



Prasar Bharati
(Broadcasting Corporation of India)
Directorate General: All India Radio
(Planning & Development Unit)

INTRODUCTION: This Technical specification is for supply, installation, testing and commissioning of GIS based software for preparation and documentation of radio broadcast transmitter coverage contours and associated tools and data for Akashvani Bhawan, New Delhi.

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Specification No.Spec/1050/2006/IT

TECHNICAL SPECIFICATIONS FOR SUPPLY, INSTALLATION, TESTING AND COMMISSIONING (SITC) OF GIS BASED SOFTWARE FOR PREPARATION AND DOCUMENTATION OF RADIO BROADCAST TRANSMITTER COVERAGE CONTOURS AND ASSOCIATED TOOLS AND DATA FOR AKASHVANI BHAWAN, NEW DELHI

1.0 GENERAL

AIR invites tenders from Software Companies providing Turn Key Solutions in the field of GIS based coverage maps in India for radio broadcast networks at its headquarters at Akashwani Bhawan, New Delhi.

- 1.1 The enclosed specification describes the functionality required for SITC of comprehensive GIS based software for coverage maps .
- 1.2 The tenderer shall quote for the complete turnkey solution. The prices shall be quoted by the tenderer as per the format enclosed in Tender form.
- 1.3 The software is to be supplied on perpetual license basis to All India Radio.
- 1.4 The tenderer must submit detailed printed technical literature of the offered software giving complete details of its functionalities, features and requirements.
- 1.5 The quote should either be from the original software developer or it's authorized agent. In case, the quote is from the authorized agent, a certificate in original from the original software developer that the tenderer is authorized agent should be enclosed with the tender.
- 1.6 The tenderer will be required to demonstrate the functioning of the tendered software at the time of technical evaluation in New Delhi. Non-compliance of demonstration shall disqualify the tender.
- 1.7 Incomplete offers shall be liable for rejection.
- 1.8 One bidder shall quote only one offer.
- 1.9 The tenderer is required to submit
 - a) Point-by-Point Compliance Statement to Section1, Section 2 and Section3 as per format given in Annexure – A, highlighting deviations, if any, on all the clauses of specification for the offered software product duly signed in original by the Original Software Developer or authorized agent.
 - b) Schedule of Materials (unpriced as per format at section 3.0 in Technical Offer).

AIR reserves the right to accept or reject any or all tender(s) without assigning any reason whatsoever.

2.0 TECHNICAL SPECIFICATION

The tenderer needs to supply, install, test and commission the Software to meet the specific requirements of AIR. The detailed requirements / functionalities of AIR are given below:

- 2.1** As part of the key functional requirements of the software it should be able to provide the following:
- a. Predict Field strength according to ITU recommendations
 - b. Display of stations and calculations on selectable background map
 - c. It shall be able to handle spatial data - Raster and vector data
 - d. Terrain based propagation models including diffraction effects (Epstein Peterson, Okumura Hata)
 - e. Signal strength Contour calculations
 - f. Interference calculations
 - g. Various multiple interference calculation algorithms (power sum, simplified multiplication method, log-normal, simplified log-normal)
 - h. Network analysis and optimization
 - i. Population Analysis considering administrative borders

The following sub-sections give the technical specifications of the various modules.

2.2 FM MODULE

The RF planning tool will help to plan broadcast transmitter stations in the frequency band 88 – 108 MHz. It shall have features to analyze existing networks and perform necessary interference calculations. The tool should conform to various ITU recommendations (e.g. ITU-R P. 1546 as well as former ITU-R P.370, ITU-R P. 526, ITU-R P.453, Geneva Plan 84, ITU-R BS. 412, ITU-R BS. 599, etc.) and should also have all the features mentioned in the following sections.

2.2.1 The FM module should support the following radio wave propagation models:

- a. ITU-R P.1546 and ITU-R P.370
- b. Longley - Rice
- c. Free-space
- d. Line of sight
- e. Line of sight (with Fresnel Zone check)
- f. Epstein - Peterson

The module must provide the following as per ITU-R P. 1546 (and former ITU-R P. 370)

- g. Basic field strength curves as a function of distance for the VHF frequency range for different time and location probabilities with 10 m receiving antenna height
- h. Curves for propagation over land and sea paths
- i. Mixed path field strength calculation for radio paths over both land and sea
- j. Use of terrain roughness Δh correction
- k. Correction based on Terrain clearance angle
- l. Variability of atmospheric refractive index
- m. Correction for receiver antenna heights different from 10 m
- n. Extension for distances below 10 km from the transmitter site

2.2.2 Demographic analysis

The planning tool should allow the user to analyze and quantify the size of population served in a defined area, which can be defined by:

- a. An area within a certain range of field strength
- b. An area where the available protection ratio is below a pre-defined value
- c. One or more polygons (vectors) to be defined by the user

It should be possible to combine population coverage analysis with additional raster layers e.g. administrative boundaries of states, districts, tehsil / block and rural / urban population divide.

2.2.3 Import and Export Formats

The planning tool should provide the facility to import and export terrain, vector, graphic and transmitter database into multiple formats such as TIFF and BMP for Graphics, ASCII for Graphics and Vector. The tool should also support:

- a. Electronic notification according to ITU TerRaSys format.
- b. XML export
- c. Direct reading from the BRIFIC CD-ROM, which is published by the ITU
- d. Save and load text files, and also copy and paste from planning tool package to common window applications like MS Word, MS PowerPoint, MS Excel.

2.2.4 Field Strength Studies

Field strength calculation should be possible with any of the models given above using both terrain and clutter (optional) data. Field strength should be possible at discrete test points, along an arbitrary straight line (e.g. a line starting from the transmitter to a desired location point), along a "polyline" (e.g. following a road) or for each pixel of a user defined rectangular region. It should be possible to assign different propagation model to different sites. Additionally, if there are areas where no Digital Terrain Map is available, the program should automatically switch to the ITU-R P.1546/370 model using the effective height values that can be stored with each transmitter in the transmitter database.

2.2.4.1 Time and Location Statistics

Time and location statistics should be incorporated in different stages of the network analysis process. Field strength prediction models normally represent field strength values for 50% of time and at 50% of location. The offered software product should include method as per ITU for calculating corrections required for percentages of location and time other than 50% for example 70%, 90%, 95%.

2.2.4.2 Interference Studies and Calculations

The planning tool should provide following type of analysis:

- a. At a desired transmitter site (transmitter coordinate) a wanted transmitter calculation based on a frequency range given by the user should be done and the usable field strength should be calculated for each frequency.
- b. It should show for each pixel the transmitter with the highest wanted field strength. Additionally the wanted field strength must be higher than the minimum field strength. If several transmitters have wanted field strengths, which exceed the minimum field strength at a pixel, then the number of such transmitters should be indicated preferably as a thematic map.
- c. It should indicate the usable field strength (summation of the unwanted fields of all interfering transmitters) in the whole calculation area.

- d. It should indicate the coverage reserve (difference between usable field strength and the wanted field strength) in dB.
- e. Several transmitter groups cover a pixel, the planning tool should indicate the number of transmitter groups serving this pixel.

In the interference calculation routines, when multiple interferences need to be considered, the offered software product shall have statistical methods like the Simplified Multiplication or Log Normal procedures to 'sum' up the different interfering signals. It should be possible to calculate predicted interference limited coverage in terms of a coverage probability, i.e. the probability that the wanted signal is higher than a required minimum field strength and additionally, that the wanted signal is higher than the 'sum' of all interference signals.

2.2.4.3 Land Sea Path

Land/Sea discrimination should be included in the ITU-R P.1546 / ITU-R P.370) calculations and can be based either on a vectorised approach or derived from the clutter (optional) maps.

2.2.5 Antenna Data

The offered software product should include a database for antenna patterns that can be stored in 10-degree or better resolution in the azimuth and elevation cut. The user should be able to create antenna patterns either manually (by entering the attenuations for each step of 10-degree or better) or by entering or modifying in a graphical antenna pattern editor.

It should also be possible to read standard custom antenna formats, which are normally based on ASCII-text files. An antenna from the antenna database can be 'linked' to different transmitter sites (frequencies) and modified in horizontal or vertical (tilt) position.

Additionally, the planning tool should offer the possibility to store an antenna pattern with each transmitter entry in the database according to the widely used international broadcast formats.

2.2.6 Contour Calculations

The planning tool shall have the feature to perform fast contour calculations. They can be used to check the dimensions of the expected coverage areas. Contour calculation should be possible directly for constant field strength, C/I or coordination distance. For field strength and C/I usually the ITU-R P.1546 / TX-Database model should be used. The calculation should be done with 10° azimuth radials around the transmitter.

2.2.7 Map Creation and Printing

The tool should have a print preview feature. Copy and paste of maps should be possible to other MS Windows based applications, like Microsoft Word or Power Point, to easily produce larger reports or presentations.

2.2.8 Path Profile Analysis

The offered software product should be able to study the path profile, calculate Fresnel zone clearance as well as do line of sight checks or minimum receiver height calculations along the path between two transmitters or in a complete area.

2.2.9 System Compatibility

The offered software should run on Microsoft based Windows XP Professional or latest OS installed on Intel P-IV or latest model.

2.3 MF MODULE (OPTIONAL)

For Frequency Range 531 KHZ to 1605 MHZ for Medium Wave Broadcast Transmitters

The AM (MF) module should support the following functions:

2.3.1 Field strength prediction models

The AM module should support ITU-R P.368 Ground wave propagation and ITU 1975 Geneva Plan, considering conductivity and permittivity in following three different calculation modes:

- a. Fixed path Calculations (conductivity and permittivity based on assigned values)
- b. Millington formula (conductivity and permittivity values taken from database or conductivity and permittivity maps)

2.3.2 AM module should also support ITU based Sky wave propagations.

2.3.3 Interference Module

The Interference module should provide for the following:

- a. Consideration of co- and adjacent channels
- b. Consideration of different adjacent channel protection ratios
- c. User definable protection ratios
- d. Search for the strongest interferers for a certain station
- e. Search for the interfered stations for a certain Transmitter
- f. Calculation of usable field strength

2.3.4 AM module should be able to generate following contours with user selectable contour steps

- a. Field strength contours for one or several transmitters for a user defined field strength value
- b. Interference contours with a user definable C/I
- c. Fading Zone contours with user definable fading threshold values
- d. Co-ordination distance contours

All contour results can be displayed either as vectors or as text result

2.3.5 AM module should provide support for

- a. Direct Import of TX data from ITU Plan or IFL CD-ROM
- b. Direct Import from Weekly circulars from ITU
- c. Flexible search and sort criteria

2.4 HF MODULE (OPTIONAL)

For Frequency Range 3.0 MHz to 30 MHz for Short Wave Broadcast Transmitters

The HF module should allow the user to design and analyze HF (short wave) networks. The detailed examination of a single transmitter should cover all critical frequencies and additionally propagation specific characteristics like the radiation angles for every receiver location. All calculations should be possible either in the area calculation mode

resulting in color-coded bitmap pictures or the contour mode, which produces iso lines for field strength.

2.4.1 The planning tool should support the ITU Sky wave propagation model for HF networks

2.4.2 The planning tool should support calculation of following frequencies

- a. Maximum usable frequency (MUF)
- b. Operational maximum usable frequency (OPMUF)
- c. Lowest usable frequency (LUF)

2.4.3 The Propagation information should also include

- a. Optimum elevation angle of radiation at transmitter site
- b. 24 hour prediction at test points

2.4.4 The following field strength Calculation modes should be supported

- a. Test point calculation
- b. Calculation along lines
- c. Calculation along user defined polylines
- d. Area calculation with user defined raster resolution
- e. Contour calculation

2.4.5 The planning tool should allow Maximum field strength level from a single transmitter at a specific point

2.5 DRM SERVICE FUNCTIONS IN MF, HF AND VHF (OPTIONAL)

DRM module should support calculations for different field strength values in MF, HF and VHF range. It should also support different DRM propagation modes A, B, C and D and different constellations 16 QAM, 64 QAM as per ETSI standards.

2.6 DIGITAL MAPS AND POPULATION DATABASE

The digitized maps of 1:200,000 scale or better should be provided by bidder in RF planning tool. The bidder shall indicate the GIS engine and data formats supported. A certificate of authenticity verifying the accuracy or correctness of map data should be enclosed by the bidder.

2.6.1 Digital maps should have following layers with accuracy requirements:

- a. Terrain: Terrain database of resolution upto 100 meters or better should be provided for each state of India. Terrain database should have elevation / z coordinate accuracy of 30 meters or better and latitude, longitude / (x, y) coordinate accuracy of 100 meters or better.
- b. Boundaries: All administrative boundaries including country, state, district, tehsil / block should be provided along with 2001 population census data of State, district and sub-division with rural / urban divide. The city/ town details, if not available in digitized map should be duly marked as available in the latest census data.

The maps should be provided for each state and one seamless integrated map should also be provided for whole country for all the layers listed above. Latest Census Data

shall be linked by Bidder with State and District boundary databases. It should be possible to update the Census data as and when new census is available.

2.6.2 The following is the requirement for optional data:

- a. Terrain (in lieu of 2.6.1.a): Terrain database of resolution upto 50 meters or better should be provided for each state of India. Terrain database should have elevation / z coordinate accuracy of 25 meters or better and latitude, longitude / (x, y) coordinate accuracy of 50 meters or better.
- b. Clutter:
 - i) Clutter database of resolution 100 meters or better should be provided for each state of India. Clutter database should have been generated from latest satellite data of resolution better than 100 meters and should have minimum of 8 classes: - Sea, Inland water, open, agricultural land, Urban built-up, rural settlements, High dense vegetation, Low dense vegetation.
 - ii) Clutter database of resolution 50 meters or better should be provided for each state of India. Clutter database should have been generated from latest satellite data of resolution better than 50 meters and should have minimum of 8 classes: - Sea, Inland water, open, agricultural land, Urban built-up, rural settlements, High dense vegetation, Low dense vegetation.
- c. Road and Rail Network: Complete road and rail network consisting of National and state highways, major district roads, major roads and unmetalled roads as derived from 1:200,000 scale or better maps and duly updated.

2.7 DIGITIZATION OF RADIO COVERAGE CONTOUR MAPS

Radio Coverage contours in respect of existing transmitters of AIR are marked on various coverage maps available with AIR. These contours have been prepared on the basis of practical data received after field survey as well as by theoretical data in some cases. It should be possible to superimpose the digitized AIR coverage maps (in BMP, TIFF and JPEG formats) in the RF planning tool. These maps should be open for future editing in the RF planning tool. Contour data pertaining to radio coverage of existing transmitters will be provided by AIR in the form of hard copy maps.

2.8 OTHER REQUIREMENTS

2.8.1 Licensing

All the modules shall have an essential single user license and expandable to multiple user licenses. The bidder shall also quote for optional - 3-user pack, 5-user pack and 10-user pack (stand alone desktops).

2.8.2 Documentation:

Minimum 3 sets of the following documents shall be provided:

- a. Application and installation manual including system administration
- b. User manual along with Test Data Sheet

2.8.3 Deliverables:

- a. System requirement specifications
- b. Application software - supply & installation including media

- c. Documentation - hard & soft copies
- d. Paper License for software

2.8.4 Training:

The successful bidder shall provide basic training of installation, operation and maintenance of the system to 15 users for 5 working days free of cost at the place of installation of the software.

3.0 SCHEDULE OF MATERIALS

3.1 The tenderer is required to indicate the items quoted in Bill of Materials in the Performa given below.

Sr. No.	Description	Qty	Quoted/Not Quoted	Remarks
A)	<i>Planning Software</i>			
	SITC of RF planning software with FM module	1 Job		
B)	<i>Digital Map Data (Refer section 2.6)</i>			
	SITC of India terrain Map	1 Job		
	SITC of mapped boundaries with 2001 population census	1 Job		
	SITC of Locations of towns and cities	1 Job		

3.2 Optional Items: The tenderer is also required to indicate the optional items quoted in Bill of Materials in the Performa given below. These will not be considered for ranking purpose.

Sr. No.	Description	Qty	Quoted/Not Quoted	Remarks
A)	<i>Planning Software</i>			
	SITC of AM module for MF	1 Job		
	SITC of AM module for HF	1Job		
	SITC of DRM module for MF, HF, and VHF	1 Job		
B)	<i>Digital Map Data (Refer section 2.6)</i>			
	SITC of India Terrain map (2.6.2.a) (in lieu of 2.6.1.a)	1Job		
	SITC of whole India Clutter map { 2.6.2.b.i) and ii) }	1Job		
	SITC of Road and Rail Network (2.6.2.c)	1 Job		
C)	Conductivity and Permittivity map	1 Job		
D)	SITC of RF planning software with FM module – 3, 5 and 10 user pack	1 Job		

(S.N.Jhanwar)
Dir. Engg. (Planning)

(V.K.Chowdhary)
Dir. Engg. (Project)

(A. Shanmugam)
Dir. Engg. (IT)

Format of Point-by-Point Compliance Statement

Sr. No.	Specification		
		Complied (Yes/No)	Remarks
1.0 1.1 1.2 -- --			
2.0 2.1 --			
3.0 -- --			
4.0 --			

Special conditions for supply, Installation, Testing and Commissioning (SITC) of GIS based software for preparations and documentation of Radio Broadcast Transmitter coverage contours and associated tools and data for Akashvani Bhawan, New Delhi.

The following are special terms and conditions for the Supply, Installation, Testing and Commissioning (SITC) of GIS based software for preparations and documentation of Radio Broadcast Transmitter coverage contours and associated tools and data for Akashvani Bhawan, New Delhi.

These terms and conditions supercede wherever they appear elsewhere in the tender enquiry booklet.

1. Eligibility to Bid: Bidders should have in-house infrastructure facilities and expertise for preparation of RF Planning and Mapping Data and comprehensive maintenance support during and after warranty period. The turn around time for fault repair service will be 72 hours from the time reported. Bidder or its original software developer must have executed at least two similar RF planning and coverage software projects in India or outside India in the last three years. Documentary proof of such projects executed, especially the turnkey solutions provided for RF planning software based products and services to be attached. Bidder shall also enclose authorization certificate for software support services from original software developer for warranty period. In case the bidder is original software developer, latter shall give an undertaking to provide software support services during warranty period.
2. Maintenance/Warranty: (i) The tenderer shall warrant from original software developer that software to be supplied shall be free from all errors including but not limited to bugs and runtime errors and shall perform in full conformity with the specifications.
ii) The price quoted should include 12 months comprehensive onsite warranty from original software developer from the date of successful commissioning. During the warranty period removal of bugs in the software/data are also required to be done free of charge.
iii) During the warranty period, the customer call should be attended and rectified within 72 hours from time reported. In addition, regular visit of the support engineer is also required once a week during the warranty period.
3. Testing: AIR or its representative shall have the right to test software for conformity to the specifications and result validation. In case the software fails testing, AIR shall reject the software and the supplier shall either replace the rejected software or make necessary alterations to meet the specifications at his own cost, before re-offering the same for further inspection.
4. Payment terms and conditions: 90% against proof of inspection and provisional receipt certificate of stores by consignee for having received the stores on said to contain basis. Balance 10% after installation, commissioning and final acceptance of stores by consignee and on submission of Bank Guarantee for the balance 10% value of the order valid till warranty period indemnifying the purchaser against all losses incurred during the warranty/guarantee period.
5. The Delivery Period is Four months from the date of placement of the order.

