



International Monitoring

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 - Regular and Special Programmes
 - Use of Monitoring Data by the Radiocommunication Bureau (BR)
 - Study Groups
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Spectrum monitoring overview

The purpose of spectrum monitoring is to support the spectrum management process in general, including frequency assignment and spectrum planning activities

Monitoring is closely associated with inspection and compliance in that it enables to:

- Assist in the resolution of electromagnetic spectrum interference, whether on a local, regional or global scale
- Detect and identify illegal transmitters
- Verify the proper technical and operational characteristics of emissions
- Assist in ensuring an acceptable quality of radiocommunication services, especially for security services
- Provide valuable monitoring data to an administration's electromagnetic spectrum management process concerning:
 - The actual use of frequencies and bands (e.g., channel occupancy and band congestion)
 - The effectiveness of spectrum management policies
- Provide valuable monitoring information for programmes organized by the Bureau by participating in the International Monitoring System (IMS)

Role of monitoring in spectrum management

Key elements of spectrum management

Frequency
management

Licensing

Enforcement



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

- 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



ITU-R activities relative to spectrum monitoring



Study Groups

Study Group 1: “Spectrum management”

- WP 1C - Spectrum monitoring
- Next meeting: 13-20 June 2017
- <http://www.itu.int/ITU-R/go/rwp1c/en>
- Handbook on Spectrum Monitoring
 - Available free of charge at <http://www.itu.int/pub/R-HDB-23>

Spectrum Monitoring
Edition of 2011



The Handbook on Spectrum Monitoring contains the latest information on all aspects of monitoring and represents a valuable reference manual for the spectrum management community. It is intended for the use by administrations of both developing and developed countries and by the Radiocommunication Bureau. The Handbook will also be useful to radiocommunication engineers everywhere.

Study Group 4: “Satellite Services”

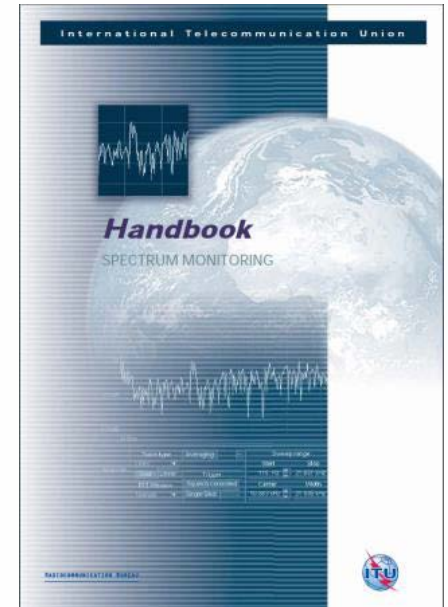
- WP 4C – Efficient orbit/spectrum utilization for MSS and RDSS
- Continue studies for the special programme
- Next meeting: 26 April - 2 May 2017
- <http://www.itu.int/ITU-R/go/rwp4c>



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



Historical background

- Historically, it was the intensive use of the HF bands, which led to the installation of numerous international monitoring stations:
 - In 1930, the first regional monitoring station was opened in Brussels (predecessor of the European Broadcasting Union - EBU)
 - At the 1947 Atlantic City Conference, Article 18 of the Radio Regulations (RR) laid down the foundation of the international monitoring system
 - In 1998, it became Article 16 of the RR
- Monitoring of the HF bands is still an important task but special attention should also be paid to the VHF, UHF and SHF bands, in view of the constant increase in the demand for the use of these bands



ITU-R activities relative to spectrum monitoring



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 to be made of the emissions of stations under their jurisdiction, to ensure that these stations comply with the RR at the national level



ITU-R activities relative to spectrum monitoring



International Monitoring System (IMS) (cont'd)

- One of the main conditions for successful operation of the IMS is uniform coverage of all parts of the world by monitoring stations adequately equipped and participating in ITU monitoring programmes
- 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 23-3 (2015) resolves to:
 - Urge the participating administrations to continue to participate in the IMS
 - Urge non-participating administrations to establish monitoring stations and/or take part in the IMS
 - Encourage cooperation and data exchange among stations of different administrations
 - Invite administrations that have more advanced systems to train officials from other administrations
- In accordance with this Resolution, the BR prepares and publishes summaries of monitoring data, supplied by the stations participating in the IMS, pursuant to Article 16 of the RR



ITU-R activities relative to spectrum monitoring



List VIII – Monitoring Stations

- Monitoring station details are notified to the ITU and, in accordance with Article 20 of the RR, published by the ITU in List VIII
- List VIII contains particulars of monitoring stations participating in international monitoring, together with the addresses of the centralizing offices and includes information on the measurements that each monitoring station is able to perform
- It is essential that those administrations already having terrestrial and/or space monitoring facilities which participate in the IMS notify the BR of the particulars of their monitoring stations for inclusion into this List
- Monitoring stations contained in List VIII may help in the detection and elimination of harmful interference or infringements
- Instructions for updating List VIII are found in the ITU Operational Bulletin.
- A free online search functionality of List VIII is available at:
http://www.itu.int/online/mms/mars/monitoring/l8_station_search.sh



ITU-R activities relative to spectrum monitoring



List VIII – Monitoring Stations (cont'd)

- The new format of List VIII, Edition 2013 (Circular Letter CR/348 of 10 May 2013):
 - Preface in form of a booklet: contains explanations concerning the contents of the publication in Arabic, Chinese, English, French, Russian and Spanish
 - Summary Listings:
 - List of administrations and their terrestrial monitoring stations
 - List of administrations and their space monitoring stations
 - Information concerning monitoring stations carrying out measurements related to stations of Terrestrial services:
 - Centralizing offices
 - Particulars and contact information of monitoring stations
 - Map of monitoring stations
- Additional information is available at:
<http://www.itu.int/go/ITU-R/ListVIII>



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	Helsinki
	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)
	Athens, Penteli (IMS)		
	Heraklion, Airport (IMS)		
	Mobile station		
CLN	Kadirana		Rhodes, Paradisi (IMS)
CME	Douala-Deido		Thessaloniki, Psili Korifi (IMS)
COD	Kinshasa		Thessaloniki, Water Tower (IMS)
	Lubumbashi		
CTI	Abidjan	HND	Miraflores (IMS)
CUB	Cuatro Caminos (IMS)	HNG	Tárnok (IMS)
CZE	Brno	HOL	Amersfoort (AT_EZ-Nera) (IMS)
	Ceske Budejovice	I	Monza (IMS)
	Hradec Kralove		Roma (IMS)
	Jihlava		Sorrento (IMS)
	Karlovice		
	Pizen	IND	Chennai (IMS)
	Praha		Kolkata (IMS)
	Tehov		Mumbai (IMS)
Usti nad Labem	Nagpur (IMS)		
D	Berlin (IMS)		New Delhi (IMS)
	Darmstadt (IMS)	INS	Cangkudu
	Itzehoe (IMS)		Kupang
	Konstanz (IMS)		Medan
	Krefeld (IMS)		Merauke
	Leipzig (IMS)		Samarinda
München (IMS)	Surabaya		
E	El Casar	IRN	Ali Abad
	La Esperanza		Mashhad
	Rozas		Tehran
EGY	Giza	ISR	Tel Aviv
EQA	Calderón	J	Ishigaki
	Quito		Kumamoto
	Riobamba		Osaka
	Taura		Sapporo
Turi	Suzu		
			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)		

Information concerning monitoring stations carrying out measurements related to stations of Terrestrial services

CME - Cameroon			
Centralizing office	Postal address	Telephone, Telefax, Electronic-mail	Remarks
Centre de contrôle international de Douala	Circonscription des télécommunications Douala	TF : +237 3 421140	

Name of the station		Postal address		Telephone, Telefax, Electronic-mail	
Douala-Deido		Cameroun			
Geographical coordinates	Types of measurements	Ranges of frequencies for each measurement	Hours of service	Remarks	
04°03'45"N 009°43'36"E	Frequency measurements	2 MHz - 30 MHz	H24		

CME - Cameroon



Notified terrestrial monitoring stations





Monitoring stations reporting to ITU



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 and special programmes

- Regular monitoring programme in the HF bands (2 850 – 28 000 kHz)
 - 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>



ITU-R activities relative to spectrum monitoring



Regular and special programmes (cont'd)

Example summary of monitoring data for 01.10.12 to 31.12.12

http://www.itu.int/ITU-R/terrestrial/docs/monitoring/files/pdf/files/336.pdf

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	2K90E	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	2K90E	A3E										11
KOR	CRMO	6400,000	14	11	0434	0434	58,5	PYONGYANG BS	KRE	BC	2K99E	A3E										11

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
BEL	C.C.R.M.	6413,000	05	10	0858						3K00E	G7D									59	A		
E	EL CASAR	6413,000	20	10	1900	2200	34,0	OSN4ti	BEL	FC	1K10E	F1B									22	B		
E	EL CASAR	6414,500	15	10	1000	1200	12,0		G		3K00E	G7D									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	0913						3K00	J2D											9	
BEL	C.C.R.M.	6467,000	05	10	0916			LFI Rogaland Radio	NOR	FC	450HE	F1B											9	
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											9	
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											9	
BEL	C.C.R.M.	6501,000	05	10	1127						3K00	J2D											9	
J	TOKYO	6517,000	22	10	1023				KRE	BC	A3E		125	E	30	39	N	05	291				B	
J	TOKYO	6517,000	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											11	fishers



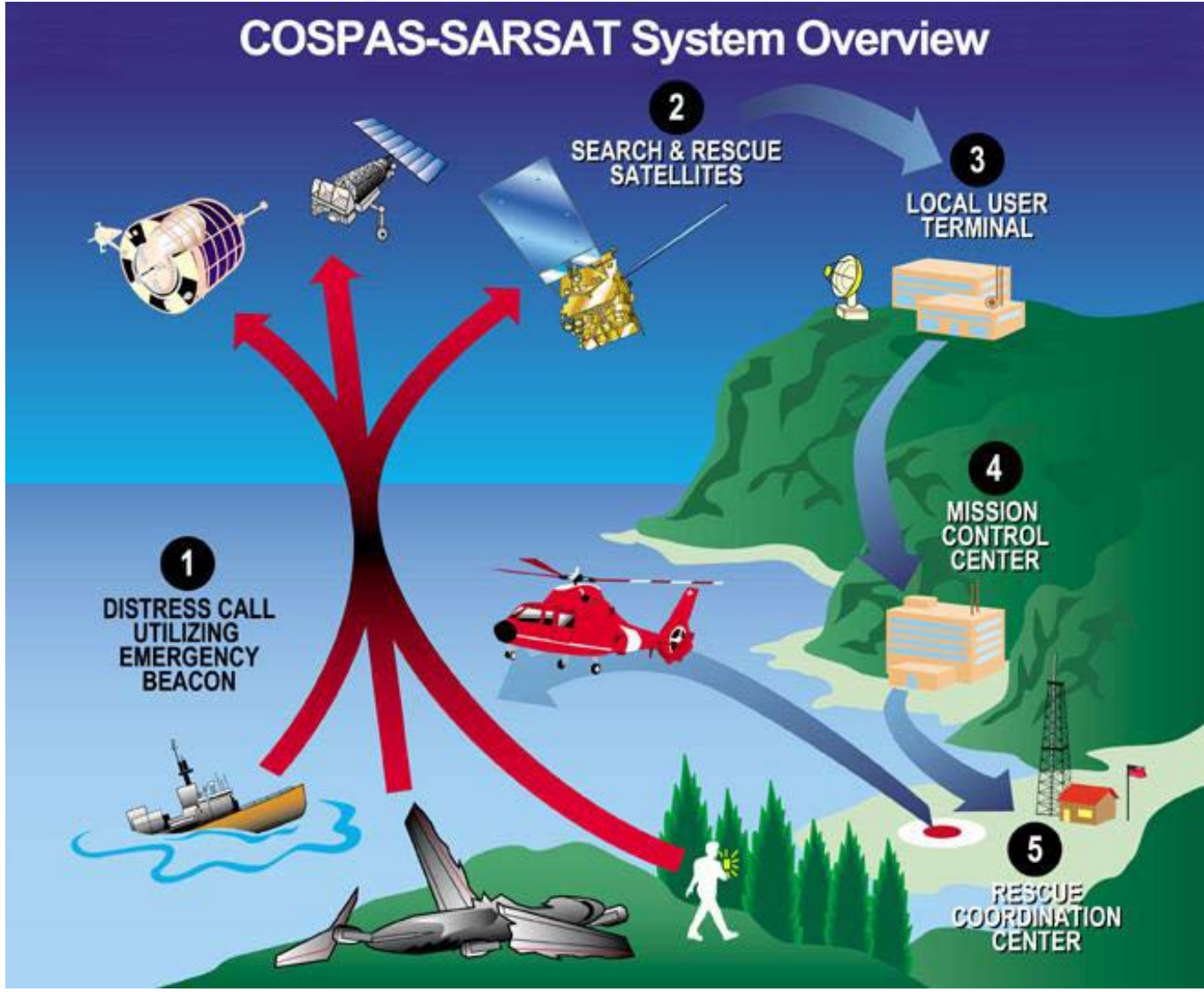
ITU-R activities relative to spectrum monitoring



Regular and special programmes (cont'd)

- **Special programme:**

- Pursuant to Resolution 205 (Rev. WRC-12), a special monitoring campaign has been in progress since 1987 in the 406-406.1 MHz band allocated exclusively to satellite emergency position-indicating radio beacons (EPRIBs) used in the COSPAS/SARSAT programme
- 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>
- This Resolution was revised at the WRC-15 and one of the changes was the addition of the following item to the “*instructs the Director of the Radiocommunication Bureau*” part:
 - “2 *to organize monitoring programmes on the impact of unwanted emissions from systems operating in the frequency bands 405.9-406 MHz and 406.1-406.2 MHz on MSS reception in the frequency band 406-406.1 MHz in order to assess the effectiveness of this Resolution, and to report to subsequent world radiocommunication conferences,*”
- The Bureau is collaborating with interested administrations through ITU-R Working Party 1C and COSPAS/SARSAT on defining the requirements for organising the monitoring programme.





ITU-R activities relative to spectrum monitoring



Regular and special programmes (cont'd)

- 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):

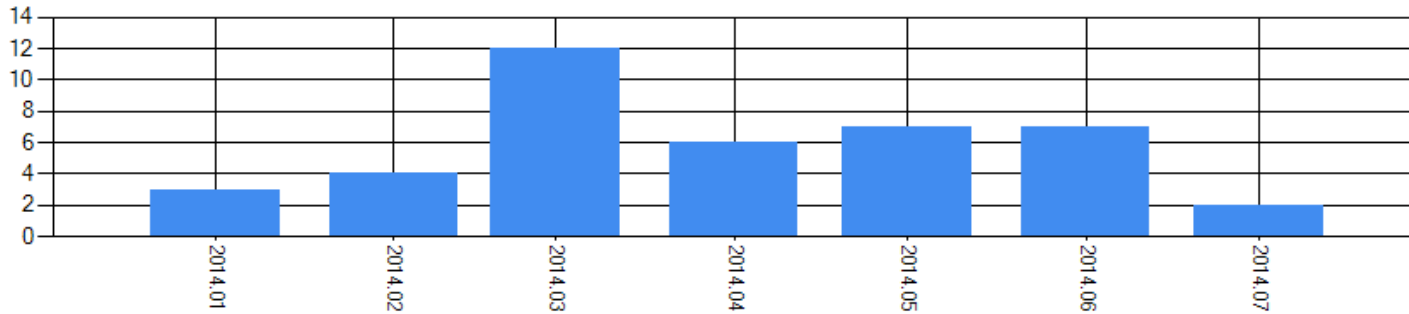
Date of observation: From: To: Paged Results

Total Number of observations retrieved:

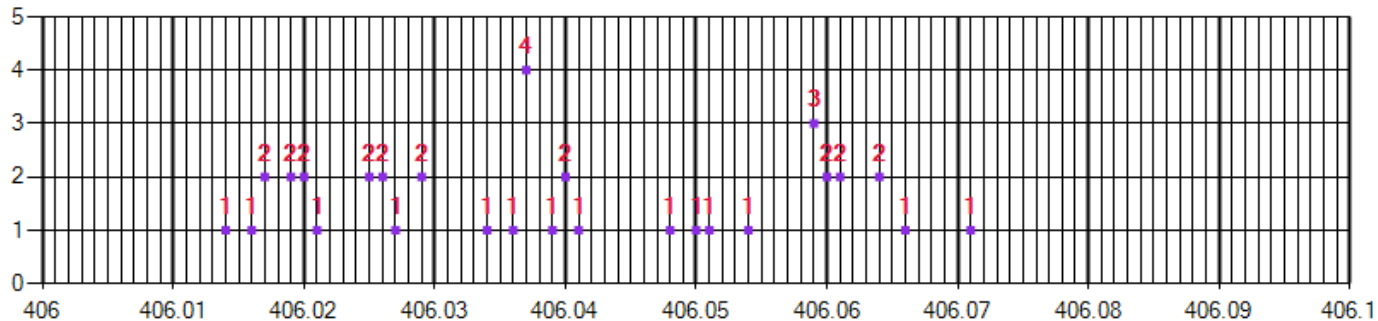
Total Number of observations retrieved: 41

	Observer	SiteID	Country	City	Direction	Distance	Latitude	Longitude	Frequency (MHz)	Observations	Monthly Ratio	First Date	Last Date
1	TUR	271013305	HOL	Rotterdam	E	33.2	52.21	4.43	406.06106	179	0.18	20140412	20140626
2	TUR	271013753	RUS	Gubkin	SSE	97.3	51.71	36.22	406.02904	32	0.02	20140527	20140701
3	TUR	271013857	RUS	Gubkin	ESE	41.5	51.53	37.17	406.02557	27	0.03	20140610	20140701
4	TUR	271013916	RUS	Ivanovo	SSW	46.3	56.85	40.34	406.02905	25	0.10	20140624	20140630
5	I	247000062	RUS	KURSK	ENE	8	51.77	36.28	406.014	58		20140523	20140630
6	I	247000064	HOL	LEIDEN	NE	4	52.19	4.52	406.071	17		20140605	20140619
7	I	247000065	RUS	TEYKOVO	SE	8	45.43	61.29	406.02	17		20140625	20140630
8	TUR	271012616	RUS	Groznyy	NNE	27.7	43.3	45.76	406.04800	92	0.10	20140111	20140220
9	TUR	271012619	RUS	Groznyy	NNE	27.6	43.31	45.76	406.06402	92	0.08	20140111	20140304
10	TUR	271012861	E	Valencia	E	16.3	39.63	-0.42	406.05912	25	0.10	20140218	20140219

1 2 3 4 5



Number of emissions reported per month



Number of emissions reported per frequency (MHz)



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 appropriate administrations or specially designated stations of the International Monitoring System that may be able to help in identifying the source of harmful interference
- After having analysed 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'd)

Preparation for radiocommunication conferences:

- During preparations for a radiocommunication conference, and in view of changes to the Table of Frequency Allocations, the Bureau may organize special monitoring campaigns designed to supplement the data in the Master Register
 - Results are submitted to the Conference in the form of a report so that it may evaluate the impact of the proposed changes in spectrum use
- Equally, a radiocommunication conference may instruct the Bureau to organize special 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 analysed by a subsequent conference



Final Remarks

- As demands on spectrum increase through the introduction of new services, so increases the importance of spectrum monitoring
- The BR continues to organize the regular HF band monitoring programme as well as the special programmes on 406-406.1 MHz and its adjacent bands
- Administrations not yet participating in these monitoring programmes are encouraged to take part in these programmes in accordance with No. 16.5 of the RR
- Join ITU-R WP 1C to participate in the technical studies related to spectrum monitoring



*Thank you for
your attention!*

ITU – Radiocommunication Bureau
Questions to brmail@itu.int or brtpr@itu.int