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VSAT Radio Safety application note

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HughesNet
Broadband Unbound.

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1.0 Overview

Hughes has looked at the question of radio safety very carefully and is completely satisfied that the energy level is many times lower than the safety limit.

A few people have expressed concern about the possibility of a Hughes VSAT antenna causing personal harm due to the level of radio energy. In fact, both measurements and calculations show that the levels one can be exposed to are well below internationally recognised safety levels by a factor of 20 or more, and even these low levels are hard to achieve.

2.0 The VSAT Installation

2.1 Power calculations

The VSAT radio system can transmit a maximum of 2W power and the smallest antenna we us is "74cm" antenna. Actually this antenna is really elliptical but has the surface area equivalent to a 74cm circular antenna.

Table 1 in the annex of "**Corrigendum to the DIRECTIVE 2004/40/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, of 29 April 2004**" defines the maximum exposure levels as 50W/m^2. Table 6 and 7 of the **ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields** give a limit of 50W/m^2 for occupation and 10W/m^2 for the general public. The following table shows that the power levels are well below this limit with our smallest antenna and most powerful transmit amplifier.

Antenna diameter	0.74 m
Antenna area	0.43 m^2
Power output	2 W
Feed losses	0.5 dB
Power at feed	1.8 W
VSAT power density	4.1 W / m^2
Public limit	10 W / m^2
Safety margin	59%

In actual fact in many installations the system is not transmitting most of the time. Considering typical applications such as;

a) *Lottery or ATM* – during the busier times we might expect 3 transactions per minute which results in 3 to 6 bursts of perhaps 10ms each. This reduces the average power to less than 0.1W/m^2 – safety margin of 99.9%.

b) *Office Internet* – for a busy office of 5 people one can calculate a peak rate of one 25ms burst every 90ms; this reduces the average power to less than 1.2W/m^2 – safety margin of 88%.

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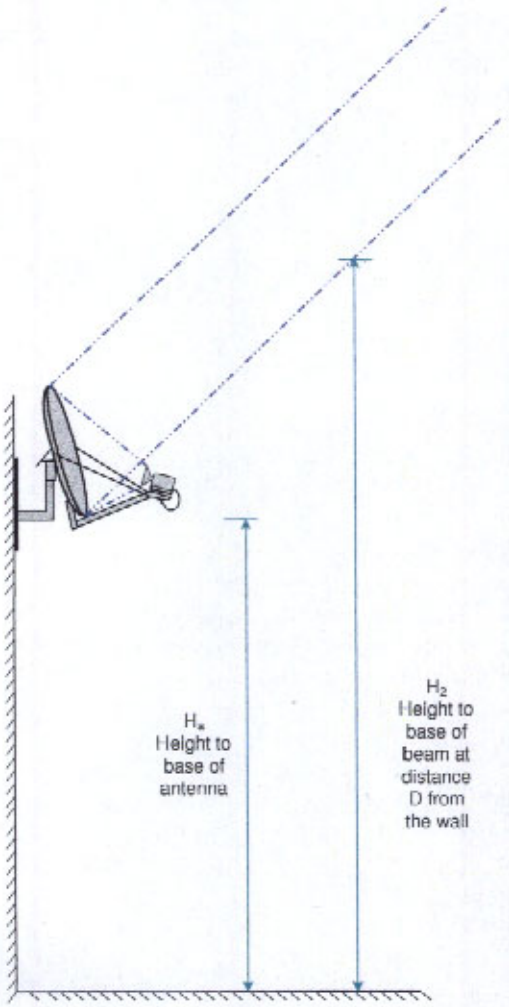
2.2 Antenna Location

Typically the antenna is mounted between 3m and 10m above the ground which means the antenna beam points some way over where anyone will be, indeed this is a fundamental requirement of a Hughes VSAT installation. This is illustrated in the following diagram.



When installed, the antenna seems to be pointing lower in the sky than the direction the radio energy is actually transmitted. This energy tends to stay within a tube the size of the antenna until it reaches something called the collimation point where it will then spread out a little. The collimation point for our antennas will be in excess of 50m from the VSAT antenna.

Over 99.99% of the radio energy is focused in the beam towards the satellite so less than 0.01% of the radio energy can be transmitted to the sides and rear of the antenna.

The following table shows the height of the bottom of the beam above ground level (H_2 in the diagram) for a typical UK antenna elevation of 25º.

Typical elevation angle		25 degrees	
Distance from wall	2	5	10 m
Height H_a of antenna base	Height of beam (H_2) in m		
2	2.93	5.26	9.93
3	3.93	6.26	10.93
4	4.93	7.26	11.93
5	5.93	8.26	12.93

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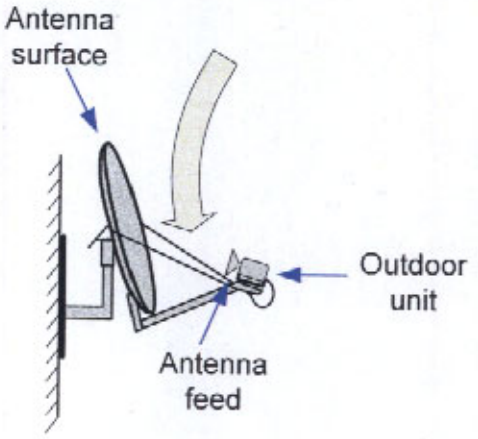
2.3 Safety built in

Hughes VSATs will detect if an object (such as a person on a ladder) is between the antenna surface and the feed as shown below. If an object is detected or the receive signal is otherwise blocked all transmissions will be ceased immediately and automatically.



2.4 Measurements

Even with highly sensitive radio energy meters[1] it is not possible to measure any energy more than a few centimetres away from the feed horn.

3.0 Conclusions

By its very nature, a Hughes VSAT antenna;

- Emits low levels of radio energy with a safety factor of between 88% and in excess of 99 % below the safety requirements;
- Focuses 99.9% of this radio energy into a tight beam of about 1m in diameter in to the sky in the direction of the satellite and away from the ground;
- Will stop transmissions when its path is blocked;
- Is always pointed into the sky away from people; and
- Is located well above the ground and is difficult to get close to.

For these reasons Hughes is able to reassure its Customers and their end users of their safety from the HughesNet VSAT radio transmissions.

[1] Where the minimum level they can detect is about 0.1W/m^2.

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Change control

Issue	Date	By	Notes
Issue 1	1999	S Watts	
Issue 1.1	Nov 2007	S Watts	Updated to reflect branding, move to 2W 74cm and referring to current legislation

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