Independent Communications Authority of South Africa
350 Witch-Hazel Avenue, Eco Point Office Park
Eco Park, Centurion.
Private Bag X10, Highveld Park 0169
Telephone number: (012) 568 3000/1

APPOINTMENT OF A SERVICE PROVIDER TOSUPPLY,INSTALL, COMMISSION,CONFIGURE SPECTRUM MONITORING SYSTEMS AND PROVIDE SUPPORT AND MAINTENANCE FOR THREE (3) YEARS.

1. Purpose of submission

To appoint a service provider that will supply, install, commission, configure a spectrum monitoring system in four (4) provinces of South Africa, three (3) transportable systems, a cellular network scanner and provide support and maintenance for a period of three (3) years.

2. Background

2.1. In accordance with the Electronic Communications Act No. 36 of 2005 (the ECA) and the Independent Communications Authority of South Africa Act No. 13 of 2000 (the ICASA Act) as amended, ICASA has a key mandate to perform routine spectrum monitoring to ensure efficient spectrum utilisation and effective spectrum management.

2.2. The Authority currently has a spectrum monitoring system consisting of ten (10) fixed sites, two (2) mobile sites and one portable unit. The monitoring system is used to investigate the spectrum usage of frequencies to ensure the compliant use of the spectrum.

2.3. The Authority plans to expand its spectrum monitoring footprint, capabilities and mobility options. This will be achieved through the appointment of a qualified

service provider to supply, install, commission, and configure a spectrum monitoring system in four (4) provinces of South Africa.

2.4. The project envisages the establishment of four (4) fixed and three (3) transportable spectrum monitoring sites that are comprised of hardware and software components. The installation will be conducted in four (4) Provinces namely, Gauteng; KwaZulu-Natal; Eastern Cape and Western Cape. The focus will be in the main metropolitan areas where spectrum is deemed to have a high usage.

2.5. The monitoring system should be compliant with the International Telecommunications Union (ITU) Recommendations and Spectrum Monitoring Handbook, e.g. Rec. ITU-R SM.1047-2.

3. Scope of work

3.1. The Authority invites eligible service providers to supply, install, commission, and configure a radio frequency spectrum monitoring system in four (4) provinces namely: Gauteng, KwaZulu-Natal, Eastern Cape and Western Cape. The list of coordinates for the sites installations is given in Appendix A.

3.2. The bid requirement is to supply, install, commission, and configure[1] the spectrum monitoring systems consisting of the following:

3.2.1. Four (4) spectrum sensors/receivers operating from 20 MHz to 8 GHz,

3.2.2. Four (4) Omi-directional antenna systems operating from 20 MHz to 8 GHz,

3.2.3. Three (3) Transportable sensors/receivers operating from 20 MHz to 18 GHz,

3.2.4. Three (3) direction finding antenna systems operating from 20 MHz to 18 GHz,

3.2.5. GPS connectivity for all fixed and transportable systems,

3.2.6. Four (4) industrial controllers (rugged computer) for onsite data processing, data acquisition and data retention for the four (4) fixed sites,

[1] Configuration involves physical setup and integration of the fixed and transportable systems to a central monitoring control centre. This includes the software interoperability according to the technical specification in Appendix A.

3.2.7. Four (4) steel cabinets for the housing of the rack-mount receivers in the four (4) fixed sites,

3.2.8. Associated brackets for antenna systems, cabling and accessories, and earthing kits for the four (4) fixed sites,

3.2.9. Interface for the fixed and transportable systems to a central control monitoring software, and

3.2.10. Supply a cellular network scanner with Automatic detection of all GSM, UMTS, LTE (TDD and FDD), 5G NR, CDMA2000 and EV-DO networks, bands and channels, with its own encasing.

3.3. The service provider shall deliver the complete spectrum monitoring systems consisting of integrated hardware and software according to the technical specification in Appendix B.

3.4. The service provider must supply the integration of the monitoring systems with a spectrum management software and all applicable licenses. The Workstation Software must be installed on four operator laptops. The spectrum monitoring systems must interface to Windows Operating System, Microsoft Office and Google earth.

3.5. The monitoring systems make use of masts and related facilities (GPS, electricity and fixed or wireless communications). Spectrum monitoring receivers shall be installed at each fixed site to be able to measure the various parameters such as occupancy and power levels, amongst others. Each site shall have an industrial controller to enable dynamic and continuous monitoring to be performed as well as used for on-site data processing, data acquisition and data storage in cases where the site loses connection to the central monitoring server.

3.6. The service provider shall commission the sites and provide:

3.6.1. On-site Acceptance Test (OSAT) report for each site;

3.6.2. Measurements results for each site as part of the OSAT and produce a typical report from the system (monitoring software), example is a spectrum occupancy report according to the ITU-R Recommendation SM.328 and ITU Spectrum Monitoring Handbook.

3.7. Provide support and maintenance on the supplied system for a period of three (3) years.

3.8. Product Manuals and Technical description

3.8.1. Manuals on the proposed system that guide on how to operate the system, conduct troubleshooting, and basic service maintenance of the system must be provided in soft and hard copy at the time of delivery of the solution and shall be in English.

3.8.2. Technical description (schematics and system architecture) of the proposed solution must be included in the response to this bid response.

3.9. Training

3.9.1. Within the context of this procurement, the supplier shall provide full training to a minimum of 5 officials of ICASA.

3.9.2. The training shall cover the functionality and maintenance of the system with practical hands-on sessions.

3.9.3. The training shall be done on the actual system being supplied under this bid.

3.10. A typical monitoring site configuration block diagram is provided in Appendix C.

4. Support of equipment

Warranties will apply for the supplied hardware, software and workmanship for twelve (12) months following complete delivery, commissioning and site acceptance tests. The service provider must provide support and maintenance on the supplied systems for a period of at least three (3) years.

5. Briefing Session

There will be a compulsory briefing session on Microsoft Teams. All enquiries shall be coordinated through supply chain email.

6. Mandatory Requirements

The Bidder shall ensure full compliance with the minimal technical requirements listed in Appendix B. Bidders who do not comply with the mandatory requirements will be disqualified.

7. Bid evaluation

The bid will be advertised for a period of 21 calendar days in the e-tender portal, and ICASA's website on an 80/20 procurement principle.

Bidders will be evaluated on:

a) meeting the mandatory conditions,
b) functionality and
c) price/BBBEE.

Only bidders who meet the cut-off score of 70 points out of 100 points for functionality will be considered further for price evaluation. All bid proposals submitted will be evaluated in accordance with the 80/20 procurement principle as prescribed by National Treasury Regulations.

Table 1 Bid evaluation criteria and weights

No.	**Weight**	**Functionality Criteria per Category**
A.	**80**	**Price**
B.	**20**	**BBBEE Status Level Contribution**
TOTAL	**100**	
C.		**Functionality: Pre-qualification criteria**

1. Completeness of project plan covering the entire scope of work as defined in Section 3 The Service Provider must provide a detailed project plan showing the following: (1) Work breakdown structure; (2) Detailed project schedule including activities, milestone activities, timelines and resources; (3) Timing, example, the amount of time that is required for each activity; (4) Resources, example, the minimum resources that is required for each activity. (5) Project risks management plan including risks and mitigations; and (6) Quality control management plan including factory acceptance test plan, inspection procedures and on-site acceptance test plan.	**20**	5 = Project plan covers all 6 requirements. 3 = Project plan covers any 5 requirements. 1 = Project Plan covers any 4 or less requirements; or No project plan provided.
2. Capability to Supply, install, commission, and configure all items in the scope (Meeting all requirements as listed in the Scope) and provide the following for all the items 1 to 3 listed below:	**30**	5 = Supply, install, commission and configure all items in the scope including a logistics plan, integration plan, and safety plan. 3= Supply, install, commission and configure all items in the scope including a logistics plan and integration plan.

a. Integration plan (i.e., schematics on how all components listed below integrate with each other); b. Safety plan (i.e., OHS plan); c. Provide logistical plan (i.e., delivery schedule). (1) Fixed monitoring components and complete systems; (2) Transportable monitoring components and complete systems; and (3) Cellular network scanner.		1= Supply, install, commission and configure all items in the scope without logistics plan and integration plan provided; or supply, install, commission and configure less than the items specified in the scope.
3. Proof of support from the Original Equipment Manufacturer (OEM) regarding the availability of spares and parts and their repair facilities.	**30**	5 = Provision of Support (written confirmation by OEM) for 5 years including Local presence/office, proof of certification of partnership or co-location with accredited lab/test facility, electronic fault logging system and dedicated support engineers/personnel. 1 = Insufficient support documents provided.

4. Provide contactable (email and telephone) reference letters, with company letter heads, of similar work done in the past/current in relation to radio frequency spectrum monitoring (supply, install, integrate, commission, support and maintenance).	**10**	5 = Provide more than three (>3) testimonial reference letters. 4 = Provide three (3) testimonial reference letters. 3 = Provide two (2) testimonial reference letters. 2 = Provide one (1) testimonial reference letter. 1 = No submission of testimonial reference letters.
5. Provide training plan for five (5) ICASA staff members with timeframes.	**10**	5 = A training plan which includes timeframes, objectives and working methodology. 3 = A training plan with timeframes and objectives. 1 = Training plan submitted with no timeframes and objectives
TOTAL FOR FUNCTIONAL PRE-QUALIFICATION CRITERIA.	**100**	

APPENDIX A: LIST OF COORDINATES OF FIXED SITES INSTALLATIONS

Province	**Site name**	**Latitude (DMS)**	**Longitude (DMS)**
Gauteng	**Kayalami (Gauteng)**	**25°59'59.66"S**	**28° 5'0.27"E**
KwaZulu-Natal	**Richards Bay (KwaZulu Natal)**	**28°44'51.81"S**	**32° 3'17.23"E**
Eastern Cape	**Kariega (Gqeberha)**	**33°45'52.38"S**	**25°25'29.73"E**
Western Cape	**Signal Hill (Cape Town)**	**33°55'3.38"S**	**18°24'11.09"E**

APPENDIX B MANDATORY REQUIREMENTS– SPECTRUM MONITORING SYSTEM TECHNICAL REQUIREMENTS AND SPECIFICATIONS

The bidder must complete and return the below list.

	COMPLY	DOES NOT COMPLY	NOTES
1. Basic Requirements The Spectrum Monitoring system shall provide the means to execute a number of functions. The system shall:			
1.1. Perform all ITU-recommended electromagnetic monitoring and technical verification measurements. The system should perform all of the monitoring and radiolocation functions required for an ITU-compliant monitoring station (guided by the ITU Spectrum Monitoring Handbook).			
1.2. Perform automatic recognition measurements and storage of the signals monitored by the system, including but limited to complex signals such as TDMA, CDMA and spread spectrum signals.			
1.3. Perform automatic cataloging of electromagnetic emissions, signal decoding for transmitter identification, identification of illegal, unlicensed, and non-compliant signals by comparing the measured values to the licensed radio stations database.			
1.4. Generate spectrum occupancy data and statistics showing the utilization of the radio spectrum.			

1.5. Perform and evaluate frequency offset, frequency deviation, field strength, power density, bandwidth, modulation depth and spectrum occupancy measurements.			
1.6. Identify co-channel, adjacent-channel & inter-modulation interference.			
1.7. Use state-of-art digital signal processing (DSP) techniques. If new signal types are used or new bandwidths are needed, they can be simply added by modifying the system software.			
1.8. Perform discrete frequency scans, such as for forensic interference investigations.			
1.9. Intercept and locate analog and digital signals.			
1.10. All transportable monitoring systems should have the functionality of operating as a central station that is able to send and receive measurements to and from other fixed and transportable monitoring systems.			
1.11. Provide a geographical location display with a selectable map format.			
2. Operational Requirements As a minimum, the Monitoring system should support the following requirements:			

2.1. Configuration System configurations should be suitable for use as fixed, mobile and transportable installations in land-based application as an integrated frequency monitoring system.			
2.2. Number of Monitoring Systems to be delivered The system should consist of 1 cellular network scanner, 4 fixed systems and 3 transportable systems.			
2.3. Network Connectivity to the Central Server The system should be capable of operating in networks connected by wireless mobile (3G and LTE) type technology.			
2.4. Software Architecture The system software should be open architecture, upgradeable and it should also use user-friendly Graphic User Interface (GUI) Forms that are easy to learn and intuitive to use.			
2.5. Signal Analysis Signal analysis tools should be equipped with the system to perform IF/AF/Video signal analysis (such as Modulation, Frequency, Bandwidth, Signal decoding … etc).			
2.6. Bandwidth The system should be able to perform all measurements in any bandwidth up to 40 MHz.			

2.7. Display The system should include displays which allow showing spectrum at least up to 40 MHz and other large wide portions of the spectrum, locate interferers, and identify the types of signals and interference found.			
2.8. Interoperability Integration between the monitoring systems and a spectrum management software should be applicable. The results of monitoring and Direction Finding (DF) should be displayed on the spectrum management software in both modes, on-line (real time display) and off-line.			
2.9. Modes of Operation In performing its functions, the system provided shall meet the following requirements: a) The system's equipment configuration must be flexible, programmable, and capable of operating in different modes. This includes operating in a variety of scheduled and unscheduled directed search modes, a general search mode, and performing the signal analysis tasks specified for each mode.			
b) The directed search mode shall allow the operators to create menus and schedules of search and measurement functions to accommodate a variety of monitoring tasks. These include			

verification of conformance of licensed transmitters and the identification of unlicensed transmitters.			
c) The directed search mode shall detect, classify and report activity in channels contained in the programmed search specification that are not licensed by ICASA.			
d) The program shall allow the operator to specify one or more frequency ranges for monitoring by either start and stop frequencies or designated channel numbers.			
e) The system must allow the operator to specify the receiver settings for each measurement.			
f) The system equipment must be capable of being programmed by the system administrator to skip specified frequency blocks. These blocks would become inaccessible to the system operators.			
g) The system should be capable of being programmed to allow studying of a specified frequency band or sub-band and scanning, detecting and classifying all emitters and all signals present.			
3 Technical Requirements and Specifications The system should meet, as a minimum, the following specifications:			
3.1. Frequency Range			

The spectrum monitoring system shall be designed to monitor radio frequencies currently used in the radio environment. The primary focus of the spectrum monitoring system shall be at least from 20 MHz to 8 GHz and 18 GHz.			
3.2. Power, Field Strength & Flux Density The spectrum monitoring equipment shall have the ability to measure and present signal strength in a variety of ways. While receivers generally measure the received signal in terms of power, the measurement system shall be able to express the measurement as power, equivalent field strength, or equivalent flux density. The signal strength shall be capable of being measured as: a) Linear average b) Log average c) Peak d) RMS			
3.2.1. Power Level Measurements Power level measurements (i.e. the transmitter before the antenna, the ERP and EIRP) shall be expressed in dBm and dBµV, to a resolution of ±0.1 dB.			
3.2.2. Field Strength Measurements While receivers generally measure the received signal in terms of power, the measurement system shall express the signal			

measurements as either an equivalent RMS and peak field strength in volts per meter as decibels (dBV/m), millivolts per meter (dBmV/m), or as microvolts per meter (dBμV/m).			
3.2.3. Power Flux Density Measurements The measurement system shall also be able to express the received signal level as Power flux density in the following units: a) Milliwatts/m2 (dBm/m2); b) Watts/m2 (dBW/m2).			
3.3. Co-channel Signals The system should be able to identify and extract basic parameters of interferers			
3.4. Measurement Settings In addition to the measurement values recorded, the receivers shall record all the settings used in making the measurements. These shall include as a minimum: a) Attenuation b) Bandwidth c) Scan rate d) Centre frequency e) Start and stop frequencies f) Channel numbers g) Antenna configuration h) Antenna orientation i) Noise floor levels j) Time and date of measurement			
3.5. Spectrum Occupancy The monitoring system shall be capable of producing spectrum occupancy			

measurements through the use of the programmed scan modes and data logging capabilities. The measurement periods shall be adjustable by the operator in minutes for periods of up to one month.			
3.6. Types of Modulation The monitoring system shall be able to demodulate and identify the modulation types and report the modulation characteristics for each of the types described below. a) Unmodulated Signals b) Amplitude Modulation c) Double Side Band (DSB) d) Single Side Band, Full Carrier (SSB-FC) e) Single Side Band, Reduced Carrier (SSBRC) f) Single Side Band, Suppressed Carrier (SSB-SC) g) Independent Side Bands h) Frequency Modulation i) Angle Modulation j) Phase Modulation k) Code Modulation l) Amplitude & Phase Modulation m) Pulse Modulation n) Combinations of Angle, Amplitude & Pulse			
3.7. Measurement Configuration The measurement configuration should be recorded along with all measured data. This configuration information must include: a) Site Location, GPS coordinates b) Antenna & Receiver c) Antenna Height			

d) Receiver Attenuation e) Frequency Scan Range f) Measurement Bandwidth g) Calibration h) Date & Time			
3.8. Occupied Bandwidth Measurement The monitoring system shall utilise the techniques described by ITU-R Recommendation SM.328 and ITU Spectrum Monitoring Handbook			
3.9. Measurement Bandwidth Measurement bandwidths available in the system shall be as follows: a) Minimum bandwidth: 500 Hz b) Maximum bandwidth:50 MHz c) Amplitude accuracy better than ±0.5 dB d) Dynamic range greater than 70 dB			
3.10. Required Types of Information The monitoring system shall be able to identify and provide characteristics about the types of information contained in the received signal. The FM and Television (TV) broadcast stations video waveform monitoring for requirements shall be performed by an automatic video analyser and as a minimum shall meet the requirements contained in the ITU Spectrum Monitoring Handbook. The analyser shall report the measurement results to any component of the monitoring system (screen,			

printer or database) for presentation or further analysis activities. Measurements should include*:* a) Carrier Frequency, b) Field Strength, c) Power density, d) Occupied Bandwidth, and e) Video Waveform **-** and be compliant with the ITU recommendations.			
3.11. Signal Analysis & Processing The system shall be capable of operating in either the frequency or time domain or both and shall return the measurements contained in the list below, whether they be a single tone, noise or a complex signal. Measurements shall be capable of being averaged over the time period or the number of samples specified by the operator or the control program. The software shall also be able to capture and record all measurements for replay and analysis later, especially transient, time varying, spread spectrum signals such as those used by TDMA, frequency-hopped, CDMA and other advanced communications systems. Replay and analysis shall be applicable to the entire signal or any part of it. Trigger capability shall be provided to support the acquisition and logging of burst signals. The system software shall be configurable and capable of being upgraded to permit the analysis of new signal types as they become available.			

The system should be able to perform clock extraction for digital signals and be able to use digital tuning to compensate for any transmitter or receiver drift. The system shall be able to demodulate the signals commonly used by communications systems and present or store the modulation signal. In the case of digital signals, each modulating symbol stream shall be demodulated.			
3.12. Self Test and Alerts The spectrum monitoring system shall have both simple and comprehensive self-test capabilities that validate spectrum monitoring functions and give confidence of the measuring accuracy. The built-in testing of the system should run continuously in the background of the computer programs. This testing should allow fault isolation down to the replaceable printed circuit assembly level. The alarms generated by this testing should be able to be masked by the analyst with the appropriate level of password protection. The individual tests shall be operator-selectable in order to test specific boards.			
3.13. Post processing and data analysis on raw measurements The system shall be capable of processing the raw measurements and produce reports for each type of technical requirement listed above. The system shall be capable of managing, processing, and performing data			

analytics to make sense out of the collected data.			
4. Computers Workstations The monitoring "workstation" software must be installed on the operators' laptops. The "workstation" software must be Windows 11 compatible and the monitoring systems must integrate into: - Google Earth software or similar; and - Microsoft Office 365 – Outlook, Word, Excel.			
5. Integration with a Spectrum Management Software The system should be able to perform a real-time analysis and consequently generate a real-time report, real-time data should be sent to a Spectrum Management software (transmitter databases and spectrum band plans) using fixed (Ethernet) and cellular mobile network (3G and LTE or later technology). The system should have the capability of recording and saving results for future use and for building trend reports.			
6. Documentation The Bidder shall provide support documentation in accordance with the requirements specified herein:			
6.1. Hardware Documentation Documentation for vendor and supplier developed hardware items shall include operation manuals, maintenance manuals, and parts lists.			

6.2. Operation Manuals Operation manuals shall contain all information to allow an operator to control and use the items of equipment.			
6.3. Maintenance Manuals Maintenance manuals shall contain all information to allow a maintenance engineer/technician to install, and to perform maintenance on the equipment.			

APPENDIX C: A TYPICAL MONITORING STATION CONFIGURATION BLOCK DIAGRAM

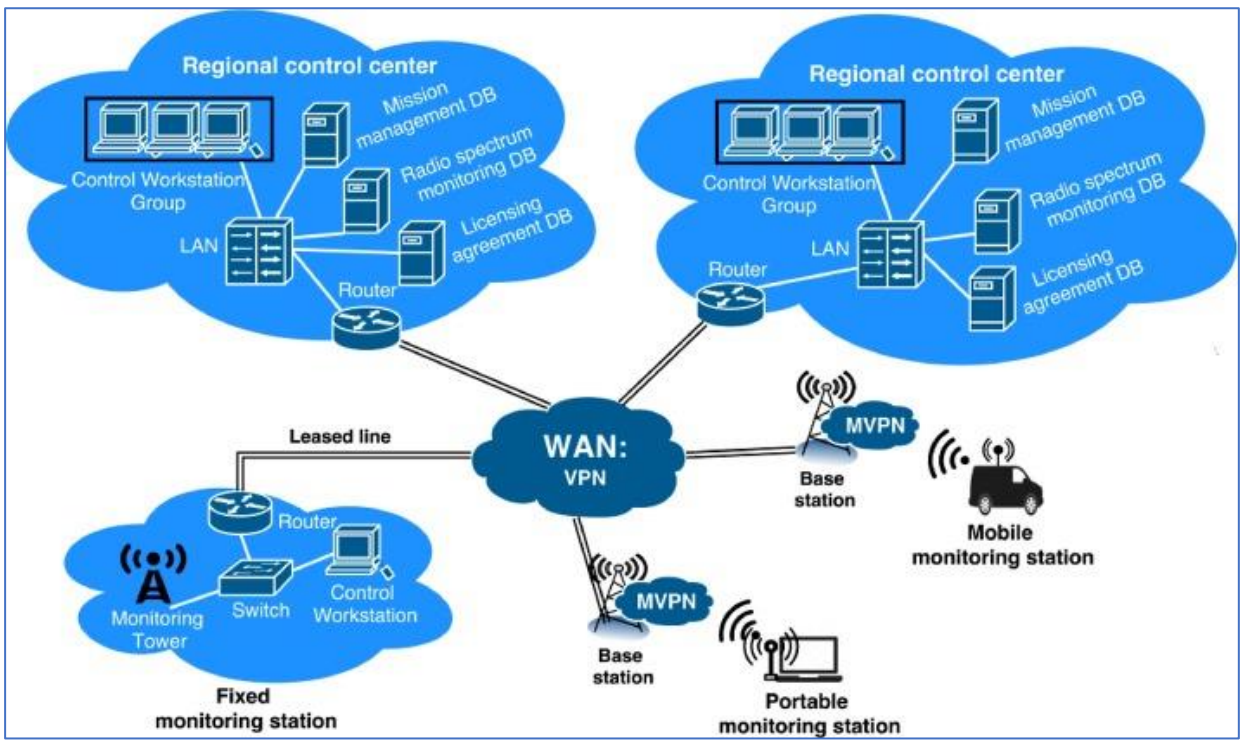

Figure 1: Typical configuration of a spectrum monitoring system