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新世代電波監測系統之建置規劃與優化分析研究  
建議書徵求說明書  
(英文版)

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## 1. RADIO MONITORING SYSTEM

The radio monitoring system shall be structured in three layers: one national control center, three regional control centers, and some fixed/mobile/transportable/portable stations, as shown in Fig. 1.1. The national control center and the north regional center are in the same location. Each regional center shall be able to control some fixed, mobile, transportable, and portable stations located within its coverage.

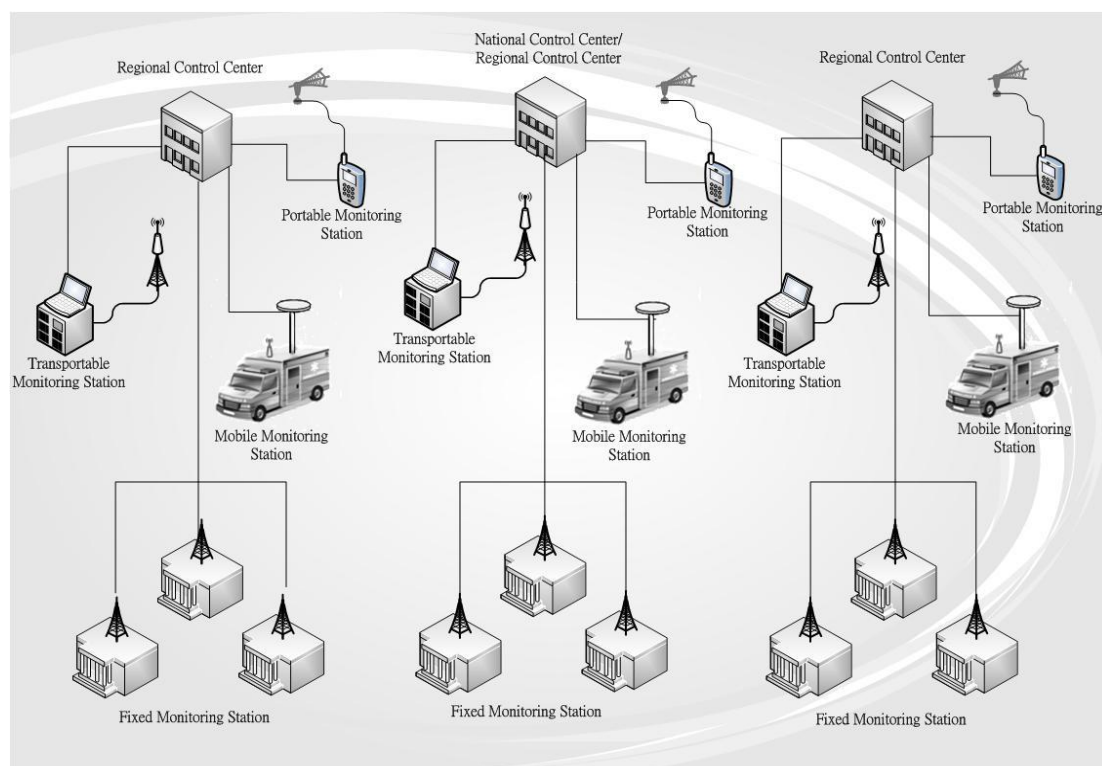


Figure 1.1 The structure of radio monitoring system

The responsibilities for each unit are as follows:

- (1) CC/RC : The CC/RCs are responsible for the management of monitoring data and assigning and controlling monitoring missions. The radio monitoring system shall include three regional control centers.
- (2) FMS: It is responsible for performing the monitoring missions assigned by CC/RC. There are two types of FMS. The first type is used to perform both

monitoring and direction findings missions. The other type is used to perform the monitoring mission only. The number of first type FMS is 24. The number of the second type FMS is 6. The detailed information for FMS is shown in Appendix 3.

- (3) MMS: It is responsible for the function to carry out all those monitoring operations that make it impossible for measurements to be made by fixed stations. The radio monitoring system shall have three types of MMS.

Type I: This type MMS is designed for monitoring in urban and mountain environments with high mobility vehicles. A total of 6 Type-I MMS shall be included.

Type II: This type MMS is designed for monitoring in rural environments with high mobility vehicles. A total of 3 Type-II MMS shall be included.

Type III: This type MMS is designed for SHF band monitoring. Only one Type-III MMS shall be included.

- (4) TMS: This type of monitoring station shall be locally operated but also remote controlled by the control center. It shall be able to be placed in a particular location, such as on the ground or on the roof of a building, and then be moved to another location as required by the monitoring needs. A total of 4 TMSs shall be included.

- (5) PMS: It is responsible for the determination of the exact location of interference, or the verification of compliance of radio equipment with the relevant technical parameters on site. This type of monitoring station shall be equipped with a portable receiver and a handheld directional antenna. A total of 6 PMSs shall be included.



The system network configuration is shown in Fig. 1.2. Each regional center communicates with fixed stations via a virtual private network (VPN). The communication links are used to exchange information such as monitoring data and audio recording data. Mobile stations and transportable stations transmit data to regional centers via 3G mobile VPN.

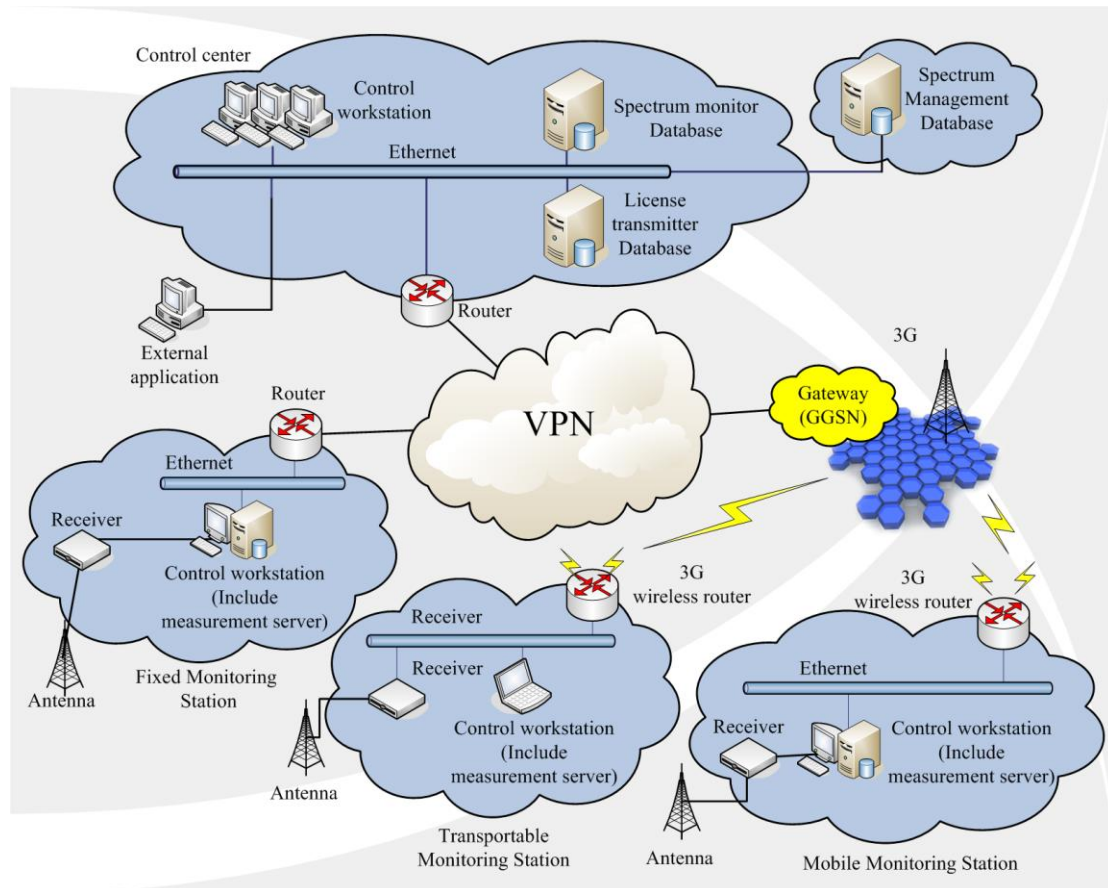


Figure 1.2 The data communication network of monitoring system

## 1.1 CONTROL CENTER/REGIONAAL CENTERS

The monitoring system shall include northern, middle, and southern regional centers. The northern center is also used as national center. Each regional center is in charge of the control of monitoring stations within their coverage. The functions of regional centers include:

- (1) spectrum monitoring via remote control operations;

- (2) resolution of interference;
- (3) verification of technical and operational parameters;
- (4) identification of unauthorized transmitters.

Each control center requires install a licensed transmitter database and a monitored database. The monitored data is sent from monitoring stations to control center via VPN and is compared with the relevant record in the licensed transmitter database. Each control center shall have the equipment listed in Table 1.1.

Table 1.1 Equipment at control center

<b>No.</b>	<b>Equipment</b>	<b>Description</b>
RC-DV-001	Control workstation(x3)	for remote control of monitoring operations
RC-DV-002	DHCP server	to support dynamic allocation of IP address
RC-DV-003	Spectrum monitoring database	store the spectrum monitoring data from monitoring stations
RC-DV-004	Licensed transmitter database	store the information of licensed transmitters
RC-DV-005	TCP/IP network	for data communication
RC-DV-006	router	connect to VPN
RC-DV-007	Color laser printer	report output
RC-DV-008	UPS	to prevent computer systems from losing information due to power failure and having the capability of running for a sufficiently interval more than 30 min.
RC-DV-009	Rack	for the placement of equipment

## 1.2 FIXED MONITORING STATIONS

### 1.1.2 The type of both monitoring and direction finding stations

This type of monitoring stations is used to carry out all measurements including spectrum usage as well as direction findings. Further, they can cooperate with other stations to position transmitters. The functions of fixed monitoring stations include:

- (1) monitoring signals at MF, HF, VHF, or UHF bands;
- (2) finding the direction of signal at VHF, or UHF bands;
- (3) spectrum occupancy measurements;
- (4) measurements of signal parameters including frequency, bandwidth, field strength, and modulation;
- (5) audio recording and replay.

Every fixed monitoring station shall have the equipment listed in Table 1.2.

Table 1.2 equipment at fixed monitoring and DF stations

No.	Equipment	Description
FMS-T1DV-001	Monitoring and DF antennas	The frequency range of the antennas shall include MF, HF, VHF, or UHF bands. The type of antennas shall be suitable for long-term outdoor usage in strong wind, high temperature, and salty damage environments.
FMS-T1DV-002	receiver	It receives signal coupling from antenna. Monitoring receivers require good linearity and high dynamic range.
FMS-T1DV-003	Control workstation	for local operations of monitoring tasks
FMS-T1DV-004	Measurement server	The server shall include measurement server software and local database

	(include local database)	system. The measurement server software is used to control radio monitoring device; while the database system is used to record temporarily the monitoring data.
FMS-T1DV-005	TCP/IP network	for data communication
FMS-T1DV-006	router	connect to VPN
FMS-T1DV-007	UPS	to prevent computer systems from losing information due to power failure and having the capability of running for a sufficiently interval more than 30 min.
FMS-T1DV-008	Rack	for the placement of equipment
FMS-T1DV-009	Antenna base	Antenna base and necessary accessories.

### 1.2.2 The type of monitoring stations

This type of monitoring stations is used to carry out monitoring measurement but not include direction findings. The functions of this type of stations include:

- (1) monitoring signals at MF, HF, VHF, or UHF bands;
- (2) spectrum occupancy measurements;
- (3) measurements of signal parameters including frequency, bandwidth, field strength, and modulation;
- (4) audio recording and replay.

Every station for this monitoring shall have the equipment listed in Table 1.3:

Table 1.3 equipment at fixed monitoring stations

No.	Equipment	Description
FMS-T2DV-001	Monitoring antennas	The frequency range of the antennas shall include MF, HF, VHF, or UHF bands. The type of antennas shall be suitable for long-term outdoor usage in strong wind, high temperature, and salty damage environments.
FMS-T2DV-002	receiver	It receives signal coupling from antenna. Monitoring receivers require good linearity and high dynamic range.
FMS-T2DV-003	Control workstation	for local operations of monitoring tasks
FMS-T2DV-004	Measurement server (include local database)	The server shall include measurement server software and local database system. The measurement server software is used to control radio monitoring device; while the database system is used to record temporarily the monitoring data.
FMS-T2DV-005	TCP/IP network	for data communication
FMS-T2DV-006	router	connect to VPN
FMS-T2DV-007	UPS	to prevent computer systems from losing information due to power failure and having the capability of running for a sufficiently interval more than 30 min.
FMS-T2DV-008	Rack	for the placement of equipment
FMS-T1DV-009	Antenna base	Antenna base and necessary accessories.

### 1.3 MOBILE MONITORING STATIONS

Mobile monitoring stations can be divided into three types.

#### 1.3.1 Type I

The features of Type I mobile monitoring stations include:

- (1) monitoring signals at VHF or UHF bands;
- (2) finding the direction of signals at VHF or UHF bands
- (3) spectrum occupancy measurements;
- (4) measurements of signal parameters including frequency, bandwidth, field strength, and modulation;
- (5) audio recording and replay;
- (6) a mast can be extend the antenna up to approximately 6 m above ground level.

Every Type I mobile monitoring station shall have the equipment listed in Table 1.4.

Table 1.4 equipment at Type I mobile monitoring stations

No.	Equipment	Description
MMS-T1DV-001	Monitoring and DF antennas	The frequency range of the antennas shall include VHF and UHF bands.
MMS-T1DV-002	receiver	It receives signal coupling from antenna. Monitoring receivers require good linearity and high dynamic range.
MMS-T1DV-003	Control workstation	for local operations of monitoring tasks
MMS-T1DV-004	Measurement server (include local	The server shall include measurement server software and local database system. The measurement server

	database)	software is used to control radio monitoring device; while the database system is used to record temporarily the monitoring data.
MMS-T1DV-005	TCP/IP network	for data communication
MMS-T1DV-006	3G wireless router	Connect with 3G wireless networks
MMS-T1DV-007	Extendable mast	Allow to adjust the height of antennas
MMS-T1DV-008	GPS receiver and antenna	to position the mobile station
MMS-T1DV-009	Safety protection device	include anti-collision alarm device to protect antenna, video monitoring for parking, and fire-fighting apparatus
MMS-T1DV-010	Rechargeable battery	At least 2 hours power supply for monitoring equipment and can transfer 12V-DC power to 110V-AC power
MMS-T1DV-011	Car's embedded power generator	To supply 2kW power.
MMS-T1DV-012	External power socket	Power extension wire.
MMS-T1DV-013	Rack	for the placement of equipment
MMS-T1DV-014	Satellite navigation system	To navigate the vehicle
MMS-T1DV-015	compass	To verify vehicle's direction
MMS-T1DV-016	Front seat display	Monitoring display for driver.
MMS-T1DV-017	Car	SUV

### 1.3.2 Type II

The features of Type II mobile monitoring stations include:

- (1) monitoring signals at MF, HF, VHF, or UHF bands;
- (2) finding the direction of signals at VHF or UHF bands
- (3) spectrum occupancy measurements;

- (4) measurements of signal parameters including frequency, bandwidth, field strength, and modulation;
- (5) audio recording and replay;
- (6) digital signal analysis;
- (7) a mast can be extend the antenna up to approximately 10 m above ground level.

Every Type II mobile monitoring station shall have the equipment listed in Table 1.5.

Table 1.5 equipment at Type II mobile monitoring stations

No.	Equipment	Description
MMS-T2DV-001	Monitoring and DF antennas	The frequency range of the antennas shall include MF, HF, VHF, and UHF bands for monitoring; and VHF and UHF bands for DF.
MMS-T2DV-002	receiver	It receives signal coupling from antenna. Monitoring receivers require good linearity and high dynamic range.
MMS-T2DV-003	Control workstation	for local operations of monitoring tasks
MMS-T2DV-004	Measurement server (include local database)	The server shall include measurement server software and local database system. The measurement server software is used to control radio monitoring device; while the database system is used to record temporarily the monitoring data.
MMS-T2DV-005	TCP/IP network	for data communication
MMS-T2DV-006	3G wireless router	Connect with 3G wireless networks
MMS-T2DV-007	Extendable mast	Allow to adjust the height of antennas



MMS-T2DV-008	GPS receiver and antenna	to position the mobile station
MMS-T2DV-009	Safety protection device	include anti-collision alarm device to protect antenna, video monitoring for parking, and fire-fighting apparatus
MMS-T2DV-010	Rechargeable battery	At least 3 hours power supply for monitoring equipment and can transfer 12V-DC power to 110V-AC power
MMS-T2DV-011	Car's embedded power generator	To supply 2kW power.
MMS-T2DV-012	External power socket	Power extension wire.
MMS-T2DV-013	Rack	for the placement of equipment
MMS-T2DV-014	Satellite navigation system	To navigate the vehicle
MMS-T2DV-015	compass	To verify vehicle's direction
MMS-T2DV-016	Front seat display	Monitoring display for driver.
MMS-T2DV-017	Car	VAN

### 1.3.3 Type III

The features of Type III mobile monitoring stations include:

- (1) monitoring signals at SHF band;
- (2) finding the direction of signals at SHF band
- (3) spectrum occupancy measurements;
- (4) measurements of signal parameters including frequency, bandwidth, field strength, and modulation;
- (5) digital signal analysis;

Every Type III mobile monitoring station shall have the equipment listed in Table 1.6.

Table 1.6 equipment at Type III mobile monitoring stations

No.	Equipment	Description
MMS-T3DV-001	Monitoring and DF antennas	The frequency range of the antennas shall include SUHF band. The antennas shall be rotatable and with directional pattern.
MMS-T3DV-002	receiver	It receives signal coupling from antenna. Monitoring receivers require good linearity and high dynamic range.
MMS-T3DV-003	Control workstation	for local operations of monitoring tasks
MMS-T3DV-004	Measurement server (include local database)	The server shall include measurement server software and local database system. The measurement server software is used to control radio monitoring device; while the database system is used to record temporarily the monitoring data.
MMS-T3DV-005	TCP/IP network	for data communication
MMS-T3DV-006	3G wireless router	Connect with 3G wireless networks
MMS-T3DV-007	Extendable mast	Allow to adjust the height of antennas
MMS-T3DV-008	GPS receiver and antenna	to position the mobile station
MMS-T3DV-009	Safety protection device	include anti-collision alarm device to protect antenna, video monitoring for parking, and fire-fighting apparatus
MMS-T3DV-010	Rechargeable battery	At least 3 hours power supply for monitoring equipment and can transfer 12V-DC power to 110V-AC power
MMS-T3DV-011	Car's embedded	To supply 2kW power.

	power generator	
MMS-T3DV-012	External power socket	Power extension wire.
MMS-T3DV-013	Rack	for the placement of equipment
MMS-T3DV-014	Satellite navigation system	To navigate the vehicle
MMS-T3DV-015	compass	To verify vehicle's direction
MMS-T3DV-016	Front seat display	Monitoring display for driver.
MMS-T3DV-017	Car	VAN

#### 1.4 TRANSPORTABLE MONITORING STATIONS

The features of transportable monitoring stations include:

- (1) monitoring signals at VHF or UHF bands;
- (2) finding the direction of signals at VHF or UHF bands
- (3) spectrum occupancy measurements;
- (4) measurements of signal parameters including frequency, bandwidth, field strength, and modulation;
- (5) audio recording and replay;

Every transportable monitoring station shall have the equipment listed in Table 1.7.

Table 1.7 equipment at transportable monitoring stations

No.	Equipment	Description
TMS-DV-001	Monitoring and DF antennas	The frequency range of the antennas shall include VHF and UHF bands.
TMS-DV-002	receiver	It receives signal coupling from antenna. Monitoring receivers require good linearity and high dynamic range.
TMS-DV-003	Control workstation	for local operations of monitoring tasks
TMS-DV-004	Measurement server (include local	The server shall include measurement server software and local database

	database)	system. The measurement server software is used to control radio monitoring device; while the database system is used to record temporarily the monitoring data.
TMS-DV-005	TCP/IP network	for data communication
TMS-DV-006	3G wireless router	Connect with 3G wireless networks
TMS-DV-007	GPS receiver	to position the station
TMS-DV-008	Rack	for the placement of equipment
TMS-DV-009	compass	To verify direction
TMS-DV-010	Antenna tripod activities	To facilitate the movement and storage of the antenna.

## 1.5 PORTABLE MONITORING STATIONS

Portable monitoring stations perform direction finding tasks using handheld receiver with a directional antenna. They can measure the distance from the signal source via its strength that can be transformed into audio signal. .

The features of portable monitoring stations include:

- (1) direction finding;
- (2) searching signal source.

Every portable monitoring station shall have the equipment listed in Table 1.8.

Table 1.8 equipment at portable monitoring stations

No.	Equipment	Description
PMS-DV-001	Handheld directional antenna	The frequency range of the antennas shall include 30 kHz to 6 GHz..
PMS-DV-002	receiver	It receives signal coupling from antenna. Monitoring receivers require

		good linearity and high dynamic range.
PMS-DV-003	compass	To verify direction
PMS-DV-004	E-map	To display directional line on it.
PMS-DV-005	GPS	For the purpose of Homing

## 1.6 SYSTEM SOFTWARE CONFIGURATION

The software configuration of the spectrum monitoring system adopts three-tier architecture, as shown in Fig. 1.3. Each tier can be implemented using various coding languages. Also, the changes of function in one tier shall not affect other tier's operations.

The software components of the three-tier architecture are as follows.

- (1) User Interface, UI: provide operators with task selection, parameter setting, and display of measurement results.
- (2) Radio Monitoring Functionalities, RMF: the implementation of various monitoring functions
- (3) Measurement Server, MS: provide measurement service and equipment management requested by control workstations, and implement the control commands of monitoring equipment including monitoring receiver, GPS receiver, antenna controller, etc.

The software components of the three-tier architecture can be installed in a computer or in different computers. If the software components are installed in different computer hosts, the vendor must provide a well-predefined interface for the software components in each tier to communicate with each other. The interfaces are described as follows.

- (1) Application Programming Interface, API: through the interface, UI and outside program can communicate with RMF. The detailed description for API requirements can be found in Section 1.7.

- (2) Generic Interface, GI: the interface allows RMF communicate with equipment made by different manufacturers without revising the source code of RMF. The requirements for GI can be found in Section 1.8

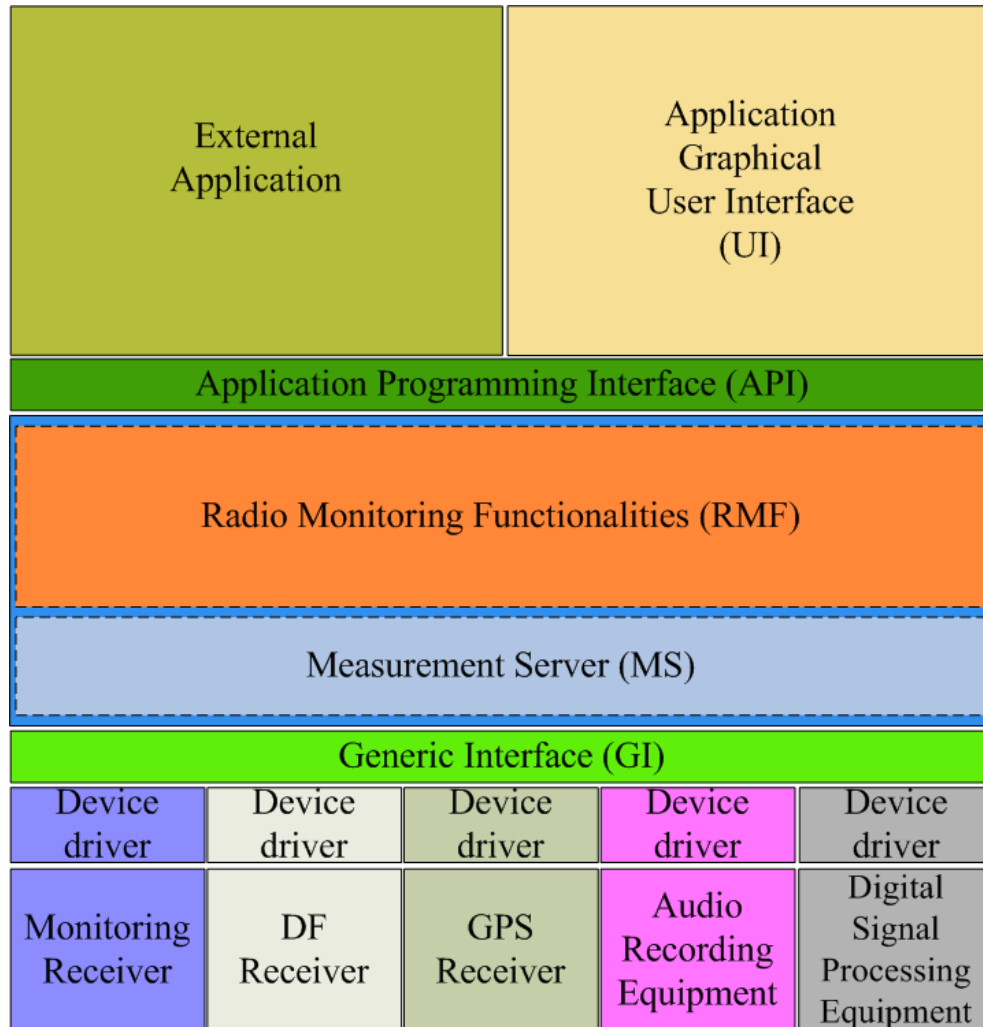


Figure 1.3 system software configuration

## 1.7 APPLICATION PROGRAMMING INTERFACE REQUIREMENTS

The requirements for the application programming interface of spectrum monitoring software system are specified as follows:

No.	Description
APIR-001	The API should support both UI and external application layer to connect and control the spectrum monitoring system to accomplish the monitoring tasks, including the parameter

	settings and the reception of monitoring results.
APIR-002	API should define the standards of communication protocols and message syntax that can be used in the message exchange in the form of text format between external applications and the spectrum monitoring system.
APIR-003	<p>For the purposes of spectrum monitoring, API should support external application to accomplish the following jobs:</p> <ol style="list-style-type: none"> <li>1. Get position information for all of the monitoring stations and the equipments installed in the system, and the parameter lists that can be adjusted by the external application.</li> <li>2. Get information for all of the available stations and equipments together with the tasks in progress status.</li> <li>3. Export/import frequency list and transmitter list.</li> <li>4. Start/Stop monitoring tasks.</li> <li>5. Request monitoring results.</li> </ol>
APIR-004	<p>The interface should support external application to instruct the spectrum monitoring system for executing multiple monitoring tasks simultaneously. And, for each monitoring task, the external application can determine the following parameter settings:</p> <ol style="list-style-type: none"> <li>1. Task types (e.g., fixed frequency, frequency range scan, frequency list scan, transmitter list scan)</li> <li>2. Signal frequency (e.g., fixed frequency, frequency list, frequency range, frequency step size)</li> <li>3. Measurement date/time (e.g., start/stop date/time)</li> <li>4. Transmitter list (e.g., transmitter frequency, transmitter latitude/longitude)</li> <li>5. Measurement stations and devices (e.g., station/device parameter settings)</li> <li>6. Measurement types and units (e.g., level, modulation, bandwidth, bearing, location, audio, IF, or other ITU measurement and units)</li> </ol>
APIR-005	The interface should define the format of measurement results that are sent to the external applications in terms of text messages (e.g., XML format). Each measurement result includes the parameter settings, the result values and units.
APIR-006	The seller should provide the interface definition documents,

	programmer manuals, and sample application source code for the development of external applications.
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## 1.8 GENERIC INTERFACE REQUIREMENTS

The requirements for the generic interface of spectrum monitoring software system are specified as follows:

No.	Description
GIR-001	This interface should define the standards of device control instruction sets, communication message syntax and protocols between MS and device drivers.
GIR-002	Any device driver that is compliant to the specification of this interface is able to integrate with the MS layer of spectrum monitoring software system.
GIR-003	This interface should be able to integrate homogeneous/heterogeneous devices in case of future system expansion projects.
GIR-004	<p>The interface should define each, or combination of two or more device driver instruction sets of the following device driver classes:</p> <ol style="list-style-type: none"> <li>1. Receiver class : Device drivers are able to control the connected receiver in order for performing all of the connected receiver functionalities and receipting the corresponding measurement results by using the receiver control commands.</li> <li>2. Direction-finding class: Device drivers are able to control the connected direction-finding (DF) receiver in order for performing all of the connected DF receiver functionalities and receipting the bearings of emissions and the corresponding measurement results by using the DF receiver control commands.</li> <li>3. General sensor class : Device drivers are able to control the connected sensor devices (e.g., GPS receiver, and</li> </ol>



	<p>compass) in order for performing all of the connected sensor device functionalities and receipting the measurement results by using the sensor control commands.</p> <p>4. Device controller class: Device drivers are able to control the connected device controller (e.g., antenna switch, and rotor) in order for performing all of the connected controller functionalities and receipting the information of device status by using the controller control commands.</p>
GIR-005	For each class of device driver, include single or combinations of classes mentioned in GIR-004, this interface should define individual instruction sets which are opened to MS to support all of the RMFs.
GIR-006	<p>The basic common instruction set available to all of the device drives should at least include:</p> <ol style="list-style-type: none"> <li>1. Device initialization/de-initialization.</li> <li>2. Device driver class query/reply.</li> <li>3. Parameter list query/reply.</li> <li>4. Set measurement parameters and start measurement.</li> <li>5. Stop measurement.</li> <li>6. Receive measurement results.</li> <li>7. Acknowledge data received.</li> <li>8. Reset device.</li> </ol>
GIR-007	<p>Instruction set for device drivers in receiver class should at least include:</p> <ol style="list-style-type: none"> <li>1. Query/set start and stop frequencies.</li> <li>2. Query/set frequency step width.</li> <li>3. Query/set frequency list.</li> <li>4. Query/set central frequency.</li> <li>5. Set measure period.</li> <li>6. Query/set IF bandwidth.</li> <li>7. Query/set demodulator.</li> </ol>
GIR-008	Instruction set for device drivers in direction-finding class

	<p>should at least include:</p> <ol style="list-style-type: none"> <li>1. Query/set central frequency.</li> <li>2. Query/set IF bandwidth.</li> <li>3. Set measure period.</li> </ol>
GIR-009	<p>Instruction set for device drivers in general sensor class should at least include:</p> <ol style="list-style-type: none"> <li>1. Query the format of sensor reading.</li> <li>2. Read current date/time.</li> <li>3. Synchronize system time.</li> <li>4. Read longitude, latitude, and elevation.</li> <li>5. Read azimuth.</li> <li>6. Calibrate azimuth, longitude/latitude.</li> </ol>
GIR-010	<p>Instruction set for device drivers in device controller class should at least include:</p> <ol style="list-style-type: none"> <li>1. Query/set controller parameters.</li> <li>2. Query current device status.</li> </ol>
GIR-011	<p>Seller should provide interface specification documents and the source codes of sample device drivers and its corresponding external application.</p>

## **2. SOFTWARE REQUIREMENTS FOR RADIO MONITORING SYSTEM**

This chapter is devoted to state the functional requirements for the radio monitoring software. The requirement specification is divided into two parts: the general requirement, and type-specific requirement. The general requirement part defines the functions of radio monitoring software installed in each control centers, and serves as the basis of type-specific software requirement for the various types of monitoring stations.

### **2.1 GENERAL REQUIREMENT (GR)**

#### **2.1.1 System operation requirements (SOR)**

This section specifies the requirements on how the radio monitoring system should be operated by the system operators via the radio monitoring software.

<b>No.</b>	<b>Description</b>
GR-SOR-001	The radio monitoring system must provide graphic-based software operating environment.
GR-SOR-002	The software operating environment must include at least the following functionalities:  1. User authentication and management 2. Equipment control and management 3. Geographic information tool set 4. Radio monitoring tool set 5. Report generation tool set
GR-SOR-003	Each user must be authenticated by the software system before he or she is able to access the radio monitoring

	system.
GR-SOR-004	Authenticated users must be able to execute remotely radio monitoring tasks or equipment configuration in an interactive or batch manner from the control workstation the users are used.
GR-SOR-005	Single- or multiple-station direction finding task should be accomplished by using the same user interface.
GR-SOR-006	Multiple users must be able to access to a single stations simultaneously, and the system should display the current status of the station equipment to all of these users.
GR-SOR-007	Users can remotely switch to use the various antennas that are installed in each station, display the latest antenna information on the same user interface.
GR-SOR-008	Each station must equip with one UPS to offer at least 30 minutes electric power supply to the computer and monitoring receivers when station's AC is turned off. The UPS must have both remote manual and automatic functions to shutdown or power on the computers and monitoring receivers it has connected.

### 2.1.2 User interface requirements (UIR)

This section specifies the requirements for the user interfaces that are provided by the radio monitoring software.

No.	Description
GR-UIR-001	All user interfaces must be traditional Chinese language and

	base on the Microsoft Windows application style.
GR-UIR-002	Users should be able to customize their own user interface and save these setting for use in the subsequent use.
GR-UIR-003	User interfaces must support the mouse and knob devices for users to easily make adjustment and setting operation of the radio monitoring tasks.
GR-UIR-004	Various kind of measurement results, such as spectrum, direction-finding, audio, or pictures, resultant from related monitoring tasks must be able to render within a single user interface.
GR-UIR-005	<p>The software must offer user interfaces associated with at least the following functionalities:</p> <ol style="list-style-type: none"> <li>1. User authentication and management</li> <li>2. Equipment control and management</li> <li>3. Radio monitoring tool set</li> <li>4. Report generation tool set</li> </ol>
GR-UIR-006	<p>User interface for user authentication and management should support to:</p> <ol style="list-style-type: none"> <li>1. Enter user account ID and password for user authentication.</li> <li>2. Display information of users, such as user's actual name, and authorized access right etc.</li> <li>3. Modify user's own password.</li> <li>4. Insert/delete user accounts and modify authorized access rights</li> </ol>

GR-UIR-007	<p>User interface for Equipment control and management should support to:</p> <ol style="list-style-type: none"> <li>1. Choose single or multiple stations to access.</li> <li>2. Display all the connected stations at the digital map according to their own coordinates.</li> <li>3. Make parameter setting for controlling the equipments installed in the stations.</li> </ol>
GR-UIR-008	<p>User interface for radio monitoring tool set should support to accomplish each individual radio monitoring task and take the following statements into consideration:</p> <ol style="list-style-type: none"> <li>1. User interface for signal measurement task should support to : <ol style="list-style-type: none"> <li>(1) Choose stations for executing the measurement.</li> <li>(2) Make parameter setting, e.g., central frequency, bandwidth etc.</li> <li>(3) Display measurement results in graphic and tabular form.</li> </ol> </li> <li>2. User interface for direction-finding/location task should support to : <ol style="list-style-type: none"> <li>(1) Choose one or more stations for executing the direction-finding.</li> <li>(2) Make parameter setting, e.g., confidentiality, frequency, bandwidth, modulation, etc.</li> <li>(3) Display direction-finding results in a radar chart.</li> <li>(4) Display both the location results and all of the</li> </ol> </li> </ol>

	<p>related stations in the digital map according their own coordinates.</p> <p>3. User interface for direction-finding scan task should support to :</p> <ul style="list-style-type: none"> <li>(1) Choose stations for executing the measurement.</li> <li>(2) Make parameter settings, e.g., noise level threshold, scan duration, DF resolution, start frequency, stop frequency, bandwidth etc.</li> <li>(3) Display measurement results in graphic and tabular form.</li> </ul> <p>4. User interface for spectrum occupancy measurement task should support to :</p> <ul style="list-style-type: none"> <li>(1) Choose stations for executing the measurement.</li> <li>(2) Make parameter settings, e.g., start frequency, stop frequency, bandwidth, store interval, measure duration, noise level threshold, confidentiality, etc.</li> <li>(3) Display measurement results in graphic and tabular form.</li> </ul> <p>5. User interface for signal analysis and identification task should support to :</p> <ul style="list-style-type: none"> <li>(1) Choose stations for executing the measurement.</li> <li>(2) Make parameter settings, e.g., start frequency, stop frequency, bandwidth, store interval, measure duration, noise level threshold, etc.</li> <li>(3) Display measurement results in graphic and tabular</li> </ul>
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	<p>form, e.g., constellation diagram, eyes diagram, spectral power density histogram, instantaneous frequency histogram, instantaneous phase histogram, and instantaneous amplitude histogram.</p> <p>6. User interface for unknown transmitters detection task should support to :</p> <ol style="list-style-type: none"> <li>(1) Choose stations for executing the detection.</li> <li>(2) Make parameter settings, e.g., start frequency, stop frequency, bandwidth, store interval, measure duration, noise level threshold, etc.</li> <li>(3) Invoke direct-finding/location task to obtain unknown transmitters' positions and display these positions in the digital map</li> </ol> <p>7. User interface for coverage measurement task should support to :</p> <ol style="list-style-type: none"> <li>(1) Choose stations for executing the measurement.</li> <li>(2) Make parameter settings, e.g., start time, stop time, frequency, bandwidth, reference area, reference route, store interval, measure duration, etc.</li> <li>(3) Display measurement results in graphic and tabular form.</li> </ol> <p>8. User interface for audio recording task should support to :</p> <ol style="list-style-type: none"> <li>(1) Make parameter settings, e.g., file type, etc.</li> <li>(2) Perform record, play, pause, stop, and replay for</li> </ol>
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	<p>audio signal.</p> <p>9. User interface for automatic radio monitoring task should support to :</p> <ol style="list-style-type: none"> <li>(1) Make parameter settings, e.g., measurement task, start date/time, stop date/time and task execution period etc.</li> <li>(2) Export/import history task parameter settings.</li> <li>(3) Display the progress of each automatic measurement task.</li> </ol> <p>10. User interface for radio monitoring results management should support to :</p> <ol style="list-style-type: none"> <li>(1) Choose which measurement task result to be retrieved</li> <li>(2) Display the retrieved results in graphic and tabular form for further examination.</li> </ol>
GR-UIR-009	<p>User interface for report generation should support to :</p> <ol style="list-style-type: none"> <li>(1) Make parameter setting, e.g., report form, options for history measurement task, etc.</li> <li>(2) Display the generated report, and export the report into a disk file as necessary.</li> </ol>

### 2.1.3 User authentication requirements (UAR)

This section specified the functional requirements for user authentication and user account management as follows:

No.	Description
GR-UAR-001	People who attempt to access the radio monitoring system

	must be authenticated in accordance with the user account information stored in the spectrum monitoring database.
GR-UAR-002	Information related to those currently login users must be displayed to each login user; the displayed items includes at least those mentioned in UIR-006.
GR-UAR-003	Login users are able to modify their own password as demand or prompted by the system periodically.
GR-UAR-004	The system administrator account must be provided with the top access right to manage the whole system resource.
GR-UAR-005	The administrator is responsible for the management of user accounts.
GR-UAR-006	The administrator must be able to manage the users into user groups and assign various authorized right to individual users or user groups for accessing file directories, database tables, hardware devices, and software functions.

#### **2.1.4 Equipment control and management requirements (EMR)**

This section specifies the functional requirements for the management and control of radio monitoring related equipments :

<b>No.</b>	<b>Description</b>
GR-EMR-001	Each control workstation located in CC and RCs must be able to connect to multiple remote stations simultaneously.
GR-EMR-002	Each connected remote station should be displayed in the digital map at the control workstation.
GR-EMR-003	The polarization type of antenna (horizontal and vertical)

	and the associated parameter setting must be chosen by the operator of control workstation.
GR-EMR-004	The information of all of the equipments that have installed in each station must be managed and queried by accesses to the spectrum monitoring database.
GR-EMR-005	The equipments installed in each station should be set to test/calibrate manually or automatically by the operator from the control workstation.
GR-EMR-006	One or more stations can be chosen to perform system examination simultaneously, without interrupting or affecting the other equipments in the same station.
GR-EMR-007	The calibration and test results should be displayed in graphic or tabular form.

### 2.1.5 Geographic information tool set requirements (GITR)

This section specifies the functional requirements for geographic information management to support the rendering of radio measurements in digital maps and radar charts.

No.	Description
GR-GITR-001	Accurate digital maps must be provided to display: <ol style="list-style-type: none"> <li>1. Geographic information</li> <li>2. Transmitters and their geographic information</li> <li>3. Geographic information of radio measurement results.</li> </ol>
GR-GITR-002	Geographic information management tool set must closely integrate with other radio monitoring measurement tasks to

	easily render the measurement results in digital maps.
GR-GITR-003	<p>The following digital formats must be supported:</p> <ol style="list-style-type: none"> <li>1. Raster Maps</li> <li>2. Vector Maps</li> <li>3. Drawing Exchange Format(DXF)</li> <li>4. Mapinfo Interchange Format(MIF)</li> <li>5. Mapinfo Native Format(TAB)</li> </ol>
GR-GITR-004	<p>The following coordinate systems must be supported:</p> <ol style="list-style-type: none"> <li>1. TWD97</li> <li>2. UTM</li> </ol> <p>The user can choose either of these two coordinate systems, and the tool set must carry out automatic conversion between these two coordinate systems.</p>
GR-GITR-005	<p>Maps for Taiwan and its associated outlay islands, in the scale of 1/25000 for suburban, 1/5000 for metro must be preloaded with correct coordinate system.</p>
GR-GITR-006	<p>The tool set must provide the following functions to:</p> <ol style="list-style-type: none"> <li>1. Perform coordinate registration process when importing new digital maps into the tools set.</li> <li>2. Avoid causing distortion when moving the digital map within the display window.</li> <li>3. Be able to display stations in the digital map according to their coordinate.</li> <li>4. Be able to store and print the displayed map.</li> <li>5. Be able to operate multiple displayed map windows</li> </ol>

	simultaneously.
GR-GITR-007	<p>For multiple-layer maps, the following functions should be supported to:</p> <ol style="list-style-type: none"> <li>1. Display individual layer of map at any resolution.</li> <li>2. Be able to edit content of each layer of map and store the edited result.</li> </ol>
GR-GITR-008	<p>The following functions must be provided to :</p> <ol style="list-style-type: none"> <li>1. Calculate the actual distance between any pair of points located at the displayed map.</li> <li>2. Display any specified transmitters in the digital map.</li> <li>3. Update the latest position of objects in the digital map according the information received from the corresponding GPS receivers.</li> <li>4. Display the geographic distance, azimuth, and line of bearing for measurement results.</li> </ol>
GR-GITR-009	The result of direction-finding can be displayed in the form of radar charts.
GR-GITR-010	Radar charts should use different colors to indicate line of bearings, azimuth and other related information of direction-finding task.

### 2.1.6 Radio management tool set requirements (RMTR)

This section specified the functional requirements for the radio monitoring measurement tool set as follows:

No.	Description
GR-RMTR-001	Each measurement task must support various operation modes to support:  1. Fix frequency scanning  2. Frequency scanning  3. Memory scanning
GR-RMTR-002	Alert notification (SMS, Voice etc.) should be sent to the operator if the monitoring signal appears, or disappears abruptly.
GR-RMTR-003	The monitoring task for legal broadcast station with full-day increased power emissions should be provided.
GR-RMTR-004	Each measurement task must support users to select frequency band, modulation type, IF filter, threshold mask, and any appropriate parameter settings according to the user demands of the task and the user.
GR-RMTR-005	In each monitoring task, RF measurement, direction-finding, location, and audio recording should be performed simultaneously.
GR-RMTR-006	Parameter settings for each radio monitoring task can be exported as history parameter settings for later user, and can be imported as the current setting of parameters as necessary.

GR-RMTR-007	Upon generating one radio monitoring task, the system must assign a unique radio monitoring task identification number (ID) to the generated task, and the task's measurement parameter settings and the corresponding results can be stored along with this task ID and the user ID to spectrum monitoring database after finishing the measurement.
GR-RMTR -008	The parameter settings of each radio monitoring task should be stored along with the corresponding measure results in the spectrum monitoring database.
GR-RMTR -009	The monitoring tool set should support automatic search and comparison from the records of licensed transmitters database with the executing measurements.
GR-RMTR -010	<p>Signal measurement task tool must offer at least following functions:</p> <ol style="list-style-type: none"> <li>1. User can accomplish the task initialization and parameter setting for the task through the signal measurement user interface.</li> <li>2. Signal measurement task must be able to measure radio signal features, including: <ol style="list-style-type: none"> <li>(1) Frequency</li> <li>(2) Bandwidth</li> <li>(3) Field strength</li> <li>(4) Modulation</li> <li>(5) RF level</li> </ol> </li> </ol>

	<p>3. The signal frequency bands that the task can measure are as follows:</p> <ul style="list-style-type: none"> <li>(1) MF</li> <li>(2) HF</li> <li>(3) VHF</li> <li>(4) UHF</li> <li>(5) SHF</li> </ul> <p>4. The parameter settings (refer to UIR-008) of the task can be stored along with the measure results (such as frequency, bandwidth, field strength, modulation parameter, and RF level) in the spectrum monitoring database.</p> <p>5. Other signal measurement specifications that are not stated here should be compliant with the recommendations from ITU-R Spectrum Monitoring Handbook 2011 Chapter 4 Sections 4.2-6.</p>
GR-RMTR -011	<p>Direction-finding and location task tool must offer at least following functions:</p> <ul style="list-style-type: none"> <li>1. User can accomplish the task initialization and parameter setting for the task through the direction-finding/location task user interface.</li> <li>2. The signal frequency bands that the task can measure are as follows: <ul style="list-style-type: none"> <li>(1) VHF</li> <li>(2) UHF</li> </ul> </li> </ul>



	<p>(3) SHF</p> <ol style="list-style-type: none"> <li>3. Single or multiple remote stations can be chosen to find the directions and the location of target emissions.</li> <li>4. Multiple emissions from various directions at the same frequency must be found and located.</li> <li>5. The digital map must be able to invoke to display the location and line of bearings of the found emissions.</li> <li>6. The ability of direction-finding and location for burst signal should be offered and the history measurement results can be replayed as demand.</li> <li>7. The parameter settings (refer to UIR-008) of the task can be stored along with the measure results (such as date, start time, stop time, frequency, confidence value, azimuths in relative to the stations, location method, transmitter latitude, and transmitter longitude) in the spectrum monitoring database.</li> <li>8. Other signal measurement specifications that are not stated here should be compliant with the recommendation from ITU-R Spectrum Monitoring Handbook 2011 Chapter 4 Sections 4.7.</li> </ol>
GR-RMTR -012	<p>Direction-finding scan task tool must offer at least following functions:</p> <ol style="list-style-type: none"> <li>1. User can accomplish the task initialization and parameter setting for the task through the direction-finding scan task user interface.</li> </ol>

	<ol style="list-style-type: none"> <li>2. The scan results can be rendered in graphic and tabular form.</li> <li>3. The parameter settings (refer to UIR-008) of the task can be stored along with the measure results (such as date, start time, stop time, frequency, confidence value, and azimuths in relative to the stations) in the spectrum monitoring database.</li> </ol>
GR-RMTR-013	<p>Transmitters signal analysis and identification task tool must offer at least following functions:</p> <ol style="list-style-type: none"> <li>1. User can accomplish the task initialization and parameter setting for the task through the transmitters signal analysis and identification task user interface.</li> <li>2. User can specify the frequency of emissions to do the signal analysis and identification.</li> <li>3. User can select the entire or part of legal transmitters to do their individual signal analysis and identification, and can automatically make a comparison with the information stored in the legal transmitter database in order to find illegal or violate transmitters.</li> <li>4. The parameter settings (refer to UIR-008) of the task can be stored along with the measure results (such as date, start time, stop time, violate/illegal transmitter ID, transmitter longitude, transmitter latitude, frequency, bandwidth, modulation parameters, and RF level) in the spectrum monitoring database.</li> </ol>

	<ol style="list-style-type: none"> <li>5. The measurement results can be rendered in graphic and tabular form.</li> <li>6. Other signal measurement specifications that are not stated here should be compliant with the recommendation from ITU-R Spectrum Monitoring Handbook 2011 Chapter 4 Sections 4.8 and Section 4.12 to accomplish: <ol style="list-style-type: none"> <li>(1) QAM, PSK, FSK, etc. digital demodulation techniques.</li> <li>(2) Parametric identification for digital/analog signals.</li> <li>(3) Signal aided identification for digital/analog signals.</li> <li>(4) Detection of unwanted emission.</li> </ol> </li> </ol>
RMTR -014	<p>Spectrum occupancy measurement task tool must offer at least following functions:</p> <ol style="list-style-type: none"> <li>1. User can accomplish the task initialization and parameter setting for the task through the spectrum occupancy measurement task user interface.</li> <li>2. Measurement for multiple transmitters can be performed simultaneously.</li> <li>3. Measurement result can be compared with the corresponding information stored in the spectrum monitoring database.</li> <li>4. The parameter settings (refer to UIR-008) of the task can be stored along with the measure results (such as date, start time, stop time, transmitter ID, maximum</li> </ol>

	<p>occupancy, and average occupancy) in the spectrum monitoring database.</p> <ol style="list-style-type: none"> <li>5. The measurement results can be rendered in graphic and tabular form.</li> <li>6. Other signal measurement specifications that are not stated here should be compliant with the recommendation from ITU-R Spectrum Monitoring Handbook 2011 Chapter 4 Sections 4.10.</li> </ol>
GR-RMTR -015	<p>Transmitter coverage measurement task tool must offer at least following functions:</p> <ol style="list-style-type: none"> <li>1. User can accomplish the task initialization and parameter setting for the task through the transmitter coverage measurement task user interface.</li> <li>2. Stations that are equipped with monitoring receiver, antenna, GPS receiver can move along the selected reference route or area while recording the measurement of transmitter signal features and geographic information from GPS.</li> <li>3. The estimated transmitter coverage must be calculated according to the measurement results, and are compared automatically with the information from legal transmitter database to find out any illegal or violation of emission.</li> <li>4. The parameter settings (refer to UIR-008) of the task can be stored along with the measure results (such as</li> </ol>

	<p>date, start time, stop time, measurement time, measurement longitude, measurement latitude, transmitter ID, field strength, signal-to-noise ratio, and adjacent channel noise level) in the spectrum monitoring database.</p> <ol style="list-style-type: none"> <li>5. The measurement results can be rendered in digital map as traces with different colors indicating various signal strength.</li> <li>6. Other signal measurement specifications that are not stated here should be compliant with the recommendation from ITU-R Spectrum Monitoring Handbook 2011 Chapter 4 Sections 4.11.</li> </ol>
GR-RMTR -016	<p>Unknown transmitter detection task tool must offer at least following functions:</p> <ol style="list-style-type: none"> <li>1. User can accomplish the task initialization and parameter setting for the task through the unknown transmitter detection task user interface.</li> <li>2. User can specify the frequency range of emissions and threshold mask of signal level for detection. Emissions with signal level larger than the threshold mask are defined as effective emissions.</li> <li>3. Effective emissions can be compared automatically to all of the illegal transmitters to detection which emissions are emitted from unknown transmitters.</li> <li>4. The location of the unknown transmitters can be</li> </ol>

	<p>determined via direction-finding/location tool and then they are displayed in the digital map.</p> <p>5. The parameter settings (refer to UIR-008) of the task can be stored along with the measure results (such as date, start time, stop time, azimuth in relative to the measuring station, location method, transmitter longitude, and transmitter latitude) in the spectrum monitoring database.</p>
GR-RMTR -017	<p>Audio recording task tool must offer at least following functions:</p> <ol style="list-style-type: none"> <li>1. User can accomplish the task initialization and parameter setting for the task through the audio record task user interface.</li> <li>2. The audio signal from AM/FM stations can be demodulated, recorded, and played in real-time. Replay of the recorded audio file can be pause, reward, forward, and stop as demand from the user.</li> <li>3. The parameter settings (refer to UIR-008) of the task can be stored along with the measure results (such as date, start time, stop time, audio file pathname, sampling frequency, audio bit rate, and modulation type) in the spectrum monitoring database.</li> </ol>
GR-RMTR -018	<p>Automatic measurement task tool must offer at least following functions:</p> <ol style="list-style-type: none"> <li>1. User can accomplish the task initialization and</li> </ol>

	<p>parameter setting for the task through the automatic measurement task user interface.</p> <ol style="list-style-type: none"> <li>2. This tool must support to schedule the automatic execution of at least following tasks: <ol style="list-style-type: none"> <li>(1) Signal measurement</li> <li>(2) Direction-finding scan</li> <li>(3) Spectrum occupancy measurement</li> <li>(4) Transmitter signal analysis and identification</li> <li>(5) Unknown transmitters detection</li> <li>(6) Audio record</li> </ol> </li> <li>3. One or more stations can be chosen to perform the automatic tasks.</li> <li>4. The start data/time, period and duration of automatic measurement can be selected for each chosen task.</li> <li>5. The parameter settings (refer to UIR-008) of each automatic task can be stored along with the measure results in the spectrum monitoring database.</li> <li>6. The progress of automatic measurement tasks can be displayed on request by the user, and the task results can be rendered in tabular form or other graphic forms with support from geographic information tool set.</li> </ol>
GR-RMTR-019	<p>Measurement result management tool must offer at least following functions:</p> <ol style="list-style-type: none"> <li>1. User can retrieve the result of any finished task from the measurement result management user interface and</li> </ol>

	<p>shows the retrieved data in tabular form and graphic representation with the support from geographic information tool set.</p> <ol style="list-style-type: none"> <li>2. Users can retrieve history radio monitoring tasks from the spectrum monitoring database via specifying appropriate search conditions on user ID, task ID, or other related attributes.</li> <li>3. The display formats for the retrieved task results includes at least: <ol style="list-style-type: none"> <li>(1) Text format to show measurement data.</li> <li>(2) Graphic/tabular to show statistical data.</li> <li>(3) Digital map to show geographic data.</li> <li>(4) Audio play-out to render some content.</li> </ol> </li> <li>4. The retrieved records of history task result can be exported as disk file.</li> </ol>
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### 2.1.7 Report generation tool requirements (RGR)

This section specified the functional requirement for the generation of radio monitoring reports as follows:

No.	Description
GR-RGR-001	The tool must follow the authorized access right of individual user or user group to prevent illegal manipulation of radio monitoring results.
GR-RGR-002	User can customize the style and formats of the reports to be generated.
GR-RGR-003	The data source of the report must include the database



	queries from the spectrum monitoring database.
GR-RGR-004	The generated report can be edited or deleted.
GR-RGR-005	The generated report can be printed as hard copies.
GR-RGR-006	The generated report can be exported as a disk file in formats specified by IDF-005.

### 2.1.8 Information format definition (IFD)

This section specifies in the following all of the formats that might be used in the radio monitoring system:

No.	Description
GR-IFD-001	<p>The formats of exported files are as follows:</p> <ol style="list-style-type: none"> <li>1. Text files with delimiters.</li> <li>2. Extensible markup language defined text file.</li> </ol>
GR-IFD-002	<p>The formats of spectrum pictures include:</p> <ol style="list-style-type: none"> <li>1. MS Windows bitmap file (*.bmp)</li> <li>2. JPEG file (*.jpg)</li> <li>3. Portable network graphic (*.png)</li> </ol>
GR-IFD-003	<p>The formats for storing streaming or continuous spectrum pictures must be:</p> <ol style="list-style-type: none"> <li>1. MS Windows video format (*.avi)</li> <li>2. Windows media video (*.wmv)</li> </ol>
GR-IFD-004	<p>The formats for storing audio are as follows:</p> <ol style="list-style-type: none"> <li>1. Uncompressed waveform file (*.wav)</li> <li>2. Windows media audio (*.wma)</li> <li>3. Mpeg-1 layer 3 format (*.mp3)</li> </ol>

GR-IFD-005	<p>The formats for the report disk files are as follows:</p> <ol style="list-style-type: none"> <li>1. Microsoft Word format (*.doc)</li> <li>2. Microsoft Excel format (*.xls)</li> <li>3. Adobe PDF (*.pdf)</li> <li>4. HTML page (*.html)</li> </ol>
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### 2.1.9 Database requirements (DR)

This section specified the general requirements for the storage of radio monitoring tasks and the related database design and management issues.

No.	Description
GR-DR-001	Each control center, including central center and regional centers must install one spectrum monitoring database to store the results of monitoring tasks issued from the center.
GR-DR-002	Each control center, including central center and regional centers must install one legal transmitter database to store the license information of all of the transmitters with valid license.
GR-DR-003	The database management (DBMS) software must adopt commercial products with sufficient number of usage licenses (such as, Oracle 8, Microsoft SQL Server 7 or later versions) and capacity for manipulating large volume of stored data records.
GR-DR-004	The database administrator account, the ID and password, must be revealed to the buyer for performing appropriate data management operations.
GR-DR-005	The adopted DBMS software must support standard SQL

	statements for database operations and ODBC software interface to accept TCP/IP connection from remote applications for remote database access and operation.
GR-DR-006	Database system management tools are required for manual or procedural management of data records and database schema using standard SQL statements.
GR-DR-007	The database system must include a complete database schema designed correspondingly in accordance with the actual radio monitoring software functionalities, and a set of system data tables storing the system basic data records.
GR-DR-008	Measurement records in each database must be stored with precise measurement time stamps for the sake of synchronization across measurement tasks.

#### **2.1.10 Licensed transmitter database requirements (LTDR)**

The section specifies the requirements for the storage and application of licensed legal transmitters' information in the radio monitoring system. They are stated as follows:

<b>No.</b>	<b>Description</b>
GR-LTSR-001	The licensed transmitter database must periodically synchronize the latest records of licensed transmitters from the spectrum management database to maintain the validity of data records for legal transmitters. (The interval between data synchronizations is specified by the system administrator.)
GR-LTSR-002	Licensed transmitter database must at least include the

	<p>following tables:</p> <ol style="list-style-type: none"> <li>1. Licensed transmitter frequency data</li> <li>2. Antenna data</li> <li>3. Station data</li> <li>4. Proprietor data</li> </ol>
GR-LTSR-003	<p>Licensed transmitter frequency data must at least include the following fields:</p> <ol style="list-style-type: none"> <li>1. Transmitter ID</li> <li>2. Transmitter name</li> <li>3. Station ID</li> <li>4. Proprietor ID</li> <li>5. Antenna ID</li> <li>6. Transmit power and unit</li> <li>7. Start frequency and unit</li> <li>8. Stop frequency and unit</li> <li>9. Central frequency and unit</li> <li>10. Bandwidth and unit</li> <li>11. Modulation type</li> </ol>
GR-LTSR-004	<p>Proprietor data must at least include the following fields:</p> <ol style="list-style-type: none"> <li>1. Proprietor ID</li> <li>2. Proprietor Chinese name</li> <li>3. Proprietor English name</li> <li>4. Web URL</li> <li>5. Value added tax no.</li> <li>6. Business registration no.</li> </ol>

	7. Telephone 8. Fax 9. Address 10. Responsible person full name 11. Responsible person identification no. 12. Responsible person telephone 13. Responsible person address
GR-LTSR-005	Station data must at least include the following fields: 1. Station ID 2. Name 3. Address 4. Height 5. Altitude 6. Height of antenna tower 7. Manager 8. Manager telephone 9. Manager mobile phone 10. Usage ID 11. Technical manager name 12. Technical manager telephone
GR-LTSR-006	Antenna data must at least include the following fields: 1. Antenna ID 2. Manufacture 3. Model no. 4. Serial no.

	5. Type 6. Dimension 7. Location 8. Height 9. Yaw 10. Gain 11. Frequency band 12. Number of antenna 13. bearing capacity
GR-LTSR-007	The design for database tables, field name, data type, and schema must be consistent with that of buyer's spectrum management database; if there is any inconsistency, the spectrum management database prevails.

### 2.1.11 Spectrum monitoring database requirements(SMDR)

The section specifies the requirements for the storage and application of radio monitoring measurement tasks and results. They are stated as follows:

No.	Description
GR-SMDR-001	Spectrum monitoring database must at least include the following five types of data: <ol style="list-style-type: none"> <li>1. Monitoring station data</li> <li>2. Station's equipments data</li> <li>3. Users data</li> <li>4. Radio monitoring task parameter settings, including at least the following data: <ol style="list-style-type: none"> <li>(1) Signal measurement task parameter settings</li> </ol> </li> </ol>

	<ul style="list-style-type: none"> <li>(2) Direction-finding/location task parameter settings</li> <li>(3) Direction-finding scan task parameter settings</li> <li>(4) Spectrum occupancy measurement task parameter settings</li> <li>(5) Transmitter signal analysis and identification task parameter settings</li> <li>(6) Unknown transmitter detection task parameter settings</li> <li>(7) Coverage measurement task parameter settings</li> <li>(8) Audio record task parameter setting</li> <li>(9) Automatic measurement task parameter settings</li> </ul> <p>5. Radio monitoring task results, including at least the following data:</p> <ul style="list-style-type: none"> <li>(1) Signal measurement task results</li> <li>(2) Direction-finding/location task results</li> <li>(3) Direction-finding scan task results</li> <li>(4) Spectrum occupancy measurement task results</li> <li>(5) Transmitter signal analysis and identification task results</li> <li>(6) Unknown transmitter detection task results</li> <li>(7) Coverage measurement task results</li> <li>(8) Audio record task results</li> <li>(9) Automatic measurement task results</li> </ul>
GR-SMDR-002	The design of the database must include a complete database schema designed correspondingly in accordance

	with the actual radio monitoring software functionalities, and a set of system data tables storing the system basic data records.
GR-SMDR-003	The fields used to describe monitoring stations should at least include station ID, station name, station address, build date, station longitude, station latitude etc.
GR-SMDR-004	The fields used to describe the equipments installed in monitoring stations should at least include station ID, equipment name, available date, replaced date, manufacture, etc.
GR-SMDR-005	The fields used to describe the users authorized to operate the system should at least include user/operator ID, access right, telephone, department, etc.
GR-SMDR-006	The fields used to describe the various measurement task parameter settings should at least include measuring station ID, user/operator ID, measurement task ID, etc.
GR-SMDR-007	The fields used to describe the various measurement task results should at least include measuring station ID, user/operator ID, measurement task ID, and other appropriate fields describing the measurement results.
GR-SMDR-008	Depending on the operation modes the measurement task is used, the control workstation that initiates the measurement task can choose to disconnect with the involved remote stations after submitting and starting the task. During the disconnected measurement period, the monitoring results



	should be stored temporarily in the station's local database, and the spectrum monitoring database system should constantly synchronize all of the finished measurement results from the local databases.
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## **2.2 MONITORING STATION TYPE-SPECIFIC FUNCTIONAL REQUIREMENT (MSTFR)**

The type-specific functional requirements for all the types of monitoring stations are described in terms of individual station type specific functions, and are classified as follows:

1. Monitoring and direction finding stations (Type I)
2. Monitoring stations (Type II)
3. Mobile monitoring station of Type I (Type I)
4. Mobile monitoring station of Type II (Type II)
5. Mobile monitoring station of Type III (Type III)
6. Transportable monitoring station
7. Portable monitoring station

### **2.2.1 Requirement for fixed monitoring station with DF (Type I)**

<b>No.</b>	<b>Description</b>
FMSFR-Type1-001	The station should offer the radio monitoring tools that are specified in the requirement specifications GR-RMTR-001 to 009 and the related user interface requirements GR-UIR-001 to 007 in Section 2.1.
FMSFR-Type1-002	Signal measurement task tool should be compliant to : <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008.</li> <li>2. The signal measurement functionalities specified in GR-RMTR-010.</li> </ol>

FMSFR-Type1-003	<p>Direction-finding and location task tool should be compliant to :</p> <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008</li> <li>2. The direction-finding and location functionalities specified in GR-RMTR-011.</li> </ol>
FMSFR-Type1-004	<p>Direction-finding scan task tool should be compliant to :</p> <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008</li> <li>2. The direction-finding scan functionalities specified in GR-RMTR-012.</li> </ol>
FMSFR-Type1-005	<p>Transmitters signal analysis and identification task tool should be compliant to :</p> <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008</li> <li>2. The transmitters signal analysis and identification functionalities specified in GR-RMTR-013.</li> </ol>
FMSFR-Type1-006	<p>Spectrum occupancy measurement task tool should be compliant to :</p> <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008</li> <li>2. The spectrum occupancy measurement functionalities specified in GR-RMTR-014.</li> </ol>
FMSFR-Type1-007	<p>Unknown transmitters detection task tool should be compliant to :</p> <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008</li> <li>2. The unknown transmitters detection functionalities specified in GR-RMTR-016.</li> </ol>
FMSFR-Type1-008	<p>Audio recording task tool should be compliant to :</p> <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008</li> <li>2. The audio recording functionalities specified in GR-RMTR-017.</li> </ol>
FMSFR-Type1-009	<p>Automatic measurement task tool should be compliant to :</p> <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008</li> <li>2. The automatic measurement functionalities specified in GR-RMTR-018.</li> </ol>

FMSFR-Type1-010	<p>Measurement result management tool should be compliant to :</p> <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008</li> <li>2. The measurement result management functionalities specified in GR-RMTR-019.</li> </ol>
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### 2.2.2 Requirement for fixed monitoring station with DF (Type II)

No.	Description
FMSFR-Type2-001	The station should offer the radio monitoring tools that are specified in the requirement specifications GR-RMTR-001 to 009 and the related user interface requirements GR-UIR-001 to 007 in Section 2.1.
FMSFR-Type2-002	<p>Signal measurement task tool should be compliant to :</p> <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008.</li> <li>2. The signal measurement functionalities specified in GR-RMTR-010.</li> </ol>
FMSFR-Type2-003	<p>Transmitters signal analysis and identification task tool should be compliant to :</p> <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008</li> <li>2. The transmitters signal analysis and identification functionalities specified in GR-RMTR-013.</li> </ol>
FMSFR-Type2-004	<p>Spectrum occupancy measurement task tool should be compliant to :</p> <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008</li> <li>2. The spectrum occupancy measurement functionalities specified in GR-RMTR-014.</li> </ol>
FMSFR-Type2-005	<p>Audio recording task tool should be compliant to :</p> <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008</li> <li>2. The audio recording functionalities specified in GR-RMTR-017.</li> </ol>
FMSFR-Type2-006	<p>Automatic measurement task tool should be compliant to :</p> <ol style="list-style-type: none"> <li>1. The user interface specification GR-UIR-008</li> </ol>

	2. The automatic measurement functionalities specified in GR-RMTR-018.
FMSFR-Type2-007	Measurement result management tool should be compliant to : 1. The user interface specification GR-UIR-008 2. The measurement result management functionalities specified in GR-RMTR-019.

### 2.2.3 Requirement for mobile monitoring station SUV vehicle (Type I)

No.	Description
MMSFR-Type1-001	The station should offer the radio monitoring tools that are specified in the requirement specifications GR-RMTR-001 to 009 and the related user interface requirements GR-UIR-001 to 007 in Section 2.1.
MMSFR-Type1-002	Signal measurement task tool should be compliant to : 1. The user interface specification GR-UIR-008. 2. The signal measurement functionalities specified in GR-RMTR-010.
MMSFR-Type1-003	The frequency range for signal measurement should include at least VHF/UHF Band °.
MMSFR-Type1-004	Direction-finding and location task tool should be compliant to : 1. The user interface specification GR-UIR-008 2. The direction-finding and location functionalities specified in GR-RMTR-011.
MMSFR-Type1-005	The frequency range for direction-finding and location should include at least VHF/UHF Band °.
MMSFR-Type1-006	Transmitters signal analysis and identification task tool should be compliant to : 1. The user interface specification GR-UIR-008 2. The transmitters signal analysis and identification functionalities specified in GR-RMTR-013.
MMSFR-Type1-007	Spectrum occupancy measurement task tool should be compliant to : 1. The user interface specification GR-UIR-008

	2. The spectrum occupancy measurement functionalities specified in GR-RMTR-014.
MMSFR-Type1-008	Transmitters coverage measurement task tool should be compliant to : 1. The user interface specification GR-UIR-008 2. The transmitters coverage measurement functionalities specified in GR-RMTR-015.
MMSFR-Type1-009	Audio recording task tool should be compliant to : 1. The user interface specification GR-UIR-008 2. The audio recording functionalities specified in GR-RMTR-017.
MMSFR-Type1-010	Measurement result management tool should be compliant to : 1. The user interface specification GR-UIR-008 2. The measurement result management functionalities specified in GR-RMTR-019.
MMSFR-Type1-011	The station should offer exam-fraud signal detection task tool with the following requirements: 1. User interface includes: (1) Make parameter settings (e.g., start frequency, stop frequency, bandwidth, noise level threshold, store interval, measure duration, etc.) (2) Display measurement results in graphic and tabular form. 2. Users should be able to choose to generate signal activity mask based on a period of monitoring for the exam environment and then uses it as the normal signal activity scene for abnormal signal detection in the same environment. 3. Automatic alarm should be prompted immediately if there are abnormal signal detected during the detection process. 4. Direction-finding and location functionalities should be integrated to measure the direction and location of the abnormal signal emission and to display them in the digital map for a period of at least 30 seconds.

	5. The signal alarm should be repeatedly sent if necessary.
MMSFR-Type1-012	<p>The station should offer homing direction-finding and location task tool with the following requirements:</p> <ol style="list-style-type: none"> <li>1. User interface includes : <ol style="list-style-type: none"> <li>(1) Make parameter settings (e.g., central frequency, bandwidth, store interval, measure duration, etc.)</li> <li>(2) Display measurement results in graphic and tabular form.</li> <li>(3) Flexibility of bearing selection.</li> </ol> </li> <li>2. Frequency bands are : <ol style="list-style-type: none"> <li>(1) VHF</li> <li>(2) UHF</li> </ol> </li> <li>3. Digital map should display the locating result while the vehicle is moving for finding the signal source.</li> <li>4. The parameter settings (refer to UIR-008) of the task can be stored along with the measure results (such as date, start time, stop time, frequency, confidence value, azimuths in relative to the stations, location method, transmitter latitude, and transmitter longitude) in the spectrum monitoring database.</li> </ol>

#### 2.2.4 Requirement for mobile monitoring station VAN vehicle (Type II)

No.	Description
MMSFR-Type2-001	The station should offer the radio monitoring tools that are specified in the requirement specifications GR-RMTR-001 to 009 and the related user interface requirements GR-UIR-001 to 007 in Section 2.1.
MMSFR-Type2-002	Signal measurement task tool should be compliant with MMSFR-Type1-002.
MMSFR-Type2-003	The frequency range for signal measurement should include at least MF/HF/VHF/UHF Band.
MMSFR-Type2-004	Direction-finding and location task tool should be compliant with the specification MMSFR-Type1-004.

MMSFR-Type2-005	The frequency range for direction-finding and location should be compliant with MMSFR-Type1-005
MMSFR-Type2-006	Transmitters signal analysis and identification task tool should be compliant with the specification MMSFR-Type1-006.
MMSFR-Type2-007	Spectrum occupancy measurement task tool should be compliant with the specification MMSFR-Type1-007.
MMSFR-Type2-008	Transmitters coverage measurement task tool should be compliant with the specification MMSFR-Type1-008.
MMSFR-Type2-009	Audio recording task tool should be compliant with the specification MMSFR-Type1-009.
MMSFR-Type2-0010	Measurement result management tool should be compliant with the specification MMSFR-Type1-0010.
MMSFR-Type2-011	Exam-fraud signal detection tool should be compliant with the specification MMSFR-Type1-011.
MMSFR-Type2-012	Homing direction-finding and location task tool should be compliant with the specification MMSFR-Type1-012.
MMSFR-Type2-013	<p>The station should offer V/UHF signal analysis and identification task tool with the following requirements:</p> <ol style="list-style-type: none"> <li>1. User interface includes: <ol style="list-style-type: none"> <li>(1) Parameter settings for signal analysis and identification, e.g., start frequency, stop frequency, bandwidth, noise level threshold, store interval, measure period, etc.</li> <li>(2) Display measurement results in graphic and tabular form, e.g., constellation diagram, eyes diagram, spectral power density histogram, instantaneous frequency histogram, instantaneous phase histogram, and instantaneous amplitude histogram.</li> </ol> </li> <li>2. Users can specify transmitter frequency or other related parameter to do the signal analysis and</li> </ol>

	<p>identification task.</p> <p>Users can specify the whole or parts of the licensed transmitter database to do the signal analysis and identification task.</p>
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### 2.2.5 Requirement for mobile monitoring station for SHF (Type III)

No.	Description
MMSFR-Type3-001	<p>The station should offer SHF signal measurement task tool with the following requirements:</p> <ol style="list-style-type: none"> <li>1. User interface includes: <ol style="list-style-type: none"> <li>(1) Make parameter setting, e.g., central frequency, bandwidth etc.</li> <li>(2) Display measurement results in graphic and tabular form.</li> </ol> </li> <li>2. Signal measurement task must be able to measure radio signal features, including: <ol style="list-style-type: none"> <li>(1) RF level</li> <li>(2) Frequency deviation</li> <li>(3) Occupied Bandwidth</li> <li>(4) Field strength</li> <li>(5) Emission Class</li> <li>(6) Observed Polarization</li> </ol> </li> <li>3. Other signal measurement specifications that are not stated here should be compliant with the recommendation from ITU-R Spectrum Monitoring Handbook 2011 Chapter 4 Sections 4.8.</li> </ol>
MMSFR-Type3-002	<p>The station should offer SHF signal measurement task tool with the following requirements:</p> <ol style="list-style-type: none"> <li>1. User interface includes: <ol style="list-style-type: none"> <li>(1) Parameter settings for direction-finding and location task (e.g., central frequency, bandwidth, and measure period etc.)</li> <li>(2) Display measurement result in the form of Radar chart</li> </ol> </li> <li>2. Be able to make location of single source by means</li> </ol>



	<p>of single-station multiple positions measurement.</p> <p>3. Display both the location results and all of the related stations in the digital map according their own coordinates.</p> <p>4. Other direction-finding and location specifications that are not stated here should be compliant with the recommendation from ITU-R Spectrum Monitoring Handbook 2011 Chapter 4 Sections 4.7.</p>
MMSFR-Type3-003	<p>The station should offer SHF signal analysis and identification task tool with the following requirements:</p> <p>3. User interface includes:</p> <p>(3) Parameter settings for signal analysis and identification, e.g., start frequency, stop frequency, bandwidth, noise level threshold, store interval, measure period, etc.</p> <p>(4) Display measurement results in graphic and tabular form, e.g., constellation diagram, eyes diagram, spectral power density histogram, instantaneous frequency histogram, instantaneous phase histogram, and instantaneous amplitude histogram.</p> <p>4. Users can specify transmitter frequency or other related parameter to do the signal analysis and identification task.</p> <p>5. Users can specify the whole or parts of the licensed transmitter database to do the signal analysis and identification task.</p>
MMSFR-Type3-004	<p>Measurement results and the associated parameter settings can be stored temporally in an equipped removable storage device, e.g., a USB removable disk, and then be off-line imported into the spectrum monitoring database.</p>
MMSFR-Type3-005	<p>Users are able to instruct the station to adjust the azimuth, and elevation angle of each equipped antennas in order for accomplishing the measurement tasks.</p>

## 2.2.6 Requirement for transportable monitoring station

<b>No.</b>	<b>Description</b>
TMSFR-001	The station should offer the radio monitoring tools that are specified in the requirement specifications GR-RMTR-001 to 009 and the related user interface requirements GR-UIR-001 to 007 in Section 2.1.
TMSFR-002	Signal measurement task tool should be compliant with MMSFR-Type1-002.
TMSFR-003	The frequency range for signal measurement should be compliant with MMSFR-Type1-003.
TMSFR-004	Direction-finding and location task tool should be compliant with MMSFR-Type1-004.
TMSFR-005	The frequency range for direction-finding and location task should be compliant with MMSFR-Type1-005.
TMSFR-006	Spectrum occupancy measurement task tool should be compliant with the specification MMSFR-Type1-007.
TMSFR-007	Audio recording task tool should be compliant with the specification MMSFR-Type1-009.
TMSFR-008	Measurement result management tool should be compliant with the specification MMSFR-Type1-0010.
TMSFR-009	Same as MMSFR-Type1-011
TMSFR-010	Same as MMSFR-Type1-012

### **2.2.7 Requirement for portable monitoring station**

<b>No.</b>	<b>Description</b>
PMSFR -001	The station should offer signal measurement capability that is compliant with the specification GR-RMTR-010 and its associated user interface requirement (GR-UIR-8), except the method of storing the measurement results, where the measurement results and the associated parameter settings can be stored temporally in an equipped removable storage device, e.g., a USB removable disk, and then be off-line imported into the spectrum monitoring database.

PMSFR -002	The station should be able to make location of signal interference source by means of single-station multiple positions measurement, and display both the location results and all of the related stations in the digital map according their own coordinates.
PMSFR -003	To help user search for signal source in an indoor difficult environment, the station should equip with a handheld directional antenna, alarm voice varying with the measured field strength, and Radar chart etc. user interface and function.
PMSFR -004	The frequency range for direction-finding and location task should include VHF/UHF.
PMSFR -005	Audio recording task tool should be compliant with the specification MMSFR-Type1-009.

### 3. THE HARDWARE REQUESTS OF SPECTRUM MONITORING SYSTEM

#### 3.1 SPECIFICATIONS OF FIXED MONITORING STATION

##### 3.1.1 The Type of both Monitoring and Direction Finding Stations

##### 3.1.1.1 Antenna of monitoring

No.	Parameter	Specification
MF/HF		
FST1-SMAT-HF-001	Frequency Range	300kHz to 30MHz
FST1-SMAT-HF-002	Polarization	Vertical
FST1-SMAT-HF-003	Pattern	Omni-directional
FST1-SMAT-HF-004	Impedance	50Ω
FST1-SMAT-HF-005	VSWR	$\leq 3$ (3:1)
FST1-SMAT-HF-006	Cable loss	$\leq 0.02\text{dB/m}$
FST1-SMAT-HF-007	Antenna System	Active
VHF/UHF		
FST1-SMAT-VHF-001	Frequency Range	20MHz to 3GHz
FST1-SMAT-VHF-002	Polarization	Vertical, Optional: horizontal
FST1-SMAT-VHF-003	Pattern	Omni-directional
FST1-SMAT-VHF-004	Impedance	50Ω
FST1-SMAT-VHF-005	VSWR	$\leq 2.5$ (2.5:1)
FST1-SMAT-VHF-006	Cable loss	30MHz< $f$ ≤300MHz : $\leq 0.06\text{dB/m}$
		300MHz< $f$ ≤1GHz : $\leq$ 0.1dB/m
		1GHz< $f$ ≤2GHz : $\leq$ 0.14dB/m
		2GHz< $f$ ≤3GHz : $\leq$ 0.18dB/m
FST1-SMAT-VHF-007	Antenna Mode	Passive

### 3.1.1.2 Monitoring Receiver

No.	Parameter	Specification
MF/HF		
FST1-RXHF-001	Frequency Range	300kHz to 30MHz
FST1-RXHF-002	Tuning resolution	1Hz
FST1-RXHF-003	3 <sup>rd</sup> Order Intercept (IP3)	$\geq 25\text{dBm}$
FST1-RXHF-004	2 <sup>nd</sup> Order Intercept (IP2)	$\geq 70\text{dBm}$
FST1-RXHF-005	Noise figure	$\leq 15\text{dB}$
FST1-RXHF-006	Scanning speed	1GHz/s
FST1-RXHF-007	Lo-Phase Noise	$\leq -100\text{dBc/Hz}$ (offset 10kHz)
FST1-RXHF-008	IF rejection	$\geq 80\text{dB}$
FST1-RXHF-009	Image rejection	$\geq 80\text{dB}$
FST1-RXHF-010	IF Bandwidth (-6 dB)	from 0.2kHz to at least 16kHz, or selectable
FST1-RXHF-011	Selectivity 60 to 6dB	2:1
FST1-RXHF-012	Detection modes	AM、FM、CW、LSB、 USB
FST1-RXHF-013	AGC range	$\geq 120\text{dB}$
FST1-RXHF-014	Output IF Audio IF Monitor	digital IF output 0dBm(600Ω) For external IF monitoring, or digital data stream
FST1-RXHF-015	Remote control	Ethernet LAN
FST1-RXHF-016	AC power	110V/60Hz
FST1-RXHF-017	Electromagnetic compatibility, EMC	IEC61000-4-2,-3,-4 CISPR11, Group 1, Class B
FST1-RXHF-018	Vibration	IEC68-2-6 or MIL-STD810F
VHF/UHF		
FST1-RXVHF-001	Frequency Range	20MHz to 3GHz
FST1-RXVHF-002	Tuning resolution	10Hz
FST1-RXVHF-003	3 <sup>rd</sup> Order Intercept (IP3)	$\geq 12\text{dBm}$
FST1-RXVHF-004	2 <sup>nd</sup> Order Intercept (IP2)	$\geq 40\text{dBm}$
FST1-RXVHF-005	Noise figure	$\leq 12\text{dB}$

FST1-RXVHF-006	Scanning speed	10GHz/s
FST1-RXVHF-007	Lo-Phase Noise	$\leq -110\text{dBc/Hz}$ (offset 10kHz)
FST1-RXVHF-008	IF rejection	$\geq 80\text{dB}$
FST1-RXVHF-009	Image rejection	$\geq 80\text{dB}$
FST1-RXVHF-010	IF Bandwidth(-6 dB)	At least 20MHz Optional: 40MHz
FST1-RXVHF-011	Selectivity 60 to 6dB	2:1
FST1-RXVHF-012	Detection modes	AM 、 FM 、 CW 、 LSB 、 USB
FST1-RXVHF-013	AGC range	$\geq 120\text{dB}$
FST1-RXVHF-014	Output IF/IQ  Audio IF Monitor	Digital IQ output Digital IF output 0dBm (600Ω) For external IF monitoring, or digital data stream
FST1-RXVHF-015	Remote control	Ethernet LAN
FST1-RXVHF-016	AC power	110V/60Hz
FST1-RXVHF-017	Electromagnetic compatibility, EMC	IEC61000-4-2,-3,-4 CISPR11,Group 1, Class B
FST1-RXVHF-018	Vibration	IEC68-2-6 or MIL-STD810F

### 3.1.1.3 Measurements

No.	Parameter	Specification
Frequency Measurement		
FST1-MSFM-001	Accuracy 1. Measurements of the frequencies of stations, except broadcasting stations, operating in the frequency range 9-4000kHz. 2. Measurements of the frequencies of broadcasting stations, operating in the frequency range 9-4000kHz. 3. Measurements of frequencies of	$\pm 5\text{ppm}$  $\pm 1\text{Hz}$  $\pm 1\text{Hz}$

	stations operating in the frequency range 4000kHz to 29.7MHz. 4. Measurements of frequencies of stations, except television stations, operating in the frequency range 29.7-2450MHz. 5. Measurements of frequencies of television stations operating in the frequency range 47-960MHz. 6. Measurements of frequencies of stations operating in the frequency range 2450MHz to 10.5GHz. 7. Measurements of frequencies of stations operating in the frequency range 10.5-40GHz.	±0.5ppm  ±50Hz  ±5ppm  ±10ppm
FST1-MSFM-002	Resolution	0.1Hz
Bandwidth Measurement		
FST1-MSBM-001	<b>xdB method</b> Amplitude Accuracy  BandwNo.th Accuracy  <b>β% method</b> value of β  BandwNo.th Accuracy	±1dB at -6dB ±1dB at -26dB ±10%  Default 1-99%,or selectable ±10%
Modulation Measurement		
FST1-MSMM-001	Frequency Modulation Deviation Rate Accuracy	± 5kHz to ±100kHz 20Hz to 100kHz ≤ 3%
FST1-MSMM-002	Amplitude Modulation Deviation Rate Accuracy	1% to 99% 20Hz to 100kHz ≤ 3%

FST1-MSMM-003	Phase Modulation Deviation Deviation Resolution Rate Accuracy	$\leq 8$ radian 0.1 radian 300Hz to 5kHz $\leq 3\%$
Field Measurement		
FST1-MSFS-001	Accuracy	$\leq \pm 2\text{dB}$ , less than 30MHz; $\leq \pm 3\text{dB}$ , 30MHz-3GHz
FST1-MSFS-002	Measurement Unit	dB $\mu$ V/m

#### 3.1.1.4 DF Antenna

No.	Parameter	Specification
VHF/UHF		
FST1-DFAT-VHF-001	Frequency Range	20MHz to 3GHz
FST1-DFAT-VHF-002	Polarization	Vertical, Optional: horizontal
FST1-DFAT-VHF-003	Impedance	50 $\Omega$
FST1-DFAT-VHF-004	VSWR	$\leq 3$ (3:1)
FST1-DFAT-VHF-005	Antenna System	Passive

#### 3.1.1.5 DF Processor

No.	Parameter	Specification
VHF/UHF		
FST1-DFPX-VHF-001	Frequency Range	20MHz to 3GHz
FST1-DFPX-VHF-002	Bearing Accuracy	$\leq 1.5^\circ$ rms
FST1-DFPX-VHF-003	Bearing Resolution	$\leq 0.1^\circ$
FST1-DFPX-VHF-004	DF Modulation	All types of modulation
FST1-DFPX-VHF-005	DF Sensitivity	$\leq 10\mu\text{V/m}$
FST1-DFPX-VHF-006	Scanning Speed	At least 1GHz/s, at RBW 25kHz
FST1-DFPX-VHF-007	Instantaneous Bandwidth	$\geq 20\text{MHz}$
FST1-DFPX-VHF-008	Minimum Signal duration	$\leq 1\text{ms}$
FST1-DFPX-VHF-009	Result Display	Azimuth · DF quality and signal level
* Specifications of noise figure, IP3, IF Bandwidth and other related		



parameters of DF receiver are the same as monitoring receiver.

### 3.1.1.6 Operating Equipment

No.	Parameter	Specification
Measurement Server		
FST1-OECC-001	CPU Clock	Intel Core i7 or same level $\geq 2.5\text{GHz}$
FST1-OECC-002	RAM	$\geq 4\text{GB}$
FST1-OECC-003	Hard Disk	$\geq 1\text{TB}$
FST1-OECC-004	Network Interface	Ethernet 100Mbps/1Gbps
FST1-OECC-005	LCD Monitor Size	19"
FST1-OECC-006	Power Supply	400W
FST1-OECC-007	Operating System	Windows XP or Windows 7
FST1-OECC-008	Periphery Equipments	DVD disc(R/W) 、optical mouse 、 keyboard
Power Supply		
FST1-OEPS-001	UPS AC power Capacity Backup Time	110V 3KVA $\geq 30\text{min}$ (system full load)
Network Equipment		
FST1-OENE-001	Switch Supported Speed Number of RJ45 Port TCP/IP	100Mbps/1Gbps 12 port Support IPv4 and IPv6
FST1-OENE-002	Router	At least one WAN port and 2 LAN ports
GPS receiver		
FST1-OEGPS-001	Channel number	$\geq 12$
FST1-OEGPS-002	Stability of timing	$\leq 1\mu\text{s/day}$
FST1-OEGPS-003	Frequency output	10MHz
FST1-OEGPS-004	Stability of frequency	$\leq 1 \times 10^{-11}$
FST1-OEGPS-005	Accuracy of frequency	$\leq 5 \times 10^{-12}/\text{day}$
FST1-OEGPS-006	Coordinate System	TWD97 or UTM
FST1-OEGPS-007	CEP Accuracy	$< 2.5\text{m}$
Lightening Protection		
FST1-THPTC-001	Antenna protection	External structure and

		electricity devices should be protected by lightening protection system.
FST1-THPTC-002	Other protections	Include equipment protection, signal protection and power protection

### 3.1.2 The Type of Monitoring Stations

#### 3.1.2.1 Antenna of monitoring

No.	Parameter	Specification
MF/HF		
FST2-SMAT-HF-001	Frequency Range	300kHz to 30MHz
FST2-SMAT-HF-002	Polarization	Vertical
FST2-SMAT-HF-003	Pattern	Omni-directional
FST2-SMAT-HF-004	Impedance	50Ω
FST2-SMAT-HF-005	VSWR	≤ 3 (3:1)
FST2-SMAT-HF-006	Cable loss	≤ 0.02dB/m
FST2-SMAT-HF-007	Antenna System	Active
VHF/UHF		
FST2-SMAT-VHF-001	Frequency Range	20MHz to 3GHz
FST2-SMAT-VHF-002	Polarization	Vertical, Optional: horizontal
FST2-SMAT-VHF-003	Pattern	Omni-directional
FST2-SMAT-VHF-004	Impedance	50Ω
FST2-SMAT-VHF-005	VSWR	≤ 2.5 (2.5:1)
FST2-SMAT-VHF-006	Cable loss	30MHz<f≤300MHz : ≤ 0.06dB/m
		300MHz<f≤1GHz : ≤ 0.1dB/m
		1GHz<f≤2GHz : ≤ 0.14dB/m
		2GHz<f≤3GHz : ≤ 0.18dB/m
FST2-SMAT-VHF-007	Antenna Mode	Passive

### 3.1.2.2 Monitoring Receiver

No.	Parameter	Specification
MF/HF		
FST2-RXHF-001	Frequency Range	300kHz to 30MHz
FST2-RXHF-002	Tuning resolution	1Hz
FST2-RXHF-003	3 <sup>rd</sup> Order Intercept (IP3)	$\geq 25\text{dBm}$
FST2-RXHF-004	2 <sup>nd</sup> Order Intercept (IP2)	$\geq 70\text{dBm}$
FST2-RXHF-005	Noise figure	$\leq 15\text{dB}$
FST2-RXHF-006	Scan speed	1GHz/s
FST2-RXHF-007	Lo-Phase Noise	$\leq -100\text{dBc/Hz}$ (offset 10kHz)
FST2-RXHF-008	IF rejection	$\geq 80\text{dB}$
FST2-RXHF-009	Image rejection	$\geq 80\text{dB}$
FST2-RXHF-010	IF Bandwidth (-6 dB)	from 0.2kHz to at least 16kHz, or selectable
FST2-RXHF-011	Selectivity 60 to 6dB	2:1
FST2-RXHF-012	Detection modes	AM 、 FM 、 CW 、 LSB 、 USB
FST2-RXHF-013	AGC range	$\geq 120\text{dB}$
FST2-RXHF-014	Output IF Audio IF Monitor	digital IF output 0dBm(600Ω) For external IF monitoring, or digital data stream
FST2-RXHF-015	Remote control	Ethernet LAN
FST2-RXHF-016	AC power	110V/60Hz
FST2-RXHF-017	Electromagnetic compatibility, EMC	IEC61000-4-2,-3,-4 CISPR11, Group 1, Class B
FST2-RXHF-018	Vibration	IEC68-2-6 or MIL-STD810F
VHF/UHF		
FST2-RXVHF-001	Frequency Range	20MHz to 3GHz
FST2-RXVHF-002	Tuning resolution	10Hz
FST2-RXVHF-003	3 <sup>rd</sup> Order Intercept (IP3)	$\geq 12\text{dBm}$
FST2-RXVHF-004	2 <sup>nd</sup> Order Intercept (IP2)	$\geq 40\text{dBm}$

FST2-RXVHF-005	Noise figure	$\leq 12\text{dB}$
FST2-RXVHF-006	Scan speed	10GHz/s
FST2-RXVHF-007	Lo-Phase Noise	$\leq -110\text{dBc/Hz}$ (offset 10kHz)
FST2-RXVHF-008	IF rejection	$\geq 80\text{dB}$
FST2-RXVHF-009	Image rejection	$\geq 80\text{dB}$
FST2-RXVHF-010	IF Bandwidth(-6 dB)	At least 20MHz Optional: 40MHz
FST2-RXVHF-011	Selectivity 60 to 6dB	2:1
FST2-RXVHF-012	Detection modes	AM 、 FM 、 CW 、 LSB 、 USB
FST2-RXVHF-013	AGC range	$\geq 120\text{dB}$
FST2-RXVHF-014	Output IF/IQ  Audio IF Monitor	Digital IQ output Digital IF output 0dBm (600 $\Omega$ ) For external IF monitoring, or digital data stream
FST2-RXVHF-015	Remote control	Ethernet LAN
FST2-RXVHF-016	AC power	110V/60Hz
FST2-RXVHF-017	Electromagnetic compatibility, EMC	IEC61000-4-2,-3,-4 CISPR11, Group 1, Class B
FST2-RXVHF-018	Vibration	IEC68-2-6 or MIL-STD810F

### 3.1.2.3 Measurements

No.	Specification
Frequency Measurement	
FST2-MSFM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.337-3)
Bandwidth Measurement	
FST2-MSBM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.443)
Modulation Measurement	
FST2-MSMM-001	Same as 3.1.1.3

	(According to the Recommendations of ITU-R SM.328)
Field Strength Measurement	
FST2-MSFS-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.378)

#### 3.1.2.4 Operating Equipment

No.	Parameter	Specification
Measurement Server		
FST2-OECC-001	CPU Clock	Intel Core i7 or same level $\geq 2.5\text{GHz}$
FST2-OECC-002	RAM	$\geq 4\text{GB}$
FST2-OECC-003	Hard Disk	$\geq 1\text{TB}$
FST2-OECC-004	Network Interface	Ethernet 100Mbps/1Gbps
FST2-OECC-005	LCD Monitor Size	19"
FST2-OECC-006	Power Supply	400W
FST2-OECC-007	Operating System	Windows XP or Windows 7
FST2-OECC-008	Periphery Equipments	DVD disc(R/W) 、optical mouse 、 keyboard
Power Supply		
FST2-OEPS-001	UPS AC power Capacity Backup Time	110V 3KVA $\geq 30\text{min}$ (system full load)
Network Equipment		
FST2-OENE-001	Switch Supported Speed Number of RJ45 Port TCP/IP	100Mbps/1Gbps 12 port Support IPv4 and IPv6
FST2-OENE-002	Router	At least one WAN port and 2 LAN ports
GPS receiver		
FST2-OEGPS-001	Channel number	$\geq 12$
FST2-OEGPS-002	Stability of timing	$\leq 1\mu\text{s/day}$
FST2-OEGPS-003	Frequency output	10MHz
FST2-OEGPS-004	Stability of frequency	$\leq 1 \times 10^{-11}$
FST2-OEGPS-005	Accuracy of frequency	$\leq 5 \times 10^{-12}/\text{day}$
FST2-OEGPS-006	Coordinate System	TWD97 or UTM

FST2-OEGPS-007	CEP Accuracy	<2.5m
Lightening Protection		
FST2-THPTC-001	Antenna Protection	External structure and electricity devices should be protected by lightening protection system.
FST2-THPTC-002	Other protections	Include equipment protection, signal protection and power protection

## 3.2 SPECIFICATIONS OF MOBILE MONITORING STATION

### 3.2.1 Mobile Monitoring Station of Type I

#### 3.2.1.1 Specifications of Vehicle

No.	Parameter	Specification
Dimension		
MS-T1VS-CP-001	Type	SUV
MS-T1VS-CP-002	Seating Capacity	At least 2 seatings
MS-T1VS-CP-003	Length/WNo.th/Height	$\leq 5000/2000/1800$ mm
MS-T1VS-CP-004	Gross Vehicle Weight	$\leq 3,000$ kg
MS-T1VS-CP-005	Pay Load	$\geq 1,000$ kg
General Component		
MS-T1VS-GC-001	Engine	Diesel or Turbo engine
MS-T1VS-GC-002	Number of Cylinders	4-6
MS-T1VS-GC-003	Displacement	$\geq 3000$ c.c
MS-T1VS-GC-004	Horsepower	$\geq 150$ hp at 4000rpm
MS-T1VS-GC-005	Torque	$\geq 300$ Nm at 500rpm
MS-T1VS-GC-006	Transmission	$\geq$ Six-speed steptronic
MS-T1VS-GC-007	Drivetrain	4-wheel drive system
MS-T1VS-GC-008	Cargo volume	$\geq 1500$ L
MS-T1VS-GC-009	Alternative Tire	1
MS-T1VS-GC-010	Air-conditioning	Climate Control
MS-T1VS-GC-011	Regulation	Should pass the inspection of regulators

### 3.2.1.2 Antenna of Monitoring

No.	Parameter	Specification
VHF/UHF		
MS-T1AT-VHF-001	Frequency Range	20MHz to 3GHz
MS-T1AT-VHF-002	Polarization	Vertical, Optional: horizontal
MS-T1AT-VHF-003	Impedance	50Ω
MS-T1AT-VHF-004	VSWR	≤2.5 (2.5:1)
MS-T1AT-VHF-005	Cable loss	30MHz<f≤300MHz : ≤ 0.06dB/m
		300MHz<f≤1GHz : ≤ 0.1dB/m
		1GHz<f≤2GHz : ≤ 0.14dB/m
		2GHz<f≤3GHz : ≤ 0.18dB/m
MS-T1AT-VHF-006	Antenna System	Passive

### 3.2.1.3 Monitoring Receiver

No.	Parameter	Specification
VHF/UHF		
MS-T1RX-VHF-001	Frequency Range	20MHz to 3GHz
MS-T1RX-VHF-002	Tuning resolution	10Hz
MS-T1RX-VHF-003	3 <sup>rd</sup> Order Intercept (IP3)	≥12dBm
MS-T1RX-VHF-004	2 <sup>nd</sup> Order Intercept (IP2)	≥40dBm
MS-T1RX-VHF-005	Noise figure	≤12dB
MS-T1RX-VHF-006	Scanning speed	10GHz/s
MS-T1RX-VHF-007	Lo-Phase Noise	≤-110dBc/Hz (offset 10KHz)
MS-T1RX-VHF-008	IF rejection	≥80dB
MS-T1RX-VHF-009	Image rejection	≥80dB
MS-T1RX-VHF-010	IF Bandwidth (-6 dB)	At least 20MHz Optional: 40MHz
MS-T1RX-VHF-011	Selectivity 60 to 6dB	2:1
MS-T1RX-VHF-012	Detection modes	AM 、 FM 、 CW 、 LSB 、

		USB
MS-T1RX-VHF-013	AGC range	$\geq 120\text{dB}$
MS-T1RX-VHF-014	Output IF/IQ  Audio IF Monitor	Digital IQ output Digital IF output 0dBm (600 $\Omega$ ) For external IF monitoring, or digital data stream
MS-T1RX-VHF-015	Remote control	Ethernet LAN
MS-T1RX-VHF-016	AC power	110V/60Hz
MS-T1RX-VHF-017	Electromagnetic compatibility, EMC	IEC61000-4-2,-3,-4 CISPR11,Group1,Class B
MS-T1RX-VHF-018	Vibration	IEC68-2-6 or MIL-STD810F

#### 3.2.1.4 Measurements

No.	Specification
Frequency Measurement	
FST2-MSFM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.337-3)
Bandwidth Measurement	
FST2-MSBM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.443)
Modulation Measurement	
FST2-MSMM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.328)
Field Strength Measurement	
FST2-MSFS-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.378)

#### 3.2.1.5 DF Antenna

No.	Parameter	Specification
VHF/UHF		
MS-T1DF-VHF-001	Frequency Range	20MHz to 3GHz
MS-T1DF-VHF-002	Polarization	Vertical Optional: horizontal



MS-T1DF-VHF-003	Impedance	50Ω
MS-T1DF-VHF-004	VSWR	$\leq 3$ (3:1)
MS-T1DF-VHF-005	Antenna System	Passive

### 3.2.1.6 DF Processor

No.	Parameter	Specification
VHF/UHF		
MS-T1PX-VHF-001	Frequency Range	20MHz to 3GHz
MS-T1PX-VHF-002	Bearing Accuracy	$\leq 1.5^{\circ}$ rms
MS-T1PX-VHF-003	Bearing Resolution	$\leq 0.1^{\circ}$
MS-T1PX-VHF-004	DF Modulation	All types of modulation
MS-T1PX-VHF-005	DF Sensitivity	$\leq 10\mu\text{V/m}$
MS-T1PX-VHF-006	Scanning Speed	At least 1GHz/s, at RBW 25kHz
MS-T1PX-VHF-007	Instantaneous Bandwidth	$\geq 20\text{MHz}$
MS-T1PX-VHF-008	Minimum Signal duration	$\leq 1\text{ms}$
MS-T1PX-VHF-009	Result Display	Azimuth 、DF quality and signal Level
* Specifications of noise figure, IP3, IF Bandwidth and other related parameters of DF receiver are the same as monitoring receiver.		

### 3.2.1.7 Operating Equipment

No.	Parameter	Specification
Work Station & Measurement Server		
MS-T1OE-WS-001	Type	Notebook
MS-T1OE-WS-002	CPU Clock rate	Intel Core i7 or same level $\geq 2.5\text{GHz}$
MS-T1OE-WS-003	RAM	$\geq 4\text{GB}$
MS-T1OE-WS-004	Hard Disk	$\geq 1\text{TB}$
MS-T1OE-WS-005	Network Interface	Ethernet 100Mbps/1Gbps
MS-T1OE-WS-006	LCD Monitor Size	19"
MS-T1OE-WS-007	Power Supply	400W
MS-T1OE-WS-008	Operating System	Windows XP or Windows 7
MS-T1OE-WS-009	Periphery Equipment	DVD ROM(R/W) 、optical mouse 、keyboard
Power Supply		

MS-T1OE-PS-001	Rechargeable Battery DC power AC power Capacity Backup Time Recharge mode	12V 110V 3KVA $\geq 2\text{Hr}$ (system full load) Can be recharged through 110V AC power or alternator.
Network Equipment		
MS-T1OE-NE-001	Switch Supported Speed Number of RJ45 Port TCP/IP	100Mbps/1Gbps 12port Support IPv4 and IPv6
MS-T1OE-NE-002	3G router	At least 2 LAN ports
GPS receiver		
MS-T1OE-GPS-001	Channel number	$\geq 12$
MS-T1OE-GPS-002	Stability of timing	$\leq 1\mu\text{s/day}$
MS-T1OE-GPS-003	Frequency output	10MHz
MS-T1OE-GPS-004	Stability of frequency	$\leq 1 \times 10^{-11}$
MS-T1OE-GPS-005	Accuracy of frequency	$\leq 5 \times 10^{-12}/\text{day}$
MS-T1OE-GPS-006	Coordinate System	TWD97 or UTM
MS-T1OE-GPS-007	CEP Accuracy	<2.5m

### 3.2.2 Mobile Monitoring Station of Type II

#### 3.2.2.1 Specifications of Vehicle

No.	Parameter	Specification
Dimension		
MS-T2VS-CP-001	Type	van
MS-T2VS-CP-002	Seating capacity	At least 3 seats
MS-T2VS-CP-003	Length/WNo.th/Height	$\leq 5500/2000/2500$ mm
MS-T2VS-CP-004	Gross Vehicle Weight	$\leq 4,800\text{kg}$
MS-T2VS-CP-005	Pay Load	$\geq 1,500\text{kg}$
General Component		
MS-T2VS-GC-001	Engine	Diesel or turbo engine
MS-T2VS-GC-002	Number of Cylinders	4-6
MS-T2VS-GC-003	Displacement	$\geq 3000\text{c.c}$
MS-T2VS-GC-004	Horsepower	$\geq 180\text{hp}$ at 4000rpm

MS-T2VS-GC-005	Torque	$\geq 400\text{Nm}$ at 2500rpm
MS-T2VS-GC-006	Transmission	$\geq$ Six-speed steptronic
MS-T2VS-GC-007	Drivetrain	4-wheel drive system
MS-T2VS-GC-008	Alternative Tire	1
MS-T2VS-GC-009	Air-conditioning	Climate control
MS-T2VS-GC-010	Regulation	Should pass the inspection of regulators

### 3.2.2.2 Antenna of monitoring

No.	Parameter	Specification
MF/HF		
MS-T2AT-HF-001	Frequency Range	300kHz to 30MHz
MS-T2AT-HF-002	Polarization	Vertical
MS-T2AT-HF-003	Impedance	$50\Omega$
MS-T2AT-HF-004	VSWR	$\leq 3$ (3:1)
MS-T2AT-HF-005	Cable loss	$\leq 0.02\text{dB/m}$
MS-T2AT-HF-006	Antenna System	Active
VHF/UHF/SHF		
MS-T2AT-VHF-001	Frequency Range	20MHz to 30GHz
MS-T2AT-VHF-002	Polarization	Vertical Optional: horizontal
MS-T2AT-VHF-003	Impedance	$50\Omega$
MS-T2AT-VHF-004	VSWR	$\leq 2.5$ (2.5:1)
MS-T2AT-VHF-005	Cable loss	$30\text{MHz} < f \leq 300\text{MHz} : \leq 0.06\text{dB/m}$
		$300\text{MHz} < f \leq 1\text{GHz} : \leq 0.1\text{dB/m}$
		$1\text{GHz} < f \leq 2\text{GHz} : \leq 0.14\text{dB/m}$
		$2\text{GHz} < f \leq 3\text{GHz} : \leq 0.18\text{dB/m}$
MS-T2AT-VHF-006	Antenna System	Passive

### 3.2.2.3 Monitoring Receiver

No.	Parameter	Specification
MF/HF		
MS-T2RX-HF-001	Frequency Range	300kHz to 30MHz
MS-T2RX-HF-002	Tuning resolution	1Hz
MS-T2RX-HF-003	3 <sup>rd</sup> Order Intercept (IP3)	$\geq 25\text{dBm}$
MS-T2RX-HF-004	2 <sup>nd</sup> Order Intercept (IP2)	$\geq 70\text{dBm}$
MS-T2RX-HF-005	Noise figure	$\leq 15\text{dB}$
MS-T2RX-HF-006	Scanning Speed	1GHz/s
MS-T2RX-HF-007	Lo-Phase Noise	$\leq -100\text{dBc/Hz}$ (offset 10kHz)
MS-T2RX-HF-008	IF rejection	$\geq 80\text{dB}$
MS-T2RX-HF-009	Image rejection	$\geq 80\text{dB}$
MS-T2RX-HF-010	IF Bandwidth(-6 dB)	From 0.2kHz to at least 16kHz,or selectable
MS-T2RX-HF-011	Selectivity 60 to 6dB	2:1
MS-T2RX-HF-012	Detection modes	AM 、 FM 、 CW 、 LSB 、 USB
MS-T2RX-HF-013	AGC range	$\geq 120\text{dB}$
MS-T2RX-HF-014	Output IF Audio IF Monitor	Digital IF output 0dBm (600Ω) For external IF monitoring, or digital data stream
MS-T2RX-HF-015	Remote control	Ethernet LAN
MS-T2RX-HF-016	AC power	110V/60Hz
MS-T2RX-HF-017	Electromagnetic compatibility, EMC	IEC61000-4-2,-3,-4 CISPR11,Group1,Class B
MS-T2RX-HF-018	Vibration	IEC68-2-6 or MIL-STD810F
VHF/UHF/SHF		
MS-T2RX-VHF-001	Frequency Range	20MHz to 3GHz
MS-T2RX-VHF-002	Tuning resolution	10Hz
MS-T2RX-VHF-003	3 <sup>rd</sup> Order Intercept (IP3)	$\geq 12\text{dBm}$
MS-T2RX-VHF-004	2 <sup>nd</sup> Order Intercept (IP2)	$\geq 40\text{dBm}$

MS-T2RX-VHF-005	Noise figure	$\leq 12\text{dB}$
MS-T2RX-VHF-006	Scanning Speed	10GHz/s
MS-T2RX-VHF-007	Lo-Phase Noise	$\leq -110\text{dBc/Hz}$ (offset 10kHz)
MS-T2RX-VHF-008	IF rejection	$\geq 80\text{dB}$
MS-T2RX-VHF-009	Image rejection	$\geq 80\text{dB}$
MS-T2RX-VHF-010	IF Bandwidth(-6 dB)	At least 20MHz
MS-T2RX-VHF-011	Selectivity 60 to 6dB	2:1
MS-T2RX-VHF-012	Detection modes	AM 、 FM 、 CW 、 LSB 、 USB
MS-T2RX-VHF-013	AGC range	$\geq 120\text{dB}$
MS-T2RX-VHF-014	Output IF/IQ  Audio IF Monitor	Digital IQ output Digital IF output 0dBm (600Ω) For external IF monitoring, or digital data stream
MS-T2RX-VHF-015	Remote control	Ethernet LAN
MS-T2RX-VHF-016	AC power	110V/60Hz
MS-T2RX-VHF-017	Electromagnetic compatibility, EMC	IEC61000-4-2,-3,-4 CISPR11,Group 1, Class B
MS-T2RX-VHF-018	Vibration	IEC68-2-6 or MIL-STD810F

#### 3.2.2.4 Measurements

No.	Specification
Frequency Measurement	
FST2-MSFM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.337-3)
Bandwidth Measurement	
FST2-MSBM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.443)
Modulation Measurement	
FST2-MSMM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.328)

Field Strength Measurement	
FST2-MSFS-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.378)

### 3.2.2.5 DF Antenna

No.	Parameter	Specification
VHF/UHF/SHF		
MS-T2DF-VHF-001	Frequency Range	20MHz to 3GHz
MS-T2DF-VHF-002	Polarization	Vertical Optional: horizontal
MS-T2DF-VHF-003	Impedance	50Ω
MS-T2DF-VHF-004	VSWR	$\leq 3$ (3:1)
MS-T2DF-VHF-005	Antenna System	Passive

### 3.2.2.6 DF Processor

No.	Parameter	Specification
VHF/UHF/SHF		
MS-T2PX-VHF-001	Frequency Range	20MHz to 3GHz
MS-T2PX-VHF-002	Bearing Accuracy	$\leq 1.5^{\circ}$ rms
MS-T2PX-VHF-003	Bearing Resolution	$\leq 0.1^{\circ}$
MS-T2PX-VHF-004	DF Modulation	All types of modulation
MS-T2PX-VHF-005	Sensitivity	$\leq 10\mu\text{V/m}$
MS-T2PX-VHF-006	Scanning Speed	At least 1GHz/s, at RBW 25kHz
MS-T2PX-VHF-007	Instantaneous Bandwidth	$\geq 20\text{MHz}$
MS-T2PX-VHF-008	Minimum Signal duration	$\leq 1\text{ms}$
MS-T2PX-VHF-009	Result Display	Azimuth 、 DF quality and Signal Level

### 3.2.2.7 Operating Equipments

No.	Parameter	Specification
Work Station & Measurement Server		
MS-T2OE-WS-001	Type	Notebook
MS-T2OE-WS-002	CPU Clock rate	Intel Core i7 or same level $\geq 2.5\text{GHz}$
MS-T2OE-WS-003	RAM	$\geq 4\text{GB}$

MS-T2OE-WS-004	Hard Disk	$\geq 1\text{TB}$
MS-T2OE-WS-005	Network Interface	Ethernet 100Mbps/1Gbps
MS-T2OE-WS-006	LCD Monitor Size	19"
MS-T2OE-WS-007	Power Supply	400W
MS-T2OE-WS-008	Operating System	Windows XP or Windows 7
MS-T2OE-WS-009	Periphery Equipments	DVD ROM(R/W) 、optical mouse
Power Supply		
MS-T2OE-PS-001	Rechargeable Battery DC power AC power Capacity Backup Time Recharge mode	12V 110V 3KVA $\geq 2\text{Hr}$ (system full load) Can be recharged through 110V AC power or alternator.
Network Equipment		
MS-T2OE-NE-001	Switch Supported Speed Number of RJ45 Port TCP/IP	100Mbps/1Gbps 12 ports Support IPv4 及 IPv6
MS-T2OE-NE-002	3G Router	At least 2 LAN ports
GPS receiver		
MS-T2OE-GPS-001	Channel number	$\geq 12$
MS-T2OE-GPS-002	Stability of timing	$\leq 1\mu\text{s/day}$
MS-T2OE-GPS-003	Frequency output	10MHz
MS-T2OE-GPS-004	Stability of frequency	$\leq 1 \times 10^{-11}$
MS-T2OE-GPS-005	Accuracy of frequency	$\leq 5 \times 10^{-12}/\text{day}$
MS-T2OE-GPS-006	Coordinate System	TWD97 or UTM
MS-T2OE-GPS-007	CEP Accuracy	$< 2.5\text{m}$

### 3.2.3 Mobile Monitoring Station of Type III

#### 3.2.3.1 Specifications of Vehicle

No.	Parameter	Specification
Dimension		
MS-T3VS-CP-001	Type	van
MS-T3VS-CP-002	Seating capacity	At least 3 seats

MS-T3VS-CP-003	Length/WNo.th/Height	$\leq 5500/2000/2500$ mm
MS-T3VS-CP-004	Gross Vehicle Weight	$\leq 4,800$ kg
MS-T3VS-CP-005	Pay Load	$\geq 1,500$ kg
General Component		
MS-T3VS-GC-001	Engine	Diesel or turbo engine
MS-T3VS-GC-002	Number of Cylinders	4-6
MS-T3VS-GC-003	Displacement	$\geq 3000$ c.c
MS-T3VS-GC-004	Horsepower	$\geq 180$ hp at 4000rpm
MS-T3VS-GC-005	Torque	$\geq 400$ Nm at 2500rpm
MS-T3VS-GC-006	Transmission	$\geq$ Six-speed steptronic
MS-T3VS-GC-007	Drivetrain	4-wheel drive system
MS-T3VS-GC-008	Alternative Tire	1
MS-T3VS-GC-009	Air-conditioning	Climate control
MS-T3VS-GC-010	Regulation	Should pass the inspection of regulators

### 3.2.3.2 Antenna of monitoring

No.	Parameter	Specification
SHF		
MS-T3AT-SHF-001	Frequency Range	3GHz to 30GHz
MS-T3AT-SHF-002	Polarization	Vertical, horizontal
MS-T3AT-SHF-003	Type	Parabolic antenna
MS-T3AT-SHF-004	Impedance	$50\Omega$
MS-T3AT-SHF-005	VSWR	$\leq 2.5$ (2.5:1)
MS-T3AT-SHF-006	Cable loss	$3\text{GHz} < f \leq 6\text{GHz} : \leq 0.26\text{dB/m}$
		$6\text{GHz} < f \leq 12\text{GHz} : \leq 0.85\text{dB/m}$
		$12\text{GHz} < f \leq 18\text{GHz} : \leq 1.04\text{dB/m}$
		$18\text{GHz} < f \leq 30\text{GHz} : \leq 1.28\text{dB/m}$
MS-T3AT-SHF-007	Antenna System	Passive



### 3.2.3.3 Monitoring Receiver

No.	Parameter	Specification
SHF		
MS-T3RX-SHF-001	Frequency Range	3GHz to 30GHz
MS-T3RX-SHF-002	Tuning resolution	10Hz
MS-T3RX-SHF-003	3 <sup>rd</sup> Order Intercept (IP3)	$\geq 15\text{dBm}$
MS-T3RX-SHF-004	2 <sup>nd</sup> Order Intercept (IP2)	$\geq 45\text{dBm}$
MS-T3RX-SHF-005	Noise figure	$\leq 12\text{dB}$
MS-T3RX-SHF-006	Scanning Speed	10GHz/s
MS-T3RX-SHF-007	Lo-Phase Noise	$\leq -110\text{dBc/Hz}$ (offset 10kHz)
MS-T3RX-SHF-008	IF rejection	$\geq 80\text{dB}$
MS-T3RX-SHF-009	Image rejection	$\geq 80\text{dB}$
MS-T3RX-SHF-010	IF Bandwidth(-6 dB)	At least 40MHz
MS-T3RX-SHF-011	Selectivity 60 to 6dB	2:1
MS-T3RX-SHF-012	Detection modes	AM 、 FM 、 CW 、 LSB 、 USB
MS-T3RX-SHF-013	AGC range	$\geq 120\text{dB}$
MS-T3RX-SHF-014	Output IF/IQ  Audio IF Monitor	Digital IQ output Digital IF output 0dBm (600Ω) For external IF monitoring, or digital data stream
MS-T3RX-SHF-015	Remote control	Ethernet LAN
MS-T3RX-SHF-016	AC power	110V/60Hz
MS-T3RX-SHF-017	Electromagnetic compatibility, EMC	IEC61000-4-2,-3,-4 CISPR11,Group 1, Class B
MS-T3RX-SHF-018	Vibration	IEC68-2-6 or MIL-STD810F

### 3.2.3.4 Measurements

No.	Specification
Frequency Measurement	
FST3-MSFM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.337-3)
Bandwidth Measurement	
FST3-MSBM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.443)
Modulation Measurement	
FST3-MSMM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.328)
Field Strength Measurement	
FST3-MSFS-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.378)

### 3.2.3.5 DF Antenna

No.	Parameter	Specification
SHF		
MS-T3DF-SHF-001	Frequency Range	3Gz to 6Hz
MS-T3DF-SHF-002	Polarization	Vertical, horizontal
MS-T3DF-SHF-003	Pattern	Parabolic antenna
MS-T3DF-SHF-004	Impedance	50Ω
MS-T3DF-SHF-005	VSWR	≤3 (3:1)
MS-T3DF-SHF-005	Antenna System	Passive

### 3.2.3.6 DF Processor

No.	Parameter	Specification
VHF/UHF/SHF		
MS-T3PX-SHF-001	Frequency Range	3GHz to 6GHz
MS-T3PX-SHF-002	Bearing Accuracy	≤ 1.5°rms
MS-T3PX-SHF-003	Bearing Resolution	≤ 0.1°
MS-T3PX-SHF-004	DF Modulation	All types of modulation
MS-T3PX-SHF-005	Sensitivity	≤ 10μV/m
MS-T3PX-SHF-006	Scanning Speed	At least 1GHz/s, at RBW 25kHz

MS-T3PX-SHF-007	Instantaneous Bandwidth	$\geq 40\text{MHz}$
MS-T3PX-SHF-008	Minimum Signal duration	$\leq 1\text{ms}$
MS-T3PX-SHF-009	Result Display	Azimuth 、DF quality and Signal Level

### 3.2.3.7 Operating Equipments

No.	Parameter	Specification
Work Station & Measurement Server		
MS-T3OE-WS-001	Type	Notebook
MS-T3OE-WS-002	CPU	Intel Core i7 or same level
	Clock rate	$\geq 2.5\text{GHz}$
MS-T3OE-WS-003	RAM	$\geq 4\text{GB}$
MS-T3OE-WS-004	Hard Disk	$\geq 1\text{TB}$
MS-T3OE-WS-005	Network Interface	Ethernet 100Mbps/1Gbps
MS-T3OE-WS-006	LCD Monitor Size	19"
MS-T3OE-WS-007	Power Supply	400W
MS-T3OE-WS-008	Operating System	Windows XP or Windows 7
MS-T3OE-WS-009	Periphery Equipments	DVD ROM(R/W) 、optical mouse
Power Supply		
MS-T3OE-PS-001	Rechargeable Battery DC power AC power Capacity Backup Time Recharge mode	12V 110V 3KVA $\geq 2\text{Hr}$ (system full load) Can be recharged through 110V AC power or alternator.
Network Equipment		
MS-T3OE-NE-001	Switch	
	Supported Speed	100Mbps/1Gbps
	Number of RJ45 Port	12 ports
	TCP/IP	Support IPv4 及 IPv6
MS-T3OE-NE-002	3G Router	At least 2 LAN ports
GPS receiver		
MS-T3OE-GPS-001	Channel number	$\geq 12$
MS-T3OE-GPS-002	Stability of timing	$\leq 1\mu\text{s/day}$
MS-T3OE-GPS-003	Frequency output	10MHz

MS-T3OE-GPS-004	Stability of frequency	$\leq 1 \times 10^{-11}$
MS-T3OE-GPS-005	Accuracy of frequency	$\leq 5 \times 10^{-12}/\text{day}$
MS-T3OE-GPS-006	Coordinate System	TWD97 or UTM
MS-T3OE-GPS-007	CEP Accuracy	<2.5m

### 3.3 TRANSPORTABLE MONITORING STATION

#### 3.3.1 Antenna of Monitoring

No.	Parameter	Specification
VHF/UHF		
TS-SMAT-VHF-001	Frequency Range	20MHz to 3GHz
TS-SMAT-VHF-002	Polarization	Vertical Optional: horizontal
TS-SMAT-VHF-003	Impedance	50Ω
TS-SMAT-VHF-004	VSWR	$\leq 2.5$ (2.5:1)
TS-SMAT-VHF-005	Cable loss	30MHz< $f$ ≤300MHz : ≤ 0.06dB/m
		300MHz< $f$ ≤1GHz : ≤ 0.1dB/m
		1GHz< $f$ ≤2GHz : ≤ 0.14dB/m
		2GHz< $f$ ≤3GHz : ≤ 0.18dB/m
TS-SMAT-VHF-006	Antenna System	Passive

#### 3.3.2 Monitoring Receiver

No.	Parameter	Specification
VHF/UHF		
TS-RXVHF-001	Frequency Range	20MHz to 3GHz
TS-RXVHF-002	Tuning resolution	10Hz
TS-RXVHF-003	3 <sup>rd</sup> Order Intercept (IP3)	≥12dBm
TS-RXVHF-004	2 <sup>nd</sup> Order Intercept (IP2)	≥40dBm
TS-RXVHF-005	Noise figure	≤12dB
TS-RXVHF-006	Lo-Phase Noise	≤-110dBc/Hz (offset 10kHz)

TS-RXVHF-007	IF rejection	$\geq 80\text{dB}$
TS-RXVHF-008	Image rejection	$\geq 80\text{dB}$
TS-RXVHF-009	IF Bandwidth(-6 dB)	At least 20MHz Optional 40MHz
TS-RXVHF-010	Selectivity 60 to 6dB	2:1
TS-RXVHF-011	Detection modes	AM、FM、CW、LSB、USB
TS-RXVHF-012	AGC range	$\geq 120\text{dB}$
TS-RXVHF-013	Output IF/IQ  Audio IF Monitor	Digital IQ output Digital IF output 0dBm (600Ω) For external IF monitoring, or digital data stream
TS-RXVHF-014	Remote control	Ethernet LAN
TS-RXVHF-015	AC power	110V/60Hz
TS-RXVHF-016	Electromagnetic compatibility, EMC	IEC61000-4-2,-3,-4 CISPR11,Group 1,Class B
TS-RXVHF-017	Vibration	IEC68-2-6 or MIL-STD810F

### 3.3.3 Measurements

N0.	Specification
Frequency Measurement	
TS-MSFM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.337-3)
Bandwidth Measurement	
TS-MSBM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.443)
Modulation Measurement	
TS-MSMM-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.328)
Field Strength Measurement	
TS-MSFS-001	Same as 3.1.1.3 (According to the Recommendations of ITU-R SM.378)

### 3.3.4 DF Antenna

No.	Parameter	Specification
VHF/UHF		
TS-DFAT-VHF-001	Frequency Range	20MHz to 3GHz
TS-DFAT-VHF-002	Polarization	Vertical Optional: horizontal
TS-DFAT-VHF-003	Impedance	50Ω
TS-DFAT-VHF-004	VSWR	$\leq 3$ (3:1)
TS-DFAT-VHF-005	Antenna System	Passive

### 3.3.5 DF Processor

No.	Parameter	Specification
VHF/UHF		
TS-DFPX-VHF-001	Frequency Range	20MHz to 3GHz
TS-DFPX-VHF-002	Bearing Accuracy	4°rms
TS-DFPX-VHF-003	Bearing Resolution	$\leq 0.1^\circ$
TS-DFPX-VHF-004	DF Modulation	All types of modulation
TS-DFPX-VHF-005	Sensitivity	$\leq 10\mu\text{V/m}$
TS-DFPX-VHF-006	Scanning Speed	At least 1GHz/s, at RBW 25kHz
TS-DFPX-VHF-007	Instantaneous Bandwidth	$\geq 20\text{MHz}$
TS-DFPX-VHF-008	Minimum Signal duration	$\leq 1\text{ms}$
TS-DFPX-VHF-009	Result Display	Azimuth, DF quality and Signal Level
* Specifications of noise figure, IP3, IF Bandwidth and other related parameters of DF receiver are the same as monitoring receiver.		

### 3.3.6 Operating Equipment

No.	Parameter	Specification
Work Station & Measurement Server		
TS-OEWS-001	Type	Notebook
TS-OEWS-002	CPU Clock rate	Intel Core i7 or same level $\geq 2.5\text{GHz}$
TS-OEWS-003	RAM	$\geq 4\text{GB}$
TS-OEWS-004	Hard Disk	$\geq 1\text{TB}$

TS-OEWS-005	Network Interface	Ethernet 100Mbps/1Gbps
TS-OEWS-006	LCD Monitor Size	19"
TS-OEWS-007	Power Supply	400W
TS-OEWS-008	Operating System	Windows XP or Windows 7
TS-OEWS-009	Periphery Equipment	DVD-ROM(R/W) 、optical mouse
Network Equipment		
TS-OENE-001	Switch Supported Speed Number of RJ45 Port TCP/IP	100Mbps/1Gbps 12ports Support IPv4 and IPv6
TS-OENE-002	3G router	At least 2 LAN ports
GPS receiver		
TS-OEGPS-001	Channel number	$\geq 12$
TS-OEGPS-002	Stability of timing	$\leq 1\mu\text{s/day}$
TS-OEGPS-003	Frequency output	10MHz
TS-OEGPS-004	Stability of frequency	$\leq 1 \times 10^{-11}$
TS-OEGPS-005	Accuracy of frequency	$\leq 5 \times 10^{-12}/\text{day}$
TS-OEGPS-006	Coordinate System	TWD97 or UTM
TS-OEGPS-007	CEP Accuracy	<2.5m

### 3.4 PORTABLE MONITORING STATION

#### 3.4.1 DF Antenna

No.	Parameter	Specification
MF/HF		
PS-DFAT-HF-001	Frequency Range	300kHz to 30MHz
PS-DFAT-HF-002	Polarization	Linear
PS-DFAT-HF-003	Pattern	Directional
PS-DFAT-HF-004	Impedance	50Ω
PS-DFAT-HF-005	VSWR	$\leq 3$ (3:1)
PS-DFAT-HF-006	Antenna System	Passive
VHF/UHF/SHF		
PS-DFAT-VHF-001	Frequency Range	20MHz to 30GHz
PS-DFAT-VHF-002	Polarization	Linear
PS-DFAT-VHF-003	Pattern	Directional
PS-DFAT-VHF-004	Impedance	50Ω

PS-DFAT-VHF-005	VSWR	$\leq 3$ (3:1)
PS-DFAT-VHF-006	Antenna System	Passive

### 3.4.2 DF Receiver

No.	Parameter	Specification
MF/HF		
PS-DFRX-HF-001	Frequency Range	300kHz to 30MHz
PS-DFRX-HF-002	Noise figure	$\leq 15\text{dB}$
PS-DFRX-HF-003	3 <sup>rd</sup> Order Intercept (IP3)	$\geq 20\text{dBm}$
PS-DFRX-HF-004	Display Modes	Clearwrite, Average, MaxHold, MinHold
PS-DFRX-HF-005	Detection Mode	AM,FM,LSB,USB,CW
VHF/UHF/SHF		
PS-DFRX-VHF-001	Frequency Range	30MHz to 6GHz
PS-DFRX-VHF-002	Noise figure	$\leq 15\text{dB}$
PS-DFRX-VHF-003	3 <sup>rd</sup> Order Intercept (IP3)	$\geq 20\text{dBm}$
PS-DFRX-VHF-004	Display Modes	Clearwrite, Average, MaxHold, MinHold
PS-DFRX-VHF-005	Detection Mode	AM,FM,LSB,USB,CW,I/Q

## 3.5 REGIONAL CONTROL CENTER

### 3.5.1 Operating Equipments

No.	Parameter	Specification
Work Station		
RC-OEWS-001	CPU Clock rate	Intel Core i7 or same level $\geq 2.5\text{GHz}$
RC-OEWS-002	RAM	$\geq 4\text{GB}$
RC-OEWS-003	Hard Disk	$\geq 500\text{GB}$
RC-OEWS-004	Network Interface	Ethernet 100Mbps/1Gbps
RC-OEWS-005	LCD Monitor Size	19"
RC-OEWS-006	Power Supply	400W
RC-OEWS-007	Operating System	Windows XP or Windows 7
RC-OEWS-008	Periphery Equipment	DVD-ROM(R/W) 、optical mouse 、keyboard
Database Server		



RC-OEDB-001	CPU Clock rate	Intel Core i7 or same level $\geq 2.5\text{GHz}$
RC-OEDB-002	RAM	$\geq 4\text{GB}$
RC-OEDB-003	Hard Disk	$\geq 1\text{TB}$
RC-OEDB-004	Network Interface	Ethernet 100Mbps/1Gbps
RC-OEDB-005	Power Supply	400W
Power Supply		
RC-OEPS-001	UPS AC power Capacity Backup Time	110V 3KVA $\geq 30\text{min}$ (system full load)
Network Equipment		
RC-OENE-001	Switch Supported Speed Number of RJ45 Port TCP/IP	100Mbps/1Gbps 24 ports Support IPv4 and IPv6
RC-OENE-002	Router	At least 1 WAN port and 2 LAN ports
Lightening Protection		
RC-THPTC-002	Other protections	Include equipment protection, signal protection and power protection