5. EXHIBIT B : TEST REPORT

5.1. INTRODUCTION

The following information is submitted for 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 2.999.

5.2. MEASUREMENT RESULTS SUMMARY

Table 1 is a summary of the measurement results for the S2000L BTS.

Table 1 : Measurement Results Summary

FCC Measurement Specification	FCC Limit Specification	Description	Result
2.985	24.232	RF Power Output	Complies
2.987		Modulation Characteristics	Not Applicable
2.989		Occupied Bandwidth	$OBW_{(max)}$=306.6 kHz
2.991, 2.997	24.328	Spurious Emissions at Antenna Terminals	Complies
2.993, 2.997	24.328	Field Strength of Spurious Radiation	Complies
2.995	24.235	Frequency Stability	Complies
24.51(d)	24.51(d)	RF Hazards	Complies

5.3. DECLARATION OF THE ACCURACY OF DATA

The signatories of this document attest to the accuracy of the measurement data contained herein.

5.4. GENERAL TEST SETUP

Figure 1 shows the general test setup used during testing of the S2000L BTS.

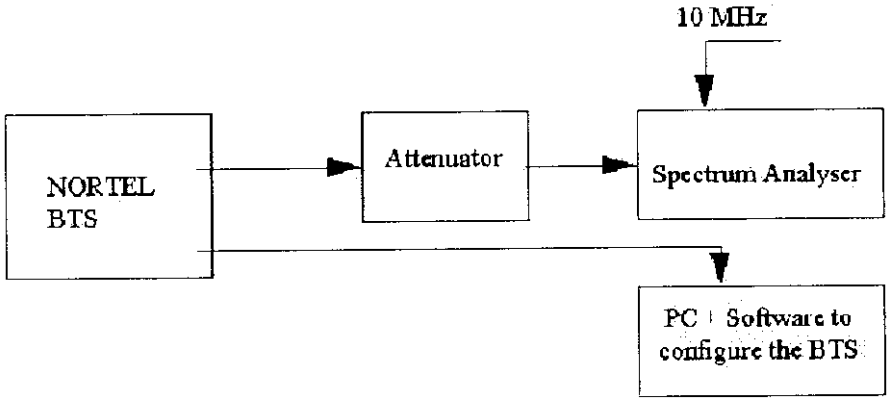


Figure 1 : General Test Setup

The BTS was configured as shown in the Technical Description (Exhibit B) in an (O2) configuration consisting of a main module and a Low Power RF module.
A DTM (Digital Test Module) was connected to the Abis interface with a Rubidium Frequency Reference connected to the DTM. The BTS uses the T1 signal from the Abis interface for synchronization.
A PC computer was connected to the BTS test connector via three ethernet connections. Software running on the PC was used to configure the BTS which allows control of such parameters as RF channel selection and output power level.
During all applicable tests the BTS was configured to produce modulated signal representative of those used during actual use. The modulated bit rate used wad 270.833 kb/s. A description of the test simulation signals can be found in ETSI Technical specification GSM 11.40 System Simulator Specification section 2.2.1.1. The bandwidth characteristics are the same as those found in GSM 05.05. A description of the modulation used during actual use may be found in section 2 of GSM 05.04.

5.5. MEASUREMENT RESULTS

The following sections contain the measurement results.

5.6. NAME OF TEST : 2.985 RF POWER OUTPUT

5.6.1. FCC REQUIREMENTS

5.6.1.1. FCC Part 24.232

(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 100 watts

(c) 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.

5.6.2. TEST RESULTS

Table 2 shows the test results for RF Output Power.

Table 2 : Test results for RF Output Power

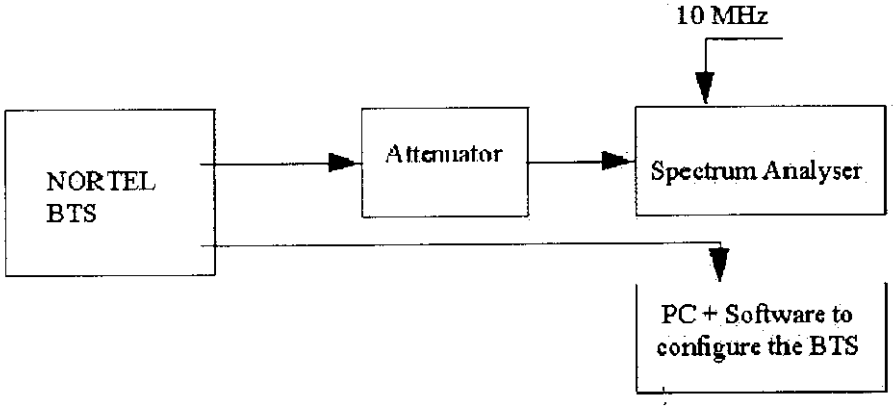
ARFCN	Frequency (MHz)	Measured RF Output Power (dBm)		Maximum Rated Power (dBm)	Limit (dBm)
		Ant 1	Ant 2		
513	1930.4	35.1	35.0	37.0	50
548	1937.4	35.4	35.4	37.0	50
585	1944.8	35.5	35.6	37.0	50
587	1945.2	35.5	35.6	37.0	50
598	1947.4	35.5	35.6	37.0	50
610	1949.8	35.5	35.7	37.0	50
612	1950.2	35.6	35.7	37.0	50
648	1957.4	35.7	35.8	37.0	50
685	1964.8	35.7	35.8	37.0	50
687	1965.2	35.7	35.8	37.0	50
698	1967.4	35.7	35.7	37.0	50
710	1969.8	35.6	35.7	37.0	50
712	1970.2	35.6	35.6	37.0	50
723	1972.4	35.6	35.6	37.0	50
735	1974.8	35.6	35.6	37.0	50
737	1975.2	35.6	35.6	37.0	50
773	1982.4	35.6	35.6	37.0	50
809	1989.6	35.5	35.6	37.0	50

From the results shown in table 2, the S2000L BTS complies with the requirement.

5.6.3. TEST PROCEDURE

The equipment was configured as shown in figure 2.

Figure 2 : 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.
The peak output power was measured using the spectrum analyzer which had the following settings :

	Resolution bandwidth :	1 MHz
	Video bandwidth :	3 MHz
	Span :	0 Hz
	Attenuation :	30 dB
	Reference level :	38 dBm
–	Reference Level Offset :	30.3 dB
	Level range :	50 dB
	Sweep time :	0.54 ms

5.7. NAME OF TEST : 2.989 OCCUPIED BANDWIDTH

5.7.1. FCC REQUIREMENTS

5.7.1.1. FCC Part 2.289

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable : ...

5.7.2. TEST RESULTS

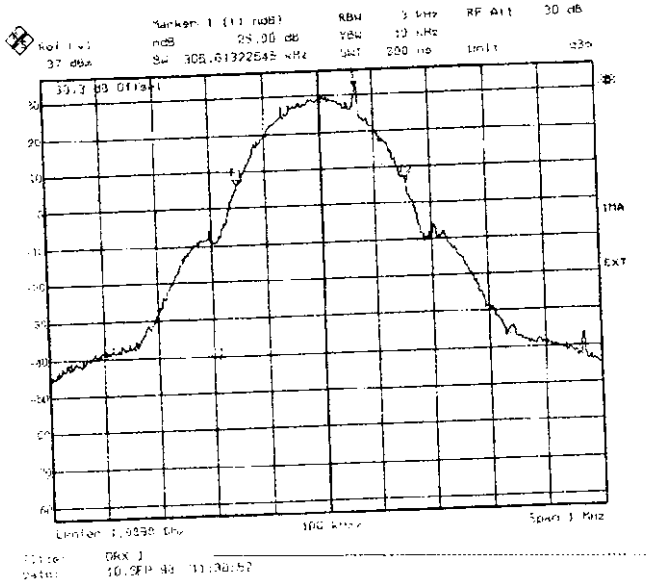
Table 3 shows the results for Occupied Bandwidth.

Table 3 : Test Results for Occupied bandwidth

ARFCN	Frequency (MHz)	Measured Occupied Bandwidth (kHz)	
		Ant 1	Ant 2
512	1930.2	304.6	300.6
661	1960.0	294.6	294.6
810	1989.8	294.6	306.6

Figure 3 shows a sample plot for case of the maximum measured occupied bandwidth. The maximum occupied bandwidth was found to be 306.6 kHz.

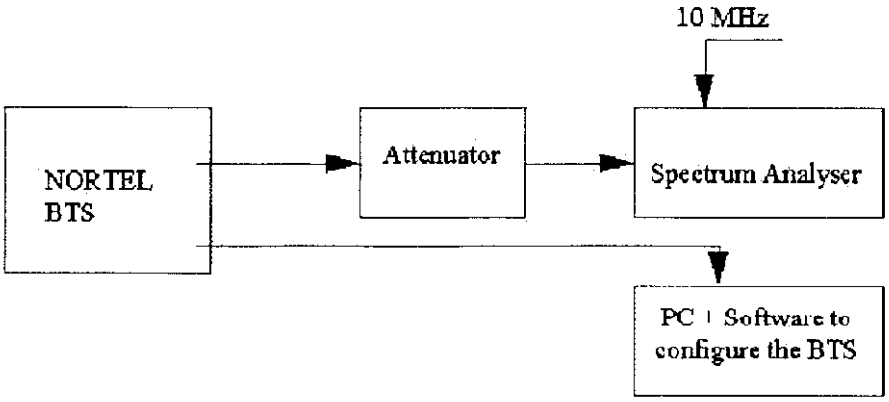
Figure 3 : Sample plot for occupied bandwidth



5.7.3. TEST PROCEDURE

The equipment was configured as shown in figure 4.

Figure 4 : 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 using the channel power (99% power) feature of the spectrum analyzer which had the following settings :

Resolution bandwidth :	3 kHz
Video bandwidth :	10 kHz
Span :	1 MHz
Attenuation :	30 dB
Reference level :	37 dBm
Reference Level Offset :	30.3 dB
Level range :	120 dB
Sweep time :	280 ms

5.8. NAME OF TEST : 2.991 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

5.8.1. FCC REQUIREMENTS

5.8.1.1. 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.

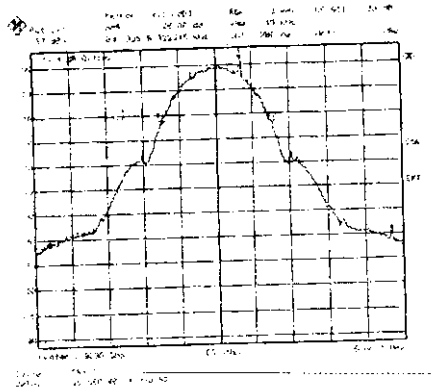
(c) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(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.

5.8.2. TEST RESULTS

The emission bandwidth was found to be 306.6 kHz. A sample plot for the emission bandwidth measurement is shown on figure 5. This value was used to determine the resolution bandwidth required for measurements in the first adjacent MHz outside the licensee's frequency block.

Figure 5 : Sample plot for occupied bandwidth



The reference level for spurious emissions at the antenna terminals was taken from the measured output power (35.8 dBm = 3.8 Watts). Therefore the

spurious emisions must be attenuated by at least 43 + 10*Log(3.8) = 48.8 dB. The measured output power was 35.8 dBm ; therefore the limit is 48.8 - 35.8 = -13 dBm.

Table 4 shows the results for Spurious Emissions at Antenna Terminals.

Table 4 : Test results for Spurious Emissions at Antenna Terminals

Frequency (MHz)	Spurious Emissions Level (dBm)		Limit (dBm)	Margin (dB)
	Antenna #1	Antenna #2		
1929.9 (@ Ch. 512)	-13.6		-13	0.6
1929.9 (@ Ch. 512)		-13.7	-13	0.7
1929.9 (@ Ch. 513)	-38.8		-13	25.8
1930 (@ Ch. 513)		-39.8	-13	26.8
1945.1 (@ Ch. 584)	-37.9		-13	24.9
1945 (@ Ch. 584)		-37.6	-13	24.6
1945 (@ Ch. 585)	-13.1		-13	0.1
1945 (@ Ch. 585)		-13.1	-13	0.1
1944.9 (@ Ch. 587)	-13.4		-13	0.4
1944.9 (@ Ch. 587)		-13.6	-13	0.6
1945 (@ Ch. 588)	-38.5		-13	25.5
1944.9 (@ Ch. 588)		-39.0	-13	26.0
1950.1 (@ Ch. 609)	-36.8		-13	23.8
1950 (@ Ch. 609)		-36.7	-13	23.7
1950 (@ Ch. 610)	-13.5		-13	0.5
1950 (@ Ch. 610)		-13.6	-13	0.6
1949.9 (@ Ch. 612)	-13.5		-13	0.5
1949.9 (@ Ch. 612)		-14.8	-13	1.8
1949.9 (@ Ch. 613)	-37.7		-13	24.7
1949.9 (@ Ch. 613)		-37.6	-13	24.6
1965 (@ Ch. 684)	-38.4		-13	25.4
1965 (@ Ch. 684)		-37.6	-13	24.6
1964.9 (@ Ch. 685)	-14.4		-13	1.4
1965 (@ Ch. 685)		-14.6	-13	1.6
1965 (@ Ch. 687)	-14.5		-13	1.5
1964.9 (@ Ch. 687)		-14.2	-13	1.2
1964.9 (@ Ch. 688)	-37.3		-13	24.3
1964.9 (@ Ch. 688)		-37.5	-13	24.5
1970 (@ Ch. 709)	-37.9		-13	24.9
1970 (@ Ch. 709)		-36.4	-13	23.4
1970 (@ Ch. 710)	-13.7		-13	0.7
1970 (@ Ch. 710)		-13.1	-13	0.1

Frequency (MHz)	Spurious Emissions Level (dBm)		Limit (dBm)	Margin (dB)
	Antenna #1	Antenna #2		
1969.9 (@ Ch. 713)	-38.2		-13	25.2
1969.9 (@ Ch. 713)		-38.7	-13	25.7
1975 (@ Ch. 734)	-39.2		-13	26.2
1975 (@ Ch. 734)		-39.4	-13	26.4
1975 (@ Ch. 735)	-13.8		-13	0.8
1975 (@ Ch. 735)		-14.3	-13	1.3
1974.9 (@ Ch. 737)	-13.3		-13	0.3
1974.9 (@ Ch. 737)		-13.4	-13	0.4
1974.9 (@ Ch. 738)	-37.8		-13	24.8
1974.9 (@ Ch. 738)		-38.8	-13	25.8
1990 (@ Ch. 809)	-37.1		-13	24.1
-1990.1 (@ Ch. 809)		-38.2	-13	25.2
1990 (@ Ch. 810)	-13.2		-13	0.2
1990 (@ Ch. 810)		-13.7	-13	0.5
0.249 (@ Ch. 661)	-57.8		-13	44.8
0.232 (@ Ch. 661)		-57.6	-13	44.6
0.4 (@ Ch. 661)	-56.9		-13	43.9
0.3 (@ Ch. 661)		-57.8	-13	44.8
166.3 (@ Ch. 661)	-49.9		-13	36.9
50 (@ Ch. 661)		-51.8	-13	38.8
1930 (@ Ch. 661)	-37.0		-13	24.0
1930 (@ Ch. 661)		-36.6	-13	23.6
3923 (@ Ch. 661)	-22.4		-13	9.4
3923 (@ Ch. 661)		-23.1	-13	10.1
5883 (@ Ch. 661)	-26.3		-13	13.3
5883 (@ Ch. 661)		-26.0	-13	13.0
10861 (@ Ch. 661)	-31.4		-13	18.4
10861 (@ Ch. 661)		-32.4	-13	19.4
18541 (@ Ch. 661)	-32.4		-13	19.4
14581 (@ Ch. 661)		-31.4	-13	18.4

Notes :

1- Measurements were made for both Antenna 1 and Antenna 2 connectors. The worst case emission was presented for each frequency range measured.

Figure 6, resp. Figure 7 show sample plots for the case when the transmitter was tuned to Channel 512, resp. 810 (lowest channel in Tx band, resp. highest channel in Tx band) with the power reduced by 6 dB.

Figure 8, resp. Figure 9 show sample plots for the case when the transmitter was tuned to Channel 513, resp. 809 (lowest channel in Tx band, highest channel in Tx band) with the maximum available power.
Figure 10 to Figure 15 show sample plots for frequency spans from 0 to 20 GHz (the transmitter was tuned to channel 661 which is the middle of PCS 1900 frequency band).

Figure 6 : -1 MHz adjacent band (Channel 512, Pmax - 6 dB)

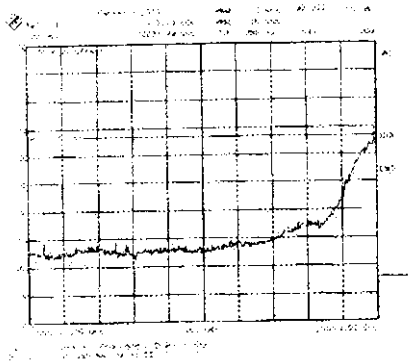


Figure 7 : +1 MHz adjacent band (Channel 810, Pmax - 6 dB)

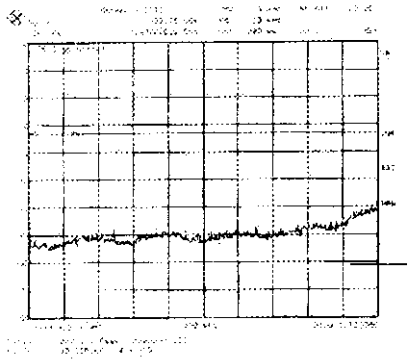


Figure 8 : -1 MHz adjacent band (Channel 513, Pmax)

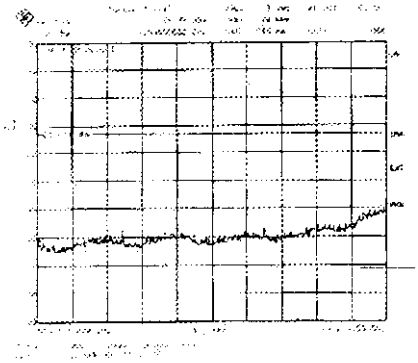


Figure 9 : +1 MHz adjacent band (Channel 809, Pmax)

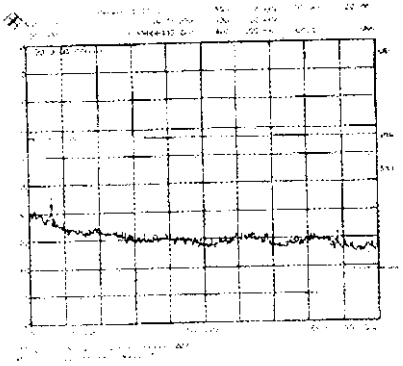


Figure 10 : 100 kHz to 300 kHz band (Channel 661, Pmax)

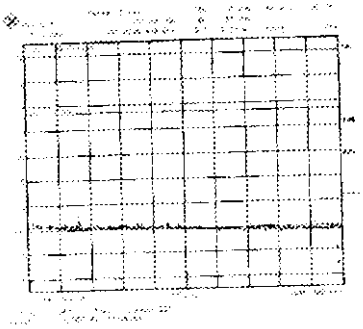


Figure 11 : 300 kHz to 50 MHz band (Channel 661, Pmax)

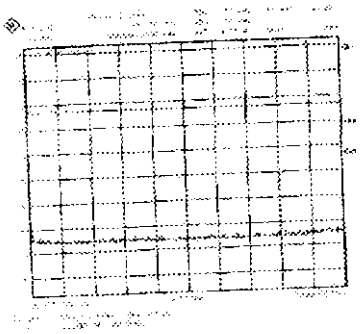


Figure 12 : 50 MHz to 500 MHz band (Channel 661, Pmax)

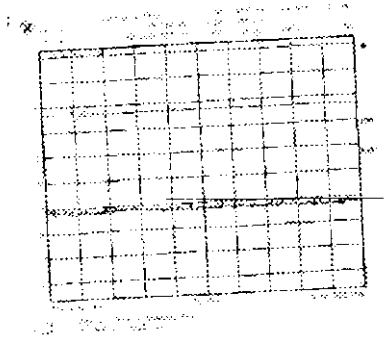


Figure 13 : 500 MHz to 1930 MHz band (Channel 661, Pmax)

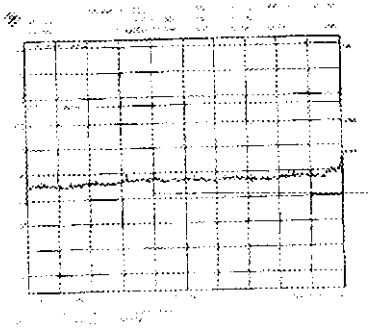


Figure 14 : 1990 MHz to 4 GHz band (Channel 661, Pmax)

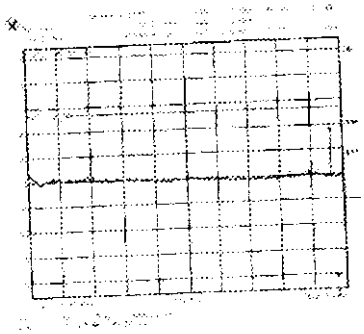


Figure 15 : 4 GHz to 8 GHz band (Channel 661, Pmax)

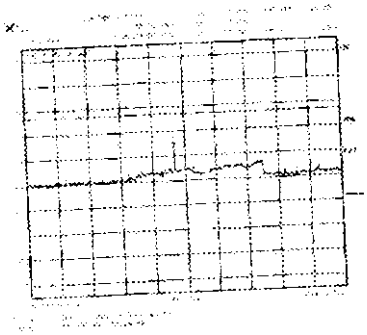


Figure 16 : 8 GHz to 12 GHz band (Channel 661, Pmax)

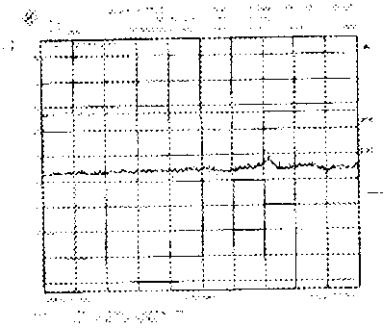
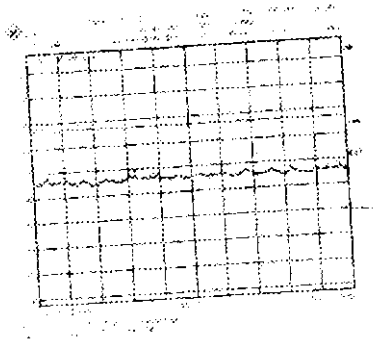


Figure 17 : 12 GHz to 20 GHz band (Channel 661, Pmax)

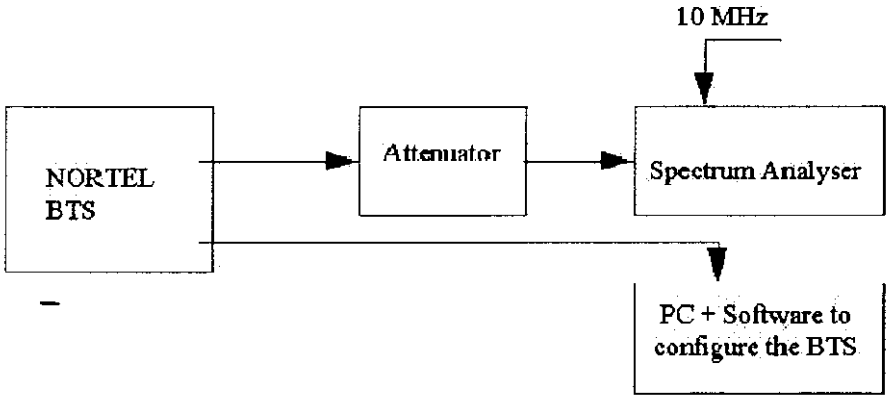


In order to comply with the emission limits in the 1 MHz bands immediately outside and adjacent to the frequency block, the transmit power level of the block edge channels has been reduced by 6 dB .
Measurements were also performed when the BTS was maximum power on Channels 513 and 809 (channels adjacent to band edge channels) and it was found that the emission requirements were met with greater than 20 dB margin. From the results shown in Table 4, the S2000L BTS complies with the requirement.

5.8.3. TEST PROCEDURE

The equipment was configured as shown in figure 18.

Figure 18 : Test configuration for Spurious emissions at antenna terminals



For adjacent channels emissions, the BTS nominal carrier frequency was adjusted to every channel which are at the lower and upper edges of the PCS blocks respectively. The transmitter was set to operate to maximum power minus 6 dB.

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 306.6 kHz. Therefore, the resolution bandwidth was set to 3 kHz. The spectrum analyzer had the following settings :

Resolution bandwidth :	3 kHz
Video bandwidth :	10 kHz
Span :	1 MHz
Attenuation :	30 dB
Reference level :	37 dBm
Reference Level Offset :	30.3 dB
Level range :	100 dB
Sweep time :	Coupled

For all other measurements the BTS carrier frequency was adjusted to Channel 661 with the transmitter at maximum output power.

Measurements were made on both Antenna 1 and Antenna 2 connectors. 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.

5.9. NAME OF TEST : 2.993 FIELD STRENGHT OF SPURIOUS RADIATION

5.9.1. FCC REQUIREMENTS

5.9.1.1. 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.

5.9.1.2. FCC Part 2.993

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission.

5.9.2. TEST RESULTS

Table 5 shows the results for radiated spurious emissions measurements.

Table 5 : Test results for spurious emissions

Frequency (MHz)	Antenna Polarization	Measured Level (dBµV)	Correction Factor (dB)	Corrected Level (dBµv/m)	Limit (dBµV/m) @ 1 m
3860.4	Horizontal	11.5	37.9	49.4	93.9
3979.6	Horizontal	12.7	37.9	50.6	93.9

The field strength is calculate by adding the correction factor to the measured level to obtain the corrected level. A sample calculation is as follows :

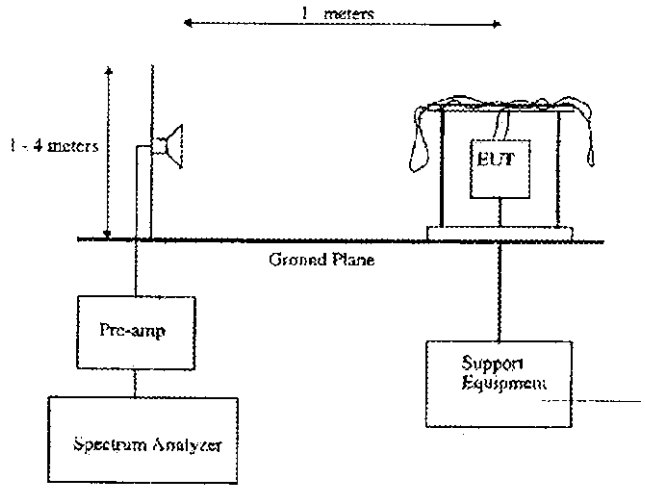
$Gerrection\ Factor_{(dB)} = Cable\ Losses_{(dB)} + Antenna\ Factor_{(dB)} - pre\text{-}amplifier\ gain_{(dB)}$
$Corrected\ Level_{(dB\mu V/m)} = Measured\ Level_{(dB\mu V/m)} + Correction\ Factor_{(dB)}$

All spurious emissions were below the limit by greater than 50 dB except for those recorded in Table 5.

5.9.3. TEST PROCEDURE

The equipment was configured as shown in figure 19.

Figure 19 : Test configuration for Radiated Spurious emissions



The BTS was configured to transmit at maximum power (static level 0).
Measurements were made according to the procedures outline in ANSI C63.4.
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 limit.
The reference level for spurious radiation was taken with reference to an ideal dipole antenna excited by the rated output power according to the following relationship :

$$E\left(\frac{V}{M}\right) = \frac{1}{R(m)} * \sqrt{30 * Pt * G}$$

Where,

E = Field Strength in Volts/meter,
R = Measurement distance in meters,
Pt = Transmitter Rated Power in Watts (5 Watts),
G = Gain of Ideal Dipole (linear)

Therefore :

$$E\left(\frac{V}{M}\right) = \sqrt{30 * 5 * 1.64}$$

E = 15.7 V/m = 143.9 dBµV/m
The spurious emissions must be attenuated by at least 43 + 10*Log(5) = 50 dB.
Therefore the field strength limit at 1 meters is :
E = 143.9 dBµV/m - 50 dB = 93.9 dBµV/m

5.10. NAME OF TEST : 2.995 FREQUENCY STABILITY

5.10.1. FCC REQUIREMENTS

5.10.1.1. FCC Part 24.235

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

5.10.2. TEST RESULTS

Table 6 shows the results for Frequency Stability.

Table 6 : Test results for Frequency Stability

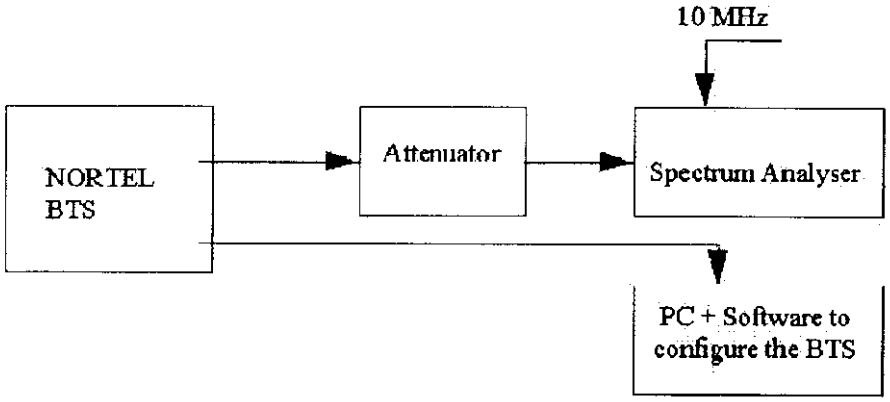
Temperature (°C)	Maximum Carrier Frequency Deviation (Hz)		
	Supply Voltage (85% of Nominal) 176 VAC	Supply Voltage (Nominal) 240 VAC	Supply Voltage (115% of Nominal) 276 VAC
-30	-130.2	-48.0	-45.7
-20	-38.4	-40.6	-35.7
-10	-55.7	-58.2	-62.6
0	-67.2	-39.1	-39.1
10	-38.7	-35.4	-38.4
20	-38.9	-54.9	-71.9
30	-38.5	-38.1	-38.0
40	-66.4	-41.9	-39.6
50	-64.9	-37.2	-39.7

As nominal voltage can be between 208 V and 240 V, tests were performed at : 176.8 V (0.85*208 V), 240 V and 276 V (1.15*240 V).
The maximum carrier frequency deviation was found to be -130.2 Hz. This deviation is more than sufficient to ensure that the fundamental emission stays within the authorized frequency block. Therefore the S2000L BTS complies with the requirement.

5.10.3. TEST PROCEDURE

The equipment was configured as shown in figure 20.

Figure 20 : Test configuration for Frequency Stability



The BTS was configured to transmit at maximum power (Static level 0).
The BTS was subjected to ambient temperatures from -30 to +50 centigrade at intervals of 10 centigrade. A period of at least one hour was allowed prior to measurement to ensure that all of the component s of the oscillator circuit had stabilized at each temperature.
At each temperature, measurements were made with the primary supply voltage set to 85, 100 and 115 percent of the nominal value (between 208 and 240 VAC). The nominal primary supply voltage in this case was 240 VAC.
At each of the above specified conditions, the maximum carrier frequency deviation was recorded from the time the transmitter was keyed-on for a period of ten minutes using a Rhode & Schwarz FSEA spectrum analyzer.

5.11. NAME OF TEST : 24.51(D) RF HAZARDS

5.11.1. FCC REQUIREMENTS

5.11.1.1. FCC Part 24.51

(d) Applicants for type acceptance of transmitters that operate in these services must determine that the equipment complies with IEEE C95.1-1991, "IEEE Standards for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300.GHz" as measured using methods specified in IEEE C95.3-1991, "Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave." The applicant for type acceptance is required to submit a statement affirming that the equipment complies with these standards as measured by an approved method and to maintain a record showing the basis for the statement of compliance with IEEE C.95.1-1991.

5.11.1.2. Limit

The maximum field strength limit was derived from the newly adopted NCPR recommended limits for maximum permissible exposure for uncontrolled environments of 1 mW/cm² as follows :

$$PowerDensity\left(\frac{W}{m^2}\right) = \frac{EField\left(\frac{V}{m}\right)^2}{\eta}$$

$$EField = \sqrt{PowerDensity\left(\frac{W}{m^2}\right) * \eta}$$

$$EField = \sqrt{10\left(\frac{W}{m^2}\right) * 377\Omega}$$

Therefore,
E-Field = 61.4 V/m = 155.8 dBµV/m

5.11.2. TEST RESULTS

S2000L BTS is a low power variant of S2000H BTS which has already been approved by FCC under FCC Id AB6NTQA2629.
As such, the field strength generated by the BTS will be lower or of the same order of the one from S2000H BTS.
As S2000H BTS was found to comply with a safety margin of more than 40 dB, S2000L BTS complies with RF Hazard requirements.

5.12. MEASUREMENT EQUIPMENT LIST

Table 8 is a list of all of the measurement equipment used in this report.

Table 8 : Measurement Equipment List

Equipment Description	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Rohde & Schwarz	FSEA	515960
Signal Generator	HP	HP8657B	508065
20 dB Attenuator	Radiall	R417320110	-
30 dB attenuator	Radiall	R417030128	-
Spectrum Analyzer	Rohde & Schwarz	FSEM	502383
30 dB attenuator	HP	HP8498A	519472
Power meter (probe)	Gigatronics	80401A	500344
Power meter	Gigatronics	8542C	515956
Signal Generator	HP	HP83712B	521712
Network Analyzer	HP	HP8753C	500009
Climatic chamber	SECASI	30 m^3	-

5.13. HARDWARE EQUIPMENT MODULE LIST

Table 9 lists the technical status of the equipment tested.

Table 9 : Technical status of tested equipment

Designation	Technical Status	Comment
Main cabinet	NTQA28AA	
Main module	NTQA27AL	In Main cabinet
Power Supply Unit	NTQA2612	In Main module
SBCF	NTQA2785	In Main module
I&C interface module	NTQA2790	In Main module
DRX	NTQA01AG	In Main module
LPRF Module	NTQA26AV	In Main cabinet
LNA	NTQA2626	In LPRF module
PA	NTQA2624	In LPRF module
Duplexer	NTQA26GA	In LPRF module

- End of Exhibit -