IEEE P802.11
Wireless LANs

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| TSPEC Data Rates |
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Abstract

This document proposes resolutions to CIDs 6275, 6125, 6306, 6133 on Draft 5.0 of TGad

**Assumes Draft 5.0 as a baseline.**

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| 6275 | Perahia, Eldad |  |  | (Transfer from 802.11ac, Eldad Perahia) In 8.4.2.32 TSPEC element. The Mean Data Rate allows to indicate only up to 4.2Gbps; "The Mean Data Rate field is 4 octets long and contains an unsigned integer that specifies the average datarate specified at the MAC\_SAP, in bits per second, for transport of MSDUs or A-MSDUs(11n) belonging tothis TS within the bounds of this TSPEC."."The Peak Data Rate field is 4 octets long and contains an unsigned integer that specifies the maximumallowable data rate, in bits per second, for transfer of MSDUs or A-MSDUs(11n) belonging to this TSwithin the bounds of this TSPEC." | For TSPECs between two VHT STAs, define the Mean Data Rate in multiple of 2bits per second | Agree in principle. See 12/0023r2 |
| 6125 | RISON, Mark | 8.4.2.32 | 155.8 | The Minimum Data, Mean Data, Peak Data and Minimum PHY Rate fields ofa TSPEC are 32 bits long and their unit is bps. Therefore they onlysupport rates of up to about 4 Gbps, which is insufficient for themaximum rates supported by 11ad. | Change these fields to be a piecewise linear function, with a gradientchange at 2\*\*31 bps (this is above the maximum HT rates, and alsoabove the "current" 11ac rates). Above this rate, each unit shouldcorrespond to 1024 bps.Make sure it is clear that:- The Peak Data Rate does not include the MAC and PHY overheadsincurred in transporting the MSDUs or A-MSDUs (as is already statedfor the Minimum and Mean Data Rates)- The Peak Data Rate is specified at the MAC SAP (as is already statedfor the Minimum and Mean Data Rates)- Values are rounded up where necessaryA proposal for a set of specific changes is available on request. | Agree in principle. See 12/0023r2 |
| 6306 | Myles, Andrew | 8.4.2.32 | 155.8 | Raw data rate of 11ad exceeds 2^32-1 bps with margin, so extend TSPEC min/mean/max data rates (from baseline | Convert 32-bit field to piecewise linear, with steeper slope above 2 Gbps. Commenter will bring presentation | Agree in principle. See 12/0023r2 |
| 6133 | RISON, Mark | 8.4.2.32 | 155.8 | The Minimum Data, Mean Data, Peak Data and Minimum PHY Rate fields ofa TSPEC are 32 bits long and their unit is bps. Therefore they onlysupport rates of up to about 4 Gbps, which is insufficient for themaximum rates supported by 11ad. There are also some inconsistenciesin the text. | Change these fields to be a piecewise linear function, with a gradientchange at 2\*\*31 bps (about 2 Gbps; this is above the maximum HT rates,and also above the "current" 11ac rates). Above this rate, each unitshould correspond to 1024 bps.Make sure it is clear that:- The Peak Data Rate does not include the MAC and PHY overheadsincurred in transporting the MSDUs or A-MSDUs (as is already statedfor the Minimum and Mean Data Rates)- The Peak Data Rate is specified at the MAC SAP (as is already statedfor the Minimum and Mean Data Rates)- Values are rounded up where necessaryAlso fix the inconsistencies in the text.A proposal is attached. | Agree in principle. See 12/0023r2 |

**Problem**: the Minimum Data Rate, Mean Data Rate and Peak Data Rates fields in the TSPEC only allow rates up to 4.2Gbps, but 11ac and 11ad go to ~6.8 Gbps. Meanwhile, MIMO and channel bonding at 60 GHz and the entire Terahertz band are untapped opportunities and could lead to much higher data rates. Given that 802.3 is looking at 400 Gbps, there are use cases for these high speeds. In order to keep 2.4/5/60 GHz all aligned, and noting that 11n could never have used more than 600e6 in this field (and even 11ac implementations presently under development are unlikely to exceed 2 Gbps), we should keep the same size of the field, but define the field in a piecewise linear fashion, with an aspirational coefficient:

1 bit/sec per count for <= 2^31

1024 bits/sec per count for > 2^31

This maxes out at 1\*2^31 + 1024\*(2^32-1-2^31) = 2.2 Tbps, which is traditionally about 2-4 PHY generations away, and well exceeds all of today’s well-known flows.

Resolution remains exceedingly fine, at better than 1024/2^31 = 0.5ppm

***Change Set 1:***

#### TSPEC element

*Change the following paragraphs*

The Minimum Data Rate field is 4 octets long and indicates the lowest data

rate specified at the MAC\_SAP for transport of MSDUs or A-MSDUs(11n) belonging to

this TS within the bounds of this TSPEC. The minimum data rate does not include the MAC and PHY

overheads incurred in transferring the MSDUs or A-MSDUs(11n). The field is encoded as a piecewise linear function described by:

Minimum Data Rate (in units of bits per second) =

{ Minimum Data Rate field, if field <= 231

{ 1024\*(Minimum Data Rate field - 231) + 231, if field > 231

The Mean Data Rate field is 4 octets long and indicates the average data rate specified at the MAC\_SAP for transport of MSDUs or A-MSDUs belonging to this TS within the bounds of this TSPEC. The field is encoded as a piecewise linear function described by:

Mean Data Rate (in units of bits per second) =

{ Mean Data Rate field, if field <= 231

{ 1024\*(Mean Data Rate field - 231) + 231, if field > 231

The mean data rate does not include the MAC and PHY overheads incurred in transferring the MSDUs or A-MSDUs.

The Peak Data Rate field is 4 octets long and indicates the maximum allowable data rate for transfer of MSDUs or A-MSDUs belonging to this TS within the bounds of this TSPEC.

The field is encoded as a piecewise linear function described by:

Peak Data Rate (in units of bits per second) =

{ Peak Data Rate field, if field <= 231

{ 1024\*(Peak Data Rate field - 231) + 231, if field > 231

If *p* is the peak rate in bits per second, then the maximum amount of data, belonging to this TS, arriving in any time interval [*t*1,*t*2], where *t*1 < *t*2 and *t*2 – *t*1 > 1 TU, does not exceed *p* ×(*t*2 – *t*1) bits.

[…]

The Minimum PHY Rate field is 4 octets long and indicates the desired minimum PHY rate to use for this TS, that is required for transport of the MSDUs or A-MSDUs(11n) belonging to the TS in this TSPEC.25 See 10.4.2 (TSPEC construction) for constraints on the selection of this field.(#94). The field is encoded as a piecewise linear function described by:

Minimum PHY Rate (in units of bits per second) =

{ Minimum PHY Rate field, if field <= 231

{ 1024\*( Minimum PHY Rate field - 231) + 231, if field > 231

***Change Set 2 (conditional on change set 1):***

Discussion: these are “editorial-scale” improvements

#### TSPEC element

*Change the following paragraphs*

The Minimum Data Rate field is 4 octets long and indicates the lowest data rate specified at the MAC\_SAP for transport of MSDUs or A-MSDUs(11n) belonging to this TS within the bounds of this TSPEC. The field is encoded as a piecewise linear function described by:

Minimum Data Rate (in units of bits per second) =

{ Minimum Data Rate field, if field <= 231

{ 1024\*(Minimum Data Rate field - 231) + 231, if field > 231

The Mean Data Rate field is 4 octets long and indicates the average data rate specified at the MAC\_SAP for transport of MSDUs or A-MSDUs belonging to this TS within the bounds of this TSPEC. The field is encoded as a piecewise linear function described by:

Mean Data Rate (in units of bits per second) =

{ Mean Data Rate field, if field <= 231

{ 1024\*(Mean Data Rate field - 231) + 231, if field > 231

The Peak Data Rate field is 4 octets long and indicates the maximum allowable data rate specified at the MAC\_SAP for transport of MSDUs or A-MSDUs belonging to this TS within the bounds of this TSPEC. The field is encoded as a piecewise linear function described by:

Peak Data Rate (in units of bits per second) =

{ Peak Data Rate field, if field <= 231

{ 1024\*(Peak Data Rate field - 231) + 231, if field > 231

If *p* is the peak rate in bits per second, then the maximum amount of data, belonging to this TS, arriving in any time interval [*t*1,*t*2], where *t*1 < *t*2 and *t*2 – *t*1 > 1 TU, does not exceed *p* ×(*t*2 – *t*1) bits.

The Minimum, Mean and Peak Data Rates do not include the MAC and PHY overheads incurred in transporting the MSDUs or A-MSDUs.

[…]

The Minimum PHY Rate field is 4 octets long and indicates the desired minimum PHY rate for transport of MSDUs or A-MSDUs(11n) belonging to this TS within the bounds of this TSPEC.25 See 10.4.2 (TSPEC construction) for constraints on the selection of this field.(#94). The field is encoded as a piecewise linear function described by:

Minimum PHY Rate (in units of bits per second) =

{ Minimum PHY Rate field, if field <= 231

{ 1024\*( Minimum PHY Rate field - 231) + 231, if field > 231