EXHIBIT 2

Test Report

Applicant: Northern Telecom Ltd.

For Certification on:

AB6OUDS8000

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PCS

NORTEL
NORTHERN TELECOM

S8000 Outdoor and Indoor BTS GSM 1900 : FCC Part 24 Class II Permissive Change Application AB6OUDS8000 : exhibits document

Reference : PCS/BTS/DJD/004574
Version : 01.01 / EN
Date : 05/Sept/02

Ext. ref. : AB6OUDS8000
Type : DQF
Product : S8000
Cat : E
Status : A

Author : A. CAILLE

Approved by : R. JACQUES

Abstract / Comments :

This document is reporting exhibits and present the FCC regulatory assessment realized in order to introduce the combiner H4D into the S8000 outdoor and indoor BTS system.

RF Tests concerning FCC Part 24 are performed by RF GSM Department
In laboratory 007 – Nortel Networks , 38 Bd Paul Cezanne , 78280 Guyancourt , France

Distribution lists :

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DOCUMENT AMENDMENTS

VERSION	DATE	COMMENTS	AUTHOR
01.01	05/09/02	Document creation	H. MARTEAU A. CAILLE

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TABLE OF CONTENTS

1. INTRODUCTION 4

1.1. OBJECT 4

1.2. SCOPE 4

2. RELATED DOCUMENTS 4

2.1. APPLICABLE DOCUMENTS 4

2.2. REFERENCE DOCUMENTS 4

3. ABBREVIATIONS & DEFINITIONS 5

3.1. ABBREVIATIONS 5

3.2. DEFINITIONS 5

4. EXHIBIT 1 : TEST REPORT 6

4.1. INTRODUCTION 6

4.2. MEASUREMENT RESULTS 6

4.3. NAME OF TEST : 2.1046 RF POWER OUTPUT 7

4.3.1. FCC REQUIREMENTS - FCC PART 24.232 7
4.3.2. TEST RESULTS 7
4.3.3. TEST PROCEDURE 9

4.4. NAME OF TEST : 2.1049 OCCUPIED BANDWIDTH 10

4.4.1. FCC REQUIREMENTS 10
4.4.2. TEST RESULTS 10
4.4.3. TEST PROCEDURE 11

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4.5. NAME OF TEST : 2.1051 SPURIOUS EMISSIONS AT ANTENNA TERMINALS13
4.5.1. FCC REQUIREMENTS LIMITS – FCC PART 24.238 13
4.5.2. TEST RESULTS 14
4.5.3. TEST PROCEDURE 27

4.6. MEASUREMENT EQUIPMENT LIST 29

5. EXHIBIT 2 : UPDATED EQUIPMENT LIST 30

☙ END OF DOCUMENT ❧ 31

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1. INTRODUCTION

1.1. OBJECT

In complement with PCS/BTS/DJD/0746 document, this report present the FCC regulatory assessment realized in order to introduce the combiner H4D into the S8000 outdoor and indoor BTS system.

1.2. SCOPE

This document applies to the S8000 BTS GSM 1900, Outdoor and Indoor versions. It is the Exhibit part of the FCC Part 24 Class II Permissive Change Application.

2. RELATED DOCUMENTS

2.1. APPLICABLE DOCUMENTS

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

2.2. REFERENCE DOCUMENTS

[R1]	PE/BTS/DJD/0222	FCC Part 24 Type Acceptance Filing for Nortel's S8000 Outdoor BTS AB6OUDS8000
[R2]	PCS/BTS/DJD/0730	AB6OUDS8000 : FCC Part 24 Class II Permissive Change Application : S8000 Indoor BTS
[R3]	PCS/BTS/DJD/0743	S8000 Outdoor and Indoor BTS GSM 1900 : FCC Part 24 Class II Permissive Change Application AB6OUDS8000
[R4]	PCS/BTS/DJD/0746	S8000 Outdoor and Indoor BTS GSM 1900 : FCC Part 24 Class II Permissive Change Application AB6OUDS8000

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3. ABBREVIATIONS & DEFINITIONS

3.1. ABBREVIATIONS

DRX	Driver Receiver Unit
e-DRX	EDGE DRX
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
LNA	Low Noise Amplifier
OMC	Operation and Maintenance Center
TCU	Trans-Coding Unit
MSC	Mobile Switching Center
RF	Radio Frequency
Tx	Transmitter

3.2. DEFINITIONS

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

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

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

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4. EXHIBIT 1 : TEST REPORT

4.1. 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.

4.2. MEASUREMENT RESULTS

Table 1 is a summary of the measurement results for this update.

Table 1 : 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	
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	Not tested	Note 1
2.1053		Fieldstrength of spurious radiation	Not tested	Note 2

Note 1 : Frequency stability is not tested because the combiner H4D is a passive coupler which doesn't affect BTS frequency stability.
Frequency stability results are the same as those reported in document [R4].
Note 2 : H4D module is a linear component, as H2D module (see H4D presentation document), that Spurious emissions at antenna terminals complies with the rules, with sufficient margin as H2D module, that H2D module complies with §2.1053, it is not necessary to make a measurement on the equipment with H4D configuration.

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4.3. NAME OF TEST : 2.1046 RF POWER OUTPUT

4.3.1. 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.

4.3.2. TEST RESULTS

Table 2 shows the test results for RF Output Power with the diplexer configuration :

- For GMSK modulation
- For 8PSK modulation supported by eDRX/eSCPA 1900.

Radio Channel	Frequency (MHz)	Measured RF Output Power (dBm) GMSK	Measured RF Output Power (dBm) 8PSK	Limit (dBm)
512	1930,2	43.8	43.9	50
548	1937,4	43.9	44.2	50
585	1944,8	44	44.3	50
587	1945,2	44	44.2	50
598	1947,4	44	44.3	50
610	1949,8	44	44.3	50
612	1950,2	44	44.3	50
648	1957,4	44.1	44.3	50
685	1964,8	44.1	44.3	50
687	1965,2	44.1	44.3	50
698	1967,4	44.1	44.3	50
710	1969,8	44.1	44.1	50
712	1970,2	44.1	44.1	50
723	1972,4	44	44.1	50
735	1974,8	44	44.1	50
737	1975,2	44	44.2	50

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773	1982,4	44	44	50
810	1989,8	43.8	44	50

Table 3 shows the test results for RF Output Power with the diplexer and hybrid H4D in GMSK modulation.

Radio Channel	Frequency (MHz)	Measured RF Output Power (dBm)	Limit (dBm)
512	1930,2	37.1	50
548	1937,4	37.3	50
585	1944,8	37.4	50
587	1945,2	37.4	50
598	1947,4	37.4	50
610	1949,8	37.4	50
612	1950,2	37.4	50
648	1957,4	37.5	50
685	1964,8	37.5	50
687	1965,2	37.5	50
698	1967,4	37.5	50
710	1969,8	37.5	50
712	1970,2	37.5	50
723	1972,4	37.5	50
735	1974,8	37.5	50
737	1975,2	37.5	50
773	1982,4	37.5	50
810	1989,8	37.4	50

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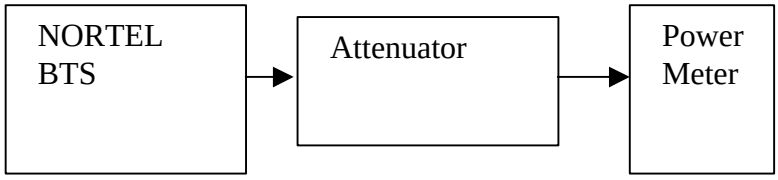
4.3.3. TEST PROCEDURE

The equipment was configured as shown in schematic 1.

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

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4.4. NAME OF TEST : 2.1049 OCCUPIED BANDWIDTH

4.4.1. 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 23 dB below the transmitter power.

4.4.2. TEST RESULTS

The maximum occupied bandwidth was found to be:
308.6 kHz , measured on channel 661, f = 1960.0 MHz GMSK modulation.
300.6 kHz , measured on channel 661, f = 1960.0 MHz 8PSK modulation.

Figure 1: Sample plot for occupied bandwidth . GMSK modulation

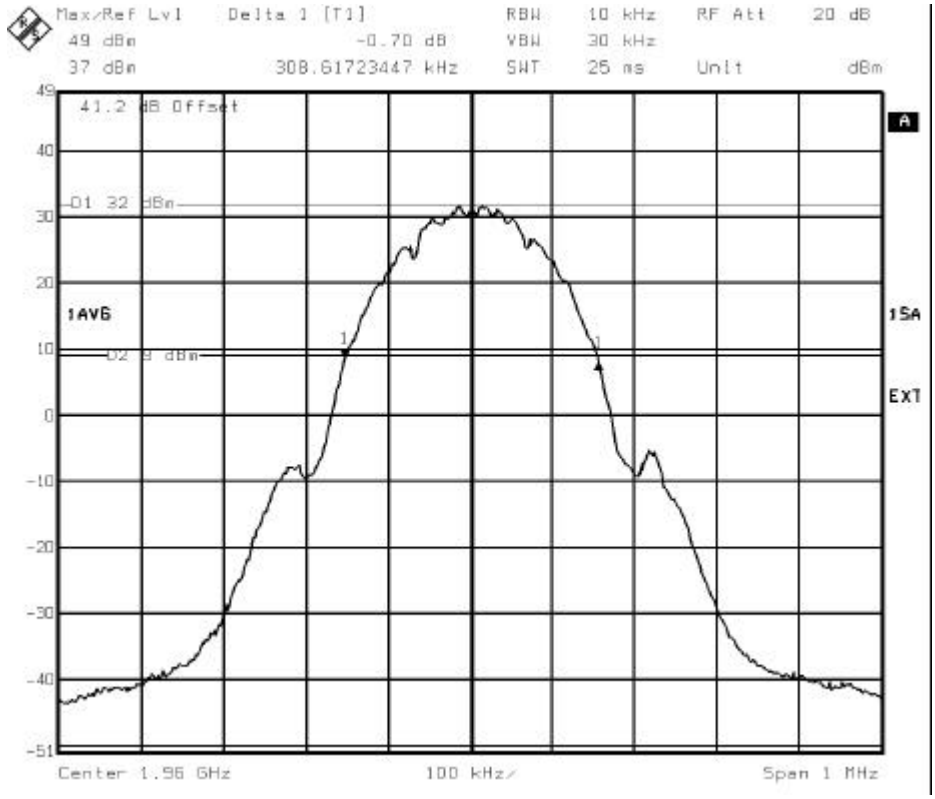

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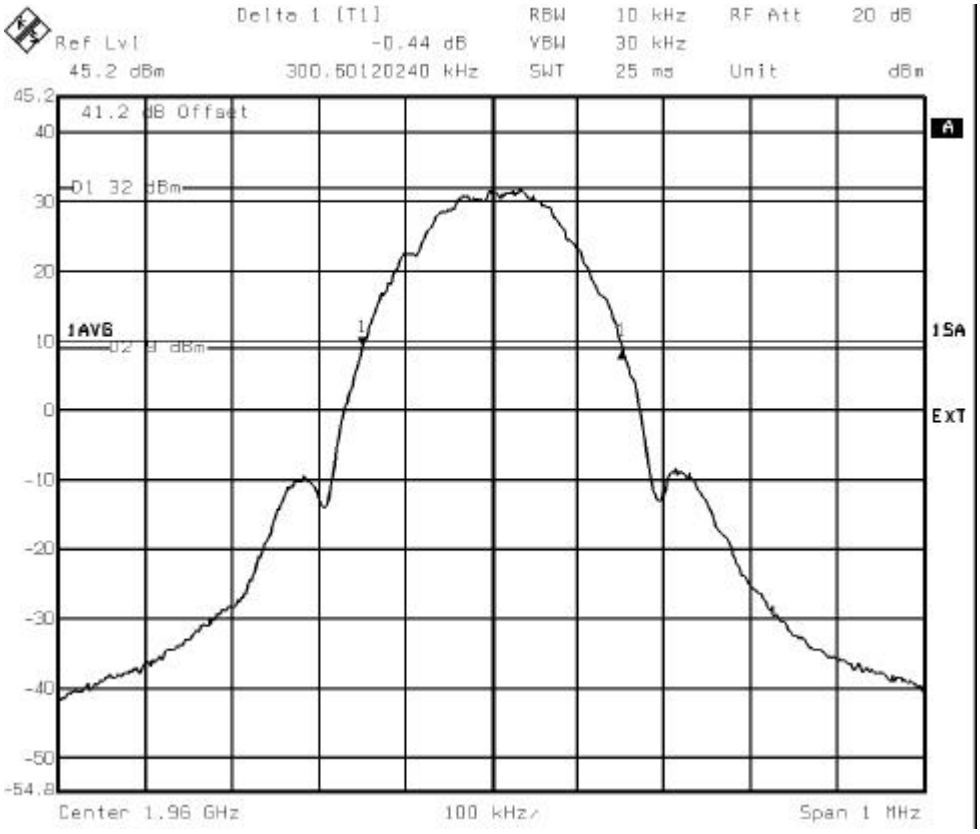
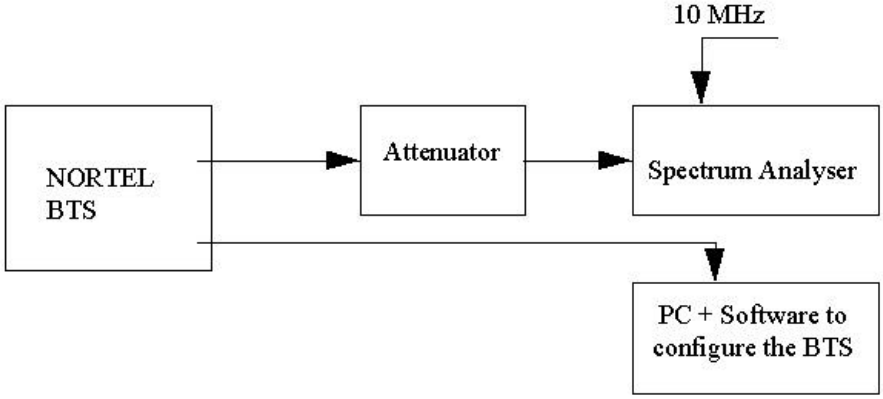
Figure 2 : Sample plot for occupied bandwidth . 8PSK modulation



4.4.3. TEST PROCEDURE

The equipment was configured as shown in schematic 2.

Schematic 2 : Test configuration for Occupied bandwidth



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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 were at the bottom and top of the transmit band.

The occupied bandwidth was measured by determining the bandwidth out of which all emissions are attenuated at least 23 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

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4.5. NAME OF TEST : 2.1051 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

4.5.1. 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 23 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.

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4.5.2. TEST RESULTS

The reference level for spurious emissions at the antenna terminals is taken from the measured output power (43.9 dBm = 24.5 Watts).
Therefore the spurious emissions must be attenuated by at least 43 + 10*Log(24.5) = 56.9 dB. The measured output power was 43.9 dBm ; therefore the limit is 43.9 - 56.9 = -13 dBm.

Spurious measurement is performed with the worst configuration with Duplexer coupling and 30W Power amplifier .
The Nominal power at antenna connector : PD max =44dBm.
The test compliance with duplexer involves the compliance with H2D (two input coupler with 3dB loss coupling associated with duplexer) and the compliance with H4D configuration (four input coupler with 7dB loss coupling associated with duplexer).

Tables 3 and 4 show the results for Spurious Emissions at Antenna Terminals.

Table 3 : Test results for Spurious Emissions at Antenna Terminals with the diplexer for GMSK modulation.

	Channel	Power emission level	Spurious Emissions Level (dBm)	Limit (dBm)	Margin (dB)
A	512	Pmax - 4 dB	-16.6	-13	3.6
A	585	Pmax - 4 dB	-14.1	-13	1.1
D	587	Pmax - 4 dB	-16.9	-13	3.9
D	610	Pmax - 4 dB	-14.5	-13	1.5
B	612	Pmax - 4 dB	-17.5	-13	4.5
B	685	Pmax - 4 dB	-14.1	-13	1.1
E	687	Pmax - 4 dB	-17.2	-13	4.2
E	710	Pmax - 4 dB	-14.9	-13	1.9
F	712	Pmax - 4 dB	-17.2	-13	4.2
F	735	Pmax - 4 dB	-14.5	-13	1.5
C	737	Pmax - 4 dB	-17.1	-13	4.1
C	810	Pmax - 4 dB	-14.4	-13	1.4

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Table 4 : Test results for Spurious Emissions at Antenna Terminals with the diplexer for 8PSK modulation

	Channel	Power emission level	Spurious Emissions Level (dBm)	Limit (dBm)	Margin (dB)
A	512	P max	-14.9	-13	1.9
A	585	P max	-13.3	-13	0.3
D	587	P max	-15.1	-13	2.1
D	610	P max	-13.8	-13	0.8
B	612	P max	-14.9	-13	1.9
B	685	P max	-13.3	-13	0.3
E	687	P max	-14.6	-13	1.6
E	710	P max	-13.5	-13	0.5
F	712	P max	-14.5	-13	1.5
F	735	P max	-13.8	-13	0.8
C	737	P max	-14.6	-13	1.6
C	810	P max	-14.1	-13	1.1

Table 5 : Test results for Spurious Emissions at Antenna Terminals with the hybrid H4D Diplexer for GMSK modulation

	Channel	Power emission level	Spurious Emissions Level (dBm)	Limit (dBm)	Margin (dB)
A	512	Pmax	-19.8	-13	6.8
A	585	Pmax	-17.8	-13	4.8
B	612	Pmax	-18.8	-13	5.8
B	685	Pmax	-16.8	-13	3.8
C	737	Pmax	-19.6	-13	6.6
C	810	Pmax	-17.1	-13	4.1

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Table 6 : Test results for Spurious Emissions at Antenna Terminals with diplexer for GMSK modulation.

Frequency (MHz)	Spurious Emissions Level (dBm)	Limit (dBm)	Margin (dB)
50	-36	-13	23
68	-44.4	-13	31.4
1231	-41	-13	28
1972.5	-47.1	-13	34.1
1974.8	-58	-13	45
1991	-39.8	-13	26.8
3750.8	-32	-13	19
6966	-28.4	-13	15.4
10926	-27.7	-13	14.7
12337	-27.2	-13	14.2

Notes :

GMSK modulation measurements:
Figures from 3 to 6 show sample plots for the case when the transmitter was tuned with the power reduced by 4 dB in diplexer configuration for differents Edge Channel 512 , 585, 737, 810.

Figures from 7 to 10 show sample plots for the case when the transmitter was tuned at maximum power in Hybrid H4D diplexer configuration for differents Edge Channel 512 , 585, 737, 810.

8PSK modulation measurements:
Figures from11 to 14 show sample plots for the case when the transmitter was tuned at maximum power in diplexer configuration.

Out of band measurement in GMSK modulation:
Figures from 15 to 17 show sample plots for frequency spans from 0 to 20 GHz with emission on channel 810 at maximum power with diplexer configuration.

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Figure 3 : -1 MHz adjacent band (Channel 512, Pmax - 4 dB)
Diplexer only, GMSK modulation

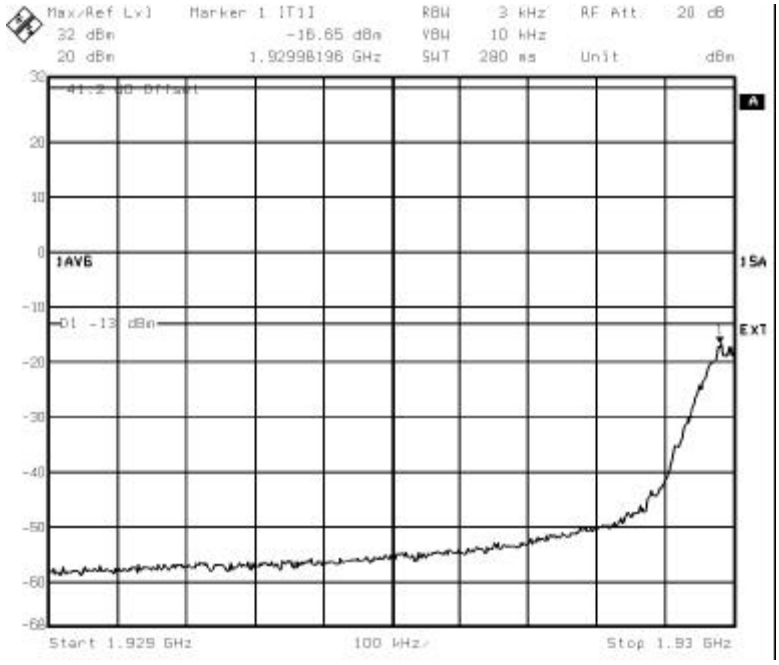

Figure 4 : +1 MHz adjacent band (Channel 585, Pmax - 4 dB)
Diplexer only, GMSK modulation

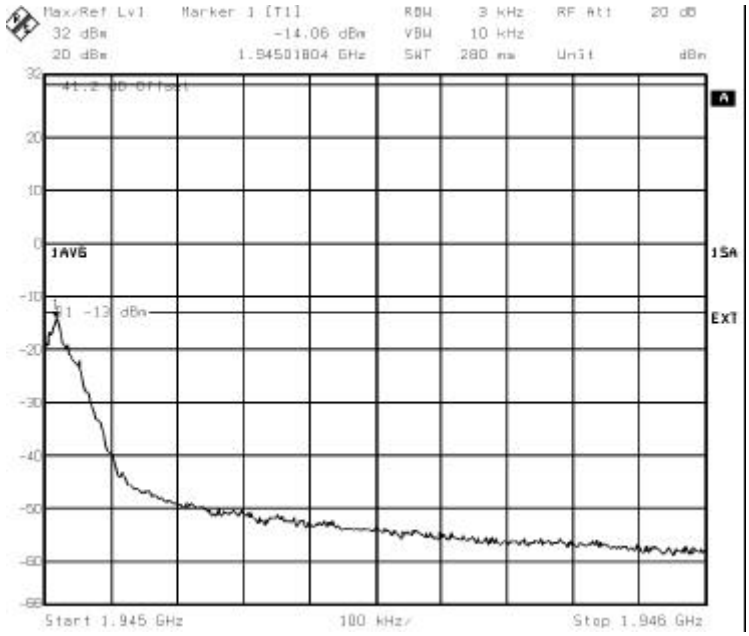

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Figure 5 : -1 MHz adjacent band (Channel 737, Pmax - 4 dB)
Diplexer only, GMSK modulation

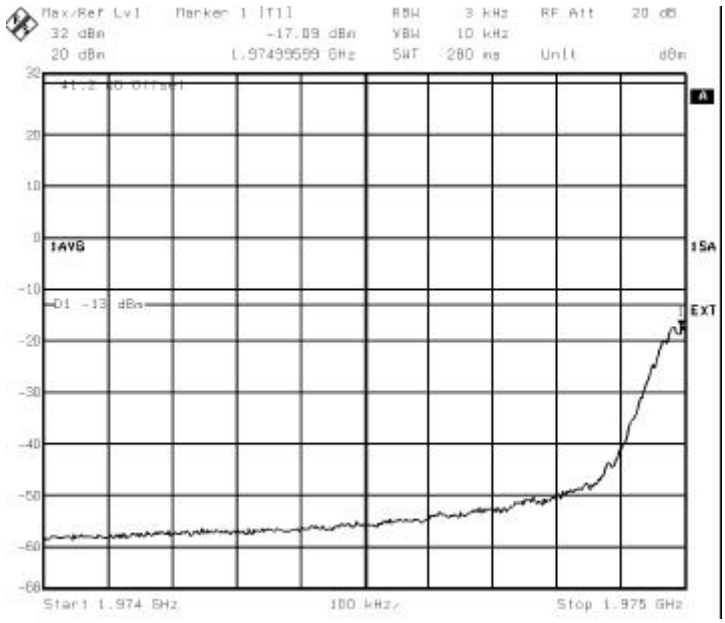

Figure 6 : +1 MHz adjacent band (Channel 810, Pmax - 4 dB)
Diplexer only, GMSK modulation

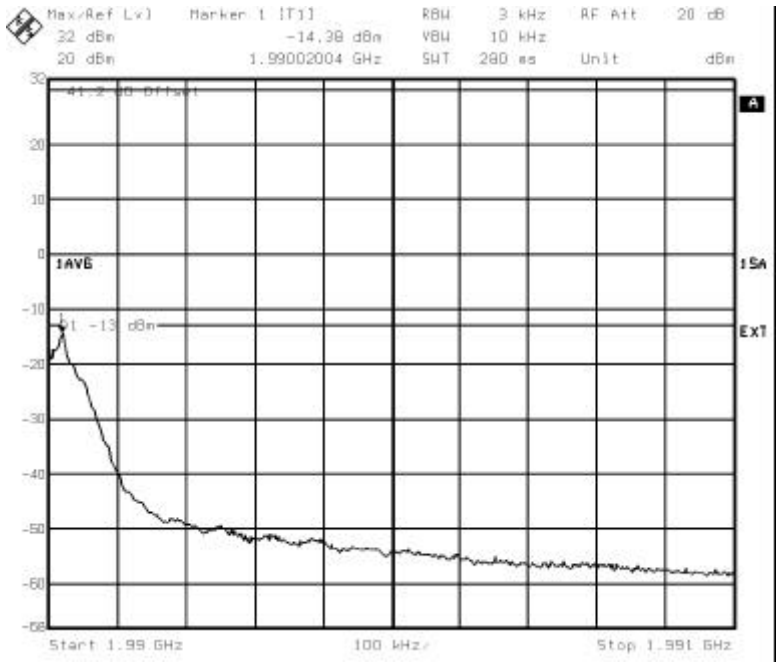

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Figure 7 : -1 MHz adjacent band (Channel 512, Pmax).
Diplexer Hybrid H4D, GMSK modulation

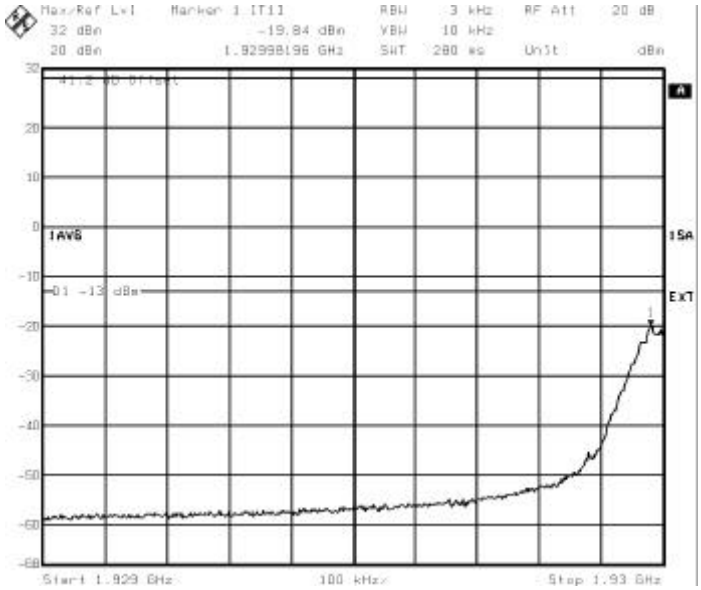

Figure 8 : +1 MHz adjacent band (Channel 585, Pmax).
Diplexer Hybrid H4D, GMSK modulation

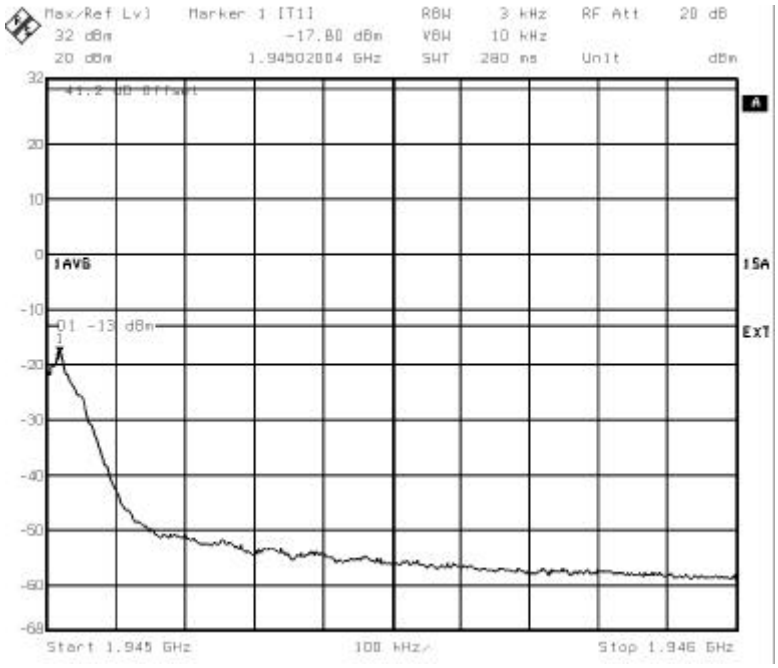

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Figure 9 : -1 MHz adjacent band (Channel 737, Pmax).
Diplexer Hybrid H4D, GMSK modulation

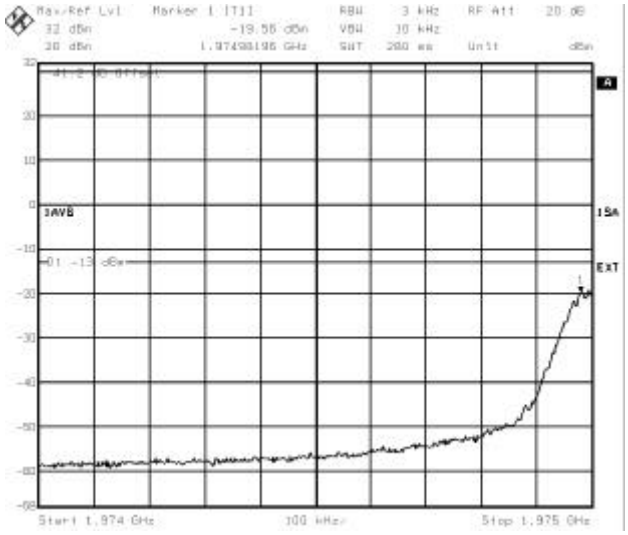

Figure 10 : +1 MHz adjacent band (Channel 810, Pmax)
Diplexer Hybrid H4D , GMSK modulation

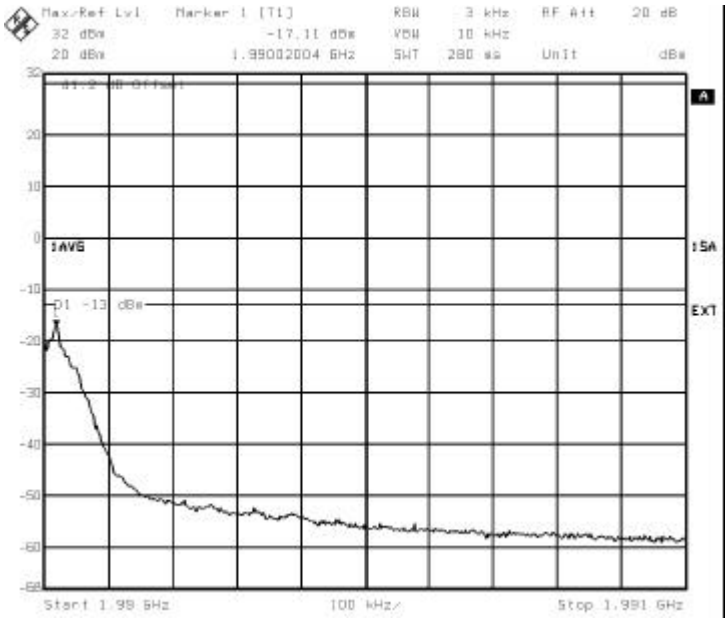

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Figure 11 : - 1 MHz adjacent band (Channel 512, Pmax)
Diplexer only, 8PSK modulation.

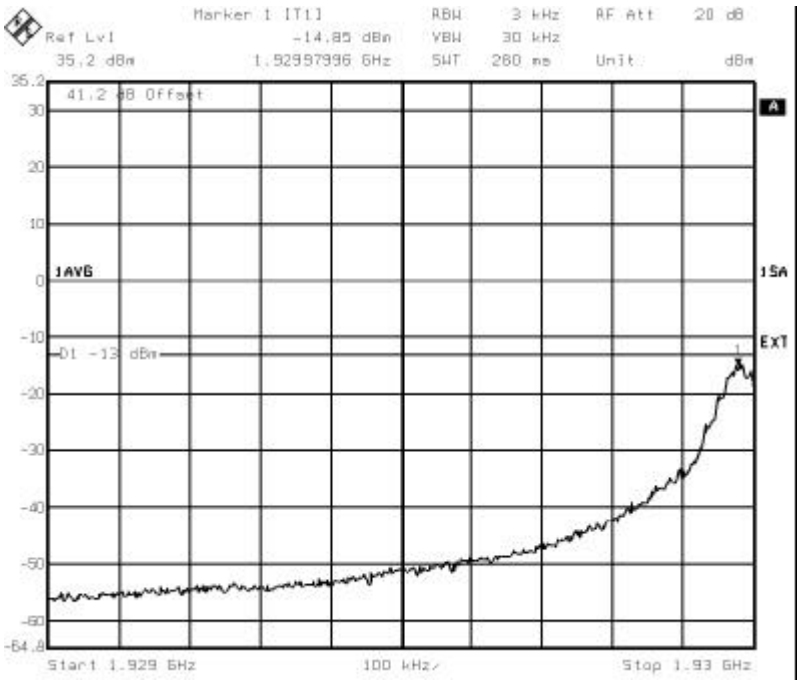

Figure 12 : + 1 MHz adjacent band (Channel 585, Pmax)
Diplexer only, 8PSK modulation.

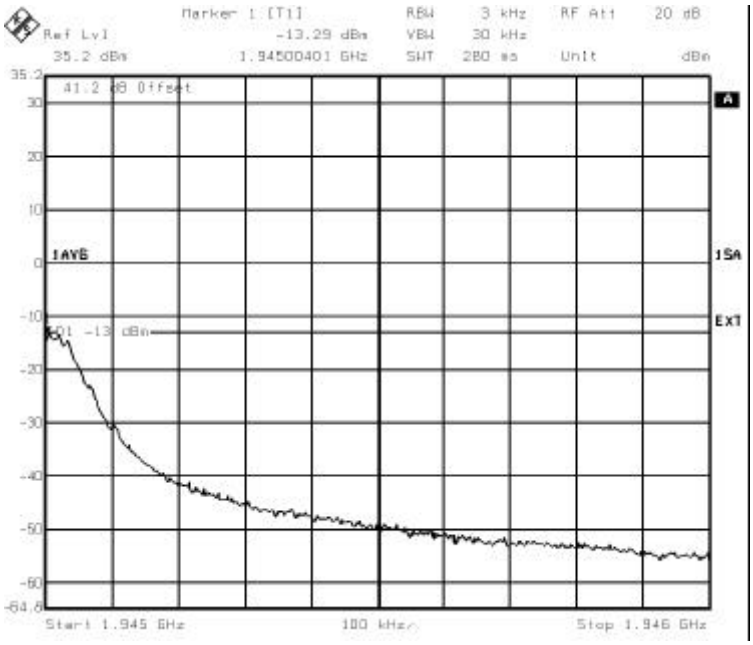

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Figure 13 : - 1 MHz adjacent band (Channel 737, Pmax)
Diplexer only, 8PSK modulation.

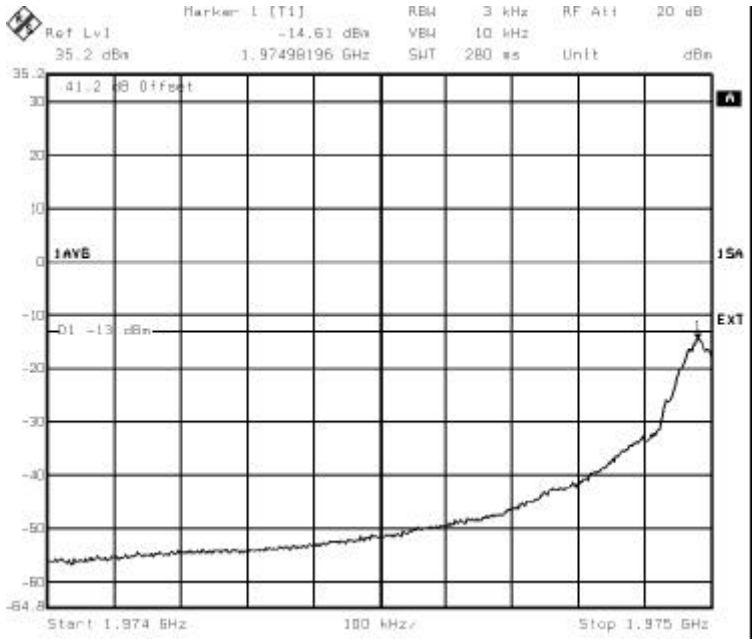

Figure 14 : + 1 MHz adjacent band (Channel 810, Pmax)
Diplexer only, 8PSK modulation.

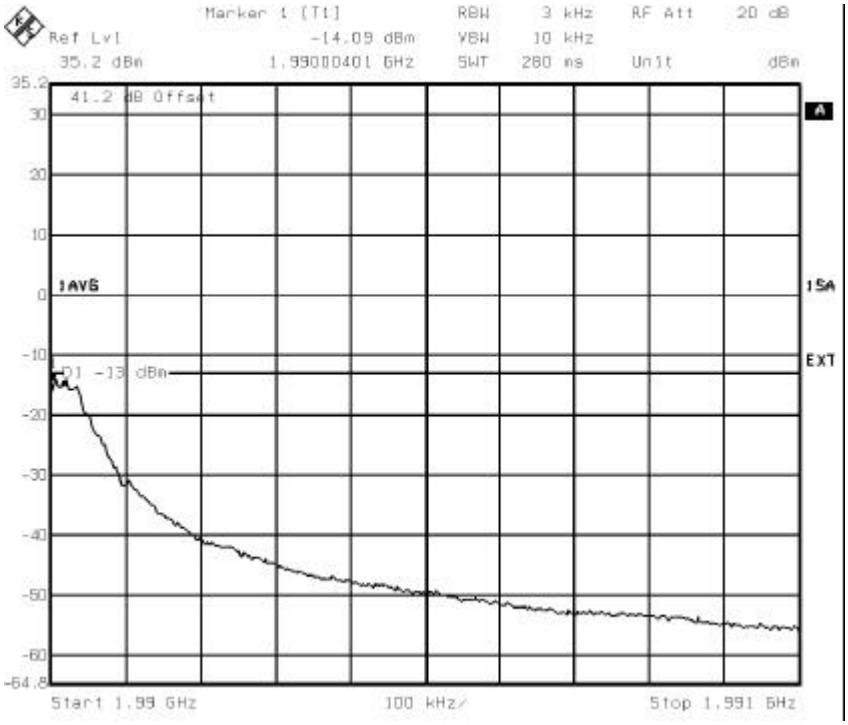

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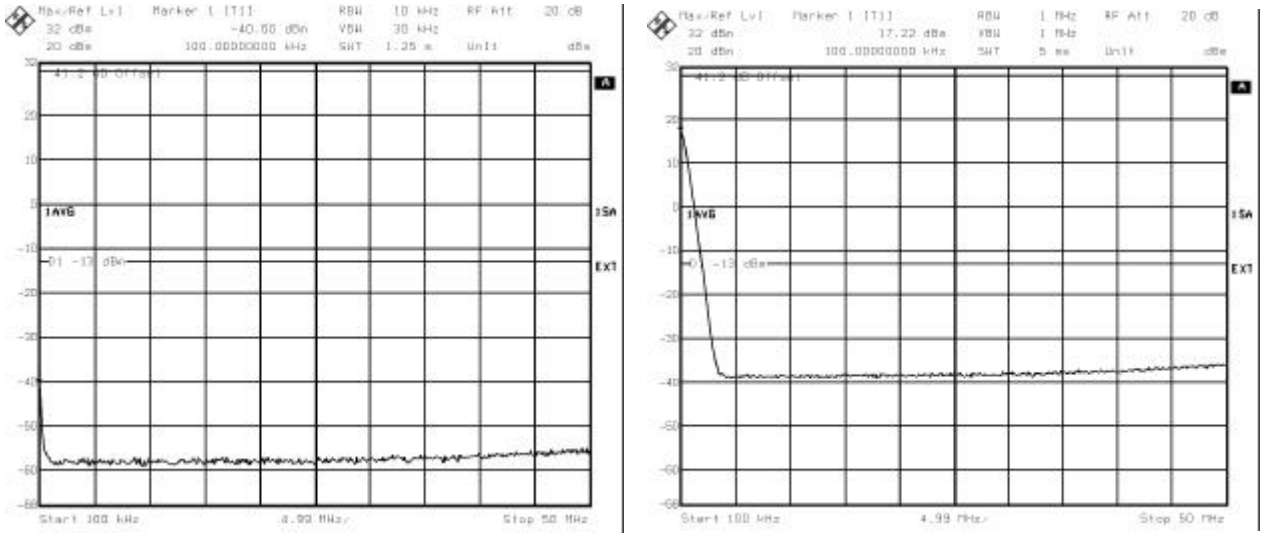
Figure 15 : Out of block emissions (Channel 810, Pmax)
GMSK modulation

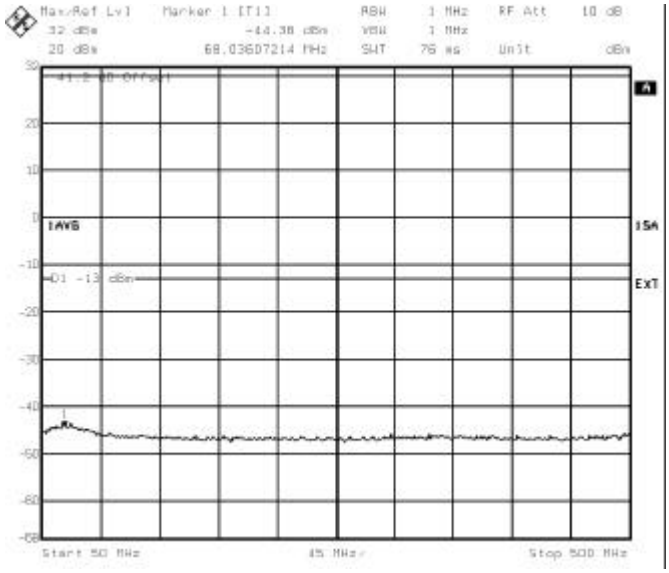
Band 100kHz – 50 MHz



RBW = 10 kHz RBW = 1 MHz (*)

(*) Note : spectrum lines at 100 kHz is internal DC spectrum line of analyzer.

Band 50 MHz –500MHz



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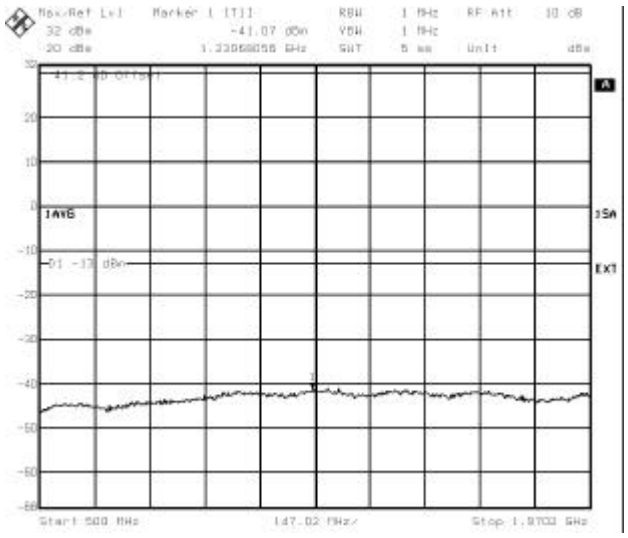
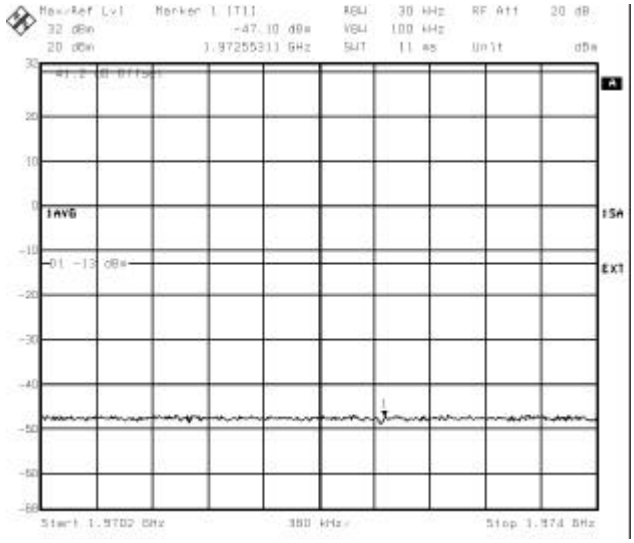
Band 500 MHz- 1970.2 MHz



Band 1970.2 – 1974 MHz



Band 1974 MHz - 1975 MHz

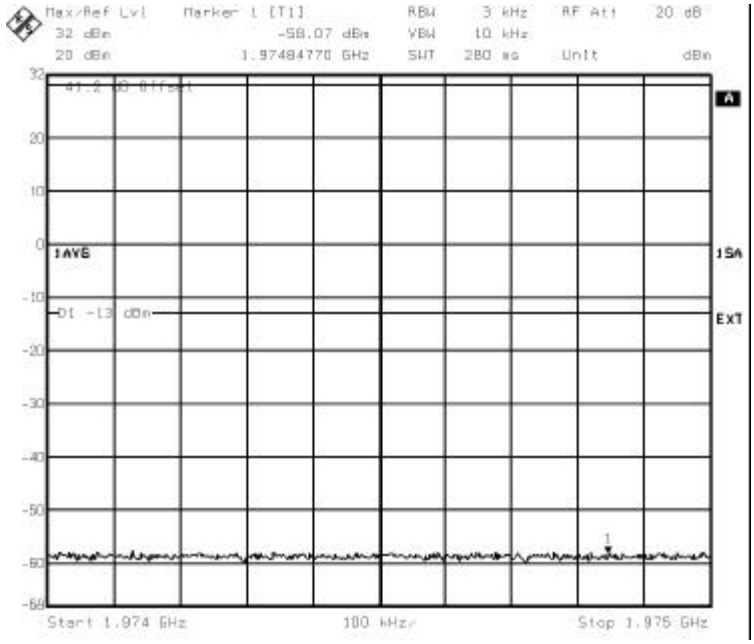


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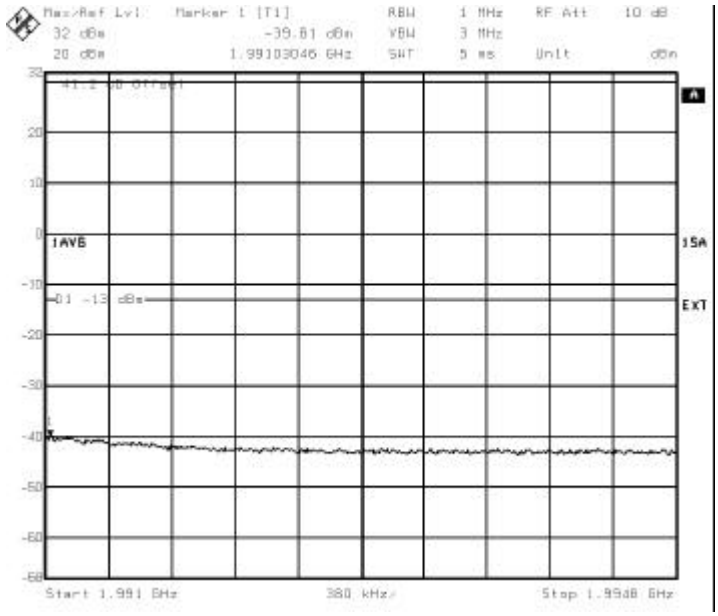
Figure 16 : Out of block emissions (Channel 810, Pmax)
GMSK modulation

Band 1991 MHz - 1994.8 MHz



Band 1994.8 MHz - 4 GHz

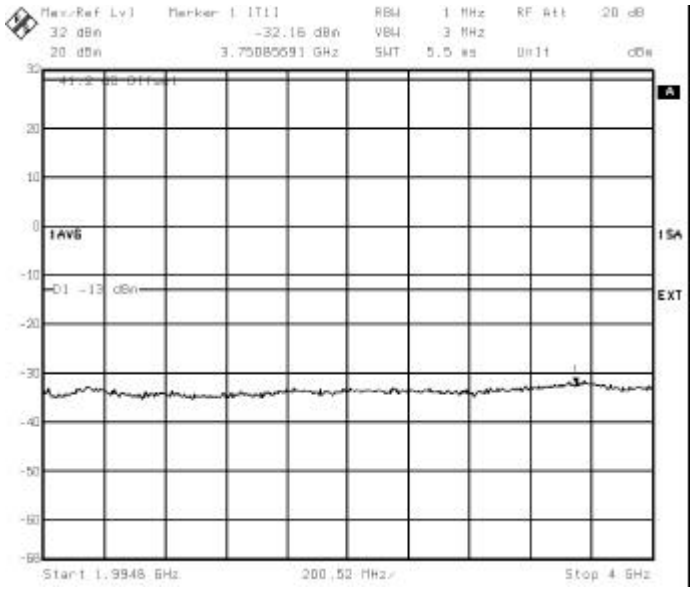


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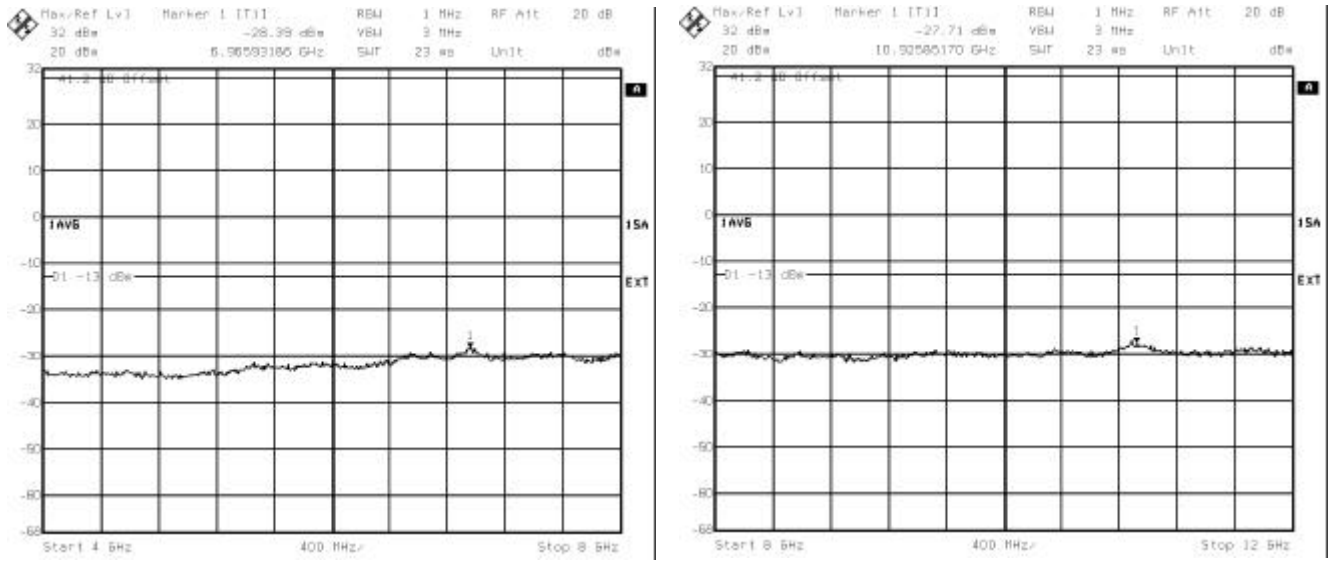
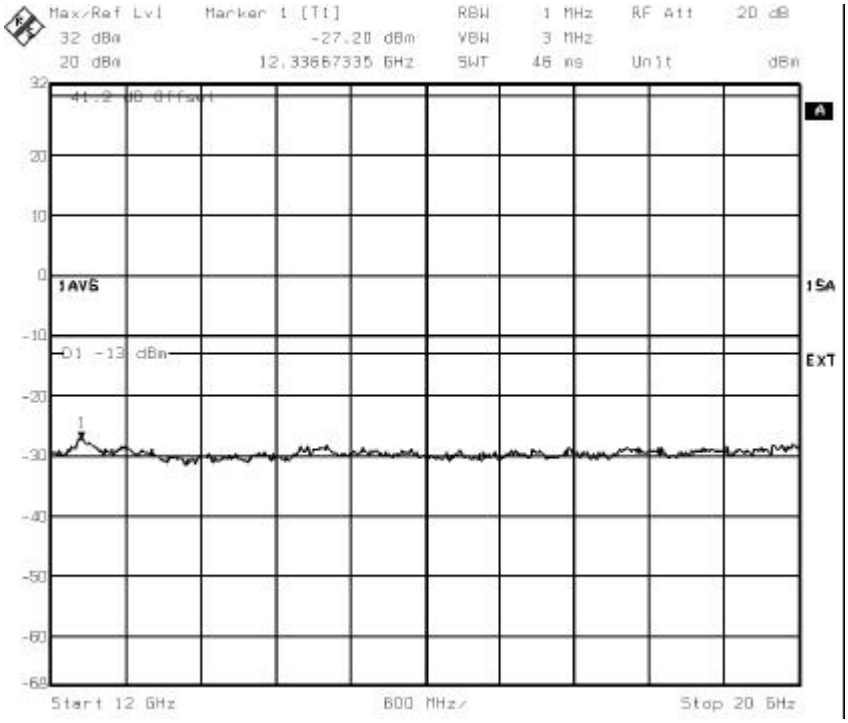
Figure 17 : Out of block emissions (Channel 810, Pmax)
GMSK modulation

Band 4 – 12 GHz



Band 12 - 20 GHz



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Conclusion :

GMSK modulation:

The worst case is the Duplexer configuration and emission power has been done at P_D max - 4dB = 40 dBm

In order to comply with the emission limits in the 1 MHz bands immediately outside and adjacent to the frequency block, the absolute transmit power level of the block edge channels is set to **40 dBm** for GMSK modulation.

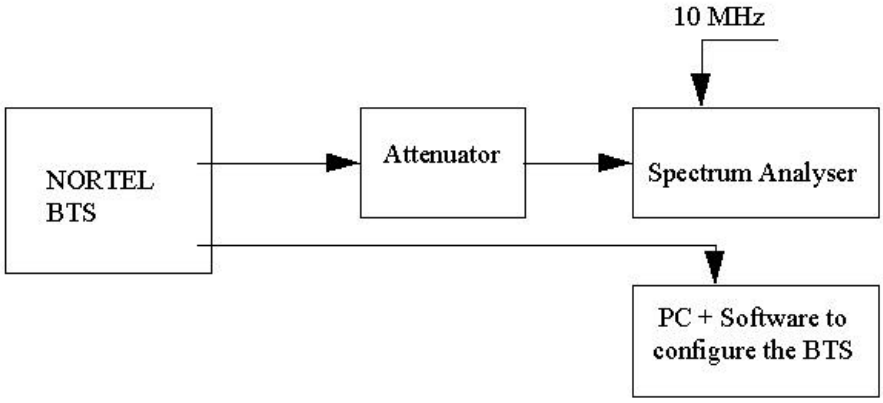
8PSK modulation:

eDRX and eSCPA 1900 support 8 PSK modulation.
In the worst configuration (Diplexer) , **maximum emission power P=44 dBm** allows to be compliant with the spurious emission limits (-13 dBm) in the 1 MHz bands immediately outside and adjacent to the frequency block for 8PSK modulation.

4.5.3. TEST PROCEDURE

The equipment was configured as shown in schematic 3 .

Schematic 3 : 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.

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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 .

For these measurements, the resolution bandwidth was of the spectrum analyzer was set to at least 1% of the emission bandwidth. In this case the emission bandwidth measured was 308.6 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.

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4.6. MEASUREMENT EQUIPMENT LIST

Table 5 is a list of all of the measurement equipment used in this report.

Table 5 : Measurement Equipment List

Equipment Description	Manufacturer	Model No.	Serial No.	V/A date
Power Meter	Giga-tronics	8542C	519565	02/03
CW Power Sensor	Giga-tronics	80401A	522394	02/03
Spectrum Analyzer	Rohde & Schwarz	FSEM	517751	03/03
30 dB attenuator	HP	8498A	519471	
Signal Generator	HP	HP 8657 B	509093	03/03
Attenuator 20 dB	Radiall	R417020128	-	

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5. EXHIBIT 2 : UPDATED EQUIPMENT LIST

Description	Hardware code	Comment
Base Cabinet	NTQA30AA NTQA30EA NTQA30CA NTQA30FA	To be used with ACU cooling system " To be used with DACS cooling system "
Sectorial or extension cabinet	NTQA30BA NTQA30EA NTQA30DA NTQA30FA	To be used with ACU cooling system " To be used with DACS cooling system "
AC main US	NTQA90AA	
ACU	NTQA95AB	
DACS	NTQA97AA	
Rectifier unit	NTQA91AA NT5C15BC NT6C34AB	Philips APS APS Low Cost
Power Control Unit	NTQA9101 NT5C90LZ NT5C90NP	
Converter Type F	NTQA57AA	
Converter Type J	NTQA02CA	
PSCMD	NTQA08AA	
GTW	NTQA06AA	
CSWM	NTQA09AA	
PCMI T1	NTQA04AA	
DSC	NTQA05AA	
SYNC	NTQA03AA	
ALCO	NTQA21AA	
COMICO	NTQA60AA NTQA60CA	Interconnection panel
PAICO	NTQA41AA	Interconnection panel
DRXICO	NTQA40AA	Interconnection panel
RECAL	NTQA66DA	
CPCMI T1	NTQA66AA	
CMCF	NTQA66CA	
CBCF	NTQA66BA	

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Radio Modules GSM 850		
GSM 1900 DRX	NTQA01AA NTQA01BA NTQA01CA NTQA01CB NTQA01DA NTQA88PA	 New Design DRX (support only GMSK modulation) EDRX (support 8PSK modulation)
GSM 1900 Splitter	NTQA10AA	
GSM 1900 Power Amplifier	NTQA50AA NTQA50GA	PA (support only GMSK modulation) ESCPA (support 8PSK modulation)
GSM 1900 Duplexer	NTQA51DA	
GSM 1900 Two Ways Hybrid Duplexer	NTQA51AA	
GSM 1900 Tx Filter	NTQA52CA	
GSM 1900 Four Way Hybrid Duplexer	**NTQA52BA** **NTQA52BB**	**Without TOS meter** **With TOS meter**

Power limitation to comply to Adjacent Band spurious for PCS1900 Band

The transmit power level of the block edge channels power has been done at PDmax = 40dBm for GMSK modulation at antenna connector .

The transmit power level of the block edge channels power has been done at PDmax = maximum power 44dBm for 8PSK modulation (GPRS mode) at antenna connector .

END OF DOCUMENT

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