



# **GEORGIA**

**Georgian National Communication Commission (GNCC)**

Request For Proposal (RFP)

for a

**Georgian Spectrum Monitoring System (GSMS)**

**TECHNICAL & SERVICES**

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## 1. Introduction

This document is Appendix 01 of the GSMS RFP list of documents as shown in Table 1. It contains technical specifications of the Georgian Spectrum Monitoring System (GSMS) as part of the GSMS

**Table 1: List of RFP documents**

Doc. ID	Title	Description
GSMS - General	General requirements	This document contains the general, the commercial and legal requirements
GSMS – Appendix 01	RFP for Monitoring System – TECHNICAL & Services	This document contains: <ul style="list-style-type: none"> <li>• Technical Specifications</li> <li>• Services requirements</li> </ul>
GSMS – Appendix 02	Compliance Matrix Template	This document shall be used by the Supplier to respond to requirements in respective RFP documents.

## 2. Terminology

Table 2 lists terminology used in this document.

**Table 2 : Terminology**

Terminology	Description
<b>DBMS</b>	Data Base Management System
<b>DF</b>	Direction Finding
<b>FAT</b>	Factory Acceptance Test
<b>GIS</b>	Geographical Information System
<b>GNCC</b>	Georgian National Communication Commission
<b>GPIB</b>	General Purpose Interface Bus
<b>GPS</b>	Global Positioning System
<b>GSM</b>	Global System for Mobile communications
<b>GUI</b>	Graphical User Interface
<b>HTML</b>	Hyper Text Markup Language
<b>IP3</b>	3 <sup>rd</sup> Intercept Point
<b>LAN</b>	Local Area Network
<b>LOB</b>	Line of Bearing
<b>MAINT</b>	Section of Maintenance, Testing and Calibration
<b>MCC</b>	Monitoring Control Centre
<b>MIS</b>	Monitoring Information System
<b>MMS</b>	Mobile Monitoring Station frequency range 20 – 3000 MHz. For the DR range see the station information
<b>MS</b>	Monitoring System
<b>MTP</b>	Monitoring Task Plan
<b>RDFS-1</b>	Remote Fixed Direction Finding Station 20 – 3000 MHz with the possibility of local control. For DF range see the station information
<b>RDFS-2</b>	Remote control only Fixed Direction Finding Station 20 –



	3000 MHz For DF range see station information.
<b>RF</b>	Radio Frequency
<b>RFMS</b>	Remote Fixed Monitoring Station 20 – 3000 MHz, with the possibility of local control. For DF range see station information
<b>SAT</b>	Site Acceptance Test
<b>RFP</b>	Request For Proposal
<b>TS</b>	Technical Specification
<b>WAN</b>	Wide Area Network

### 3. Overview of the design of the Monitoring System

GNCC's intention is procuring a limited spectrum monitoring system (GSMS). The objective is to design, supply, install and commission a Spectrum Monitoring System (GSMS), covering the Tbilisi and nearby areas. The GSMS shall cover the frequency range 20 to 3000 MHz for monitoring and measurements and cover from 20 – 1300 MHz for DF with features to upgrade . The GSMS shall provide coverage in indicated area.

Figure 1 represents a high level overview of the system comprising out of the existing stations and new foreseen stations

**Figure 1**

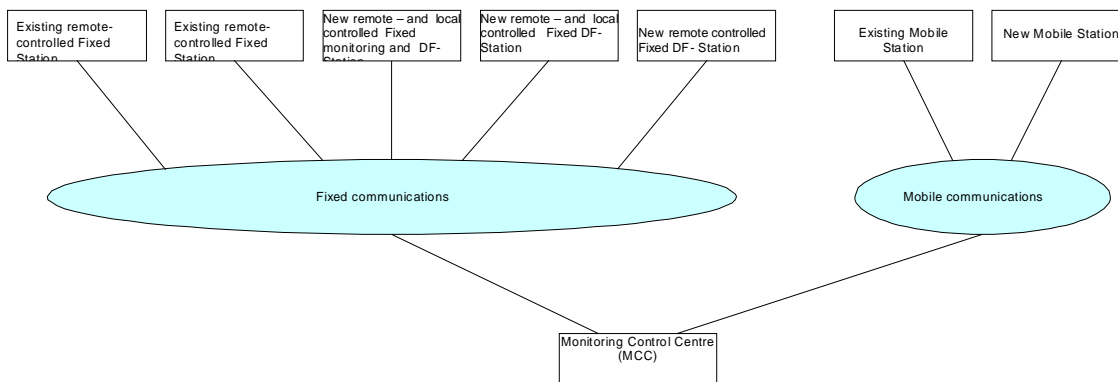


Figure 2 represents a high level overview of the new required stations.

**Figure 2:**

Type of station	Frequency range Monitoring	Frequency range DF	
		DF antenna	DF receiver
<b>New remote and local controlled Fixed station (RFMS)</b>	20 – 3000 MHz	20 – 1300 MHz or wider	20 -3000 MHz
<b>New remote and local</b>		20 - 1300 MHz or wider	20 – 3000 MHz



<b>controlled DF station (RDFS-1)</b>			
<b>New remote controlled DF station (RDFS-2)</b>		20 – 1300 MHz or wider	20 – 3000 MHz
<b>New Mobile DF station (MMS)</b>		20 – 1300 MHz or wider	20 – 3000 MHz

Detailed information on the above mentioned stations are included in other clauses in this RFP.

Statement of requirements included in this document cover the following areas:

- a) **Architecture:** Describe, through a suitable diagram, the role and breakdown of each sub-system including the items listed in the following paragraphs;
- b) **Interfaces:** This refers to interfaces with the spectrum management sub-systems and external users, which might be other users within Georgia or even other international users.
- c) **SW Specifications** including:
  - a. Monitoring network control
  - b. Data control software
  - c. Monitoring task software
  - d. Basic Demodulation software
  - e. Monitoring coverage determination software
  - f. Measurement software related to ITU-R Recommendations
  - g. WAN/LAN communications between the monitoring network
- d) **Hardware specifications** including:
  - a. (measurement) receivers
  - b. Direction finders
  - c. Antennas

### 3.1 Delivery of the system

The GSMS system shall be delivered in phases as described below.

Phase	Spectrum Monitoring System	Date
1	<ul style="list-style-type: none"> <li>• Supply the software to control the existing fixed and remote stations as well as MCC;</li> <li>• Design, supply and the implementation of the RFMS in Tbilisi;</li> </ul>	Delivery until 31 <sup>st</sup> December 2015
2	<ul style="list-style-type: none"> <li>• Design, supply and implementation of the RDFS-1;</li> <li>• Design, supply and implementation of the RDFS-2;</li> <li>• Design, supply and implementation of the Mobile Monitoring Station (MMS).</li> </ul>	Delivery until 31 <sup>st</sup> December 2016

### 3.2 Monitoring Control Centre (MCC)

In Tbilisi the MCC will be installed in the headquarters of GNCC. Via this MCC, all of the Remote Fixed Monitoring Stations (RFMS), Remote Direction Finding System (RDFS-1 and RDFS-2), will be realised via remote control. Also for the Mobile Monitoring Station (MMS) remote control via the MCC will be realized. All stations shall be interconnected to this MCC. For the RFMS and RDFS-1 the possibility for local control is required as well. It shall also be possible to control the existing RFMS and MMS with the same control software as for the new stations. See also Figure 1.

### 3.3 Remote Fixed Monitoring Station (RFMS)

It is foreseen that there will be:

- One (1) RFMS to control the city of Tbilisi;



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The station for covering the Tbilisi area should be able to control the VHF/UHF-bands for monitoring, measurement, direction finding. This RFMS station will be remote controlled by the MCC in Tbilisi but also local control is required.

The RFMS shall be equipped to cover the frequency range 20 – 3000 MHz (VHF/UHF) for monitoring and measurements and to cover the frequency range 20 – 3000 MHz for the DF receiver with 20 – 1300 MHz or wider range for DF antenna. The offered equipment should have the possibility to upgrade the DF functionality to 3000 MHz.

A second receiver covering the frequency range 20 – 3000 MHz is required.

The design of the RFMS is shown in Annex A at the end of this document.

### **3.4 Remote Direction Finding Station (RDFS)**

It is foreseen that to support the RFMS for the Tbilisi area two additional RDFS (RDFS-1 and RDFS-2) are needed for triangulation reasons. Besides the remote control for both RDFS, local control for RDFS-1 is required as well. These RDFS shall cover the frequency range 20 – 3000 MHz for the DF receiver and 20 -1300 MHz or wider range for the DF antennas. It should be possible in the future to upgrade the RDFS antennas system for the 20 – 3000 MHz frequency range.

The design of the RDFS-1 is shown in Annex B at the end of this document.

The design of the RDFS-2 is shown in Annex C at the end of this document.

### **3.5 Mobile Monitoring Station (MMS)**

One (1) Mobile Monitoring Station (MMS) will be stationed at the MCC in Tbilisi. The MMS will be equipped with a DF system to cover the frequency range 20 – 3000 MHz (VHF/UHF) for the DF receiver and to cover the range 20 – 1300 MHz or wider range for the DF antennas. It should be possible in the future to upgrade the RDFS antenna system for the frequency range 20 – 3000 MHz.

A radio access to the MCC will be provided by GNCC. The DF equipment will be installed in an existing van Toyota Landcruiser 76. This van is already equipped with racks for mounting the DF equipment. The design of the MMS is shown in Annex D at the end of this document.



### 3.6 Existing stations to integrate into the system

GNCC has 2 (two) existing RFMS covering the frequency range 20 – 3000 MHz and 1 (one) MMS covering the frequency range 20 MHz – 30 GHz.

It is required to integrate these existing stations into the new setup of the GSMS.

The details of these existing stations are shown in Annex E and F to this document.

## 4 Statement of Requirements

### 4.1 Monitoring System General Technical Requirements

Req. ID	Description
	<b>Generic equipment requirements</b>
	<b>Complete Systems</b>
1.	<p><b>Main Control Centre (MCC):</b> The new monitoring system will be remote controlled at the MCC appropriate workstations and from all stations which will have local control. This MCC will be equipped with all necessary equipment to remote control the RFMS , 2 RDFS and one MMS as well as the 2 existing RFMS and one existing MMS.</p> <p>The Bidder is requested to provide all necessary equipment as per requirement, recording equipment, cables, equipment cabinets, power supplies, enclosures, cooling, racks, mounting hardware, interface devices and terminal blocks if needed to form a complete and working system.</p> <p><b>New Remote Fixed Monitoring Station (RFMS) and Remote Direction Finding Stations (RDFS-1 and RDFS-2):</b> Each RFMS and the RDFS shall be provided complete with all necessary monitoring- and DF equipment as per requirements, antennas, cables, equipment cabinets and/or shelters, power supplies, enclosures, racks, mounting hardware, interface devices and terminal blocks to form a complete and working system, which is capable of taking measurements and direction finding, in compliance with this technical specification.</p> <p><b>Mobile Monitoring Station (MMS):</b> The new MMS (existing Toyota Landcruiser 76) shall be supplied complete with all necessary DF equipment, antennas, interconnecting cables etc. to form a complete and working system.</p>
	<b>General Requirements on the vehicle</b>
2.	All cable entry fixtures shall be weatherproof;
3.	A GPS receiver and associated antenna shall be provided, integrated into a position monitoring system for automatic position monitoring and recording
4.	An electronic flux gate compass shall be integrated into the monitoring system for azimuth determination and to allow the motion of the vehicle to be tracked (if necessary via alternative technology)
5.	An AC power transfer switch and distribution panel must be provided;
6.	In the vehicle a position for an operator shall be provided with keyboard, mouse or trackball, display unit, colour inkjet printer and writing area. These



	items will be provided by GNCC
7.	<p>For the vehicle a Global Positioning System (GPS) will be provided with a performance, in accordance with Chapter 6, Table 6.1-1 of the ITU Spectrum Monitoring Handbook, edition 2011.</p> <p>The Global Positioning System (GPS) shall be capable of:</p> <ul style="list-style-type: none"> <li>• determining the position (longitude, latitude, altitude) of the stations;</li> <li>• providing a time accuracy;</li> <li>• providing instant and continuous position and bearing information to the DF System;</li> <li>• providing UTC time to the DF System;</li> <li>• time synchronisation of bearings received.</li> </ul>
8.	GNCC will provide suitable laptop PC suitable for mobile operations along earth roads shall be included for all software operations executing, data storage and displaying in real time;
9.	The mobile monitoring station shall be equipped with adequate communication system(s) providing the possibility for a bidirectional data communication between mobile monitoring station and Monitoring Control Centre. Through this data communication system(s) the mobile unit can transmit monitoring and direction finding data and can receive commands and data. This communication system will be taken care by GNCC.
<b>Spectrum Management System</b>	
10.	For its spectrum management, GNCC, is using a custom developed spectrum management system . The Bidder shall make sure that in the future the total GSMS system can be interfaced with this system and have an open/documented interface.
<b>Antenna requirements</b>	
11.	All antennas shall be designed to withstand the environmental (humidity, temperature, etc.) conditions in Georgia. The antennas shall meet following requirements as a minimum:
12.	<ul style="list-style-type: none"> <li>a) The mounted antennas shall survive wind speeds for at least 150 km/h. for fixed mounted antennas. The operating temperature shall be within the range -15/+65°Celsius;</li> <li>b) Taking into account the mentioned environmental conditions in Georgia, the proper operation of VHF/UHF antennas, including direction finding must be ensured for at least 15 years.</li> </ul>
<b>Power Supplies</b>	
<b>For the RFMS and both RDFS:</b>	
13.	<p>For the RFMS and RDFS, the Bidder shall:</p> <ul style="list-style-type: none"> <li>a) Provide surge protection devices and circuit breakers on the AC power input panel;</li> <li>b) Design each fixed station in such a way that when the AC power is restored, following a previous power failure as envisaged above, the fixed station shall automatically switch itself on and restore remote access capabilities. The design shall include a delay arrangement in the switching on mechanism to ensure that the AC power stabilizes before the station is switched on (to avoid switching the station on and off during intermitted return of the AC power);</li> <li>c) Provide the possibility to remotely switch on- and- off the RFMS and RDFS.</li> </ul>
<b>For the MCC:</b>	
14.	For the MCC at the GNCC office in Tbilisi, is already an UPS and





	emergency generator installed. The Bidder shall propose additional emergency generator capacity if found necessary.
	<b>For the Mobile Monitoring Station(MMS):</b>
	The mobile monitoring vehicle (MMS) shall include a power supply and distribution system to operate from each of the following independent power sources:
15.	Single phase commercial AC power (via an isolating transformer mounted in the vehicle and including ground fault protection) when the vehicle is stationary;
16.	Main AC power source must be as specified below: <ul style="list-style-type: none"> <li>• 210-240 Volts with <math>\pm</math> 10% tolerance, 50 Hertz.</li> <li>• Include all required adapters, fuses and connectors.</li> <li>• Power cable roll with connectors.</li> </ul>
17.	The Bidder shall also provide the mobile monitoring vehicle with Surge protection devices and circuit breakers on the ac power input panel;
	<b>Towers</b>
18.	<ol style="list-style-type: none"> <li>1) All towers for the RFMS and RDFS, specified in this TS, shall be delivered by GNCC with a height which depends on the calculations to cover the Tbilisi area for DF and monitoring purposes.</li> <li>2) Separate to the towers, the Bidder shall supply and supervise the installation of the following: <ol style="list-style-type: none"> <li>a) Antenna mounts;</li> <li>b) Cable and waveguide supports on the tower, with a closed cable tray (for physical protection and theft prevention) below the 10m level;</li> <li>c) Cable and waveguide bridge (closed cable tray for physical protection and cable theft prevention) between the tower and the equipment shelter.</li> </ol> </li> </ol>
	<b>Lightning Protection</b>
19.	<p>For the <b>RFMS and RDFS</b>, the Bidder shall supply any additional devices necessary to protect the station equipment from damage by lightning.</p> <p>For the <b>mobile monitoring vehicle</b>, the Bidder shall supply an earthing rod and connecting cable for earthing the vehicle and equipment while the vehicle is stationary.</p> <p>The Bidder shall also supply any additional devices necessary to protect the station equipment from damage by lightning and build-up by static charges, while the vehicle is stationary and grounded.</p>
	<b>Recording equipment</b>
20.	Facilities shall be provided for the recording of audio and video received from the monitoring equipment
21.	Signal sources shall be recordable including: voice, data, video
22.	The recorded audio shall be stored in a digital format;
23.	The recordings shall be routed to a specific database of the digital recording systems for each of the said services, including the file format;
24.	Facilities shall be provided for the recording of the file format, I/Q samples of the RF signal. Off line signal analysis according to ITU-R SM.1600 shall be possible on recorded I/Q samples.
	<b>Monitoring and direction finding equipment</b>
	The offered equipment should be latest and state of art
	For the quality the Bidder shall confirm that the relevant values as given for



	the various specifications of the offered equipment are retrieved in accordance with the following ITU Recommendations:	
	<b>Functionality</b>	<b>ITU-R Recommendation</b>
25.	Selectivity of monitoring receivers	Recommendation ITU-R SM.1836 Report ITU-R SM.2125
26.	IP3 of monitoring receivers	Recommendation ITU-R SM.1837 Report ITU-R SM.2125
27.	Noise figure of monitoring receivers	Recommendation ITU-R SM.1838 Report ITU-R SM.2125
28.	Scanning speed of monitoring receivers	Recommendation ITU-R SM.1839 Report ITU-R SM.2125
29.	Sensitivity of monitoring receivers	Recommendation ITU-R SM.1840 Report ITU-R SM.2125
	<b>NOTE: For all mentioned Recommendations the latest version should be used!</b>	
	<b>The Monitoring System (MS) shall meet the following general requirement but not limited to:</b>	
30.	Modular, upgradable with ability to be integrated with a future network of monitoring stations (Fixed and mobile), with a tolerability to add new hardware or software	
31.	Easy operation by a friendly and interactive Graphical User Interface (GUI)	
32.	Perform Direction Finding and location.	
33.	Geographical Information System (see also clause 73)	
34.	Support manual and automated measurements procedures	
35.	Processing and evaluation of measurement results.	
36.	Storage of all measurement activities including results.	
37.	Basic features for signal analysis.	
38.	Measurement and evaluation of digital signals.	
39.	Possibility for Remote control	
40.	In built self-testing and calibration	
41.	Web interface (if appropriate) may be offered as an option.	
42.	The <b>RFMS</b> shall support as a minimum the following frequency bands for monitoring 20 MHz – 3000 MHz for monitoring purposes and 20 – 1300 MHz or wider range for the DF antenna. It should be possible to upgrade in the future the DF antennas to the frequency range up to 3000 MHz	
43.	Both <b>RDFS-1</b> and <b>RDFS-2</b> shall support as a minimum the following frequency bands 20 – 3000 MHz for the DF receiver and 20 – 1300 MHz or wider range for the DF antenna. It should be possible to upgrade in the future the DF antennas to the frequency range up to 3000 MHz	
44.	The <b>MMS</b> shall support as minimum the following frequency bands for 20 – 3000 MHz for the DF receiver and 20 – 1300 MHz or wider for the DF antenna range. It should be possible to upgrade in the future the DF antennas to the frequency range up to 3000 MHz	
	<b>Requirements for the monitoring equipment</b>	
	For the monitoring and direction finding equipment the following measurements are required and are in accordance with the measuring protocols of the relevant ITU Recommendations and as described in the Handbook Spectrum Monitoring, edition 2011:	



	<b>Measurement</b>	<b>ITU-R and/or other Recommendations</b>
45.	Direction finding measurement and location determination	Recommendation ITU-R SM.854 Recommendation ITU-R SM.1598 ITU Spectrum Monitoring Handbook, 2011, Section 4.7
46.	Spectrum and channel Occupancy measurement	Recommendation ITU-R SM.1880 Report ITU-R SM.2256 ITU Spectrum Monitoring Handbook, 2011, Section 4.10
47.	Unwanted emissions	Recommendation ITU-R SM.328 Recommendation ITU-R SM.329 Recommendation ITU-R SM.1752 Recommendation ITU-R SM.1792 ITU Spectrum Monitoring Handbook, 2011, Section 4.12
48.	Standard data exchange format at monitoring stations	Recommendation ITU-R SM.1809
<b>Signal parameter measurements:</b>		
49.	Frequency	Recommendation ITU-R SM.377 ITU Spectrum Monitoring Handbook, 2011, Section 4.2
50.	Field strength (see also Radio Regulations Art. 21)	Recommendation ITU-R P.845 Recommendation ITU-R SM.378 Recommendation ITU-R SM.1447 Recommendation ITU-R SM.1708 ITU Spectrum Monitoring Handbook, 2011, Section 4.10
51.	Modulation	Recommendation ITU-R SM. 1268 ITU Spectrum Monitoring Handbook, 2011, Sections 4.6 and 4.8
52.	Bandwidth	Recommendation ITU-R SM.443 ITU Spectrum Monitoring Handbook, 2011, Section 4.5
53.	Identification	Recommendation ITU-R SM.1600 ITU Spectrum Monitoring Handbook, 2011, Section 4.8
54.	Signal analysis	ITU Spectrum Monitoring Handbook, 2011, Section 4.8
<b><i>NOTE: For all mentioned Recommendations the latest version should be used!</i></b>		
<b>Details of the equipment foreseen for the RFMS, RDFS-1 and MMS:</b>		
<b>A wide band receiver covering the frequency band 20 – 3000 MHz, to be used as monitoring receiver and as DF processor, having a:</b>		
55.	<ul style="list-style-type: none"> <li>a) Instantaneous bandwidth (IBW) of at least 20 MHz upgradable to e.g. 80 MHz</li> <li>b) Sensitivity of at least <math>&lt; 2 \mu\text{V}</math>;</li> <li>c) Noise Figure at receiver input <math>\leq 12 \text{ dB}</math>;</li> <li>d) 3<sup>rd</sup> Order Intercept <math>\geq 10 \text{ dBm}</math>;</li> <li>e) At least six IF bandwidths, nominally, from 1 kHz - 1 MHz;</li> <li>f) Synchronisation of the receiver by GPS;</li> <li>g) Demodulation of at least CW, AM, FM, PULSE, LSB/USB/ISB.</li> </ul>	



	<p>Decoders should be provided where necessary;</p> <p>h) panorama scanning speed: at least 1 GHz/s or better</p> <p>i) Facilities shall be provided which allow to analyse emissions of Broadband Wireless Access (BWA) systems</p> <p>j) Channel filter resolutions down to 1 kHz shall be available;</p> <p>k) Classification and analysis of signals up to 500 kHz (analogue and digital modulation);</p> <p>l) LAN interface for remote control and data output</p>
	<b>For the Direction Finding functionality the following applies:</b>
56.	<p>a) Instrument Bearing accuracy: 20 – 80 MHz: <math>\leq 2^\circ</math> RMS and 80 – 1300 MHz: <math>1^\circ</math> RMS. Detailed specifications shall be provided by the Bidder for ranges higher than 1300 MHz;</p> <p>b) Minimum signal duration : 1 ms;</p> <p>c) Switchable between horizontal and vertical polarisation;</p> <p>d) DF measurements up to ITU class A DF accuracy;</p> <p>e) The mobile unit shall be equipped with digital mapping software that shall be integrated with the DF software, thus allowing positions of emission sources to be located in real-time. Free available maps (e.g. via internet) should be used.</p>
	<b>For the RFMS an additional receiver is required, covering the frequency band 20 – 3000 MHz for monitoring purposes, having as a minimum:</b>
57.	<p>a) Instantaneous bandwidth (IBW) of at least 10 MHz;</p> <p>b) At least six IF bandwidths, nominally, from 1 kHz - 1 MHz;</p> <p>c) Synchronisation of the receiver by GPS;</p> <p>d) Demodulation of at least CW, AM, FM, PULSE, LSB/USB/ISB. Decoders should be provided where necessary;</p> <p>e) panorama scanning speed: at least 1 GHz/s or better</p> <p>f) Channel filter resolutions down to 1 kHz shall be available;</p> <p>g) Classification and analysis of signals up to 500 kHz (analogue and digital modulation);</p> <p>h) LAN interface for remote control and data output</p>
	<b>Details of the equipment foreseen for the RDFS-2:</b>
	<b>A wide band receiver covering the frequency band 20 – 3000 MHz, to be used as receiver for monitoring and DF, having a:</b>
58.	<p>a) Instantaneous bandwidth (IBW) of at least 20 MHz</p> <p>b) Scan speed up to 12 GHz/s;</p> <p>c) Demodulation bandwidth up to 20 MHz</p> <p>d) LAN interface for remote control and data output</p>
	<b>For the Direction Finding functionality the following applies:</b>
59.	<p>a) Instrument Bearing accuracy: 20 – 80 MHz: <math>\leq 2^\circ</math> RMS and 80 – 1300 MHz: <math>1^\circ</math> RMS. Detailed specifications shall be provided by the Bidder for ranges higher than 1300 MHz;</p> <p>b) Minimum signal duration: 1 ms</p> <p>c) Switchable between horizontal and vertical polarisation;</p> <p>d) DF measurements up to ITU class A DF accuracy;</p> <p>e) The mobile unit shall be equipped with digital mapping software that shall be integrated with the DF software, thus allowing positions of emission sources to be located in real-time. Free available maps (e.g. via internet) should be used.</p>



<b>Antenna specifications</b>	
60.	<p>For the <b>RFMS</b> the Bidder must propose an antenna system configuration that allow monitoring in VHF/UHF frequency band (20 MHz – 3000 MHz) and direction finding/location (20 – 1300 MHz or wider range) at the RFMS and has to demonstrate that the specified system performance has been achieved. The VHF/UHF (up to 3 GHz) antenna systems for monitoring and direction-finding purposes at the remote fixed stations (where they are used) shall include, but not be limited to:</p> <ul style="list-style-type: none"> <li>a) Omni- directional monitoring antennas, vertical and horizontal polarization, in VHF/UHF/ frequency band (20 – 3000 MHz);</li> <li>b) Wide aperture direction finding antennas, switchable between horizontal and vertical polarisation, in VHF/UHF frequency band (20 – 1300 MHz or wider range).</li> </ul> <p>The passive VHF/UHF antennas of the RFMS, whenever feasible, are intended to be mounted permanently on a single tower. The Bidder shall provide a drawing showing the physical layout and loading figures for the configuration proposed. GNCC will provide the tower and will install the antennas under the supervision of the winning Vendor.</p>
61.	<p>For both <b>RDFS</b> the Bidder must propose an antenna system configuration that allow direction finding/location (20 – 1300 MHz or wider range) at the RFMS and has to demonstrate that the specified system performance has been achieved. The VHF/UHF (up to 1.3 GHz) antenna systems for direction-finding purposes at the RDFS shall include, but not be limited to:</p> <ul style="list-style-type: none"> <li>a) Wide aperture direction finding antennas, switchable between horizontal and vertical polarisation, in VHF/UHF frequency band (20 – 1300 MHz or wider range).</li> </ul> <p>The passive DF antennas of the RDFS, whenever feasible, are intended to be mounted permanently on a single tower. The Bidder shall provide a drawing showing the physical layout and loading figures for the configuration proposed. GNCC will provide the tower and will install the antennas under the supervision of the winning Vendor.</p>
62.	<p>For the <b>mobile monitoring station (MMS)</b> the Bidder shall propose an antenna configuration that will allow direction finding and shall demonstrate that the specified system performance has been achieved. Antennas are required for direction finding that shall include, but not be limited to:</p> <ul style="list-style-type: none"> <li>a) VHF/UHF (20 - 1300 MHz or wider range) direction finding antennas with switchable between horizontal and vertical polarisation, for use while vehicle is in motion or stationary</li> </ul>

#### 4.2 Monitoring Software

Req. ID	Description
63.	Bidders must design, supply, deliver at site, supervise the installation process, test and commission a fully integrated and operational spectrum monitoring system.
<b>Functional Specification</b>	
64.	This Technical Specification identifies the functional capabilities of the software to control the new as well as existing spectrum monitoring system (GSMS), but also the requirements for additional software to optimise the cooperation between the MMS and MCC. The technical and performance requirements for the GSMS specified in these sections are the minimum.



	<p>Solutions with higher specification and performance standards, or more innovative ones, yet meeting the stated objectives can be offered, but modifications to, or differences from, the specified requirements shall be clearly indicated. It shall be demonstrated that the solution offered is equivalent, or superior, to the specified standards and performance requirements.</p> <p>This Technical Specification is based on a concept of functional specification. As such, it describes the required function and performance of the system and outlines, only in general terms, individual components of the system. It is up to the Bidder to design and clearly describe the system meeting fully, or exceeding, the specified performance.</p> <p>The software functions defined in this specification shall be executed by a set of integrated software modules in the form of menus, forms, reports or graphic displays. One or more functions may be performed by a single module, or conversely, several software modules may be required to perform a single function.</p>
	<b>Proven technology</b>
65.	<p>The system to be implemented must be a product of a long-term development and the current, as well as previous, versions must have a good performance record in a national regulatory working environment. A comprehensive plan for the long-term maintenance program including updates and upgrades becoming available over a period of time shall be submitted.</p>
	<b>Integration</b>
66.	<p>The GSMS shall be totally integrated i.e. there should be no extra steps between different modules or inappropriate import/export of data (e. g. interim text files) but direct data exchange interfaces are required between different modules. The system shall perform all functions described herein, yet the concept shall be modular with the possibility of updating the system over a period of time without jeopardizing any of the functions installed initially.</p>
	<b>Inclusions</b>
67.	<p>The GSMS shall be comprised of software to support spectrum monitoring and the necessary interfaces to the currently used spectrum management system. The successful Bidder shall furnish a turnkey system installed in the GNCC building, Tbilisi, Georgia and at other locations as described, including the following elements and services:</p> <ul style="list-style-type: none"> <li>• Design;</li> <li>• Supply of Hardware and software;</li> <li>• Installation, the integration, the start-up and the acceptance tests;</li> <li>• Commissioning;</li> <li>• Operation and maintenance manuals;</li> <li>• As-built documentation including all device addresses and driver names;</li> <li>• Personnel training including software systems support personnel;</li> <li>• Technical support;</li> <li>• Maintenance, repairs and operational supervision during the initial warranty period.</li> </ul>
	<b>General requirements</b>
68.	<p>The GSMS shall produce data on the effectiveness of spectrum management policies by enabling the identification and measurement of</p>



	<p>spectrum usage, interference sources, the verification of proper technical and operational characteristics of radiated signals, and detection and identification of illegal transmitters. The GSMS must also obtain information on the operation of individual stations, for regulatory, enforcement, and compliance purposes, and must be used to establish the location and identity of stations causing interference.</p> <p>The GSMS must further support the overall spectrum management effort by providing general measurement of channel and band usage, including channel availability statistics of a technical and operational nature, thereby giving a measure of spectrum occupancy.</p> <p>The GSMS will be able to obtain detailed information on the technical and/or operational characteristics of radio systems. Although many types of technical parameters will be measured, probably the most important one is the emitted spectrum of a transmitter.</p> <p>All routine monitoring measurements should be automated:</p> <ul style="list-style-type: none"> <li>➤ Occupancy measurements: Fine-resolution scanning of the frequency bands with computer-generated displays and storage capacity of channel occupancy over several days;</li> <li>➤ Frequency measurements: These can be made automatically when the signal-to-noise ratio is sufficient and for transmissions with carrier frequency.</li> <li>➤ Level and, if applicable, field strength measurements;</li> <li>➤ Bandwidth measurements;</li> <li>➤ Modulation parameter measurements. Advancements in digital signal processing hardware and algorithms have led to the development of modulation recognition systems which identify modulation types in real-time. These systems should be included to recognize various modulation formats (both digital and analogue) and measure common technical parameters;</li> <li>➤ Signal analysis. It is recognized that not all aspects of signal analysis can be done fully automatically;</li> <li>➤ Transmission direction-finding;</li> <li>➤ Station identification, through location, or automatic signal analysis;</li> <li>➤ All of these measurements should generally be made automatically, but some measurements, such as bandwidth and modulation, require signals with good signal to noise ratio to achieve sufficient accuracies. These measurement tasks yield technical measurement data that should be compared to the technical parameters recorded in software databases.</li> </ul>
	<p><b>Monitoring Database</b></p>
69.	<p>The GSMS will also create its own databases of monitored transmission activity and measured characteristics. This information will be used for event records and later correlated to the central databases.</p> <p>Data formats for Monitoring Task Plans (MTPs), results and reports are not standardised and have therefore not been proposed.</p>
	<p><b>Data Server</b></p>
70.	<p>All monitoring measurements received from fixed monitoring stations by LAN/WAN shall be recorded to the monitoring database in a suitable digital format and be easily retrievable by MTP number, date of monitoring and name of monitoring station.</p>



	<p>All monitoring measurements made by the RFMS shall be able to be recorded in real-time at the monitoring centre and retrieved later and MCC staff shall be provided with access to this data using the LAN. Access from the MCC to this data shall be controlled using the monitoring network control workstation of the MCC and the defined security roles.</p>
	<p><b>Software</b></p>
71.	<p>The MS shall contain a significant amount of software to automate data collection, processing, evaluation, and interference analysis tasks. Using software to save spectrum monitoring results in relational databases and correlating this information with the central database of authorized users will save considerable research time while increasing accuracy.</p> <p>The GSMS application software shall utilise a proven set of basic monitoring system applications that are modular, configurable, upgradeable and easy to use. It shall operate in a network environment and provide for remote and local control of equipment.</p> <p>It shall be possible for the end user to configure the software modules, where necessary, to accommodate the need for particular screens. Bidders should clearly indicate which software components can be upgraded and/or customised by GNCC staff, by the bidder and by the original developer. The application software and associated documentation shall be in English. A back-up version shall be provided on DVD.</p> <p>The software system shall perform both interactive and automated measurements. Interactive measurements shall allow the operator to investigate signals rapidly. Interactive measurements include observation of multiple bands in multiple formats, hand off signals to carrier measurements and control of the spectrum analyser and optional receiver and recorder, printer and/or plotter. Automated measurements shall optionally be commanded to happen under control or scheduled to occur without an operator present. Power capabilities such as task scheduling and alarms will be used to coordinate signal logging, carrier measurements and spectral occupancy and statistical measurements. RF templates for measurements, including amplitude correction, will apply to all measurements made by the system. It shall be possible to display the RF measurement template in use. It shall be possible to retrieve all data for subsequent analysis at any time. Both fixed and mobile monitoring stations shall have the ability to download tasking information and to upload reports relating to these tasks for analysis via the mechanisms outlined. The software shall enable full integration of the monitoring and management sub-systems.</p> <p>All provided software shall be provided on DVDs.</p> <p>In addition, back-up facilities for application software and data residing on the MCC servers and workstations shall be integral to the system design and operate with a minimum of operator intervention. It shall be easy to recover files accidentally erased and to restore them to their original location. The software complement at the MCC shall also be able to meet routine office needs.</p> <p>The monitoring application program shall be of a user-friendly design, and shall be described in detail in relevant manuals and guidelines.</p>
	<p><b>Software Licences</b></p>
72.	<p>GNCC would prefer that the sub-system supplied for GSMS should have limitations in licenses according to provided functionalities and/or plug-ins</p>





	supplied by Bidder.
	<b>General Software Requirements</b>
73.	<p>GNCC requires that all dates being input or output from the system conform to the Gregorian format. All date calculations must also conform to this calendar. Bidders should detail in their response how this requirement will be met and what format is used internally for dates.</p> <p>The following general requirements apply to all modules created or supplied for the GSMS:</p> <ul style="list-style-type: none"> <li>➤ All GSMS applications will be developed using standard development tools from market-leading suppliers. The applications shall be modular to facilitate their upgrade and customisation;</li> <li>➤ All GSMS applications will be integrated and appear as one complete system;</li> <li>➤ It shall be easy to add new equipment to the system. This should preferably require no software source code changes but simply new database or reference file entries and the additional device drivers;</li> <li>➤ The application software shall be simple to use and shall follow logical steps in applying and retrieving information from a computer-based database.</li> <li>➤ The GSMS software modules are to be provided for use in the English language;</li> <li>➤ The application software shall be GUI based and each application accessible by a drop-down menu, direct mouse operations or key-shortcuts. The operating system and database structure must be suitable for complex mathematical, equipment control and administrative processing;</li> <li>➤ Reference files in support of on-going applications and operations involving data entry, technical applications such as radio equipment control, calibration, certain default technical parameters and measurement processes must be included;</li> <li>➤ The application software shall restrict access to either the system as a whole to unauthorized staff and also restrict certain discrete applications to only those authorized to access those applications;</li> <li>➤ Information in the database must be retrievable in formats suitable for each specific application. For example, technical measurement transactions must be illustrated by information that is specific to the measurement with sufficient detail to support measurement, evaluation, investigation and analysis. Information must be made available both in on-screen visual and paper report format;</li> <li>➤ The application software must also be supported with on-line help features to assist in both data entry transactions as well as interpreting information and instructions produced by the software;</li> <li>➤ The application software shall be designed around the different types of measurement operations including calibration, testing, and maintenance but shall form an integrated whole;</li> <li>➤ Statistical and management reports should be available from all modules showing units of work completed for each period, work pending if applicable, average time to complete each unit and any other relevant information;</li> <li>➤ Standard reports should be available from all modules indicating the date and time, the type of measurement being completed, the</li> </ul>



	<p>monitoring station, the equipment used, the set-up and the measurement results including any intermediate results;</p> <ul style="list-style-type: none"> <li>➤ All software manuals and documentation shall be in the English language.</li> </ul>
	<b>System Administration</b>
74.	<p>The system administration functions should be as common as possible. The GSMS should:</p> <ul style="list-style-type: none"> <li>➤ have utilities to perform all user administration functions;</li> <li>➤ maintain user access control through predefined user roles;</li> <li>➤ provide capabilities for reference table maintenance;</li> <li>➤ have extensive automatic housekeeping functions, e.g., record purging;</li> <li>➤ provide automated procedures for routine backup, database integrity validation, and recovery;</li> <li>➤ provide for the maintenance of system parameters controlling the overall operation of GSMS;</li> <li>➤ have extensive management report capabilities.</li> </ul> <p>Each system user will have to be defined in advance by the administrator in the system itself.</p> <p>The system must refuse access to a user who has not been previously defined by the administrator. This access monitoring must be done on two levels: operating system and application.</p> <p>An initial level of identification will be provided by the operating system of the workstation from which the user wants to access the system.</p> <p>A second level of identification will be provided by the application. The user will therefore have to enter his identifier and associated password to be able to access the system.</p> <p>The System Administration functions shall be directly integrated at the data level with all modules to secure reference data maintenance, user maintenance and system operation.</p> <p>The GSMS System Administration function shall conform to the specifications outlined in the General Requirements of this Technical Specification.</p>
	<b>Remote Control</b>
	<b>Principles</b>
75.	<p>The monitoring software shall provide features to control and monitor from the MCC the RFMS, RDFS and MMS through the computer system and data communications network.</p> <ul style="list-style-type: none"> <li>➤ The Mobile monitoring station will have communication with the MCC through the mobile network and the capability of connecting the mobile monitoring to the MCC for the purposes of transferring monitoring and direction finding data, thereby integrating the fixed and mobile monitoring stations.</li> <li>➤ The Bidder shall describe in detail the limitations, in terms of performance, of the mobile monitoring station in comparison to the fixed station in the case where two or three types of stations are integrated as proposed.</li> <li>➤ The Bidder shall identify possible limitations on the data transfer in case the data communications network does not provide sufficient data throughput as well as minimum required speed</li> </ul>



76.	The Bidder shall provide the necessary software to control and monitor the existing RFMS and MMS together with the new stations as mentioned in the clause above.
<b>Features</b>	
77.	<p>The remote control features shall include, but not be limited to, the following features:</p> <ul style="list-style-type: none"> <li>• It shall be possible to create MTPs for monitoring stations or units to be executed automatically;</li> <li>• It shall be possible to create MTPs remotely and to transfer these to the monitoring stations or units;</li> <li>• Results and reports of the executed MTPs shall be retrievable remotely from the monitoring stations or units and from the spectrum management centre;</li> <li>• It should be easy to export results and reports of MTPs to other software such as MS-Office™ components;</li> <li>• The results of direction finding and triangulation tasks shall be displayable at the RFMS on digitally generated maps. These maps should be publicly available (e.g. via internet);</li> <li>• RFMS and RDFS stations shall be controllable remotely on-line and measured values and spectrum display traces shall be transferable back, and be displayed on “virtual instrumentation” screens; compression should be used to ensure adequate performance;</li> <li>• It shall be possible to set-up the station or unit configuration and run diagnostic utilities remotely and reset the monitoring station or unit computer system. This includes the possibility to remotely switching on and off of the RFMS and RDFS.</li> </ul>
<b>Local Control Functionality</b>	
78.	<p>For the RFMS and RDFS-1 also local control is required by authorised staff. Not only for performing monitoring tasks but also for purposes of diagnostic and checking in the course of testing sessions. The local control functions shall include, but not be limited, to the features described below:</p> <ul style="list-style-type: none"> <li>➤ It shall be possible to create, load and run MTP-s for monitoring stations/units associated with this station;</li> <li>➤ The results/reports of the executed MTP-s shall be displayable and storable locally and transferable to MCC;</li> <li>➤ Individual receivers, direction finders, etc. shall be controllable on-line and measured values and spectrum display traces shall be displayable on the specific unit or on “virtual instrumentation” screens;</li> <li>➤ It shall be possible to run set-up and diagnostics utilities for the station/unit configuration and performance diagnosis;</li> <li>➤ It shall be possible to reset the monitoring station/unit computer system.</li> </ul>
<b>Communications</b>	
79.	<ul style="list-style-type: none"> <li>• The GSMS system shall have the capability of transferring a subset of control information and monitoring data between (to and from) monitoring stations (remote fixed and mobile) and the MCC using the telecommunications infrastructure or such other mechanisms that may be appropriate.</li> </ul>



	<ul style="list-style-type: none"> <li>• GNCC will make available the links between MCC and the RFMS and RDFS.</li> <li>• It is assumed that for the control of the RFMS 1 MB/sec will be sufficient. The Bidder is expected to give guidance on this.</li> </ul> <p>Depending on the design of the Bidder's system, communication links has to be available between stations when a client is issuing tasking to remote servers, and later when the client is requesting results of his tasking; as long as communication links are available when the tasking is issued, if they then become unavailable, measurement results must not be lost, but must be retained on the measurement servers both at the remote and MCC until requested.</p>
<b>Monitoring Task Plan</b>	
80.	<p>A Monitoring Task Plan (MTP) is a set of instructions that may be used to programme the monitoring equipment to carry out a predefined set of measurements.</p> <p>The Frequency monitoring application software shall provide facilities for the end users to set up MTPs for the execution of automated measurements by the fixed monitoring units. The MTP facility shall include but not be limited to:</p> <ul style="list-style-type: none"> <li>• Selection of individual or multiple stations for co-ordinated operations (e.g. triangulation, transmitter location),</li> <li>• Definition of higher priority for multiple tasks,</li> <li>• Definition of start and stop date and time for each task,</li> <li>• Definition of automatic start of data processing as soon relevant data is stored of all involved RFMS,</li> <li>• Selection of display and report format,</li> <li>• Variety of task types, including:             <ul style="list-style-type: none"> <li>○ spectrum occupancy scanning,</li> <li>○ signal parameter measurements, (frequency, voltage/power, field strength, modulation, bandwidth, etc.)</li> <li>○ direction finding,</li> <li>○ triangulation and transmitter location,</li> <li>○ audio recording (in digitised form).</li> </ul> </li> </ul> <p>The software details shall include, but not be limited to, the features listed below:</p> <ul style="list-style-type: none"> <li>• Designed in a consistent layout, compatible with the Microsoft Windows 7 or 8 graphical user interface, with pull-down menus and point-and-click selection, and generally be designed in accordance with the Microsoft User Interface Style Guide or equivalent;</li> <li>• A process shall be available for intuitive navigation between related screens;</li> <li>• The screen shall be context sensitive and self-explanatory. In line help system shall be present in every application;</li> <li>• ensure (by automatic data validation and display of descriptive error messages) that data entered are in a valid format and sequence, within the desired range and form a complete MTP message.</li> </ul>
<b>Display formats</b>	
81.	<p>The monitoring application software by use of the real time mode and/or through the Monitoring Task Plan (MTP) shall provide displays, which shall include, but not be limited to the following features:</p> <ol style="list-style-type: none"> <li>a) For frequency band occupancy e.g. according to Recommendation</li> </ol>



	<p>ITU-R SM.1809:</p> <ul style="list-style-type: none"> <li>➤ Spectrogram,</li> <li>➤ Curves minimum, median and maximum value</li> <li>➤ Band occupancy,</li> <li>➤ Waterfall;</li> </ul> <p>b) for frequency channel occupancy e.g. via Recommendation ITU-R SM.1880 :</p> <ul style="list-style-type: none"> <li>➤ Curves minimum, median and maximum value, and indication of busy hour,</li> <li>➤ counts (hits) versus signal level,</li> <li>➤ percent occupancy (in a sampling set) versus time,</li> <li>➤ percent occupancy (in a sampling set) versus (single) frequency,</li> <li>➤ percent occupancy (in a sampling set) versus signal level,</li> <li>➤ signal level versus time;</li> </ul> <p>c) for signal parameter measurements:</p> <ul style="list-style-type: none"> <li>➤ time domain,</li> <li>➤ frequency domain;</li> <li>➤ available equipment including antennas;</li> </ul> <p>for direction finding:</p> <ul style="list-style-type: none"> <li>➤ signal bearing polar plot on a digitally-generated maps, which are publicly available (e.g. via internet);</li> <li>➤ signal bearing triangulation plot on a digitally-generated map;</li> </ul> <p>d) for virtual instrumentation:</p> <ul style="list-style-type: none"> <li>➤ receiver,</li> <li>➤ direction finder,</li> <li>➤ spectrum analyser (if included),</li> <li>➤ RF switch matrix and active connections,</li> <li>➤ Audio switch matrix, recorder (or digital equivalent) and active connections.</li> </ul> <p>The switch matrix displays has to allow the operator to see the connections between the equipment and to change these connections from the display panel. When controlling remote equipment, these displays should clearly indicate the station being controlled and any lockouts in place due to local measurements in progress.</p> <p>The system should have a capability of displaying both by visual display and through hard copy the received signals in the display formats of:</p> <ul style="list-style-type: none"> <li>➤ Spectrum</li> <li>➤ Constellation</li> <li>➤ Occupancy waterfall diagram</li> <li>➤ Demodulated data in line with basic demodulation features.</li> <li>➤ At the MCC it should be possible to display at one (1) screen the results of real time on-line registration of the spectrum under investigation during automatic frequency band registration according to Recommendation ITU-R SM.1809 of the RFMS.</li> </ul>
	<p><b>Identification and Measurement of Spectrum Usage</b></p>
<p>82.</p>	<p>The Spectrum Surveillance Administration System shall provide an interface to the monitoring equipment to create monitoring orders and to analyse and process monitoring measurement from the monitoring equipment.</p>



	<p>The general features of the Spectrum Surveillance Administration System shall have the following capabilities:</p> <ul style="list-style-type: none"> <li>• Graphical user interface for simultaneous work in monitoring and spectrum management technical data domains;</li> <li>• GIS component for data representation on maps;</li> <li>• Visualise measurements in the 2D/3D mode;</li> <li>• Visualise frequency assignments;</li> <li>• Detailed analysis of spatial radio emissions;</li> <li>• Processing measurements collected by the radio monitoring equipment;</li> </ul> <p>Selection functions for defined access to spectrum management data.</p>
	<p><b>Verification of Proper Technical and Operational Characteristics of Radiated Signals</b></p>
<p>83.</p>	<p>The GSMS should automate the following measurements, if applicable:</p> <ul style="list-style-type: none"> <li>• Frequency Measurements</li> <li>• Voltage/Power Level Measurements</li> <li>• Field Strength Measurements</li> <li>• Modulation Measurements</li> <li>• Bandwidth Measurements (XdB and β%)</li> <li>• Occupancy Measurements <ul style="list-style-type: none"> <li>○ Channel Occupancy</li> <li>○ Spectrum band Occupancy</li> <li>○ Determination of Unlicensed Operation</li> <li>○ Radio Direction Finding</li> </ul> </li> </ul> <p>In general, if full automation is not possible, the GSMS should include the following features/steps:</p> <ul style="list-style-type: none"> <li>• The software will identify the equipment to be used to perform the measurement;</li> <li>• It will prompt the operator to make or confirm any connections or settings necessary for the measurement;</li> <li>• It will record in the database all equipment actually used;</li> <li>• It will record in the database all intermediate and final results;</li> <li>• It will produce a standard report indicating the date and time of the measurement, the equipment used for the measurement, the intermediate and final results and the conclusions;</li> <li>• Where possible, the equipment will be controlled through a GPIB (IEEE-488) or other interface and the measurements will be automated. Where not feasible, the technician will be prompted to make and record the measurement;</li> <li>• If values are out-of-range, this will be brought to the technician's attention so that he may adjust the equipment and repeat the measurements;</li> <li>• All measurement work is to be logged and is to be available in a database for review.</li> </ul>
	<p><b>Monitoring Measurement results analysis</b></p>
<p>84.</p>	<p>This function shall have the following capabilities:</p> <ul style="list-style-type: none"> <li>• Display of measurements on the map. Access directly by locate-and-click the measurements at a given location on the map;</li> </ul>



	<ul style="list-style-type: none"> <li>• Channel Occupancy Calculation. Calculate and display the channel occupancy from the recorded measurements;</li> <li>• Predicted Levels and Comparison. Display the predicted levels on charts and compare the predicted field strength and frequencies with the measured values;</li> <li>• Direction Finder. Display and compare measured bearing data to licensed frequency data;</li> <li>• Possibility of linking measured emissions with licensed transmitters. Possibility of check for compliance of measured signals with licence parameters stored in the central spectrum management database by linking licensed transmitters and real emissions captured by the radio monitoring system;</li> <li>• The Spectrum Surveillance subsystem shall be fully integrated with the monitoring equipment, to allow submission of monitoring tasks to monitoring stations and loading of the monitoring data collected by the fixed and mobile monitoring stations.</li> </ul>
<b>Calibration and self-Testing</b>	
85.	<p>The fixed-, and mobile monitoring stations shall include features for calibration and self-testing. The mandatory features and equipment are listed below:</p> <ul style="list-style-type: none"> <li>• Each station shall be provided with built-in test equipment (BITE) features to self-test overall systems and sub-systems on start-up or on request, and results of the test shall be reported to MCC (i.e. success or failure).</li> <li>• The measurement equipment at the RFMS will be connected to a reference frequency.</li> <li>• Self-calibration features shall be provided in a form that calibrated signals can be generated to test the calibration of the system.</li> <li>• It shall be possible to inject calibrated signals from electronic instruments to test or recalibrate the system.</li> <li>• It shall be possible to run system calibration tests and record the results in reference tables to create calibration curves for signal parameter measurements.</li> </ul>
<b>Reports</b>	
86.	<p>Reports in modern spectrum monitoring systems are generated with the computer software. A large variety of reports should be available, including raw trace information, carrier analysis by date or band, channel occupancy and availability statistics, message length statistics, channel power statistics, system and alarm logs, and monitoring plan and schedule reports. The system should allow adaptation or customization of reports according to requirements of the operator.</p> <p>Reports should be produced automatically from any results screen. The operator specifies the report type of interest and the measurement data to be used; the operator activates a "Report" function to generate text reports automatically on his screen. Graphical reports are a preferred method of examining data, because they provide a view of data which summarizes the information and makes it easy to identify trends and exceptions. Through the use of colour, even more information is conveyed in a single graph.</p> <p>The GSMS should offer the same automated report capability whether one is in a mobile unit, fixed station or management system. The capability to</p>



	<p>remotely create a report based on data which is located at a different site must also be part of the system software.</p> <p>The format of standard reports and statistics should ensure uniform data compilation and data comparability. The data needs to be tailored to individual recipients' needs and therefore report formats must be flexibly defined at the time of production.</p> <p>An analysis of statistical data often leads to further questions. It must hence be possible to carry out non-standardised, individual database queries without the need for additional programming.</p> <p>The reporting system should consider HTML techniques. The key feature of HTML is its capability of handling different types of data such as text, pictures and graphs and presenting them in a unified layout by using a simple browser.</p>
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### 4.3 GSMS Services Requirements

Standards	
87.	The GNCC considers it necessary that the management systems of the Bidder shall meet relevant international standards. In this regard, the following requirements will apply.
88.	The Bidder shall operate a quality management system that is certified under ISO 9001 and this quality management system shall be used to assure quality throughout this project.
89.	The Bidder whose quality management systems are not certified under the standard must illustrate how quality will be managed throughout their activities on this project.
90.	The Bidder shall operate an information security management system that is certified under ISO 27001 and this information management system shall be used to control information throughout this project.
91.	The Bidder whose information management systems are not certified under the standard must illustrate how information security will be managed throughout their activities on this project.
92.	The Bidder shall operate an environmental management system that is certified under ISO 14001 and this environmental management system shall be used to control the environmental impact of implementation activities throughout this project.
93.	The Bidder whose environmental management systems are not certified under the standard must illustrate how environmental impact will be controlled throughout their activities on this project.
Project Management	
94.	The GNCC places great importance on the discipline and activities of project management and sees effective project management as the primary way to secure success. The following project management requirements will apply:
95.	The Bidder must develop, propose and have agreed with the GNCC a project plan for the implementation of the GSMS. This project plan shall illustrate all project activities, dependencies and responsibilities against time. This project plan shall illustrate where timings are critical.
96.	The Bidder must integrate in its project plan the activities of delivery, installation, testing, acceptance testing, direct support, training of the staff, warranty, software and hardware maintenance and civil work support. The Bidder's plan shall illustrate clearly the start and end dates of each of these activities.





<b>Installation</b>	
97.	<p>Installation is in two parts:</p> <ul style="list-style-type: none"> <li>• the technical deliverables comprising the GSMS itself;</li> <li>• the implementation of accommodation and support services in which and upon which the GSMS relies;</li> </ul> <p>The implementation of the technical deliverables as set out in this RFP is the responsibility of the Bidder.</p>
98.	<p>The Bidder shall take total responsibility for the implementation of its technical deliverables. Since the Bidder's deliverables and the accommodation and support services (for which the GNCC is responsible) are directly linked, the Bidder shall act as adviser, taking total interest in the implementation of both accommodation and support services and technical deliverables in order to achieve project success</p>
99.	<p>The Bidder shall specify its requirements for accommodation and support services to GNCC.</p>
100.	<p>The Bidder shall provide with its technical deliverables all necessary licences for the use of any intellectual property held or supplied by the Bidder, its subcontractors and its partners.</p> <p>These licenses shall grant the GNCC perpetual, irrevocable use of the hardware or software supplied containing this intellectual property. Payment for these licenses shall be included within invoicing for the contract as a whole and no further charges shall be due.</p>
<b>Ancillary Technical Deliverables</b>	
	<p>The GNCC regards it is important that the system that the Bidder implements is adequately described and documented. To that end the following requirements shall apply:</p>
101.	<p>The Bidder shall document all system elements supplied using drawings and handbooks to illustrate the GSMS as built. This documentation shall cover all standard product, all customised product and the integration of the various subsystems.</p> <p>The Bidder shall illustrate how they intend to document all system elements.</p>
<b>Language Support</b>	
102.	<p>The Bidder shall supply all the relevant system documents in English.</p>
103.	<p>The Bidder must provide a full list of documents supplied in their proposal.</p>
<b>Training</b>	
104.	<p>The Bidder shall train the monitoring staff GNCC (approx. 5 persons) on all functionalities of the new system. A training schedule, including the duration, shall be offered</p>
105.	<p>The Bidder shall take responsibility for building the spectrum monitoring capability in GNCC from its current level where there is limited use of technology to a level commensurate with the application of the systems outlined in this RFP.</p>
106.	<p>The Bidder shall consider carefully the requirement for foundation training and the requirement for training on the tools supplied.</p>
107.	<p>The Bidder shall firm up its training plans in light of assessed GNCC staff competency and shall deliver training against these plans. In drawing up its training plans the Bidder shall also consider the requirements set out below for direct support to the GNCC.</p>



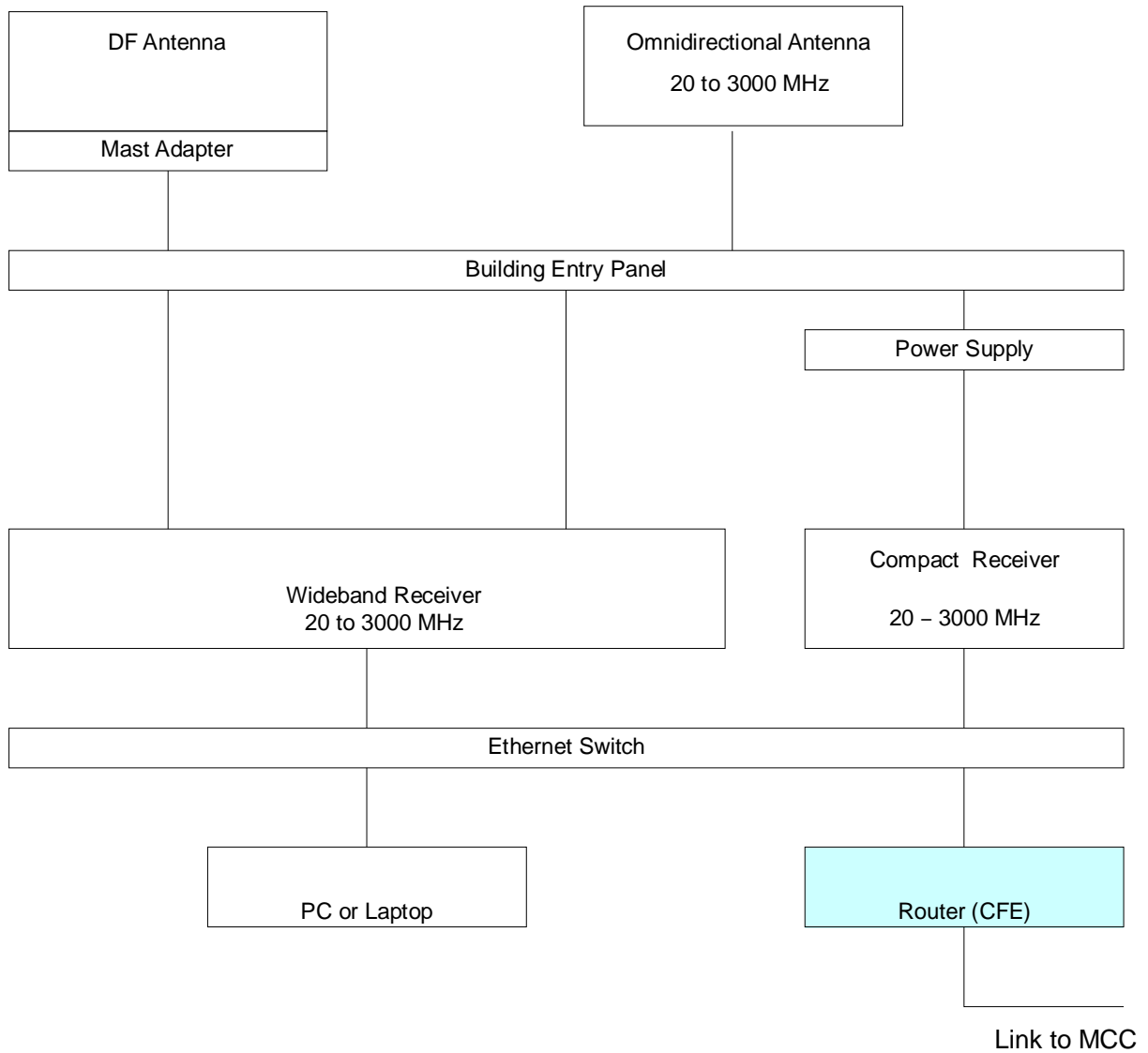
108.	GNCC is in agreement to have training outside Georgia such as in the Bidder's home country. What matters is the quality of the training in both the period before training delivery, training delivery itself and the period after training delivery when the trainee returns to their job.
<b>Testing and Commissioning</b>	
109.	The Bidder shall undertake factory acceptance testing (FAT) and it shall offer to GNCC that it witnesses such tests. The test cases used during factory acceptance testing shall be specially developed to test the correct working of the equipment. These may be a subset of site acceptance testing (SAT).
110.	The Bidder shall note that FAT will take place at Bidder's premises in the country of origin. The Bidder shall specify where in its proposal.
111.	<p>The Bidder shall offer certificates of conformity that warranty that its standard products have been tested and are compliant with the requirements set out in this RFP.</p> <p>The aim behind such certificates of conformity is that standard product or standard functionality need not be tested when installed in Georgia. This is not to avoid testing the standard products or standard functionality but rather to seek an expedient way for the Bidder to prove compliance. The GNCC has in mind here that the Bidder shall provide such evidence and documentation of standard product or standard functionality test to avoid duplication of such tests.</p> <p>The Bidder shall outline their approach to standard product and standard functionality testing and shall set out how they propose convincing the GNCC that duplication of test is not necessary.</p>
112.	The Bidder shall set out its approach to on-site integration testing. Integration testing aims to prove that the MMS, when integrated operates as a whole.
113.	The Bidder shall undertake on-site acceptance testing (SAT) witnessed by the GNCC to prove to the GNCC that the requirements set out in this RFP have been met.
114.	The SAT shall take place at in Georgia.
<b>Software &amp; Hardware Maintenance</b>	
115.	<p>Software maintenance is defined as the provision of the latest available software in response to one or more of five events:</p> <ul style="list-style-type: none"> <li>• correction of bugs in the software;</li> <li>• in reaction to hardware and operating system changes (when hardware must change as technology evolves);</li> <li>• to permit changes in methods;</li> <li>• to react to requests for enhancements;</li> <li>• generally to take advantage of evolving functionality as the Bidder develops its product offering.</li> </ul> <p>The Bidder shall provide the GNCC with new software, or revisions to current software, software patches and other changes in order to respond to one or more of the five events noted above.</p>
116.	The Bidder shall contact GNCC in a timely manner to carry out software maintenance whilst ensuring that the GNCC will be able to maintain its operation and enhance the quality and scope of its operation through software change.
117.	The Bidder shall attend to all software faults and irregularities and shall analyse and determine cause in a timely manner. The Bidder shall specify in its proposal typical turnaround time for fixing the issues.



118.	The Bidder shall provide information and offers regarding new software versions and new software of interest to the GNCC, as well as improvements of delivered software.
119.	The Bidder will likely evolve its product range as it seeks to sustain competitive advantage over its competitors. The GNCC expects to benefit from such evolution. The Bidder shall provide information and offers regarding new software versions and new software of interest to the GNCC as it progressively evolves its software. The Bidder shall set out their approach to supporting the GNCC through offers of upgrade as their software evolves.
120.	The Bidder shall fully detail its hardware maintenance proposal including various stages of repairing and/or replacing faulty equipment during the warranty period and outside of the warranty period.
<b>Hardware and Software Warranty</b>	
121.	The Bidder shall warrant throughout the warranty period that all materials and workmanship are free from defect, except that which occurs through normal wear and tear of consumables. The warranty period shall be specified by the GNCC.
122.	The Bidder shall also quote for extended warranty periods for the following periods, provided they fall outside normal warranty period specified by the GNCC for: <ul style="list-style-type: none"> <li>• 3 Years</li> <li>• 5 Years</li> </ul>
<b>Maintenance and Repair (outside warranty)</b>	
123.	The Bidder shall offer GNCC an ongoing maintenance and repair in line with the requirements for software maintenance that supports GNCC's use of the system beyond warranty.
124.	The Bidder shall guarantee the availability of maintenance support for at least 10 years from the date of commissioning of the equipment.
125.	The Bidder shall offer a maintenance contract comprehensive of the whole GSMS. The Bidder shall provide the maintenance planning, contents and its duration.
126.	The Bidder shall provide annual costs for hardware and software maintenance. The software maintenance should include software version upgrades whenever a new version is available
127.	The Bidder shall also quote the same level of Maintenance for periods of: <ul style="list-style-type: none"> <li>• 3 Years</li> <li>• 5 Years</li> </ul>
128.	The Bidder shall provide an overview of which spare parts will be needed and provided. Spare parts support, at frame-agreed prices, availability during the Maintenance Contract period and beyond, if required.

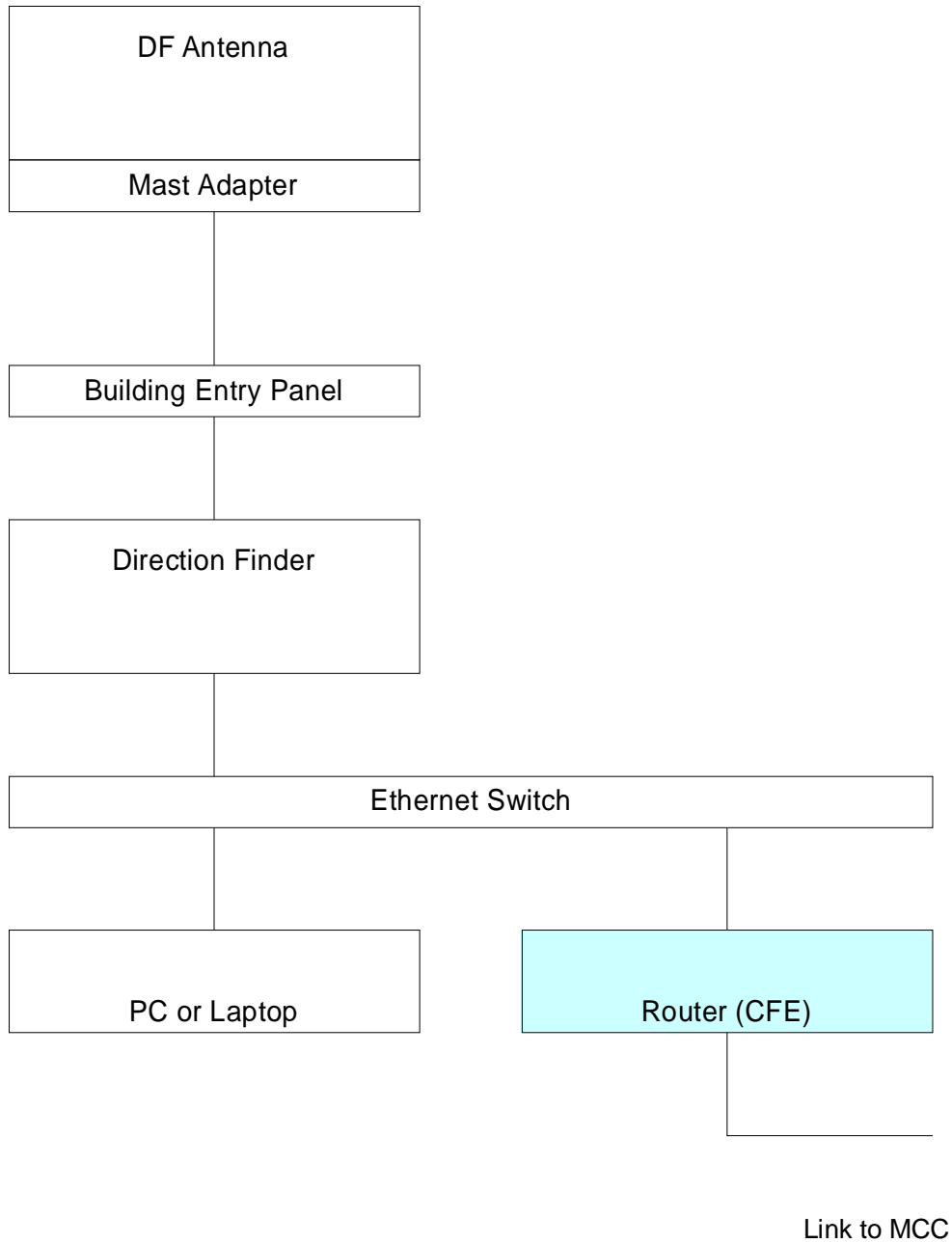


**Annex A: new RFMS (remote and local control)**





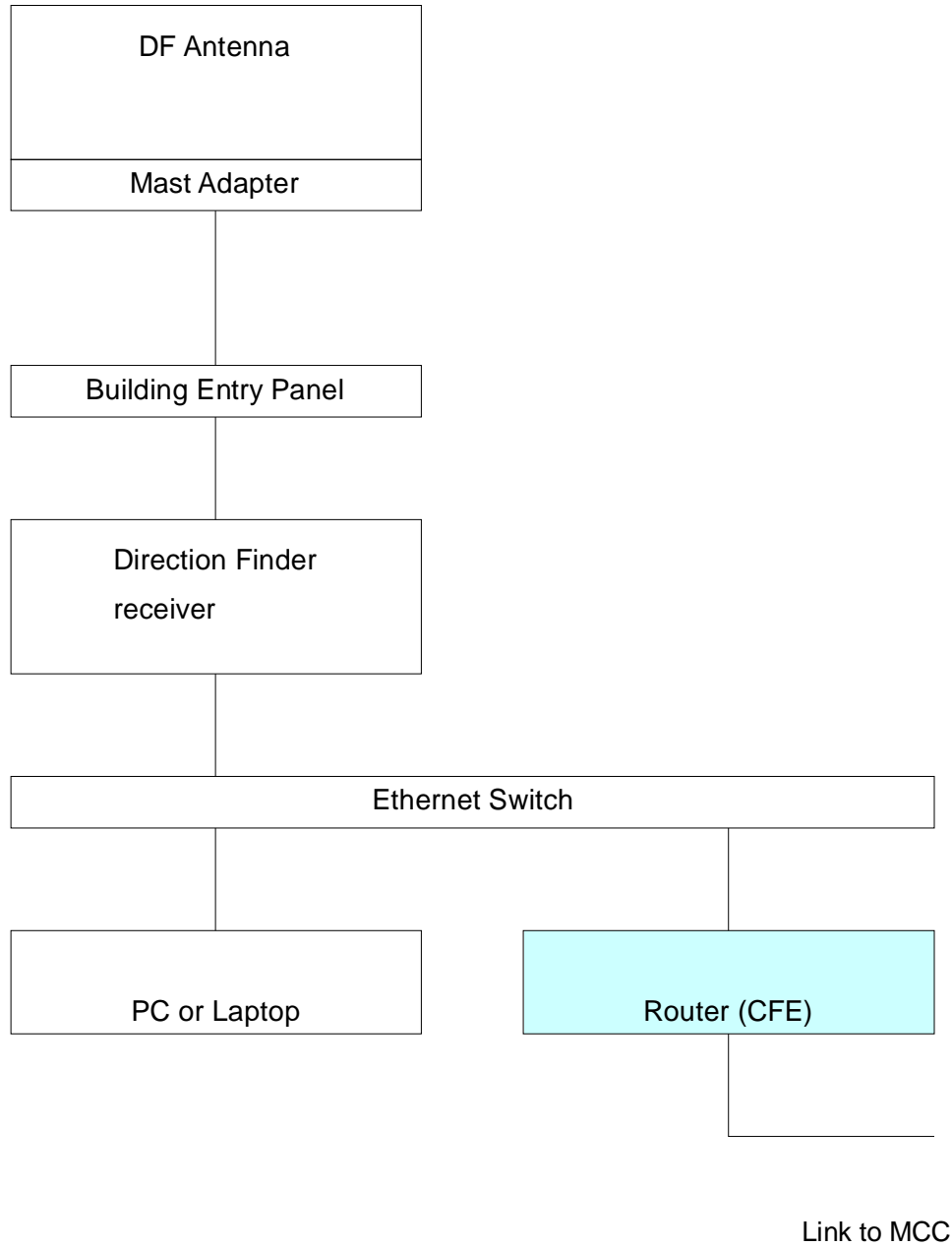
**Annex B: new RDFS-1 (remote and local control)**





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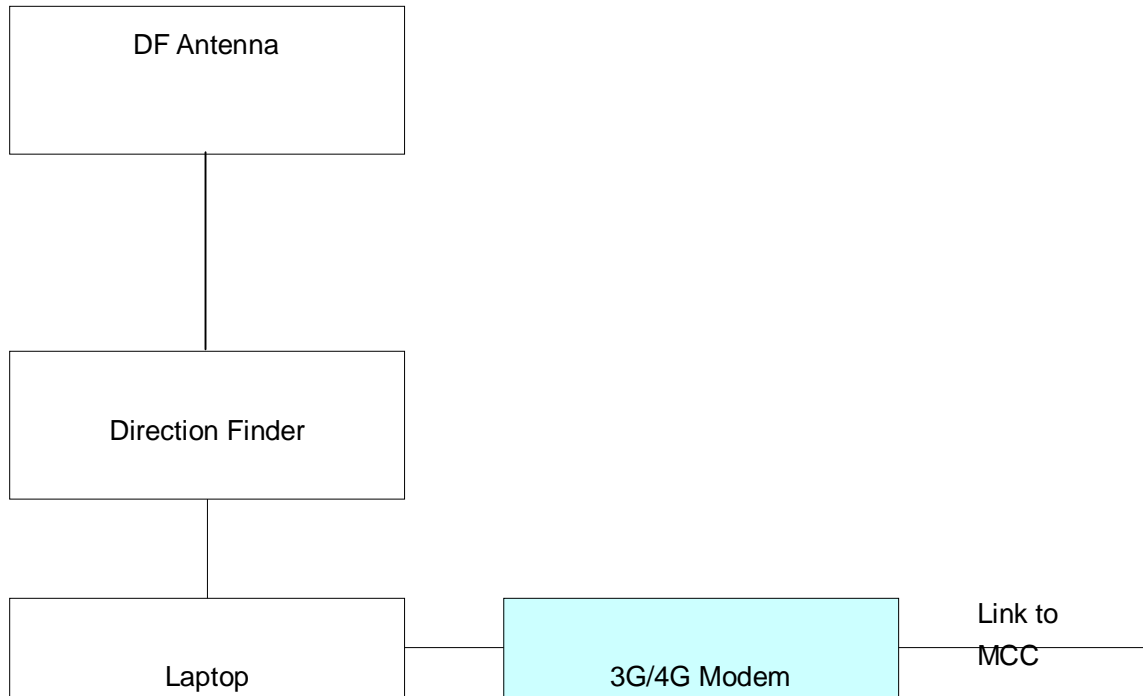
**Annex C: new RDFS-2 (remote control only)**





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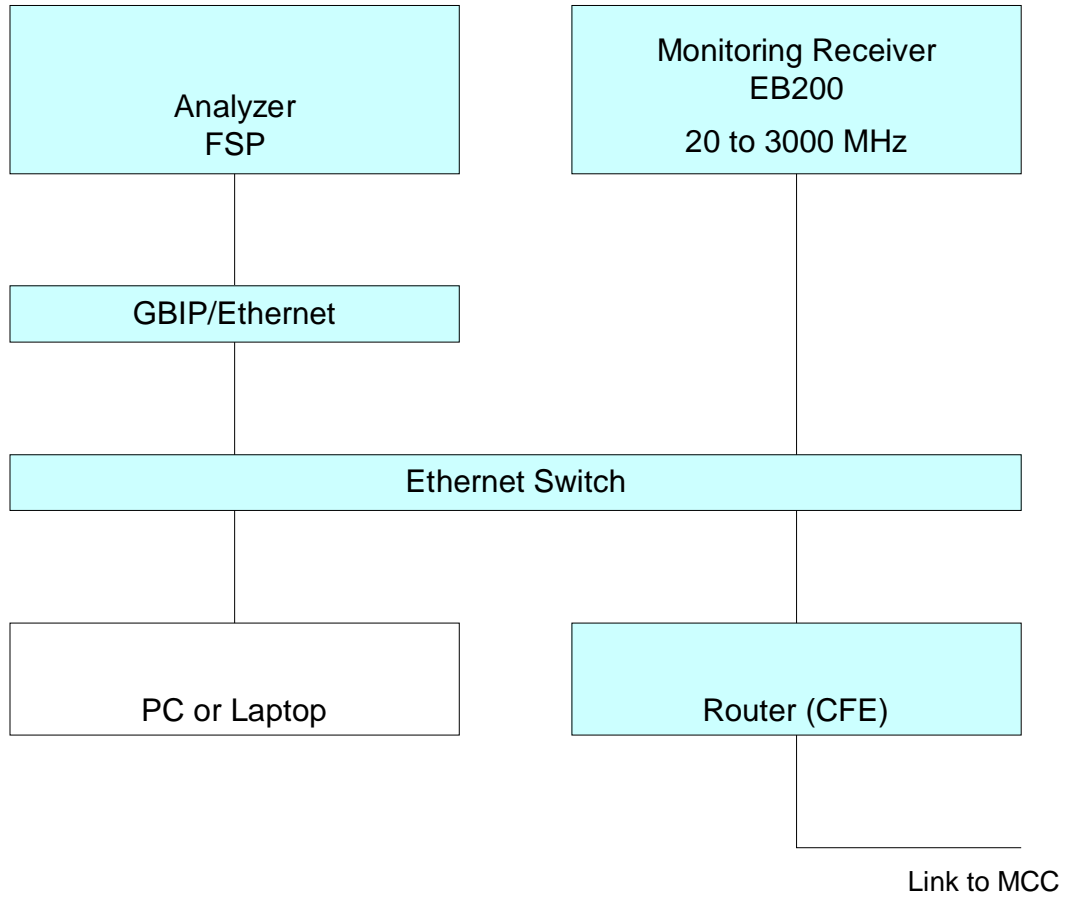
**Annex D: new MMS (DF only)**





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**Annex E: Design of the existing RFMS**







**Annex F: Design of the Existing MMS**

