NORTEL NETWORKS™

GSM 18000 MCPA BTS OUTDOOR BASE STATION Test Report according to FCC Part 24 (FCC ID#AB6BTS18000MCPA)

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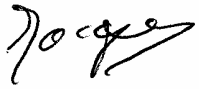
RF Tests concerning FCC Part are performed by RF GSM Department
In laboratory 007 – Nortel Networks, 38 Bd Paul Cezanne, 78280 Guyancourt - France.

Author:	A. CAILLE BTS RF HW GSM engineer	
Approved by:	R. JACQUES BTS RF HW Senior manager	

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Stéphane VINCENT

CONTENTS

1. INTRODUCTION

1.1. OBJECT

This document presents the measurement results of tests performed on this report presents the test data in accordance with FCC Part 24 Subpart E for the Nortel Networks GSM 18000 MCPA BTS in PCS1900 band.

This report presents test data for GMSK modulation and 8PSK modulation (EDGE functionality).

1.2. SCOPE OF THIS DOCUMENT

This document applies to the Nortel Networks GSM 18000 MCPA BTS AB6BTS18000MCPA

GSM 18000 MCPA BTS can integrate a maximum of 9 Radio-Modules (MRM).

The "GSM18000 MCPA BTS " is used with the Powerwave(PWW) MCPA BTS cabinet which is independently FCC certified.

Two sets of results are presented :

- The "GSM18000 MCPA BTS " alone (for FCC acceptance purpose on FCC ID#AB6BTS18000MCPA)

- The complete system "GSM18000 MCPA BTS " + " MCPA PWW BTS " cabinet (for verification purpose)

1.3. AUDIENCE FOR THIS DOCUMENT

This document is to be used by any person needing a view on Nortel Networks GSM 18000 MCPA BTS.

2. RELATED DOCUMENTS

2.1. APPLICABLE DOCUMENTS

[A1]	47CFR Part 24	PERSONAL COMMUNICATIONS SERVICES January 2003
[A2]	47CFR Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS October 2003

2.2. REFERENCE DOCUMENTS

[R1] Radio Test Report for FCC Regulatory
in extreme conditions of GSM 18000 MCPA BTS
External Laboratory GYL TECHNOLOGY – Report N°151014FB

3. TEST REPORT: GSM 18000 MCPA BTS OUTDOOR

3.1. INTRODUCTION

The following information is submitted for update of the type acceptance of a Broadband PCS Base Station for Northern Telecom, Inc., in accordance with FCC Part 24, Subpart E and Part 2, Subpart J of the FCC Rules and Regulations.
The measurement procedures were in accordance with the requirements of Part 2.

3.2. MEASUREMENT RESULTS

Table below is a summary of the measurement results for this update.

Measurement Results Summary

FCC Measurement Specification	IC Limit Specification	Description	Result	Note
2.1046(a), 2.1033(c)(8) 24.232	6.2	RF Power Output	**Complies**	Results available on this document
2.1049		Occupied Bandwidth	**Complies**	
2.1051, 2.1057 24.238	6.3 6.4	Spurious Emissions at Antenna Terminals	**Complies**	
2.1055 24.235	7.0	Frequency Stability	**Complies**	**[R1]** External Laboratory Additional report

CONCLUSION:

GSM18000 MCPA BTS (FCC ID AB6BTS18000MCPA) is compliant with FCC Part24 requirement .

The following Power limitation is required to comply to Adjacent Band spurious :

	GMSK modulation	8 PSK modulation
Config S888 (Pmax = 43dBm)	**Power Limitation :** Pmax – 2 dB = **41 dBm**	**Power Limitation :** **Pmax – 2 dB** = 41 dBm

3.3. NAME OF TEST: RF POWER OUTPUT

3.3.1. FCC REQUIREMENTS – FCC PART 24.232

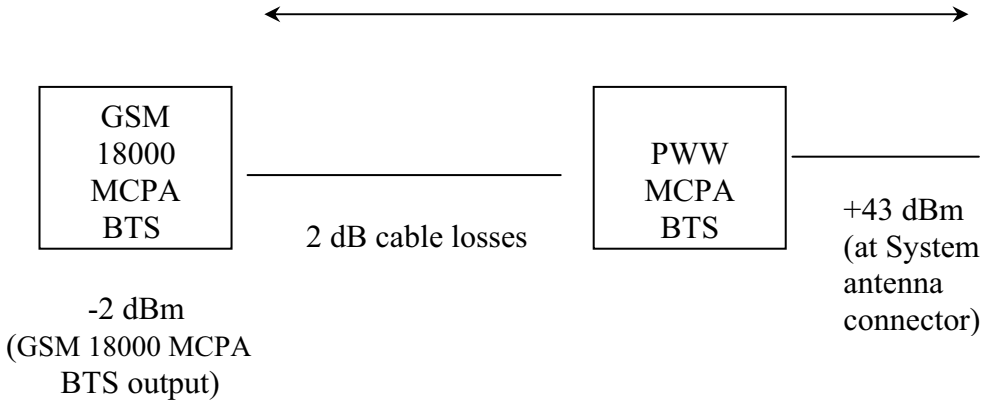
Base stations are limited to 1640 watts peak equivalent isotropically radiated power (e.i.r.p.) with an antenna height up to 300 meters HAAT. See 24.53 for HAAT calculation method. Base station antenna heights may exceed 300 meters with a corresponding reduction in power. In no case may the peak output power of a base station transmitter exceed 100 watts.

3.3.2. TEST RESULTS

To determine whether the GSM 18000 MCPA BTS is FCC compliant, we need to proceed to some extrapolation of the RF output power emitted from the "GSM 18000 MCPA BTS " . We need to apply a power offset to simulate the gain of the MCPA. Indeed, the "GSM 18000 MCPA BTS " outputs -2 dBm +/- 0.5 dB whereas the FCC specification is written for a nominal output power of +43 dBm.

The amplitude offset between GSM 18000 MCPA BTS output connector and antenna connector is 45 dB:

PWW MCPA BTS antenna connector (+43dBm) – GSM 18000 MCPA BTS connector (-2 dBm)



- **GSM 18000 MCPA BTS connector :**

The output power at the GSM 18000 MCPA BTS connector is measured for channels 512, 661 and 810 in both modulation types (GMSK and8PSK):

	GMSK			8PSK		
Channels	**C512**	**C661**	**C810**	**C512**	**C661**	**C810**
MRM18000 BTS Output Power	**-1.8**	**-1.7**	**-1.8**	**-1.8**	**-1.7**	**-1.8**
Output Power Antenna connector system MRM 18000 BTS + ‘ Perfect ‘ MCPA BTS (with perfect offset 45 dB)	43.2	43.3	43.2	43.2	43.3	43.2

- **GSM 18000 MCPA BTS + MCPA PWW BTS connector :**

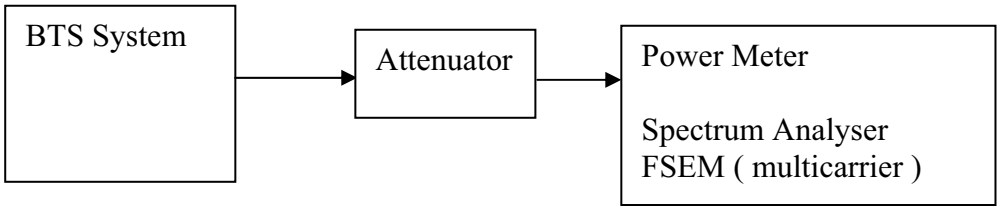
Table show power measurement at antenna connector of the complete system GSM18000 MCPA BTS + Prototype MCPA PWW BTS.

	GMSK			8PSK		
Channels	**C512**	**C661**	**C810**	**C512**	**C661**	**C810**
Pmax	42.2	42.8	42.6	42.3	43	42.7
Pmax – 2 dB	40.3	40.9	40.6	40.4	41	40.8

3.3.3. TEST PROCEDURE

The equipment was configured as shown in schematic1.

Schematic 1 : Test configuration for RF Output Power



The BTS was configured to transmit at maximum power (static level 0) :

- for GMSK modulation, in mode GMSK no synchro,
- for 8PSK modulation, in mode logical PDCH, Type GPRS, coding MCS5.

Measurements were made at frequencies which are the bottom, middle and top of each of the licensed blocks.

The output power was measured using the power meter which has the following settings :

Mode :	Average
Reference Level Offset :	Corrected to account for cable(s) and attenuator losses

3.4. NAME OF TEST : OCCUPIED BANDWIDTH

3.4.1. FCC REQUIREMENTS

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.

3.4.2. TEST RESULTS

- **Occupied bandwidth in GMSK modulation**

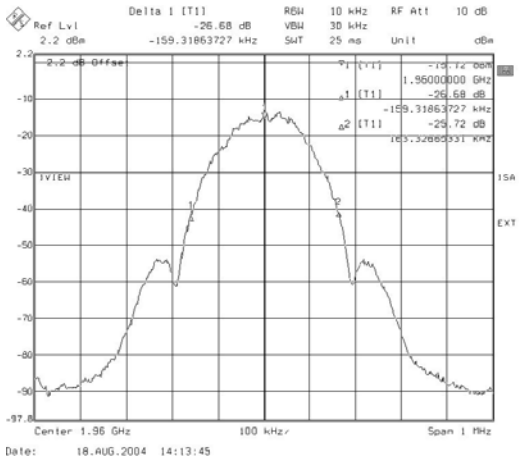


Figure 1 : GSM18000 BTS

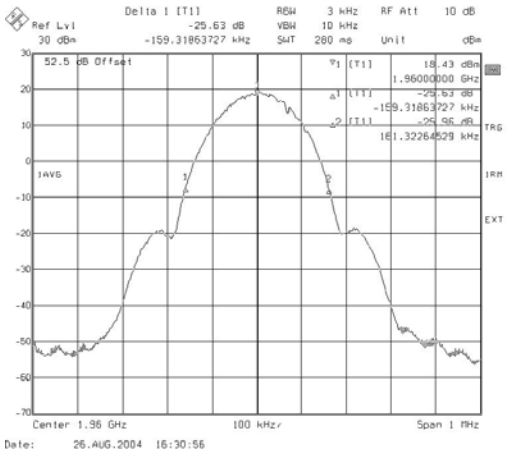


Figure 2 : GSM18000 BTS + MCPA PWW BTS

The maximum occupied bandwidth was found to be 320 kHz.

➢ Occupied bandwidth in 8PSK modulation

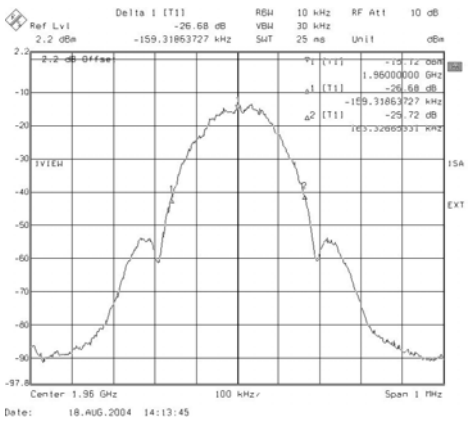


Figure 3 : GSM18000 BTS

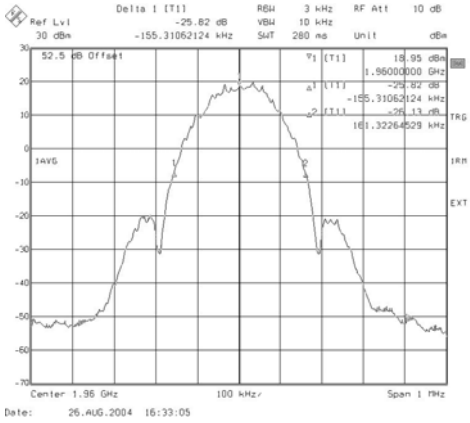


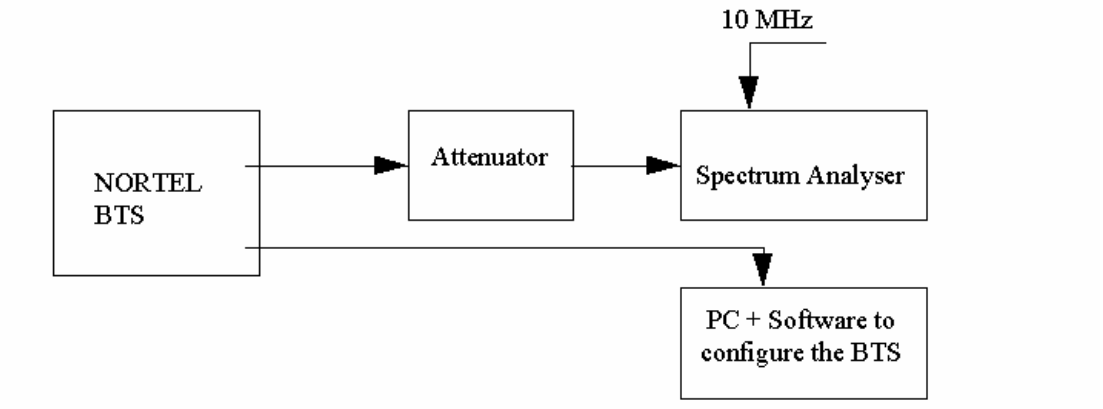
Figure 4 : GSM18000 BTS + MCPA PWW BTS

The maximum occupied bandwidth was found to be 320 kHz.

3.4.3. TEST PROCEDURE

The equipment was configured as shown in schematic 2.

Schematic 2 : Test configuration for Occupied bandwidth



The BTS was configured to transmit at maximum power (static level 0) :

- for GMSK modulation, in mode GMSK no synchro,
- for 8PSK modulation, in mode logical PDCH, Type GPRS, coding MCS5.

The occupied bandwidth was measured by determining the bandwidth out of which all emissions are attenuated at least 26 dB below the transmitter power.

The spectrum analyzer had the following settings :

Detector :	RMS	
Trace :	Average	
	Resolution bandwidth :	3 kHz
	Video bandwidth :	10 kHz
	Span :	1 MHz
	Reference Level Offset :	52.5 dB (correction to account for cable(s) and attenuator losses)
	Level range :	100 dB
	Sweep time :	280 ms
	Trigger :	extern (from ICM)

3.5. NAME OF TEST: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

3.5.1. FCC REQUIREMENTS LIMITS – FCC PART 24.238

(a) On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB.

(b) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission 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.

(c) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(d) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

3.5.2. TEST RESULTS ON "GSM 18000 MCPA BTS"

The reference level for spurious emissions at the antenna terminals is taken from the measured output power (43 dBm = 20 Watts).

Therefore the spurious emissions must be attenuated by at least 43 + 10*Log(20) =56 dB
The measured output power was 43 dBm ; therefore the limit is 43 – 56 = -13 dBm.

Tables show the results for Spurious Emissions at Antenna Terminals.

Spurious emissions for GMSK modulation

Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
512	Pmax	-14.3	-13	1.3
810	Pmax	-13.7	-13	0.7

Spurious emissions for 8PSK modulation

Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
512	Pmax	-15.6	-13	2.6
810	Pmax	-17.5	-13	4.5

➢ FIGURES FOR GMSK MODULATION

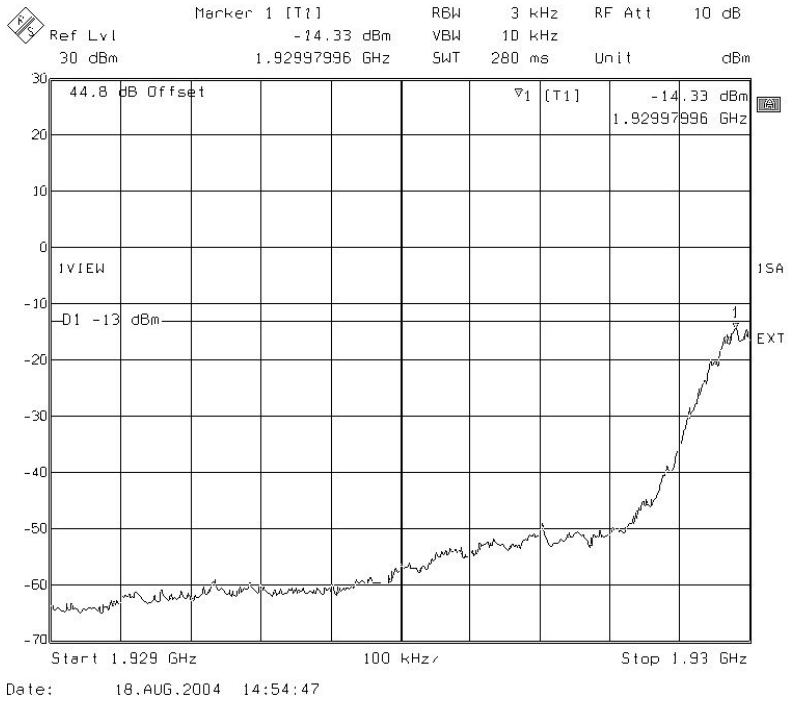


Figure 5 : -1 MHz adjacent band (Channel 512, Pmax), GMSK modulation (BTS18000)

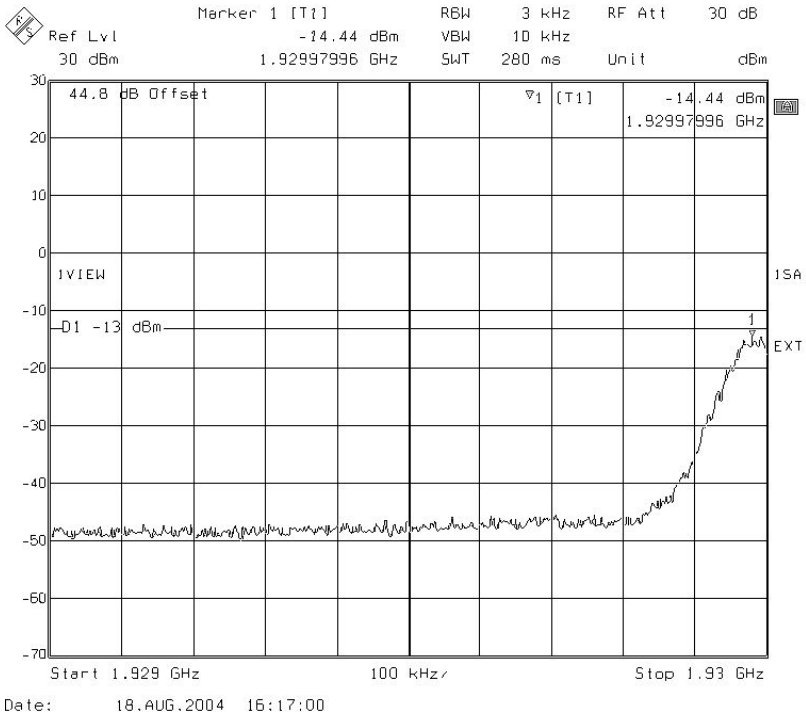


Figure 6 : -1 MHz adjacent band (Channel 512 + 7BCCH, Pmax), GMSK modulation (BTS18000)

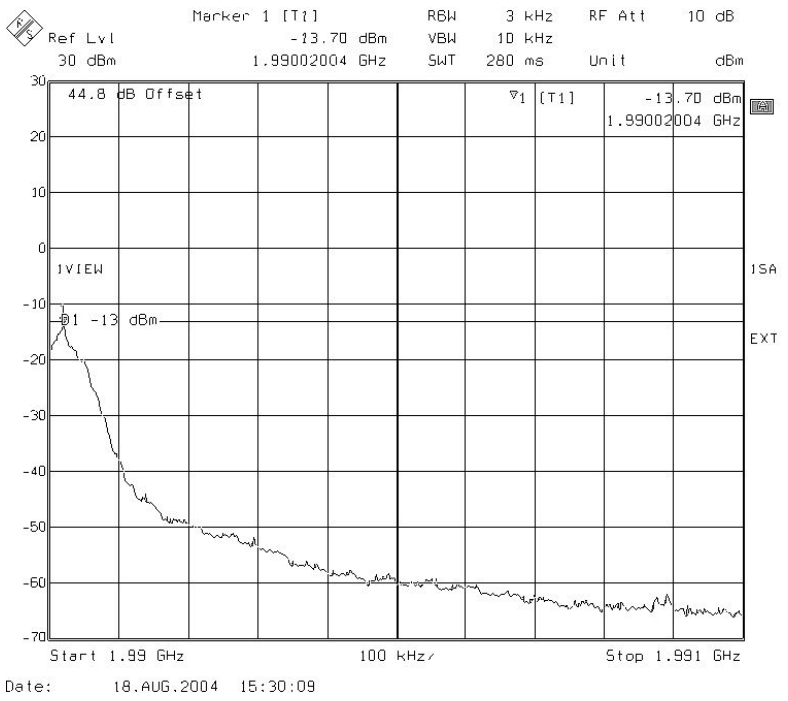


Figure 7 : +1 MHz adjacent band (Channel 810, Pmax), GMSK modulation (BTS18000)

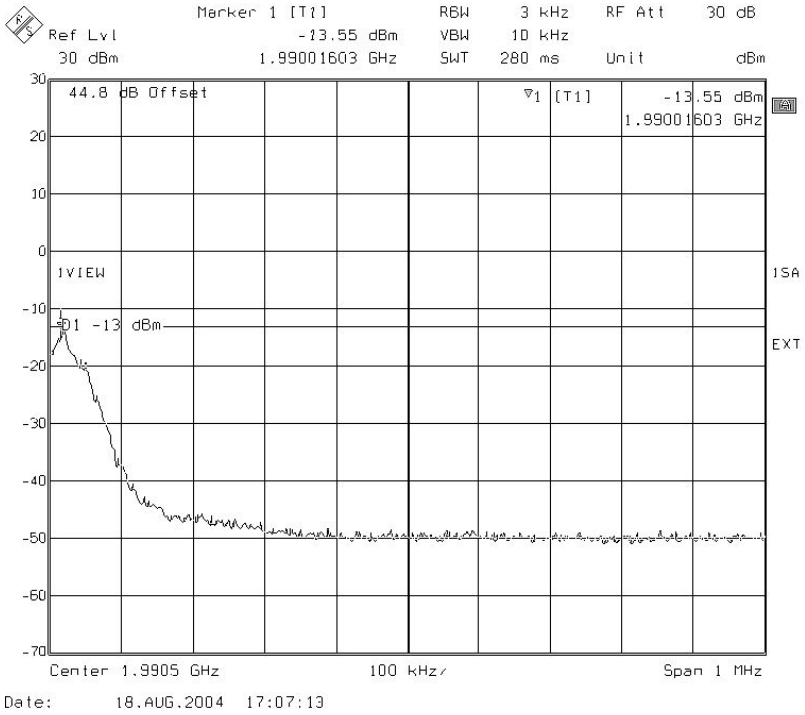


Figure 8 : +1 MHz adjacent band (Channel 810+ 7BCCH, Pmax), GMSK modulation (BTS18000)

➢ FIGURES FOR 8PSK MODULATION

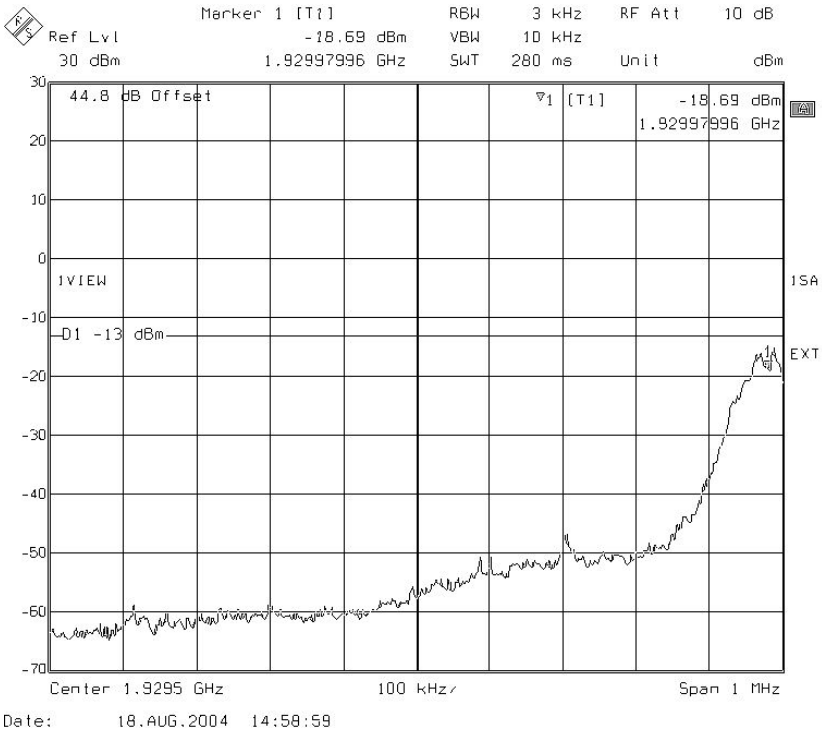


Figure 9 : -1 MHz adjacent band (Channel 512, Pmax), 8PSK modulation (BTS18000)

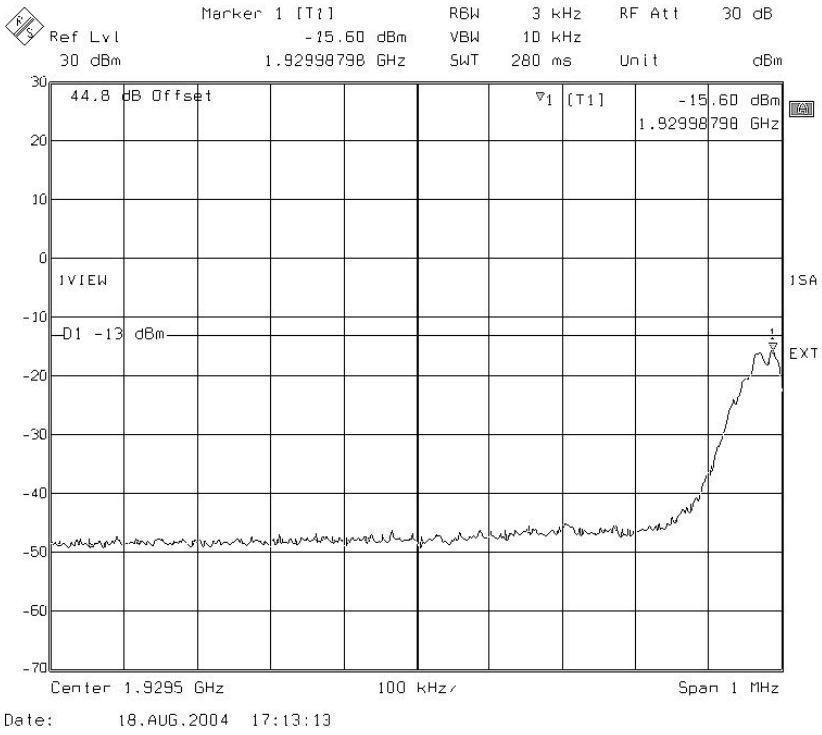


Figure 10 : -1 MHz adjacent band (Channel 512 + 7BCCH, Pmax), 8PSK modulation (BTS18000)

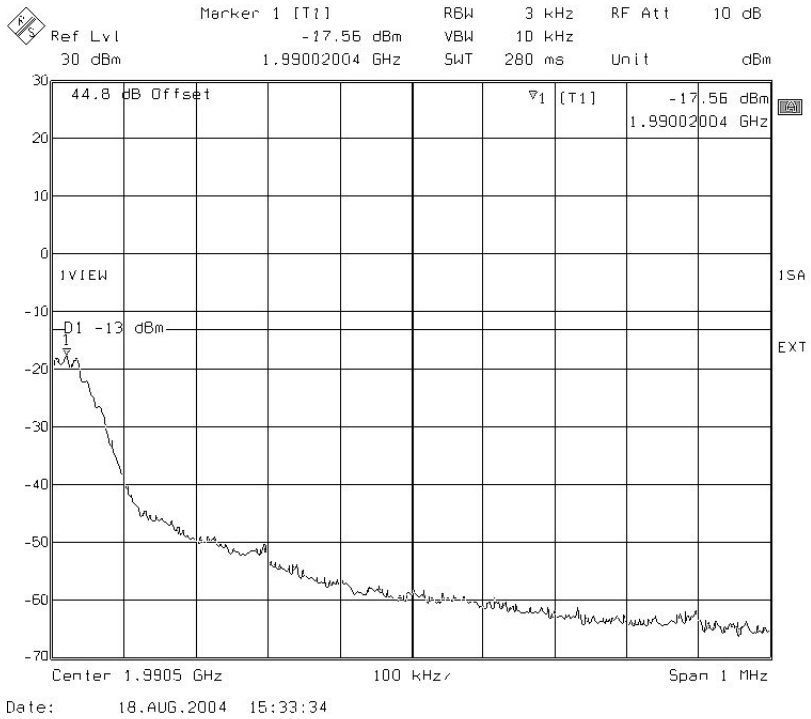


Figure 11 : +1 MHz adjacent band (Channel 810, Pmax), 8PSK modulation (BTS18000)

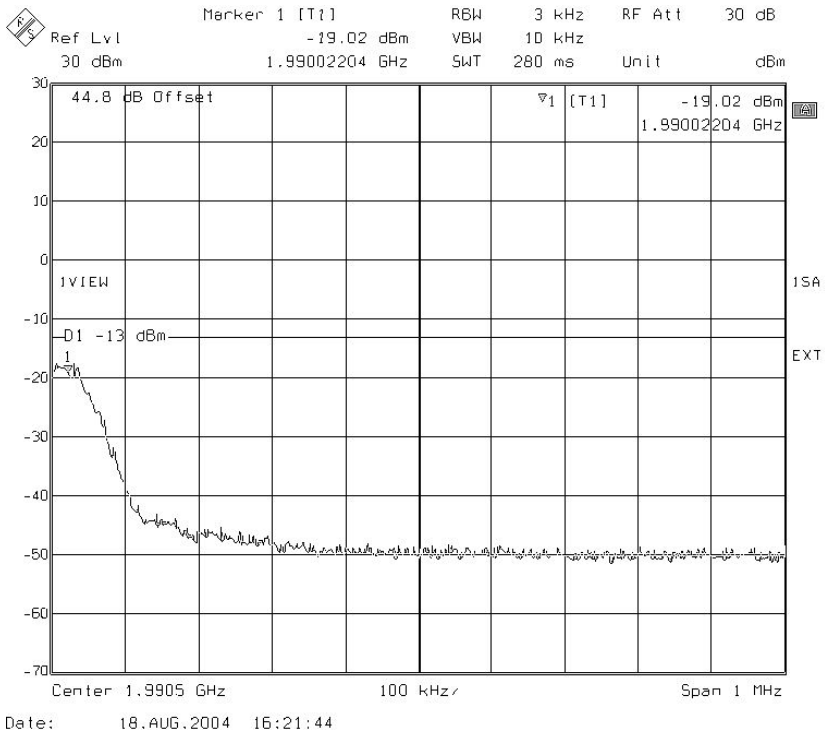


Figure 12 : +1 MHz adjacent band (Channel 810+ 7BCCH, Pmax), 8PSK modulation (BTS18000)

➢ OUT-OF-TX BAND TEST

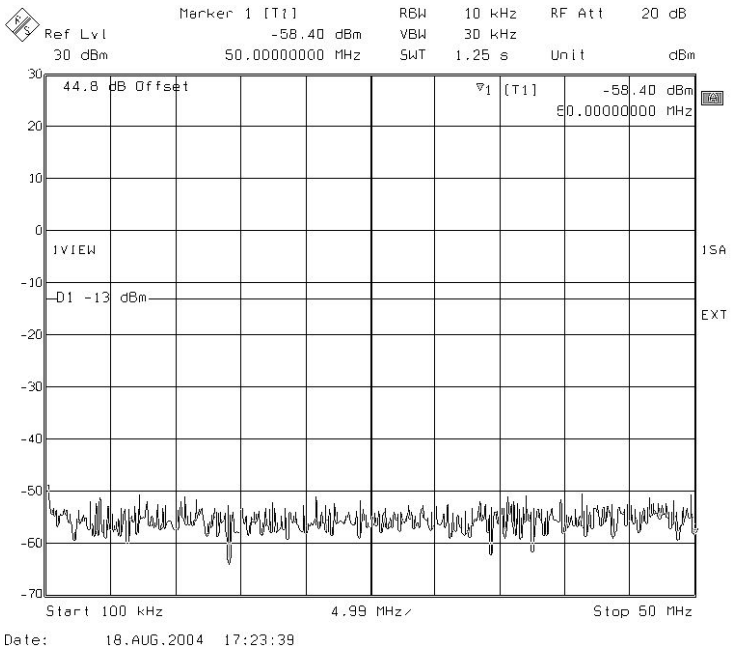


Figure 13: 100 kHz – 50 MHz Out-of-block emissions (Channel 810, Pmax), GMSK modulation (BTS18000)

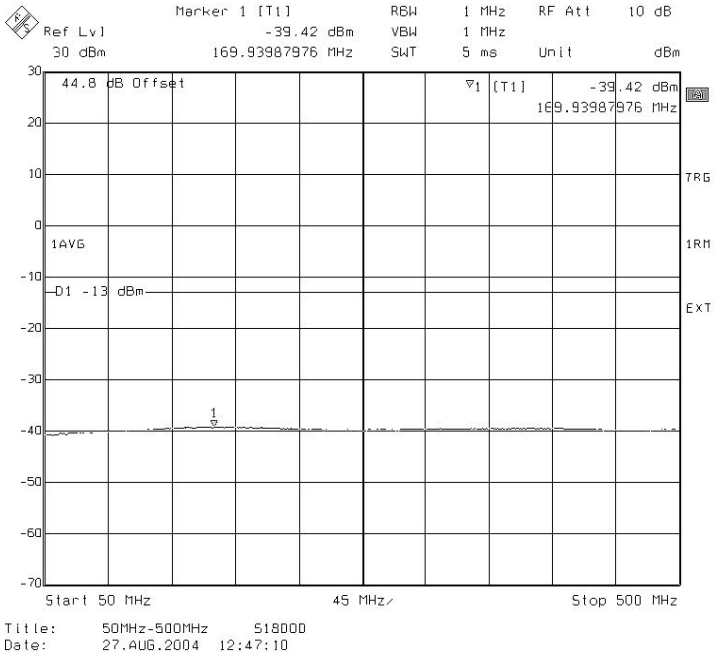


Figure 14: 50 MHz – 500 MHz Out-of-block emissions (Channel 810, Pmax), GMSK modulation (BTS18000)

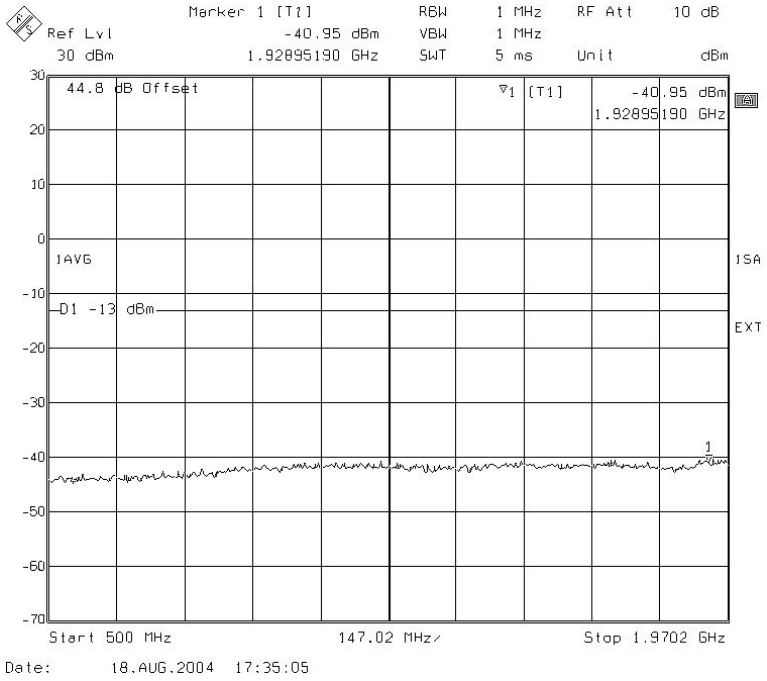


Figure 15: 500 MHz – 1970.2 MHz Out-of-block emissions (Channel 810, Pmax), GMSK modulation (BTS18000)

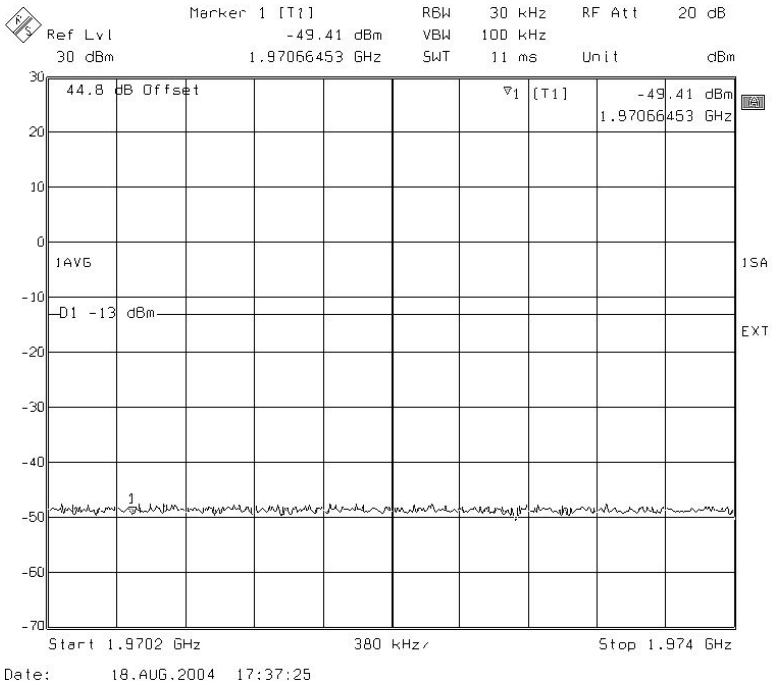


Figure 16: 1970.2 MHz – 1974 MHz Out-of-block emissions (Channel 810, Pmax), GMSK modulation (BTS18000)

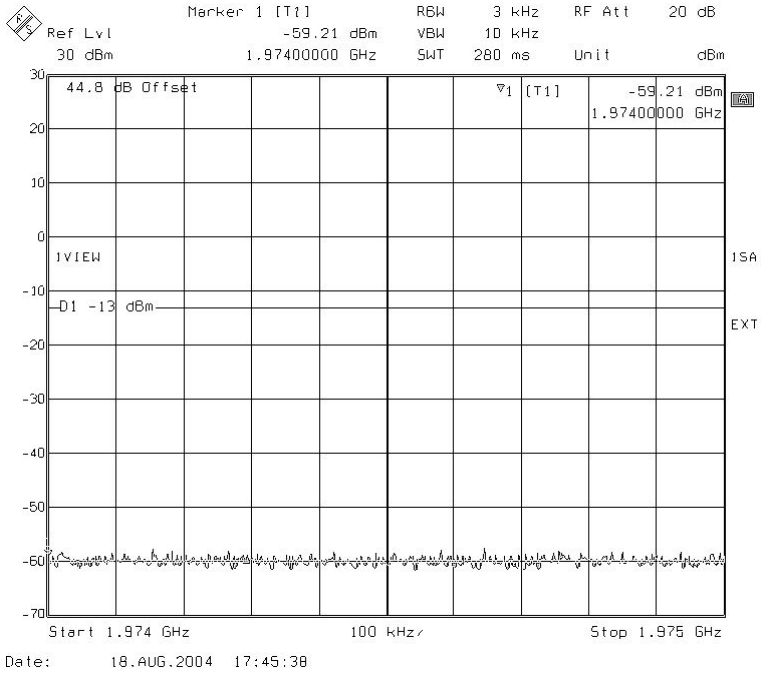


Figure 17: 1974 MHz – 1975 MHz Out-of-block emissions (Channel 810, Pmax), GMSK modulation (BTS18000)

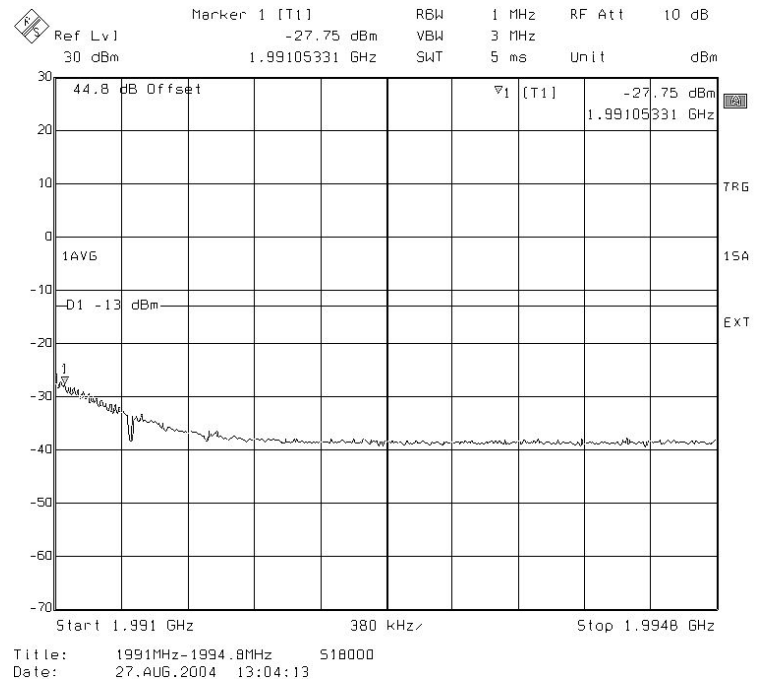


Figure 18: 1991 MHz – 1994.8 MHz Out-of-block emissions (Channel 810, Pmax), GMSK modulation (BTS18000)

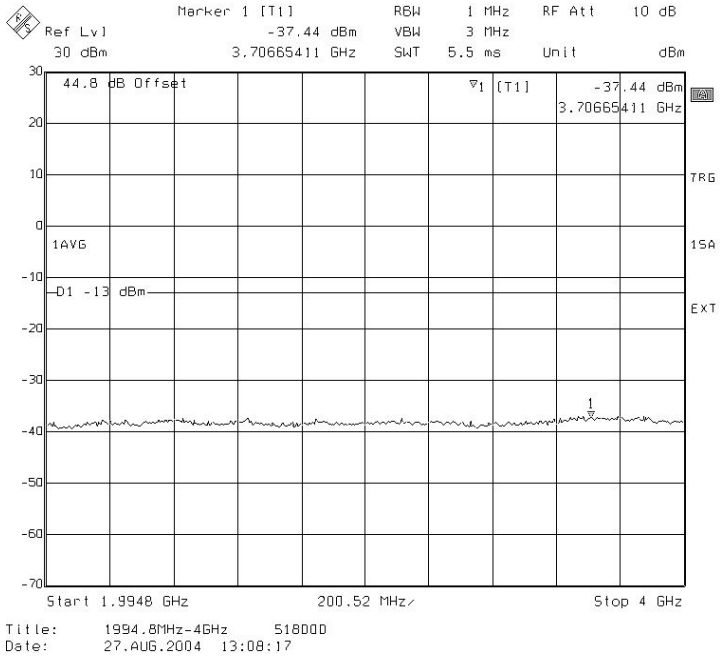


Figure 19: 1994 MHz –4 GHz Out-of-block emissions (Channel 810, Pmax), GMSK modulation (BTS18000)

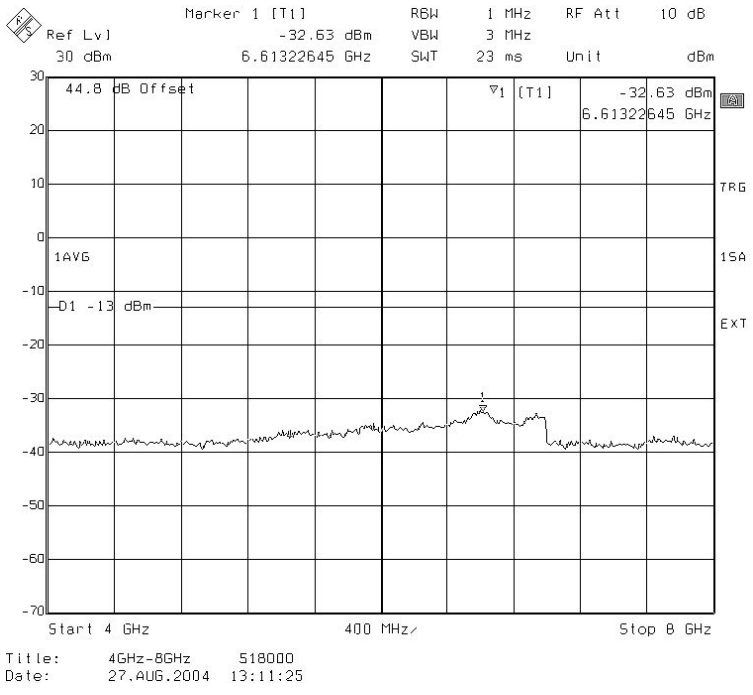


Figure 20: 4 GHz – 8 GHz Out-of-block emissions (Channel 810, Pmax), GMSK modulation (BTS18000)

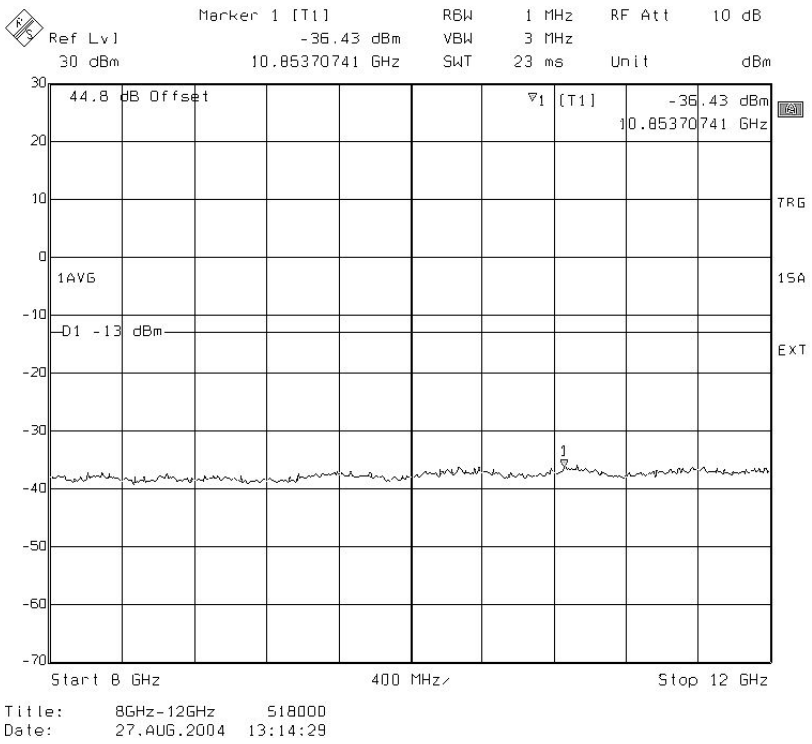


Figure 21: 8 GHz – 12 GHz Out-of-block emissions (Channel 810, Pmax), GMSK modulation (BTS18000)

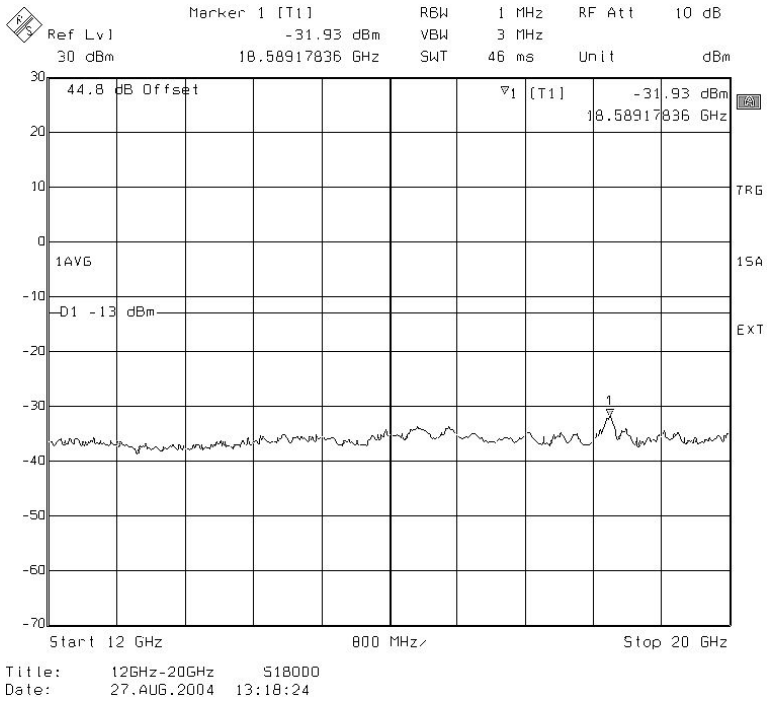


Figure 22: 12 GHz – 20 GHz Out-of-block emissions (Channel 810, Pmax), GMSK modulation (BTS18000)

3.5.3. TEST RESULTS ON COMPLETE SYSTEM : “GSM18000 MCPA BTS “+ “ MCPA PWW BTS “

Table show Power measurement at antenna connector of the complete system GSM18000 MCPA BTS + MCPA PWW BTS.

	GMSK			8PSK		
Channels	**C512**	**C661**	**C810**	**C512**	**C661**	**C810**
Pmax	42.2	42.8	42.6	42.3	43	42.7
Pmax – 2 dB	40.3	40.9	40.6	40.4	41	40.8

Tables show the results for Spurious Emissions at Antenna Terminals .

Spurious emissions for GMSK modulation

Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
512	Pmax	-13	-13	0
810	Pmax	-12.5	-13	-0.5

Spurious emissions for 8PSK modulation

Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
512	Pmax	-12.7	-13	-0.3
810	Pmax	-11.6	-13	-1.4

2dB power restriction on edge block channel C512 – C810 permit to comply to -13dBm limit on adjacent band on the complete system.

➢ FIGURES FOR GMSK MODULATION

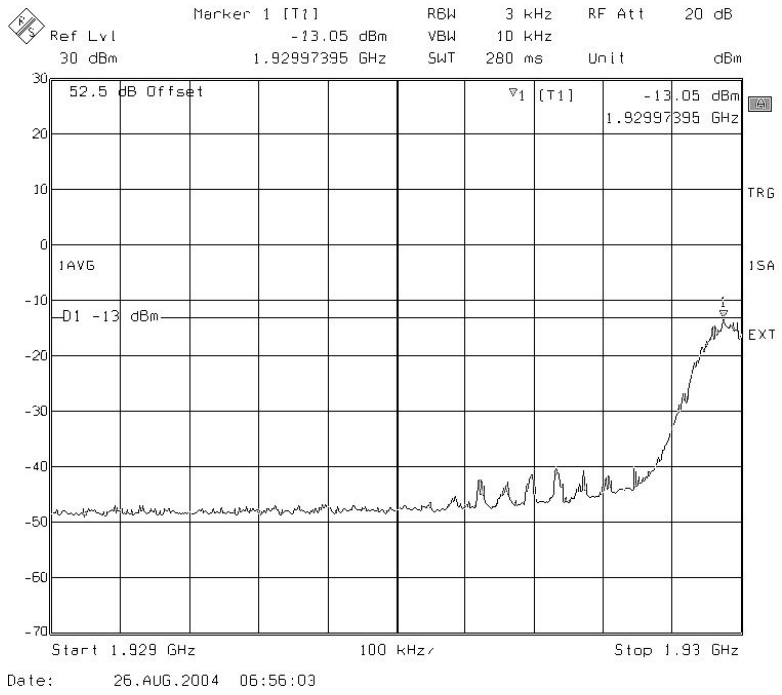


Figure 23: -1 MHz adjacent band (Channel 512, Pmax), GMSK modulation (GSM 18000 BTS + MCPA PWW BTS)

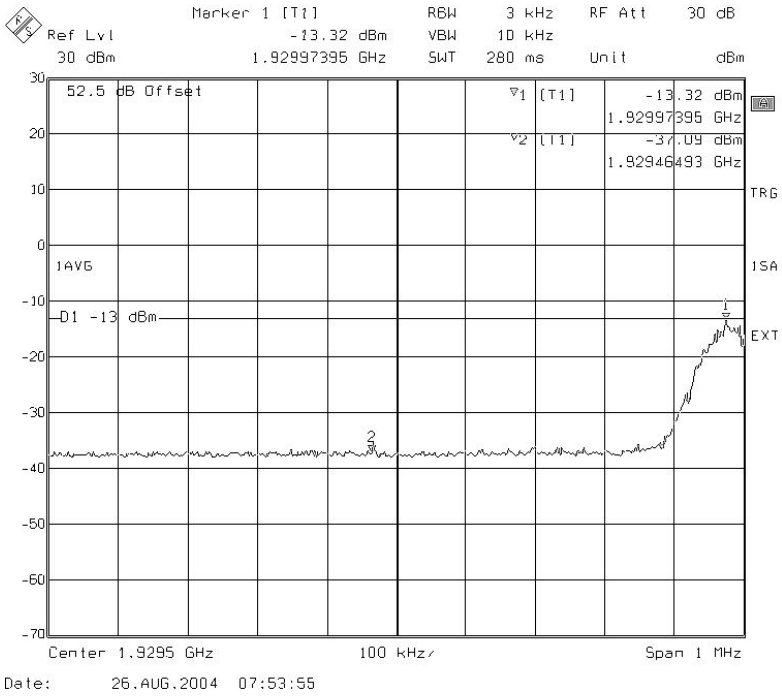


Figure 24: -1 MHz adjacent band (Channel 512 + 7BCCH, Pmax), GMSK modulation (GSM 18000 BTS + MCPA PWW BTS)

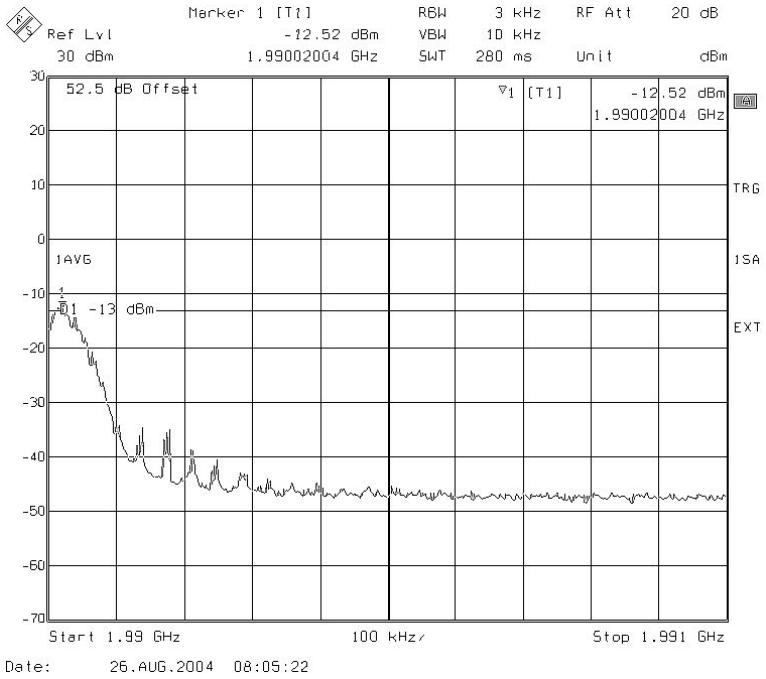


Figure 25 : +1 MHz adjacent band (Channel 810, Pmax), GMSK modulation (GSM 18000 BTS + MCPA PWW BTS)

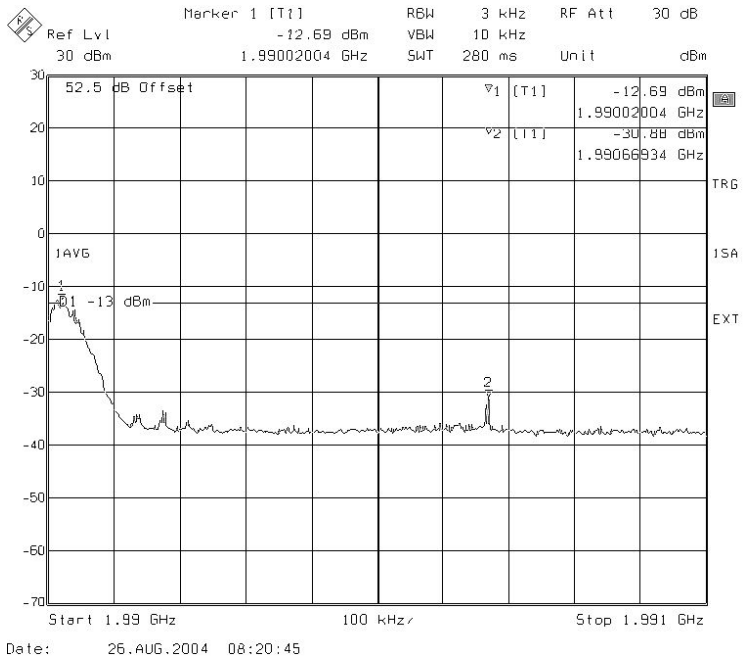


Figure 26 : +1 MHz adjacent band (Channel 810+ 7BCCH, Pmax), GMSK modulation (GSM 18000 BTS + MCPA PWW BTS)

➢ FIGURES FOR 8PSK MODULATION

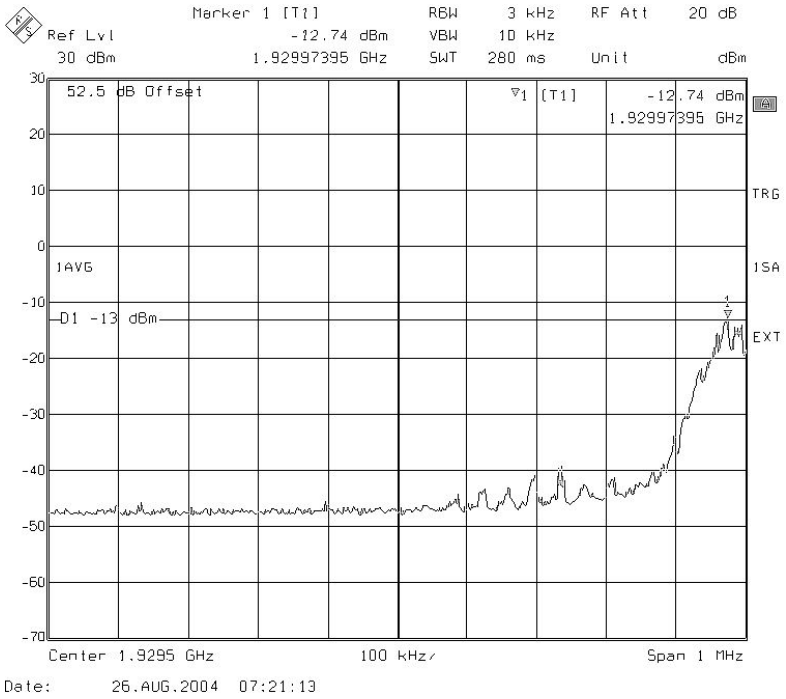


Figure 27 : -1 MHz adjacent band (Channel 512, Pmax), 8PSK modulation (GSM 18000 BTS + MCPA PWW BTS)

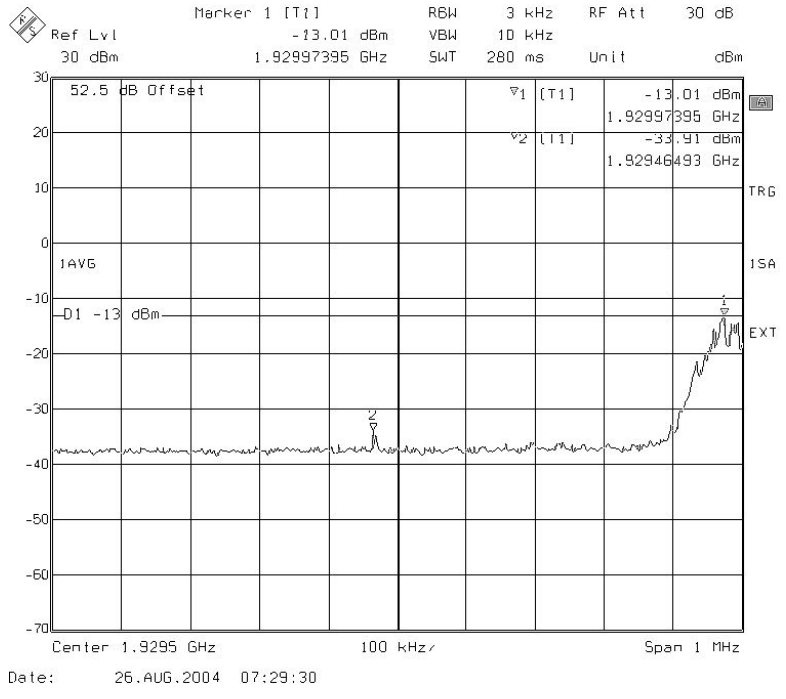


Figure 28 : -1 MHz adjacent band (Channel 512 + 7BCCH, Pmax), 8PSK modulation (GSM 18000 BTS + MCPA PWW BTS)

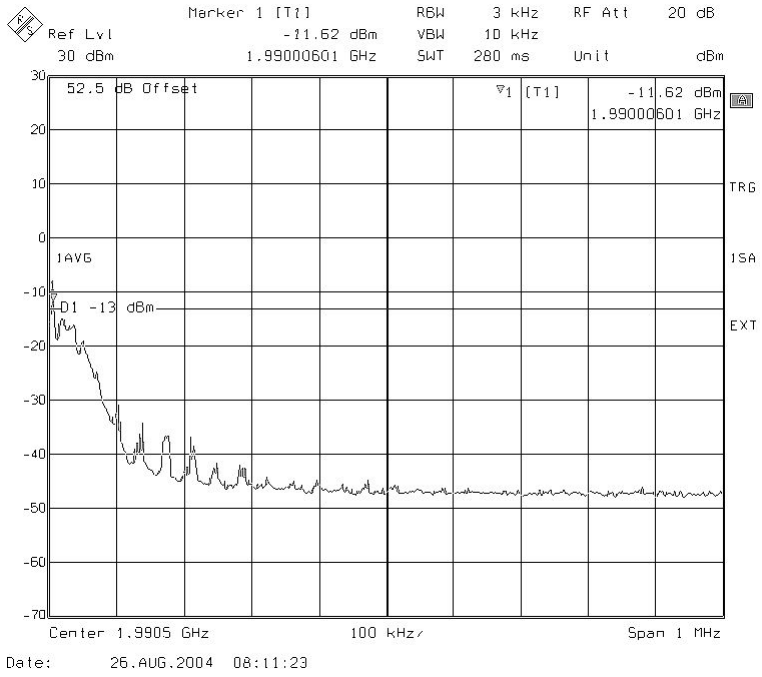


Figure 29 : +1 MHz adjacent band (Channel 810, Pmax), 8PSK modulation (GSM 18000 BTS + MCPA PWW BTS)

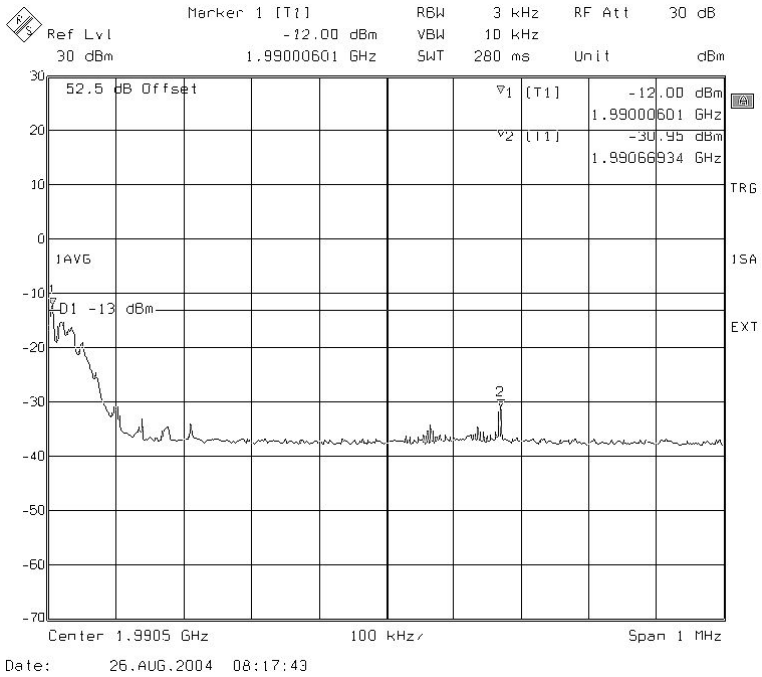


Figure 30 : +1 MHz adjacent band (Channel 810+ 7BCCH, Pmax), 8PSK modulation (GSM 18000 BTS + MCPA PWW BTS)

➢ OUT-OF-TX BAND TEST IN GMSK MODULATION FOR (GSM 18000 BTS + MCPA PWW BTS)

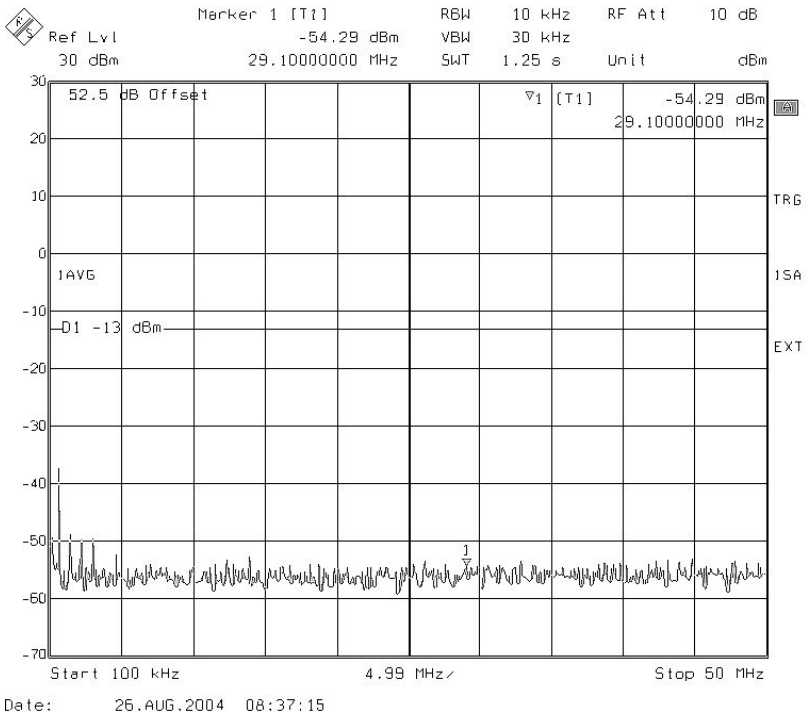


Figure 31: 100 kHz – 50 MHz Out-of-block emissions (Channel 810, Pmax),

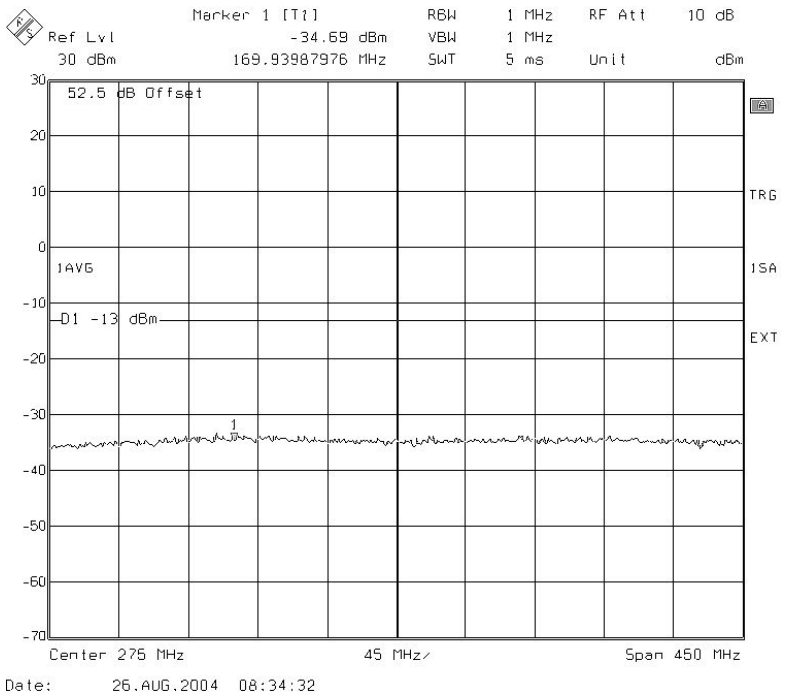


Figure 32: 50 MHz – 500 MHz Out-of-block emissions (Channel 810, Pmax),

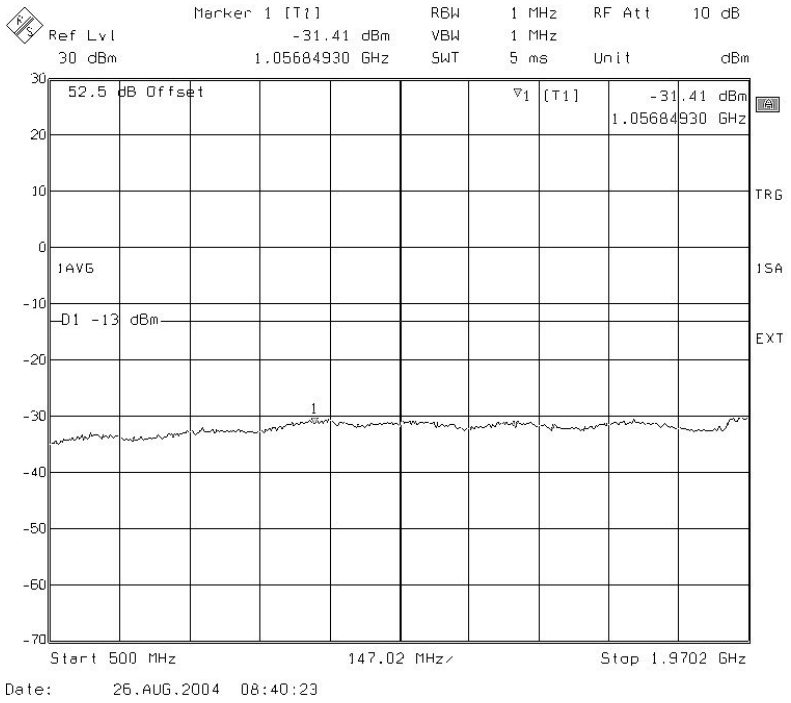


Figure 33: 500 MHz – 1970.2 MHz Out-of-block emissions (Channel 810, Pmax),

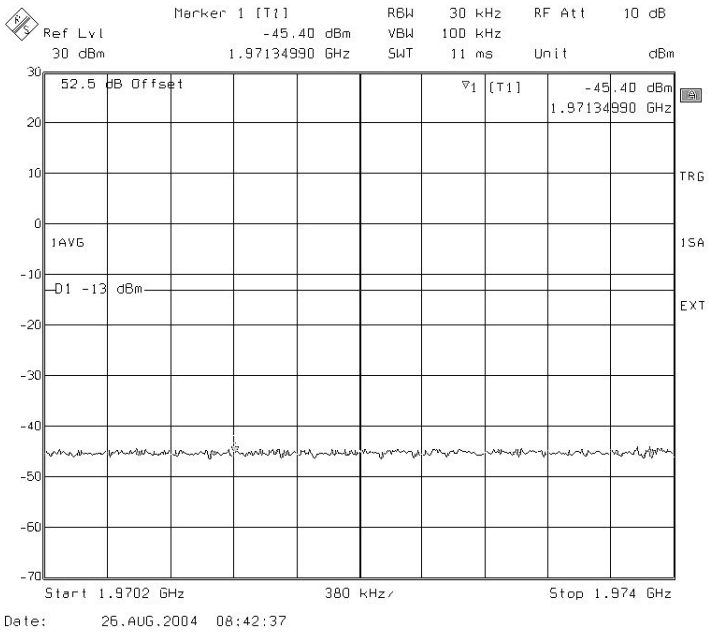


Figure 34: 1970.2 MHz – 1974 MHz Out-of-block emissions (Channel 810, Pmax),

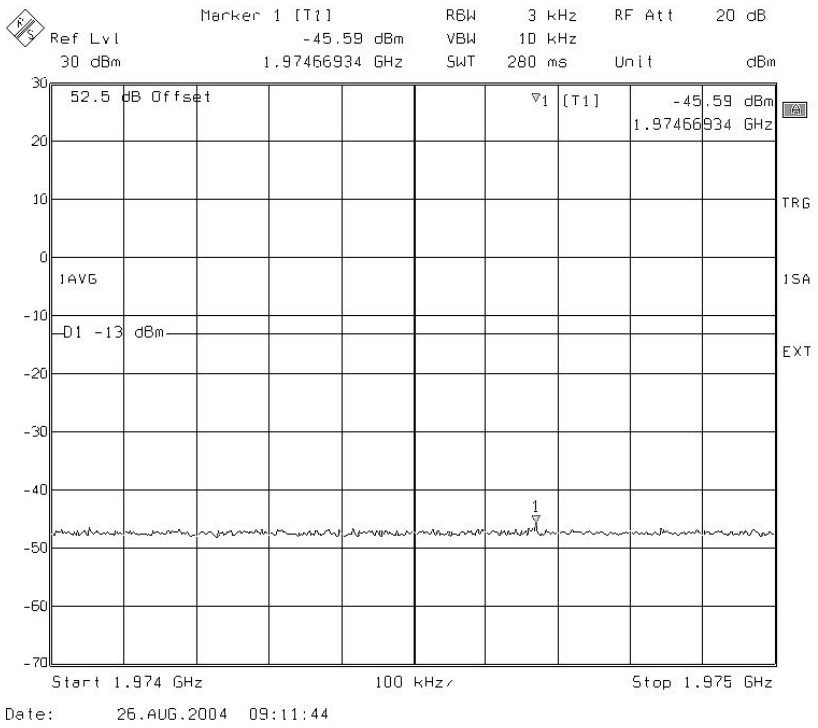


Figure 35: 1974 MHz – 1975 MHz Out-of-block emissions (Channel 810, Pmax),

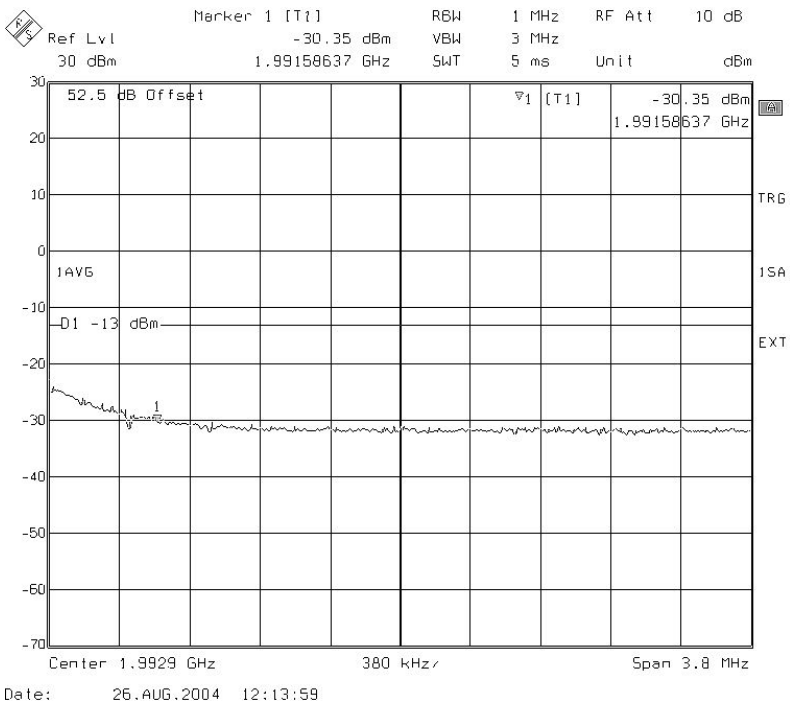


Figure 36: 1991 MHz – 1994.8 MHz Out-of-block emissions (Channel 810, Pmax),

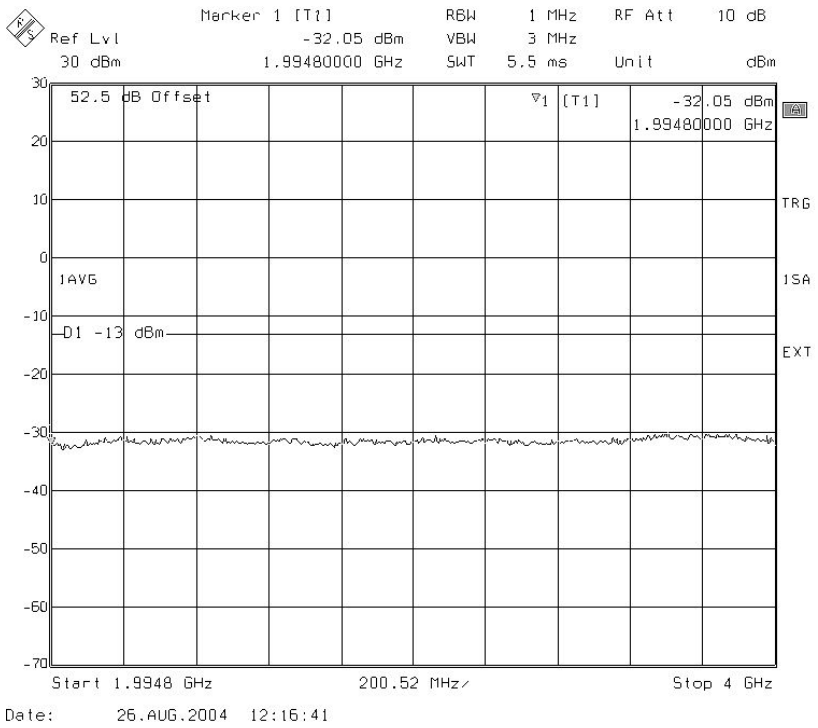


Figure 37: 1994 MHz –4 GHz Out-of-block emissions (Channel 810, Pmax),

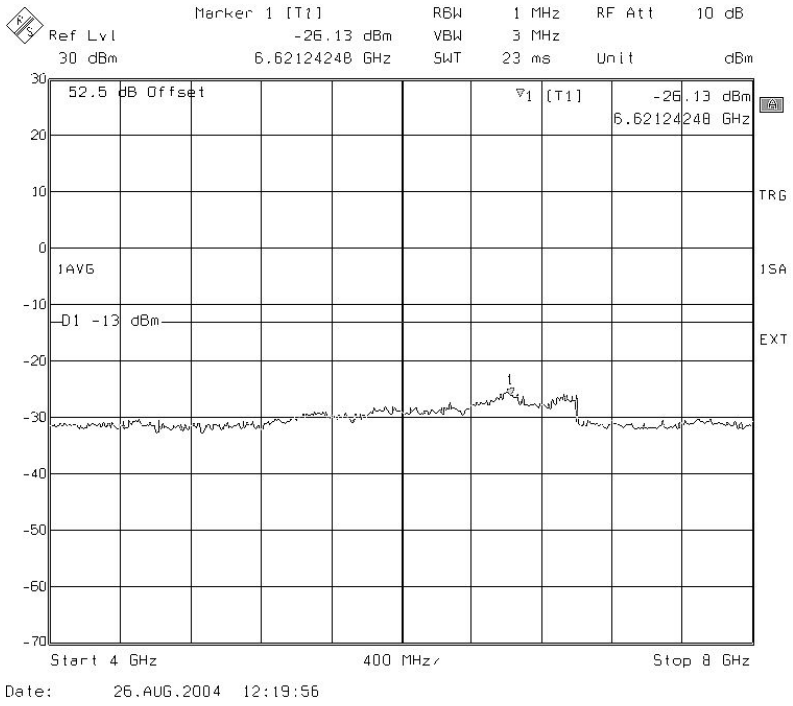


Figure 38: 4 GHz – 8 GHz Out-of-block emissions (Channel 810, Pmax),

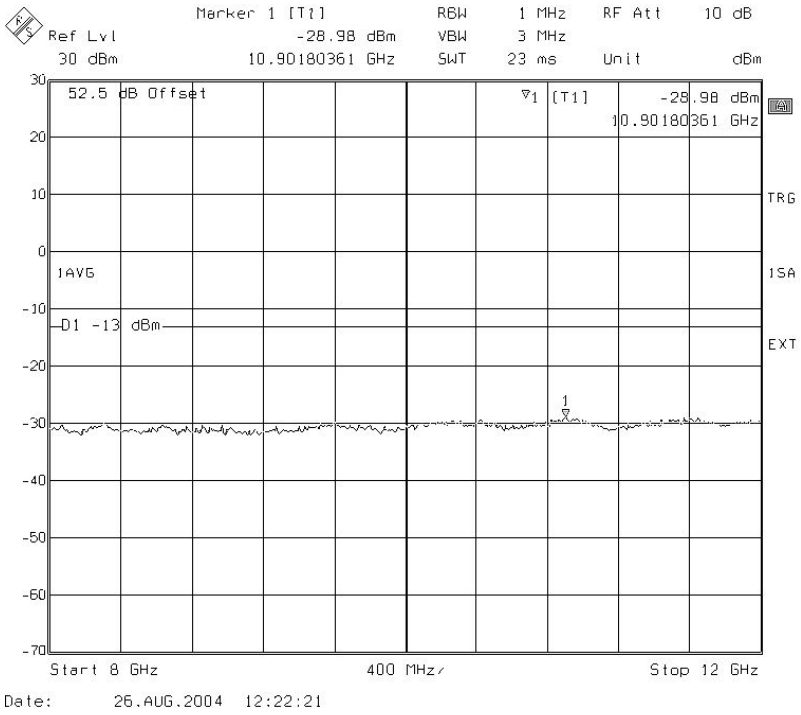


Figure 39: 8 GHz – 12 GHz Out-of-block emissions (Channel 810, Pmax),

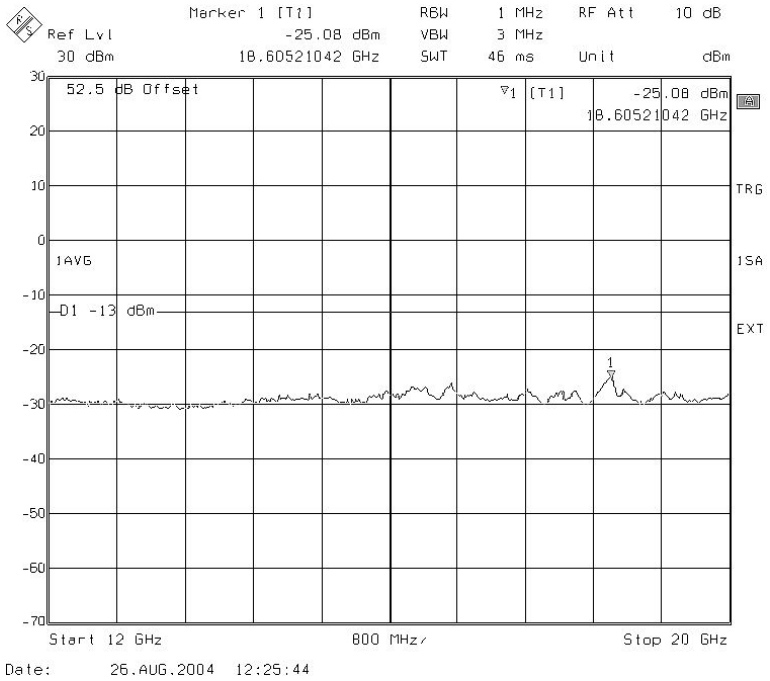


Figure 40: 12 GHz – 20 GHz Out-of-block emissions (Channel 810, Pmax),

4. ABBREVIATIONS & DEFINITIONS

4.1. ABBREVIATIONS

BTS	Base Transceiving Station
GSM	Global System for Mobile Communications
EDGE	Enhanced Data for GSM Evolution
PDTCH	Packet Data Logical Channel
MCPA	Multi Carrier Power Amplifier
LNA	Low Noise Amplifier
OMC	Operation and Maintenance Center
TCU	Trans-Coding Unit
MSC	Mobile Switching Center
RF	Radio Frequency
Tx	Transmitter

4.2. 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 $512 < n < 810$

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

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

IF frequencies on Radio Board: For Tx path 299 MHz
For Rx path 211 MHz

Clock frequency on the Radio Board 13MHz created from 4.096MHz coming from the Digital board.

5. MEASUREMENT EQUIPMENT LIST

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

Equipment description	Manufacturer	Model	Serial No.	V/A date
Power Meter	Giga-tronics	8542B	524088	09/2005
Spectrum Analyser	R&S	FSEM	525495	08/2006
30 dB attenuator 100 W	Spinner		25483	
20 dB attenuator 80 W	Radiall		R417720118	

6. EQUIPMENT LIST UNDER TEST

Software Compatibility :
BTS load : Modules software version : Load MRM / V15A118 (CDI103265) Load ICM / V15A123 (CDI103369) Load ABM / V15A123 (CDI103369)
PI software tools: TIL COAM version: Vv03b108 TIL Alarm version : V01d102 WIN TMI version : V03d302 WINSPU version : V04b201

HARDWARE EQUIPEMENT UNDER TEST GSM18000 MCPA BTS		
Description	**Hardware code**	**Comment**
BARE CABINET & ECU	NTT91600 D2	
Power Supply module		
UCPS rack	NTW703AA N2	
UCPS Rectifier 1000w	NTW703BB N3	
Interconnect board		
IBP0 - IBP 1	NTN027AA D1	
DBP 0 - DBP 1	NTN030AA D1	
ECU control board	NTT971CM D2	
RICO	NTN020CA D1	
Logical board		
IFM 0 - IFM 1	NTN025AA D1	
ICM 0 - ICM 1	NTN023AA D1	
ABM 0 – ABM 1	NTN029AA D2	
Radio modules PCS1900		
MRM	NTN050BA D1	
TX Coupler	NTN055CA 01	
RX Splitter	NTN055BA 01	

Additional delivery:

ARTICLE	PEC code	Release	Serial number	Comment
Filler ICM	NTN079CG		N/A	Qty : 1
External cable for alarm S18000/ALPRO 2	NTT997FA			Qty : 1
Cable : INTERCABINET TYPE N	NTQA4726			Qty : 9
Cable : DLNA MCPA L=10M	NTT995LD			Qty : 1
Cable : EXTERNAL D-LINK L=10M	NTT995ED			Qty : 4
Cable : EXTERNAL ABIS T1	NTT995ER			Qty : 1 Updated with an Abis box
Cable : EXTERNAL SYNCHRO S18O L=10M	NTT995EK			Qty : 1

Example of complete System configuration with MCPA PWW BTS:
CONFIG MCPA PARAGON 3 SECTORS HIGH POWER : **Config S888 (43dBm)**
Adjunct MCPA = NTT917DA-N0008442 => CONFIG MCPA PARAGON 3 SECT HPW
CONFIG MCPA PARAGON 3 SECTORS MEDIUM POWER : **Config S121212 (40dBm)**
Adjunct MCPA = NTT917DA-N0008445 => CONFIG MCPA PARAGON 3 SECT MPW

Power limitation to comply to Adjacent Band spurious at antenna connector

	System Power limitation **GMSK modulation**	**System Power limitation** **8 PSK modulation**
Config S888 **(Pmax = 43dBm)**	**Power Limitation :** Pmax – 2 dB **= 41 dBm**	**Power Limitation :** **Pmax – 2 dB** = 41 dBm
Config S121212 **(Pmax = 40dBm)**	**Pmax**	**Pmax**

As the margin for Edge blocks tests are not met with the complete system (GSM1800 MCPA BTS + MCPA PWW BTS) , we need the power restriction Pmax-2 on edge channel for the "GSM 18000 MCPA BTS" to comply to adjacent band spurious in the complete system .

End of DOCUMENT