TGAM数据流格式说明

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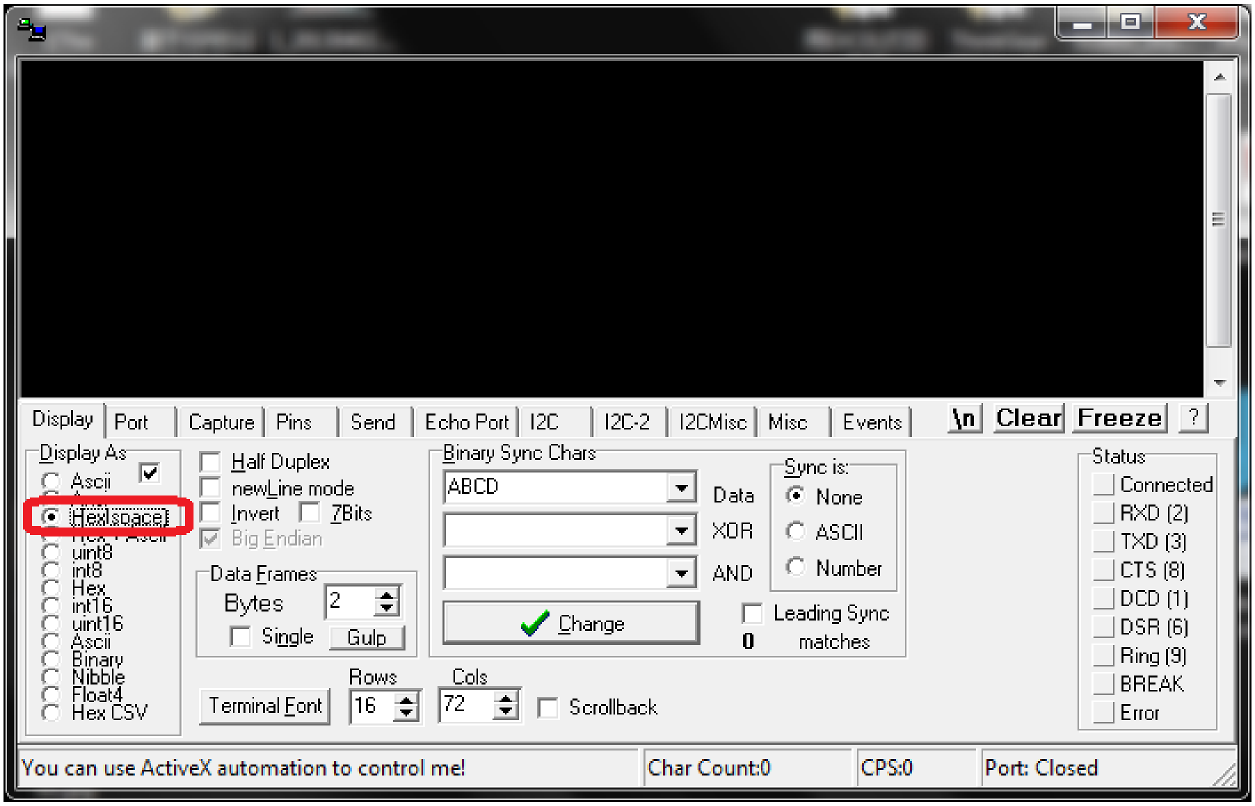
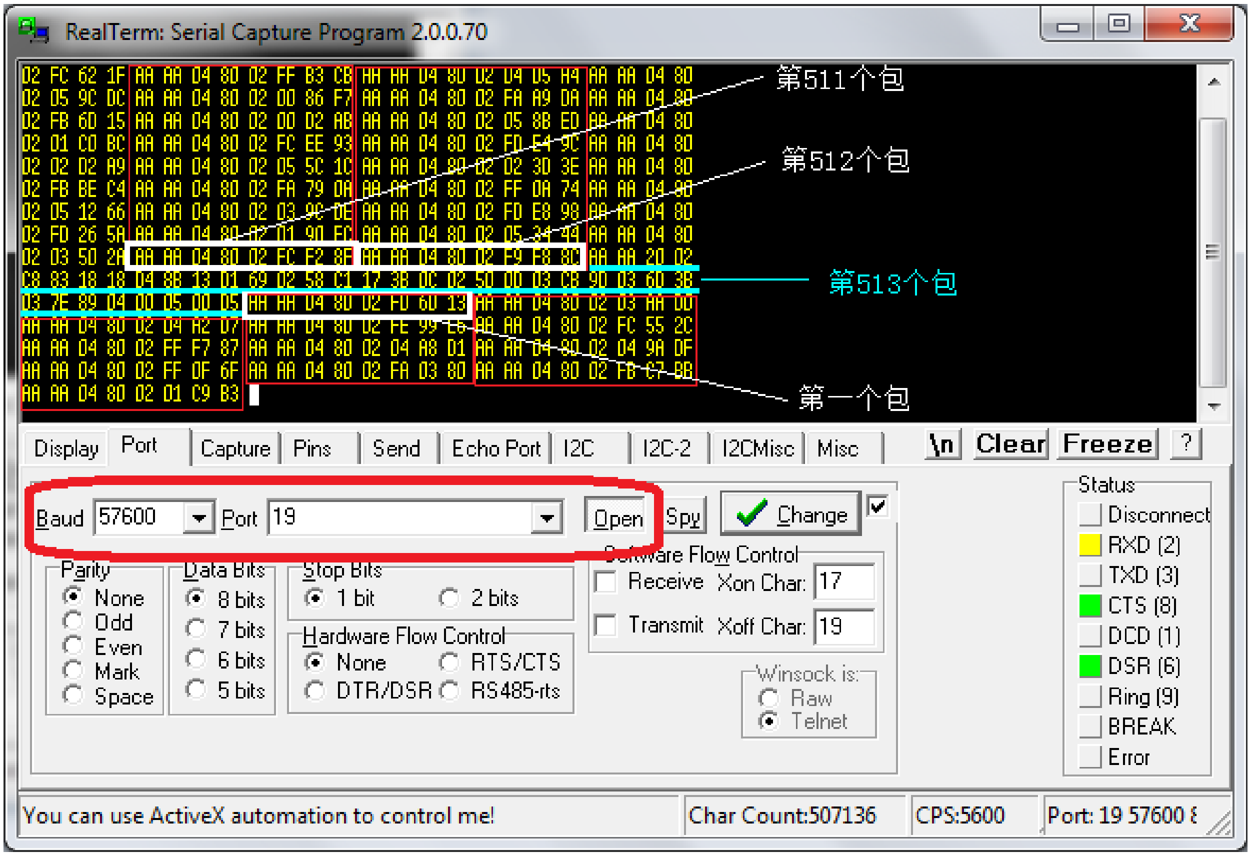
1.建议用RealTerm从串口抓数据，下载地址：
http://realterm.sourceforge.net/index.html#downloads_Download

2.打开RealTerm，指定显示方式：在Displa标签页，选择Hex+space。 下图中红圈标记的地方：



3.指定波特率，端口，点击Open按钮。如果连接成功，你应该会看到类似下图的数据。



4.说明：
TGAM大约每秒钟发送513个包，注意是“大约每秒钟”，意思就是发送包的个数是不会变的，只是发送513个包所花费的时间是一秒左右。
发送的包有小包和大包两种：小包的格式是AA AA 04 80 02 xxHigh xxLow xxCheckSum 前面的AA AA 04 80 02 是不变的，后三个字节是一只变化的，xxHigh和xxLow组成了原始数据rawdata，xxCheckSum就是校验和。所以一个小包里面只包含了一个对开发者来说有用的数据，那就是rawdata，可以说一个小包就是一个原始数据，大约每秒钟会有512个原始数据。
那怎么从小包中解析出原始数据呢？rawdata = (xxHigh << 8) | xxLow;
if(rawdata > 32768){ rawdata -=65536; }
现在原始数据就这么算出来了，但是在算原始数据之前，我们先应该检查校验和。校验和怎么算呢？sum = ((0x80 + 0x02 + xxHigh + xxLow)^ 0xFFFFFFFF) & 0xFF
什么意思呢？就是把04后面的四个字节加起来，取反，再取低八位。
如果算出来的sum和xxCheckSum是相等的，那说明这个包是正确的，然后再去计算rawdata，否则直接忽略这个包。丢包率在10%以下是不会对最后结果造成影响的。

现在，原始数据出来了，那我们怎么拿信号强度Signal,专注度Attention,放松度Meditation,和8个EEG Power的值呢？就在第513个这个大包里面，这个大包的格式是相当固定的，我们就拿上图中的数据来一个字节一个字节地说明他们代表的含义：

红色的是不变的
AA 同步
AA 同步
20 是十进制的32，即有32个字节的payload，除掉20本身+两个AA同步+最后校验和
02 代表信号值Signal
C8 信号的值
83 代表EEG Power开始了
18 是十进制的24，说明EEG Power是由24个字节组成的，以下每三个字节为一组
18 Delta 1/3
D4 Delta 2/3
8B Delta 3/3
13 Theta 1/3
D1 Theta 2/3
69 Theta 3/3
02 LowAlpha 1/3
58 LowAlpha 2/3
C1 LowAlpha 3/3
17 HighAlpha 1/3
3B HighAlpha 2/3
DC HighAlpha 3/3
02 LowBeta 1/3
50 LowBeta 2/3
00 LowBeta 3/3
03 HighBeta 1/3
CB HighBeta 2/3
9D HighBeta 3/3
03 LowGamma 1/3
6D LowGamma 2/3
3B LowGamma 3/3
03 MiddleGamma 1/3
7E MiddleGamma 2/3
89 MiddleGamma 3/3
04 代表专注度Attention
00 Attention的值(0到100之间)
05 代表放松度Meditation
00 Meditation的值(0到100之间)
D5 校验和

解析EEG Power：拿Delta举例，Delta 1/3是高字节，Delta 1/3是中字节，Delta 1/3是低字节；高字节左移16位，中字节左移8位，低字节不变，然后将他们或运算，得到的结果就是Delta的值。这些值是无符号，没有单位的，只有在和其他的Beta，Gamma等值相互比较时才有意义。

5.关于眨眼

TGAM芯片 本身是不会输出眨眼信号的，眨眼是用rawdata原始数据算出来的。表现在原始数据的波形上，眨眼就是一个很大的波峰。只要用代码检测这个波峰的出现，就可以找到眨眼的值了。

还有，眨眼其实和脑电波一点儿关系都没有，眨眼只是眼睛动的时候在前额产生的肌（肉）电，混合在了脑波原始数据中。

以下C#代码说明怎么解析数据。

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;

namespace ReadParseTGAM
{
    public class Parser
    {

        public const int PARSER_CODE_POOR_SIGNAL = 2;
        public const int PARSER_CODE_HEARTRATE = 3;
        public const int PARSER_CODE_CONFIGURATION = 4;
        public const int PARSER_CODE_RAW = 128;
        public const int PARSER_CODE_DEBUG_ONE = 132;
        public const int PARSER_CODE_DEBUG_TWO = 133;
        public const int PARSER_CODE_EEG_POWER = 131;

        public const int PST_PACKET_CHECKSUM_FAILED = -2;
        public const int PST_NOT_YET_COMPLETE_PACKET = 0;
        public const int PST_PACKET_PARSED_SUCCESS = 1;
        public const int MESSAGE_READ_RAW_DATA_PACKET = 17;
        public const int MESSAGE_READ_DIGEST_DATA_PACKET = 18;

        private const int RAW_DATA_BYTE_LENGTH = 2;
        private const int EEG_DEBUG_ONE_BYTE_LENGTH = 5;
        private const int EEG_DEBUG_TWO_BYTE_LENGTH = 3;
        private const int PARSER_SYNC_BYTE = 170;
        private const int PARSER_EXCODE_BYTE = 85;
        private const int MULTI_BYTE_CODE_THRESHOLD = 127;
        private const int PARSER_STATE_SYNC = 1;
        private const int PARSER_STATE_SYNC_CHECK = 2;
        private const int PARSER_STATE_PAYLOAD_LENGTH = 3;
        private const int PARSER_STATE_PAYLOAD = 4;
        private const int PARSER_STATE_CHKSUM = 5;

        private int parserStatus;
        private int payloadLength;
```

```
    private int payloadBytesReceived;
    private int payloadSum;
    private int checksum;
    private byte[] payload = new byte[256];


    public Parser()
    {
      this.parserStatus = PARSER_STATE_SYNC;
    }

    public int parseByte(byte buffer)
    {
      int returnValue = 0;
      switch (this.parserStatus)
      {
        case 1:
          if ((buffer & 0xFF) != PARSER_SYNC_BYTE) break; this.parserStatus =
PARSER_STATE_SYNC_CHECK;
          break;
        case 2:
          if ((buffer & 0xFF) == PARSER_SYNC_BYTE)
            this.parserStatus = PARSER_STATE_PAYLOAD_LENGTH;
          else
          {
            this.parserStatus = PARSER_STATE_SYNC;
          }
          break;
        case 3:
          this.payloadLength = (buffer & 0xFF);
          this.payloadBytesReceived = 0;
          this.payloadSum = 0;
          this.parserStatus = PARSER_STATE_PAYLOAD;
          break;
        case 4:
          this.payload[(this.payloadBytesReceived++)] = buffer;
          this.payloadSum += (buffer & 0xFF);
          if (this.payloadBytesReceived < this.payloadLength) break; this.parserStatus =
PARSER_STATE_CHKSUM;
          break;
        case 5:
          this.checksum = (buffer & 0xFF);
          this.parserStatus = PARSER_STATE_SYNC;
```

```
            if (this.checksum != ((this.payloadSum ^ 0xFFFFFFFF) & 0xFF))
            {
                returnValue = -2;
                Console.WriteLine("CheckSum ERROR!!");
            }
            else
            {
                returnValue = 1;
                parsePacketPayload();
            }
            break;
    }
    return returnValue;
}

private void parsePacketPayload()
{
    int i = 0;
    int extendedCodeLevel = 0;
    int code = 0;
    int valueBytesLength = 0;

    int signal = 0; int config = 0; int heartrate = 0;
    int rawWaveData = 0;
    while (i < this.payloadLength)
    {
        extendedCodeLevel++;

        while (this.payload[i] == PARSER_EXCODE_BYTE)
        {
            i++;
        }

        code = this.payload[(i++)] & 0xFF;

        if (code > MULTI_BYTE_CODE_THRESHOLD)
        {
            valueBytesLength = this.payload[(i++)] & 0xFF;
        }
        else
        {
            valueBytesLength = 1;
        }
```

```
            if (code == PARSER_CODE_RAW)
            {
                if ((valueBytesLength == RAW_DATA_BYTE_LENGTH))
                {
                    byte highOrderByte = this.payload[i];
                    byte lowOrderByte = this.payload[(i + 1)];

                    rawWaveData = getRawWaveValue(highOrderByte, lowOrderByte);

                    if (rawWaveData > 32768) rawWaveData -= 65536;

                    Console.WriteLine("Raw:"+rawWaveData);

                }
                i += valueBytesLength;
            }
            else
            {
                switch (code)
                {
                    case PARSER_CODE_POOR_SIGNAL:
                        signal = this.payload[i] & 0xFF;
                        i += valueBytesLength;
                        Console.Write("PQ:" + signal);
                        break;
                    case PARSER_CODE_EEG_POWER:
                        i += valueBytesLength;
                        break;
                    case PARSER_CODE_CONFIGURATION:
//Signal 等于以下值，代表耳机没有戴好
                        if ( signal == 29 || signal == 54 || signal == 55 || signal == 56 || signal == 80 ||
signal == 81 || signal == 82 || signal == 107 || signal == 200)
                        {
                            config = this.payload[i] & 0xFF;

                            Console.Write("--NoShouldAtt:" + config);

                            Console.WriteLine("");

                            i += valueBytesLength;

                            break;
```

```
                }
                else
                {

                    config = this.payload[i] & 0xFF;

                    Console.Write("--Att:" + config);
                    Console.WriteLine("");

                }

                i += valueBytesLength;
                break;
            case PARSER_CODE_HEARTRATE:
                heartrate = this.payload[i] & 0xFF;
                i += valueBytesLength;

                break;
            case PARSER_CODE_DEBUG_ONE:
                if (valueBytesLength == EEG_DEBUG_ONE_BYTE_LENGTH)
                {
                    i += valueBytesLength;
                }
                break;
            case PARSER_CODE_DEBUG_TWO:
                if (valueBytesLength == EEG_DEBUG_TWO_BYTE_LENGTH)
                {
                    i += valueBytesLength;
                }
                break;
        }
    }
}
this.parserStatus = PARSER_STATE_SYNC;
}

private int getRawWaveValue(byte highOrderByte, byte lowOrderByte)
{
    /* Sign-extend the signed high byte to the width of a signed int */
    int hi = (int)highOrderByte;

    /* Extend low to the width of an int, but keep exact bits instead of sign-extending */
    int lo = ((int)lowOrderByte) & 0xFF;
```

```
            /* Calculate raw value by appending the exact low bits to the sign-extended high bits */
            int value = (hi << 8) | lo;

            return (value);
        }




    }

}
```