TEST REPORT

Report Number: 3140979LEX-001
Project Number: 3140979

Evaluation of the CB Radio
Model Number: RS20250
FCC ID: JOFS20250
ICID: 5855A-20250

FCC Part 2, 15 Subpart B, 95 Subpart D and
RSS-136 Issue 5, October 2002

For

Radio Sound Inc.

Test Performed by:	Test Authorized by:
Intertek 731 Enterprise Drive Lexington, KY 40510	Radio Sound Inc. 1713 Cobalt Drive Louisville, KY 40299

Prepared By:_____ **Date:** 1/30/2008

Bryan C. Taylor, EMC Team Leader

Approved By:_____ **Date:** 1/30/2008

Jason Centers, Senior Project Engineer

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1 EXECUTIVE SUMMARY

Testing performed for: Radio Sound Inc.

Equipment Under Test: RS20250

IC Rule	FCC Rule	Test Description	Result	Page
RSS-136 Section 7.1	§2.1046, §95.639	RF Power Output	**Compliant**	11
---	§2.1047, §95.637	Modulation Characteristics	**Compliant**	12
RSS-Gen	§2.1049 §95.633(a)	Occupied Bandwidth	**Compliant**	15
RSS-136 Section 7.2	§2.1051, §95.635	Spurious Emissions at Antenna Terminals	**Compliant**	22
---	§2.1053, §95.635	Field Strength of Spurious Radiation	**Compliant**	24
RSS-136 Section 7.4	§2.1055, §95.625(b)	Frequency Stability	**Compliant**	26
---	§15.107	Power Line Conducted Emissions	NA[1]	29
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[1] The RS20250 did not have any AC power leads.

2 JOB DESCRIPTION

2.1 Client information

The CB Radio has been tested at the request of:

Company: Radio Sound Inc.
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
- RSS-136 Issue 5, 2002

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

2.3 Equipment Under Test (EUT)

The Radio Sound Inc. model RS20250 is an AM-only (A3E), 40 channel, Citizen's Band transceiver operating under FCC Rules CFR 47 Part 95, Subpart D. The unit consists of a transceiver module enclosed in aluminum extrusion case. The RS20250 is designed for professional installation (eg factory/dealer) on a motorcyle. The user interface consists of a remote head unit (an existing entertainment radio) and handlebar pushbutton controls. The transceiver is designed to operate with common commercially available citizens band antennas having a nominal impedance of 50 ohms.

Product	CB Radio
EUT Model Number	RS20250
EUT Serial Number	Not Labeled
Whether quantity (>1) production is planned	Quantity production is planned.
Type(s) of Emission	A3E
RF Output Power	3.94 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	[x] Audio [] Digital Data

EUT receive date: 1/7/2008

EUT receive condition: The EUT was received in good condition with no apparent damage.

Test start date: 1/7/2008

Test completion date: 1/10/2008

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

2.4 System Support Equipment

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

Figure 1: System Support Equipment

Description	Manufacturer	Part Number
CB Test Box[2]	Radiosound	#5
Laptop Computer	Compaq	EVO N410c

2.5 Cables associated with EUT

Figure 2 contains the details of the cables used during the evaluation.

Figure 2: Interconnecting cables between modules of EUT

Cables					
Description	Length	Shielding	Ferrites	Connection	
				From	To
12 AWG DC Power Cable	4 ft	None	None	DC Power Supply	CB Power Input
CB Radio Antenna Cable	1 ft	Coax	None	CB Radio Antenna Port	Antenna / Termination
Control Cable	5 ft	None	None	CB Radio	CB Test Box

[2] The CB test box provides audio inputs and serves as an interface to allow connection and control via the laptop computer.

2.6 Justification

The EUT was operated in a stand-alone configuration.

2.7 Mode(s) of operation

The CB Radio was powered by an external variable DC power supply during all testing. The appropriate tests were performed with the CB Radio transmitting in the citizens band.

2.8 Modifications required for compliance

No modifications were implemented by Intertek.

2.9 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 and ANSI C63.4. 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 2055A-1. The FCC registration number is 485103.

3.1 Test Equipment

The following test equipment was used for the evaluation.

Description	Manufacturer	Model Number	Asset Number	Calibration due date
Modulation Analyzer	HP	8901A	1374	3/22/2008
Signal Generator	HP	83620B	2352	8/20/2008
Synthesizer	HP	3325B	1001	2/21/2008
Arbitrary Waveform Generator	Agilent	33120A	2390	9/14/2008
Multi-meter	Fluke	87	2022	6/23/2008
Test Receiver	Rohde & Schwarz	ESI26	2327	9/17/2008
Spectrum Analyzer	Rohde & Schwarz	FSP7	3099	8/28/2008
Tunable Notch Filter	Eagle	411-5FNM	None	Verify At Time of Use
Tower / Turntable Controller	Sunol Sciences	SC99V	121701-1	Verify At Time of Use
Bilog Antenna	ETS	3142C	3133	11/14/2008
Loop Antenna	EMCO	6502	2366	1/11/2008
50 Ohm Termination	Bird	50-T-MN	2360	1/10/2008
50 Ohm Attenuator	Bird	50-A-MFN-20	2312	1/10/2008
Environmental Chamber	Thermotron	SM-8C	2392	1/24/2008

4 RF POWER OUTPUT

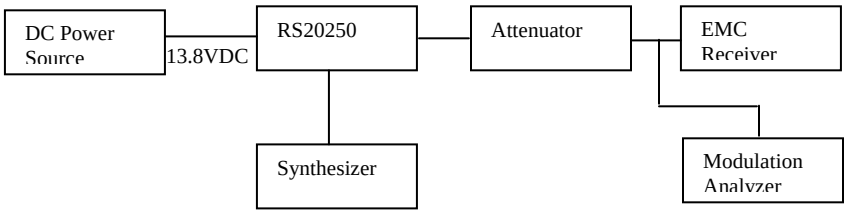
FCC §2.1046, §95.639

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 on channels 1, 20, and 40 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 CB Radio met the RF power output requirements of FCC Part 2.1046 and 95.639. The test results are located in Figure 3.

Figure 3 RF Power Output

Channel	Measured Power (dBm)	Measured Power (W)	Limit (W)
1	35.94	3.93	4.0
20	35.95	3.94	4.0
40	35.95	3.94	4.0

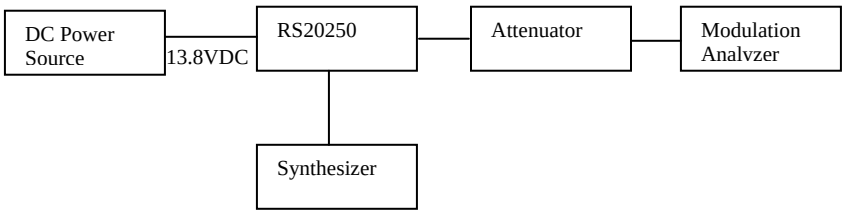
5 MODULATION CHARACTERISTICS

§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 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

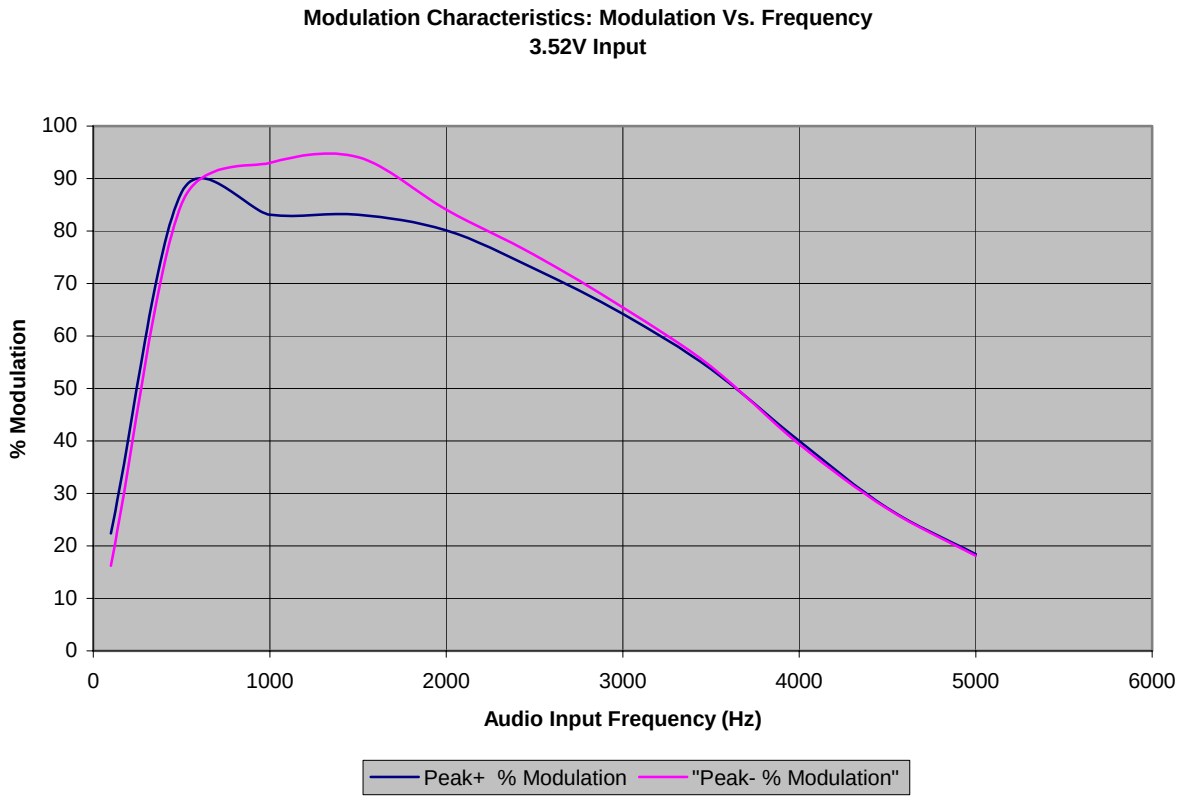
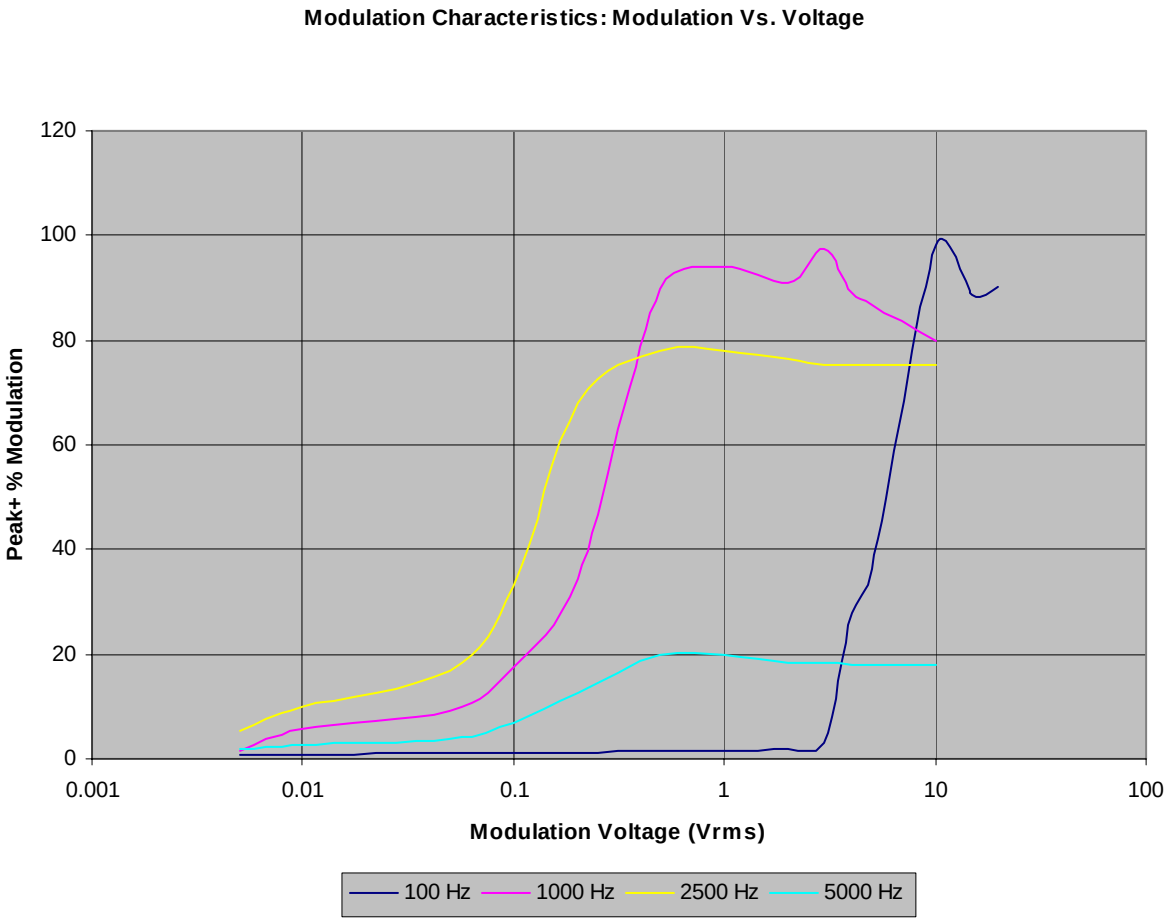


Figure 5-2: Modulation Vs. Voltage



6 OCCUPIED BANDWIDTH

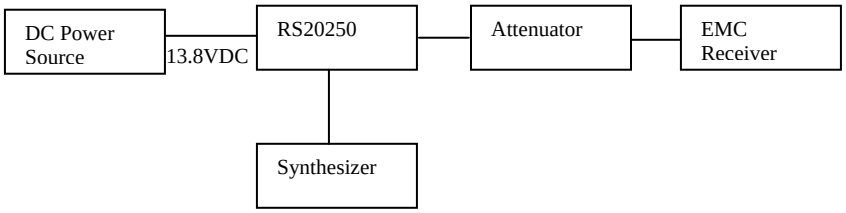
§2.1049, §95.633(a), RSS-Gen

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 the microphone 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 channels 1, 20, and 40 under modulated and un-modulated conditions. The 2.5kHz tone was set to a level 16dB above that which was necessary to product 50% modulation.

6.2 Block Diagram



6.3 Test Results

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

Figure 3: Occupied bandwidth measurements

Mode	Channel	Resolution Bandwidth	Video Bandwidth	Sweep time	Measured Bandwidth
Un-Modulated	1	0.3 kHz	1 kHz	5.6 second	0.601kHz
2.5 kHz Tone	1	0.3 kHz	1 kHz	5.6 second	5.41kHz
Un-Modulated	20	0.3 kHz	1 kHz	5.6 second	0.601kHz
2.5 kHz Tone	20	0.3 kHz	1 kHz	5.6 second	5.41kHz
Un-Modulated	40	0.3 kHz	1 kHz	5.6 second	0.601kHz
2.5 kHz Tone	40	0.3 kHz	1 kHz	5.6 second	5.41kHz

Figure 6-4: Occupied Bandwidth – Channel 1 Un-Modulated

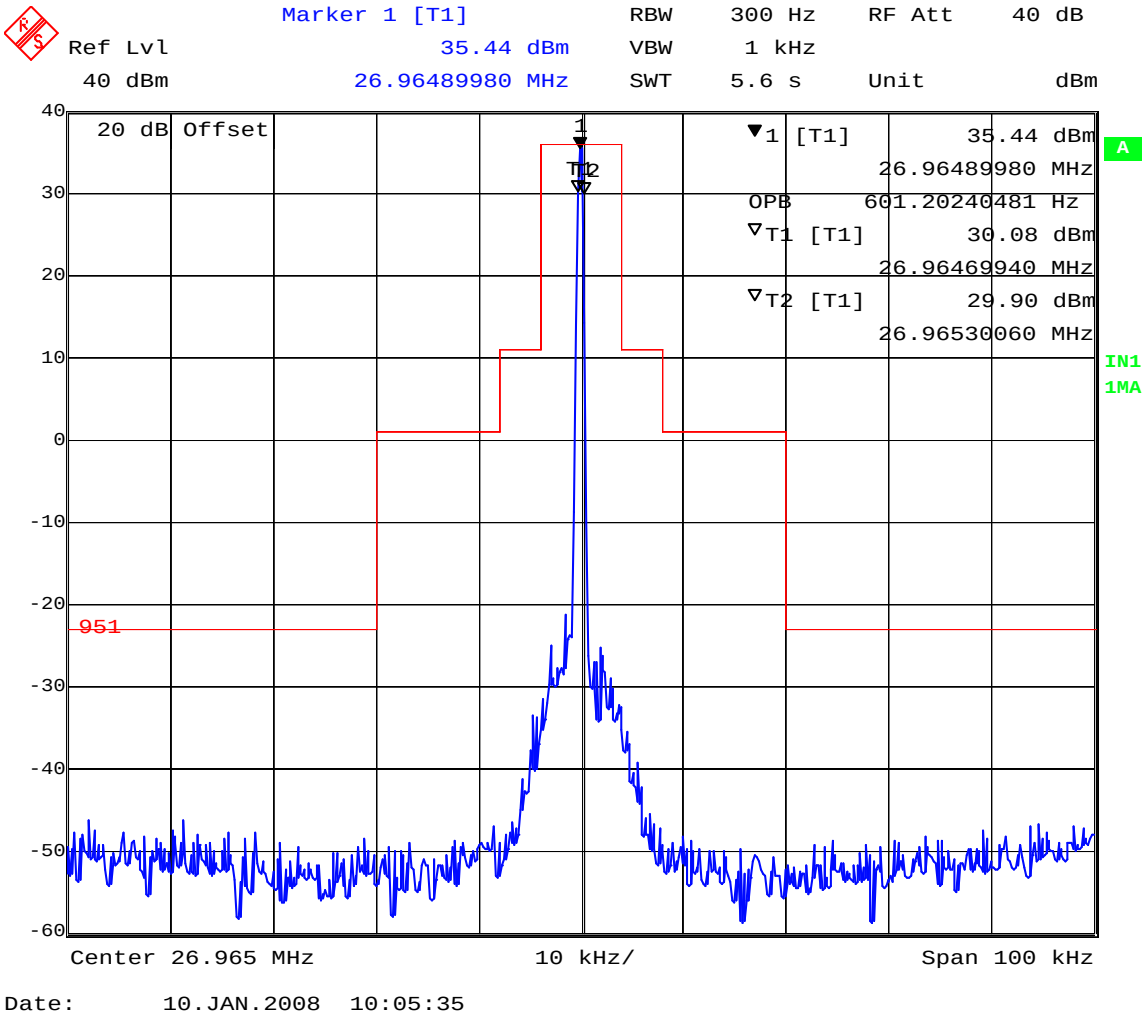


Figure 6-5: Occupied Bandwidth – Channel 1 Modulated with 2.5kHz Tone

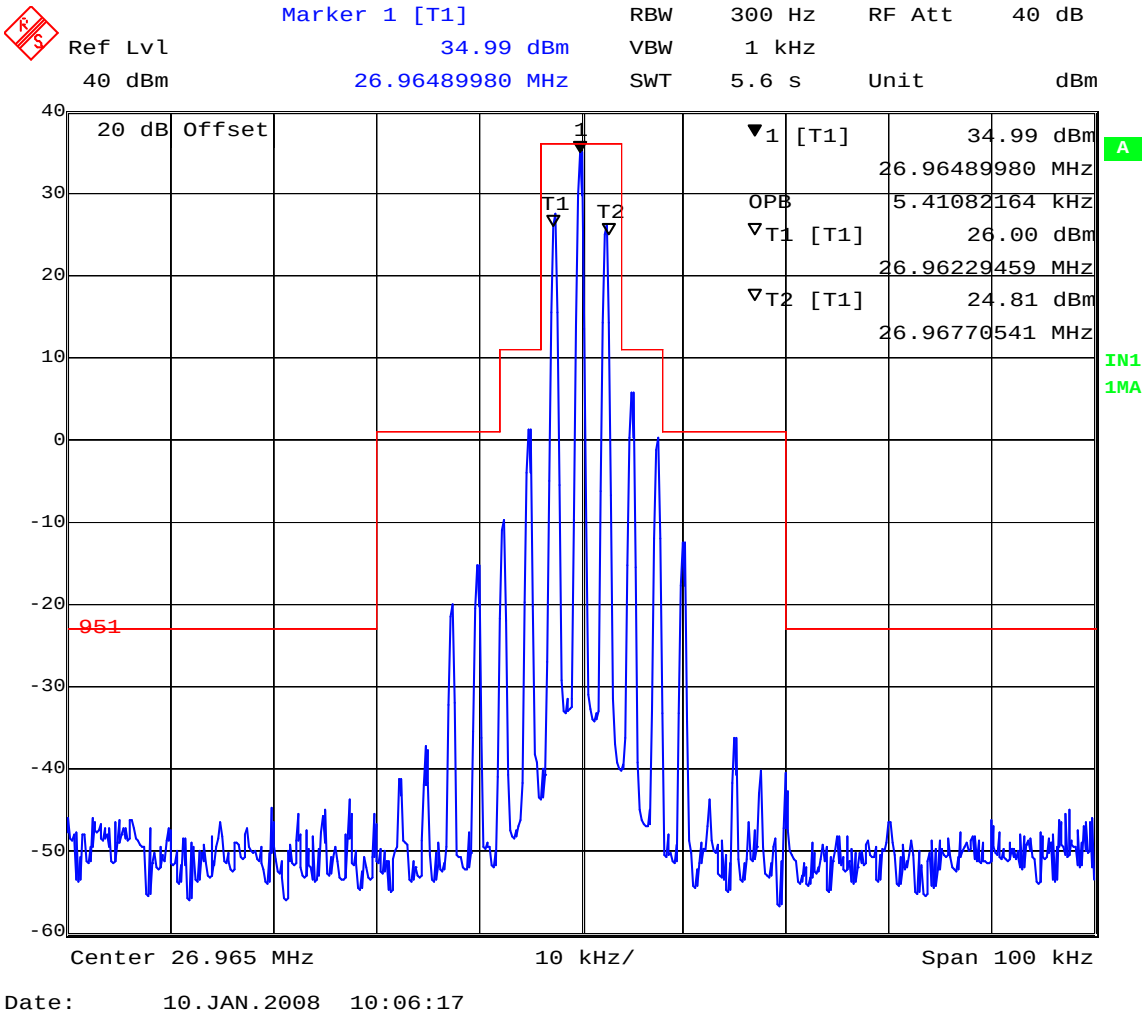


Figure 6-6: Occupied Bandwidth – Channel 20 Un-Modulated

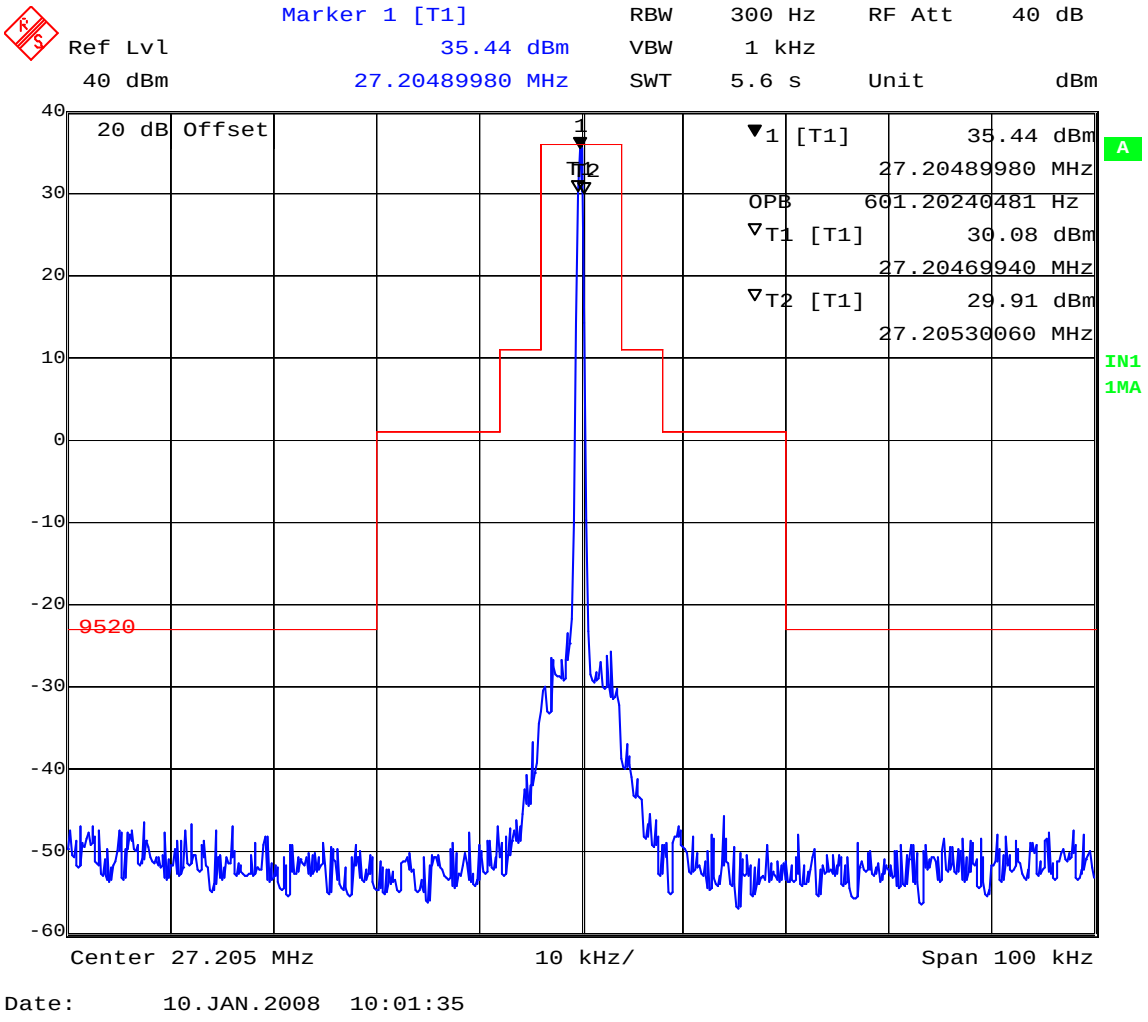


Figure 6-7: Occupied Bandwidth – Channel 20 Modulated with 2.5kHz Tone

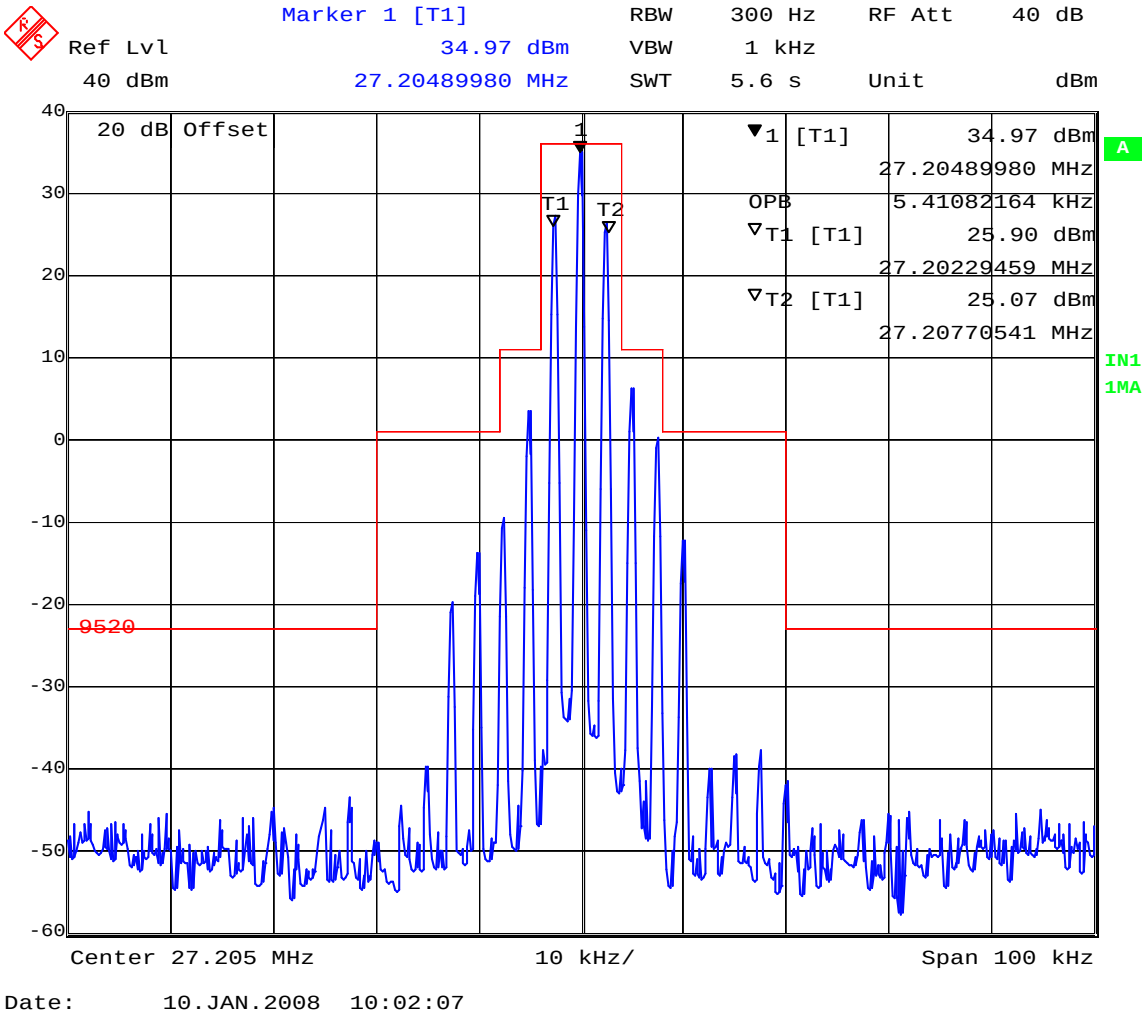


Figure 6-8: Occupied Bandwidth – Channel 40 Un-Modulated

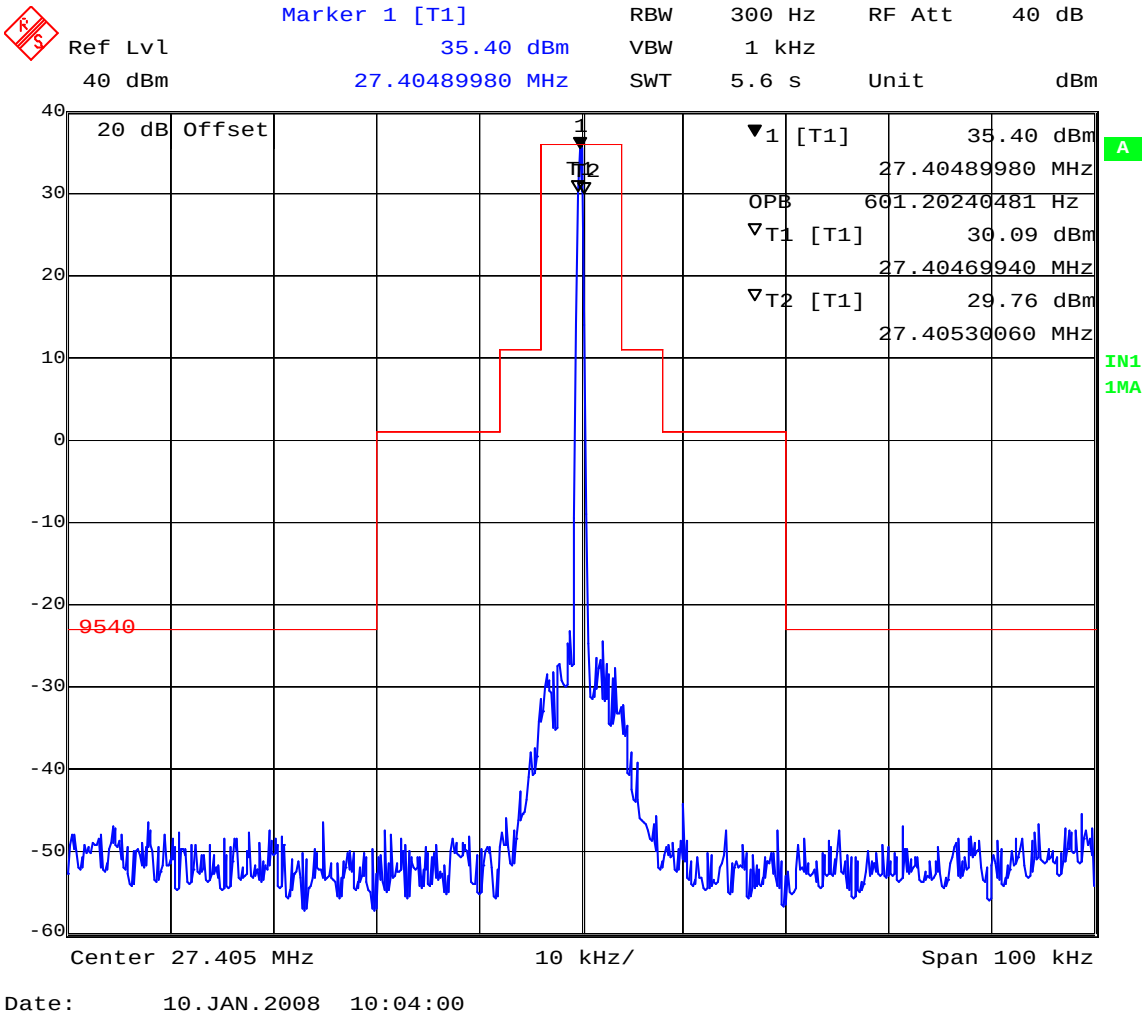
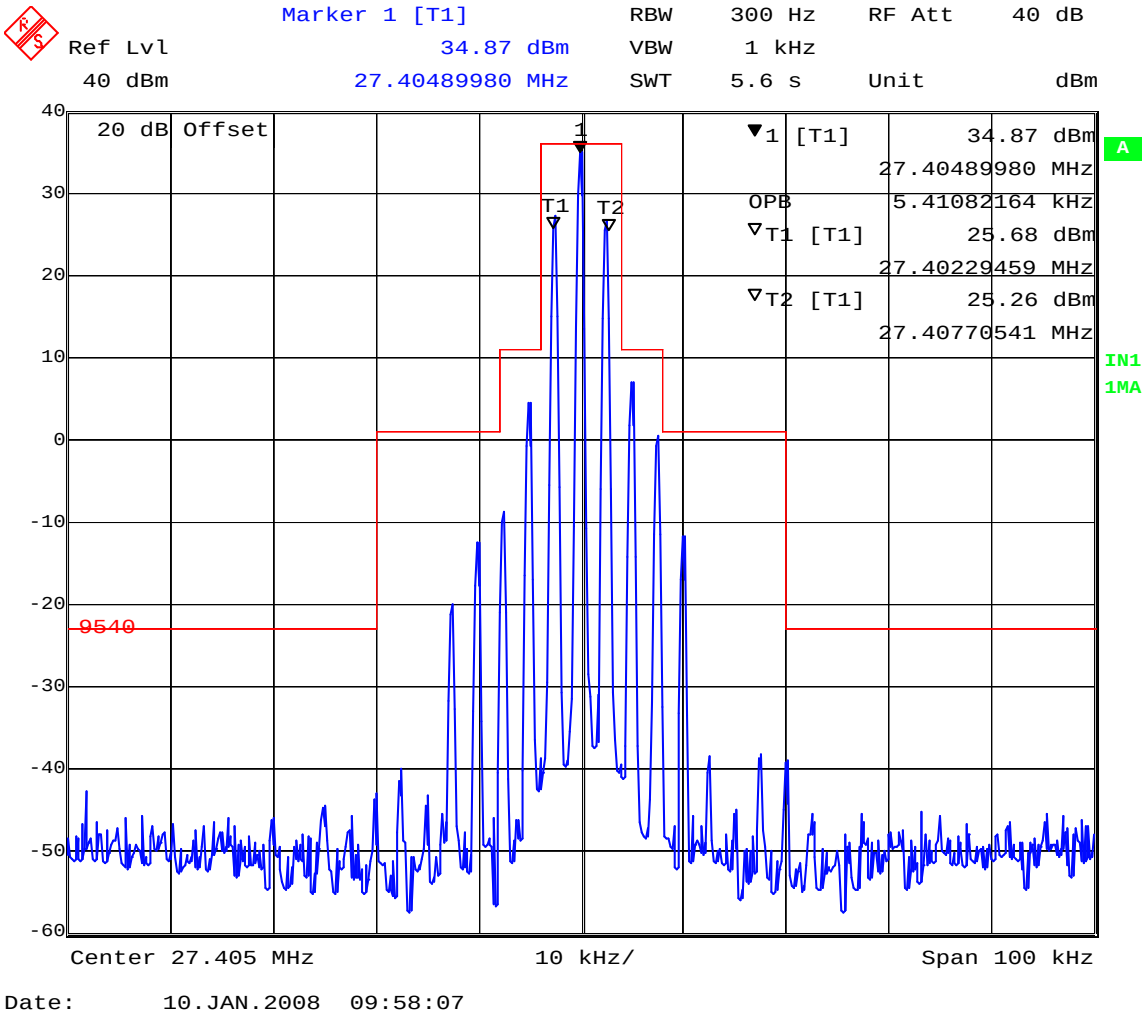


Figure 6-9: Occupied Bandwidth – Channel 40 Modulated with 2.5kHz Tone



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 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 10^{th} harmonic of the fundamental. This test was performed on channels 1, 20, and 40.

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 :

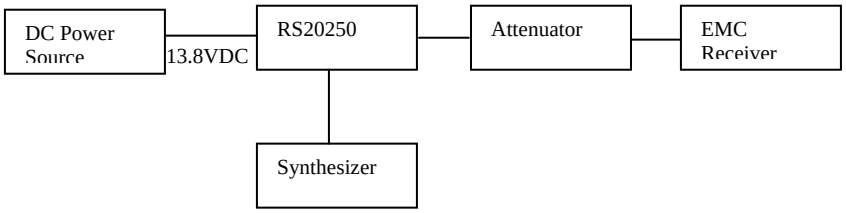
§95.635(b)(1): At least 25 dB (decibels) on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.

§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 log10 (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.

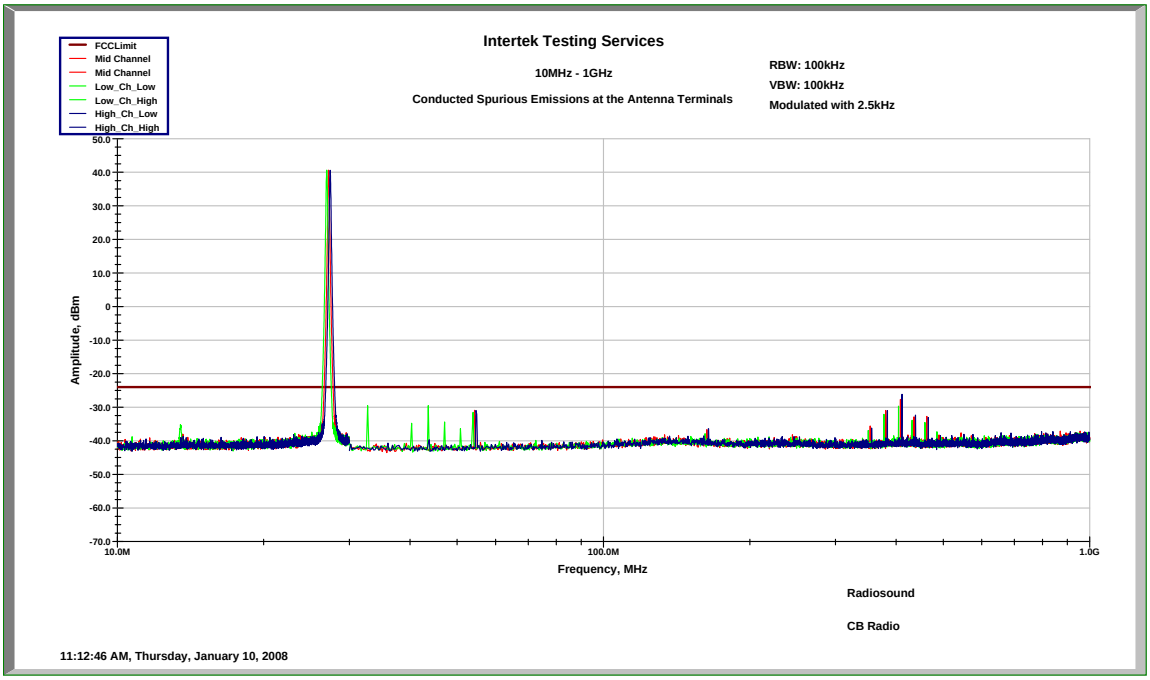
7.2 Block Diagram



7.3 Test Results

The 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). For spurious emissions close to the fundamental please see Figure 6-4 through Figure 6-9 starting on page 16. Spurious emissions ranging in frequency from 10MHz to 1GHz are shown in Figure 7-1 below.

Figure 7-1: Spurious Emissions at Antenna Terminals – Channels 1, 20, and 40



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. All equipment was arranged on the 80 cm high table to closely resemble the geometry during actual installation. The CB was powered and the microphone was keyed at channel 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. Below 30MHz a magnetic field loop antenna was used. 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. Once spurious emissions were identified, the power of the emission was determined using the substitution method described in TIA-603-B section 2.2.12 (Radiated Spurious Emissions).

The ERP of the individual spurious emissions were calculated by using the following formula:

$$ERP_{(dBm)} = P_{SG} - CL + G$$

Where,

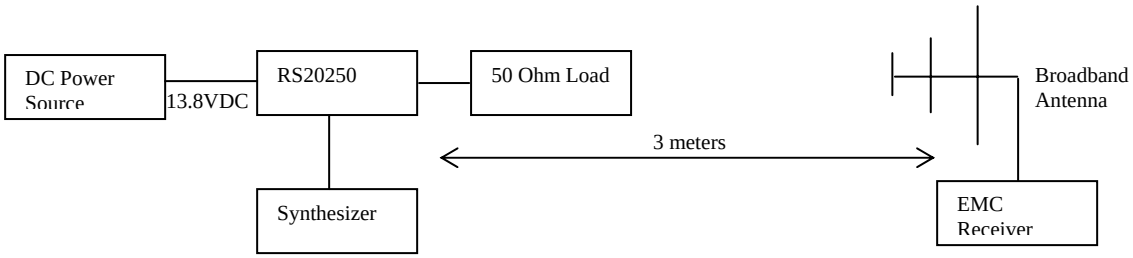
$ERP_{(dBm)}$ is the Effective Radiated Power (in dBm) referenced to a dipole

P_{SG} is the output power setting on a calibrated signal generator

CL is the cable loss between the signal generator and the substitution antenna

G is the gain (referenced to a dipole) of the substitution antenna

8.2 Block Diagram



8.3 Test Results

The 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

Frequency (MHz)	Polarity	Device Reading (dBuV)	Cable Loss (dB)	Tx Antenna Gain (dBd)	Signal Generator Output (dBm)	ERP (dBm)	Limit (dBm)	Margin
54.41	V	34.17	0.56	-3.94	-52.47	-56.97	-24	-32.97
	H	24.68	0.56	-5.54	-56.56	-62.66	-24	-38.66
81.64	V	38.92	0.68	-0.94	-50.6	-52.22	-24	-28.22
	H	32.73	0.68	0.06	-55.39	-56.01	-24	-32.01
108.78	V	53.72	0.8	1.06	-36.08	-35.82	-24	-11.82
	H	54.1	0.8	1.96	-34.4	-33.24	-24	-9.24
135.98	V	47.3	0.9	3.16	-45.6	-43.34	-24	-19.34
	H	48.97	0.9	4.06	-43.73	-40.57	-24	-16.57
163.22	V	49.49	0.99	2.06	-38.62	-37.55	-24	-13.55
	H	51.41	0.99	4.06	-39	-35.93	-24	-11.93
217.67	V	45.04	1.16	2.96	-39.9	-38.1	-24	-14.1
	H	54.81	1.16	4.16	-35.13	**-32.13**	-24	**-8.13**
244.89	V	35.66	1.22	2.96	-47.22	-45.48	-24	-21.48
	H	41.57	1.22	4.16	-41.51	-38.57	-24	-14.57
272.33	V	32.44	1.31	3.66	-51.85	-49.5	-24	-25.5
	H	37.95	1.31	4.86	-49.64	-46.09	-24	-22.09

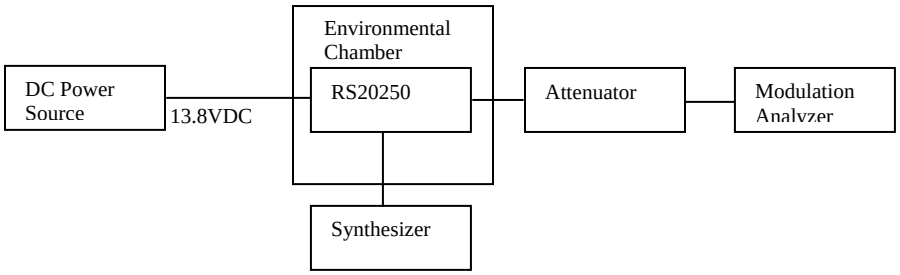
9 FREQUENCY STABILITY

§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. Also, in order to meet the requirements of RSS-136, the procedure in section 7.4 was performed and the results reported separately.

9.2 Block Diagram



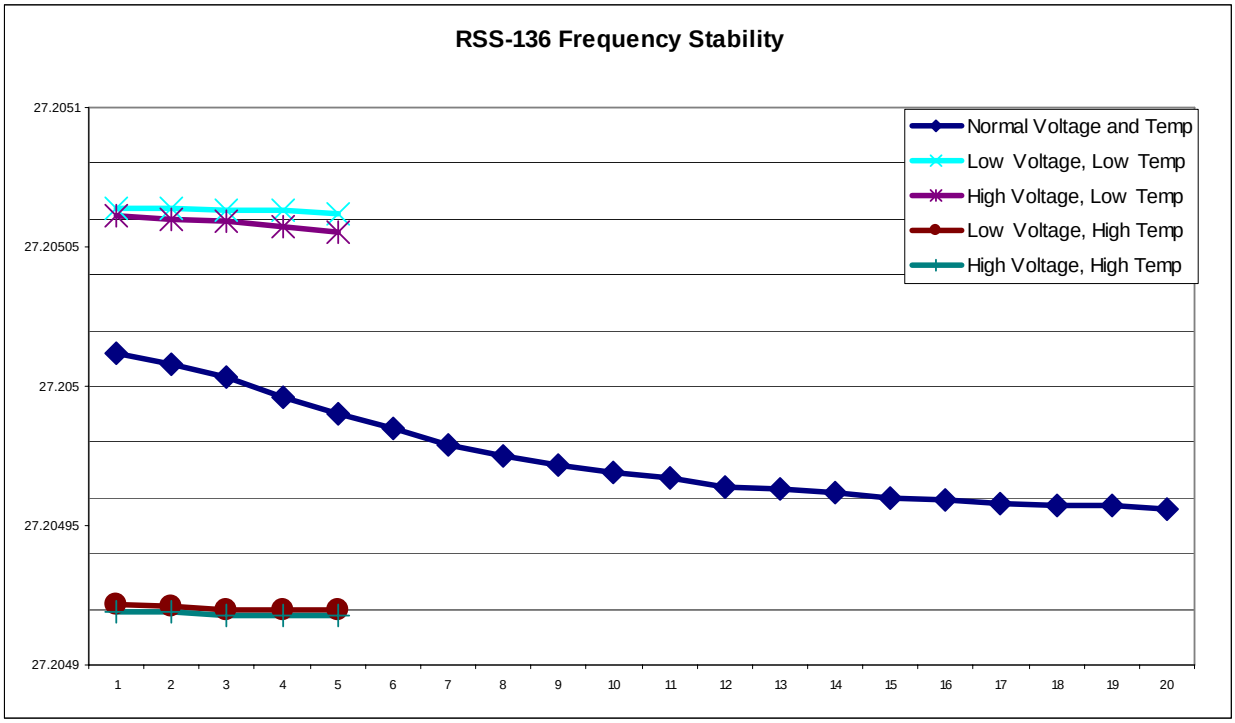
9.3 Test Results

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. Also, the graph in Figure 9-2 shows that the frequency stability is compliant the RSS-136 requirements since the frequency never deviated by more than 1360Hz.

Figure 9-1 Frequency Stability vs. Temperature and Voltage Per FCC Requirements

Power Supply (Vdc)	Temperature (Celcius)	Measured Power (dBm)	Measured Freq. (MHz)	Delta (Hz)	Percent Error (%)
13.3	50	35.72	27.20492	-80	0.0003
13.3	40	35.81	27.20493	-70	0.0003
13.3	30	35.79	27.20494	-60	0.0002
13.3	25	35.87	27.20496	-40	0.0001
13.3	20	35.83	27.20499	-10	0.0000
13.3	10	35.7	27.20502	20	0.0001
13.3	0	35.67	27.20504	40	0.0001
13.3	-10	35.83	27.20506	60	0.0002
13.3	-20	35.82	27.20505	50	0.0002
13.3	-30	35.82	27.20494	-60	0.0002
11.305	25	35.85	27.20496	-40	0.0001
15.29	25	35.88	27.20496	-40	0.0001
Target Freq. =	**27.205**				**Channel 20**

Figure 9-2 Frequency Stability Per RSS-136



10 POWER LINE CONDUCTED EMISSIONS

FCC §15.107, FCC §15.207

10.1 Test Procedure

Not applicable.

10.2 Test Results

Not applicable. The CB Radio did not have any AC power leads and it installs exclusively in a motor vehicle. Therefore the conducted emissions tests on the AC power lines were not applicable.

11 RECEIVER SPURIOUS EMISSIONS

FCC §15.109

11.1 Test Limits

Figure 3 Radiated Emission Limit for FCC §15.109

Radiated Emission Limits at 3 meters	
Frequency (MHz)	**Quasi-Peak limits, dB (μV/m)**
25 to 30[3]	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.

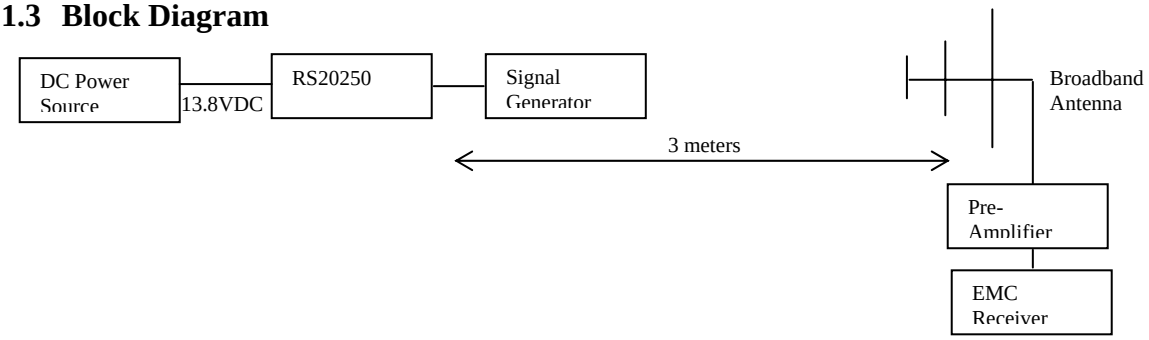
Measurements of the radiated field were made with the antenna located at a distance of 3 meters from the EUT and in vertical and horizontal polarities. The EUT was rotated from 0 to 360 degrees and the antenna adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each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

This test was performed twice. During the first test all of the cables connecting to the CB Radio were hanging down off the 80cm high table. During the second test the cables, including the microphone cable, were extended vertically above the CB Radio and held there with a non-conductive support structure as specified in RSS-136.

[3] This frequency range is for part 15.109 (d) for CB receivers.

11.3 Block Diagram



11.4 Test Results

The CB Radio met the radiated disturbance requirements of FCC §15.109. The maximized quasi peak data and graphical results can be found in Figure 11-4 through Figure 11-8.

Figure 11-4 Maximized Quasi Peak Emissions with Cables Hanging Down from 80cm High Table

Frequency (MHz)	Polarity (H/V)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Azimuth (deg)	Tower (m)	Results
101.99 MHz	V	1.36	9.26	32.71	43.52	-10.81	214	1	**Compliant**
114.0 MHz	V	1.45	8.64	29.72	43.52	-13.8	246	1	**Compliant**
118.0 MHz	V	1.48	8.26	33.38	43.52	-10.14	68	1	**Compliant**
120.0 MHz	V	1.51	8.1	34.25	43.52	-9.27	24	1	**Compliant**
186.0 MHz	V	1.89	10.22	33.85	43.52	-9.67	345	1	**Compliant**
194.0 MHz	V	1.9	10.22	34.63	43.52	-8.89	312	1	**Compliant**

Figure 11-3 Graphical Scan (10MHz – 30MHz) with Cables Hanging Down from 80cm High Table

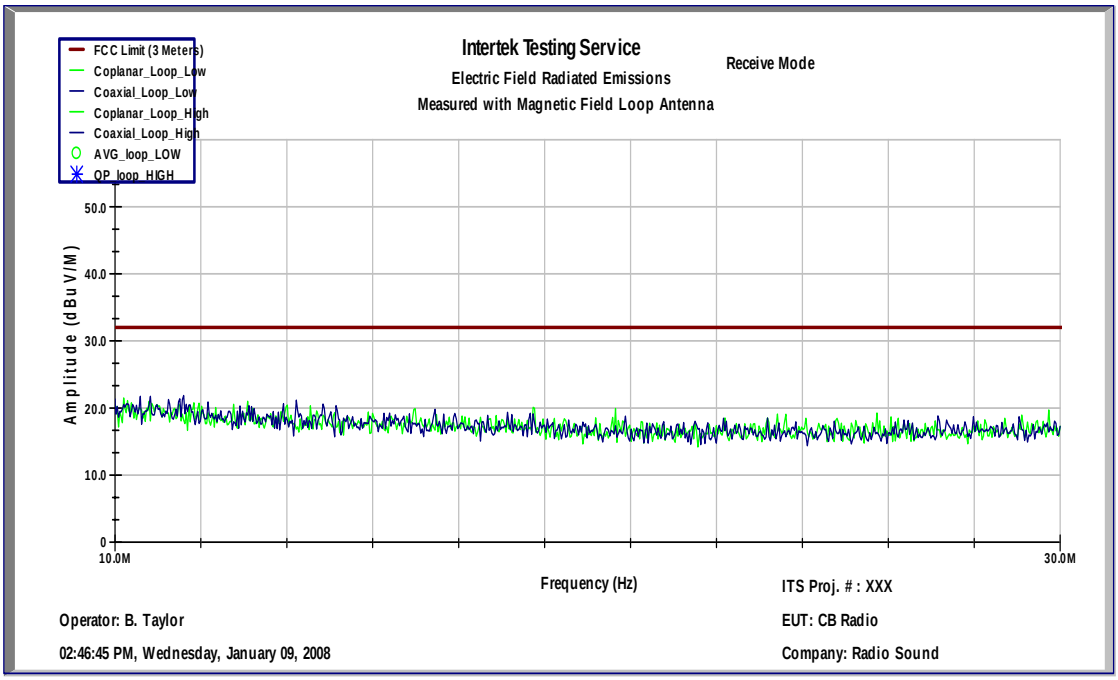


Figure 11-4 Graphical Scan (30MHz – 1GHz) Cables Hanging Down from 80cm High Table

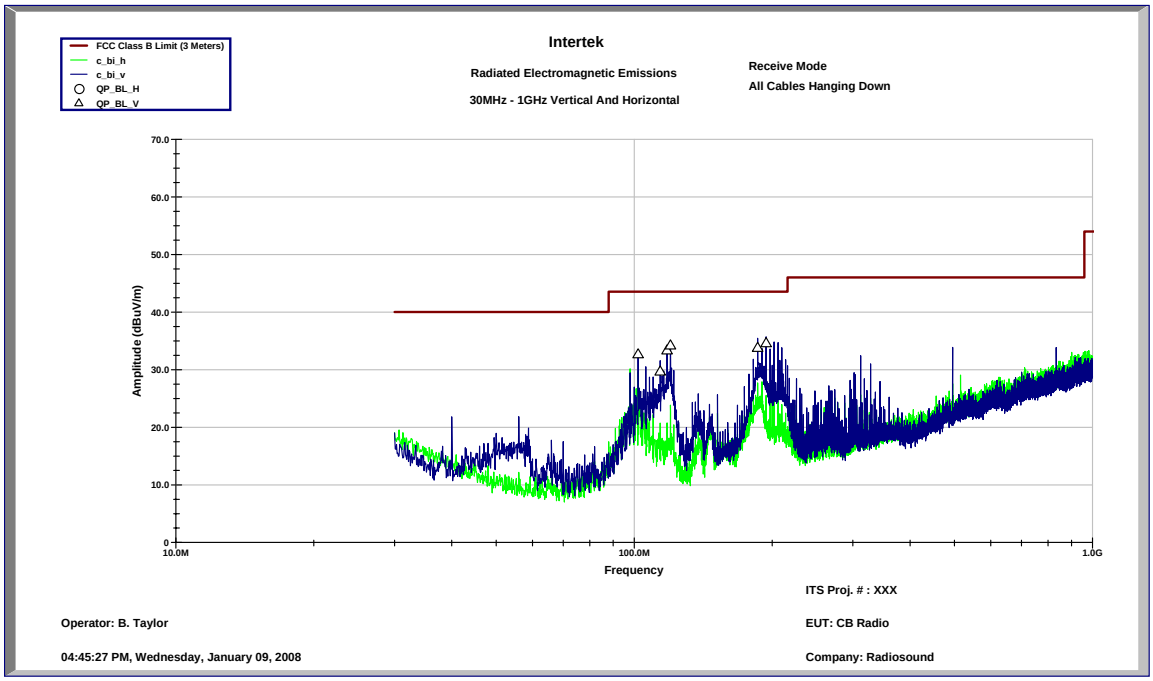
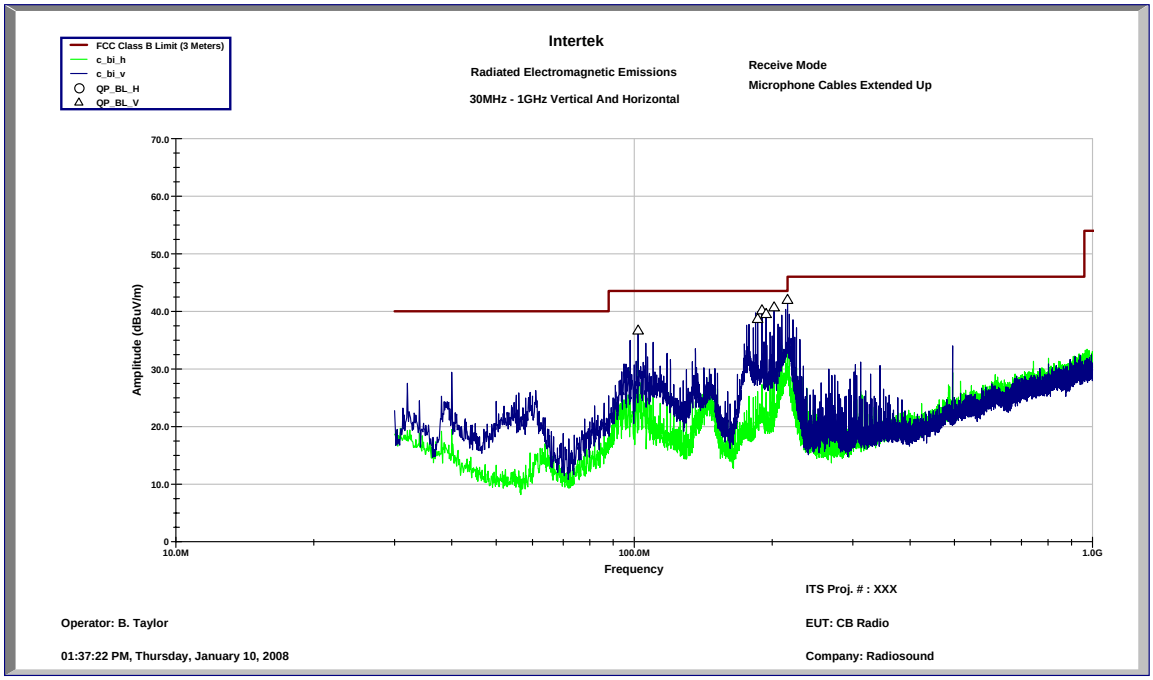


Figure 11-5 Maximized Quasi Peak Emissions with Cables Extended Vertically Above EUT

Frequency (MHz)	Polarity (H/V)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Azimuth (deg)	Tower (m)	Results
102.0 MHz	V	1.36	9.26	36.71	43.52	-6.81	331	1	**Compliant**
186.0 MHz	V	1.89	10.22	38.73	43.52	-4.79	197	1	**Compliant**
190.0 MHz	V	1.89	10.3	40.22	43.52	-3.3	196	1	**Compliant**
194.0 MHz	V	1.9	10.22	39.58	43.52	-3.94	214	1	**Compliant**
202.0 MHz	V	1.95	10.32	40.73	43.52	-2.79	213	1	**Compliant**
216.0 MHz	V	2.02	11.32	42.04	43.52	-1.48	183	1	**Compliant**

Figure 11-8 Graphical Scan (30MHz – 1GHz) with Cables Extended Vertically Above EUT



12 ANTENNA POWER CONDUCTED LIMITS FOR RECEIVERS

FCC §15.111

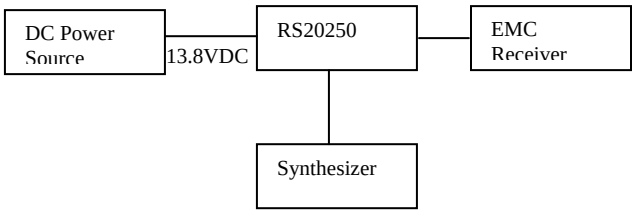
12.1 Test Limits

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 added 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

The plot in Figure 12-1 shows that no emissions were above the 50dBuV (2nW) limit at the antenna terminals.

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