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S8000 Outdoor BTS GSM 1900 : FCC Part 24 Class II Permissive Change Application AB6OUDS8000

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Author :	E. QUIRIN
Documentalist :	A.M. LE BERRE
Approved by :	C. LEFEBVRE
Quality representative :	G. CALLEWAERT

Abstract / Comments :

This document presents the FCC regulatory assessment realized in order to introduce the following items into the S8000 Outdoor BTS system :

- Compact BCF (CBCF) module
- New Design DRX
- Low cost APS rectifier
- Tx Filter coupling system
- Four way Hybrid duplexers
- Extension and sectorial cabinets
- Codification changes

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VERSION	DATE	COMMENTS	AUTHOR
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TABLE OF CONTENTS

1. INTRODUCTION

1.1. OBJECT

This document presents the FCC regulatory assessment realized in order to introduce the following items into the S8000 Outdoor BTS system:

- Compact BCF (CBCF) module
- New Design DRX
- Low cost APS rectifier
- Tx Filter coupling system
- Four way Hybrid duplexers
- Extension and sectorial cabinets
- Codification changes

These modifications have been evaluated to be a class II permissive change to the original FCC Part 24 Type Accepted equipment, as described in FCC Part 2 rules:

2.1001 Changes in type accepted equipment.

(a) Equipment of the same type is defined for purposes of type acceptance as being equipment which is electrically and mechanically interchangeable and in addition will have the same basic tube or semiconductor lineup, frequency multiplication, basic frequency determining and stabilizing circuitry, basic modulator circuit and maximum power rating. Variations in electrical and mechanical construction, other than the items indicated above are permitted, provided the variation or change is made in compliance with the requirements of paragraphs (b), (c) and (d) of this section.

(b) Two classes of permissive changes may be made in type accepted equipment without requiring a new application for and grant of type acceptance.

(1) A Class I permissive change includes those modifications in the equipment which do not change the equipment characteristics beyond the rated limits established by the manufacturer and accepted by the Commission when type acceptance is granted, and which do not change the type of equipment as defined in paragraph (a) of this section. No filing with the Commission is required for a Class I permissive change.

(2) A Class II permissive change includes those modifications which bring the performance of the equipment outside the manufacturer's rated limits as originally filed but not below the minimum requirements of the applicable rules, and do not change the type of

equipment as defined in paragraph (a) of this section. When a Class II permissive change is made by the grantee, he shall supply the Commission with complete information and results of tests of the characteristics affected by such change. The modified equipment shall not be marketed under the existing grant of type acceptance prior to acknowledgment by the Commission that the change is acceptable.

1.2. SCOPE

This document applies to the S8000 Outdoor BTS GSM 1900.

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/0229	S8000 Outdoor BTS : CBCF FCC Part 24 Frequency Stability test report
[R3]	PCS/BTS/DJD/0232	S8000 BTS : DRX ND and TxF 1900 Modules RF Emissions Tests Report at ambient

3. ABBREVIATIONS & DEFINITIONS

3.1. ABBREVIATIONS

DRX	Driver Receiver Unit
BCF	Base Common Function
BTS	Base Transceiving Station
GSM	Global System for Mobile Communications
PA	Power Amplifier
LNA	Low Noise Amplifier
OMC	Operation and Maintenance Center
TCU	Trans-Coding Unit
MSC	Mobile Switching Center
RF	Radio Frequency

3.2. DEFINITIONS

None

4. ONGOING COMPLIANCE

As part of the Nortel Engineering Change Process, the Product Integrity group reviews all product changes to the S8000 Outdoor BTS System. These reviews include an assessment of the impact that the changes or additions will have to the ongoing EMC/Radio Compliance of the System. When required, Analysis and Testing are performed to ensure continued compliance of the System.
Below is a list of the type of changes which are flagged during the reviews of product changes:

- Device changes which impact the clock speed or rise time
- Routing changes which could affect the emission and/or immunity profile for a circuit pack
- Changes to Power Supplies (input/output filtering, switching frequency, etc.)
- Addition of new circuit pack (electronic sub-assembly) to the S8000 Outdoor BTS system (potential change in emission and/or immunity profile)
- Re-configuration of existing S8000 Outdoor BTS hardware (variants) which change the emission profile (additional units, new combinations of units, etc.)
- Changes to the physical design which could impact Radio and/or EMC performances
- Addition of new sub-systems (variants) to the S8000 Outdoor BTS system

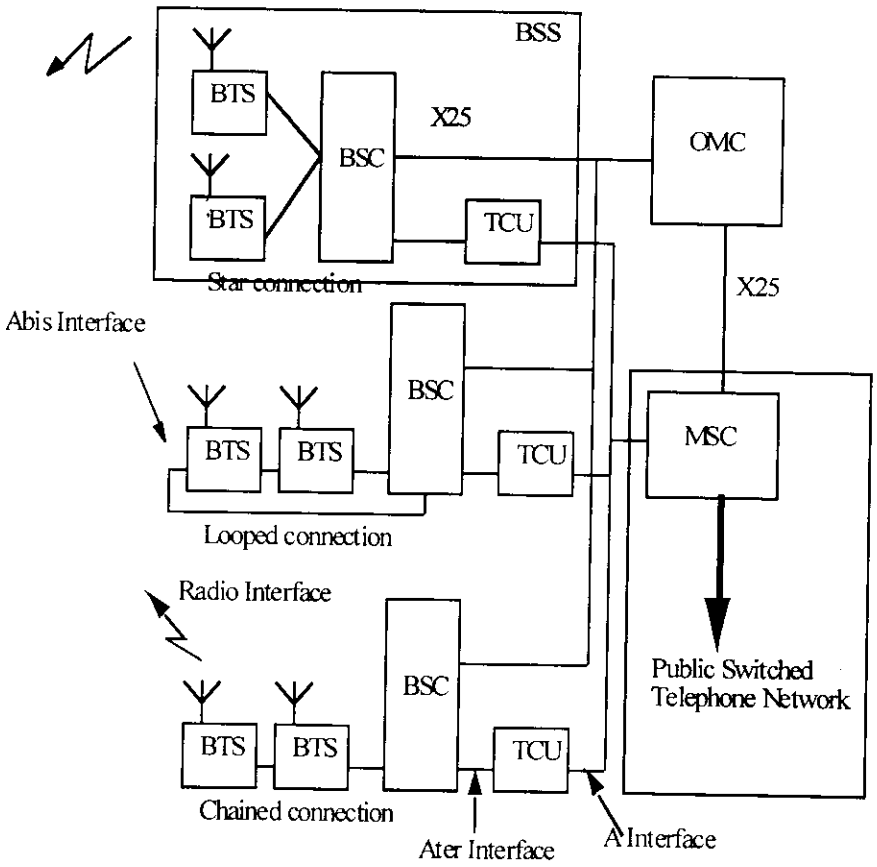
Where analysis of changes to the S8000 Outdoor BTS system indicates that verification testing is required to confirm continued compliance, the details of the changes to the system, test configuration and rationale, test results, and conclusions are included in this document for review and approval by the FCC, when required.
The BTS software is released in a controlled batch release format. For each of these releases, there may or may not be hardware content. New features are introduced at these structured release dates.
New features can be both hardware and software, or just one of the two. For all releases with hardware content, the ongoing compliance process outlined in this section is applied. For releases with only software content, no radio, engineering, or testing is required.
The architecture of the BTS Family of Products is such that the communication links are defined by the hardware (e.g. the ABIS link remains at the same data bit rate regardless of the actual data being transported). As such, the changes to software features which are not accompanied by hardware upgrades do not have any impact on the radio performances of the BTS Family of Products.
During testing, care is taken to ensure "worst case" system operational states are addressed. This ensures that all applications available on the BTS Family

Hardware have been evaluated. Until there are updates to the hardware, no further system testing is required.

5. DESCRIPTION OF APPARATUS

5.1. BTS SYSTEM

The Base Transceiver Station (BTS) provides the interface between the fixed network and the mobile stations which is a radio interface.
The radio interface carries signaling and speech/data channels using digitized and encoded signals modulated in GMSK in GSM 1900 MHz band for North American products.
Communication with the fixed network are enabled across a wire interface called the Abis interface. It connects the BTS to its Base Station Controller (BSC). The transmission of signaling, speech, and data channels is carried out on PCM link (also called ABIS interface).
The BTS configures its equipment, establishes, maintains and clears calls to and from mobile stations as directed by the Base Station Controller (BSC). The BTS organizes and manages radio-electric resources, supervises its own equipment and conducts stand-alone defense actions as and when required.



5.2. RF MANAGEMENT

Two frequency bands are allocated to the system as follows:

- downlink or "base to mobile" (TX part),
- uplink or "mobile to base" (RX part).

Both RX and TX bands are frequency divided into 200 kHz channels. Each channel is identified by an Absolute Radio Frequency Channel Number (ARFCN).

The first and the last channel on the edge of the bandwidth are not used for actual RF transmissions, and may be used for testing purposes.

All RF channels are time multiplexed according to the system fundamental TDMA frame, composed of up to eight time slots.

Each time slot is occupied by an RF burst. During the RF burst, the RF carrier may be modulated at a bit rate of 270 kb/s, using GMSK (Gaussian Minimum Shift Keying, with BT = 0.3) modulation.

In order to overcome propagation problems, the system uses slow frequency hopping techniques. The carrier frequency of each transmitter remains constant during each burst, and jumps randomly to any RF channel (over the full RF bandwidth) before transmitting the next burst.

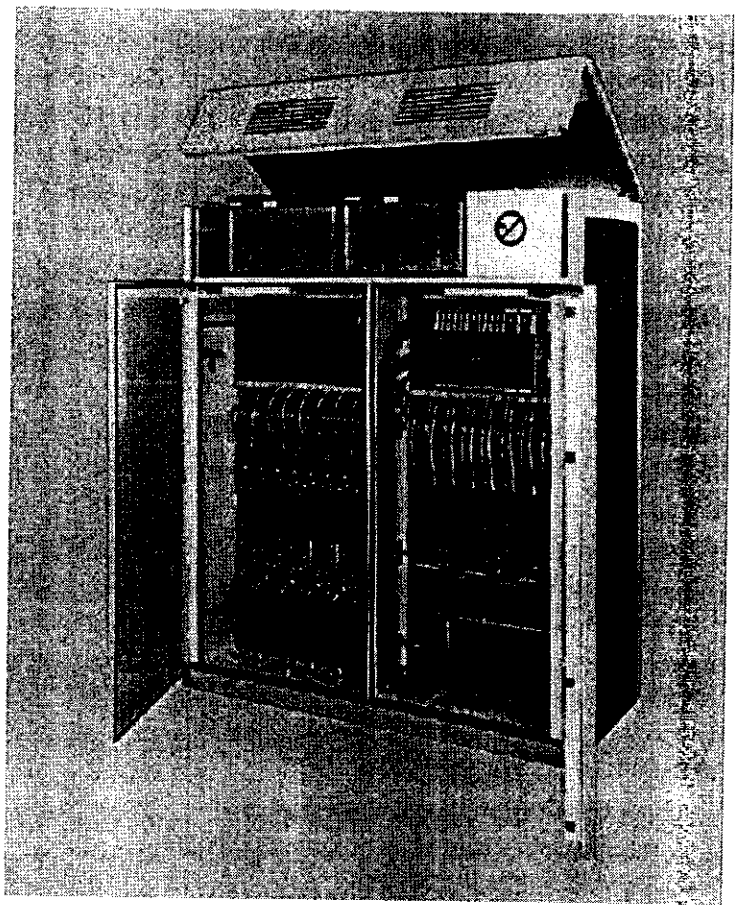
The RF power generated by the transmitters is not constant: the peak power (defined as the r.m.s. power during the burst, excluding the leading and trailing edges) may be adjusted by the network operator for cell dimensioning and frequency reuse purpose.

In addition, the peak power may vary from one burst to the next one by 30 dB depending of the distance between the Base Transceiver Station and the mobiles.

The system may use voice activity detection (V.A.D.) and discontinuous transmission techniques (D.T.X.).

It is consequently impossible to predict, at each transmitter output, if a time slot will be actually used to transmit an RF burst, at which level, and how many carrier.

5.3. S8000 OUTDOOR BTS SYSTEM



The S8000 Outdoor BTS System is subdivided into eight major areas:

- Base Common Function (BCF) - This block is made of digital packs and provides management of the system as well as connection to the network.
- Radio Modules (DRX) – The DRX includes the whole set of functions necessary to handle a full TDMA frame including RF reception with diversity and RF transmission at low level.
- Power Amplifiers (PA) - The necessary amplification for transmission is achieved by a separate Power Amplifier.
- RF Combiner modules - They include up to four different modules: VSWR-meter, Duplexer, Low Noise Amplifier/Splitter and Hybrid combiner.
- Rectifiers and Power Management unit – Provides energy to the system (first layer is made of rectifiers and second layer is made of DC to DC converters).
- Internal battery backup (for short interruptions)
- Thermal Management System.

- Miscellaneous accessories devices - This shelf is dedicated to user functions.

The BCF block is set up only on the main cabinet and comprises and can be of two different types:

1- BCF Module which comprises :
   - a PCM interface module with the BSC. PCMI boards interface and synchronize the external PCM link in both transmit and receive mode. Each unit handles two external PCM link. The external PCM reference clock is extracted by a PLL. The external ABIS interface may be protected against lightning surges through the external module PRIPRO (option).
   - a communication module with the BSC, duplicated and operating in active/standby mode, using the LAPD protocol (2 CSWM boards). It also includes a switching matrix, duplicated and operating in active/standby mode, providing an internal and external PCM link switching function and which are used to connect a number of base transceiver stations over the same PCM link with their controller.
   - a module concentrating signaling data from the Frame Processors called DSC.
   - a duplicated synchronization module (SYNC) and operating in active/standby mode, supplying the GSM time to all relevant units of the site. The SYNC module delivers the reference time, generated by the external frequency reference, a VCO, frequency dividers and phase locked loop (PLL).
   - a duplicated interface module (GTW) to distribute the GSM time and O&M buses.
   - three power supplies type A which convert 48V into 5V, plus a power supply control board (PSCMD).
   - a specific board ALCO in charge of alarms collecting, plus its associated input protection board ALPRO (option).

2- or a CBCF Module (realizing exactly the same functionality as the BCF) which comprises :
   - Up to 3 CPCMI boards
   - Up to 2 SMCF boards
   - a specific RECAL in charge of alarms collecting.

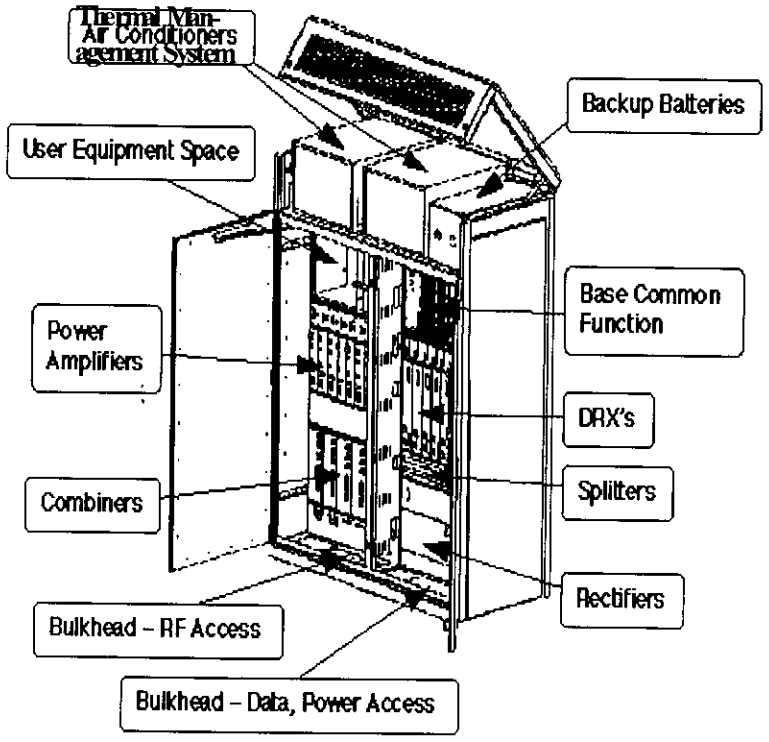
The radio block comprises:

1) DRX entities, each DRX module is composed of:
   a) one radio board offering slow frequency hopping capability, static and dynamic power controls, diversity reception.
   b) one logic board offering channel (de)coding, (de)ciphering and management of the DRX.

c) two power supplies which convert 48V into +5V, +12V, -12V and +24V.

2) Power Amplifiers entities, boosting the level of the GMSK modulated pulse, generated by the DRX, up to the RF power level necessary to the transmission.
3) one transmission coupling device which concentrates the signals arriving from the transmitters and/or one duplexer module providing transmit and receive bandpass filtering, and connected to the transmission/reception antenna port and/or one transmit filter connecet to the transmission antenna port.
4) one RX-splitter, composed of one or more splitters fitted together in the same container together with a Low Noise Amplifier (LNA).

A cell can be divided in up to three different sectors. Thus, inside a cabinet, there may be several sectors and several radio channels per sector.



6. DESCRIPTION OF APPLICATION

6.1. CBCF MODULE

The principal functions of the CPCMI are the following:

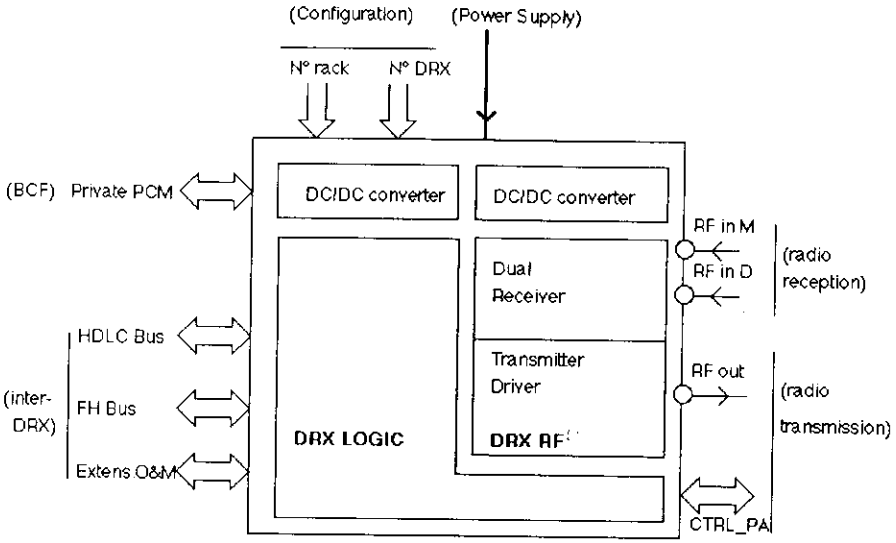
- provides the line transceivers and framers for two T1 or E1 backhaul interfaces
- presents a microprocessor interface for control and monitoring
- recovers timing from each line and provides to the synchronization block
- performs rate justification between T1 (1.544 Mbps) and internal PCM (2.048 Mbps)
- performs frame alignment of each of the two received streams to the master frame synchronization pulse from the CMCF
- power/sanity fail-safe pass through of line for daisy chained configurations
- provides secondary level of regulatory/safety protection on the T1 or E1 lines

In order to demonstrate compliance of the S8000 Outdoor BTS equipped with CBCF, the following tests were performed :

- Frequency stability from -30 °C to +50 °C with power supply variations (the CBCF generates the reference clock for all modules and have thus impacts on frequency stability)

6.2. NEW DESIGN DRX

In order to achieve some cost reduction, the S8000 BTS DRX were redesigned. The general architecture of the DRX remains unchanged (see next figure) but modifications have been done to the RF boards (leading to RF performances improvements).



In order to demonstrate compliance of the S8000 Outdoor BTS equipped with New Design DRX, the following tests were performed :

- Frequency stability from -30 °C to +50 °C with power supply variations
- Conducted spurious emissions at antenna connector
- occupied bandwidth
- RF Output power

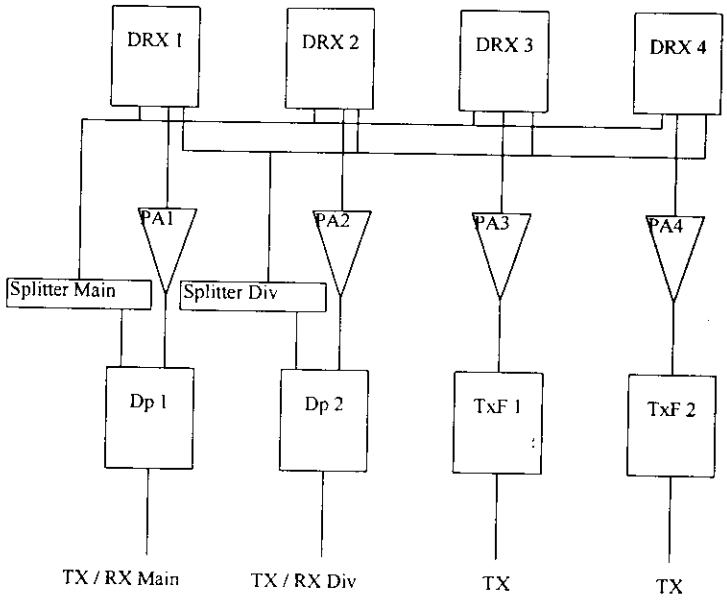
6.3. LOW COST APS RECTIFIER

In order to achieve some cost reduction at system level and increase conducted emissions performance of the S8000 Outdoor BTS, the rectifier has been redesigned.
In order to demonstrate compliance of the S8000 Outdoor BTS equipped with low cost APS rectifier, the following tests were performed :

- Frequency stability from -30 °C to +50 °C with power supply variations

6.4. TX FILTER COUPLING SYSTEM

In order to decrease the number of antennas in some specific site configurations, a Transmit filter is made available. The diagram bellow shows an O4 configuration :

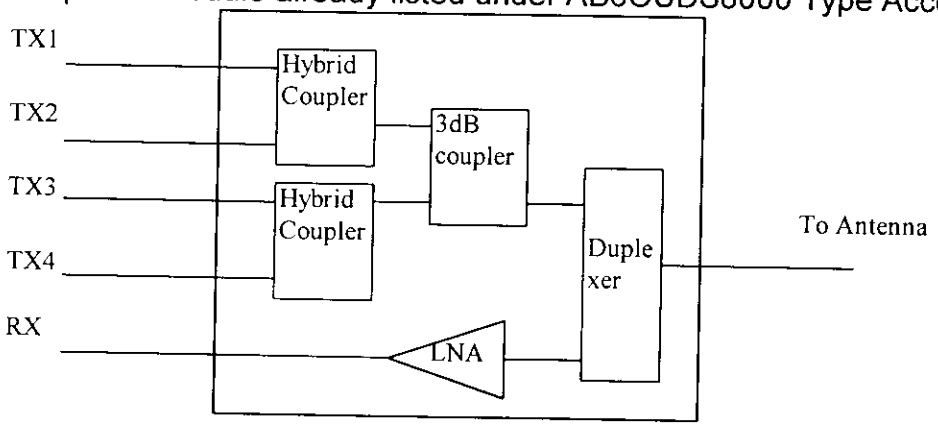


In order to demonstrate compliance of the S8000 Outdoor BTS equipped with Tx filter coupling system, the following tests were performed :

- conducted spurious emissions at antenna connector
- occupied bandwidth
- RF Output power

6.5. FOUR WAY HYBRID DUPLEXER

In order to address high capacity configurations such as S444 (three radio sectors with 4 transmitters each) with the minimum number of antennas, a four way Hybrid Duplexer is introduced. This four way hybrid duplexer can be represented as bellow (elements in gray are common to the two way hybrid duplexer module already listed under AB6OUDS8000 Type Acceptance) :



Since this coupling system only differ from the two way hybrid duplexer by the use of a 3 dB coupler, it is deemed that their is no impact on the FCC Part 24 Type Acceptance of the S8000 Outdoor BTS.

6.6. EXTENSION AND SECTORIAL CABINETS

In order to implement configurations with more than 8 DRXs, an extension (or sectorial) cabinet is introduced for S8000 Outdoor BTS. This extension (or sectorial) cabinet is identical to the base cabinet except that there is no BCF functionality (boards are replaced by a filler).

This new functionality has no impact on actual FCC Type Acceptance of Nortel S8000 Outdoor BTS.

6.7. CHANGES IN CODIFICATION

In order to have common codes between base and extension cabinets of the S8000 Outdoor BTS, a small modification has been done to the architecture of the product. As such, some code changes (with no impacts on design and performances) were done.

The changes in codification does not impact FCC Part 24 Type Acceptance of Nortel S8000 Outdoor BTS.

7. CONCLUSION

As demonstrated in Exhibit 1, the S8000 Outdoor BTS including all the above listed modifications still complies with FCC Part 24 requirements.

8. EXHIBIT 1 : TEST REPORT

8.1. 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 2.999.

8.2. MEASUREMENT RESULTS

The following sections contain the measurement results.

8.3. NAME OF TEST : 2.985 RF POWER OUTPUT

8.3.1. FCC REQUIREMENTS

8.3.1.1. 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.

8.3.2. TEST RESULTS

Table 1 shows the test results for RF Output Power.

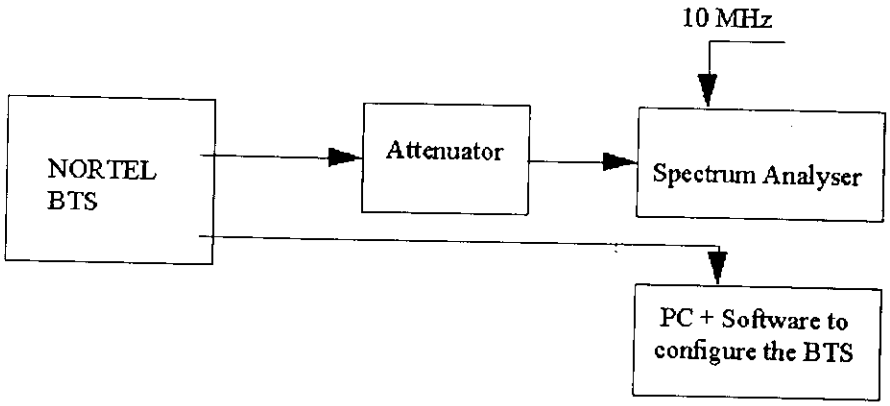
Table 1 : Test results for RF Output Power

Radio Channel	Frequency (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)	Limit (dBm)
549	1937.6	43.7	44.8 (30 Watts)	50
599	1947.6	43.7	44.8 (30 Watts)	50
649	1957.6	43.9	44.8 (30 Watts)	50
699	1967.6	43.9	44.8 (30 Watts)	50
724	1972.6	43.9	44.8 (30 Watts)	50
774	1982.6	43.9	44.8 (30 Watts)	50

8.3.3. 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.
The peak 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

8.4. NAME OF TEST : 2.989 OCCUPIED BANDWIDTH

8.4.1. FCC REQUIREMENTS

8.4.1.1. FCC Part 2.289

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.

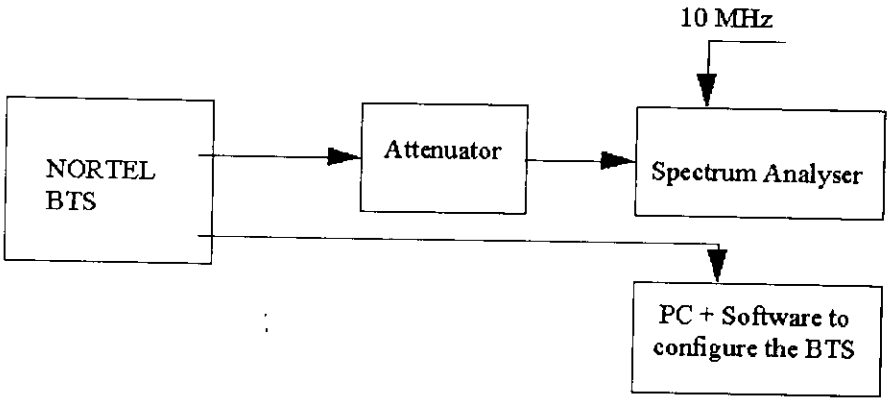
8.4.2. TEST RESULTS

The maximum occupied bandwidth was found to be 300.6 kHz (measured on channel 661, f = 1960.0 MHz).

8.4.3. TEST PROCEDURE

The equipment was configured as shown in figure 2.

Figure 2 : 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 26 dB below the transmitter power.
The spectrum analyzer had the following settings :

Resolution bandwidth :	10 kHz
Video bandwidth :	30 kHz
Span :	1 MHz
Reference level :	45 dBm
Reference Level Offset :	Corrected to account for cable(s) and attenuator losses
Level range :	100 dB
Sweep time :	25 ms

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

8.5.1. FCC REQUIREMENTS

8.5.1.1. 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.

8.5.2. 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.

Tables 2 and 3 show the results for Spurious Emissions at Antenna Terminals.

Table 2 : Test results for Spurious Emissions at Antenna Terminals

Channel	Power emission level	Spurious Emissions Level (dBm)	Limit (dBm)	Margin (dB)
512	Pmax - 12dB	-15.7	-13	2.7
513	Pmax	-28.1	-13	15.1
584	Pmax	-16.1	-13	3.1
585	Pmax - 12dB	-15.0	-13	2.0
587	Pmax - 12dB	-15.9	-13	2.9

588	Pmax	-28.0	-13	15.0
609	Pmax	-21.4	-13	8.4
610	Pmax - 12dB	-15.4	-13	2.4
612	Pmax - 12dB	-15.6	-13	2.6
613	Pmax	-27.6	-13	14.6
684	Pmax	-19.9	-13	6.9
685	Pmax - 12dB	-14.9	-13	1.9
687	Pmax - 12dB	-15.7	-13	2.7
688	Pmax	-28.2	-13	15.2
709	Pmax	-15.6	-13	2.6
710	Pmax - 12dB	-15.2	-13	2.2
712	Pmax - 12dB	-15.7	-13	2.7
713	Pmax	-28.2	-13	15.2
734	Pmax	-16.6	-13	3.6
735	Pmax - 12dB	-15.5	-13	2.5
737	Pmax - 12dB	-15.9	-13	2.9
738	Pmax	-27.8	-13	14.8
809	Pmax	-16.2	-13	3.2
810	Pmax - 12dB	-16.3	-13	3.3

Table 3 : Test results for Spurious Emissions at Antenna Terminals

Frequency (MHz)	Spurious Emissions Level (dBm)	Limit (dBm)	Margin (dB)
0.1	-31.5	-13	18.5
112.2	-39.3	-13	26.3
1926.0	-29.3	-13	16.3
-1971.8	-45.3	-13	32.3
1974.0	-56.3	-13	43.3
1990.01	-16.3	-13	3.3
1993.3	-45.7	-13	32.7
2348.4	-29.5	-13	16.5
6997.9	-22.4	-13	9.4
10989.9	-19.5	-13	6.5
12336.6	-16.3	-13	3.3

Notes :

Figure 3 and Figure 4 show sample plots for the case when the transmitter was tuned to Channel 512 (lowest channel in Tx band) with the power reduced by 12 dB.

Figure 5 shows a sample plots for the case when the transmitter was tuned to Channel 810 (highest channel in Tx band) with the power reduced by 12 dB.
Figure 6 and Figure 7 show sample plots for the case when the transmitter was tuned to Channel 513 with the maximum power available.
Figure 8 to Figure 10 show sample plots for frequency spans from 0 to 20 GHz with emission on channel 810 (Pmax -12 dB).

Figure 3 : -1 MHz adjacent band (Channel 512, Pmax - 12 dB)

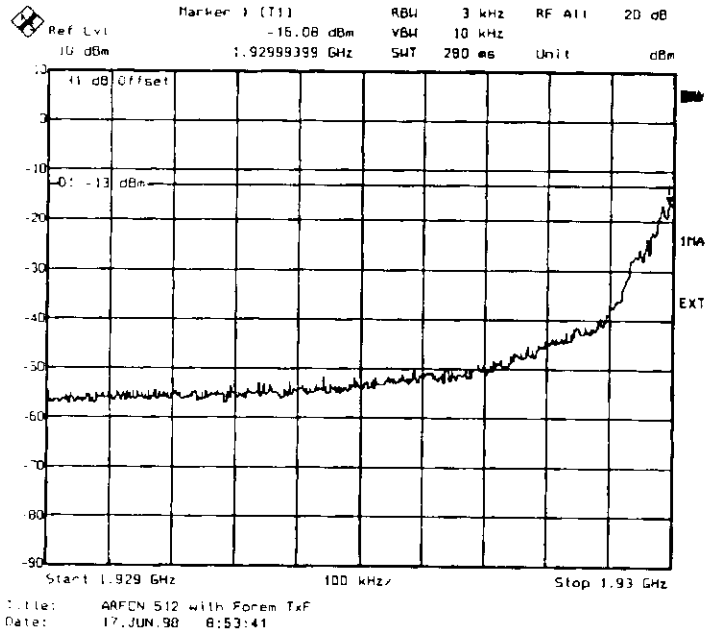


Figure 4 : +1 MHz adjacent band (Channel 512, Pmax - 12 dB)

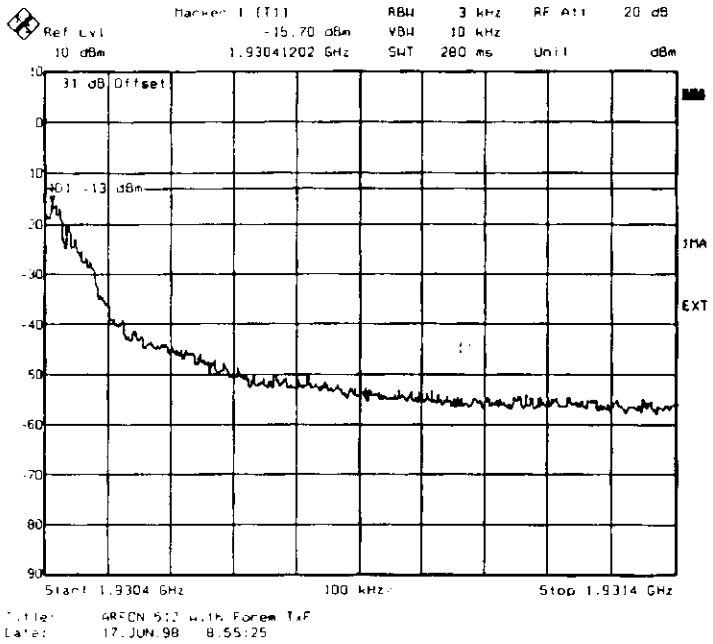


Figure 5 : +1 MHz adjacent band (Channel 810, Pmax - 12 dB)

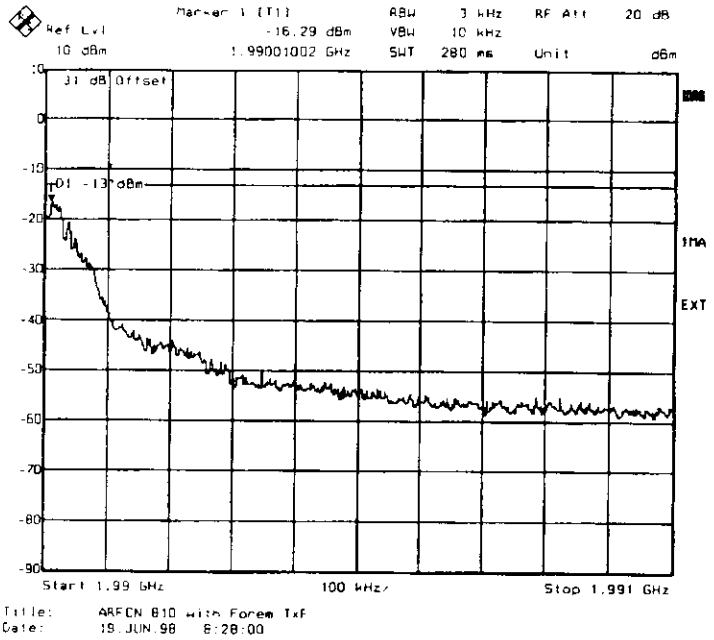


Figure 6 : -1 MHz adjacent band (Channel 513, Pmax)

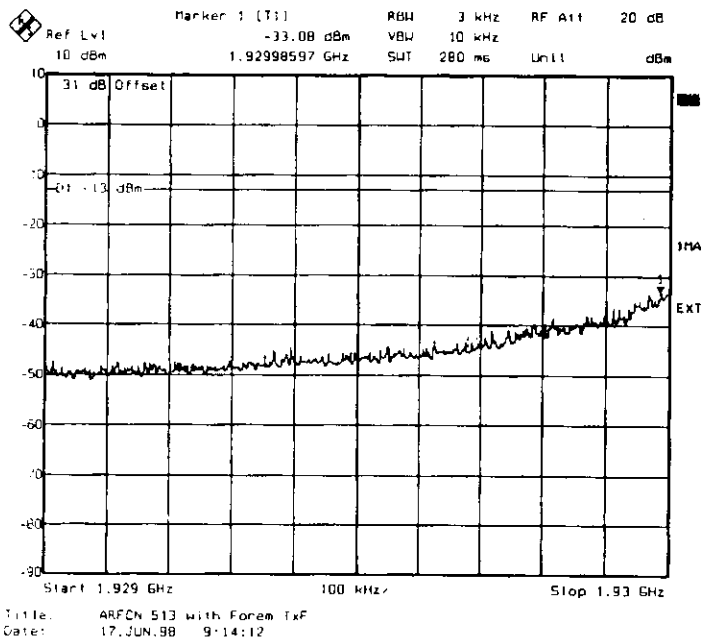


Figure 7 : +1 MHz adjacent band (Channel 809, Pmax)

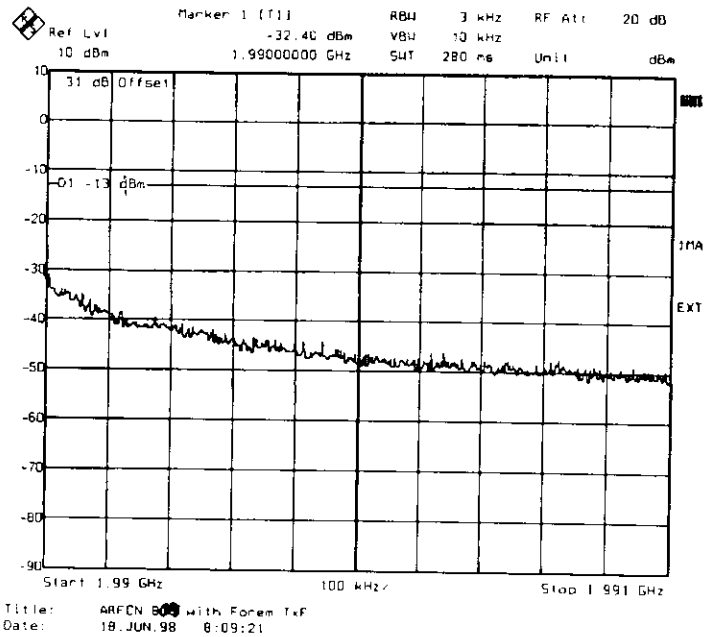
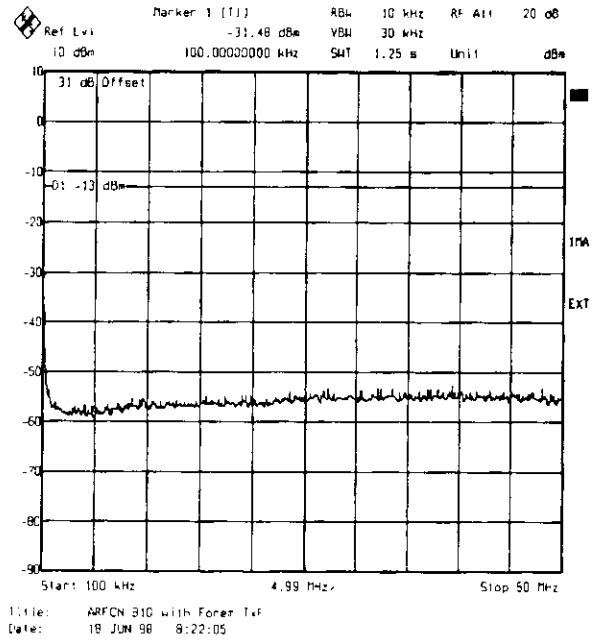
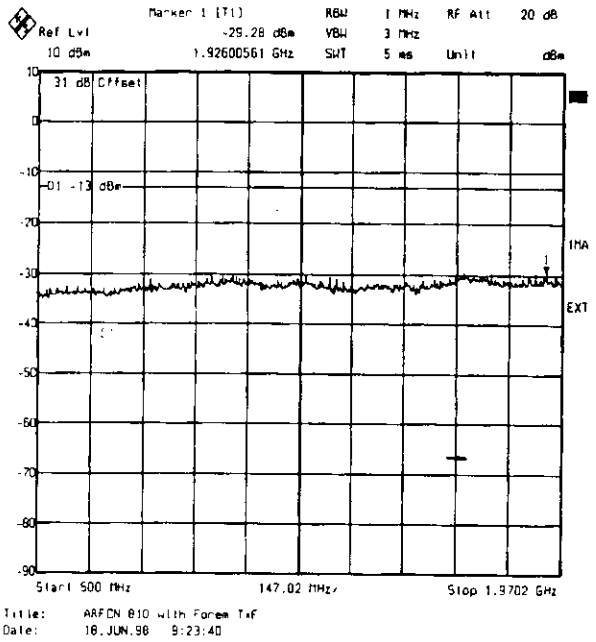
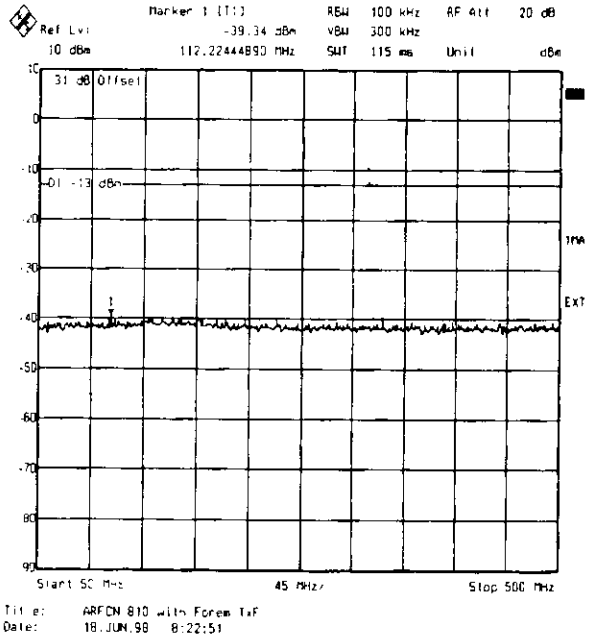


Figure 8 : Out of block emissions (Channel 810, Pmax - 12 dB)







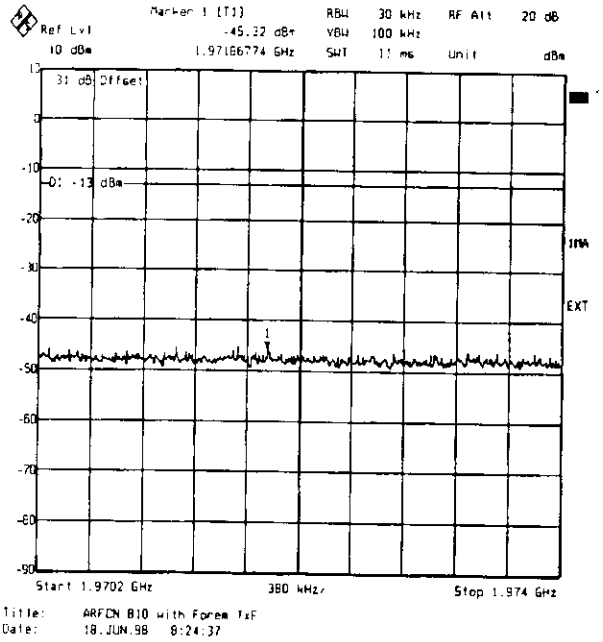
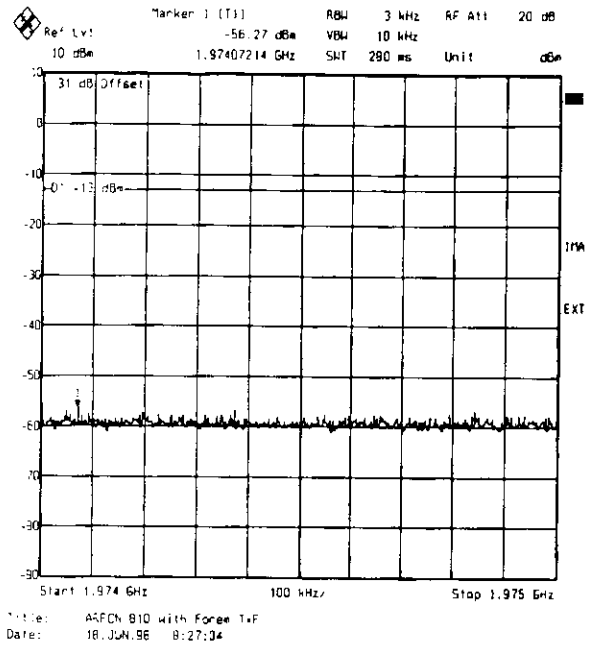
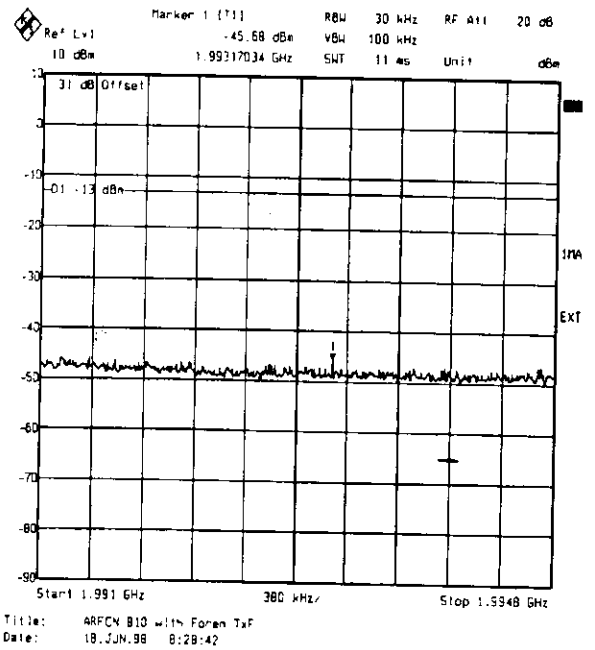
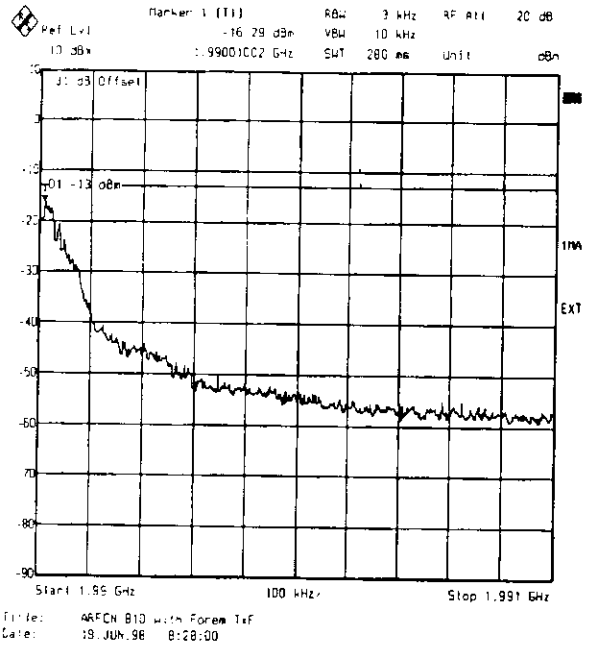


Figure 9 : Out of block emissions (Channel 810, Pmax - 12 dB)







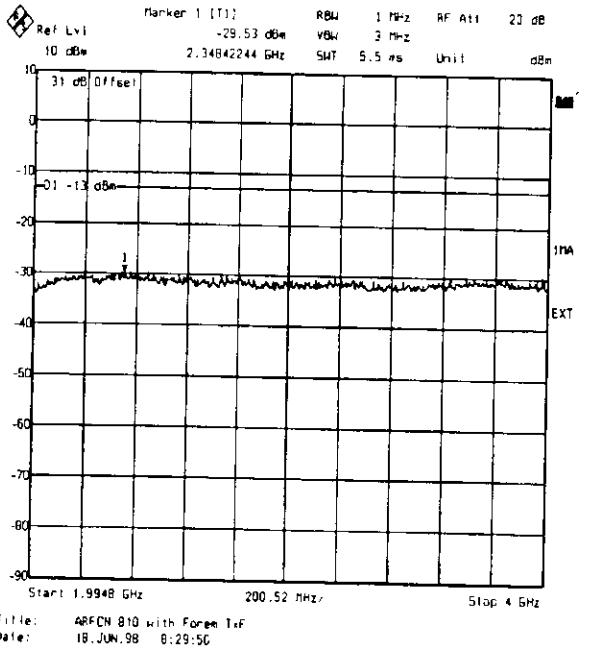
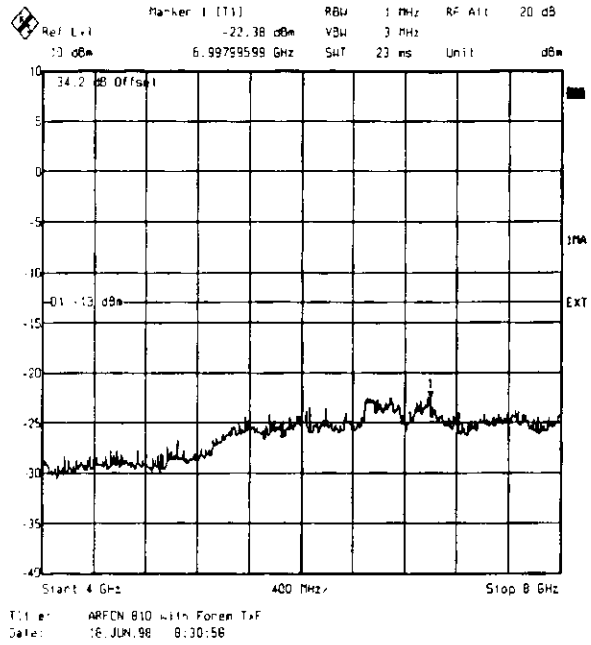
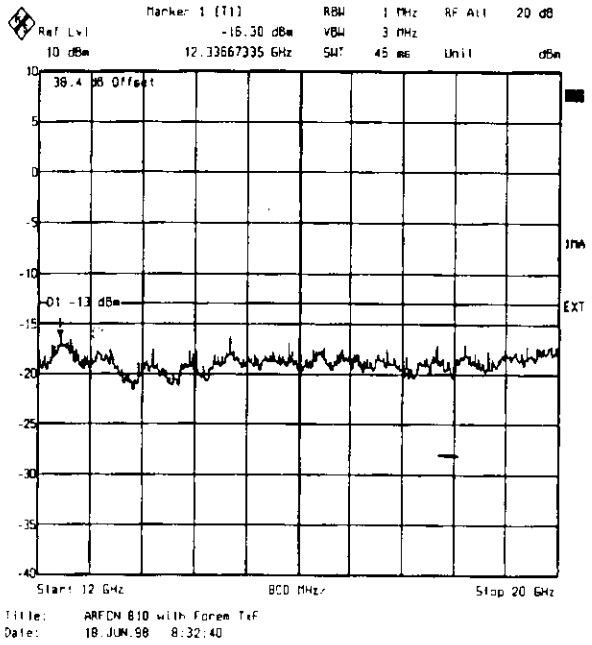
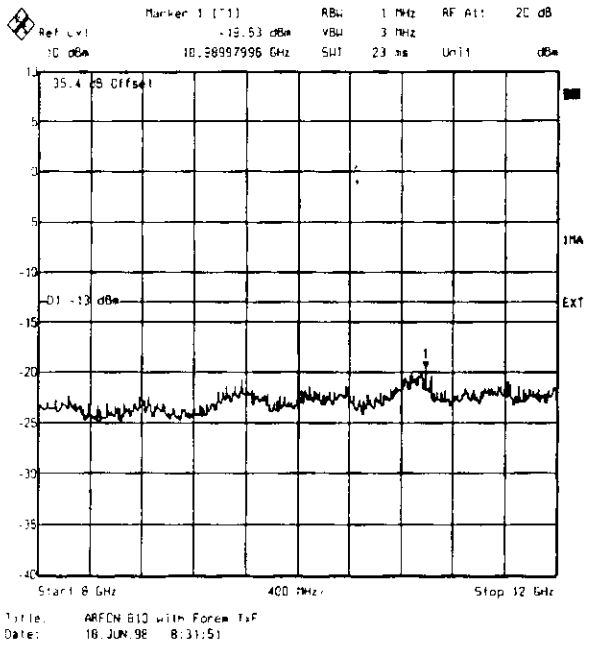


Figure 10 : Out of block emissions (Channel 810, Pmax - 12 dB)







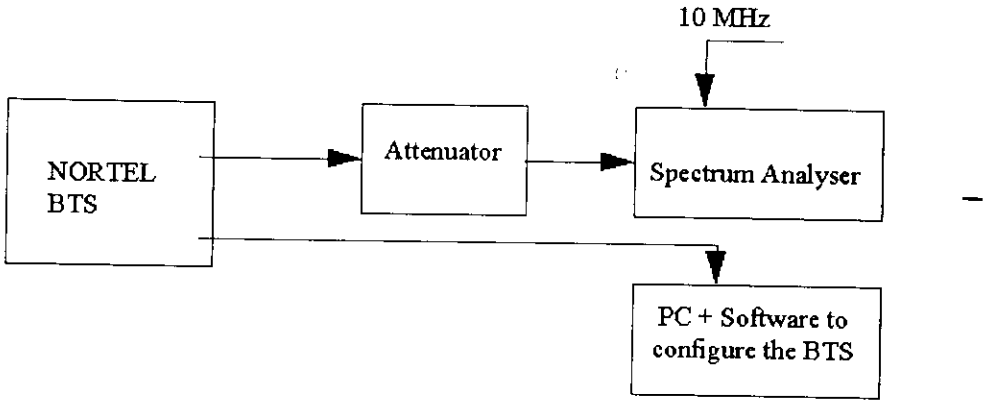
In order to comply with the emission limits in the 1 MHz bands immediately outside and adjacent to the frequency block, the transmit power level of the block edge channels has been reduced by 12 dB .

Measurements were also performed when the BTS was maximum power on channels adjacent to band edge channels and it was found that the emission requirements were met with greater than 15 dB margin in the 1 MHz adjacent frequency band.

8.5.3. TEST PROCEDURE

The equipment was configured as shown in figure 11.

Figure 11 : 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 transmitter was set to operate to maximum power minus 12 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 300.6 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
Reference level :	10 dBm
Reference Level Offset :	Corrected to account for cable(s), filter and attenuator losses
Level range :	100 dB
Sweep time :	Coupled

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

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.

8.6. NAME OF TEST : 2.995 FREQUENCY STABILITY

8.6.1. FCC REQUIREMENTS

8.6.1.1. FCC Part 24.235

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

8.6.2. TEST RESULTS

Table 4 shows the results for Frequency Stability.

Table 4 : Test results for Frequency Stability

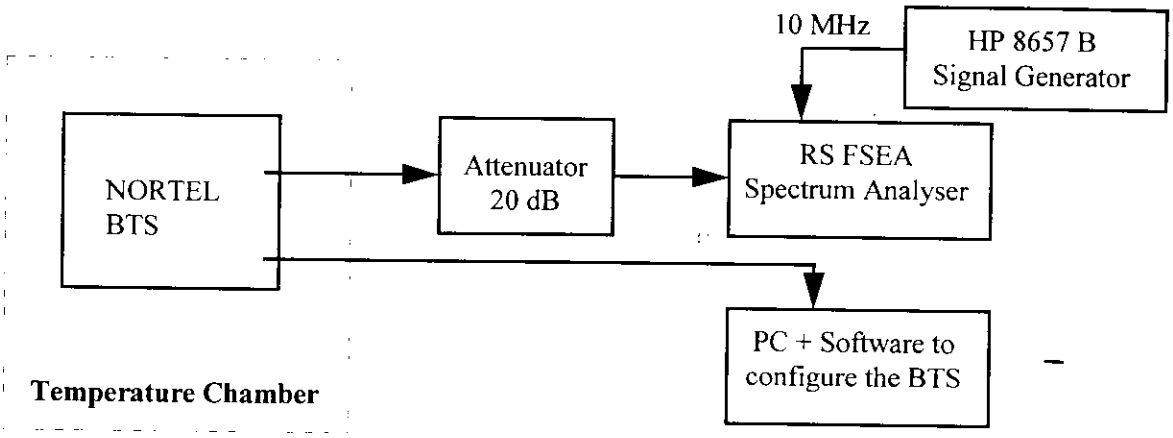
Temperature (°C)	Maximum Carrier Frequency Deviation (Hz)		
	Supply Voltage (85% of Nominal) 195 VAC	Supply Voltage (Nominal) 230 VAC	Supply Voltage (115% of Nominal) 264 VAC
-30	-66	+64	-61
-20	+67	+45	+48
-10	+89	+68	+51
0	-49	+62	+65
10	+66	+73	-68
20	+56	+67	+53
30	+65	-64	+48
40	-39	+42	+35
50	+25	-42	+42

The maximum carrier frequency deviation was found to be 89 Hz. This deviation is more than sufficient to ensure that the fundamental emission stays within the authorized frequency block. Therefore the S8000 Outdoor BTS still complies with the requirement.

8.6.3. TEST PROCEDURE

The equipment was configured as shown in figure 12.

Figure 12 : 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. The nominal primary supply voltage in this case was 230 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.

8.7. 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.
Network Analyzer	HP	85047A	500009
Network Analyzer	HP	8719D	515337
Power Meter	Giga-tronics	8542C	515955
CW Power Sensor	Giga-tronics	80401A	511085
Spectrum Analyzer	Rohde & Schwarz	FSEA	502581
Spectrum Analyzer	Rohde & Schwarz	FSEM	502571
Generator	HP	8648B	505911
Frequency Meter	Racal	1992	503541
30 dB attenuator	HP	8498A	519470
Spectrum Analyzer	Rohde & Schwarz	FSEA	502383
Signal Generator	HP	HP 8657 B	508463
Programmable AC source	CHROMA	Model 6590	515963
Variac		715 G2 PE	511490
Attenuator 20 dB	Radial	R417020128	-

9. EXHIBIT 2 : UPDATED EQUIPMENT LIST

Description	Hardware code	Comment
Base Cabinet	NTQA30AA	To be used with ACU cooling system
	NTQA30EA	"
	NTQA30CA	To be used with DACS cooling system
	NTQA30FA	"
Sectorial or extension cabinet	NTQA30BA	To be used with ACU cooling system
	NTQA30EA	"
	NTQA30DA	To be used with DACS cooling system
	NTQA30FA	"
AC main US	NTQA90AA	
ACU	NTQA95AB	
DACS	NTQA97AA	
GSM 1900 DRX	NTQA01AA	
	NTQA01BA	
	NTQA01CA	
	NTQA01CB	
	NTQA01DA	New Design DRX
GSM 1900 Splitter	NTQA10AA	
GSM 1900 Power Amplifier	NTQA50AA	
GSM 1900 Duplexer	NTQA51DA	
GSM 1900 Two Ways Hybrid Duplexer	NTQA51AA	
GSM 1900 Four Way Hybrid Duplexer	NTQA52QA	
GSM 1900 Tx Filter	NTQA52CA	
VSWR	NTQA51ZC	
Rectifier unit	NTQA91AA	Philips
	NT5C15BC	APS
	NT6C34AB	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	Interconnection panel
	NTQA60CA	
PAICO	NTQA41AA	Interconnection panel
DRXICO	NTQA40AA	Interconnection panel
RECAL	NTQA66DA	
CPCMI T1	NTQA66AA	
CMCF	NTQA66CA	
CBCF	NTQA66BA	