RECOMMENDATION ITU-R SM.1370-1

Design guidelines for developing advanced automated spectrum management systems

(Question ITU-R 68/1)

(1998-2001)

The ITU Radiocommunication Assembly,

considering

a) that the demand for spectrum is increasing, that radio systems are becoming more complex and thus the task of frequency assignment is becoming more challenging;

b) that an advanced automated spectrum management system (AASMS) would facilitate national spectrum management and monitoring, coordination among administrations and notification to the Radiocommunication Bureau (BR);

c) that data elements used in national spectrum management have been reflected in the Preface to the International Frequency List (IFL) and Recommendation ITU-R SM.1047;

d) that Recommendation ITU-R SM.1413 on a Radiocommunications Data Dictionary may replace or supplement the Preface to the IFL and modify Recommendation ITU-R SM.1047;

e) that many administrations have been successful in implementing an automated database management system (DBMS) in the development and maintenance of their national spectrum management data;

f) that various computer programs which accomplish engineering analysis and other spectrum management tasks are described in the ITU catalogue of software for radio spectrum management and will be available on a website in accordance with Resolution ITU-R 21;

g) that a Windows multi-lingual basic automated spectrum management system (WinBASMS) has been developed jointly by the Telecommunication Development Bureau (BDT) in cooperation with the ITU-R for developing countries that does frequency assignment for the fixed, mobile, broadcasting and other services and operates only as a stand-alone system;

h) that AASMS also need to be developed to effectively meet the requirements of spectrum management, to handle additional radio services, to add the capability of using digital terrain data in some calculations, and to add multi-user capabilities,

recommends

the following design guidelines for an AASMS:

1 that the AASMS should use as a minimum the data elements contained in Annex 1 and provide a mechanism for transferring existing data to the AASMS data structure;

2 that the AASMS should allow multiple users and have appropriate data security features;

3 that the AASMS should contain advanced engineering calculation features for radio services including, if necessary, the space services as determined by the radio service requirements of the administration;

4 that the AASMS should be capable of using a terrain database for specific engineering calculations;

5 that the AASMS should, where feasible, operate in the customer's national language(s);

6 that output documents intended for the general population (e.g. Licences) should be easily generated in the local language and character set;

7 that the implementation of such systems should include the necessary training and support;

8 that the following specific functions and hardware capabilities should be considered when developing an AASMS.

8.1 Operational requirements

The operation of the AASMS should be designed around the same steps involved in the manual administration of licences. As a minimum, it should support the following administrative functions:

8.1.1 Application processing

This function should support the data entry of an application for wireless service. This can be an application for new service, for modification to an existing licence, or modification to a pending application. The applications should be processed sequentially through the following steps: check that all information is included and the fee paid; check specified equipment; check channel availability; check administrative compliance. If any of these checks fail, a standard letter should be produced for the applicant indicating the nature of the problem. If the proposed site is located within a region of international coordination (i.e. border area), the system should produce a request for international coordination complete with all the data required by ITU or by bilateral agreements with neighbouring administrations. In those cases where it is required, the system should also produce the appropriate ITU-R notification document (e.g. T11, T12). Once all approvals are granted and all fees are paid, the application may become a licence ready to be issued.

8.1.2 Frequency allocation plan/channel processing

This function should support the processing and analyses required to approve a requested frequency channel, or to respond to a request for international coordination from a neighbouring administration. This function may also be used to investigate the availability of open channels in the spectrum.

This function should have the following characteristics:

– provide utilities for the maintenance of national frequency allocation plan. Information to be recorded should include ITU primary and secondary services as a minimum;

– provide capability to maintain channelling plans. Utility should be included for the automated generation of channelling plan with user entered parameters;

– capability to store and retrieve frequency plan footnotes on all levels;

– retrieval of frequency channel pairs and applicable footnotes confirming with user specified parameters;

– system should be able to access the national frequency allocation plan, channelling plans, footnotes, and other system maintained databases on user supplied parameters;

– provide the allocation table in an automated display that a frequency assignment can be checked against to ensure that it is a valid frequency assignment.

8.1.3 Licence processing

This function should support the following activities:

– issue a licence that has been indicated as ready;

– renew an existing licence for which all conditions of renewal have been satisfied;

– increase the fee for an existing licence;

– terminate a licence for non-compliance with existing requirements for operation;

– query the database to locate one or a group of licences.

No licence should be issued without comparing the proposed frequency assignments to the Table of Frequency Allocations (Article 5 of the Radio Regulations (RR)), regional allotments, national regulations and decisions; regional radio conferences and agreements (such as RJ81GW, RJ81SHA, GE.84) should also be referenced. National broadcasting plans provided by the administration for sound (AM, FM) and video (VHF, UHF) should also be inputs. The system may use occupancy parameters from the database or from monitoring data before providing a licence. A note could be marked if an international notification is needed in the band or if an IFL channel exists. The system should enable the renewal and printing of licences. Licence printing follows a standard format.

The system should support licensing process for:

– stations in aeronautical services;

– stations in maritime mobile services;

– land fixed and mobile stations in the land-mobile and fixed services;

– terrestrial fixed microwave stations above 1 GHz;

– earth stations in the space services;

– stations in broadcasting service;

– amateur radio stations;

– other services that are a priority for the administration. Note that space services require extensive additional data elements and add significantly to the cost;

– for aeronautical and maritime mobile services, the system should support assigning sets of recognized, pre-allocated frequencies;

– system should support data collection for existing licences (data conversion);

– support data entry of new licence applications;

– the system should provide a convenient manner for printing of licences conforming with administration specified formats;

– support licence replacement procedure to handle loss of licences and apply appropriate fees whenever applicable;

– system should automatically detect licences due for renewal, and generate renewal invoices;

– should support licence amendment processes which allow the existing licence to remain in force, and maintain the availability of all existing licence details until the amendment is approved;

– supports licence cancellation and cancelled licence re-instatement and automatically calculate the appropriate fees whenever applicable;

– on-line queries capability should be provided to permit perusal of technical and licence information contained in the database (more details in § 8.11.5);

– the system reports should provide extensive management reporting capabilities (see § 8.9);

– the system should control and track the processing of licence applications to ensure that the correct applications are available at each stage of the application cycle, and that applications are automatically progressed to the next stage as each process is completed.

8.1.4 Fee processing

This function should support the management of financial tasks, such as recording of fee payments, production of invoices, and production of financial statements in statistical or individual format. It should also allow the setting and changing of fee rates. The fee processing function should use the standard double-entry accounting method to record and report all transactions (see also § 8.6).

The choice of cash or accrual accounting should be in line with the administration's common practice.

– Provide fee schedule maintenance. Must support current administration fee structure. Should include the capability of entering new fee schedules into system while existing schedule remains in force, and switching over to a user specified new schedule on a user selected date.

– System should provide fee calculations for all transactions with charges and automatic interface to invoice generation. Fee calculation should be capable of applying and accounting for sales taxes or value added taxes.

8.1.5 Report processing

This function supports the query of the database and production of reports in graphic or text form. The AASMS should have a number of standard reports and standard letters, and should also support the production of custom reports as specified by the operator. (More details are given in § 8.9.)

8.1.6 Complaint processing

This function should support the efficient processing of interference complaints through the following steps:

– record the complaint;

– check the complaint for administrative merit;

– analyse the complaint for technical merit (use engineering analysis tools);

– generate a monitoring task for the technical verification of stations;

– review the monitoring results and produce a complaint resolution report.

8.1.7 Reference tables processing

This function should support the review, update and printing of all reference tables used by the system. The system administrator should be the only person with the authority to view or modify any table in the system. Equipment tables, such as antennas, transmitters, receivers may be viewed by all operators, but should be modified only by technical personnel. The security access table should only be viewed and modified under the authority of the director of spectrum management and the system administrator. The frequency allocation table, which defines frequency plans used by the system may be viewed by all operators, but should be modified only by the director or the system administrator.

8.1.8 Security processing

Spectrum management staff should, in general, have read access to the data records. This function should restrict update access to specific data records or to certain types of transactions to only those operators who have the proper security access role. The required security roles should be built into the design of the AASMS. The allocation of operators to one of several security roles should be controlled by the password table or by some other mechanism created as each operator is registered by the system administrator.

Other security mechanisms such as watermarks on official forms may be required to prevent counterfeit production of licences or other authorities by others.

8.1.9 Transaction processing

This function creates a record in the database, registering the date, time and identity of the operator who performs each transaction, such as administrative approval of a licence, for instance. The system should also ensure that the operator attempting the transaction meets the security access criteria, and that all necessary preceding transactions have been completed. For instance, a request for international coordination should not be issued until the fees have been paid, the equipment has been approved, and the in-country frequency assignment has been completed. This function should also prevent an operator from repeating a transaction that has already been completed once. The transaction processing implemented by the AASMS should guarantee the integrity, reliability and recoverability of the database.

8.2 Record keeping requirements

The AASMS should support a database containing frequency assignment data and information concerning individual licence holders. The database should consider as a minimum the data elements of WinBASMS (see Annex 1). Technical data specified in Recommendation ITU-R SM.1047 for other terrestrial radio services should also be included. Any data required to solve rough earth propagation programs should be provided. The radiocommunication data dictionary (Recommendation ITU-R SM.1413) should also be referenced in system design to ensure compatibility of definitions and formats for future coordination and notification purposes.

The AASMS should include a high-performance, relational DBMS (RDBMS) for distributed client-server or centralized operation depending on the configuration and needs of the administration. The DBMS should support forms generation, query by example (QBE) and structured query language (SQL) query generation. It should use friendly graphical user interface screens and forms to enter information and generate queries and reports. It should support user definable reports to provide a variety of data retrieval alternatives. It should have a built in audit trail function for database transactions and it should allow multi-level security access protection. The DBMS should also allow new fields to be added to the database without losing or changing existing data; this provides for flexible, easy expansion as requirements change.

The DBMS software should provide the following features:

Security: The database administrator defines the operations (read, write, modify) that each user can perform on each database object. When a user performs an operation that he is not allowed, the database will cancel the operation.

Performance: The DBMS engine should be highly integrated with the operating system to provide the highest throughput for the platform selected.

Replication/scalability: The DBMS engine should support replication in order to increase the availability of the database in remote locations and reduce the number of transactions executed in the main database. If decentralized operation is an important requirement, the system will have some objects replicated in each remote location. If replication is not used, care should be taken to ensure that the DBMS is scaleable in order to handle future growth.

Reliability/integrity: The DBMS engine should guarantee that every transaction that was executed successfully will not be lost despite a system failure.

Transaction based operations: Transaction based databases guarantee that an operation will be done in a discrete fashion. The operation will be done completely or not at all. This capability guarantees semantic integrity in the database. Database definition languages also include the ability to impose constraints in order to assure referential integrity in the data.

Multi-user: The DBMS engine should allow multiple users to be connected to the database and handle concurrent access to the information. A large number of users can be connected to the system.

Contentions: The database will handle the contentions of users trying to access the same piece of data and appropriately lock data that is being updated.

The database should implement the data content recommended by the ITU. The following types of data may be stored in the database:

– National table of frequency allocation

– Frequency assignment

– Block assignments for concessions

– Licence/concession holder

– Equipment characteristics

– Monitoring

– Applications

– Fee

– Complaint

– Violations/infractions

– Spectrum occupancy statistics

– Unidentified transmitters

– Assigned frequency(ies)

– Cancelled licence.

Each data type should be stored in one or more tables. The content of each table should be normalized to eliminate any duplication of data and to improve the efficiency of the relational database design.

Appropriate descriptions of the transmitter, receiver and antenna characteristics are essential for optimal spectrum management. In order to facilitate data entry, the system should highlight the suitable fields and suggest defaults according to the designation of emission or type of service. For example, only for broadcasting TV (BT) should the system prompt for TV and colour system. The form for equipment characteristics can also be used for type approval. When the antenna pattern is unknown, the system should estimate the side-lobes using an appropriate reference radiation pattern such as given in Recommendation ITU-R F.699.

All data needed to define the site should be included: coordinates system (GEO, UTM, LAMBERT, CASSINI ...) chosen by pop-up menu, height above sea level from the digital terrain map. The specific azimuth and elevation angles are part of the station defined in the licence.

As recommended in Recommendation ITU-R SM.1047, the data elements in the system should be based on the latest revision of Annex 1 of the ITU-R Handbook on computer-aided techniques for spectrum management (1999). To ease data input, the operator should be allowed to choose the element from predetermined tables by using a pop-up menu; the system should be capable of using defaults for most inputs. Every screen should allow “remarks” to add information not coded as data elements to be recorded. For ITU notifications, where possible the definitions of the fields should be in accordance with the Preface to the BR International Frequency Information Circular (BR IFIC) and the radiocommunication data dictionary (Recommendation ITU-R SM.1413).

User management

An individual, a supplier, a service provider or an operator may be prohibited from marketing or operating telecommunication equipment without assignment of an applicant/grantee code. The applicant fills in a request form, the user enters the legal company name and address into the records. A code is permanently assigned and is valid only for the party listed. This applicant/grantee code is used for equipment authorization and then for operating applications. The owner list is the foundation for invoicing, fee type and licensing control.

This module should address the licensing process of general vendors. The following procedures should be taken into consideration when processing vendor applications:

– provide facilities for data collection of existing vendor certificates;

– support data entry of new vendor certification applications;

– support situations where the applicant has multiple business locations;

– support single vendor having multiple type of business areas;

– generate application refusal letters;

– provide fee schedule maintenance. Should support current fee structure. Should include the capability of entering new fee schedules into the system while existing schedule remains in force, and switching over to a user specified new schedule on a user selected date;

– provide automatic fee calculations for all transactions resulting with charges and automatic interface to invoice generation. Fee calculation should be capable of applying and accounting for sales taxes or value-added taxes;

– provide for printing of vendor certificates conforming with specified formats;

– support vendor certificate replacement procedure to handle loss of certificates and apply appropriate fees whenever applicable;

– automatically detect certificates due for renewal, and generate renewal invoices;

– support certificate amendment processes which allow the existing certificate to remain in force, and maintain the availability of all existing details until the amendment is approved;

– support vendor certificate cancellation and cancelled certificate reinstatement and automatically calculate the appropriate fees whenever applicable;

– support on-line queries capability to permit perusal of technical and vendor certificate information contained in the database.

8.3 Engineering analysis requirements

The AASMS should automatically identify interference-free frequencies for an applicant if such a frequency is available; if not, it should identify the acceptable interference case. Such automatic techniques should be included where practicable. The process is to use appropriate calculations in conformity with commonly used interference assessment methods, frequency-distance functions or tables that allow for the user specification of minimum acceptable distance separations for co- and adjacent channels for each service in each band. It should also be possible to analyse a specific proposed frequency assignment using the same models to determine its interference potential. An option to calculate the power density from a transmitter should be provided.

This module provides tools to assist frequency assignment. Tools should include:

Environmental search

– Identifies radio stations in the licensed station database with parameters specified by the user. This function should allow the user to specify the interested area of study on a displayed map, and display search results on the map;

– display details of selected station and associated frequency information identified by the search function;

– it should be able to produce a report identifying the search results and the parameters used.

General characteristic of all electromagnetic compatibility (EMC) analysis tools supplied

- Frequency plan look-up function to assist in the selection of candidate frequencies based on user given national frequency allotment plans, planned types of services/operations, user categories;
- facility for spectrum management officers to produce lists of several candidate frequencies for a more detailed analysis, if needed;
- automatic validation of user selected candidate frequencies against frequency plan;
- system should include facilities to retrieve occupancy data held in monitoring database;
- all EMC analysis tools provided should be an integral part of the licensing system and be available for a station to station analysis;
- EMC analysis tools should be operating in a temporary system area allowing the user to experiment with different technical parameters without affecting actual records in the system;
- utilities should be provided to the user to update actual system records upon completion of analysis;
- EMC tools should allow the analysis of candidate frequency assignments requested by applicants or incoming coordination requests against existing licence records and coordination records in the database using predetermined criterion which are user changeable at execution time;
- user should be able to enter into the temporary area an arbitrary frequency record and perform analysis against another user entered frequency record in the temporary area, or perform analysis against licence records and coordination records in the database using predetermined criterion which are user changeable at execution time;
- all EMC tools should have the capability to be executed on-line or at a user specified time;
- utilities should be provided to allow retrieval of analysis results;
- all modules should analyse both existing and proposed transmitters/receivers as potential offenders and victims;
- all modules should provide the following levels of reporting:
  - detailed report identifying the relevant administrative, technical and operational details for each interference case;
  - report identifying all stations/frequency assignments involved in each interference case;
  - generate summary histogram of number of potential interference cases involved.

The AASMS should include a set of engineering analysis tools to assist in the assignment of frequencies in accordance with ITU-R Recommendations, as well as national frequency plans, and the local policies established by the spectrum management authority. Six types of analysis tools should be provided: broadcasting analysis tools, HF analysis tools, VHF/UHF analysis tools, microwave analysis tools, intermodulation analysis tools, and EMC analysis tools.

Broadcasting analysis tools

This function supports the assignment of frequency channels based on a search of the database. The frequency of the new transmitter is compared to the transmitters already licensed in the area. The program checks for geographic proximity with co-channel and adjacent channel frequencies when assigning new frequencies. This method is based on the calculation of interference levels or on minimum frequency-distance rules, which must take into account the type of service under consideration, the operating frequency, and the maximum transmitter power. The operator, with an appropriate security access role should be able to override the parameters of the frequency-distance rule or interference calculation.

Results of analysis should be displayed on screen with user selectable map background. System should support printing of analysis results as displayed on screen together with parameters used in the analysis. The following functions should be provided:

– station coverage zone prediction;

– station interference zone prediction.

EMC of broadcasting services with other services

Analyses to ensure compatibility, following Recommendations ITU-R SM.1009 – Compatibility between the sound-broadcasting service in the band of about 87-108 MHz and the aeronautical services in the band 108-137 MHz; and ITU-R SM.851 – Sharing between the broadcasting service and the fixed and/or mobile services in the VHF and UHF bands, should be available.

HF analysis tools

These tools should use an appropriate propagation model to compute propagation loss and field strength in the HF frequency range. The model should compute both groundwave and skywave propagation. The model may use the following inputs in the computation: transmitter characteristics, antenna characteristics, terrain conditions, ionospheric conditions, geographic coordinates, time-of-day, and month of the year. Based on these inputs the model computes the propagation path at any desired distance from the transmitter site. The HF analysis tools could include the following:

a) HF link analysis

b) HF path propagation loss

c) HF field strength contour

d) Service area analysis

e) HF interference analysis.

HF point-to-point service

Optimal operating frequency ranges should be calculated, taking into account time-of-day and period-of-year.

VHF/UHF analysis tools

These tools should use an appropriate propagation model (e.g. Recommendation ITU-R P.370) to compute propagation loss and field strength in the VHF/UHF frequency range. A selection of propagation models may also be offered for user choice. The models should take into account transmitter characteristics, antenna characteristics, antenna heights above average terrain,

topographic terrain profile, and average soil and climate conditions. The VHF/UHF analysis tools could include the following:

a) VHF/UHF link analysis

b) VHF/UHF path propagation loss

c) VHF/UHF field strength contour

d) Service area analysis

e) VHF/UHF interference analysis.

Land-mobile, maritime mobile and fixed services

General

– Analysis tools provided should utilize propagation models which consider the effects of terrain (using digital terrain elevation and surface cover data), and should be consistent with the procedures discussed in Recommendation ITU-R P.1144 – Guide to the application of the propagation methods of Radiocommunication Study Group 3.

– The supplied analysis tools should be able to function in the absence of digital terrain elevation and surface cover data.

– Potential interference cases identified after an analysis run should be displayed on screen with user selectable map background.

– Analysis results should also be available in the form of reports.

EMC analysis tools

The EMC analysis tools could include the following interference mechanisms:

– receiver desensitization analysis;

– transmitter noise analysis;

– frequency interference (co-channel, interstitial and adjacent channel or distant channel) analyses;

– multi-signal third order intermodulation analysis. Intermodulation analysis module shall provide frequency combination reports identifying all combinations of existing frequency assignments within search limits which combine to produce a given intermodulation frequency product;

– co-site analysis.

System engineering tools should be provided to:

– calculate the base station coverage for base station to mobile and pager applications;

– calculate the mobile talk-back range.

Microwave analysis tools

These tools should use the free space (Recommendation ITU-R P.525) or other appropriate propagation models to compute propagation loss and field strength at frequencies up to 50 GHz. The following microwave analysis tools should be provided:

a) Microwave link analysis

b) Microwave path propagation loss

c) Microwave field strength computation

d) Microwave interference analysis

e) Antenna height analysis (Fresnel zone clearance)

f) Microwave frequency planning.

General

– The propagation model provided should be implemented specifically for the purpose of interference analysis and should consider the effects of terrain (use of digital terrain elevation and surface cover data).

– The supplied analysis tools should be able to function in the absence of digital terrain elevation and surface cover data.

– Analysis results after an analysis run should be displayed on screen with user selectable map background.

– Analysis results should also be available in the form of reports.

The EMC analysis tools should consider the following interference mechanisms:

Terrestrial microwave networks

– This tool enables the user to evaluate the potential interference of a selected candidate fixed terrestrial microwave network against other fixed terrestrial microwave stations.

– Provide analysis of potential interference between terrestrial microwave assignments and geostationary satellite earth stations.

– Orbit avoidance verification and power limits calculations.

– Health safety distance calculations for terrestrial antennae.

Earth station

– This tool provides coordination contour calculation for geostationary satellite earth station as per RR Appendix 7.

– The tool provided should utilize GIS-based terrain information to perform automatic horizontal elevation angle calculation.

– Provides analysis of potential interference between geostationary satellite earth station and terrestrial microwave assignments.

Intermodulation analysis tool

This tool should compute the near and far field intermodulation products (at least 3 frequency, third order) produced by two or more transmitters.

8.4 Border coordination

The AASMS should identify licence applications requiring border coordination and automatically create a coordination document to be used for coordination with bordering administrations. The ITU recommends international coordination for certain frequency assignments, depending essentially on the frequency (and power) of the transmitter. Recommendation ITU-R SM.1049 – A method of spectrum management to be used for aiding frequency assignment for terrestrial services in border areas, is a nice example of coordination practices.

The system should check if the area of interference is crossing a border using the ITU-Digitized World Map (IDWM) and the ITU program to plot geographical maps (GEOPLT). IDWM contains: geographical data-coastlines, seas, islands, lakes; political data-borders, regional boundaries. The program provides the name of the country for specific “geo” coordinates, and the distance from a

transmitter to the closest border. All available data in IFL and other ITU documents or diskettes should be used to check whether there is overlap with channels allotted by regional agreements such as Stockholm 1961, Rio de Janeiro 1981, and Geneva 1984.

The system should enable the identification of licence applications requiring border coordination. For this purpose, the field strength coverage in the bordering countries' transmitters should be calculated, as well as interference. In this manner, the system should support interference calculations and prints forms for coordination.

The system should automatically identify whether stations under evaluation are located in a coordination zone using a GIS-based map. It should also provide a query function to enable on-line viewing of coordination data and status of selected coordination records using user specified parameters.

8.5 Notification to the BR

As required in RR Article 11 – Notification and recording of frequency assignments, the system should automatically identify applications requiring BR notification and create appropriate notification forms suitable for submission to the BR according to RR Appendix 4 – Consolidated list and tables of characteristics for use in the application of the procedures of Chapter III. The system should print on request the notification for ITU-R and draw the notice to the attention of the spectrum manager if the request is inappropriate. It should create appropriate entries in the AASMS for tracking notification progress.

As a minimum, the following frequency assignments should be supported:

– HF/VHF/UHF

– Terrestrial microwave

– Geostationary satellite earth station.

System should generate the appropriate BR forms with data filled in (e.g. T11, T12). Alternatively, an electronic interface to the systems of the ITU-R should be established for notification purposes.

8.6 Licensing fees and fee collection

The system should provide for recording fee payments and payment status associated with licensing and certification functions. Simple facilities should be included for recording fees and identifying payment status since methods of calculating fees and requirements for billing vary from administration to administration. The programs should be open for modification by the administration in this area so that they can be adapted to the particular local circumstances.

The system should have facilities to accept prepayment from applicants and, at a later time, apply the prepaid sum to invoices.

The system should produce invoices conforming with specified formats. Invoice amounts should be automatically calculated by the system based on fee schedule. Invoice generation and fee calculation are an integral part of the licensing process. System should support the functionality that allows an invoice to be created manually, without being integrated to the licensing process.

The system should have an invoice query and reprint function.

A payment reminder function should be provided to print reminders to applicants or licence holders for overdue invoices.

Authorized users should be able to cancel any invoice line item or the entire invoice.

Facilities should be provided to record payment, by cash or by cheque, against any number of invoices. This should be an integrated function of the licensing process.

A payment receipt should be issued by the system whenever a payment transaction is completed.

Capability to handle non sufficient funds cheque should be provided.

Authorized users should be able to cancel invoice, cancel prepayment, cancel payment, and perform journal adjustments.

The system should allow for refund of payment by authorized users.

Maintain a financial ledger to record all transactions within the licensing system, including: invoice payment distribution, client cash and/or cheque payment, client advance payments, adjustments such as refunds, inter-account fund transfers, etc.

Provide a user-definable chart of accounts and other financial transaction codes and procedures necessary to maintain an independent and auditable ledger facility related to licensing activities consistent with the national accounting standards and practices.

Provide ledger reports including: ledger and account summary, account posting record, voucher detail, account detail, fee collection reconciliation reports, etc.

Provide general ledger queries including: ledger and account summary, ledger and account detail, outstanding customer balance, past due accounts, fee payment histories for individual clients.

The system should provide functions to query ledger, journal, client account, invoice, and payment records.

The system should have extensive management reporting capabilities.

8.7 Monitoring

The AASMS should provide spectrum management data to the monitoring system to assist the operators. The monitoring data should be available to the spectrum managers.

As described in Recommendation ITU-R SM.1050 – Tasks of a monitoring service, monitoring assists spectrum management by being its eyes and ears, enabling the verification of proper technical and operational characteristics of authorized (and unauthorized) transmitters, the detection and location of unauthorized transmitters, the identification and resolution of interference problems, and the validation of propagation and sharing models.

Penalties may be enforced on licensees whose emitting parameters are different than in the database of authorized stations. The system should provide spectrum management data, tasks and priorities to the monitoring stations as explained in Chapter 1 of the ITU-R Handbook on Spectrum Monitoring. The data is essential for comparing the monitored signal (in a particular frequency channel within a certain geographic area) to the licensed data, and to draw attention to discrepancies and ensure their correction.

Inspection

The following capability, related to the preparation and execution of on-site inspections of stations, should be provided:

– facility to produce inventory report of all equipment (transmitters, receivers, antenna, filters, etc.) and frequency assignments expected to be found (on the basis of the licence granted) for each station inspected;

– facility to record inspection results of the station;

– facility to record future inspection requirements for the station;

– facility to produce reports of stations requiring inspection according to planned inspection date and geographic area.

8.8 Equipment approval process

The AASMS should optionally provide for the authorization, certification, type acceptance, or type approval processes of the administration. Such a computer-aided tool could be used to ensure that new applications entered into the system for approval are using approved or acceptable equipment.

Applications for type approval could be entered and tracked in the system. When the process is completed, a new type approval certificate in a form approved by the administration can be delivered to the applicant. Other documents of this type, such as import permits and production certificates, could also be issued in a similar manner. The system should provide for the type approval (acceptance, certification, authorization) for transmitters (and receivers) based on the resolutions of the national committee, any trade treaty obligations undertaken by the administration and conform to the allocations outlined in RR Article 5.

The system could be used to track approvals by the type of service, the frequency band, the output power, the bandwidth characteristics, the modulation parameters, the manufacturer, the importer and could also to track approvals granted by other national authorities that could have equivalent status as a result of trade treaties. The output of the system is the type approval document to be signed by the national spectrum manager.

The type approval is an authorization that the equipment is acceptable for use in the country - not an authorization to operate it. However, low power devices (LPD) may be exempted from licensing depending on the administration's rules and regulations.

The system may provide for special type-approval and short-term licences for experiments/ tests/exhibitions.

Type acceptance certificate

This module handles the process of issuing type acceptance certificates. The following procedures should be taken into consideration when processing type acceptance certificates:

– data collection of existing certificates;

– data entry of new certificate applications;

– facility to issue application refusal letters;

– provide fee schedule maintenance. Should support current fee structure. Should include the capability of entering new fee schedules into the system while the existing schedule remains in force, and switching over to a user specified new schedule on a user selected date;

– provide automatic fee calculations for all transactions with charges and automatic interface to invoice generation. Fee calculation should be capable of applying and accounting for sales taxes or value added taxes;

– provide for printing of certificates conforming with specified formats;

– support certificate replacement procedure to handle loss of certificates and apply appropriate fees whenever applicable;

– automatically detect certificates due for renewal, and generate renewal invoices;

– support the certificate amendment process which allows existing certificate to remain in force, and maintain the availability of all existing certificate details until the amendment is approved;

– support certificate cancellation and cancelled certificate re-instatement and automatically calculate the appropriate fees whenever applicable;

– on-line queries capability should be provided to permit perusal of technical and certificate information contained in the database.

8.9 Reports generation

An AASMS should be capable of producing a number of built-in standard notices, invoices, correspondence, text format reports, and graphic reports, available to the operator via the report processing function. In addition, the system should be equipped with all the tools required to produce custom reports, using only simple operator commands.

Notices, invoices, correspondence

The spectrum management system should be capable of producing the following outputs:

Notices: Notice of application incomplete, notice of application rejected, notice of licence approval, notice of licence modification, notice of licence renewal, notice of licence termination, notice of fee increase, notice of warning, notice of violation.

Invoices: Request for fee payment, request for fine payment.

Others: Operating licence, complaint acknowledgement, complaint resolution report, request for international coordination, response to international coordination.

Database records: Printouts of licence information, equipment information, site information, fee information, complaint information, monitoring task information, frequency allocation information.

Engineering analysis results: Graphic plots of field strength threshold contour, shadow plot, interference plots, terrain profile for given path, interference computation report, and EMC computation report.

Text format reports

An AASMS should be capable of producing the following reports in text format:

Frequency allocation report: This report includes the following data items: lower band limit, upper band limit, service name, service category, function, class of station, ITU Region.

Licensed station report: This report includes the following data items for each licence:

1) Licence holder data, including reference number, regional authority, type of registration, name of legal licence holder, address of legal licence holder, name and address of point of contact, telephone number of point of contact.

Frequency assignment report, including the following data items (as per ITU-R Handbook on computer-aided techniques for spectrum management (1999), Annex 1, Table A1-2): frequency, preferred band, assigned band, frequency offset, schedule of operation, hours of operation, seasonal periods, class of station nature of service, experimental station, effective height above average terrain, country, latitude and longitude of transmitter, nominal radius of transmitting area, standard defined area of transmission, ground conductivity code, height above sea level, call sign emission designator, class of operation, designation of TV system, power delivered to antenna, radiated power, height of antenna above ground, type of antenna, polarization of antenna, characteristics of antenna, azimuth of maximum radiation, horizontal beamwidth, elevation angle of main lobe, gain of antenna, name of receiving station, longitude and latitude of receiving site, equipment code, interconnection to telecommunications net, notes.

Licence general report: This report includes the licence holder data from the previous report, plus the following additional data items:

1) Date licence issued;

2) date of expiration;

3) class of licence fee;

4) amount of fee;

5) date of next payment;

6) type and date of violation;

7) reason and date of termination.

Custom reports: The operator should have the capability to specify custom reports, either based on the above reports with only selected information included in the report, or different reports based on selected sets of data from the database. The following custom reports are available to the operator:

1) Report on number of applications, pending resolution, approved, rejected, or incomplete;

2) Report on number of licences, valid, terminated, or due to expire;

3) financial reports of amount invoiced and amount collected;

4) report of number of complaints, received, rejected, or solved.

Graphic format reports

An AASMS should be able to produce the following reports in graphic format:

Licensed transmitter plot: This plot shows a geographic map background, the location of the licensed transmitter, its call sign, frequency, effective radiated power (e.r.p.), field strength coverage contour, interference contour. This plot can show one single transmitter, or multiple transmitters on the same channel, on adjacent channels, or on different channels.

Shadow plot: This plot shows the colour-coded field strength values around a transmitter site.

Terrain profile plot: This plot shows the terrain elevation as function of distance on the path between two sites. This plot is calculated as a cross section through the topographic map data.

Monitored signal plot: This plot shows on a map background the locations of remote monitoring stations; the locations of intercepted signals; and if applicable, the locations of licensed transmitters from the database.

Band allocation plots: This plot shows in graphic format the allocation of the radio spectrum to different services, as a function of frequency.

8.9.1 Licence printing

Print licences at the spectrum manager's request. Licences should follow a format determined by each administration or be configurable by the user.

8.9.2 Record summary

Provide one-line summary data from each of the records selected by the user.

8.9.3 Record detail

Provide a full listing of all data contained in selected records.

8.9.4 Transaction activity reports

Provide periodic reports of transaction activity at the spectrum manager's request; such reports to include, but not necessarily be limited to: number of applications in process (total, by service, by band); total number of applications.

8.9.5 Expiration and renewal notice

Automatically create a list of applications due to expire at some user-specified future date. Optionally generate hard-copy expiration notices.

8.9.6 Summary status reports

Provide summary statistics and specific record summaries for records in each processing status category.

8.9.7 Status reports

Provide a list of all records in any user-designated status category (such as pending, incomplete, etc.).

8.10 User interface

User interfaces should, where feasible, operate in the language(s) of the administration. The user interface should be graphical with extensive use of help features, menus, etc.

An AASMS should provide for the ease of use of operators, as illustrated by the following features:

– Database implementation must follow a simple structure that mirrors the manual process.

– The system should use graphical user interface forms that are easy to learn and intuitive to use.

– Data entry fields should be defined by titles to prevent confusion of the operator over what quantity to enter.

– The display cursor should point automatically to the field where the next data needs to be entered so operators cannot miss an entry.

– Data entries should be checked for type of data and range of values.

– Invalid data should be rejected by the system. Operators should be given a warning message giving a description of the mistake and the correct range of values.

– Should be designed to utilize client-server computing system architecture.

– The application software should preferably be written in “C” Language or in RDBMS based forms and reports programming tools.

– The RDBMS used should be a popular product in use by most other government organizations worldwide to support large volume of operational data and complex applications.

– The system should support multiple regional office operation if required by the administration.

– Should provide record level data access security control.

– Should provide audit trail upon data record status change and provide such information as: identification of records being changed, identification of user causing the change, time and date, from status, to status.

– The operators at workstations should not be required to have knowledge of the software details.

– Should have self-explanatory instructions for the user available in the form of “help windows” on screen.

– All data entered by users should be validated upon entry to ensure that the data being entered is valid and within desired range.

– The system should provide ad hoc query capabilities to meet a variety of operational requirements.

System administration

An AASMS should:

– have utilities to perform all necessary user administration;

– maintain user access control through predefined user roles;

– provide capabilities for reference table maintenance;

– have extensive automatic housekeeping functions, e.g. record purging;

– provide automated procedures for routine backup, database integrity validation, and recovery;

– have query functions for on-line on screen viewing of system administration data;

– have extensive management report capabilities.

8.11 Data processing requirements

An AASMS should be Windows-oriented using an appropriate database management language, chosen for its suitability to spectrum management requirements. An AASMS program should be designed to support the following:

8.11.1 Standard data transaction (must be accomplished in a multi-user environment) record creation; record editing/modification; record deletion

8.11.2 Data entry

Provisions should be made to make data entry as simple as possible, including the use of logical full screen editing and data entry validation and logical, user-changeable defaults. Data entry should be optimized for input data validation and, to the extent practicable, should be consistent with BR data forms.

8.11.3 Data modification

Changes to records should be made using the same screen-editing specified for new data entry whenever possible.

8.11.4 Data back-up and archiving

Standard features should be included that support routine back-up for data loss protection. Archiving should be provided for any deleted records identified by the spectrum manager for archive retention.

Records should be identified singly and by class attributes (which should be specified in a user changeable data table).

It may be desirable to maintain historical records in order to allow the retrieval of prior licence awards or renewals that may affect the processing of a new application.

Audit trails should also be maintained for each application. The audit trail includes all database changes, time and date of those changes, and name or ID code of the individual authorizing the changes.

Time and date stamps are recorded in the system as the application completes the various processing steps allowing the reports module to calculate throughput times and statistics relating to the percentage completion of applications in process by category.

8.11.5 Database inquiry

Records of interest should be easily identified and extracted. Primary selection is to use a set of standard selection screens incorporating standard selection criteria. The AASMS is also to support selection using query by example and extended query techniques.

Inquiries could include, *inter alia*: selection by frequency range; selection by frequency range and bandwidth; a designated frequency or channel; selection by unique record identifier; selection by geographic area; selection by services; selection by user; selection by call sign or station identifier; selection by equipment manufacturer; selection by transmitter output power; selection by licence status.

Outputs from all data inquiries should be ordered according to fields specified by the user.

8.11.6 Validation

Validation is the process whereby data entered into the AASMS is tested to see that it is permissible or appropriate. An AASMS should include validation on every input field using information in user controllable validation tables.

8.11.7 Record status

Information in the AASMS data files will be subject to continual change. For planning purposes, the AASMS recognizes multiple record status categories (although records will not necessarily be kept in different files matching these categories). Provision should be made to assign and track record status. Status attributes should be user assignable, but will typically identify processing status like preliminary processing, hold for data correction, hold for coordination, approved, etc.

8.11.8 Program parameters modification

The program should be as simple as possible to maintain and modify. Modifications that are allowed should be minimal.

8.11.9 Data conversion

The issue of conversion of the existing data to the new system, either from paper form or from an existing electronic format, is often underestimated. Special programs are often necessary to accomplish this data conversion and can sometimes add significantly to the cost of acquiring a computerised spectrum management system. Differences in data structure from the old to the new system can sometimes render a computer conversion near impossible and manual decisions and intervention may be necessary during the conversion process. This again can significantly add to the cost of the system.

8.11.10 Data content

Recommendation ITU-R SM.1047 presents specifications for data items to be included in a spectrum management database. An AASMS should optionally provide for the import and export of data in the specified formats. For internal use, such data should be stored in that format most efficient for the specific applications. For efficiency consider total data storage requirements, data precision requirements, and needs for processing speed. In general, data should be stored in compact, internal format until required for some external application. Display formats should be chosen as appropriate to individual output forms.

The standard group of data elements in Recommendation ITU-R SM.1047 and the Preface to the IFL should be used as guidelines for the selection and definition of data items to be included in the AASMS database. Data elements should include those required for BR notification.

An AASMS should provide facilities to import data from the International Frequency List on CD-ROM and from the Radiocommunication Information Circular/Local Frequency List.

8.12 Hardware/software environment

8.12.1 Hardware requirements

An AASMS should include the computer equipment and computer peripheral devices which meet the characteristics described in the following sections. Administrations should note that technology

is changing at a very rapid pace and the suggestions here were current at the time the Recommendation was produced (2000) but need to be reviewed against available equipment and the administration's needs.

Network server

The network server computer should meet or exceed the following operational and performance characteristics:

Central processing unit

– Technology: Dual Pentium III™ A multi-processor architecture will further facilitate future expansion

– Clock frequency > 700 MHz

– Data bus: 64-bit

– Number of instructions per cycle: 4 (2 per Pentium™ CPU)

– Number of CPUs required: two or more.

Memory

– Memory Size 256 Mbytes of error checking and correcting memory

– Access time for RAM: 70 ns

– Size of cache memory: 512 kbytes

– Maximum memory expansion capability: 1 Gbyte.

Controller for secondary storage

– Total number of controllers required: one

– Data transfer rate: 1 Mbit/s

– Burst transfer rate: 7.5 Mbit/s synchronous, 3.0 Mbit/s asynchronous.

Hard drive unit

– Number of units required: one

– Controller technology: Integrated Dual Fast and Wide SCSI-2

– Disk storage technology: RAID level 1 configuration (RAID = redundant array of independent drives) (mirroring to safeguard against failure)

– Capacity per formatted unit: 30 Gbytes (additional capacity for 5-year growth)

– Access time: 11 ms maximum

– Transfer rate between controller and disk: 9 Mbit/s.

Network communications controller

– Technology of controller: PCI LAN adapter

– Supports: 10 Mbit 10 BASE-T Ethernet (100 Mbit/s backbone)

– Supports TCP/IP protocol

– Transmission speed: 10 Mbit/s.

Display

– Number of units required: one
– Screen size: 17 in.
– Screen resolution: 1 280 × 1 024
– Video subsystem: 256 colours
– Memory: 2 Mbytes of video RAM.

Magnetic tape unit

– Type: industry standard DDS-2
– Total number required: one
– Data transfer rate: 1 Mbit/s
– Burst transfer rate: 7.5 Mbit/s synchronous, 3.0 Mbit/s asynchronous
– Data storage capacity: 8 Gbytes.

Floppy disk unit

– Number of units required: one
– Controller technology: IDE
– Data storage capacity: 1.44 Mbytes.

CD-ROM unit

– Number of units required: one
– Controller technology: SCSI-2 or IDE
– Data storage capacity: 660 Mbytes
– Access time: 190 ms
– Speed: quad-speed.

Printer

– Printer technology: Laser quality
– Print resolution: 600 dpi
– Fonts managed: Adobe PostScript Level 2. Supports other downloadable fonts and bit map fonts
– Printer memory: 12 Mbytes.

Workstation computers

The workstation computers should meet or exceed the following operational and performance characteristics:

Central processor unit

– Technology Pentium™ III
– Clock frequency: 700 MHz
– Data bus: 64-bit
– Number of instructions per cycle: two.

Memory

– Memory size: 128 Mbytes
– Access time for RAM: 70 ns
– Size of cache memory: 256 kbytes
– Maximum expandable memory size: 512 Mbytes.

Display

– Number of units required: one
– Screen size: 17 in.
– Screen resolution: $1\,280 \times 1\,024$
– Video subsystem: 256 colours
– Memory: 2 Mbytes of video RAM.

Hard drive unit

– Number of units required: one
– Controller technology: fast SCSI-2
– Capacity per formatted unit: 7.0 Gbytes
– Access time: 11 ms maximum
– Transfer rate between controller and disk: 8 Mbit/s.

Floppy disk unit

– Number of units required: one
– Data storage capacity: 1.44 Mbytes.

CD ROM unit

– Number of units required: one
– Controller technology: SCSI-2 or IDE
– Capacity: 660 Mbytes
– Data transfer speed: quad-speed.

Warranty

All deliverables shall carry a full warranty of 12 months from date of acceptance of the provisional acceptance test.

Auto-diagnostics

The automatic spectrum management system should be equipped with tools for the continuous monitoring of system performance and auto-diagnostics.

8.12.2 Software requirements

An AASMS should be designed to run on computers configured with at least 128 Mbytes of RAM. Windows should be used since it is likely that future software will be developed for this environment. Some administrations may prefer UNIX, although this will add to the system’s complexity. A good quality database management system is required. GIS software is also useful.

8.13 Geographic map display functions

The AASMS should include the software for the storage, processing and display of geographic data and terrain/topography data. The system should be capable of accepting map data in standard formats. The spectrum management system should be capable of storing, processing and displaying of the digital map data with no degradation in accuracy, up to a scale of 1:24 000 and a height accuracy of 10 m, for a total of up to 500 maps.

The first layer is the digital terrain map as detailed in Recommendation ITU-R P.1058 – Digital topographic databases for propagation studies. On this layer by geo-coding conforms a map that includes by raster or vector all needed geographical, political, cultural landmarks, drainage, land cover, populations, utilities data. Conductivity parameters of the ground σ and ε are retrieved from GRWAVE or IDWM.

8.13.1 Profile

On the digital terrain model (DTM) and image layers we add the best propagation and fading models with proven accuracy: Recommendations* ITU-R P.370 for the broadcasting services, ITU-R P.525 for free-space attenuation, ITU-R P.526 for diffraction, ITU-R P.618 for Earth-space prediction, ITU-R P.833 for attenuation in vegetation, ITU-R P.834 for tropospheric refraction, ITU-R P.529 for Okumura-Hata for cities. On the Map, the system should be capable of showing a specific station with its coordinates, e.i.r.p., azimuth and elevation, altitude above sea level and antenna pattern. The basis for EMC analysis is the profile estimation along the interference and wanted signal paths. Without digitized terrain data, Recommendation ITU-R P.370 should be used to estimate the field-strength for stations. In this case, for determined percentages of time and place, kind of topography, you only need to know the effective height of the antenna.

8.13.2 Coverage

The system should calculate the estimated field strengths for any contour from the transmitter, e.g. every 25 m, 50 m, 100 m ..., depending on the DTM pixel resolution.

8.13.3 GIS system

To provide a system that generates electronic maps, that are required for the analysis programs, through the use of multiple kinds of input data. Hardware and software components to ensure the proper functioning of the map scanner and plotting system are also necessary.

8.13.4 GIS software

The GIS software to be supplied should preferably be from a well-proven leading market vendor, The GIS software should have the following characteristics:

– full topological data structure (nodes, arcs and features both implicit and explicit topology), feature object oriented design;

– full SQL and RDBMS support;

– support for Microsoft Windows 95, Windows NT, and UNIX RISC (Sun Sparc, HP, etc.) as a minimum;

---

* *Note by the Secretariat:* see Recommendation ITU-R P.1144 – Guide to the application of the propagation methods of Radiocommunication Study Group 3.

– built-in mapping facility for data capture and map production. Integrated and fully functional DTM;

– windowed display of the data associated with a chosen object depicted on a map background on the screen should be possible;

– facilities should be provided to display that information in user-definable scales and projections;

– facilities should be available to display positions of specific points, lines, and areas over the map background with associated descriptive texts;

– facilities should be provided to make hard copy of the screen (including graphics) produced by the application modules.

8.14 Documentation

A complete user's manual should be supplied. The manual should include a description of all operating features of the program sufficient to allow a user untrained in the use of the program:

– to specify the computer required for the use of this program;

– to install this program on the computer;

– to explain the procedure used to arrive at a frequency assignment;

– to train others in the proper use of the program;

– to change the parameters which control the operation of the program through the use of user changeable data tables;

– to back-up and archive data as required to ensure data security.

Administrations should specify their further requirements for documentation.

For example:

– Number of copies and format (e.g. documents shall be provided with five (5) copies in hard copy in A4 paper of three rings format in appropriate binders, and two (2) sets of soft copies in a word processor format of either Word for Windows Version 6.0 or higher or WordPerfect for Windows, Version 6.1 or higher, on one or more 3.5" floppy disks).

– All documents should have a table of contents and an index generated by the word processor program.

– Text in the documents shall be in a 12-point, easy to read font. The administration should specify the language(s) that it requires the documentation to be delivered in.

– Whenever possible documents should use descriptive diagrams, screen copies, photographs, flow charts, and graphical illustrations.

– Documents from original vendors should conform as much as possible with the requirements above; however, the administration should be aware that bidders do not necessarily have control over the format of documentation from original vendors. Documents from original vendors of equipment or software should be in originals hard copies and in the specified number of copies. Documents in hole-punched (e.g. three ring) formats should be in appropriate binders.

– System diagram showing details of system configuration.

– Installation drawing detailing the site layout and the interconnections of various equipment.

– System manager manual describing system management procedures and utilities.

– Reference manual organized in accordance to logical operation areas of operation with flow charts detailing the operations of the specific functional areas. This manual shall include instructions to users on how specific operations can be achieved.

– Operator manuals from original equipment and software vendors. Programmer manuals from original software vendors.

– Administrator manuals from original RDBMS software vendor.

Training

Training requirements should be estimated according to the number of staff to be trained on each subject. Training requirements described below are limited and a training plan may need to be proposed that is adequate and suitable for the proposed solutions. The administration should specify clearly where the training courses are to take place, how many staff are to be trained on each subject, and what facilities are provided or to be provided by the administration. Training manuals and other necessary materials should be provided to the trainees, one set per trainee.

Spectrum management applications (1 day)

Introduction to spectrum management

Understanding the spectrum management system

Understanding the role of the spectrum management system.

Understanding the spectrum management system structure (1 day)

Spectrum management system structure

Understanding integration aspects of subsystems.

Understanding and using the spectrum management subsystems (10 days)

Understanding/using the radio licensing subsystem

Understanding/using the technical analysis subsystem

Understanding/using the international coordination/notification subsystem

Understanding/using the invoice and payment subsystem

Understanding/using the radio operator certification subsystem

Understanding/using the radio vendor (dealer) subsystem

Understanding/using the type acceptance subsystem

Understanding/using the inspection subsystem

Understanding/using the management planning subsystem

Understanding/using the system administration subsystem

Understanding/using the monitoring interface subsystem

Understanding system reference tables.

Understanding the project (1 day)

Understanding the scope of the project

Understanding the project deliverables

Understanding how the various subsystems are integrated.

Understanding the project implementation schedule (0.5 day)

Understanding the implementation schedule

Understanding the impacts of the schedule

Understanding the responsibilities of the contractor

Understanding the responsibilities of the administration.

Radio licensing subsystem (3 days)

Data entry (applications for radio licences, all services)

Authorizing operation of a radio station (all classes)

Invoicing licence fees

Issuing the radio licence

Modifying/cancelling/renewing radio licences

Queries to the licence database

Generating and understanding reports.

Understanding/performing the technical analysis process (5 days)

Introduction to technical analysis

Performing technical analysis.

Understanding/performing international coordination (1 day)

Introduction to notification registration of frequencies and international coordination performing notification/registration (International Regulations) query and reports.

Understanding the user management process (0.5 day)

Defining vendors

Understanding the certification and registration process

Understanding fee schedules relating to vendor licensing.

Understanding the equipment type acceptance process (0.5 day)

Introduction to the type acceptance system

Understanding the type acceptance function and process.

System administration (5 days)

Understanding and performing system configuration

Understanding and performing network configuration

Understanding system access considerations

Understanding and performing system back-up and recovery

Understanding system security considerations

Understanding and performing database administration.

Database administration tools (5 days)

Introducing RDBMS

Understanding the function of RDBMS

Understanding the use of RDBMS in the licensing system

Using SQL language

Using data browsing utilities.

The inspection system

Understanding and using the inspection subsystem.

Maintaining and using licensing system reference tables and codes (2 days)

Different types of codes

Detailed use of each code tables.

Understanding the monitoring and direction finding function (10 days)

Introduction to the monitoring system

Introduction to the direction finding system

Understanding the interface between to monitoring system and licensing system

Understanding the role of monitoring in spectrum management

Introduction to the mobile monitoring system

Introduction to the fixed monitoring system

Monitoring reports

Operation of the fixed and mobile monitoring system

Spectrum measurement techniques.

Administrations are advised that similar training materials are available in the virtual training centre of the ITU-D.

ANNEX 1

Frequency assignment data table

ADMINISTRATIVE (PRIMARY)

Field	Number/ RDD No.[1]	Remark
Owner and address	New	Smart popup linked to table of names and addresses
Remarks	New	A memo field for entering comments by national administrations
Email	New	
Fax number	New	
Telex number	New	
Telephone number	New	
Licence fee	New	Manually entered data based upon national administrative table look-up or other procedure
Data licence fee is due	New	Default determined by national administration
Date licence fee paid	New	Manually entered by national administration when appropriate
Billing name and address	New	Default owner and address. Smart popup to name and address table
ITU-R frequency notification date - type of notification	8.10[2]	Popup code. Default “0”
Date of bringing into use	8.8/0141	Default today’s date
Status of administrative frequency assignment	8.7	Popup codes. Codes can be changed by national data administration
Security classification	8.5	Popup codes. Default “U”
Frequency assignment/coordination number (registration number)	8.1/0201	Code originated by national administration. Used to print a licence

[1] RDD No. refers to reference number in the radio data dictionary (RDD), Recommendation ITU-R SM.1413.

[2] Number indicates data field described in more detail in Annex 1 of ITU-R Handbook on computer-aided techniques for spectrum management, Geneva, 1999.

ADMINISTRATIVE (SECONDARY)

Field	Number/ RDD No.	Remark
ITU-R frequency notification data – result of examination – ITU-R identification number	8.10	Popup code and text
Date of ITU-R registration – type – date	8.12	
Operating administration/company	8.13/0011	Popup code and text
Coordination code	New	A 3 character country code and a 1 character coordination status. Allow for 6 pairs of country and status fields. Popup of country codes of surrounding or close (180 km) countries. (Must be a user editable list.) Also popup coordination code and text
Type of transaction for frequency assignment – purpose of transaction – transaction number	8.4	Popup code and explanation. Default “A”

FREQUENCY (PRIMARY)

Field	Number/ RDD No.	Remark
Class of station	1.9/0277	Popup code
User group	1.12	Popup (list availability)
Number of mobile stations with which communication is to be established	1.15	
Response frequency	New	Frequency assigned to a mobile transmitter in a mobile network where the assigned frequency is the base frequency
Assigned frequency	1.1/0345	Store in numeric field capable of handling the smallest frequency as an integer (e.g. Hertz × 10)

FREQUENCY (SECONDARY)

Field	Number/ RDD No.	Remark
Carrier frequency	New/0348	Same storage procedure as assigned frequency
Frequency offset	1.6	Popup codes
Hours of circuit operation	1.8/0307/0308	Enter limits of operating time. Check if 24 h or 59 min is exceeded. Default "I", "0000", "2400"
Nature of service	1.10/0156	Popup code
Experimental station	1.10.1	Default blank. Prompt "Y" or "N". Store "X" for "Y"

RECEIVER ANTENNA (PRIMARY)

Field	Number/ RDD No.	Remark
Code number of receiving antenna	7.1	Linkage only
Azimuth of maximum reception	7.9	Check for numeric < or = 360. Default "ND". If "ND" is selected, then store 999.9
Horizontal beamwidth	7.10/0147	Check for numeric. Popup codes. Default "360.00"
Height of receiving antenna above ground	7.2	Check for numeric. Popup code
Gain of receiving antenna	7.14	Check for numeric. Popup codes. Default +0 dBi

RECEIVER EQUIPMENT (PRIMARY)

Field	Number/ RDD No.	Remark
Code number for receiving equipment	6.1	Linkage only
Receiver sensitivity	6.3	Popup code. Check for numeric

RECEIVER SITE (PRIMARY)

Field	Number/ RDD No.	Remark
Identification of receiver site	5.1/0347	Linkage only
Name of the receiving station	5.2/0267	
Country or geographic area in which the receiving station is located	5.6/0174	Popup country codes
Latitude/longitude of receiver site	5.7/0037	Check for valid ranges of the degrees, minutes, seconds, and direction
Height of the receiver site above the average level of the sea	5.8	Check for numeric
Geographic coordinates	5.11	Check for valid ranges of degrees, minutes, seconds, and direction
Radius of a circular receiving area	5.12/0071	Check for a numeric

RECEIVER SITE (SECONDARY)

Field	Number/ RDD No.	Remark
Standard defined area of reception	5.10	Popup codes

TRANSMITTER ANTENNA (PRIMARY)

Field	Number/ RDD No.	Remark
Type of transmitting antenna	4.3	Popup codes
Gain of transmitting antenna	4.14/0129	Check for numeric. Popup codes. Default +0 dBi
Height of transmitting antenna above ground	4.2/0125	Check for numeric. Popup codes
Polarization of transmitting antenna	4.4/0131	Popup codes
Horizontal beamwidth	4.10/0147	Popup codes. Check for numeric. Default 360.00
Azimuth of maximum radiation	4.9/0108	Check for numeric < or = 360 radiation degrees. Popup “ND” as an option, but if entered store 999.9. Values should be numeric. Display 999.9 as “ND”. Default value is “ND”

TRANSMITTER ANTENNA (SECONDARY)

Field	Number/ RDD No.	Remark
Type of pattern	4.6.1	Popup codes
Type of antenna	4.3.1	Popup codes
Electrical height of antenna	4.2.1	Check for numeric
Tower field ratio	4.6.5/0395	Check for numeric

TRANSMITTER EQUIPMENT (PRIMARY)

Field	Number/ RDD No.	Remark
Code number of equipment	3.1	Linkage only
Radiated power	3.5.2/0155	Check for numeric. Popup codes
Power delivered to antenna	3.5.1	Check for numeric
Designation of emission	3.2/0351	Popup emission types
Maximum authorized	3.4/0155	Popup for type of power. Popup radiated power in the units. Check for numeric direction of maximum power. Default value 1. Watt radiation “R”
Bandwidth	3.5/0157	

TRANSMITTER EQUIPMENT (SECONDARY)

Field	Number/ RDD No.	Remark
Colour system	3.3.1/0078	Popup codes
Designation of TV system	3.3/0283	Popup codes
Transmission system	3.3.2/0165	Popup codes
Class of operation	3.2.1/0494	Popup codes
Power deliver to antenna	3.5.1	Check for numeric
Radiated power	3.5.2/0155	Check for numeric. Popup codes

TRANSMITTER SITE (PRIMARY)

Field	Number/ RDD No.	Remark
Identification number of the transmitter site	2.1	Linkage only
Name of transmitter station	2.2/0276	Popup code
Country or geographic area where transmitter is located	2.6/0174	Popup linked to country name table
Latitude/longitude of transmitter site	2.7/0037	Check limits of degrees, minutes, and seconds, and direction
Nominal radius of the transmitter area	2.7.1/0071	Units, km
Height of the transmitter above sea level	2.8	Check for numeric
Call sign or other identifier	2.9/0347	

TRANSMITTER SITE (SECONDARY)

Field	Number/ RDD No.	Remark
Standard defined area of transmission	2.7.2	Popup codes