



RADIO TEST REPORT FOR FCC REGULATORY IN
EXTREME CONDITIONS
GSM 18000 INDOOR BTS 1900 MHz.

N°15103-03-CC-2-A

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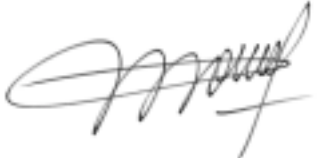
	EMC TEST REPORT The 15 pages of this report are not sharable	2 Identification: 15103-03-cc-2-a Revision : a
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Summary

1	REFERENCE AND RECORD OF REVISIONS OF THE TEST REPORT:	3
2	GENERAL INFORMATION:	4
2.1	APPLICANT:	4
2.2	MANUFACTURER:	4
2.3	APPLICANT REPRESENTATIVE:	4
2.4	TEST DATE:	4
2.5	TEST SITE:	4
3	INTRODUCTION:	5
3.1	Product description: GSM 18000 INDOOR B TS	5
3.2	Product type:	5
3.3	Cabinet serial number: 362203	5
3.4	Article code: NTN016AA 01	5
3.5	FCC ID: AB6BTS18000IND	5
3.6	Operating Frequency Range:	5
4	APPLICABLES DOCUMENTS	5
5	REFERENCES DOCUMENTS	5
6	HARDWARE AND SOFTWARE CONFIGURATION	6
7	TEST EQUIPMENT LIST	7
8	MEASUREMENT PRINCIPLE AND CONFIGURATION FOR FREQUENCY STABILITY TEST	8
8.1	Specification:	9
8.2	Test configuration:	11
9	TESTS RESULTS	12
10	CONCLUSION	13
11	ABBREVIATIONS & DEFINITIONS	15
11.1	ABBREVIATIONS	15
11.2	DEFINITIONS	15

	EMC TEST REPORT The 15 pages of this report are not sharable	3 Identification: 15103-03-cc-2-a Revision : a
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1 Reference and record of revisions of the test report:

Test report number:	Revision:	Number of pages	Modification reasons:
15103-03-cc-2-a		15	Creation
Written by: D.RAUD			Date of writing: June 29, 2005
Technical control: O. ROY 			Quality Control: L. MONTIEL 

	EMC TEST REPORT The 15 pages of this report are not sharable	4 Identification: 15103-03-cc-2-a Revision : a
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2 GENERAL INFORMATION:

2.1 APPLICANT:

S.A. GROLLEAU FLEXTRONICS
49310 MONTILLIERS
FRANCE

2.2 MANUFACTURER:

NORTEL NETWORKS
Parc d'activités de Magny Chateaufort
CHATEAUFORT 78928 Yvelines Cedex 9
France

2.3 APPLICANT REPRESENTATIVE:

Mr. Patrick Galopin

2.4 TEST DATE:

3 & 4 June 2005

2.5 TEST SITE:

LNE –Trappes

	EMC TEST REPORT The 15 pages of this report are not sharable	5 Identification: 15103-03-cc-2-a Revision : a
--	---	--

3 INTRODUCTION

The objective of this document is to present the test report for Radio qualification in extreme conditions on the system GSM 18000 Indoor BTS configured in 1900 MHz with GMSK modulation.

The tests in extreme conditions have been realized in accordance with FCC Part 24.235 and Part 2.1055 of FCC Rules and Regulation.

These tests are performed in LNE laboratory supervised by Olivier Roy of Gyl Technologies.

3.1 Product description: GSM 18000 INDOOR B TS

3.2 Product type:

GSM 18000 INDOOR BTS in S666 configuration configured in 1900 MHz

3.3 Cabinet serial number: 362203

3.4 Article code: NTN016AA 01

3.5 FCC ID: AB6BTS18000IND

3.6 Operating Frequency Range:

TX : 1930.2 MHz to 1989.8 MHz

RX : 1850.2 MHz to 1909.8 MHz

4 APPLICABLES DOCUMENTS

[A1]	47CFR Part 2 (2003)	FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations - Frequency allocations and radio treaty matters; general rules and regulations.
[A2]	47 CFR Part 24 (2003)	FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations - Personal communications services.

5 REFERENCES DOCUMENTS

[R1]	PE/BTS/DPL/014717	GSM 1800 BTS Project Qualification Plan for 1900 Mhz Indoor cabinet and additional introduction on 1900 MHz Indoor cabinet
[R2]	15101-02-CC-2-a	Radio Test Report for External Laboratory Gyl Technologies

	EMC TEST REPORT The 15 pages of this report are not sharable	6 Identification: 15103-03-cc-2-a Revision : a
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6 HARDWARE AND SOFTWARE CONFIGURATION

BASE CABINET				
Product : GSM/UMTS BTS 18000 Indoor				
Article delivered : GSM PCS BTS 18000 Indoor			Article code : NTN016AA 01	
Cabinet Serial Number : N° 362203				
MODULES DELIVERED IN THE CABINET				
ARTICLE	PEC code	Release	Serial number	Comment
PRECAB IND 48V	NTN016AA	01	NNTMGT0022C7	
IBP	NTQA0027AA	01	NNTMGR00G297	
IBP	NTQA0027AA	01	NNTMGR00H3NG	
DBP	NTN030AA	D2	NNTMGR00GTWM	
DBP	NTN030AA	D2	NNTMGR00G9G6	
IFM	NTN025AA	02	NNTMGR00GYJ4	
IFM	NTN025AA	02	NNTMGR00GYJ5	
ICM	NTN023AA	01	NNTMGR00H6H8	
ICM	NTN023AA	01	NNTMGR00H9KT	
ABM	NTN029AA	02	NNTMGR00GHE8	
ABM	NTN029AA	02	NNTMGR00GHW0	
RICO	NTN020CA	01	NNTMGT0024WS	
DDM H2 1900 W vswr	NTN063AA	02	FICT03000273	
DDM H2 1900 W vswr	NTN063AA	02	FICT030002EH	
DDM H2 1900 W vswr	NTN063AA	02	FICT0200029R	
Tx filter H2 1900 W vswr	NTN064AA	02	FICT030000SZ	
Tx filter H2 1900 W vswr	NTN064AA	02	FICT0300024E	
Tx filter H2 1900 W vswr	NTN064AA	02	FICT02000206	
Radio Module 1900 (RM0)	NTN050PM	02	NNTM7504G35C	
Radio Module 1900 (RM1)	NTN050PM	02	NNTM7504GUIT	with PSU ASTEC NTN058 AA D4 /ADPL1602W1TX
Radio Module 1900 (RM2)	NTN050PM	02	NNTM7504GE6P	
Radio Module 1900 (RM3)	NTN050PM	02	NNTM7504GE3T	with PSU ASTEC NTN058 AA D4 /ADPL1602W1V3
Radio Module 1900 (RM4)	NTN050PM	02	NNTM7504GE6U	
Radio Module 1900 (RM5)	NTN050PM	02	NNTM7504GUIO	with PSU ARTESYN NTN058 AA 06 /ATSNTA003518

Modules software version	PI software tools :
V15b1e04 - CDI107405 ➤ ICM/ABM : V15B106 -CDI107359 ➤ RM : V15B107 -CDI107361	- WINTMI: v03d302 - TIL COAM: v15c304 - TIL Alarm: v01d104 - WINTOOL: v01b2e30

	EMC TEST REPORT The 15 pages of this report are not sharable	7 Identification: 15103-03-cc-2-a Revision : a
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7 TEST EQUIPMENT LIST

List of all of the measurement equipment used in this report.

Equipment description	Supplier	Model	Serial No.	Calibration date	
				Last	Next
Advanced Networks System	W&G	ANT20	P41591	10/2004	10/2005
HF Signal Generator	HP	8657B	X278975	02/2005	02/2006
Programmable DC source	ASCOM Energy	SMPS48V	19353050	No calibrated	
Voltmeter	Agilent	34970A	Board MY41008813	01/2005	01/2006
LNE Climatic room	Sapratin	CQPE 47 – ESE 3 65m ³	F020125/5	03/2005	03/2005
Spectrum Analyser	R&S	FSEA	CVO 503907/01	05/2005	05/2006
Spectrum Analyser	AGILENT	E4406A VSA	200802	08/2004	08/2005

	EMC TEST REPORT The 15 pages of this report are not sharable	8 Identification: 15103-03-cc-2-a Revision : a
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8 MEASUREMENT PRINCIPLE AND CONFIGURATION FOR FREQUENCY STABILITY TEST

Standard Coverage : FCC Part 2.1055, FCC Part 24.235

Objective: This measurement evaluates frequency and phases errors during the active part of the timeslot.

Intend:

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

- (1) From -30 deg. to +50 deg. centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.
- (2) From -20 deg. to +50 deg. centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, and equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter.
- (3) From 0 deg. to +50 deg. centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10 deg. centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(c) In addition to all other requirements of this section, the following information is required for equipment incorporating heater type crystal oscillators to be used in mobile stations, for which type acceptance is first requested after March 25, 1974, except for battery powered, hand carried, portable equipment having less than 3 watts mean output power.

- (1) Measurement data showing variation in transmitter output frequency from a cold start and the elapsed time necessary for the frequency to stabilize within the applicable tolerance. Tests shall be made after temperature stabilization at each of the ambient temperature levels; the lower temperature limit, 0 deg. centigrade and +30 deg. centigrade with no primary power applied.
- (2) Beginning at each temperature level specified in paragraph (c)(1) of this section, the frequency shall be measured within one minute after application of primary power to the transmitter and at intervals of no more than one minute thereafter until ten minutes have elapsed or until sufficient measurements are obtained to indicate clearly that the frequency has stabilized within the applicable tolerance, whichever time period is greater. During each test, the ambient temperature shall not be allowed to rise more than 10 deg. centigrade above the respective beginning ambient temperature level.
- (3) The elapsed time necessary for the frequency to stabilize within the applicable tolerance from each beginning ambient temperature level as determined from the tests specified in this paragraph shall be specified in the instruction book for the transmitter furnished to the user.

	EMC TEST REPORT The 15 pages of this report are not sharable	9 Identification: 15103-03-cc-2-a Revision : a
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(4) When it is impracticable to subject the complete transmitter to this test because of its physical dimensions or power rating, only its frequency determining and stabilizing portions need be tested.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

- (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
- (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.
- (3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c), and (d) of this section. (For example measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

8.1 Specification:

The phase error shall not exceed:

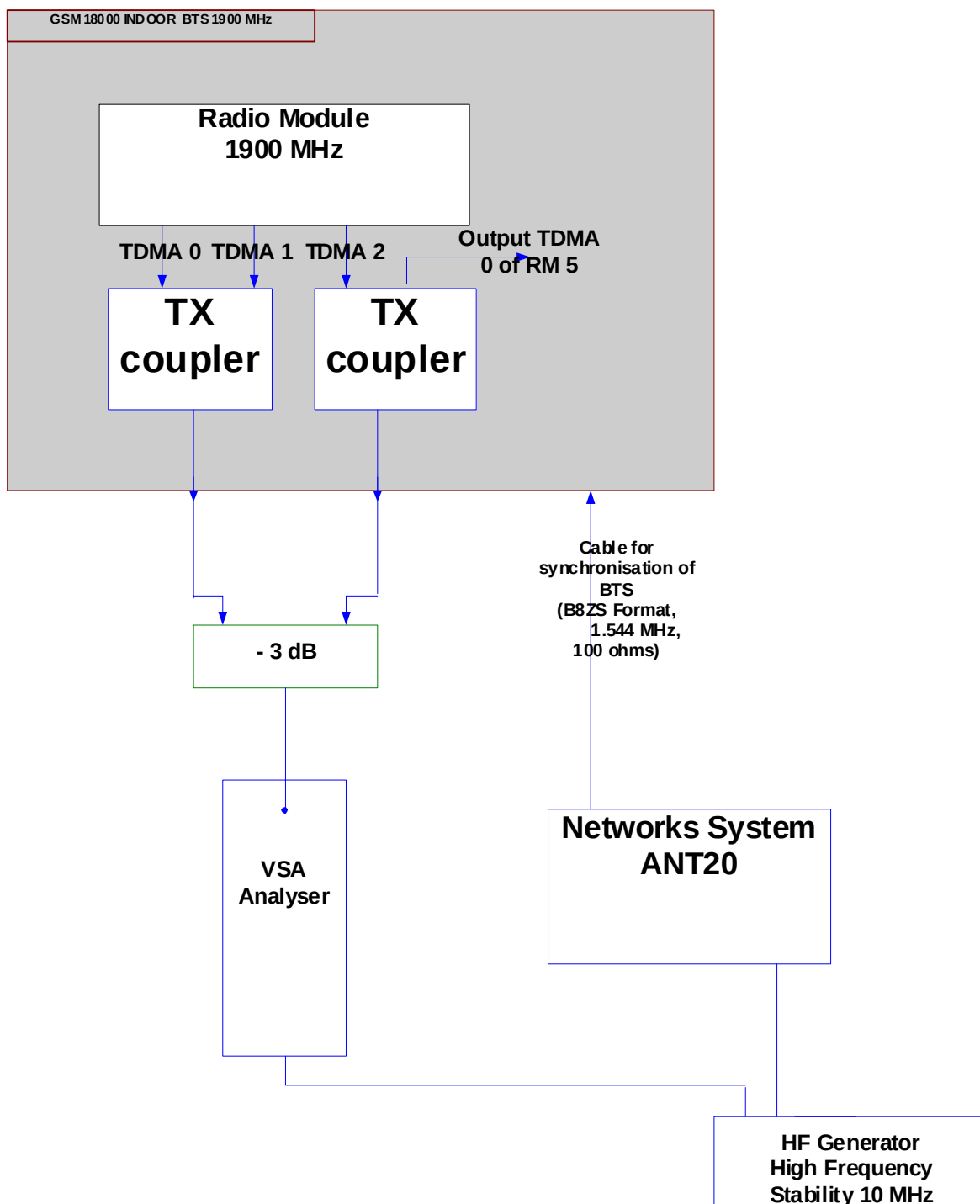
- **5 degrees rms**
- **20 degrees peak**

The mean frequency error across the burst shall not exceed **0.05 ppm or 90 Hz.**

Number of bursts: 200

	EMC TEST REPORT The 15 pages of this report are not sharable	10 Identification: 15103-03-cc-2-a Revision : a
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Measurement principle:



8.2 Test configuration:

Frequency stability test is performed under following extreme conditions:

Temperature from -40°C to +50°C at intervals of 10 degrees.

With DC power supply variations: -40V DC, -48V DC and -57V DC

.

All RM Modules run with nominal power regulation at maximum power in GMSK modulation.

The RM were configured to transmit at maximum power (Static level 0).

GSM 18000 INDOOR BTS is equipped with RM in slots 0, 1, 2, 3, 4 and 5 with following emission configuration:

:

RM0	TDMA 0	BCCH	530 @ 1933.8 MHz
	TDMA 1	BCCH	540 @ 1935.8 MHz
	TDMA 2	BCCH	550 @ 1937.8 MHz
RM1 RF Module tested	TDMA 0	TCH	(B) 512 @ 1930.2MHz
	TDMA 1	TCH	(M) 661 @ 1960.0 MHz
	TDMA 2	TCH	(T) 810 @ 1989.8 MHz
RM2	TDMA 0	BCCH	630 @ 1953.8 MHz
	TDMA 1	BCCH	640 @ 1955.8 MHz
	TDMA 2	BCCH	680 @ 1963.8 MHz
RM3	TDMA 0	BCCH	690 @ 1965.8 MHz
	TDMA 1	BCCH	700 @ 1967.8 MHz
	TDMA 2	BCCH	720 @ 1971.8 MHz
RM4	TDMA 0	BCCH	600 @ 1947.8 MHz
	TDMA 1	BCCH	610 @ 1949.8 MHz
	TDMA 2	BCCH	620 @ 1951.8 MHz
RM5	TDMA 0	BCCH	740 @ 1975.8 MHz
	TDMA 1	BCCH	760 @ 1979.8 MHz
	TDMA 2	BCCH	780 @ 1983.8 MHz

Frequency deviation is measured in RM1 on channel C512, C 661 and C 810.



EMC TEST REPORT

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12

Identification: 15103-03-cc-2-a

Revision : a

9 TESTS RESULTS

Remark: All measurements have been realized without slow frequency hopping and after thermal stabilization.

@ - 5°C

RM tested	TX tested	Voltage	Channel	Max frequency error (Hz)	Max peak phase error (°)	Max rms phase error (°)	Result
RM1	TDMA0	-40V DC	512 (B)	23.86	7.34	2.34	PASS
	TDMA0	-48V DC	512 (B)	24.15	6.85	2.61	PASS
	TDMA0	-57V DC	512 (B)	18.28	7.28	2.55	PASS
	TDMA1	-40V DC	661 (M)	24.73	7.66	2.63	PASS
	TDMA1	-48V DC	661 (M)	25.87	7.94	2.56	PASS
	TDMA1	-57V DC	661 (M)	29.73	7.29	2.45	PASS
	TDMA2	-40V DC	810 (T)	19.45	7.41	2.56	PASS
	TDMA2	-48V DC	810 (T)	-22.09	7.55	2.35	PASS
	TDMA2	-57V DC	810 (T)	18.92	7.44	2.71	PASS

@ +5°C

RM tested	TX tested	Voltage	Channel	Max frequency error (Hz)	Max peak phase error (°)	Max rms phase error (°)	Result
RM1	TDMA0	-40V DC	512 (B)	-20.63	8.35	2.70	PASS
	TDMA0	-48V DC	512 (B)	19.67	6.90	2.38	PASS
	TDMA0	-57V DC	512 (B)	-18.75	7.16	2.46	PASS
	TDMA1	-40V DC	661 (M)	21.09	7.68	2.51	PASS
	TDMA1	-48V DC	661 (M)	24.16	7.87	2.62	PASS
	TDMA1	-57V DC	661 (M)	21.38	8.12	2.39	PASS
	TDMA2	-40V DC	810 (T)	-21.28	8.58	2.34	PASS
	TDMA2	-48V DC	810 (T)	-20.38	7.05	2.58	PASS
	TDMA2	-57V DC	810 (T)	24.88	7.34	2.63	PASS

@ +15°C

RM tested	TX tested	Voltage	Channel	Max frequency error (Hz)	Max peak phase error (°)	Max rms phase error (°)	Result
RM1	TDMA0	-40V DC	512 (B)	-31.58	7.65	2.45	PASS
	TDMA0	-48V DC	512 (B)	-28.10	7.19	2.54	PASS
	TDMA0	-57V DC	512 (B)	25.93	7.66	2.41	PASS
	TDMA1	-40V DC	661 (M)	27.33	7.56	2.46	PASS
	TDMA1	-48V DC	661 (M)	35.93	7.54	2.43	PASS
	TDMA1	-57V DC	661 (M)	-27.46	8.35	2.53	PASS
	TDMA2	-40V DC	810 (T)	-22.84	7.99	2.55	PASS
	TDMA2	-48V DC	810 (T)	28.02	7.21	2.48	PASS
	TDMA2	-57V DC	810 (T)	24.60	7.15	2.61	PASS



EMC TEST REPORT

The 15 pages of this report are not sharable

13

Identification: 15103-03-cc-2-a

Revision : a

@ +25°C

RM tested	TX tested	Voltage	Channel	Max frequency error (Hz)	Max peak phase error (°)	Max rms phase error (°)	Result
RM1	TDMA0	-40V DC	512 (B)	-25.28	7.92	2.49	PASS
	TDMA0	-48V DC	512 (B)	25.16	8.29	2.75	PASS
	TDMA0	-57V DC	512 (B)	28.17	7.89	3.01	PASS
	TDMA1	-40V DC	661 (M)	23.92	8.11	2.79	PASS
	TDMA1	-48V DC	661 (M)	39.43	8.54	2.83	PASS
	TDMA1	-57V DC	661 (M)	21.82	8.06	2.89	PASS
	TDMA2	-40V DC	810 (T)	-21.88	7.43	2.52	PASS
	TDMA2	-48V DC	810 (T)	37.97	8.74	2.75	PASS
	TDMA2	-57V DC	810 (T)	30.18	8.87	2.72	PASS

@ +35°C

RM tested	TX tested	Voltage	Channel	Max frequency error (Hz)	Max peak phase error (°)	Max rms phase error (°)	Result
RM1	TDMA0	-40V DC	512 (B)	21.87	9.18	2.88	PASS
	TDMA0	-48V DC	512 (B)	29.32	8.59	2.57	PASS
	TDMA0	-57V DC	512 (B)	28.76	8.14	2.22	PASS
	TDMA1	-40V DC	661 (M)	-17.13	7.53	3.02	PASS
	TDMA1	-48V DC	661 (M)	-31.02	8.29	2.95	PASS
	TDMA1	-57V DC	661 (M)	21.58	7.31	2.88	PASS
	TDMA2	-40V DC	810 (T)	31.66	7.56	2.35	PASS
	TDMA2	-48V DC	810 (T)	27.42	7.92	2.72	PASS
	TDMA2	-57V DC	810 (T)	-23.44	7.77	2.61	PASS

@ +45°C

RM tested	TX tested	Voltage	Channel	Max frequency error (Hz)	Max peak phase error (°)	Max rms phase error (°)	Result
RM1	TDMA0	-40V DC	512 (B)	18.83	8.12	2.81	PASS
	TDMA0	-48V DC	512 (B)	22.72	9.39	2.79	PASS
	TDMA0	-57V DC	512 (B)	20.14	8.67	2.63	PASS
	TDMA1	-40V DC	661 (M)	20.32	8.89	2.70	PASS
	TDMA1	-48V DC	661 (M)	25.02	9.09	3.18	PASS
	TDMA1	-57V DC	661 (M)	20.01	8.72	2.91	PASS
	TDMA2	-40V DC	810 (T)	-17.89	9.39	2.56	PASS
	TDMA2	-48V DC	810 (T)	22.31	10.00	3.31	PASS
	TDMA2	-57V DC	810 (T)	-14.82	7.86	2.72	PASS

10 CONCLUSION

The phase error and mean frequency in extreme conditions is fully compliant with the specification of FCC requirements.

	EMC TEST REPORT The 15 pages of this report are not sharable	14 Identification: 15103-03-cc-2-a Revision : a
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The maximum deviation measured **39.43 Hz** is sufficient to ensure that the fundamental emission stays within the authorized frequency block.

The GSM 18000 Indoor BTS configured in 1900 MHz complies with the requirements FCC Part 24.235 and Part 2.1055 of FCC Rules and Regulation.

11 ABBREVIATIONS & DEFINITIONS

11.1 ABBREVIATIONS

ARFCN	Absolute Radio Frequency Channel Number
BCCH	Broadcast Control Channel
BER	Bit Error Rate
BIST	Built In Self Test
BTS	Base Transceiver System
C/I	Carrier to Interferer ratio
dBm	Ratio in decibel with respect to 1 milliwatt
dBc	Ratio in decibel with respect to the carrier level
FER	Frame Erasure Rate
FP	Frame Processor
FH bus	Transmission bus between FP and TX
IF	Intermediate Frequency
IP3	3rd order interception point
LNA	Low Noise Amplifier
NER	Nominal Error Rate
NFH	NO Frequency Hopping
OL	Local Oscillator
PA	TX Power Amplifier
PCM	Pulse Coded Modulation
RF	Radio Frequency Channel
RX	Receiver
SFH	Slow Frequency Hopping
TCH	Traffic Residual Bit Error Rate
TDMA	Time Division Multiple Access
TS	Time Slot
TX	Transmitter
TRX	Transmitter/ Receiver

11.2 DEFINITIONS

PCS1900 Frequency Band and Channels

PCS 1900	C512	C661	C810
F Tx (MHz)	1930.2	1960	1989.8
F Rx (MHz)	1850.2	1880	1909.8

For $512 < n < 810$

$$F_{Rx}(n) = 1850.2 + 0.2 \cdot (n-512)$$

$$F_{Tx}(n) = F_{Rx}(n) + 80$$