



Nemko



Test Report:

2W04953.1

Applicant:

**VTECH ENGINEERING CANADA
200-7671 Alderbridge Way
Richmond, B.C. V6X 1Z9**

**Equipment Under Test:
(EUT)**

AT&T 2230 LC P2, 2.4 GHz FHSS Cordless Phone

FCC ID:

EW722230

In Accordance With:

**FCC Part 15, Subpart C
Frequency Hopping Transmitters
2400 - 2483.5 MHz**

Tested By:

**Nemko Canada Inc.
303 River Road, R.R. 5
Ottawa, Ontario K1V 1H2**

Authorized By:

Glen Westwell, Wireless Technologist

Date:

15 May 2002

Total Number of Pages:

51

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EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone

Section 1. Summary of Test Results

General

All measurements are traceable to national standards.

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.247 for Frequency Hopping Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-1992. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

TESTED BY: Kevin Rose, Test Technician

DATE: 15 May 2002

Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada. The tests included in this report are within the scope of this accreditation. The results apply only to the samples tested.

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This report applies only to the items tested.

EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone

Summary Of Test Data

Name Of Test	Para. No.	Result
Powerline Conducted Emissions	15.207(a)	Complies
Channel Separation	15.247(a)(1)	Complies
Pseudo random Hopping Algorithm	15.247(a)(1)	Complies
Time of Occupancy	15.247(a)(1)(ii)	Complies
20 dB Occupied Bandwidth	15.247(a)(1)	Complies
Peak Power Output	15.247(b)	Complies
Spurious Emissions (Radiated)	15.247(c)	Complies

Test Conditions:

Indoor Temperature: 23°C
 Humidity: 34%

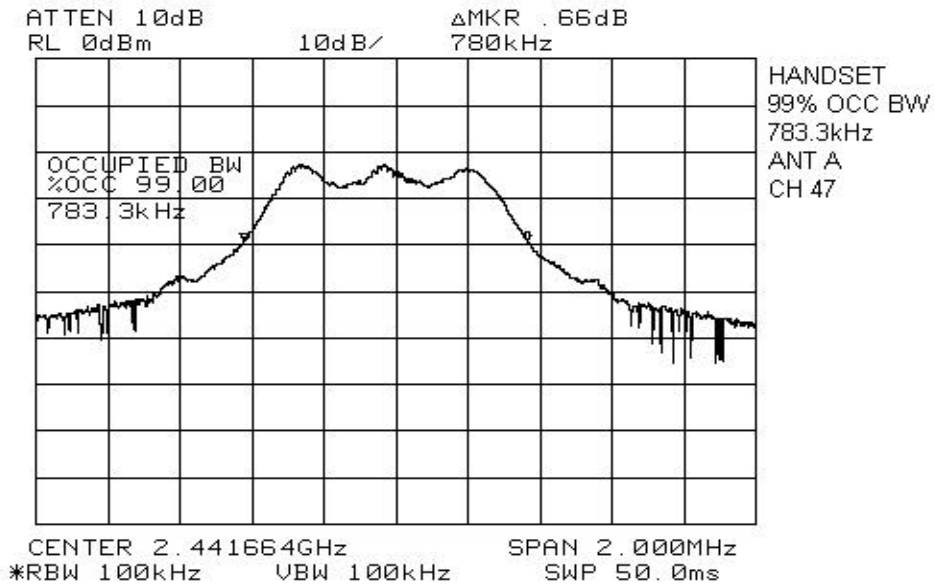
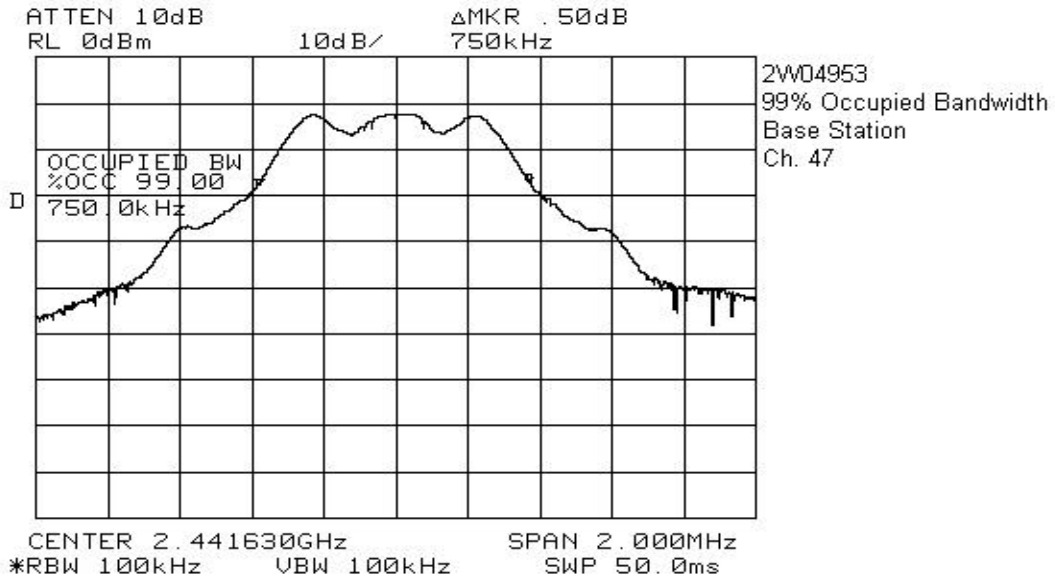
Outdoor Temperature: 15°C
 Humidity: 28%

EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone

Section 2. General Equipment Specification

Manufacturer:	VTECH Engineering Canada
Model No.:	AT&T 2230, LC, P2 2.4 GHz Cordless Phone
Serial No.:	None
Date Received In Laboratory:	April 01, 2002
Nemko Identification No.:	Item 1, Item 2
Frequency Range:	2401.056 – 2482.272 MHz
Tunable Bands:	1
Number of Channels:	95
Channel Spacing:	875kHz, 855kHz
Emissions Designator:	783k3F1D
User Frequency Adjustment:	None
Rated Output Power	20 dBm

EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone



EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone

Section 3. Powerline Conducted Emissions

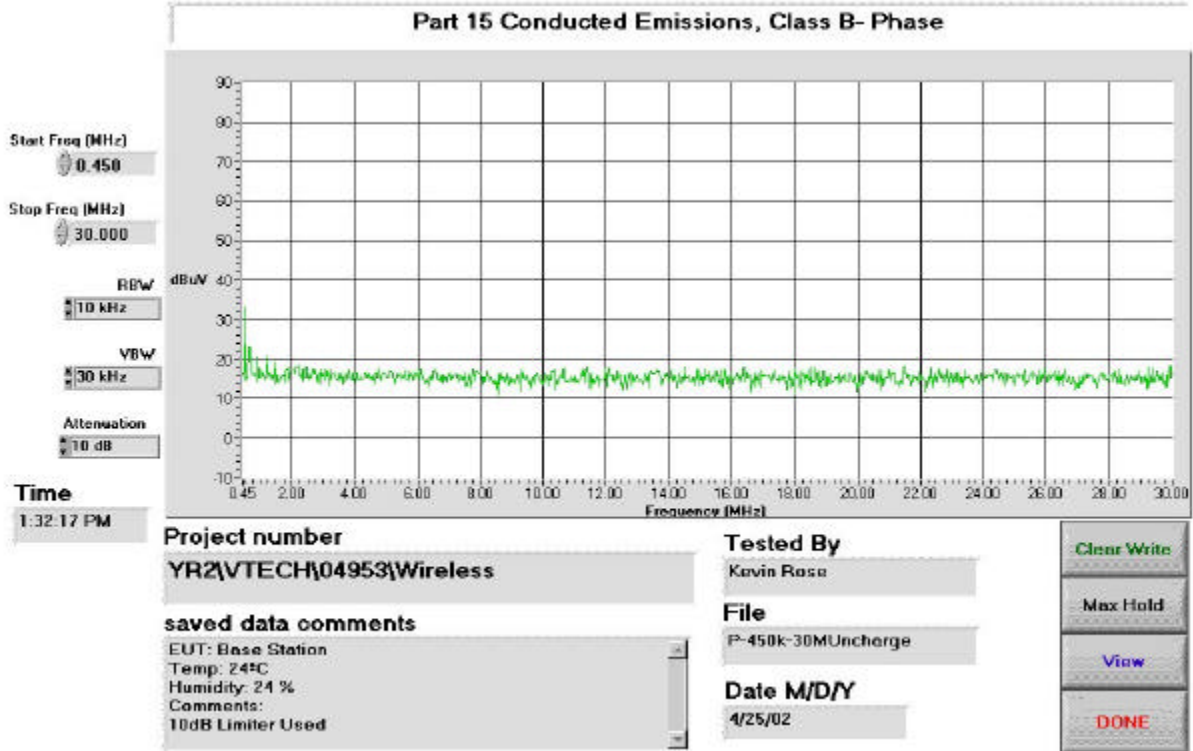
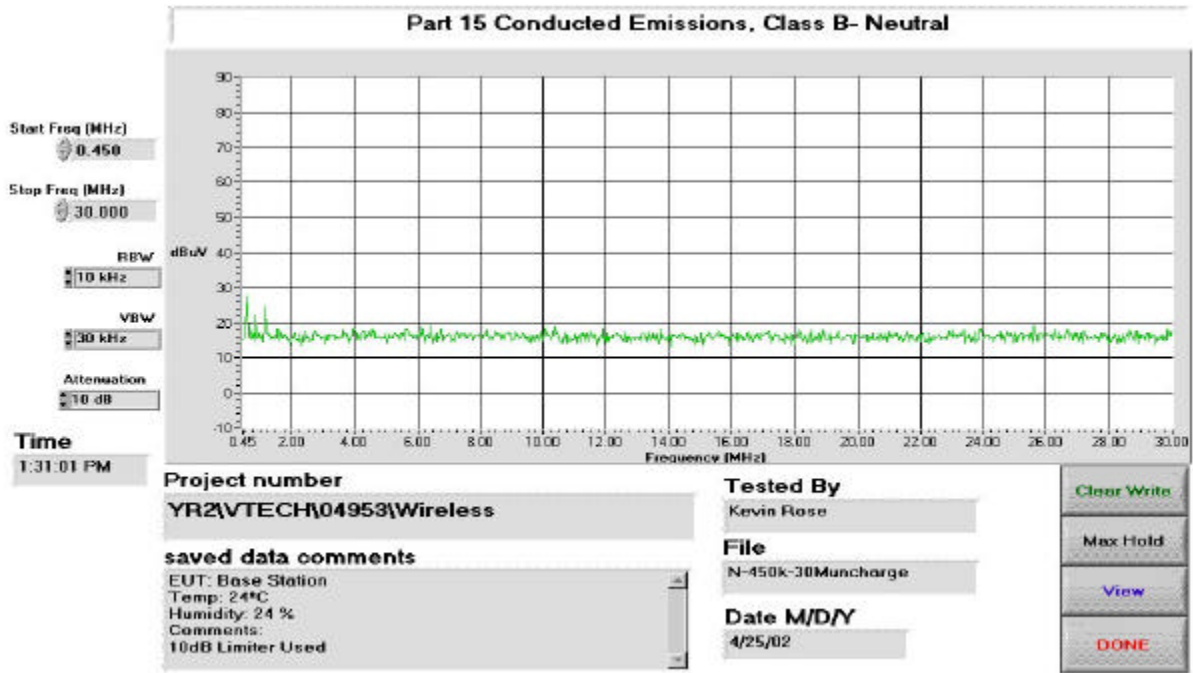
Para. No.: 15.207 (a)

Test Performed By: Kevin Rose	Date of Test: April 24, 2002
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Test Results: Complies

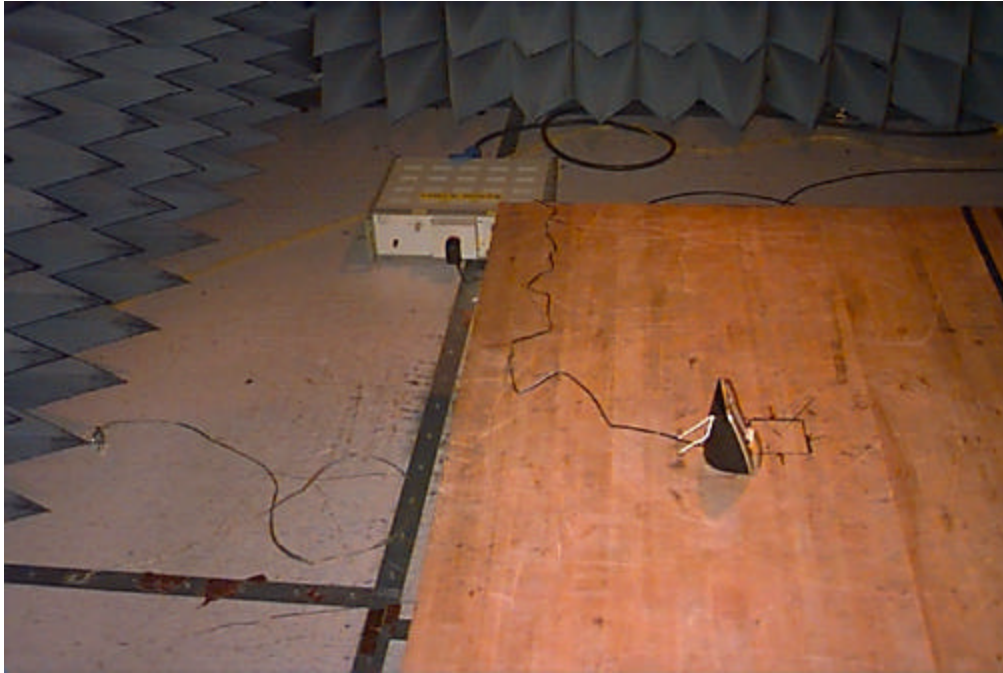
Measurement Data: No peak emissions within 6 dB of the Average Limit, See attached graph(s).

EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone



EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone

Conducted Emissions Set-up Photo



EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone

Section 4. Channel Separation

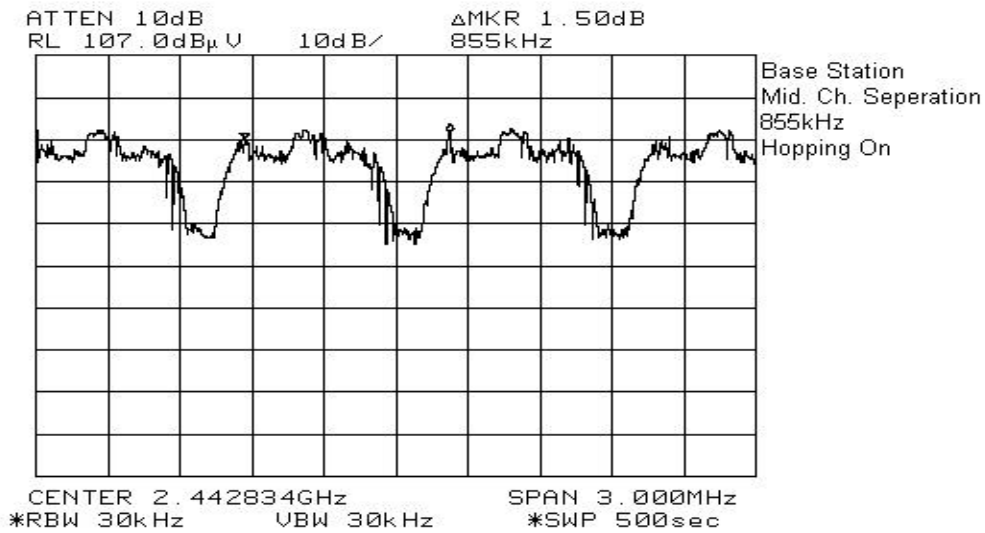
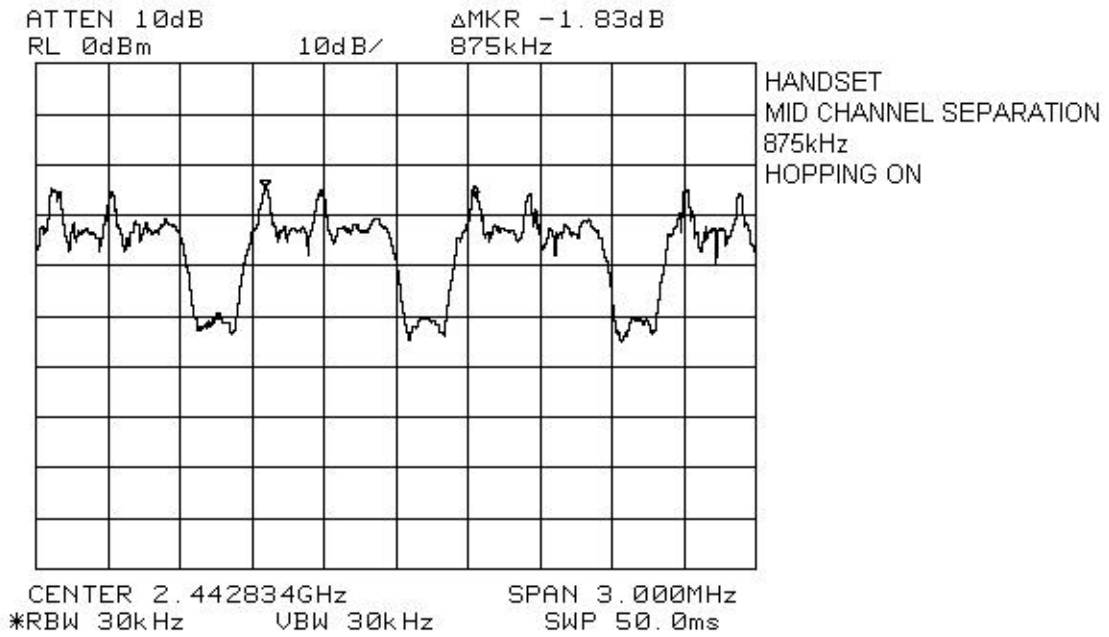
Para. No.: 15.247 (a)(1)

Test Performed By: Kevin Rose	Date of Test: April 24, 2002
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Test Results: Complies

Measurement Data: Channel Separation:
Handset: 875kHz
Base Station: 855kHz

EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone



EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone

Section 5. Pseudorandom Hopping Algorithm

Para. No.: 15.247 (a)(1)

Test Performed By: Kevin Rose	Date of Test: April 24, 2002
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Test Results: Complies

Measurement Data: Number of Hopping Channels: 95
See attached plots and customer supplied data

EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone



3.3 Frequency hopping algorithm

The number of used frequencies (NUF) in the hopping algorithm is 95. In FP and PP exists a PrimaryHoppingIndexNumber (PHIN). This number is incremented modulo NUF in the end of the normal downlink half-frame. It is broadcast in Q0 message instead of PSCN.

To a simplex or an established duplex bearer is assigned a HoppingIndexOffset (HIO), which is analogue to the used RF carrier in a FDMA system. This value is broadcast in place of CN in Q0 message. In the FP in all unused slots in up-link direction the receiver is scanning with HIO=0. The receiver scanning doesn't exclude RF-carriers.

Different FPs use different hopping sequences. The different sequences are derived from the hopping table by adding an offset, SequenceCode (SQC). See section 3.2.2.2.

A hopping table maps an index I to a carrier number: $CN = f(I)$

The physical RF carrier is calculated by the formula:

$$CN = (f((PHIN+HIO) \bmod NUF) + SQC) \bmod NUF$$

3.3.1 Excluded carriers

Excluded carriers (exceptions) are fixed carriers that constantly are interfered by CW RF-carrier. The decision for excluding a RF carrier, are based on:

- RSSI monitor during scanning in the FP.
- Bearer quality in FP correlated to specific RF-carriers.
- Bearer quality detected in PP and reported using Q1 in MAC-header.

When exception carriers are included the complete algorithm is:

```

I = (PHIN+HIO) mod NUF
CN = ( f(I) + SQC ) mod NUF
While CN in ExclusionList
{
    I = (I + FreqHopIndexExcpShift) mod NUF
    CN = ( f(I) + SQC ) mod NUF
}
    
```

where $\text{FreqHopIndexExcpShift} = (NUF-1)$.

3.3.2 Hopping tables

Three different hopping tables are defined.

3.3.2.1 Hopping sequence for North America and most of Europe

For 10.368000 MHz crystal the frequencies are derived as:
 Frequency: $2401.056 \text{ MHz} + CN * 0.864000 \text{ MHz}$

RTX	Technical Documentation			Specification
	MARS 2G4 Freq. Hopping			
File marsalgorithmstypeapp ovml	Date 2001-05-09	Revision 0.7	Ref. JTM/EM	Page 6 of 9

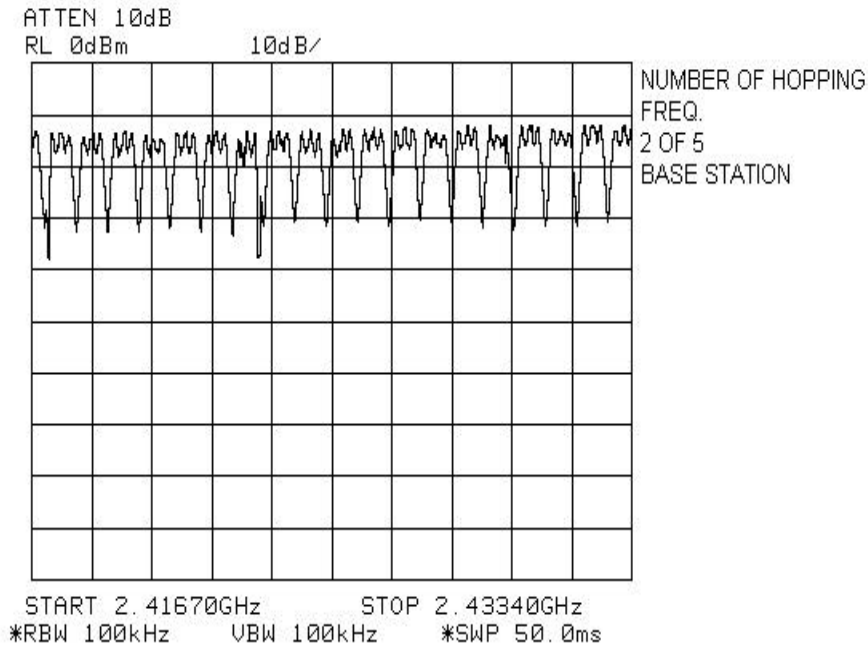
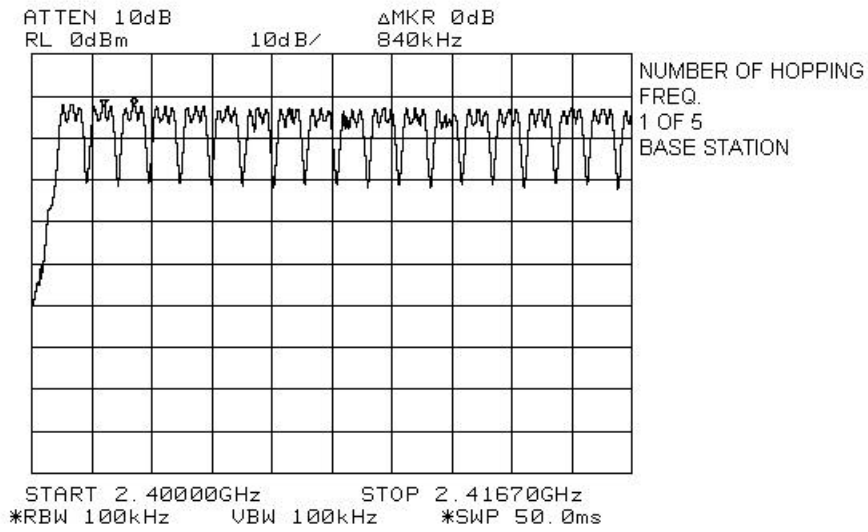
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EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone

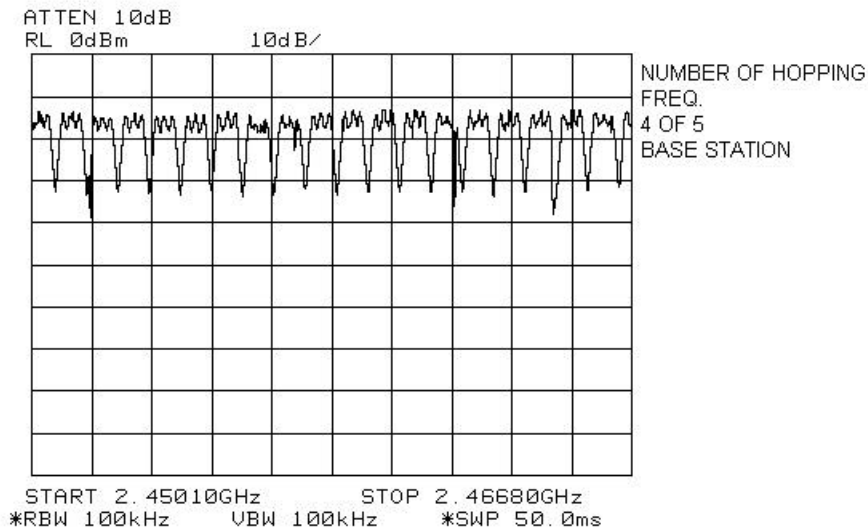
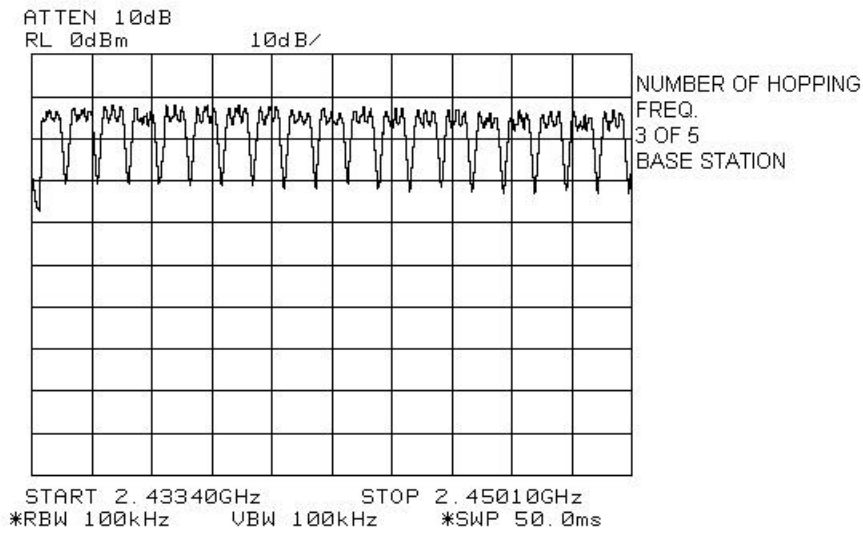
R T X

i	f(i)	I	f(i)	i	f(i)	i	f(i)	i	f(i)
0	0	20	2	40	27	60	13	80	40
1	23	21	18	41	12	61	33	81	1
2	62	22	81	42	89	62	65	82	28
3	8	23	11	43	25	63	50	83	55
4	43	24	36	44	87	64	79	84	35
5	16	25	72	45	14	65	56	85	53
6	71	26	54	46	57	66	91	86	24
7	47	27	69	47	41	67	42	87	44
8	19	28	21	48	74	68	80	88	82
9	61	29	3	49	32	69	48	89	51
10	76	30	37	50	70	70	15	90	90
11	29	31	10	51	9	71	85	91	38
12	59	32	34	52	58	72	5	92	83
13	22	33	66	53	78	73	88	93	30
14	52	34	7	54	45	74	17	94	46
15	86	35	68	55	20	75	84		
16	63	36	94	56	73	76	6		
17	26	37	75	57	93	77	67		
18	77	38	4	58	64	78	49		
19	31	39	60	59	39	79	92		

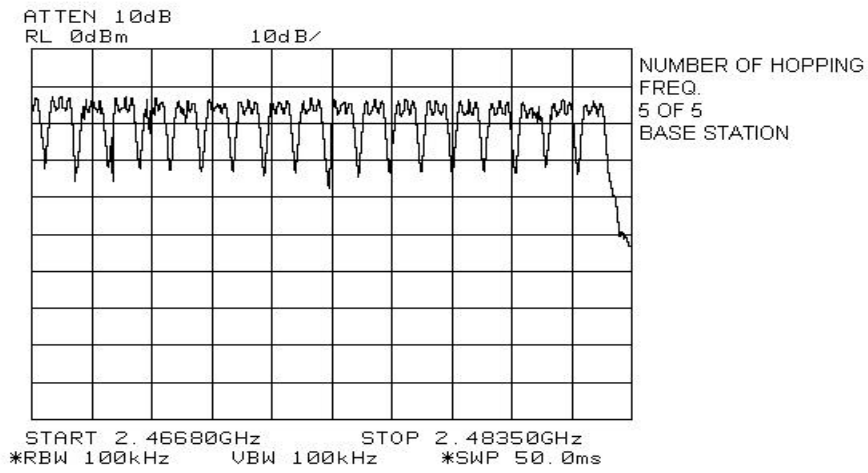
EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone



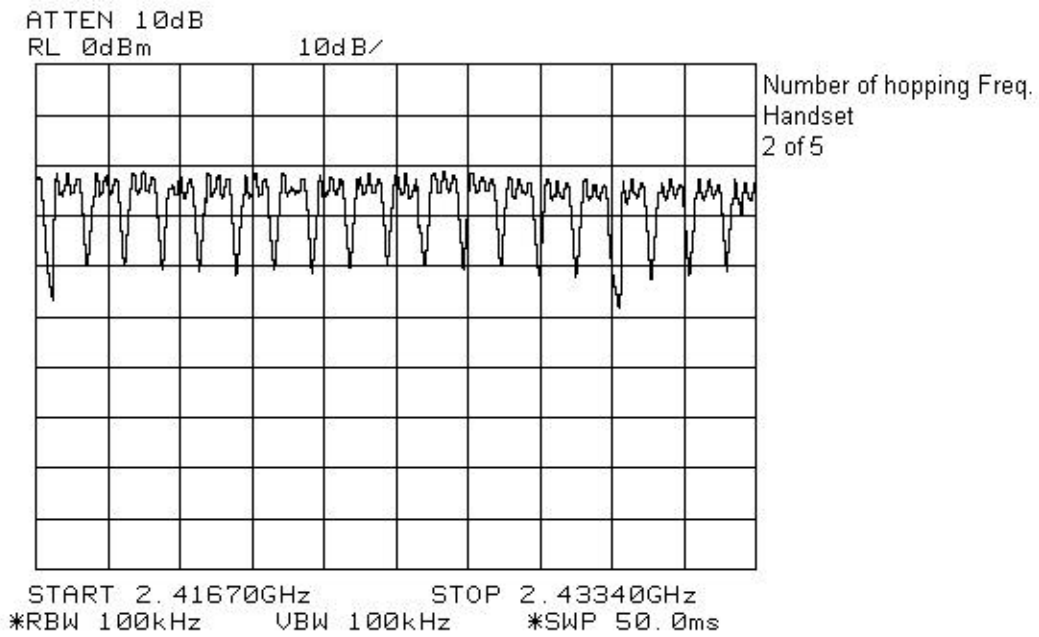
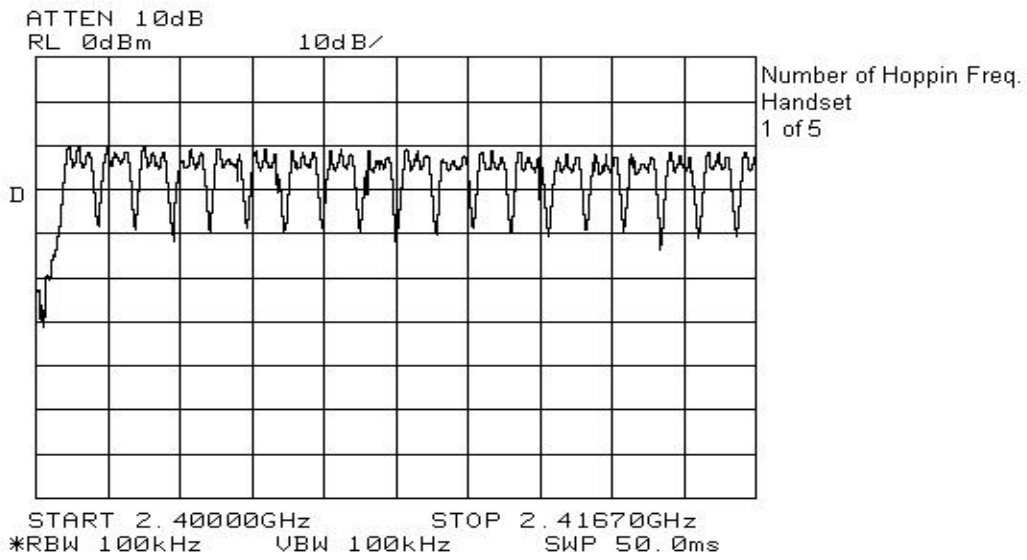
EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone



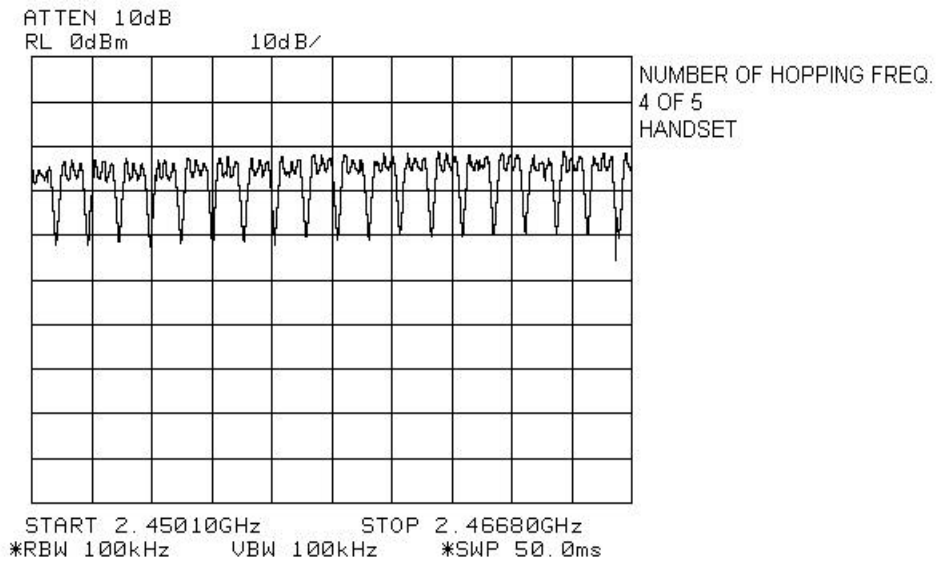
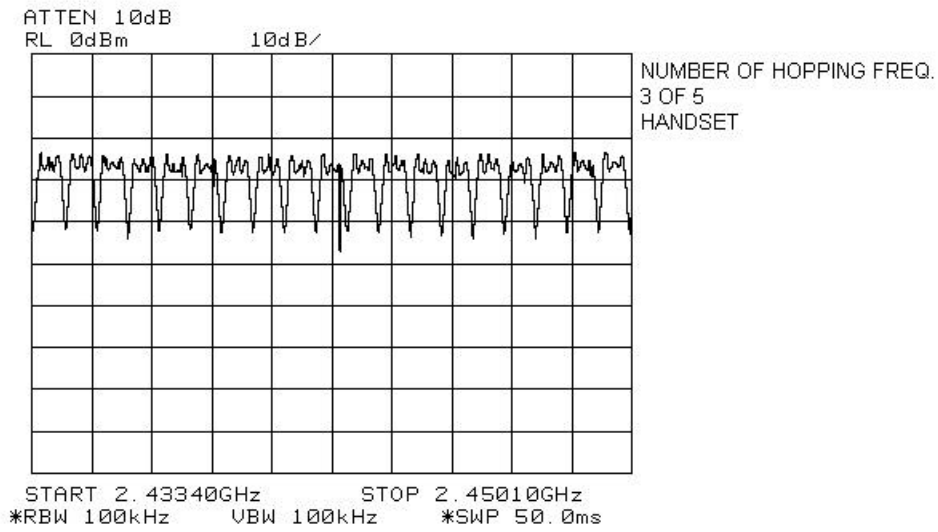
EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone



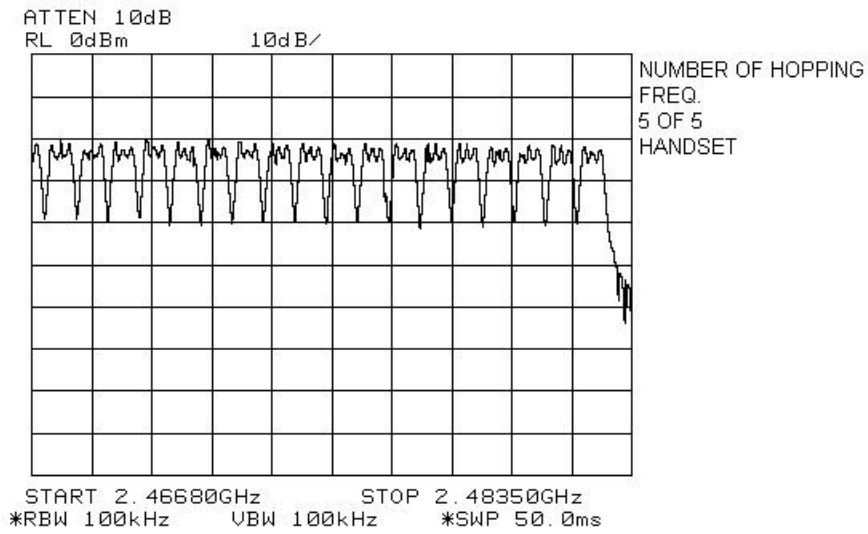
EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone



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Section 6. Time of Occupancy

Para. No.: 15.247 (a)(1)(ii)

Test Performed By: Kevin Rose	Date of Test: April 24, 2002
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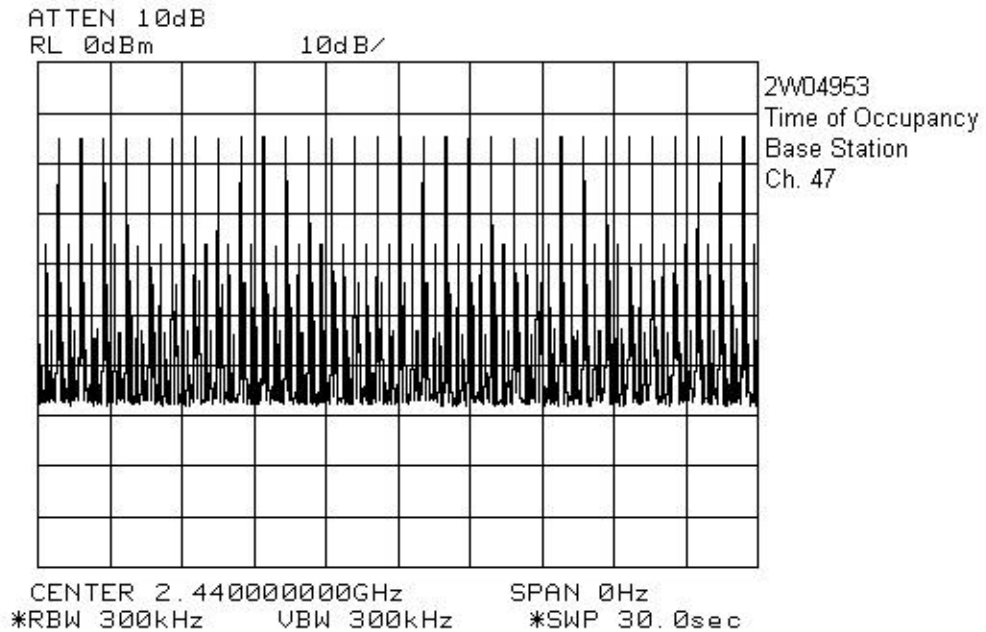
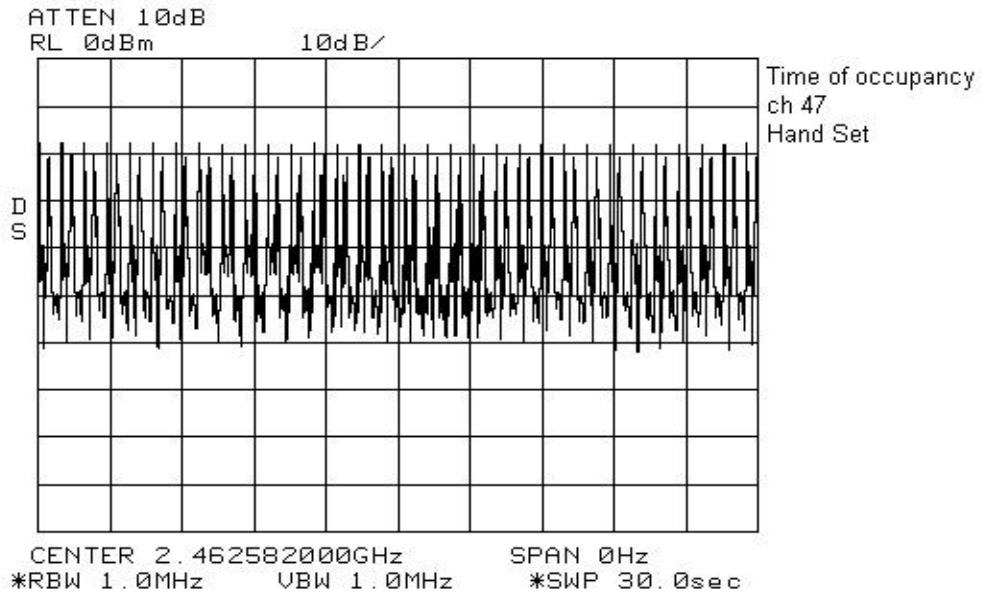
Test Results: Complies

Measurement Data: Maximum Dwell Time On Any Channel:

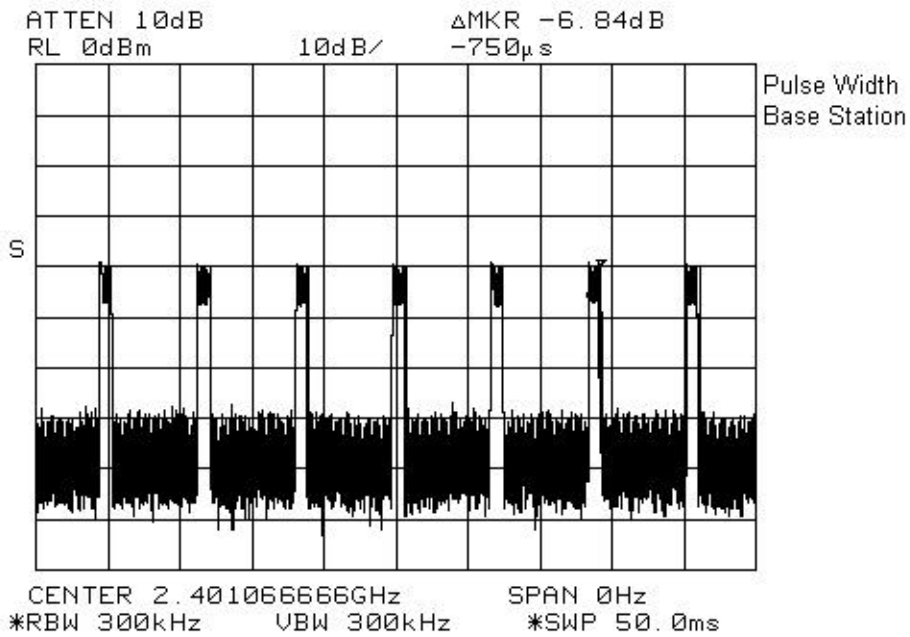
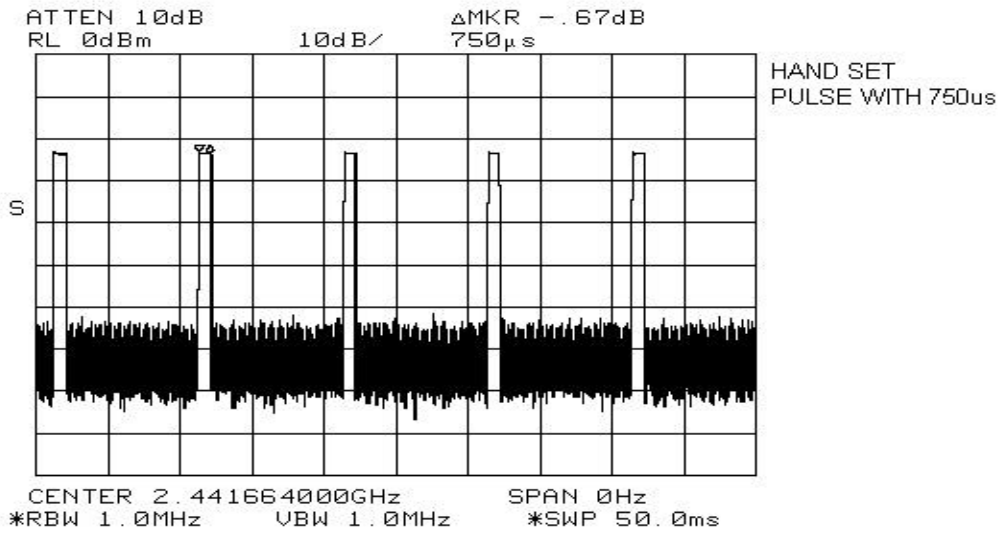
Base:
0.75ms X 31 = 23.3ms

Handset:
0.75ms X 32 = 24.0ms

EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone



EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone



EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone

Section 7. Occupied Bandwidth

Para. No.: 15.247 (a)(1)(ii)

Test Performed By: Kevin Rose	Date of Test: April 24, 2002
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Test Results: Complies

Measurement Data: See Plots
Worst case 20 dB Bandwidth

Base: 658kHz
Handset: 640kHz

EQUIPMENT: AT&T 2230 LC P2, 2.4GHz FHSS Cordless Phone

Base Station

