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APPLICATION FOR EQUIPMENT AUTHORIZATION

Type Acceptance of a Hughes Network Systems Inc.

Indoor Small Size Cellular Base Station
PICOCELL 1900MHZ

Filing for

FCC ID: K3Y-PICO-1900

Title 47 of the CFR, Part 24

HNS REPORT
May 18, 2000

PREPARED BY:
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Germantown, MD 20876

Hughes Proprietary II

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Checked:			**Title: Type Acceptance Test Plan and Test Report for PICOCELL 1900 MHz System**
	Sheet 1 of 57		**CAGE No.** **No.HNS-22671**

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1.0 INTRODUCTION

This report documents the FCC 47 CFR Rules Part 24 Type Acceptance Results of **Picocell 1900 MHz** hardware manufactured by Hughes Network Systems, Inc.

1.1 PURPOSE

This report details the test results of the Radio and Emission testing performed on the Picocell 1900MHz BTS for compliance to FCC Part 24 and FCC Part 15 Subpart B of CFR 47 requirements Along with the FCC Part 2 procedure.

1.2 TEST SPECIFICATION

The fundamental and the harmonics of the system of 1900 MHz radio transmitter and combiner local oscillator frequencies are exempt under the requirements of FCC Part 15. The Transmit Receive Unit of Picocell 1900 is a 1900 MHz TDMA transceiver and also an intentional radiator, the FCC Part 24 rules apply to this product. The FCC Part 24 verification of compliance is also covered in this report. The 1900 MHz Picocell BTS was tested to Part 15 Subpart B for Class A digital equipment and Part 24 radiated emission. Emission Measurement Techniques and procedures for Parts 15 / 24 were based on ANSI C63.4-1992, entitled “Methods of Measurement of Radio Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”.

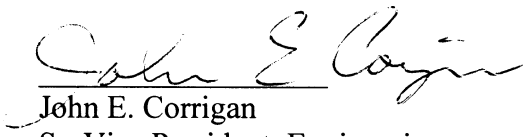
2.0 MODIFICATIONS STATEMENT

The following modifications were necessary in order for the Equipment Under Test to meet the technical requirements of 47 CFR Part 24:

Type Of Modification:

As the person responsible for the regulatory compliance products, I ATTEST that this product will be manufactured electrically identical to the product tested, including any modifications necessary for compliance (as listed above). Each unit manufactured, imported or marketed, as defined in the Commission's regulations, will conform to the sample(s) tested within the variations that can be expected due to quantity production and testing on a statistical basis. Further, in accordance with section 2.932 of CFR 47, I will take appropriate action in the event that changes to the unit are made which cause the revised product to no longer be considered electrically identical to the unit tested, as defined in section 2.908 of CFR 47.

COMPANY OFFICIAL SIGNATURE RESPONSIBLE FOR MARKETING TYPE ACCEPTED DEVICE

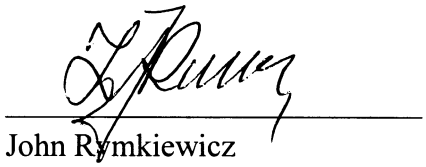


John E. Corrigan
Sr. Vice President, Engineering
Hughes Network Systems Inc.,

3.0 ENGINEERING STATEMENT

I ATTEST that this equipment has been tested in accordance with the requirements contained in the appropriate Commission regulations. To the best of my knowledge, these tests were performed using measurement procedures consistent with industry or Commission standards and demonstrate that the equipment complies with the appropriate standards. The necessary measurements were made by Hughes Network Systems Inc. 11717 Exploration Lane, Germantown, MD 20876 and at Washington Laboratories Ltd., Located at 7560 Lindbergh Drive, Gaithersburg, MD 20879.

I further attest that on the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 24 of the FCC Rules under normal operating condition and maintenance.



John Rymkiewicz
Technical Manager, Agency Certification
Hughes Network Systems Inc.,

4.0 TEST SUMMARY

Table 1: Picocell 1900 MHz Sytem Test Summary

Unit tested:	Picocell 1900 MHz BTS
Model Number and Manufacture:	Hughes Network Systems Inc.
Specifications:	ANSI C63.4 (1992), FCC Part 2, FCC Part 15 Subpart B FCC Part 24 and IC RSS-118 ANSI/IEEE C95.1-1992
Location of Test Facility:	Hughes Network Systems Inc. 11717 Exploration Lane, Germantown, MD 20876 Washington Labs 7560 Lindbergh Drive, Gaithersburg, MD 20879
Dates of Testing:	April 10, 2000 – May 8, 2000
Test Summary:	Compliant
REQUIREMENTS	**STATUS**
RF Power Output	PASS
Modulation Characteristics	PASS
Occupied Bandwidth	PASS
Spurious Emission at Antenna Terminal	PASS
Field Strength of Spurious Radiation	PASS
Frequency stability	PASS
FCC Part 15 Class A:	
Radiated Emissions	PASS
Conducted Emissions	PASS
FCC Part 24:	
Radiated Emissions	PASS

5.0 DESCRIPTION OF EQUIPMENT UNDER TEST

5.1 PRODUCT OVERVIEW

The Pico BTS base station is part of a PCS system providing the radio communications between the mobile station and the WOSC (Wireless Office System Controller). The system is integrated with the existing hardwired PBX phone system. The system is driven by an industrial computer that processes cellular telephone calls. Operators use this computer , the system controller, to configure, control, monitor and trouble shoot the system. The Picocell are small Base Transceiver Stations designed to be mounted on office walls throughout a building. They are line powered and connected to the system controller using CAT 5 T1 cables. The PicoCell 1900 Mhz operates over an input dc voltage of –24V to –54 volts. For dc power, the maximum power draw of the Picocell does not exceed 90 watts. Maximum RF power output (ERP) for the 100mW radio option of the Picocell BTS has a nominal dynamic range of at least 26 dB (from +/- 20 dBm to –6dBm), adjustable in steps of 1 dB.

The Pico BTS base station includes the following modules. Refer to Pico BTS Technical Specification for detailed description of each module.

- *Maser Oscillator/Power Supply*

  This module provides a reference frequency and converts the input 48VDC to 5VDC or 3VDC for Pico BTS operations.

- *Transceivers*

  There are four transceivers in a Pico BTS Base Station. Each transceiver has 3 full-rate channel. There are total of 12 full-rate channels for four transceivers, one of them is used as the digital control channel (DCCH) to provide the access information to the mobiles, the remaining full-rate channels are used as digital traffic channel(DTC) for the mobiles to communicate with the WOSC system.

- *Scanning Receiver*

  This module is used for monitoring the transmitted signal strength of the neighbor base stations on the downlink path and monitoring the transmitted signal strength of the mobile stations on the uplink path.

- *Controller*

  This module consists of a RISC processor as a controller and a E1/T1 interface to be connected to the external E1/T1 equipment. This controller is the brain of the Pico BTS. It configures and controls the transceivers operation using a proprietary protocol via the ST-BUS. The E1/T1 interface provides bearer services as well as the signaling between the Pico BTS and the WOSC.

- *Antenna and Branching*

  The transmit and diversity receivers of four transceivers are combined/split in this module.

- *Backplane*

The backplane contains a ST-Bus which is used for the controller to communicate with the transceivers and route the voice path of the transceiver to the proper E1/T1 slot.

Figure 5.1.1: PICOCELL BTS Architecture

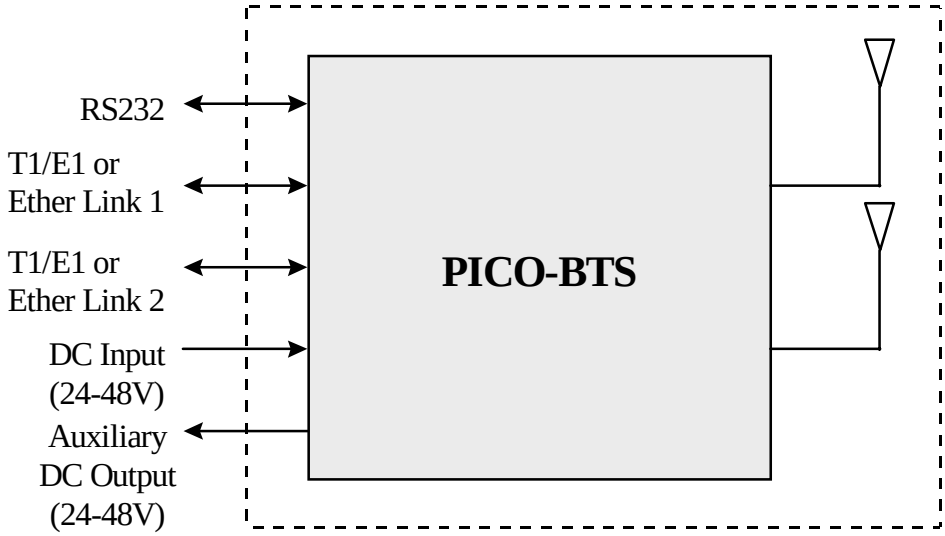
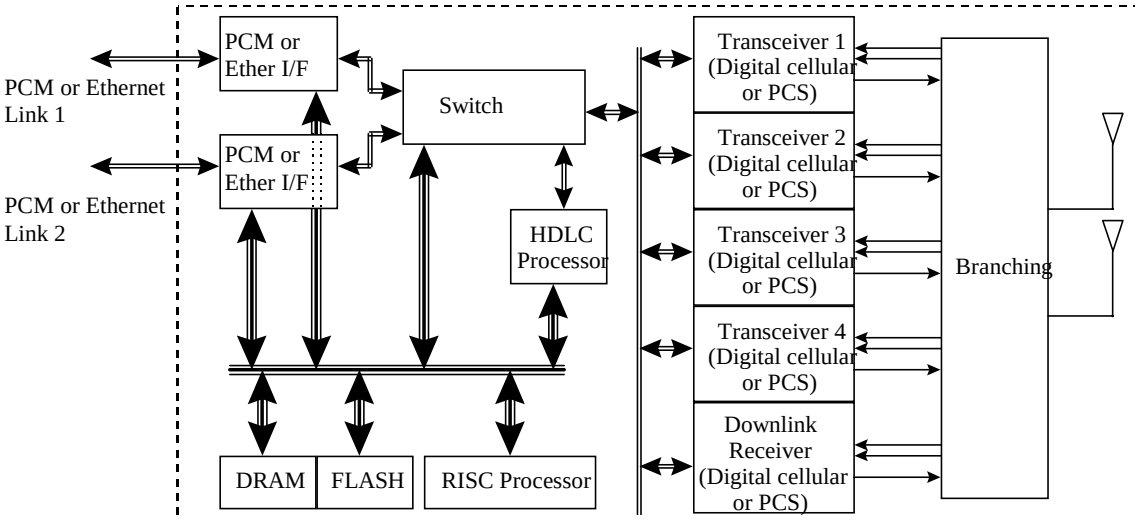


Figure 5.1.2: Inside Architecture of PICOCELL BTS



5.2 SYSTEM SETUP

The radio port was activated by a PC through the BTS debug port to set the power output level and frequency. The antenna terminals are to be terminated with dummy load via proper attenuation. The power supply provided the necessary power to the system through the RJ45 connctor. A HP spectrum analyzer was used to make the measurements for the test configuration.

5.3 SYSTEM CLOCKS

The following table lists the clock sources (e.g. discrete crystals and VCXOs) used in the system under tests and where appropriate, the sub multiples when clock division has been employed for distribution to other circuit packs

Card / Modules	Fundamental Frequencies and Sub Harmonics in MHZ
Power Supply	9.6
Controller	12.352, 16.384, 49.808
Transceiver	89.55, 135.0, 734.04, 758.97
Modem	26.4

5.4 SYSTEM CABLES

The EUT was powered by RJ45 cable by the AC to DC converter from a filtered 120 VAC power source. All excess cables were draped on the table to maximize emissions in both the horizontal and vertical polarization. The unit was not locally grounded at the terminal to represent as a typical installation. T1 cable was looped back to BTS to provide proper termination.
Antenna ports were terminated with a dummy load.

Table 6.4: System Cable Configuration

Description	Type	Manufacture	Shield Type	Length
T1-Cable with Power	24 AWG, CAT-5	General Cable	Unshield	2m
T1-Cable Loop Back	24 AWG, CAT-5	General Cable	Unshield	2m
Debug Port Cable	24 AWG, CAT-5	Hyper Grade	Unshield	0.5m
RF Cable	RG-223 SMA	Times Microwave	Regular RF	3.5m
RF Cable	SMA	Alpha Wire	Regular RF	0.5m

6.0 GENERAL TEST CONDITIONS

6.1 TEST SITE (GENERAL)

Radiated emission testing was performed at Washington Lab's located at 7560 Lindbergh Drive, Gaithersburg, MD 20879, The Open Area Test Site meets the site characteristics according to the procedures outlined in ANSI C63-4 (1992) "Characteristics of Open Field Test Site". The radio testing was performed at Hughes Network Systems located at 11717 Exploration lane, Germantown. MD 20876.

6.2 TEST CONFIGURATION

The equipment under test included only the Digital/RF circuits containing as one enclosure configuration. The contents of the system are listed in the table below with release numbers, part numbers and serial numbers.

Table 6.2.1: 1900 MHZ Picocell System Part List

No	Description	PCA	P/N	S/N
1	PCS SCANER	PCS XCVER REV-5	A5.10.0030	00033407
	Enhanced Modem	Rev. 3	A5.10.0043	N/A
2	Branching Card		A5.20.5016.000.02	00007188
3	Back Plane	040.5010.03.02	520.5010.00.02	00202001
4	Power Supply	040.5020.03.03	520.5020.00.03	00007187
5	PCS Radio 0	040.5041.00010640	520.5041.00.03	00010640
6	Enhanced Modem	Rev.03	A5.10.0043	00006089
7	PCS Radio 1	040.5041.00010643	520.5041.00.03	00010643
8	Enhanced Modem	Rev.03	A5.10.0043	00006822
9	PCS Radio 3	040.5041.00010584	520.5041.00.03	00010584
10	Enhanced Modem	Rev.03	A5.10.0043	00007058
11	PCS Radio 4	040.5041.00010642	520.5041.00.03	00010642
12	Enhanced Modem	Rev.03	A5.10.0043	00006814
13	Universal Controller	040.5030.03.02.00202004	520.5030.00.02	N/a

6.3 MEASUREMENT INSTRUMENTATION

The measurement instrumentation conforms to American National Standard Specification for Electromagnetic Interference and Field Strength Instrumentation 100 Hz - 22 GHz, ANSI C63.4 (1992) and CISPR publication 16.

Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

6.4 MEASUREMENT DETECTOR FUNCTIONS AND BANDWIDTHS

The conducted and radiated emission limits shown in this part are based on the following, unless otherwise specified elsewhere in this part:

(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission. As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, as long as the same bandwidths as indicated for CISPR quasi-peak measurements are employed.

(b) On any frequency of frequencies above 1000 MHz, the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurements are specified in the regulations, including emission measurements below 1000 MHz, there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules in this part, e.g., see § 15.255. Unless other-wise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. Measurement of AC power line conducted emissions are performed using a CISPR quasi-peak detector, even for devices for which average radiated emission measurements are specified.

(c) Unless otherwise specified, e.g. § 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurements field strength shall be deter-mined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

6.5 FREQUENCIES

§ 24.229 Frequencies.

The frequencies available in the Broadband PCS service are listed in this section in accordance with the frequency allocation table of § 2.106 of this chapter.
(a) The following frequency blocks are available for assignment on an MTA basis:
Block A: 1850–1865 MHz paired with 1930–1945 MHz; and
Block B: 1870–1885 MHz paired with 1950–1965 MHz.
(b) The following frequency blocks are available for assignment on a BTA basis:
Block C: 1895–1910 MHz paired with 1975–1990 MHz;
Block D: 1865–1870 MHz paired with 1945–1950 MHz;
Block E: 1885–1890 MHz paired with 1965–1970 MHz; and
Block F: 1890–1895 MHz paired with 1970–1975 MHz.

6.6 MEASUREMENT EQUIPMENT

Table 6.6.1: 1900 MHZ Picocell System Test Measuring Equipment

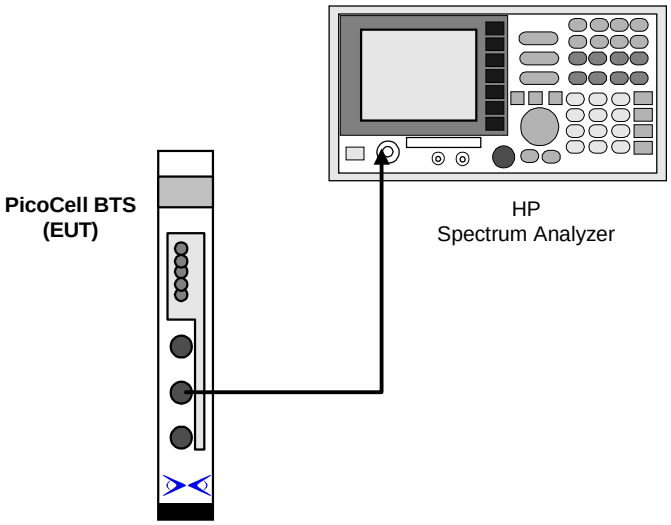
Description	Model	Manufacture	S/N	Cal Due
Power Meter / Freq. Counter	53152A	HP	US39270189	11/22/00
Spectrum Analyzer	8593E	HP	3543A02059	12/02/00
10 dB Fixed attenuator	50F-010-10	JFW	010-10	Verified
Lap Top	PA1240VVCD	Toshiba	87199291	N//A
Lap Top	LTE-5280	Compaq	249524414	N/A
Variable Attenuator	50DR-001	JFW Industries	131408-9414	Verified
Variable Attenuator	50DR-001	JFW Industries	142401-9437	Verified
Variable Power Supply	6032A	HP	28806524	18/Aug/00

Table 6.6.2: 1900 MHZ Picocell System Test Measurement Equipment; Outside Lab

Equipment	Serial Number	Date Calibrated	Calibration Due
Antenna Research Associates, Inc. Biconical Log Periodic Antenna LPB-2520 (Site 1)	044	6/7/99	6/7/00
Hewlett-Packard Spectrum Analyzer: HP 8568B (Site 1)	2928A04750	7/14/99	7/14/00
Hewlett-Packard Quasi-Peak Adapter: HP 85650A (Site 2)	3303A01786	6/23/99	6/23/00
Hewlett-Packard RF Preselector: HP 85685A (Site 1)	2817A00744	7/14/99	7/14/00
Hewlett-Packard Spectrum Analyzer: HP 8593A	3009A00739	5/26/99	5/26/00
Hewlett-Packard Preamplifier: HP 8449B	3008A00729	12/07/99	12/07/00
Antenna Research Associates, Inc. Horn Antenna DRG-118/A	1010	9/10/99	9/10/00
HP 8672 signal generator:	2311A03131 & 2311A00221	11/11/99	11/1100
Waveguide filters International Telecommunications Components	Assets 280 and 281	4/1/99	4/1/01
AH Systems 1-18 GHz SAS 200/518 log periodic antenna	117	2/10/00	2/10/01
MIL-MEGA AS0204-7B Microwave Amp;	972768	N/A	N/A
Solar Electronics LISN 8012-50-R-24-BNC	8379493	8/11/99	8/11/00
Solar Electronics LISN 8028-50-TS-24-BNC	N/A	8/11/99	8/11/00
Solar Electronics LISN 8028-50-TS-24-BNC	N/A	8/11/99	8/11/00

6.7 RADIO TEST SETUP

Figure 6.7.1: Radio Test Setup



Note: The PicoCell BTS is connected to spectrum analyzer via appropriate attenuation

7.0 TEST REQUIREMENTS AND MEASUREMENT PROCEDURES

7.1 RF OUTPUT POWER

Minimum Standard

Transmitters (mobile stations, handheld portables or TDD base stations) operating in the lower sub-band (1850-1910 MHz) shall not exceed 2 watts peak EIRP

.

For base stations transmitters operating in the band 1930-1990 MHz the output power shall not exceed 100 watts.

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.

For maximum to minimum power, and steps in between, measure and record:

RF Power output, DC voltage and DC current of the final RF amplification devices.

§ 24.232 a) Pout = 100 Watts maximum peak power, for a base station obtain “true peak measurement” Measure rms and convert.

If the transmission is in bursts, the power shall be averaged over any 100 millisecond period, or over the burst duration, if the burst is shorter than 100 milliseconds, during which its value is at its maximum. Further, the power shall only be averaged over the duration of actual transmission.

The radio port was measured for the RF output power at the upper power level and at the lowest RF power level with upper and lower frequency bands.

7.2 MODULATION CHARACTERSTICS

§ 2.1047 Measurements required: Modulation characteristics.

(a) ***Voice modulated communication equipment***. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

(b) ***Equipment employs modulation limiting***. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

(c) ***Single sideband and independent sideband radiotelephone transmitters employ a device or circuit to limit peak envelope power***. A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of § 2.1049 for the occupied bandwidth tests.

FCC § 2.1047(d) the Radio port was modulated by pseudorandom data stream generated by a T-BERT 224. The HP3865E Spectrum Analyzer was used to make the measurements and the data plotted on a HP Plotter.

The necessary bandwidth to ensure the transmission of information was measured at 99.75% (-26 dBc) occupied bandwidth at less than or equal to 300 kHz.

The following data plots shown the modulation characteristics for the modulated signal at the 29 dBm power setting as well as the 17 dBm power setting for which the equipment is to be licensed.

7.3 OCCUPIED BANDWIDTH

Per § FCC 2.1049 the Occupied Bandwidth measurements were performed using the test configuration as shown in Figure 7.5.1.

The radio port is designed to meet the standard at ninety nine percent (99%) of the total transmitted power which must be contained in the occupied bandwidth of 288 kHz (fc +/- 144khz)

The radio port was measured for the 99% occupied bandwidth at the upper power level and at the lowest RF power level.

Necessary bandwidth for a given class of emission is the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions. In practice, this may be taken as the 99% emission bandwidth.

Occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the emitted power. This is also known as the 99% emission bandwidth.

Emission bandwidth: For the purpose of this section the emission bandwidth is defined as the width of the signal between two points, one below the carrier centre frequency, and one above the carrier centre frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power (-26 dBc), when measured with a resolution bandwidth of 1% (approximately) of the occupied bandwidth.

7.4 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

§ 2.1051 Measurements required: Spurious emissions at antenna terminals.

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment out-put terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which have attenuated more than 20 dB below the permissible value need not be specified.

Unwanted Emissions

Unwanted emissions comprise out-of-band emissions (i.e. emission on a frequency or frequencies immediately outside the necessary bandwidth), spurious emissions and harmonics. They are to be measured when the transmitter is operating at the manufacturer's rated power and modulated as in the commissioning procedure.

Method of Measurement

The carrier frequency was adjusted close to the band edge at two RF power settings (min and max power) when making these measurements. All measurement are expressed in peak values consistent with the transmitter power values. Emissions attenuated by more than 20 dB below the required limit were not specified.

(a) Set the carrier to the lowest settable or programmable frequency of frequency block 'A' (or of the lowest frequency block permitted by the design of the equipment); Using the manufacturer's information on emission bandwidth:

Set the spectrum analyzer in power averaging mode and resolution bandwidth as close to 1.0% of the emission bandwidth as possible.

Set video bandwidth wider than the resolution bandwidth. Set the sweep span to cover at least +250% of the emission bandwidth.

Number of sweeps = 10.
Record the spectrum plot.

Change the frequency sweep span to cover the spurious emissions frequency search band given in section (ii) below, under Minimum Standard.
Record and submit the spectrum plots.

(b) Repeat (a), using the highest settable or programmable frequency of frequency block 'C' (or of the highest frequency block permitted by the design of the equipment).
However, the search for spurious emissions (i.e. outside the +250% of the emission bandwidth) of (a) need not be repeated.

Minimum Standard

§ 24.238 Emission limits; Out of Block Emissions

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.

(i) In the first 1.0 MHz bands immediately outside and adjacent to the licensee's frequency block, the power of emissions **(per 1% of the emission bandwidt**h) shall be attenuated below the transmitter output power P (in watts) by at least $43 + 10 \log_{10}(P)$, dB. It is only required to use the plots from (a) and (b) to demonstrate that the out of blocks A and C emissions are met.
(ii) After the first 1.0 MHz, the power of emissions shall be attenuated below the transmitter output power by at least $43 + 10 \log_{10}(P)$, dB, **per any MHz of bandwidt**h. **(Note:** If the test result using 1% of the emission bandwidth is used, then power integration over 1.0 MHz is required; alternatively, the spectrum analyzer resolution and video bandwidths can be increased to 1.0 MHz for this measurement).

The search for these emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or 30 MHz whichever is the lowest frequency, to the 5th harmonic of the highest frequency generated or used, without exceeding 40 GHz.

Out of Sub-band Emissions

Outside the sub-bands 1850-1910 MHz and 1930-1990 MHz, the attenuation shall be equal to or better than the Out of Block emission limits cited above.

Additional Out-of-Band Suppression

Since unwanted emissions are not necessary for the purpose of communication, the commission may require service providers to take corrective action should it be found that out of block or out of sub-band emissions cause harmful interference to other users. Document that contain special requirements in respect to certain band-edges, for co-existence with adjacent band services, and should be consulted.

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.

The measurements of emission power can be expressed in peak or aver-age values, provided they are expressed in the same parameters as the transmitter power.

When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

7.5 FIELD STRENGTH OF SPURIOUS RADIATION

§ 24.236 Field strength limits. The predicted or measured median field strength at any location on the border of the PCS service area shall not exceed 47 dBuV/m unless the parties agree to a higher field strength.

§ 2.1053 Measurements required: Field strength of spurious radiation.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or inter-mediate 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. For this test, single side-band, independent side band, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the farfield at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power out-put of the transmitter, assuming all emissions are radiated from half wave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:
(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
(2) All equipment operating on frequencies higher than 25 MHz.
(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter
.

7.6 FREQUENCY STABILITY

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

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 o C and rated supply voltage. The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency determining circuit element shall be made subsequent to this initial set-up. The un modulated carrier frequency shall be measured under the conditions specified below. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement:

(a) at temperatures of -30 o C, +20 o C and +50 o C at the manufacturer's rated supply voltage, and
(b) at 85% and at 115% of the manufacturer's rated supply voltage, when the temperature is at +20 o C.

The frequency stability can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range. For handheld equipment that is only capable of operating from internal batteries, the frequency stability tests shall be performed using a new battery without any further requirement to vary the supply voltage. Alternatively, an external supply voltage can be used and set at the battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

If an un modulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of symbol periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

Minimum Standard

The RF carrier frequency shall not depart from the reference frequency (reference frequency is the frequency at +20 o C and rated supply voltage) by more than +2.5 ppm for mobiles and +1.0 ppm for base stations.
In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the emission bandwidth stays within the authorized frequency block, when tested to the temperature and supply voltage variations specified above.

7.7 RADIATED SPURIOUS EMISSIONS

7.7.1 Test Requirements

FCC Part 15 Radiated Emission Limits (15.109)

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission (MHz)	Field Strength (μVolts/m)
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

(b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of Emission (MHz)	Field Strength (μVolts/m)
30 – 88	90
88 – 216	150
216 – 960	210
Above 960	300

(c) In the emission tables above, the tighter limit applies at the band edges. Sections 15.33 and 15.35 which specify the frequency range over which radiated emissions are to be measured and the detector functions and other measurement standards apply.

7.7.2 Test Procedure

Radiated emission measurement procedures shall be performed as outlined in Section 8 of the ANSI C63.4 measurement standard.

In order to maximize all emission levels from the equipment, the emissions will be searched with the receive antenna at varied height levels. The equipment shall also be rotated a full 360 degrees on the turntable with the receive antenna at varying height levels (1 to 4 meters). Tests shall be made with the antenna positioned in both the horizontal and vertical planes of polarization.

The EUT shall be powered on with the transmitter at full power. A complete scan of the emissions from 30MHz to 19GHz (the 10th harmonic of the fundamental) shall be completed. Quasi-peak measurements shall be made on readings, which are less than 10 dB from the allowable limit. For emissions above 1 GHz the peak detector function shall be used with an RBW of 1 MHz.

7.8 AC CONDUCTED EMISSIONS

7.8.1 Test Requirements

FCC Conducted Emission Limits (15.107)

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed 250 microvolts. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

(b) For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed the limits in the following table. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

Frequency of Emission (MHz)	*Conducted Limit* (μVolts)
0.45 – 1.705	1000
1.705 – 30.0	3000

7.8.2 Test Procedure

Conducted emission measurement procedures shall be performed as outlined in Section 8 of the ANSI C63.4 measurement standard.

8.0 TEST RESULTS

8.1 RF OUTPUT POWER

SUBJECT: *RF Output Power*

MFG: HNS
Tested By: Logi Balasingam
Test Dates: April 11/2000

EUT: 1900 MHz PicoCell **Channel Number:** 499 **Power:** Min/Max
FCC: § 24.232
Limit: 100W in total
Verdict: PASS

Sample power measurement was presented below as plot and tabulated in this section.

Figure 8.1.1: Maximum output power of channel 499.

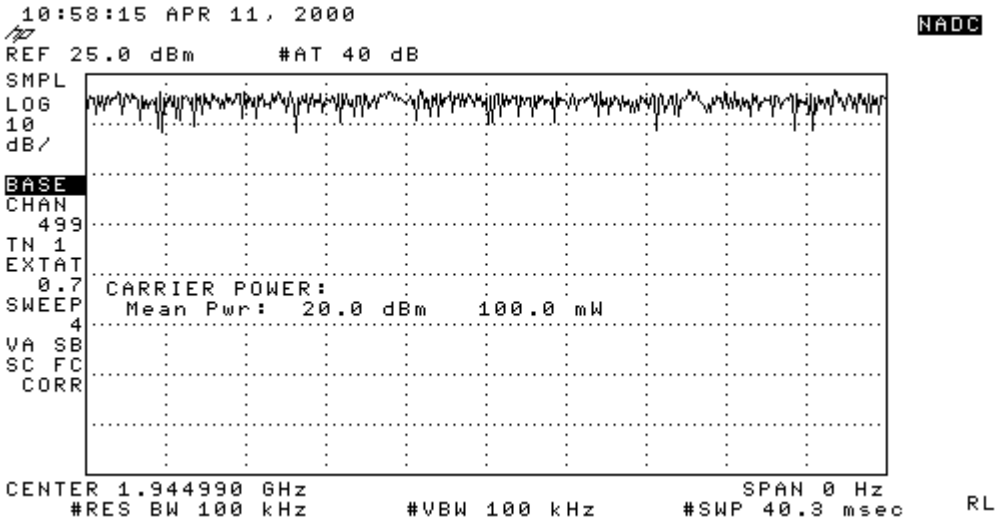


Figure 8.1.2: Minimum output power of channel 499.

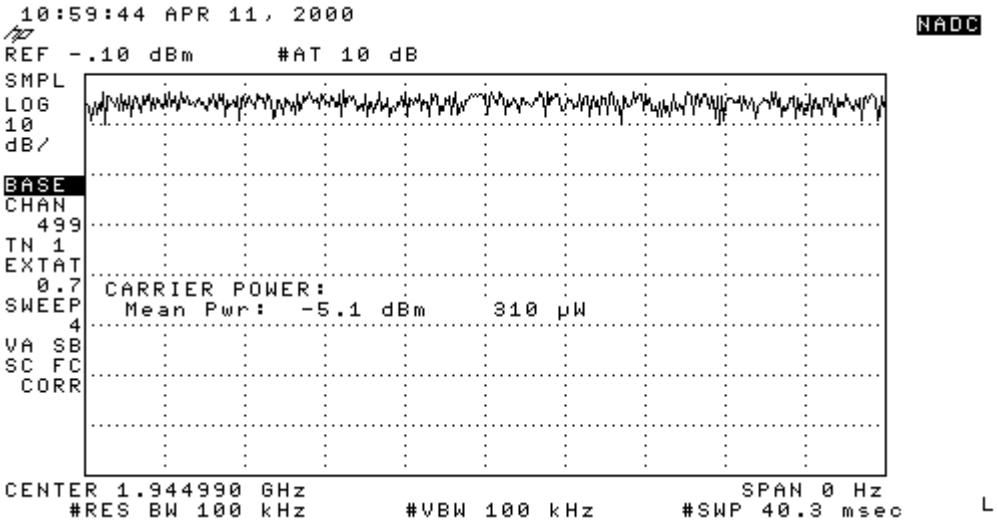


Figure 8.1.3: Carrier Off Maximum output power of channel 499.

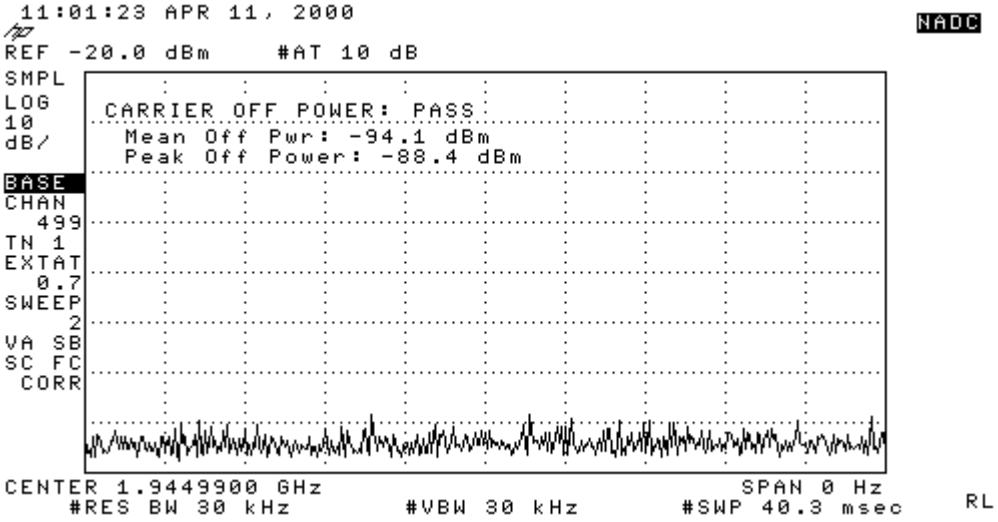


Table 8.1.1: Picocell 1900MHz System –Output Power: Main Port

Freq. Band	Channel Number	Max. Output Power (dBm)	Max. Output Power (mW)	Min. Output Power (dBm)	Min. Output Power (uW)
A-Band	2	19.9	98.4	-1.3	736
A-Band	498	20.0	99.3	-1.1	785
B-Band	668	20.2	104.0	-0.8	836
B-Band	1164	19.9	96.6	-1.1	769
C-Band	1502	19.9	97.7	-2.6	546
C-Band	1998	20.0	100	-4.1	393
D-Band	502	20.0	100	-0.8	828
D-Band	664	20.0	100	-0.8	822
E-Band	1168	20.0	99.8	-1.2	760
E-Band	1331	19.8	93.6	-1.8	661
F-Band	1335	19.9	97.6	-2.1	622
F-Band	1498	19.9	96.6	-2.7	583

Table 8.1.2 Picocell 1900MHz System –Output Power: Diversity Port

The diversity port with respect to the design, is very much identical to the main port.

Freq. Band	Channel Number	Max. Output Power (dBm)	Max. Output Power (mW)	Min. Output Power (dBm)	Min. Output Power (uW)
A-Band	498	20.0	100	-5.1	310
B-Band	1164	19.8	95	-6.2	240
C-Band	1998	20.3	107	-7.3	184
D-Band	664	20.3	107	-5.3	296
E-Band	1331	19.8	95.1	-6.8	207
F-Band	1498	20.1	103	-7.2	191

8.2 MODULATION CHARACTERSTICS

SUBJECT: *Modulation Characteristics*

MFG: HNS
Tested By: Logi Balasingam
Test Dates: April 11/2000

EUT: 1900 MHz PicoCell **Channel Number:** 498 **Power:** Min/Max
FCC: § 2.1047
Limit: n/a reference
Verdict: PASS

Figure 8.2.1: Modulation Characteristics at maximum power of channel 498.

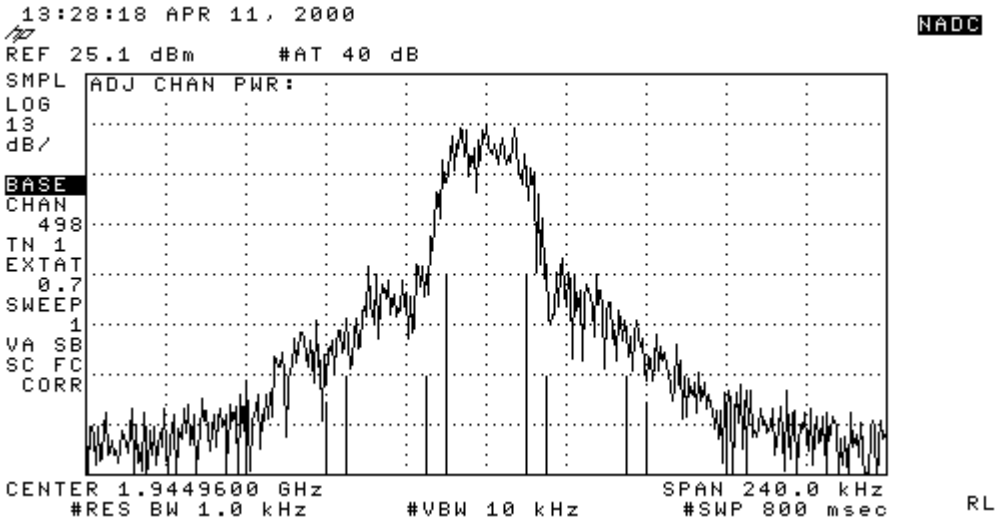


Figure 8.2.2: Modulation Characteristics at maximum power of channel 498.

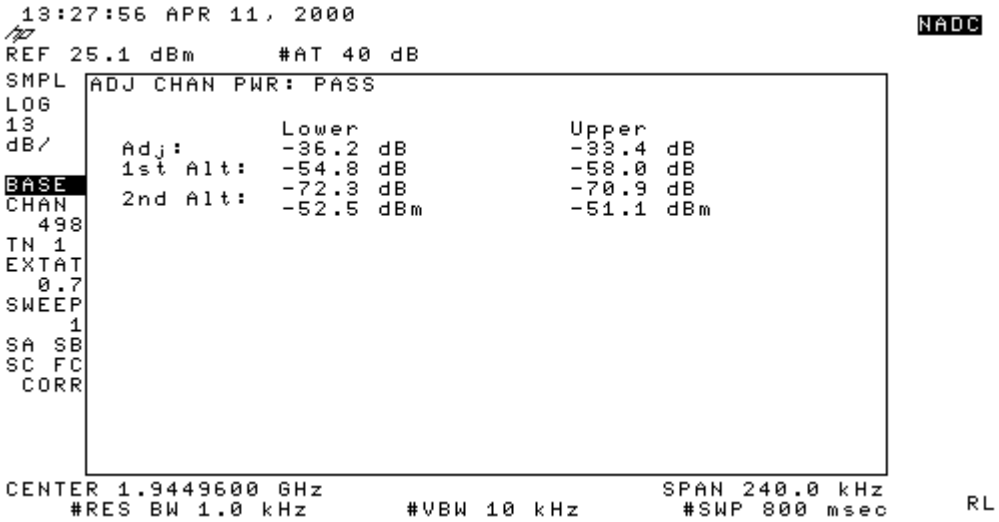


Figure 8.2.3: Modulation Characteristics at minimum power of channel 498.

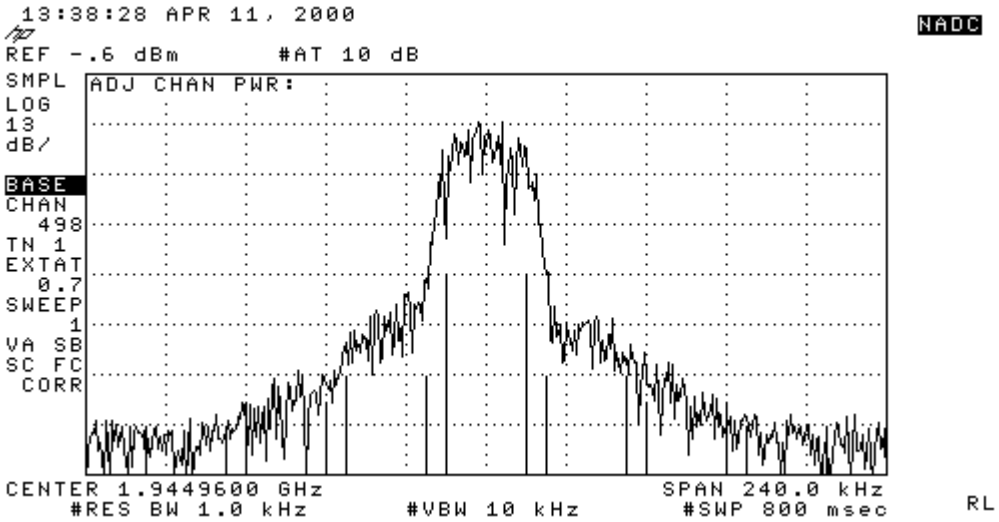


Figure 8.2.4: Modulation Characteristics at minimum power of channel 498.

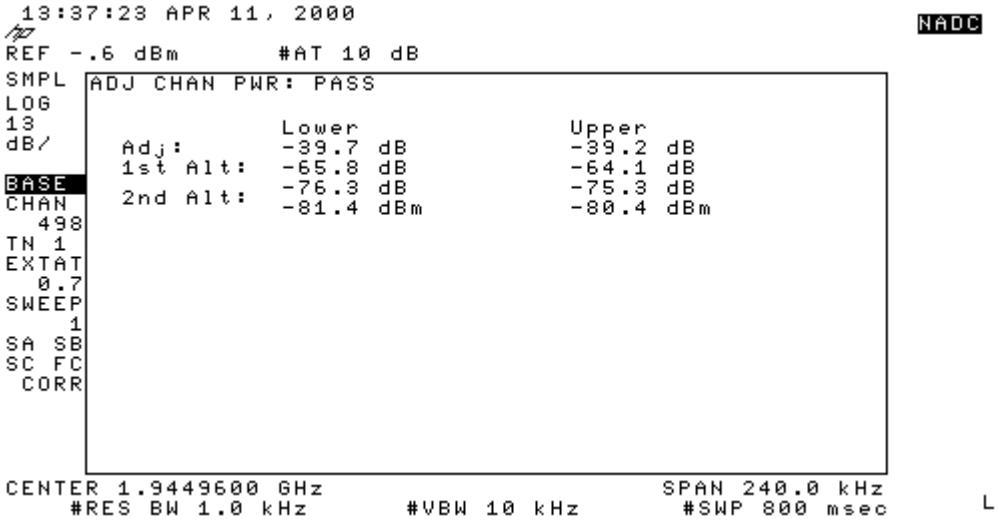
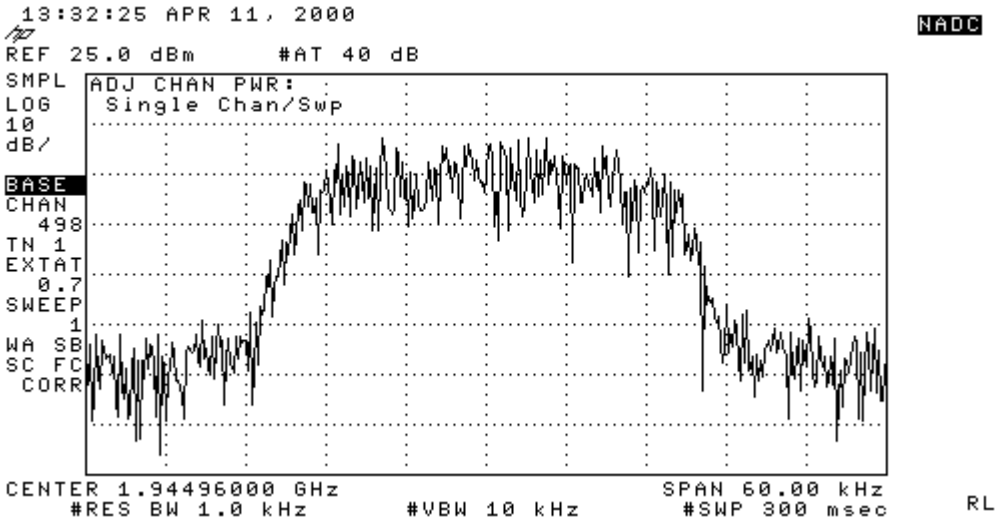


Figure 8.2.5: Modulation Characteristics at minimum power of channel 498.



8.3 OCCUPIED BANDWIDTH

SUBJECT: *Occupied Bandwidth*

MFG: HNS
Tested By: Logi Balasingam
Test Dates: April 12/2000

EUT: 1900 MHz PicoCell **Channel Number:** 498 **Power:** Min/Max
FCC: § FCC 2.1049
Limit: 28.8 KHz BW
Verdict: PASS

Figure 8.3.1: Occupied Bandwidth at maximum power of channel 498.

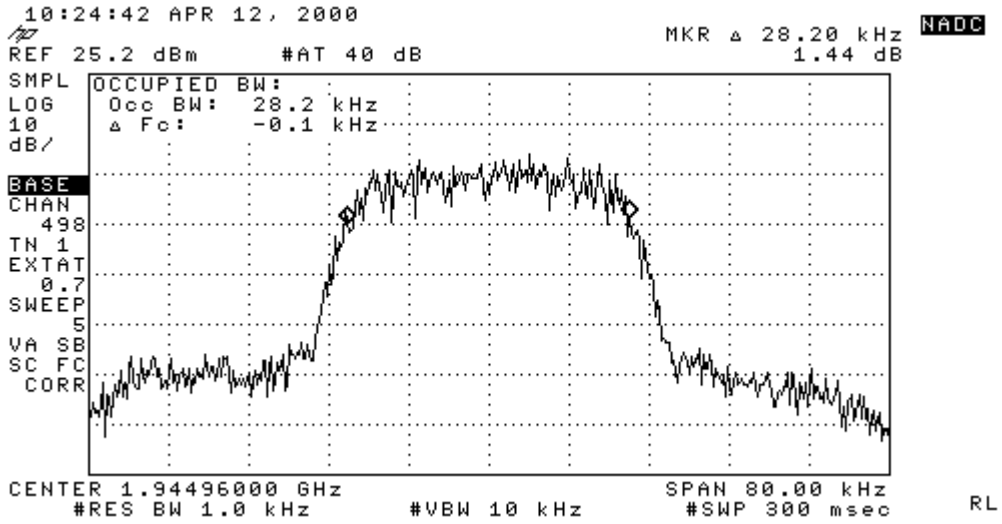


Figure 8.3.2: Occupied Bandwidth at minimum power of channel 498.

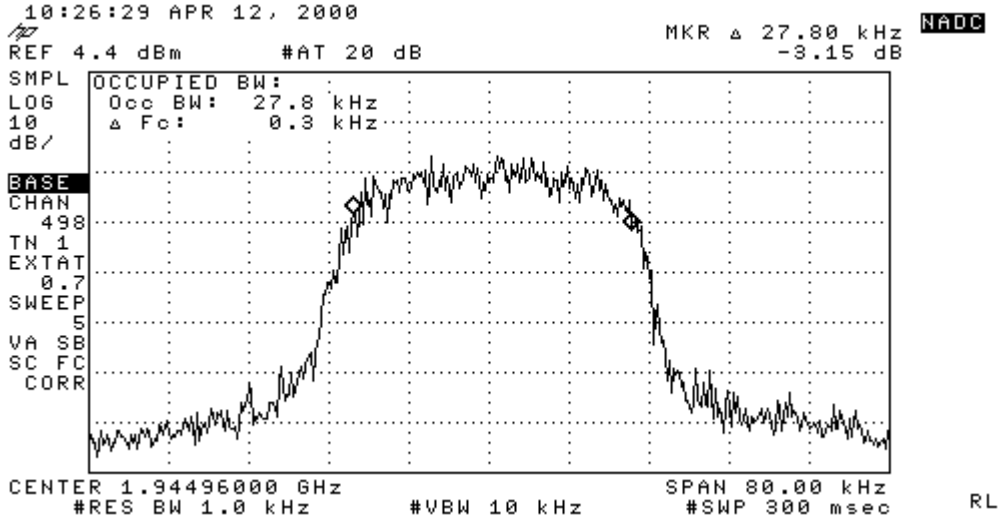
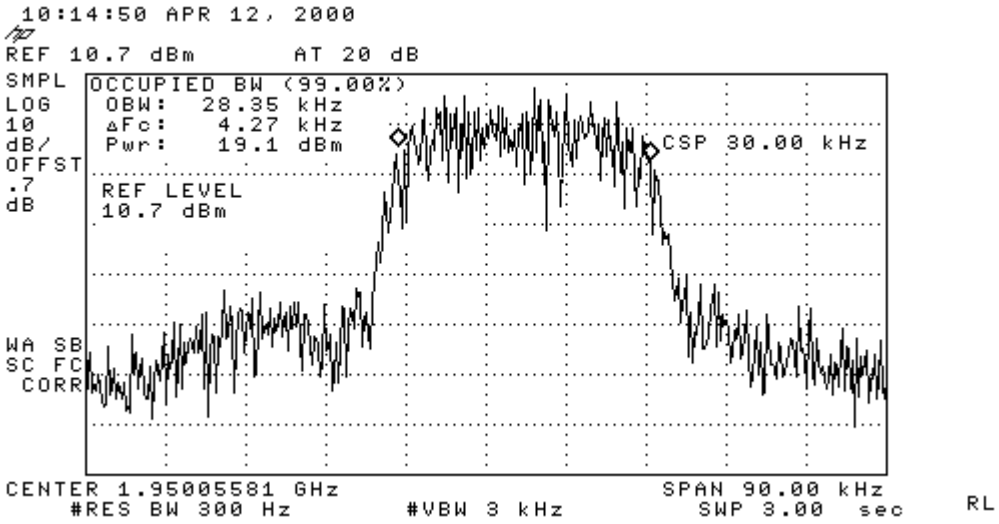


Figure 8.3.3: Occupied Bandwidth at maximum power of channel 498.



Occupied BW measurement with minimum and maximum power setting is tabulated below for both main and diversity ports.

Table 8.3.1: Picocell 1900MHz System –Occupied Bandwidth: Main Port

Freq. Band	Channel Number	OBW @ Max. Output Power (kHz)	OBW @ Min. Output Power (kHz)
A-Band	2	28.2	28
A-Band	498	28.2	27.8
B-Band	1164	27.8	28.4
C-Band	1998	28.6	28.4
D-Band	664	28.6	28.6
E-Band	1331	28.6	28.0
F-Band	1498	28.2	28.0

Table 8.3.2: Picocell 1900MHz System –Occupied Bandwidth: Diversity Port

The diversity port with respect to the design, is very much identical to the main port.

Freq. Band	Channel Number	OBW @ Max. Output Power (kHz)	OBW @ Min. Output Power (kHz)
A-Band	498	28.4	27.8
B-Band	1164	28.6	28.2
C-Band	1998	28.2	28.2
D-Band	664	28.0	28.0
E-Band	1331	28.0	27.8
F-Band	1498	28.2	27.8

8.4 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

SUBJECT: *Spurious Emissions At Antenna Terminals*

MFG: HNS
Tested By: Logi Balasingam
Test Dates: April 13/2000

EUT: 1900 MHz PicoCell **Channel Number:** **Power:** Min/Max
FCC: § FCC 2.1049, FCC 24.238
Limit: -13 dBm
Verdict: PASS

Sample spurious emission measurement plot was presented below and found that the spurious emission for other bands were below the –13dBm limit.

Figure 8.4.1: Spurious Emission (in band) with maximum output power.

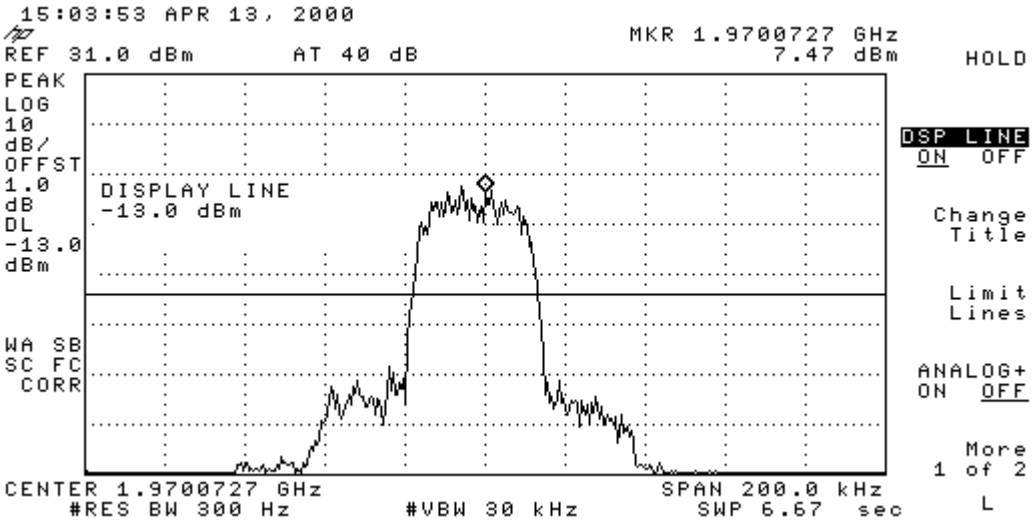


Figure 8.4.2: Spurious Emission (in band) with maximum output power.

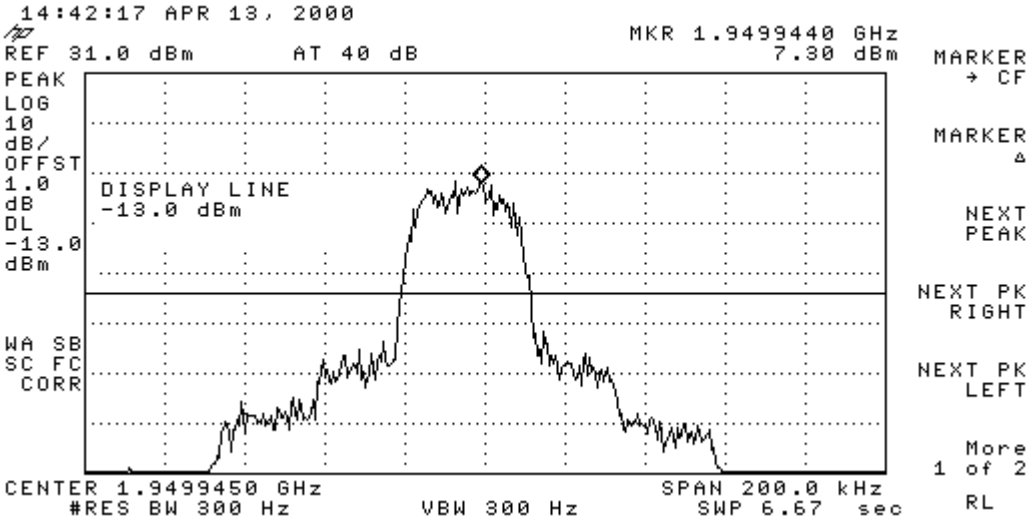


Figure 8.4.3: Spurious Emission (out band) with maximum output power.

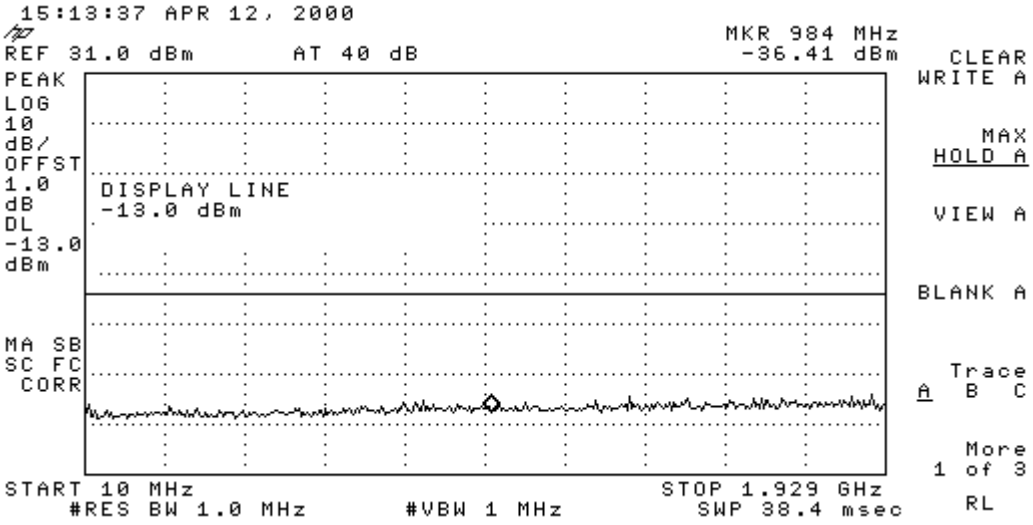


Figure 8.4.4: Spurious Emission (Band edge) with maximum output power.

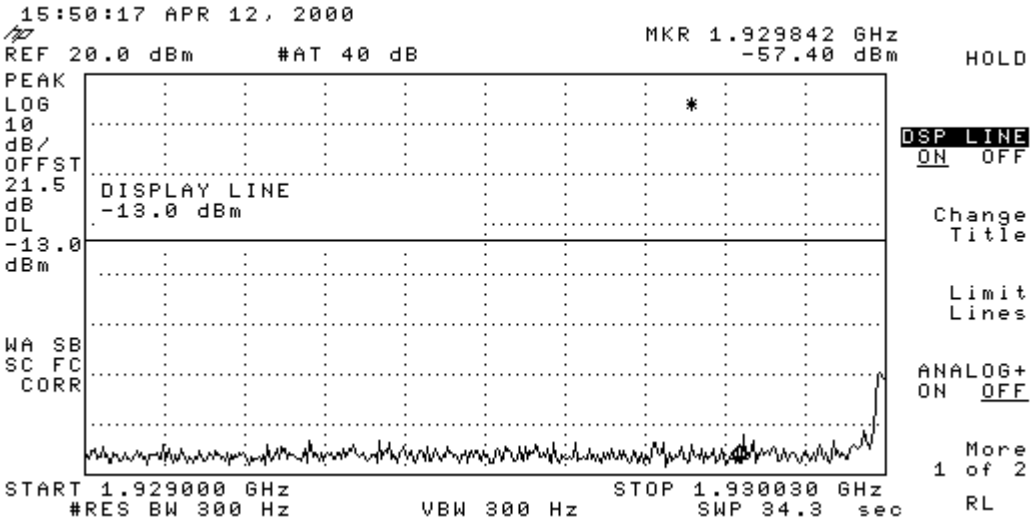


Figure 8.4.5: Spurious Emission (band edge) with maximum output power.

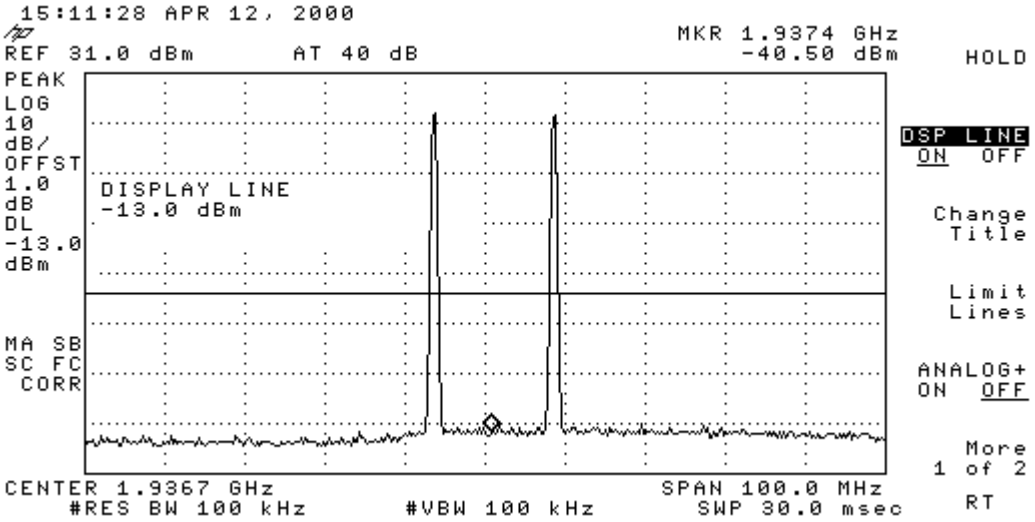


Figure 8.4.6: Spurious Emission (band edge) with maximum output power.

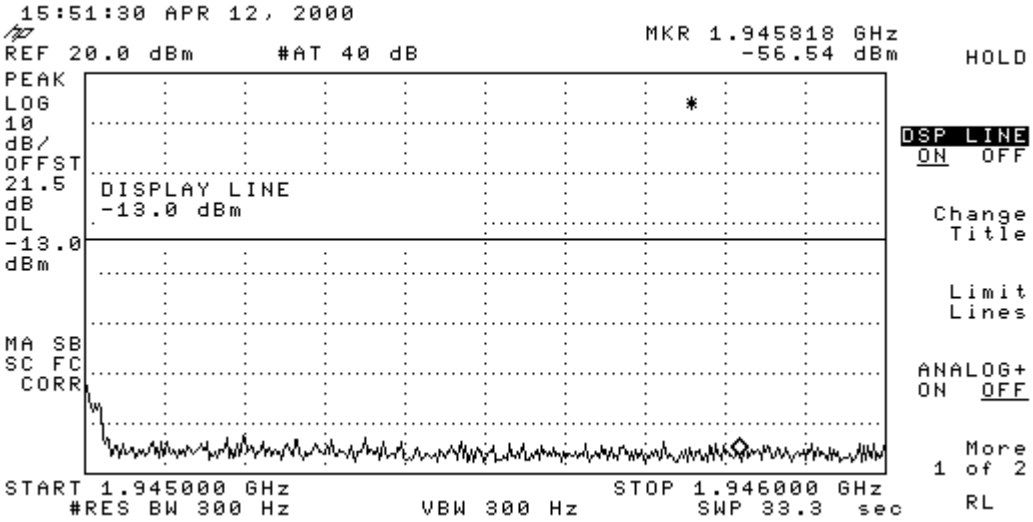


Figure 8.4.7: Spurious Emission (out band) with maximum output power.

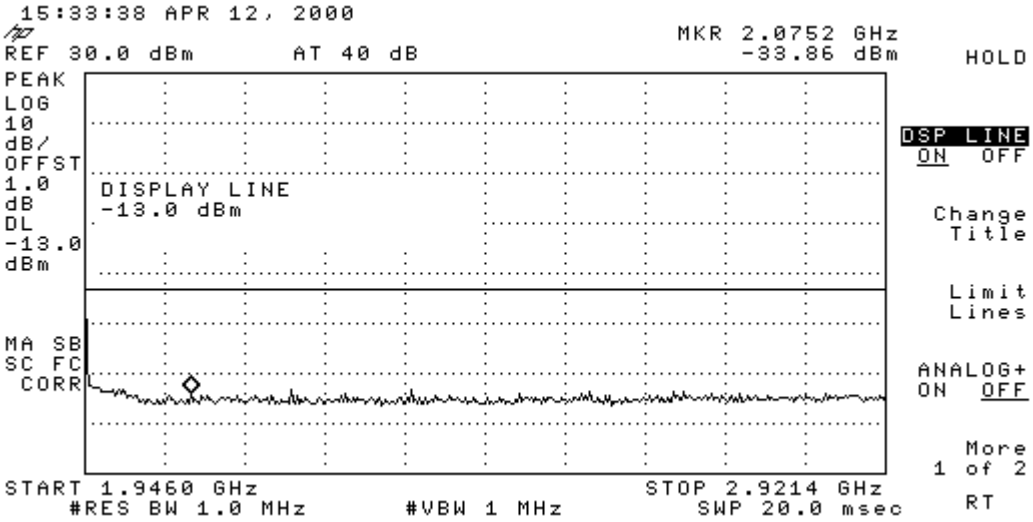


Figure 8.4.8: Spurious Emission (out band) with maximum output power.

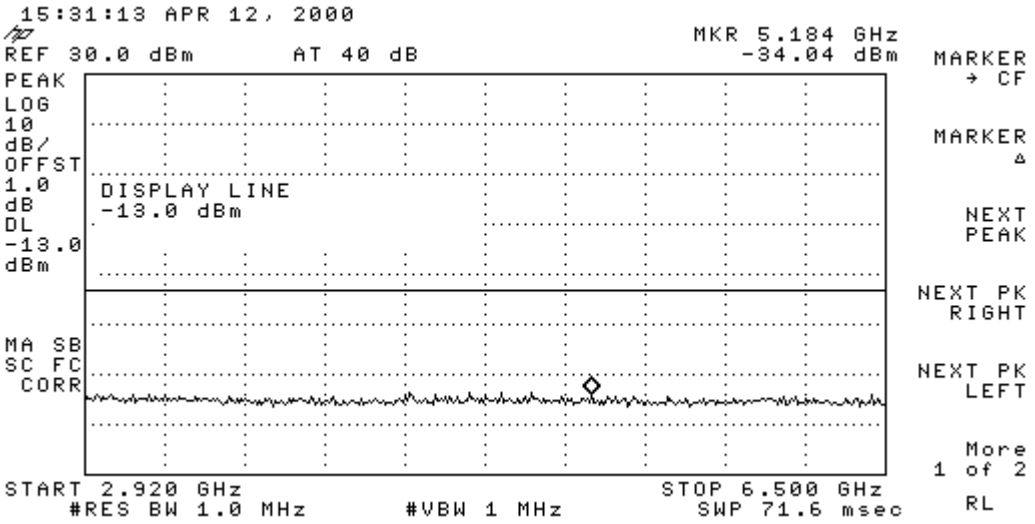


Figure 8.4.9: Spurious Emission (out band) with maximum output power.

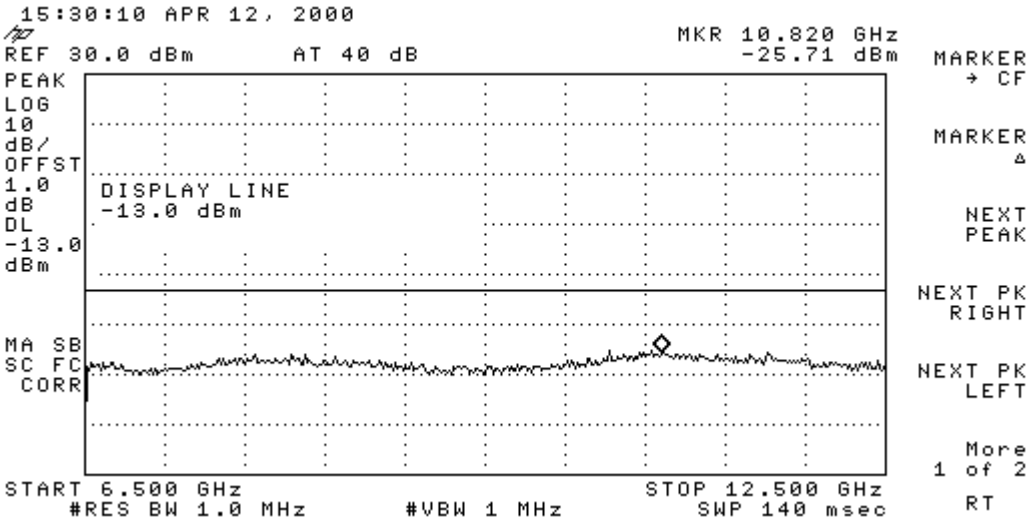
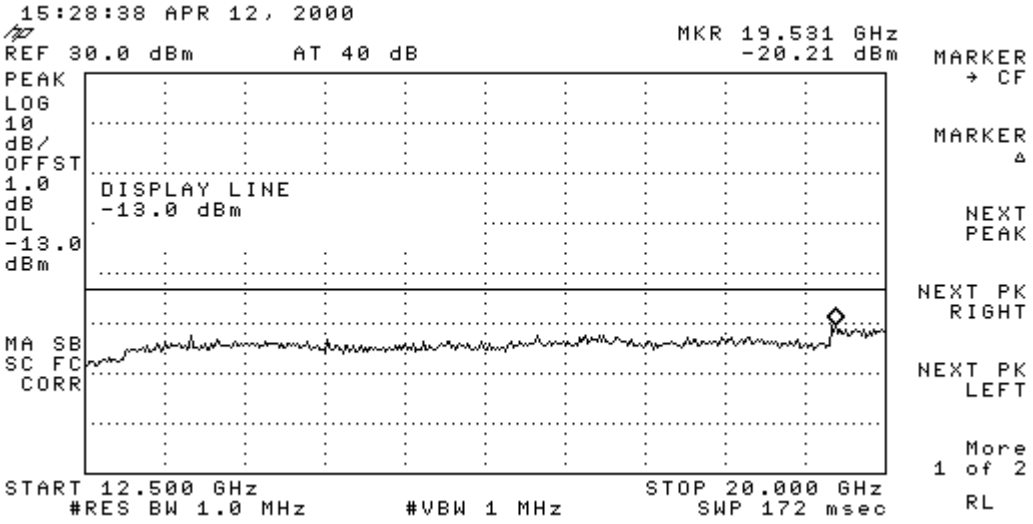


Figure 8.4.10: Spurious Emission (out band) with maximum output power.



8.5 FIELD STRENGTH OF SPURIOUS RADIATION

SUBJECT: *Field Strength of Spurious Radiation*

MFG: HNS
Tested By: Steve Koster/ Mike Violette
Test Dates: 5/3&6/00

EUT: 1900 MHz PicoCell **Channel Number:** **Power:** Min/Max
FCC: § FCC 2.1053, FCC 24.235
Limit: 84 dB uV/m
Verdict: PASS

Table 8.5.1. EIRP Measurements

EUT: HNS Pico Cell
EUT Measurements: 5/3/00 By: Steve Koster
ERP Measurements: 5/6/00 By: Mike Violette
Job Number: 5783

FREQ (GHz)	LEVEL (dBm) VER dBuV	LEVEL (dBm) HOR dBuV	Pt VER dBm	Pt HOR dBm	TX ANT GAIN dB	TX ANT FACTOR DB	**EIRP VER dBm**	**EIRP HOR dBm**
1.942006	91.1	82.5	14.8	5	4.9	31.4	**19.7**	**9.9**
1.9444013	90.7	83	14.3	5.5	4.9	31.4	**19.2**	**10.4**
1.9450013	91.8	81.2	13.8	4.5	4.9	31.4	**18.7**	**9.4**
1.9474063	91.1	84.5	14.8	3	4.9	31.4	**19.7**	**7.9**
3.884017	37.4	35.5	-67	-68	6.6	35.7	**-60.4**	**-61.4**
3.88884	37.7	36.1	-67	-67.5	6.6	35.7	**-60.4**	**-60.9**
3.89242	34.5	35.6	-70	-68	6.6	35.7	**-63.4**	**-61.4**
3.8900399	34.6	35.2	-70	-68	6.6	35.7	**-63.4**	**-61.4**
5.835043	42.1	36.4	-58	-64	8.4	37.4	**-49.6**	**-55.6**
5.837441	47.8	42.1	-52	-58	8.4	37.4	**-43.6**	**-49.6**
5.839851	46.7	43.2	-53	-57	8.4	37.4	**-44.6**	**-48.6**
5.842263	43	38.7	-56	-62	8.4	37.4	**-47.6**	**-53.6**
9.71915	38.8	NOISE FLOOR MEASUREMENT-NO DETECTABLE EMISSIONS						
11.66106	38.6	NOISE FLOOR MEASUREMENT-NO DETECTABLE EMISSIONS						
13.60317	40.4	NOISE FLOOR MEASUREMENT-NO DETECTABLE EMISSIONS						
15.54507	41.9	NOISE FLOOR MEASUREMENT-NO DETECTABLE EMISSIONS						
17.48708	44.15	NOISE FLOOR MEASUREMENT-NO DETECTABLE EMISSIONS						
19.42	46.5	NOISE FLOOR MEASUREMENT-NO DETECTABLE EMISSIONS						

8.6 FREQUENCY STABILITY

SUBJECT: *Frequency Stability*

MFG: HNS
Tested By: Logi Balasingam
Test Dates: April 20/2000

EUT: 1900 MHz PicoCell **Channel Number:** **Power:** Min/Max
FCC: § FCC 2.1049
Limit: +/- 1 ppm
Verdict: PASS
The Maximum Deviation is +/- 269 Hz

Table 8.6.1: Picocell 1900MHz System –Freq. Stability: Main Port

Temp. Degrees C	Ch. No.	Ideal (Hz)	Lower Freq. (Hz) Measured	Upper Freq. (Hz) Measured	Delta Lower (Hz)	Delta Upper (Hz)
-30						
	2	1930080000	1930080094	1930080246	94	246
	498	1944960000	1944960121	1944960221	121	221
	668	1950060000	1950060124	1950060242	124	242
	1164	1964940000	1964940126	1964940238	126	238
	1502	1975080000	1975080145	1975080255	145	255
	1998	1989960000	1989960124	1989960226	124	226
	502	1945080000	1945080143	1945080238	143	238
	664	1949940000	1949940142	1949940246	142	246
	1168	1965060000	1965060149	1965060249	149	249
	1331	1969950000	1969950134	1969950234	134	234
	1335	1970070000	1970070154	1970070244	154	244
	1498	1974960000	1974960134	1974960233	134	233

Table 8.6.1: Picocell 1900MHz System –Freq. Stability: Main Port(cont..)

Temp. Degrees C	Ch. No.	Ideal (Hz)	Lower Freq. (Hz) Measured	Upper Freq. (Hz) Measured	Delta Lower (Hz)	Delta Upper (Hz)
-20	2	1930080000	1930080124	1930080230	124	230
Degrees	498	1944960000	1944960131	1944960244	131	244
	1502	1975080000	1975080133	1975080254	133	254
	1998	1989960000	1989960130	1989960239	130	239
-10	2	1930080000	1930080155	1930080235	155	235
Degrees	498	1944960000	1944960099	1944960233	99	233
	1502	1975080000	1975080127	1975080253	127	253
	1998	1989960000	1989960123	1989960229	123	229
0	2	1930080000	1930080104	1930080244	104	244
Degrees	498	1944960000	1944960106	1944960244	106	244
	1502	1975080000	1975080096	1975080239	96	239
	1998	1989960000	1989960142	1989960240	142	240
10	2	1930080000	1930080097	1930080230	97	230
Degrees	498	1944960000	1944960102	1944960243	102	243
	1502	1975080000	1975080140	1975080248	140	248
	1998	1989960000	1989960123	1989960250	123	250
20	2	1930080000	1930080124	1930080269	124	269
Degrees	498	1944960000	1944960116	1944960249	116	249
	1502	1975080000	1975080127	1975080223	127	223
	1998	1989960000	1989960121	1989960259	121	259
30	2	1930080000	1930080123	1930080244	123	244
Degrees	498	1944960000	1944960129	1944960224	129	224
	1502	1975080000	1975080104	1975080260	104	260
	1998	1989960000	1989960125	1989960239	125	239
40	2	1930080000	1930080128	1930080254	128	254
Degrees	498	1944960000	1944960124	1944960237	124	237
	1502	1975080000	1975080129	1975080244	129	244
	1998	1989960000	1989960135	1989960229	135	229
50	2	1930080000	1930080129	1930080235	129	235
Degrees	498	1944960000	1944960132	1944960249	132	249

	1502	1975080000	1975080112	1975080232	112	232
	1998	1989960000	1989960104	1989960225	104	225

Table 8.6.2: Frequency Stability with Variation in Supply Voltage: Ambient Temp.

Supply Voltage	Ch. No.	Ideal (Hz)	Lower Freq. (Hz) Measured	Upper Freq. (Hz) Measured	Delta Lower (Hz)	Delta Upper (Hz)
41V	2	1930080000	1930080121	1930080215	121	215
	1998	1989960000	1989960117	1989960206	117	206
46V	2	1930080000	1930080130	1930080231	130	231
	1998	1989960000	1989960128	1989960222	128	222
51V	2	1930080000	1930080103	1930080213	103	213
	1998	1989960000	1989960114	1989960207	114	207
55V	2	1930080000	1930080090	1930080227	90	227
	1998	1989960000	1989960101	1989960233	101	233

Table 8.6.3: Frequency Stability with Variation in Supply Voltage: 30 degrees below 0 Temp.

Supply Voltage	Ch. No.	Ideal (Hz)	Lower Freq. (Hz) Measured	Upper Freq. (Hz) Measured	Delta Lower (Hz)	Delta Upper (Hz)
41V	2	1930080000	1930080128	1930080230	128	230
	1998	1989960000	1989960110	1989960225	110	225
46V	2	1930080000	1930080082	1930080230	82	230
	1998	1989960000	1989960129	1989960237	129	237
51V	2	1930080000	1930080110	1930080213	110	213
	1998	1989960000	1989960104	1989960218	104	218
55V	2	1930080000	1930080097	1930080207	97	207
	1998	1989960000	1989960111	1989960239	111	239

Table 8.6.4: Frequency Stability with Variation in Supply Voltage: 50 degrees above 0 Temp.

Supply Voltage	Ch. No.	Ideal (Hz)	Lower Freq. (Hz) Measured	Upper Freq. (Hz) Measured	Delta Lower (Hz)	Delta Upper (Hz)
41V	2	1930080000	1930080113	1930080225	113	225
	1998	1989960000	1989960088	1989960237	88	237
46V	2	1930080000	1930080089	1930080221	89	221

	1998	1989960000	1989960116	1989960245	116	245
51V	2	1930080000	1930080116	1930080228	116	228
	1998	1989960000	1989960115	1989960220	115	220
55V	2	1930080000	1930080101	1930080219	101	219
	1998	1989960000	1989960098	1989960227	98	227

Table 8.6.5: Picocell 1900MHz System –Freq. Stability: Diversity Port

Temp. Degrees C	Ch. No.	Ideal (Hz)	Lower Freq. (Hz)	Upper Freq. (Hz)	Delta Lower (Hz)	Delta Upper (Hz)
Degrees						
-30	2	1930080000	1930080062	1930080218	62	218
	498	1944960000	1944960084	1944960210	84	210
	668	1950060000	1950060090	1950060205	90	205
	1164	1964940000	1964940089	1964940209	89	209
	1502	1975080000	1975080079	1975080215	79	215
	1998	1989960000	1989960078	1989960204	78	204
	502	1945080000	1945080105	1945080200	105	200
	664	1949940000	1949940065	1949940209	65	209
	1168	1965060000	1965060036	1965060217	36	217
	1331	1969950000	1969950088	1969950203	88	203
	1335	1970070000	1970070077	1970070211	77	211
	1498	1974960000	1974960064	1974960216	64	216

Table 8.6.5: Picocell 1900MHz System –Freq. Stability: Diversity Port(cont..)

Temp. Degrees C	Ch. No.	Ideal (Hz)	Lower Freq. (Hz)	Upper Freq. (Hz)	Delta Lower (Hz)	Delta Upper (Hz)
-20	2	1930080000	1930080083	1930080202	83	202
Degrees	498	1944960000	1944960063	1944960204	63	204
	1502	1975080000	1975080080	1975080217	80	217
	1998	1989960000	1989960073	1989960206	73	206
-10	2	1930080000	1930080090	1930080213	90	213
Degrees	498	1944960000	1944960073	1944960200	73	200
	1502	1975080000	1975080098	1975080206	98	206
	1998	1989960000	1989960060	1989960198	60	198
0	2	1930080000	1930080089	1930080239	89	239
Degrees	498	1944960000	1944960077	1944960203	77	203
	1502	1975080000	1975080091	1975080235	91	235
	1998	1989960000	1989960097	1989960217	97	217
10	2	1930080000	1930080093	1930080211	93	211
Degrees	498	1944960000	1944960086	1944960221	86	221
	1502	1975080000	1975080095	1975080235	95	235
	1998	1989960000	1989960084	1989960220	84	220
20	2	1930080000	1930080074	1930080231	74	231
Degrees	498	1944960000	1944960088	1944960234	88	234
	1502	1975080000	1975080104	1975080220	104	220
	1998	1989960000	1989960083	1989960212	83	212
30	2	1930080000	1930080093	1930080202	93	202
Degrees	498	1944960000	1944960091	1944960220	91	220
	1502	1975080000	1975080116	1975080213	116	213
	1998	1989960000	1989960075	1989960208	75	208
40	2	1930080000	1930080083	1930080200	83	200
Degrees	498	1944960000	1944960108	1944960209	108	209
	1502	1975080000	1975080101	1975080238	101	238
	1998	1989960000	1989960097	1989960207	97	207

Table 8.6.5: Picocell 1900MHz System –Freq. Stability: Diversity Port(cont..)

Temp. Degrees C	Ch. No.	Ideal (Hz)	Lower Freq. (Hz)	Upper Freq. (Hz)	Delta Lower (Hz)	Delta Upper (Hz)
50	2	1930080000	1930080088	1930080210	88	210
Degrees	498	1944960000	1944960095	1944960217	95	217
	1502	1975080000	1975080107	1975080220	107	220
	1998	1989960000	1989960089	1989960200	89	200

Table 8.6.6: Frequency Stability with Variation in Supply Voltage: Ambient Temp.

Voltage	Ch. No.	Ideal (Hz)	Lower Freq. (Hz)	Upper Freq. (Hz)	Delta Lower (Hz)	Delta Upper (Hz)
41V	2	1930080000	1930080119	1930080227	119	227
	1998	1989960000	1989960102	1989960220	102	220
46V	2	1930080000	1930080109	1930080223	109	223
	1998	1989960000	1989960108	1989960229	108	229
51V	2	1930080000	1930080110	1930080217	110	217
	1998	1989960000	1989960119	1989960226	119	226
55V	2	1930080000	1930080088	1930080200	88	200
	1998	1989960000	1989960089	1989960222	89	222

Table 8.6.7: Frequency Stability with Variation in Supply Voltage: 30 degrees below 0 Temp.

Voltage	Ch#	Ideal	Lower Freq.	Upper Freq.	Delta Lower	Delta Upper
41V	2	1930080000	1930080041	1930080232	41	232
	1998	1989960000	1989960093	1989960211	93	211
46V	2	1930080000	1930080090	1930080201	90	201
	1998	1989960000	1989960060	1989960210	60	210
51V	2	1930080000	1930080094	1930080211	94	211
	1998	1989960000	1989960086	1989960216	86	216
55V	2	1930080000	1930080079	1930080218	79	218
	1998	1989960000	1989960096	1989960206	96	206

Table 8.6.8: Frequency Stability with Variation in Supply Voltage: 50 degrees above 0 Temp.

Voltage	Ch#	Ideal	Lower Freq.	Upper Freq.	Delta Lower	Delta Upper
41V	2	1930080000	1930080097	1930080222	97	222
	1998	1989960000	1989960101	1989960241	101	241
46V	2	1930080000	1930080112	1930080219	112	219
	1998	1989960000	1989960089	1989960216	89	216
51V	2	1930080000	1930080088	1930080222	88	222
	1998	1989960000	1989960096	1989960218	96	218
55V	2	1930080000	1930080086	1930080232	86	232
	1998	1989960000	1989960093	1989960210	93	210

8.7 RADIATED EMISSIONS

SUBJECT: *Field Strength of Spurious Radiation*

MFG: HNS
Tested By: Steve Koster
Test Dates: 5/1/00

EUT: 1900 MHz PicoCell **Channel Number:** **Power:** Min/Max
FCC: § FCC 2.1053, FCC 24.235, FCC 15 Class A
Limit: Section 7.7.1
Verdict: PASS

Table 8.7.1 Radiated Emission Data per FCC Part 15 Class A Emissions Limits

CLIENT:	Hughes Network Systems
MODEL NO:	1900 MHz Picocell
DATE:	5/1/00
BY:	Steve Koster
JOB #:	5848A

FREQ	POL	Azimuth	Antenna Height	SA LEVEL (QP)	AFc	E-FLD	E-FLD	LIMIT	MARGIN
MHz	H/V	Degree	m	dBuV	dB/m	dBuV/m	uV/m	uV/m	dB
53.27	H	180.0	3.5	10.7	12.9	23.6	15.1	90.0	-15.5
82.46	H	270.0	3.5	5.6	7.2	12.8	4.4	90.0	-26.2
86.48	H	157.5	3.5	12.7	8.1	20.8	10.9	90.0	-18.3
111.16	H	0.0	3.5	11.9	11.4	23.3	14.6	150.0	-20.2
117.75	H	292.5	3.5	15.6	11.8	27.4	23.3	150.0	-16.2
128.03	H	67.5	3.5	10.7	11.1	21.8	12.4	150.0	-21.7
135.88	H	292.5	3.5	14.0	10.4	24.4	16.7	150.0	-19.1
148.24	H	270.0	3.5	26.8	10.4	37.2	72.6	150.0	-6.3
163.85	H	270.0	3.5	19.5	12.0	31.5	37.7	150.0	-12.0
168.99	H	90.0	3.5	20.1	11.4	31.5	37.7	150.0	-12.0
172.95	H	67.5	3.5	21.2	11.3	32.5	42.2	150.0	-11.0
174.00	H	292.5	3.5	20.9	11.3	32.2	40.7	150.0	-11.3
179.23	H	67.5	3.5	19.3	11.3	30.6	33.9	150.0	-12.9
184.35	H	225.0	3.5	20.0	11.4	31.4	37.3	150.0	-12.1
185.30	H	315.0	3.5	14.8	11.5	26.3	20.6	150.0	-17.3
194.58	H	67.5	3.5	18.1	11.7	29.8	31.0	150.0	-13.7
197.65	H	67.5	3.5	19.4	11.8	31.2	36.4	150.0	-12.3
222.39	H	67.5	3.5	13.8	13.5	27.3	23.2	210.0	-19.1
310.78	H	270.0	3.5	13.1	16.6	29.7	30.4	210.0	-16.8
358.58	H	247.5	3.5	12.0	18.1	30.1	31.8	210.0	-16.4

Table 8.7.2. Radiated Emission Data per FCC Part 15 Class A Emissions Limits(cont..)

CLIENT:	Hughes Network Systems
MODEL NO:	1900 MHz Picocell
DATE:	5/1/00
BY:	Steve Koster
JOB #:	5848A

FREQ	POL	Azimuth	Antenna Height	SA LEVEL (QP)	AFc	E-FLD	E-FLD	LIMIT	MARGIN
MHz	H/V	Degree	m	dBuV	dB/m	dBuV/m	uV/m	uV/m	dB
40.99	V	270.0	1.5	7.7	16.5	24.2	16.2	90.0	-14.9
65.55	V	270.0	1.5	14.0	8.8	22.8	13.8	90.0	-16.3
81.95	V	135.0	1.5	18.5	7.1	25.6	19.1	90.0	-13.5
111.19	V	180.0	1.5	17.9	11.4	29.3	29.1	150.0	-14.2
148.25	V	0.0	1.5	24.2	10.4	34.6	53.8	150.0	-8.9
167.35	V	67.5	1.5	18.6	11.6	30.2	32.4	150.0	-13.3
172.99	V	157.5	1.5	21.0	11.3	32.3	41.2	150.0	-11.2
174.10	V	157.5	1.5	20.4	11.3	31.7	38.5	150.0	-11.8
179.22	V	157.5	1.5	17.4	11.3	28.7	27.2	150.0	-14.8
197.65	V	180.0	1.5	17.0	11.8	28.8	27.6	150.0	-14.7
215.16	V	202.5	1.5	18.5	13.1	31.6	37.9	150.0	-11.9
310.77	V	315.0	1.5	5.7	16.6	22.3	13.0	210.0	-24.2

8.8 CONDUCTED EMISSION

SUBJECT: C*onducted Emission*

MFG: HNS
Tested By: Steve Koster
Test Dates: 5/2/00

EUT: 1900 MHz PicoCell
FCC: § FCC 15
Limit: 1000 & 3000 uv
Verdict: PASS

Channel Number:

Power: Min/Max

Table 8.8.1: Class A Conducted Emissions Data

CLIENT:	Hughes Network Systems
MODEL NO:	1900 MHz Picocell
DATE:	5/2/00
BY:	Steve Koster
JOB #:	5848A
CONFIGURATION:	

LINE 1 - NEUTRAL

FREQ MHz	VOLTAGE (PEAK) dBuV	VOLTAGE uV	FCC LIMIT uV	MARGIN dB
5.38	46.7	216.3	3000	-22.8
6.92	51.8	389.0	3000	-17.7
10.05	50.5	335.0	3000	-19.0
13.16	61.1	1135.0	3000	-8.4
16.29	60.3	1035.1	3000	-9.2
19.35	51.5	375.8	3000	-18.0

Table 8.8.1: Class A Conducted Emissions Data(cont..)

LINE 2 - PHASE

FREQ MHz	VOLTAGE (PEAK) dBuV	VOLTAGE uV	FCC LIMIT uV	MARGIN dB
5.40	46.5	211.3	3000	-23.0
6.96	52.2	407.4	3000	-17.3
10.06	50.1	319.9	3000	-19.4
13.16	61.0	1122.0	3000	-8.5
16.27	60.3	1035.1	3000	-9.2
19.37	51.4	371.5	3000	-18.1

9.0 MODIFICATIONS AND RECOMMENDATIONS

The following modifications were necessary in order for the Equipment Under Test to meet the technical requirements of 47 CFR Part 15/24:

10.0 LABELING REQUIREMENTS

10.1 EQUIPMENT LABELS

Equipment that is certified under this Specification shall be permanently labelled on each item or inseparable combination. The label shall contain the following information:

(a) The certification number, prefixed by the name "FCC / Canada".
(b) The manufacturer's name or trade name or brand name.
(c) A model name or number.

Equipment for which a certificate has been issued is not considered certified if it is not properly labelled.
Note: The information on the Canadian label can be combined with the manufacturer's other labelling requirements.

To indicate compliance with FCC requirements, this device shall bear the following statement in the customer documentation. This text is not required on a label affixed to the device since this device must also meet the FCC Part 24 requirements for Type Acceptance.

> **This Class B digital apparatus meets all requirements of Part 15 of the FCC rules. Operation is subject to the condition that this device does not cause harmful interference.**

To indicate compliance with the Canadian Standard, the device shall bear the following statement in the customer documentation that it is operating under special permission and setting out the conditions of that special permission; and, that the unit complies with all conditions set out in the special permission. Suggested text for the notice indicting compliance with this Standard:

> **This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.**
>
> **Cet appareil numérique de la classe B respecte toutes ·les exigences du Règlement sur le matériel brouillleur du Canada.**

10.2 REGULATORY ID PLATE

Refer Exhibit 1 for Regulatory labels and location.

10.3 CONTINUING COMPLIANCE

It is prudent that manufacturers have an established Quality Assurance program to spot check their products on a periodic basis, either based upon time or quantities produced. Obviously, a change in the engineering design should be sufficient justification for a re-test.

The Quality assurance test need not be formal Verification or Certification such as required during the initial production of the product. However, it should be sufficient in scope to assure that the EMI characteristics of the product have not changed to the degree that the product exceeds the FCC limits. If a new model of a product is produced, it must undergo full Verification or Certification testing and, in case of Certification, be filed with the commission and regulatory agencies.

It is expected that the FCC will place greater emphasis and resources in spot checking commercially available products. If a product is found not to be compliant with the Limits specified in Part 22/24 and Part 15, Subpart B. the manufacturer will be subject to the appropriate penalties imposed by the Commission. The initial Certification or Verification is sufficient to justify initial production. The additional quality assurance testing performed is the manufacturer's responsibility to assure continued compliance.

11.0 SYSTEM PHOTOGRAPHS

Refer Exhibit 4 and 5 for External and Internal photos respectively.

11.1 ATTACHMENT 1

Federal Communication Commission

Reference: FCC ID: K3Y-PICO-1900
Hughes Network Systems Base Transceiver System

Request for Confidentiality

Dear Examiner,

In accordance with §0.459 of CFR 47, Hughes Network Systems requests confidentiality for Attachment 1 of this application. This statement contains Schematic Diagrams information of the new design of the Picocell 1900 radio system, which Hughes Network Systems considers to be proprietary and confidential and, otherwise, would not release to the general public. Hughes Network Systems feels that this information would be of benefit to its competitors, and that disclosure of the information in this exhibit would give our competitors an unfair advantage in the market.

The container holds the following items of documentation, for Attachment 1.

Contents:

HNS Drawing Number
Installation and Commissioning Manual
Part List
Schematics

Best Regards,

John Rymkiewicz
Technical Manager, Agency Certification
Hughes Network Systems Inc.,

12.0 GLOSSARY

ACELP	Adaptive Code Excited Linear Predictor
ACK	Acknowledgment
BTC	Base Transceiver Card
BTS	Base Transceiver Station
BSC	Base Station Controller
CPU	Center Process Unit (Combined CPU/NIC in this document)
DCCH	Digital Control Channel
DL	Digital Locator
DTC	Digital Traffic Channel
DTMF	Dual Tone Multiple Frequency
DVCC	Digital Verification Color Code
EBCCH	Extended Broadcast Control Channel
FACCH	Fast Associated Control Channel
FBCCH	Fast Broadcast Control Channel
HDLC	High Level Data Link Control
HNS	Hughes Network System
LED	Light Emitted Diode
NACK	Non-Acknowledgment
NIC	Network Interface Card
OAM	Operation, Administration, and Maintenance
OLC	Overload Class
PC	Personal Computer
PCS	Personal Communication Services
POST	Power On Self Test
RACH	Random Access Channel
REGID	Registration Identification
SACCH	Slow Associate Channel
SID	System ID
SPACH	Short Message Services, Paging, and Access response Channel
WBSU	Wireless Base Station Unit (i.e. Pico BTS in this document)
WOSC	Wireless Office System Controller