

**Exhibit 1**

**Discussion of basis for application**

July 14, 1995

Harold Ng  
Federal Communications Commission  
Satellite Engineering Branch  
Satellite and Radiocommunication Division  
International Bureau

Dear Mr. Ng:

Thank you for giving me the opportunity on July 13 to discuss our research project in emergency, relief, and humanitarian medical information communications, using our LEO microsatellite HealthSat-II. As I described, HealthSat-II is fully owned by SatelLife, Inc. (Cambridge MA). SatelLife was founded in 1987 as an initiative of the 1985 Nobel Peace Laureate, the International Physicians for the Prevention of Nuclear War. SatelLife is registered as a not-for-profit organization in the Commonwealth of Massachusetts and as an IRS 501(c)3 tax exempt charitable organization. Our objective is improved medical care to the developing world through appropriate, affordable communications technology.

As we discussed, SatelLife would like to resolve promptly any questions about the status of HealthSat-II under FCC regulations. This letter accompanies our application today for new experimental license authorization for HealthSat-II, and forms Exhibit 1 of that application. (It is also provided to you separately for your information.) Our exchange of correspondence of June 27 and July 14 forms Exhibit 2. A technical description of HealthSat-II as provided to us by Surrey Satellite Technology Ltd (UK) forms Exhibit 3. A 1993 draft ITU notification ( \*\* [REDACTED] ) is attached as Exhibit 4. Finally, an application, dated 7 April 1994, for experimental license for an earth station to be operated at our offices, forms Exhibit 5.

We are applying for experimental service operation of Healthsat-II under 47 CFR subsection 5.202 because:

- (a) Since 1991, SatelLife has cooperated with Antarctic Support Associates (Boulder CO), a prime contractor of the Division of Polar Programs of the National Science Foundation, in investigating emergency and medical communications for Antarctic locations using amateur-type LEO microsatellite technology. This work began with HealthSat-I (OSCAR-3) and continues with HealthSat-II. SatelLife and Antarctic Support Associates are finalizing a contract for provision of communication services as a result of this work, and our proposed operation of HealthSat-II under this license would therefore fall under of 47 CFR subsection 5.202(b) and 5.202(c).

\*\* For technical information only - no filing action was taken

(b) In addition, we are beginning a series of tests, with Surrey Satellite Technology Ltd, to develop improved communication protocols for operation of HealthSat-II to manage shared use among moderately large numbers of earth stations under the footprint. (At present, amateur-type AX.25 protocols make it possible for the first such station making contact to retain exclusive use of the satellite for the remainder of the pass.) This is experimentation in technical radio research, falling under 47 CFR subsection 5.202(a).

(c) We now provide training and demonstration in use of amateur-type LEO microsatellite technology using HealthSat-II, and will continue to do so; this falls under 47 CFR subsection 5.202(d).

We therefore believe application for operation in experimental service is appropriate for HealthSat-II. We estimate this experimental operation will continue for a period of two years, beginning in October, 1995.

If any further information is necessary regarding HealthSat-II and SatelLife, please contact:

Administrative:

John Mullaney, Executive Director  
SatelLife, Inc., Cambridge MA  
(617) 868-8522

Technical:

Alexander Brown, Technical Director  
SatelLife, Inc., Cambridge MA  
(617) 868-8522

Legal:

Paul Vishny, Esq  
D'Ancona and Pflum  
30 N. LaSalle - Suite 2900  
Chicago Illinois 60602  
(312) 580-2000

Thanks again for your assistance.

Yours truly,

Alexander S Brown  
Technical Director

**Exhibit 2**

**Correspondence between FCC and SatelLife, June26 and July 12, 1995**

Federal Communications Commission  
Washington, D.C. 20554

Alan -  
Can we draft a  
response

In Reply Refer to: 080012

June 27, 1995

Mr. John Mullaney  
Satellife  
126 Rogers Street  
Cambridge, MA 02142

Re: HealthSat-II

Dear Mr. Mullaney:

It has been brought to our attention that a satellite known as HealthSat-II, managed by Satellife, is currently providing mobile satellite data services around the world. In providing this service, it is possible that radio transmissions from the satellite will interfere with current or future U.S. licensees using the same frequency bands.

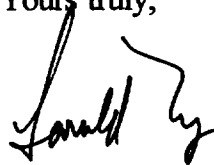
In order to understand more fully the circumstances surrounding the operation of HealthSat-II, we ask that you respond to the following:

- (1) Please identify the notifying administration before the International Telecommunications Union (ITU) for the HealthSat-II satellite. Include the ITU-BR Weekly Circular which contains the technical information for the HealthSat-II system. Please describe in detail the operation of HealthSat-II. Who owns, operates and/or controls the HealthSat-II satellite?
- (2) Under what conditions do radio transmissions from HealthSat-II reach any part of the U.S.? What are the power flux densities of those signals reaching the U.S.? What technical or operational safeguards are in place to prevent any HealthSat-II radio signals from interfering with U.S.-licensed satellite systems, both space and earth station segments?
- (3) What earth stations in the U.S. transmit to or receive radio signals from HealthSat-II? What is the relationship between the owner or user of such earth stations in the U.S. and Satellife? Who are the owners of the earth stations?

We ask that you respond to this letter within ten days of receipt. If you have any questions, please feel free to contact the undersigned at 202.739.0748.

Thank you.

Yours truly,

A handwritten signature in black ink, appearing to read "Harold Ng", written over a horizontal line.

Harold Ng, Chief  
Satellite Engineering Branch  
Satellite and Radiocommunication  
Division  
International Bureau

July 12, 1995

Harold Ng, Chief  
Satellite Engineering Branch  
Satellite and Radiocommunication Division  
International Bureau  
Federal Communications Commission  
Washington, DC

Dear Mr. Ng:

This letter is in response to your correspondence of June 27, reference number 080012, asking for information on the operation of HealthSat-II, as follows:

(1a) "Please describe in detail the operation of HealthSat-II."

The LEO microsatellite HealthSat-II (HS2) was built by Surrey Satellite Technology Ltd (UK) (SSTL) and launched on Arianespace V-59 in late September 1993. It is an amateur type store-and-forward data communications system; although it is a late model in the SSTL UoSat series, and is equipped with more powerful processors and more memory than earlier UoSats, it is still designed to use the AX.25 link protocols to provide message and file transfer to and from an onboard store-and-forward software system. AMSAT-type software (either public domain or proprietary) can be used on a ground station computer to give a user the ability to prepare messages and files for upload, automatically schedule and control upload and download during a pass, and read messages and use files after download.

HS2 was designed to use the "Little LEO" communication frequency bands allocated at WARC-92, rather than amateur satellite frequencies. HS2 provides two uplink receivers in VHF, each with two possible frequencies (all around 149.85 MHz) for data communications, and a third command uplink receiver; a single transmitter in UHF is switchable to one of three possible frequencies (all around 400.55 MHz).

HS2 is controlled by SSTL according to an annual maintenance contract with SatelLife, from its tracking, telemetry and control (TT&C) groundstation in the UK.

A detailed technical specification sheet describing HealthSat-II is attached. If more information is needed, please don't hesitate to contact us immediately.

(1b) "Who owns, operates, and/or controls the HealthSat-II satellite?"

HealthSat-II is fully owned by SatelLife, Inc. (Cambridge MA). SatelLife was founded in 1987 as an initiative of the 1985 Nobel Peace Laureate, the International Physicians for the Prevention of Nuclear War. SatelLife is registered as a not-for-profit organization in the Commonwealth of Massachusetts and as a public charity in the United Kingdom. SatelLife is governed by an international Board of Directors, chaired by its founder Dr. Bernard Lown.

(1c) "Please identify the notifying administration before the International Telecommunications Union (ITU) for the HealthSat-II satellite. Include the ITU-BR Weekly Circular which contains the technical information for the HealthSat-II system."

Our response to this question requires a brief review of this project's history.

SatelLife was created with the concept of delivering a communications alternative for medical information, that used a low-earth orbit (LEO) amateur packet radio technology satellite to link medical education centers in Africa with medical libraries and other centers in the US, Canada, and Europe. The motivation for this alternative was the absence of reliable telephone service or other electronic communications in many parts of Africa, and extremely high costs in other places. The alternative solution proposed use of the low-earth orbit satellite to support a groundstation as a national hub for electronic mail and other data communications. SatelLife raised funds to acquire Healthsat-1 (HS1, aka UoSat-3 and OSCAR-14) and began experimenting with this service on amateur frequencies using amateur licenses, until last year, when it was sold in its entirety to DataTrax Systems Inc (Calgary, Alberta, Canada).

The limited power and capacity of the HS1 satellite was insufficient to meet the demand. SatelLife learned a great deal about LEO satellite operation, and decided that the first satellite would be replaced by a second more powerful satellite, Healthsat-2, with similar technology, operating on frequencies allocated by WARC-92 for LEO operation without the content and interoperation restrictions of the amateur bands.

SatelLife raised additional funds to acquire the next SSTL satellite as HealthSat-II. Thereafter, and well before the launch, SatelLife negotiated with VITA for acquisition by VITA of a substantial interest in HS2, with the understanding that the satellite would be operated pursuant to the expected license which VITA hoped to obtain in light of its pioneer preference. Shortly before launch, VITA's frequencies were placed on HS2 at the request of VITA. After that time VITA defaulted under its contractual obligation and lost its right to any interest in HS2; however, there was not time to change the frequencies before the launch.

As a result any attempt to register HS2 with the ITU through the good offices of the FCC has been delayed. In the interim we have operated HS2 for testing and

experimental purposes only. Groundstations supporting these experiments have been licensed locally, using three sites in Africa, one in China, one in Antarctica, and two in St Johns Newfoundland CAN, at the Memorial University Center for Telemedicine, our partner in this research, with funding from Canada's International Development Research Center (IDRC), and at the Canadian Center for Marine Communication on the Memorial University campus.

Our network services to African and other underdeveloped nations' health programs in the meanwhile have been implemented using conventional international direct-dial modem communications.

(2a) "Under what conditions do radio transmissions from HealthSat-II reach any part of the US?"

HealthSat-II is in a sun-synchronous near-polar orbit with a period of approximately 100 minutes; its footprint makes approximately four passes per day of up to 15 minutes each over any location in the middle latitudes, including the U.S. During this pass the HS2 downlink transmitter, set to one of three selectable frequencies in the vicinity of 400.55 MHz, broadcasts an audio-frequency carrier tone that serves as a beacon. FSK modulation of this carrier carries data when a groundstation succeeds in establishing a connection with HS2; bandwidth required is 15 KHz.

(2b) "What are the power flux densities of those signals reaching the U.S.?"

We have asked SSTL to provide detailed calculations of the maximum power flux density at the surface based on tests of the downlink system. Our own rough calculations indicate the following:

Estimating...

$$\text{powerdensity} = (P * G) / (4 * \text{PI} * R^2)$$

where

$$\text{powerdensity} = \text{W/m}^2$$

R = distance from observation point to antenna

P = average power at the antenna

G = gain of the antenna

Let's suppose HS-2 is at TCA and its antenna radiation pattern is uniform (isotropic, 0 dBi)

R in this case = 800 Km

P = 12 Watts max

G = 1

$$\begin{aligned}\text{powerdensity} &= (12 * 1) / (4 * \text{PI} * 800000^2) \\ &= 1.49\text{E-}12 \text{ W/m}^2\end{aligned}$$

in dBW ...

$$\begin{aligned}\text{powerdensity} &= -118.27 \text{ dBW/m}^2 \\ &(\text{not taking in consideration bandwidth.})\end{aligned}$$

This is the best empirical case. In practice, the antenna is not isotropic, and the satellite is almost never at TCA. This and other factors must be taken into account for a more accurate estimate.

- (2c) "What technical or operational safeguards are in place to prevent any HealthSat-II radio signals from interfering with US-licensed satellite systems, both space and earth station segments?"

At present there are none, other than monitoring the downlink and uplink frequencies for activity on the currently selected HS2 frequencies. We could have limited control of downlink power by contracting with SSTL for modification of onboard software to provide reduced power over the US, in hopes that this would minimize any remaining potential interference. We would prefer not to do so because of the added cost to us that is involved, and are prepared instead to coordinate frequency usage with others.

- (3a) "What earth stations in the US transmit to or receive radio signals from HealthSat-II?"

No earth station in the US is presently licensed to transmit to or receive from HS2. We do not operate a groundstation for either data communications or control of HS2 at our offices here in Cambridge MA. Our research partners at the Memorial University Center for Telemedicine, and Canadian Center for Marine Communications, St Johns Newfoundland CAN, provide support of data communications under their experimental licenses; we access the Memorial University groundstation through the university's Internet connection.

Please note that we have filed applications, dated April 7, 1994, for experimental STA licenses for three fixed base satellite earth stations for the period 15 April 1994 through 14 April 1996. It is our present intent to withdraw two of these, leaving only an application for our own station, with revised dates. Copies of these applications are also attached.

SPACEQUEST LTD. (Fairfax VA) was granted an experimental special temporary authority (STA) to operate on HS2 frequencies between January 1, 1995, and June 30, 1995, in support of experimental use of its product, the SQ96 lightweight, low-power groundstation. This was used for message communications via HS2 with the support of Memorial University, by two Arctic expeditions in the vicinity of the North Pole during that period. Both expeditions have ended, and no reapplication for such

operation is anticipated at this time.

(3b) "What is the relationship between the owner or user of such earth stations in the US and SatelLife?"

SPACEQUEST is a vendor of groundstation equipment that supports our satellite system, and as a result we have an interest in their product development, but there is no further relationship between the two organizations.

(3c) "Who are the owners of the earth stations?"

There are no HS2 earth stations operating in the US at present; when they do exist, they are expected to be owned by their licensed operators.

Please don't hesitate to contact us if more information is required.

Yours truly,

John Mullaney,  
Executive Director

Alexander Brown  
Technical Director

**Exhibit 3**

**Detailed technical specification of HealthSat-II  
(Surrey Satellite Technology, 1993)**

# SURREY SATELLITE TECHNOLOGY Ltd

## HEALTHSAT-II    A COMMERCIAL STORE-&-FORWARD SATELLITE FOR MEDICAL COMMUNICATIONS



HEALTHSAT-II, to be launched in September 1993 on the Ariane ASAP, will join UoSAT-3/HealthSat-I as the second SSTL microsatellite in the HealthNet global communications system of SatelLife, a U.S. not-for-profit organisation. HealthNet, which is licensed in eighteen countries in Africa and Latin America, is providing desperately needed low cost 'last mile' communication links between medical institutions and health programmes in the developing world.

The 'state-of-the-art' design of the HealthSat-II mission is the cumulation of SSTL's pioneering work in store-&-forward communications. Surrey flew the first civil store-&-forward communications payload on UoSAT-2 in 1984 and has flown increasingly capable payloads on 5 subsequent microsatellites, basing the HealthSat design on the resulting 9 years of in-orbit experience.

The HealthSat-II mission was completed, from concept to launch, within one year. SSTL was responsible for the design, construction, test and in-orbit commissioning of the satellite from its facilities in the Centre for Satellite Engineering Research at the University of Surrey. SSTL were also responsible for all the programmatic aspects of the mission including procuring the launch slot on the Ariane ASAP and arranging suitable insurance for the launch and early commissioning phase - all within a total contract price of £1M. Following on from the highly successful S80/T and KITSAT-1 missions, HealthSat-II continues to affirm SSTL as the leading manufacturer of low cost, rapid response microsatellite missions.

HealthSat-II has been custom-designed to support cost effective store-&-forward communications using low cost, portable groundstations and consequently it has the following main mission characteristics:

### *Communications link*

- 3 uplink receivers at VHF
- 2 redundant downlink transmitters at UHF
- Omni-directional satellite antennas
- Switchable AFSK/FSK modulation
- 1200/9600 bps uplink, 9600/38,400 bps downlink
- Output transmitter power adaptive from 1W to 10W under computer control
- AX.25 packet communications protocol

### *Payload*

- Dual redundant 80C186 on-board computers at 8MHz
- Highly integrated 80C188 back-up on-board computer at 10 MHz
- 48 Mbytes SRAM on-board memory
- EDAC memory protection against radiation-induced SEUs
- Advanced solar cell technology experimental payload

Surrey Satellite Technology Ltd is a wholly-owned technology spin-off company of the University of Surrey. SSTL was formed in 1985 to transfer the results of academic research into industry - in order to fund continued research into cost-effective satellite engineering techniques, as ideally illustrated in the case of the HealthSat-II mission.

For more information on HealthSat-II and other SSTL expertise contact:

|                      |                           |                       |                       |
|----------------------|---------------------------|-----------------------|-----------------------|
| <b>SSTL</b>          | Professor Martin Sweeting | Tel +44-(0)483-509143 | Fax +44-(0)483-509503 |
| <b>SatelLife USA</b> | Charles Clements, M.D.    | Tel +1-617-868-8522   | Fax +1-617-868-6647   |

**Surrey Satellite Technology, University of Surrey, Guildford, Surrey GU2 5XH, UK**

# HEALTHSAT II TECHNICAL SPECIFICATIONS

## 1. GENERAL FRAME OF REFERENCE

HealthSat II shall build upon the experience of UoSat 3, UoSat 5, KITSAT-1, and S80/T in so far as the central elements of the program are concerned. For example, it is desirable to replicate the proven mechanical bus design used on these satellites to the extent possible to obviate re qualifying the fundamental design.

The design and fabrication of HealthSat II shall follow proven design rules established and employed on the most recent Surrey Satellite Technology Ltd missions--referred to in this document as "proven SST design."

## 2. LAUNCH

SST shall procure a launch for HealthSat II as a secondary payload on Airanespace Vol59 launch normally scheduled for 1 September 1993. The primary payload shall be the as the SPOT-3 satellite.

## 3. ORBITAL SPECIFICATIONS

HealthSat II shall be launched and inserted into an orbit with norminally the same orbital parameters SPOT-3, which are:

- a) LEO, circular, 800 km
- b) Sun synchronous, 10:30 a.m.\p.m.
- c) Orbital period: 100 minutes
- d) Inclination: 98.5 degrees

## 4. MISSION PARAMETERS

The primary purpose of HealthSat II spacecraft is to provide reliable packet store-and-forward telecommunications between earth stations.

## 5. ON-BOARD CPU

There shall be dual redundant primary onboard computers based upon proven SST design. Each will employ an 80C186 CPU operating at 8 MHz. The CPU shall employ at least 512 kilobytes of protected RAM and a special bootstrap ROM. Two serial port controllers providing a total of four serial ports shall be provided. In the nominal configuration, two ports are dedicated to house keeping and ther others used for communication.

## 6. RAMDISK MEMORY

There shall be two redundant RAMDISKS, each of which will provide

no less than 16 Mbytes of memory. The RAMDISKS of memory shall be arranged in banks to permit electrical isolation of failed units. The RAMDISK memory shall be available for message storage and operations reports.

## 7. POWER SUBSYSTEM

The Power Subsystem shall provide power to the entire spacecraft. Power generation, conditioning, storage capacity, and distribution shall be adequate to permit, when operationally required, the downlink transmitter to be operated between 10W and 8W output for at least 35% of each orbit without damage to any components of the battery. For the remaining 65% of each orbit, the output power level shall be not less than 1.5W.

## 8. SOLAR CELLS

Solar arrays shall be provided which generate the highest available efficiency commensurate with agreed general cost budget and delivery schedule constraints. Supplier shall make a good faith effort to provide high-performance GaAs solar cells with efficiency in the range of 18% or more. The goal shall be a beginning-of-life (BOL) full-power rating of 35W and a BOL on-orbit average of 15W.

## 9. POWER CONDITIONING AND DISTRIBUTION

The conditioning and distribution system shall emphasize avoidance of single-point failures modes. Appropriate hardware and software "fuses" and other protective measures, as appropriate, shall be implemented as required to maximize spacecraft safety and survival in the event of component failure. In such a case, the "fuses" should allow isolation of faulty components and, to the extent possible, allow continuation of the mission in a degraded mode.

## 10. BATTERY

The spacecraft battery shall have a capacity, at operating temperature, of 6 Ah. The cells shall be specially selected and matched to form the battery. Cells shall be selected to match, as closely as possible, the characteristics of their mates so as to insure the longevity of the battery as a whole. The battery shall be closely instrumented with telemetry monitor points as in the proven SST design.

## 11. ATTITUDE CONTROL SUBSYSTEM

The HealthSat II spacecraft shall employ an Attitude Control Subsystem similar to that used on the proven SST design, except that there will be no sun sensors, no earth horizon sensor, and no externally-mounted magnetometer head. The Attitude Control Subsystem shall be capable, under autonomous operation, of maintaining the spacecraft Z-axis within 5 degrees of nadir pointing at all times. Attitude control mechanisms shall also provide a controlled spin about the Z-axis.

## 12. GRAVITY GRADIENT BOOM

A deployable 6m long gravity gradient boom with a 2 kg tip mass shall be employed to provide the primary normalizing gravity gradient attitude control torque. The boom shall be deployable once and only once.

## 13. MAGNETORQUING COILS

At least four magnetorquing coils shall be provided. These shall be similar to those installed in the proven SST design. These coils shall be energized when/as required for attitude control, spin establishment, and maintenance and such dampening as may from time to time be required. These magnetorquing coils shall be driven under computer control as has been done on prior UoSATs.

## 14. OPERATING FREQUENCIES

HealthSat II shall operate within the newly WARC 'LITTLE LEO' communication frequency bands. The uplink shall be at VHF and the downlink at UHF. Each uplink receiver shall be capable of operating on either of two frequencies. The command receiver shall operate on a single uplink frequency.

| NAME       | SIGNAL<br>BANDWIDTH | CHANNEL<br>WIDTH | CENTER<br>FREQUENCY | REMARKS   |
|------------|---------------------|------------------|---------------------|-----------|
| Uplink A   | 15 kHz              | 25 kHz           | 149.8225            | 9600 bd   |
| Uplink B   | 15 kHz              | 25 kHz           | 149.8475            | 9600 bd   |
| Uplink C   | 15 kHz              | 25 kHz           | 149.8725            | 9600 bd   |
| Uplink D   | 5 kHz               | 15 kHz           | 149.8925            | 1200 bd   |
| -----      |                     |                  |                     |           |
| Downlink A | 15 kHz              | 40 kHz           | 400.5250            | 9600 bd   |
| Downlink B | 60 kHz              | 90 kHz           | 400.5500            | 38,400 bd |
| Downlink C | 15 kHz              | 40 kHz           | 400.5750            | 9600 bd   |

## 15. OUTPUT POWER

Each transmitter chain shall have a maximum power output of at least 10dBW as measured at the HPA output when the battery is at maximum charge and operated at the expected operating temperature. The loss incurred in the output filter, relay, power dividers, and transmission lines shall not exceed 1.6dB such that not less than 8.4 dBW (7.0 W) is coupled to the transmit antenna array.

#### 16. TRANSMIT DATA RATES

The downlink transmitter shall provide data rates of 9600 or 38400 bps. The data rate shall be under software control and selectable either under ground command or local (on the spacecraft) software control. As the 38.4 Kbps channel includes new technology, appropriate testing shall be applied.

#### 17. TRANSMIT MODULATION

The transmitter shall employ FSK modulation with a nominal 4.5 kHz peak deviation on the 9.6 Kbps downlink. When the 38.4 Kbps downlink is implemented, the FSK shift shall be 16.5kHz.

#### 18. RECEIVERS

Two communications uplink receivers (RX1 and RX2) shall be provided. Each shall have a separate low noise amplifier and a two frequency switch. A third receiver (RX0) is the command receiver and shall be separate to reduce susceptibility to single point failures.

#### 19. RECEIVE DATA RATES

All uplink receivers shall operate at 9.6 Kbps.

#### 20. UPLINK RECEIVE ANTENNAS

The uplink receive antenna shall consist of a monopole. It shall be linearly polarized and have a gain of approximately 0 dBi. The radiation pattern shall be omnidirectional about the spacecraft Z-axis.

#### 21. DOWNLINK TRANSMIT ANTENNA

The downlink transmit antenna shall consist of an array of 4 monopoles. The radiation pattern shall be linear and omnidirectional about the spacecraft Z-axis.

#### 22. SPACECRAFT TELEMETRY HARDWARE SYSTEM

The command and telemetry subsystem will be configured as per the proven SST design. Using a separate command receiver on a confidential frequency, the command subsystem shall facilitate telecommand of the spacecraft by authorized earth stations only. The usual protective measures shall be applied to the command uplink to preclude inadvertent or deliberate telecommand by unauthorized individuals. Each of the two redundant on-board computers shall have an interface to the telemetry system.

Satellite: HEATHSAT  
Catalog number: 22827  
Epoch time: 95191.19904837  
Element set: 463  
Inclination: 98.6142 deg  
RA of node: 267.3220 deg  
Eccentricity: 0.0009585  
Arg of perigee: 138.0353 deg  
Mean anomaly: 222.1564 deg  
Mean motion: 14.27898687 rev/day  
Decay rate:  $2.100\text{e-}07$  rev/day<sup>2</sup>  
Epoch rev: 9306  
Checksum: 377

CURRENT ORBITAL  
ELEMENTS REPORTED  
BY NASA .

**Exhibit 4**

**Draft ITU notification (1993)**

**For technical information only -  
no filing action was taken**

|                                                                                                        |  |                                                                       |  |                                                                                                                                        |  |                                                                                                                                |  |
|--------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------|--|
| DATE<br>(Day/Month/Year) <span style="border: 1px solid black; padding: 2px;">  /  /  </span>          |  | <b>FORM OF NOTICE</b>                                                 |  | PAGE 1 OF <span style="border: 1px solid black; padding: 2px;">06</span>                                                               |  | <b>AP3/II</b>                                                                                                                  |  |
| Administration<br>Serial Number <span style="border: 1px solid black; padding: 2px;">          </span> |  | <b>SPACE STATION / SATELLITE NETWORK</b><br>(APPENDIX 3 - SECTION II) |  |                                                                                                                                        |  |                                                                                                                                |  |
| NOTIFYING ADMINISTRATION<br><span style="border: 1px solid black; padding: 2px;">          </span>     |  | RR1488<br>Notification <input checked="" type="checkbox"/>            |  | RR1060<br>Request for Coordination <input type="checkbox"/>                                                                            |  | RR1610<br>Agreement under Art.14 <input type="checkbox"/>                                                                      |  |
|                                                                                                        |  |                                                                       |  | Request for Assistance of the IFRB for<br>RR1060 <input type="checkbox"/> and for RR1610 <input type="checkbox"/>                      |  | NOTIFICATION INTENDED FOR<br>ADD <input checked="" type="checkbox"/> MOD <input type="checkbox"/> SUP <input type="checkbox"/> |  |
| FIRST NOTIFICATION <input type="checkbox"/>                                                            |  |                                                                       |  | IFRB IDENTIFICATION NO. OF NETWORK<br>TO BE MODIFIED/SUPPRESSED <span style="border: 1px solid black; padding: 2px;">          </span> |  |                                                                                                                                |  |
| RESUBMISSION <input type="checkbox"/>                                                                  |  |                                                                       |  |                                                                                                                                        |  |                                                                                                                                |  |

### A. CHARACTERISTICS OF THE NETWORK

|                                                                                                                                                                                                                                                     |  |                                                                                                                                                                                                                                                                                                                                                                      |  |                                                                                                                                                                                                                                |  |                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                                                                                                                                                                                                                                                                                                                  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 1. NAME OF THE SPACE STATION <span style="border: 1px solid black; padding: 2px;">HEALTHSAT 2          </span>                                                                                                                                      |  |                                                                                                                                                                                                                                                                                                                                                                      |  |                                                                                                                                                                                                                                |  |                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                                                                                                                                                                                                                                                                                                                  |  |
| 4. ORBITAL INFORMATION                                                                                                                                                                                                                              |  |                                                                                                                                                                                                                                                                                                                                                                      |  |                                                                                                                                                                                                                                |  |                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                                                                                                                                                                                                                                                                                                                  |  |
| a. FOR GEOSTATIONARY SATELLITES ONLY                                                                                                                                                                                                                |  |                                                                                                                                                                                                                                                                                                                                                                      |  |                                                                                                                                                                                                                                |  |                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                                                                                                                                                                                                                                                                                                                  |  |
| 1. NOMINAL ORBITAL LONGITUDE<br><div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> <span>Degrees</span> <span>E/W</span> </div> <span style="border: 1px solid black; padding: 2px;">      </span> |  | 2. LONGITUDINAL TOLERANCE<br><div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> <span>Degrees</span> </div> <div style="display: flex; justify-content: space-between;"> <span>To West</span> <span>To East</span> </div> <span style="border: 1px solid black; padding: 2px;">      </span>                        |  | 3. INCLINATION EXCURSION<br><div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> <span>Degrees</span> </div> <span style="border: 1px solid black; padding: 2px;">      </span> |  | 4. VISIBILITY ARC<br><div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> <span>Degrees</span> </div> <div style="display: flex; justify-content: space-between;"> <span>From W</span> <span>E/W</span> <span>To E</span> <span>E/W</span> </div> <span style="border: 1px solid black; padding: 2px;">      </span> |  | 5. SERVICE ARC<br><div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> <span>Degrees</span> </div> <div style="display: flex; justify-content: space-between;"> <span>From W</span> <span>E/W</span> <span>To E</span> <span>E/W</span> </div> <span style="border: 1px solid black; padding: 2px;">      </span> |  |
| REASON FOR SERVICE ARC < VISIBILITY ARC ATTACHED <span style="border: 1px solid black; padding: 2px;">      </span>                                                                                                                                 |  |                                                                                                                                                                                                                                                                                                                                                                      |  |                                                                                                                                                                                                                                |  |                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                                                                                                                                                                                                                                                                                                                  |  |
| b. FOR NON-GEOSTATIONARY SATELLITES ONLY *                                                                                                                                                                                                          |  |                                                                                                                                                                                                                                                                                                                                                                      |  |                                                                                                                                                                                                                                |  |                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                                                                                                                                                                                                                                                                                                                  |  |
| 1. INCLINATION ANGLE<br><div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> <span>Degrees</span> </div> <span style="border: 1px solid black; padding: 2px;">98.5</span>                            |  | 2. PERIOD<br><div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> <span>Days</span> <span>D</span> <span>Hours</span> </div> <div style="display: flex; justify-content: space-between;"> <span>Hours</span> <span>H</span> <span>Min.</span> </div> <span style="border: 1px solid black; padding: 2px;">1440</span> |  | 3. APOGEE (km)<br><span style="border: 1px solid black; padding: 2px;">      820</span>                                                                                                                                        |  | 4. PERIGEE (km)<br><span style="border: 1px solid black; padding: 2px;">      806</span>                                                                                                                                                                                                                                                                            |  | 5. REFERENCE BODY<br><span style="border: 1px solid black; padding: 2px;">      </span>                                                                                                                                                                                                                                                                          |  |
|                                                                                                                                                                                                                                                     |  |                                                                                                                                                                                                                                                                                                                                                                      |  |                                                                                                                                                                                                                                |  | 6. NUMBER OF SATS.<br><span style="border: 1px solid black; padding: 2px;">01</span>                                                                                                                                                                                                                                                                                |  |                                                                                                                                                                                                                                                                                                                                                                  |  |

\* RAAN: 5.894 DEG  
 ARG OF PERIGEE 146.87 DEG  
 SERVICE ARC: WORLDWIDE

#### GENERAL NOTES:

- i. This form of notice consists of four parts - A, B, C and D. In each part, each Information item/data field includes a number in its label. This number is the same as that used for the same item in Appendix 3 (ORB-88) within the same part. For example, on the page labelled "Form AP3/II - B1" (at the bottom), the field "A2. Date of bringing into use" is the item numbered 2 in Part A of Section II.
- ii. Data items that are related are grouped together in a box. For example, the page labelled "Form AP3/II - B2" (at the bottom) contains a box titled "Emissions of the associated transmitting station(s)". It is possible to specify 12 different emissions (with associated power and power density) in this box. If there are more emissions, use another page of the same type to provide additional data, after checking (✓) the field labelled "More emissions on next page" on the preceding page. In all cases where there is more information than can fit in a box, follow this procedure.
- iii. This form can be used to add, modify or suppress an existing station, by checking the corresponding box at the top right-hand corner of this page in the area titled "Notification intended for". In the case of a modification of an existing station, where certain data fields are to be added, modified or suppressed, provide ALL the data in the particular box as they would look after the change. In addition, indicate that the corresponding beam, associated station or assignment is being modified by entering M in the field that has been provided for this purpose at these levels.
- iv. Certain fields in this notice form have a superscript "1" or "2" as part of their labels. These have the following meanings:
  - 1 - This information is to be provided when used as a basis to effect coordination with another administration. See footnote number 1 to Appendix 3 (ORB-88) for further details.
  - 2 - This information is not required for the notification of a typical earth station.

PAGE 02 OF 06

ADD/MOD/SUP   
of the beam

NOTE: For a steerable beam, the last character of the beam designation shall be "R"

111

11

|                    |  |       |
|--------------------|--|-------|
| PERIOD OF VALIDITY |  | Years |
|--------------------|--|-------|

A36. ADMINISTRATION RESPONSIBLE FOR THE STATION

| OTHER SPECIAL SECTIONS |        |
|------------------------|--------|
| Reference              | Number |

[illegible][illegible][illegible]

## Form AP3/II - B1



## SATELLITE TRANSMITTING ANTENNA BEAM DETAILS

| CHARACTERISTICS OF THE BEAM                                          |                  | ADD/MOD/SUP<br>of the beam                                                          |
|----------------------------------------------------------------------|------------------|-------------------------------------------------------------------------------------|
| 1. TRANSMITTING BEAM DESIGNATION                                     | 60               | NOTE: For a steerable beam, the last character of the beam designation shall be 'T' |
|                                                                      |                  | OLD BEAM DESIGNATION (if changed)                                                   |
| 3. ANTENNA CHARACTERISTICS                                           |                  |                                                                                     |
| c1/d1/f1. MAXIMUM ISOTROPIC GAIN                                     | +/- dBi<br>+ 0.0 | h. POINTING ACCURACY<br>Degrees ±<br>0.0                                            |
| g. POLARIZATION                                                      | LV               | c2/d2. ANTENNA GAIN CONTOURS DIAGRAM<br>ATTACHED. SEE FIGURE NO.:                   |
| e/f2. ANTENNA RADIATION PATTERN DIAGRAM<br>ATTACHED. SEE FIGURE NO.: | 01               | i. ESTIMATED ANTENNA GAIN DIAGRAM VS ORBIT<br>LONGITUDE ATTACHED SEE FIGURE NO.:    |

| INFORMATION COMMON TO THE FOLLOWING LISTS OF ASSIGNED FREQUENCIES IN THIS BEAM |                                          |
|--------------------------------------------------------------------------------|------------------------------------------|
| A2. DATE OF BRINGING INTO USE                                                  | Day Month Year<br>93                     |
| A3a. OPERATING AGENCY OR COMPANY                                               | SURREY SATELLITE TECHNOLOGY LTD          |
| A3b. ADMINISTRATION RESPONSIBLE FOR THE STATION                                | OTHER SPECIAL SECTIONS                   |
| Reference Number                                                               |                                          |
| 15d. SPECIAL SECTION AR11/A (RR1042)<br>Number                                 | (1)                                      |
| AR 11 / A /                                                                    | (2)                                      |
| 15e. SPECIAL SECTION AR11/C (RR1080)<br>Number                                 | (3)                                      |
| AR 11 / C /                                                                    | (4)                                      |
| 15f. SPECIAL SECTION ART.14 (RR1610)<br>Number                                 | (5)                                      |
| AR 14 / C /                                                                    |                                          |
| A5/A6. COORDINATED WITH OR AGREEMENT REACHED WITH                              |                                          |
| RR Provision                                                                   | Symbols of the Administrations concerned |
| RR                                                                             |                                          |
| RR                                                                             |                                          |
| RR                                                                             |                                          |
| RR                                                                             |                                          |
| RR                                                                             |                                          |
| A5/A6. COORDINATION REQUESTED WITH OR AGREEMENT SOUGHT WITH                    |                                          |
| RR Provision                                                                   | Symbols of the Administrations concerned |
| RR                                                                             |                                          |
| RR                                                                             |                                          |
| RR                                                                             |                                          |
| RR                                                                             |                                          |
| RR                                                                             |                                          |
| 15h. REMARKS                                                                   |                                          |

## NOTES ON FILLING IN THE NEXT PAGES:

FOR EACH BEAM YOU MAY PROVIDE ONE OR MORE LISTS OF ASSIGNED FREQUENCIES, EACH LIST HAVING ONE SET OF COMMON CHARACTERISTICS. THE BOTTOM HALF OF THIS PAGE CONTAINS COMMON DATA THAT IS APPLICABLE TO ONE OR MORE LISTS OF FREQUENCIES IN THIS BEAM. FOR EACH LIST OF FREQUENCIES IN THIS BEAM, FIRST FILL IN THE SET OF COMMON CHARACTERISTICS, INCLUDING ALL THE ASSOCIATED EARTH (OR SPACE) STATIONS, FOLLOWED BY THE LIST OF FREQUENCIES TO WHICH THE SET APPLIES. USE AS MANY PAGES AS NECESSARY.





|                                                                                                                                                                                                                                                                                                                             |                                                            |                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| DATE (Day/Month/Year) <span style="border: 1px solid black; padding: 2px;">93</span><br>Administration <span style="border: 1px solid black; display: inline-block; width: 100px; height: 15px;"></span><br>Serial Number <span style="border: 1px solid black; display: inline-block; width: 100px; height: 15px;"></span> | FORM OF NOTICE<br><b>SATELLITE NETWORK</b><br>(APPENDIX 4) | PAGE 1 OF <span style="border: 1px solid black; padding: 2px;">3</span><br><b>AP4</b>                                          |
| NOTIFYING ADMINISTRATION <span style="border: 1px solid black; display: inline-block; width: 100px; height: 15px;"></span>                                                                                                                                                                                                  |                                                            | RR1042<br>Advance Publication <input checked="" type="checkbox"/>                                                              |
| RR1047A<br>Request for Assistance of the IFRB <input type="checkbox"/>                                                                                                                                                                                                                                                      |                                                            | NOTIFICATION INTENDED FOR<br>ADD <input checked="" type="checkbox"/> MOD <input type="checkbox"/> SUP <input type="checkbox"/> |
| IFRB IDENTIFICATION NO. OF NETWORK TO BE MODIFIED/SUPPRESSED <span style="border: 1px solid black; display: inline-block; width: 100px; height: 15px;"></span>                                                                                                                                                              |                                                            |                                                                                                                                |

## B. CHARACTERISTICS OF THE NETWORK

|                                                                                                                    |                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 1. NAME OF THE SPACE STATION <span style="border: 1px solid black; padding: 2px;">HEALTHSAT 2</span>               |                                                                                                   |
| 2. DATE OF BRINGING INTO USE                                                                                       | REFERENCE TO PREVIOUS SPECIAL SECTION NUMBER (if network modified)                                |
| Day Month Year<br><span style="border: 1px solid black; padding: 2px;">93</span>                                   | <span style="border: 1px solid black; padding: 2px;">A R I 1 / A /</span>                         |
| 3a. ADMINISTRATIONS IN GROUP                                                                                       | 3b. OPERATING AGENCY OR COMPANY                                                                   |
| <span style="border: 1px solid black; display: inline-block; width: 100px; height: 15px;"></span>                  | <span style="border: 1px solid black; display: inline-block; width: 100px; height: 15px;"></span> |
| 3c. ADMINISTRATION RESPONSIBLE FOR THE STATION                                                                     |                                                                                                   |
| <b>SURREY SATELLITE TECHNOLOGY, INC.</b>                                                                           |                                                                                                   |
| 4. ORBITAL INFORMATION                                                                                             |                                                                                                   |
| a. FOR GEOSTATIONARY SATELLITES ONLY                                                                               |                                                                                                   |
| 1. NOMINAL ORBITAL LONGITUDE                                                                                       | 2. LONGITUDINAL TOLERANCE                                                                         |
| Degrees E/W<br><span style="border: 1px solid black; padding: 2px;">98.5</span>                                    | Degrees To West To East<br><span style="border: 1px solid black; padding: 2px;">1440</span>       |
| 3. INCLINATION EXCURSION                                                                                           | 4. VISIBILITY ARC                                                                                 |
| Degrees<br><span style="border: 1px solid black; padding: 2px;">0</span>                                           | Degrees From W E/W To E E/W<br><span style="border: 1px solid black; padding: 2px;">806</span>    |
| 5. SERVICE ARC                                                                                                     |                                                                                                   |
| Degrees From W E/W To E E/W<br><span style="border: 1px solid black; padding: 2px;">01</span>                      |                                                                                                   |
| 6. REASON FOR SERVICE ARC < VISIBILITY ARC ATTACHED <span style="border: 1px solid black; padding: 2px;">01</span> |                                                                                                   |
| b. FOR NON-GEOSTATIONARY SATELLITES ONLY *                                                                         |                                                                                                   |
| 1. INCLINATION ANGLE                                                                                               | 2. PERIOD                                                                                         |
| Degrees<br><span style="border: 1px solid black; padding: 2px;">98.5</span>                                        | Days D Hours H Min Min<br><span style="border: 1px solid black; padding: 2px;">1440</span>        |
| 3. APOGEE                                                                                                          | 4. PERIGEE                                                                                        |
| (km)<br><span style="border: 1px solid black; padding: 2px;">820</span>                                            | (km)<br><span style="border: 1px solid black; padding: 2px;">806</span>                           |
| 5. CELESTIAL BODY                                                                                                  | 6. NUMBER OF SATS.                                                                                |
| <span style="border: 1px solid black; padding: 2px;">T</span>                                                      | <span style="border: 1px solid black; padding: 2px;">01</span>                                    |

\* R.A.A.N. : 5.894 DEG ; ARG OF PERIGEE : 146.87 DEG ; SERVICE ARC : WORLDWIDE

### GENERAL NOTES :

- i. This form of notice consists of four parts - 1, 2, 3 et 4. In each part, each information item/data field includes a number in its label. This number is the same as that used for the same item in Appendix 4 (ORB-88) within the same part. For example, on the page labelled "Form AP4 - 2" (at the bottom), the field "4a1. Maximum power density" is the first item in section (a) of the paragraph numbered 4 in Part C. The items from parts F and G of Appendix 4 have been included in the parts C and D referred to above. The items from these parts have the letters F and G (correspondingly) preceding the number that is included in their labels.
- ii. Data items that are related are grouped together in a box. For example, the page labelled "Form AP4 - 2" (at the bottom) contains a box titled "Emissions and power characteristics". It is possible to specify 6 different emissions with the associated power and power density information in this box. If there are more emissions, use another page of the same type to provide additional data, after checking ( X ) the field labelled "More emissions on next page" on the preceding page. In all cases where there is more information than can fit in a box, follow this procedure.
- iii. This form can be used to add, modify or suppress an existing station, by checking the corresponding box at the top right-hand corner of this page in the area titled "Notification intended for". In the case of a modification of an existing station, where certain data fields are to be added, modified or suppressed, provide ALL the data in the particular box as they would look after the change. In addition, indicate that the corresponding beam, associated station or frequency range value is being modified by entering M in the field that has been provided for this purpose at these levels.
- iv. Certain fields in this notice form have a superscript "1" as part of their labels. This has the following meaning :  
 1 - This information is to be provided only if available.

## 5. CHARACTERISTICS OF THE BEAM

ADD. MOD/SUP ☐  
of the beam

GO

NOTE: For a steerable beam, the third character of the beam designation shall be "R".

|  |  |  |
|--|--|--|
|  |  |  |
|--|--|--|

## CB

|    |       |
|----|-------|
| 47 | cB:   |
|    | 0 • 0 |

|  |  |  |   |   |
|--|--|--|---|---|
|  |  |  | L | V |
|--|--|--|---|---|

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|                         |    |                          |    |                         |  |                          |  |
|-------------------------|----|--------------------------|----|-------------------------|--|--------------------------|--|
| 2a. CLASS<br>OF STATION | EG | 2b. NATURE<br>OF SERVICE | CP | 2a. CLASS<br>OF STATION |  | 2b. NATURE<br>OF SERVICE |  |
| 2a. CLASS<br>OF STATION | EU | 2b. NATURE<br>OF SERVICE | CP | 2a. CLASS<br>OF STATION |  | 2b. NATURE<br>OF SERVICE |  |

|  |   |   |   |   |         |
|--|---|---|---|---|---------|
|  | 1 | 0 | 0 | 0 | Kelvins |
|--|---|---|---|---|---------|

|  |  |
|--|--|
|  |  |
|--|--|

|   |   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| A | A | A |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

OR SERVICE AREA DIAGRAM ATTACHED  
SEE FIGURE NO

|      | Add/Mod/Sup<br>of the freq.range | FREQUENCY                            | k/M/G<br>Hz                    | IFRB IDENTIFICATION NUMBER<br>for modification/suppression |
|------|----------------------------------|--------------------------------------|--------------------------------|------------------------------------------------------------|
| FROM | <input type="checkbox"/>         | <input type="text" value="148.000"/> | <input type="text" value="M"/> | <input type="text" value=""/>                              |
| TO   | <input type="checkbox"/>         | <input type="text" value="150.050"/> | <input type="text" value="M"/> | <input type="text" value=""/>                              |

## EMISSIONS AND POWER CHARACTERISTICS

8. MODULATION CHARACTERISTICS ATTACHED. SEE ATTACHMENT NO. 1

|                                                                 |  |
|-----------------------------------------------------------------|--|
| 7/4a3. NECESSARY BANDWIDTH OR<br>FOG2a. DESIGNATION OF EMISSION |  |
|-----------------------------------------------------------------|--|

4a2/4c. TOTAL  
PEAK POWER 1

#### 4.1. MAXIMUM POWER DENSITY

4d. MINIMUM CARRIER  
POWER 1

Fd/G2b. SPACE/EARTH  
STATION E.I.R.P. 1

|  |  |   |   |   |   |   |   |   |
|--|--|---|---|---|---|---|---|---|
|  |  | 2 | 0 | K | 0 | F | 1 | D |
|  |  |   |   |   |   |   |   |   |
|  |  |   |   |   |   |   |   |   |
|  |  |   |   |   |   |   |   |   |
|  |  |   |   |   |   |   |   |   |
|  |  |   |   |   |   |   |   |   |

[illegible][illegible][illegible][illegible]

ADD/MOD/SUP  
of the station

4. SPACE STATION NAME

ADD/MOD/SUP  
of the station

DESIGNATION OF TYPICAL EARTH STATION

|   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |  |  |  |  |
|---|---|---|---|---|--|---|---|---|---|---|---|---|---|---|--|--|--|--|
| F | I | X | E | D |  | T | E | R | M | I | N | A | L | S |  |  |  |  |
|---|---|---|---|---|--|---|---|---|---|---|---|---|---|---|--|--|--|--|

4b1. RADIATION PATTERN (give reference pattern or provide diagram)

[illegible]

4b2. ANTENNA RADIATION DIAGRAM ATTACHED  
SEE FIGURE NO.:

02

**MORE EMISSIONS ON NEXT PAGE**

**MORE ASSOC. TRANSMITTING STATIONS ON NEXT PAGE**

REMARKS

FOR EACH BEAM FIRST FILL IN THE BOX TITLED 'CHARACTERISTICS OF THE BEAM'. THEN, FOR EACH EARTH-TO-SPACE SERVICE AREA ASSOCIATED WITH THIS BEAM, FILL IN THE UPPER PORTION OF THE BOX TITLED 'INFORMATION TO BE PROVIDED FOR THIS RECEIVING ANTENNA BEAM'. FOR EACH SIZE (TYPE) OF TRANSMITTING EARTH STATION ANTENNA, FILL IN THE PORTION OF THE BOX TITLED 'INFORMATION RELATED TO THE ASSOCIATED TRANSMITTING STATION(S)'. USE ADDITIONAL PAGES AS NECESSARY. IF THIS IS A SPACE-TO-SPACE RELAY, IDENTIFY THE OTHER SPACE STATION(S) IN THE BOX TITLED 'SPACE STATION', USING AS MANY PAGES AS NECESSARY.

# SATELLITE TRANSMITTING ANTENNA BEAM DETAILS

PAGE 3 OF 3

## 5. CHARACTERISTICS OF THE BEAM

ADD/MOD/SUP  
of the beam ☐

b TRANSMITTING BEAM DESIGNATION G0 NOTE For a steerable beam, the third character of the beam designation shall be 'R'

OLD BEAM DESIGNATION (if changed)

### ANTENNA CHARACTERISTICS

c1/d1:11 MAXIMUM ISOTROPIC GAIN

0.0 dB

OMNI-DIRECTIONAL ANTENNA

g POLARIZATION

LV

c2/d2. ANTENNA GAIN CONTOURS DIAGRAM

ATTACHED SEE FIGURE NO.

☐

b12 ANTENNA RADIATION PATTERN DIAGRAM  
ATTACHED SEE FIGURE NO.

011

h ESTIMATED ANTENNA GAIN DIAGRAM VS ORBIT  
LONGITUDE ATTACHED SEE FIGURE NO.

☐

## INFORMATION TO BE PROVIDED FOR THIS TRANSMITTING ANTENNA BEAM

|                                           |                                            |                                           |                                            |
|-------------------------------------------|--------------------------------------------|-------------------------------------------|--------------------------------------------|
| 2a. CLASS OF STATION <u>EU</u>            | 2b. NATURE OF SERVICE <u>CP</u>            | 2a. CLASS OF STATION <input type="text"/> | 2b. NATURE OF SERVICE <input type="text"/> |
| 2a. CLASS OF STATION <input type="text"/> | 2b. NATURE OF SERVICE <input type="text"/> | 2a. CLASS OF STATION <input type="text"/> | 2b. NATURE OF SERVICE <input type="text"/> |

PERIOD OF VALIDITY

1. SERVICE AREA AAA OR SERVICE AREA DIAGRAM ATTACHED SEE FIGURE NO. ☐

### 3/fb. FREQUENCY RANGE WITHIN WHICH THE CARRIERS WILL BE LOCATED

|      | Add/Mod/Sup<br>of the freq range | FREQUENCY    | k/M/G<br>Hz | IFRB IDENTIFICATION NUMBER<br>for modification/suppression |
|------|----------------------------------|--------------|-------------|------------------------------------------------------------|
| FROM | <input type="checkbox"/>         | <u>399.9</u> | <u>M</u>    | <input type="text"/>                                       |
| TO   | <input type="checkbox"/>         | <u>401.0</u> | <u>M</u>    | <input type="text"/>                                       |

## SPACE STATION EMISSIONS AND ASSOCIATED RECEIVING STATION(S) INFORMATION

| EMISSIONS AND POWER CHARACTERISTICS                                          |                                          |                                   |                                          |                                            | 7 MODULATION<br>CHARACTERISTICS<br>ATTACHED SEE<br>ATTACHMENT NO. |
|------------------------------------------------------------------------------|------------------------------------------|-----------------------------------|------------------------------------------|--------------------------------------------|-------------------------------------------------------------------|
| 5/4a3. NECESSARY BANDWIDTH OR<br>FeG3a. DESIGNATION OF EMISSION <sup>1</sup> | 4a2/4b. TOTAL<br>PEAK POWER <sup>1</sup> | 4a1/G3b. MAXIMUM<br>POWER DENSITY | 4c MINIMUM CARRIER<br>POWER <sup>1</sup> | Fd. SPACE STATION<br>E.I.R.P. <sup>1</sup> |                                                                   |
| <u>40K0FID</u>                                                               | <u>+12.0</u> dBW                         | <u>-24.0</u> dBW/Hz               | <u>.</u> dBW                             | <u>+12.0</u> dBW                           | <input type="checkbox"/>                                          |
| <u>90K0FID</u>                                                               | <u>+12.0</u> dBW                         | <u>-18.0</u> dBW/Hz               | <u>.</u> dBW                             | <u>+12.0</u> dBW                           | <input type="checkbox"/>                                          |
| <input type="text"/>                                                         | <input type="text"/>                     | <input type="text"/>              | <input type="text"/>                     | <input type="text"/>                       | <input type="checkbox"/>                                          |
| <input type="text"/>                                                         | <input type="text"/>                     | <input type="text"/>              | <input type="text"/>                     | <input type="text"/>                       | <input type="checkbox"/>                                          |
| <input type="text"/>                                                         | <input type="text"/>                     | <input type="text"/>              | <input type="text"/>                     | <input type="text"/>                       | <input type="checkbox"/>                                          |
| <input type="text"/>                                                         | <input type="text"/>                     | <input type="text"/>              | <input type="text"/>                     | <input type="text"/>                       | <input type="checkbox"/>                                          |

### F. SPACE STATION

CHARACTERISTICS OF RECEIVING SPACE  
STATIONS FOR SPACE-TO-SPACE RELAYS

ADD/MOD/SUP  
of the station ☐

a. SPACE STATION NAME

G3c. BEACON AND TELEMETRY INFORMATION<sup>1</sup>  
ATTACHED SEE ATTACHMENT NO.

☐

MORE EMISSIONS ON NEXT PAGE ☐

MORE ASSOC RECEIVING  
STATIONS ON NEXT PAGE ☐

### EARTH STATION

ADD/MOD/SUP  
of the station ☐

DESIGNATION OF TYPICAL EARTH STATION

FIXED TERMINALS

Bb1. RADIATION PATTERN

(give reference pattern or provide diagram)

Ba. RECEIVING  
SYSTEM NOISE  
TEMPERATURE

Kelvins

1000

Bb2. ANTENNA RADIATION DIAGRAM ATTACHED  
SEE FIGURE NO.

02

REMARKS

### NOTES ON FILLING IN THIS PAGE:

FOR EACH BEAM FIRST FILL IN THE BOX TITLED 'CHARACTERISTICS OF THE BEAM'

FOR EACH SPACE-TO-EARTH SERVICE AREA ASSOCIATED WITH THIS BEAM, FILL IN THE UPPER PORTION OF THE BOX TITLED 'INFORMATION TO BE PROVIDED FOR THIS TRANSMITTING ANTENNA BEAM'; ALSO PROVIDE THE 'EMISSION AND POWER CHARACTERISTICS' FOR THIS TRANSMITTING ANTENNA BEAM. FOR EACH SIZE (TYPE) OF RECEIVING EARTH STATION PROVIDE THE EARTH STATION DETAILS AS SPECIFIED. IF THIS IS A SPACE-TO-SPACE RELAY, IDENTIFY THE OTHER SPACE STATION(S) IN THE BOX TITLED 'SPACE STATION'. USE AS MANY PAGES AS NECESSARY.

FIG. 01

HealthSat B UHF Antenna pattern about the X-axis

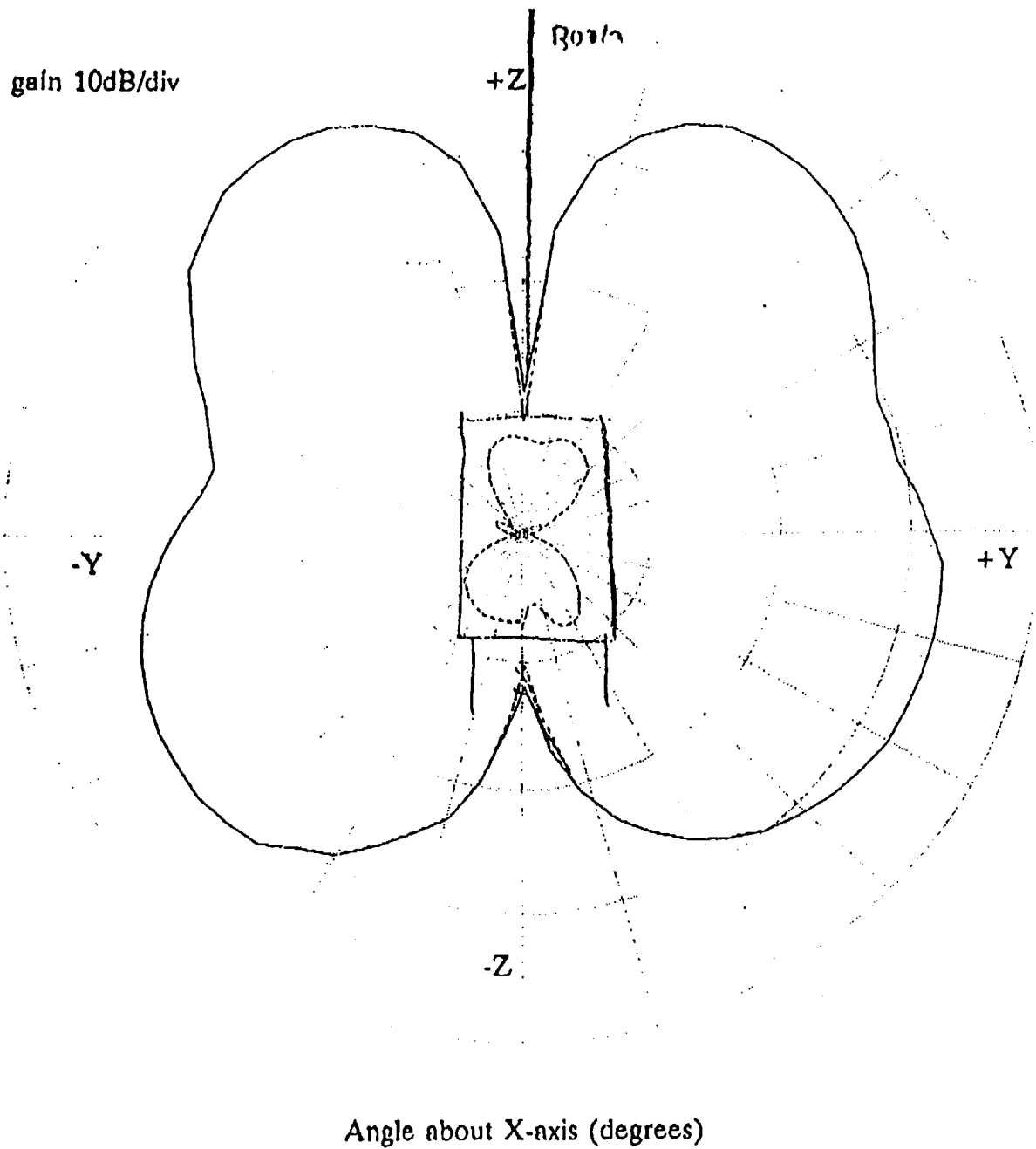
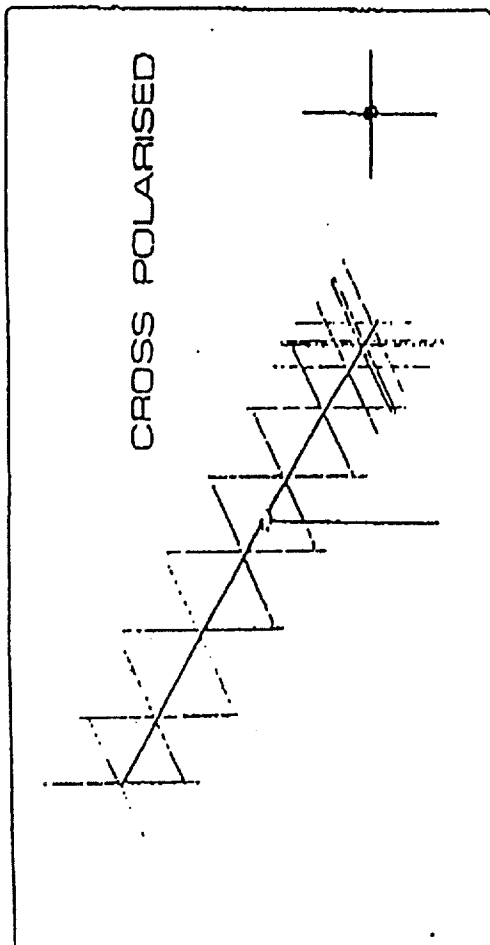


FIG. 02  
 Guildford Surrey Ground Station (Typical)  
 Radiation Patterns [HealthSat B] (un-A55)

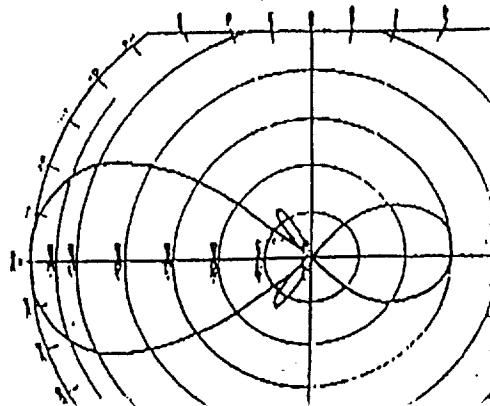


| TECHNICAL DATA             |           |
|----------------------------|-----------|
| Frequency range MHz        | 1428-1430 |
| Gain ISO                   | 17 dB     |
| Horizontal aperture angle* | 2x14°     |
| Vertical aperture angle*   | 2x16°     |
| Front-to-back ratio        | 23 dB     |
| Side lobe attenuation      | > 38 dB   |
| SWR                        | < 1.2     |
| Impedance                  | 75 Ohm    |
| Weight                     | 1.8 kg    |
| Physical length            | 3.3 m     |

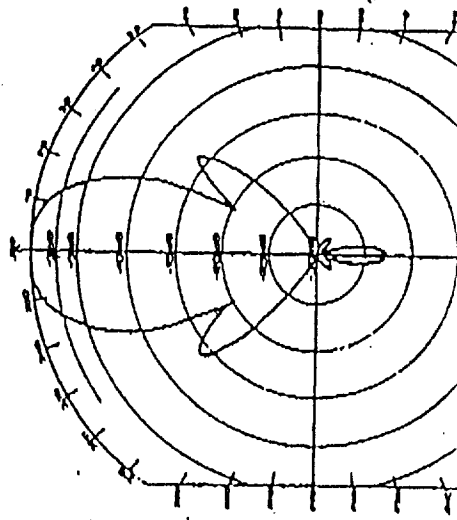
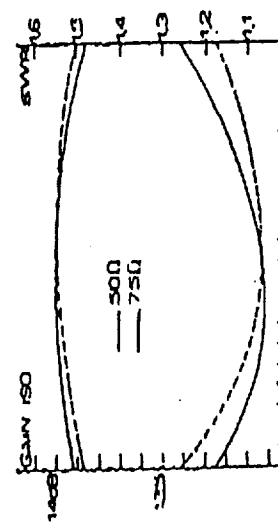
|                            |           |
|----------------------------|-----------|
| Frequency range MHz        | 1428-1430 |
| Gain ISO                   | 17 dB     |
| Horizontal aperture angle* | 2x14°     |
| Vertical aperture angle*   | 2x16°     |
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|                            |           |
|----------------------------|-----------|
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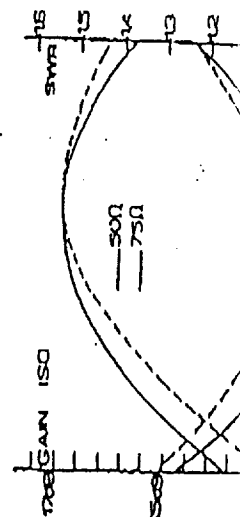
| TECHNICAL DATA             |           |
|----------------------------|-----------|
| Frequency range MHz        | 1428-1430 |
| Gain ISO                   | 17 dB     |
| Horizontal aperture angle* | 2x14°     |
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| Front-to-back ratio        | 23 dB     |
| Side lobe attenuation      | > 38 dB   |
| SWR                        | < 1.2     |
| Impedance                  | 75 Ohm    |
| Weight                     | 1.8 kg    |
| Physical length            | 3.3 m     |



\*The indicated value is given at -3 dB



\*The indicated value is given at -3 dB



enc/K8

Exhibit 5

Application for experimental license for earth station  
(April 7, 1994, still pending)

why?

~~3356-92~~ ~~KM2XHQ~~  
4259-94 PA  
18 MA  
57 NY