ENGINEERING TEST REPORT

"Kaddy-Link" Remote Control Unit
Model No.: #92021 Transmitter

FCC ID: K88-92021

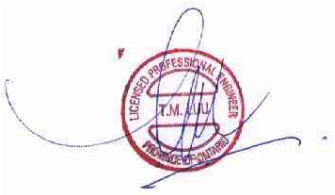
Applicant:

Lectronic Kaddy Corporation
4626 Burgoyne Street
Mississauga, Ontario
Canada, L4W 1G1

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.231
Momentarily Operated Transmitters (433.92 MHz)

UltraTech's File No.: LEC-009F15C231

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: July 23, 2003	
Report Prepared by: Dan Huynh Issued Date: July 23, 2003	Tested by: Mr. Hung Trinh, EMI/RFI Technician Test Dates: June 20, 2003

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

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EXHIBIT 1: SUBMITTAL CHECK LIST

Annex No.	Document Description	Description of Contents	Quality Check (OK)
--	Test Report	▪ Exhibit 1: Submittal check lists ▪ Exhibit 2: Introduction ▪ Exhibit 3: Performance Assessment ▪ Exhibit 4: EUT Operation and Configuration during Tests ▪ Exhibit 5: Summary of test Results ▪ Exhibit 6: Measurement Data ▪ Exhibit 7: Measurement Uncertainty ▪ Exhibit 8: Measurement Methods	OK
1	Test Setup Photos	Radiated Emissions Setup Photos	OK
2	External EUT Photos	External EUT Photos	OK
3	Internal EUT Photos	Internal EUT Photos	OK
4	Cover Letters	▪ Letter from Ultratech for Certification Request ▪ Letter from the Applicant to appoint Ultratech to act as an agent ▪ Letter from the Applicant to request for Confidentiality Filing	OK
5	Attestation Statements	--	--
6	ID Label/Location Info	▪ ID Label ▪ Location of ID Label	OK
7	Block Diagram	Lectronic Kaddy RF Transmitter Block Diagram	OK
8	Schematic Diagrams	Schematic	OK
9	Parts List/Tune Up Info	#92021 Tx BOM	OK
10	Operational Description	#92021 Tx Operational Description	OK
11	RF Exposure Info	--	--
12	Users Manual	Dyna-steer Quick Start Manual	OK

EXHIBIT 2: INTRODUCTION

2.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.231
Title:	Telecommunication – 47 Code of Federal Regulations (CFR) Part 15
Purpose of Test:	To gain FCC Certification Authorization for a Low Power Transmitter operating above 70 MHz.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	▪ Residential ▪ Commercial

2.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

2.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19	2002	Code of Federal Regulations – Telecommunication
ANSI C63.4	1992	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CISPR 22 & EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1	1999	Specification for Radio Disturbance and Immunity measuring apparatus and methods

EXHIBIT 3: PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	Lectronic Kaddy Corporation
Address:	4626 Burgoyne Street Mississauga, Ontario Canada, L4W 1G1
Contact Person:	Mr. Frank A. Eilles Phone #: 905-602-8118; 1-800-267-0098 Fax #: 905-602-8122 Email Address: frank@kaddy.com

MANUFACTURER	
Name:	Lectronic Kaddy Corporation
Address:	4626 Burgoyne Street Mississauga, Ontario Canada, L4W 1G1
Contact Person:	Mr. Frank A. Eilles Phone #: 905-602-8118 Fax #: 905-602-8122 Email Address: frank@kaddy.com

3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Lectronic Kaddy Corporation
Product Name:	"Kaddy-Link" Remote Control Unit
Model Name or Number:	#92021 Transmitter
Serial Number:	Test Sample
Type of Equipment:	Remote Control Transmitter
Input Power Supply Type:	Internal Battery
Primary User Functions of EUT:	Provide data communication link through air

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Portable
Intended Operating Environment:	▪ Residential ▪ Commercial
Power Supply Requirement:	9V Battery
RF Output Power Rating:	66.05 dBµV/m (measured at 3 meters distance)
Operating Frequency Range:	433.92 MHz
RF Output Impedance:	50 Ohms
Duty Cycle:	3.6 %
20 dB Bandwidth:	36.8 kHz
99% Emission Bandwidth:	95.0 kHz
Modulation Type:	AM (pulse width modulated)
Emission Designation:	95K0K1D
Oscillator Frequencies:	4 MHz, 13.56 MHz
Antenna Connector Type:	The antenna is an internal and integral part of the transmitter's printed circuit
Antenna Description:	The antenna is an internal and integral part of the transmitter's printed circuit board and is manufactured by Lectronic Kaddy Corporation.

3.4. GENERAL TEST SETUP

Stand-alone unit

EXHIBIT 4: EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	9V Battery

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMTNT FOR TESTS

Operating Modes:	The EUT transmits continuously during tests
Special Test Software:	None.
Special Hardware Used:	None.
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as an integral antenna equipment.

Transmitter Test Signal(s)	
Test Frequency:	433.92 MHz
Normal Test Modulation:	AM
Modulating Signal Source:	Internal

EXHIBIT 5: SUMMARY OF TEST RESULTS

5.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 24'(L) x 16'(W) x 8'(H).
- Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: Aug. 10, 2002.

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section (s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna Requirement	Yes
15.231(a)	Provisions For Periodic Operation	Yes
15.231(b)	Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious	Yes
15.231(c)	Emission Bandwidth	Yes

Note: The digital circuits portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices. The engineering test report can be provided upon FCC requests.

5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 6: MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

6.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in Exhibit 8 of this report

6.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

6.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C64-3:1992, FCC 15.231 and CISPR 16-1.

6.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUACTURER

The essential function of the EUT is to correctly communicate data to and from radios over RF link.

6.5. ANTENNA REQUIREMENTS [47 CFR § 15.203]

6.5.1. Requirements

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Note: This requirement does not apply to carrier current devices operated under the provisions of @ 15.211, 15.213, 15.217, 17.219 or 15.221.

6.5.2. Engineering Analysis

The EUT contained an internal integral antenna component mounted on the printed circuit board.

6.6. PROVISIONS FOR PERIODIC OPERATION [47 CFR § 15.231(a)]

Engineering Analysis:

FCC Provisions	Analysis on Compliance
Permitted Type of Devices (alarm systems, door opener, remote switches etc ...)	Remote switches.
Prohibited Type of Devices (radio control of toys)	Not radio control of toys
Prohibited Transmission Type (voice, video or data continuous transmission)	Recognition codes to identify other particular component as part of the system
(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.	The transmitter is automatically deactivated within less than 1 seconds of being releases.
(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.	N/A
(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.	N/A
(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition	N/A

6.7. TRANSMITTER RADIATED EMISSIONS @ 3 METERS [47 CFR §§ 15.231(b), 15.209 & 15.205]

6.7.1. Limits

In addition to the provisions of § 15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
260–470	[1] 3,750 to 12,500	[1] 375 to 1,250

[1] Linear interpolations.

- The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.
- The above table is based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. If average emission measurements are employed, the provisions in § 15.35 for averaging pulsed emissions and for limiting peak emissions apply
- The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in § 15.209, whichever limit permits a higher field strength.
- Harmonics/spurious emissions falling into the restricted bands in § 15.205 shall meet the general radiated emission limits in § 15.209.

§ 15.205(a) - Restricted Bands

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

§ 15.209(a) General Radiated Emission Limits

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

6.7.2. Method of Measurements

Refer to Exhibit 8, Sec. 8.3 of this test report & ANSI C63-4:1992

Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and highpass filter are used for this measurement.

- For measurements from 9 KHz to 150 KHz, set RBW = 200 Hz, VBW $\geq$ RBW, SWEEP=AUTO.
- For measurements from 150 KHz to 30 MHz, set RBW = 10 KHz, VBW $\geq$ RBW, SWEEP=AUTO.
- For measurements from 30 MHz to 1 GHz, set RBW = 100 KHz, VBW $\geq$ RBW, SWEEP=AUTO.
- For measurement above 1 GHz, set RBW = 1 MHz, VBW = 1 MHz, SWEEP=AUTO.

If the emission is pulsed, modified the unit for continuous operation, then use the settings above for measurements, then correct the reading by subtracting the peak-average correction factor derived from the appropriate duty cycle calculation. See section 15.35(b) and (c).

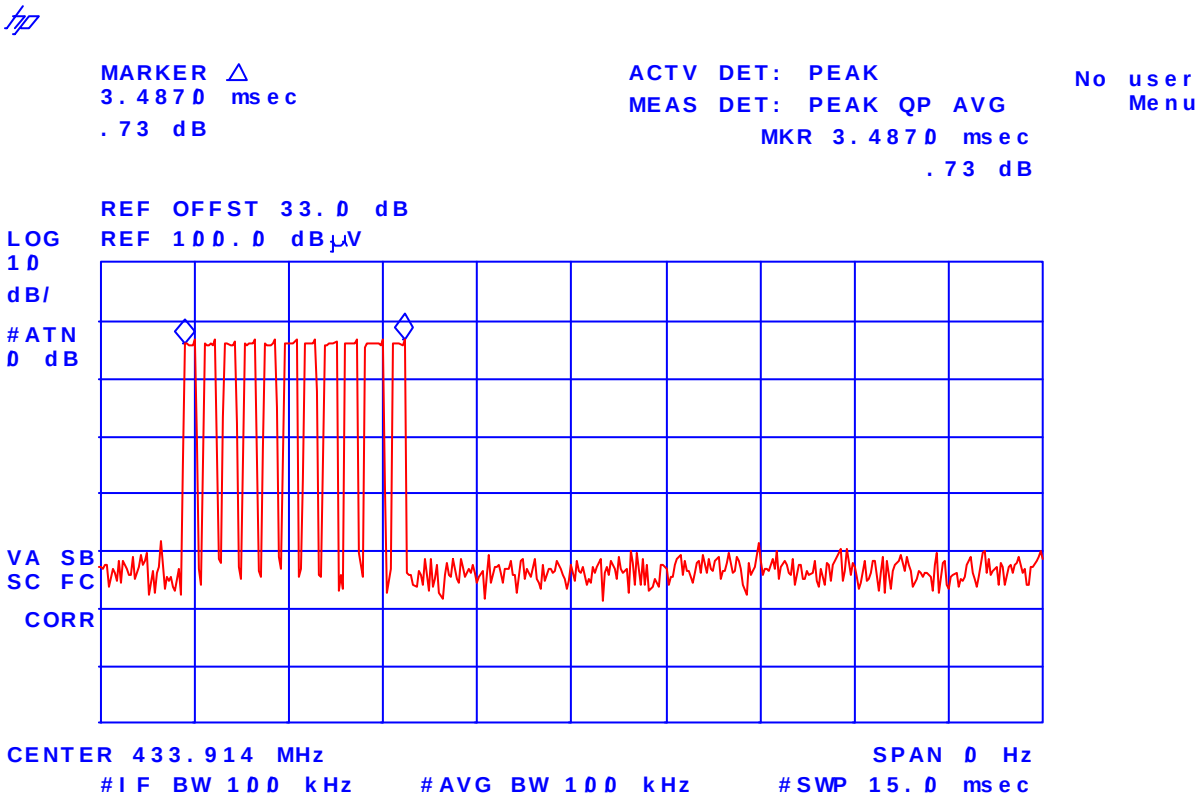
6.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz
Active Loop Antenna	EMCO	6507	8906-1167	1 kHz – 30 MHz
Log Periodic/Bow-Tie Antenna	EMCO	3143	1029	20 - 1000 MHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz

6.7.4. Test Data

6.7.4.1. Duty Cycle Measurements

Plot 1:
Duty Cycle Measurement

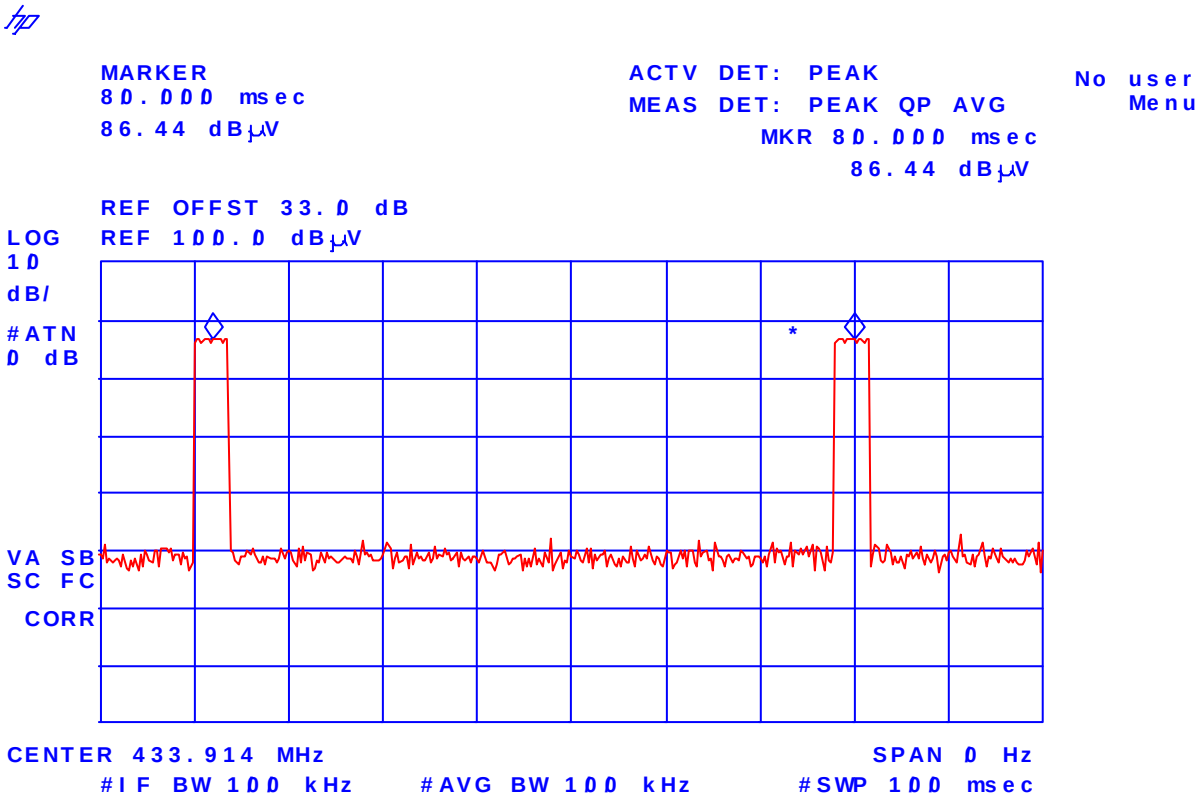


Short pulse = 150µs, Long pulse = 300µs

Each pulse train consists of 1 long pulse and 10 short pulses; therefore:

Time ON in 1 pulse train = (300µs) + (10 x 150µs)
= 1800 µs
= 1.8 ms

Plot 2:
Duty Cycle Measurement



There are 2 pulse trains in 100 ms interval; therefore:

Time ON in 100 ms = 2 x 1.8 ms = 3.6 ms

The Duty Cycle in 100 ms: 3.6 ms/100 ms = or 3.6%

Duty Cycle / Peak-Average Conversion Factor = 20*log (0.036) = -28.87 dB

6.7.4.2. RF Radiated Emissions Measured at 3 Meters Distance

The emissions were scanned from 10 MHz to 10th harmonic of the highest oscillator frequency and all emissions less 30 dB below the limits were recorded.

Note:
- For portable transmitter, EUT is placed in three different orthogonal positions for searching maximum field strength level.
- Emission in the restricted band per §15.205(a): § 15.209(a) limits applied
- Emission outside the restricted band per § 15.205(a): §15.205(a) or § 15.209(a) limits applied, whichever limit permits a higher field strength.

Frequency (MHz)	Peak E-Field @ 3m (dBµV/m)	Average E-Field @ 3m (dBµV/m)	Antenna Plane (H/V)	§15.231 Limits @ 3m (dBµV/m)	§15.209 Limits @ 3m (dBµV/m)	Margin (dB)	Pass/ Fail
433.92	93.64	64.77	V	80.8	--	-16.1	Pass
433.92	94.92	66.05	H	80.8	--	-14.8	Pass
2169.60	61.22	32.35	V	60.8	54.0	-28.5	Pass
2169.60	64.05	35.18	H	60.8	54.0	-25.6	Pass
3471.36	60.40	31.53	V	60.8	54.0	-29.3	Pass
3471.36	62.29	33.42	H	60.8	54.0	-27.4	Pass
3905.28	55.97	27.10	V	60.8	54.0	-26.9	Pass*
3905.28	58.57	29.70	H	60.8	54.0	-24.3	Pass*

* Emission in restricted bands

6.8. EMISSION BANDWIDTH [47 CFR § 15.231(c)]

6.8.1. Limits

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency.

6.8.2. Method of Measurements

Refer to Exhibit 8, Section 8.4, FCC §15.231(c) & ANSI C63-4:1992

The transmitter output was loosely coupled to the spectrum analyzer through a receiving antenna and the bandwidth of bandwidth of the fundamental frequency was measured with the spectrum analyzer with the resolution bandwidth of the spectrum analyzer set per ANSI 63-4:1992, Sec. 13.1.6.2

6.8.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz

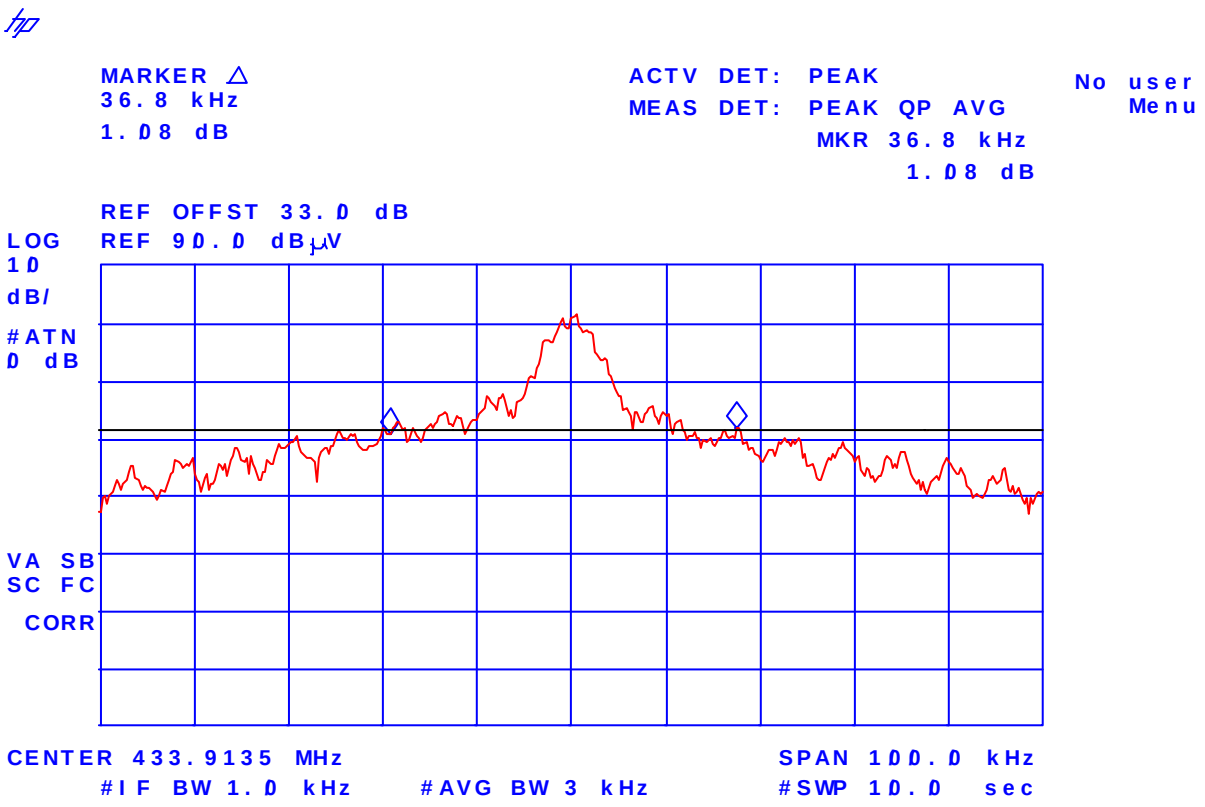
6.8.4. Test Data

6.8.4.1. 20 dB Bandwidth

Fundamental Frequency (MHz)	20 dB Bandwidth (kHz)	Maximum Limit (kHz)
433.92	36.8	1084.8

See the following test data plot (3) for detailed measurement results

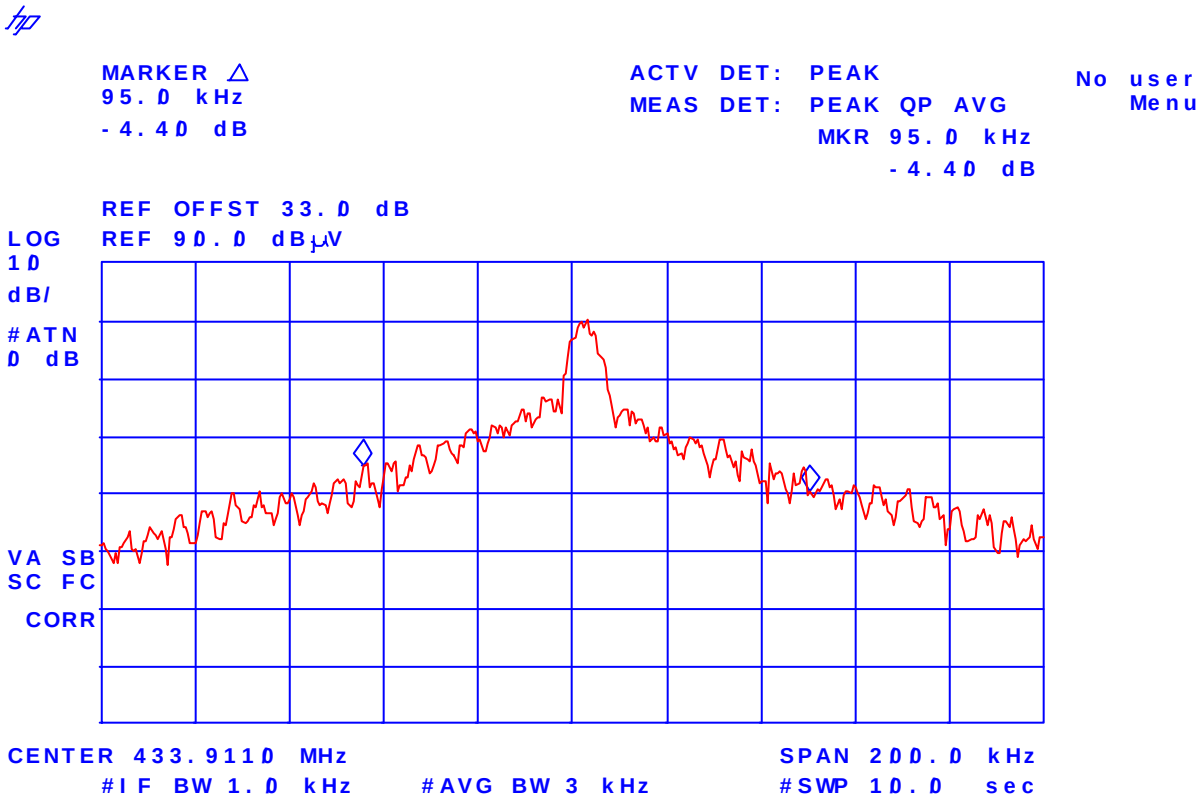
Plot 3:
20 dB Bandwidth



6.8.4.2. 99% Emission Bandwidth

Frequency (MHz)	99 % Emission Bandwidth (kHz)
433.92	95.0

Plot 4:
99% Emission Bandwidth



All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 7: MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (± dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	±1.0	±1.0
Cable Loss Calibration	Normal (k=2)	±0.3	±0.5
EMI Receiver specification	Rectangular	±1.5	±1.5
Antenna Directivit	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	±2.0	±0.5
Antenna phase center variation	Rectangular	0.0	±0.2
Antenna factor frequency interpolation	Rectangular	±0.25	±0.25
Measurement distance variation	Rectangular	±0.6	±0.4
Site imperfections	Rectangular	±2.0	±2.0
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67$(Bi) 0.3 (Lp) Uncertainty limits $20\text{Log}(1\pm\Gamma_1\Gamma_R)$	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k = 2 is used:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB

EXHIBIT 8: MEASUREMENT METHODS

8.1. GENERAL TEST CONDITIONS

The following test conditions shall be applied throughout the tests covered in this report.

8.1.1. Normal temperature and humidity

- Normal temperature: +15°C to +35°C
- Relative Humidity: +20% to 75%

The actual values during tests shall be recorded in the test report.

8.1.2. Normal power source

8.1.2.1. Mains Voltage

The nominal test voltage of the equipment to be connected to mains shall be the nominal mains voltage which is the declared voltage or any of the declared voltages for which the equipment was designed.

The frequency of test power source corresponding to the AC mains shall be between 59 Hz and 61 Hz.

8.1.2.2. Battery Power Source

For operation from battery power sources, the nominal test voltage shall be as declared by the equipment manufacturer. This shall be recorded in the test report.

8.1.3. Operating Condition of Equipment under Test

- All tests were carried out while the equipment operated at the following frequencies:
  - The lowest operating frequency,
  - The middle operating frequency and
  - The highest operating frequency

- Modulation were applied using the Test Data sequence
- The transmitter was operated at the highest output power, or in the case the equipment able to operate at more than one power level, at the lowest and highest output powers

8.2. METHOD OF MEASUREMENTS - AC MAINS CONDUCTED EMISSIONS

- AC Mains conducted emissions measurements were performed in accordance with the standard against appropriate limits for each detector function.
- The test was performed in the shielded room, 24'(L) by 16'(W) by 8'(H).
- The test was performed were made over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio noise voltage which was conducted from the EUT power-input terminals that were directly connected to a public power network.
- The EUT normally received power from another device that connects to the public utility ac power lines, measurements would be made on that device with the EUT in operation to ensure that the device continues to comply with the appropriate limits while providing the EUT with power.
- If the EUT operates only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines, AC Mains conducted measurements are not required.
- Table-top devices were placed on a platform of nominal size 1 m by 1.5m raised 80 cm above the conducting ground plane.
- The EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN to the power source. All unused 50-Ohm connectors of the LISN was terminated in 50-ohm when not connected to the measuring instruments.
- The line cord of the EUT connected to one LISN which was connected to the measuring instrument. Those power cords for the units of devices not under measurement were connected to a separate multiple ac outlet. Drawings and photographs of typically conducted emission test setups were shown in the Test Report. Each current-carrying conductor of the EUT shall be individually tested.
- The EUT was normally operated with a ground (safety) connection, the EUT was connected to the ground at the LISN through a conductor provided in the lead from the ac power mains to the LISN.
- The excess length of the power cord was folded back and forth in an 8-shape on a wooden strip with a vertical prong located on the top of the LISN case.
- The EUT was set-up in its typical configuration and operated in its various modes as described in 3.2 of the test report.
- A preliminary scan was made by using spectrum analyzer system with the detector function set to PEAK mode (9 KHz RBW, VBW > RBW), frequency span 450 kHz to 30 MHz.

- The maximum conducted emission for a given mode of operation was found by using the following step-by-step procedure:

- Monitor the frequency range of interest at a fixed EUT azimuth.
- Manipulate the system cables and peripheral devices to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.
- The effects of various modes of operation is examined. This is done by varying equipment operation modes as step 2 is being performed.
- After completing step 1 through 3, record EUT and peripheral device configuration, mode of operation, cable configuration, signal levels and frequencies for final test.

- Each highest signal level at the maximized test configuration was zoomed in a small frequency span on the spectrum analyzer's display (the manipulation of cables and peripheral devices and EUT operation modes might have to be repeated to obtain the highest signal level with the spectrum analyzer set to PEAK detector mode 10 KHz RBW and VBW > RBW). The spectrum analyzer was then set to CISPR QUASI-PEAK detector mode (9 KHz RBW, 1 MHz VBW) and AVERAGE detector mode (10 kHz RBW, 1 Hz VBW). The final highest RF signal levels and frequencies were record.

- ***Broad-band ac Powerline conducted emissions***:- If the EUT exhibits ac Powerline conducted emissions that exceed the limit with the instrument set to the quasi-peak mode, then measurements should be made in the average mode. If the amplitude measured in the quasi-peak mode is at least 6 dB higher than the amplitude measured in the average mode, the level measured in quasi peak mode may be reduced by 13 dB before comparing it to the limit.

8.3. SPURIOUS EMISSIONS (RADIATED)

For radiated measurements, the spurious emissions were scanned from the lowest frequency generated by the EUT or 10 MHz whichever is lower to 10th harmonic of the highest frequency generated by the EUT.

- The radiated emission measurements were performed at the UltraTech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario. The Attenuation Characteristics of OFTS have been filed to FCC, Industry Canada, ACA/Austel, NVLap and ITI.
- Radiated emissions measurements were made using the following test instruments:

1. Calibrated EMCO BiconiLog antenna in the frequency range from 30 MHz to 2000 MHz.
2. Calibrated Emco Horn antennas in the frequency range above 1000 MHz (1GHz - 40 GHz).
3. Calibrated Advantest spectrum analyzer and pre-selector were used. The spectrum analyzer would be used as follows:

   For frequencies below 1 GHz:

   - Resolution BW: 100 kHz
   - Video BW: same or greater
   - Detector Mode: Positive Peak
   - Averaging: Off
   - Span: 100 MHz
   - Amplitude: Adjust for middle of the instrument's range
   - Sweep Time: Auto

   For frequencies above 1 GHz:
   - Resolution BW: 1 MHz
   - Video BW: same or greater
   - Detector Mode: Positive Peak
   - Averaging: Off
   - Span: 500 MHz
   - Amplitude: Adjust for middle of the instrument's range
   - Sweep Time: Auto

- The frequencies of emissions was first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.
- During this process, cables and peripheral devices were manipulated within the range of likely configuration.
- For each mode of operation required to be tested, the frequency spectrum was monitored. Variations in antenna heights (from 1 meter to 4 meters above the ground plane), antenna polarization (horizontal plane and vertical plane), cable placement and peripheral placement were explored to produce the highest amplitude signal relative to the limit.

  The maximum radiated emission for a given mode of operation was found by using the following step-by-step procedure:

  Step 1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.

  Step 2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

  Step 3: Rotate the EUT 360 degrees to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go

back to the azimuth and repeat Step 2. Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.

Step 4: Move the antenna over its full allowable range of travel (1 to 4 meters) to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to Step 2 with the highest amplitude observation and proceed.

Step 5: Change the polarization of the antenna and repeat Step 2 through 4. Compare the resulting suspected highest amplitude signal with that found for the other polarization. Select and note the higher of the two signals. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.

Step 6: The effects of various modes of operation is examined. This is done by varying the equipment modes as steps 2 through 5 are being performed.

Step 7: After completing steps 1 through 6, record the final highest emission level, frequency, antenna polarization and detector mode of the measuring instrument.

Calculation of Field Strength:

The field strength is calculated by adding the calibrated antenna factor and cable factor, and subtracting the Amplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where	FS	=	Field Strength
	RA	=	Receiver/Analyzer Reading
	AF	=	Antenna Factor
	CF	=	Cable Attenuation Factor
	AG	=	Amplifier Gain

Example: If a receiver reading of 60.0 dBuV is obtained, the antenna factor of 7.0 dB/m and cable factor of 1.0 dB are added, and the amplifier gain of 30 dB is subtracted. The actual field strength will be:.

Field Level = 60 + 7.0 + 1.0 - 30 = 38.0 dBuV/m.
Field Level = $10^{(38/20)}$ = 79.43 uV/m.

8.4. 20 dB BANDWIDTH MEASUREMENTS

- Couple the RF output signal to the spectrum analyzer by means of direct connection or by a receiving antenna.
- The spectrum analyzer shall be se as follows:

  - Span: Minimum span to fully display the entire emission, approximately 3 x emission BW.
  - Resolution RBW: 1% to 3% of the approximate emission BW
  - Video VBW: 3 x RBW
  - EMI Detector: Peak
  - Sweep Time: Coupled or set to a slow rate
  - Trace: Max-hold

- Place the marker at both sides of the emission slope and at -20 dB down from the peak value.
- The difference of frequencies of 2 markers will be the 20 dB bandwidth
- Record and plot the test results.