

ITU TRAINING ON SPECTRUM MANAGEMENT FOR TERRESTRIAL
SERVICES

VICTORIA, REPUBLIC OF SEYCHELLES, 5 - 9 OCTOBER, 2015

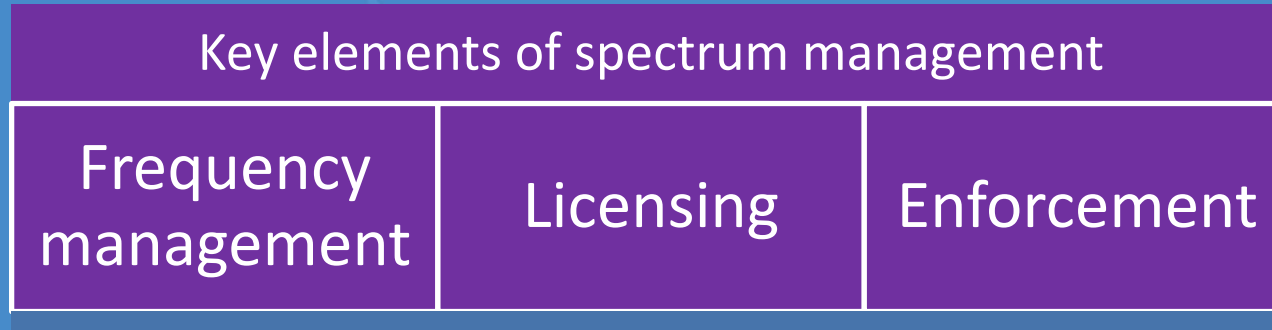
**International
spectrum monitoring**

Nikolai Vassiliev
Radiocommunication Bureau

Outline of presentation

- Introduction to spectrum monitoring
- ITU-R documents on spectrum monitoring
- International monitoring system
- Regular and special monitoring programs
- Use of monitoring data in ITU

Role of monitoring in spectrum management



Role of monitoring :
To support the above key elements in order to enable
interference-free spectrum usage

Definition: monitoring can be defined as a process of observing the radio frequency spectrum and reporting on its usage

Main goals of monitoring

- Goals of monitoring:
 - Assist in resolution of interference on a local, regional or global scale
 - Detect and identify illegal transmitters
 - Verify the proper technical and operational characteristics of emissions
 - Assist in ensuring acceptable quality of radio and TV reception by public
 - Provide information on actual use of spectrum, for example on :
 - channel occupancy
 - band congestion
 - Conformity of frequency usage to license conditions, et.
 - Provide valuable monitoring information for programs organized by the ITU/BR by participating in the International Monitoring System (IMS)

ITU-R activities on spectrum monitoring

- Development of ITU-R **Recommendations, Reports** and the **Handbook** on Spectrum Monitoring
 - studies are conducted in Working Party 1C of Study Group 1
 - The documents are available free of charge at <http://www.itu.int/pub/R-REC>, <http://www.itu.int/pub/R-REP>, <http://www.itu.int/pub/R-HDB>
- Establishment and development of the International Monitoring System
- Maintenance of the **List VIII** - International monitoring stations
- Conducting of regular and special monitoring programs (collection and distribution of data), taking actions on the reported infringements

Handbook on Spectrum Monitoring

- Handbook on Spectrum Monitoring, Geneva, 2011
 - Fundamental document (659 pages) describing all aspects of monitoring
 - Developed by leading specialist from all over the world
 - Complemented by ITU-R Recommendations



Content:

- ☞ CHAPTER 1 – SPECTRUM MONITORING AS A KEY FUNCTION OF A SPECTRUM MANAGEMENT SYSTEM
- ☞ CHAPTER 2 – ORGANIZATION, PHYSICAL STRUCTURES AND PERSONNEL
- ☞ CHAPTER 3 – MONITORING EQUIPMENT AND AUTOMATION OF MONITORING OPERATIONS
- ☞ CHAPTER 4 – MEASUREMENTS
- ☞ CHAPTER 5 – SPECIFIC MONITORING SYSTEMS AND PROCEDURES
- ☞ CHAPTER 6 – FUNDAMENTALS AND SUPPORTING TOOLS
- ☞ ANNEX 1 TO THE HANDBOOK – MONITORING SYSTEM PLANNING AND TENDERS

Examples of Recommendations on monitoring

- General requirements to monitoring stations:
 - SM.575 Protection of fixed monitoring stations against interference
 - SM.1050 Tasks of a monitoring service
 - SM.1392 Essential requirements for a spectrum monitoring system for developing countries
 - SM.1723 Mobile spectrum monitoring unit
- Methods of spectrum monitoring
 - SM.378 Field-strength measurements at monitoring stations
 - SM.1447 Monitoring of the radio coverage of land mobile networks to verify compliance with a given license
 - SM.854 Direction finding and location determination

Examples of Recommendations on monitoring (2)

- Automation of monitoring
 - SM.1537 Automation and integration of spectrum monitoring systems with automated spectrum management
- International cooperation in spectrum monitoring
 - SM.377 Accuracy of frequency measurements at stations for international monitoring
 - SM.1139 International monitoring system
 - SM. 1393 Common formats for the exchange of information between monitoring stations
 - SM. 1394 Common format for Memorandum of Understanding between the agreeing countries regarding cooperation in spectrum monitoring matters

International Monitoring System (IMS)

- Article 16 of the RR contains the provisions governing the establishment and operation of the IMS
- The IMS comprises of monitoring stations and centralizing offices voluntarily designated by administrations
- The characteristics of these monitoring stations are notified to the ITU and published in List VIII (Article 20 of the RR)
- Participating stations may be operated by an administration, a public or private agency, a monitoring service established jointly by several countries or by an international organization
- In addition to Art. 16, No. 3.14 of the RR urges administrations to arrange for frequent checks of the emissions of stations under their jurisdiction, to ensure that these stations comply with the RR

International Monitoring System (cont.)

- One of the main conditions for successful operation of the IMS is uniform coverage of the world by monitoring stations adequately equipped and participating in ITU monitoring programs
- Taking into consideration that there are still wide areas of the world where the facilities available to the IMS are inadequate or non-existent, Resolution ITU-R 23-2 (2012) resolves to:
 - Urge the participating administrations to continue to participate in the IMS
 - Urge non-participating countries to establish monitoring stations and take part in the IMS
 - Encourage cooperation and data exchange among stations of different administrations
 - Invite administrations having advanced systems to train officials from countries
- In accordance with this Resolution, the BR prepares and publishes summaries of monitoring data, supplied by stations participating in the IMS

List VIII – Monitoring Stations

- Monitoring station details are notified to the ITU and published by the ITU in List VIII
- List VIII contains particulars of monitoring stations participating in international monitoring, the addresses of centralizing offices and information on measurement abilities of stations
- It is essential that administrations having monitoring facilities notify the BR their particulars for inclusion into this List
- Monitoring stations in List VIII may help in the detection and elimination of harmful interference or infringements

List VIII – Monitoring Stations (cont.)

- The format of List VIII, Edition 2013 is described in Circular Letter CR/348 of 10 May 2013:
 - Preface : contains explanations about the publication in 6 languages
 - Summary Listings
 - Information concerning monitoring stations carrying out measurements related to stations of Terrestrial services:



- Additional information is available at:

<http://www.itu.int/en/ITU-R/terrestrial/monitoring/listVIII/Pages/Internationalmonitoringstations.aspx>

Terrestrial monitoring stations

List of administrations and their terrestrial monitoring stations
(Table 1A)

TABLE 1A	Symbol	Name of the Station	Symbol	Name of the Station
	CLM		El Caribe (Barranquilla-Atlántico)	FIN
		El Cerrito (Funza-Cundinamarca)		Jokioinen
		El Mirador (Cúcuta-N. Santander)	G	Baldock (IMS)
		La Sultana (Candelaria-Valle)	GRC	Athens, Airport (IMS)
		Llano Grande (Rionegro-Antioquia)		Athens, Aspra Chomata (IMS)
		Los Comuneros (Bucaramanga-Santander)		Athens, Marousi (IMS)
	Kadirana	Athens, Penteli (IMS)		
CLN		Heraklion, Airport (IMS)		
CME		Mobile station		
COD		Rhodes, Paradisi (IMS)		
	Lubumbashi	Thessaloniki, Psili Korifi (IMS)		
CTI		Thessaloniki, Water Tower (IMS)		
CUB		HND	Miraflores (IMS)	
CZE		Cuatro Caminos (IMS)	HNG	Tárnok (IMS)
		Brno	HOL	Amersfoort (AT_EZ-Nera) (IMS)
		Ceske Budejovice	I	Monza (IMS)
		Hradec Kralove		Roma (IMS)
		Jihlava	Sorrento (IMS)	
		Karlovice	IND	Chennai (IMS)
		Plzen		Kolkata (IMS)
		Praha		Mumbai (IMS)
		Tehov		Nagpur (IMS)
		Usti nad Labem	New Delhi (IMS)	
D		Berlin (IMS)	INS	Cangkudu
		Darmstadt (IMS)		Kupang
		Itzehoe (IMS)		Medan
		Konstanz (IMS)		Merauke
		Krefeld (IMS)		Samarinda
		Leipzig (IMS)		Surabaya
E		München (IMS)	IRN	Ali Abad
		El Casar		Mashhad
	La Esperanza	Tehran		
EGY		Rozas	ISR	Tel Aviv
EQA		Giza	J	Ishigaki
		Calderón		Kumamoto
		Quito		Osaka
		Riobamba		Sapporo
	Taura	Suzu		
	Turi	Tokyo (IMS)		
EST		Kohtla-Järva	KEN	Garissa
		Kuressaare		Kabete
		Pärnu		Kahawa
		Suurpalu		Kitale
		Tallinn		Mazeras
		Tallinn DF1		Mobile station
		Tallinn DF2		Mombasa City
		Tartu		Railways
F		Favières (IMS)		
		Rambouillet (IMS)		

Notified terrestrial monitoring stations



Monitoring stations reporting to ITU



Space monitoring stations

List of administrations and their space monitoring stations (Table 1B)

TABLE 1B

ADMINISTRATIONS AND THEIR MONITORING STATIONS
IN THE SPACE RADIOCOMMUNICATION SERVICES
(IN ALPHABETICAL ORDER OF SYMBOLS)

Symbol	Name of the Station
ARG	Benavidez ARSAT earth station
	Buenos Aires (IMS)
CHN	Beijing (IMS)
D	Leeheim
J	Tokyo (IMS)
KAZ	GCC Akkol
KOR	Icheon
PAK	Wani-II
RUS	Belgorod (IMS)
	Khabarovsk
	Smolensk (IMS)
UKR	Kyiv
USA	Columbia, Maryland
VTN	Viet Tri

TABLE 1B

Regular monitoring program

- Regular monitoring program in HF bands (2 850 – 28 000 kHz)
- From 1947, monitoring summaries published since 1953
 - Objectives:
 - Indicate the spectrum occupancy
 - Identify stations whose emissions are not in conformity with the RR
 - Share data with administrations not having HF monitoring facilities
 - Submission
 - Data format and report submission procedure are described in CR/159 (2001)
 - Summaries and full data are available on the ITU website at:
<http://www.itu.int/en/ITU-R/terrestrial/monitoring/Pages/Regular.aspx>

Regular monitoring program (cont.)

- Example summary of monitoring data for 01.10.12 to 31.12.12

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
KOR	CRMO	6400,000	06	11	0913	0913	84,7	PYONGYANG BS	KRE	BC	1K01E	A3E									11		
KOR	CRMO	6400,000	07	11	0450	0450	70,2	PYONGYANG BS	KRE	BC	10H0E	A3E										11	
KOR	CRMO	6400,000	08	11	1038	1038	76,2	PYONGYANG BS	KRE	BC	2K99E	A3E										11	
KOR	CRMO	6400,000	08	11	2148	2148	75,3	PYONGYANG BS	KRE	BC	2K99E	A3E										11	
KOR	CRMO	6400,000	09	11	0633	0633	79,1	PYONGYANG BS	KRE	BC	2K99E	A3E										11	
KOR	CRMO	6400,000	12	11	2226	2226	74,0	PYONGYANG BS	KRE	BC	2K99E	A3E										11	
KOR	CRMO	6400,000	14	11	0434	0434	58,5	PYONGYANG BS	KRE	BC	2K99E	A3E										11	
E	EL CASAR	6410,500	19	10	1000	1200	26,0				3K00E	G7D									59	A	
BEL	C.C.R.M.	6413,000	05	10	0858						3K00	J2D										9	Stanag-425 2400bps
E	EL CASAR	6413,000	20	10	1900	2200	34,0	OSN41i	BEL	FC	1K10E	F1B									22	B	
E	EL CASAR	6414,500	15	10	1000	1200	12,0		G		3K00E	F7D									4	B	
BEL	C.C.R.M.	6429,500	05	10	0900						3K00	J2D										9	
E	EL CASAR	6431,000	20	10	1900	2200	20,0				3K00E	G7D									14	B	
E	EL CASAR	6441,000	20	10			39,0		HOL		3K00E	G7D									22	A	
BEL	C.C.R.M.	6456,500	05	10	0912						3K00	J2D										9	
BEL	C.C.R.M.	6467,000	05	10	0916			LFI Rogaland Radio	NOR	FC	450HE	F1B											GW 200H : 100Bd
E	EL CASAR	6467,000	20	10	1920	2200	23,0	ROGALAND RADIO	NOR	FC	340HE	F1B									16	B	
E	EL CASAR	6476,500	20	10	1920	2200	31,0		GRC		3K00E	G7D									84	B	
BEL	C.C.R.M.	6478,000	05	10	0921			SAB Goeteborg Radio	S	FC	360H	F1B											GW-FSK 100Bd
E	EL CASAR	6478,000	20	10	1920	2200	30,0	GOETEBORG RADIO	S	FC	340HE	F1B									26	C	
KOR	CRMO	6480,000	18	10	1031	1031	42,1	R.ALATURA	PRU	BC	2K99E	A3E										11	
J	TOKYO	6480,000	22	10	1021				KRE	BC		A3E	125	E	49	40	N	00	296			C	
BEL	C.C.R.M.	6487,500	05	10	0955						3K00E	J2D										9	
BEL	C.C.R.M.	6493,500	05	10	0958			Globewireless (HEC)	SUI	FC	400HE	F1B											GlobeWireless
BEL	C.C.R.M.	6501,500	05	10	1127						3K00	J2D										9	
J	TOKYO	6517,800	22	10	1023				KRE	BC		A3E	125	E	30	39	N	05	291			B	
J	TOKYO	6517,800	29	10	0811				KRE	BC		A3E	125	E	27	39	N	17	291			B	
EL	C.C.R.M.	6550,000	19	11	0842				F	MS	2K70E	J3E									11	fishers	
EL	C.C.R.M.	6555,000	19	11	1019				F	MS	2K70E	J3E											fishers
BEL	C.C.R.M.	6576,000	19	11	0843				F	MS	2K70E	J3E											fishers

Special monitoring program

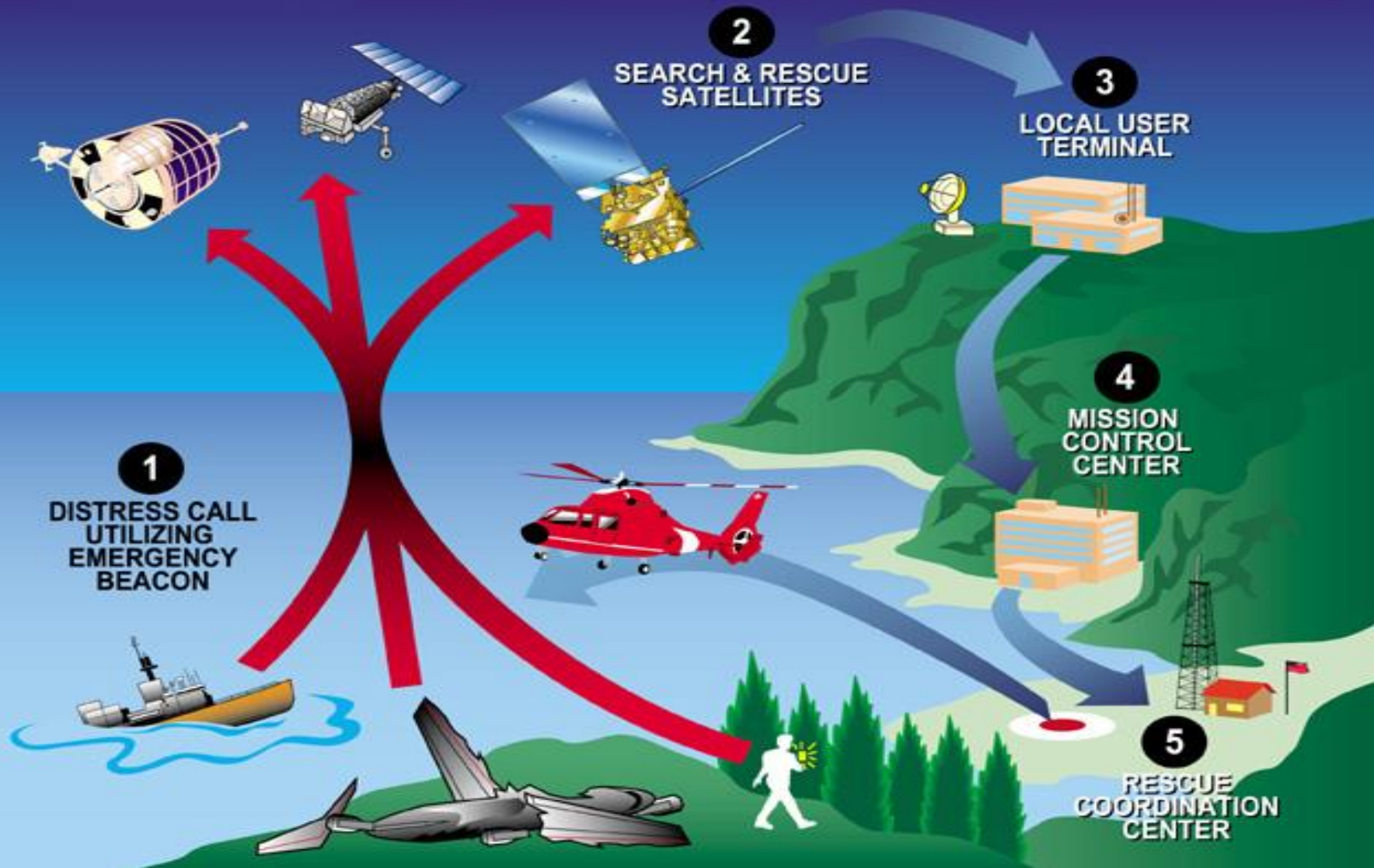
- Monitoring 406 – 406.1 MHz band
- Performed in accordance with Res. 205 (Rev. WRC-12)

- Objective: to identify and locate unauthorized emissions in the band 406-406.1 MHz that cause harmful interference to the reception of satellite EPIRB signals of the COSPAS-SARSAT
- Statistics on the number of interfering emissions that have been detected and subsequently suppressed are published in the BR annual reports and also at:

<http://www.itu.int/en/ITU-R/terrestrial/monitoring/Pages/Res205.aspx>

Cospas-Sarsat operation

COSPAS-SARSAT System Overview



Special monitoring program (cont.)

- An online database query facility for the consolidated data relative to Resolution 205 can be found at:

<http://www.itu.int/net4/ITU-R/terrestrial/res205/default.aspx>

Monitoring Programme band 406-406.1 MHz (Resolution 205, COSPAS-SARSAT)

This page provides consolidated information extracted from the reports received from Administrations participating in the monitoring programme in the band 406-406.1 MHz in application of Resolution 205(Rev. WRC-12). The objective of this programme is to identify and locate unauthorized emissions in the band 406-406.1 MHz that cause harmful interference to the reception of satellite EPIRB signals of the COSPAS-SARSAT system.

Upon receipt of the reports, the Radiocommunication Bureau immediately contacts the Administrations responsible for the area where the unauthorized transmitters are located, requesting them to take immediate action with a view to stopping the emissions.

For further information on the use of this system, click [here](#).

DATABASE CONTAINING ALL REPORTS RECEIVED BY THE BR (SINCE 2008/01/01)

Please define the criteria for data retrieval:

Observer Administration: Geographical area of unauthorized emissions:

Frequency range: from MHz to MHz Site ID:

Geographical location: Latitude(DD.DDD): Longitude(DD.DDD): Radius(km):

Date of observation: From: To: Paged Results

Search

Total Number of observations retrieved:

Use of monitoring data by the Bureau

Assistance to administrations in cases of harmful interference:

- Pursuant to Article 15 of the RR, an administration may seek the assistance of the Bureau in resolving cases of harmful interference
- The Bureau may request the cooperation of monitoring stations of the IMS to help in identifying the source of harmful interference
- After having analyzed the results of the monitoring, the Bureau will contact the concerned administrations and recommend actions to be taken

Use of monitoring data by the Bureau (cont.)

Preparation for radiocommunication conferences:

- The Bureau may organize special monitoring campaigns in order to assess the actual usage of specific band(s) under consideration of the conference (e.g. The monitoring campaign organized prior to WRC-03 to support additional HF allocations to broadcasting service)
 - Results are submitted to the Conference to evaluate the impact of the proposed changes in allocations on the spectrum use
- A radiocommunication conference may instruct the Bureau to organize monitoring campaigns in order to obtain data concerning the use of a specific part of the spectrum and/or to support studies concerning interference caused to safety communications, to be further analyzed by a subsequent conference

Conclusions

- Spectrum monitoring is one of the key elements of a national spectrum management system
- Monitoring supports frequency planning, frequency assignment process, licensing and enforcement
- The importance of spectrum monitoring increases with growing demands on spectrum and introduction of new services
- The ITU-R developed a significant number of documents covering all aspects of spectrum monitoring
- The BR created IMS and organizes regular HF monitoring program as well as special 406-406.1 MHz program to protect safety services
- Administrations not yet participating in these monitoring programs are encouraged to take part in these programs



Thank you !