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ANALYSIS OF VIDEO REAL TIME EXPERIMENT FOR LSU APLICATION

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Abstrack

Ground Control Station(or GCS) is an important part of a UAV system. That is a necessity for the development of a reliable and great GCS. This is closely related to the reliability of the control system is integrated with the UAV, the data received by the GCS will be fed back though to be a command or a data control to fly. Video is one of which is used in the UAV payload. In this case the UAV is used as a monitoring tool and mapping through the motion record , that which is done by using a camera mounted on the UAV. It can be recorded on the memory available on the device camera or instrument, videos can also be presented in realtime. Video is directly sent through the RC transmitter video data that will be sent from the RC transmitter will be received by the RC receiver. In the present study the authors provide an analysis of research on the exposure rarely reach realtime video.

***Key Words**: Video, Realtime, UAV, Ground system*

1. Introduction

Lapan Surveillance UAV or can be called LSU is an unmanned flying vehicle mode are used to perform surveillance or mapping areas. LSU is one of the fields of science that explored and researched for civilian purposes.LSU grow progressively. From tie LSU 01, LSU 02, LSU 03 and for now day Pustekbang are doing research and development for the expansion tie LSU 05. Payload is one important part in an UAV, because of this the researcher has been give a big concern on it. This is closely related to the vision and purpose of an UAV is research and developed.

At the beginning of the mission undertaken by the LSU 01 was used for mapping and monitoring rice areas, residential areas, coastal paths, fields, Merapi disaster mitigation, flood mitigation area (Penjaringan, Jakarta) and some things related to mapping and monitoring. During the monitoring is done by using the camera independent, which means that shooting is done by way of a recorded.

1.1. Specifications

The following modem specification used in this experiment:

Default Transmit Mode

In Narrowband the user has the following pre-defined modes available from the main window. Note that the Ultra Long Range Mode is only available to users who have purchased the SOLO4TXUP option (1.25MHz and MPEG-4 modes). The user can of course define their own specific FEC, bandwidth and modulation requirements from the 'Advanced' page.

Ultra Long Range:	1.25MHz QPSK FEC 1/3 (optional)
Long Range:	2.5MHz QPSK FEC 1/3
Medium Range:	2.5MHz QPSK FEC 2/3
Short Range:	2.5MHz 16QAM FEC 2/3

In DVB-T the available modes are

QPSK ½ FEC 8MHz 1/32 Guard Interval

QPSK ¾ FEC 8MHz 1/32 Guard Interval

16QAM ½ FEC 8MHz 1/32 Guard Interval

Fig. 1.Dafault Transmit Mode[1)]

Picture above is a description of the specification relating to the frequency of use of the range of the modem. In this figure are shown some options following frequency modulation levels, and range rarely if will do a considerable distance or ultra long range, for the DVB-T signal, transmitting data at the physical layer coding process will be carried out using a Forward Error Correcting (FEC), followed with QPSK modulation at a frequency of 1.25 MHz, the same way will be do when system transmitted and processing of data code using another option.

Table 1.Rayleigh Fading Models[2)]

SOM (dBm)	Availability %	Downtime (per year)
8	90	876 hours
18	99	88 hours
28	99.9	8.8 hours
38	99.99	53 mins
48	99.999	5.3 mins
58	99.9999	32 secs

In the table above, described the relationship between the percentage availability of time, link fade margin, and the downtime per year.

2. Method

To optimize the results of this research in this experiment, the application of camera and ground segment done moving around, from one place to the another place. This is done to measure and determine the distance range of the antenna. Antenna used in the system ground segment there are two types of antenna is the antenna type Omni External Antenna 4.5 dBi. Here is the configuration of the system Ground segments:

1. Antenna Omni Internal di GCS 2dBi;
2. Antenna Omni External 4.5 dBi;
3. GCS;
4. Down Converter.

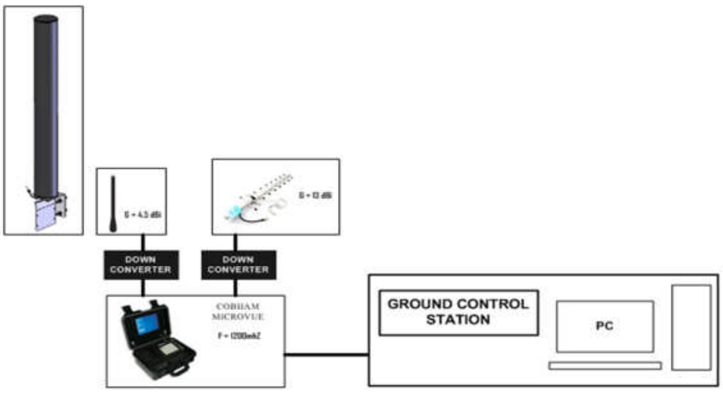

Fig. 2.Ground Segment system configuration

In this experiment not used yet a booster as amplifier transmitter signal beam. The following display configuration transmitter circuit and video circuit.

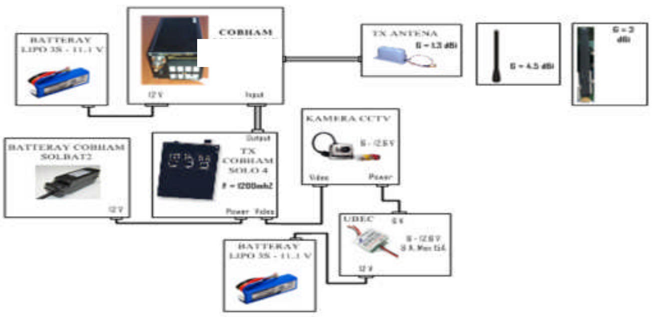

Fig. 3. Payload configuration

The configuration consists of payload set installed at Avionic Building Floor 2nd are:

1. 3 dBi Omni antenna;
2. CCTV cameras;
3. Video TX batteray;
4. Batteray CCTV cameras.

3. Research Results

3.1. Video Monitoring Results

Tests conducted in the area laboratory avionics, instruments mounted on the car is video tracker system. and for the camera system mounted on the 2nd floor at the avionics laboratory building. Here it is the work of video real times;

a). Location : 700 m from lab. Avionik b).Location : 800m from lab. Avionik
Antenna GCS : Internal Omni 2dBi Antenna GCS : External Omni 4.5dBi

c). Location :1170 m from lab. Avionik d).Location :1100 m from lab. Avionik
Antennae GCS : External Omni 4.5dBi Antennae GCS : External Omni 4.5dBi

Fig.4. The result of Video real time experiment from different location

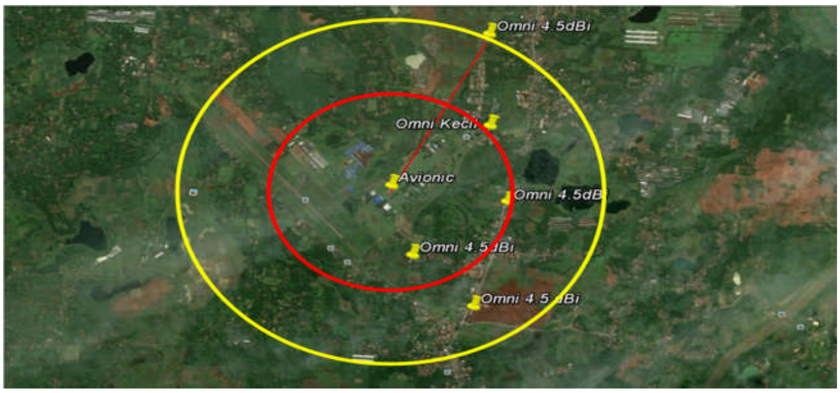

Fig. 5.Mapping range from video real time experiment.

Description:

Coverage Test Current real time video:

1. When using the internal antenna 2dBi radius coverage = 700m (Red)
2. When using an external antenna 4.5 dBi radius coverage = 1170m (yellow)

3.2. Link Budget Calculations

Link budget calculation here is used to determine the ability of RF systems to be used on video real time at LSU[3)].

Link budget calculations using the formula below[4)]:

$$C = EIRP - FSPL + G_R(dBW) \quad (1)$$

$$EIRP = 10\ log_{10}P_T + 10\ log_{10}G_T\ \ (dBW) \quad (2)$$

$$FSPL = 20log_{10}\left(\frac{4\pi R}{\lambda}\right)\ \ (dB) \quad (3)$$

C : *Receive power*
G_R : *Gain receiver*
P_T : *Power Transmitter*
R : *Distance*
λ : Panjang Gelombang

EIRP (Effective Isotropic Radiated Power) is the power of an antenna transmit power, while FSPL (Free Space Path Loss) is a damping that arises when the delivery occurs in the free air space.

To simplify the calculation, FSPL can be approximated by the other formula with putting the value of the amount of distance in km and the frequency in MHz, so the formula is used to[2)]:

$$FSPL = 20log_{10}(d) + 20log_{10}(f) + 32.45 \quad (4)$$

In a wireless communication system, the **link margin**, measured in dB, is the difference between the receiver's sensitivity and the actual received power[2].

$$LinkMargin = ReceivedPower - ReceiveSensitivity$$

There is some literature on the wireless communication system that is used to determine the value of the value of the link margin availability. In the table below is a literature that can be use to determine the value of availability RF link margin and real time video.

Table 2.Table aviability[2)]

Time Availability (%)	Link Margin (dB)
90	8
99	18
99.9	28
99.99	38
99.999	48

Availability value here is the ability to express the percentage of receivers in receiving the data properly.

From the formula (4) can be know to what extent does the system real times video that we put on the LSU can run properly taking into account the value of data availability.

3.2. Analysis Link Budget Video Real Time

- Frequensi : 1200 MHz
- Tx Power : 5 W (37dBm)
- Tipe Antenna Transmitter : Omnidireksional

- TX Antenna gain : 2.5 dBi
- TX Cable loss : 0.3 dB
- Tipe Antenna Receiver : Yagi
- RX Antenna gain : 13 dBi
- RX Cable loss : 1.8 dB
- RX Sensitifity → : FEC 1/3 = - 102dBm
  → : FEC 2/3 = - 99dBm

Of all the specifications that are used, it is known that the ability of its real time video system can be seen in the figure below:

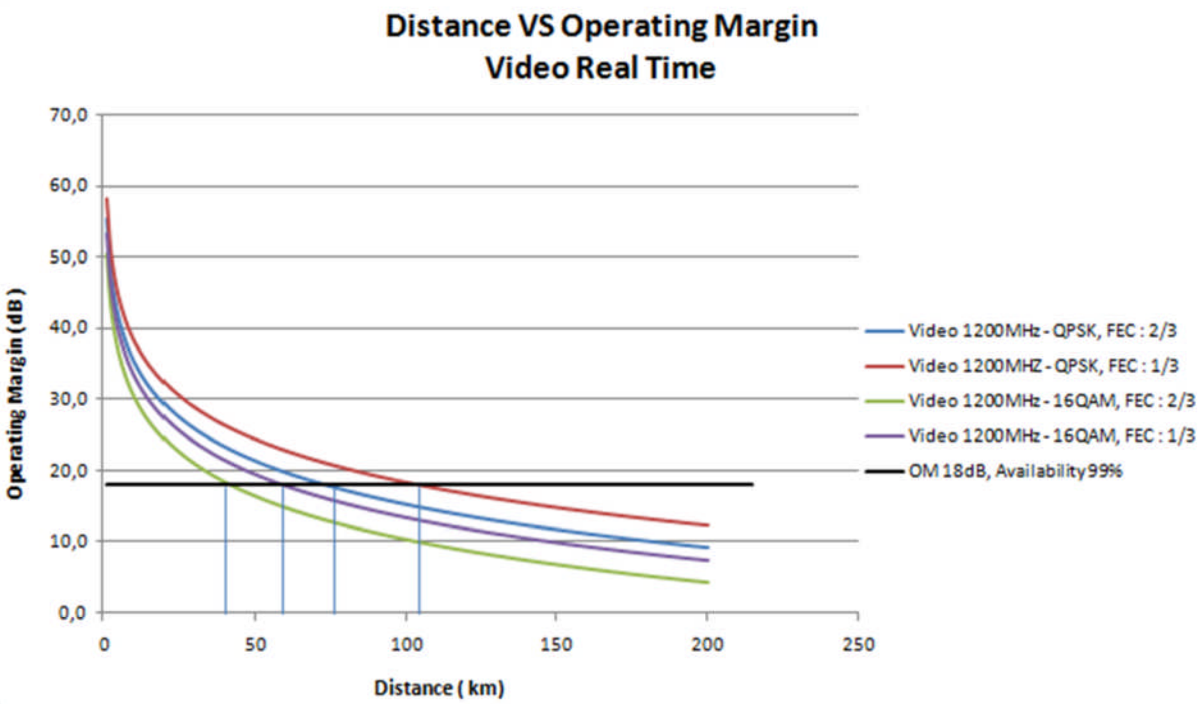

Fig. 6.Graph distance VS operating margin

In this experiment the operating margin used is equal to 18dB, the use of this value as based on some literature for the installation of wireless systems mostly use 99% availability value so that the necessary value of link margin of 18 dB.

With the provisions of the distance range telemetry system is as follows:

Range of above table should be based on Line of Sight (LOS)

Table 3. Distance reach and use of modulation

No	Frekuensi (MHz)	Modulasi	FEC	Jarak (km)
1	1200	QPSK	2/3	74
2	1200	QPSK	1/3	104
3	1200	16 QAM	2/3	41
4	1200	16 QAM	1/3	58

4. Conclusion

From the above analysis of the testing tool it can be concluded that:

1. From the use of antenna, Omni antenna can be used in residential area than Yagi antenna. This is because the characteristic of Omni antenna is more spread than Yagi. Yagies frequencies emitted and received must be in line with the receiver antenna;
2. To find the maximum distance ranges between the GCSand video real time system, the experiment must be done in the line off set area;
3. Signal strength is affected by the obstruction (buildings, trees, etc.) at the area.

References

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