EXHIBIT 2A

S8000 Radio Report

Applicant: Northern Telecom Ltd.

For Certification on:

AB6OUD850S8000

NORTEL NETWORKS

S8000 Outdoor and Indoor BTS eGSM 850: FCC Part 22 Exhibits Document

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RF Tests concerning FCC Part 22 are performed by RF GSM Department
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Creation

CONTENTS

1. INTRODUCTION

1.1. OBJECT

In complement with PCS/BTS/DJD/0743, this report presents the FCC regulatory assessment realized in order to introduce the following items into the S8000 Outdoor BTS system:

- EDGE DRX (e-DRX) module
- EDGE Single Carrier Power Amplifier (e-SCPA) module

These new modules are part of BTS evolution towards GPRS and EDGE : they are compatible with 8-PSK modulated signals and therefore ready to support EDGE functionalities in the future. For GMSK-modulated signals, they are fully compatible with previous New Design DRX and PA in the BTS.

1.2. SCOPE OF THIS DOCUMENT

This document applies to the S8000 BTS eGSM 850, Outdoor and Indoor versions.
It is the Exhibit part of the FCC Part 22 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 22 PUBLIC MOBILE 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] Nortel/STR/00138 DRX EDGE: Thermal test Report

[R4] 149014 DK : BTS S8000 Indoor EMC Test Report - GYL TECHNOLOGY
149015 DK : BTS S8000 Oudoor EMC Test Report - GYL TECHNOLOGY

[R5] PCS/BTS/DJD/0743 S8000 Outdoor and Indoor BTS GSM 1900 : FCC Part 24 Class II Permissive Change Application AB6OUDS8000

[R6] PE/BTS/DD/4322 Edge Single Channel Power Amplifier 850 (eSCPA)

3. EXHIBIT 1: TEST REPORT

3.1. INTRODUCTION

The following information is submitted for update of the type acceptance of a Broadband GSM Base Station for Nortel Networks, in accordance with FCC Part 22, Subpart H and Part 2, Subpart J of the FCC Rules and Regulations. The measurement procedures were in accordance with the requirements of Part 2.999.

3.2. MEASUREMENTS RESULTS

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

Table 1 : Measurement Results Summary

FCC Measurement Specification	IC Limit Specification RSS 128 Section	Description	Result
2.1046	7.1	RF Power Output	Complies
2.1047	7.2	Modulation characteristics	Complies
2.1049		Occupied Bandwidth	Complies
2.1051	7.4 , 7.5	Spurious Emissions at Antenna Terminals	Complies
2.1055	8.1 , 8.2	Frequency Stability	Complies
1.1307	11	RF Exposure	Not done

3.3. NAME OF TEST: 2.1046 RF POWER OUTPUT

3.3.1 FCC REQUIREMENTS

4.3.1.1. FCC PART 22.913

(a) 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 500 watts.

(b) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

3.3.2 TEST RESULTS

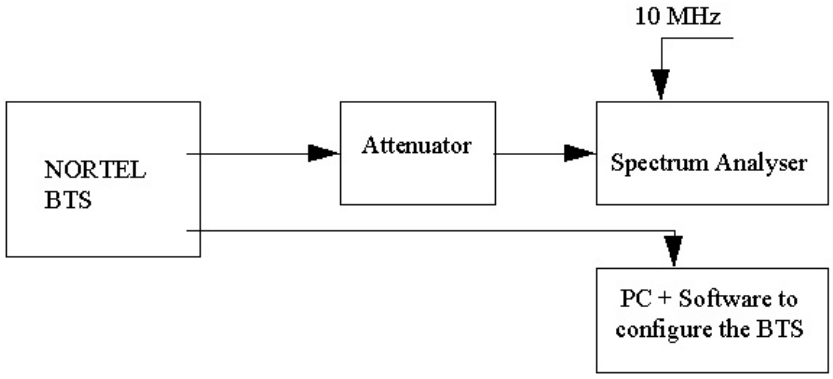
Table 2 shows the test results for RF Output Power.

Radio Channel	Frequency (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)	Limit (dBm)
128	869.2	44.09	44,8 (30 W)	50
148	873.2	44.25	44,8 (30 W)	50
168	877.2	44.31	44,8 (30 W)	50
188	881.2	44.32	44,8 (30 W)	50
208	885.2	44.15	44,8 (30 W)	50
228	889.2	44.23	44,8 (30 W)	50
248	893.2	43.96	44,8 (30 W)	50
251	893.8	43.81	44,8 (30 W)	50

3.3.3 TEST PROCEDURE

The equipment was configured as shown in figure 1.

Figure 1 : Test configuration for RF Output Power



The BTS was configured to transmit at maximum power (static level 0). Measurements were made at frequencies which are the bottom, middle and top of each of the licensed blocks.

Spectrum analyzer is calibrated with Gigatronix Powermeter using HP8657B generator.

The average output power was measured using the spectrum analyzer which had the following settings :

Resolution bandwidth :	300 kHz
Video bandwidth :	1 MHz
Span :	0 Hz
Reference level :	45 dBm
Reference Level Offset :	Corrected to account for cable(s) and attenuator losses
Level range :	10 dB
Sweep time :	5 ms

3.4. NAME OF TEST: 2.1049 OCCUPIED BANDWIDTH

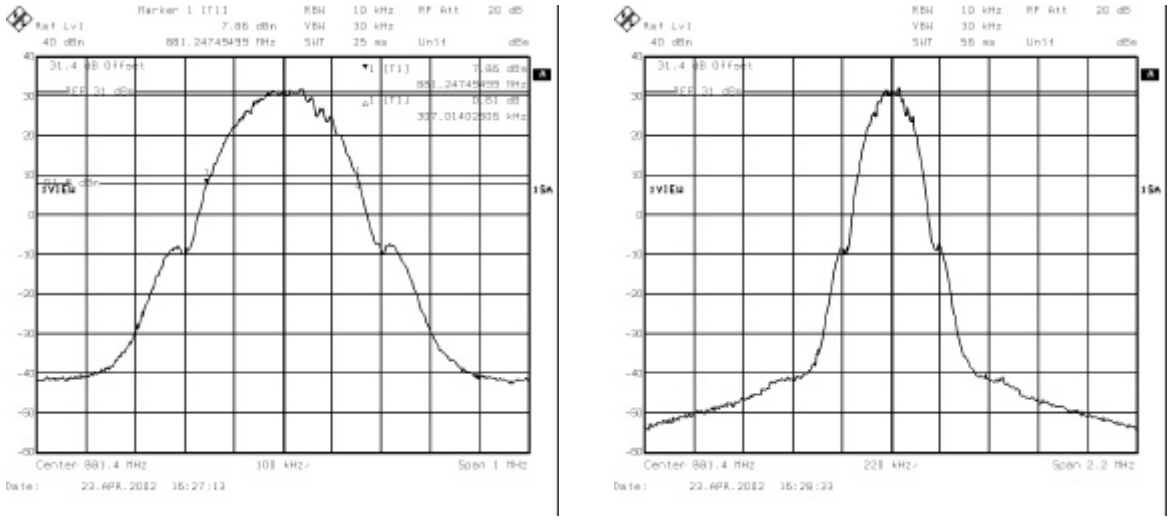
3.4.1 FCC REQUIREMENTS

4.4.1.1. FCC PART 2.1049

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.

3.4.2 TEST RESULTS

Figure 2: sample plot for occupied bandwith



Span = 1MHz

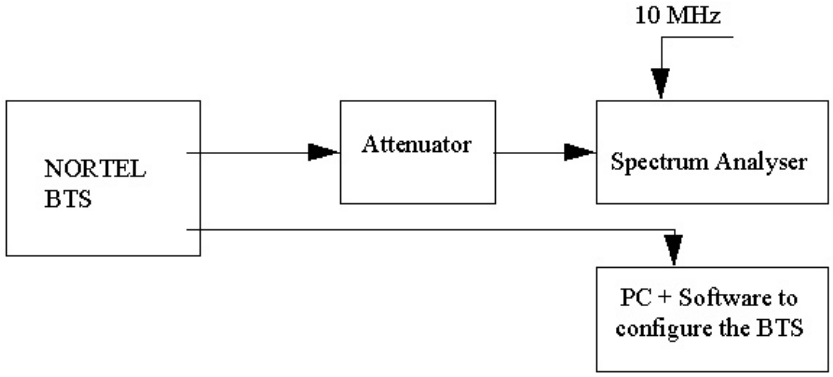
Span = 2.2 MHz

The maximum occupied bandwidth was found to be 330 kHz (measured on channel 189, f = 881.4 MHz).

3.4.3 TEST PROCEDURE

The equipment was configured as shown in figure 3.

Figure 3 : Test configuration for Occupied bandwidth



The BTS was configured to transmit at maximum power (Static Level 0). 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 :

Resolution bandwidth :	10 kHz
Video bandwidth :	30 kHz
Span :	1 MHz and 2.2 MHz
Reference level :	40 dBm
Reference Level Offset :	Corrected to account for cable(s) and attenuator losses
Level range :	90 dB
Sweep time :	25 ms

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

3.5.1 FCC REQUIREMENTS

(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.

3.5.2 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 in two following coupling configuration with 30W Power amplifier :

- with Duplexer ,
  Nominal power at antenna connector : P_D max =44dBm

- with H2D : two input coupler (3dB coupling) associated with duplexer
  Nominal power at antenna connector : P_{H2D} max =41 dBm

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

Table 3 : Test results for Spurious Emissions at Antenna Terminals

Channel	Pwr emission level	Spurious Emissions Level Duplexer (dBm)	Margin (dB) Duplexer	Spurious Emissions Level H2D (dBm)	Margin (dB) H2D	Limit (dBm)
128	Pmax - 2 dB	-15.09	2.09	No need		-13
128	Pmax	-13.39	0.39	-16.57	3.57	-13
189	Pmax - 2 dB	-14.29	1.29	No need		
189	Pmax	-12.21	- 0.79	-15.23	2.23	-13
189	Pmax - 2 dB	-15.37	2.37	No need		-13
189	Pmax	-13.18	0.18	-16.14	3.14	-13
251	Pmax - 2 dB	-14.32	1.32	No need		-13
251	Pmax	-13.54	0.54	-15.26	2.26	-13

Table 4 : Test results for Spurious Emissions at Antenna Terminals

Frequency MHz	Spurious Emissions Level Duplexer (dBm)	Margin (dB) Duplexer	Spurious Emissions Level H2D (dBm)	Margin (dB) H2D	Limit (dBm)
100 kHz - 50 MHz	-33.7	20.7	-33.9	20.9	-13
50 MHz – 500 MHz	-32.5	19.5	-33	20	-13
500 MHz – 880.2 MHz	-25.5	12.5	-29.5	16.5	-13
882..6 MHz –1994.8 MHz	-33	20	-34	21	-13
1994.8 MHz – 4 GHz	-27.3	14.3	-28.3	15.3	-13
4 GHz - 12 GHz	-22.5	9.5	-23.1	10.1	-13
12 GHz -20 GHz	-23	10	-22.8	9.8	-13

Notes :

Figure 4 and 6 and 8 and10 show sample plots for the case when the transmitter was respectively tuned to Channel 128 and 189 and 251 (bottom and middle and top channels in Tx band) with (P_D max = 44 dBm) and P_D max –2dB = 42 dBm using Duplexer.

Figure 5 and 7 and 9 and 11 show sample plots for the case when the transmitter was respectively tuned to Channel 128 and 189 and 251 (bottom and middle and top channels in Tx band) with P_{H2D}max = 41 dBm using H2D.

Figure 12 shows sample plots for frequency spans from 0 to 20 GHz with emission on channel 189 (middle channel) at $P_D$max = 44 dBm with Duplexer module.

Conclusion : .

Two series of test have been performed regarding the possibility of using a Duplexer or a H2D. This is to reflect different configurations the BTS can take.

The worst case is the Duplexer configuration and it has been done at P_D max - 2dB = 42 dBm The H2D configuration has been done at P_{H2D}max.

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 42 dBm

Figure 4 : - 1 MHz adjacent band (Channel 128, Pmax dB and Pmax - 2 dB) with Duplexer

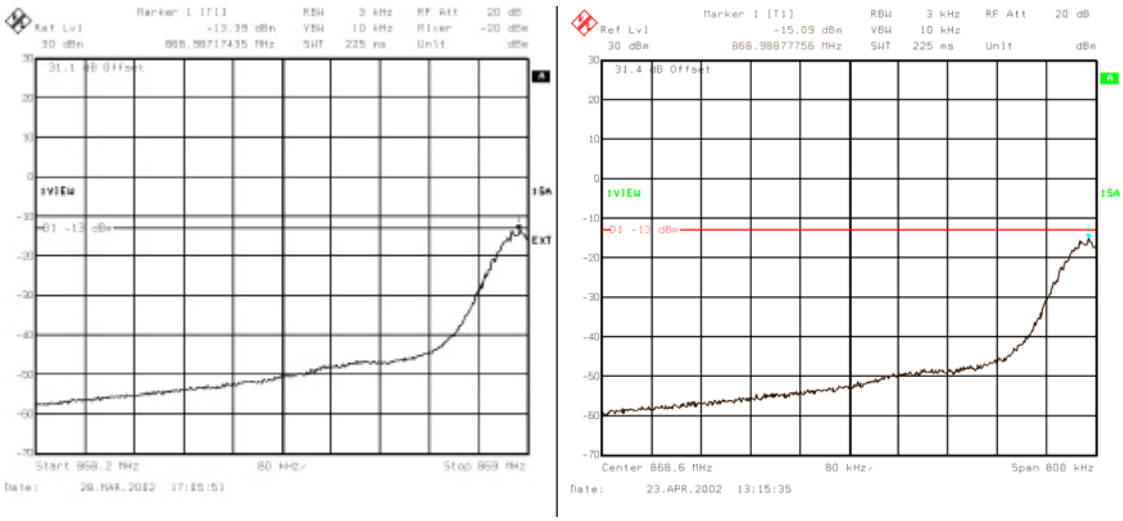


Figure 5 : - 1MHz adjacent band (Channel 128, Pmax) with H2D

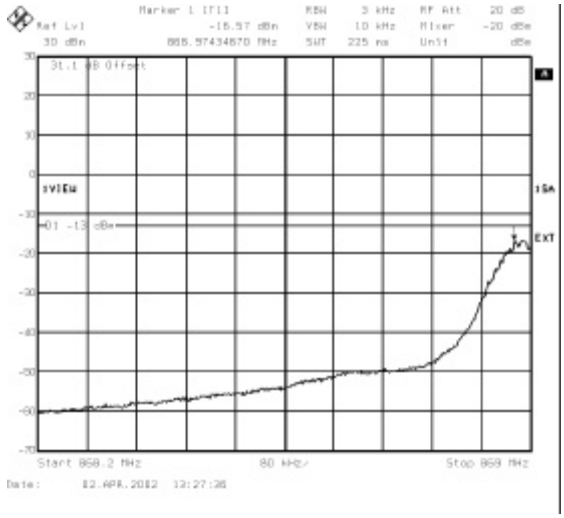


Figure 6 : +1 MHz adjacent band (Channel 189, Pmax and Pmax –2dB) with Duplexer

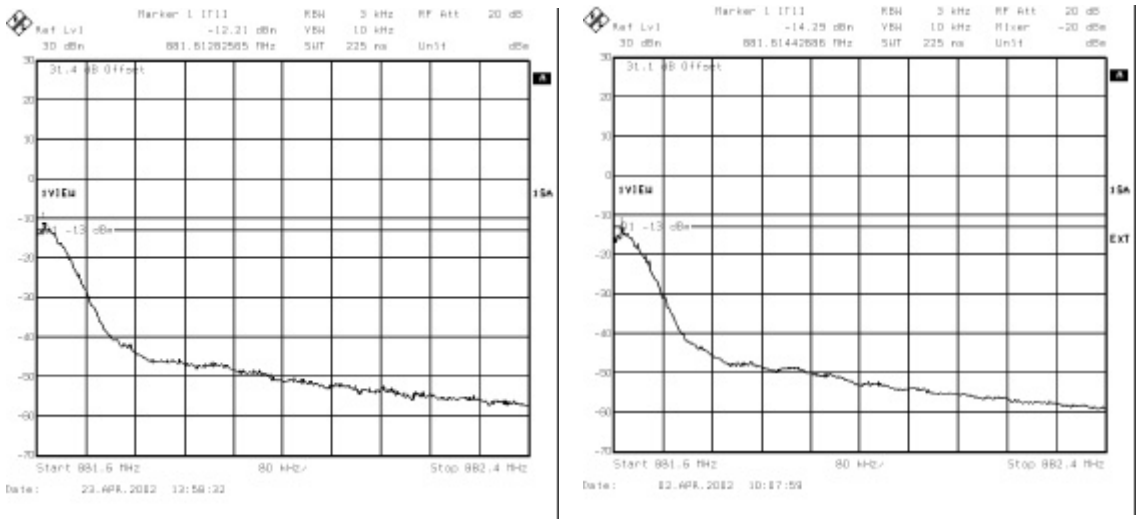


Figure 7 : +1 MHz adjacent band (Channel 189, Pmax) with H2D

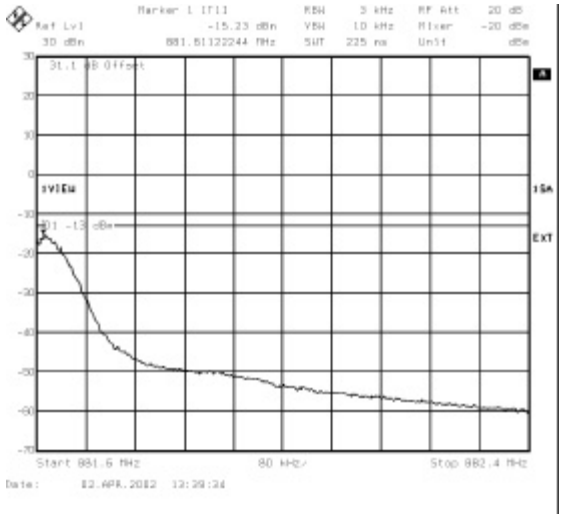


Figure 8 : -1 MHz adjacent band (Channel 189, Pmax and Pmax – 2 dB) with Duplexer

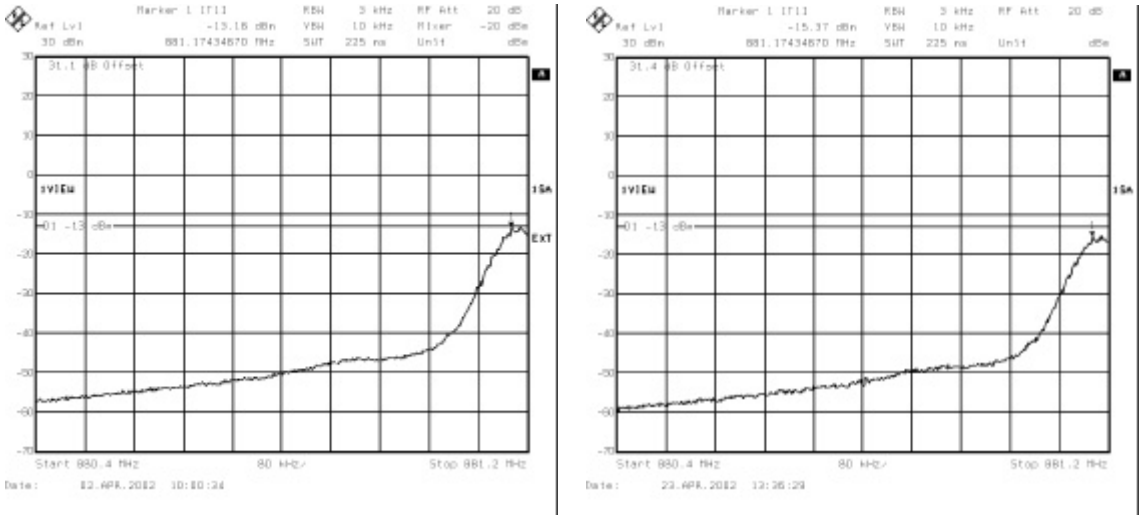


Figure 9 : -1 MHz adjacent band (Channel 189, Pmax) with H2D

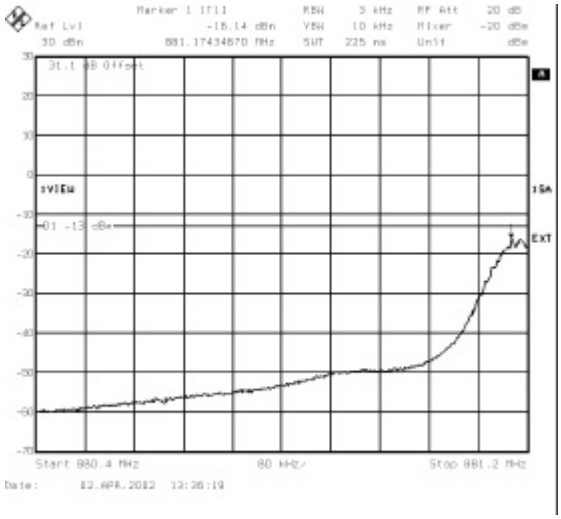


Figure 10 : +1 MHz adjacent band (Channel 251, Pmax and Pmax-2dB) with Duplexer

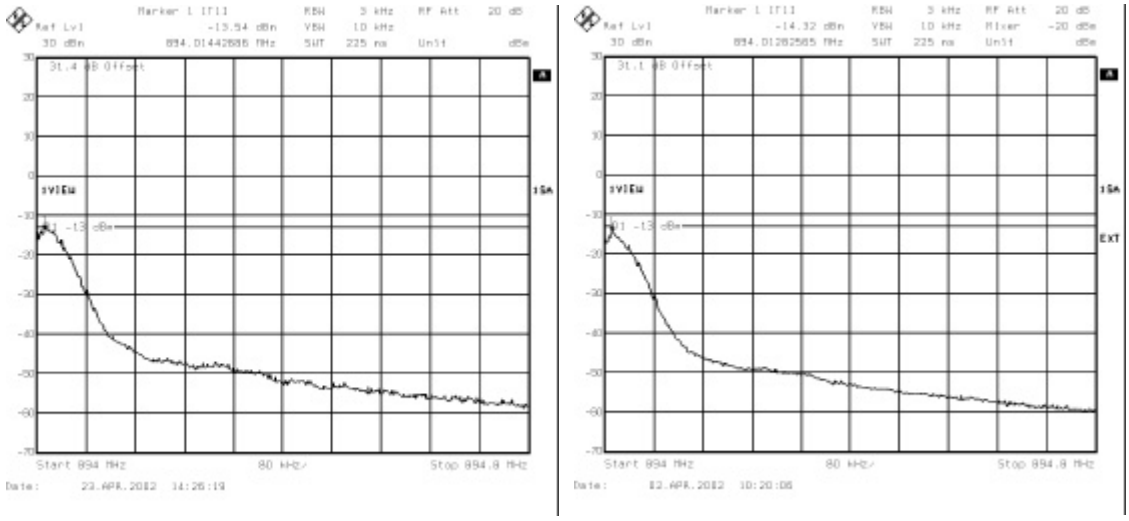


Figure 11 : +1 MHz adjacent band (Channel 251, Pmax) with H2D

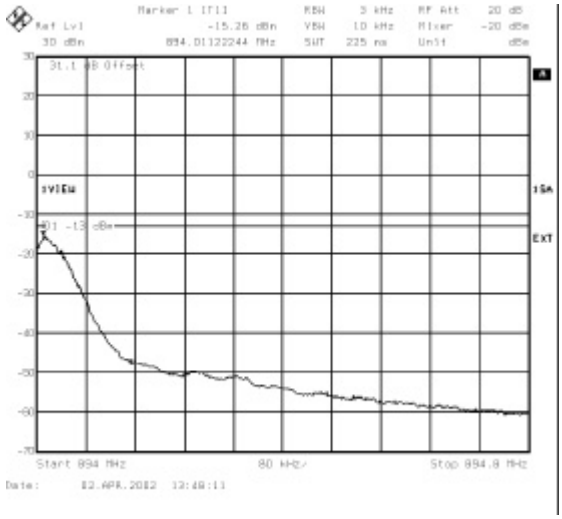
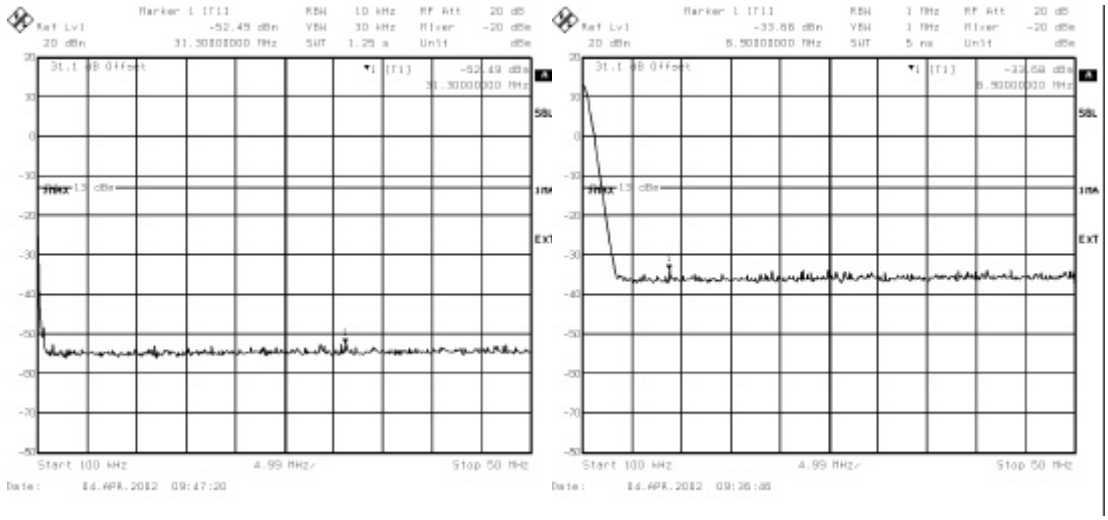


Figure 12 : Out of block emissions (channel 189, Pmax) with Duplexer

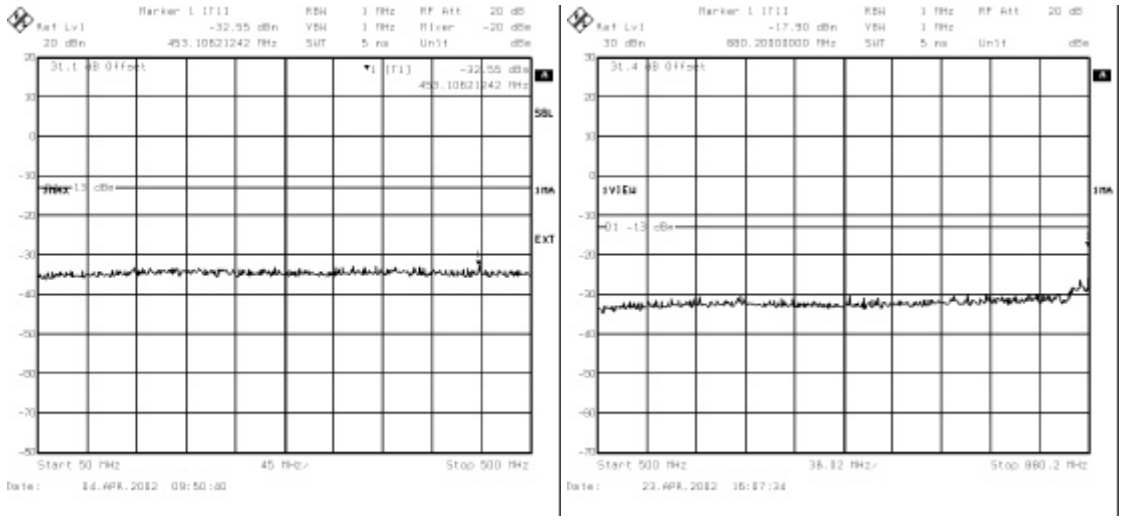
Band 100 kHz – 50 Mhz



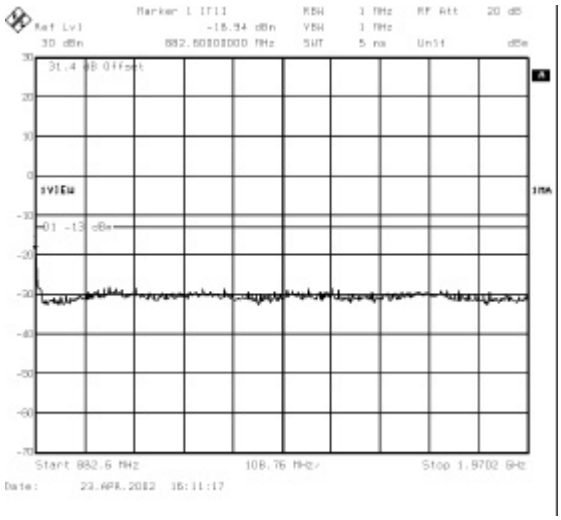
RBW = 10 kHz RBW = 1 MHz

Note: spectrum line s at 100 kHz are internal DC spectrum line of Analyser

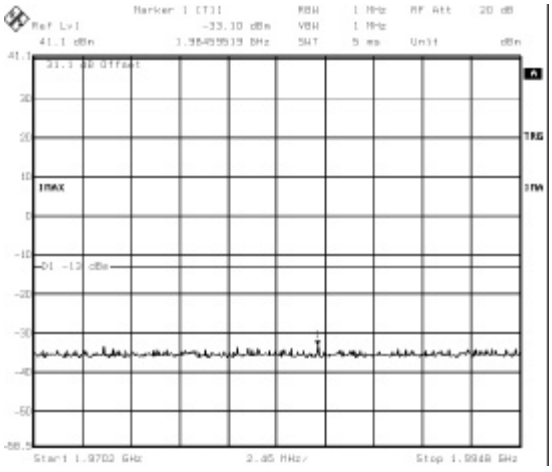
Band 50 Mhz – 500 MHz **Band 500 Mhz – 880.2 MHz**



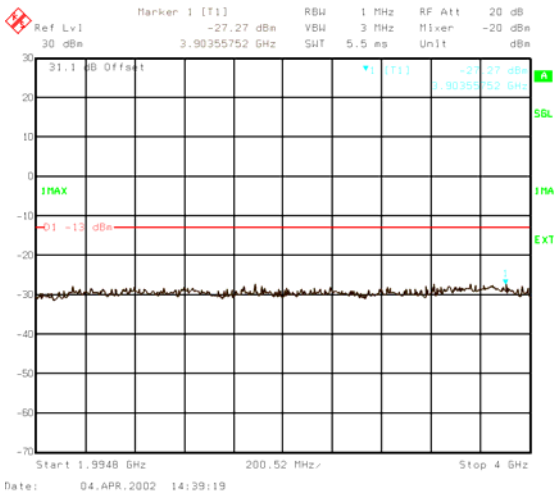
Band 882.6 Mhz – 1970.2 MHz



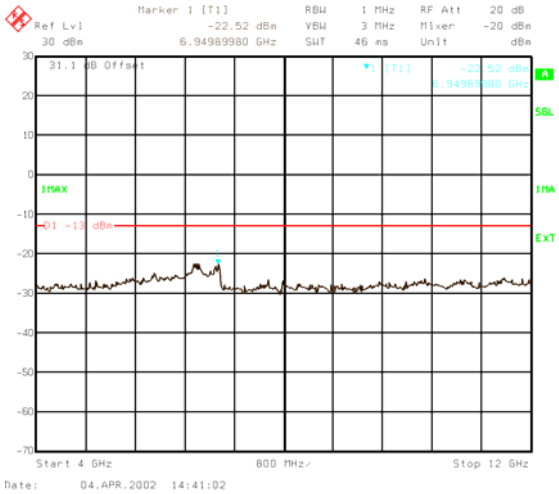
Band 1970.2 Mhz – 1994.8 MHz



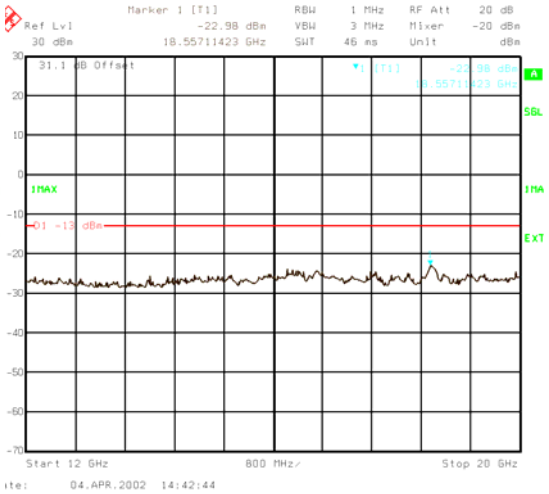
Band 1994.8 Mhz – 4 GHz



Band 4 GHz – 12 GHz



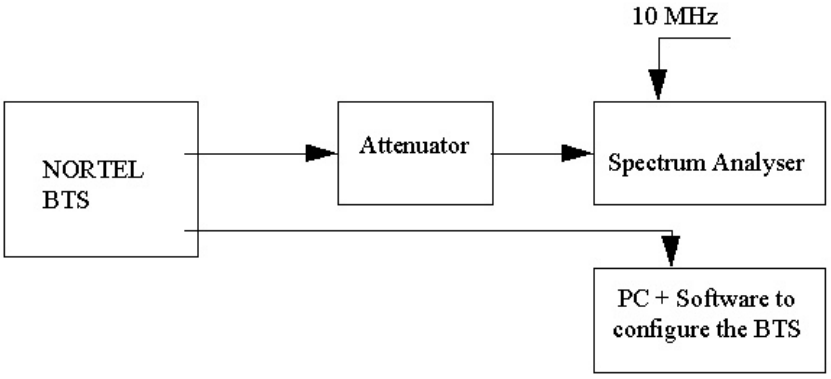
Band 12 GHz – 20 GHz



3.5.3 TEST PROCEDURE

The equipment was configured as shown in figure 12.

Figure 13 : 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 128 and 251 are those channels which are at the lower and upper edges of the eGSM 850 band respectively.

Initially the transmitter was set to operate to maximum power. Then in case of out of limits, the power has been decreased by 2 dB. The Tx activation mode was GMSK no synchro.

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 330 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 :	30 dBm
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 189.

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 twentieth harmonic of the fundamental emission (20 GHz).

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

3.6. NAME OF TEST: 2.1055 FREQUENCY STABILITY

3.6.1 FCC REQUIREMENTS

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

3.6.2 TEST RESULTS

Table 5a shows Frequency Stability for channel 189 (f=881.4MHz) in Quick Test Bench configuration in extreme conditions
Table 5b shows Frequency Stability in BTS S8000 Outdoor at ambient temperature for channels B,M,T.

Table 5a : Frequency Stability in quick test bench configuration – Channel 189

Module Temperature (°C)	Maximum Carrier Frequency Deviation (Hz) in quick test bench configuration		
	DC Supply Voltage DRX - 40V PA - 36V	DC Supply Voltage DRX - 48V PA - 48V	DC Supply Voltage DRX - 57V PA - 60V
-5	-6.91	6.91	5.94
5	-7.75	-9.3	-7.17
15	8.85	7.1	-9.1
25	-7.81	-9.17	8.14
35	-9.04	-7.81	-9.43
45	-7.68	-7.49	8.52
55	-8.78	-7.43	-6.84
65	-8.52	-9.88	-7.68

Table 5b : Frequency Stability in BTS S8000 Outdoor at ambient temperature

	Maximum Carrier Frequency Deviation (Hz) in BTS Configuration Ambient temperature		
Channel	C128 (f=869.2 MHz)	C189 (f=881.4 MHz)	C251 (f= 893.8 MHz)
	-9	-11	+9

The maximum frequency deviation allowed is 90 Hz.

The maximum deviation measured (-11Hz) is more than sufficient to ensure that the fundamental emission stays within the authorized frequency block.

The S8000 Indoor BTS still complies with the requirement.

3.6.3 TEST PROCEDURE

Thermal tests has been performed with modules eDRX with eSCPA inside BTS8000 . These tests have shown that thermal features of eDRX/eSCPA were equivalent or better than old DRX and PA versions inside BTS S8000 in extreme conditions. [R1] , [R2], [R3].

The BTS S8000 must operate in following external extreme temperatures:

- BTS S8000 Indoor: - 5°C / + 45 °C
- BTS S8000 Outdoor: - 40°C / + 50°C

These external temperature ranges involve the extreme temperature range from - 5°C to +65°C on eDRX and eSCPA modules.

Frequency stability are checked in BTS S8000 Outdoor at ambient temperature.

Frequency stability test is performed with a Quick Test Bench for module configuration in following extreme conditions:

- Temperature from -5 to +65 centigrades at intervals of 10 centigrades
- With DC power supply variations eSCPA (-36V/-60V) and eDRX (-40V/-57V)

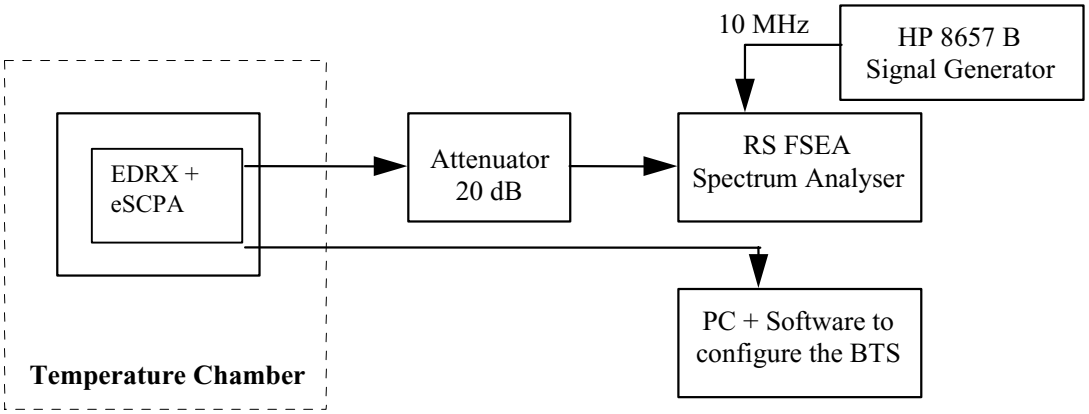
Modules (eDRX and eSCPA) run with nominal power regulation at maximum power (30W) in GMSK modulation.

The eDRX/eSCPA were configured to transmit at maximum power (Static level 0).

A period of at least one hour was allowed prior to measurement to ensure that all of the components of the oscillator circuit had stabilized at each temperature.

The equipment was configured as shown in figure 13.

Figure 14 : Test configuration for Frequency Stability



3.7. MEASUREMENT EQUIPMENT LIST

Table 7 is a list of all of the measurement equipment used in this report.

Table 7 : Measurement Equipment List

Equipment Description	Manufacturer	Model No.	Serial No.	V/A date
Network Analyzer	HP	8719D	521768	12/03
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
Programmable DC source	LAMBDA	Model LLS9060	ELC08493	03/03
Programmable DC source	LAMBDA	Model LLS9060	500222	03/03
Attenuator 20 dB	Radiall	R417020128	-	

4. 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	

Description	Hardware code	Comment
Radio Modules GSM 850		
GSM 850 DRX	NTQA88HA	eDRX
GSM 850 Splitter	NTQA88XA	
GSM 850 Power Amplifier	NTQA37AA	eSCPA
GSM 850 Duplexer	NTQA38CA	(*) Transmit Power Level : P_D max –2dB = 42 dBm
GSM 850 Two Ways Hybrid Duplexer	NTQA38BA	Transmit Power Level : P_{H2D} max = 41 dBm

(*) Power limitation to comply to Adjacent Band spurious

In order to comply with the emission limits in the 1 MHz bands immediately adjacent to the frequency block, the transmit power level of the block edge channels has been reduced by 2 dB at antenna connector ($P_D$max – 2dB = 42dBm) with a Duplexer configuration.

The transmit power level of the block edge channels power has been done at P_{H2D}max = 41 dBm at antenna connector with H2D configuration.

5. EXHIBIT 3 : SCHEMATICS

5.1. E-DRX ASSEMBLY

NTQA88HA

5.2. E-RDRX (RADIO BOARD)

NTQA8810

5.3. E-LDRX (LOGIC BOARD)

NTQA8001

5.4. E-SCPA ASSEMBLY

NTQA37AA

5.5. RX SPLITTER

NTQA88XA

5.6. DUPLEXER

NTQA38CA

5.7. H2D

NTQA38BA

6. ABBREVIATIONS AND DEFINITIONS

6.1. ABBREVIATIONS

BCF	Base Common Function
BTS	Base Transceiving Station
DRX	Driver Receiver Unit
EDGE	Enhanced Data for GSM Evolution
e-DRX	EDGE DRX
e-SCPA	EDGE Single Carrier PA
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
LNA	Low Noise Amplifier
MSC	Mobile Switching Center
OMC	Operation and Maintenance Center
PA	Power Amplifier
RF	Radio Frequency
TCU	Trans-Coding Unit
Tx	Transmitter

6.2. DEFINITIONS

Frequency Band and Channels

GSM 850	C128	C189	C251
Short	B	M	T
F Tx (MHz)	869.2	881.4	893.8
F Rx (MHz)	824.2	836.4	848.8

For $128 < n < 251$

$F_{Rx}(n) = 824.2 + 0.2*(n-128)$

$T_{Tx}(n) = F_{Rx}(n) + 45$

IF frequencies on Radio Board: For Tx path 133 MHz
For Rx path 71 MHz

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

END OF DOCUMENT