

IRAM 30-meter Telescope Radioelectric Protection

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Contents

- **IRAM-30m Radioelectric Protection**
- **Short Range Radar (SRR)**
- **Cloudsat**

Available instruments at the 30M Telescope

RECEIVERS:

EMIR- Heterodine (V/H) 3mm, 2mm, 1.3mm and 0.8mm

HERA- Multibeam 18 pixels 1.3mm

Bolometers GISMO (2mm) and NIKA (2 and 1mm) (being improved)

IF system:

8 channels (4-8)GHz (1/2" coax cables)

Downconverters and IF processors

SPECTROMETERS:

NBC Narrow Band Continuum detectors (1GHz bandwidth)

BBC Broad Band Continuum detectors (8 GHz bandwidth)

Filterbank 8 pixels x 1GHz (4MHz resolution)

Autocorrelators, Wide (16 x 1GHz) and Narrow (very flexible)

**FFTS- Bank of 24 units to cover 32GHz bandwidth, resolutions of
200 and 50KHz/channel**

VLBI Equipment: DBBC, mark5B, mark5C

VLBI Observations aprox. 15days/year at 3mm (GMVA) and 1mm (EHT)

IRAM-30m Radioelectric Protection

IRAM-30m Coordinates

Latitude: N 37° 03' 58"

Longitude: W 03° 23' 34"

Height: 2904.0 m

Cooperation Agreement

The Spanish Government will seek to ensure the radioastronomical quality of the 30m observatory



Radioelectric Protection

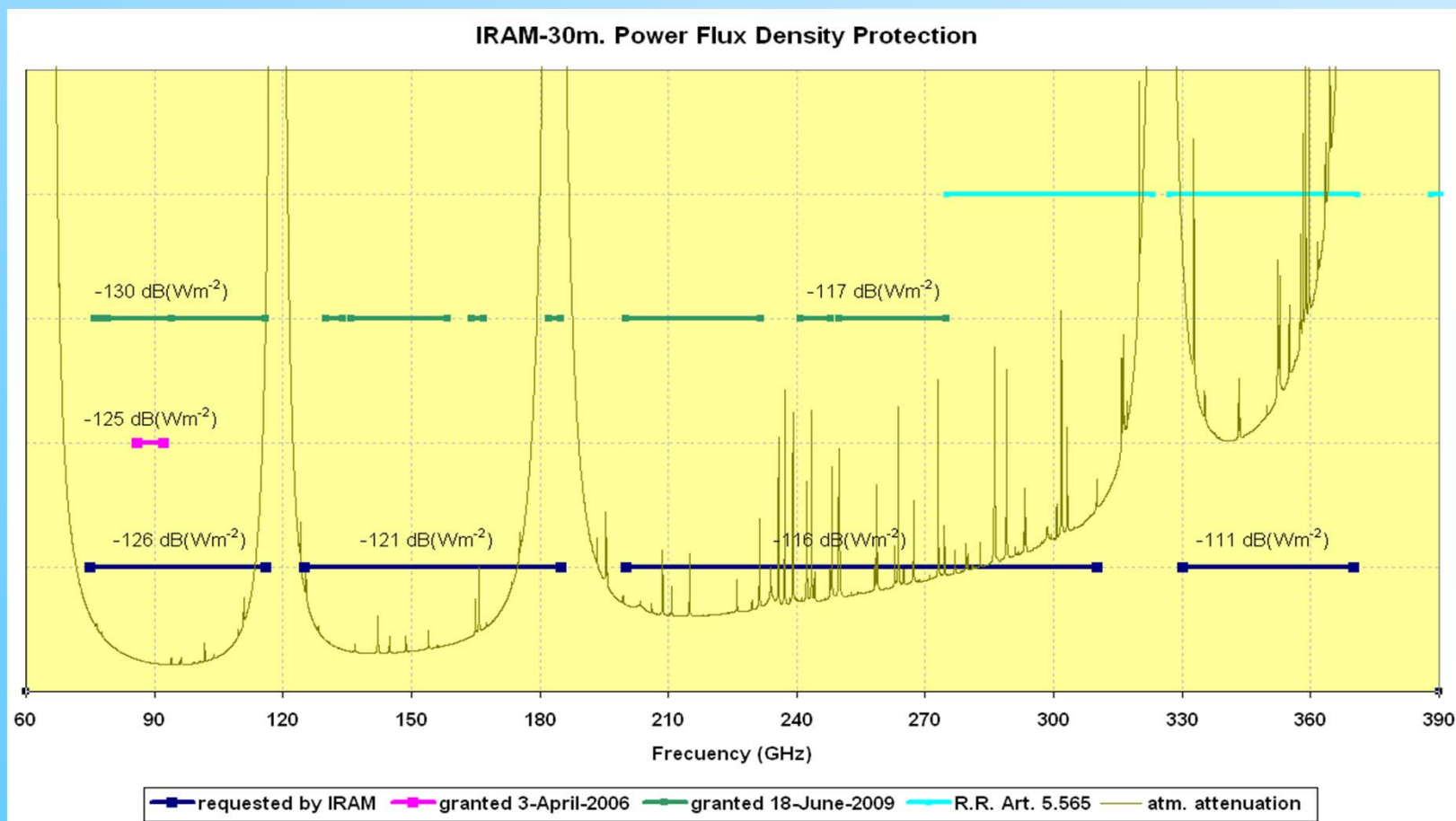
- Approved on March-2006 a minimum protection at all the frequencies - 57dB(Wm⁻²) and a good value at 86-92 GHz -125dB(Wm⁻²)
- Approved on 18-June-2009 (Orden ITC/1679/2009)
- Good protection in the frequency range 76 to 275 GHz (frequency bands according to RR ITU) (protection level according to ITU-R 769/2* and CCIR 224-7**)

* ITU-R 769/2, Protection criteria used for radio astronomical measurements

** CCIR 224-7, Interference Protection Criteria for the Radio Astronomy Service

IRAM-30m Radioelectric Protection

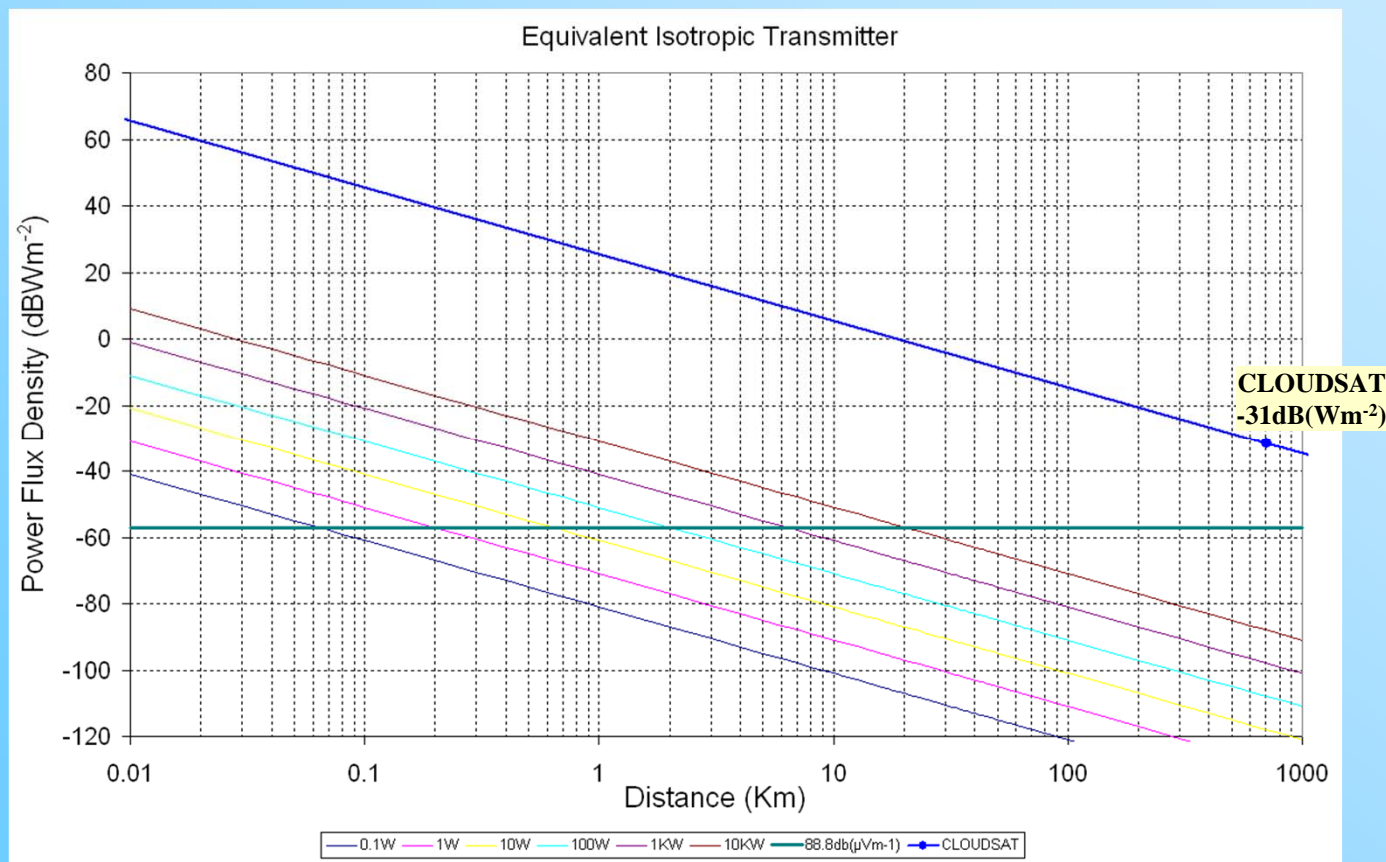
- Requested protection from 75 to 370 GHz
- Granted good protection in the frequency range 76 to 275 GHz (frequency bands according to RR ITU) (protection level according to ITU-R 769/2* and CCIR 224-7**)
- Power Flux Density established for 8 GHz bandwidth



IRAM-30m Radioelectric Protection

General Protection

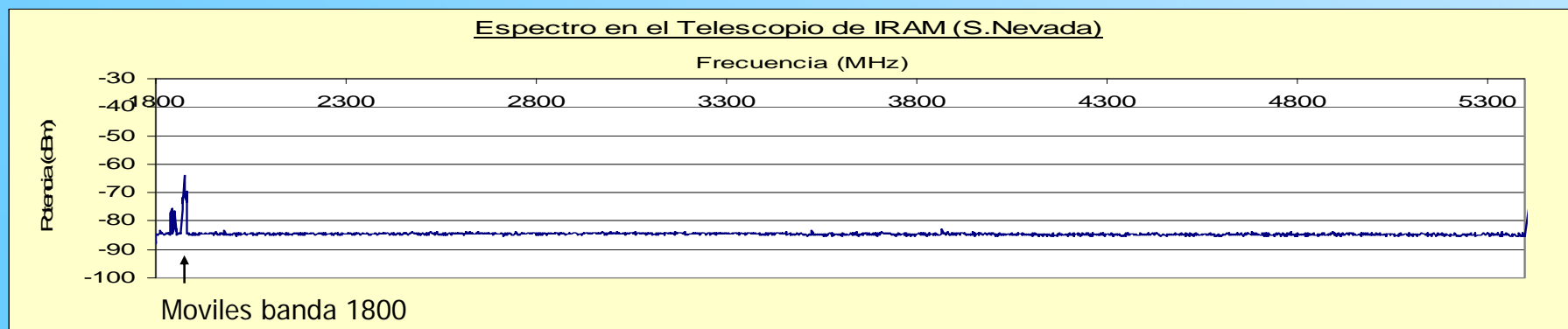
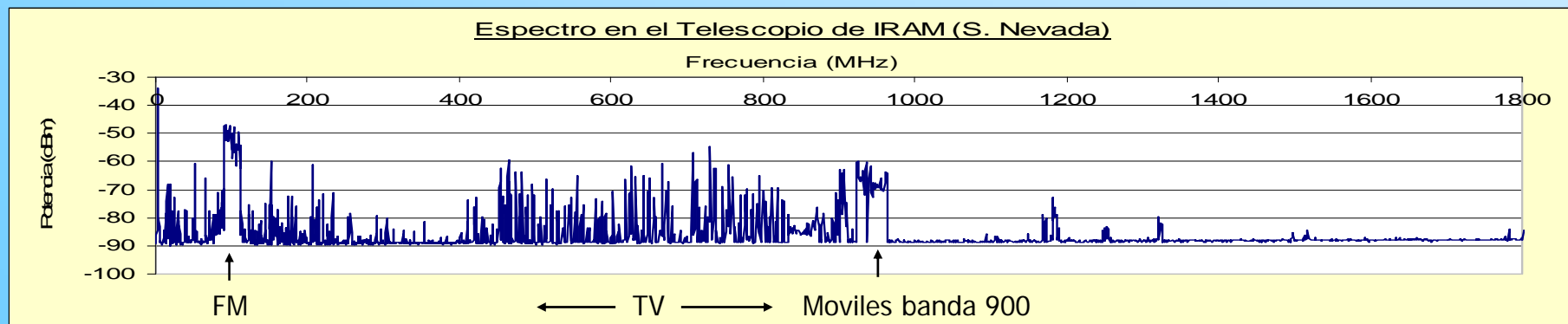
- For all frequencies no specifically protected:
the electrical field intensity $< +88.8 \text{ dB } (\mu\text{V/m})$ or
the power flux density $< -57 \text{ dB(Wm}^{-2})$



IRAM-30m Radioelectric Protection

At the 30m observatory:

- The main frequency components of the free frequency spectrum are emissions below 3 GHz
- But the number of transmitters increase
- We maintain tracking of these frequencies



Measures taken to mitigate interferences to equipments

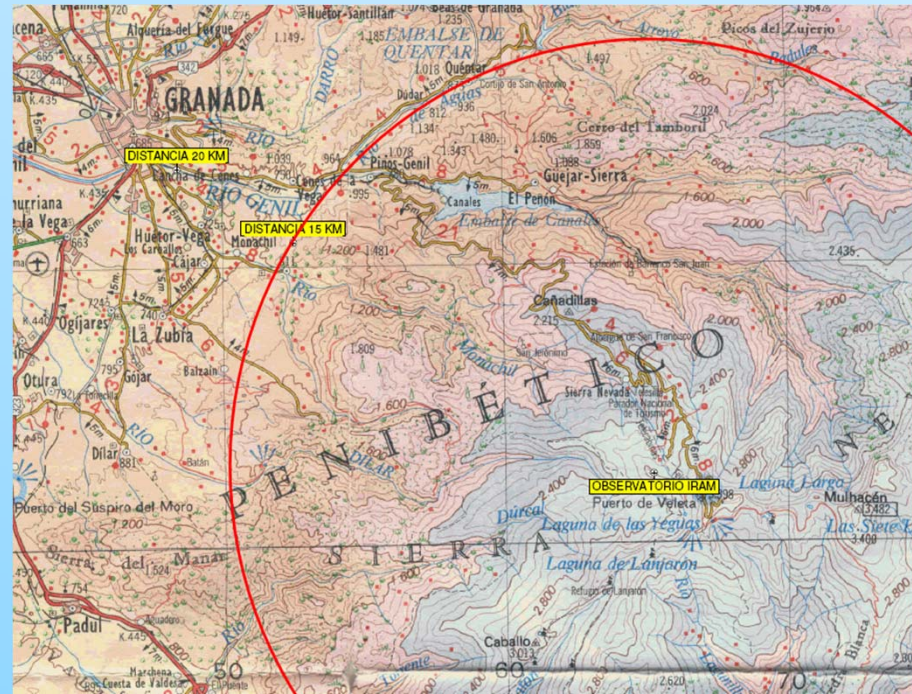
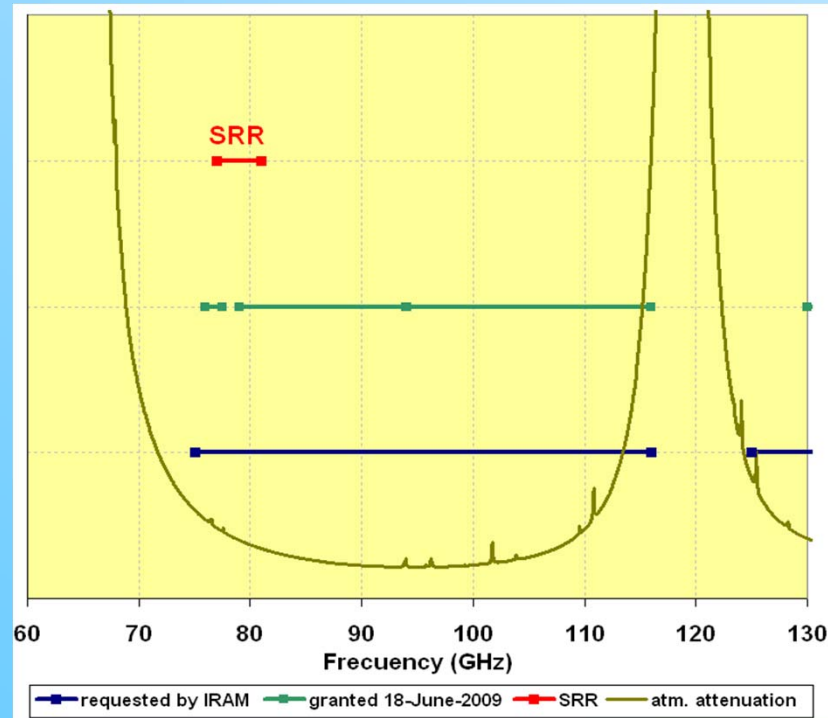
-The use of mobiles phones is not permitted in the telescope building. Specially hazardous inside the antenna to the sensitive receiver junctions.

- Only wired network, no wi-fi wlan are available.

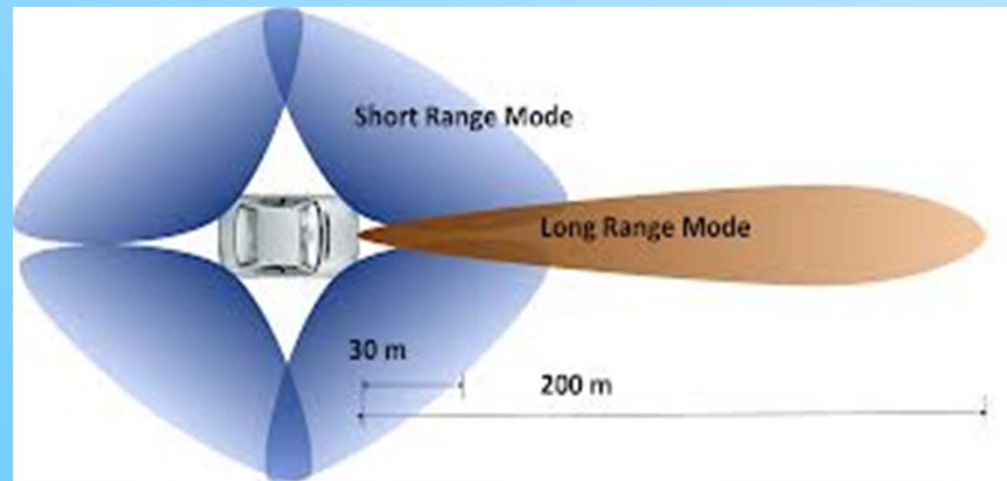
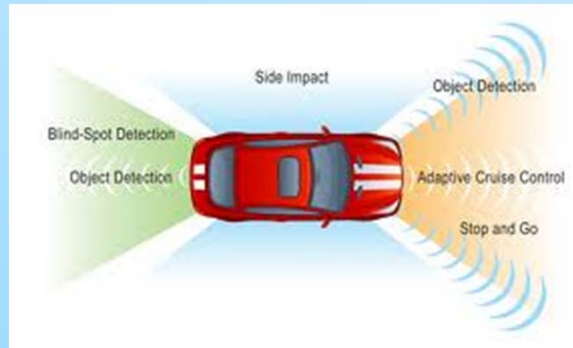
-We can do nothing about the thousands of mobiles in skier's pockets passing close to the telescope. For now we didn't see effect. On the contrary the only solution would have been a better shielding of spectrometers room.

Short Range Radar (SRR)

- SRR operate in the frequency range 77 to 81 GHz
- Protection distance granted to the IRAM-30m: 15 Km



- ECC/DEC/(04)03 and ECC report 56 established:
maximum mean power density -3dBm/Mhz e.i.r.p. => **EXCESSIVE!**
associated with a peak limit +55 dBm e.i.r.p. => **EXCESSIVE!**
- Why SRR don't operate in the non propagation atmospheric bands?
- How to control the switching OFF of the SRR in the protection distance?



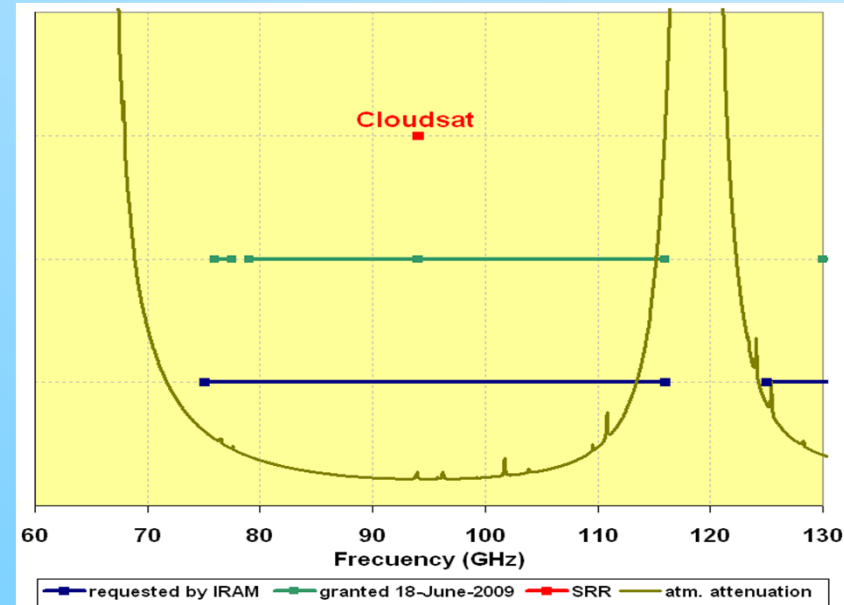
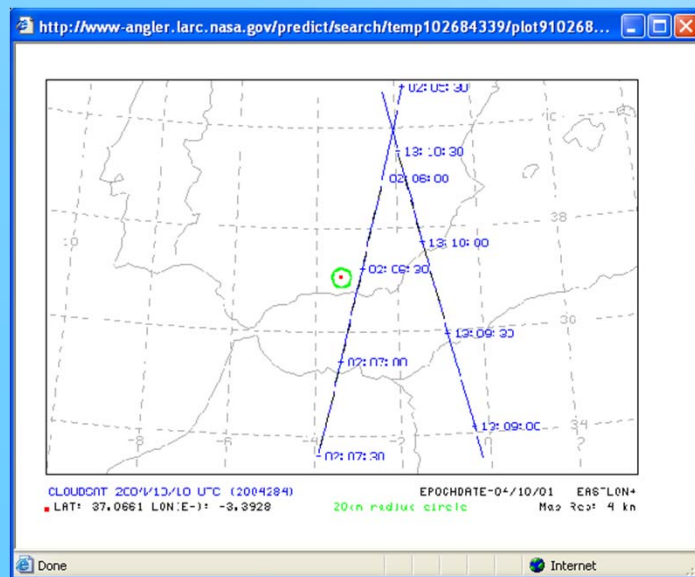
Cloudsat

Characteristics

- **Cloudsat operates in the frequency range 94 to 94.1 GHz**
- **If antenna-Cloudsat are aligned zenith-nadir then 556 mW impact into the receivers**
- **But at the IRAM-30m there are no Cloudsat orbits in a 30 Km radius from the zenith (2.4°)**

Protection

- The vertex window is automatically closed at elevations $> 88.5^\circ$
 - We monitor the Cloudsat trajectory every 5 sec.
 - An Alarm is triggered if the separation antenna-Cloudsat $< 25^\circ$
- Cloudsat is just the first Earth exploration active satellite!



CLOUDSAT Closest Approach Estimates

SITE_NAME	LON_DMS	LAT_DMS	LON	LAT	Num of Orbits within	
					15km	30km
Bordeaux_France	-000:31:37	44:50:10	-0.5269	44.8361	1	2
Effelsberg_Germany	006:53:00	50:31:32	6.8833	50.5256		2
Kayseri_Turkey	036:17:58	38:59:45	36.2994	38.9958	1	1
Metsahovi_Finland	024:23:17	60:13:04	24.3881	60.2178	2	2
Onsala_Sweden	011:55:35	57:23:45	11.9264	57.3958		2
Pico_de_Veleta_Spain	-003:23:34	37:03:58	-3.3928	37.0661		
Plateau_de_Bure_France	005:54:26	44:38:01	5.9072	44.6336	2	2
Sardinia_Italy	009:14:40	39:29:50	9.2444	39.4972		1
Yebes_Spain	-003:05:22	40:31:27	-3.0894	40.5242		1
Itapetinga_Brazil	-046:33:28	-23:11:05	-46.5578	-23.1847		
Llano_de_Chajnantor_Chil	-067:45:18	-23:01:22	-67.755	-23.0228	1	2
Sierra_Negra_MX	-097:18:48	18:59:06	-97.3133	18.985		1
Green_Bank_WVa_USA	-079:50:24	38:25:59	-79.84	38.4331		1
Haystack_MA_USA	-071:29:18	42:37:24	-71.4883	42.6233		
Quabbin_MA_USA	-072:20:42	42:23:30	-72.345	42.3917	2	2
Kitt_Peak_AZ_USA	-111:36:53	31:57:12	-111.6147	31.9533		
Cedar_Flat_CA_USA	-118:09:03	37:16:39	-118.1508	37.2775		
Brewster_WA_USA	-119:40:55	48:07:53	-119.6819	48.1314	1	1
Fort_Davis_TX_USA	-103:56:39	30:38:06	-103.9442	30.635		
Hancock_NH_USA	-071:59:12	42:56:01	-71.9867	42.9336	1	1
Kitt_Peak_AZ_USA	-111:36:42	31:57:22	-111.6117	31.9561		
Los_Alamos_NM_USA	-106:14:42	35:46:30	-106.245	35.775		
Mauna_Kea_HI_USA	-155:27:29	19:48:16	-155.4581	19.8044	1	2
North_Liberty_IA_USA	-091:34:26	41:46:17	-91.5739	41.7714		
Owens_Valley_CA_USA	-118:16:34	37:13:54	-118.2761	37.2317		2
Pie_Town_NM_USA	-108:07:07	34:18:04	-108.1186	34.3011		1
St_Croix_VI_USA	-064:34:05	17:45:31	-64.5681	17.7586		
Narrabri_Australia	149:32:56	-30:18:52	149.5489	-30.3144		
Tamna_Korea	126:27:43	33:17:18	126.4619	33.2883		1
Ulsan_Korea	129:15:04	35:32:33	129.2511	35.5425	1	1
Yonsei_Korea	126:56:35	37:33:44	126.9431	37.5622	1	2
MOPRA_Australia	149:05:58	-31:16:04	149.0994	-31.2678		1
Nobeyama_Japan	138:28:32	35:56:29	138.4756	35.9414	1	1
Purple_Mountain_China	097:44:00	37:22:00	97.7333	37.3667	2	2
Seoul_Korea	126:57:19	37:27:15	126.9553	37.4542	2	2
Taejon_Korea	127:22:18	36:23:54	127.3717	36.3983	1	1