# ISO/IEC JTC 1/SC 25/WG 3 N 711

**Date: 2004-07-03**

**Replaces ISO/IEC JTC 1/SC 25/WG 3 N n/a**

**ISO/IEC JTC 1/SC 25/WG 3**

**Customer Premises Cabling**

**Secretariat: Germany (DIN)**

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|---|---|
| **DOC TYPE:** | **Liaison document** |
| **TITLE:** | **Liaison report to IEEE 802.3 on 10GBASE-T** |
| **SOURCE:** | **WG 3 Secretariat (Chitose 68)** |
| **PROJECT:** | **25.03.02.xx: Generic cabling for customer premises** |
| **STATUS:** | **Answer to SC 25/WG 3 N 695 approved by WG 3 at Chitose 2004-06-24.** |
| **ACTION ID:** | **FYI** |
| **DUE DATE:** | **n/a** |
| **REQUESTED: ACTION** | **For information and consideration Please note that the technical information attached is subject to comments by national members of JTC 1/SC 25 and may change during the next meeting of SC 25/WG 3, will take place 2005-01-24/28 in Mexico.** |
| **MEDIUM:** | **Def** |
| **No of Pages:** | **29 (including cover and attached NWIP SC 25 N 0981)** |

**DISTRIBUTION:**

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**Liaison report to IEEE 802.3 on cabling in support of 10GBASE-T**

ISO/IEC JTC 1/SC 25/WG 3 thanks IEEE 802.3 for the liaison statements from November 2003 and March 2004 IEEE meetings.

SC 25/WG 3 continues to receive detailed reports on 10GBASE-T from Alan Flatman. SC 25/WG 3 was also very pleased to have Brad Booth participate in the February 2004 meeting.

The working group ISO/IEC JTC 1/SC 25/WG 3 welcomes the formation of the IEEE 802.3an Task Force. ISO/IEC JTC 1/SC 25/WG 3 has reviewed specific requests for comments and guidance relating to balanced cabling to support 10GBASE-T, and is pleased to offer the following responses.

## 1. 10GBASE-T cabling objectives

It is the intention of JTC 1/SC 25 to fully support cabling objectives of IEEE 802.3 with the help of a new work item proposal (NWIP). With the NWIP JTC 1/SC 25 seeks authorization from its national bodies for:

- a Technical Report entitled “Assessment of installed class E and class F cabling performance beyond their maximum specified frequencies”. The scope of the TR is “To specify methods to assess installed class E and class F cabling performance beyond their maximum specified frequencies” (see column one of the attachment to the new work item proposal).
- a first amendment to ISO/IEC 11801 2nd edition to update the performance specifications up to higher frequencies than presently specified for class E and class F (see column two and three in table 1 of the attachment to the new work item proposal: SC 25 N 981).

Please note that this table contains information for discussion, which is sent to the national bodies of JTC 1/SC 25 for comment. SC 25 expects to receive the responses by the end of 2004 and SC 25/WG 3 will incorporate them at their next meeting January 24th - 28th, 2005.

SC 25/WG 3 is also considering the inclusion of PSAELFEXT, PSAXTIR (power sum ANEXT to insertion loss ratio), electromagnetic performance parameters such as screening attenuation, coupling attenuation, TCL and ELTCTL.

## 2. Proposed 10GBASE-T channel PSANEXT limits

With reference to IEEE 802.3 proposed ANEXT requirements for each of the four cabling models considered by IEEE 802.3, SC 25/WG 3 proposes to accommodate the ANEXT slopes and intercepts (at 100 MHz) identified in the liaison letter from IEEE 802.3 of March 18 2004 (WG 3 N 695) for PSANEXT. It is the understanding of SC 25/WG 3 that IEEE 802.3 the use of the term ANEXT is meant to include the total NEXT from all external disturbers to the channel, in which case SC 25/WG 3 believes that the more appropriate parameter term should be PSANEXT.

## 3. Alien crosstalk mitigation methods

IEEE 802.3’s desire for guidance on mitigation methods has been noted and SC 25/WG 3 plans to investigate these at future meetings.

## 4. Feasibility and practicality of in-field alien crosstalk testing

Technical feasibility and practicality are being investigated by interested parties, including field tester manufacturers and cabling suppliers. SC 25/WG 3 expects to be able to provide IEEE 802.3 with the requested guidance after SC 25/WG 3 next meeting in January 2005.

Over the next several meetings and SC 25/WG 3 will be issuing liaisons to component and testing committees so that the final outcome will be a complete suite of specifications including channel and link requirements, component requirements, installation guidelines, laboratory test methods and field test methods.

**ISO/IEC JTC 1/SC 25 N 981**

**Date: 2004-07-05**

**Replaces ISO/IEC JTC 1/SC 25 N n/a**

**ISO/IEC JTC 1/SC 25**
**INTERCONNECTION OF INFORMATION TECHNOLOGY EQUIPMENT**
**Secretariat: Germany (DIN)**

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|---|---|
| **DOC TYPE:** | **NWIP** |
| **TITLE:** | **NWIP for a TR on and Amendment 1 to ISO/IEC 11801:2002** |
| **SOURCE:** | **ISO/IEC JTC 1/SC 25 (25Chitose16, 3Chitose71)** |
| **PROJECT:** | **25.03.02.02-02, -03** |
| **STATUS:** | **At its 15th Plenary, Chitose, Japan, 2004-06-25, SC 25 instructed its secretary to distribute a proposal for new work on two deliverables; see SC 25 N 990 Resolution SC 25:15/14. Since the two deliverables proposed are closely related and SC 25 WG 3 explicitly wishes that their development is authorised together, their acceptance is combined in a single vote in accordance with 6.2.16 of JTC 1 Directives Ed.5.**<br>**As guidance from national members could considerably expedite the development of these deliverables the approval of the new work is combined with technical questions.** |
| **ACTION ID:** | **ACT** |
| **DUE DATE:** | **2004-10-11** |
| **REQUESTED: ACTION** | **For voting to the P-Members of SC 25.**<br>**For information to the O- and L-members of SC 25.** |
| **MEDIUM:** | **Def** |
| **NOTE:** | **Electronically this document consists of three files:**<br>**SC 25 N 981c.pdf, SC 25 N 981v.doc and SC 25 N 981x.doc.** |
| **DISTRIBUTION:** | ITTF, JTC 1 Secretariat<br>P-, L-, O-Members of SC 25 |
| **No of Pages:** | **28** (including cover) |

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# New Work Item Proposal

## July 2004

**PROPOSAL FOR A NEW WORK ITEM**

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|---|---|
| Date of presentation of proposal: 2004-06-25 | Proposer: SC 25 |
| Secretariat: Germany<br>DIN | ISO/IEC JTC 1 N XXXX<br>**ISO/IEC JTC 1/SC 25 N 981** |

A **proposal for a new work item** shall be submitted to the secretariat of the Subcommittee of ISO/IEC joint technical committee 1 concerned with a copy to the secretariat of ISO/IEC JTC 1 and to the ISO Central Secretariat.

**Presentation of the proposal** - to be completed by the proposer.

**Title:** TR: Assessment of installed class E and class F cabling performance beyond their maximum specified frequencies and

Amendment 1 to ISO/IEC 11801 Ed.2: 2002

**Scope:** TR: To specify methods to assess installed class E and class F cabling performance beyond their maximum specified frequencies.

Amendment 1: To update the performance specifications in ISO/IEC 11801 to cover higher frequencies than presently specified for Class E and Class F and to update ISO/IEC 11801 in general.

**Purpose and justification**

ISO/IEC 11801 2nd edition is well accepted by the market. Emerging applications like 10GBASE-T are not only well supported by Class F channels but also by channels implemented with category 6 material. In order to assist IEEE in the exploitation of the installed base using such material, SC 25 has entered a dialog with IEEE 802.3 on the minimum channel requirements for 10GBASE-T and on test methods that allow qualifying installed links for this application.

SC 25 has also noted the considerable progress in cabling technology that provides the means for cabling channels with help of shielded and unshielded cables beyond the limits that could be foreseen during the development of ISO/IEC 11801 second edition. In order to guide new installations as how to exploit this progress SC 25 wants to start to develop additional / enhanced channel specifications.

**Programme of work**

If the proposed new work item is approved, which of the following document(s) is (are) expected to be developed?
_1_ a single International Standard

___ more than one International Standard (expected number: ........ )
____ a multi-part International Standard consisting of .......... parts
_1__ an amendment or amendments to the following International Standard ISO/IEC 11801
_1_ a technical report , type ..2

And which standard development track is recommended for the approved new work item?

_X_a. Default Timeframe

____b. Accelerated Timeframe

____c. Extended Timeframe

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| **Relevant documents to be considered:** New work item proposal attachment, see pages 5 to 8. |
| **Co-operation and liaison: IEC SC 46A, IEC SC 46C, IEC SC 48B, IEEE 802.3** |
| **Preparatory work offered with target date(s)** |
| **Signature:** Dr Walter von Pattay, Secretary of the ISO/IEC JTC 1/SC 25 |
| Will the service of a maintenance agency or registration authority be required? ..NO<br>- If yes, have you identified a potential candidate? ................<br>- If yes, indicate name ............................................................<br><br>Are there any known requirements for coding? ..NO<br>-If yes, please specify on a separate page<br><br>Does the proposed standard concern known patented items? ..NO<br>- If yes, please provide full information in an annex |

**Comments and recommendations of the JTC 1/SC 25 Secretariat** - attach a separate page as an annex, if necessary.

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| **Comments with respect to the proposal in general, and recommendations thereon:**<br>It is proposed to assign this new item to JTC 1/SC 25 |

**Voting on the proposal** - Each P-member of the ISO/IEC joint technical subcommittee has an obligation to vote within the time limits laid down (normally three months after the date of circulation).

**The vote shall be sent to the Secretary of ISO/IEC JTC 1 / SC 25** - Dr.-Ing. Walter P. von Pattay, Member of ZVEI FV 7 & FV 8, Gotthelfstr. 34, D- 81677 München, Germany,
Tel.: +49/89/923 967 57, Tfx.: +49/89/923 967 59 (on request only), **EM: Walter@Pattay.com**

| **Date of circulation:**<br>2004-07-05 | **Closing date for voting:**<br>2004-10-11 | **Signature of Secretary:**<br>Dr. Walter P. von Pattay |
|---|---|---|

| ***NEW WORK ITEM PROPOSAL - PROJECT ACCEPTANCE CRITERIA*** | | |
|---|---|---|
| **Criterion** | **Validity** | **Explanation** |
| **A. Business Requirement** | | |
| A.1 Market Requirement | Essential _X_<br>Desirable ___<br>Supportive ___ | |
| A.2 Regulatory Context | Essential ___<br>Desirable ___<br>Supportive ___<br>Not Relevant _X | |
| **B. Related Work** | | |
| B.1 Completion/Maintenance of current standards | Yes _X_<br>No___ | Technology advanced since ISO/IEC 11801 was published in 2002. |

| | | |
|---|---|---|
| B.2 Commitment to other organisation | Yes _X_<br>No___ | IEEE 802 needs methods to verify whether a link that exceeds the minimum requirements of ISO/IE 11801 would meet those of 10GBASE-T. |
| B.3 Other Source of standards | Yes ___<br>No_X_ | |
| **C. Technical Status** | | |
| C.1 Mature Technology | Yes _X_<br>No___ | Links that meet and exceed ISO/IEC 11801:2002 are installed. |
| C.2 Prospective Technology | Yes _X_<br>No___ | Components that surpass the minimum requirements of ISO/IEC 11801:2002 are coming up |
| C.3 Models/Tools | Yes ___<br>No_X_ | |
| **D. Conformity Assessment and Interoperability** | | |
| D.1 Conformity Assessment | Yes ___<br>No_X_ | |
| D.2 Interoperability | Yes ___<br>No_X_ | |
| **E. Cultural and Linguistic Adaptability** | Yes ___<br>No_X_ | |
| **F. Other Justification** | | |

## Notes to Proforma

**A. Business Relevance.** That which identifies market place relevance in terms of what problem is being solved and or need being addressed.

A.1 Market Requirement. When submitting a NP, the proposer shall identify the nature of the Market Requirement, assessing the extent to which it is essential, desirable or merely supportive of some other project.

A.2 Technical Regulation. If a Regulatory requirement is deemed to exist - e.g. for an area of public concern e.g. Information Security, Data protection, potentially leading to regulatory/public interest action based on the use of this voluntary international standard - the proposer shall identify this here.

**B. Related Work.** Aspects of the relationship of this NP to other areas of standardisation work shall be identified in this section.

B.1 Competition/Maintenance. If this NP is concerned with completing or maintaining existing standards, those concerned shall be identified here.

B.2 External Commitment. Groups, bodies, or fora external to JTC 1 to which a commitment has been made by JTC for Co-operation and or collaboration on this NP shall be identified here.

B.3 External Std/Specification. If other activities creating standards or specifications in this topic area are known to exist or be planned, and which might be available to JTC 1 as PAS, they shall be identified here.

**C. Technical Status.** The proposer shall indicate here an assessment of the extent to which the proposed standard is supported by current technology.

C.1 Mature Technology. Indicate here the extent to which the technology is reasonably stable and ripe for standardisation.

C.2 Prospective Technology. If the NP is anticipatory in nature based on expected or forecasted need, this shall be indicated here.

C.3 Models/Tools. If the NP relates to the creation of supportive reference models or tools, this shall be indicated here.

**D. Conformity Assessment and Interoperability**

D.1 Indicate here if Conformity Assessment is relevant to your project. If so, indicate how it is addressed in your project plan.

D.2 Indicate here if Interoperability is relevant to your project. If so, indicate how it is addressed in your project plan

**E. Cultural and Linguistic Adaptability** Indicate here if cultural and linguistic adaptability is applicable to your project. If so, indicate how it is addressed in your project plan.

**F. Other Justification** Any other aspects of background information justifying this NP shall be indicated here

## New work item proposal attachment:

In this attachment, the technical details to the new work item proposal for a Technical Report and an Amendment to ISO/IEC 11801 2nd Edition are presented.

The purpose of this NWIP is to develop:

- A Technical Report entitled "Assessment of installed class E and class F cabling performance beyond their maximum specified frequencies". The scope of the TR is "To specify methods to assess installed class E and class F cabling performance beyond their maximum specified frequencies" according to Column 1 of the table below.

and

- A first amendment to ISO/IEC 11801 2nd Edition to update the performance specifications up to higher frequencies than presently specified for Class E and Class F according to column 2 and column 3 of the table below.

Until national bodies have an opportunity to consider and comment on these values and equations, any circulation of this table (f.f.s.) beyond working group 3 experts should contain a preamble that they are not limits for conformance testing and are subject to change. Any acceptance testing of installed link and channels should be based only on those specified in ISO/IEC 11801:2002 Ed. 2.0.

**Table 1 – Channel parameters**

| **Channel Parameter** 15 to 100 m | **Freq.** (MHz) | **Column 1** **Class E and Class F [1] Ed. 2.0 capabilities** (Information only) | **Column 2** **Class E, Edition 2.1** | **Column 3** **Class F, Edition 2.1** |
|---|---|---|---|---|
| Return loss dB (min) | 1 to 10 | 19,0 | 19,0 | 19,0 |
| | 10 to 40 | 24 - 5log( $f$ ) | 24 - 5log( $f$ ) | 24 - 5log( $f$ ) |
| | 40 to 250 | 32 - 10log( $f$ ) | 32 - 10log( $f$ ) | 32 - 10log( $f$ ) |
| | 250 to 400 | 32 - 10log( $f$ ) | 8,0 | 8,0 |
| | 400 to 625 | 6,0 | 8,0 | 8,0 |
| | 625 to 1 000 | - | - | 8,0 Consider harmonization of these return loss requirements with ISO/IEC 15018 |

[1] For Class F of ISO/IEC 11801 Ed. 2.0, capabilities up to 625MHz for all parameters can be extrapolated to this frequency and PS ANEXT can be taken from column 3.

| Channel Parameter<br>15 to 100 m | Freq. (MHz) | Column 1<br>Class E and Class F [1] Ed. 2.0 capabilities<br>(Information only) | Column 2<br>Class E, Edition 2.1 | Column 3<br>Class F, Edition 2.1 |
|---|---|---|---|---|
| Insertion loss [2]<br>dB<br>(max) | 1 to 250 | $\left((L/100)+0{,}15\right)\left(1{,}82\sqrt{f}+0{,}0169f+0{,}25/\sqrt{f}\right)+4\left(0{,}02\sqrt{f}\right)$<br>15≤L≤90 | $1{,}97\sqrt{f}+0{,}0105f+0{,}21/\sqrt{f}$ | $1{,}80725\sqrt{f}+0{,}0105f+0{,}2625/\sqrt{f}$ |
| | 250 to 625 | $\left((L/100)+0{,}15\right)\left(1{,}82\sqrt{f}+0{,}0169f+0{,}25/\sqrt{f}\right)+4\left(0{,}02\sqrt{f}\right)$ | $1{,}97\sqrt{f}+0{,}0105f+0{,}21/\sqrt{f}$ | $1{,}80725\sqrt{f}+0{,}0105f+0{,}2625/\sqrt{f}$ |
| | 625 to 1 000 | - | - | $1{,}80725\sqrt{f}+0{,}0105f+0{,}2625/\sqrt{f}$ |
| NEXT<br>dB<br>(min) | 1 to 250 | $-20\log\left(\left(1{,}928\bullet10^{-4}\bullet f^{0{,}75}\right)+\left(3{,}991\bullet10^{-5}\bullet f\right)\right)$ | $-20\log\left(\left(1{,}928\bullet10^{-4}\bullet f^{0{,}75}\right)+\left(3{,}991\bullet10^{-5}\bullet f\right)\right)$ | 92,9 - 15log( $f$ ) |
| | 250 to 330 | $-20\log\left(\left(1{,}928\bullet10^{-4}\bullet f^{0{,}75}\right)+\left(3{,}991\bullet10^{-5}\bullet f\right)\right)$ | $-20\log\left(\left(1{,}928\bullet10^{-4}\bullet f^{0{,}75}\right)+\left(3{,}991\bullet10^{-5}\bullet f\right)\right)$ | 92,9 - 15log( $f$ ) |
| | 330 to 625 | 31 - 50log( $f$ / 330) | $-20\log\left(\left(1{,}928\bullet10^{-4}\bullet f^{0{,}75}\right)+\left(3{,}991\bullet10^{-5}\bullet f\right)\right)$<br>Introduce exemption for measurement uncertainty of 0-3dB @ 450 MHz to upper limit for low attenuation links (e.g., <12dB @ 450MHz). Applies to both class E ed 2.1 and class F ed 2.1.<br>National bodies are requested to provide input on whether to adopt the above approach or a “relaxed” limit line at high frequencies (for an example, see column 1). Provide input on alternatives. | 92,9 - 15log( $f$ ) |
| | 625 to 1 000 | - | - | 92,9 - 15log( $f$ )<br>See text on class E ed. 2.1 NEXT. |

[1] For Class F of ISO/IEC 11801 Ed. 2.0, capabilities up to 625MHz for all parameters can be extrapolated to this frequency and PS ANEXT can be taken from column 3.

[2] Class E channel coefficient is based on a maximum of 90 m “horizontal” cable and 10 m “work area” cable. Need to resolve difference between this equation and the one used by IEEE. Channel insertion loss requirements are applicable to measured results of 4 dB or higher.

| **Channel Parameter** 15 to 100 m | **Freq.** (MHz) | **Column 1** **Class E and Class F [1] Ed. 2.0 capabilities** (Information only) | **Column 2** **Class E, Edition 2.1** | **Column 3** **Class F, Edition 2.1** |
|---|---|---|---|---|
| PS NEXT dB (min) | 1 to 250 | $-20\log\left(\left(2{,}427 \bullet 10^{-4} \bullet f^{0{,}75}\right)+\left(6{,}324 \bullet 10^{-5} \bullet f\right)\right)$ | $-20\log\left(\left(2{,}427 \bullet 10^{-4} \bullet f^{0{,}75}\right)+\left(6{,}324 \bullet 10^{-5} \bullet f\right)\right)$ | $89{,}9 - 15\log(f)$ |
| | 250 to 330 | $-20\log\left(\left(2{,}427 \bullet 10^{-4} \bullet f^{0{,}75}\right)+\left(6{,}324 \bullet 10^{-5} \bullet f\right)\right)$ | $-20\log\left(\left(2{,}427 \bullet 10^{-4} \bullet f^{0{,}75}\right)+\left(6{,}324 \bullet 10^{-5} \bullet f\right)\right)$ | $89{,}9 - 15\log(f)$ |
| | 330 to 625 | $28 - 42\log(f / 330)$ | $-20\log\left(\left(2{,}427 \bullet 10^{-4} \bullet f^{0{,}75}\right)+\left(6{,}324 \bullet 10^{-5} \bullet f\right)\right)$ Introduce exemption for measurement uncertainty of 0-3dB @ 450 MHz to upper limit for low attenuation links (e.g., <12dB @ 450MHz). Applies to both class E ed 2.1 and class F ed 2.1. National bodies are requested to provide input on whether to adopt the above approach or a "relaxed" limit line at high frequencies (for an example, see column 1). Provide input on alternatives. | $89{,}9 - 15\log(f)$ |
| | 625 to 1 000 | - | - | $89{,}9 - 15\log(f)$ See text on class E ed. 2.1 PS NEXT. |
| ELFEXT dB (min) | 1 to 625 | $63{,}257 - 20\log(f)$ | $63{,}257 - 20\log(f)$ | $-20\log\left(0{,}00002 \bullet 10^{-\log(f)} + 0{,}000126 \bullet 10^{-0{,}75\log(f)}\right)$ |
| | 625 to 1 000 | - | - | $-20\log\left(0{,}00002 \bullet 10^{-\log(f)} + 0{,}000126 \bullet 10^{-0{,}75\log(f)}\right)$ |
| PS ELFEXT DB (min) | 1 to 625 | $60{,}257 - 20\log(f)$ | $60{,}257 - 20\log(f)$ | $-20\log\left(0{,}0000282 \bullet 10^{-\log(f)} + 0{,}000179 \bullet 10^{-0{,}75\log(f)}\right)$ |
| | 625 to 1 000 | - | - | $-20\log\left(0{,}0000282 \bullet 10^{-\log(f)} + 0{,}000179 \bullet 10^{-0{,}75\log(f)}\right)$ |
| Prop. delay µs (max) | 1 to 625 | $\left(0{,}544 + 0{,}036/\sqrt{f}\right)$ | $\left(0{,}544 + 0{,}036/\sqrt{f}\right)$ | $\left(0{,}544 + 0{,}036/\sqrt{f}\right)$ |
| | 625 to 1 000 | - | - | $\left(0{,}544 + 0{,}036/\sqrt{f}\right)$ |

[1] For Class F of ISO/IEC 11801 Ed. 2.0, capabilities up to 625MHz for all parameters can be extrapolated to this frequency and PS ANEXT can be taken from column 3.

| **Channel Parameter** 15 to 100 m | **Freq.** (MHz) | **Column 1** **Class E and Class F [1] Ed. 2.0 capabilities** (Information only) | **Column 2** **Class E, Edition 2.1** | **Column 3** **Class F, Edition 2.1** |
|---|---|---|---|---|
| Delay skew µs (max) | 1 to 625 | 0,050 | 0,050 | 0,030 |
| | 625 to 1 000 | - | - | 0,030 |
| Unbalance atten. [3] dB (min) | 1 to 625 | 40 - 10log( ƒ ) | See footnote 3. | See footnote 3. |
| | 625 to 1 000 | - | - | See footnote 3. |
| Coupling atten. [4] dB (min) | 1 to 625 | See footnote 4. | See footnote 4. | See footnote 4. |
| | 625 to 1 000 | - | - | See footnote 4. |
| PS ANEXT [5] dB (min) | 1 to 100 | 47 - 10log( ƒ / 100) | 60 - 10log( ƒ / 100) | 75 - 10log( ƒ / 100) |
| | 100 to 625 | 47 - 15log( ƒ / 100) | 60 - 15log( ƒ / 100) | 75 - 15log( ƒ / 100) |
| | 625 to 1 000 | - | - | 75 - 15log( ƒ / 100) |

[1] For Class F of ISO/IEC 11801 Ed. 2.0, capabilities up to 625MHz for all parameters can be extrapolated to this frequency and PS ANEXT can be taken from column 3.

[3] Requirements for unbalance attenuation, and other parameters relating to cabling system and component electromagnetic performance are under study. See attached document SC 25/WG 3 N685A.

[4] Requirements for coupling attenuation, and other parameters relating to cabling system and component electromagnetic performance are under study. See attached document SC 25/WG 3 N685A.

[5] The Class E values shown are indicative of unshielded cable and channel performance capability. PS ANEXT performance for screened class E systems is estimated to be 15 dB higher. PS ANEXT and other parameters relating to cabling system and component electromagnetic performance are under study. See document ‘SC 25/WG 3 N685. Corresponding test methods, models and requirements for PS ELFEXT may be required. There is no activity on specification of pair to pair ANEXT. The requirements for class E, edition 2.0 are applicable to channel lengths up to 55 m. For channels between 55m and 100m the number 47 in the ANEXT equation shall be: 62 - ((IL(100) - IL(L))*15/15.6). Based on this function, the value for a 100-meter channel is 62 dB.

Once the channel requirements are agreed within the working group, this table can be expanded to include specifications for models, cables, connectors, cords and links. Creation of separate tracker for updates related to each of the referenced standards may be considered.

All consolidated equations have been verified by the editor against the extrapolated limits in ISO/IEC 11801:2002 edition 2.0. Discrepancies, if any, that are pointed out in responses to the NWIP will be addressed and alternate equivalent equations will be considered.

# ISO/IEC JTC 1/SC 25/WG 3 N 685A

**Date: 2004-07-03**

**Replaces ISO/IEC JTC 1/SC 25/WG 3 N 685**

**ISO/IEC JTC 1/SC 25/WG 3**
**Customer Premises Cabling**
**Secretariat: Germany (DIN)**

| | |
|---|---|
| **DOC TYPE:** | **Liaison document** |
| **TITLE:** | **Report on SC 25 WG 3 meeting Bordeaux 2004-02-23/27; Liaison report to IEEE 802.3 on electromagnetic performance** |
| **SOURCE:** | **WG 3 Secretariat** (Bordeaux ~~48A, 72A~~, 78, Chitose16A, 69) |
| **PROJECT:** | **25.03.02.xx: Generic cabling for customer premises** |
| **STATUS:** | **Forwarding of the Bordeaux 48A and 72A was approved by WG 3 at its meeting at Bordeaux, France, 2004-02-23/27. The attachment has been updated at Chitose, Japan, 2004-06-21/24** |
| **ACTION ID:** | **FYI** |
| **DUE DATE:** | **n/a** |
| **REQUESTED:** | **For information** |
| **ACTION** | **IEEE 802 is requested to consider the attached information, provide feedback to SC 25/WG 3 and to expect further contributions to be developed at the next meeting of SC 25/WG 3. The next meeting of WG 3 planned at IXTAPA, Zihuatanejo, Mexico, 2005-01-24/28.** |
| **MEDIUM:** | **Def** |
| **No of Pages:** | **16 (including cover)** |

**DISTRIBUTION:**

Members of JTC 1/SC 25/WG 3, see N 680
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JTC 1/SC 25 Sec Dr. von Pattay
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Home page SC 25: "http:/www.iec.ch/sc25"

To: IEEE 802.3 Bob Grow
copy to Brad Booth, Alan Flatman
From: IEC/JTC1/SC25/WG 3
Date: 2004-02-27
Venue: Bordeaux, France, 23/27 February 2004

**Report from the convener of ISO/IEC JTC 1/SC 25/WG 3 to the chairman of IEEE 802.3 on SC 25/WG 3 meeting at Bordeaux, 2004-02-23/27**

SC 25/WG 3 thankfully received the answer from IEEE 802.3 to the liaison report SC 25 N 912 and the tutorials provided on electromagnetic performance and10GBASE-T. in addition the explanations provided by Bradley Booth and Alan Flatman where most helpful.

The working group advanced both topics during its Bordeaux meeting, 2004-02-23/27.

The preliminary findings on **electromagnetic performance** are forwarded to IEEE 802.3 with the following letter and attachments that where endorsed by SC 25/WG 3.

The discussions on the **minimum channel performance** needed **for 10GBASE-T** and the possibilities to meet this moving target with different kinds of installed and new cabling did not come to conclusions during the meeting that where found ripe enough to be forwarded to IEEE 802.3. Homework was allocated in order to be able to provide IEEE 802.3 with helpful input after the next meeting of WG 3, Chitose, Japan, 2004-06-21/24.

As a Convenor of WG 3 I kindly ask IEEE 802.3 not to hesitate to provide WG 3 with its own findings even before our next meeting. Further information on the channel performance requirements, the distances to be covered and the significance of installed park could be helpful to focus the discussions in WG 3 on those points that are most important to IEEE 802.3.

Best regards
Dr Walter v. Pattay
Convenor ISO/IEC JTC 1/SC 25/WG 3

**Liaison letter from SC25/WG 3 to IEEE 802.3 on electromagnetic performance of generic cabling**

During the meeting of JTC 1/SC 25/WG 3 in Bordeaux, February 2004, the following documents were presented and developed:

Bor048A, Establishment of the needed electromagnetic performance of generic cabling for compliance with EMC requirements.

Bor072A, Parameters, which influences immunity of IT systems utilizing generic cabling.

WG 3 kindly requests you to consider these documents and provide input for the modeling proposed in the first document.

Our next meting will take place on 21-24 June 2004 in Chitose, Japan.

Best regards
Dr Walter v. Pattay
Convenor ISO/IEC JTC 1/SC 25/WG 3

**Note:** during the meeting the documents Bor048A and Bor072A have been updated to Chitose16A, 69 that are attached to this document.

The next meeting of ISO/IEC JTC 1/SC 25/WG 3 will take place at IXTAPA, Zihuatanejo, Mexico, 2005-01-24/28

**ISO/IEC JOINT TECHNICAL COMMITTEE 1**
SUBCOMMITTEE No.25: INTERCONNECTION OF
INFORMATION TECHNOLOGY EQUIPMENT
WORKING GROUP 3: CUSTOMER PREMISES CABLING

37th Meeting of WG 3
Chitose, Japan, 2004-06-21/24

# Establishment of the needed electromagnetic performance of generic cabling for compliance with EMC requirements.

Table of contents



## 1 Summary

This document describes the necessary electromagnetic performance, here expressed as coupling attenuation, for a cabling system for compliance with EMC limits. The necessary

coupling attenuation is dependant of the specifications for the application in use and the EMC limits. A cabling system for which coupling attenuation is equal to or better than calculated, is a necessary but not sufficient condition for a system to comply. The active equipment must also in it self comply with the EMC requirements.

The calculations are approximate. They do not give a guarantee for compliance, but they may be used as a guideline for design. The document firstly gives the basis for the calculations, and then calculations are performed for known popular applications. These calculations are based on knowledge given in the standards and reference 1 for the applications and guess work where information is not available.

## 2 References

References are the information given in:

1. ISO/IEC JTC 1/SC 25/WG 3(Bordeaux/Flatman)045 10/100/1000BASE-T Electromagnetic Noise Requirements
2. New Pseudo ternary line code for high speed Twisted Pair Data Lines. Alistair Coles. Network Technology Department, HP Laboratories Bristol. HPL-95-103, Sept. 1995
3. Gigabit 1000BASE-T. White paper. Gigabit Ethernet alliance, 1997
4. Evaluation of proposed generic cabling set-up to be included in EMC testing of information technology equipment based on radiation emission tests. JTC 1/SC 25/WG 3N447B

## 3 Document history

| Version | Changes | Date |
|---|---|---|
| 3Bor48a | New | 27 February 2004 |
| 3Chi016 | Results from measured spectra included. 10 dB correction for traffic rate taken out | 17 May 2004 |

## 4 Electromagnetic performance

The electromagnetic performance of cabling is here defined as the performance parameters, which determines how cabling influences EMC performance of systems.

This is balance for unscreened and screened cabling and in addition screening attenuation for screened cabling. The modern definition of these parameters relates to the ratio of power transmitted in the system to the power radiated from the system. A convenient parameter, which adds the balance and screening (if applicable), is coupling attenuation. Coupling attenuation is used in this paper in order to make the rationales independent of the cabling technology.

## 5 Radiated emission

### 5.1.1 Limits

There are mainly two classes of limits, which has to be used: Class A for industrial environments and class B for residential environments.
The field is measured at a bandwidth of 120 kHz.

**Table 1 - EMC limits expressed in V/m**

| | | |
|---|---|---|
| Class A | 40 dB/µV/m, 30 - 230 MHz | 47 dB/µV/m, 230 - 1000 MHz |
| Class B | 30 dB/µV/m, 30 - 230 MHz | 37 dB/µV/m, 230 - 1000 MHz |

These limits can be expressed in power density [W/m$^2$] by using the formula

$$P = \frac{V^2}{R}$$

P Power density [W/m$^2$]
V Field strength [V/m]
R Impedance of empty space, 377 Ω

**Table 2 - EMC limits expressed in W/m2**

| | | |
|---|---|---|
| Class A | 2.65E-11 W/m$^2$, 30 - 230 MHz | 1.33E-10 W/m$^2$, 230 - 1000 MHz |
| Class B | 2.65E-12 W/m$^2$, 30 - 230 MHz | 1.33E-11 W/m$^2$, 230 - 1000 MHz |

### 5.1.2 Required power for emission to limit.

Under the assumption that all power is radiated from a point source, the power required for generating a field strength equal to the limit can be calculated as:

$$P_r = 4\pi r^2 P_L$$

$P_r$ Radiated power to get the limit [W]
$P_L$ Limit power density [W/m$^2$]
r measurement distance [m]

The measurement distance, r, is equal to 10 m for the limits in section 5.1.1

### 5.1.3 Power of transmitted signal

The power of the transmitted signal is dependent of the application, on the rate of traffic (see clause 8) and on any low pass filtering applied in the transmitter circuit. The power is a pseudo noise signal, which shall be measured in a bandwidth of 120 kHz for EMC calculations. The rate of traffic is specified to >10 % in CISPR 22:1997. The power function is dependent of frequency. The signal power for the different applications can be gained either by measurements or by examination of the standards. The power will normally follow a sin(x)/x function up to the first null. At higher frequencies filtering will normally limit the power.

### 5.1.4 Required coupling attenuation

If we look away from radiation from the electronic equipment and only take radiation from the cabling into account, the required coupling attenuation can be calculated as the ratio (expressed in difference in dB) between the power required to get the limit and the transmitted power. This is a conservative assumption as it is calculated as if the power is radiated from a point source. The power is actually radiated along the cabling. The power is therefore distributed so that the intensity is lower than calculated based on the assumption.

In figure 1 it is shown how the calculation may be performed (the power of the transmitted signal is just a calculation example)

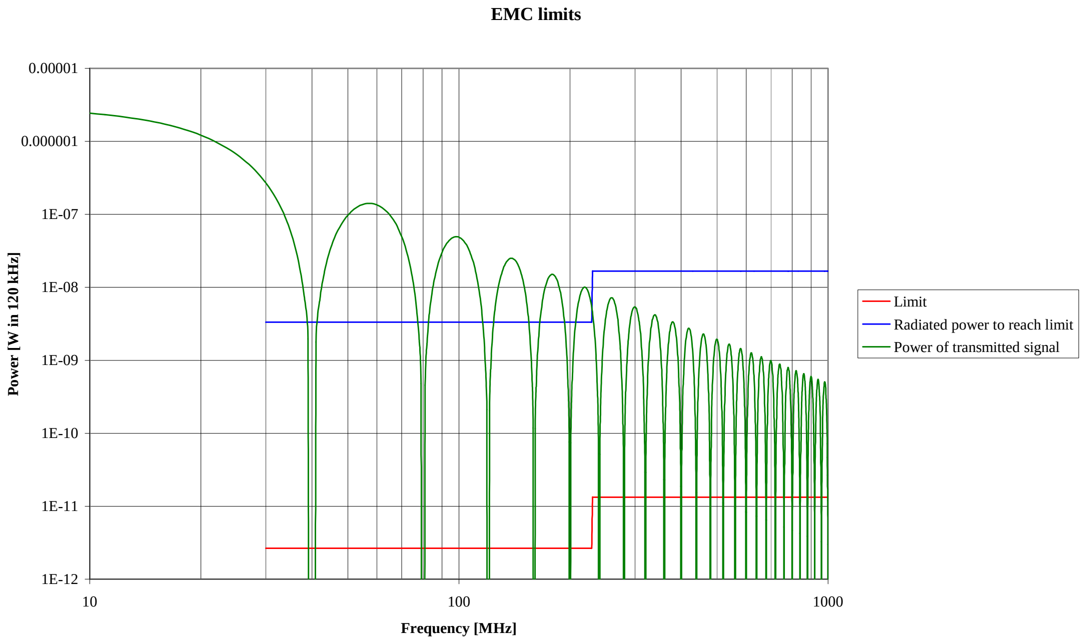


**Figure 1 - Limit for radiation, required radiated power and transmitted power.**

The required coupling attenuation is the ratio between the blue and the green graph.

# 6 Immunity

### 6.1.1 Limits

There are mainly two classes of limits, which has to be used: 10V/m for industrial environments and 3V/m for residential environments.

The power density can be calculated using the formula:

$$P = \frac{F^2}{R}$$

P Power density [W/m$^2$]
F Field strength [V/m]
R Impedance of empty space, 377 Ω

This is shown in the table below:

**Table 3 - EMC immunity limits**

| Environment | Field strength | Power density |
|---|---|---|
| Residential | 3 V/m | 0.024 W/m$^2$ |
| Industrial | 10 V/m | 0.26 W/m$^2$ |

### 6.1.2 Received power in cabling

The cabling can be viewed as an antenna in an electromagnetic field. If the gain of the antenna is one, the antenna is isotropic and it receives the power equally from all directions. An isotropic antenna is not possible, but it is a good estimate, that a cabling system will have a performance as an antenna, which is equal to an isotropic antenna plus minus some dB.

The received power from an isotropic antenna is:

$$P_r = \frac{\lambda^2}{4\pi} \cdot P_D$$

$P_r$ Received power [W]

λ Wavelength [m]

$P_D$ Power density [W/m$^2$]

The wavelength is:

$$\lambda = \frac{c}{f}$$

c velocity of light 3e8 m/s
f frequency [Hz]

### 6.1.3 Received power in the inner symmetrical circuit

The power in the inner symmetrical system is dependent of the coupling attenuation of the cabling. We can express the power in the inner system by:

$$P_i = P_r \cdot \frac{1}{C_{att}}$$

$P_r$ Received power [W]

Pi Power in inner system

Catt Coupling attenuation

The power in the inner system, generated from outside noise, determines the signal to noise ratio. The tolerable signal to noise ratio is very dependant of the character of the noise. For many applications a requirement for the tolerable voltage at the input of the receiving circuit is defined. The voltage generated by the noise in the inner system can be calculated, bearing in mind that the impedance for the signal is 50 Ω (100 Ω from the receiver in parallel with 100 Ω from the transmitter):

$$V_i = \sqrt{P_i \cdot Z}$$

Vi Noise voltage in inner system from the external field.

Z Impedance in inner system, 50 Ω (100Ω in parallel with 100 Ω).

Some examples can be calculated to investigate the usefulness of these considerations:

**Table 4 - Calculated noise voltage.**

| Outer field strength | Frequency | Coupling attenuation | Noise voltage, Vi |
|---|---|---|---|
| 10 V/m | 30 MHz | 40 dB | 0.1 V |
| 10 V/m | 100 MHz | 40 dB | 0.03 V |
| 10 V/m | 1000 MHz | 40 dB | 0.003 V |

The figures from the table are well aligned with the results presented in ref. 4.

## 7 Calculations for popular applications

### 7.1 Ethernet 10 Base-T

#### 7.1.1 Radiated emission

Specification (ref. 1)
*Peak differential output voltage ±2.2 V to ±2.8 V with any harmonic at least 27 dB below fundamental for an all-one code sequence (i.e. 10 MHz).*

#### 7.1.2 Signal spectrum

The lowest frequency of 5 MHz is obtained when a sequence of 1-0-1 is sent; 10 MHz is obtained for an all one code sequence. The maximum power is:

$$P = \frac{2.8^2}{100} = 0.0784 \text{ W}$$

For a random signal of zeroes and ones this is a noise signal, where the main power is between 5 and 10 MHz. If we make a rough estimation that the power is evenly distributed between 5 and 10 MHz the power density will be:

$$P_d = \frac{0.0784}{5 \cdot 10^6} = 0.0156 \, \mu\text{W/Hz}$$

As the measurement bandwidth is 120 KHz, the power in this bandwidth is:

$$P_{120} = 0.0156 \cdot 120000 = 1872 \ \mu\text{W}$$

At harmonic frequencies the signal is attenuated at least 27 dB, and it is estimated that the spectrum is at least attenuated 20 dB pr. Decade at higher frequencies. In a graph this estimated power spectrum is shown in figure 2.

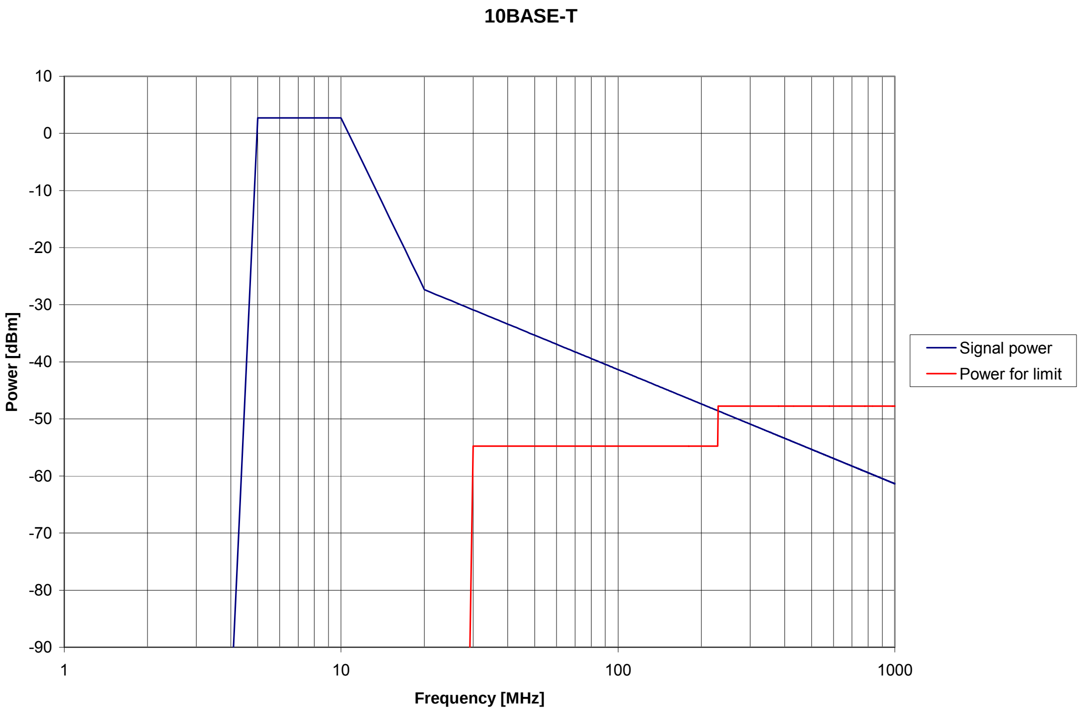


**Figure 2 - Estimated spectrum for Ethernet 10 Base-T**

In figure 2 the blue graph is the estimated power spectrum measured in a bandwidth of 120 kHz. The red graph is the power, which will generate field strength at the limit (class B), if it is radiated by an isotropic antenna. The difference between the blue and red graph is the required coupling attenuation for the cabling system, in order to comply with the radiation limit. From this figure it is seen that a coupling attenuation of 23 dB or better at 30 MHz is enough. For this application cabling is not the limiting factor.

### 7.1.3 Immunity

Common mode rejection specification (from ref. 1):
*The receiver must operate as specified (process data with a BER of no worse that $10^{-8}$) when a common mode voltage of 25V peak-to-peak, 500 kHz or lower in frequency is applied to the input signal.*
This specification applies to the receiver. It cannot be translated to requirements for cabling unless tolerance of the receiver for differential noise is known.

The Receiver Differential Input Signals are specified at

*± 585mV (minimum) with a BER of no worse that 10-8.*

If we calculate with a required S/N ratio of 15 dB, then the differential noise voltage at the receiver input shall be below ±104 mV. The required common mode ratio is then:

$$CMR = \frac{25}{0.104} = 240 \text{ or 48 dB}$$

If the receiver and the cabling contribute equally to the common mode rejection, then the balance of the cabling should be better than 54 dB up to 500 KHz. There is no information on requirements for higher frequencies.

## 7.2 Ethernet 100 BASE-T

### 7.2.1 Radiated emission

Peak differential output voltage ±0.95 V to ±1.05 V. The symbol rate is 125 MB/s. The signal is a 3-level signal, where ones are transmitted as alternative -1 and +1 V, and zeroes are transmitted as 0 V. Coding and scrambling ensures that long lengths of ones and zeroes does not happen.

### 7.2.2 Signal spectrum

The signal has some energy at low frequencies, because a zero is transmitted as 0 V. The highest frequency is for all ones transmission. This frequency is 62.5 MHz. The maximum power is:

$$P = \frac{1^2}{2 \cdot 100} = 0.005 \text{ W}$$

(the factor 2 is because the voltage is zero half of the time for the MLT-3 code)

For a random signal of zeroes and ones this is a noise signal, where the main power is between 0.06 and 0.2 times the symbol rate (Ref. 2, figure 3). This is between 7.5 MHz. and 25 MHz. If we make a rough estimation that the power is evenly distributed between 7.5 and 25 MHz the power density will be:

$$P_d = \frac{0.005}{17.5 \cdot 10^6} = 0.00029 \, \mu\text{W/Hz}$$

As the measurement bandwidth is 120 KHz, the power in this bandwidth is:

$$P_{120} = 0.00029 \cdot 120000 = 35 \; \mu\text{W or -14.6 dBm}$$

The estimated power spectrum is shown in figure 3, using information from Ref. 2, figure 3.

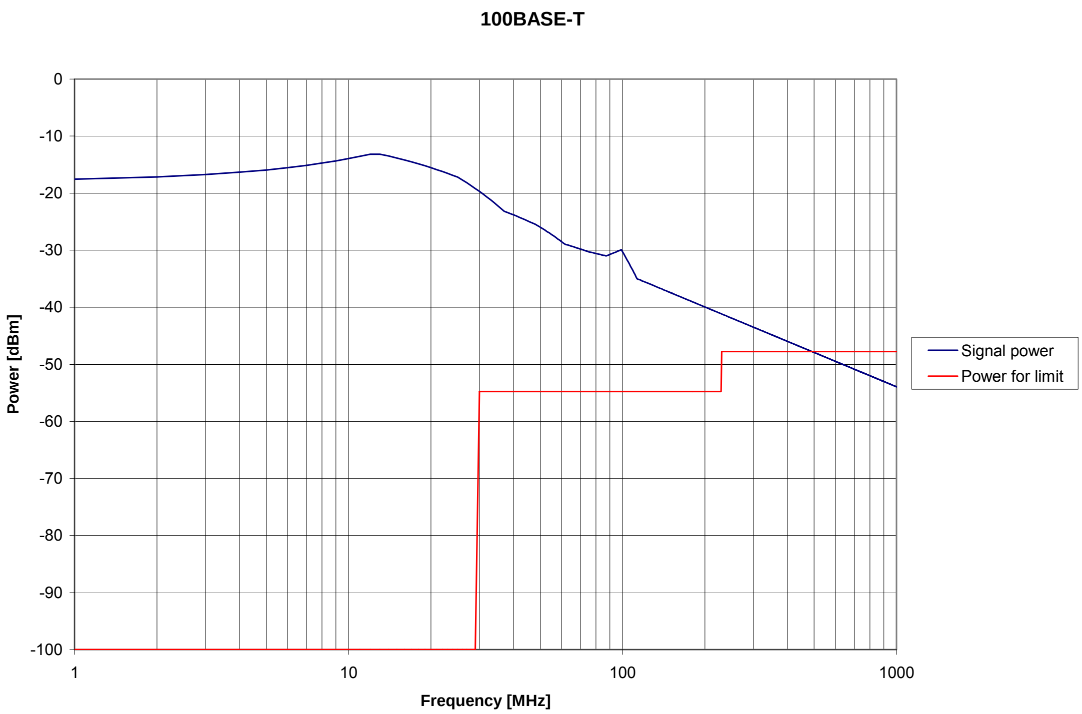


**Figure 3 - Estimated power spectrum for 100BASE-T**

In figure 3 the blue graph is the estimated power spectrum measured in a bandwidth of 120 kHz. The red graph is the power, which will generate field strength at the limit (class B), if it is radiated by an isotropic antenna. The difference between the blue and red graph is the required coupling attenuation for the cabling system, in order to comply with the radiation limit. From this figure it is seen that a coupling attenuation of 35 dB or better at 30 MHz is adequate.

#### 7.2.3 Immunity

Noise specification (from ref. 1):
*The noise coupled from external sources measured at the output of a filter attached to the output of the near end of a disturbed channel should not exceed 40mV peak-to-peak. The measurement filter is a 5$^{th}$ order Butterworth filter with a 3 dB cutoff @ 100 MHz.*
The noise power, which can be tolerated, is then:

$$P_N = \frac{0.04^2}{8 \cdot 100} = 2 \text{ μW}$$

Using the information in clause 6, the required coupling attenuation can be found.

$$C_{att} = \frac{P_D}{P_N} \cdot \frac{\lambda^2}{4\pi}$$

$P_D$ Power density of disturbing field
$P_N$ Tolerable noise power
$\lambda$ Wavelength of noise signal

In the table below this is calculated for a noise field of 10 V/m

**Table 5 - Required coupling attenuation for 100 BASE-T, Industrial environment**

| Frequency | Required coupling attenuation |
|---|---|
| 30 MHz | 60 dB |
| 50 MHz | 56 dB |
| 100 MHz | 50 dB |

For residential environment the required coupling attenuation is 10 dB less.

At higher frequencies than 100 MHz the requirements are less, due to the measurement filter required in the above specification. This is in practice only true if a filter is implemented in the receiver circuit.

### 7.3 Ethernet 1000 BASE-T

#### 7.3.1 Radiated emission

Peak differential output voltage is ±1 V. The symbol rate is 125 MB/s. The signal is a 5-level signal, pulse amplitude modulation

#### 7.3.2 Signal spectrum

The signal spectrum is essentially the same as for 100 BASE-T, but signals are transmitted simultaneously at all four pairs in order to achieve the high bit rate. This means that the total power transmitted is 4 times that of 100BASE-T (The transmission also allows for full duplex operation, but this is not taken into account here). The power spectrum is therefore 6 dB higher than that of 100BASE-T. This is shown in figure 4.

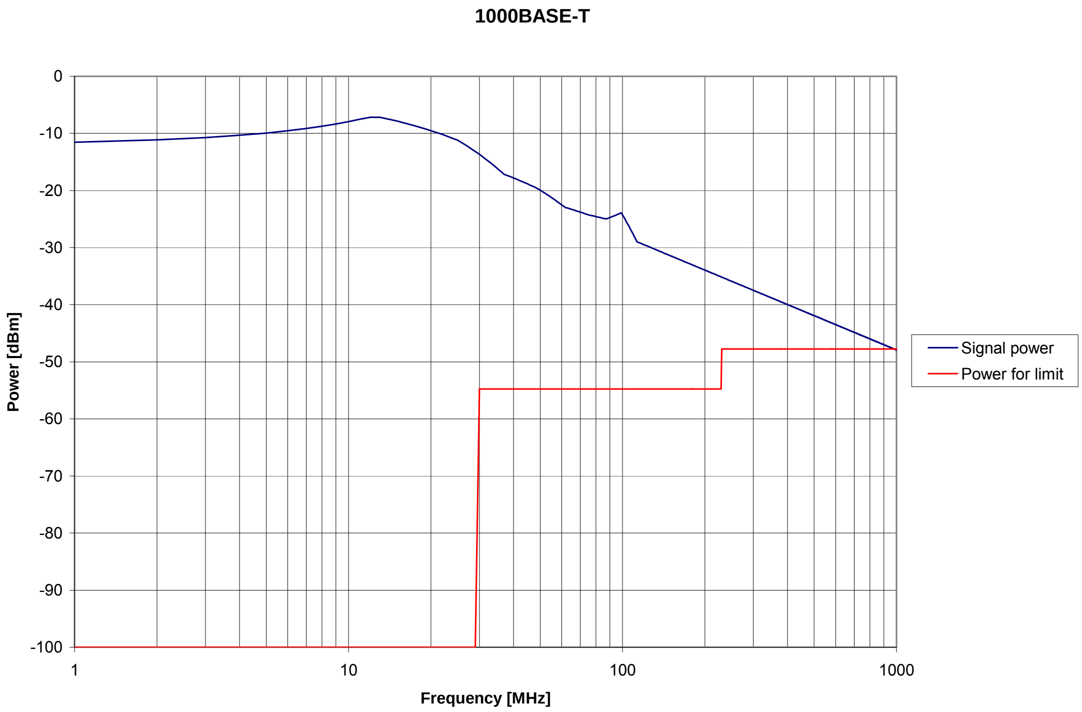


**Figure 4 - Estimated power spectrum for 1000BASE-T**

For explanation of the figure, see figure 3. The required coupling attenuation is 42 dB at 30 MHz. This is not impossible for modern cabling. Good UTP cabling will comply with this requirement. But is must be stressed that the calculation only comprises one cable to one work station. For a bundle of cables close to the distributor the radiation is worse, depending of the number of active channels.

### 7.3.3 Immunity

The noise specification (from ref. 1) is the same as for 100BASE-T (see clause 7.2.3).

The requirements are therefore the same, although it is known that a 5 level code is more prone to noise disturbances as a 3 level code. With the same specification a higher burden is put on the 1000BASE-T receiver design.

### 7.4 Ethernet 10GBASE-T

No information yet.

## 8 Measured spectrum for 100 BASE-T

In order to verify the theoretical calculation in clause 7.2.2, the signal spectrum for a 100 BASE-T LAN was measured using an EMI receiver.

A short link was connecting two computers. The LAN was either kept in idle state or in a state where the one computer was transmitting large files to the other. The signal was picked up by a directional coupler, with an attenuation of 20 dB.

Graphs were obtained in the frequency range of 20 MHz to 200 MHz. Quasi peak, peak and average detectors were used, and the LAN was in the idle or heavy traffic state

The signal strength recorded by the receiver is in dB over 1 µV. This is calculated in dBm and the attenuation of the baluns and directional coupler is accounted for.

The results are shown in the graphs below:

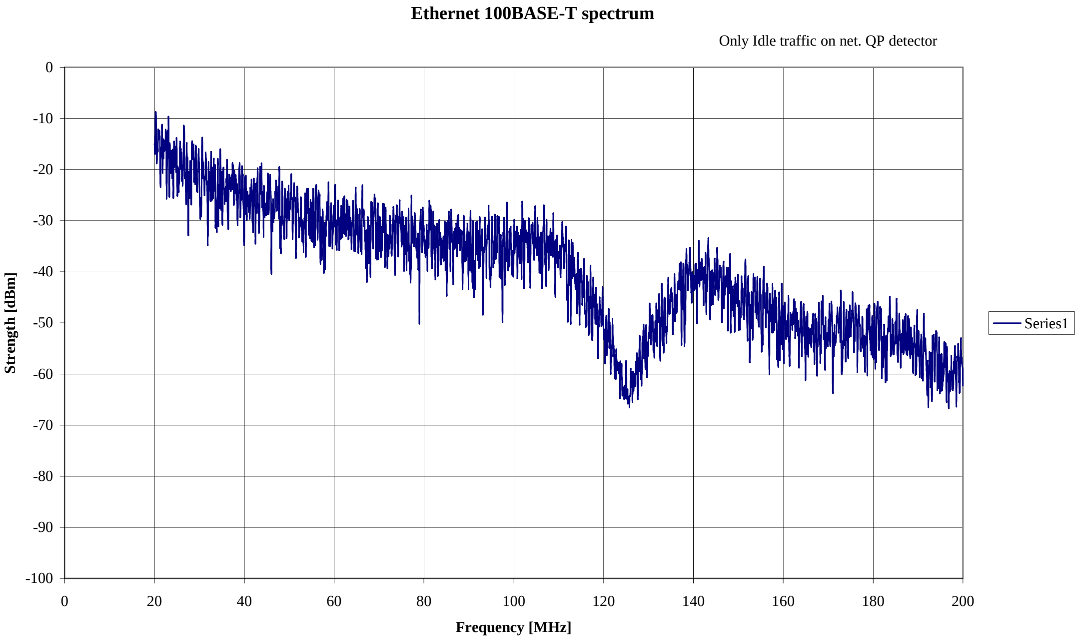


**Figure 5 – Ethernet 100BASE-T spectrum**

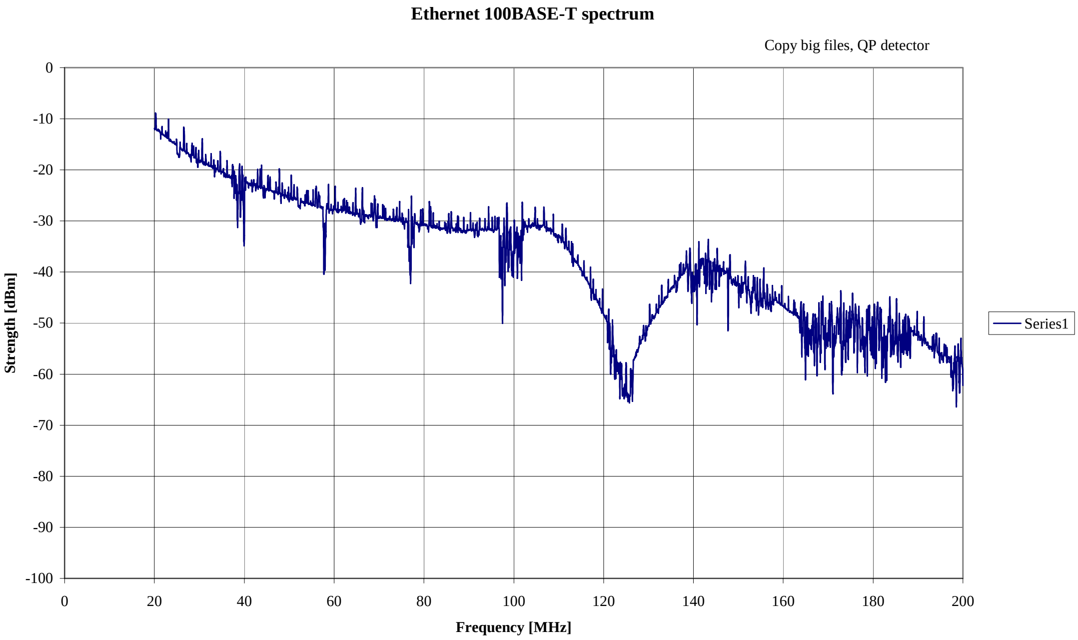


**Figure 6 – Ethernet 100BASE-T spectrum**

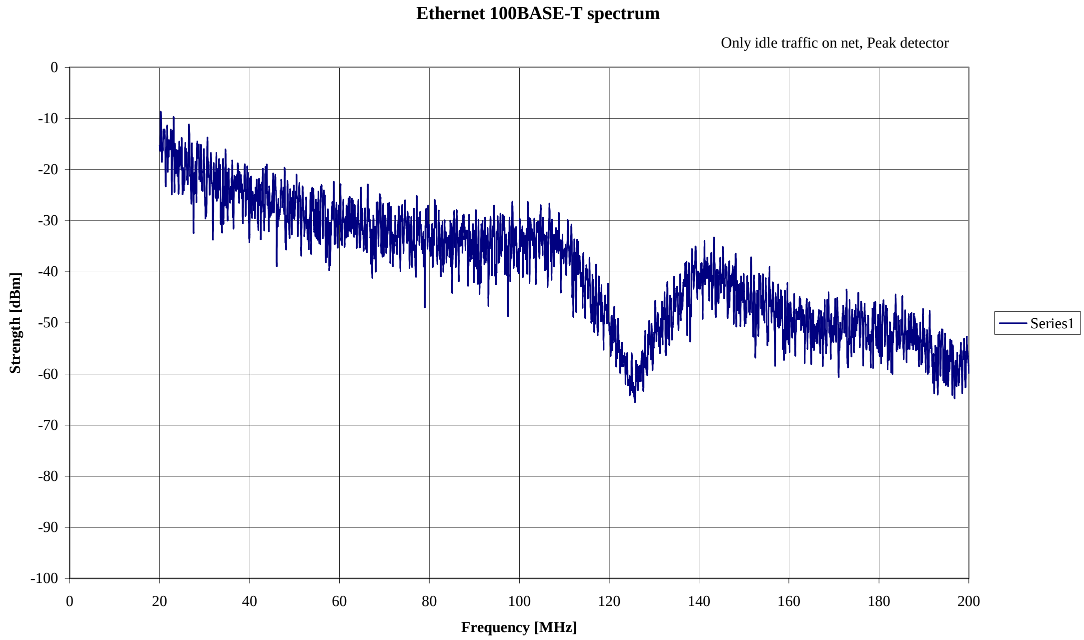


**Figure 7 – Ethernet 100BASE-T spectrum**

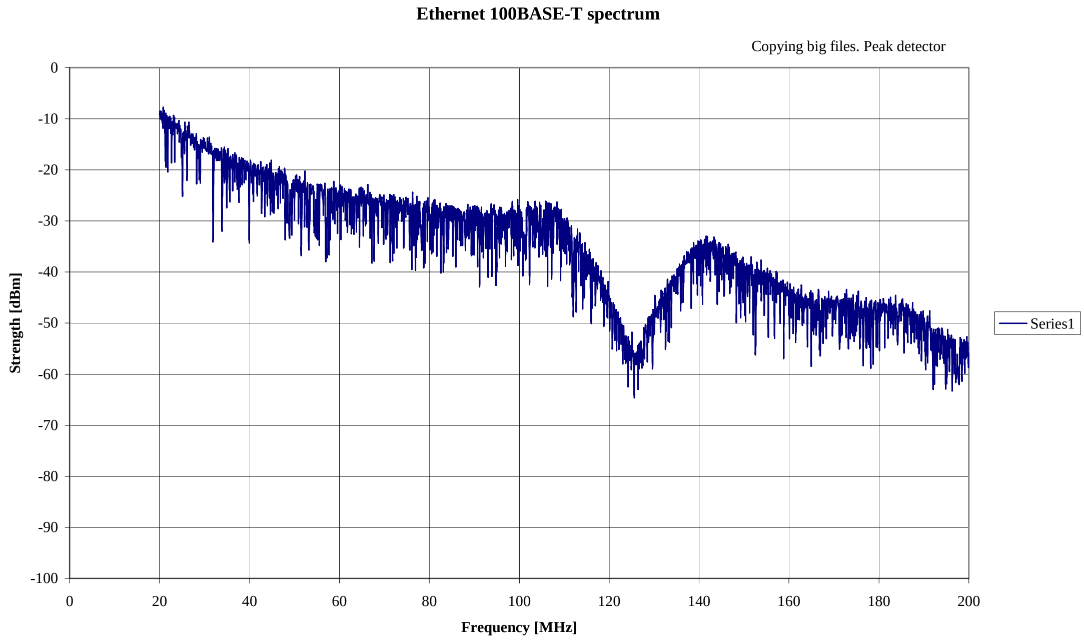


**Figure 8 – Ethernet 100BASE-T spectrum**

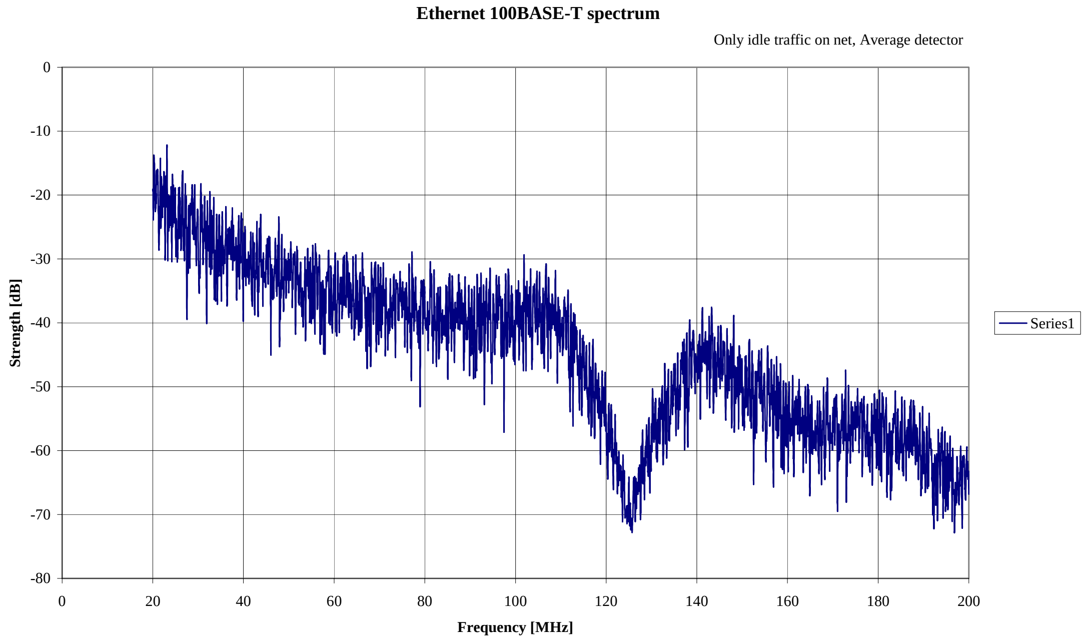


**Figure 9 – Ethernet 100BASE-T spectrum**

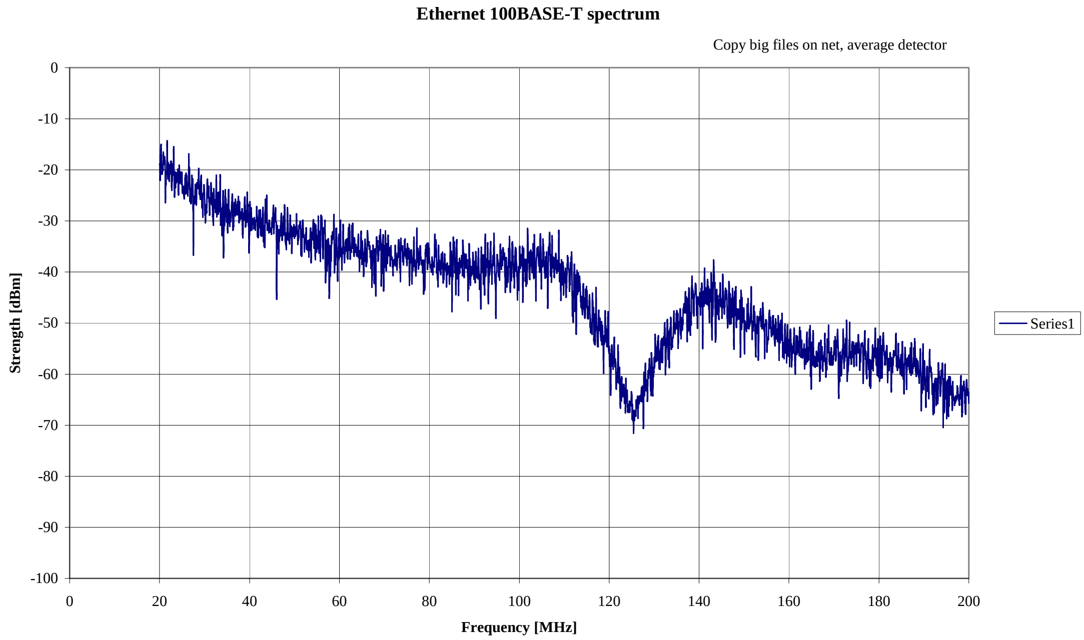


**Figure 10 – Ethernet 100BASE-T spectrum**

It is seen from the graphs that the measured peak emissions show very little dependency of the rate of traffic. This is true for all the detectors. The reference detector for EMI measurements is the quasi peak detector. This detector gives the same results as the peak detector for these kinds of signals. It can also be seen that the measured spectrum is very close to the theoretical spectrum of fig. 3.

In the former version of this document, 3Bor048a, I made a correction for 10 % traffic rate of 10 dB. The results show that this is not true. This correction has therefore been taken out of this version of the document.

## 9 Conclusion

A simple way to specify and calculate the necessary EM performance of cabling has been proposed. The method uses the parameter coupling attenuation for this characterization. This parameter is applicable in the frequency range of 30 MHz 1000 MHz. Radiation and immunity at lower frequencies should also be covered in the future. The method has been used to find the requirement for cabling for popular applications. Although the method is very simple it is found that the calculated results are in line with expected results. It is also found that the results are in agreement with results found in anechoic chamber measurements.

It must be stressed that the fact that the cabling complies with the calculated EM requirements is a necessary but not sufficient condition for EMC compliance. It is also important that the active equipment is in compliance when it is tested according to CISPR 22.

An interesting result is that the requirement of immunity, especially in industrial environments, puts a higher requirement to cabling than radiation. This is true, especially when we have single channels.

# Parameters, that influence immunity of IT systems utilising generic cabling

## Electromagnetic performance of generic cabling systems, channels and links. 3ch069

Reference is made to the minutes of the add hoc for the pre assumptions for the tabled values.

IS 11801: Sub-clause 6.4.14-6.4.15
2004-06-23 Chitose ad hoc on EM performance.

| | | | Balanced Cabling Channel | |
|---|---|---|---|---|
| | | | Typical construction | |
| | | | Unscreened | Screened |
| Performance class | Crosstalk parameters | Alien crosstalk | ≥ Channel PSNEXT (ffs) | ≥ Channel PSNEXT (ffs) |
| | Unbalance attenuation | TCL | 64-20log(f) 1-max f for Class | ffs |
| | | ELTCTL | 30-20Log(f) 1-30 MHz | ffs |
| | Screen parameters | Screening attenuation | not applicable | not specified |
| | | Coupling attenuation | not specified | 39-20log(f/100) 30-1000MHz* |
| | | | | |
| | Installation mitigation | | see note | see note |
| E1 | | | | |
| Performance class | Crosstalk parameters | Alien crosstalk | ≥ Channel PSNEXT (ffs) | ≥ Channel PSNEXT (ffs) |
| | Balance parameters | TCL | 74-20log(f) 1-max f for Class | ffs |
| | | ELTCTL | 40-20Log(f) 1-30 MHz | ffs |
| | Screen parameters | Screening attenuation | not applicable | not specified |
| | | Coupling attenuation | not specified | 49-20log(f/100) 30-1000MHz* |
| | Installation mitigation | | see note | see note |
| E2 | | | | |
| Performance class | Crosstalk parameters | Alien crosstalk | ≥ Channel PSNEXT (ffs) | ≥ Channel PSNEXT (ffs) |
| | Balance parameters | TCL | 84-20log(f) 1-max f for Class | ffs |
| | | ELTCTL | 50-20Log(f) 1-30 MHz | ffs |
| | Screen parameters | Screening attenuation | not applicable | not specified |
| | | Coupling attenuation | not specified | 59-20log(f/100) 30-1000MHz* |
| | Installation mitigation | | not necessary | not necessary |
| E3 | | | | |
| | Balance parameters | TCL | 40-10 log (f) f.f.s. | |
| ISO/IEC 11801 | | Coupling attenuation | No value | |

Note:Instalation mitigation may be used when components from a lower E class has to meet a higher E class.
* formula for coupling attenuation means: A constant value from 30 MHz to 100 MHz. Use the formula from 30 MHz to max of class, up to 1GHz information for general EMC

E1 would follow CISPR 22 "ISN cat5"
E2 would follow CISPR 22 "cat6" and industrial crossmodal 45 dB at 62 MHz
E3 resembles industrial crossmodal 55 dB at 62 MHz

CISPR ISN TCL values are probably so high because they are average values, we should decrease our values by 15 dB because of max values. There will be a low frequency plateau for TCL (40-50 dB)

**VOTE ON A PROPOSED NEW WORK ITEM**

ISO/IEC JTC 1 N **XXXX**

ISO/IEC JTC 1/SC 25 N **0981**

Date of Circulation of NP: 2004**-07-09**

Date of Ballot Close: **2004-10-11**

Please return all votes and comments directly to the JTC 1/SC 25 Secretariat by the due date indicated.

**Proposal for a new work item on**

**Title TR: Assessment of installed class E and class F cabling performance beyond their maximum specified frequencies and**

**Amendment 1 to ISO/IEC 11801 Ed.2: 2002**

Any proposal to add a new item to the programme of work shall be voted on by correspondence, even if it has appeared in the agenda of a meeting.

| **A. Vote** | | **YES** | **NO** | **Comments** |
|---|---|---|---|---|
| **Q.1** | Do you accept the proposal in document JTC 1 N XXXX and JTC 1/SC 25 N 981 respectively as a sufficient definition of the new work item? (If you have responded "NO" to the above question, you are required to comment.) | ____ | ____ | ____ |
| **Q.2** | Do you support the addition of the new work item to the programme of work of the joint technical committee? | ____ | ____ | ____ |
| **B. Participation** | | | | |
| **Q.3** | Do you commit yourself to participate in the development of this new work item? | ____ | ____ | ____ |
| **Q.4** | Are you able to offer a project editor who will dedicate his/her efforts to the advancement and maintenance of this project? (If "YES," please identify ............................................................) | ____ | ____ | ____ |
| **C. Documentation** | | | | |
| **Q.5** | Do you have a major contribution or a reference document ready for submittal? | ____ | ____ | ____ |
| **Q.6** | Will you have such a contribution in ninety days? | ____ | ____ | ____ |

| | | |
|---|---|---|
| P-member Voting:<br>National Body ______________________ | Date:<br>________________ | Submitted by:<br>Name _______________________________ |

## Advisory questions

| **A. Answer to** | | Equation provided | **Relaxed limit** | **Comments** |
|---|---|---|---|---|
| **Q.1 to attachment Table 1, column 2, line NEXT** | The under signing national member recommendsthe following approach | ____ | ____ | ____ |
| **Q.2 to attachment Table 1, column 2, line PS NEXT** | The under signing national member recommendsthe following approach | ____ | ____ | ____ |
| **A. Answer to** | | Yes | No | Details |
| **Q.3 to attachment**<br>**Line 17** | Is there a need to change the equations provided. If so, provide details. | ____ | ____ | ____ |

| P-member Advising: | Date: | Submitted by: |
|---|---|---|
| National Body ______________________ | ________________ | Name _______________________________ |