ConfigurationAudit/ca\_summary\_excel.py": assembly of "SummaryAudit" and discrepancy dataframes.
- "src/modules/ConsistencyChecks/ConsistencyChecks.py": PRE/POST loading, relation comparison, discrepancies, and output export.
- "src/modules/ProfilesAudit/ProfilesAudit.py": profiles audit (integrated into module 1).
- "src/modules/CleanUp/FinalCleanUp.py": final clean-up (base implementation for extension).

#### 2.1.3 Common layer and utilities

- "src/modules/Common/\*.py": correction command logic and shared functions.
- "src/utils/\*.py": IO, parsing, frequency handling, Excel, pivots, sorting, infrastructure, and timing.

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## 3 Inputs, outputs, and content per module

### 3.1 Module 0 — Update Network Frequencies

#### 3.1.1 Input

- Input folder (may contain subfolders/ZIPs already supported by the IO layer).
- Logs with an "NRFrequency" table and the "arfcnValueNRDI" column.

#### 3.1.2 Process

1. Scan logs and detects "NRFrequency" blocks.
2. Extracts numeric values from "arfcnValueNRDI".
3. Removes duplicates and sorts frequencies.
4. Updates the persisted "Network frequencies" configuration for GUI/CLI.

#### 3.1.3 Output

- Does not generate Excel/PPT.
- Updates the persisted network frequency value used for filtering and selection in later runs.

#### 3.1.4 Detailed implementation notes

- The module reuses the same input resolver used by the other modules ("ensure\_logs\_available"), so it can consume either plain folders or folders containing ZIPs without changing operator workflow.
- It scans **all** detected logs, slices each "SubNetwork" block, and processes only blocks where MO name is exactly "NRFrequency".
- Inside each "NRFrequency" block, it reads "arfcnValueNRDI", keeps only strictly numeric values, deduplicates, and sorts numerically.
- The resulting list is persisted to "config.cfg" in "network\_frequencies" and also loaded in-memory into the "NETWORK\_FREQUENCIES" global list.
- In practice, this module should be executed after collecting representative logs from the network and then only when new frequencies are introduced. For stable markets, running it once is usually enough.

#### 3.1.5 Impact on GUI and Web Interface

- **Desktop GUI:** when launching in GUI mode (no CLI args), the app loads "network\_frequencies" from "config.cfg" and uses that list as the selectable values shown to users.

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- **Web Interface:** the backend endpoint loading defaults first tries persisted "network\_frequencies"; if empty, it falls back to parsing the hardcoded defaults from "SSB\_RetuningAutomations.py".
- This means Module 0 is the canonical mechanism to keep both interfaces aligned with real network frequency inventory.

## 3.2 Module 1 — Configuration Audit & Logs Parser

### 3.2.1 Inputs

- Input folder with logs ("log", ".logs", ".txt") or ZIPs resolvable by utilities.
- Frequency parameters:
  - "n77\_ssbb\_pre"
  - "n77\_ssbb\_post"
  - "n77b\_ssbb"
  - allowed SSB/ARFCN lists pre/post.
- Flags:
  - "profiles\_audit"
  - "frequency\_audit"
  - "export\_correction\_cmd"
  - "fast\_excel\_export".

### 3.2.2 Process

1. Parses files and extracts MO tables by "SubNetwork" blocks.
2. Generates one sheet per detected table.
3. Builds "SummaryAudit" + pivots/auxiliary summaries.
4. Runs profiles audit if enabled.
5. Exports CA correction commands if requested.
6. Generates the summary PPT.

### 3.2.3 Outputs

- Folder "ConfigurationAudit\_<timestamp>\_v<version>/".
- Excel file "ConfigurationAudit\_<timestamp>\_v<version>.xlsx":

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- Sheets for each parsed MO table.
- "SummaryAudit".
- NR/LTE parameter discrepancy sheets.
- Summary/pivot sheets by frequencies and relations.
- PPT file "ConfigurationAudit\_<timestamp>\_v<version>.pptx".
- Optional folder "Correction\_Cmd\_CA/" with AMOS commands.

### 3.2.4 Main semantic content

- **SummaryAudit** contains rows with:
- "Category", "SubCategory", "Metric", "Value", "ExtraInfo",
- and execution context fields (stage, module, etc. depending on the flow).
- "Value" usually represents a count of impacted nodes/cells/relations.
- "ExtraInfo" contains the NodeId list or a compact discrepancy detail.

## 3.3 Module 2 — Consistency Check (Pre/Post)

### 3.3.1 Inputs

- "input\_pre" and "input\_post" (or equivalent resolved structure).
- Frequencies "n77\_ssbb\_pre" and "n77\_ssbb\_post".
- Optional reference to PRE and POST "ConfigurationAudit" to enrich target classification.
- Optional list of frequency filters ("cc\_freq\_filters").

### 3.3.2 Process

1. Loads relation tables ("GUtranCellRelation", "NRCellRelation").
2. Normalizes columns/keys and selects the most recent snapshots by date.
3. Detect:
  - new relations,
  - missing relations,
  - parameter discrepancies,
  - frequency discrepancies,

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- summary by PRE/POST frequency pair.
4. Classify destination targets as "SSB-Pre", "SSB-Post" or "Unknown".
5. Exports detailed Excel outputs and correction commands.

### 3.3.3 Outputs

- "CellRelation\_<timestamp>\_v<version>.xlsx" (end-to-end relations view).
- "ConsistencyChecks\_CellRelation\_<timestamp>\_v<version>.xlsx" with:
  - "Summary"
  - "SummaryAuditComparisson" (if there is PRE/POST SummaryAudit)
  - "Summary\_CellRelation"
- GU blocks: "GU\_relations", "GU\_param\_disc", "GU\_freq\_disc", "GU\_freq\_disc\_unknown", "GU\_missing", "GU\_new"
- NR blocks: "NR\_relations", "NR\_param\_disc", "NR\_freq\_disc", "NR\_freq\_disc\_unknown", "NR\_missing", "NR\_new"
- optional "GU\_all", "NR\_all".
- "Correction\_Cmd\_CC/" with commands per type (new/missing/discrepancies).

## 3.4 Module 3 — Consistency Check Bulk

### 3.4.1 Inputs

- Root folder with subfolders like "yyyymmdd\_hhmm\_step0" (optionally nested by market).

### 3.4.2 Process

1. Detects PRE/POST candidates by the most appropriate date/time.
2. Excludes folders using a blacklist ("ignore", "old", "bad", "partial", "incomplete", "discard", etc.).
3. Runs Module 2 for each detected market.

### 3.4.3 Outputs

- Same output structure as module 2, per market.
- Traceability file "FoldersCompared.txt".

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## 3.5 Module 4 — Final Clean-Up

### 3.5.1 Inputs

- Final retune working folder.

### 3.5.2 Process

- Executes final cleanup policies (structure prepared to expand rules).

### 3.5.3 Outputs

- Versioned cleanup directory according to the active implementation.

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## 4 Configuration Audit module in detail

### 4.1 SummaryAudit checks philosophy

SummaryAudit sheet contains a high-level checks table by categories. The flow:

1. Excludes "UNSYNCHRONIZED" nodes based on "MeContext".
2. Evaluates NR, LTE, ENDC, Externals, TermPoints, cardinalities, and profiles.
3. Records each check as a row ("Category/SubCategory/Metric/Value/ExtraInfo").

### 4.2 Operational meaning of SummaryAudit rows

- **Category:** audited technical domain (NR/LTE/ENDC/MeContext/etc.).
- **SubCategory:** type of analysis (Audit/Inconsistencies/Profiles).
- **Metric:** specific rule evaluated.
- **Value:**
  - Integer: number of affected nodes/relations/cells.
  - "N/A": not evaluable due to missing columns.
  - Text: captured status or error.
  - **ExtraInfo:** list of nodes or bounded detail for troubleshooting.

### 4.3 SummaryAudit checks catalog

#### 4.3.1 MeContext Audit

- total unique nodes and unsynchronized node exclusion.
- "UNSYNCHRONIZED" nodes (excluded from the rest of the audits).

#### 4.3.2 NR Frequency Audit / NR Frequency Inconsistencies

**Source tables:** "NRCellIDU", "NRFrequency", "NRFreqRelation", "NRSectorCarrier", "NRCellRelation", "ExternalNRCellICU", "TermPointToGNodeB", "TermPointToGNB".

Main checks:

- Detection of NR nodes with N77 SSB (band 646600–660000).
- Classification of NR nodes as LowMidBand / mmWave / mixed.
- Nodes whose N77 SSBS are fully within allowed PRE or POST lists.

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- Nodes with N77 SSB outside allowed lists.
- Old/new SSB presence per node (only old, only new, both).
- Nodes with NRFreqRelationId in an unexpected format (auto-created outside convention).
- NR relations to old/new SSB.
- NR externals and termpoints pointing to old/new/unknown.

#### Typical triggering:

- Each check is enabled if the table and minimum required columns exist.
- If columns are missing, a "N/A" status row is added.
- If the table is empty or not found, an informative row "Table not found or empty" is added.

#### Interpretation:

- "Value > 0" in inconsistencies indicates a real deviation that requires investigation.
- "ExtraInfo" typically lists affected nodes for operational targeting.

### 4.3.3 LTE Frequency Audit / LTE Frequency Inconsistencies

**Source tables:** "GUtranSyncSignalFrequency", "GUtranFreqRelation", "GUtranCellRelation", "ExternalGUtranCell", "TermPointToENodeB".

#### Main checks:

- LTE nodes with old/new SSB.
- Nodes with both old/new or old without new.
- SSB outside the expected pre/post set.
- LTE relations to old/new and parameter discrepancies per cell relation.
- LTE externals OUT\_OF\_SERVICE for old/new.

### 4.3.4 ENDC Audit / ENDC Inconsistencies

**Source tables:** "EndcDistrProfile", "FreqPrioNR".

#### Main checks:

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- "gUtranFreqRef" and "mandatoryGUtranFreqRef" with old/new + N77B combinations.
- Nodes that do not contain the expected frequency combination.
- In "FreqPrioNR": old without new, both present, and parameter mismatch per cell.

#### 4.3.5 Cardinalities Audit / Inconsistencies

Cardinality checks per relation table (per node and/or per cell) to detect overprovisioning or gaps versus expected limits.

#### 4.3.6 Profiles Audit (if enabled)

- Compares PRE/POST profiles by supported profile MO.
- Detects parameter discrepancies between old/new variants.
- Adds results to SummaryAudit and auxiliary detail sheets.

### 4.4 Detailed check execution order and gating rules

#### 1. MeContext pre-processing

- Computes total nodes and "UNSYNCHRONIZED" nodes.
- Builds an exclusion list and filters all other MO dataframes by "NodeId" before running any other checks.

#### 2. Node scoping for Pre/Post interpretation

- "NRCellIDU" checks run first because they generate the rows used to infer node scope (Pre-retune vs Post-retune).
- This scope is reused by relation/externals/termpoint checks to classify targets ("SSB-Pre", "SSB-Post", "Unknown").

#### 3. Per-table processors

- NR processors: "NRFrequency", "NRFreqRelation", "NRSectorCarrier", "NRCellRelation".
- LTE processors: "GUtranSyncSignalFrequency", "GUtranFreqRelation", "GUtranCellRelation".
- Externals/Termpoints: "ExternalNRCellCU", "ExternalGUtranCell", "TermPointToGNodeB", "TermPointToGNB", "TermPointToENodeB".
- ENDC/Cardinality/Profile processors follow and append their own rows.

#### 4. Resilience model

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- If a table is missing/empty: emits "Table not found or empty" metric rows.
- If required columns are missing: emits "N/A" rows.
- If exceptions occur: emits "ERROR: ..." rows without aborting the full SummaryAudit generation.

## 4.5 Additional columns injected into parsed MO sheets

Besides SummaryAudit, Module 1 enriches several raw MO sheets with operational columns for execution/cleanup.

### 4.5.1 "MeContext" enrichment (main planning helper)

Additional columns are computed per "NodeId" by aggregating NR/LTE relation tables:

- Topology and inventory:
- "mmWave Cells", "LowMidBand Cells", "N77 Cells"
- "N77A old SSB cells", "N77A new SSB cells"
- Relation counters:
- "NRFreqRelation to old N77A SSB", "NRFreqRelation to new N77A SSB"
- "GUtranFreqRelation to old N77A SSB", "GUtranFreqRelation to new N77A SSB"
- Priority snapshots (unique consolidated values):
- "NRFreqRelation to old N77A SSB cellReselPrio"
- "NRFreqRelation to new N77A SSB cellReselPrio"
- "GUtranFreqRelation to old N77A SSB cellReselPrio"
- "GUtranFreqRelation to new N77A SSB cellReselPrio"
- "GUtranFreqRelation to old N77A SSB EndcPrio"
- "GUtranFreqRelation to new N77A SSB EndcPrio"
- Workflow recommendation fields:
- "Step1", "Step2b", "Step2ac", "Next Step", "EndcPrio Next Step"

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Operational interpretation:

- "Step1" focuses on old/new relation parity and reselection-priority convergence.
- "Step2b" focuses on old/new N77A cell presence.
- "Step2ac" focuses on ENDC priority transition validation.
- "Next Step" concatenates pending actions to provide a single execution hint per node.

#### 4.5.2 "NRCellRelation" and "GUtranCellRelation" enrichment

Both relation tables are normalized with helper columns used for discrepancy targeting and command generation:

- "Frequency" extracted from relation references.
- External endpoint decomposition fields (function/cell identifiers parsed from references).
- "GNodeB\_SSB\_Target" classification ("SSB-Pre"/"SSB-Post"/"Unknown").
- "Correction\_Cmd" prebuilt command text for the rows considered actionable.

#### 4.5.3 "ExternalINRCellCU" and "ExternalGUtranCell" enrichment

- Adds "Frequency", "TermPoint", "TermPointStatus", "TermPointConsolidatedStatus".
- Adds "GNodeB\_SSB\_Target" and "Correction\_Cmd" for retune remediation flows.
- For LTE externals, service state ("OUT\_OF\_SERVICE") is also reflected in SummaryAudit checks.

#### 4.5.4 "TermPointToGNodeB" / "TermPointToGNB" enrichment

- Adds consolidated termpoint health/status fields and "SSB needs update" boolean.
- Adds "GNodeB\_SSB\_Target" and generated "Correction\_Cmd" when target and frequency logic indicates migration to post-retune SSB.

### 4.6 Key SummaryAudit checks by source table (implementation-level)

Below is the practical checklist implemented by the processors:

- NRCellDU:
  - Node classification LowMidBand/mmWave/mixed.
  - N77-in-band detection.

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- Allowed pre/post SSB-list compliance and out-of-list inconsistencies.
- **NRFrequency:**
  - old/new/both/old-without-new presence by node.
  - values outside expected old/new sets.
- **NRFreqRelation:**
  - old/new/both/old-without-new relation presence.
  - naming-convention checks for auto-created relation IDs.
  - cell-level old-vs-new parameter mismatch detection.
  - profile reference transition checks (old profile clones vs expected post clone).
- **NRSectorCarrier:**
  - allowed ARFCN list compliance (pre/post).
  - out-of-list inconsistencies.
- **NRCellRelation:**
  - relation counts to old/new targets.
  - extraction/parsing consistency from "nRFreqRelationRef".
- **GUtranSyncSignalFrequency:**
  - old/new/both/old-without-new LTE presence by node.
  - out-of-set inconsistencies.
- **GUtranFreqRelation:**
  - old/new/both/old-without-new checks.
  - naming convention validation ("<ssb>-30-20-0-1" style).
  - old/new cell-level parameter and ENDC priority checks.
- **GUtranCellRelation:**
  - relation counts to old/new LTE targets.

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- **ExternalNRCellCU / ExternalGUtranCell:**
  - old/new external references counts.
  - target classification and termpoint correlation.
- **TermPoint tables:**
  - locked/disabled/unhealthy transport endpoint detection.
  - alignment with external-cell update needs.
- **EndcDistrProfile / FreqPrioNR:**
  - expected old/new + N77B combinations.
  - unexpected combinations and param discrepancies.
- **Cardinality checks:**
  - hard-limit and threshold checks per node/cell relation families.
  - explicit inconsistency rows when limits are reached/exceeded.

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## 5 Consistency Check module in detail

### 5.1 Filtering by non-retuned nodes

If a POST SummaryAudit exists, the module obtains PRE/POST node lists and can exclude discrepancies whose target points to nodes that did not complete retune, reducing operational noise.

### 5.2 How it detects parameter discrepancies

1. Selects common PRE and POST relations by composite key:
  - GU: typically "NodeId", "EUtranCellFDDId", "GUtranCellRelationId".
  - NR: typically "NodeId", "NRCellCUId", "NRCellRelationId".
2. Excludes control columns (keys, frequency, Pre/Post, Date).
3. Compares value-by-value across shared columns.
4. Sets "ParamDiff=True" if at least one column differs.
5. In GU it ignores "timeOfCreation" and "mobilityStatusNR" to avoid false positives.

### 5.3 How it detects frequency discrepancies

1. Extracts base frequency from relation references ("extract\_gu\_freq\_base" / "extract\_nr\_freq\_base").
2. Discrepancy rule:
  - if PRE had "freq\_before" or "freq\_after", and POST does **not** end up in "freq\_after", it marks "FreqDiff=True".
3. Classifies the discrepancy as:
  - "FreqDiff\_SSBPost" (target identified as SSB-Post),
  - "FreqDiff\_Unknown" (cannot be associated to a known target).

### 5.4 How it detects neighbor discrepancies

They are split into three groups:

- **New relations:** keys present in POST and absent in PRE.
- **Missing relations:** keys present in PRE and absent in POST.
- **Discrepancies:** same key in PRE/POST but with parametric or frequency differences.

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0.7.4	0.7.4	2026-02-16	



## 5.5 Content of each ConsistencyChecks output sheet

- **Summary:** KPIs per table (PRE/POST volume, discrepancies, new/missing, source files).
- **SummaryAuditComparisson:** diff of SummaryAudit PRE vs POST metrics (without "ExtraInfo" to keep the comparison clean).
- **Summary\_CellRelation:** KPI per "Freq\_Pre/Freq\_Post" pair and per technology.
- **GU\_relations / NR\_relations:** relation universe enriched with target classification and command snippets.
- **GU\_param\_disc / NR\_param\_disc:** common relations with param differences.
- **GU\_freq\_disc / NR\_freq\_disc:** frequency discrepancies to SSB-Post targets.
- **GU\_freq\_disc\_unknown / NR\_freq\_disc\_unknown:** discrepancies with non-classifiable targets.
- **GU\_missing / NR\_missing:** relations removed versus PRE.
- **GU\_new / NR\_new:** relations added in POST.
- **GU\_all / NR\_all:** optional consolidated dump for extended analysis.

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## 6 Input requirements and operational best practices

- Keep market log exports in a consistent structure (especially for bulk).
- Validate that PRE/POST have the same table granularity and consistent naming.
- Validate frequency inputs ("n77\_ssbb\_pre", "n77\_ssbb\_post", "n77b\_ssbb") before batch execution.
- Correctly configure allowed SSB/ARFCN lists to minimize false positives.
- Run **Configuration Audit** before Consistency Checks whenever possible.
- Use Bulk mode only with a controlled folder naming convention.
- Review "Summary" and "Summary\_CellRelation" first, then then deep-dive into detail sheets (ConfigurationAudit) and discrepancy tabs (ConsistencyCheck).
- Consume "Correction\_Cmd\_CA" and "Correction\_Cmd\_CC" as a remediation proposal, not as blind execution.

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## 7 Execution Modes and Versioning

- **GUI mode:** run without CLI arguments.
- **CLI mode:** run with explicit module and options.
- **Web Interfacee:** the tool can be run in a server/client infrastructure, accessing the server through a Web Interface where you can upload your inputs, enqueue different tasks and export the results when finish..

All Generated artifacts include a versioned suffix: "<timestamp>\_v<TOOL\_VERSION>".

This guarantees traceability and avoids collisions between runs.

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## 8 Known limitations and considerations

- The engine depends on log quality and structure: missing columns downgrade checks to "N/A".
- Some rules depend on naming conventions in references (NR/GU relation refs).
- The Final Clean-Up module is prepared to extend operation-specific policies.

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## 9 Quick module reference

Module	Main input	Main output	Goal
0 Update Network Frequencies	Logs folder	Persisted config	Update network frequency list
1 Configuration Audit	Logs/ZIP folder	Excel + PPT + CA commands	Audit configuration and profiles
2 Consistency Check	PRE and POST folders	2 Excel + CC commands	Compare pre/post relations
3 Consistency Check (Bulk)	Multi-market root folder	Module 2 outputs per market	Run bulk comparison
4 Final Clean-Up	Final folder	Clean-up folder	Operational final clean-up

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## 10

## Additional documentation recommendations (detected gaps)

To keep the guide aligned with the real behavior, these areas are also important to document in future iterations:

- Explicit mapping of each "SummaryAudit" metric to its correction-command export sheet/folder.
- Full decision table for "Step1/Step2b/Step2ac" outcomes and expected operator actions.
- Cardinality thresholds per MO (including rationale and vendor constraints).
- Frequency-audit feature toggle behavior ("frequency\_audit") and which checks are suppressed when disabled.
- Detailed limitations of reference parsing when vendor naming conventions are not respected.