

**EXHIBIT E: REPORT OF MEASUREMENTS [2.1033(B6)]****Abbreviated Test Report for FCC ID: FBR CRS5200-FH****FCC Part 2.1031, Part 15 Subpart C(15.247)****Report #0500781KF****Issued 06/18/04****FREQUENCY HOPPING TRANSCEIVER**  
**MODEL CRS5200-E                      MODEL CRS5200-M**

Prepared for:

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## Statements Concerning this Report

### **NVLAP Accreditation: NVLAP Lab Code 200129-0**

The scope of AHD accreditation is the conducted emissions, radiated emissions test methods of:

IEC/CISPR 22: Limits and methods measurement of radio disturbance characteristics of information technology equipment.

FCC Method – 47 CFT Part 15 – Digital Devices.

AS/NZS 3548: Electromagnetic Interference – Limits and Methods of Measurement of Information Technology Equipment.

IEC61000-4-2 and Amend.1: ElectroStatic Discharge Immunity

IEC61000-4-5: Surge Immunity

### **Test Data:**

This test report contains data included in the scope of the NVLAP accreditation.

### **Subcontracted Testing:**

This report contains data recorded at the University of Michigan Radiation Laboratory. The University of Michigan test facility is located at 8501 Beck Road, Belleville, Michigan 48111. This test facility has been fully described and accepted by the FCC and Industry Canada. This facility was utilized to measure emissions occurring at frequencies greater than 6GHz.

### **Test Traceability:**

The calibration of all measuring and test equipment and the measured data using this equipment are traceable to the National Institute for Standards and Technology (NIST).

### **Limitations on results:**

The test results contained in this report relate only to the Item(s) tested. Any electrical or mechanical modification made to the test item subsequent to the test date shall invalidate the data presented in this report. Any electrical or mechanical modification made to the test item subsequent to this test date shall require an evaluation to verify continued compliance.

### **Limitations on copying:**

This report shall not be reproduced, except in full, without the written approval of AHD.

### **Limitations of the report:**

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

**Statement of Test Results Uncertainty:** Following the guidelines of NAMAS publication NIS81 and NIST Technical Note 1297, the Measurement Uncertainty at a 95% confidence level is determined to be:  $\pm 1.4$  dB

**Manufacturer/Applicant [2.1033(b1)]**

The manufacturer and applicant:

FLEETWOOD GROUP Inc.  
P.O. Box 1259  
Holland, Michigan 49422-1259**Measurement/Test Site Facility & Equipment****Test Site [2.948, 2.1033(b6)]****SITE 1.**

The AHD test facility is centered on 9 acres of rural property near Sister Lakes, Michigan. The mailing address is 92723 M-152, Dowagiac, Michigan 49047. This test facility is NVLAP accredited (LabCode 200129-0). It has been fully described in a report filed with the FCC (No.90413) and Industry Canada (file:IC3161).

**Measurement Equipment Used [2.947(d), 15.31(b)]****SITE 1.**

Equipment Calibration	Model	S/N	Last Cal	
			Date	Interval
HP EMI Receiver system	HP 8546A			
RF Filter Section	HP-85460A	3448A00283	26-Aug-04	12 months
RF Receiver Section	HP-85462A	3625A00342	26-Aug-04	12 months
EMCO BiconiLog Antenna	3142	1077	24-Aug-04	12 months
Solar LISN	8012-50-R-24-BNC	962137	24-Aug-04	12 months
Solar LISN	8012-50-R-24-BNC	962138	24-Aug-04	12 months
(LCI) Double shielded 50ohm Coax	RG58/U	920809	29-Nov-04	12 months
(3-M) Type 129FF Ultra Flex LowLoss	RG58/U	9910-12	25-Oct-04	6 months
(3-M) LMR-400 Ultra Flex	LMR400	9812-11	25-Oct-04	6 months
(10-M) Amelco 50ohm Coax	RG213/U	9903-10ab	25-Oct-04	6 months
50ohm Coax	RG223/U	9802302	07-Mar-05	12 months
Double Ridged Horn	ONO91202-2	A00329	02-Mar-05	physical inspection

**Measurement Environment**

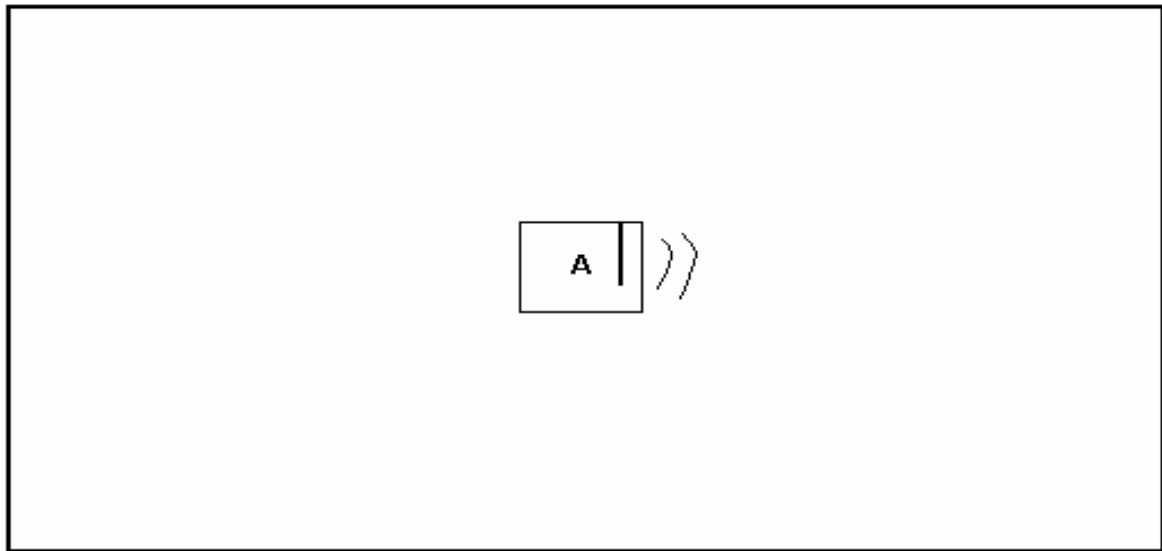
The tests were performed with the equipment under test, and measurement equipment inside the all-weather enclosure. Ambient temperature was 22deg.C., the relative humidity 30%.

**Tested Configuration /Setup: [2.1033(b8)]****Support Equipment & Cabling**

Setup Diagram Legend	Description	Model	Serial No. / Part No.	EMC Consideration
A	[EUT] eInstruction Keypad Transceiver	[Fleetwood Group] CRS5200-E/M	preproduction	FCC ID: FBR CRS5200-FH

**Setup Diagram**

Note: Setup photographs are located in Attached Electronic File, Exhibit E.



setup\_1a 1 b

**BASIC EUT SETUP**  
(Legend designation is above)

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**Summary of Results:**

1. This test series evaluated the Equipment Under Test to FCC Part 15, SubPart C.
2. The system tested is compliant to the requirement of CFR 47, FCC Part 15, SubPart C for Frequency Hopping operation in the 2400-2483.5MHz frequency band, ( Part 15.247 ).
3. The equipment under test was received on April 11, 2005 and this test series commenced on April 26, 2005.
4. This model is electrically the same as previously tested using FCC ID: FBRLCK-EI. This model differs in the housing shape/color and the indicator LED's are replaced by a seven segment display. The PCB layout is not changed. The transceiver circuitry and components are not changed.
5. This submittal presents the measurement report of the previous model (Exhibit G) as evidence of compliance. In addition, new measurements were taken on this model to ensure continued compliance. This additional data is presented in this document.
6. The output level of the fundamental was measured for 2401MHz, 2438MHz, and 2475MHz. The evaluation showed the emission nearest the limit occurred at approximately 2475MHz. The EUT was positioned on the 'end' and the receive antenna oriented in the horizontal polarization. This signal was measured with a peak detection and the calculated EIRP was determined to be 30.2dB below the peak power limit of 1 Watt.
7. The suspects frequencies for spurious emissions were determined in a shielded enclosure. All suspects were determined to be below the background noise at the open area test site. The suspect frequency nearest the limit was vertically polarized at 31.8MHz. This level was measured to be 23.1dBuV/m QPeak which is 16.9dB below the limit of 40dBuV/m.

## Previous Testing Summary of Results:

1. This summary of measurements is taken from the test data presented in Exhibit G.
2. The system tested is compliant to the requirement of CFR 47, FCC Part 15.247, SubPart C, RSS-210 for Frequency Hopping operation in the 2400-2483.5MHz frequency band.
3. The equipment under test was received on November 11, 2004 and this test series commenced on November 11, 2004.
4. The frequencies selected for final evaluation include 2401MHz, 2437MHz, and 2475MHz. This is in accordance with 47 CFR 15.31(m). The product is designed for 2401MHz to be the lowest frequency transmitted and 2475MHz to be the highest frequency transmitted.
5. The product is powered using two AA 1.5vdc batteries. There was no power line conducted evaluation.
6. The occupied bandwidth was greatest while observing 2401MHz. Using 10KHzRBW, the 99% bandwidth measured 755KHz.
7. The Band Edge measurements: All spurious below the lower band edge of 2400MHz and above the upper band edge of 2483.5MHz are greater than 20dB below the level of the fundamental carrier.
8. The output level of the fundamental was measured for 2401MHz, 2437MHz, and 2475MHz. The evaluation showed the emission nearest the limit occurred while operating at 2437MHz. The EUT was positioned on the 'end' and the receive antenna oriented in the horizontal polarization. This signal was measured with a Peak detection and the calculated EIRP was determined to be 27.0dB below the peak power limit of 1 Watt.
9. The evaluation of the field strength levels of the transmitter harmonics showed the emission nearest the limit occurred while operating at 2437MHz. This emission was measured using Peak detection and corrected for the 'hopping' duty cycle. The emission at 14622MHz was calculated to be 13.9dB below the average limit of 54dBuV/m (500uV/m).
10. The field strength emission levels local oscillator and harmonics were below the background noise floor of the measurement system. No emissions were detected.
11. The spurious emission level nearest the limit was measured while in transmitting mode. This emission, at 2335MHz, was determined to be 44.6dBuV/m Average which is 9.4dB below the limit of 54dBuV/m (500uV/m). The receive antenna was horizontally polarized.

### Changes made to achieve compliance

1. None

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**Standards Applied to Test: [2.1033(b6)]**

ANSI C63.4 - 2001

CFR47 FCC Part 2, Part 15, SubPart C, 15.247 Intentional Radiator; SubPart B, Digital Device

AHD test procedures TP0101-01, TP0102-01

**Test Methodology: [2.1033(b6)]**

This abbreviated test plan evaluated the spurious/digital emissions of the product and evaluated the fundamental power output as a field strength at 3 meters and with the output directly connected to the analyzer.

The system was placed at the center of the table 80cm above the ground plane pursuant to ANSI C63.4 for stand-alone equipment. The setup pictures in this report indicate the configurations of testing for this product.

This product contains a Nordic 2.4GHZ RF chip. The antenna is a foil trace on the circuit board. The antenna can not be adjusted by the user.

Most of the evaluations in transmit mode were performed with the frequency hopping function enabled. In this mode the EUT was setup up to transmit continuously with modulation. The measurements of the fundamental were recorded with Peak detection and the results peak power limit of section 15.247.

Line conducted emission testing was not performed on this product. The product is powered from two AA 1.5Volt batteries only. The batteries were replaced during the course of testing to maintain battery 'freshness'.



## Radiated

The system was placed upon a 1 x 1.5 meter non-metallic table 80cm above the open field site ground plane in the prescribed setup per ANSI C63.4.

The table sits upon a remote controlled turntable. The receiving antenna, located at the appropriate standards distance of 3 or 10 meters from the table center, is also remote controlled.

The principle settings of the EMI Receiver for radiated testing include:

IF Bandwidth: 120KHz for frequencies less than 1GHz.  
1 MHz for frequencies greater than 1GHz.

Detector Function: Peak Mode for transmitter fundamental.  
Quasi-Peak for emissions < 1000MHz  
Average for emissions > 1000MHz

Occupied Bandwidth settings:  
RBW: 10KHz  
VBW: 30KHz

At frequencies up to 1000MHz a BiconiLog broadband antenna was used for measurements. At frequencies above 1000MHz a double-ridge Horn broadband antenna was used for measurements.

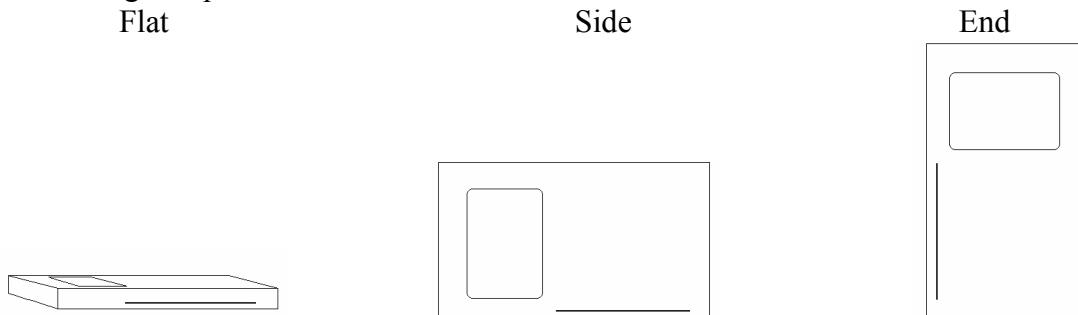
During the transmitter evaluation the EUT was transmitting continuously.

The turntable was rotated 360 degrees and the receiving antenna height varied from 1 to 4 meters to search out the highest emissions.

The final measurements were made at the lowest transmit frequency (2401MHz), a mid band frequency (2438MHz), and the highest transmit frequency (2475MHz) pursuant to the requirements of 47CFR 15.31(m). At each frequency the EUT was placed in three orthogonal positions (designated as flat, side, and end). Measurements were recorded with the receive antenna in vertical and horizontal positions.

The unit was evaluated up to the tenth harmonic of the transmit fundamental and up to 5GHz for other spurious signals.

The orthogonal positions of EUT are:



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**FORMULAS AND SAMPLE CALCULATIONS:**

THE HP8546A EMI Receiver has stored in memory the antenna and coax correction factors used in this test. The resultant Field Strength (FS) in dBuV/m presented by the HP8546A is the summation in decibels (dB) of the Received Level (RF), the Antenna Correction Factor (AF), and the Cable Loss Factor (CF).

Formula 1: Field Strength  $FS(\text{dBuV/m}) = RF(\text{dBuV}) + AF(\text{dB/m}) + CF(\text{dB})$

With the EUT transmitting the resultant Field Strength measurement is recorded using the peak hold detector of the HP8546A.

Formula 2: Equivalent Isotropic Radiated Power  $PG = \frac{(E \cdot d)^2}{30}$   
 $E = 10^{(FS(\text{dBuV/m}) / 20)} / 1000000$   
 $d = 3 \text{ meter}$

Where applicable, the recorded level is further corrected, by calculation, using a duty cycle correction factor. The duty cycle factor is determined by:

Formula 3: Duty Cycle factor  $DC \text{ factor (dB)} = 20 * \text{LOG}(\text{dwell time} / 100\text{mSec}).$

When the dwell time is determined to be less than 10mSec, the duty cycle factor to apply is determined to be 20dB. [ duty cycle factor(dB) =  $20 * \text{Log}(0.1) = -20.0 \text{ dB}$  ]

Where it was necessary to move the EUT to 1 meter distance to take measurements a 'dB' factor which adjusts for this distance variance is used before comparing the emission level to the FCC limits. This factor is determined by the following formula.

Formula 4:  $\text{Distance factor(dB)} = 20 * \text{Log}(3\text{meter}/1\text{meter}) = 20 * \text{Log}(3) = 9.54\text{dB}.$

**Test Data [2.1033(b6)]****Antenna Characteristics [15.203, 15.204]**

The antenna is a tuned copper trace on the printed circuit board. The user can not adjust nor replace the trace antenna.

**Restricted Bands: [15.205]**

The following frequency bands are restricted. Only spurious emissions are permitted at levels limited by 15.209:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.25
0.490-0.510	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			

**LIMIT @ 3meter: [15.209(a)]**

30-88MHz	100uV/m	40dBuV/m
88-216MHz	150uV/m	43.5dBuV/m
216-960MHz	200uV/m	46dBuV/m
above 960MHz	500uV/m	54dBuV/m

The spurious emissions observed in the restricted bands did not exceed the allowed limits for the restricted bands.

**Radiated Field Strength / Output Power Measurements: [15.209, 15.247(b,c)]****Field Strength Measurements : [15.247, 15.209, RSS-210.6.1.1, 6.5, 6.2.2]]****MEASUREMENT PROCEDURE:**

Direct Connect Measurements at antenna output.

**Transmit Mode. Fundamental**

Frequency	Module #2 Direct Connect PEAK Measurement	FCC Limit 15.247b	Margin
MHz	dBm	=1 Watt	dB
2401	-2.0	30dBm	<b>32.0</b>
2437	-0.5	30dBm	<b>30.5</b>
2475	-0.4	30dBm	<b>30.4</b>

**Field Strength Measurements of Fundamental & harmonics [15.247(a), 15.209]****MEASUREMENT PROCEDURE:**

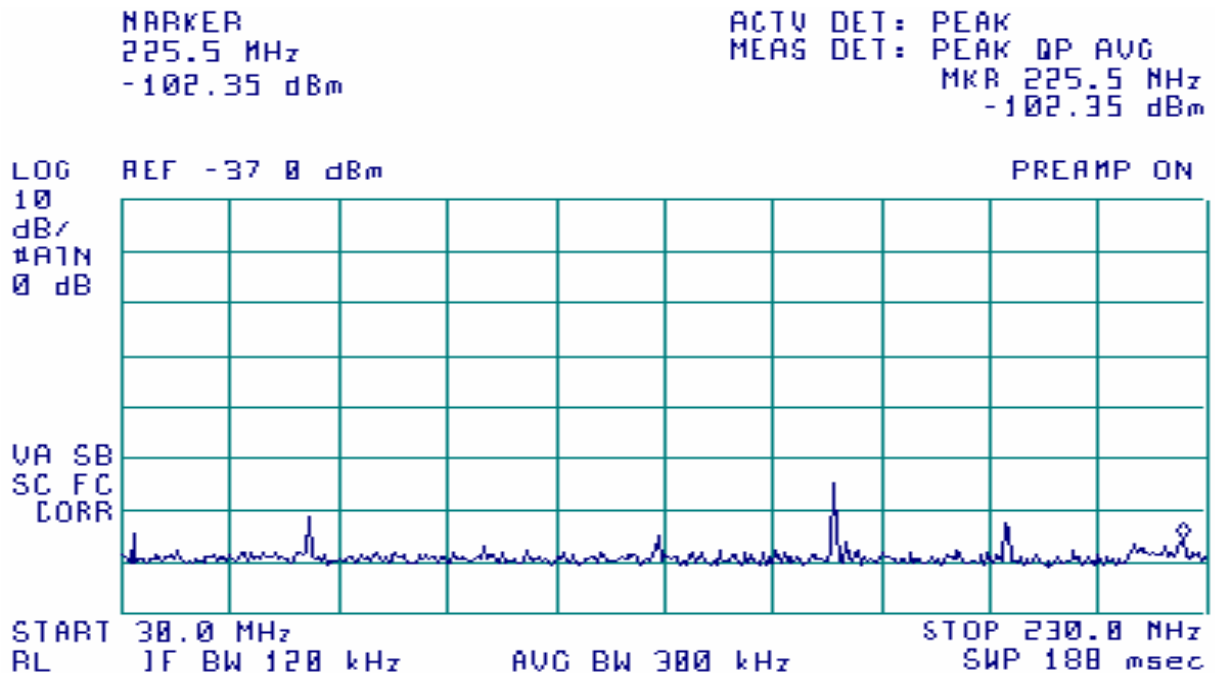
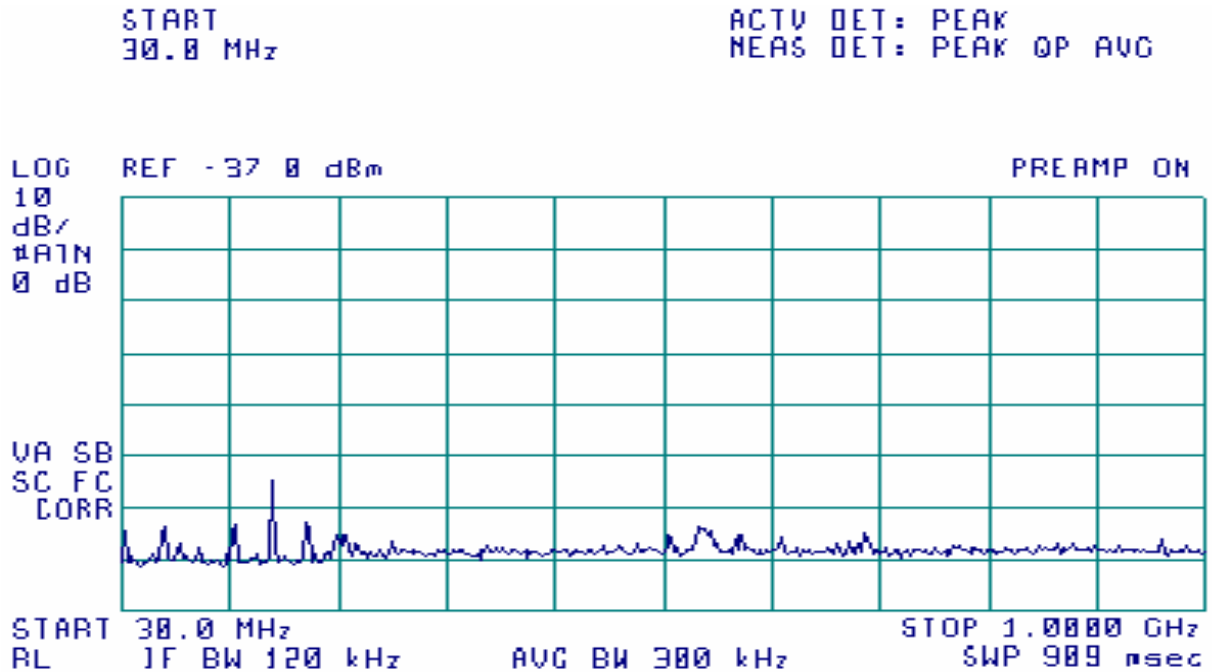
1. The EUT was measured at three test frequencies.
2. The receiving antenna and EUT were placed in the orientation determined in earlier testing (re: Exhibit G).

**Transmit Mode. Fundamental**

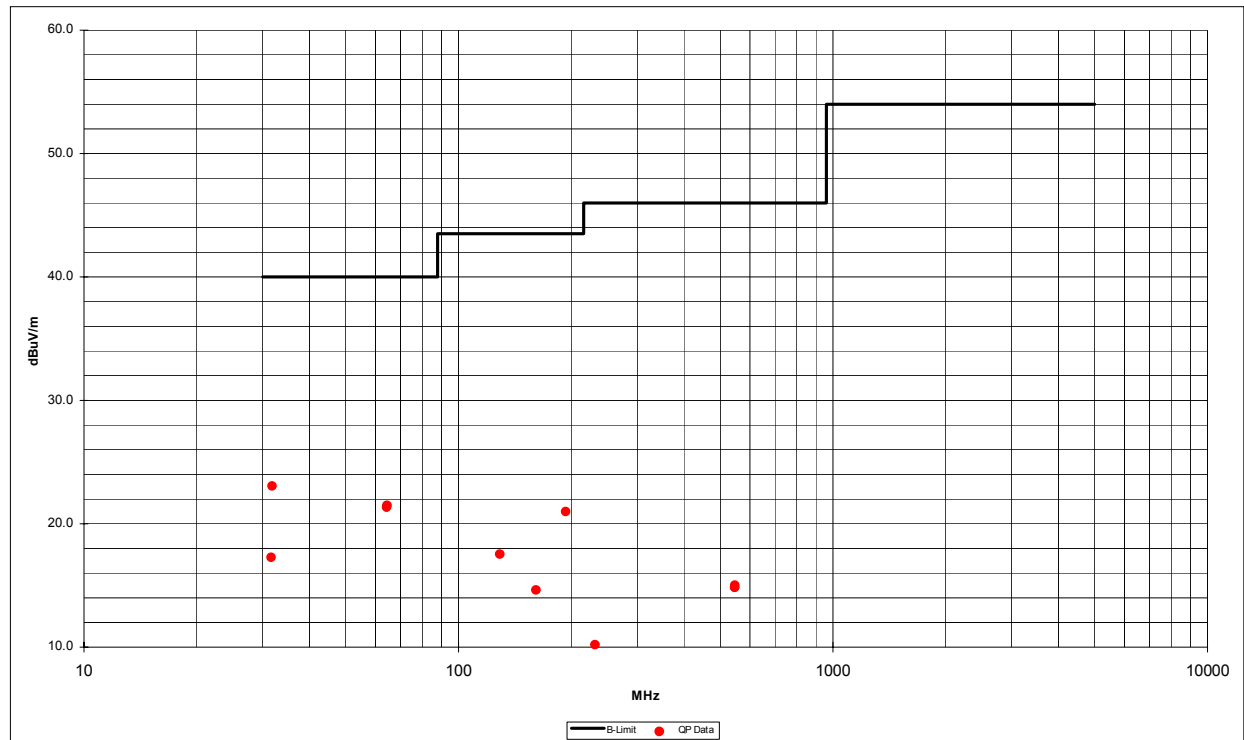
Frequency	Corrected PEAK Measurement	Included Cable+Antenna Factors	Turntable Azimuth	Antenna Height	Calculated EIRP	FCC Limit 15.247b	Margin	EUT position	Ant Pol.
MHz	dBuV/m	dB+dB/m	deg	Mtr	mWatt	mWatt	dB		
2401	92.55	35.39	0	1.5	0.54	1000	<b>32.7</b>	end	H
2438	93.93	35.61	0	1.5	0.74	1000	<b>31.3</b>	End	H
2475	95.07	35.83	1	1.5	0.96	1000	<b>30.2</b>	end	H

**Spurious Emissions: [15.247c]**

A scan of the CRS5200 was made in a shielded room to study the emission profile of the EUT. These scans indicate spurious emissions from the unit other than the fundamental and its associated harmonics. These suspect signals were measured at the 3-meter open area test site.



## Other Spurious emissions



Tabulated Quasi-Peak Measurements.

Frequency MHz	Corrected Quasi Peak Measurement dBuV/m	Included Cable+Antenna Factors dB+dB/m	Turntable Azimuth deg	Antenn a Height Mtr	Polarity	FCC Class B Limit dBuV/m	Margin dB
31.78**	23.07	17.89	-	1.0	V	40.00	16.93
64.40**	21.50	7.66	-	1.0	V	40.00	18.50
128.91**	17.54	8.50	-	1.0	V	43.50	25.96
161.09**	14.64	10.08	-	2.0	H	43.50	28.86
193.26**	21.00	11.28	-	1.0	V	43.50	22.50
231.41**	10.20	12.83	-	1.0	V	46.00	35.80
546.53**	14.86	19.93	-	1.0	H	46.00	31.14

The frequencies for measurements were determined by the suspect list generated from the shielded room prescan of 30MHz through 1GHz.

\*\*The measured levels represent the background floor noise of the measurement system.