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Use of Appendix 10 of the Radio Regulations to convey information related to emissions from both GSO and non-GSO space stations including geolocation information

SM Series

Spectrum management

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REPORT ITU-R SM.2181

Use of Appendix 10 of the Radio Regulations to convey information related to emissions from both GSO and non-GSO space stations including geolocation information

(Question ITU-R 232/1)

(2010)

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1 Introduction

Article 15 of the Radio Regulations (RR) describes the procedure for the resolution of cases of harmful interference. When cases of harmful interference occur as result of emissions from space stations, the administrations having jurisdiction over these interfering stations shall, upon request from the administration having jurisdiction over the station experiencing the interference, furnish current ephemeral data necessary to allow determination of the positions of the space stations when not otherwise known. Having determined the source and characteristics of the harmful interference, the administration having jurisdiction over the transmitting station whose service is being interfered with shall inform the administration having jurisdiction over the interfering station, giving all useful information in order that this administration may take such steps as may be necessary.

Full particulars relating to harmful interference shall, whenever possible, be given in the form indicated in RR Appendix 10.

2 Problem definition

Appendix 10 was designed with terrestrial services in mind. Therefore its applicability related to emissions from space stations is limited. This is even more problematic when graphical geolocation information has to be conveyed. The relatively limited number of interference cases, however, would not justify conducting rather complex procedures aiming in a modification of Appendix 10.

3 Proposal for solution

The shortcomings related to the need of conveying ephemeris or geolocation data can simply be overcome by attaching additional information and figures to the Report of harmful interference describing the information in a narrative or graphic form.

Annex 1 of this Report provides data fields and additional information which may be used in an interference report as required.

Annex 2 of this Report provides two example reports of harmful interference. According to the note at the end of Appendix 10 only those letters for which information is provided was used.

Annex 1

Data fields and additional information that can be used in an interference report

The elements in the following three tables are extracted from RR Appendix 10.

Particulars concerning the station causing the interference:

a	Name, call sign or other means of identification	
b	Frequency measured Date: Time (UTC)	
h	Location/position/area/bearing (QTE)	

Particulars concerning the transmitting station interfered with:

j	Name, call sign or other means of identification	
o	Location/position/area/bearing (QTE)	

Particulars furnished by the receiving station experiencing the interference:

q	Name, call sign or other means of identification	
r	Location/position/area	
x	Action requested	

The additional information presented in Tables 1 and 2 is suggested to supplement RR Appendix 10 to provide the additional information needed to fully report the information.

TABLE 1

Particulars concerning the interference

	Type of interference:	
	Satellite interferes with stations of terrestrial services or earth stations of space services (yes/no)	
	Terrestrial emissions or earth stations interfere with a satellite (yes/no)	
	Name of the satellite:	
	– as ITU filing	
	– as commercial name(s)	
	– as NORAD number of spacecraft	
	Name of the satellite system:	
	– Satellite operator	
	– Type of satellite service	
	Satellite orbit:	
	– GSO orbit position (nominal):	
	– Position measured (Lat./Lon.)	
	– Inclination	
	– Position within tolerance (yes/no)	
	– LEO/MEO/HEO orbit:	
	– Orbital period	
	– Time of visibility	
	– Orbit type	
	– Name of the satellite system	
	– Number of satellites in the system	
	Satellite downlink:	
	– Frequency range (nominal) (MHz)	
	– Frequency range measured (MHz)	
	– Polarization (nominal)	
	– Polarization measured	
	– Transmitted power (nominal)	
	– Transmitted power measured	
	Interfering signal:	
	– Frequency measured (downlink) (MHz)	
	– Frequency calculated (uplink) (MHz)	
	– Date of measurement (yyyy-mm-dd)	
	– Time of measurement (UTC)	
	– Bandwidth (kHz)	
	– Power flux-density (dBW/m²)	

TABLE 1 (*end*)

	– Class of emission	
	– Plot of interfering signal (Figure No.)	
	– Descriptions (Dates and times (UTC) of occurrence of harmful interference)	
	– Frequency behaviour characteristics (sweeping or drifting)	
	– Remark about interfering signal	
	Ground based geolocation measurement:	
	– Interferer position result (Lat./Lon.)	
	– Interferer location (country, state, town)	
	– Plot of measurement (Figure No.)	
	– Semi-major axis (km)	
	– Semi-minor axis (km)	
	– Orientation of ellipse (true north clockwise)	
	– Confidence level (%)	
	Transponder in which the interferer is appearing:	
	– Transponder on satellite	
	– Transponder name/number	
	– Polarization (downlink)	
	– Polarization (uplink)	
	– Frequency range (downlink)	
	– Centre frequency (downlink)	
	– Frequency range (uplink)	
	– Centre frequency (uplink)	
	– Measurement Plot (Figure No.)	
	– Description/identification of authorized signal	
	Footprint in which the interferer is downlinked	
	Footprint in which the interferer is uplinked	

TABLE 2

Particulars furnished by the monitoring station measuring the interference

	Name of monitoring station:	
	– Organization	
	– Location (country, state, area, town)	
	– Position of the monitoring station which made the measurements	
	Dates and times (UTC) of occurrence of harmful interference	
	Interference description	
	Equipment used for interferer detection:	
	– Antenna type	
	– Antenna size	
	– G/T (dB/K)	
	– Antenna tracking – (Manual/TLE/Step-Track/Monopulse-Track)	
	– Antenna location (country, state, town)	
	– Antenna position (Lat./Lon.)	
	– Received satellite	
	– Antenna pointing toward satellite	
	– Antenna type (2nd antenna for geolocation)	
	– Antenna size	
	– G/T (dB/K)	
	– Antenna tracking – (Manual/TLE/Step-Track/Monopulse-Track)	
	– Antenna location (country, state, town)	
	– Antenna position (Lat./Lon.)	
	– Received satellite	
	– Earth station antenna pointing toward satellite	
	Other equipment besides antennas	
	Satellites used for geolocation measurement:	
	Main satellite (victim):	
	– Name	
	– Satellite operator	
	– Orbital location	
	– Transponder number	
	– Uplink polarization	
	– Uplink frequency	
	– Downlink polarization	
	– Downlink frequency	
	– Uplink footprint (Figure No.)	

TABLE 2 (*end*)

	– Adjacent satellite:	
	– Name	
	– Satellite operator	
	– Orbital location	
	– Transponder number	
	– Uplink polarization	
	– Uplink frequency	
	– Downlink polarization	
	– Downlink frequency	
	– Uplink footprint (Figure No.)	
	Accuracy Prediction for the time of measurement	
	Quality of the geolocation measurement (High/Medium/Low/Undefined/unclear/difficult)	
	Repetition of geolocation measurements	
	Remark	
	Action requested	

Annex 2

Example reports of harmful interference related to satellites

(See RR Article 15, Section VI.)

The examples below provide some guidance on how this information is to be used. A complaint of interference by a satellite operator may be reported to the regulatory authority, and their satellite monitoring facility may make geolocation measurements to identify an area where the interference source is located. The information can be conveyed to other administrations using RR Appendix 10, with additional information, as shown in the examples below.

EXAMPLE 1

A report of harmful interference related to GSO satellites monitored in Germany

Particulars concerning the station causing the interference:

a	Name, call sign or other means of identification	unknown
b	Frequency measured Date: Time (UTC)	14 191.250 MHz (calculated) 2007-04-25 11:58
h	Location/position/area/bearing (QTE)	50.98102°N 6.88505°E Germany, Cologne

Particulars concerning the transmitting station interfered with:

j	Name, call sign or other means of identification	Satellite ASTRA 3A
o	Location/position/area/bearing (QTE)	23.5°E

Particulars furnished by the receiving station experiencing the interference:

q	Name, call sign or other means of identification	Private Sat TV receivers
r	Location/position/area	Belgium, Eupen
x	Action requested	Elimination of the interfering signal

More details can be found in Tables 3 and 4.

TABLE 3

Particulars concerning the interference

	Type of interference:	
	Satellite interferes with stations of terrestrial services or earth stations of space services (yes/no)	no
	Terrestrial emissions or earth stations interfere with a satellite (yes/no)	yes
	Name of the satellite:	
	– as ITU filing	
	– as commercial name(s)	ASTRA 3A
	– as NORAD number of spacecraft	27 400
	Name of the satellite system	
	Satellite operator	SES-ASTRA, Luxembourg
	Type of Satellite Service	Fixed-Satellite Service
	Satellite orbit:	GSO
	– GSO orbit position (nominal):	23.5° E
	– Position measured (Lat./Lon.)	0.0037°N 23.5821°E
	– Inclination	0.5°
	– Position within tolerance (yes/no)	yes
	– LEO/MEO/HEO orbit:	
	– Orbital period	
	– Time of visibility	
	– Orbit type	
	– Name of the satellite system	
	– Number of satellites in the system	
	Satellite downlink:	
	– Frequency range (nominal) (MHz)	
	– Frequency range measured (MHz)	

TABLE 3 (*end*)

	– Polarization (nominal)	
	– Polarization measured	
	– Transmitted power (nominal)	
	– Transmitted power measured	
	Interfering signal:	
	– Frequency measured (downlink) (MHz)	12 691.250 MHz
	– Frequency calculated (uplink) (MHz)	14 191.250 MHz interferer
	– Date of measurement (yyyy-mm-dd)	2007-04-25
	– Time of measurement (UTC)	11:58
	– Bandwidth (kHz)	2 000 kHz visible above transponder noise
	– Power flux-density (dBW/m²)	Level 3 dB above satellite transponder noise
	– Class of emission	unknown
	– Plot of interfering signal (Figure No.)	Figure 2
	Descriptions (dates and times (UTC) of occurrence of harmful interference)	
	– Frequency behaviour characteristics (sweeping or drifting)	Frequency stable signal
	Remark about interfering signal	Looks like digital modulation
	Ground based geolocation measurement:	
	– Interferer position result (Lat./Lon.)	50.98102°N 6.88505°E
	– Interferer location (country, state, town)	Germany, Cologne
	– Plot of measurement (Figure No.)	Figures 3 and 4 (zoom)
	– Semi-major axis (km)	
	– Semi-minor axis (km)	
	– Orientation of ellipse (true north clockwise)	
	– Confidence level (%)	
	Transponder in which the interferer is appearing :	
	– Transponder on satellite	ASTRA 3A
	– Transponder name/number	G21
	– Polarization (downlink)	LY
	– Polarization (uplink)	LX
	– Frequency range (downlink)	
	– Centre frequency (downlink)	
	– Frequency range (uplink)	
	– Centre frequency (uplink)	
	– Measurement plot (Figure No.)	Figure 1
	– Description/identification of authorized signal	TV channels
	Footprint in which the interferer is downlinked	
	Footprint in which the interferer is uplinked	

TABLE 4

Particulars furnished by the monitoring station measuring the interference

	Name of monitoring station:	Space Radio Monitoring Station Leeheim
	– Organization	Federal Network Agency
	– Location (country, state, area, town)	Germany, Hessen, Leeheim
	– Position of the monitoring station which made the measurements	49.853°N 8.396°E
	Dates and times (UTC) of occurrence of harmful interference	2007-04-23 14:00
	Interference description	
	Used equipment for interferer detection:	
	– Antenna type	
	– Antenna size	
	– G/T (dB/K)	
	– Antenna tracking – (Manual/TLE/Step-Track/Monopulse-Track)	
	– Antenna location (country, state, town)	
	– Antenna position (Lat./Lon.)	
	– Received satellite	
	– Antenna pointing toward satellite	
	– Antenna type (2nd Antenna for geolocation)	
	– Antenna size	
	– G/T (dB/K)	
	– Antenna tracking – (Manual/TLE/Step-Track/Monopulse-Track)	
	– Antenna location (country, state, town)	
	– Antenna position (Lat./Lon.)	
	– Received satellite	
	– Earth station antenna pointing toward satellite	
	Other equipment besides antennas	
	Satellites used for geolocation measurement:	
	– Main satellite (victim):	
	– Name	
	– Satellite operator	
	– Orbital location	
	– Transponder number	
	– Uplink polarization	
	– Uplink frequency	
	– Downlink polarization	
	– Downlink frequency	
	– Uplink footprint (Figure No.)	

TABLE 4 (*end*)

	– Adjacent satellite:	
	– Name	
	– Satellite operator	
	– Orbital location	
	– Transponder number	
	– Uplink polarization	
	– Uplink frequency	
	– Downlink polarization	
	– Downlink frequency	
	– Uplink footprint (Figure No.)	
	Accuracy prediction for the time of measurement	1 km
	Quality of the geolocation measurement (High/Medium/Low/Undefined/unclear/difficult)	High
	Repetition of geolocation measurements	Several times with same result
	Remark	
	Action requested	

FIGURE 1

Interferer (transponder spectrum)

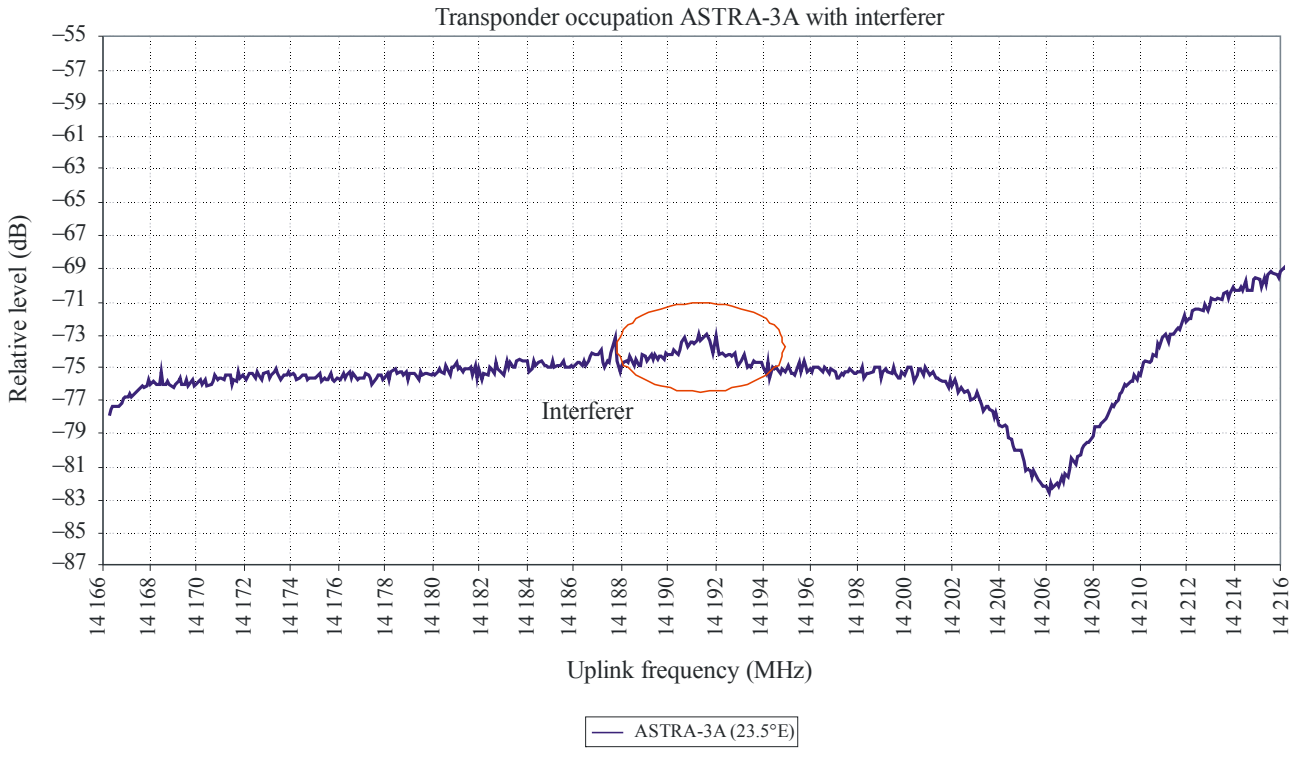

FIGURE 2

Transponder occupation

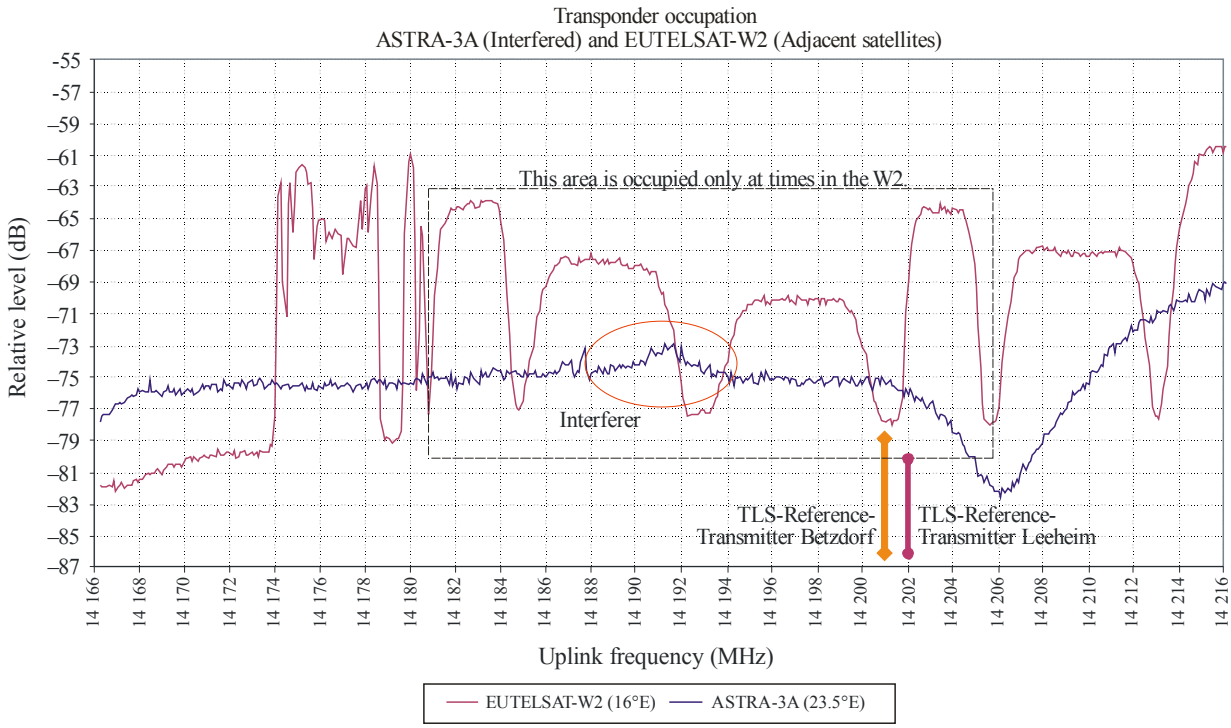

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FIGURE 3

Location Result: Cologne Area Overview

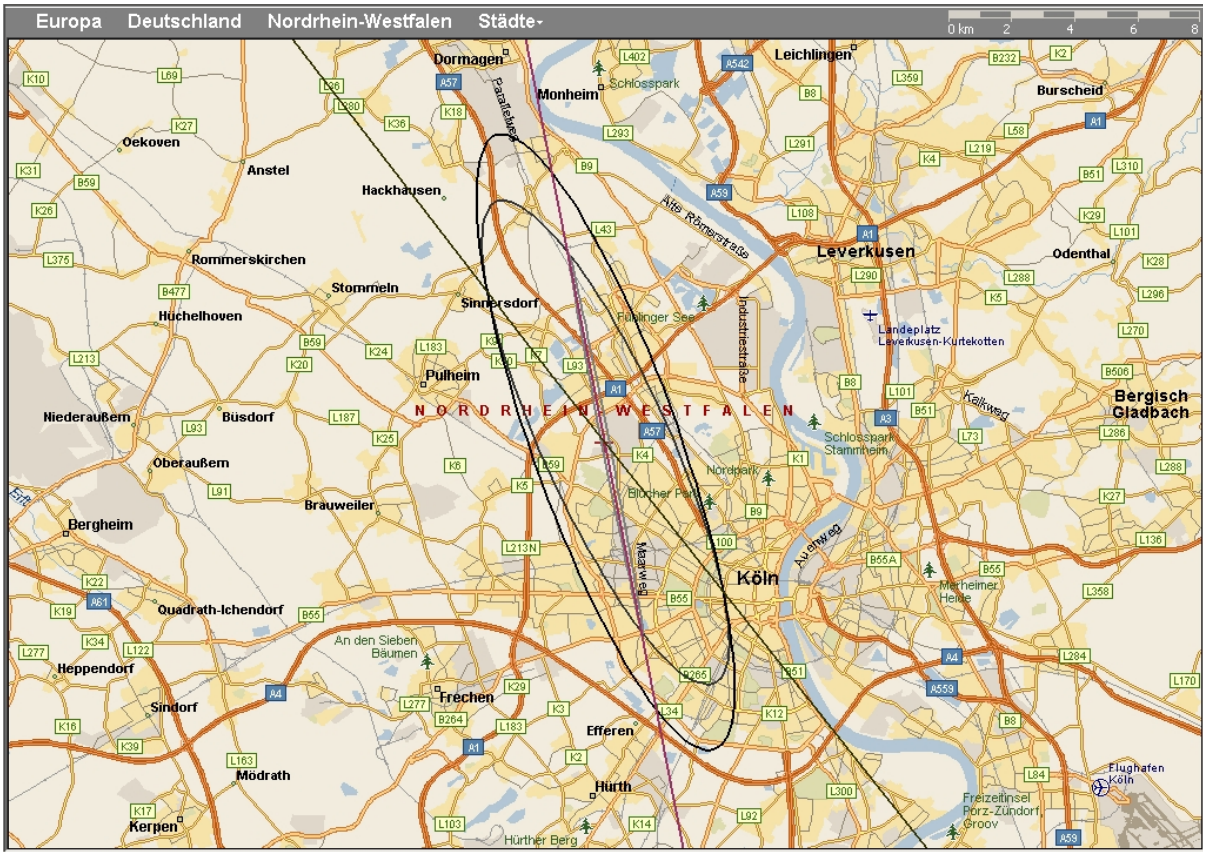

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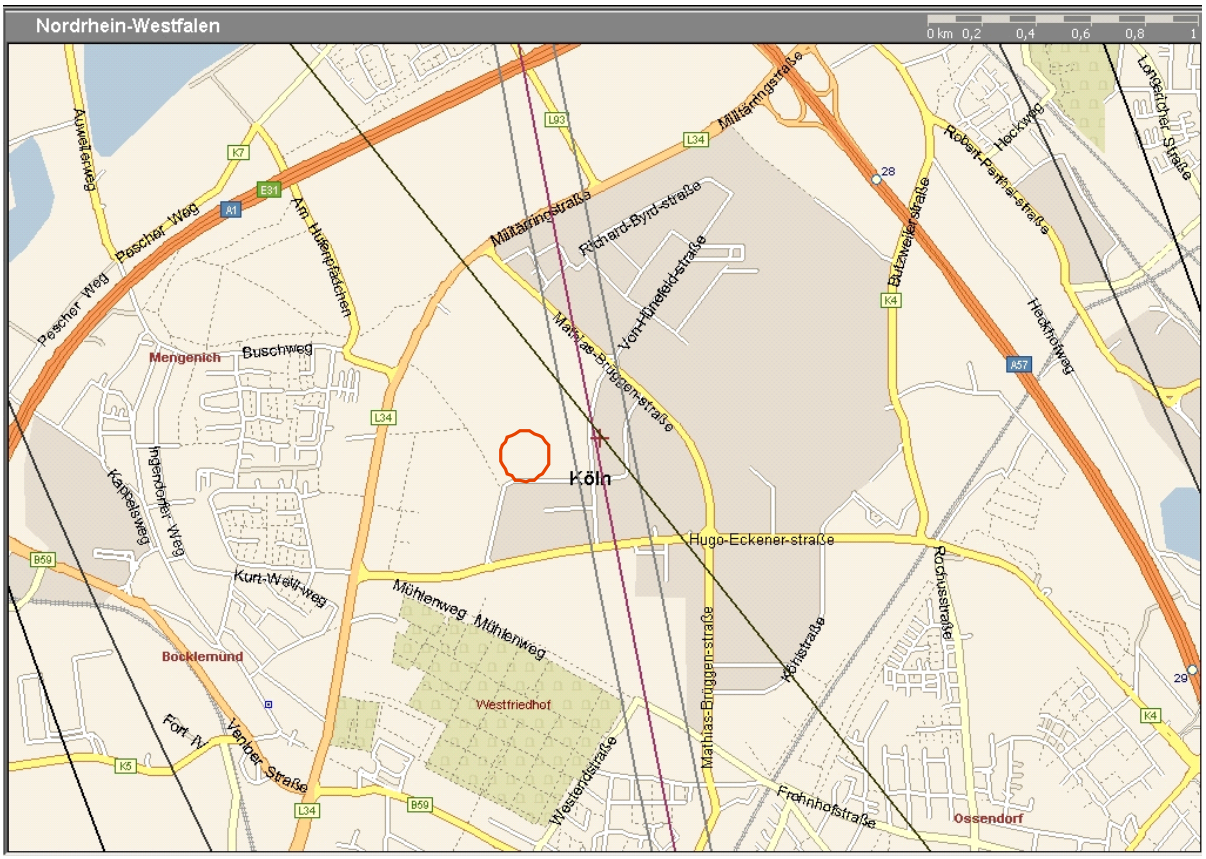
FIGURE 4

Location Result: 50.981°N 6.885°E Detail



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EXAMPLE 2

A report of harmful interference related to GSO satellites monitored in China

Particulars concerning the station causing the interference:

a	Name, call sign or other means of identification	unknown
b	Frequency measured Date: Time (UTC)	14 273.018472 MHz (calculated) 2010-06-18 11:58
h	Location/position/area/bearing (QTE)	30°47’58’’N 114°17’28’’E China, Wuhan

Particulars concerning the transmitting station interfered with:

j	Name, call sign or other means of identification	Satellite Sinosat 1
o	Location/position/area/bearing (QTE)	110.5°E

Particulars furnished by the receiving station experiencing the interference:

q	Name, call sign or other means of identification	
r	Location/position/area	
x	Action requested	Elimination of the interfering signal

More details can be found in Tables 5 and 6.

TABLE 5

Particulars concerning the interference

	Type of interference:	
	Satellite interferes with stations of terrestrial services or earth stations of space services (yes/no)	no
	Terrestrial emissions or earth stations interfere with a satellite (yes/no)	yes
	Name of the satellite:	
	– as ITU filing	
	– as commercial name(s)	SINOSAT 1(XINNUO 1)
	– as NORAD number of spacecraft	25404
	Name of the satellite system	
	Satellite operator	China Satellite Communications Corporation, Beijing
	Type of satellite service	Fixed-satellite service
	Satellite orbit:	
	– GSO orbit position (nominal):	110.5°E
	– Position measured (Lat./Lon.)	0.0395°N 110.4775°E
	– Inclination	0.077°
	– Position within tolerance (yes/no)	Yes
	– LEO/MEO/HEO orbit:	
	– Orbital period	
	– Time of visibility	
	– Orbit type	
	– Name of the satellite system	
	– Number of satellites in the system	
	Satellite downlink:	
	– Frequency range (nominal) (MHz)	12 250-12 750
	– Frequency range measured (MHz)	12 320-12 740
	– Polarization (nominal)	Horizontal
	– Polarization measured	Horizontal

TABLE 5 (*continued*)

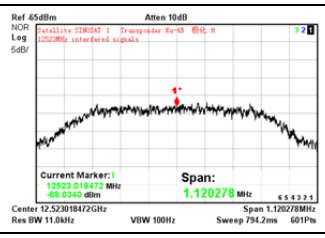
	– Transmitted power (nominal)	48 dBW/transponder
	– Transmitted power measured	32.96 dBW, interfered transponder
	Interfering signal:	
	– Frequency measured (downlink) (MHz)	12 523.018472MHz
	– Frequency calculated (uplink) (MHz)	14 273.018472MHz
	– Date of measurement (yyyy-mm-dd)	2010-6-18
	– Time of measurement (UTC)	14:03:31
	– Bandwidth (kHz)	1 120
	– Power flux density (dBW/m²)	–216.94 dBW/m²/Hz
	– Class of emission	
	– Plot of interfering signal (Figure No.)	
	Descriptions (dates and times (UTC) of occurrence of harmful interference)	Time stable
	– Frequency behaviour characteristics (sweeping or drifting)	Frequency invariant, FDMA
	Remark about interfering signal	QPSK modulation
	Ground based geolocation measurement:	
	– Interferer position result (Lat./Lon.)	30.721°N 104.013°E
	– Interferer location (country, state, town)	China, Hubei, Wuhan
	– Plot of measurement (Figure No.)	
	– Semi-major axis (km)	52
	– Semi-minor axis (km)	10
	– Orientation of ellipse (true north clockwise)	177.39
	– Confidence level (%)	95
	Transponder in which the interferer is appearing:	
	– Transponder on satellite	
	– Transponder name/number	Ku-4B
	– Polarization (downlink)	Horizontal
	– Polarization (uplink)	Vertical
	– Frequency range (downlink)	
	– Centre frequency (downlink)	
	– Frequency range (uplink)	

TABLE 5 (*end*)

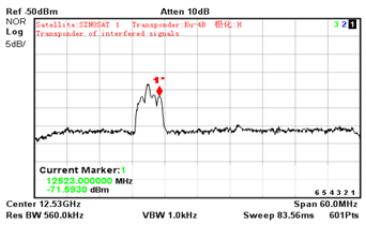
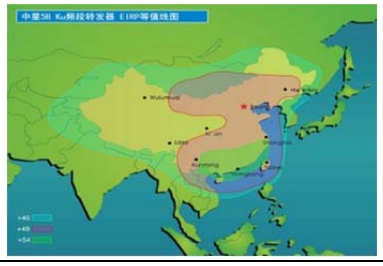
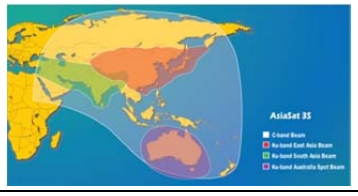
	– Centre frequency (uplink)	
	– Measurement plot (Figure No.)	
	– Description/identification of authorized signal	
	Footprint in which the interferer is downlinked	
	Footprint in which the interferer is uplinked	

TABLE 6

Particulars furnished by the monitoring station measuring the interference

	Name of monitoring station:	Beijing Monitoring Station
	– Organization	CHINA/State Radio Monitoring Center
	– Location (country, state, area, town)	China, Beijing, Daxing
	– Position of the monitoring station which made the measurements	39.661°N 116.255°E
	Dates and times (UTC) of occurrence of harmful interference	Time stable
	Interference description	
	Used equipment for interferer detection:	
	– Antenna type	Cassegrain
	– Antenna size	7.3 m
	– G/T (dB/K)	≥ 40.548
	– Antenna tracking – (Manual/TLE/Step-Track/Monopulse-Track)	Step-track
	– Antenna location (country, state, town)	China, Beijing, Daxing
	– Antenna position (Lat./Lon.)	39.659°N 116.2548°E
	– Received satellite	SINOSAT 1
	– Antenna pointing toward satellite	AZ = 188.97, EL = 43.73
	– Antenna type (2nd Antenna for geolocation)	Cassegrain
	– Antenna size	7.3m
	– G/T (dB/K)	≥ 40.553
	– Antenna tracking – (Manual/TLE/Step-Track/Monopulse-Track)	Step-track
	– Antenna location (country, state, town)	China, Beijing, Daxing
	– Antenna position (Lat./Lon.)	39.658°N 116.2549°E
	– Received satellite	Asiasat 3S
	– Earth station antenna pointing toward satellite	AZ = 196.56°, EL = 42.78°
	Other equipment besides antennas	

TABLE 6 (*end*)

	Satellites used for geolocation measurement:	
	– Main satellite (victim):	
	– Name	SINOSAT 1(XINNUO 1)
	– Satellite operator	China Satellite Communications Corporation, Beijing
	– Orbital location	110.5°E
	– Transponder number	Ku-4B
	– Uplink polarization	Vertical
	– Uplink frequency	14 273.018472MHz
	– Downlink polarization	Horizontal
	– Downlink frequency	12 523.018472MHz
	– Uplink footprint (Figure No.)	
	– Adjacent Satellite:	
	– Name	AISASAT-3S
	– Satellite operator	Asia Satellite Telecommunications Company Limited, Hongkong
	– Orbital location	105.5°E
	– Transponder number	
	– Uplink polarization	Vertical
	– Uplink frequency	14 273.018472 MHz
	– Downlink polarization	Horizontal
	– Downlink frequency	12 525.018472 MHz
	– Uplink footprint (Figure No.)	
	Accuracy prediction for the time of measurement	
	Quality of the geolocation measurement (High/Medium/Low/Undefined/unclear/difficult)	
	Repetition of geolocation measurements	
	Remark	
	Action requested	