



Nemko



Test Report: 2W06435.1

Applicant: VTech Engineering Canada Ltd.
Suite 200 – 7671 Alderbridge Way
Richmond, B.C., Canada V6X 1Z9

**Equipment Under Test:
(EUT)** Base Station VT20-2437

FCC ID: EW780-5285-00

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: 30 August 2002

Total Number of Pages: 31

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EQUIPMENT:VT20-2437

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. *It is recommended that the margin of compliance be improved to allow for manufacturing tolerances. The companion handset was not tested, it has been previously certified.*



Test Performed By: _____
Kevin Carr, EMC Specialist

Date: 29 August 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: VT20-2437

Summary Of Test Data

Name Of Test	Para. No.	Result
Powerline Conducted Emissions	ET Docket No. 98-80, FCC 02-157	Complied
Channel Separation	15.247(a)(1)	Complied
Pseudorandom Hopping Algorithm	15.247(a)(1)	Complied
Time of Occupancy	15.247(a)(1)(ii)	Complied
20 dB Occupied Bandwidth	15.247(a)(1)	Complied
Peak Power Output	15.247(b)	Complied
Spurious Emissions (Antenna Conducted)	15.247(c)	N/A
Spurious Emissions (Radiated)	15.247(c)	Complied

Footnotes For N/A's:**Test Conditions:**

Indoor Temperature: 23°C
 Humidity: 36%

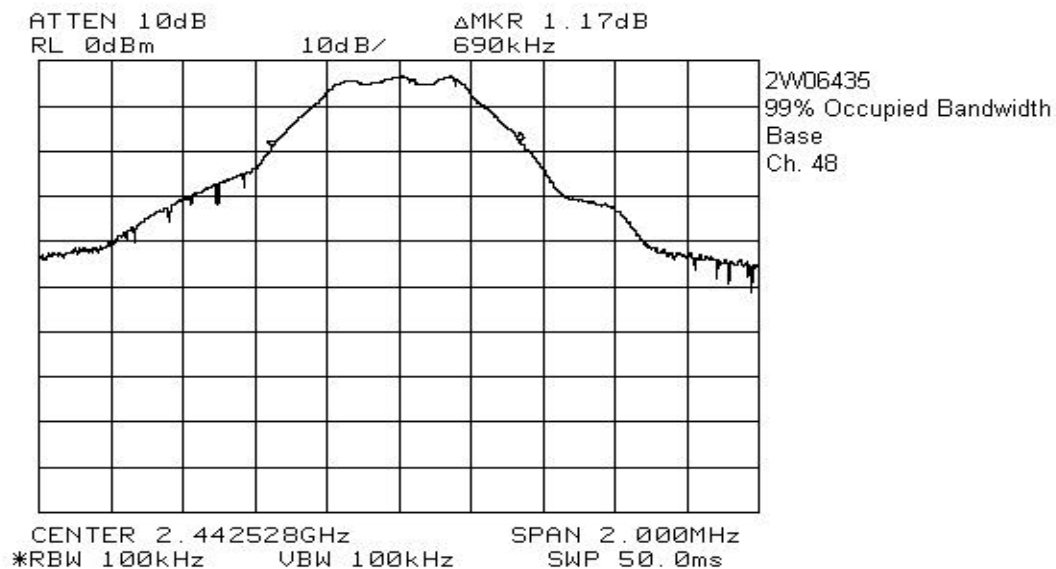
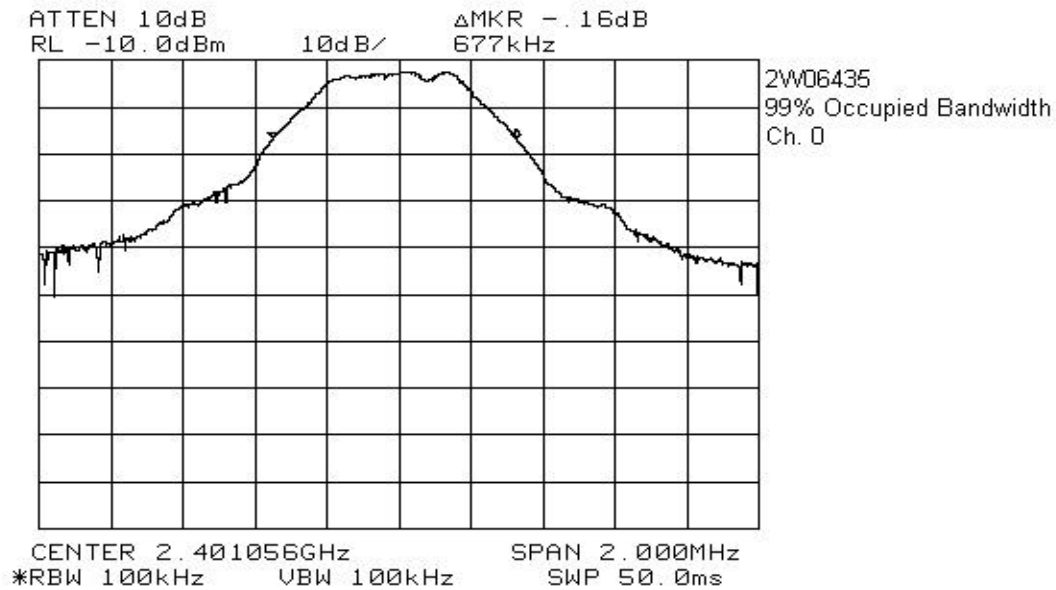
Outdoor Temperature: 26°C
 Humidity: 45%

Section 2. General Equipment Specification

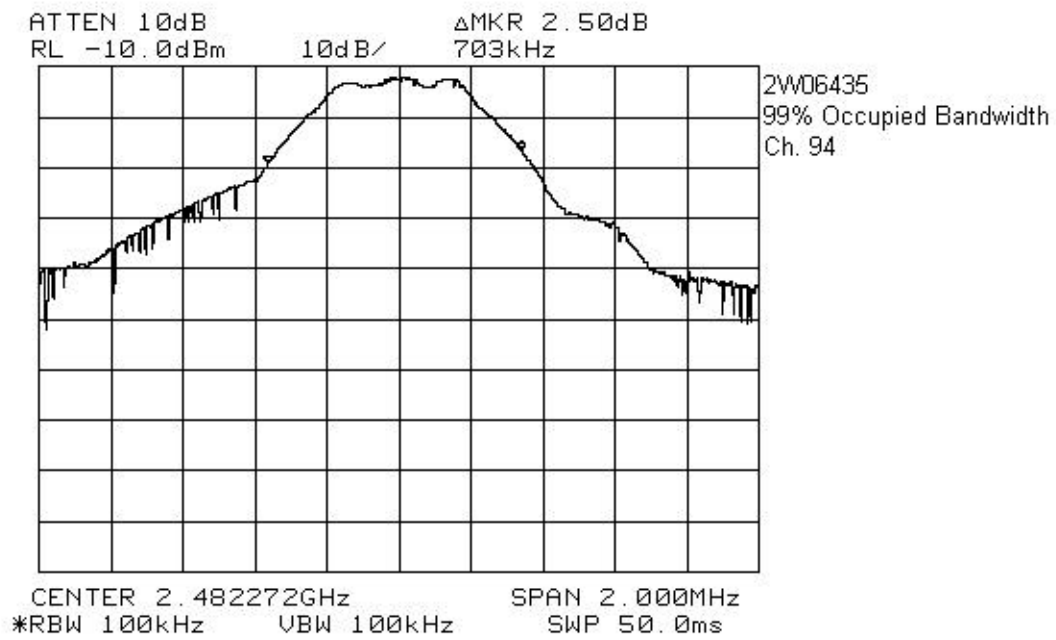
Manufacturer:	VTech (Dongguan) Electronics and Communications Ltd.
Address:	Xia Ling Bei Management Zone, Liaobu, Dongguan, guangdong, China 523411
Model No.:	20-2437
Serial No.:	None
Date Received In Laboratory:	21 Aug. 2002
Nemko Identification No.:	Item 2 and 4
Frequency Range:	2401.056-2482.272 MHz
Tunable Bands:	1
Number of Channels:	75
Modulation:	GFSK
Emissions Designator:	703kF1D
User Frequency Adjustment:	None
Rated Output Power:	0.261watts, 24.2dBm

EQUIPMENT:VT20-2437

Base Station, 99% Occupied Bandwidth



EQUIPMENT:VT20-2437



Section 3. Powerline Conducted Emissions

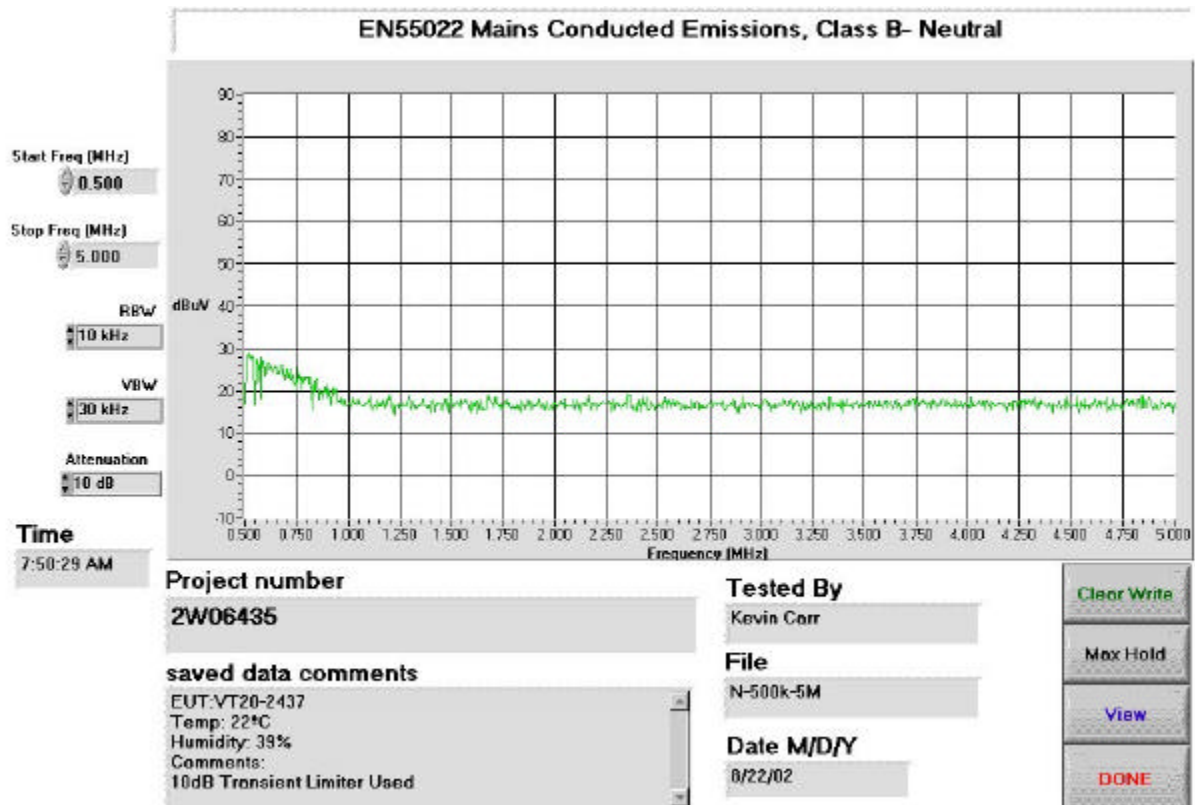
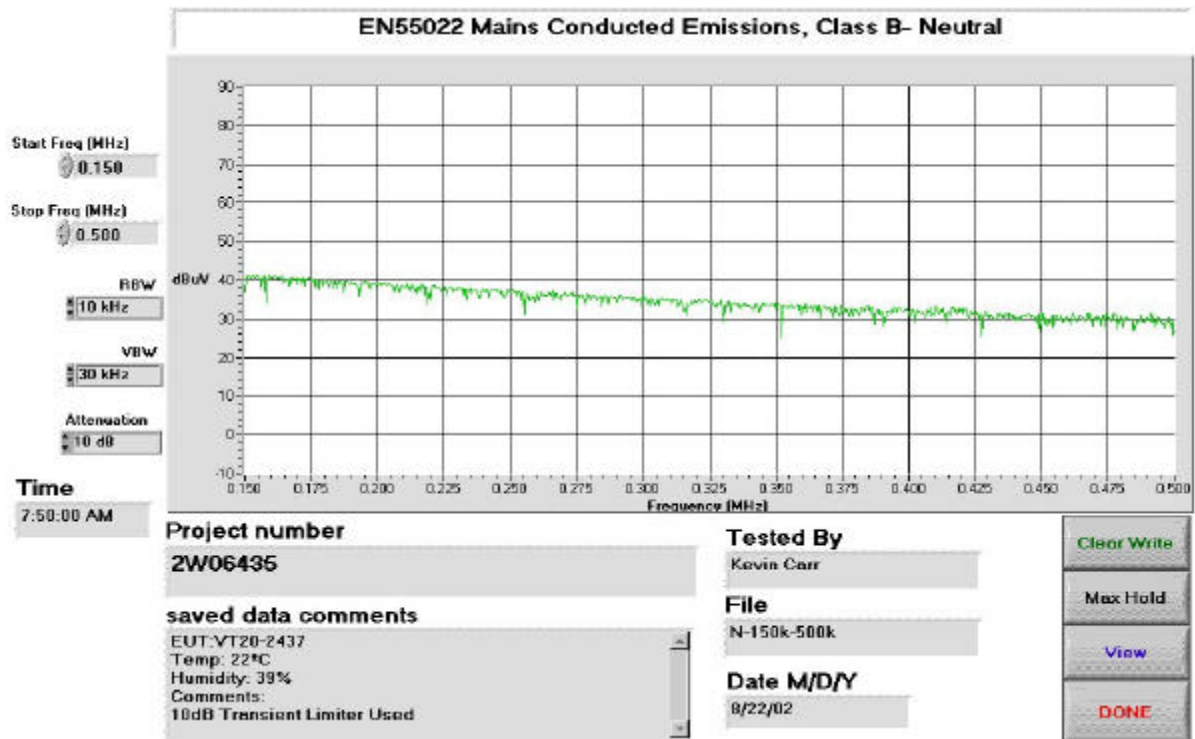
Para. No.: ET Docket No. 98-80, FCC 02-157

Test Performed By: Kevin Carr	Date of Test: 22 Aug. 2002
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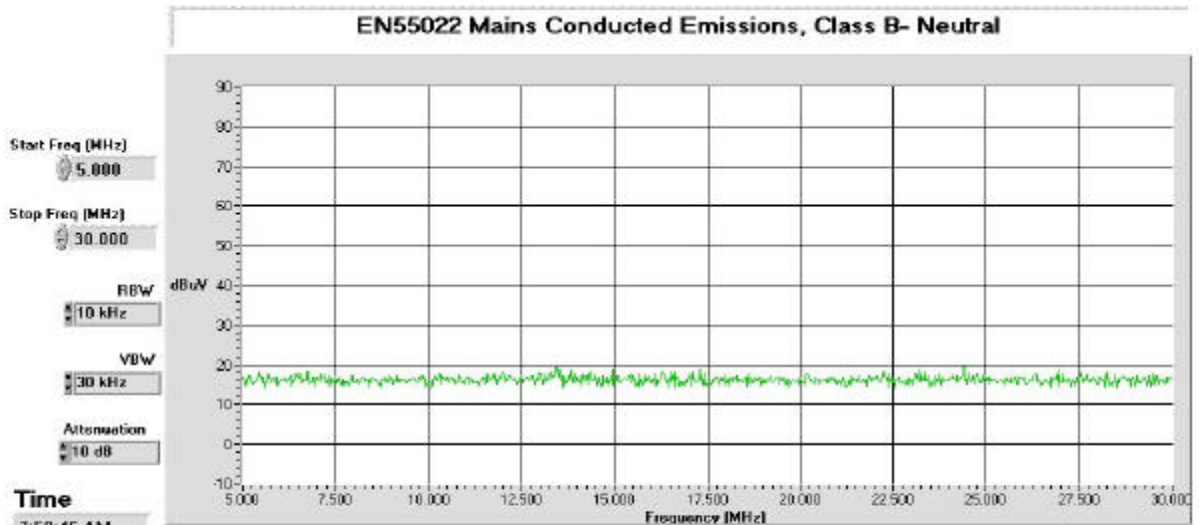
Test Results: Complied

Measurement Data: No peak emissions were detected within 6dB of the average limit.
See attached graphs.

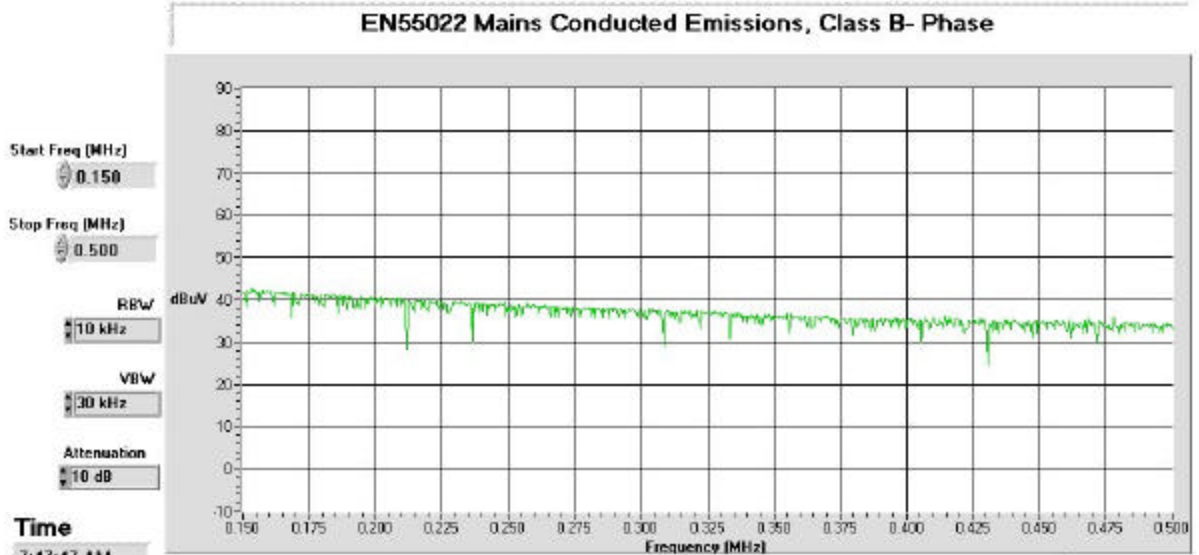
EQUIPMENT:VT20-2437



EQUIPMENT:VT20-2437

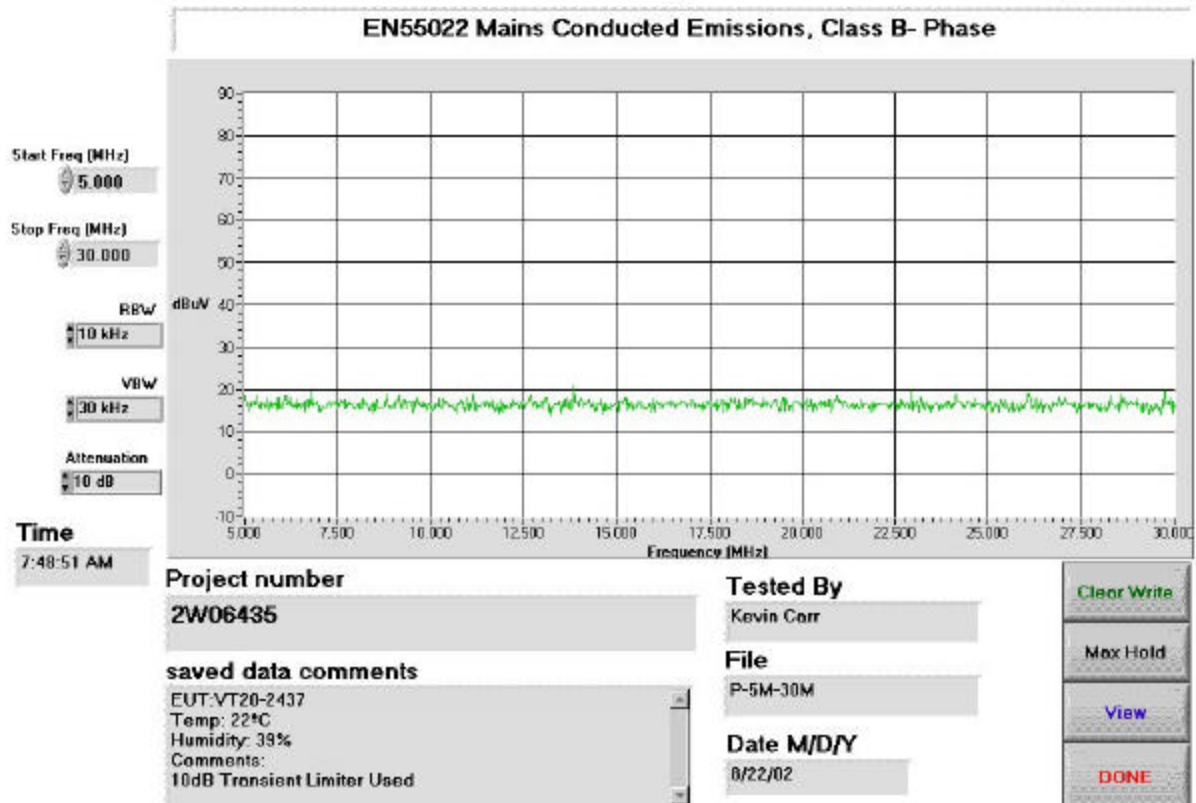
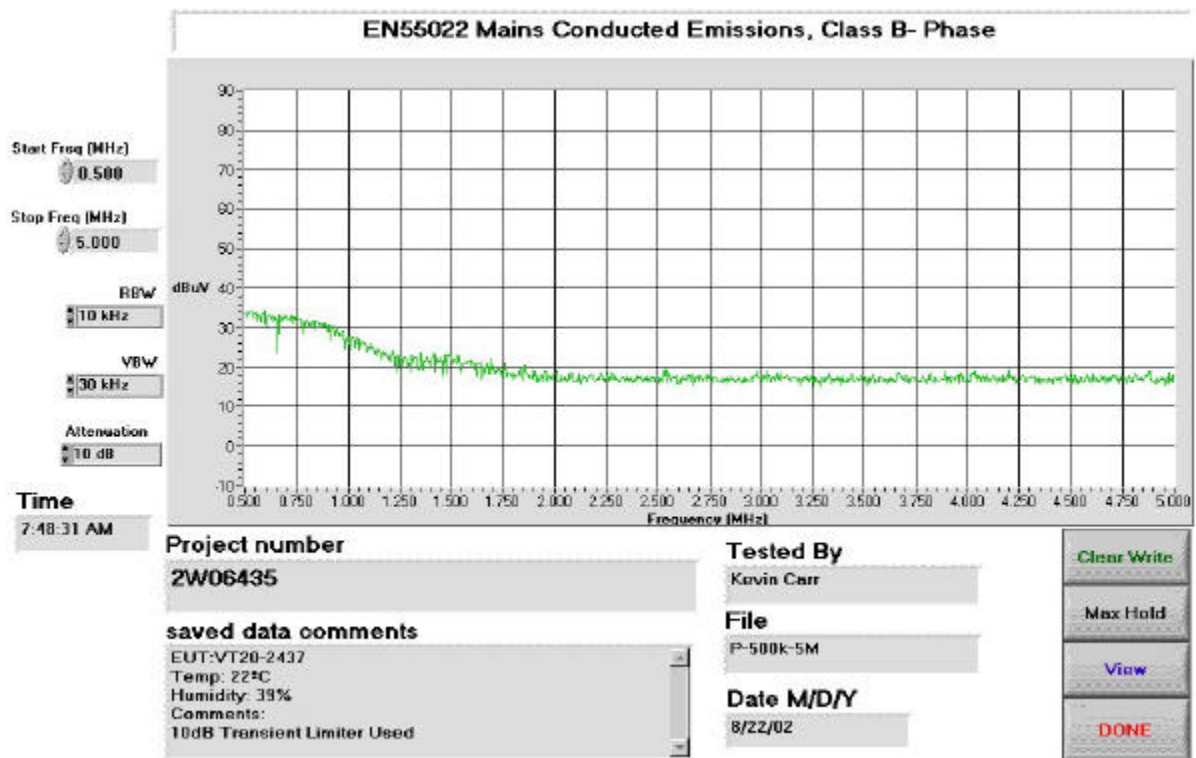


Project number 2W06435	Tested By Kevin Carr	Clear Write
saved data comments EUT:VT20-2437 Temp: 22°C Humidity: 39% Comments: 10dB Transient Limiter Used	File N-5M-30M	Max Hold
	Date M/D/Y 8/22/02	View
		DONE



Project number 2W06435	Tested By Kevin Carr	Clear Write
saved data comments EUT:VT20-2437 Temp: 22°C Humidity: 39% Comments: 10dB Transient Limiter Used	File P-150k-500k	Max Hold
	Date M/D/Y 8/22/02	View
		DONE

EQUIPMENT:VT20-2437



EQUIPMENT:VT20-2437

Section 4. Channel Separation

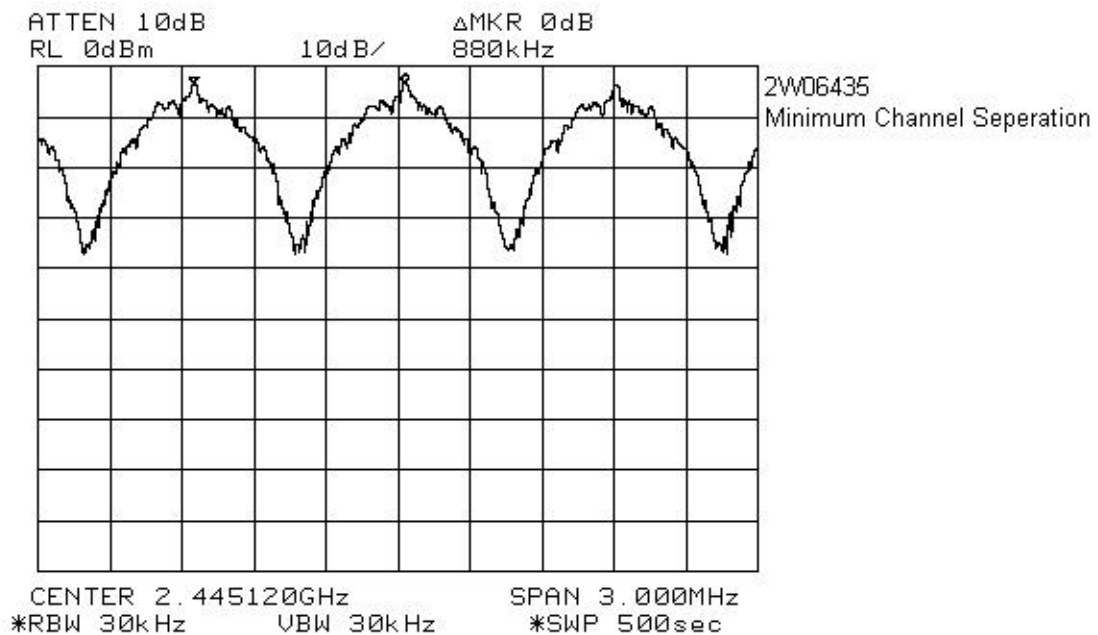
Para. No.: 15.247 (a)(1)

Test Performed By: Kevin Carr

Date of Test: 23 Aug. 2002

Test Results: Complied.

Measurement Data: Channel Separation:
Base: 880kHz



Section 5. Pseudorandom Hopping Algorithm**Para. No.: 15.247 (a)(1)**

Test Performed By: Kevin Carr	Date of Test: 23 Aug. 2002
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Test Results: Complied.**Measurement Data:** Number of Hopping Frequencies: 75**WDCT, Random pattern generation**

Hopping sequence is randomly generated by using the pseudo random number generator. Random number generator is based on primitive polynomial modulo 2.

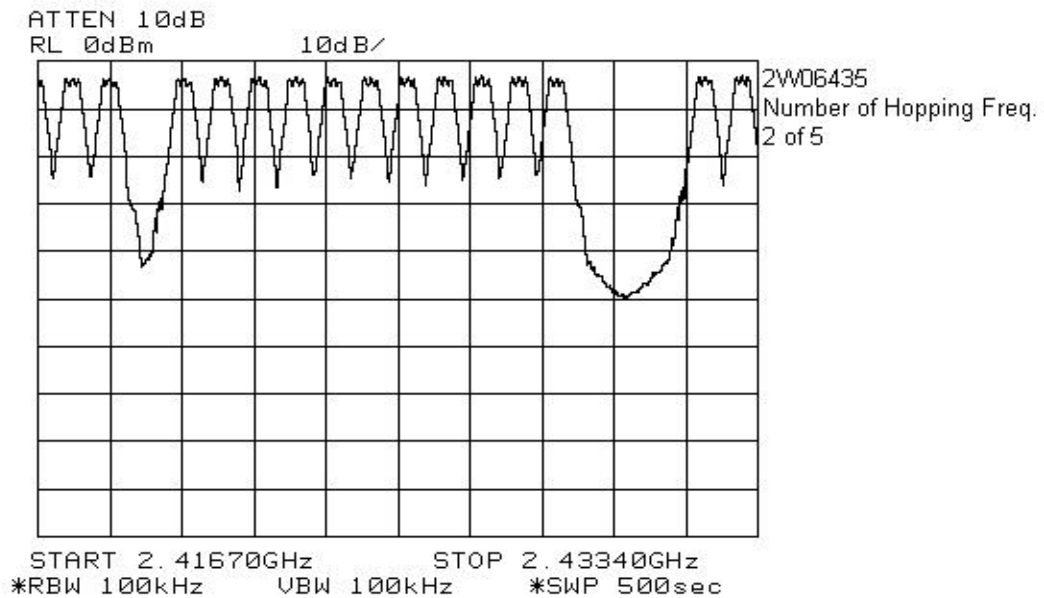
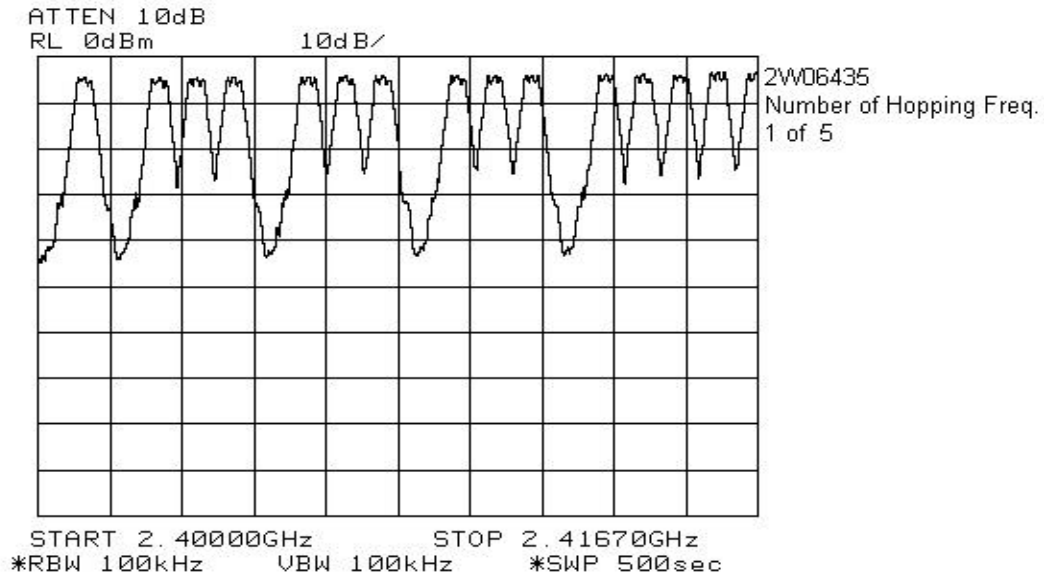
$$x^8 + x^4 + x^3 + x^2 + 0$$

Only generated numbers that are in the range of allowed channels will be included in the hopping sequence. If generated random number is out of range, calculation is repetitively performed until number in range is not generated.

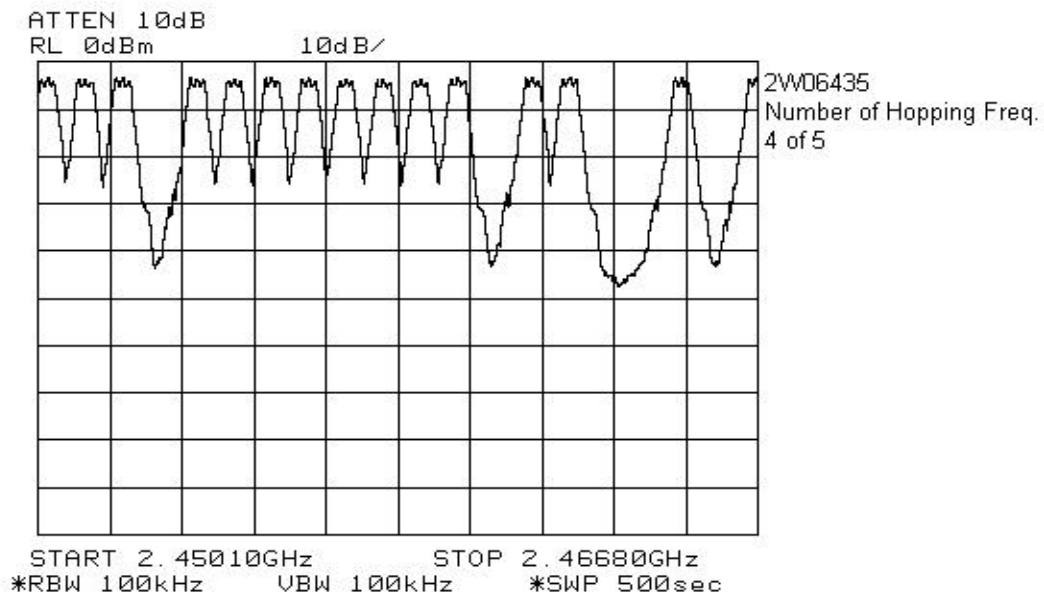
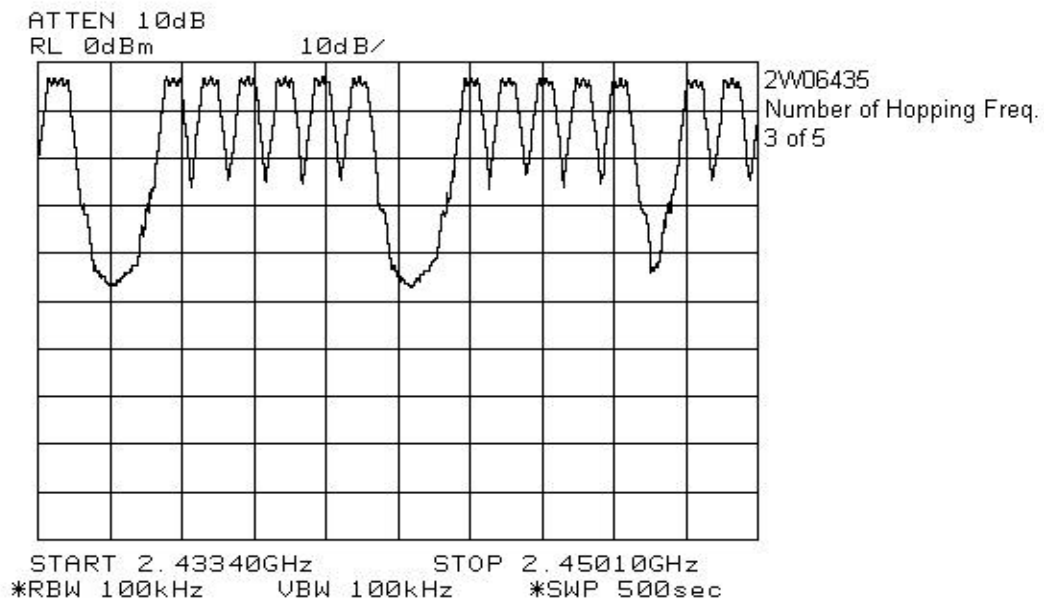
It is not allowed to use same channel more than once in hopping sequence. Because of that there is a second check. If in the hopping sequence there is already a channel equal to generated random number, random number calculation is repeated until valid number is not generated. After that random number is included in hopping sequence.

First 75 generated channels in hopping sequence are used for hopping. Rest channels in hopping pattern array are used as a spare for channel replacement. Those channels are also randomly generated.

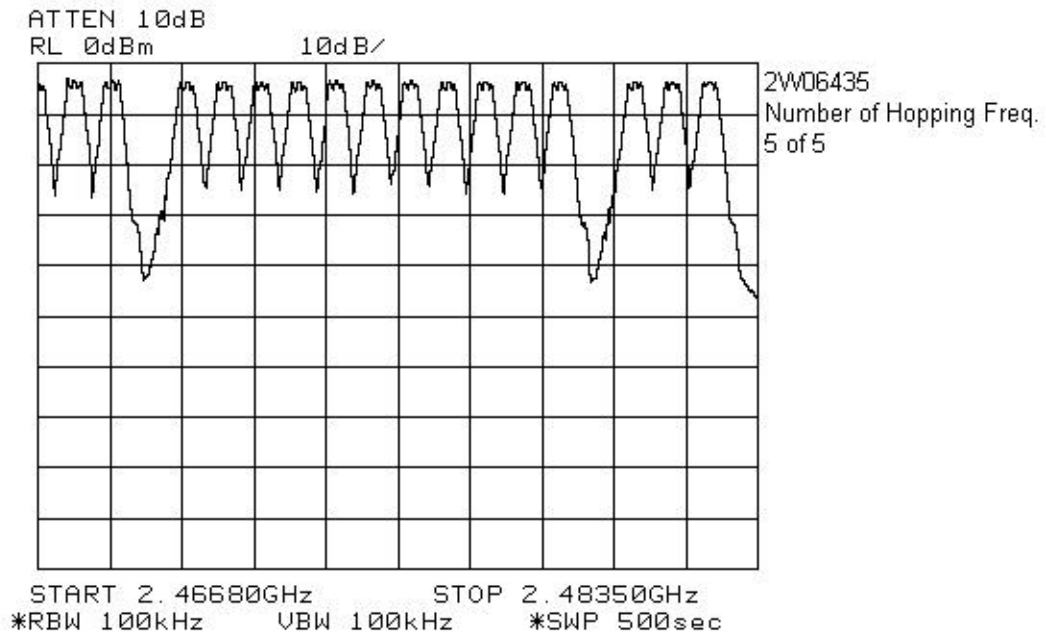
EQUIPMENT:VT20-2437



EQUIPMENT:VT20-2437



EQUIPMENT:VT20-2437



EQUIPMENT:VT20-2437

Section 6. Time of Occupancy

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

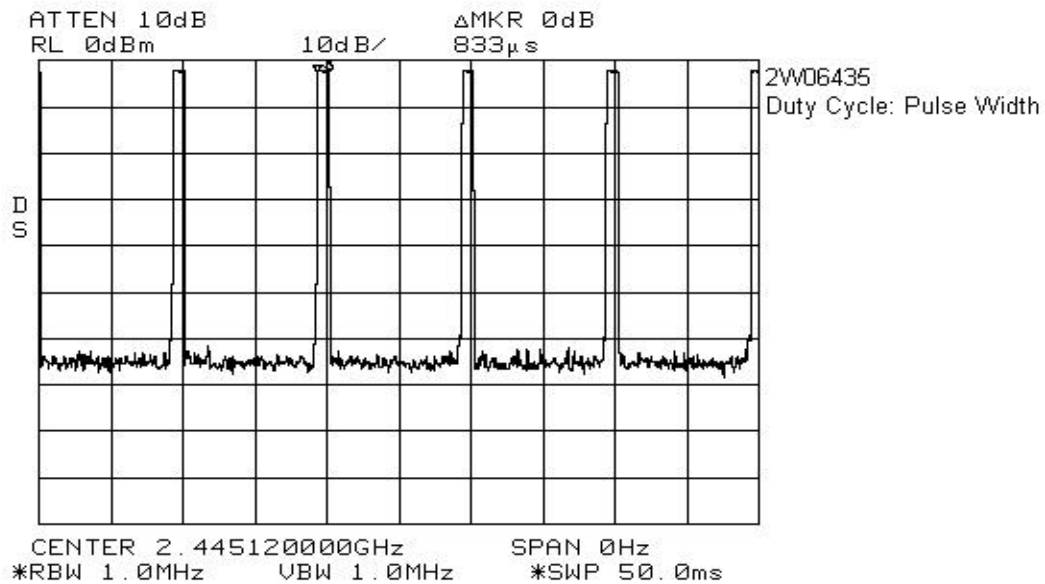
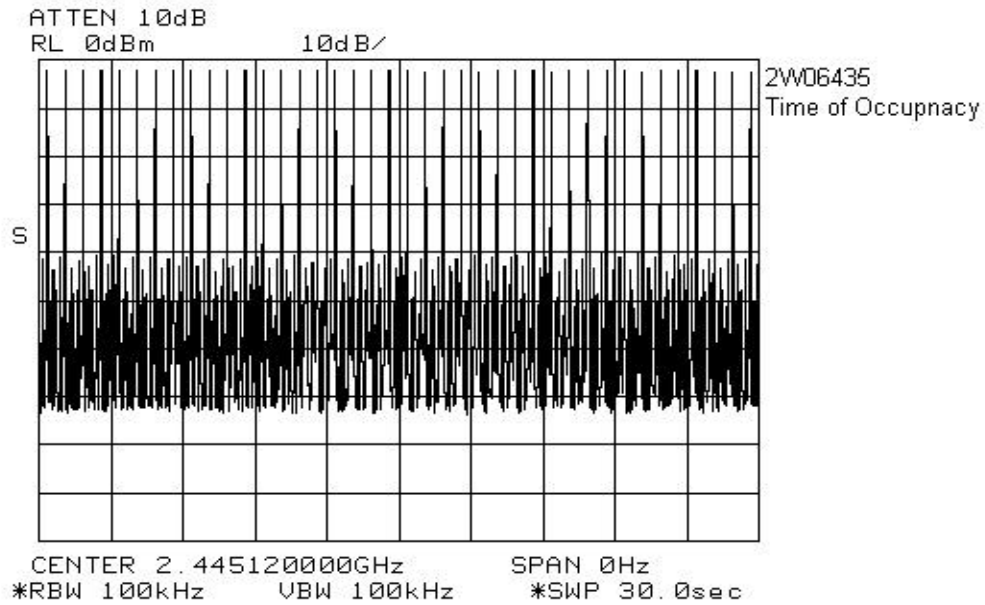
Test Performed By: Kevin Carr	Date of Test: 23 Aug. 2002
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Test Results: Complied.

Measurement Data: Maximum Dwell Time On Any Channel in 30 Seconds.

Base: 0.833ms X 40=33.32ms

EQUIPMENT:VT20-2437



EQUIPMENT:VT20-2437

Section 7. Occupied Bandwidth

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

Test Performed By: Kevin Carr	Date of Test: 23 Aug. 2002
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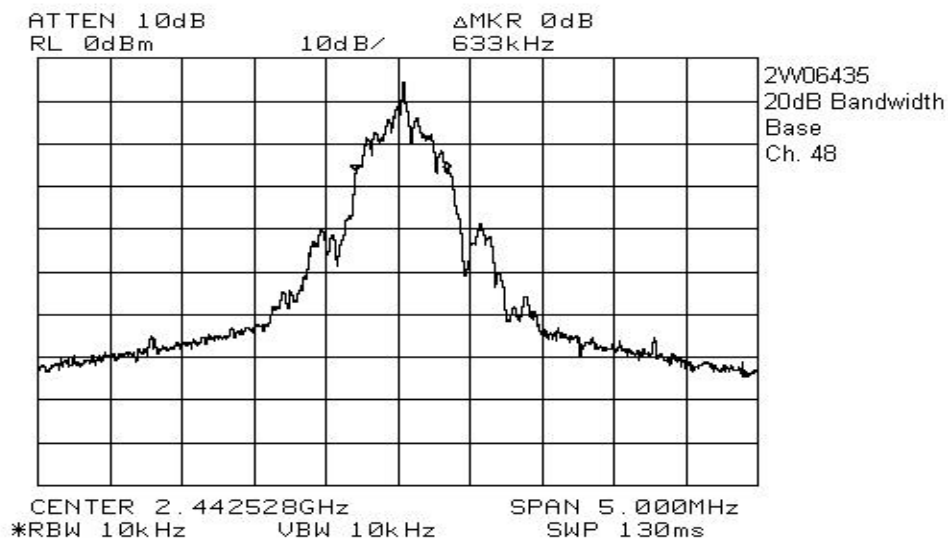
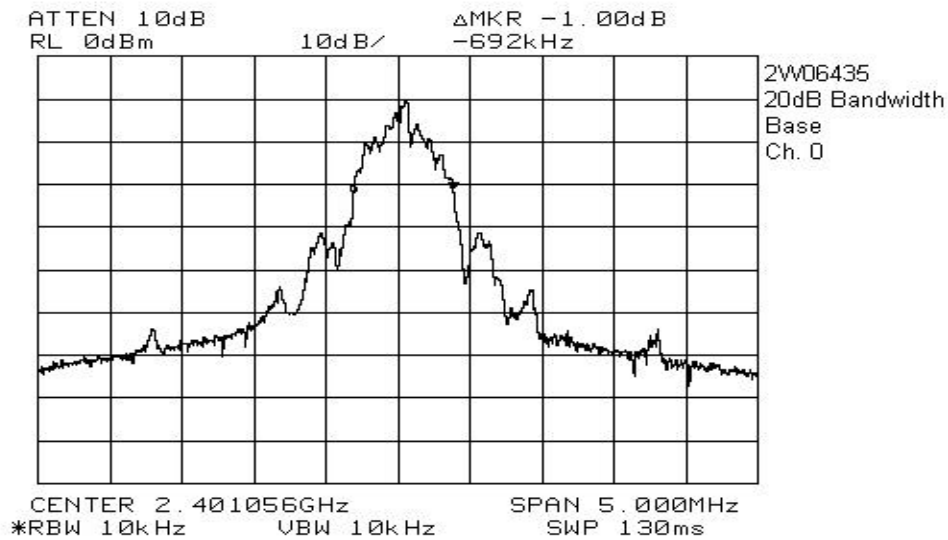
Test Results: Complied.

Measurement Data: See Plots.
 Worst Case 20dB Bandwidth:

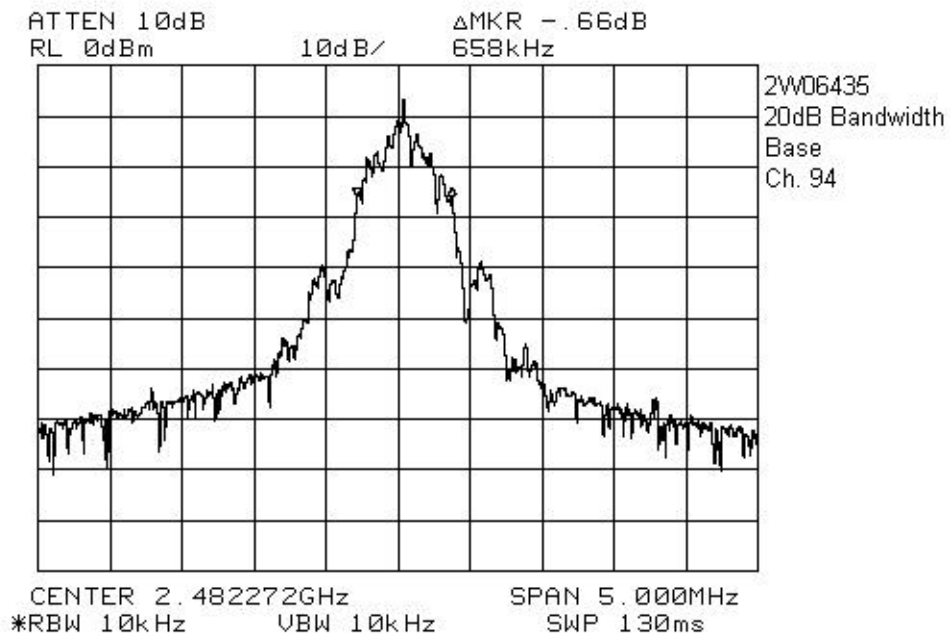
 Base: 692kHz

EQUIPMENT:VT20-2437

Base Station, 20 dB Occupied Bandwidth



EQUIPMENT:VT20-2437



Section 8. Peak Power Output

Para. No.: 15.247 (b)

Test Performed By: Kevin Carr	Date of Test: 26 Aug. 2002
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Test Results: Complies. The maximum peak power output of the transmitter is 0.261watts

Measurement Data: Detachable antenna? ☐ Yes ☒ No

Base Station

Directional Gain of Antenna: 0 dBi or 1.0 Numeric.

Peak Power Output: 0.261 watts.

Field Strength: 119.4 dB μ V/m @ 3m or 0.933V/m @ 3m.

See attached radiated measurements.

EQUIPMENT:VT20-2437

Test Data - Radiated Emissions, Base, Peak

Test Distance (meters) : 3		Range: A		Receiver: HP8565E			RBW(kHz): 1000		Detector: PEAK	
No.	Freq. (MHz)	Ant. *	Pol (V/H)	RCVD Signal (dBμV/ m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBμV/m)		
1	2401.27	Hrn2	V	82.7	34.6			117.3		
2	2400.93	Hrn2	H	78.8	34.6			113.4		
3	2442.24	Hrn2	V	84.7	34.7			119.4		
4	2442.54	Hrn2	H	79.7	34.7			114.4		
5	2482.21	Hrn2	V	83.8	34.8			118.6		
6	2482.24	Hrn2	H	81.3	34.8			116.1		
Notes: B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole * Re-measured using dipole antenna. ** Includes cable loss when amplifier is not used. *** Includes cable loss. () Denotes failing emission level. N.D. = Not Detected										

EQUIPMENT:VT20-2437

Section 9. Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Performed By: Kevin Carr	Date of Test: 26 Aug. 2002
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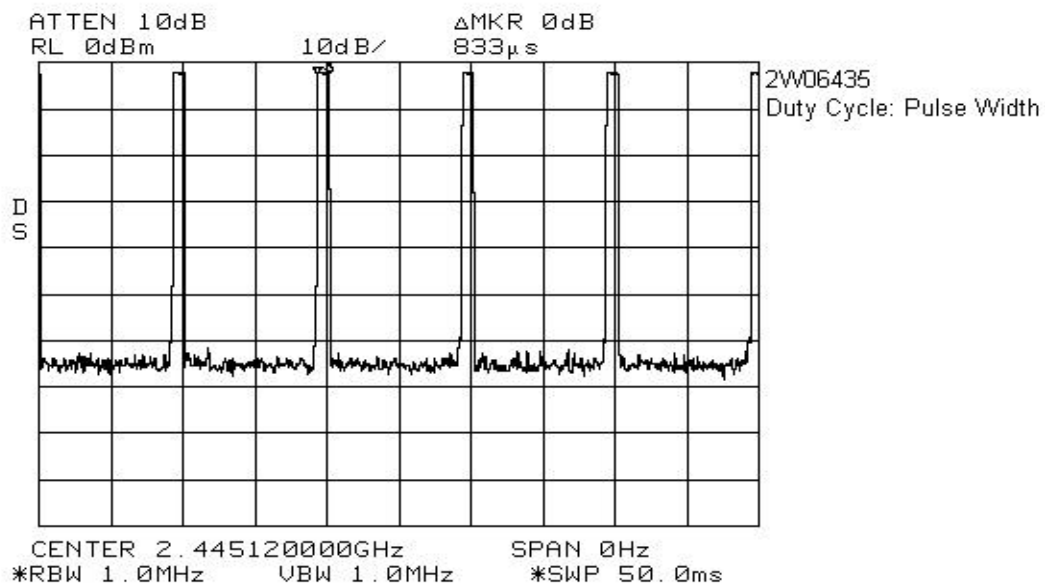
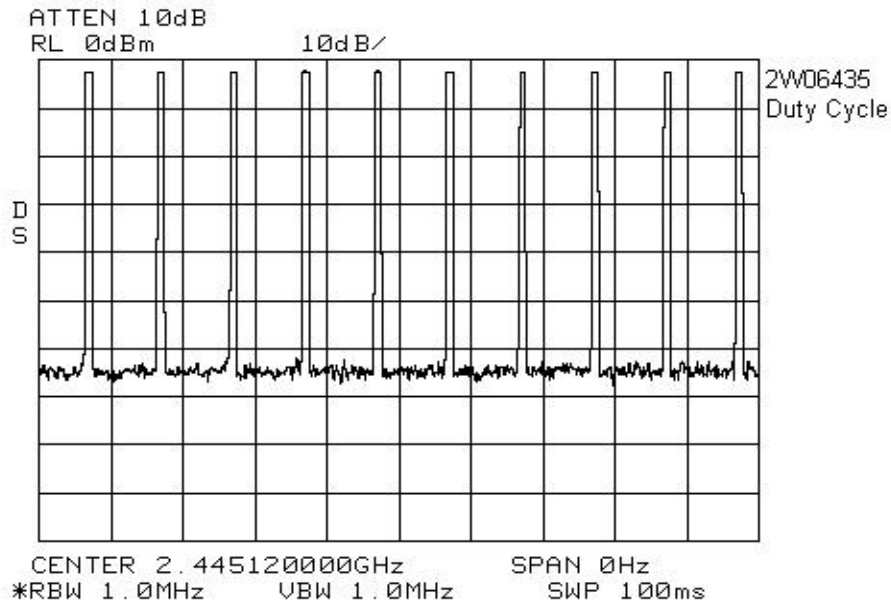
Test Results:

The worst case emission level is 53.3 dB μ V/m @ 3m at 7446.3MHz. This is 0.7 dB below the specification limit.

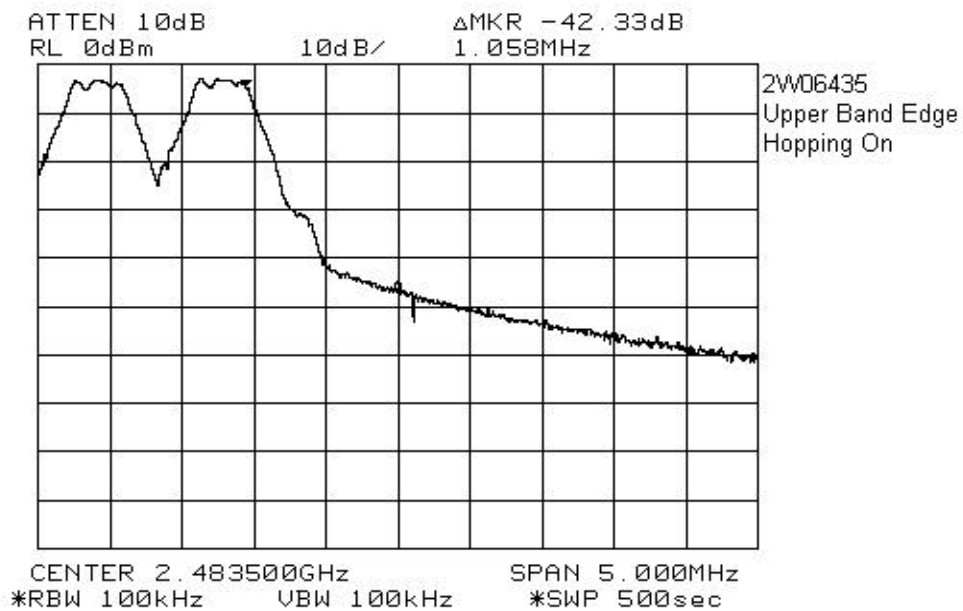
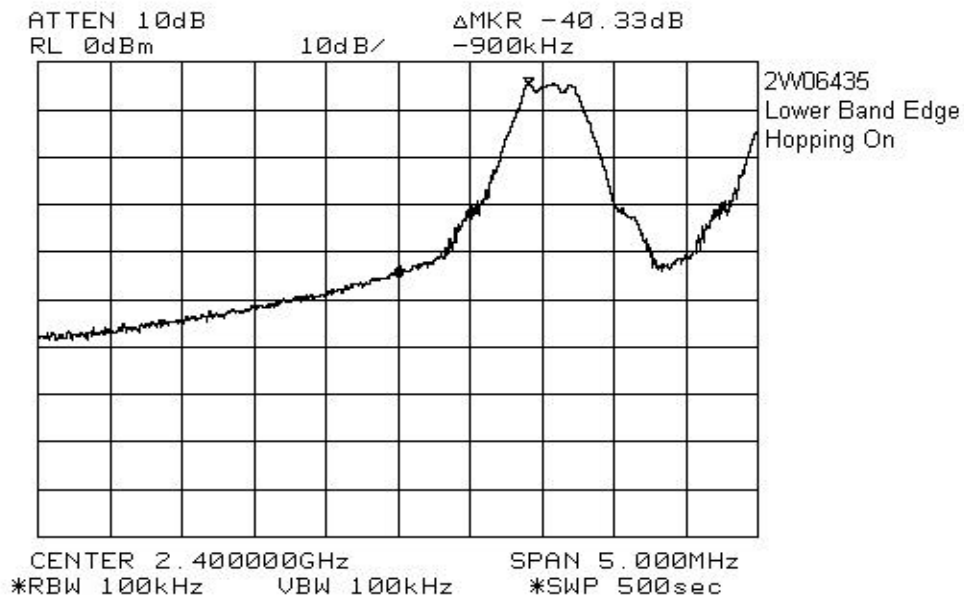
Measurement Data: See attached table.

Duty Cycle Calculation: Base: $20\text{Log}\{(10 \times 0.833)/100\} = -21.6\text{dB}$

EQUIPMENT:VT20-2437

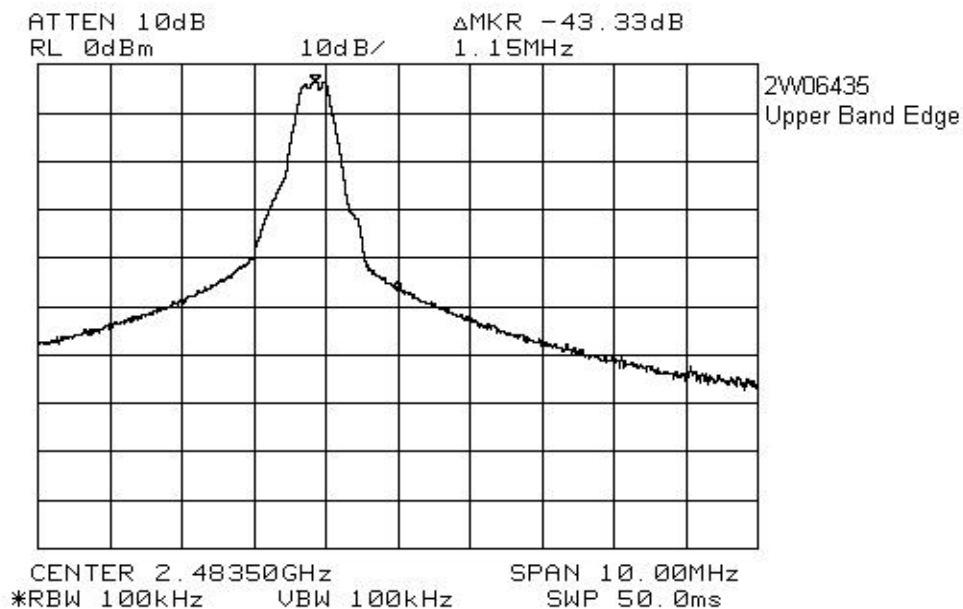
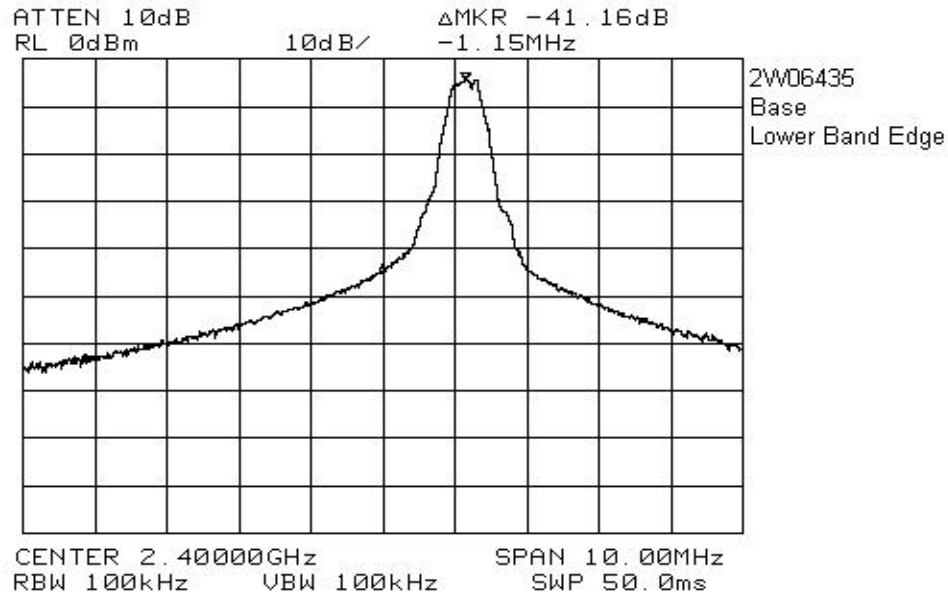


EQUIPMENT:VT20-2437



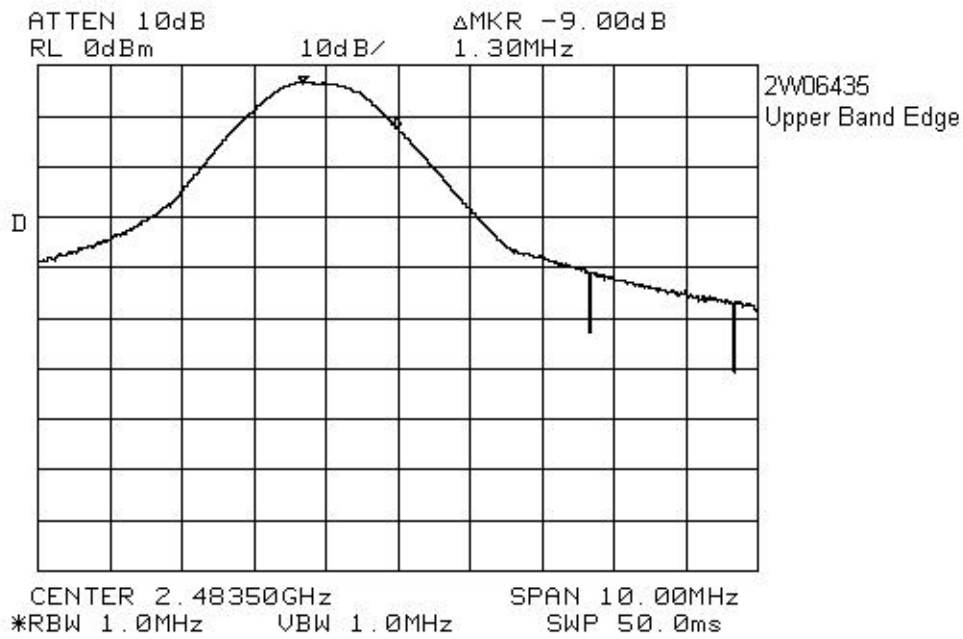
EQUIPMENT:VT20-2437

Base Station, Band Edge Plots, Hopping Off



EQUIPMENT:VT20-2437

Upper Band Edge with 1MHz RBW/VBW



Field Strength at Band Edge:

$118.6\text{dBuV@3m} - 9.0\text{dB} = 109.6\text{dBuV@3m}$

Marker Delta

$100\text{kHz RBW} = 43.3\text{dB}$

Therefore:

$\text{Peak Field Strength} = 109.6\text{dBuV@3m} - 43.3\text{dB} = 66.3\text{dBuV}$

$\text{Average Field Strength} = 66.3\text{dBuV@3m} - 20\text{dB} = 46.3\text{dBuV@3m}$

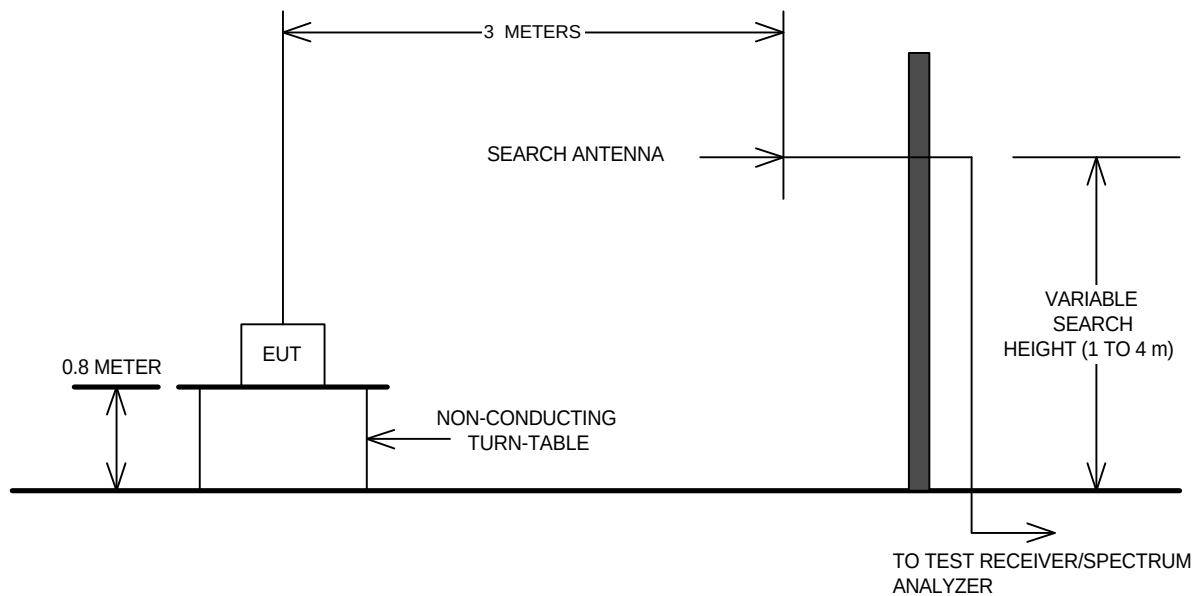
EQUIPMENT:VT20-2437

Test Data – Base Station, Radiated Emissions, Base, Average

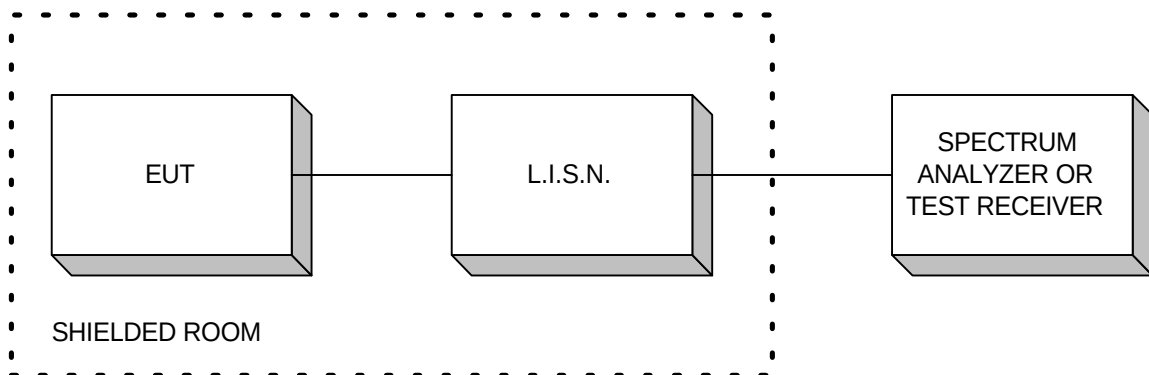
Test Distance (meters) : 3		Range: A		Receiver: HP8565E			RBW(kHz): 1000Hz		Detector: PEAK	
No.	Freq. (MHz)	Ant. *	Pol (V/H)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Duty Cycle Corr. (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1	4801.62	Hrn2	V	76.5	42	55.2	-20	43.3	54	10.7
2	4802.36	Hrn2	H	80.7	42	55.2	-20	47.5	54	6.5
3	7202.75	Hrn2	V	79	47.8	56	-20	50.8	54	3.2
4	7202.65	Hrn2	H	79.5	47.8	56	-20	51.3	54	2.7
5	4884.57	Hrn2	V	72.2	42.3	54.9	-20	39.6	54	14.4
6	4884.79	Hrn2	H	74.5	42.3	54.9	-20	41.9	54	12.1
7	7327.12	Hrn2	V	79.7	48.2	56	-20	51.9	54	2.1
8	7327.08	Hrn2	H	79.5	48.2	56	-20	51.7	54	2.3
9	4964.42	Hrn2	V	74.2	42.8	54.7	-20	42.3	54	11.7
10	4964.42	Hrn2	H	78.5	42.8	54.7	-20	46.6	54	7.4
11	7446.30	Hrn2	V	80.7	48.6	56	-20	53.3	54	0.7
12	7446.40	Hrn2	H	75.2	48.6	56	-20	47.8	54	6.2
Notes: B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole * Re-measured using dipole antenna. ** Includes cable loss when amplifier is not used. *** Includes cable loss. () Denotes failing emission level. N.D. = Not Detected										

Section 10. Block Diagrams

Test Site For Radiated Emissions



Conducted Emissions



EQUIPMENT:VT20-2437

Section 11. Test Equipment List**Equipment List – Conducted Emissions**

CAL Cycle	Equipment	Manufacturer	Model No.	Asset/Serial No.	Last Cal.	Next Cal.
1 Year	LISN	EMCO	4825/2	FA001545	Oct. 09/01	Oct. 09/02
1 Year	Spectrum Analyzer	Hewlett-Packard	8566B	FA001309	Nov. 27/01	Nov. 27/02
1 Year	Spectrum Analyzer Display	Hewlett-Packard	85662A	FA001309	Nov. 27/01	Nov. 27/02
1 Year	Quasi-Peak Adapter	Hewlett-Packard	85650A	FA000801	Nov. 27/01	Nov. 27/02
1 Year	Transient Limiter	Hewlett-Packard	1194 7A	FA000975	Oct. 19/01	Oct. 19/02

Equipment List – Prescan for Radiated Emissions - Anechoic Chamber

CAL Cycle	Equipment	Manufacturer	Model No.	Asset/Serial No.	Last Cal.	Next Cal.
1 Year	Spectrum Analyzer	Hewlett-Packard	8565E	FA000981	July. 15/02	July. 15/03
1 Year	Spectrum Analyzer	Hewlett-Packard	8566B	FA001309	Nov. 27/01	Nov. 27/02
1 Year	Spectrum Analyzer Display	Hewlett-Packard	85662A	FA001309	Nov. 27/01	Nov. 27/02
1 Year	Quasi-Peak Adapter	Hewlett-Packard	85650A	FA000801	Nov. 27/01	Nov. 27/02
	Bilog	Schaffner	CBL6112B	FA001504	NCR	NCR
1 Year	Horn Antenna #2	EMCO	3115	FA000825	Dec. 01/01	Dec. 01/02
3 Year	Horn 18 – 26.5 GHz	Electro-Metrics	SH-50/60-1	FA000479	July. 07/00	July. 07/03
COU	High Pass Filter (3.9GHz)	K&L	11SH10-4000	FA001340		
NCR	0.1 – 1300 MHz Amplifier	Hewlett Packard	8447D	FA001748	NCR	NCR
1 Year	1.0 – 2.0 GHz Amplifier	JCA	12-400	FA001498	June. 04/02	June. 04/03
1 Year	2.0 – 4.0 GHz Amplifier	JCA	24-600	FA001496	June. 04/02	June. 04/03
1 Year	4.0 – 8.0 GHz Amplifier	JCA	48-600	FA001498	June. 04/02	June. 04/03
COU	5.0 – 18.0 GHz Amplifier	NARDA	DWT-186N23U40	FA001409		
COU	18.0 – 26.0 GHz Amplifier	NARDA	BBS-1826N612	FA001550		

Equipment List - Radiated Emissions

CAL Cycle	Equipment	Manufacturer	Model No.	Asset/Serial No.	Last Cal.	Next Cal.
1 Year	Receiver	Rohde & Schwarz	ESVS-30	FA001437	July. 04/02	July. 04/03
1 Year	Spectrum Analyzer	Hewlett-Packard	8565E	FA000981	July. 15/02	July. 15/03
1 Year	Horn Antenna #2	EMCO	3115	FA000825	Dec. 01/01	Dec. 01/02
3 Year	Horn 18 – 26.5 GHz	Electro-Metrics	SH-50/60-1	FA000479	July. 07/00	July. 07/03
3 Year	Horn 26.5 – 40 GHz	Electro-Metrics	SH-50/60-2	FA000485	July. 07/00	July. 07/03
1 Year	1.0 – 2.0 GHz Amplifier	JCA	12-400	FA001498	June. 04/02	June. 04/03
1 Year	2.0 – 4.0 GHz Amplifier	JCA	24-600	FA001496	June. 04/02	June. 04/03
1 Year	4.0 – 8.0 GHz Amplifier	JCA	48-600	FA001498	June. 04/02	June. 04/03
COU	5.0 – 18.0 GHz Amplifier	NARDA	DWT-186N23U40	FA001409		
COU	18.0 – 26.0 GHz Amplifier	NARDA	BBS-1826N612	FA001550		
COU	26 – 40.0 GHz Amplifier	NARDA	DBL-2640N610	FA001556		