TITLE **RFI tone levels for testing ADSL and SDSL**

PROJECTS ADSL, SDSL

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STATUS for Decision

ABSTRACT This contribution, supported by various operators, proposes the levels of a 10 tone RFI model for testing ADSL and SDSL. Both xDSL systems are to be tested with the same set of RFI tones. An ingress noise measurement is included to demonstrate that the proposed tone levels are realistic.

1. Current Status of RFI tones

RFI Tones are required to test how xDSL modems can cope with ingress noise (mainly from broadcast stations), and to know how much the reach may reduce when ingress noise is added to crosstalk noise to stress a modem under test.

In ETR 328 (The ETSI ADSL report from nov 1996), the following values for RFI ingress noise are defined. These numbers were left unchanged in the ADSL draft that was recently submitted for approval by ETSI.
These numbers are controversial because many operators have raised the position that these levels are too low for the purpose of ingress noise testing.

frequency	99	207	333	387	531	603	711	801	909	981	kHz
power	–70	–70	–70	–70	–70	–70	–70	–70	–70	–70	dBm

In TD35 from Edinburgh (sept 1999), the following values for RFI ingress noise have been proposed for SDSL. These numbers have been copied into the SDSL standard TS 101 524.
The numbers are controversial because several vendors have raised the position that these levels are too high for the purpose of ingress noise testing. Reasons that have been raised include that they are seen as unrealistic high and that it is seen as unfair that ADSL ingress testing is less stressfull then SDSL

frequency	99	207	333	387	531	603	711	801	909	981	kHz
power	–70	–40	–60	–60	–40	–50	–40	–50	–60	–60	dBm

2. Current Status of RFI tone discussion

To improve matters, various tone levels (different from the original ADSL tone levels) have been proposed, including TD34 (Amsterdam), WD12 (Montreux), WD14 (Helsinki), TD35 (Vienna). These contributions could not resolve the controverse behind it.

To support the discussion with some theoretical background, some additional papers about modelling have been contributed, including TD36, 38, 39 (Vienna). More recently TD24 (Gent) reported a preliminary study on a pre-standard SDSL prototype, illustrating that real systems can resist severe RFI tones associated with some reduction of reach.
The only field measurement made available to ETSI-TM6 was TD26 (Monterey) showing example ingress measurements on rural overhead lines and sub-urban underground cables in the United Kingdom. Figure 1 shows a copy of one of the measurements presented by BT.

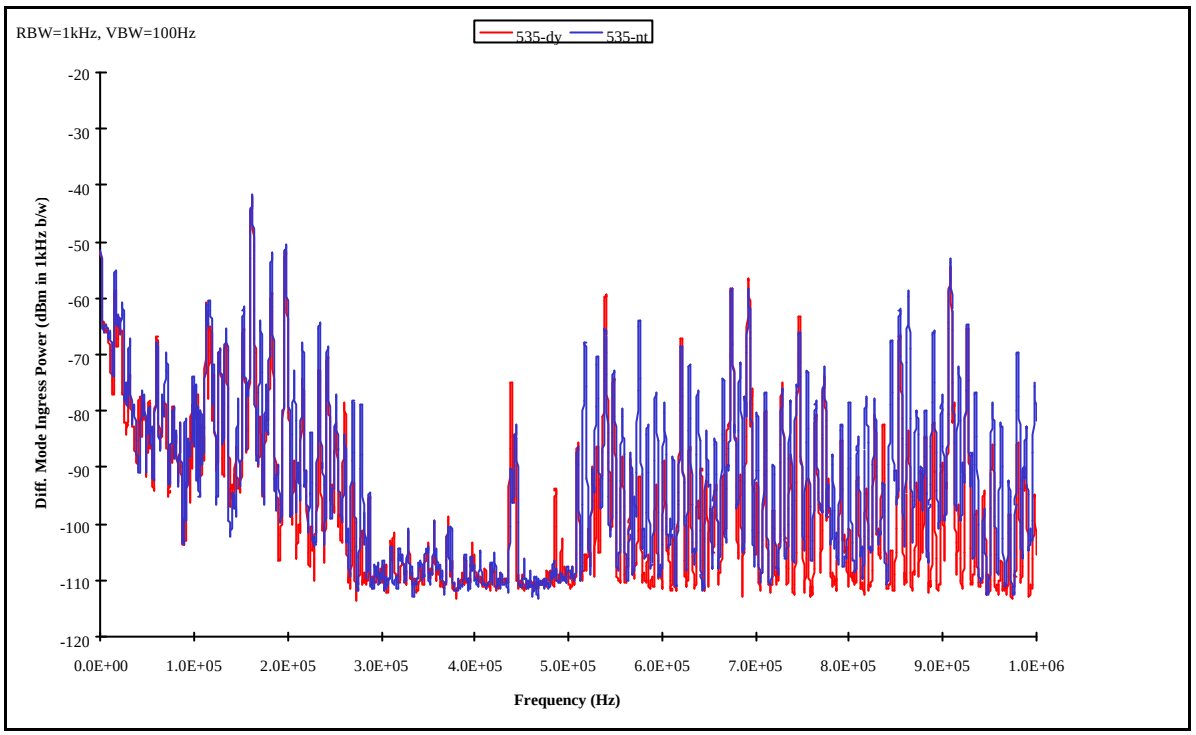

Figure 1. Measurements on ingress noise, presented by BT in Monterey (TD26, dec 2000, file 004t26.pdf), representing "differential mode ingress levels on rural overhead line L535"

So far, the issue is unsolved. In WD12 (Torino, 021w12) several European operators (KPN, BT, DTAG, FT, Swisscom, Telecom Italia Lab, Telekom Austria, Czech Telecom) made a very clear position that tests with RFI tones are important for them to support decisions on how to deploy xDSL in the field. It was an operators desire to have a common RFI test solution for both ADSL and SDSL. It was a clear operator request to have this issue solved. As long as this issue remains unsolved, the current RFI tone level specifications published in ADSL and SDSL documents should not be deleted nor reduced in level.

3. Operator's proposal

RFI testing should inform operators on what happens during worst case situations. This means RFI models higher in level then currently defined for ADSL, but there is no need to make them as pessimistic as is currently defined for SDSL.

We propose to use a worst case model for RFI tones. To ensure realistic levels, we propose to base them on the measurements from BT on BT cables (see TD26, Monterey), and shown again in figure 1.

- The BT measurements on BT-cables have demonstrated that a multi disturber model fully makes sense. The current model with 10 disturbers, at fixed frequencies, is assumed to be fully adequate for the job. Their frequencies are artificial (have not been chosen to

match frequencies of broadcast stations), and are chosen to be distributed over 1 MHz span at minimum harmonic relationship.

- The BT measurements in figure 1 demonstrated that the highest 10 tones observed in the field on a single cable have levels like -43, -50, -52, -54, -57, -58, -59, -60, -62, -63 dBm (sorted in power). These numbers may be considered as worst case for overhead cables, but are anyhow ***realistic***! Levels up to -50 dBm have been observed for underground cables as well (see TD26, Monterey), so the application of high tone levels is not restricted to overhead cables. We propose to construct the RFI tone model with these 10 levels, as shown below, using the carrier frequencies being defined in the past for both ADSL and SDSL.

RFI Tone Model for ADSL and SDSL

frequency	99	207	333	387	531	603	711	801	909	981	kHz
power diff	–58	–43	–50	–54	–59	–60	–57	–62	–52	–63	dBm
power com	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**	dBm
D											*dB*

This proposal is dedicated to the levels of the *differential mode* RFI tones. The levels for the common mode case are left for further study here.