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DECLARATION

The maximum duty cycle of the Sony LAN card model ERA-201D1 for use in AIBO (toy dog) is declared to be 30%.

Please see Conclusion & Comment section on page 4 for the attached report (test and measurement conducted by Sony Corporation) as evidence of this declaration.

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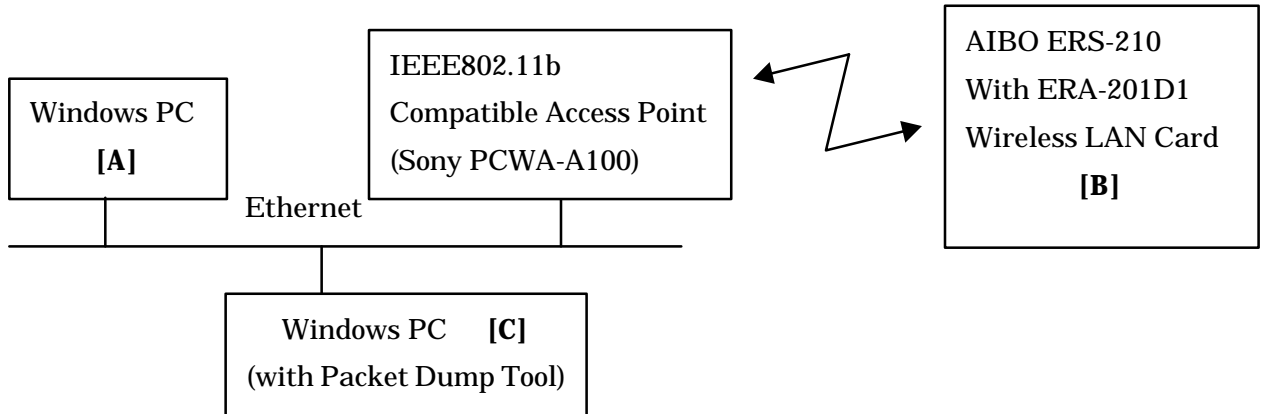
MEASUREMENT RESULTS OF DUTY RATIO OF AIBO WIRELESS LAN CARD

Purpose:

This report describes a measurement results regarding duty ratio of communications between ERA-201D1 AIBO wireless LAN card and a host computer in condition of typical application.

Measurement Block Diagram:

The measurement block diagram is shown as below:



[A] : Hostname is “hirata03.erc.sony.co.jp” and connects to the Ethernet.

[B] : Hostname is “900h-ice1.erc.sony.co.jp” and completes a connection to the IEEE 802.11b access point with the Ethernet over radio.

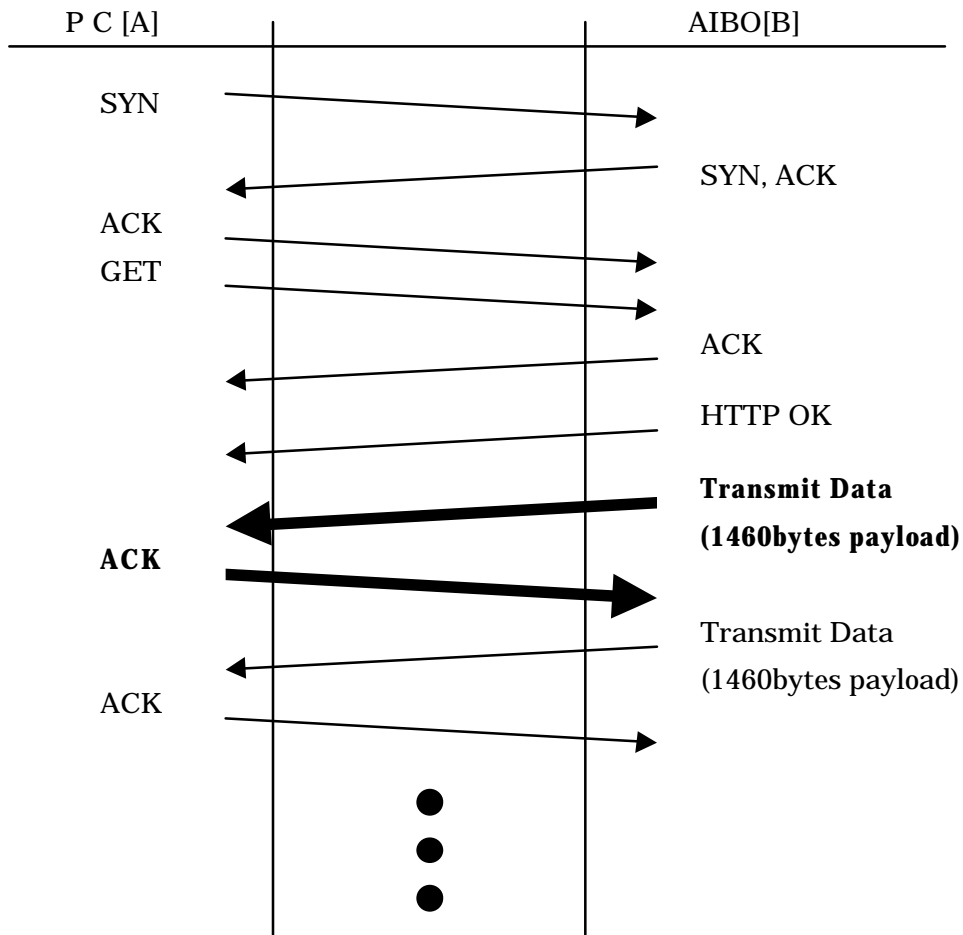
[C] : This computer monitors communications between the host computer and the AIBO.

Conditions of Communication Test:

The AIBO ERS-210 and AIBO wireless LAN card ERA-201D1 are supported communications each other using TCP/IP protocol.

The measurement flow for the measurement is shown as below and a file with 6924 byte is transmitted on HTTP(Hyper Text Transfer Protocol).

The flow shows the transmission from AIBO to the host computer and vice versa.



The maximum payload length of Ethernet(IEEE802.3) is 1460 bytes.

In TCP transmission, when the receiver receive a data, the receiver side always returns the acknowledgement data. Transaction period between the host and AIBO is measured as time shown with bold line in above flow chart in condition of transmitting the maximum length packet from AIBO.

Calculation procedure:

Maximum transmitting duty ratio from AIBO is calculated as follows:

$$(\text{Max. Duty Ratio}) = (\text{Transmit Period for Maximum Payload Data}) / (\text{Transaction Period (described the previous page)})$$

AIBO wireless LAN card, ERA-201D1, is applicable to 4 transmitting speeds, 11, 5.5, 2 and 1 Mbps in accordance with IEEE802.11b.

The transmitting data comprise of those shown as following expression;

$$(\text{Transmitting Data Length}) = (\text{HR/DSSS Frame Length}) + (\text{Ethernet Frame Length})$$

$$(\text{HR/DSSS Frame Length}) = 192\text{bits} \text{ --- (i)}$$

$$\begin{aligned}(\text{Ethernet Frame Length}) &= (\text{Ethernet Header Length}) + (\text{IP Header Length}) \\ &\quad + (\text{TCP Header Length}) + (\text{Payload Data}) \\ &= 14 + 20 + 20 + 1460 \\ &= 1514 \text{ bytes} \\ &= 12112\text{bits} \text{ --- (ii)}\end{aligned}$$

Where, transmitting period of HR/DSSS Frame Length of expression (i) is constant in 1Mbps transmission speed and transmitting period of Ethernet Frame Length of expression (ii) is variable with change of transmission speeds.----- (this period changes adaptively depending on radio condition)

Therefore, transmitting period is calculated as follows:

$$(\text{transmitting period of data}) = (\text{transmitting period of (i)}) + (\text{transmitting period of (ii)})$$

$$\begin{aligned}&= 192 / 1.0 \times 10^{-6} + 12112 / (\text{transmitting speed [bps]}) \\ &= (192 + 12112 / (\text{transmitting speed [Mbps]})) \text{ [us]} \text{ --- (iii)}\end{aligned}$$

(1) 11Mbps transmitting speed

$$(\text{Transmitting Period}) = 192 + 12112 / 11 = 1293\text{us}$$

(2) 5.5Mbps transmitting speed

$$(\text{Transmitting Period}) = 192 + 12112 / 5.5 = 2394\text{us}$$

(3) 2Mbps transmitting speed

$$(\text{Transmit Period}) = 192 + 12112 / 2 = 6248\text{us}$$

(4) 1Mbps transmitting speed

$$(\text{Transmit Period}) = 192 + 12112 / 1 = 12304\text{us}$$

Measurement result:

Measurement result of ethereal tool is as below.

Speed	Transaction Start Time [s]	Transaction End Time [s]	Transaction Period [s] (I) (End – Start)	Max. Payload Transmit Period [s] (II)	Duty Ratio ((II) / (I))
11Mbps	0.324660	0.349816	0.025156	1293×10^{-6}	0.051
5.5Mbps	0.324302	0.350305	0.026003	2394×10^{-6}	0.092
2Mbps	0.333636	0.358180	0.024544	6248×10^{-6}	0.25
1Mbps	1.844316	1.873928	0.029612	12304×10^{-6}	0.42

Conclusion & Comment:

Maximum Transmitting Duty Rate is variable depending on the communication speed of Wireless LAN card as below.

11Mbps : 5.1% < 30%

5.5Mbps : 9.2% < 30%

2Mbps : 25% < 30%

1Mbps : 42% > 30% (NOTE: 1Mbps Communication is unstable)

Maximum Duty Rate of 30% that we indicated is the value of which stable transmitting is put into practice at the rate of 2Mbps, 5.5Mbps and 11Mbps. Transmitting rate of 1Mbps is an impracticable rate for this wireless LAN card because of transmitting error due to the unqualified transmitting. Also, if the transmitting error of frequent occurrence, transmitting window size of TCP is switched over to smaller rate by the regulation of its software. Therefore, transmission at maximum payload on 1Mbps is not carried out continuously. From a practical standpoint, performance faster than 2Mbps is considered reasonable and proper for this wireless LAN card. We hereby declare that the maximum duty rate of this device is 30%.

In addition to the above, under conditions using actual application, data transmission from PC to the wireless LAN card in AIBO and data transmission from the wireless LAN card to PC are transmitted simultaneously. The duty rates in this report are maximum value based on this measurement method. Due to characteristic features of bi-directional transmission of this wireless LAN card, actual duty rate of this wireless LAN card is less than the rates measured and shown in this report.

Display of the measurement: 11Mbps

The screenshot shows the Wireshark interface with a network traffic capture. The main pane displays a list of 21 packets. Packet 8 is highlighted, showing it is an HTTP continuation from 900h-ice1.erc.sony.co to hirata03.erc.sony.co. The detailed view pane shows the structure of this packet: Ethernet II, Internet Protocol, Transmission Control Protocol (Src Port: 80, Dst Port: 1149, Seq: 1192656562), and Hypertext Transfer Protocol (Data: 1460 bytes). The packet bytes pane shows the raw data in hexadecimal and ASCII.

No.	Time	Source	Destination	Protocol	Info
1	0.000000	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	ARP	43.3.71.121 is at 00:02:2
2	0.000108	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1149 > 80 [SYN] Seq=41753
3	0.004252	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1149 [SYN, ACK] Seq=
4	0.004414	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1149 > 80 [ACK] Seq=41753
5	0.004988	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	HTTP	GET /header.gif HTTP/1.1
6	0.012241	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1149 [ACK] Seq=11926
7	0.324660	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	HTTP/1.1 200 OK
8	0.349540	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
9	0.349816	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1149 > 80 [ACK] Seq=41754
10	0.351362	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
11	0.351382	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1149 [ACK] Seq=11926
12	0.360233	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
13	0.360552	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1149 > 80 [ACK] Seq=41754
14	0.362533	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
15	0.362555	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
16	0.362788	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1149 > 80 [ACK] Seq=41754
17	0.372587	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
18	0.372606	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1149 [ACK] Seq=11926
19	0.568467	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1149 > 80 [ACK] Seq=41754
20	0.916033	0.0080923163cf	0.devsvr01.erc.sony.c	IPX SAP	Nearest Query
21	0.916133	0.0080923163cf	0.devsvr01.erc.sony.c	IPX SAP	Nearest Query

Frame 8 (1514 on wire, 1514 captured)

- Ethernet II
- Internet Protocol
- Transmission Control Protocol, Src Port: 80 (80), Dst Port: 1149 (1149), Seq: 1192656562, A
- Hypertext Transfer Protocol
 - Data (1460 bytes)

```

0000  00 c0 4f 9a 96 c0 00 02 2d 03 94 2c 08 00 45 00  ..O....-...E.
0010  05 dc 59 61 00 00 40 06 36 c4 2b 03 47 79 2b 03  ..Ya..@.6.+Gy+.
0020  47 78 00 50 04 7d 47 16 7e b2 02 7d 1e 4c 50 10  GX.P.}G.~.}.LP.
0030  20 00 76 5f 00 00 47 49 46 38 39 61 7d 02 5c 00  .v...GI F89a}.\.
0040  f7 00 00 00 00 00 00 33 00 00 66 00 00 99 00  ....3..f....
    
```

Filter: / Reset File: <capture> Drops: 0

Display of the measurement: 5Mbps

The screenshot shows the Wireshark interface with a network traffic capture. The main pane displays a list of 21 packets. Packet 7 is highlighted in blue and is an HTTP continuation packet. The detailed view pane below shows the structure of packet 7, including Ethernet II, Internet Protocol, Transmission Control Protocol (TCP), and Hypertext Transfer Protocol (HTTP) data (1460 bytes).

No.	Time	Source	Destination	Protocol	Info
1	0.000000	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1150 > 80 [SYN] Seq=419236
2	0.004800	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1150 [SYN, ACK] Seq=1
3	0.004991	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1150 > 80 [ACK] Seq=419236
4	0.005571	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	HTTP	GET /header.gif HTTP/1.1
5	0.014046	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1150 [ACK] Seq=119268
6	0.324302	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	HTTP/1.1 200 OK
7	0.350282	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
8	0.350305	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1150 > 80 [ACK] Seq=419238
9	0.352649	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
10	0.352669	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1150 [ACK] Seq=119268
11	0.357215	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
12	0.357486	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1150 > 80 [ACK] Seq=419238
13	0.360060	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
14	0.360081	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
15	0.360324	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1150 > 80 [ACK] Seq=419238
16	0.373946	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
17	0.373967	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1150 [ACK] Seq=119268
18	0.443489	43.3.71.252	255.255.255.255	RIPv1	Response
19	0.496850	adelaide.erc.sony.co.	NTP.MCAST.NET	IGMP	Host response (v2)
20	0.544145	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1150 > 80 [ACK] Seq=419238
21	0.548028	collie.erc.sony.co.jp	NTP.MCAST.NET	IGMP	Host response (v2)

Frame 7 (1514 on wire, 1514 captured)

- [-] Ethernet II
- [-] Internet Protocol
- [-] Transmission Control Protocol, Src Port: 80 (80), Dst Port: 1150 (1150), Seq: 1192681562, A
- [-] Hypertext Transfer Protocol
 - Data (1460 bytes)

```

0000  00 c0 4f 9a 96 c0 00 02 2d 03 94 2c 08 00 45 00  ..O....-...E.
0010  05 dc 59 6c 00 00 40 06 36 b9 2b 03 47 79 2b 03  ..Y]..@.6.+Gy+.
0020  47 78 00 50 04 7e 47 16 e0 5a 02 7f b4 f9 50 10  GX.P.~G. .Z....P.
0030  20 00 7e 06 00 00 47 49 46 38 39 61 7d 02 5c 00  ~...GI F89a}.\.
0040  f7 00 00 00 00 00 00 00 33 00 00 66 00 00 99 00  .....3..f...
  
```

Filter: / Reset File: <capture> Drops: 0

Display of the measurement: 2Mbps

The screenshot shows the Wireshark interface with a network traffic capture. The main pane displays a list of 21 packets. Packet 9 is highlighted in blue and is an HTTP continuation packet. The packet list pane shows the following details:

No.	Time	Source	Destination	Protocol	Info
1	0.000000	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1159 > 80 [SYN] Seq=435277
2	0.004396	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1159 [SYN, ACK] Seq=1
3	0.004565	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1159 > 80 [ACK] Seq=435277
4	0.005132	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	HTTP	GET /header.gif HTTP/1.1
5	0.015449	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1159 [ACK] Seq=161316
6	0.210109	43.3.71.252	ALL-ROUTERS.MCAST.NET	HSRP	Hello (state Standby)
7	0.213732	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1159 [ACK] Seq=161316
8	0.333636	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	HTTP/1.1 200 OK
9	0.357902	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
10	0.358180	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1159 > 80 [ACK] Seq=435279
11	0.369911	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
12	0.369931	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1159 [ACK] Seq=161316
13	0.378304	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
14	0.378572	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1159 > 80 [ACK] Seq=435279
15	0.393627	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
16	0.394989	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
17	0.395106	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1159 > 80 [ACK] Seq=435279
18	0.409266	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
19	0.410517	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1159 [ACK] Seq=161317
20	0.594214	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1159 > 80 [ACK] Seq=435279
21	1.733479	00:30:b6:34:69:74	devsvr01.erc.sony.co.	ARP	who has 43.3.71.92? Tell

The packet details pane for packet 9 shows:

- Frame 9 (1514 on wire, 1514 captured)
- Ethernet II
- Internet Protocol
- Transmission Control Protocol, Src Port: 80 (80), Dst Port: 1159 (1159), Seq: 1613164566, A
- Hypertext Transfer Protocol
 - Data (1460 bytes)

The packet bytes pane shows the raw data in hexadecimal and ASCII:

```

0000  00 c0 4f 9a 96 c0 00 02 2d 03 94 2c 08 00 45 00  ..O.... -....E.
0010  05 dc ca be 00 00 40 06 c5 66 2b 03 47 79 2b 03  .....@. .f+.Gy+.
0020  47 78 00 50 04 87 60 26 f0 16 02 98 2f 30 50 10  GX.P.. & .../OP.
0030  20 00 da e1 00 00 47 49 46 38 39 61 7d 02 5c 00  ....GI F89a}.\.
0040  f7 00 00 00 00 00 00 33 00 00 66 00 00 99 00  ..... 3..f....
  
```

The filter bar at the bottom shows: Filter: / Reset File: <capture> Drops: 0

Display of the measurement:1Mbps

The screenshot shows the Wireshark interface with a network traffic capture. The main pane displays a list of 21 packets. Packet 8 is highlighted, showing an HTTP continuation from 900h-ice1.erc.sony.co to hirata03.erc.sony.co. The detailed view pane below shows the structure of frame 8: Ethernet II, Internet Protocol, Transmission Control Protocol (Src Port: 80, Dst Port: 1164, Seq: 220137489), and Hypertext Transfer Protocol (Data: 1460 bytes). The hex dump at the bottom shows the raw data of the frame.

No.	Time	Source	Destination	Protocol	Info
1	0.000000	rhino.erc.sony.co.jp	NTP.MCAST.NET	IGMP	Host response (v2)
2	0.064448	43.3.71.253	ALL-ROUTERS.MCAST.NET	HSRP	Hello (state Active)
3	0.114781	00:01:97:10:57:3b	01:80:c2:00:00:00	STP	Conf. Root = 32768/00:01:97:10:57:3b
4	1.524971	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	HTTP	GET /header.gif HTTP/1.1
5	1.620935	43.3.71.252	ALL-ROUTERS.MCAST.NET	HSRP	Hello (state Standby)
6	1.649344	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1164 [ACK] Seq=220137489
7	1.844316	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	HTTP/1.1 200 OK
8	1.873643	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
9	1.873928	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1164 > 80 [ACK] Seq=441839
10	1.880569	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
11	1.880704	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
12	1.880820	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1164 > 80 [ACK] Seq=441839
13	1.894020	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
14	1.900777	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
15	1.900844	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
16	1.901061	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1164 > 80 [ACK] Seq=441839
17	1.905473	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	HTTP	Continuation
18	1.905493	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1164 [ACK] Seq=220144
19	1.906139	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1164 [ACK] Seq=220144
20	1.911034	900h-ice1.erc.sony.co	hirata03.erc.sony.co.	TCP	80 > 1164 [ACK] Seq=220144
21	2.073277	hirata03.erc.sony.co.	900h-ice1.erc.sony.co	TCP	1164 > 80 [ACK] Seq=441839

Frame 8 (1514 on wire, 1514 captured)

- Ethernet II
- Internet Protocol
- Transmission Control Protocol, Src Port: 80 (80), Dst Port: 1164 (1164), Seq: 220137489, Ack: 1164
- Hypertext Transfer Protocol
 - Data (1460 bytes)

```

0000  00 c0 4f 9a 96 c0 00 02 2d 03 94 2c 08 00 45 00  ..O.... -...E.
0010  05 dc 00 1b 00 00 40 06 90 0a 2b 03 47 79 2b 03  .....@. ...Gy+.
0020  47 78 00 50 04 8c 0d 1f 08 11 02 a2 31 a5 50 10  GX.P.... ...l.P.
0030  20 00 13 6b 00 00 47 49 46 38 39 61 7d 02 5c 00  ..k..GI F89a}.\.
0040  f7 00 00 00 00 00 00 33 00 00 66 00 00 99 00  .... 3..f...
    
```