tsbin1.0.pdf – Binary Frequency and Data
Updated 5/246/10

BINARY FORMAT DESCRIPTION

Introduction

This section describes an optional binary format for the numerical portion under the [Network Data] and [Noise Data] keywords. A binary format is useful for large files since as 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 descriptions.

Conversions to and from the binary format are expected toshall preserve all existing ASCII content in the file except for the numerical portions under either or both the [Network Data[-] and/or [Noise Data] keywords. Any conversion utility would shall not process (shall ignore) comment characters, and the text which follows, to the end of the commented line. and ignore bBlank lines shall also be ignored by binary conversion utilities. Such content would not be restored if converted back to ASCII format.

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

The [Binary] keyword is the first keyword that would following either the [Network Data] or the [Noise Data] keywords (or both keywords) whenever the numerical entries data that followindicated by those keywords are is encoded in a binary format.

-The [Binary] keyword may appear only once under the [Network Data] keyword and only once under the [Binary Data] keyword.

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

[Binary] shall be followed by three arguments separated from the keyword and each other by whitespace. ~~For explanatory purposes in this document only, the arguments are designated T1, T2 and T3 below. The three arguments shall be separated by whitespace..~~

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

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

The third argument~~, T3~~ indicates the ~~byte~~ assumed significance ordering of the bits within each byte.

~~Both T1 and T2 designate precision~~Only one of the two strings below is permitted for each of the first two (precision) arguments; these shall include the numerical values and '-' (dash) character as shown:

32-Bit: also known as single precision floating point
64-Bit: also know as double precision

~~The T3, indicates designates byte order as~~Only one of the two strings below is permitted for the third (byte order) argument; this shall include the '-' (dash) character as shown:

Big-Endian: most significant byte first
Little-Endian: least significant byte first

Example #:

```
[Binary] 64-Bit 32-Bit Little-Endian
```

The example above indicates ~~double-~~64-bit precision frequency and 32-bit precision floating point data in little-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 file ~~is still~~shall be terminated by the [End] keyword, regardless of the presence of the [Binary] keyword.

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]
```

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

```
[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]
```