

TEST REPORT

Report Number: 3099998-001
Project Number: 3099998
7/21/2006

Evaluation of the Unbridled CB Radio
Model Number: RS50827
FCC ID: JOFRS50827

FCC Part 2
FCC Part 15 Subpart B
FCC Part 95 Subpart D

For

Radio Sound

Test Performed by:

Intertek
731 Enterprise Drive
Lexington, KY 40510

Test Authorized by:

Radio Sound
1713 Cobalt Drive
Louisville, KY 40299

Prepared By: Jason Centers **Date:** 7/21/2006
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Bryan C. Taylor, EMC Team Leader



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1 EXECUTIVE SUMMARY

Testing performed for: Radio Sound

Equipment Under Test: RS50827

FCC RULE	DESCRIPTION OF TEST	RESULT	PAGE
§2.1046, §95.639	RF Power Output	Passed	11
§2.1047, §95.637	Modulation Characteristics	Passed	12
§2.1049 §95.633(a)	Occupied Bandwidth	Passed	15
§2.1051, §95.635	Spurious Emissions at Antenna Terminals	Passed	18
§2.1053, §95.635	Field Strength of Spurious Radiation	Passed	20
§2.1055, §95.625(b)	Frequency Stability	Passed	22
§15.107	Power Line Conducted Emissions	NA ¹	24
§15.109	Receiver Spurious Emissions	Passed	25
§15.111	Antenna Power Conducted Limits for Receivers	Passed	30

N/S: Not under scope of this evaluation

¹ The RS50827 did not have any AC power leads.

2 JOB DESCRIPTION**2.1 Client information**

The Unbridled CB Radio has been tested at the request of

Company: Radio Sound
1713 Cobalt Drive
Louisville, KY 40299

Name of contact: Eric Weber
Telephone: (502)-267-6768
Fax: (502)-267-6794

2.2 Test plan reference:

Tests were performed to the following standards:

- FCC Part 2
- FCC Part 15 Subpart B
- FCC Part 95 Subpart D

The test procedures described in this test report and ANSI C63.4: 2003 and EIA/TIA 603B were employed.

2.3 Equipment Under Test (EUT)

Radio Sound, Incorporated Model **RS50827** is an AM-only (A3E), 40 channel, Citizen’s Band transceiver for use with FCC Rules Part 95, Subpart D. The unit consists of a transceiver module enclosed in aluminum extrusion case. This module is designed for professional installation (eg factory/dealer) in a motorcycle. No user interface (controls or display) is incorporated in the unit. All CB transceiver functions are operated via remotely located (motorcycle handlebar) controls. There are no control buttons on the transceiver. The display of an external AM/FM entertainment system is used for the display function. A single interface connector on the transceiver provides lines for control data, receive and transmit audio, and power. A separate connector (SO-239) is provided on the transceiver for connection to the antenna. The transceiver is designed to operate with common commercially available citizens band antennas having a nominal impedance of 50 ohms.

Product	Unbridled CB Radio
EUT Model Number	RS50827
EUT Serial Number	Not Labeled
Whether quantity (>1) production is planned	Quantity production is planned.
Type(s) of Emission	A3E
RF Output Power	3.93 W
Frequency Range	Channel 1 (26.965 MHz) – Channel 40 (27.405 MHz)
Antenna & Gain	Standard ¼ wave CB antenna with approximately 50 Ohm Impedance
Detachable Antenna ?	Yes
External input	<input checked="" type="checkbox"/> Audio <input type="checkbox"/> Digital Data

EUT receive date: 6/21/2006
 EUT receive condition: The EUT was received in good condition with no apparent damage.
 Test start date: 6/21/2006
 Test completion date: 6/23/2006

The test results in this report pertain only to the item tested.

2.3.1 System Support Equipment

Table 2-1 contains the details of the support equipment associated with the Equipment Under Test during the FCC testing.

Table 2-1: System Support Equipment

Description	Manufacturer	Part Number	Serial Number	FCC ID number
Main Radio Controller	Radio Sound	4011257	15	None
XM Radio	Radio Sound	4011267	6	None

2.3.2 Cables associated with EUT

Table 2-2 contains the details of the cables associated with the EUT.

Table 2-2: Interconnecting cables between modules of EUT

Cables					
Description	Length	Shielding	Ferrites	Connection	
				From	To
12 AWG DC Power Cable	6 ft	None	None	DC Power Supply	CB Power Input
FM Radio Antenna Cable	7 ft	Coax	None	FM Radio Antenna Port	FM Antenna
Main Electrical Wiring Harness	6 ft	Yes	None	Wiring Harness Connections on Radio	Four Speakers and Control Switches

2.3.3 Justification

The EUT was operated in the stand-alone configuration.

2.3.4 Mode(s) of operation

The Unbridled CB Radio was powered by an external variable DC power supply during all testing. The appropriate tests were performed with the Unbridled CB Radio transmitting in the citizens band, with the FM radio set to receive, and with the weather band radio set to receive.

2.4 Modifications required for compliance

No modifications were implemented by Intertek.

2.5 Related Submittal(s) Grants

None

3 TEST FACILITY

The INTERTEK-Lexington is located at 731 Enterprise Drive, Lexington Kentucky, 40510. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1: 1993 and ANSI C63.4: 1992. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters.

For radiated immunity testing, removable ferrite tiles are positioned between the transmitting antenna and the area occupied by the equipment under test. The remaining tests typically are performed outside the chamber on the conducting ground reference plane.



The Industry Canada filing number for this site is 2055. The FCC registration number is 485103. The VCCI registration numbers are R-2056, C-2214, and T-195.

3.1 Test Equipment

The following test equipment was used for the evaluation.

Description	Manufacturer	Model Number	Serial Number	Calibration due date
Modulation Analyzer	HP	8901A	2142A01663	2/26/07
Signal Generator	HP	83620B	3614A00199	8/17/06
Synthesizer	HP	3325A	2801A02016	6/10/07
Test Receiver	Rohde & Schwarz	ESI26	1088.7490.26	8/16/07
Tunable Notch Filter	Eagle	411-5FNM	None	6/13/07
Bilog Antenna	ETS	3142C	00051864	11/30/06
Loop Antenna	EMCO	6502	3416	1/20/07
Environmental Chamber	Thermotron	SM-8C	32692	1/13/07

4 RF POWER OUTPUT

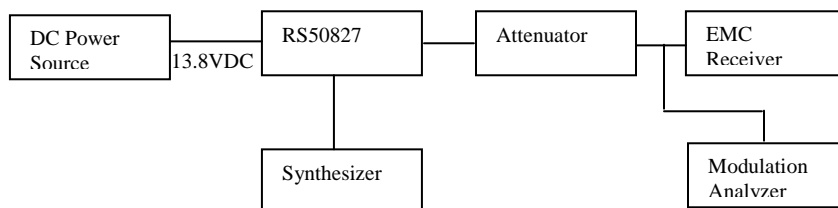
FCC §2.1046, §95.639

4.1 Test Procedure

The transmitter output was connected to a calibrated coaxial cable, the other end of which was connected through a 20 dB attenuator to an EMC receiver. The transmitter was keyed and the output power at the EMC receiver was recorded. The RF output power at the antenna terminal was then determined by adding the insertion loss of the attenuator and cable to the receiver reading.

Tests were performed at center frequency of the band and on the highest power levels, which can be setup on the transmitter. Power measurements were made with an un-modulated carrier.

4.2 Block Diagram



4.3 Test Results

The Unbridled CB Radio met the RF power output requirements of FCC Part 2.1046 and 95.639. The test results are located in Table 4-1.

Table 4-1 RF Power Output

Measured Freq. (MHz)	Measured Power (dBm)	Measured Power (W)
27.205	35.94	3.93

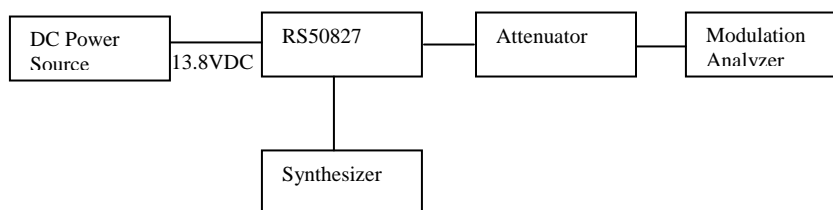
5 MODULATION CHARACTERISTICS

§2.1047, §95.637

5.1 Test Procedure

The CB antenna output connector was connected to an attenuator which was in turn connected to a modulation analyzer. The CB was then powered on and channel 20 was selected. A function generator / synthesizer was coupled to the microphone input, which was used to feed a modulating tone to the CB. The modulated input frequency was then varied from 100 Hz to 5 kHz and the percent modulation was recorded.. The modulating level was then varied from 0.005 Vrms to 10 Vrms at various input frequencies.

5.2 Block Diagram



5.3 Test Results

The Unbridled CB Radio met the requirements of FCC §2.1047 and §95.637. The Modulation vs. Frequency results are located in Figure 5-1. The Modulation vs. Voltage results are located in Figure 5-2. The graphical data presented show that the modulation percent is limited to below 100% in all cases.

Figure 5-1: Modulation Vs. Frequency

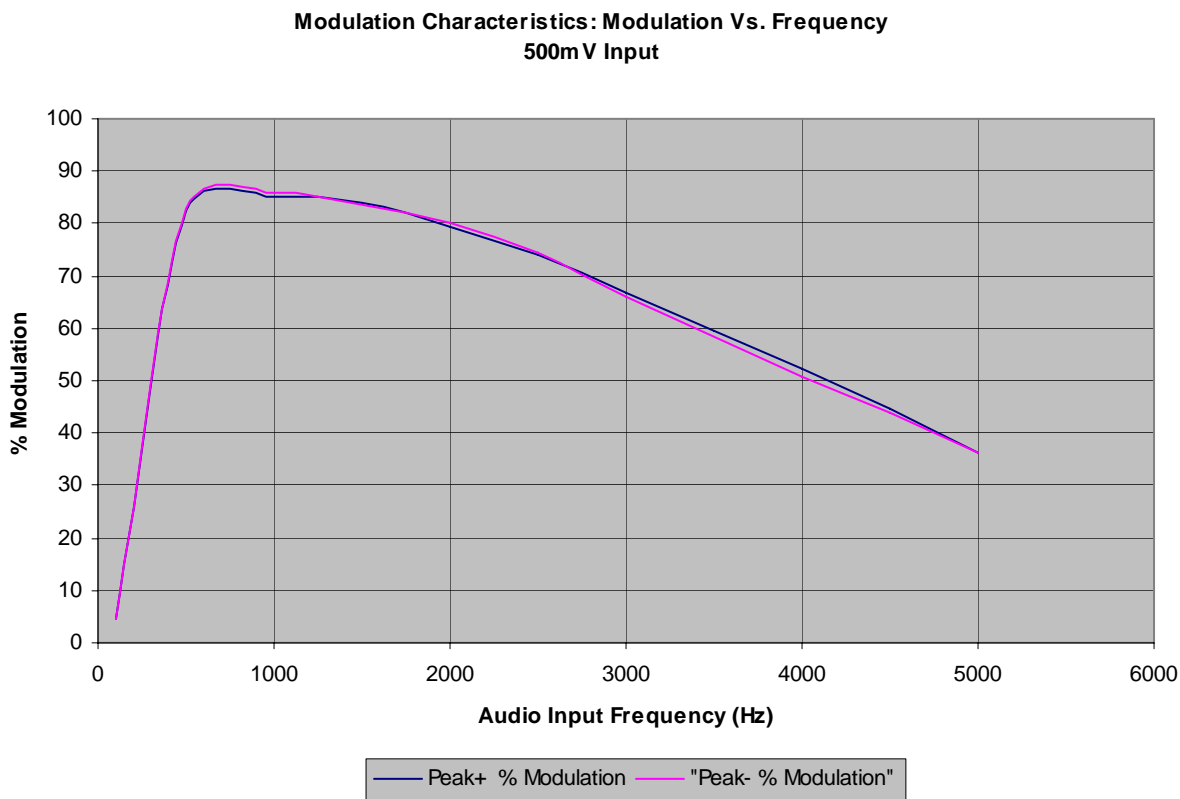
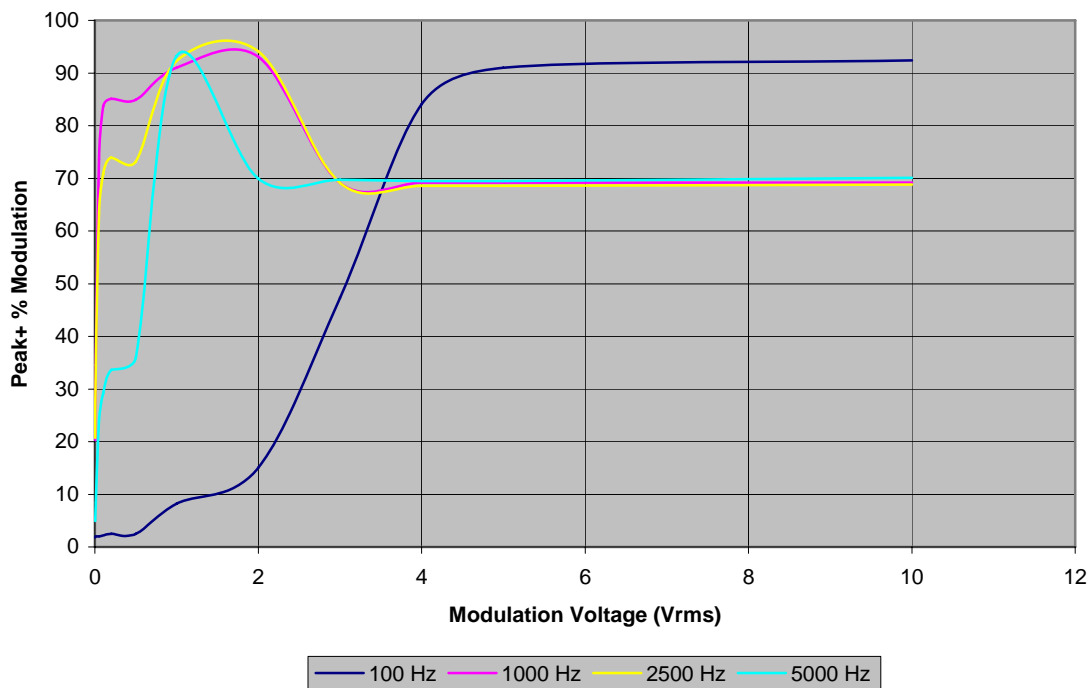


Figure 5-2: Modulation Vs. Voltage

Modulation Characteristics: Modulation Vs. Voltage



6 OCCUPIED BANDWIDTH

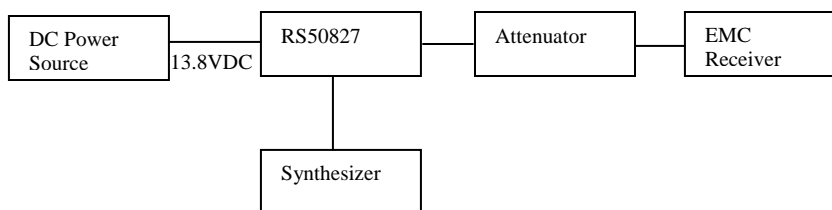
§2.1049, §95.633(a)

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

6.1 Test Procedure

The CB antenna output connector was connected to an attenuator which was connected to an EMC receiver. The CB was powered on and channel 20 was selected. The microphone was then keyed and subjected to a 2.5 kHz tone using a function generator which was coupled into the microphone input jack. The occupied bandwidth function of the EMC receiver was then used to generate plots of each configuration. This test was then performed on channel 20 under modulated and un-modulated conditions.

6.2 Block Diagram



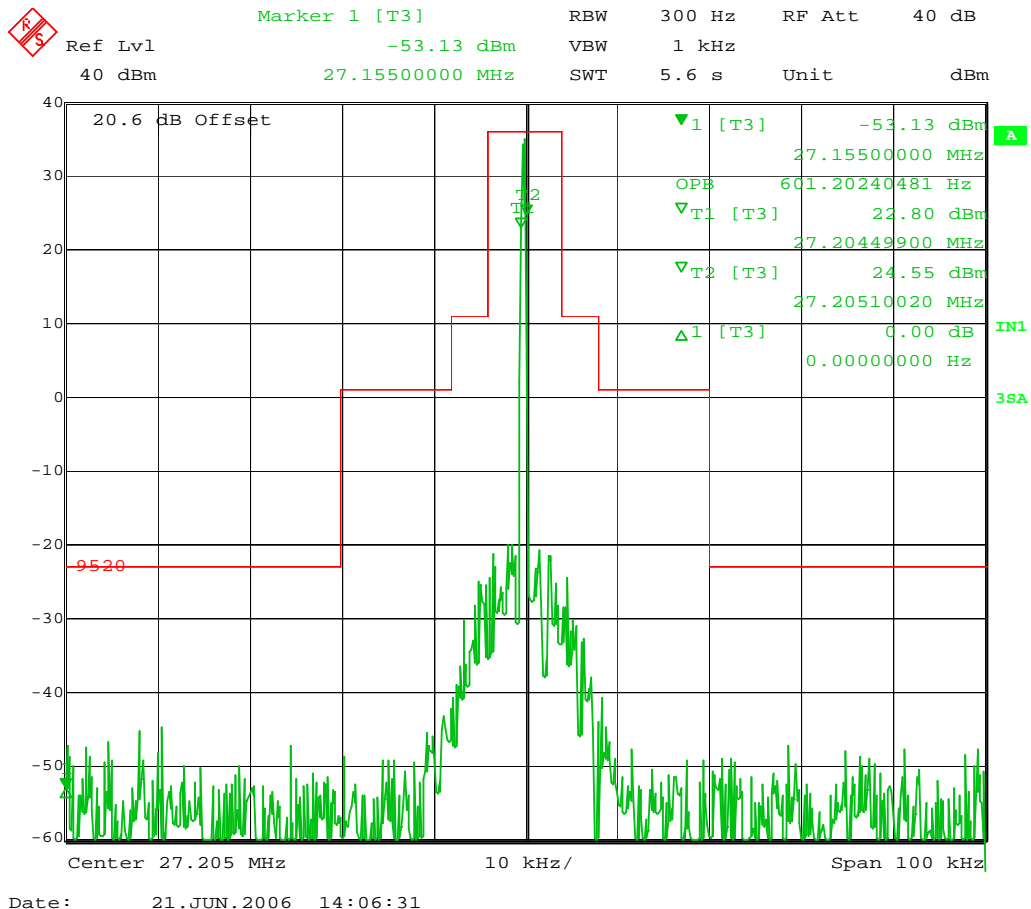
6.3 Test Results

The following is the occupied bandwidth data for the Unbridled CB Radio.

Table 6-1: Occupied bandwidth measurements

Mode	Channel	Resolution Bandwidth	Video Bandwidth	Sweep time	Measured Bandwidth
Un-Modulated	20	0.3 kHz	1 kHz	5.6 second	0.6012 kHz
2.5 kHz Tone	20	0.3 kHz	1 kHz	5.6 second	5.4108 kHz

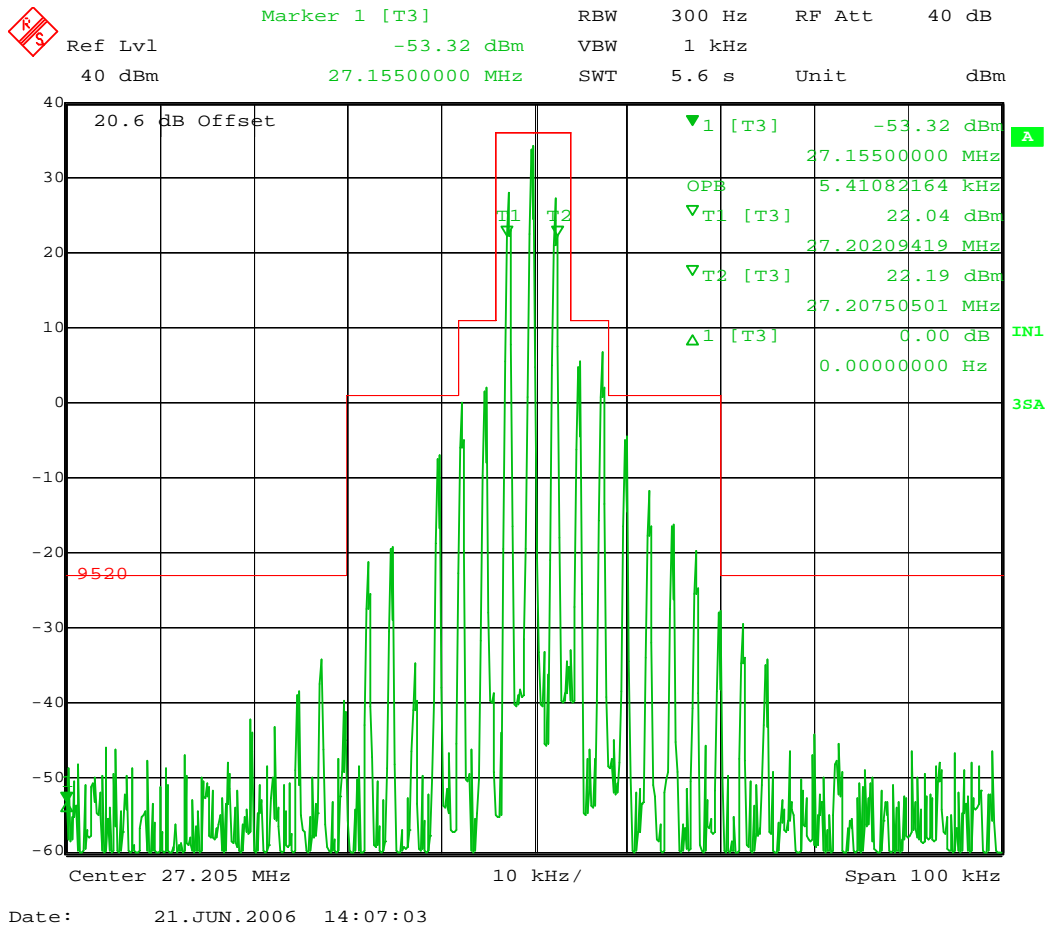
Figure 6-1: Occupied Bandwidth – Channel 20 Un-Modulated



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Figure 6-2: Occupied Bandwidth – Channel 20 Modulated with 2.5kHz Tone



7 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

FCC §2.1051

7.1 Test Procedure

This test was performed to show the magnitude of each spurious and harmonic emission that is detectable when the equipment is operated under the conditions specified in 2.1049. The CB antenna output connector was connected to an attenuator, which was in turn connected to an EMC receiver. The CB was powered on and channel 20 was selected. The microphone was then keyed and subjected to a 2.5 kHz tone using a function generator which was coupled into the microphone input jack. The spectrum was then captured up to the 10th harmonic of the fundamental.

For a CB transmitter, notes (1), (3), (8), and (9) of FCC §95.635(b) apply. These notes state that “the power of each unwanted emission shall be less than TP” by :

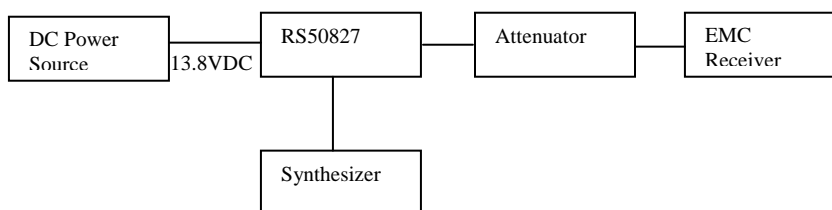
§95.635(b)(1): At least 25 dB (decibels) on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.

§95.635(b)(3): At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.

§95.635(b)(8): At least $53 + 10 \log_{10}(T)$ dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

§95.635(b)(9): At least 60 dB on any frequency twice or greater than twice the fundamental frequency.

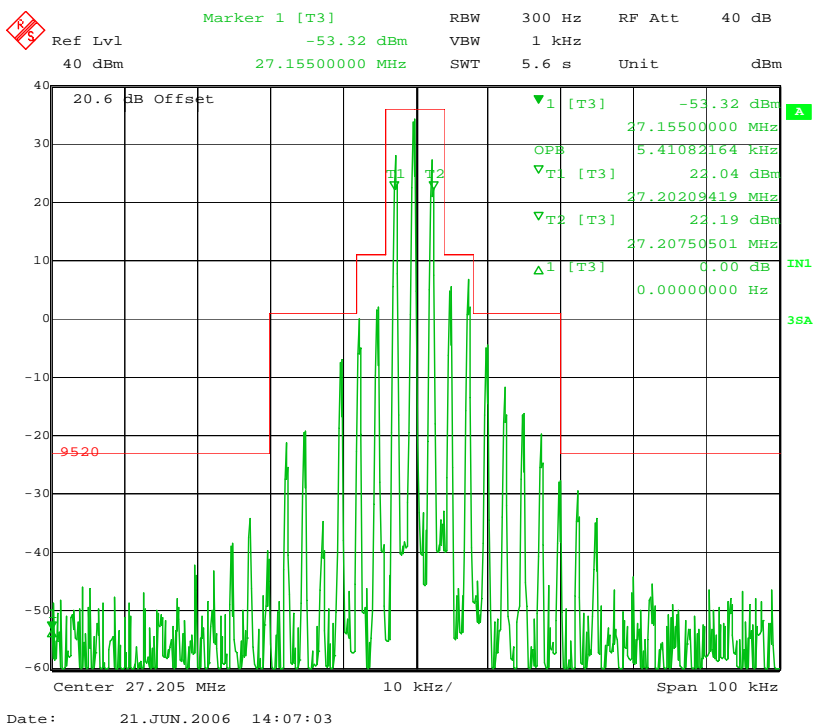
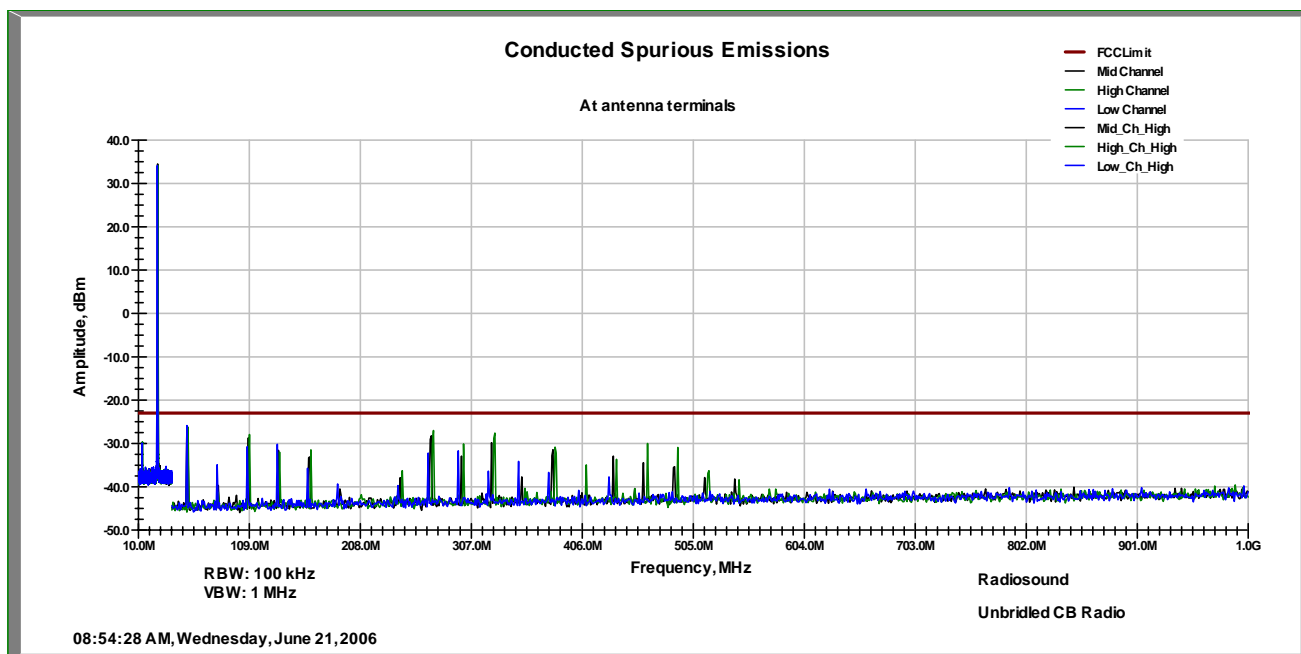
7.2 Block Diagram



7.3 Test Results

The Unbridled CB Radio met the out of band emission at antenna terminal requirements. None of the harmonics or spurious emissions at the antenna terminals exceeded the criteria stated in FCC Part §2.1051, FCC §95.635(a)(b) notes (1), (3), (8), and (9).

Figure 7-1: Spurious Emissions at Antenna Terminals – Channel 20



8 FIELD STRENGTH OF SPURIOUS RADIATION

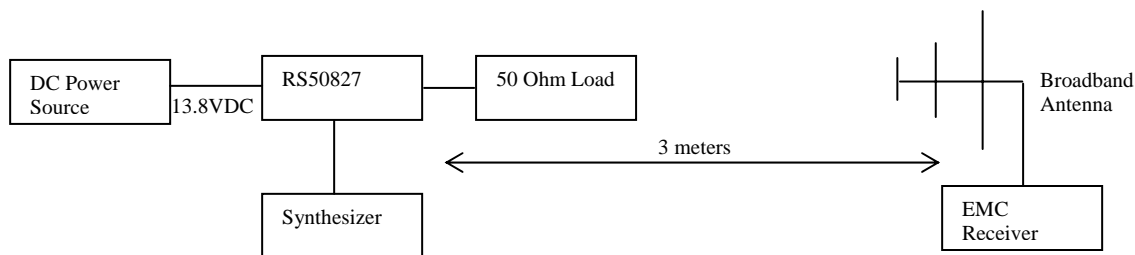
FCC §2.1053, §95.635

8.1 Test Procedure

The EUT was placed on a non-conductive 80 cm high turntable. During this test, the CB antenna port was terminated into a non-radiating 50 Ohm load. The four speakers were connected, as was the FM band receive antenna. All equipment was arranged on the 80 cm high table to closely resemble the geometry during actual installation on a motorcycle. The CB was powered and the microphone was keyed at channels 20.

The broadband measurement antenna was placed at a distance of 3 meters from the EUT. A bilog antenna was used from 30 MHz to 1 GHz. During the tests, the antenna height and EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The frequency range up to tenth harmonic was investigated.

8.2 Block Diagram



8.3 Test Results

The Unbridled CB Radio met the field strength of spurious radiation requirements of FCC §2.1053 and §95.635. All spurious emissions were attenuated below the transmitter power by at least the levels described in FCC Part §95.635(a)(b) notes (1), (3), (8), and (9). Radiated spurious emissions within 20dB of the limit are shown in Figure 8-1.

Figure 8-1: Field Strength of Spurious Radiation – Channel 20

TX Channel	Polarity	TX Frequency (MHz)	Device Reading (dBm)	Sub. Generator Reading (dBm)	Cable Loss (dB)	Tx Antenna Gain (dBi)	Tx Antenna Gain (dBd)	ERP (dBm)	Limit	Margin
20	V	136	-54.13	-34.1	0.92	1.4	-0.75	-35.77	-24	-11.77
20	V	272.1	-54.5	-28.6	1.3	1.5	-0.65	-30.55	-24	-6.55
20	V	299.3	-58.82	-32.2	1.36	1.9	-0.25	-33.81	-24	-9.81
20	V	326.5	-62.22	-35.7	1.44	1.9	-0.25	-37.39	-24	-13.39
20	V	462.5	-64.35	-34.5	1.71	2.2	0.05	-36.16	-24	-12.16
20	V	489.7	-56.07	-26.4	1.79	2.2	0.05	-28.14	-24	-4.14
20	V	516.9	-62.47	-32.1	1.82	2.1	-0.05	-33.97	-24	-9.97
20	H	136	-50.3	-30.6	0.92	1.7	-0.45	-31.97	-24	-7.97
20	H	272.1	-46.8	-23.2	1.3	1.8	-0.35	-24.85	-24	-0.85
20	H	299.3	-48.61	-25.6	1.36	1.7	-0.45	-27.41	-24	-3.41
20	H	326.5	-51.1	-27.6	1.44	1.8	-0.35	-29.39	-24	-5.39
20	H	462.5	-63.09	-34.2	1.71	2	-0.15	-36.06	-24	-12.06
20	H	489.7	-58.71	-30.2	1.79	1.9	-0.25	-32.24	-24	-8.24
20	H	516.9	-66.88	-37.5	1.82	1.8	-0.35	-39.67	-24	-15.67

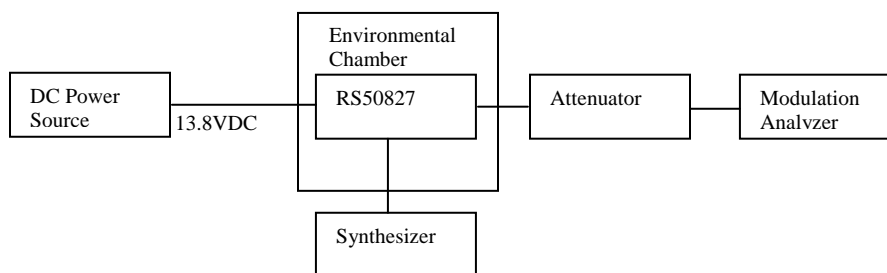
9 FREQUENCY STABILITY

§2.1055, §95.625(b)

9.1 Test Procedure

The CB was placed in an environmental chamber. All cables connecting to the CB were routed through a port in the side of the chamber. The CB antenna output connector was connected to an attenuator, which was in turn connected to the input of a modulation analyzer located outside the chamber. The CB was then powered on and channel 20 was selected. The microphone was then keyed and the frequency was then measured to determine compliance with the .005% frequency tolerance. The procedure was repeated while varying the temperature from -30 to +50 degrees Celsius using 10 degree increments. At 25 degrees the input DC voltage was varied from 85% to 115% of nominal and the frequency measured on channel 20.

9.2 Block Diagram



9.3 Test Results

In all cases shown below, the output frequency is well within the 0.005% tolerance required by FCC Part §2.1055 and §95.625(b) for CB transmitters.

Table 9-1 Frequency Stability vs. Temperature Data

Temperature (Celcius)	Measured Power (dBm)	Measured Freq. (MHz)	Delta (Hz)	Percent Error (%)
50	35.8	27.2048	-200	0.0007
40	35.75	27.2055	500	0.0018
30	35.85	27.205	0	0.0000
25	35.9	27.2052	200	0.0007
20	35.94	27.2051	100	0.0004
10	35.9	27.2049	-100	0.0004
0	35.92	27.205	0	0.0000
-10	35.91	27.205	0	0.0000
-20	35.81	27.2049	-100	0.0004
-30	35.63	27.2049	-100	0.0004

Table 9-2 Frequency Stability vs. Input Voltage Data

Power Supply (Vdc)	Temperature (Celcius)	Measured Power (dBm)	Measured Freq. (MHz)	Delta (Hz)	Percent Error (%)
11.73	25	35.9	27.2048	-200	0.0007
15.87	25	35.68	27.2048	-200	0.0007

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10 POWER LINE CONDUCTED EMISSIONS

FCC §15.107, FCC §15.207

10.1 Test Procedure

Not applicable.

10.2 Test Results

Not applicable. The Unbridled CB Radio did not have any AC power leads.

11 RECEIVER SPURIOUS EMISSIONS

FCC §15.109

11.1 Test Limits

Table 11-1 Radiated Emission Limit for FCC §15.109

Radiated Emission Limits at 3 meters	
Frequency (MHz)	Quasi-Peak limits, dB (µV/m)
25 to 30 ²	32.04
30 to 88	40.0
88 to 216	43.5
216 to 960	46.0
960 and up	54.0

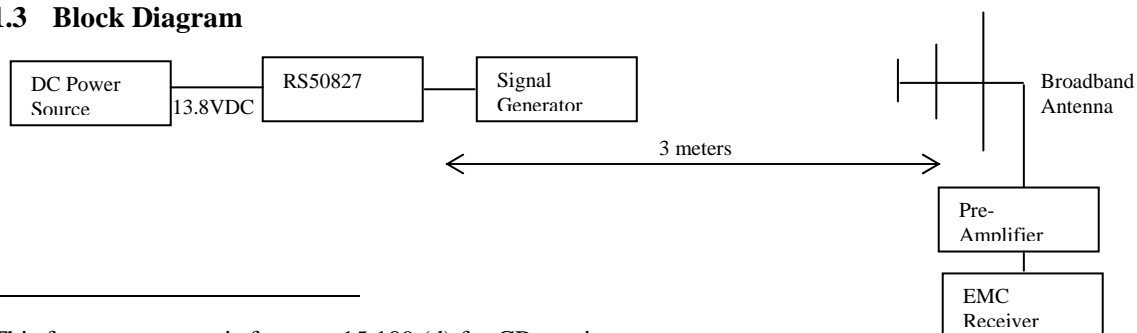
11.2 Test Procedure

Measurements were made over the frequency range of 25 MHz to five times the highest frequency operating within the device. The measuring receiver met the requirements of Section One of CISPR 16 and the measuring antenna was correlated to a balanced dipole. From 25 to 1000 MHz, a quasi-peak detector was used for measurement. Above 1000 MHz, average measurements were performed.

Measurements of the radiated field were made with the antenna located at a distance of 3 meters from the EUT and in vertical and horizontal polarities. The EUT was rotated from 0 to 360 degrees and the antenna adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The EUT was placed on a non-conductive 80 cm high turntable. During this test, the CB antenna port was connected to a signal generator. A signal generator was used to supply the receiver tested with a CW signal at the tuned frequency with a level of -60 dBm so that all the circuitry would operate in receive mode. The four speakers were connected, as was the FM band receive antenna. All equipment was arranged on the 80 cm high table to closely resemble the geometry during actual installation on a motorcycle. The test was performed with the CB in receive mode on channel 20. The FM receiver tested tuned to the high, mid, and low channels in the FM band. The weather band receiver was tuned to the middle channel in the WB band.

11.3 Block Diagram



² This frequency range is for part 15.109 (d) for CB receivers.

11.4 Test Results

The Unbridled CB Radio met the radiated disturbance requirements of FCC §15.109. The maximized quasi peak data and graphical results for the CB, FM and WB receivers can be found in Figure 11-2 through Figure 11-7.

Figure 11-1 FCC §15.109 Maximized Quasi Peak and Average Emissions – FM Receiver

Frequency (MHz)	Polarity (H/V)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Azimuth (deg)	Tower (cm)	Results
273.7 MHz	H	1.34	12.87	37.33	46.02	-8.69	172	1	Compliant (Low Ch.)
801.8 MHz	H	2.38	21.93	37.22	46.02	-8.8	317	1	Compliant (Low Ch.)
273.65 MHz	H	1.34	12.87	38.24	46.02	-7.78	163	1	Compliant (Mid Ch.)
801.81 MHz	H	2.38	21.93	37.37	46.02	-8.65	311	1	Compliant (Mid Ch.)
273.65 MHz	H	1.34	12.87	33.61	46.02	-12.41	152	1	Compliant (High Ch.)
801.81 MHz	H	2.38	21.93	37.24	46.02	-8.78	236	1	Compliant (High Ch.)

Figure 11-2 FCC §15.109 Worse Case Receiver Spurious Emission (25 – 30 MHz) – CB Channel 20

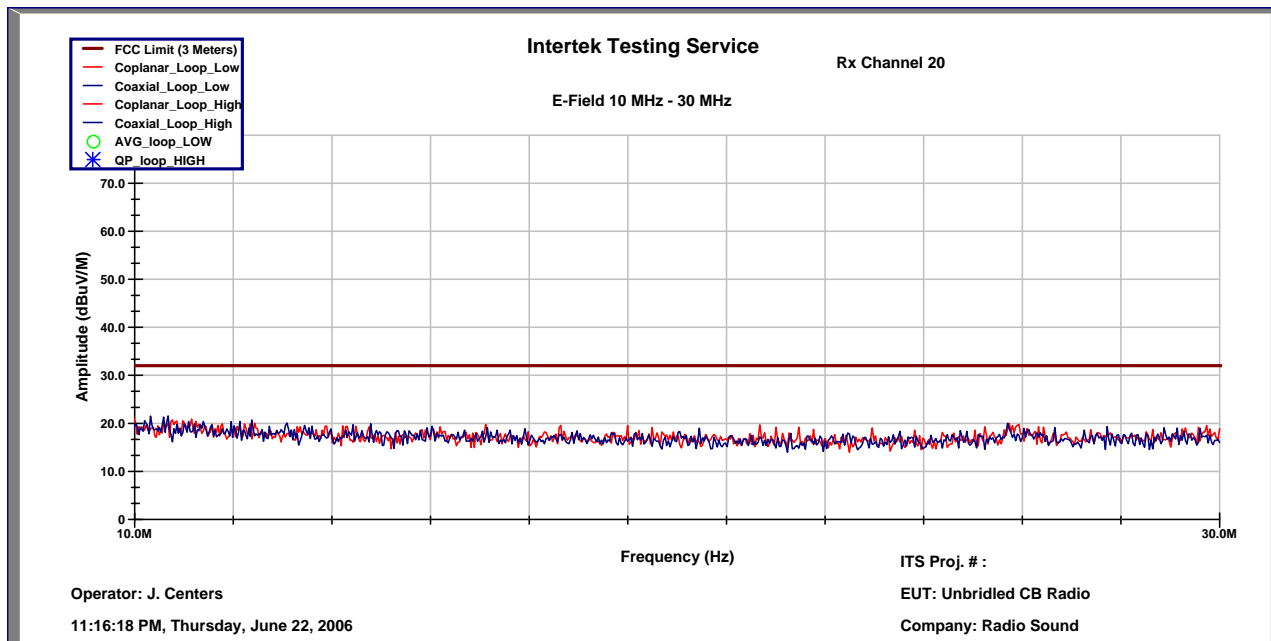


Figure 11-3 FCC §15.109 Worse Case Receiver Spurious Emission (30-1000 MHz) – FM Low Channel

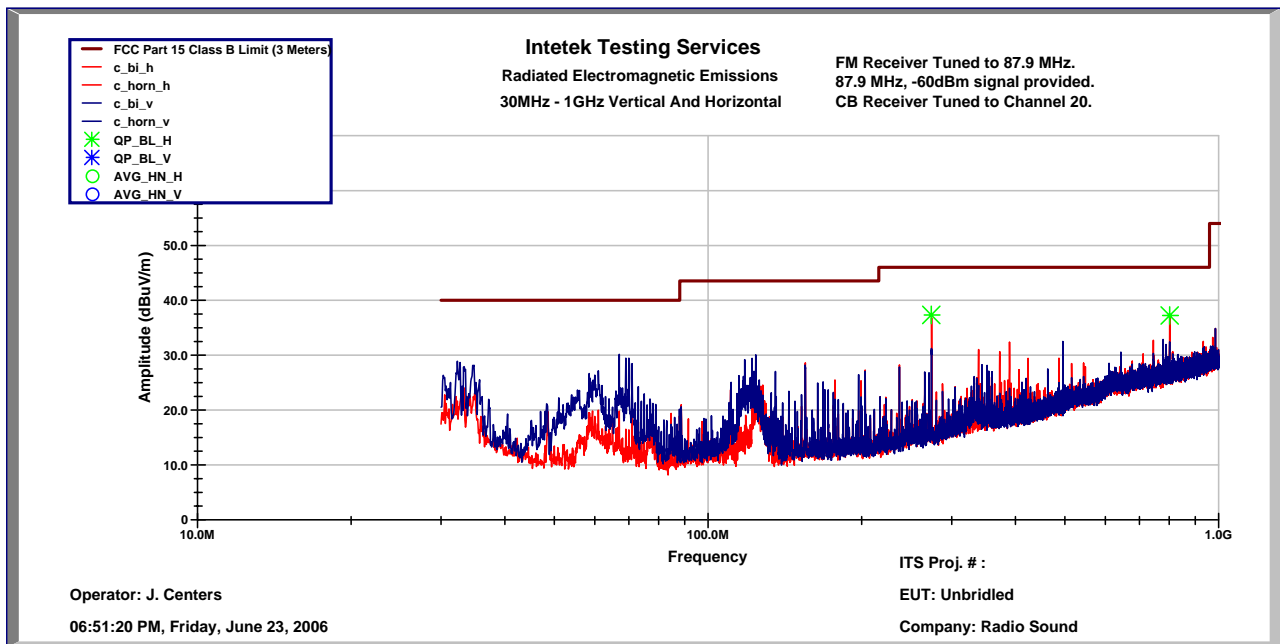
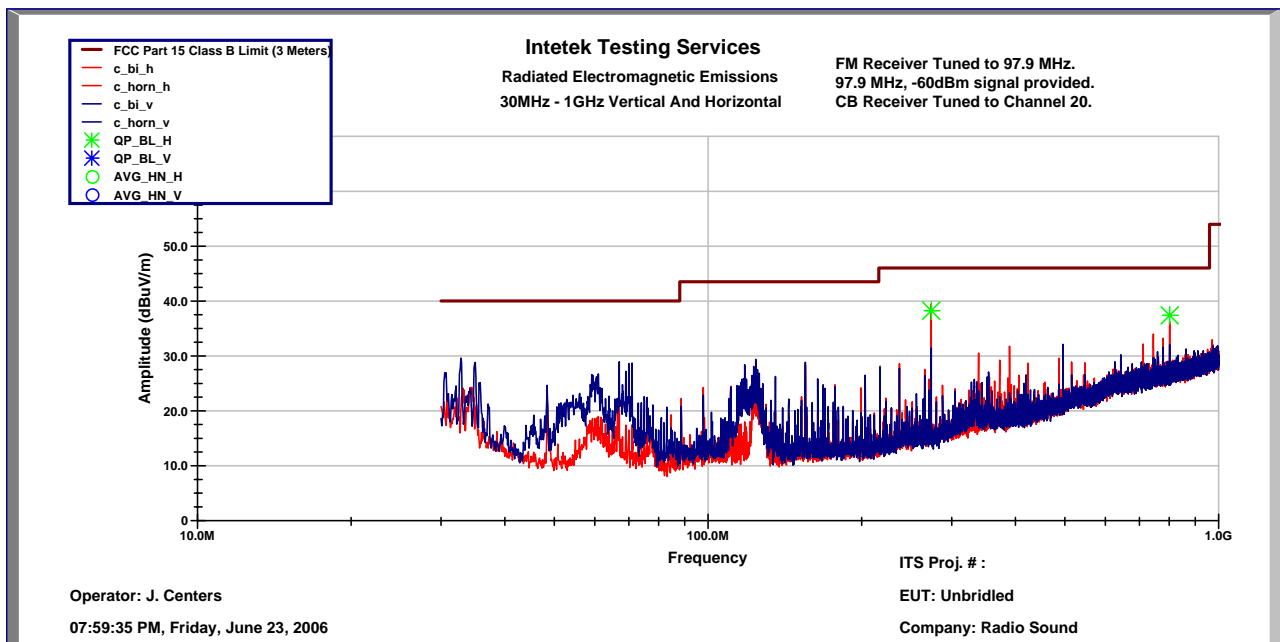


Figure 11-4 FCC §15.109 Worse Case Receiver Spurious Emission (30-1000 MHz) – FM Mid Channel



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Figure 11-5 FCC §15.109 Worse Case Receiver Spurious Emission (30-1000 MHz) – FM High Channel.

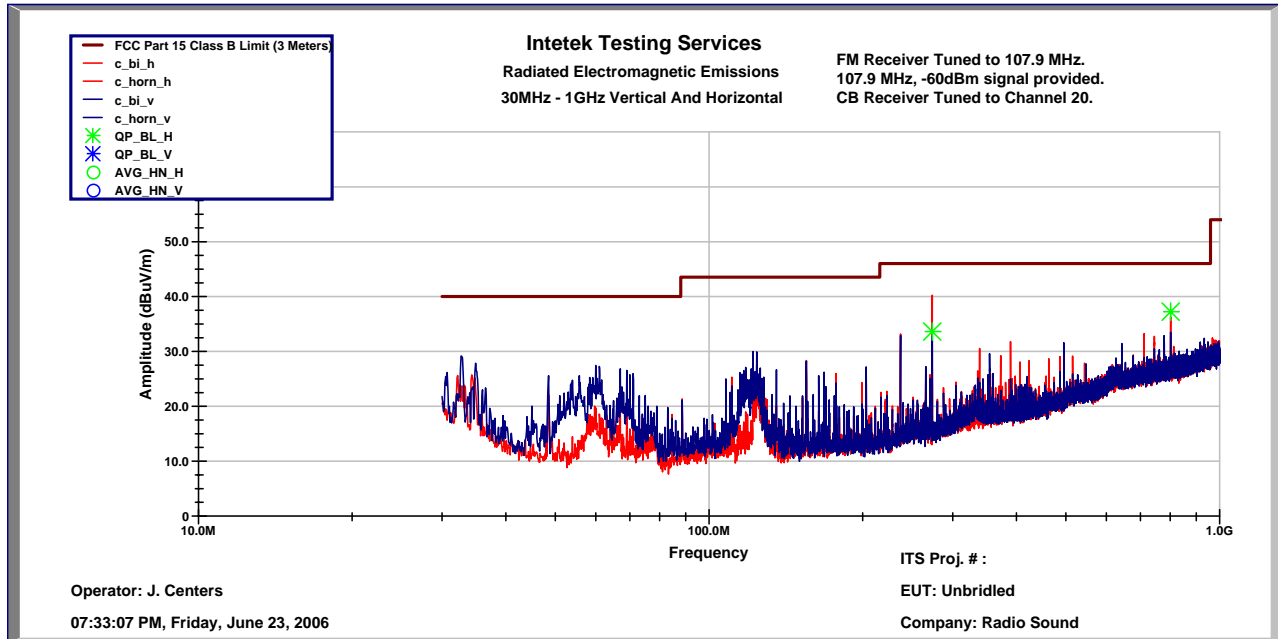
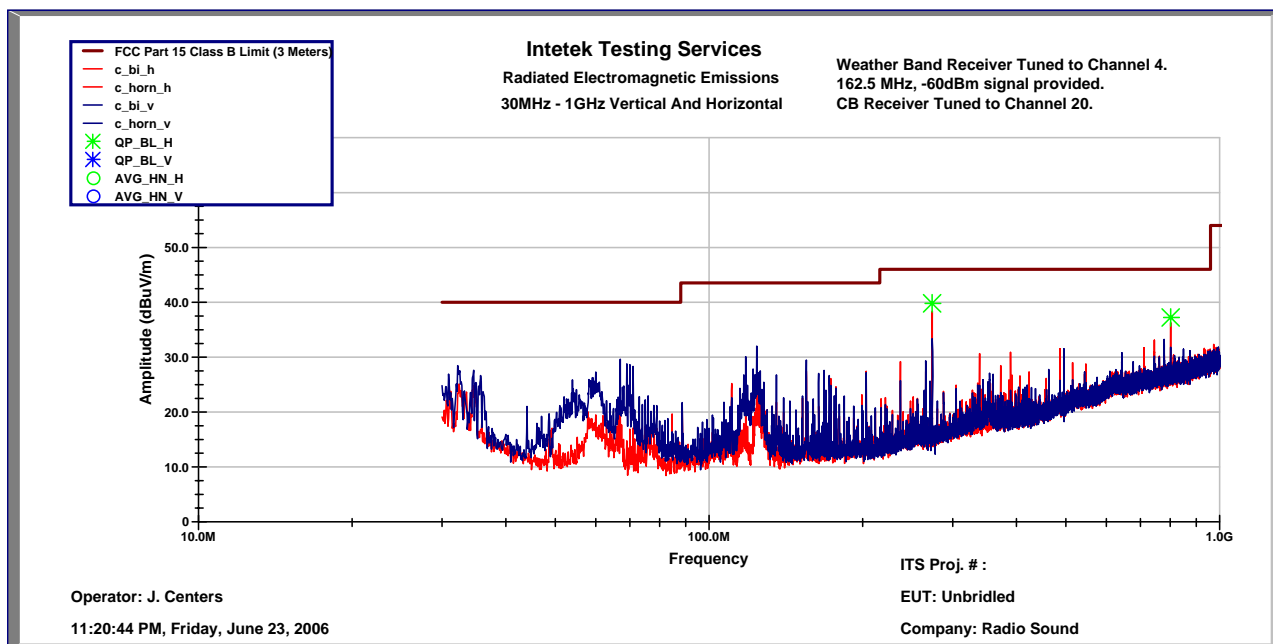


Figure 11-6 FCC §15.109 Maximized Quasi Peak and Average Emissions – FM Receiver

Frequency (MHz)	Polarity (H/V)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Azimuth (deg)	Tower (cm)	Results
273.5 MHz	H	1.34	12.87	39.81	46.02	-6.21	162	1	Compliant
801.81 MHz	H	2.38	21.93	37.22	46.02	-8.8	311	1	Compliant

Figure 11-7 FCC §15.109 Worse Case Receiver Spurious Emission (30-1000 MHz) – WB Mid Channel



12 ANTENNA POWER CONDUCTED LIMITS FOR RECEIVERS

FCC §15.111

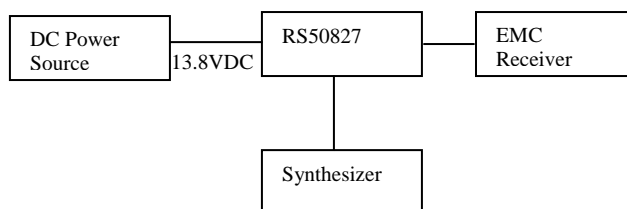
12.1 Test Limits

The power at the antenna terminals of the receiver shall not exceed 2.0 nanowatts (50 dBuV).

12.2 Test Procedure

The transmitter output was connected to a calibrated coaxial cable, the other end of which was connected to an EMC receiver. The output power at the EMC receiver was recorded. The RF output power at the antenna terminal was then determined by adding the insertion loss of the attenuator and cable to the receiver reading. The resulting graphical data was then compared to the 2.0 nanowatt (50 dBuV) limit.

12.3 Block Diagram



12.4 Test Results

Figure 12-1 FCC §15.111 Antenna Power Conducted Limits for Receivers

