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SUMMARY OF PERFORMANCE TESTS RESULTS OBTAINED ON THE 3 TRIAL SITES

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	NAME	**DATE**	**VISA**
Authors	I. Claussmann	18/10/98	I. Claussmann
Reviewed	W. Grethe	21/10/98	W. Grethe
Approval	R. Sarfati	23/10/98	

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EVOLUTION SHEET

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1	08/05/98	I. Claussmann	Creation
2	01/07/98	W. Grethe	Update for the completion of the FS tables
3	18/10/98	I. Claussmann	Update for the completion of the DB tables as well as for phase 1 results

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1. INTRODUCTION

The scope of this document is to indicate the performance results obtained on the three MORANE trial sites.

2. REFERENCE DOCUMENTS

[1] MORANE Radio Transmission test specification, A 05 T 6001 1, 28 June 1996
[2] Amendment to MORANE Radio Transmission Test Specification Data aspects, A 05 T 6002 1, 19 December 1996
[3] MORANE test specification- MORANE phase 1 features performances, A 25 T 8001 1, 2 May 1998

3. PERFORMANCE TESTS STATUS

3.1. SNCF Trial site

The performance tests for standard GSM have been performed in November/December 1997 before the network tuning and in February 1998 after the network tuning. The corresponding results have been issued into the following measurement reports:

- Radio transmission tests on standard GSM along the MORANE French Trial site- Voice Measurement Results - “ 97 Campaign ”, M25 T 8001 1, 8 March 1998,
- Data transmission on the French MORANE Trial Site, Measurements carried out in November 1997, O 25 T 8001 1, 30 January 1998,
- Radio Transmission Tests on Standard GSM along the MORANE French Trial site, end to end data measurement results, M 25 T 8002 1, 5 March 1998,
- Radio Transmission Tests on Standard GSM along the MORANE French Trial site, End to end data measurement results, January-February 1998, M 25 T 8003 1, 1 March 1998,
- Data transmission on the French MORANE trial site, Measurements carried out in February 1998, O 25 T 8003 2,16 March 1998.

The performance tests of the MORANE phase 1 features have been done end of April 1998 during one day with Melusine and two nights with RMR. The corresponding results have been issued into the following measurement report :

- Radio transmission tests along the MORANE French trial site, MORANE system phase 1, M 25 T 8004 1, 30 June 1998.

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3.2. FS trial site

The performance tests for standard GSM have been performed in December 1997 and in February/March 1998. The corresponding results have been issued into the following measurement reports:

- Radio transmission tests on standard GSM along the MORANE Italian trial site, Report on voice measurements, Doc n° N 25 T 8003 1, 30 July 1998,

- Radio transmission tests on standard GSM along the MORANE Italian trial site, Report on data measurements, Doc. N° N 25 T 8004 1, 7 October 1998,

The performance tests of the MORANE phase 1 features have been done during week 22 and week 30. The corresponding results have been issued into the following measurement report :

- Radio transmission tests on standard GSM along the MORANE Italian trial site, Report on phase 1 measurements, Doc. n° N 25 T 8005 1, 15 October 1998,

3.3. DB/Mannesmann Arcor Trial site

The performance tests have been performed in July 98. The corresponding results have been issued into the following measurement report :

- Radio transmission tests along the MORANE German Trial Site, Doc. N° M 25 T 8005 1, 8 October 1998.

4. Network configuration on the three trial sites

4.1. SNCF trial site

The following network configuration has been tested:

- without authentication,
- with ciphering messages,
- without TMSI allocation procedure,
- without Identity Request.

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4.2. FS trial site

The following network configuration has been tested:

- without authentication,
- with ciphering messages,
- with TMSI allocation procedure,
- with Identity Request.

4.3. DB/Mannesmann Arcor trial site

The following network configuration has been tested:

- without authentication,
- with ciphering messages,
- without TMSI allocation procedure
- with Identity Request .

5. Measurements to be performed

5.1. Measurements on standard GSM

The following measurements have been performed:

- Call set up time for voice and data,
- Handover time for voice and data,
- End to end transmission time,
- Byte error rate.

The test procedures have followed the MORANE test specification elaborated in 1996 for the measurements on the DIBMOF trial site (see [1] and [2]).

5.2. Measurements of MORANE phase 1 features

The following measurements should be performed:

- Timing performance of registration/deregistration procedures,
- Call set-up time for the usage of functional addressing,
- Call set up time for the usage of location dependent addressing,
- Call success rate,
- Time to perform a confirmation of a high priority call.

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The test procedures have followed the MORANE Test Specification elaborated in May 1998 (see [3]).

6. MEASUREMENTS RESULTS (STANDARD GSM)

6.1. Voice measurements

6.1.1. Call set-up time

	Number of samples	MOC-95%	MOC-100%	Number of samples	MTC -95%	MTC - 100%	Number of samples	MTM - 95%	MTM-100%
SNCF (80)	861	≤ 3.3s	≤ 3.8s	986	≤ 5.3s	≤ 6.9s	614	≤ 7.9s	≤ 13.4s
FS (100)	878	≤ 3.1s	≤ 5.5s	120	≤ 5.1s	≤ 6.5s			
DB				676	≤ 5.8s	≤ 7.2s			

Remark: *Values in bracket represent the speed in km/h*

The tests on the three trial sites have shown that the results obtained for call set-up time are very close to each other.

The MOC call set-up times are meeting the EIRENE requirements (<5s for 95% of calls and 7.5s for 100% of calls). The MTC call set-up times are slightly higher than 5 s.

6.1.2. Handover time

	Number of samples	80km/h - 95%	80km/h-100%	Number of samples	100km/h 95%	100km/h 100%
SNCF	226	≤ 410ms	≤ 440ms			
FS				190	≤ 360ms	≤ 365ms
DB						

	Number of samples	200km/h-95%	200km/h-100%	Number of samples	250 km/h-95%	250 km/h-100%
SNCF						
FS	202	≤ 360ms	≤ 531ms	198	≤ 360ms	≤ 390ms
DB						

	Number of	200<V<280	200<V<280	Number	280<V<300	280<V<300

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	samples	km/h- 95%	km/h-100%	of samples	km/h -95%	km/h-100%
SNCF	87	≤ 425ms	≤ 440ms	41	≤ 370ms	≤ 370ms
FS						
DB						

It can be noticed that 95% of the results are lower or equal to 425ms for SNCF trial site. It can be noticed that 95% of the results are lower or equal to 360ms for FS trial site.
No EIRENE requirements have been provided on the handover time.

6.1.3. End to end transmission delay

	Number of samples	MOC-Mean value	Number of samples	MTC - Mean value	Number of samples	MTM - Mean value
SNCF (80)					629	216ms
FS (100)			400	175ms	400	169ms
DB						

Remark: *Values in bracket represent the speed in km/h*

The GSM reference delay for MTM calls is 180ms. This is met on the FS trial site but not on the SNCF trial site. In fact, on the Alcatel BSS along the LGV Nord, the values obtained are lower or equal to 180ms. At the opposite, on the MATRA BSS on the Barreau, the values obtained are lower or equal to 230ms.

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6.2. Data measurements

6.2.1. Data analogue measurements

6.2.1.1. Call set-up time

- 9600bit/s

	Number of samples	MOC -95%	MOC-100%	Number of samples	MTC-95%	MTC-100%	Number of samples	MTM -95%	MTM-100%
SNCF (V=80)	368	3.8s	4.3s	235	6.4s	6.6s			
SNCF (V=200)				87	6.35s	6.5s			
SNCF (200<V<280)	27	3.8s	4s	15	6.1s	6.2s			
SNCF (V>280)	30	3.75s	4.1s	40	6.45s	6.7s			
FS(100)	228	3.8s	9.30s	81	6.3s	7.4s			
FS (250)	73	3.7s	4.20s						
DB									

Remark: *Values in bracket represent the speed in km/h*

95% of the results obtained for the MOC call set up times are lower than 3.8s on the SNCF trial site and 95% of the results obtained for the MOC call set up times are lower than 3.8s on the FS trial site. This is meeting the EIRENE requirements of 95% lower or equal to 5s and is similar to the results obtained on the DIBMOF trial site in 1996.
At the contrary, 95% of the results obtained for the MTC call set-up times on the SNCF trial site are lower than 6.45s and 95 % of the results obtained for the MTC call set-up times on the FS trial site are lower than 6.3s. These values do not meet the EIRENE Requirements.

6.2.1.2.Handover time

It has been confirmed on the SNCF trial site that the handover time measured on a data channel is similar to the one obtained on a voice channel.

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6.2.1.3. End to end transmission time

- 2400bit/s

	Number of samples	MOC-Mean value	Number of samples	MTC-Mean value	Number of samples	MTM - Mean value
SNCF						
FS	208(0-200)	135ms			229(200)	222ms
DB						

Remark : *Values in bracket represent the speed in km/h*

The value obtained is lower than the GSM reference delay value which is 158,80ms for MOC.
The value obtained is lower than the GSM reference delay value which is 317,60ms for MTM.

- 4800bit/s

	Number of samples	MOC-Mean value	Number of samples	MOC - Mean value	Number of samples	MTM - Mean value
SNCF						
FS	319 (0-200)	200ms			217 (200)	366ms
DB						

Remark : *Values in bracket represent the speed in km/h*

The value obtained is lower than the GSM reference delay value which is 223.50ms for MOC.
The value obtained is lower than the GSM reference delay value which is 447ms for MTM.

- 9600bit/s

	Number of samples	MOC-Mean value	Number of samples	MOC - Mean value	Number of samples	MTM - Mean value
SNCF (300)	968	206ms (ALCATEL)	251	229ms (NORTEL)		
FS	306 (0-200)	190 ms			337 (200)	338ms
DB						

Remark : *Values in bracket represent the speed in km/h*

The values obtained on the French trial site (LGV Nord part only) and on the FS trial site are lower than the GSM reference delay value which is 211,3ms for MOC.
The value obtained on the FS trial site is lower than the GSM reference delay value which is 422,60ms for MTM.

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6.2.1.4. Handover breaks

6.2.1.4.1. Downlink

- 2400bit/s

	Number of samples	Average (in bytes)	Maximum (in bytes)	Average duration (in ms)
SNCF (ALCATEL-80)	15	139	190	579
SNCF (NORTEL-80)	6	154	195	641
FS				
DB (≤ 200)				

Remark : *Values in bracket represent the speed in km/h*

- 9600 bit/s

	Number of samples	Average (in bytes)	Maximum (in bytes)	Average duration (in ms)
SNCF(ALCATEL-80)	12	557	617	580
SNCF (NORTEL-80)	6	598	655	623
SNCF (ALCATEL-300)	5	555	682	578
SNCF (NORTEL-300)	4	639	798	665
FS (100)	29	571	1010	595
FS (250)	25	604	1127	629
DB (SIEMENS - ≤200)	90	485	547	506
DB (NORTEL - ≤200)	28	604	641	630
DB (ALCATEL - ≤200)	7	565	596	589

Remark : *- Values in bracket represent the speed in km/h.*
- Some results are not statistically representative due to few samples

6.2.1.4.2. Uplink

- 9600 bit/s

	Number of samples	Average (in bytes)	Maximum (in bytes)	Average duration (in ms)
SNCF(ALCATEL-80)	17	165	202	171
SNCF (NORTEL-80)	17	370	490	385
FS (100)	20	331	768	348
DB (SIEMENS - ≤ 200)	53	370	534	385
DB (NORTEL - ≤ 200)	19	316	426	329
DB (ALCATEL - ≤ 200)	6	386	462	402

Remark : - *Values in bracket represent the speed in km/h*
- Some results are not statistically representative due to few samples

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The handover break reflects the real interruption in data transmission. The values measured are in average around 500 - 700 ms for the downlink and 170 - 400 ms in uplink. The long handover breaks are mainly due to problems in the network coverage, like interference, ping-pong handover. It has to be noticed that a real improvement on the handover break times has been observed after network optimisation.

6.2.1.5.. Byte Error Rate

6.2.1.5.1. Downlink

- 2400 bit/s

	Bytes sent (kbytes)	**BER (x 10^{-4})**
SNCF(ALCATEL-80)	810	0.6
SNCF(NORTEL-80)	334	2.7
SNCF (ALCATEL-300)	446	0.25
SNCF (NORTEL-300)	565	1
FS		
DB		

Remark : *Values in bracket represent the speed in km/h*

- 9600bit/s

	Bytes sent (kbytes)	**BER (x 10^{-4})**
SNCF(ALCATEL-80)	4073	4.0
SNCF(NORTEL-80)	2278	0.9
SNCF (ALCATEL-300)	2279	4.7
SNCF (NORTEL-300)	1558	5.7
FS (100)	2591	2.5
FS (250)	2602	2.7
DB		

Remark: *Values in bracket represent the speed in km/h*

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6.2.1.5.2. Uplink

- 9600bit/s

	Bytes sent (kbytes)	BER (x 10^{-4})
SNCF(ALCATEL-80)	2700	0.018
SNCF (NORTEL-80)	6800	0.004
FS	2436	4,11
DB		

Remark : *Values in bracket represent the speed in km/h*

As far as the SNCF trial site is concerned, the BER for non-handover areas is in the range of 10^{-5} to 5 x 10^{-4} for the downlink direction and 10^{-6} to 2 x 10^{-5} for the uplink direction.

As far as the FS trial site is concerned, the value in uplink is much higher. This should be investigated.

6.2.2. Data ISDN measurements

6.2.2.1. Call set-up time

- 2400bit/s

	Number of samples	MOC -95%	MOC-100%	Number of samples	MTC -95%	MTC-100%	Number of samples	MTM -95%	MTM-100%
SNCF(80)				165	5.8s	6s			
FS									
DB									

Remark : *Values in bracket represent the speed in km/h*

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- 9600bit/s

	Number of samples	MOC -95%	MOC-100%	Number of samples	MTC -95%	MTC-100%	Number of samples	MTM - 95%	MTM-100%
SNCF (80)	397	3.8s	4.2s	474	6s	6.6s			
SNCF (V=200)				47	5.6s	5.8s			
SNCF (200<V<280	130	3.85s	4.9s	126	5.8s	6.1s			
SNCF (>280)	164	3.7s	3.8s	52	5.9s	7s			
FS(100)	172	3.8	6.36s	75	5,9s	6,6s			
FS (250)	140	3.7	3.90s						
DB (≤200)	279	3,95s	4,2s	837	7,4s	8.3s			

Remark : *Values in bracket represent the speed in km/h*

95% of the results obtained for the MOC call set up times are lower than 3.85s on the SNCF trial site, lower than 3.8s on the FS trial site and lower than 3,95 s on the DB trial site. This is meeting the EIRENE requirements of 95% lower or equal to 5s.
At the contrary, 95% of the results obtained for the MTC call set-up times are lower than 6s on the FS and SNCF trial sites and lower than 7,4s on the DB trial site.These values do not meet the EIRENE requirements.

6.2.2.2. End to end transmission time

- 2400bit/s

	Number of samples	MOC-Mean value	Number of samples	MOC -Mean value	Number of samples	MTM - Mean value
SNCF (80)	839	224ms (ALCATEL)	445	239ms (NORTEL)		
FS						
DB						

Remark : *Values in bracket represent the speed in km/h*

The values obtained on the French trial site are higher than the GSM reference delay value which is 158,80 ms for MOC which does not take into account the delay from the MSC to the fixed terminal.

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- 9600bit/s

	Number of samples	MOC- Mean value	Number of samples	MOC - Mean value	Number of samples	MOC - Mean value
SNCF(300)	568	250ms (ALCATEL)	425	261ms (NORTEL)		
FS (200)	100	221ms				
DB (≤ 200)	58	247ms (ALCATEL)	296	258ms (NORTEL)	814	214ms (SIEMENS)

Remark : *Values in bracket represent the speed in km/h*

The values obtained on the three trial sites are higher than the GSM reference delay value which is 211,3ms for MOC which does not take into account the delay from the MSC to the fixed terminal.

6.2.2.3. Handover breaks

6.2.2.3.1. Downlink

- 2400bit/s

	Number of samples	Average (in bytes)	Maximum (in bytes)	Average duration (in ms)
SNCF(ALCATEL-80)	18	138	179	575
SNCF (NORTEL-80)	15	146	157	608
SNCF (ALCATEL-300)	41	131	171	545
SNCF (NORTEL-300)	17	153	268	637
FS				
DB				

Remark : *Values in bracket represent the speed in km/h*

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- 4800 bit/s

	Number of samples	Average (in bytes)	Maximum (in bytes)	Average duration (in ms)
DB (SIEMENS - ≤ 200)	39	194	232	202
DB (NORTEL - ≤ 200)	8	239	280	249

- 9600 bit/s

	Number of samples	Average (in bytes)	Maximum (in bytes)	Average duration (in ms)
SNCF (ALCATEL-80)	11	554	636	577
SNCF (NORTEL-80)	10	610	642	635
SNCF(ALCATEL-300)	27	549	831	571
SNCF(NORTEL-300)	14	644	831	670
FS (100)	29	524	620	546
FS (250)	26	559	1040	582
DB (SIEMENS - ≤ 200)	52	492	534	512
DB (NORTEL- ≤ 200)	13	624	709	650
DB (ALCATEL - ≤ 200)	4	556	588	579

Remark : *Values in bracket represent the speed in km/h*

6.2.2.3.2. Uplink

- 4800 bit/s

	Number of samples	Average (in bytes)	Maximum (in bytes)	Average duration (in ms)
DB (SIEMENS - ≤ 200)	27	104	154	108
DB (NORTEL - ≤ 200)	2	124	136	129

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- 9600 bit/s

	Number of samples	Average (in bytes)	Maximum (in bytes)	Average duration (in ms)
SNCF(ALCATEL-80)	5	171	187	178
SNCF (NORTEL-80)	7	422	629	440
SNCF (ALCATEL-300)	39	167	259	174
SNCF(NORTEL-300)	15	396	458	412
FS	25	300	629	312
DB (SIEMENS - ≤ 200)	152	364	525	379
DB (NORTEL - ≤ 200)	40	297	419	310
DB (ALCATEL - ≤ 200)	9	433	470	452

Remark : *Values in bracket represent the speed in km/h*

The handover break reflects the real interruption in data transmission. The values measured are in average around 500 - 700 ms for the downlink and 170 - 450 ms in uplink. The long handover breaks are mainly due to problems in the network coverage, like interference, ping-pong handover. It has to be noticed that a real improvement on the handover break times has been observed after network optimisation.

6.2.2.4. Byte Error Rate

6.2.2.4.1. Downlink

- 2400 bit/s

	Bytes sent (kbytes)	BER (x 10^{-4})
SNCF(ALCATEL-300)	1080	1.2
SNCF(NORTEL-300)	476	0.6
FS		
DB		

Remark : *Values in bracket represent the speed in km/h*

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- 9600bit/s

	Bytes sent (kbytes)	**BER (x 10^{-4})**
SNCF(LGV-300)	2728	6.6
SNCF(NORTEL-300)	1491	3.9
FS (100)	3965	2.5
FS (250)	2990	1
DB		

Remark : *Values in bracket represent the speed in km/h*

6.2.2.4.2. Uplink

- 9600bit/s

	Bytes sent (kbytes)	**BER (x 10^{-4})**
SNCF(ALCATEL-80)	3326	0.20
SNCF (NORTEL-80)	1857	1.1
FS	3349	1,8
DB		

Remark : *Values in bracket represent the speed in km/h*

The BER for non-handover areas is in the range of 6 x 10^{-5} to 6,6 x 10^{-4} for the downlink direction and 2 x 10^{-5} to 1,8 x 10^{-4} for the uplink direction.

6.3. Conclusions

The following conclusions could be drawn with the results obtained on the SNCF, DB and FS trial sites.

- Call set-up time measurements

The call set-up time measurements for Mobile Originated Calls are meeting the EIRENE requirements. This is not the case for Mobile Terminated Calls.

- Handover time measurements

The handover time measurements give 95% of results lower than 425ms. This can not be compared with the existing EIRENE requirements because the handover time is measured between handover command and handover complete and does not represent only the handover break as referred to by EIRENE.

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- End to end delay measurements

The end to end delay measurements give results mainly below the maximum allowed delay stated by GSM recommendations on the Italian trial site and on the LGV Nord equipped with the ALCATEL BSS for voice and analogue data transmission. On the Barreau equipped with MATRA BSS, the results go over the maximum allowed as also the results for ISDN data transmission. It has to be noticed that for data transmission the reference value represents only the delay due to the GSM network. It does not include the delay between the interworking function in the MSC and the user terminal on the fixed side.

- Handover break duration for data transmission

It has been found that the average HO-break duration (in ms) does not depend on transmission mode (analogue or ISDN) and bit rate but strongly depends on:

- Transmission direction,
- BSS manufacturer.

On the French trial site, in uplink and downlink, HO-breaks are always shorter on the LGV Nord (Alcatel) than on the Barreau (NORTEL). In fact, on the Barreau, the HO-break always includes two error bursts separated by a relatively long sequence of correctly received bytes. This aspect is under investigation by NORTEL.

On the Italian trial site, in uplink, HO-breaks are always shorter on the ALCATEL part than on the Siemens part. No difference is noticed between the two suppliers in downlink.

On the German trial site, in downlink, the HO-Breaks on the NORTEL part are much higher than for SIEMENS. In fact, on the NORTEL part, the HO-Break always include two error bursts separated by a relatively long sequence of correctly received bytes. This aspect is under investigation by NORTEL.

It has been noticed that, on the three trial sites, the HO-break in uplink is always shorter than in downlink.

When comparing the maximum values, long HO-breaks occur more frequently at high speed.

- Byte Error Rate

The byte error rate has been found lower at 2.4 kbit/s than at 9.6 kbit/s on the SNCF trial site.

It appears that, for the ALCATEL part (northwards and Southwards) and for the NORTEL part (northwards) the BER is much lower in uplink than in downlink. On the FS trial site, there is no difference between the uplink and the downlink.

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- Network tuning

It has been observed that the call set-up time and the end-to-end transmission delay were not affected by network tuning performed. On the contrary network tuning has a big influence for the handover behaviour of the system and the handover break time for data transmission.

7. MEASUREMENT RESULTS (MORANE PHASE 1 FEATURES)

7.1. Call set-up time with the use of functional addressing

7.1.1. Voice measurements

	Number of samples	MTC-95%	MTC-100%	Number of samples	MTM - 95%	MTM- 100%
SNCF (ALCATEL-80)	414	≤ 6,2s	≤ 8,4 s	394	≤ 7,4 s	≤ 9,2 s
SNCF (NORTEL-80)	217	≤ 5,8s	≤ 6,6 s	213	≤ 7,2 s	≤ 8,4 s
SNCF (ALCATEL-<300)	208	≤ 6,2s	≤ 7,8 s	278	≤ 7,35 s	≤ 8,2 s
SNCF (NORTEL-<300)	211	≤ 5,8s	≤ 7,9 s	215	≤ 6,95 s	≤8,2 s
SNCF (ALCATEL-300)	292	≤ 6,3s	≤ 8,6 s	233	≤ 7,25 s	≤ 8,1 s
DB (≤ 200)	124	≤ 7,1s	≤ 8,1 s			
FS (100)	89	≤ 7,1 s	≤ 8,4s	1109	≤ 6,9s	≤ 12,76s
FS (250)				105	≤ 7,5s	≤ 9,31s

7.1.2. Data measurements

7.1.2.1. ISDN (9,6 kb/s)

	Number of samples	MTC-95%	MTC-100%
SNCF (ALCATEL-80)	124	≤ 6,1 s	≤ 6,3 s
SNCF (NORTEL-80)	39	≤ 5,7 s	≤ 5,8 s
FS (100)	44	≤ 6,1 s	≤ 6,5 s
DB			

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7.1.2.2.Analogue (9,6 kb/s)

	Number of samples	MTC - 95%	MTC-100%
FS (100)	102	≤ 6,7 s	≤ 12,4 s

7.1.3. Conclusion

The different tables show that the results obtained for Mobile Terminated call set-up times with the use of functional addressing are in the same range than those obtained for standard GSM measurements and are not meeting the EIRENE requirements. The results are in the same order of magnitude on the 3 trial sites.

7.2. Call set-up time with the use of Location dependent addressing

7.2.1. Voice measurements

	Number of samples	MOC-95%	MOC-100%
SNCF (ALCATEL-80)	476	≤ 3,25 s	≤ 3,8 s
SNCF (NORTEL-80)	240	≤ 3,4 s	≤ 3,6 s
SNCF (ALCATEL-<300)	343	≤ 3,3 s	≤ 7,3 s
SNCF (NORTEL-<300)	291	≤ 3,5 s	≤ 6,2 s
SNCF (ALCATEL-300)	323	≤ 3,3 s	≤ 7,7 s
FS (100)	1200	≤ 3,2 s	≤ 9,62 s
FS (250)	302	≤ 3,2 s	≤ 15,45 s
DB (Siemens - ≤ 200)	103	≤ 3,1 s	≤ 3,3 s
DB (Nortel - ≤ 200)	40	≤ 3,5 s	≤ 3,6 s
DB (Alcatel - ≤ 200)	54	≤ 3,3 s	≤ 3,5 s

7.2.2. Data measurements

7.2.2.1. ISDN (9,6 kb/s)

	Number of samples	MOC-95%	MOC-100%
SNCF (ALCATEL-80)	180	≤ 3,75 s	≤ 4,1 s
SNCF (NORTEL-80)	113	≤ 4 s	≤ 4,1 s
FS (100)	313	≤ 3,8 s	≤ 10,28 s
FS (250)	184	≤ 3,8 s	≤ 10,02 s

7.2.2.2. Analogue (9,6 kb/s)

	Number of samples	MOC -	MOC-

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		95%	100%
FS (100)	246	≤ 3,8 s	≤ 8 s
FS (250)	109	≤ 3,8 s	≤ 11,03 s

7.2.3. Conclusion

The different tables show that the results obtained for Mobile Originated Call set-up times with location dependent addressing are in the same range than those obtained for standard GSM measurements. Beside of some long values on the FS trial site the values meet the EIRENE requirements. The results are in the same order of magnitude on the 3 trial sites.

7.3. Call success rate

7.3.1. Standard GSM –Data

7.3.1.1. SNCF

	Data analogue 4.8- MTC
Number of calls	163
Destination out of order	1
Temporary Failure	0
Call success rate	99.4%

	Data analogue 9.6-MOC
Number of calls	189
General problems	2
CM_SERVICE REJECT	0
ASSIGNMENT FAILURE	0
Handover	0
Call success rate	98,9%

The success rate for data standard GSM call set-ups is always greater or equal to 98.9 %.

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7.3.2. Functional addressing

7.3.2.1.SNCF

	Voice-MTC	ISDN-9.6-MTC
Number of calls	1555	163
Destination out of order	20	1
Temporary Failure	7	0
Call success rate	98.3%	99.4%

	Voice-MTM
Number of calls	1333
General problems	17
CM_SERVICE REJECT	3
ASSIGNMENT FAILURE	5
Handover	1
Call success rate	98%

The success rate for call set-ups with the use of functional addressing is greater or equal to 98 %.

7.3.2.2. FS

	Voice – MTC	Analogue – 9.6 - MTC
Number of calls	106	104
Destination out of order	1	0
Temporary failure	1	2
Resource unavailable unspecified	1	1
Call success rate	97,2 %	97,1 %

The success rate for call set-ups is around 97 %.

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7.3.3. Location dependent addressing

7.3.3.1. SNCF

	Voice-MOC	ISDN 9.6 MOC
Number of calls	1673	293
General problems	10	0
CM_SERVICE REJECT	4	0
ASSIGNMENT FAILURE	3	0
Handover	0	1
Call success rate	99%	99,7%

The success rate for call set-ups with the use of location dependent addressing is greater or equal to 99 %.

7.3.3.2. FS

- **100 km/h**

	Voice – MOC	ISDN - 9.6 – MOC
Number of calls	1329	185
General problems	140	10
CM-SERVICE REJECT	3	-
Call success rate	89,2 %	94,5 %

- **250 km/h**

	Voice – MOC
Number of calls	333
General problems	35
CM-SERVICE REJECT	1
Call success rate	89,2 %

The success rate for call set-ups with the use of location dependent addressing is around 90 %.

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8. GENERAL CONCLUSION

Two types of performance tests have been performed on the 3 trial sites during the year 1998 :

- Performance tests on a standard GSM-R system implemented on the 3 trial sites,
- Performance tests on a GSM-R system upgrated with the MORANE phase 1 features.

These performances tests have had as a main objective to verify that the GSM-R system is meeting the railways requirements specified within the EIRENE Project.

1. Performance results on a standard GSM-R system

Voice and Data services have been investigated.

- As far as call set-up times are concerned, the EIRENE requirements are met for Mobile Originated Calls on the three trial sites. They are not met for Mobile Terminated Calls.

- The handover time measured on SNCF and on FS trial sites gives 95 % of results lower than 425 ms. This cannot be compared with the existing EIRENE requirements because the handover time does not represent only the handover break as referred to by EIRENE.

- As far as to end-to-end transmission delay is concerned, the results for voice and analogue data transmission are below the maximum allowed delay stated by the GSM recommendations on the FS and SNCF trial sites. In the contrary, the results for ISDN data transmission are above the maximum allowed delay stated by the GSM recommendations on the three trial sites. It has to be said that for data transmission the reference value represents only the delay due to the GSM network. It does not include the delay between the interworking function in the MS and the user terminal on the fixed side.

- Concerning handover break duration for data transmission, it has been observed that the handover break is always shorter in uplink (170-400 ms) than in downlink (500-700 ms). Moreover, it has been noticed that differences exist between the suppliers. One specific observation which has been made on the NORTEL BSS is the existence of two error bursts separated by a relatively long sequence of correctly received bytes. This specific behaviour is currently under investigation by NORTEL.

- Concerning Byte Error rates, the values obtained are between 10^{-6} (analogue 9.6 uplink) to $6{,}6.10^{-4}$ (ISDN 9.6 downlink).

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2. Performance results on the GSM-R system upgraded with MORANE phase 1 features

Call set-up times have been measured with the use of functional addressing and location dependent addressing. The results obtained are in the same range as those obtained for the standard GSM-R System.

Call Success Rates have been measured for data connections on standard GSM-R on SNCF trial site and the value is greater or equal to 98.9 %. They have also been measured in the context of the use of functional addressing where the value is greater than 97 % and in the context of the use of location dependent addressing where the value is greater than 90 % (average values for SNCF and FS trial sites).

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