



Measurement of RF Interference from a Model M-2913 Blue Jay Wireless Data Transceiver Using Digital Modulation

For : Beckwith Electric
Largo, FL

P.O. No. : 35097
Date Received : August 6, 2004
Date Tested : August 16, 2004 through September 7, 2004
Test Personnel : Mark E. Longinotti, NARTE® Certified
EMC Test Engineer, ATL-0154-E
Specification : FCC "Code of Federal Regulations" Title 47 Part 15,
Subpart C, Section 15.247 for Intentional Radiators
Using Digital Modulation Operating within the 2400-
2483.5MHz band.

Test Report By :

A handwritten signature in black ink that reads "Mark E. Longinotti".

Mark E. Longinotti
NARTE® Certified
EMC Test Engineer, ATL-0154-E

Approved By :

A handwritten signature in black ink that reads "Raymond J. Klouda".

Raymond J. Klouda
Registered Professional Engineer of
Illinois - 44894



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Measurement of RF Emissions from a model M-2913 Blue Jay Wireless Data Transceiver Using

Digital Modulation

1.0 INTRODUCTION:

1.1 Description of Test Item - This document represents the results of the series of radio interference measurements performed on a model M-2913 BlueJay Wireless Data Transceiver (here in after referred to as the test item). No serial number was assigned to the test item. The test item is a wireless data transceiver which uses digital modulation. It transmits at 2.45GHz and uses an external antenna. The test item was manufactured and submitted for testing by Beckwith Electric located in Largo, FL.

1.2 Purpose - The test series was performed to determine if the test item meets selected portions of the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.247 for Intentional Radiators. Testing was performed in accordance with ANSI C63.4-2001.

1.3 Deviations, Additions and Exclusions - There were no deviations, additions to, or exclusions from the test specification during this test series.

1.4 Applicable Documents - The following documents of the exact issue designated form part of this document to the extent specified herein:

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C, dated 1 October 2003
- FCC-97-114, Appendix C, Federal Communications Commission, Guidance on Measurements for Direct Sequence Spread Spectrum Systems
- DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
- ANSI C63.4-2001, "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"

1.5 Subcontractor Identification - This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP Lab Code: 100278-0.

1.6 Laboratory Conditions The temperature at the time of the test was 19°C and the relative humidity was 49%.

2.0 TEST ITEM SETUP AND OPERATION:

The test item is a BlueJay Wireless Data Transceiver, Part No. M-2913. A 4.51 inch whip antenna was supplied with the test item. The whip antenna was connected to the antenna port of the test item during all radiated emissions tests. A block diagram of the test item setup is shown as Figure 1.

2.1 Power Input - A Sony laptop computer, M/N: PCG-GRX500P, was connected to the test item via a 2-meter long USB cable. The laptop computer was used to supply 5VDC to the test item via the USB cable.

The laptop computer was supplied with a Sony, AC Adapter, M/N: PCGA-AC19V4. The AC Adapter received 115, 60Hz power via a 70cm long unshielded, two-wire power cable. The AC Adapter supplied 19.5VDC to the laptop computer via a 1.7 meter long unshielded two-wire power cable.

For conducted emissions tests, the high and low leads of the power input to the AC Adapter of the laptop computer were connected through line impedance stabilization networks (LISNs) which were located on the ground plane. The network complies with the requirements of Paragraph 4.1.2 of ANSI C63.4-2001.

2.2 Grounding - The test item was ungrounded during the test.

2.3 Support Equipment - A Sony laptop computer, M/N: PCG-GRX500P, was connected to the test item via a 2-meter long USB cable. The laptop computer was used to supply 5VDC to the test item via the USB cable.

2.4 Interconnect Cables - The test item was connected to the laptop computer via a 2-meter long USB cable.

2.5 Operational Mode - For all tests, the test item was transmitting at approximately 2451MHz.

3.0 TEST EQUIPMENT:

3.1 Test Equipment List - A list of the test equipment used can be found on Table I. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

3.2 Calibration Traceability Test equipment is maintained and calibrated on a regular basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

4.0 REQUIREMENTS, PROCEDURES AND RESULTS:

4.1 Powerline Conducted Emissions

4.1.1 Requirements - All radio frequency voltages on the power lines for any frequency or frequencies of an intentional radiator shall not exceed the limits in the following table:

Frequency MHz	RFI Voltage dBuV(QP)	RFI Voltage dBuV(Average)
0.15-0.5	66 decreasing with logarithm of frequency to 56	56 decreasing with logarithm of frequency to 46
0.5-5	56	46
5-30	60	40

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: If the levels measured using the QP detector meet both the QP and the Average limits, the test item is considered to have met both requirements and measurements do not need to be performed using the Average detector.

4.1.2 Procedures - The interference on each power lead of the AC Adapter of the laptop computer was measured by connecting the measuring equipment to the appropriate meter terminal of the LISN. The meter terminal of the LISN not under test was terminated with 50 ohm. Measurements were first made over the entire frequency range from 150kHz to 30MHz with a peak detector and the results were automatically plotted. The data thus obtained was then searched by the computer for the highest levels. Quasi-peak measurements were automatically performed at the frequencies selected from the highest peak measurements, and the results printed.

4.1.3 Results - The plots of the peak preliminary conducted voltage levels on each power line of the AC Adapter of the laptop computer with the test item **not connected** are presented on pages 18 and 19. The conducted limits are shown as a reference. The final quasi-peak results are presented on pages 20 and 21.

The plots of the peak preliminary conducted voltage levels on each power line of the AC Adapter of the laptop computer with the test item **connected** are presented on pages 22 and 23. The conducted limits are shown as a reference. The final quasi-peak results are presented on pages 24 and 25.

As can be seen from the data, all emissions measured from the test item were within the specification limits.

Photographs of the test configuration which yielded the highest or worst case, conducted emission levels are shown on Figure 2.

4.2 Antenna Conducted Emissions

4.2.1 Requirements - Per section 15.247(c), in any 100 kHz bandwidth outside of the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power based on either an RF conducted or a radiated emissions measurement. Attenuation below the general limits specified in 15.209(a) is not required.

4.2.2 Procedures - The antenna port of the test item was connected to a spectrum analyzer through two 20dB attenuators and one 10dB attenuator. The resolution bandwidth was set to 100 kHz with a video bandwidth of 1MHz. Conducted emissions plots were made from 30MHz to 25GHz with the test item transmitting at 2451MHz. The display line on the plots represents the 20dB down point from the transmit

frequency.

4.2.3 Results - The antenna conducted emissions plots with the test item transmitting at 2451MHz are shown on data pages 26 through 31. As can be seen by the data, the test item did meet the antenna conducted emissions limits of 15.247(c). Photographs of the test setup are shown as Figure 2.

4.3 Radiated Measurements

4.3.1 Spurious Radiated Emissions

4.3.1.1 Requirement – Per section 15.247(c), radiated emissions which fall in the restricted bands, as defined in 15.205(a), must comply with the radiated emissions limits specified in 15.209(a).

Paragraph 15.209(a) has the following radiated emissions limits:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	2400/F(kHz)	30
1.705 - 30	30	3
30.0 - 88.0	100	3
88.0 - 216.0	150	3
216.0 - 960.0	200	3
Above 960	500	3

4.3.1.2 Procedures - Preliminary radiated measurements from 30MHz to 18GHz were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. The shielded enclosure prevents emissions from other sources such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

Final radiated measurements were performed on the following:

- all significant radiated emissions detected in the preliminary tests which were in the restricted bands listed in 15.205(a).
- the 2nd, 3rd, 5th, 8th, and 9th harmonics of the transmit frequency - all of which fall in the restricted bands of 15.205(a).

All final radiated emissions measurements were manually performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. Measurements below 1GHz were made using a quasi-peak detector and a bilog antenna. Measurements above 1GHz were made using an average detector and a standard gain horn antenna.

To ensure that maximum emission levels were measured, the following steps were taken:

- 1) The test item was rotated so that all of its sides were exposed to the receiving antenna.
- 2) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
- 3) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.

Radiated emissions measurements above 5GHz were taken at a distance of 1 meter. The reading was converted to an equivalent field intensity at 3 meters using linear extrapolation. A -9.5dB ($-9.5 = 20 \cdot \log(1\text{m}/3\text{m})$) distance correction factor was applied to the data.

4.3.1.3 Results - Photographs of the test item setup are presented as Figure 4. The preliminary radiated emissions plots from 30MHz to 18GHz are presented on data pages 32 through 37. The final radiated emissions data from 30MHz to 1GHz are presented on data page 38. The final radiated emissions data above 1GHz are presented on data page 39. As can be seen by the data, the test item did meet the emissions limits of 15.247(c).

4.3.2 Band-edge Compliance

4.3.2.1 Requirements - Systems designed to operate under the rules of section 15.247 are allowed to transmit in the frequency range of 2400MHz to 2483.5MHz. However, 2483.5MHz is the start of a restricted band as defined in 15.205(a). Therefore, all radiated emissions at the upper band-edge of the frequency range in which the system is allowed to transmit must comply with the radiated emissions limits specified in 15.209(a).

4.3.2.2 Procedures - The marker-delta method described in DA 00-705 was used to perform the band-edge compliance test.

The measurements were manually performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. A standard gain horn antenna was connected to the input of a spectrum analyzer. The spectrum analyzer was tuned to the transmit frequency of the test item. The test item was rotated so that all of its sides were exposed to the receive antenna and the receive antenna was raised and lowered so that the emissions reading were maximized. An average reading was taken at that frequency.

The resolution bandwidth of the spectrum analyzer was adjusted to 100 kHz. The span on the spectrum analyzer was set wide enough so that the peak of the fundamental of the test item could be seen and the band-edge was the center frequency of the display. Several sweeps were made in the peak hold mode. This peak emission reading is used as a relative measurement to determine how far down the emissions must be at the band-edge relative to the highest fundamental emission level.

To determine how far down the radiated emissions must be at the band-edge, subtract the general limit of 54dBuV/m from the maximum average reading. This determines how far down the band-edge emissions must

be from the peak emissions reading at the fundamental.

4.3.2.3 Results - The band-edge plot is shown on data page 40. The average reading at 2451MHz was 81.4 dBuV/m. In order for the band-edge (2483.5MHz) emissions to meet the general limit of 54 dBuV/m, the band-edge emissions must be down ($81.4\text{dB} - 54\text{dB} = 27.4\text{dB}$) 27.4 dB from the fundamental. The display line on the plot shows the 27.4 dB down point from the fundamental. As can be seen from the plot, the radiated emissions at the band-edge meet the general limits of 15.209(a).

4.4 Power Spectral Density

4.4.1 Requirements - Per section 15.247(d), for digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

4.4.2 Procedures - The antenna port of the transmitter was connected to a spectrum analyzer through two 20dB attenuators and one 10dB attenuator. Per FCC 97-114, an emission peak was located in the passband. The resolution bandwidth was set to 3kHz with a video bandwidth of 5kHz and the span was set to 1.5MHz. The sweep time was set to 500 seconds ($\text{SPAN}/3\text{kHz} = 1.5 \times 10^6 / 3 \times 10^3 = 500$ seconds). A power spectral density plot was made with the test item transmitting at 2451MHz.

4.4.3 Results - A power spectral density plot is shown on data page 41. The display line on the plot represents the 8dBm limit ($8\text{dBm} - 50\text{dBm external attenuation} = -42\text{dBm}$).

4.5 Bandwidth Measurements

4.5.1 Requirements - Per section 15.247(a)(2), for digitally modulated systems, the minimum 6dB bandwidth shall be at least 500kHz.

4.5.2 Procedures - The antenna port of the transmitter was connected to a spectrum analyzer through two 20dB attenuators and one 10dB attenuator. The resolution bandwidth was set to 100kHz with a video bandwidth of 300kHz and the span was set to 40MHz. A bandwidth plot was made for the test item transmitting at 2451MHz. The markers on the plots represent the 6dB down points from the transmit frequency.

4.5.3 Results - A bandwidth plot is shown on data page 42. As can be seen by the data, the test item did meet the minimum 6dB bandwidth requirements.

4.6 Power Output

4.6.1 Requirements - Per section 15.247(b)(3), for digitally modulated systems, the maximum peak output power shall not exceed 1 watt (30dBm).

4.6.2 Procedures - The antenna port of the transmitter was connected to a spectrum analyzer through two 20dB attenuators and one 10dB attenuator. The resolution bandwidth was set to 1MHz with a video bandwidth of 3MHz. The voltage output at the antenna port of the transmitter was measured in 50 separate 1MHz blocks around the fundamental frequency of the test item. The peak power output was

calculated using the following equation:

$$P = (1/50) \sum_{n=1}^{n=50} (V_n)^2 ; \text{ for a 50 ohm system}$$

4.6.3 Results - Power output data are shown on data page 43 and 44. The measured peak power output was 22.5dBm. As can be seen by the data, the test item did meet the maximum peak output power requirements of 15.247(b)(3).

5.0 CONCLUSIONS:

It was determined that the Beckwith Electric Blue Jay Wireless Data Transceiver, Part No. M-2913, Serial No. None Assigned, did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15.247, Subpart C, Section 15.205 et seq. for Intentional Radiators, when tested per ANSI C63.4-2001.

6.0 CERTIFICATION:

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications.

The data presented in this test report pertains to the test item at the test. Any electrical or mechanical modification made to the test item subsequent to the specified test date will serve to invalidate the data and void this certification.

7.0 ENDORSEMENT DISCLAIMER:

This report must not be used to claim product endorsement by NVLAP or any agency of the US Government.



TABLE I: TEST EQUIPMENT LIST

ELITE ELECTRONIC ENG. INC.							Page: 1	
Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Cal Inv	Due Date
Equipment Type: ACCESSORIES, MISCELLANEOUS								
XPR0	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/	001	4.8-20GHZ	07/19/04	12	07/19/05
XZG3	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	2421A03059	---		N/A	
Equipment Type: AMPLIFIERS								
APK3	PREAMPLIFIER	AGILENT TECHNOL	8449B	3008A01593	1-26.5GHZ	05/10/04	12	05/10/05
Equipment Type: ANTENNAS								
NTA0	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2057	0.03-2GHZ	07/12/04	12	07/12/05
NWI1	RIDGED WAVE GUIDE	AEL	H1498	154	2-18GHZ	09/05/04	12	09/05/05
NWN0	DOUBLE RIDGED GUIDE ANTENN	ETS-LINDGREN	3116	00026778	18 TO 40 GHZ	08/15/03	13	09/15/04
Equipment Type: ATTENUATORS								
T1E3	10DB, 25W ATTENUATOR (DCC-	WEINSCHTEL	46-10-43	AV5804	DC-18GHZ	03/12/04	12	03/12/05
T1EE	10DB 25W ATTENUATOR	WEINSCHTEL	46-10-34	BN2321	DC-18GHZ	02/24/04	12	02/24/05
T2D1	20DB, 25W ATTENUATOR	WEINSCHTEL	46-20-43	AV5814	DC-18GHZ	03/11/04	12	03/11/05
T2D8	20DB, 25W ATTENUATOR	WEINSCHTEL	46-20-43	AY9247	DC-18GHZ	05/19/04	12	05/19/05
T2DB	20DB, 25W ATTENUATOR	WEINSCHTEL	46-20-34	BH5447	DC-18GHZ	12/02/03	12	12/02/04
Equipment Type: CONTROLLERS								
CDD2	COMPUTER	HEWLETT PACKARD	D4171A#ABA	US61654645	---		N/A	
CDV0	REPLACEMENT FOR CDD0	COMPAQ	PRESARIO	MXK3391BPJ	2.5GHZ		N/A	
Equipment Type: PROBES; CLAMP-ON & LISNS								
PLL9	50UH LISN 462D	ELITE	462D/70A	010	0.01-400MHZ	03/02/04	12	03/02/05
PLLA	50UH LISN 462D	ELITE	462D/70A	011	0.01-400MHZ	03/02/04	12	03/02/05
Equipment Type: PRINTERS AND PLOTTERS								
HRE1	LASER JET 5P	HEWLETT PACKARD	C3150A	USHB061052	---		N/A	
HRE5	LASER JET 5P (DCC-DRFI)	HEWLETT PACKARD	LJ 6P	SUSBB43325	---		N/A	
Equipment Type: RECEIVERS								
RAC2	SPECTRUM ANALYZER	HEWLETT PACKARD	85660B	3638A08770	100HZ-22GHZ	02/10/04	12	02/10/05
RACD	RF PRESELECTOR	HEWLETT PACKARD	85685A	3010A01205	20HZ-2GHZ	02/11/04	12	02/11/05
RAF4	QUASIPPEAK ADAPTER	HEWLETT PACKARD	85650A	2043A00320	0.01-1000MHZ	02/11/04	12	02/11/05
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	03/14/03	18	09/14/04

Cal. Interval: Listed in Months I/O: Initial Only N/A: Not Applicable

Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

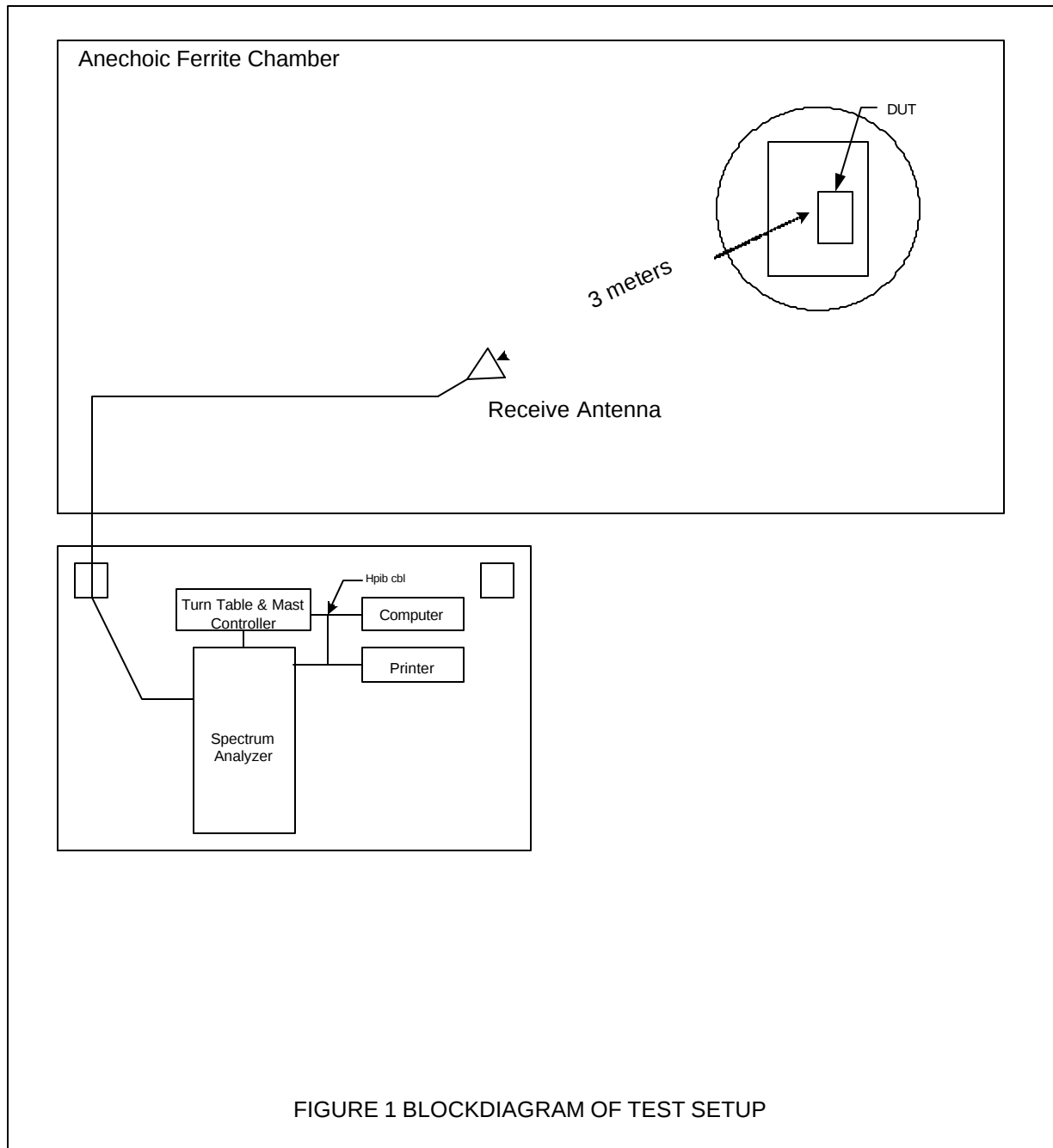


Figure 2



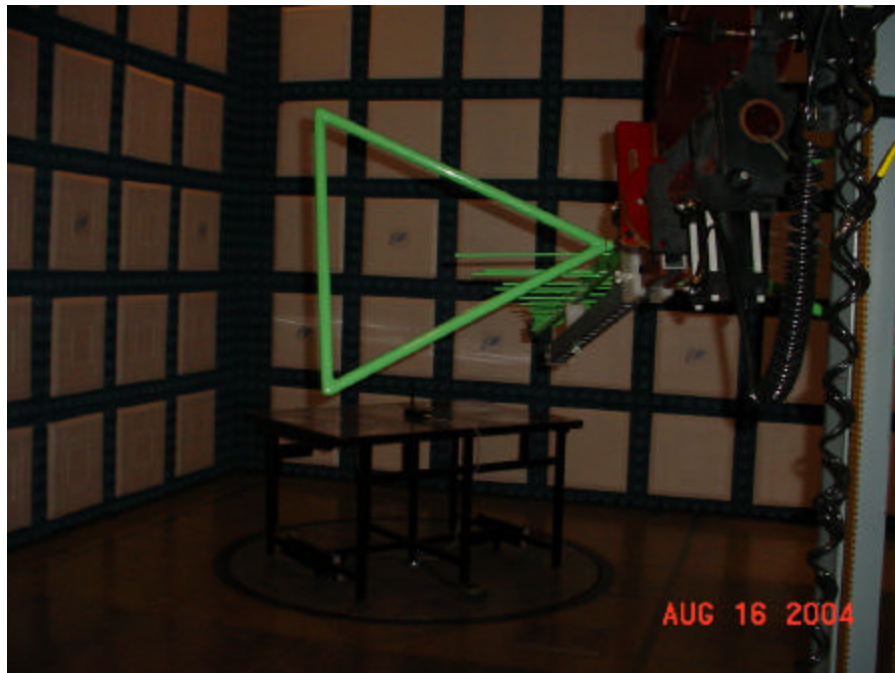
Test Setup for Conducted Emissions

Figure 3



Test Setup for Measurement of Antenna Conducted Emissions

Figure 4a



Test Setup for Radiated Emissions, 30MHz to 2GHz - Horizontal Polarization



Test Setup for Radiated Emissions, 30MHz to 2GHz - Vertical Polarization

Figure 4b



Test Setup for Radiated Emissions, 2GHz to 5GHz - Horizontal Polarization

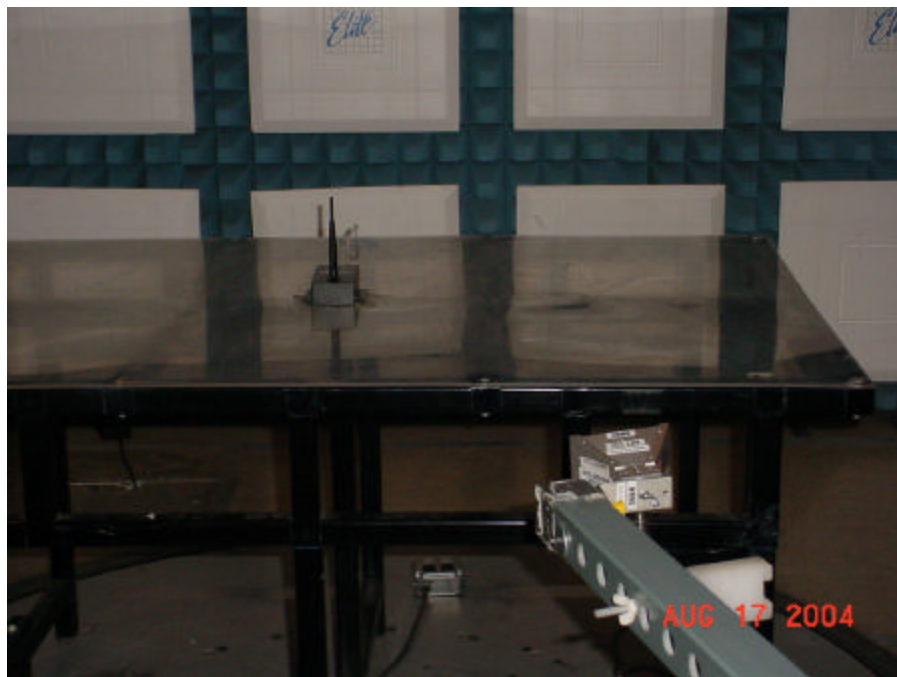


Test Setup for Radiated Emissions, 2GHz to 5GHz - Vertical Polarization

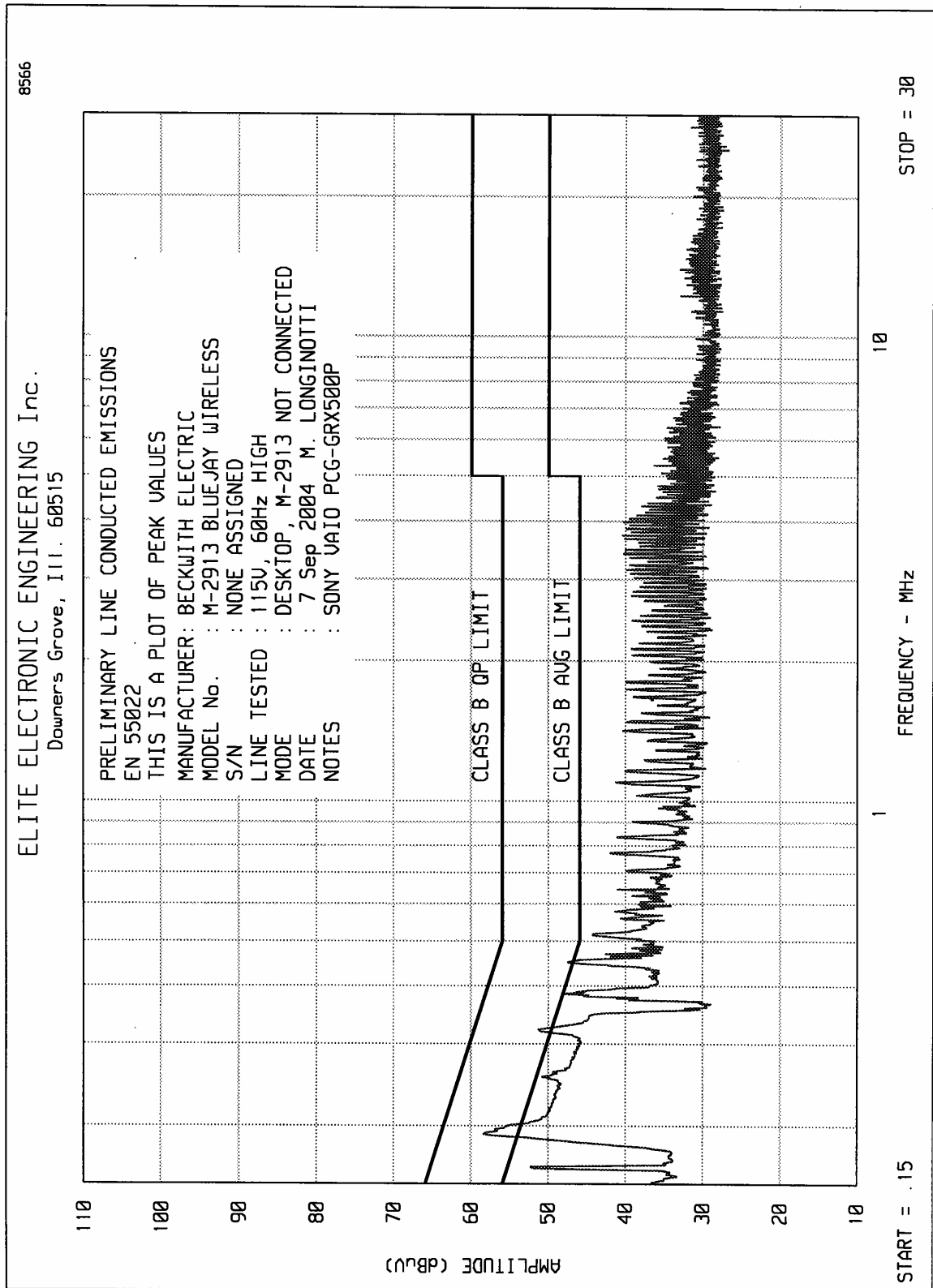
Figure 4c

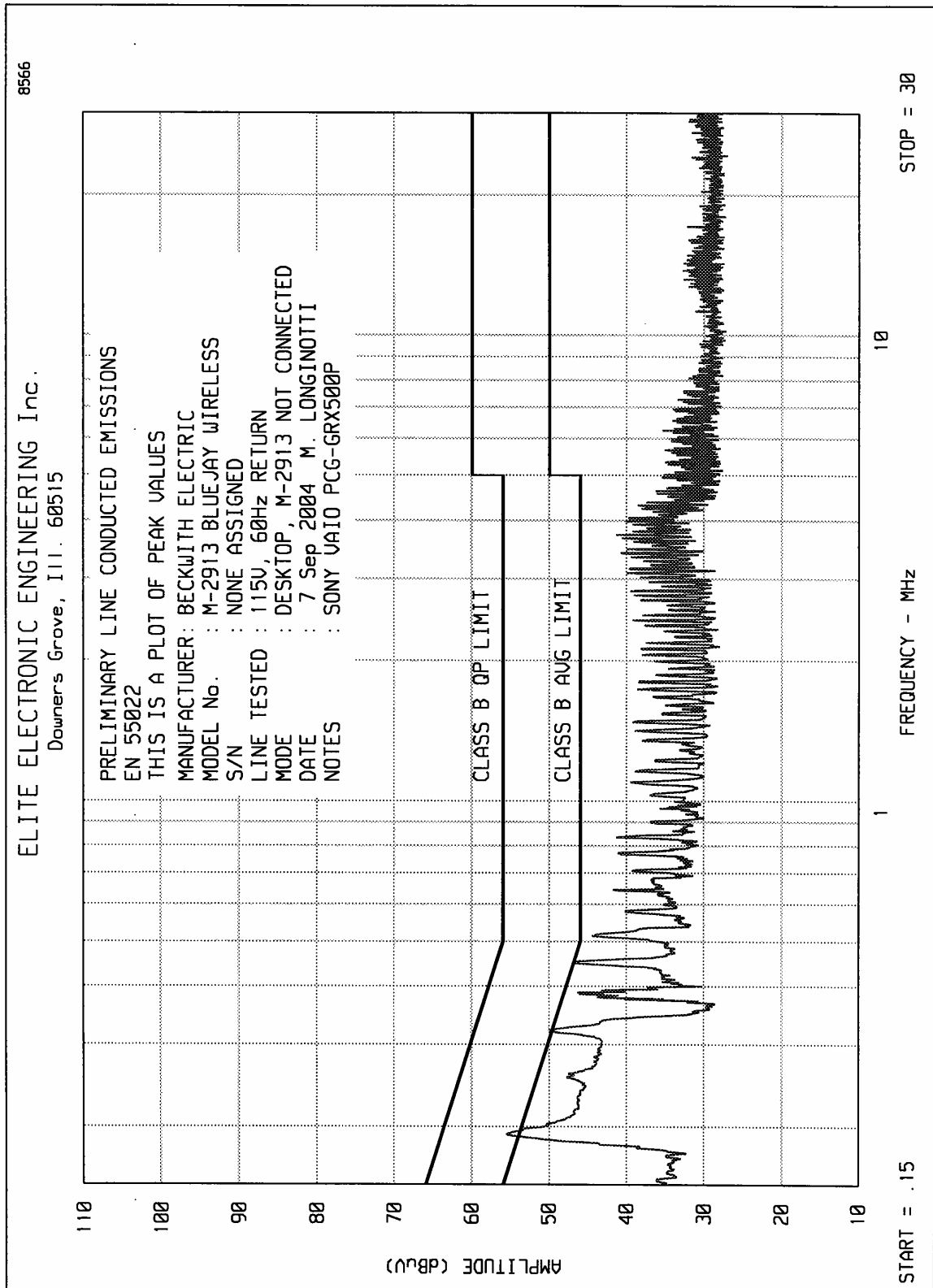


Test Setup for Radiated Emissions, 5GHz to 24GHz - Horizontal Polarization



Test Setup for Radiated Emissions, 5GHz to 24GHz - Vertical Polarization







ETR No.
ELITE ELECTRONIC ENGINEERING CO.

MANUFACTURER : BECKWITH ELECTRIC
MODEL : M-2913 BLUEJAY WIRELESS
S/N : NONE ASSIGNED
SPECIFICATION : EN 55022, CLASS B
TEST : LINE CONDUCTED EMISSIONS
LINE TESTED : 115V, 60Hz HIGH
MODE : DESKTOP, M-2913 NOT CONNECTED
DATE : 7 Sep 2004
NOTES : SONY VAIO PCG-GRX500P
RECEIVER : HP 8566 w/ HP85650A QP ADAPTOR
VALUES MEASURED WITH QP DETECTOR USING 9kHz BANDWIDTH

FREQUENCY MHz	METER RDG. dBuV	QP LIMIT dBuV	AVG RDG dBuV	AVG LIMIT dBuV	NOTES
.194	52.2	63.8		53.8	
.323	44.9	59.6		49.6	
.387	44.0	58.1		48.1	
.452	43.6	56.8		46.8	
.773	37.5	56.0		46.0	
.837	36.8	56.0		46.0	
1.094	36.4	56.0		46.0	
1.415	36.2	56.0		46.0	
1.736	35.7	56.0		46.0	
2.764	35.2	56.0		46.0	
3.664	35.9	56.0		46.0	
3.727	37.4	56.0		46.0	
4.049	35.9	56.0		46.0	
4.756	31.3	56.0		46.0	
6.619	29.5	60.0		50.0	
9.895	24.8	60.0		50.0	
12.400	26.1	60.0		50.0	
15.226	27.1	60.0		50.0	
17.926	25.3	60.0		50.0	
22.039	24.3	60.0		50.0	
24.092	23.6	60.0		50.0	
28.270	25.3	60.0		50.0	

CHECKED BY:


M. LONGINOTTI



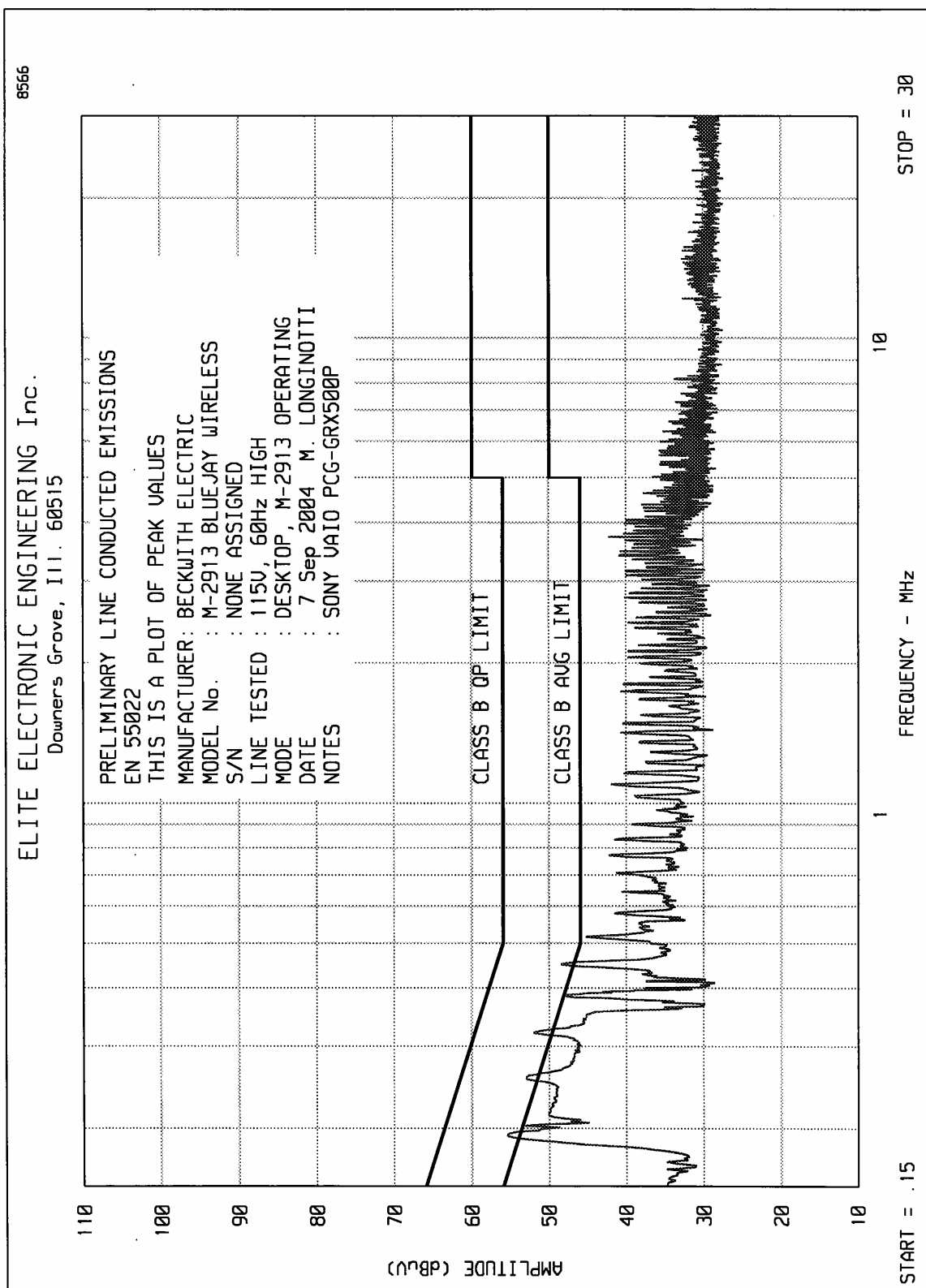
ETR No.
ELITE ELECTRONIC ENGINEERING CO.

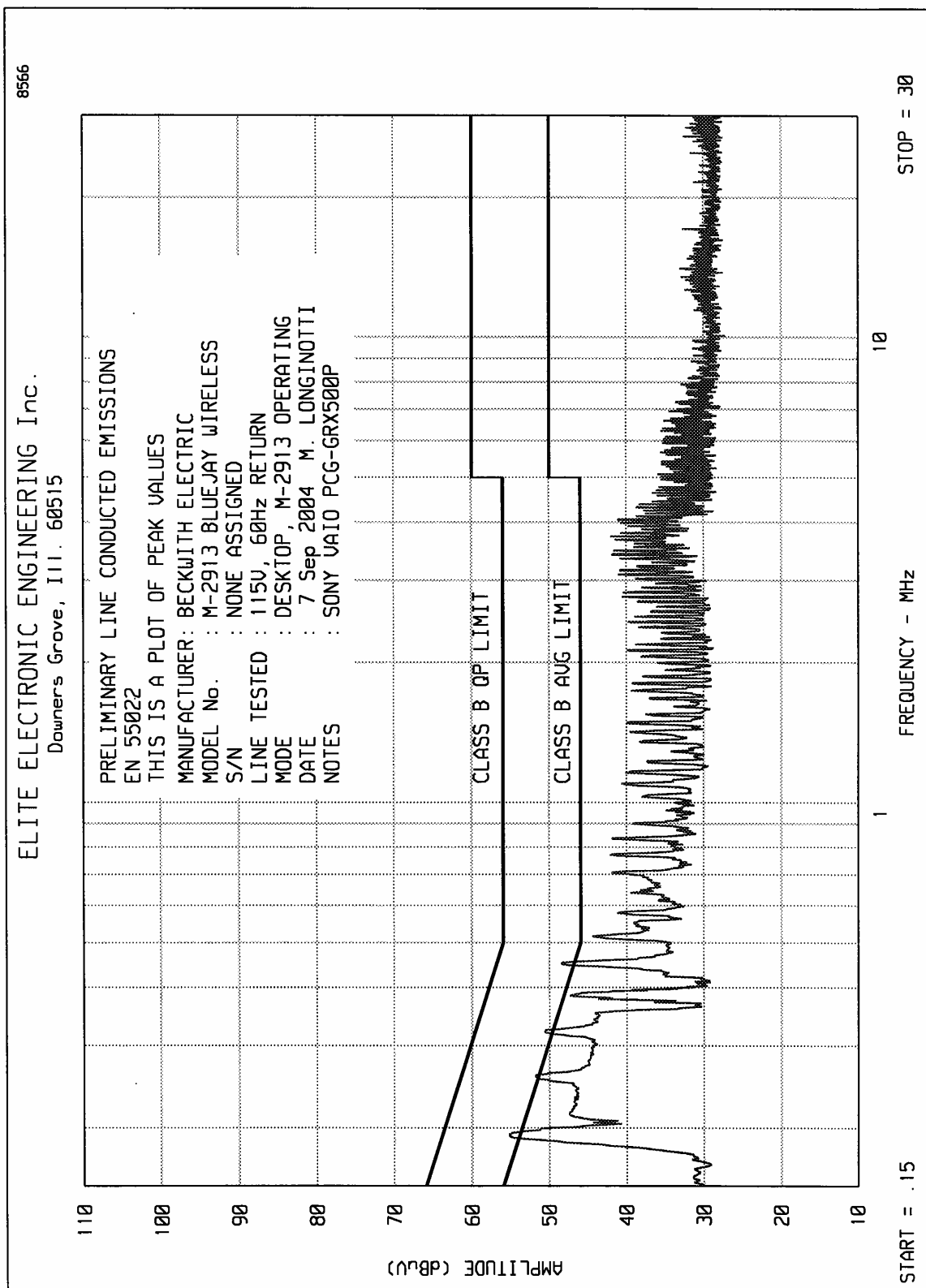
MANUFACTURER : BECKWITH ELECTRIC
MODEL : M-2913 BLUEJAY WIRELESS
S/N : NONE ASSIGNED
SPECIFICATION : EN 55022, CLASS B
TEST : LINE CONDUCTED EMISSIONS
LINE TESTED : 115V, 60Hz RETURN
MODE : DESKTOP, M-2913 NOT CONNECTED
DATE : 7 Sep 2004
NOTES : SONY VAIO PCG-GRX500P
RECEIVER : HP 8566 w/ HP85650A QP ADAPTOR
VALUES MEASURED WITH QP DETECTOR USING 9kHz BANDWIDTH

FREQUENCY MHz	METER RDG. dBuV	QP LIMIT dBuV	AVG RDG dBuV	AVG LIMIT dBuV	NOTES
.195	52.3	63.8		53.8	
.323	43.9	59.6		49.6	
.451	43.4	56.9		46.9	
.451	43.3	56.9		46.9	
.644	31.2	56.0		46.0	
.773	36.8	56.0		46.0	
.837	36.4	56.0		46.0	
1.094	35.9	56.0		46.0	
1.159	35.5	56.0		46.0	
1.736	35.1	56.0		46.0	
2.829	35.5	56.0		46.0	
3.728	38.0	56.0		46.0	
4.049	36.5	56.0		46.0	
4.949	31.6	56.0		46.0	
6.234	30.5	60.0		50.0	
8.740	26.0	60.0		50.0	
13.173	27.1	60.0		50.0	
15.166	26.5	60.0		50.0	
17.543	24.6	60.0		50.0	
21.911	23.4	60.0		50.0	
24.098	24.0	60.0		50.0	
27.245	25.7	60.0		50.0	

CHECKED BY:


M. LONGINOTTI







ETR No.
ELITE ELECTRONIC ENGINEERING CO.

MANUFACTURER : BECKWITH ELECTRIC
MODEL : M-2913 BLUEJAY WIRELESS
S/N : NONE ASSIGNED
SPECIFICATION : EN 55022, CLASS B
TEST : LINE CONDUCTED EMISSIONS
LINE TESTED : 115V, 60Hz HIGH
MODE : DESKTOP, M-2913 OPERATING
DATE : 7 Sep 2004
NOTES : SONY VAIO PCG-GRX500P
RECEIVER : HP 8566 w/ HP85650A QP ADAPTOR
VALUES MEASURED WITH QP DETECTOR USING 9kHz BANDWIDTH

FREQUENCY MHz	METER RDG. dBuV	QP LIMIT dBuV	AVG RDG dBuV	AVG LIMIT dBuV	NOTES
.195	52.7	63.8		53.8	
.259	46.5	61.5		51.5	
.323	44.9	59.6		49.6	
.451	44.4	56.8		46.8	
.452	44.3	56.8		46.8	
.773	38.1	56.0		46.0	
.837	37.7	56.0		46.0	
1.094	37.3	56.0		46.0	
1.415	37.1	56.0		46.0	
1.736	36.8	56.0		46.0	
2.764	36.4	56.0		46.0	
2.828	36.2	56.0		46.0	
3.728	38.1	56.0		46.0	
4.049	37.0	56.0		46.0	
4.627	33.0	56.0		46.0	
6.297	31.1	60.0		50.0	
8.802	26.3	60.0		50.0	
12.208	26.3	60.0		50.0	
15.419	26.9	60.0		50.0	
17.669	25.3	60.0		50.0	
21.137	24.1	60.0		50.0	
23.837	24.5	60.0		50.0	
27.498	26.4	60.0		50.0	

CHECKED BY: M. Longino
M. LONGINO



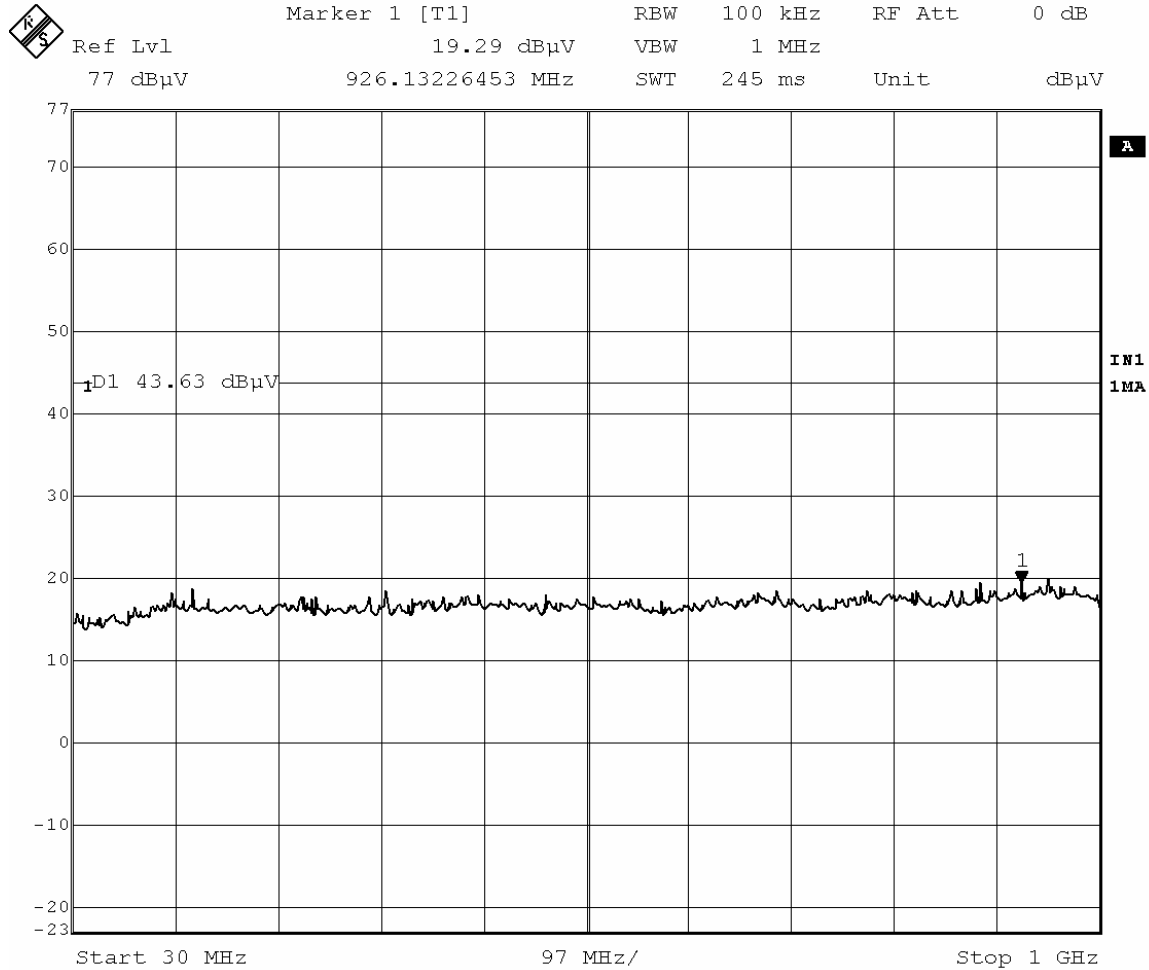
ETR No.
ELITE ELECTRONIC ENGINEERING CO.

MANUFACTURER : BECKWITH ELECTRIC
MODEL : M-2913 BLUEJAY WIRELESS
S/N : NONE ASSIGNED
SPECIFICATION : EN 55022, CLASS B
TEST : LINE CONDUCTED EMISSIONS
LINE TESTED : 115V, 60Hz RETURN
MODE : DESKTOP, M-2913 OPERATING
DATE : 7 Sep 2004
NOTES : SONY VAIO PCG-GRX500P
RECEIVER : HP 8566 w/ HP85650A QP ADAPTOR
VALUES MEASURED WITH QP DETECTOR USING 9kHz BANDWIDTH

FREQUENCY MHz	METER RDG. dBuV	QP LIMIT dBuV	AVG RDG dBuV	AVG LIMIT dBuV	NOTES
.194	52.6	63.8		53.8	
.258	45.4	61.5		51.5	
.451	44.4	56.9		46.9	
.773	37.8	56.0		46.0	
.837	37.1	56.0		46.0	
1.094	36.6	56.0		46.0	
2.122	36.1	56.0		46.0	
2.764	36.8	56.0		46.0	
3.727	39.0	56.0		46.0	
4.048	37.5	56.0		46.0	
4.691	33.1	56.0		46.0	
5.076	31.6	60.0		50.0	
8.160	27.6	60.0		50.0	
11.435	25.1	60.0		50.0	
14.070	27.7	60.0		50.0	
17.088	25.4	60.0		50.0	
20.558	24.3	60.0		50.0	
24.927	24.8	60.0		50.0	
27.174	25.9	60.0		50.0	

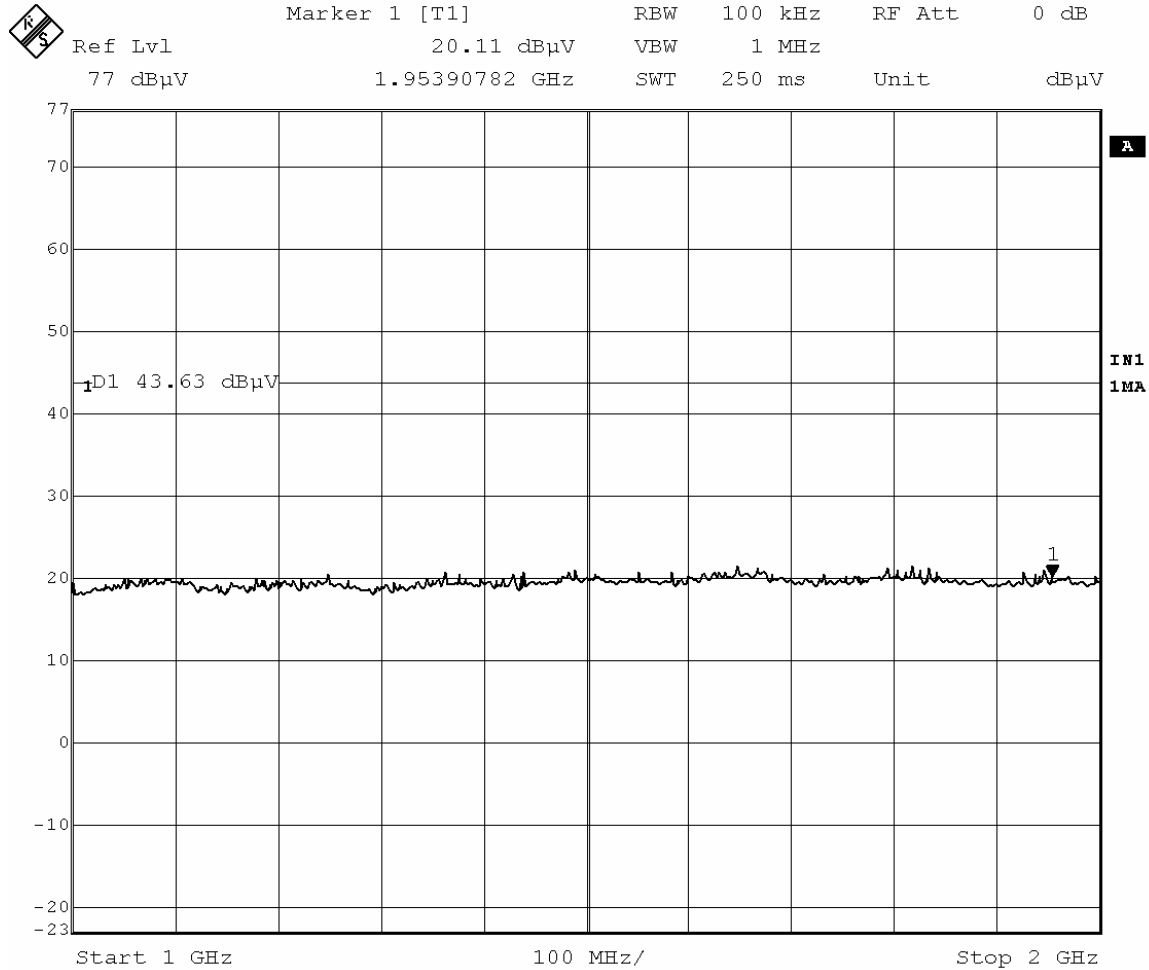
CHECKED BY:


M. LONGINOTTI



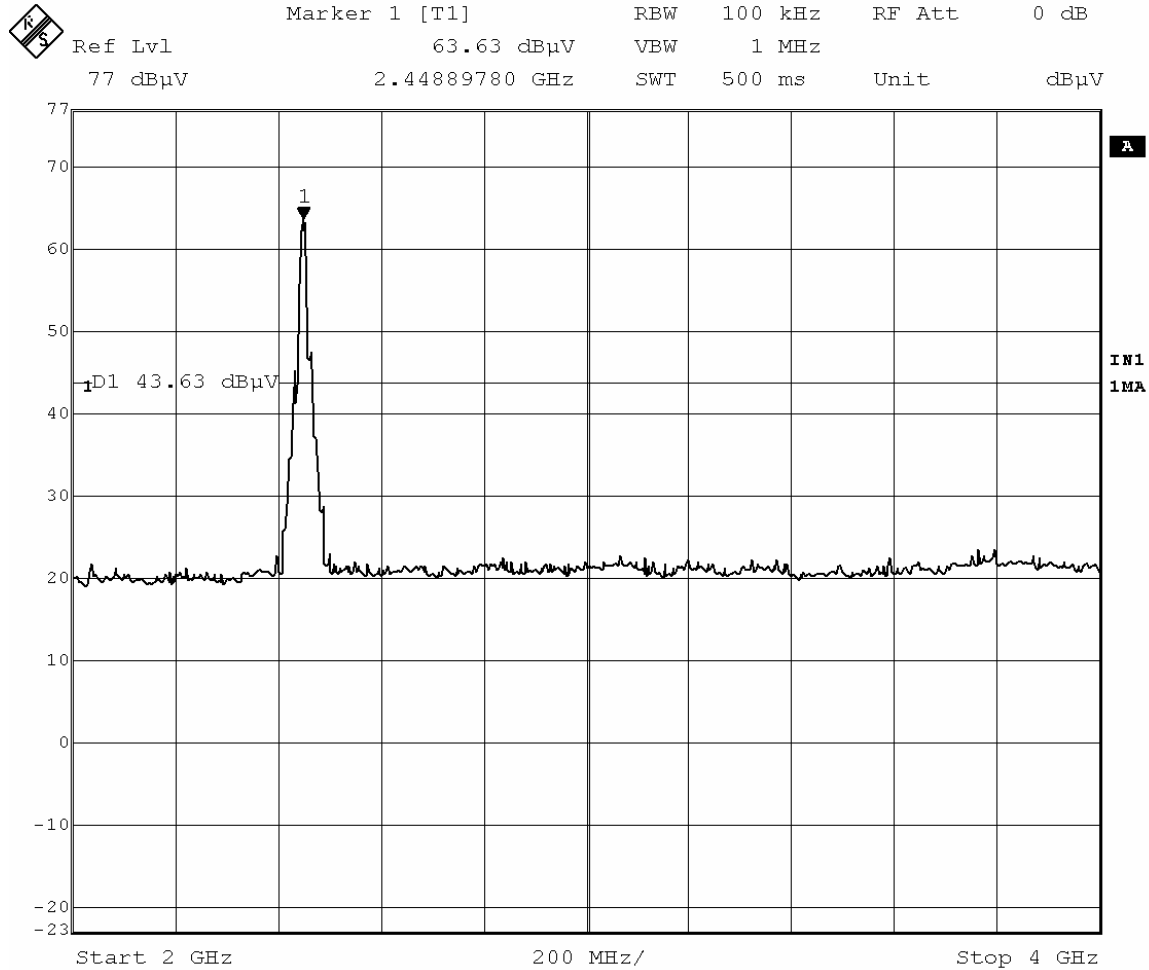
Date: 19.AUG.2004 16:09:01

Manufacturer : Beckwith Electric
Model No. : BlueJay Wireless M-2913
Serial No. : none assigned
SPECIFICATION : FCC-15.247(c) Antenna Conducted Emissions
DATE : August 19, 2004
NOTES : 50dB External Attenuation
: The display line indicates the 20dB down limit.



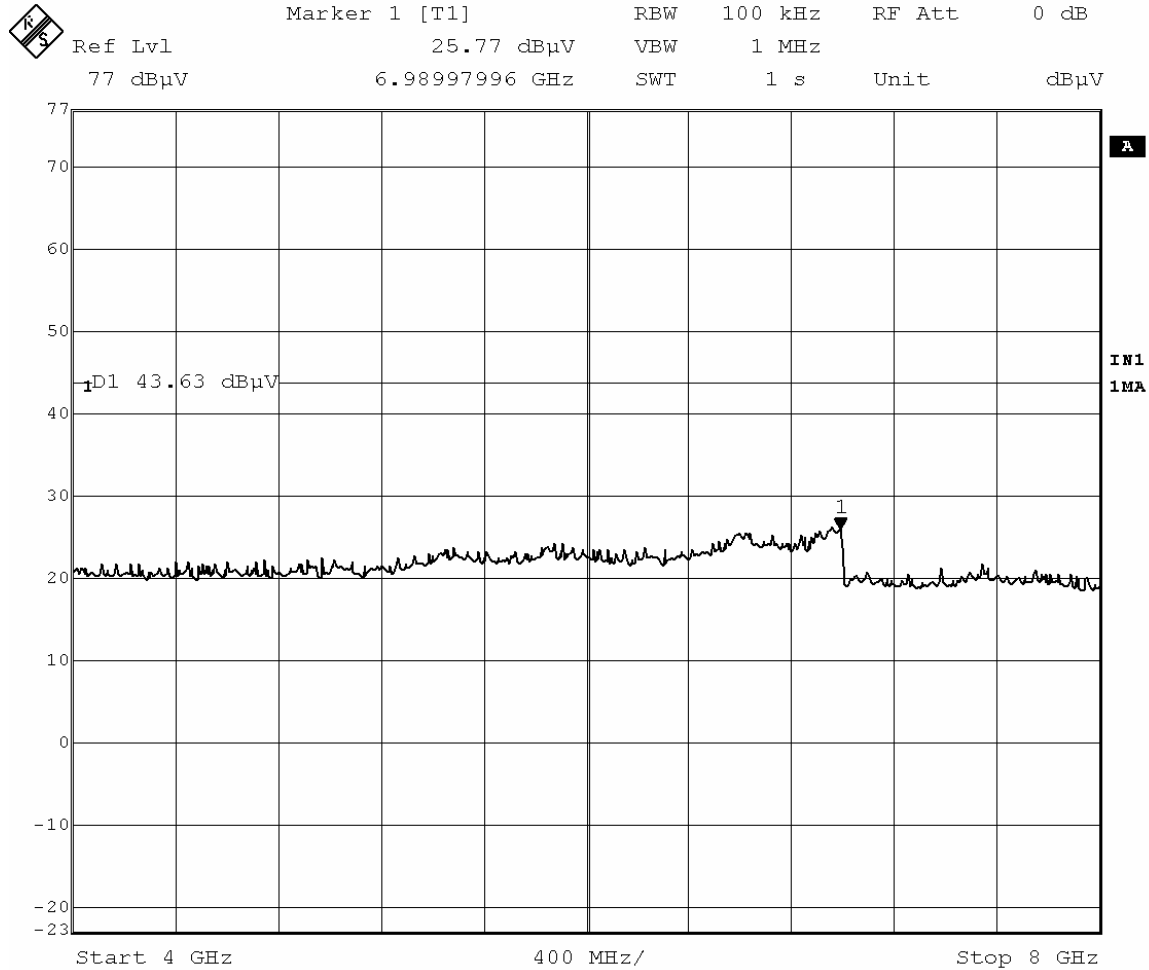
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Manufacturer : Beckwith Electric
Model No. : BlueJay Wireless M-2913
Serial No. : none assigned
SPECIFICATION : FCC-15.247(c) Antenna Conducted Emissions
DATE : August 19, 2004
NOTES : 50dB External Attenuation
: The display line indicates the 20dB down limit.



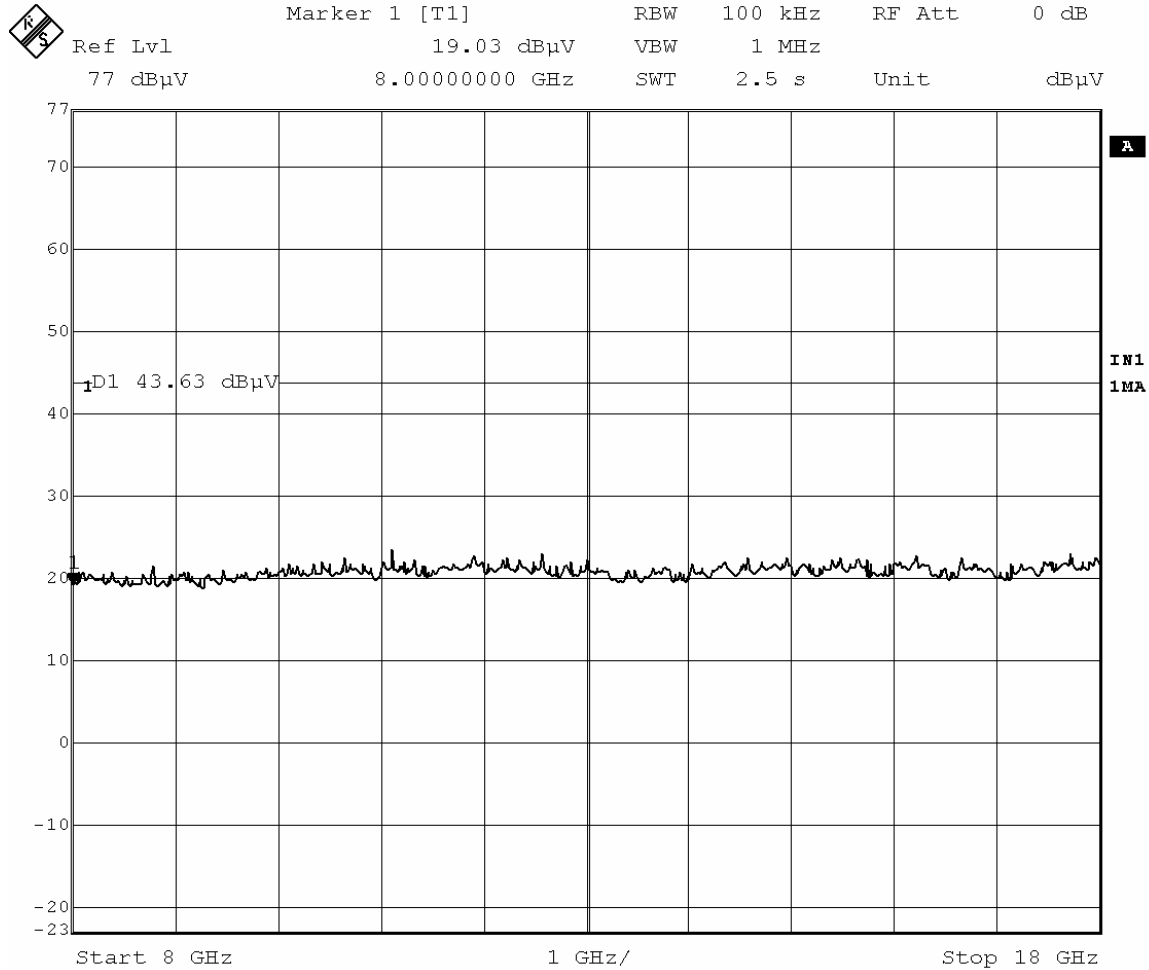
Date: 19.AUG.2004 15:58:28

Manufacturer : Beckwith Electric
Model No. : BlueJay Wireless M-2913
Serial No. : none assigned
SPECIFICATION : FCC-15.247(c) Antenna Conducted Emissions
DATE : August 19, 2004
NOTES : 50dB External Attenuation
: The display line indicates the 20dB down limit.



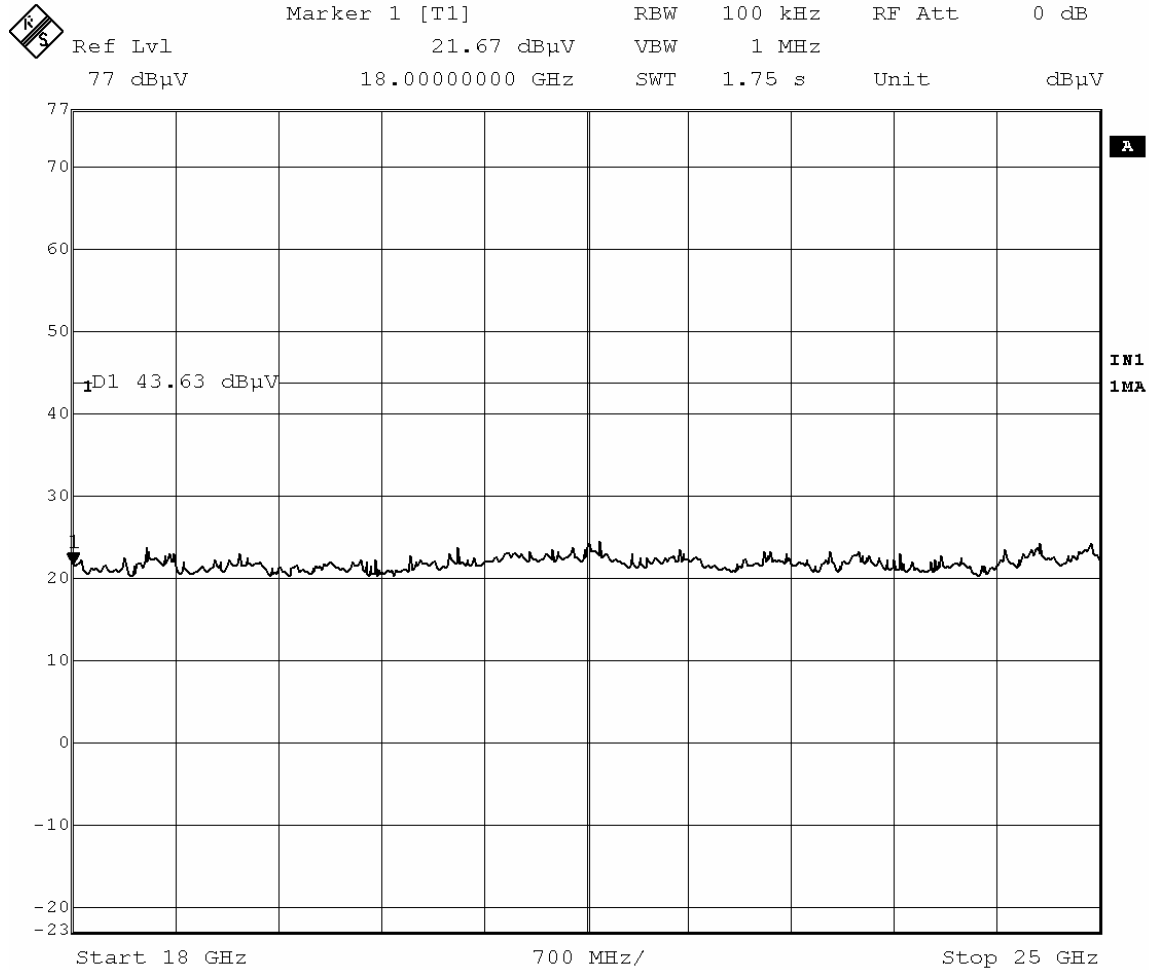
Date: 19.AUG.2004 16:14:20

Manufacturer : Beckwith Electric
Model No. : BlueJay Wireless M-2913
Serial No. : none assigned
SPECIFICATION : FCC-15.247(c) Antenna Conducted Emissions
DATE : August 19, 2004
NOTES : 50dB External Attenuation
: The display line indicates the 20dB down limit.



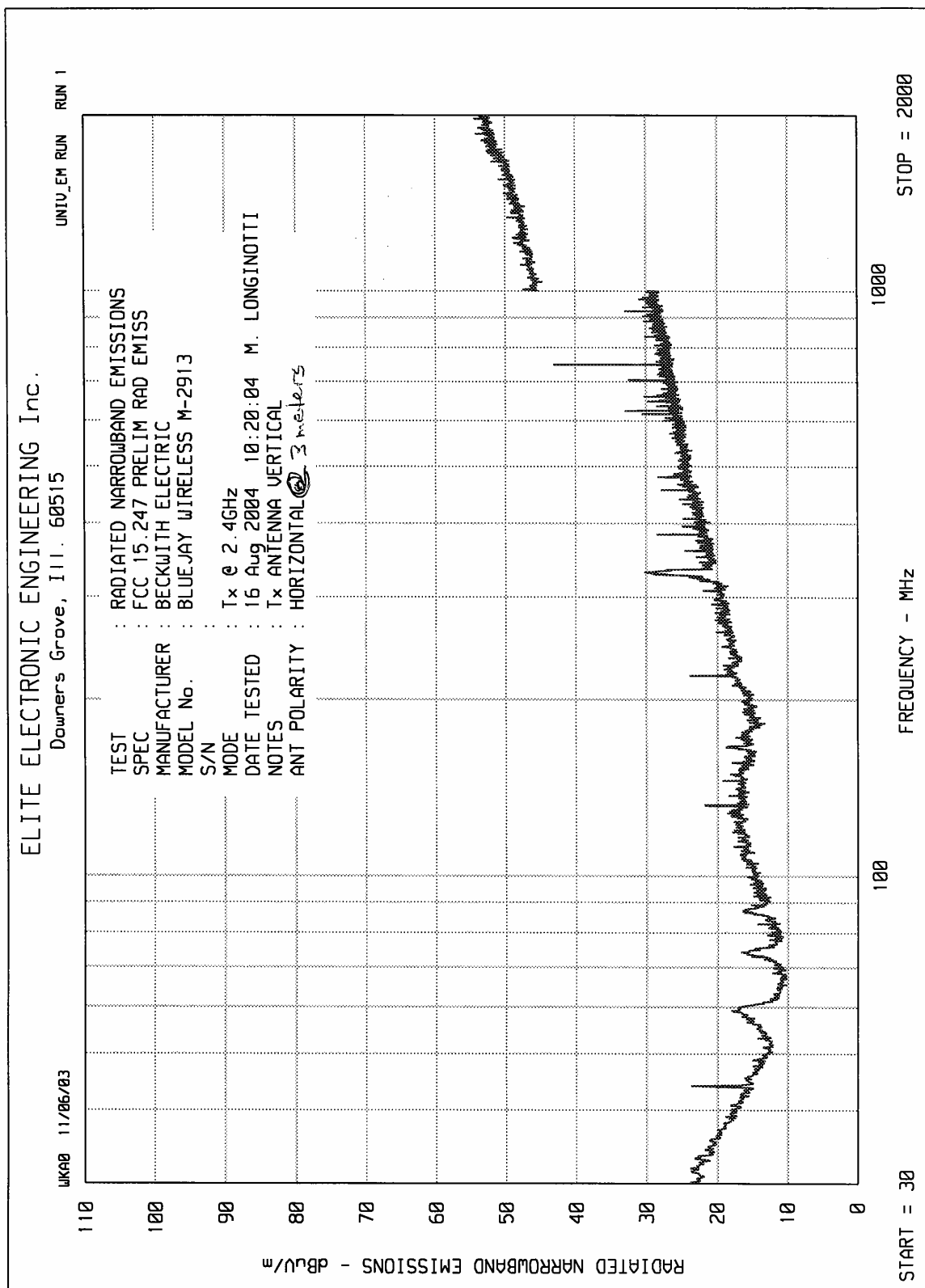
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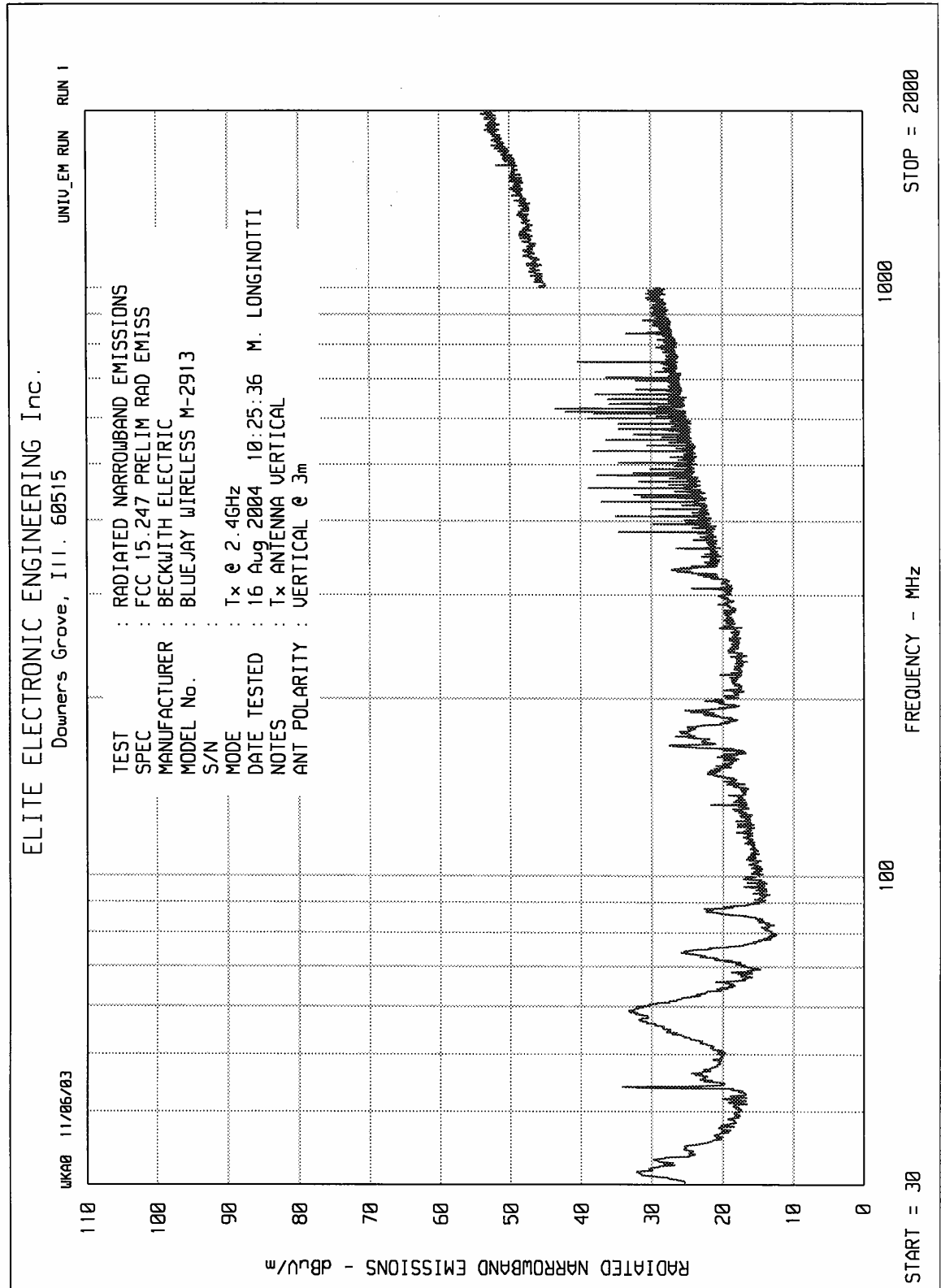
Manufacturer : Beckwith Electric
Model No. : BlueJay Wireless M-2913
Serial No. : none assigned
SPECIFICATION : FCC-15.247(c) Antenna Conducted Emissions
DATE : August 19, 2004
NOTES : 50dB External Attenuation
: The display line indicates the 20dB down limit.

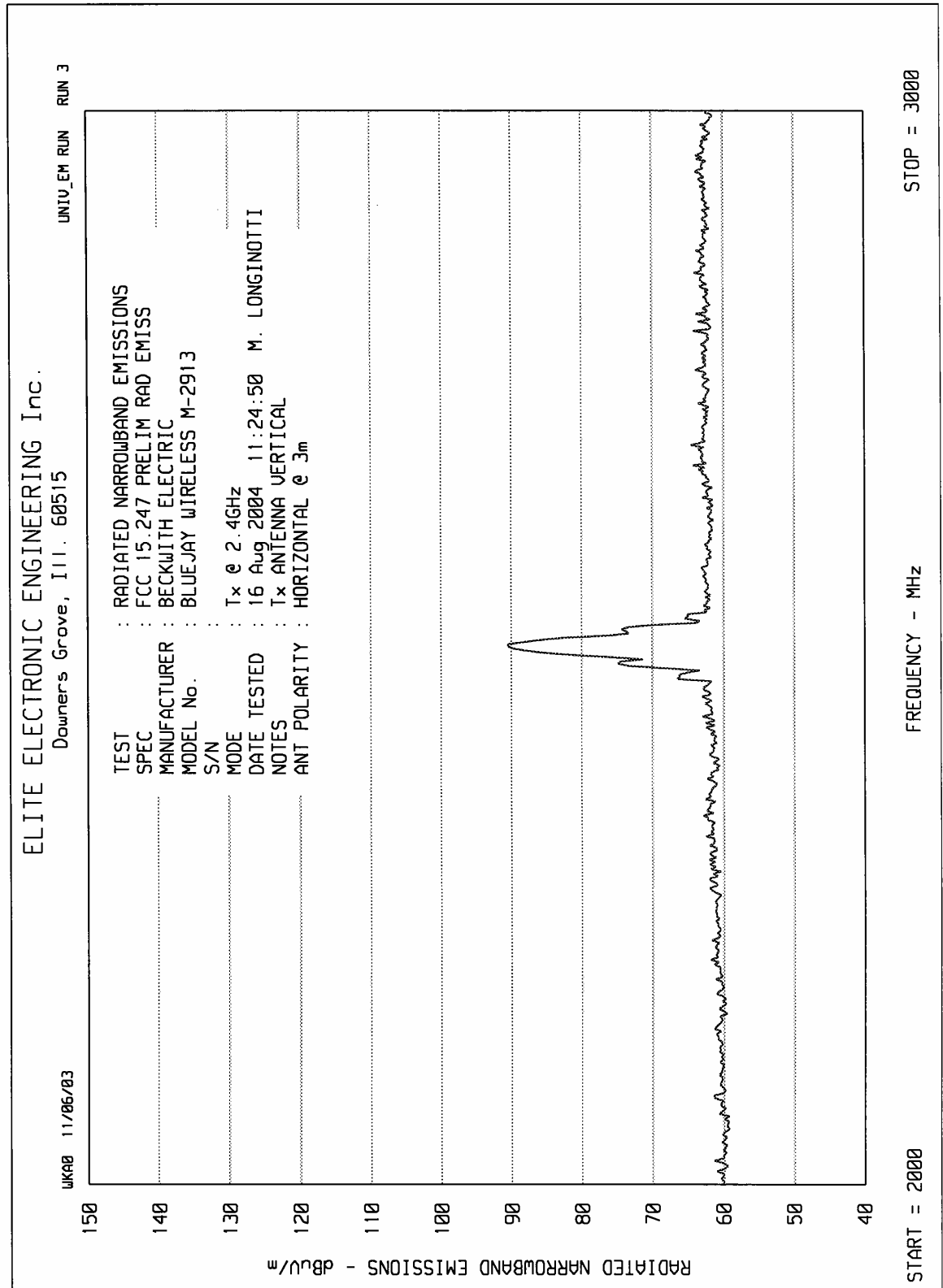


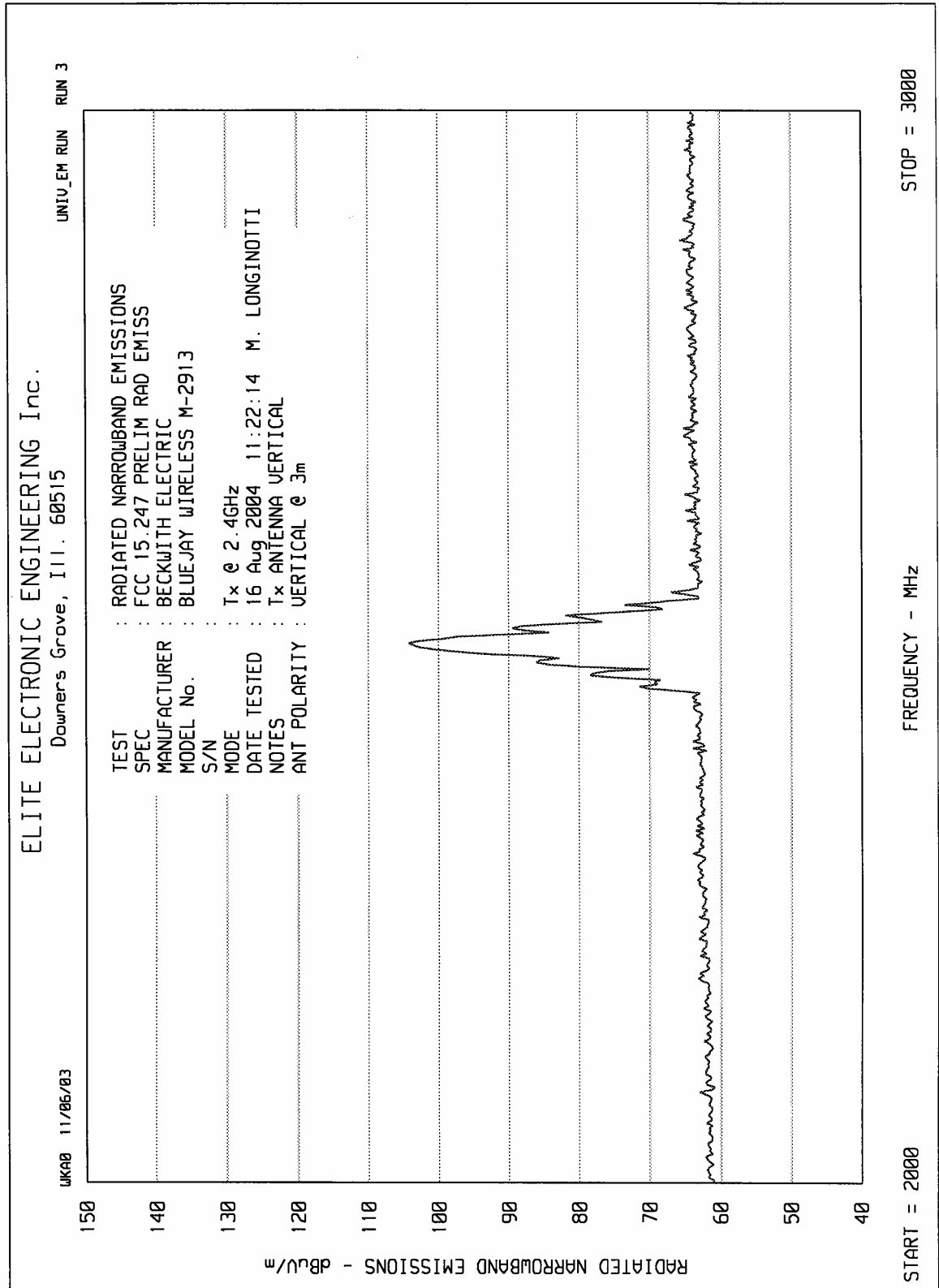
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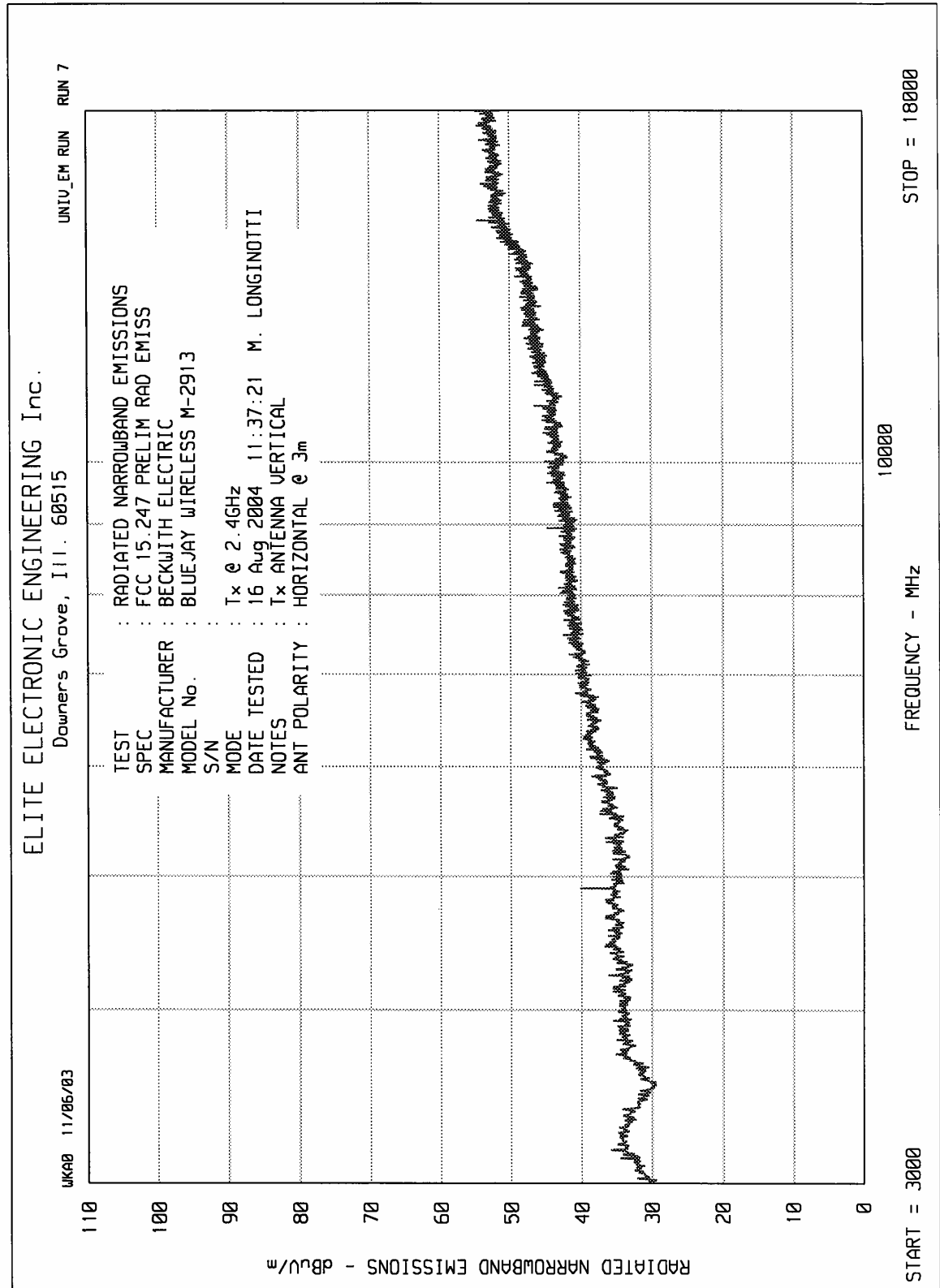
Manufacturer : Beckwith Electric
Model No. : BlueJay Wireless M-2913
Serial No. : none assigned
SPECIFICATION : FCC-15.247(c) Antenna Conducted Emissions
DATE : August 19, 2004
NOTES : 50dB External Attenuation
: The display line indicates the 20dB down limit.

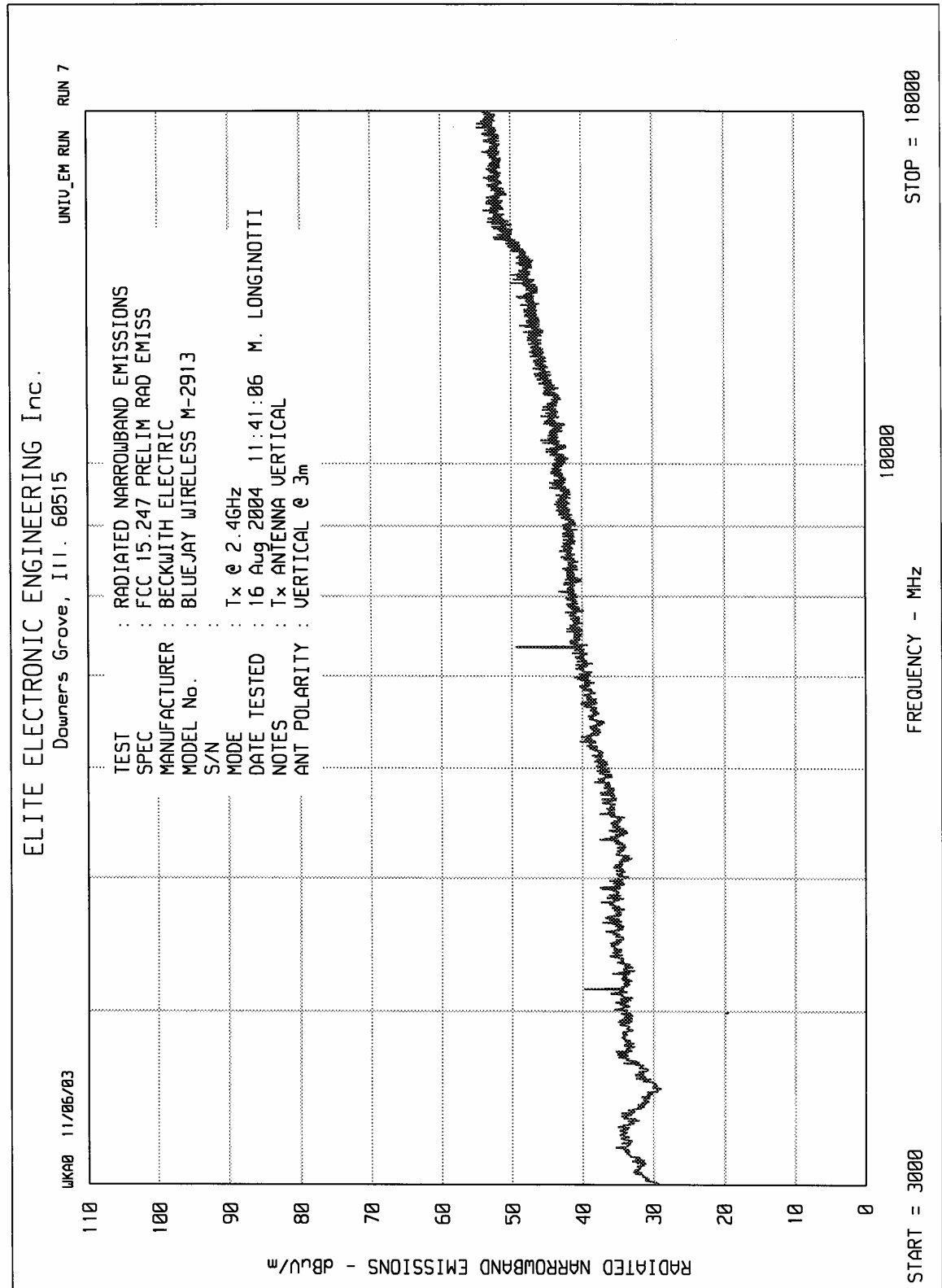














MANUFACTURER : Beckwith Electric
MODEL : BlueJay M-2913
SERIAL NO. : None Assigned
SPECIFICATION : FCC-15.247 Radiated Emissions
DATE : August 17, 2004
NOTES : Tx @ 2.45GHz
TEST DISTANCE : 3 meters

		MTR.		B. W. RBW/VB W	DIST. CORR	ANT.	CABLE	PRE.	15.209	
FREQ.	ANT.	RDG.	AMBIENT		FACT.	FACT.	LOSS	AMP.	TOTAL dBuV/ m	Limit
MHz	POL.	dBuV		Hz	dB	dB	dB	dB		dBuV/m
408.01	V	18.4		100k/1M	---	16.9	1.5	---	36.8	46.0
408.01	H	13.1		100k/1M	---	16.9	1.5	---	31.5	46.0
612.03	V	19.4		100k/1M	---	19.9	1.7	---	41.0	46.0
612.03	H	11.4		100k/1M	---	19.9	1.7	---	33.0	46.0

Checked By: *Mark E Longinoth*

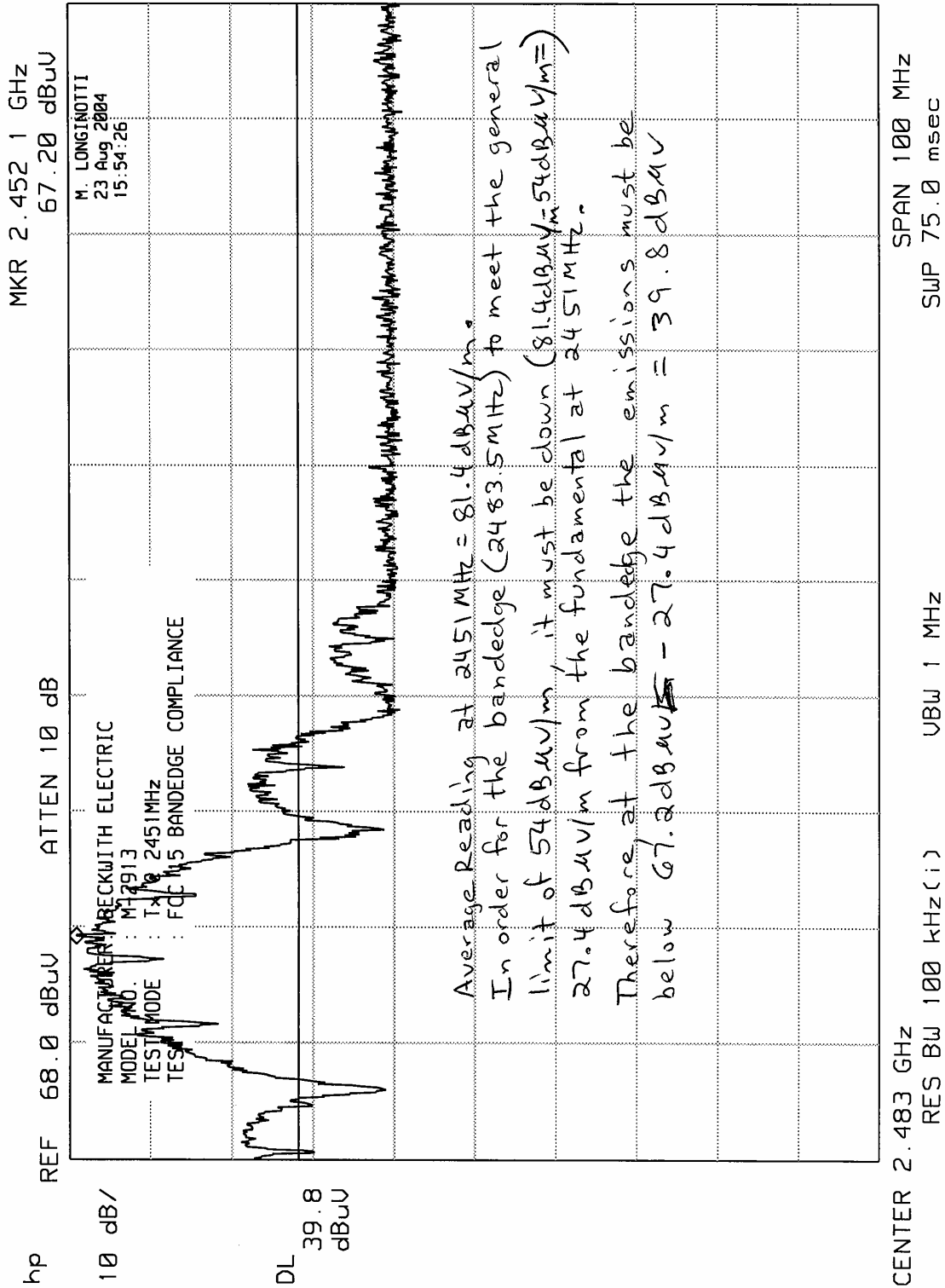


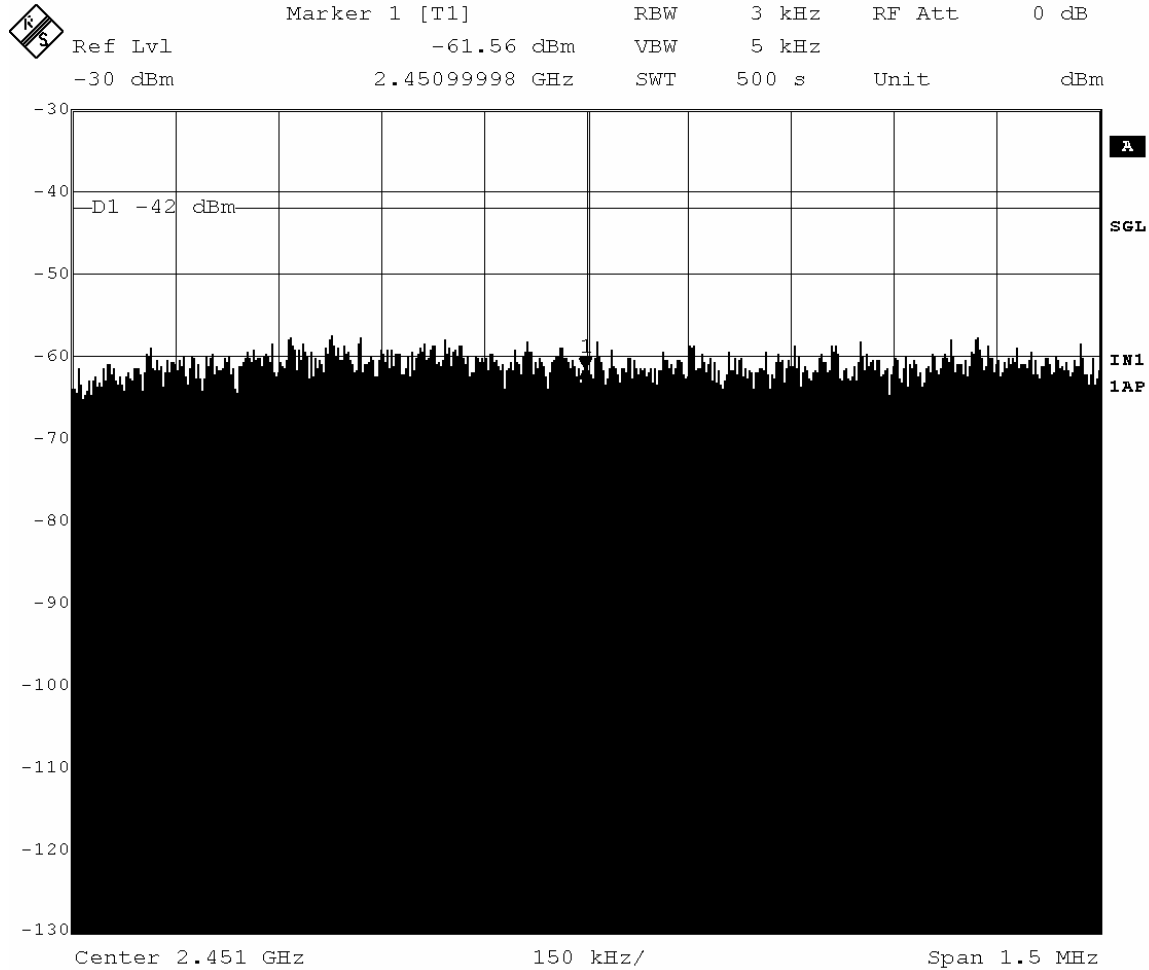
MANUFACTURER : Beckwith Electric
MODEL : BlueJay M-2913
SERIAL NO. : None Assigned
SPECIFICATION : FCC-15.247 Radiated Emissions
DATE : August 17, 2004
NOTES : Tx @ 2.45GHz
TEST DISTANCE : 3 meters

FREQ.	ANT.	MTR.		B. W.	DIST.	ANT.	CABLE	PRE.		15.209
RDG.				RBW/VB	CORR					
dBuV	POL.	dBuV	AMBIENT	W	FACT.	FACT.	LOSS	AMP.	TOTAL	Limit
MHz				Hz	dB	dB	dB	dB	dBuV/ m	dBuV/m
4902	V	32.1		1M/10		35.1	0.6	-36	31.8	54
4902	H	32.5		1M/10		35.1	0.6	-36	32.2	54
7353	V	45.3		1M/10	-9.5	38.3	0.8	-36	38.9	54
7353	H	35.8		1M/10	-9.5	38.3	0.8	-36	29.4	54
12255	V	29.9		1M/10	-9.5	40.3	1.1	-36.2	25.6	54
12255	H	30.6		1M/10	-9.5	40.3	1.1	-36.2	26.3	54
19608	V	34.9	AMBIENT	1M/10	-9.5	45.8	3.9	-35.6	39.5	54
19608	H	34.9	AMBIENT	1M/10	-9.5	45.8	3.9	-35.6	39.5	54
22059	V	35.9	AMBIENT	1M/10	-9.5	46.4	5.1	-35.9	42	54
22059	H	35.9	AMBIENT	1M/10	-9.5	46.4	5.1	-35.9	42	54

Checked By: *Mark E Longinoth*

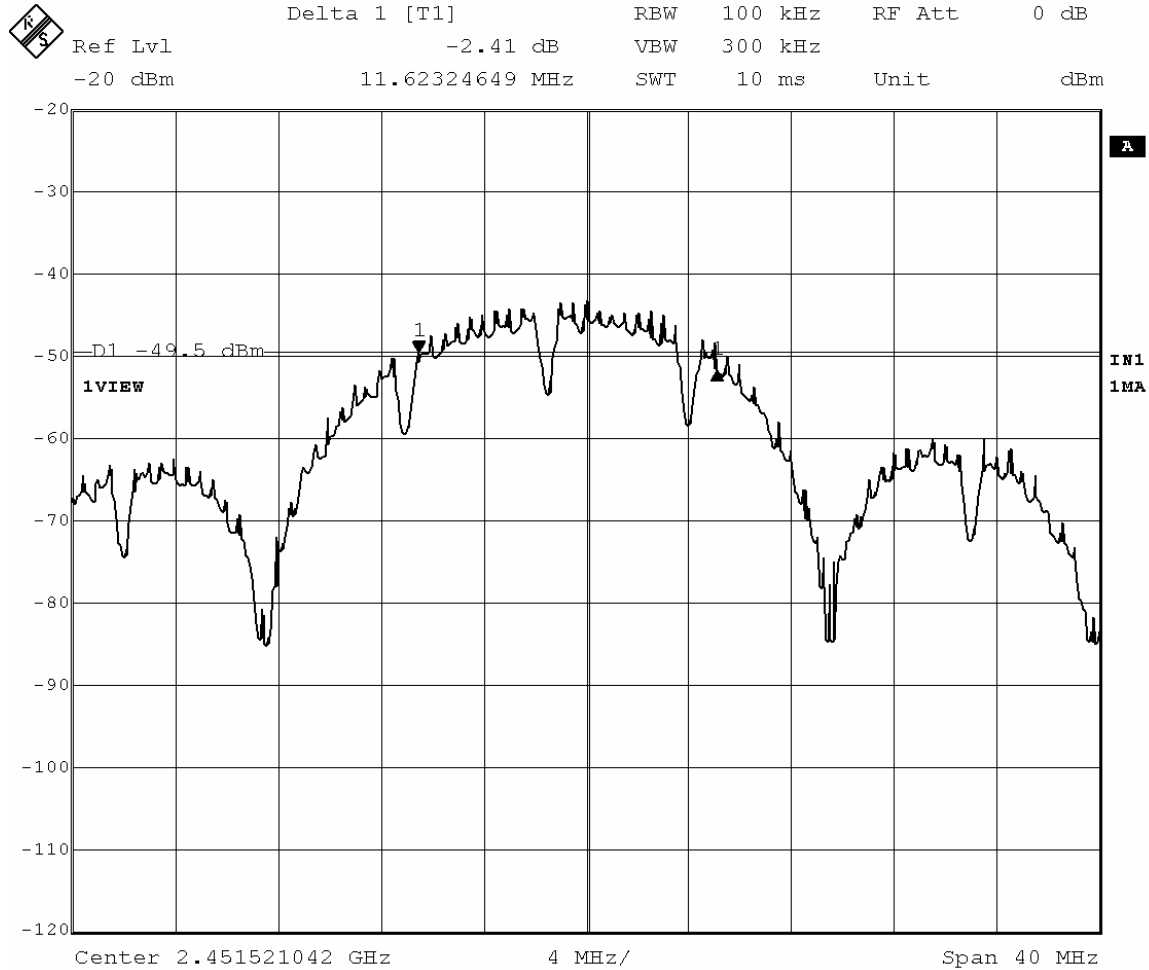
ELITE ELECTRONIC ENGINEERING Inc.





Date: 20.AUG.2004 10:57:12

Manufacturer : Beckwith Electric
Model No. : BlueJay Wireless M-2913
Serial No. : none assigned
SPECIFICATION : FCC-15.247(d) Power Spectral Density
DATE : August 20, 2004
NOTES : 50dB External Attenuation
: The display line indicates the +8dBm limit



Date: 19.AUG.2004 14:28:13

Manufacturer : Beckwith Electric
Model No. : BlueJay Wireless M-2913
Serial No. : none assigned
Test : FCC 15.247 (a)(2) 6dB Bandwidth
Test Mode : Tx @ 2415MHz
Date : August 19, 2004
Notes : 50 dB of external attenuation used.



Manufacturer : Beckwith Electric
Model No. : BlueJay Wireless M-2913
Serial No. : none assigned
Test : FCC 15.247 (a)(3) Output Power
Test Mode : Tx @ 2415MHz
Date : August 20, 2004
Notes : 50 dB of external attenuation used.

Frequenc y MHz	Meter Reading mV	Meter Reading Squared (mV) ²
2423.5	0.132	0.017424
2424.5	0.107	0.011449
2425.5	0.091	0.008281
2426.5	0.082	0.006724
2427.5	0.075	0.005625
2428.5	0.098	0.009604
2429.5	0.129	0.016641
2430.5	0.153	0.023409
2431.5	0.277	0.076729
2432.5	0.364	0.132496
2433.5	0.396	0.156816
2434.5	0.364	0.132496
2435.5	0.339	0.114921
2436.5	0.281	0.078961
2437.5	0.273	0.074529
2438.5	0.208	0.043264
2439.5	0.294	0.086436
2440.5	0.402	0.161604
2441.5	0.582	0.338724
2442.5	1.05	1.1025
2443.5	1.44	2.0736
2444.5	1.75	3.0625
2445.5	2.09	4.3681
2446.5	2.09	4.3681
2447.5	2.43	5.9049
2448.5	2.68	7.1824
2449.5	2.63	6.9169
2450.5	2.77	7.6729
2451.5	2.94	8.6436
2452.5	2.77	7.6729
2453.5	2.63	6.9169
2454.5	2.59	6.7081
2455.5	2.37	5.6169
2456.5	1.78	3.1684
2457.5	1.44	2.0736
2458.5	0.793	0.628849
2459.5	0.768	0.589824
2460.5	0.633	0.400689
2461.5	0.447	0.199809
2462.5	0.447	0.199809
2463.5	0.452	0.204304
2464.5	0.465	0.216225
2465.5	0.536	0.287296
2466.5	0.554	0.306916
2467.5	0.471	0.221841
2468.5	0.37	0.1369
2469.5	0.217	0.047089
2470.5	0.189	0.035721
2471.5	0.141	0.019881
2472.5	0.123	0.015129
2473.5	0.127	0.016129



Manufacturer : Beckwith Electric
Model No. : BlueJay Wireless M-2913
Serial No. : none assigned
Test : FCC 15.247 (a)(3) Output Power
Test Mode : Tx @ 2415MHz
Date : August 20, 2004
Notes : 50 dB of external attenuation used.

$$\sum_{n=1}^{n=50} (V_n)^2 = 88.47484 \text{ (mV)}^2 = 88.47 \times 10^{-6} \text{ V}^2$$

and

$$P = (1/50) \sum_{n=1}^{n=50} (V_n)^2 ; \text{ for a 50 ohm system}$$

Solving for P

$$P = (1/50 \text{ ohms}) \times (88.47 \times 10^{-6} \text{ V}^2) = 1.769 \times 10^{-6} \text{ W} = .001769 \text{ mW} = -27.5 \text{ dBm}$$

Taking into account the 50dB of External Attenuation:

$$P = -27.5\text{dBm} + 50\text{dB external attenuation} = 22.5 \text{ dBm}$$

Therefore the output power is:

$$P = 22.5 \text{ dBm} = 177 \text{ mW}$$

Checked By:

Mark E Longinoth