tsbin1.0.pdf – Binary Frequency and Data
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BINARY FORMAT DESCRIPTION

Introduction

This section describes an optional binary format for the numerical portion under [Network Data] and [Noise Data]. A binary format is useful for large files since it can reduce memory storage requirements to about 20 to 33 percent of the original ASCII data file.

The binary format is designated by the [Binary] keyword and is supported in [Version] 2.1 and above Touchstone files. The rules and limitations are discussed under the keyword description.

Conversions to and from the binary format are expected ~~to be supported by a a utility that~~ to preserve all existing ASCII content except for the numerical portions under either or both the [Network Data[and [Noise Data] keywords.~~s the ASCII portion of the file above the [Network Data] keyword.~~ A ~~The~~ conversion utility would not process comment characters and text to the end of the line and ignore blank lines. Such content would not be restored if converted back to ASCII format.

~~The conversion utility to a binary format is expected to use the same arguments (designated as T1, T2, and T3) associated with the [Binary] keyword to direct the conversion.~~

[Binary]

Rules for Version 1.0 Files:
The [Binary] keyword is not permitted in Version 1.0 files.

Rules for Version 2.0 and Greater Files:
The [Binary] keyword is not permitted in Version 2.0 files. The [Binary] keyword is optional for Version 2.1 and greater files. The [Binary] keyword is the first keyword that would follow either the [Network Data] or the [Noise Data] keywords (or both keywords) whenever the numerical entries that follow are encoded in a binary format.
~~However, the [Noise Data] keyword and the [Binary] keyword shall not be used in the same file.~~

~~Each Touchstone Version 2.1 file may contain one and only one [Binary] keyword.~~

The [Binary] keyword indicates that network data is presented in binary format, for purposes of file size compression and faster file parsing.

~~The [Binary] keyword shall be the first keyword after the [Network Data] keyword and before any data (i.e., between the [Network Data] keyword and the network data itself, to inform parsers that the network data is in binary format).~~

[Binary] shall be followed by ~~a single~~ three~~ character~~ arguments separated by whitespace.~~.~~ For explanatory purposes in this document only, ~~the characters of~~ the arguments are designated T1, T2 and T3 below. The three ~~characters comprising the~~ arguments shall ~~not~~ be separated by whitespace~~ or line-termination sequences~~.

The first argument~~character~~, T1, indicates the numerical precision of the frequency information.

The second argument~~character~~, T2, indicates numerical precision of the data.

The third argument, T3 indicates the byte order.

Both ~~-~~T1 and T2 designate precision: ~~tokens shall use the same upper-case characters to designate precision:~~
32-Bit: also known as single precision floating point~~F: single precision (floating point)~~
64-Bit: also know as double preciion~~D: double precision~~

The ~~third token,~~ T3, indicates designates byte order as~~byte order using the following upper-case characters~~:
~~B: B~~big-Endian~~ig-endian:~~ ~~(~~most significant byte first~~)~~
~~L: L~~ittle-Endian~~little-endian:~~ ~~l (l~~east significant byte first~~)~~

Example #:
[Binary] 64-Bit 32-Bit Little-Endian~~DFB~~

The example above indicates double-precision frequency and floating point data in little~~big~~-endian order.
The [Binary] keyword arguments shall be followed by a line-termination sequence. Immediately following the line-termination sequence shall be a single byte with value 0 (e.g., binary 00000000) to indicate that the information that follows will be in binary format.

No other keywords or comments are permitted after line-termination sequence following the [Binary] keyword's arguments.

~~The [Noise Data] keyword shall be prohibited in any file containing the [Binary] keyword.~~

The file is still terminated by the [End] keyword~~. shall be prohibited in any file containing the [Binary] keyword. The use of [Binary] with network data implies that only binary data, and not ASCII information, shall be present between the line-termination sequence after the [Binary] arguments and the end of the file.~~

Example #:

```
[Version] 2.1
# MHZ S RI R 50
[Number of Ports] 4
[Number of Frequencies] 1
! FREQ S11 S12 S13 S14
! S21 S22 S23 S24
! S31 S32 S33 S34
```

```
! S41 S42 S43 S44
!
[Network Data]                    ! numerical data in (hex) binary format
[Binary] 64-Bit 32-Bit Little-Endian
00 00 00 80 3f 65 8f ed 08 e9 21 95 3f 1a a5 4b ff 92 54 8e bf 85 c3 1c 4e aa
87 ee 3f 2b 58 99 df 1f a5 c8 bf 1b 37 c5 7b bf e5 62 bf 5e 74 42 80 bd d6 7e
3f 78 25 7d e5 37 08 77 bf 27 ca 48 37 6e a3 54 bf 3c 67 0b 08 ad 87 ee 3f d7
81 18 8d 21 a5 c8 bf f1 47 51 67 ee 21 95 3f 32 16 13 bc 9d 54 8e bf b2 31 47
40 99 07 77 bf 9d d5 02 7b 4c a4 54 bf e5 71 67 12 34 e7 62 bf 90 4a a7 31 fe
d6 7e 3f 0c 4f f9 21 80 e5 62 bf 31 8c 26 dd b7 d6 7e 3f 58 c0 cf 7b 0d 08 77
bf 23 be 0e fa a4 a3 54 bf d5 53 b3 20 f7 21 95 3f d4 c8 19 50 90 54 8e bf bb
a8 cc 83 aa 87 ee 3f d4 04 9b 84 1c a5 c8 bf ae 96 94 eb 08 08 77 bf df 58 01
d2 bf a3 54 bf cc 6b 8a 9f 7d e7 62 bf 8a 4a 97 bc 09 d7 7e 3f 72 4c bb 3d ad
87 ee 3f 01 ed 58 b6 20 a5 c8 bf 9b 5f c5 90 39 22 95 3f 43 81 2d 65 cf 54 8e
bf

[End]
```

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~~DFB~~

~~HBž_Đ¼ÚŒ,½²÷_?_ƒO¿¢Õ·<~~

~~à <_rN¼ƒYŒ»¾÷_?_ƒO¿6öŸ¼FŠ,½KrN¼žˆŒ»x‰·<_Ç <²Õ·<ûß <ögqN¼¿ZŒ»ý_Đ¼_ ,½Í÷_?î,O¿wr N¼;[Œ»ƒ‰·<EÇ <Ò÷_?"ƒO¿PöŸ¼P‹,½À_‹B_'!½MíÈ¼;×/>›š^¿×ÔÇ<%ˆ <kÎ ¼Êù§:M×/>°š^¿Ãv!½`ÒÈ¼_Ï ¼ôí§:NŠÇ< <âÔÇ<Ù‡ <…Î ¼WÖ§:Ú !½ÇíÈ¼¾×/>¤š^¿ÏÎ ¼å÷§:WŠÇ<Ë <š×/>Âš^¿_w!½ ×È¼€_²B{üZ½™áß»Ï§<¾_ m¿æÕ =<_&»;tÈ¼_~~

~~{insert binary frequency and data in hex format here, for example}~~

Except for the [Binary] keyword, its arguments and the ~~The~~ hex data shown above ~~in the example above~~ the example corresponds to the following ASCII ~~corresponds to the following ASCII~~ text~~network information~~:

```
[Version] 2.1
# MHZ S RI R 50
[Number of Ports] 4
[Number of Frequencies] 1
! FREQ S11 S12 S13 S14
! S21 S22 S23 S24
! S31 S32 S33 S34
! S41 S42 S43 S44
!
[Network Data]
1.000000e+001
2.063717e-002 -1.480975e-002 9.540607e-001 -1.925392e-001
-2.306818e-003 7.529011e-003 -5.623072e-003 -1.259668e-003
9.540620e-001 -1.925394e-001 2.063725e-002 -1.480983e-002
-5.622481e-003 -1.259875e-003 -2.307512e-003 7.529252e-003
-2.306700e-003 7.528990e-003 -5.622914e-003 -1.259719e-003
2.063738e-002 -1.480973e-002 9.540608e-001 -1.925388e-001
-5.622897e-003 -1.259744e-003 -2.307649e-003 7.529295e-003
9.540621e-001 -1.925393e-001 2.063837e-002 -1.481020e-002
```

[End]