Radio Test Plan for the introduction of RM2 1900MHz (FCC & 3GPP)

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CONTENTS

1. INTRODUCTION

1.1. OBJECT

This document presents the radio qualification plan of following modules introduction:

- Introduction of RM2 PCS1900 (GMSK 50W / 8PSK 30W) Radio module .
- Introduction of RM2 PCS1900 (GMSK 30W / 8PSK 30W) Radio module

Hereafter is the PEC code list to be introduced:

PEC CODE	TITLE	COMMENT
NTN050PP	MOD: RM2 1900 50/30 ROHS VERSION	Manufacturer: Nortel
NTN050CP	MOD: RM2 1900 30/30 ROHS VERSION	Manufacturer: Nortel

The main tests of Qualification will be performed on RM2 1900 (50W /30W) because the RM2 50W is the worst critical module concerning consumption, thermal, RF power features.

Only some tests will be performed on RM2 30W (listed in the document), for the others tests RM2 50W compliance will ensure the RM2 30W compliance

Following RF performances tests will be performed to check FCC compliance and 3GPP TS11.21 compliance:

- At ambient temperature, Radio tests will be performed in Indoor 18000 BTS.
- At extreme temperature, Radio tests will be performed in GSM Outdoor & Indoor 18000 BTS, GSM6000 BTS, GSM9000 BTS.

Radio Tests will be performed in GMSK & 8PSK modulation

2. RELATED DOCUMENTS

2.1. APPLICABLE DOCUMENTS

[A1]	3GPP TS 05.05 – V8.7.1	Release 1999 Digital Cellular Telecommunication System Phase 2+ Radio Transmission and Reception
[A2]	3GPP TS 11.21 – V8.9.0	Release 1999 Base Station System (BSS) Equipment Specification – Radio Aspects
[A3]	47 CFR Part 24	PERSONAL COMMUNICATIONS SERVICES

3. BTS 18000 RF QUALIFICATION TESTS FOR 3GPP PERFORMANCES

The RF performances are performed at BTS18000 antenna connector.

3.1. INDOOR 18000 BTS: 3GPP TS11.21 RF TESTS IN NORMAL CONDITION

3GPP TS11,21 performances			
	Tests	**RM2 PCS1900 (50W/30W) + DDM PCS1900**	**RM2 PCS1900 (30W/30W) + DDM PCS1900**
		Tx0 (B) ,Tx1(M) ,Tx2(T)	**Tx0 (B) ,Tx1(M) ,Tx2(T)**
	Mean RF power	C512 , C661, C810	C512 , C661, C810
	Static /dynamic steps	C512 , C661, C810	C512 , C661, C810
	Power vs time (graph)	C512 , C661, C810	
	phase frequency & mo	C512 , C661, C810	
GMSK modulation	Modulation spectrum (curves)	C512 , C661, C810	
	Switching transient spectrum	C512 , C661, C810	
	Spurious emission (Tx band)	C512 , C810	
	Spurious emission (outsideTx band)	NFH_SFH(C512-C810)	
	Intermodulation Tx	C661 (>6MHz)	
	Intramodulation Tx	Rx & C661 (>6MHz)	
	Static layer NER NFH/ SFH	C512 , C661, C810	
	Static sensitivity TCH/FS	C512 , C661, C810 Full Rx PCSBand	
	Rxlev measurement	C512 , C661, C810	
	Blocking characteristic		
	Intermodulation Rx		
	Mean RF power	C512 , C661, C810	C512 , C661, C810
	Static /dynamic steps	C512 , C661, C810	C512 , C661, C810
	Power vs time (graph)	C512 , C661, C810	
	EVM	C512 , C661, C810	
EDGE modulation	Modulation spectrum (curves)	C512 , C661, C810	
	Switching transient spectrum	C512 , C661, C810	
	Intermodulation Tx		
	Intramodulation Tx		
	Static layer NER	C512 , C661, C810	
	Static sensitivity TCH/FS	C512 , C661, C810	
	Rxlev measurement	C512 , C661, C810	
	Blocking characteristic	C661	
	Intermodulation Rx	C512 , C661, C810	

3.2. GSM 1800 BTS: 3GPP TS11.21 RF TESTS IN EXTREME CONDITIONS

		GSM 18000 BTS Indoor	**GSM 18000 BTS Outdoor**
		T=-5°C	**T=50°C**
		RM2 PCS1900 (50W/30W) + DDM PCS1900	**RM2 PCS1900 (50W/30W) + DDM PCS1900**
		Minimum configuration VDCmin= -40,5V Tx0 RM at Pmax-12dB one way under test successively at Pmax	Maximum configuration VACmin= 187V All Tx at Pmax
		Tx0: 512 - Tx1: C661 - Tx2: C810	
GMSK modulation	Modulation accuracy - phase & freq	C512, C661, C810	C512, C661, C810
	Mean RF power	C512, C661, C810	C512, C661, C810
	Static step	C512, C661, C810	C512, C661, C810
	Dynamic Step	C512, C661, C810	C512, C661, C810
	Power vs time	C512, C661, C810	C512, C661, C810
	Modulation spectrum	C512, C661, C810	C512, C661, C810
	Switching transient spectrum	C512, C661, C810	C512, C661, C810
	Static sensitivity TCH/FS	C512, C661, C810	C512, C661, C810
EDGE modulation	Modulation accuracy- EVM	C512, C661, C810	C512, C661, C810
	Mean RF power	C512, C661, C810	C512, C661, C810
	Static step	C512, C661, C810	C512, C661, C810
	Dynamic Step	C512, C661, C810	C512, C661, C810
	Power vs time	C512, C661, C810	C512, C661, C810
	Modulation spectrum	C512, C661, C810	C512, C661, C810
	Switching transient spectrum	C512, C661, C810	C512, C661, C810
	Static layer NER NFH	C512, C661, C810	C512, C661, C810
	Rxlev measurement	C512, C661, C810	C512, C661, C810

- **Radio performance Tests** :

Measurement will be performed on each way for RM2 PCS1900
The other Tx way will be configured at maximum power on frequencies no used for measurement.

For Tx measurements:

-Maximum Mean RF power step will be done with VSA
- Static & dynamic step will be done with VSA
- Spectrum will be done with Analyser FSE
  Sweep number: 200 for modulation
  Sweep number: 200 for switching

For receiver measurements:

- GMSK sensitivity (search rberII = 2%) will be performed on main / diversity way

- 8PSK sensitivity (& RXLEV) (for antenna level to obtain rberII = 10%) will be performed on main / diversity way .

- NER / Rxlev:
  Measurement in 8PSK modulation .TCH 23.2 – Main way
  Antenna Level: -26dBm, -50dBm, -55dBm, -60 dBm, -80dBm, -101dBm, -104dBm

Environmental Conditions:

INDOOR BTS =

For low Temperature T= -5°C
For Low temperature T=-5°C VDC min = -40.5V
Emission at Max Power on 1way for RM under test.
For others RM , one way at Pmin (Pmax-12dB) activated per RM.

OUTDOOR BTS =

For High temperature T=50°C VDC min = 187V
Temperature stabilization at least a minimum 1 hour at T=50°C before beginning RF tests.

4. BTS 18000 RF QUALIFICATION TESTS FOR FCC REGULATORY

4.1. FCC PART24 (PCS1900) AT AMBIENT TEMPERATURE – BTS18000 INDOOR

FCC Certification : Part 24				
FCC Specification	Title	GMSK	8PSK	Comment
2.1046 24.232	RF Power Output	X	X	Note 1 GSM1900 Band (GDNT Lab)
2.1049	Occupied Bandwidth	X	X	Note 2 GSM1900 Band (GDNT Lab)
2.1051 24.238	Spurious Emissions at Antenna Terminals	X	X	Note 3 GSM1900 Band (GDNT Lab)

PCS1900 Sub-band:
A (512 , 548 , 585) ; D (587 , 598 , 610) ; B (612 , 648 , 685) ; E (687 , 698 , 710) ;
F (712 , 723 , 735) ; C (737 , 773 , 810)

- **Note 1:**

PCS1900 Sub-band =

A (C512) ; D (C587) ; B (C661) ; E (C687) ; F (C735) ; C (C810)

- For RM2 PCS (50W/30W) DDM Dp and DDM H2 configuration

- For RM2 PCS (30W/30W) DDM Dp configuration

For 8PSK and GMSK modulation

- **Note 2 :** The occupied bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power (Measurement on Channel M)
  Measurement power at M(661) Channel.

  - For RM2 PCS (50W/30W) DDM Dp (GMSK and 8PSK modulation)

- **Note 3:** Block Edge channel: Spurious measurement power at
A (512 , 585) ; D (587 , 610) ; B (612 , 685) ; E (687 , 710) ; F (712 , 735) ; C (737 , 810)

Configuration to be tested =

RM2 PCS (50W/30W) - GMSK and 8PSK - DDM Dp
RM2 PCS (50W/30W) - GMSK and 8PSK - DDM H2
RM2 PCS (30W/30W) - GMSK - DDM Dp

	Channel	Block Edge channel: **Power level (Pmax, …, Pmax –I)**
A	512	
	585	
D	587	
	610	
B	612	
	685	
E	687	
	710	
F	712	
	735	
C	737	
	810	

Out of block emission: Spurious measurement power for T(C810) Channel.

4.2. FCC PART24 (PCS1900) IN EXTREME CONDITIONS : FREQUENCY STABILITY

FCC Certification : Part 24				
FCC Specification	Title	GMSK	8PSK	Comment
2.1055 24.235	Frequency Stability	X		Note 4 : (GDNT Lab / LCIE lab)

- **RF Test at LCIE Laboratory**

GSM 18000 BTS Outdoor	**Dual Band GSM850 / PCS 1900**	
GSM850	**Tx0: C128- Tx1: C190 - Tx2: C251**	
Modulation accuracy - phase & freq	C128, C190, C251	Vmin (187V) / Vmax (265V) From -40°C to +50 °C by 10°C step
Mean RF power	C128, C190, C251	
PCS 1900	**Tx0: C512 - Tx1: C698 - Tx2: 810**	
Modulation accuracy - phase & freq	C512, C661, C810	Vmin (187V) / Vmax (265V) From -40°C to +50 °C by 10°C step
Mean RF power	C512, C661, C810	

GSM6000 BTS	**Dual Band GSM850 / PCS 1900**	
GSM850	**Tx0: C128- Tx1: C190 - Tx2: C251**	
Modulation accuracy - phase & freq	C128, C190, C251	Vmin (187V) / Vmax (265V) From -33°C to +50 °C by 10°C step
Mean RF power	C128, C190, C251	
PCS 1900	**Tx0: C512 - Tx1: C698 - Tx2: 810**	
Modulation accuracy - phase & freq	C512, C661, C810	Vmin (187V) / Vmax (265V) From -33°C to +50 °C by 10°C step
Mean RF power	C512, C661, C810	

- **RF Test at GDNT Laboratory**

GSM 18000 BTS Indoor	Dual Band GSM850 / PCS 1900	
GSM850	**Tx0: C128- Tx1: C190 - Tx2: C251**	
Modulation accuracy - phase & freq	C128, C190, C251	Vmin (-40V) / Vmax (-57V) From -5°C to +45 °C by 10°C step
Mean RF power	C128, C190, C251	
PCS 1900	**Tx0: C512 - Tx1: C698 - Tx2: 810**	
Modulation accuracy - phase & freq	C512, C661, C810	Vmin (-40V) / Vmax (-57V) From -5°C to +45 °C by 10°C step
Mean RF power	C512, C661, C810	

GSM 9000 BTS Indoor	Dual Band GSM850 / PCS 1900	
GSM850	**Tx0: C128- Tx1: C190 - Tx2: C251**	
Modulation accuracy - phase & freq	C128, C190, C251	Vmin (-40V) / Vmax (-57V) From -5°C to +45 °C by 10°C step
Mean RF power	C128, C190, C251	
PCS 1900	**Tx0: C512 - Tx1: C698 - Tx2: 810**	
Modulation accuracy - phase & freq	C512, C661, C810	Vmin (-40V) / Vmax (-57V) From -5°C to +45 °C by 10°C step
Mean RF power	C512, C661, C810	

Note 4 : Frequency stability

Frequency stability test is performed under following extreme conditions:

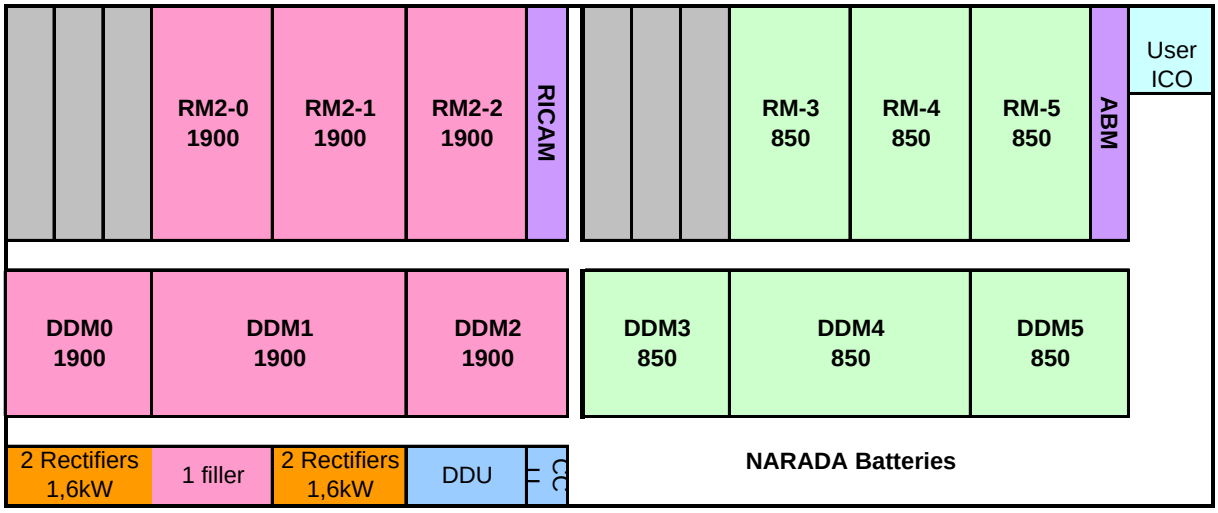
- From Minimum to maximum operational temperature by step temperature.
- With AC power supply variations: 187 VAC, 264 VAC.
- With DC power supply variations: -40 VDC, -57VDC.

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

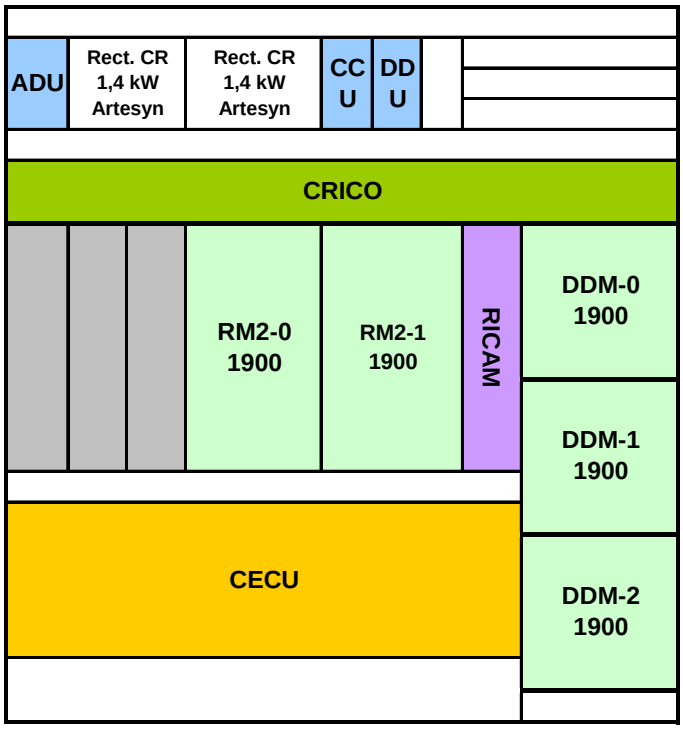
5. BTS HARDWARE CONFIGURATION

5.1. BTS18000 OUTDOOR & BTS6000 HARDWARE (UNDER TEST AT LCIE LAB)

- **NG GSM 18000 outdoor BTS**

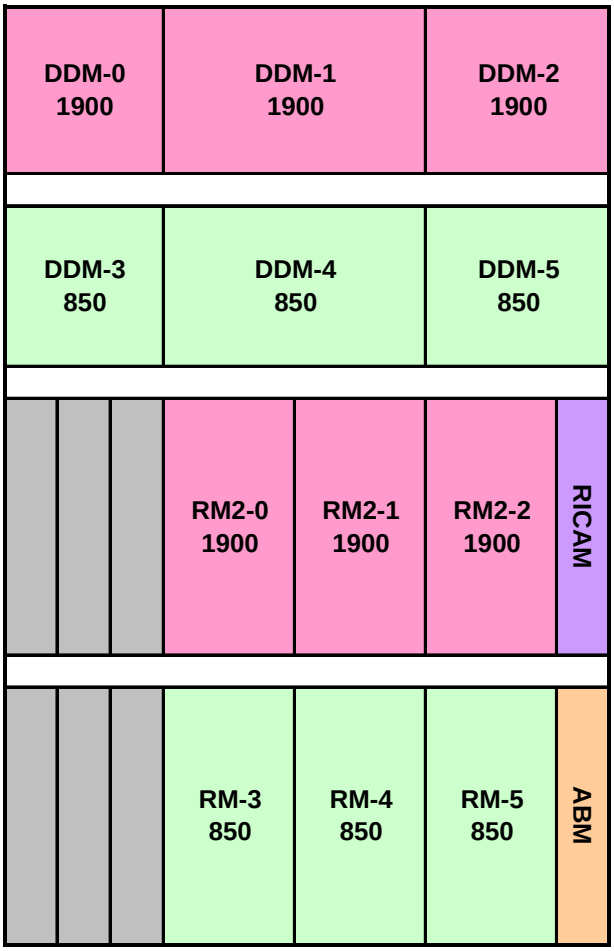


- **GSM 6000 outdoor BTS**

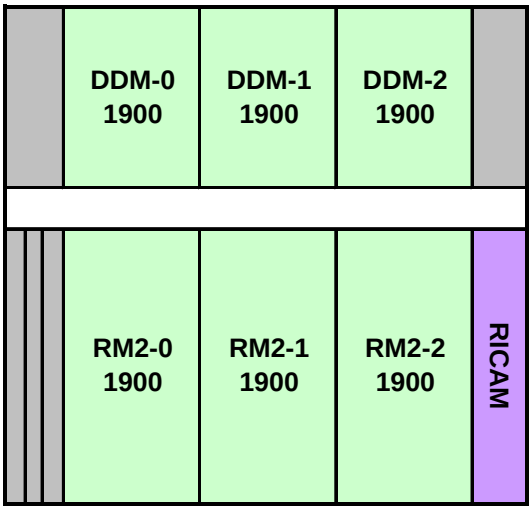


5.2. BTS18000 INDOOR & BTS9000 HARDWARE (UNDER TESTS AT GDNT LAB)

- **GSM 18000 indoor BTS**



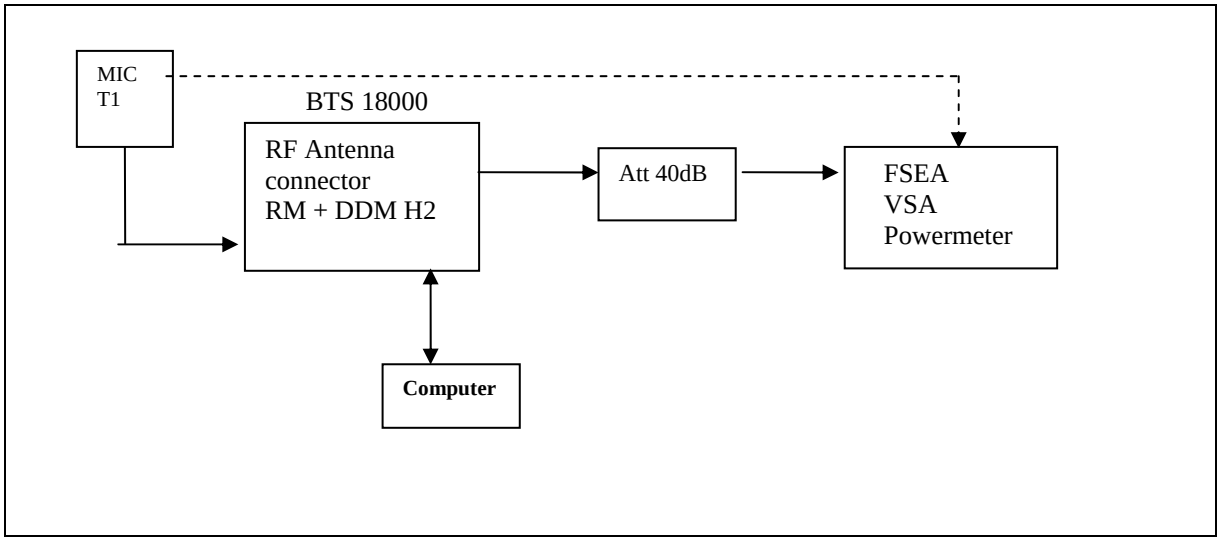
- **GSM 9000 BTS**



6. TEST BENCH RADIO CONFIGURATION

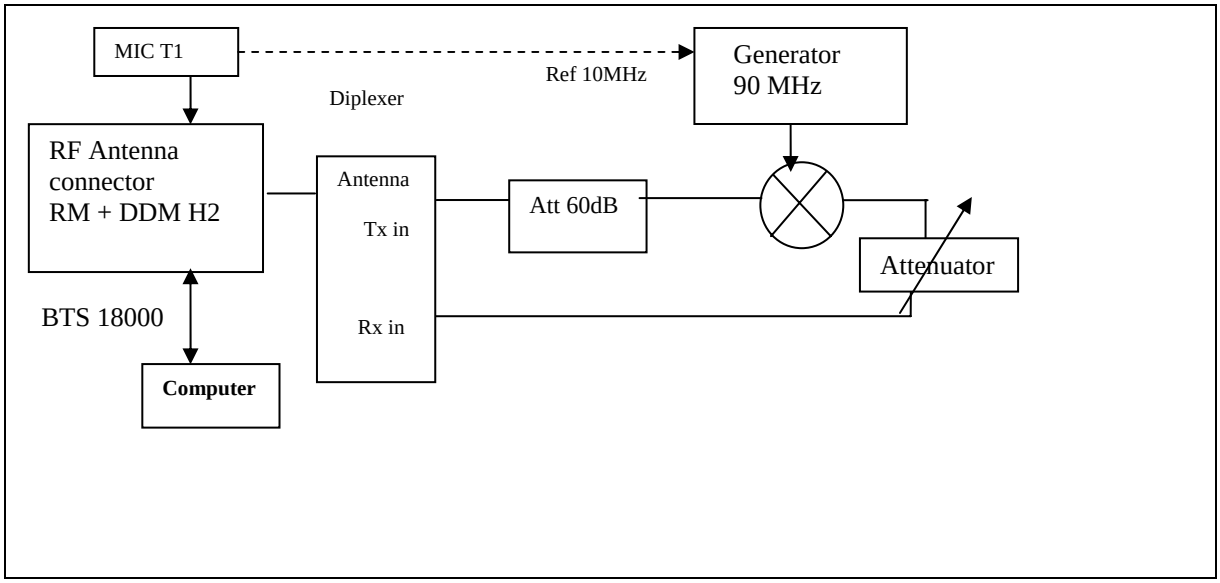
6.1. TX TEST BENCH

Bench for Tx measurement:



6.2. RX TEST BENCH

Base-base loop-back bench for RX measurement (NER , ber sensitivity) .



7. ABBREVIATIONS AND DEFINITIONS

7.1. 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

END OF DOCUMENT

Test Plan for Dual Band GSM 850 & PCS1900 BTS 6000 Cabinets Radio Qualification (FCC & 3GPP)

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CONTENTS

1. INTRODUCTION

1.1. OBJECT

This document presents the radio qualification plan for Dual Band GSM850 /PCS1900 BTS 6000.

Dual Band GSM850/PCS1900 BTS 6000 equipments are with following Radio modules:

- RM PCS1900 equipped with BPM30W (GMSK & 8PSK) and DDM coupling module in PCS1900 Band.
  These modules have been already introduced in BTS6K in previous Qualification.

- HPRM 3T GSM850 equipped with BPM (60W GMSK & 45W 8PSK) and DDM coupling module in GSM850 Band.
  This qualification introduces these GSM850 Radio modules (already introduced in BTS18000 during Q1_2007) in the BTS 6000.

- During this qualification, we introduced also the logical board RICAM in BTS 6000.
  The RICAM (equivalent IFM+ 2 ICM+ 1 ABM) has also introduced and validated in BTS18000.

BTS 6000 are equipped with the module as BTS18000 with equivalent radio paths.

Radio Qualification has been performed on BTS18000 and BTS18000 radio performances are applicable to BTS6000.

The BTS6000 radio qualification is performed in order to check the most critical radio performances which could be impacted by the BTS6000 configuration.

The Following RF performances tests will be performed to check FCC compliance and 3GPP TS11.21 compliance and IC RSS-133 compliance :

- At ambient temperature, Radio tests will be performed in BTS 6000 OUTDOOR (AC)

The BTS 6000 will be equipped with Dual Band RM GSM850 & RM PCS1900.
Some critical 3GPP and FCC radio performances will be checked with this dual configuration.

- At extreme temperature, Radio tests will be performed in following configuration :

  - OUTDOOR BTS 6000 (AC supply) & Full GSM850 radio modules
    FCC tests & Critical 3GPP performances

  - OUTDOOR BTS 6000 (DC supply) & Full GSM850 radio modules
    FCC Tests & Critical 3GPP performances

  - INDOOR BTS 6000 (DC supply) & Full GSM850 radio modules
    FCC Tests
    The Indoor BTS 6000 AC version is also covered by BTS 6000 OUTDOOR (AC)

Radio Tests will be performed in GMSK & 8PSK modulation

2. RELATED DOCUMENTS

2.1. APPLICABLE DOCUMENTS

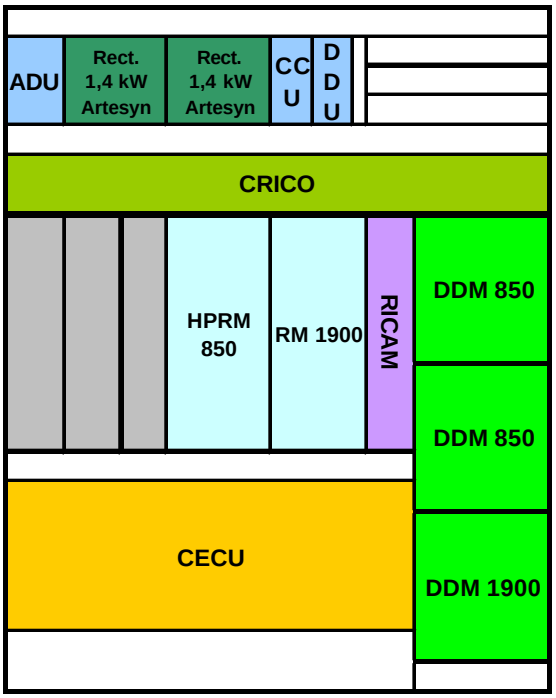
[A1]	3GPP TS 05.05 – V8.7.1	Release 1999 Digital Cellular Telecommunication System Phase 2+ Radio Transmission and Reception
[A2]	3GPP TS 11.21 – V8.9.0	Release 1999 Base Station System (BSS) Equipment Specification – Radio Aspects
[A3]	47CFR Part 24	PERSONAL COMMUNICATIONS SERVICES January 2003
[A4]	47CFR Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS October 2003
[A5]	IC RSS-133	Spectrum Management and Telecommunication Policy - Radio Standards Specifications Issue 3 – June 2005

3. BTS 6000 RF QUALIFICATION TESTS FOR 3GPP PERFORMANCE

The RF performances will be performed in Dual Band GSM850/PCS1900 at BTS 6000 antenna connector.

3.1. OUTDOOR GSM 6000 BTS: RF TESTS IN NORMAL CONDITION

- GSM 850 OUTDOOR BTS 6000 AC VERSION configuration .



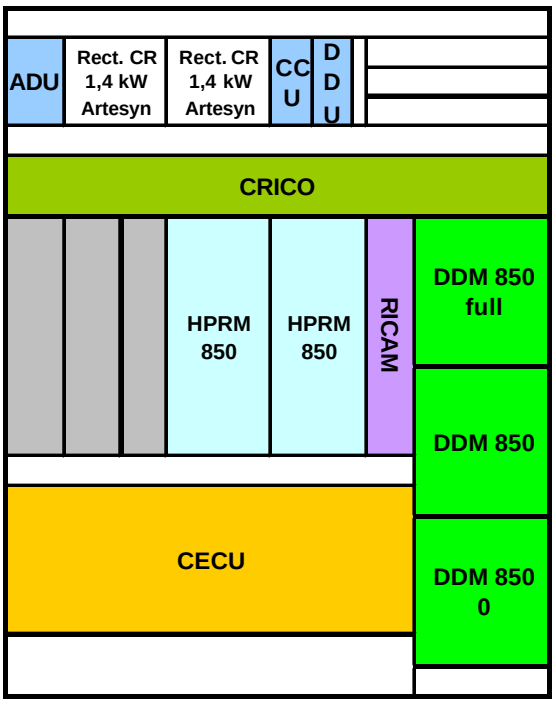
- **Radio performance Tests** :

Radio performances are measured on Tx0 / Rx0 way.

	BTS 6000 OUTDOOR AC Dual Band PCS1900 / GSM850		
	Tests	**RM850 + DDM850 - TDMA0**	**RM1900 + DDM1900 - TDMA0**
GMSK modulation	Max Mean RF power	Test B,M,T	Test B,M,T
	Power vs time	Test B,M,T	Test B,M,T
	phase frequency error	Test B,M,T	Test B,M,T
	Modulation spectrum	Test B,M,T	Test B,M,T
	Switching transient spectrum	Test B,M,T	Test B,M,T
	Spurious emission	Test B,T	*Not tested*
	Static sensitivity TCH/FS	Test (Full band)	Test (Full band)
EDGE modulation	Mean RF power	Test B,M,T	*Not tested*
	Power vs time	Test B,M,T	*Not tested*
	EVM	Test B,M,T	Test B,M,T
	Spurious emission	*Not tested*	Test B,T
	Static layer NER & RXLEV	Test B,M,T	Test B,M,T
	Static sensitivity	Test B,M,T	*Not tested*
	Blocking characteristic	Test M	*Not tested*

3.2. GSM850 OUTDOOR GSM 6000 BTS AC & DC VERSION: RF TESTS IN EXTREME CONDITIONS

3.2.1. GSM850 OUTDOOR BTS 6000 (AC VERSION)



❖ **Environmental Conditions:**

- For High temperature : T= +50°C (Outdoor BTS)

  Outdoor AC Temperature T= +50°C VDC min = 187VAC

  Emission at Full Power Pmax on all tranceivers
  For test at high temperature, the other Tx ways will be configured at maximum power
  Temperature stabilization at least a minimum 1 hours at T=50°C before beginning RF tests.

- For low Temperature :
  Outdoor AC Low temperature T=-33°C VAC = 264 VAC

  Emission at Max Power on 1 way:
  Measurements will be done with one Tx way in emission.
  For test at low temperature, the other Tx ways will be configured in idle mode.

- **3GPP Radio performance Tests :**

	BTS	GSM 6000 BTS Outdoor AC - GSM850 TDMA0	
		Cold start T=-33°C	**T=50°C**
GMSK modulation	Modulation accuracy - phase & freq	C128, C190, C251	C128, C190, C251
	Mean RF power	C128, C190, C251	C128, C190, C251
	Dynamic Step	C190	C190
	Power vs time	C190	C190
	Modulation spectrum	C190	C190
	Switching transient spectrum	C190	C190
	Static sensitivity TCH/FS	C128, C190, C251	C128, C190, C251
EDGE modulation	Modulation accuracy- EVM	C128, C190, C251	C128, C190, C251
	Mean RF power	C128, C190, C251	C128, C190, C251
	Dynamic Step	C190	C190
	Power vs time	C190	C190
	Modulation spectrum	*NT*	*NT*
	Switching transient spectrum	*NT*	*NT*
	Static layer NER NFH	C128, C190, C251	C128, C190, C251
	Rxlev measurement	C128, C190, C251	C128, C190, C251

- Test Parameters configuration :

For Tx measurements :

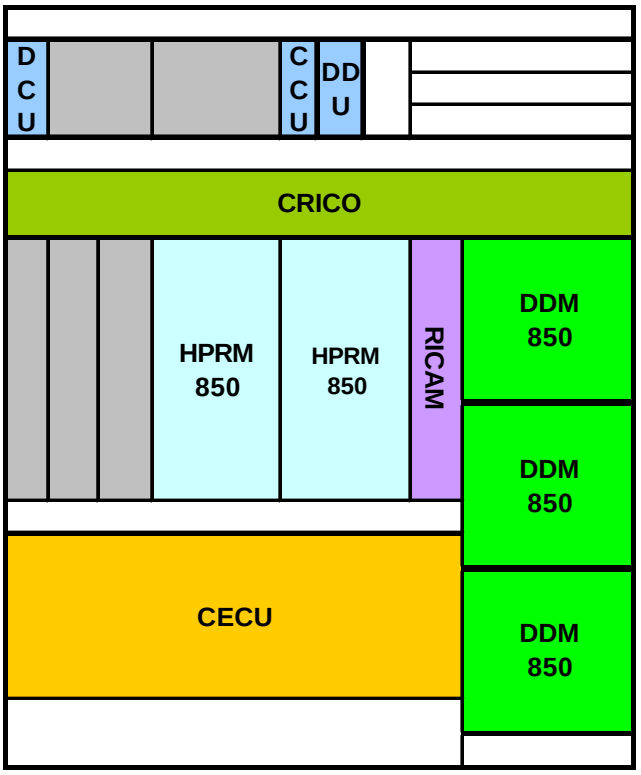
-Maximum Mean RF power step will be done with Analyser
- Dynamic step will be done with VSA.
- Spectrum will be done with Analyser
  Sweep number: 100 for modulation
  Sweep number: 50 for switching

For receiver measurements:

Receiver measurements will be done in RX0 Main way.

- GMSK sensitivity (search rberII = 2%) will be performed on main way
- NER / Rxlev:
  Measurement in 8PSK modulation .TCH 23.2 – Main way
  Antenna Level: -30dBm, -50dBm, -80dBm, -104dBm,-106 dBm

3.2.2. GSM850 OUTDOOR BTS 6000 (DC VERSION)



❖ **Environmental Conditions:**

- For High temperature : T= +50°C (Outdoor BTS)

  Outdoor DC Temperature T= +50°C VDC min = -52 VDC

  Emission at Full Power Pmax on all tranceivers.
  For test at high temperature, the other Tx ways will be configured at maximum power
  Temperature stabilization at least a minimum 1 hours at T=50°C before beginning RF tests.

- For low Temperature : T=- 33°C

  Outdoor Low temperature T=-33°C VDC max = -57 VDC
  Emission at Max Power on 1 way:
  Measurements will be done after a cold start (T=-5°C) with one Tx way in emission.
  For test at low temperature, the other Tx ways will be configured in idle mode.

- **3GPP Radio performance Tests** :

Radio performances are measured on Tx0 / Rx0 way.

	BTS	GSM 6000 BTS Outdoor DC - GSM850 TDMA0	
		Cold start T=-33°C	**T=50°C**
GMSK modulation	Modulation accuracy - phase & freq	C128, C190, C251	C128, C190, C251
	Mean RF power	C128, C190, C251	C128, C190, C251
	Dynamic Step	C190	C190
	Power vs time	C190	C190
	Modulation spectrum	C190	C190
	Switching transient spectrum	C190	C190
	Static sensitivity TCH/FS	C128, C190, C251	C128, C190, C251
EDGE modulation	Modulation accuracy- EVM	C128, C190, C251	C128, C190, C251
	Mean RF power	C128, C190, C251	C128, C190, C251
	Dynamic Step	C190	C190
	Power vs time	C190	C190
	Modulation spectrum	*NT*	*NT*
	Switching transient spectrum	*NT*	*NT*
	Static layer NER NFH	C128, C190, C251	C128, C190, C251
	Rxlev measurement	C128, C190, C251	C128, C190, C251

- Test Parameters configuration :

For Tx measurements :

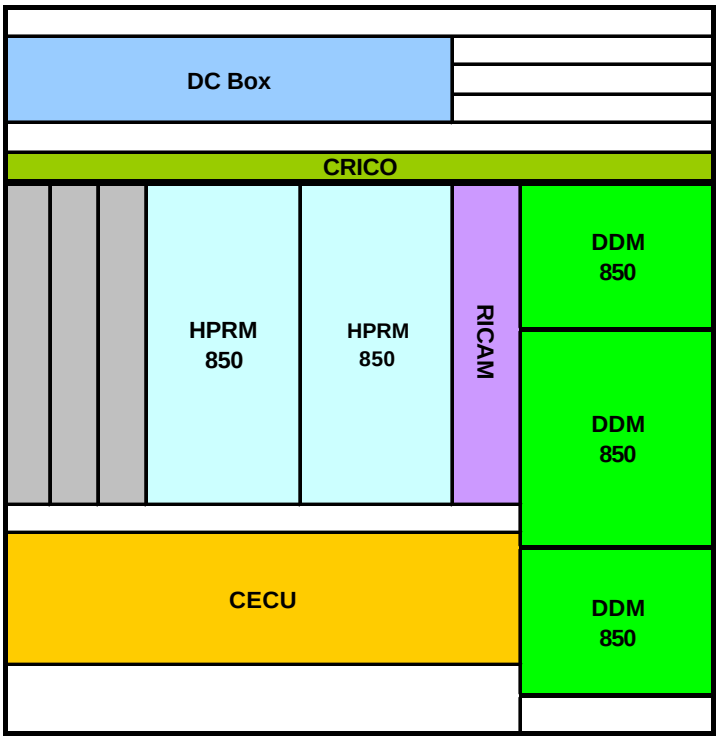
-Maximum Mean RF power step will be done with Analyser
- Dynamic step will be done with VSA.
- Spectrum will be done with Analyser
  Sweep number: 100 for modulation
  Sweep number: 50 for switching

For receiver measurements:

Receiver measurements will be done in RX0 Main way.

- GMSK sensitivity (search rberII = 2%) will be performed on main way
- NER / Rxlev:
  Measurement in 8PSK modulation .TCH 23.2 – Main way
  Antenna Level: -30dBm, -50dBm, -80dBm, -104dBm,-106 dBm

3.2.3. GSM850 INDOOR BTS 6000 (DC VERSION)



❖ **Environmental Conditions:**

- For High temperature : T= +50°C (INDOOR BTS 6000 DC version)

  Outdoor DC Temperature T= +50°C VDC min = -40.5 VDC

  Emission at Full Power Pmax on all tranceivers.
  For test at high temperature, the other Tx ways will be configured at maximum power
  Temperature stabilization at least a minimum 1 hours at T=50°C before beginning RF tests.

- For low Temperature : T=- 33°C

  Outdoor Low temperature T=-5 °C VDC max = -57 VDC
  Emission at Max Power on 1 way:
  Measurements will be done after a cold start (T=-5°C) with one Tx way in emission.
  For test at low temperature, the other Tx ways will be configured in idle mode.

➢ **3GPP Radio performance Tests** :

No 3GPP TS11.21 radio tests will be performed on GSM850 BTS6000 Indoor DC versions. The radio performances will be covered by the radio performances checking with Outdoor BTS 6000 Ac & DC version.

Only FCC Tests will be performed on the INDOOR BTS 6000 DC version.

4. BTS 6000 RF QUALIFICATION TESTS FOR FCC REGULATORY

- **FCC Part 22 (GSM850) in normal conditions.**

Frequency Stability test tests will be done during thermal test by external contract manufacturer . Result sand RF Report done by contract manufacturer will be checked by RF Team.

FCC Certification : Part 22				
FCC Specification	Title	GMSK	8PSK	Comment
2.1046 24.232	RF Power Output	X	X	Note 1 (Done by Nortel RF Team)
2.1049	Occupied Bandwidth	X	X	Note 2 (Done by Nortel RF Team)
2.1051 24.238	Spurious Emissions at Antenna Terminals	X	X	Note 3 (Done by Nortel RF Team)
FCC radio tests will be performed in GSM850 band for a Dual Band GSM850/PCS1900 BTS 6000 Outdoor AC version. These tests have been already performed in BTS18000. As the same modules and same radio paths are used in BTS 60000, Only critical performances will be checked in BTS6000 for each tests.				

Note 1 : Measurement power at B(512) , M(661) , T(810) Channel.

Note 2 : The occupied bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.Measurement on Channel M.

Note 3 : Block Edge channel : Spurious measurement for B(512), T(810) Channel.
Out of block emission: Spurious measurement power for T(810) Channel.

- **FCC Part 22 (GSM850) in extreme conditions.**

FCC Test in extreme conditions (FCC Part 22)				
2.1055 **24.235**	**Mean RF Power** **Frequency Stability**	**X**		**Note 4 :** **Done by** **Contract Manufacturer**

- Test is done with full emission on Tx RM (theoretical worst thermal case)
- Check all emission is at full power during test.
- Test Frequency stability on RM under worst thermal case.

Note 4 : Frequency stability (Test Performed by a contract Manufacturer)

Frequency stability test is performed on each RM Tx0 & Tx1 & Tx2 under following extreme conditions:

- GSM850 OUTDOOR BTS 6000 AC version :
  - Temperature from minimum T=-33°C to maximum temperature T=50°C at intervals of 10 degrees.
  - With AC power supply variations: 187 VAC , 264 VAC
  - All Modules run with nominal power regulation at maximum power in GMSK modulation.

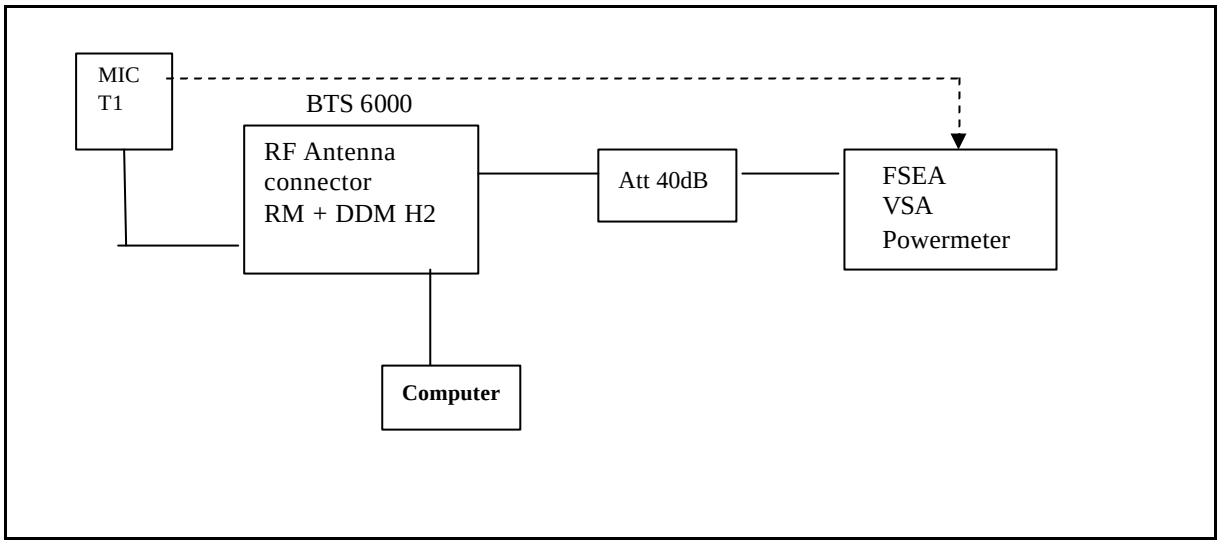
- GSM850 OUTDOOR BTS 6000 DC version :
  - Temperature from minimum T=-33°C to maximum temperature T=50°C at intervals of 10 degrees.
  - With DC power supply variations: -52 VDC , -57VDC.
  - All Modules run with nominal power regulation at maximum power in GMSK modulation.

- GSM850 INDOOR BTS 6000 DC version :
  - Temperature from minimum T=-5°C to maximum temperature T=50°C at intervals of 10 degrees.
  - With DC power supply variations: -40.5 VDC , -57VDC.
  - All Modules run with nominal power regulation at maximum power in GMSK modulation.

5. TEST BENCH RADIO CONFIGURATION

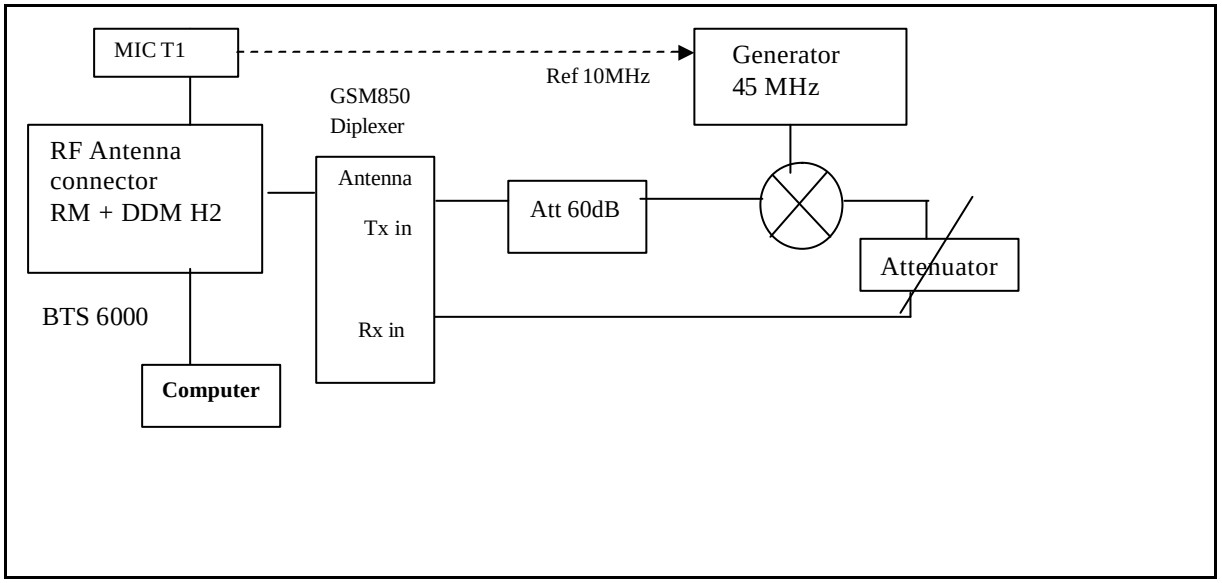
5.1. TX TEST BENCH

Bench for Tx measurement:



5.2. RX TEST BENCH

Base-base loop-back bench for RX measurement (NER , ber sensitivity) .



6. ABBREVIATIONS AND DEFINITIONS

6.1. 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

END OF DOCUMENT

Radio Test Plan for the qualification of GSM 1900Mhz BTS 6000 Cabinets (FCC & 3GPP)

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Author : Jérôme SOTTAS (LCIE)

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Author : Alain CAILLE

CONTENTS

1. INTRODUCTION

1.1. OBJECT

This document presents the radio qualification plan of BTS 6000 for the PCS1900 Band

BTS 6000 will be equipped with Radio modules:
- RM PCS1900 equipped with BPM30W (GMSK & 8PSK) in PCS1900 Band.

BTS 6000 are equipped with the module as BTS18000 with equivalent radio paths.

Radio Qualification is also performed on BTS18000 and some BTS18000 radio performances are applicable to BTS6000.

The BTS6000 radio qualification is performed in order to check the most critical radio performances which could be impacted by the BTS6000 configuration.

Following RF performances tests will be performed to check FCC compliance, 3GPP TS11.21 compliance and IC RSS-133 compliance :

- At ambient temperature, Radio tests will be performed in BTS 6000 OUTDOOR (AC)
  The BTS 6000 will be equipped with PCS1900 module.

- At extreme temperature, Radio tests will be performed in following configuration :

  - OUTDOOR BTS 6000 (DC supply) & PCS1900 radio modules
  - INDOOR BTS 6000 (AC supply) & PCS1900 radio modules

Radio Tests will be performed in GMSK & 8PSK modulation

2. RELATED DOCUMENTS

2.1. APPLICABLE DOCUMENTS

[A1]	3GPP TS 05.05 – V8.7.1	Release 1999 Digital Cellular Telecommunication System Phase 2+ Radio Transmission and Reception
[A2]	3GPP TS 11.21 – V8.9.0	Release 1999 Base Station System (BSS) Equipment Specification – Radio Aspects
[A3]	47CFR Part 24	PERSONAL COMMUNICATIONS SERVICES January 2003
[A4]	47CFR Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS October 2003
[A5]	IC RSS-133	Issue 3 – June 2005 Spectrum Management and Telecommunication Policy - Radio Standards Specifications

3. BTS 6000 RF QUALIFICATION TESTS FOR 3GPP PERFORMANCE

The RF performances will be performed at BTS 6000 antenna connector.

3.1. OUTDOOR GSM 6000 BTS : RF TESTS IN NORMAL CONDITION

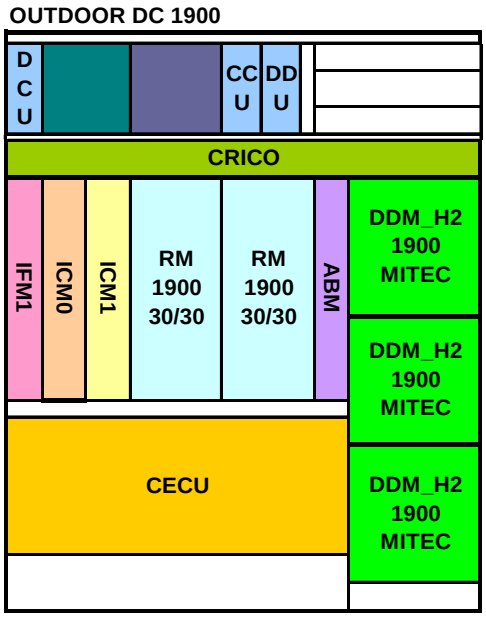
	BTS 6000 OUTDOOR AC	
	Tests	**RM1900 + DDM1900**
GMSK modulation	Max Mean RF power	*Test B,M,T*
	Power vs time	*Test B,M,T*
	phase frequency error	*Test B,M,T*
	Modulation spectrum	*Test B,M,T*
	Switching transient spectrum	*Test B,M,T*
	Static sensitivity TCH/FS	*Test (Full band)*
	Rxlev & NER	Test B,M,T
EDGE modulation	Mean RF power	*Test B,M,T*
	Static & Dynamic step	*Test B,M,T*
	Power vs time	*Test B,M,T*
	EVM	*Test B,M,T*
	Modulation spectrum	*Test B,M,T*
	Switching transient spectrum	*Test B,M,T*
	Spurious emission	*Test B,T*
	Static layer NER	*Test B,M,T*
	Static sensitivity	*Test B,M,T*
	Rxlev measurement	*Test B,M,T*
	Blocking characteristic	Test M

3.2. OUTDOOR DC & INDOOR AC GSM 6000 BTS : RF TESTS IN EXTREME CONDITIONS

➢ **Configurations required to test GSM 6000 BTS in worst thermal case:**

- At extreme temperature, Radio tests will be performed in following configuration :

❖ OUTDOOR BTS 6000 (DC supply)



❖ **Environmental Conditions:**

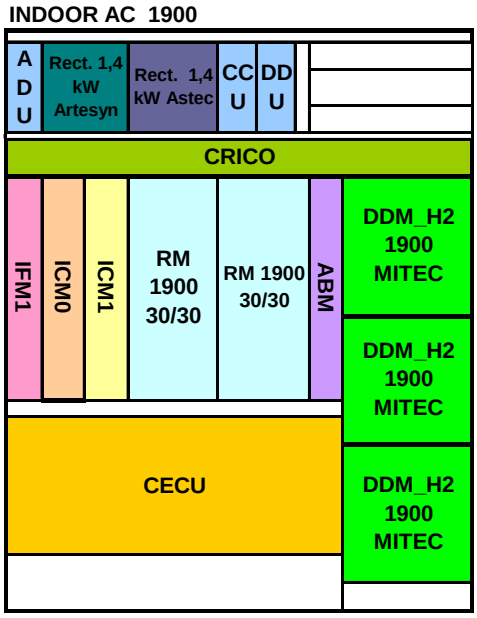
- For High temperature : T= +50°C (Indoor & Outdoor BTS)
  Outdoor Temperature T= +50°C Vdc min = -52VDC

  Emission at Full Power Pmax on all tranceivers
  For test at high temperature, the other Tx ways will be configured at maximum power
  Temperature stabilization at least a minimum 1 hours at T=50°C before beginning RF tests.

- For low Temperature :
  Outdoor Low temperature T=-33°C Vdc max = -57VDC

  Emission at Max Power on 1 way:
  Measurements will be done with one Tx way in emission.
  For test at low temperature, the other Tx ways will be configured in idle mode.

❖ INDOOR BTS 6000 (AC supply)



❖ **Environmental Conditions:**

- For High temperature : T= +50°C (Indoor & Outdoor BTS)

  Indoor Temperature T= +50°C Vac min = 187VAC

  Emission at Full Power Pmax on all tranceivers
  For test at high temperature, the other Tx ways will be configured at maximum power
  Temperature stabilization at least a minimum 1 hours at T=50°C before beginning RF tests.

- For low Temperature :

  (T= -5°C for Indoor BTS)
  Indoor Low temperature T=-5°C Vac max = 264VAC

  Emission at Max Power on 1 way:
  Measurements will be done after a cold start (T=-5°C) with one Tx way in emission.
  For test at low temperature, the other Tx ways will be configured in idle mode.

- **Radio performance Tests** :

  - OUTDOOR BTS 6000 (DC supply)

Radio performances are measured on Tx0 / Rx0 way.

	BTS	GSM 6000 BTS Outdoor DC	
		Cold start T=-33°C	**T=50°C**
GMSK modulation	Modulation accuracy - phase & freq	C512, C661, C810	C512, C661, C810
	Mean RF power	C512, C698, C885	C512, C661, C810
	Static step	*NT*	*NT*
	Dynamic Step	*NT*	*NT*
	Power vs time	*NT*	C661
	Modulation spectrum	*NT*	C661
	Switching transient spectrum	*NT*	C661
	Static sensitivity TCH/FS	*NT*	C512, C661, C810
EDGE modulation	Modulation accuracy- EVM	C661	C512, C661, C810
	Mean RF power	C661	C512, C661, C810
	Static step	*NT*	C661
	Dynamic Step	*NT*	C661
	Power vs time	*NT*	*NT*
	Modulation spectrum	*NT*	*NT*
	Switching transient spectrum	*NT*	*NT*
	Static layer NER NFH	*NT*	C512, C661, C810
	Rxlev measurement	*NT*	C512, C661, C810

  - INDOOR BTS 6000 (AC supply)

Radio performances are measured on Tx0 / Rx0 way.

	BTS	GSM 6000 BTS Indoor AC	
		Cold start T=-5°C	**T=50°C**
GMSK modulation	Modulation accuracy - phase & freq	C512, C661, C810	C512, C661, C810
	Mean RF power	C512, C661, C810	C512, C661, C810
	Power vs time	C661	*NT*
	Modulation spectrum	C661	*NT*
	Switching transient spectrum	C661	*NT*
	Static sensitivity TCH/FS	C512, C661, C810	*NT*
EDGE modulation	Modulation accuracy- EVM	C512, C661, C810	C512, C661, C810
	Mean RF power	C512, C661, C810	C512, C661, C810
	Static step	C661	*NT*
	Dynamic Step	C661	*NT*
	Power vs time	*NT*	*NT*
	Modulation spectrum	*NT*	*NT*
	Switching transient spectrum	*NT*	*NT*
	Static layer NER NFH	C512, C661, C810	*NT*
	Rxlev measurement	C512, C661, C810	*NT*

❖ Test Parameters configuration :

For Tx measurements :

-Maximum Mean RF power step will be done with Analyser
- Static & dynamic step will be done with Powermeter.
- Spectrum will be done with Analyser
  Sweep number: 100 for modulation
  Sweep number: 50 for switching

For receiver measurements:

- GMSK sensitivity (search rberII = 2%) will be performed on main way
- NER / Rxlev:
  Measurement in 8PSK modulation .TCH 23.2 – Main way
  Antenna Level: -30dBm, -50dBm, -80dBm, -104dBm,-106 dBm

4. BTS 6000 RF QUALIFICATION TESTS FOR FCC REGULATORY

FCC Part 24 (PCS1900)

Frequency Stability test tests will be done during thermal test by external contract manufacturer .
Result sand RF Report done by contract manufacturer will be checked by RF Team.

FCC Certification : Part 24 & IC RSS-133					
IC RSS-133 Specification	**FCC Specification**	Title	GMSK	8PSK	Comment
§ 4.3	2.1046 24.232	RF Power Output	X	X	Note 1 (Done by Nortel RF Team)
/	2.1049	Occupied Bandwidth	X	X	Note 2 (Done by Nortel RF Team)
§ 6.5	2.1051 24.238	Spurious Emissions at Antenna Terminals	X	X	Note 3 (Done by Nortel RF Team)
§ 4.2	**2.1055 24.235**	**Frequency Stability**	**X**		**Note 4 : Done by Contract Manufacturer**

Note 1 : Measurement power at B(512) , M(661) , T(810) Channel.

Note 2 : The occupied bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.
Measurement on Channel M.

Note 3 :
Block Edge channel : Spurious measurement for B(512), T(810) Channel.
Out of block emission: Spurious measurement power for T(810) Channel.

Note 4 : Frequency stability (Test Performed by a contract Manufacturer)
Frequency stability test is performed on each RM Tx0 & Tx1 & Tx2 under following extreme conditions:

- Temperature from minimum to maximum temperature at intervals of 10 degrees.
- With AC power supply variations: 187 VAC , 230 VAC, 264 VAC
- With DC power supply variations: -52 VDC , -48 VDC, -57VDC.

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

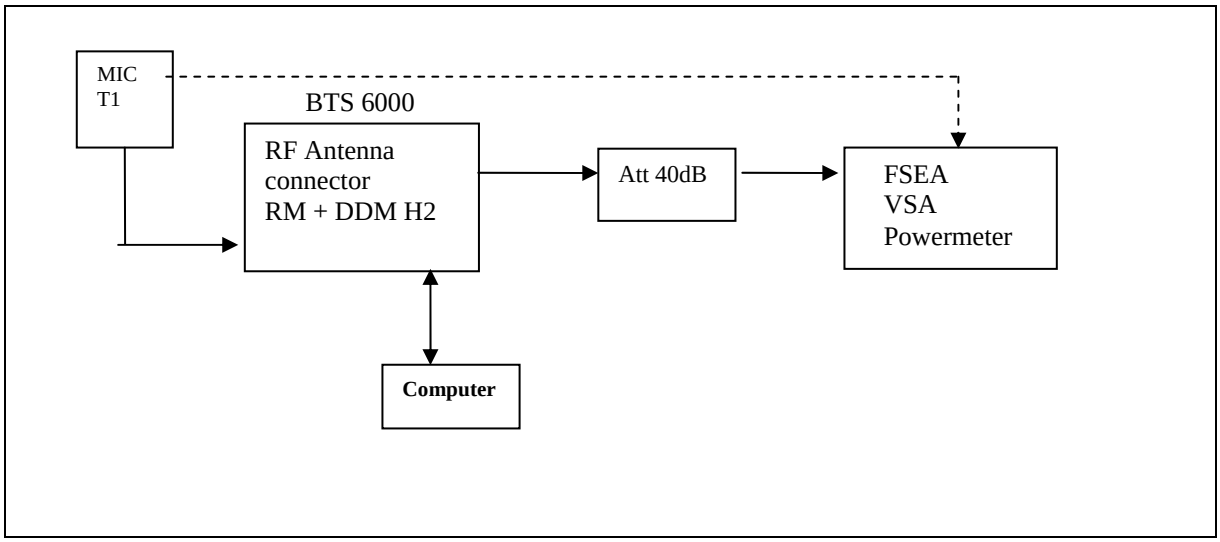
RF Test :

- Test is done on RM3 for each Tx (theoretical worst thermal case)
- Check all emission is at full power during test.
- Test Frequency stability on RM under worst thermal case.

5. TEST BENCH RADIO CONFIGURATION

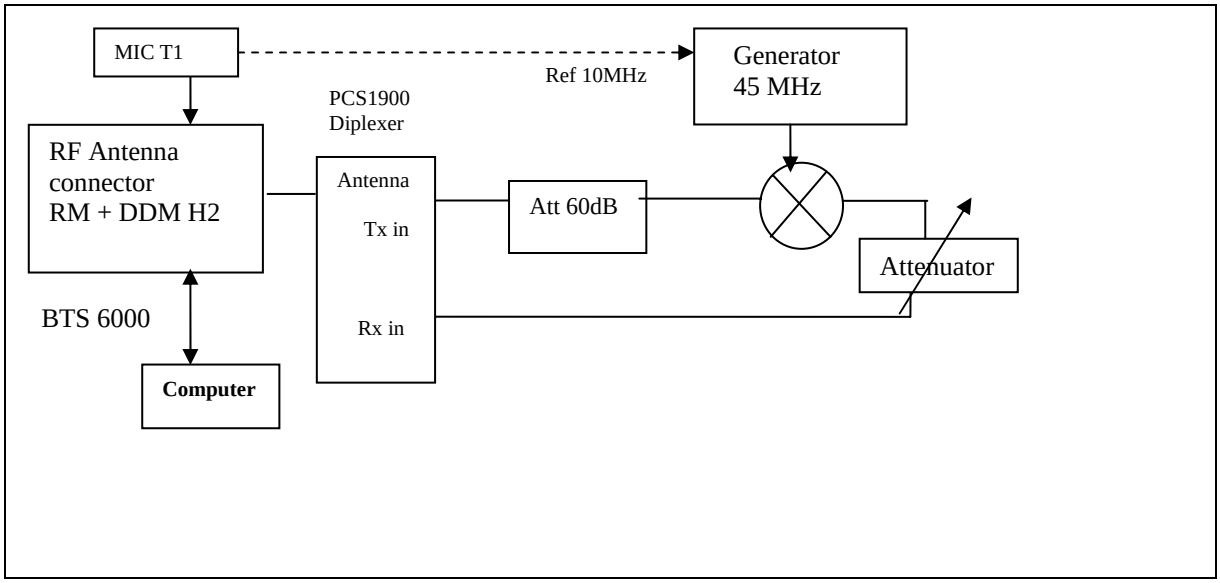
5.1. TX TEST BENCH

Bench for Tx measurement:



5.2. RX TEST BENCH

Base-base loop-back bench for RX measurement (NER , ber sensitivity) .



6. ABBREVIATIONS AND DEFINITIONS

6.1. 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

END OF DOCUMENT