Radio Test Report for the qualification of GSM 1900Mhz BTS 6000 Cabinets (FCC ID AB6BTS6000)

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Standard

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 6000 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 6000 BTS (FCC ID AB6BTS6000).

GSM 6000 BTS can integrate a maximum of 2 Radio-Modules (RM).

1.3. AUDIENCE FOR THIS DOCUMENT

This document is to be used by any person needing a view on Nortel Networks GSM 6000 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
[A3]	IC RSS-133	Spectrum Management and Telecommunication Policy – Radio Standards Specifications Issue 3– June 2005

2.2. REFERENCE DOCUMENTS

[R1] Radio Test Report in extreme conditions for the qualification of GSM1900Mhz BTS 6000 Cabinets (FCC)

EXTERNAL LABORATORY LCIE – N° 60049617-550145-R-TR-FCC

3. TEST REPORT: GSM 6000 BTS

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. TX RF CHAIN CONFIGURATION UNDER TESTS

Tests are performed on Radio Module (RM) in first slot RM0.

Radio Module is equipped with three identical RF ways Tx0, Tx1 and Tx2.
Each RF path includes a 30W Power amplifier.
The different RF way can be coupled with a coupling module placed before antenna connector.

Two types of coupling device are tested:

- DDM Duplexer on ways Tx0, Tx1,Tx2
- DDM H2 on way Tx0

H2 combiner introduces additional 3dB losses

3.3. MEASUREMENT RESULTS

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:

GSM 6000 BTS (FCC ID AB6BTS6000) is compliant with FCC Part24 requirement.

- **The following Power limitation is required to comply with Adjacent Band spurious which depends on coupling configuration:**

Coupling configuration	System Power limitation GMSK modulation	System Power limitation 8 PSK modulation
DDM Duplexer & Tx Filter (without H2)	**Power Limitation : Pmax – 2 dB = 42 dBm**	**Power Limitation : Pmax – 2 dB = 42 dBm**
DDM H2 Tx Filter H2	**Pmax = 41 dBm**	**Pmax = 41 dBm**

3.4. NAME OF TEST: RF POWER OUTPUT

3.4.1 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.

3.4.2 TEST RESULTS

The Table shows the test results of RF Output Power for **GMSK modulation** with DDM Duplexer configuration:

Radio Channel	**Frequency (MHz)**	**Tx0 DDM w/o H2 Power (dBm)**	**Tx1 DDM w/o H2 Power (dBm)**	**Tx2 TXF w/o H2 Power (dBm)**	**PA Output Power (dBm)**	**Limit (dBm)**
512	1930,2	43.3	43.4	43.4	GMSK (30W) 44.8 dBm +/- 0.5 dB	50
661	1960	43.7	43.8	43.8		
810	1989,8	43.6	43.6	43.6		

The Table shows the test results of RF Output Power for **8PSK modulation** with DDM duplexer configurations:

Radio Channel	**Frequency (MHz)**	**Tx0 DDM w/o H2 Power (dBm)**	**Tx1 DDM w/o H2 Power (dBm)**	**Tx2 TXF w/o H2 Power (dBm)**	**PA Output Power (dBm)**	**Limit (dBm)**
512	1930,2	43.5	43.5	43.6	8PSK (30W) 44.8 dBm +/- 0.5 dB	50
661	1960	43.8	43.9	43.9		
810	1989,8	43.7	43.8	43.8		

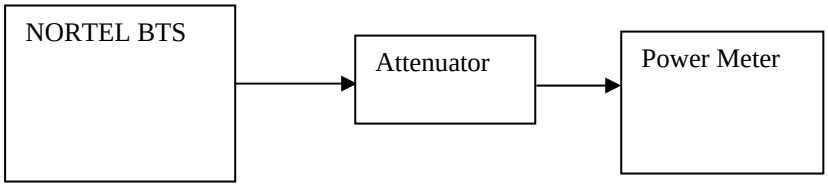
The Table shows the test results of RF Output Power with DDM H2 configuration:

Radio Channel	**Frequency (MHz)**	**Tx0 DDM H2 Power (dBm) GMSK**	**Tx0 DDM H2 Power (dBm) 8PSK**	**PA Output Power (dBm)**	**Limit (dBm)**
512	1930,2	40	40.2	GMSK / 8PSK (30W) 44.8 dBm +/- 0.5 dB	50
661	1960	40.4	40.5		
810	1989,8	40.2	40.4		

3.4.3 TEST PROCEDURE

The equipment was configured as shown in schematic 1.

Schematic: 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

3.5. NAME OF TEST: OCCUPIED BANDWIDTH

3.5.1 FCC REQUIREMENTS

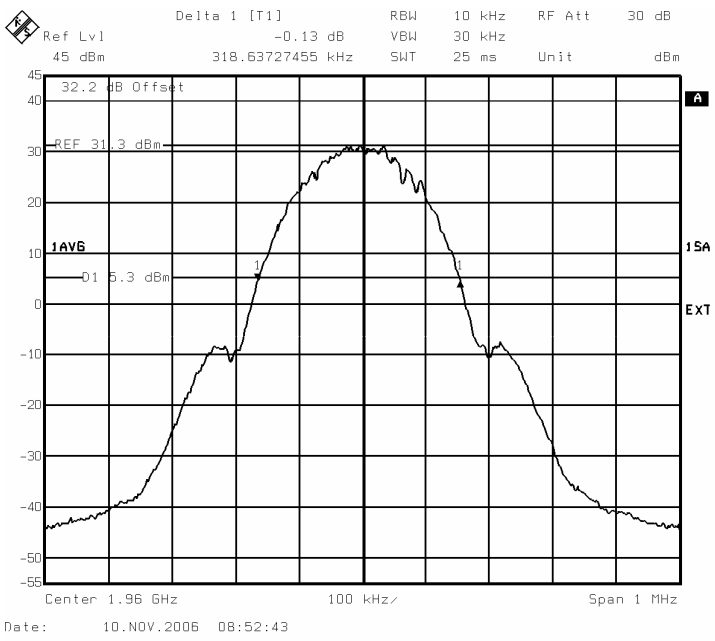
The occupied bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

3.5.2 TEST RESULTS WITH DDM DP CONFIGURATION

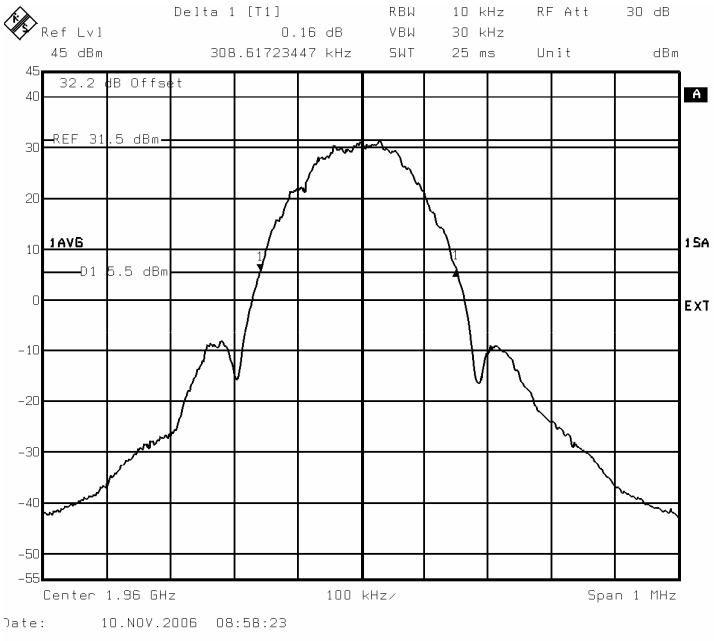
- **The maximum occupied bandwidth on Tx0** was found to be:
  318.6 kHz, measured on channel 661, f=1960 MHz in GMSK modulation,
  308.6 kHz, measured on channel 661, f=1960 MHz in 8PSK modulation.

Figure: Sample plot for occupied bandwidth for Tx0.

GMSK modulation



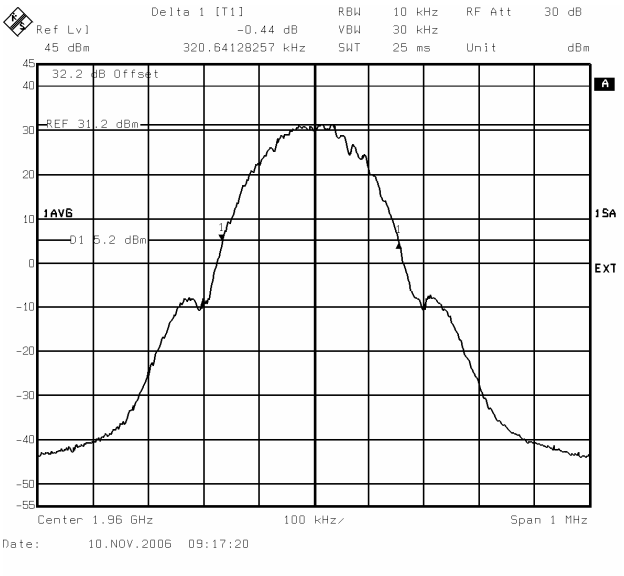
8PSK modulation



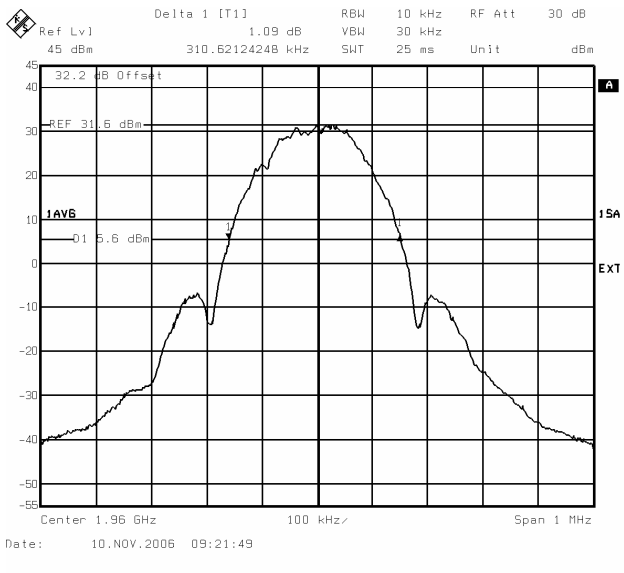
- **The maximum occupied bandwidth on Tx1** was found to be:
  320.6 kHz, measured on channel 661, f=1960 MHz in GMSK modulation,
  310.6 kHz, measured on channel 661, f=1960 MHz in 8PSK modulation.

Figure: Sample plot for occupied bandwidth in Tx1

GMSK modulation



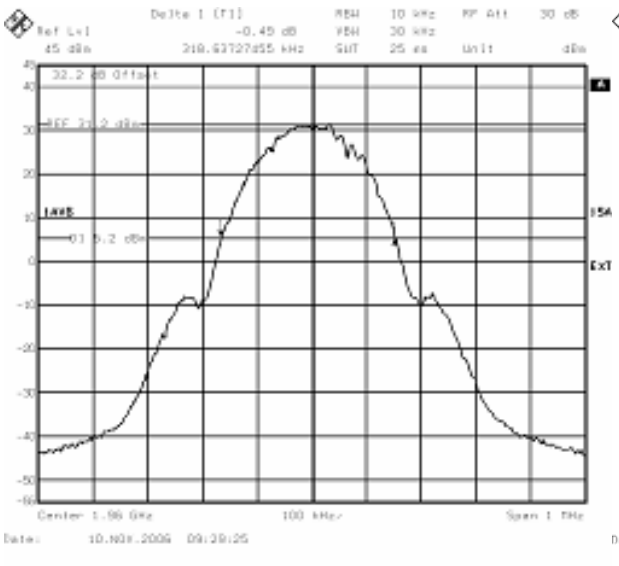
8PSK modulation



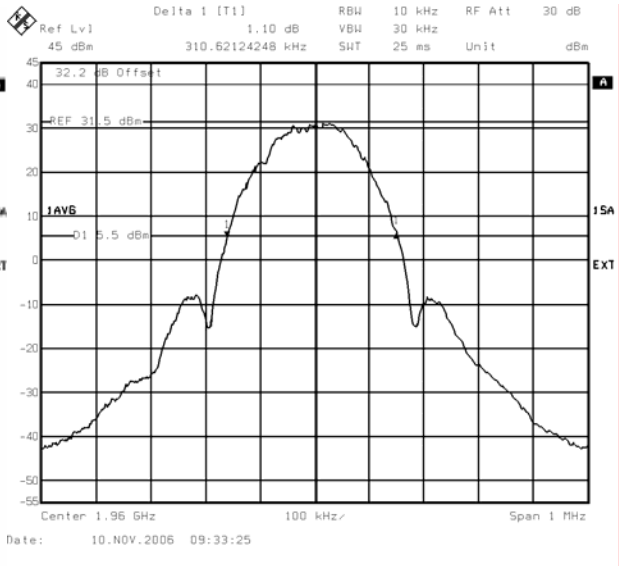
- **The maximum occupied bandwidth on Tx2** was found to be:
  318.6 kHz, measured on channel 661, f=1960 MHz in GMSK modulation,
  310.6 kHz, measured on channel 661, f=1960 MHz in 8PSK modulation.

Figure: Sample plot for occupied bandwidth in Tx2

GMSK modulation



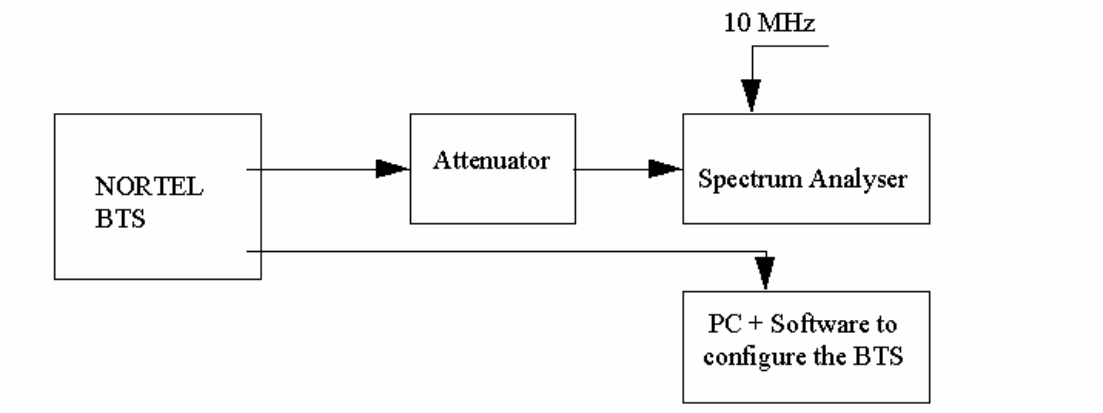
8PSK Modulation



3.5.3 TEST PROCEDURE

The equipment was configured as shown in schematic 2.

Schematic: 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:	Sample
Trace:	Average
Resolution bandwidth:	10 kHz
Video bandwidth:	30 kHz
Span:	1 MHz
Reference Level Offset:	Corrected to account for cable(s) and attenuator losses
Level range:	100 dB
Sweep time:	25 ms

3.6. NAME OF TEST: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

3.6.1 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.

3.6.2 TEST RESULTS WITH DDM DUPLEXER & TX FILTER (W/O H2) CONFIGURATION

The reference level for spurious emissions at the antenna terminals is taken from the measured output power (44.8 dBm = 30 Watts).

Therefore the spurious emissions must be attenuated by at least 43 + 10*Log (30) =57.8dB

The measured output power was 44.8 dBm therefore the limit is 44.8 – 57.8 = -13 dBm.

Spurious measurement is performed with the worst configuration with Duplexer coupling
The Nominal power at antenna connector: PD max =44.8 dBm.

The test compliance with DDM duplexer / TXF without H2 involves the compliance with DDM/ TxF H2 (two input coupler with 3dB loss coupling associated with TxF/duplexer).

- TX0 TEST WITH DDM DUPLEXER OR TX FILTER WITHOUT H2 CONFIGURATION

Tx 0 – Spurious emissions with the DDM Dp / TxF w/o H2 for GMSK modulation

Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
512	Pmax-2	-15.23	-13	2.23
810	Pmax-2	-14.88	-13	1.88

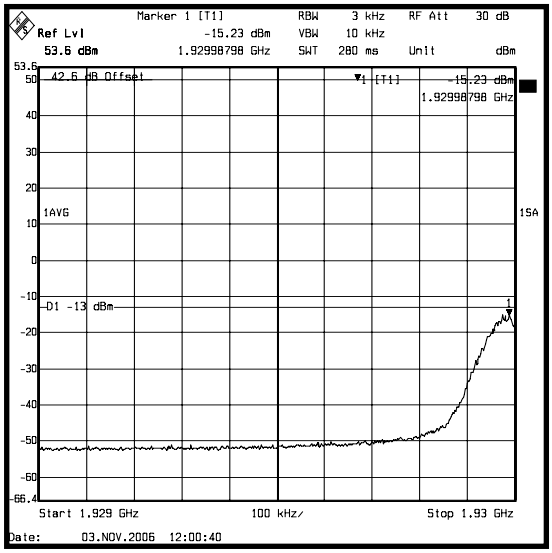
Tx 0 – Spurious emissions with the DDM Dp &TxF w/o H2 for 8PSK modulation

Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
512	Pmax-2	-15.25	-13	2.25
810	Pmax-2	-15.57	-13	2.57

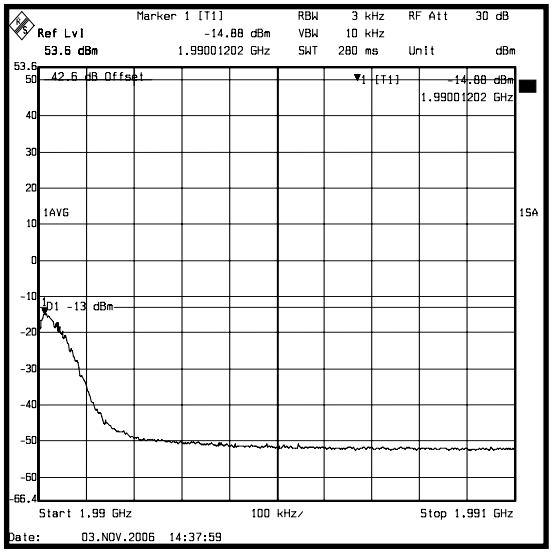
- **Graphs : Tx 0 – Spurious emissions with the DDM Dp &TXF w/o configuration**

GMSK modulation

-1 MHz adjacent band (Channel 512, Pmax-2dB)

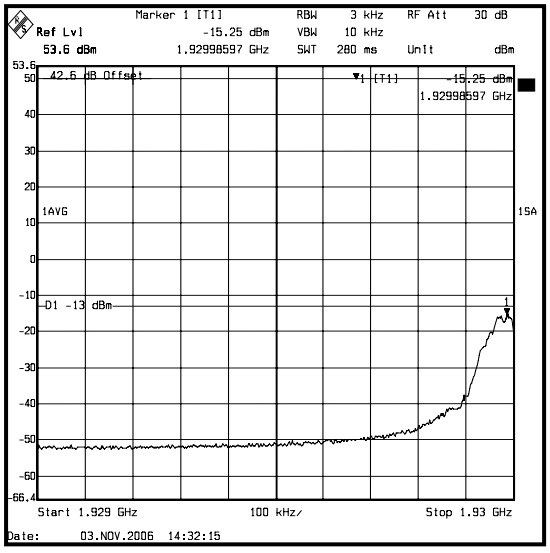


+1 MHz adjacent band (Channel 810, Pmax-2dB)

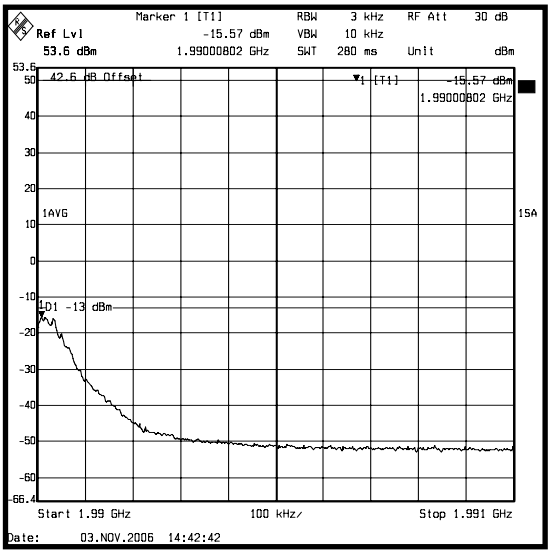


8PSK modulation

-1 MHz adjacent band (Channel 512, Pmax-2dB)



+1 MHz adjacent band (Channel 810, Pmax-2dB)



- TX1 TEST WITH DDM DUPLEXER OR TX FILTER WITHOUT H2 CONFIGURATION

Tx 1 – Spurious emissions with the Dp &TxF w/o H2 for GMSK modulation

Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
512	Pmax-2	-15.45	-13	2.45
810	Pmax-2	-14.42	-13	1.42

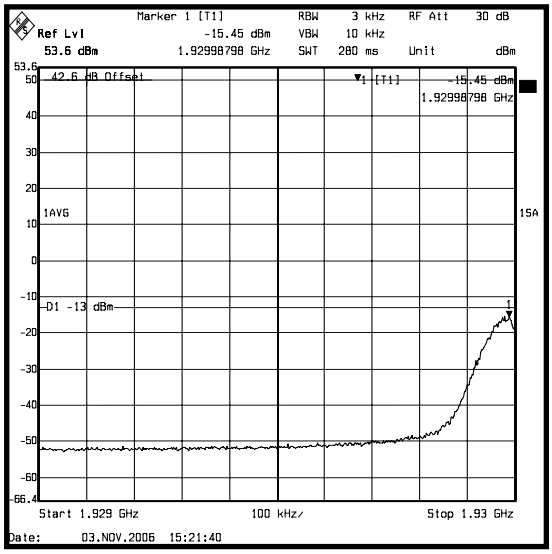
Tx 1 – Spurious emissions with the Dp & TxF w/o H2 for 8PSK modulation

Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
512	Pmax-2	-14.23	-13	1.23
810	Pmax-2	-14.29	-13	1.29

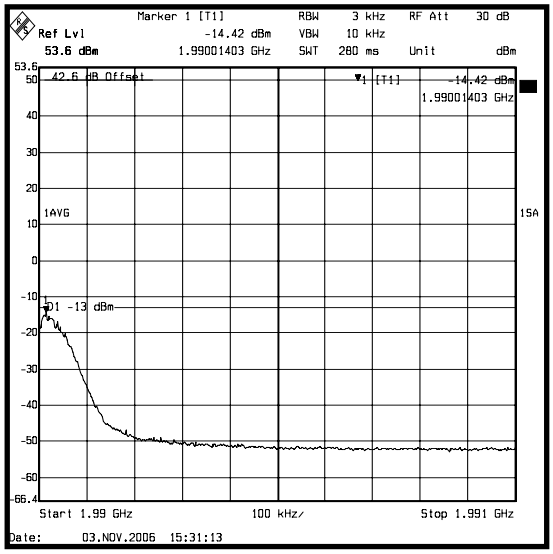
- **Graphs : Tx 1 – Spurious emissions with the Dp & TXF w/o configuration**

GMSK modulation

-1 MHz adjacent band (Channel 512, Pmax-2dB)

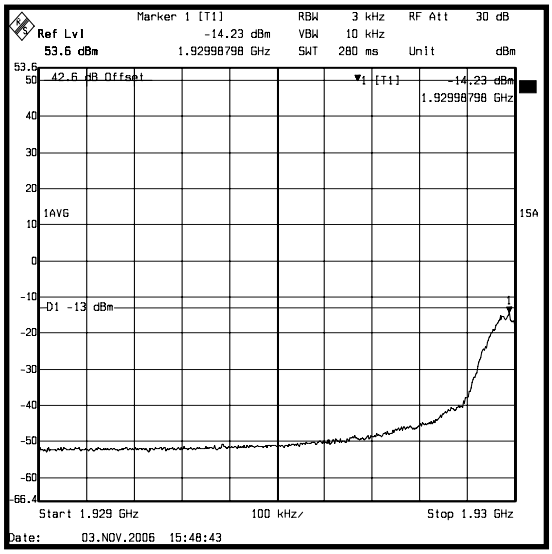


+1 MHz adjacent band (Channel 810, Pmax-2dB)

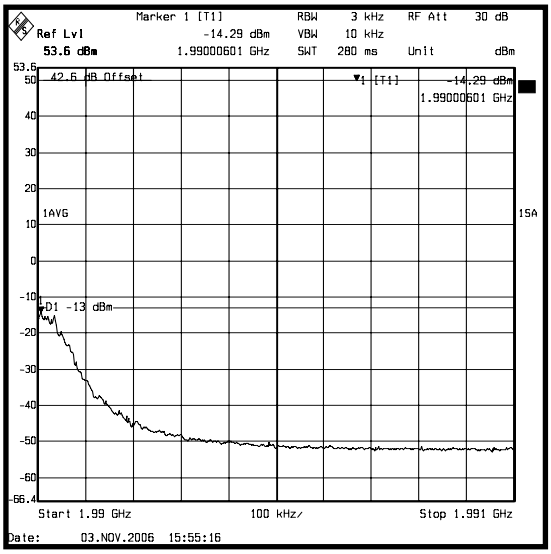


8PSK modulation

-1 MHz adjacent band (Channel 512, Pmax-2dB)



+1 MHz adjacent band (Channel 810, Pmax-2dB)



- TX2 TEST WITH DDM DUPLEXER OR TX FILTER WITHOUT H2 CONFIGURATION

Tx 2 – Spurious emissions with the DDM Dp & TxF w/o H2 for GMSK modulation

Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
512	Pmax-2	-15.83	-13	2.83
810	Pmax-2	-15.31	-13	2.31

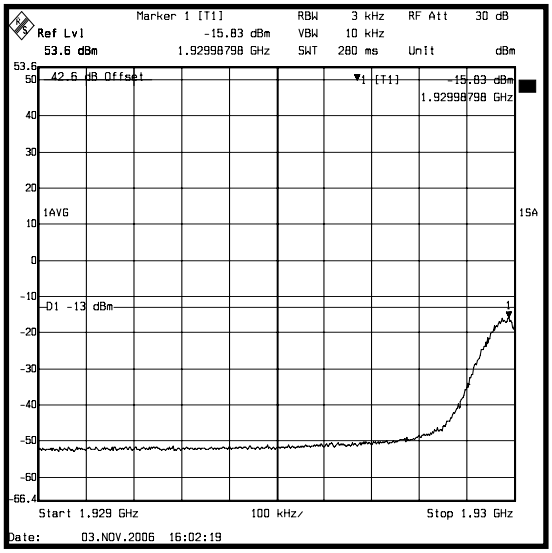
Tx 2 – Spurious emissions with the DDM Dp & TxF w/o H2 for 8PSK modulation

Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
512	Pmax-2	-15.05	-13	2.05
810	Pmax-2	-15.02	-13	2.02

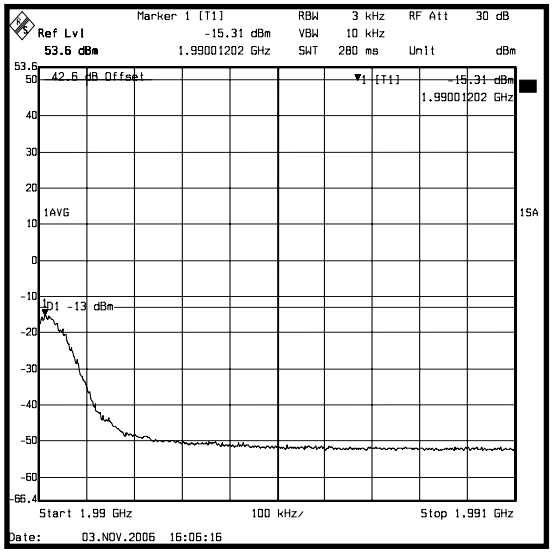
- **Graphs : Tx 2 – Spurious emissions with the DDM Dp & TXF w/o configuration**

GMSK modulation

-1 MHz adjacent band (Channel 512, Pmax-2dB)

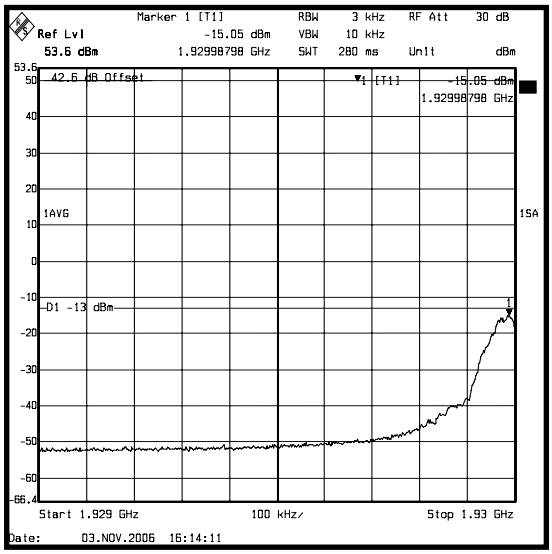


+1 MHz adjacent band (Channel 810, Pmax-2dB)

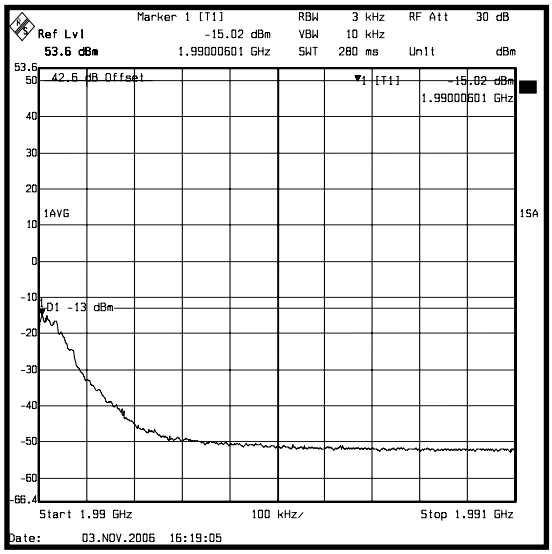


8PSK modulation

-1 MHz adjacent band (Channel 512, Pmax-2dB)



+1 MHz adjacent band (Channel 810, Pmax-2dB)



- OUT OF BLOCK EMISSION BAND – TX0 TEST WITH DDM DP & TX FILTER (W/O H2)

Test results for Tx0 DDM Dp & TxF w/0 H2, GMSK modulation

Frequency band	Level max. (dBm)	Spec. (dBm)	Margin (dB)
100 kHz – 50 MHz	-34.48	-13	21.48
50 – 500 MHz	-34.22	-13	21.52
500 – 1970.2MHz	-33.58	-13	20.58
1970.2 – 1974 MHz	-45.12	-13	35.12
1974 – 1975 MHz	-56.09	-13	43.09
1991 – 1994.8 MHz	-45.45	-13	32.45
1994.8 MHz – 3.5 GHz	-29.90	-13	16.9
3.5 – 8 GHz	-39.14	-13	26.14
8 – 12 GHz	-51.56	-13	38.56
12 – 20 GHz	-44.67	-13	31.67

Test results for Tx0 DDM Dp & TxF w/0 H2, 8PSK modulation

Frequency band	Level max. (dBm)	Spec. (dBm)	Margin (dB)
100 kHz – 50 MHz	-46.18	-13	33.18
50 – 500 MHz	-45.03	-13	32.03
500 – 1970.2MHz	-40.20	-13	27.20
1970.2 – 1974 MHz	-54.46	-13	41.46
1974 – 1975 MHz	-64.70	-13	51.70
1991 – 1994.8 MHz	-45.15	-13	32.15
1994.8 MHz – 4 GHz	-32.48	-13	19.48
4 – 8 GHz	-38.80	-13	25.80
8 – 12 GHz	-48.36	-13	35.36
12 – 20 GHz	-44.88	-13	31.88

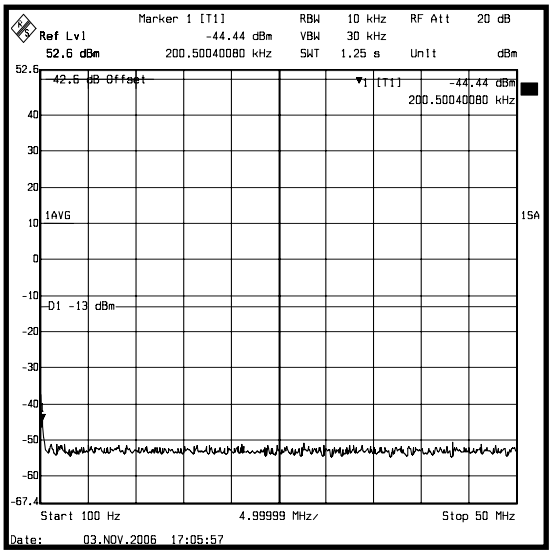
OUT OF BLOCK EMISSION BAND – GRAPHS

TX0 TEST WITH DDM DP & TX FILTER (W/O H2) - MODULATION GMSK

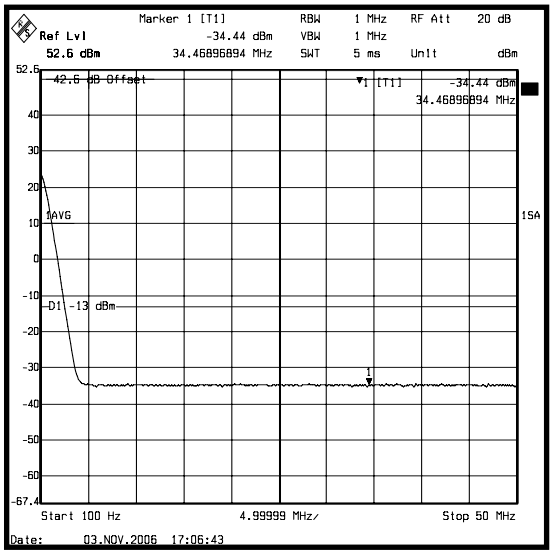
(Channel 810, Pmax), GMSK modulation.

100 Hz – 50 MHz

RBW=10 kHz

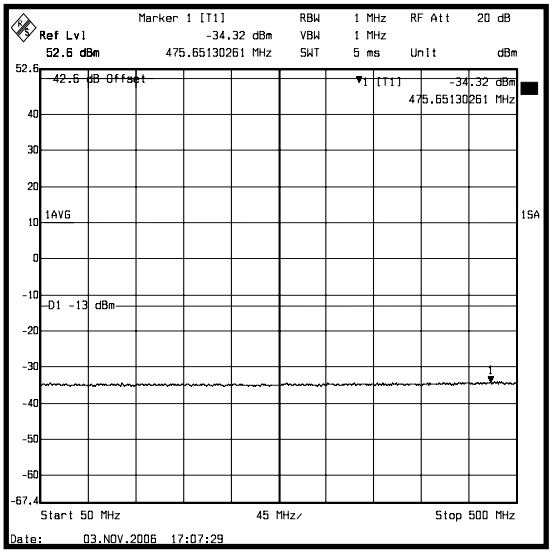


RBW=1 MHz (*)

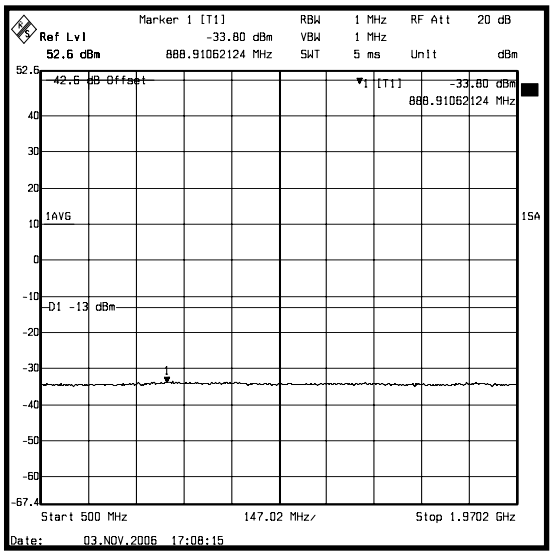


(*) *Note: spectrum line at 100 kHz is internal DC spectrum line of analyser*

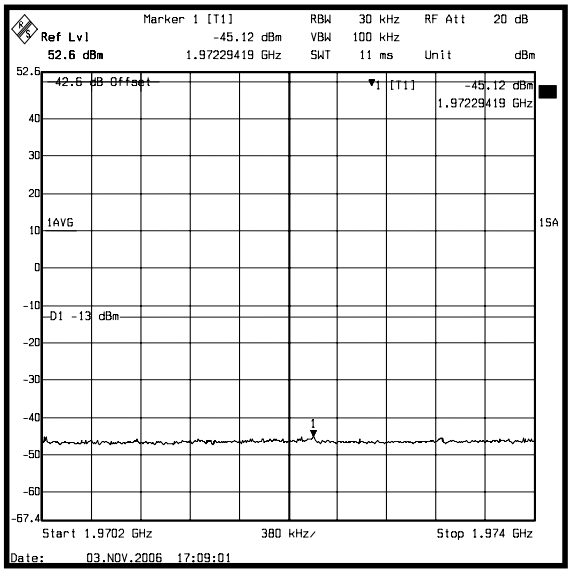
50 MHz – 500 MHz



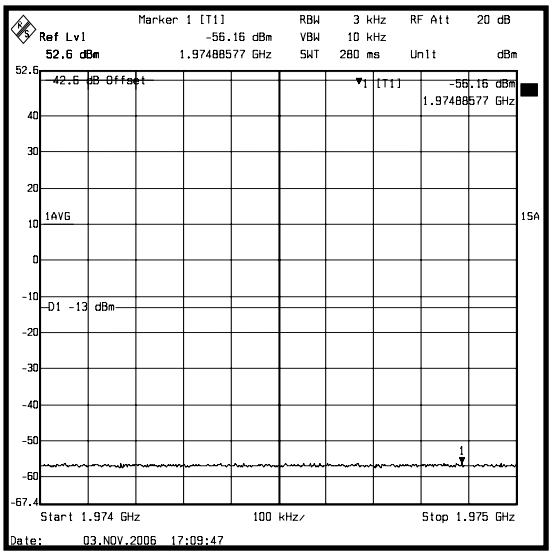
500 MHz – 1970.2 MHz



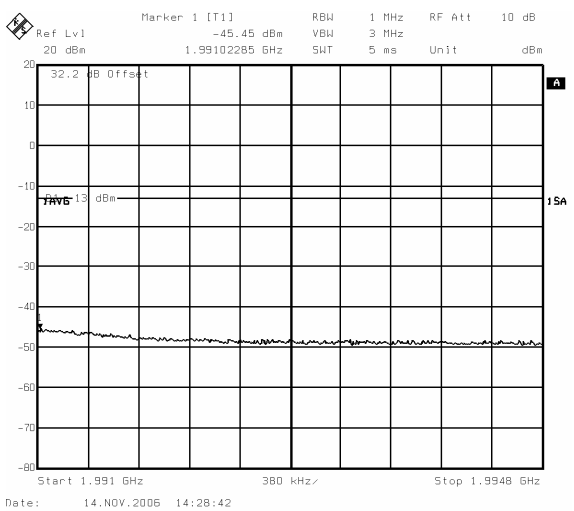
1970.2 – 1974 MHz



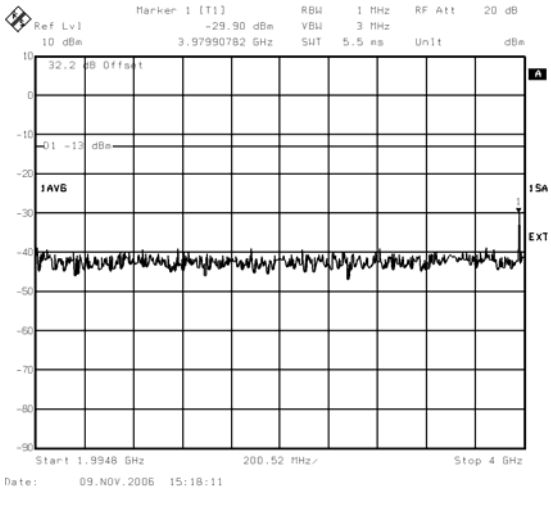
1974 – 1975 MHz



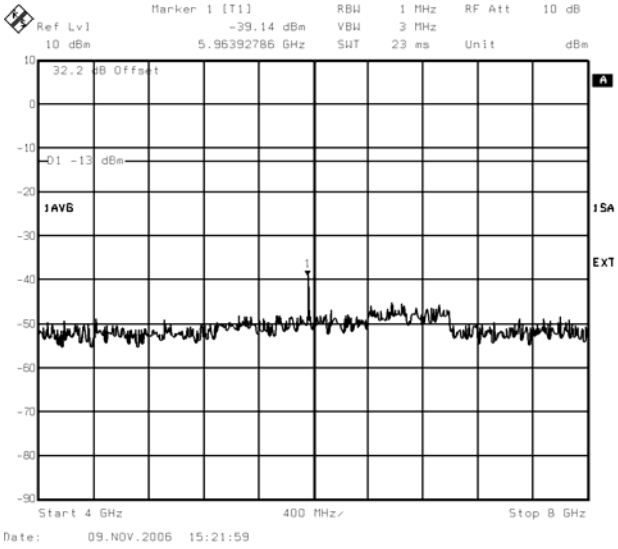
1991 – 1994.8 MHz



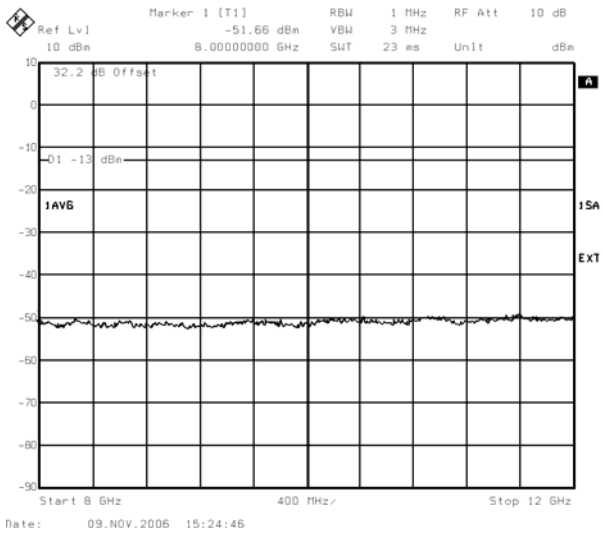
1994.8 MHz – 4 GHz



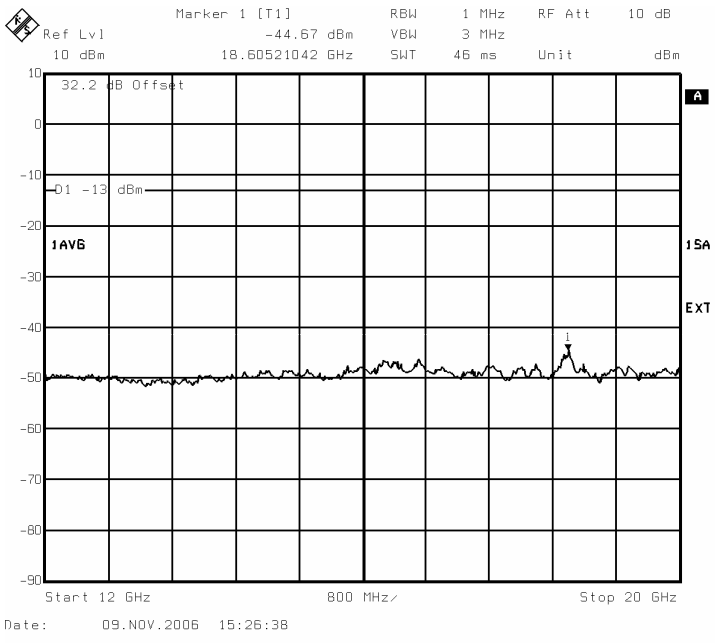
4 GHz – 8 GHz



8 GHz – 12 GHz



12 GHz – 20 GHz



3.6.3 TEST RESULTS WITH DDM H2 & TXF H2 CONFIGURATION

The reference level for spurious emissions at the antenna terminals is taken from the measured output power (41 dBm = 12.6 Watts).

Therefore the spurious emissions must be attenuated by at least 43 + 10*Log (12, 6) = 54 dB

The measured output power was 41 dBm therefore the limit is 41 – 54 = -13 dBm.

Spurious measurement is performed with the DDM H2 configuration.

The Nominal power at antenna connector: PD max =41 dBm.

Tx 0 – Spurious emissions with DDM H2 & TXF H2 for GMSK modulation

Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
512	Pmax	-17.19	-13	4.19
810	Pmax	-16.44	-13	3.44

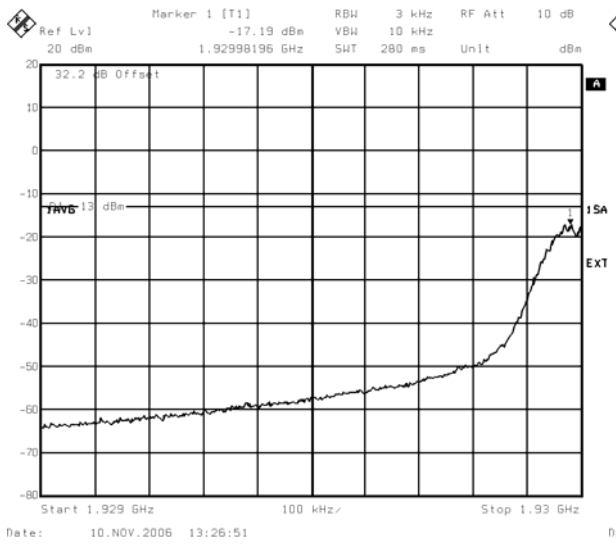
Tx 0 – Spurious emissions with the DDM H2 & TXF H2 for 8PSK modulation

Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
512	Pmax	-17.36	-13	4.36
810	Pmax	-17.49	-13	4.49

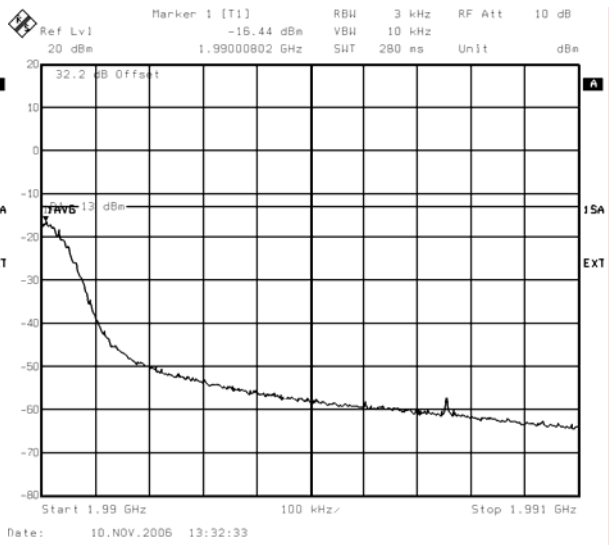
- **Tx 0 Spurious emissions with DDM H2 & TXF H2 configuration.**

GMSK modulation

-1 MHz adjacent band (Channel 512, Pmax),

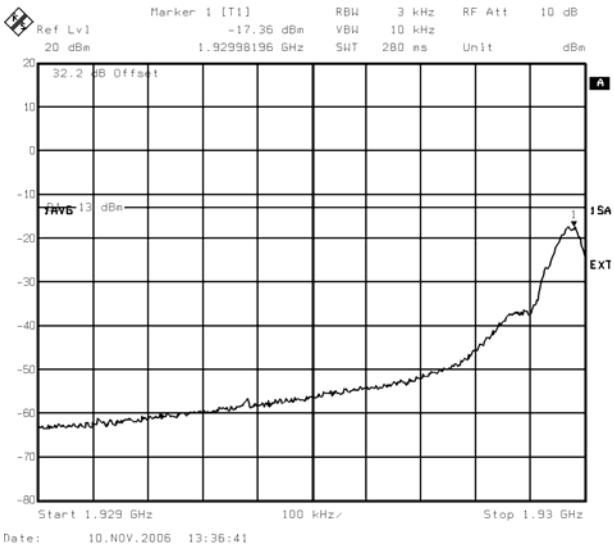


+1 MHz adjacent band (Channel 810, Pmax),

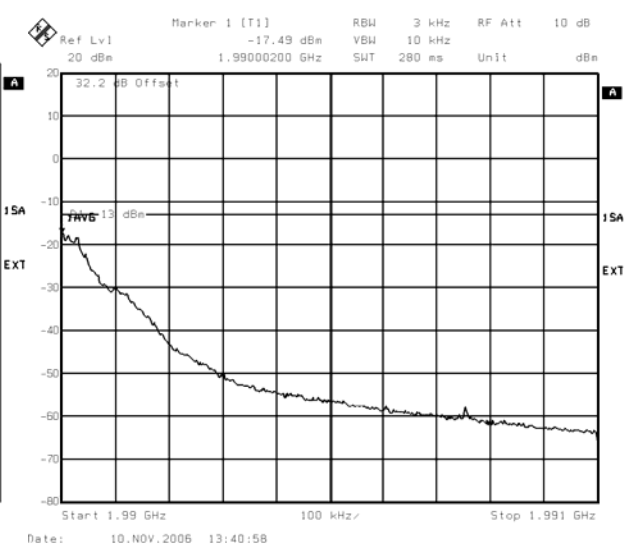


8PSK modulation

-1 MHz adjacent band (Channel 512, Pmax),



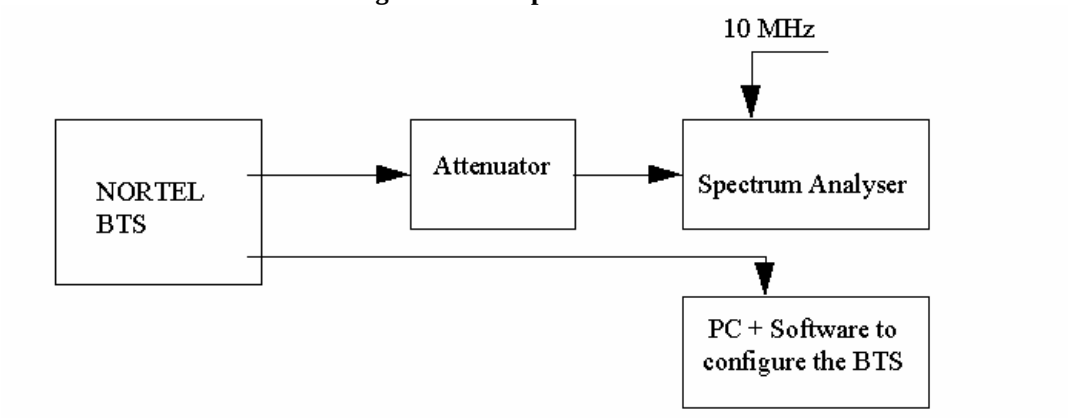
+1 MHz adjacent band (Channel 810, Pmax),



3.6.4 TEST PROCEDURE

The equipment was configured as shown in schematic 3.

Schematic: Test configuration for spurious emissions at antenna terminals



For adjacent channels emissions, the BTS nominal carrier frequency was adjusted to each block edge channel.

Channels 512 and 810 are those channels which are at the lower and upper edges of the PCS band respectively.

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

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

For these measurements, the resolution bandwidth of the spectrum analyzer was set to at least 1% of the emission bandwidth. In this case the emission bandwidth measured was closed to 300 kHz. Therefore, the resolution bandwidth was set to 3 kHz.

The spectrum analyzer had the following settings for adjacent band:

Resolution bandwidth:	3 kHz
Video bandwidth:	10 kHz
Span:	1 MHz
Reference Level Offset:	Corrected to account for cable(s), filter and attenuator losses
Level range:	100 dB
Sweep time:	Coupled
Detector :	Sample
Trace :	Average
Sweep count :	200

For all other measurements the BTS carrier frequency was adjusted to Channel 810.

The spectrum analyzer had the following settings for out of block emissions.

Resolution bandwidth:	1 MHz
Video bandwidth:	1 MHz

The emissions were investigated up to the tenth harmonic of the fundamental emission (20 GHz).

The measured level of the emissions was recorded and compared to the -13 dBm limit.

4. ABBREVIATIONS AND DEFINITIONS

4.1. ABBREVIATIONS

RM	Radio Module
BCF	Base Common Function
BTS	Base Transceiving Station
GSM	Global System for Mobile Communications
GPRS	General Packet Radio Service
EDGE	Enhanced Data for GSM Evolution
PDTCH	Packet Data Logical Channel
PA	Power Amplifier
e-SCPA	EDGE Single Carrier PA
HePA	Edge High 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.
Spectrum Analyser	Rohde & Schwarz	FSEA	502582
Spectrum Analyser	Rohde & Schwarz	FSEM	517751
Power Meter	Giga-tronics	8542C	520450
Signal Generator	Hewlett Packard	8657B	502223

6. EQUIPMENT LIST UNDER TEST

Software Compatibility :	**BTS load** :	V15E3E08
	Modules software version :	V15E2E09
PI software tools:	**Wintools**	v04b04e08

Hardware Equipment under test				
Designation	**Hardware code PEC Code**	**Release**	**Serial number**	**comments**
CABINET BTS6K	NTQ610FA	D1	NNTMGT004KG5	OUT AC ROHS VERS
IFM1	NTN025BF	01	NNTMGR00MFRW	INTERFACE MODULE1
ICM	NTN023AF	01	NNTMGR00MFWT	INTERFACE CTRL MOD
ICM	NTN023AF	01	NNTMGR00MFXC	INTERFACE CTRL MOD
ABM	NTN029AF	01	NNTMGR00MFL8	ABM ROHS VERSION
DDM 1900	NTN063AA	04	FICT02001FE9	HYBRIDS ROHS
RM 1900	NTN050PM	D4	CDN200640004	RADIO MODULE
UCPS RECTIFIER	NTN070BF	01	ATSNZH085330	1400W ROHS VERS
UCPS RECTIFIER	NTN070BF	01	ATSNZH085333	1400W ROHS VERS

Note : *RM0 NTN050PM D4 - CDN200640004*
LRM NTN021AC
RX NTN038AA
TX NTN036AB
RMPSU WIR NTN058AF

- **Power limitation to comply to Adjacent Band spurious at antenna connector**

Coupling configuration	**System Power limitation** **GMSK modulation**	**System Power limitation** **8 PSK modulation**
DDM Duplexer Tx Filter **(without H2)**	**Power Limitation :** **Pmax – 2 dB** = 42 dBm	**Power Limitation :** **Pmax – 2 dB** = 42 dBm
DDM H2 Tx Filter H2	**Pmax** = 41 dBm	Pmax = 41 dBm

END OF DOCUMENT