Certification Test Report

FCC & Industry Canada Certification Test Report

for

Cobra Electronics Corporation

FCC ID: BBOPR250

IC ID: 906B-PR250

January 21, 2004

Prepared for:

Hyak Laboratories, Inc.
7011 Calamo St. Suite 107
Springfield, VA 22150

Prepared By:

Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879

FCC & Industry Canada Certification Test Report
for the
Cobra Electronics Corporation
PR 250 WX FRS/GMRS Transceiver
FCC ID: BBOPR250
IC ID: 906B-PR250

January 21, 2004

WLL JOB# 8522

Prepared by: Brian J. Dettling
Documentation Specialist

Reviewed by: Gregory M. Snyder
Chief EMC Engineer

Abstract

This report has been prepared on behalf of Hyak Laboratories, Inc. to support the attached Application for Equipment Authorization. The test report and application are submitted under Part 95 of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-210 of Industry Canada. This Certification Test Report documents the test configuration and test results for the Cobra Electronics Corporation PR 250 WX FRS/GMRS Transceiver.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

The Cobra Electronics Corporation PR 250 WX FRS/GMRS Transceiver complies with the limits under Part 95 of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-210 of Industry Canada.

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1 Introduction

1.1 Compliance Statement

The Cobra Electronics Corporation PR 250 WX FRS/GMRS Transceiver complies with the limits under FCC Part 95 and Industry Canada RSS-210.

1.2 Test Scope

Tests for radiated emissions and conducted emissions at antenna terminals were performed. All measurements were performed according to the 2001 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer: Hyak Laboratories, Inc.
7011 Calamo St. Suite 107
Springfield, VA 22150

For: Cobra Electronics Corporation
6500 West Cortland Street
Chicago, IL 60707

Purchase Order Number: 05-001

Quotation Number: 62063-A

1.4 Test Dates

Testing was performed from January 5 to January 12, 2005.

1.5 Test and Support Personnel

Washington Laboratories, LTD Mike Violette, Steve Koster, James Ritter

1.6 Abbreviations

A	Ampere
Ac	alternating current
AM	Amplitude Modulation
Amps	Amperes
b/s	bits per second
BW	Bandwidth
CE	Conducted Emission
cm	centimeter
CW	Continuous Wave
dB	decibel
dc	direct current
EMI	Electromagnetic Interference
EUT	Equipment Under Test
FM	Frequency Modulation
G	giga - prefix for 10^9 multiplier
Hz	Hertz
IF	Intermediate Frequency
k	kilo - prefix for 10^3 multiplier
M	Mega - prefix for 10^6 multiplier
m	Meter
	micro - prefix for 10^{-6} multiplier
NB	Narrowband
LISN	Line Impedance Stabilization Network
RE	Radiated Emissions
RF	Radio Frequency
rms	root-mean-square
SN	Serial Number
S/A	Spectrum Analyzer
V	Volt

2 Equipment Under Test

2.1 EUT Identification & Description

The Cobra Electronics Corporation PR 250 WX FRS/GMRS Transceiver is a self-contained FRS/GMRS transceiver unit intended for use as a general communication tool. Per the FCC definition: GMRS is a land mobile radio service available to persons for short distance two-way communications to facilitate the activities of licensees and their immediate family members. The PR250 WX model has 22 channels of which channels 1-7 share the FRS channels 1-7.

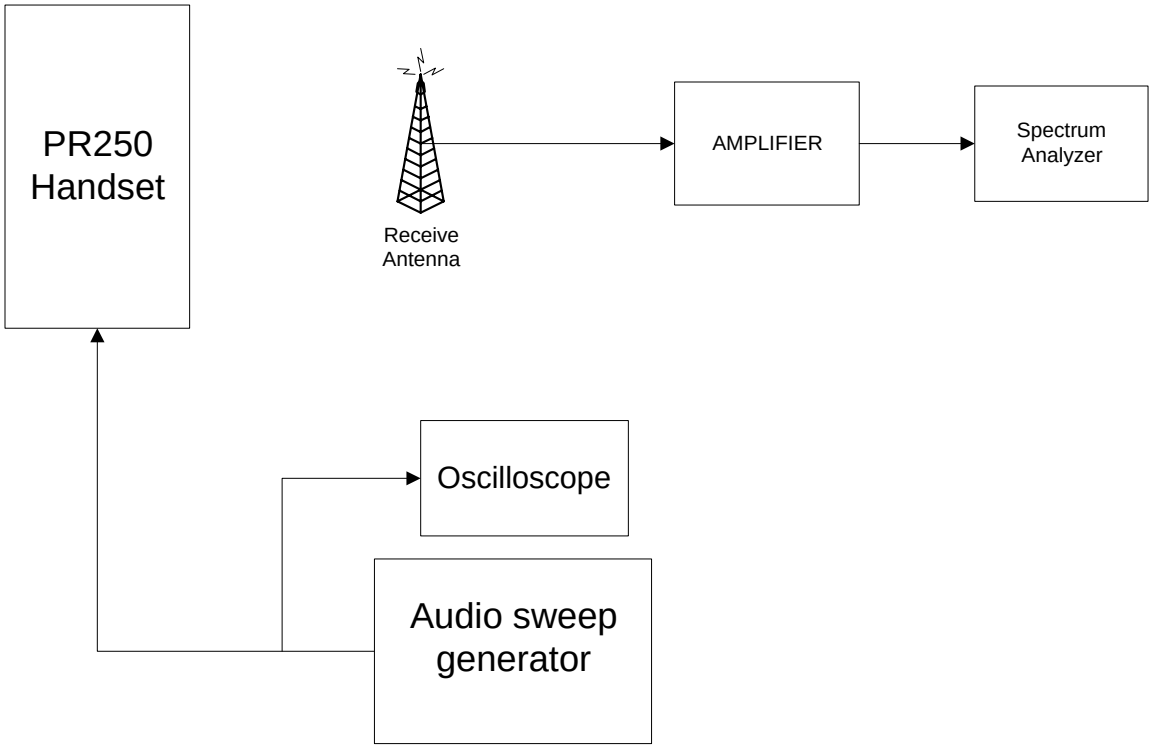
Other features include a CTCSS system with 38 pre-defined, user selectable sub-audible tones for channel quieting. The useable range, while dependent upon terrain and other radio propagation principles, is typically five miles based on the transmit power specified at 1 watt ERP.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Cobra Electronics Corporation
EUT Name:	FRS/GMRS Transceiver
Model:	PR 250 WX
FCC ID:	BBOPR250
IC ID:	906B-PR250
FCC Rule Parts:	§95
Industry Canada:	RSS-210
Frequency Range:	462.5625MHz to 467.125MHz
Maximum Output Power:	1W GMRS, 0.5W FRS
Modulation:	FM
Necessary Bandwidth:	11kHz
Keying:	Manual
Type of Information:	Voice
Number of Channels:	22 Total (7 FRS/GMRS, 7 FRS Only, 8 GMRS only)
Power Output Level	Fixed
Antenna Type	Permanently attached
Frequency Tolerance:	GMRS: <0.0005% FRS: <0.00025%
Emission Type(s):	11KOF3E
Interface Cables:	External microphone input
Power Source & Voltage:	6VDC via four “AA” batteries

2.2 Test Configuration

The PR 250 WX was tested in a stand-alone configuration. See the following illustration.



2.3 Testing Algorithm

The PR 250 WX was powered on and set to either Channel 8 (FRS) or Channel 15 (GMRS). A 2500Hz signal was provided to the EUT microphone port from the audio generator.

Worst-case emission levels are provided in the test results data.

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

Land Mobile FM or PM Communications Equipment Measurement and Performance Standards (ANSI/TIA/EIA-603-93)

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ±2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5\ (2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB.

3 Test Equipment

Table 2 shows a list of the test equipment used for measurements along with the calibration information.

Table 2. Test Equipment List

Equipment	WLL Asset #	Calibration Due
Hewlett-Packard 8568B Spectrum Analyzer	0073	7/08/05
Hewlett-Packard 85650A Quasi-Peak Adapter	0069	7/08/05
Hewlett-Packard 8593A Spectrum Analyzer	0074	8/17/05
Hewlett-Packard 8449B Microwave Preamp	0312	9/29/05
Solar Electronics 8012-50-R-24BNC LISN	0125	10/01/05
ARA LPB-2520 BiconiLog Antenna	0007	9/14/05
ARA DRG118/A Microwave Horn Antenna	0425	4/17/05
Hewlett-Packard 85685A RF Preselector	0071	7/08/05
EMCO 3110B Biconical Antenna	0026	6/22/05
EMCO 3146A Log Periodic Antenna	0029	6/24/05

4 Test Results

4.1 RF Power Output: FCC 2.1046: GMRS Mode & FRS Mode

The output from the transmitter was fitted with a coax connector for performing certain tests. The conducted output power was measured via connecting the output to an attenuator and then to the input of the RF Spectrum Analyzer. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system.

The carrier was modulated with a 2500 Hz signal.

The Diode detector substitution method was used. The following table lists the results of the conducted output power.

Table 3. RF Power Output

Channel and/or Frequency	Measured Level (dBm)	Measured Level (Watts)	Rated (Watts)	Limit (Watts)	Pass/ Fail
Channel 17 -462.6 MHz (GMRS)	29.95	0.990	1	50	Pass
Channel 8 -467.5625 MHz (FRS)	26.80	0.480	0.5	0.5	Pass

4.1.1 Effective Radiated Power (§2.1046)

Effective radiated power was measured using the substitution method described in TIA/EIA–603 . The unit was placed on an open area test site at a test distance of 3m. The ERP level is determined using signal substitution and is referenced to the gain of a half-wave dipole. The unit was tested in three orthogonal planes to determine the highest power.

The following table lists the results of the ERP measurements.

Table 4: ERP Test Results (§2.1046(a))

CLIENT:	HYAK Labs	DATE:	1/7/05
TESTER:	James Ritter	JOB #:	8522

Test Requirements:

EUT: PR250WX FRS/GMRS Transceiver
TEST STANDARD: FCC Part 95/RSS-210
DISTANCE: 3m

MODE: Channel 15 @ 462.6 MHz (GMRS)

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (dBµV)	Ant. Gain dBi	Signal Gen Level dBm	EIRP Level dBm	ERP Level (dBm)	ERP Watts
462.58	H	270.0	1.0	102.1	7.0	21.4	28.4	26.3	0.462
462.58	V	45.0	1.3	95.6	7.0	17.5	24.5	22.4	0.171

MODE: Channel 8 @ 467.5625MHz (FRS)

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (dBµV)	Ant. Gain dBi	Signal Gen Level dBm	EIRP Level dBm	ERP Level (dBm)	ERP Watts
467.59	H	250.0	1.0	97.4	6.9	17.0	23.9	26.0	0.398
467.59	V	0.0	1.3	85.1	6.9	9.0	15.9	18.0	0.064

4.2 Modulation Characteristics (FCC 2.1047)

This section summarizes the results of the testing of the modulation characteristics of the EUT.

4.2.1 Audio Frequency Response

The audio frequency response was measured in accordance with TIA/EIA-603. The audio signal was fed into an external dummy microphone circuit and supplied to the microphone connector.

The following table lists the test results of the transmit audio response and Figure 4-1 is a curve of the audio frequency response.

Table 5. Transmit Audio Response

Client: Hyak Laboratories
EUT: Cobra MicroTalk
Date: 23-Jan-04
Test Engineer: Mike Violette

FCC Part 2.1047: Modulation Characteristics
Transmit Audio Response
2mVrms applied before 8200 pf coupling capacitor

Frequency	Input	Output	Ratio	Ratio dB	Normalized Response	TIA Upper Limit	TIA Lower Limit
200							
300	2	3	1.5	3.5	-20.2	-9.4	-17.9
400	2	8.5	4.25	12.5	-11.2	-6.9	-12.9
500	2	14.4	7.2	17.1	-6.6	-5.0	-9.0
600	2	18.4	9.2	19.3	-4.5	-3.4	-7.4
700	2	21.6	10.8	20.7	-3.1	-2.0	-6.1
1000	2	31	15.5	23.8	0	1.0	-3
1250	2	38.4	19.2	25.7	1.8	2.9	-1.0
1500	2	48.7	24.35	27.7	3.9	4.5	0.5
2000	2	61.5	30.75	29.7	5.9	7.0	3.0
2250	2	66.6	33.3	30.4	6.6	8.04	4.0
2500	2	66	33	30.3	6.6	8.9	4.9
2750	2	67.1	33.55	30.5	6.7	9.7	4.9
3000	2	60	30	29.5	5.7	10.5	4.9
4000	2	39.9	19.95	25.9	2.2	-	-
5000	2	25.2	12.6	22.0	-1.8	-	-
6000	2	17.4	8.7	18.8	-5.0	-	-
7000	2	11.5	5.75	15.2	-8.6	-	-
8000	2	7.4	3.7	11.3	-12.4	-	-
9000	2	5	2.5	7.9	-15.8	-	-
10000	2	4	2	6.0	-17.7	-	-

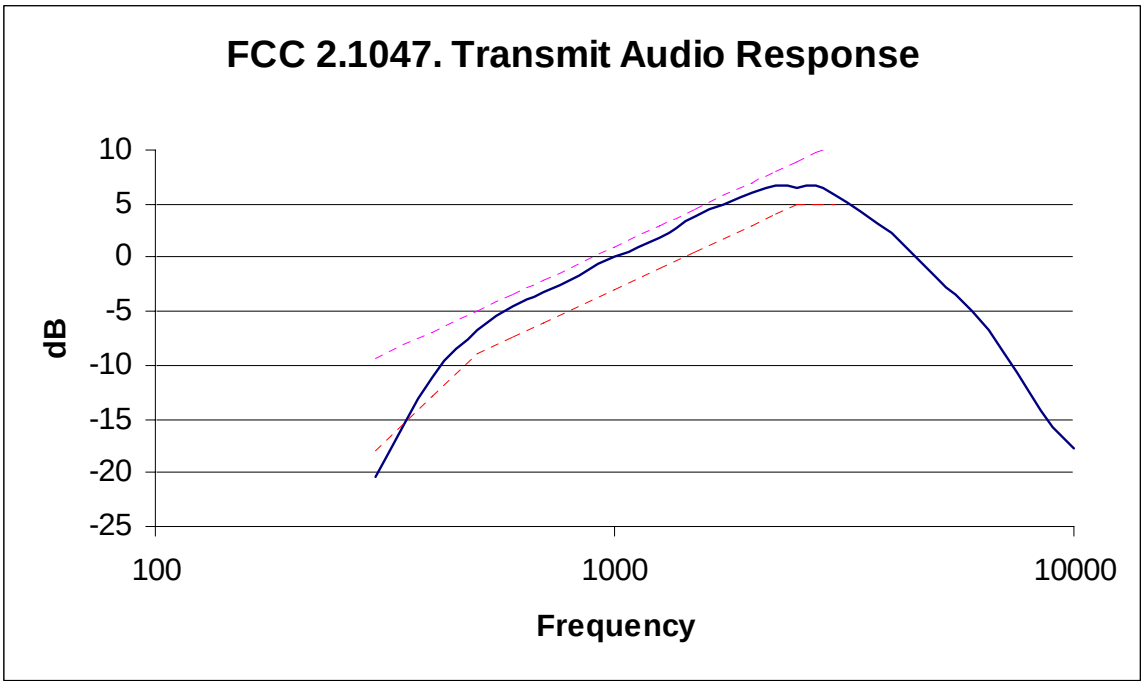


Figure 4-1. Transmit Audio Response

4.2.2 Modulation Deviation Over Frequency and Input (§95.637(a))

Modulation limiting was performed in accordance with the procedure of TIA-603. Per Section 95.637(a) the modulation deviation shall not exceed 5kHz for a GMRS radio and 2.5kHz for a FRS radio.

Test results for modulation limiting over frequency and input are shown in Table 6 and

Table 8 respectively.

Figure 4-2 shows a curve of the modulation deviation over frequency and Figure 4-3 is a curve of modulation frequency over input.

Table 6. Modulation Deviation Over Frequency

Frequency: GMRS Channel 17@ 462.6 MHz
Frequency: FRS Channel 8 @ 467.5625 MHz
Input: 63mVrms

Frequency (Hz)	FRS	GMRS	GMRS Limit	FRS Limit
100	0.2	0.22	5	2.5
150	0.2	0.22	5	2.5
200	0.36	0.37	5	2.5
250	0.36	0.4	5	2.5
300	0.93	0.95	5	2.5
350	1.58	1.62	5	2.5
400	2.19	1.96	5	2.5
500	2.48	2.49	5	2.5
700	2.48	2.35	5	2.5
750	2.49	2.4	5	2.5
1000	2.4	2.23	5	2.5
1100	2.4	2.22	5	2.5
1200	2.35	2.21	5	2.5
1300	2.35	2.2	5	2.5
1400	2.37	2.19	5	2.5
1500	2.39	2.2	5	2.5
1600	2.39	2.21	5	2.5
1700	2.38	2.5	5	2.5
1800	2.3	2.42	5	2.5
1900	2.28	2.12	5	2.5
2000	2.22	2.09	5	2.5
2100	2.14	2.03	5	2.5
2200	2.08	1.94	5	2.5
2300	1.98	1.83	5	2.5
2400	1.85	1.67	5	2.5
2500	1.7	1.59	5	2.5
2600	1.59	1.5	5	2.5
2700	1.5	1.38	5	2.5
2800	1.32	1.25	5	2.5

Frequency (Hz)	FRS	GMRS	GMRS Limit	FRS Limit
2900	1.14	1.15	5	2.5
3000	1.06	1.02	5	2.5
3100	0.98	0.93	5	2.5
3200	0.89	0.79	5	2.5
3300	0.79	0.7	5	2.5
3400	0.7	0.65	5	2.5
3500	0.63	0.2	5	2.5
4000	0.4	0.2	5	2.5
4500	0.3	0.2	5	2.5
5000	0.3	0.2	5	2.5

Table 7. Test Equipment Used

Description	Model	Asset/ Serial Number	Cal Due
Deviation meter	Boonton 82AD	12	4/14/05
Sweep Generator	B&K Precistion 4040A	406	N/A
Oscilloscope	Tektronix TDS220	476	7/29/05

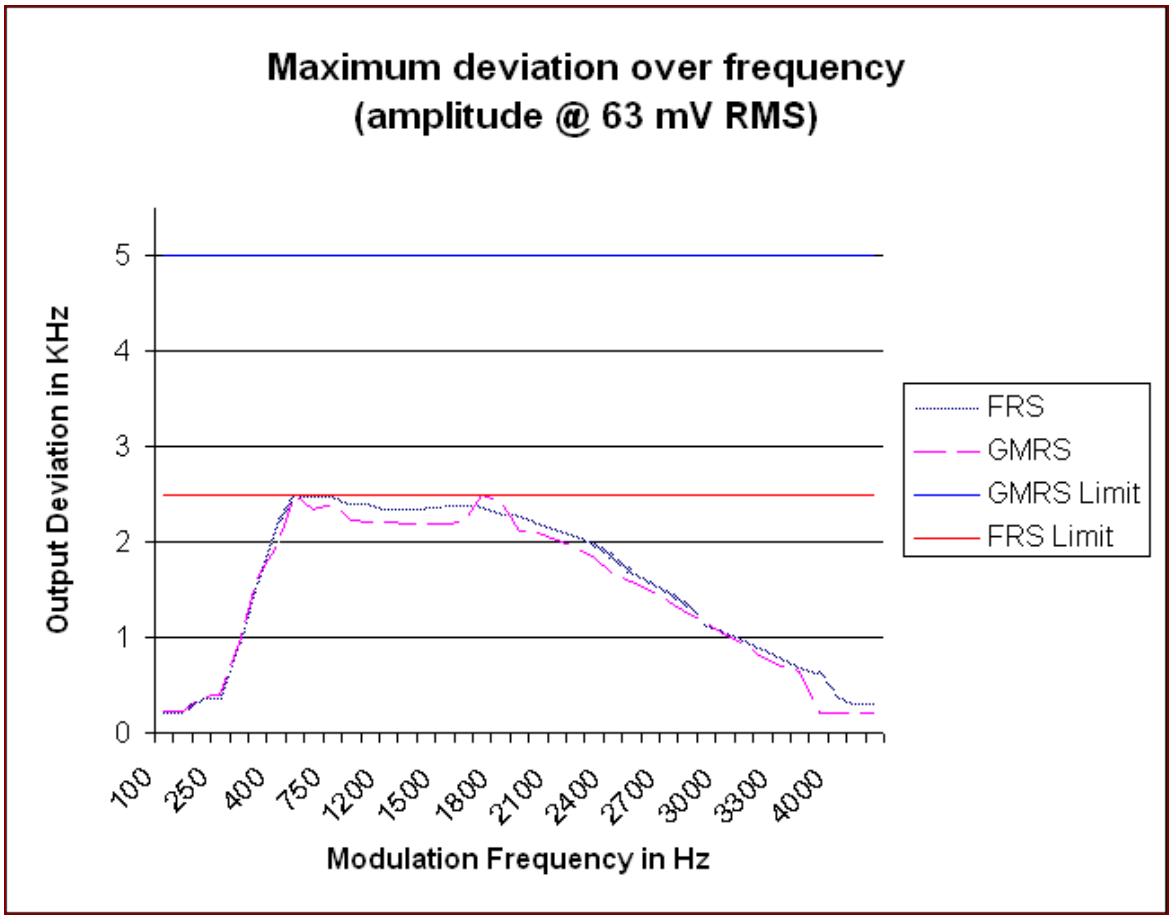


Figure 4-2. Modulation Deviation vs Frequency

Table 8. Modulation Deviation Over Input

Level (mV)	300 Hz in	1500 Hz in	2500 Hz in
0.5	0.11	0.18	0.21
1	0.11	0.28	0.32
3	0.16	0.69	0.74
4	0.15	0.89	1
5	0.17	0.98	1.22
10	0.23	2.28	1.56
15	0.29	2.28	1.56
20	0.36	2.29	1.59
50	0.78	2.3	1.63
60	0.9	2.28	1.64
70	0.98	2.28	1.64
80	1.16	2.28	1.64
90	1.3	2.28	1.64
100	1.48	2.3	1.64

Table 9. Test Equipment Used

Description	Model	Asset/ Serial Number	Cal Due
Deviation meter	Boonton 82AD	12	4/14/05
Sweep Generator	B&K Precistion 4040A	406	N/A
Oscilloscope	Tektronix TDS220	476	7/29/05

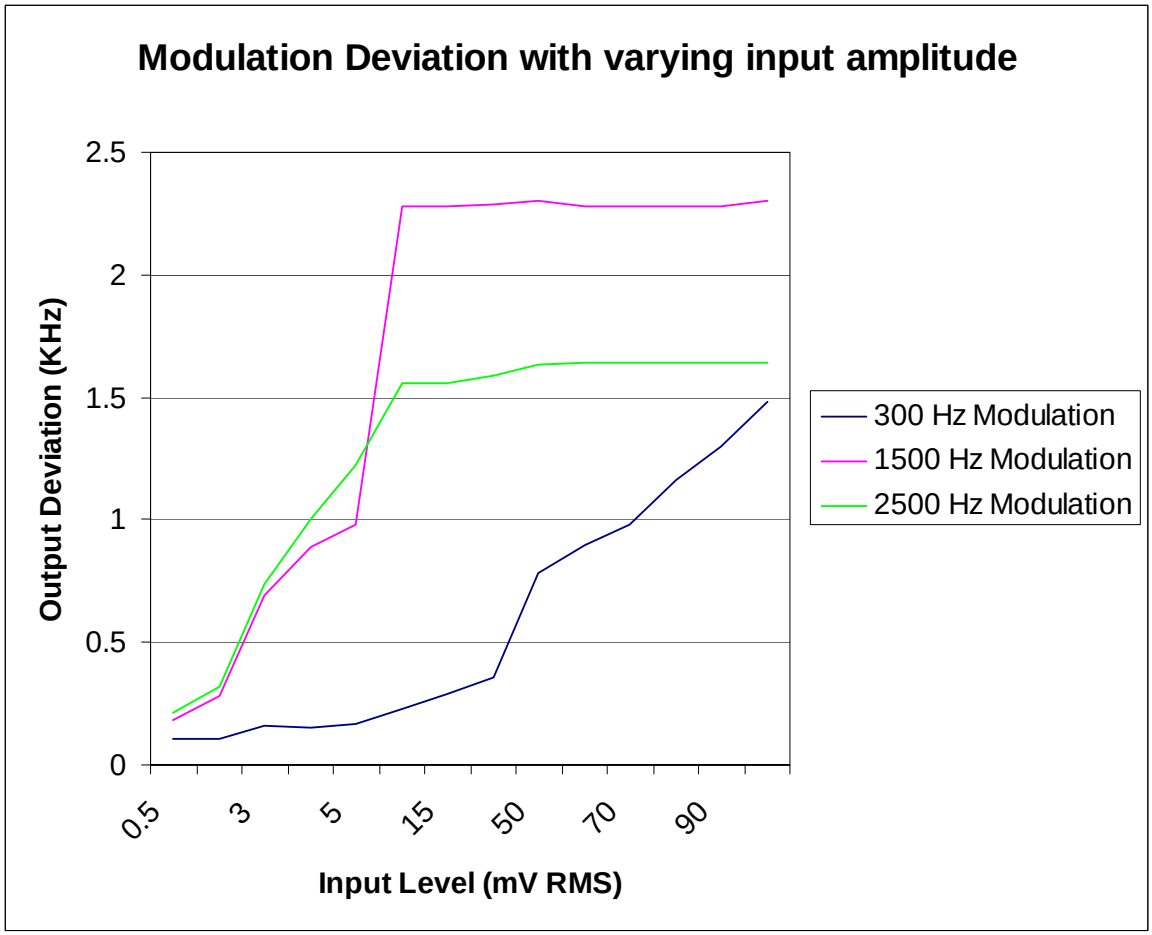


Figure 4-3. Modulation Deviation vs Input Voltage

4.2.3 Audio Low Pass Filter Response (§95.637)

The audio low pass filter response was measured in accordance with §95.637(b). Testing was performed per the method given in TIA-603. The following table lists the results of the audio low pass filter response. Figure 4-4 is a curve showing the response.

Table 10. Normalized Low Pass Filter Response

Client:	Hyak Laboratories	EUT:	Cobra MicroTalk
Date:	23-Jan-04	Test Engineer:	Mike Violette

Modulation Characteristics

2mVrms applied before 8200 pf coupling capacitor

Frequency Hz	Input	Output	Ratio	Ratio dB	Normalized Response	TIA Limit
100	50	121	2.42	7.6	-2.6	0
200	50	138	2.76	8.8	-1.5	0
300	50	147	2.94	9.3	-1.0	0
400	50	150	3	9.5	-0.8	0
500	50	151	3.02	9.6	-0.7	0
600	50	153	3.06	9.7	-0.6	0
700	50	154	3.08	9.7	-0.5	0
1000	50	160	3.2	10.1	-0.2	0
1250	50	163	3.26	10.2	-0.1	0
1500	50	165	3.3	10.3	0	0
2000	50	160	3.2	10.1	-0.2	0
2250	50	155	3.1	9.8	-0.5	0
2500	50	141	2.82	9.0	-1.3	0
2750	50	125	2.5	7.9	-2.4	0
3000	50	104	2.08	6.3	-4.0	0
4000	50	64.2	1.284	2.1	-8.1	-7.4
5000	50	39	0.78	-2.1	-12.5	-13.3
6000	50	26	0.52	-5.6	-16.0	-18.0
7000	50	20	0.4	-7.9	-18.3	-22.0
8000	50	15	0.3	-10.4	-20.8	-25.5
9000	50	11.2	0.224	-12.9	-23.3	-28.6
10000	50	9.5	0.19	-14.4	-24.7	-31.3
15000	50	3.9	0.078	-22.1	-32.5	-41.9
20000	50	2.2	0.044	-27.1	-37.5	-49.4

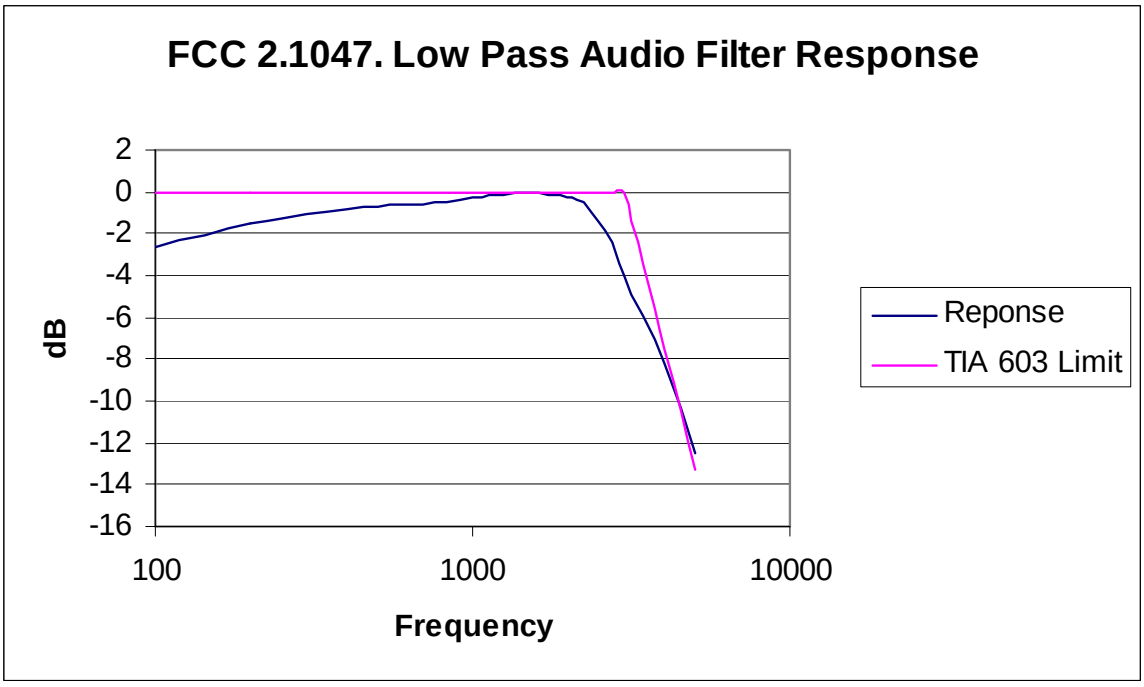


Figure 4-4. Audio Low Pass Filter Response

Table 11. Test Equipment Used

Description	Model	Asset/ Serial Number	Cal Due
Signal Generator	BK Precision	406	N/A
Oscilloscope	Tektronix TDS220	476	7/29/05

4.3 Occupied Bandwidth (§2.1049)

Occupied bandwidth was performed by connecting the output of the EUT to the input of a spectrum analyzer. The unit was supplied a 2500Hz audio signal and the 20dB bandwidth was measured for both the FRS and GMRS modes.

At full modulation, the occupied bandwidth was measured and the results are shown in the following plots.

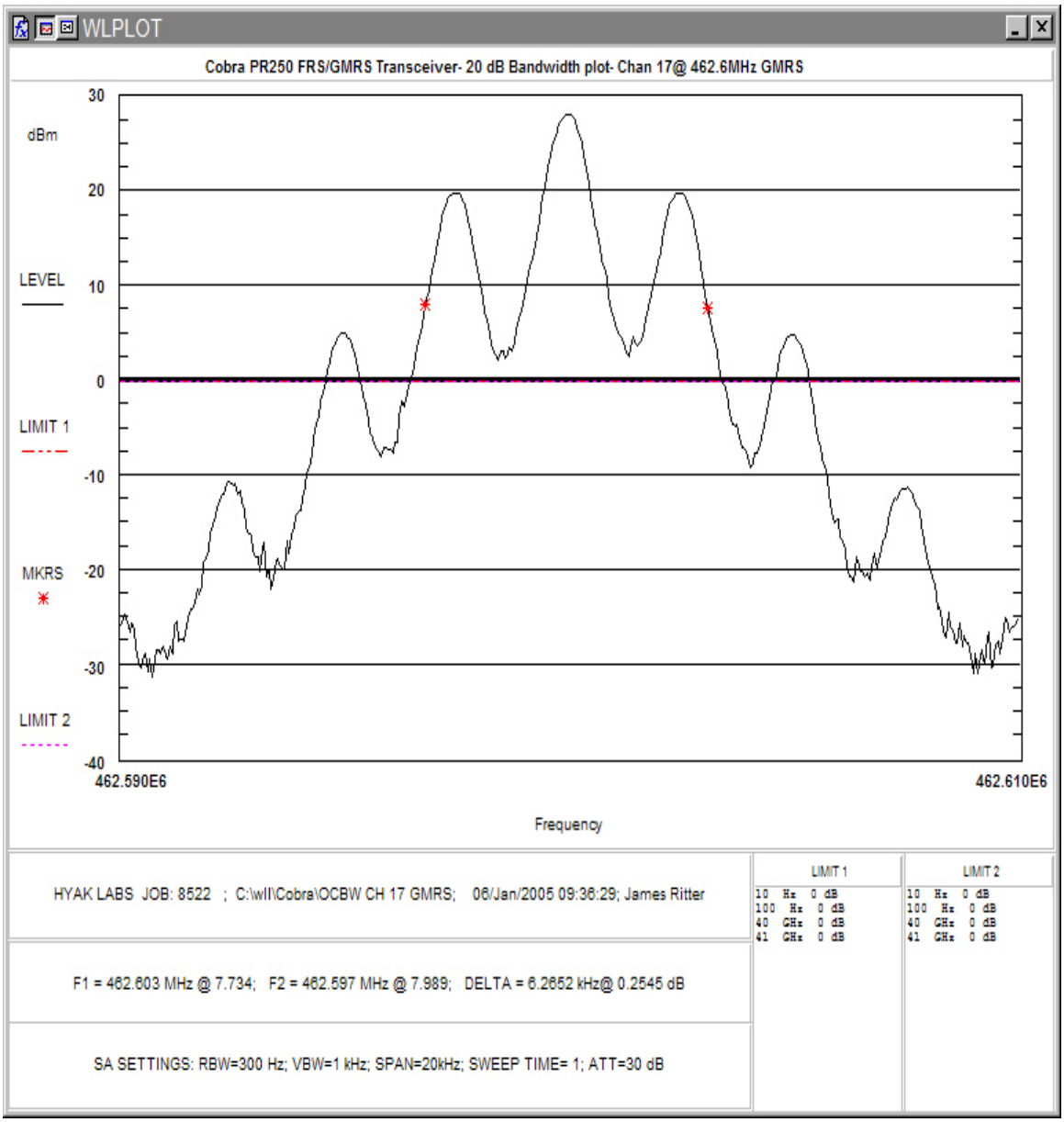


Figure 4-5. Occupied Bandwidth, GMRS

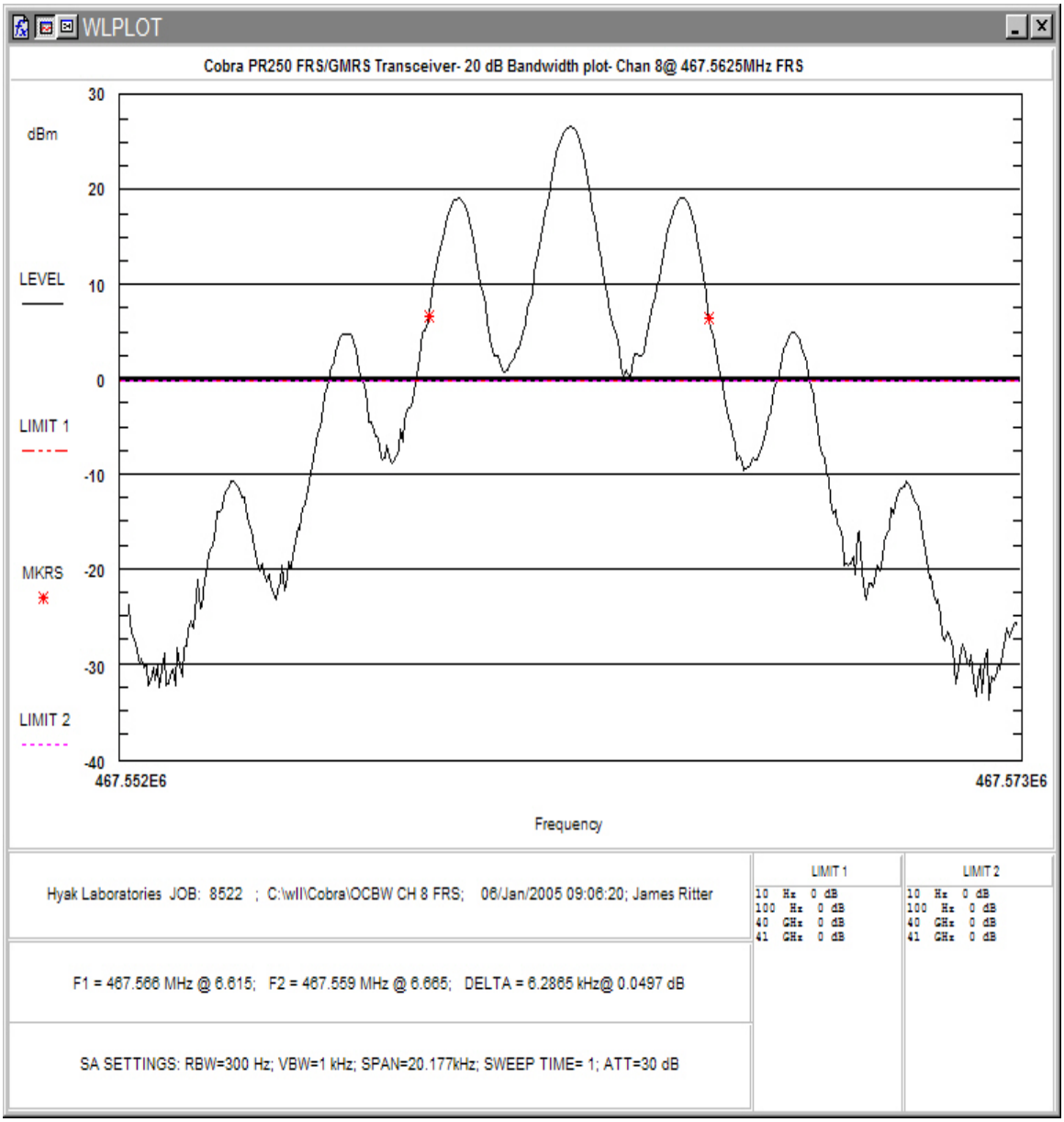


Figure 4-6. Occupied Bandwidth, FRS

Table 12 provides a summary of the Occupied Bandwidth Results.

Table 12. Occupied Bandwidth Results: GMRS

Frequency	Mode	Bandwidth
462.6 MHz	GMRS	6.26 kHz
467.56 MHz	FRS	6.28 kHz

4.4 Spurious Emissions at Antenna Terminals (§2.1051 and §95.635(b))

4.4.1 GMRS Mode

The EUT must comply with requirements for spurious emissions at antenna terminals pre the requirements of §95.635(b)(1)(3)(7). All emissions must be suppressed by:

§95.635(b)(1): at least 25dB 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 35dB 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)(7): at least 43 + 10Log(T) dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

The unit with the connector in place of the antenna was connected via an attenuator to the input of the spectrum analyzer. The conducted spurious emissions were measured through the 10^{th} harmonic of the fundamental.

Figure 4-7 through Figure 4-14 are plots of the conducted spurious emissions.

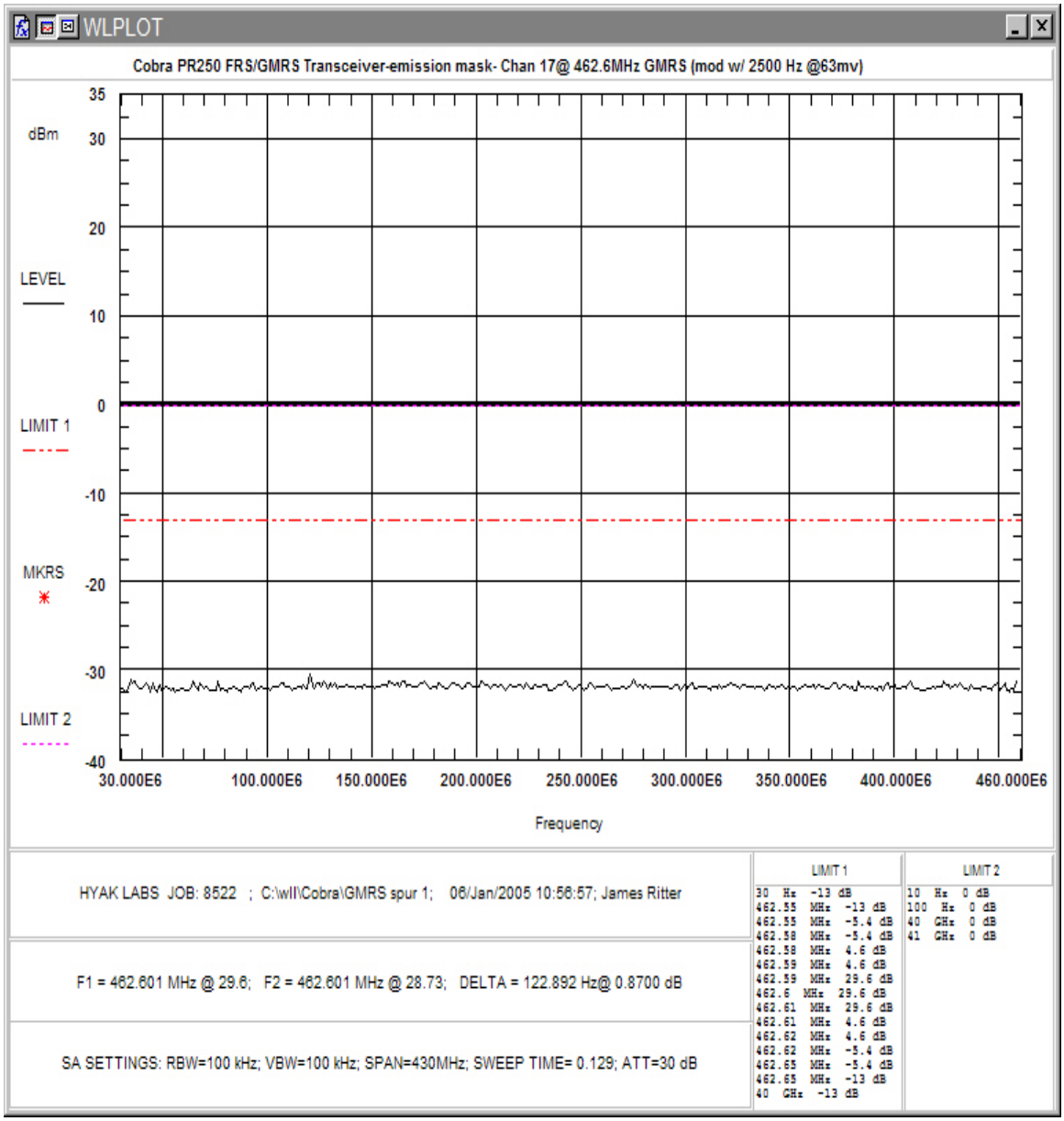


Figure 4-7. GMRS Mode Conducted Spurious Emissions, 30 – 460MHz

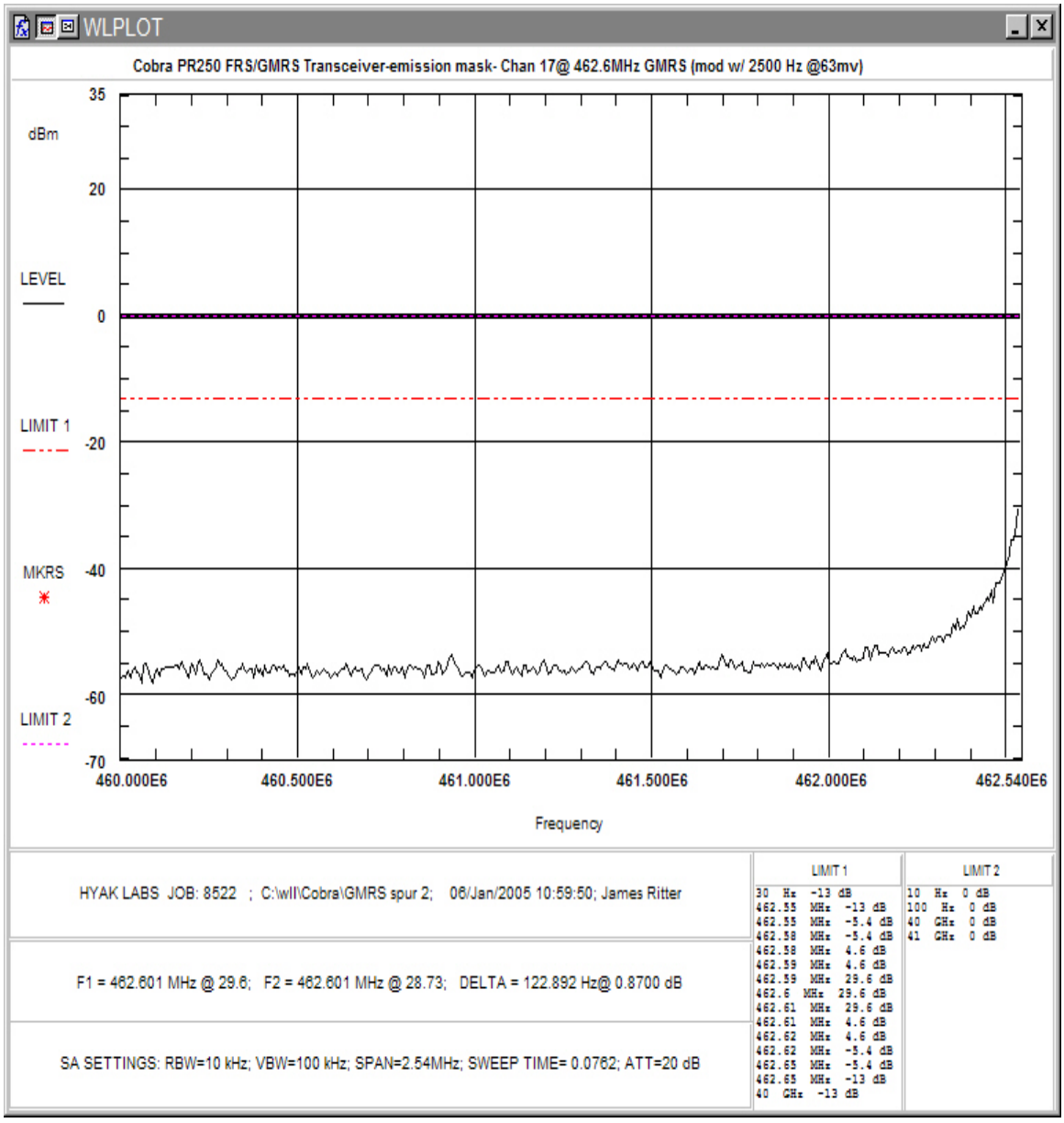


Figure 4-8. GMRS Mode Conducted Spurious Emissions, 460 – 462.54MHz

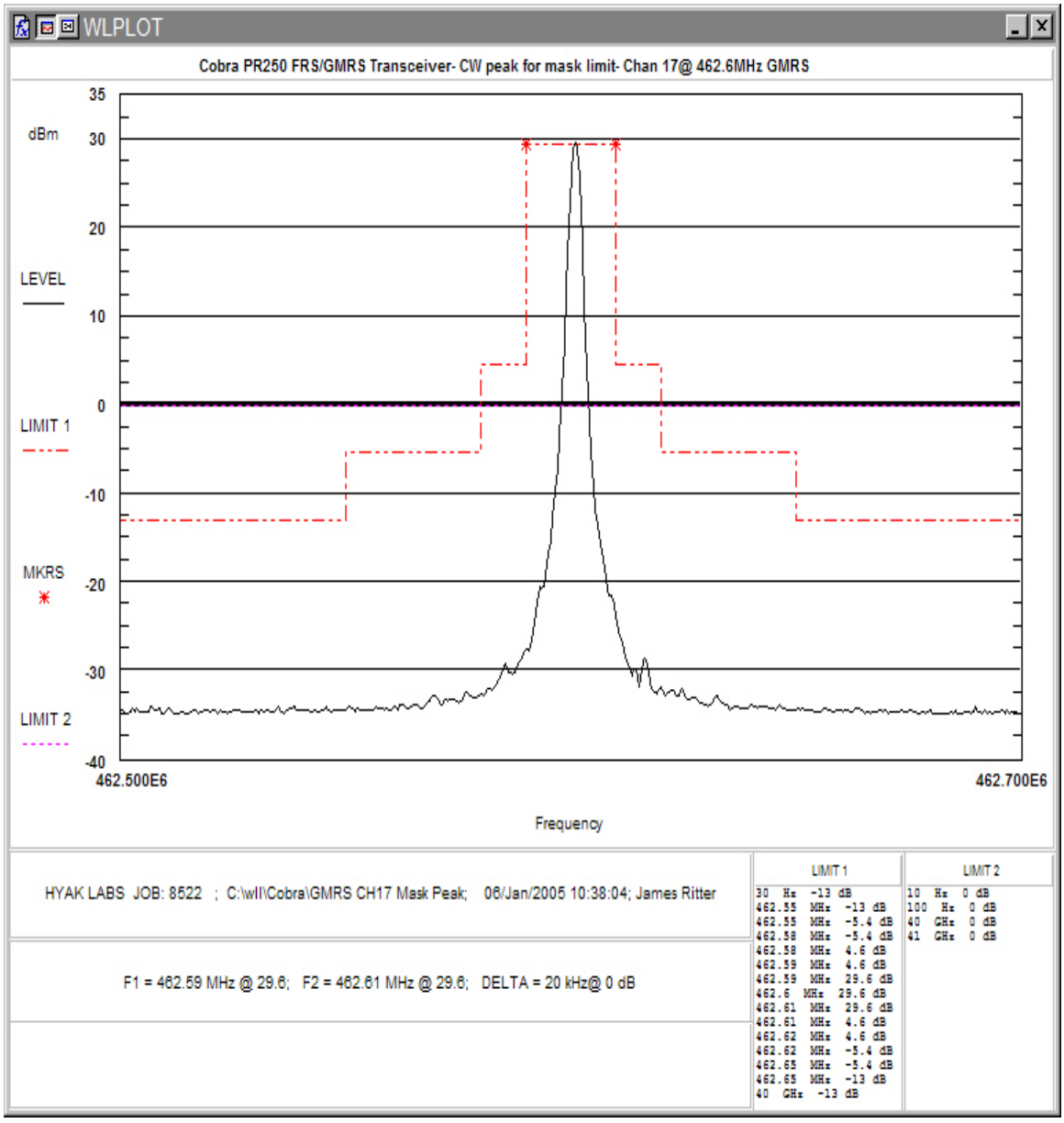


Figure 4-9. GMRS Mode Conducted Spurious Emissions, 462.5 – 462.7MHz (Unmodulated)

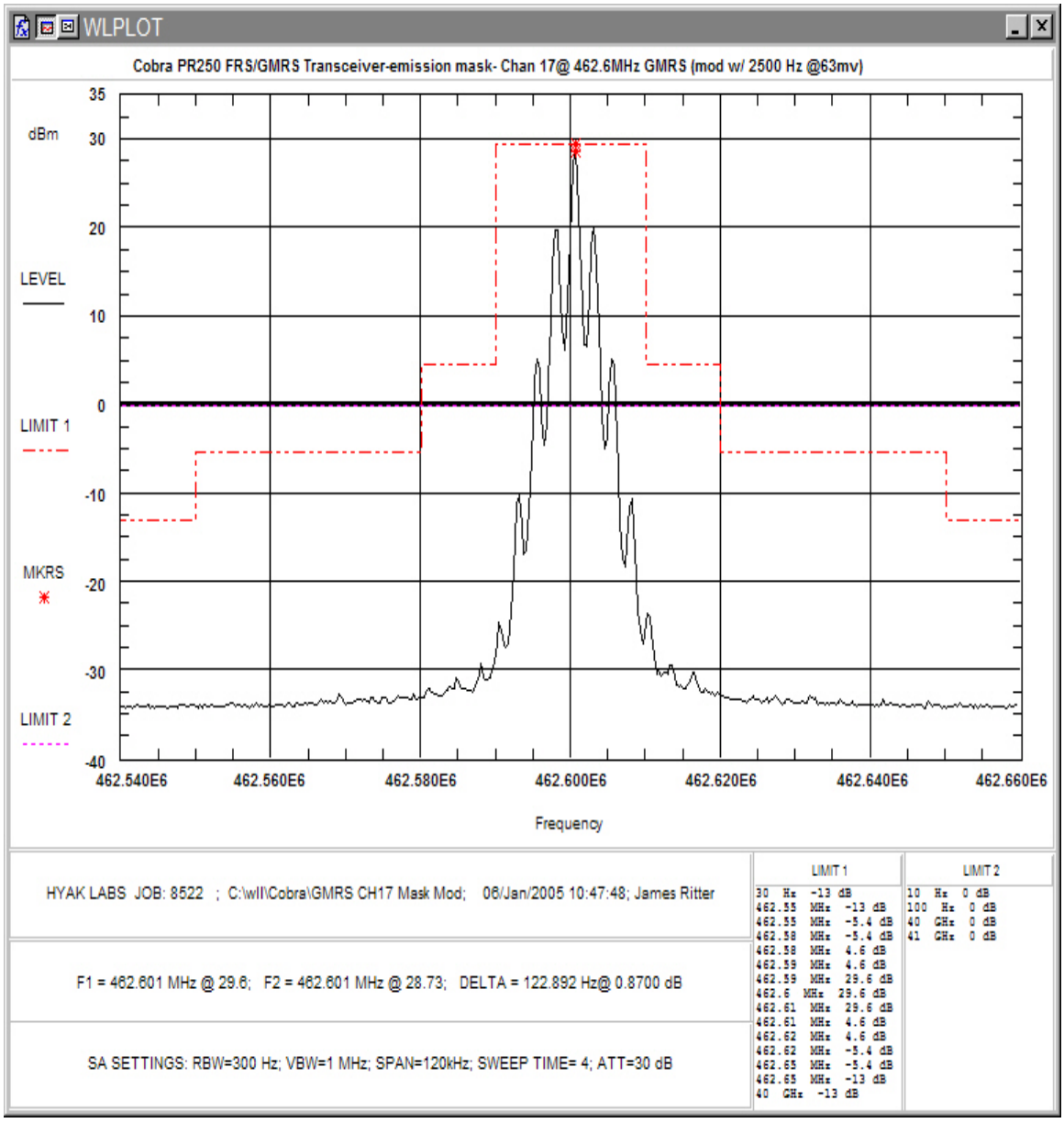


Figure 4-10. GMRS Mode Conducted Spurious Emissions, Emission Mask

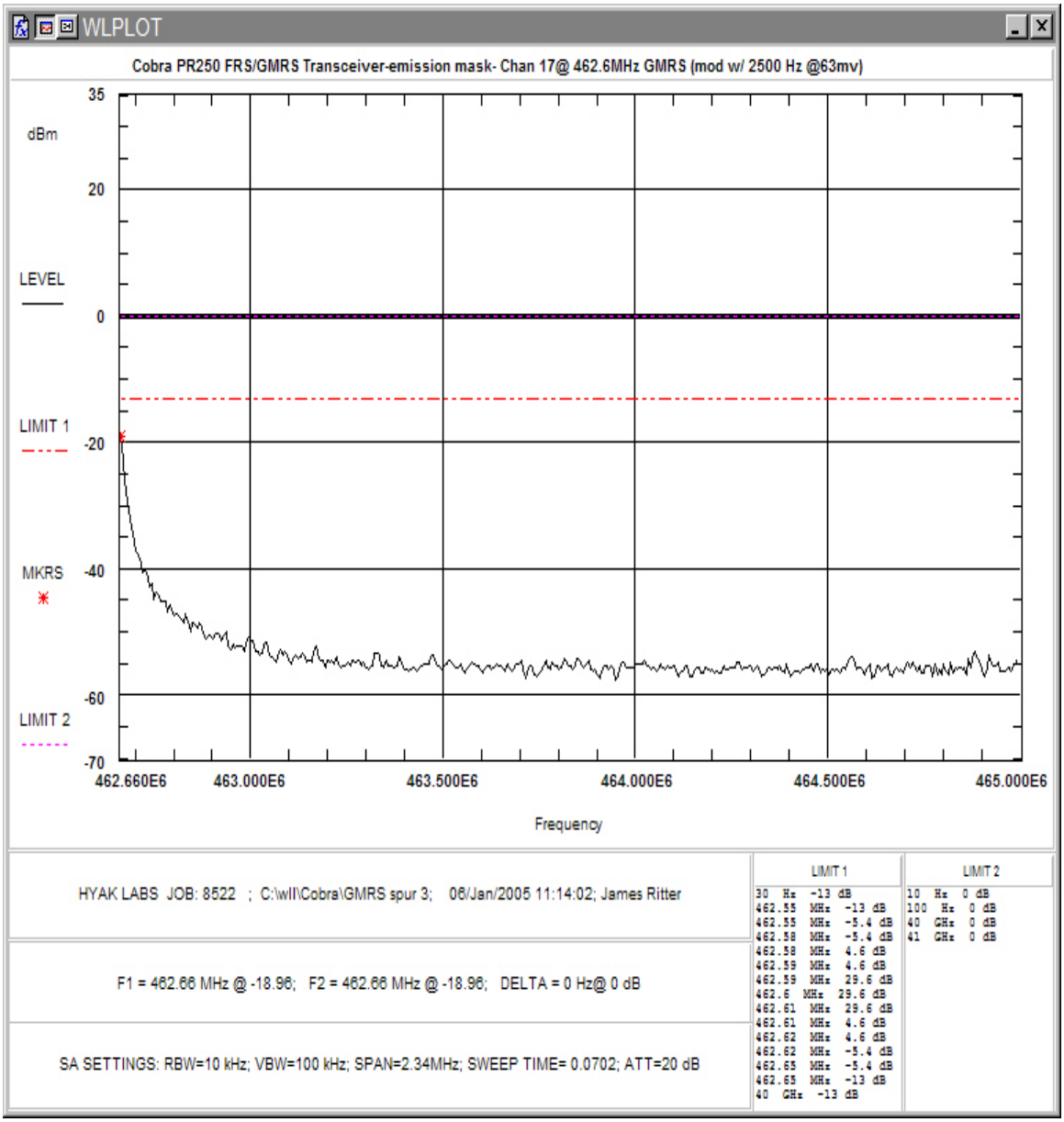


Figure 4-11. GMRS Mode Conducted Spurious Emissions, 462.66 – 465MHz

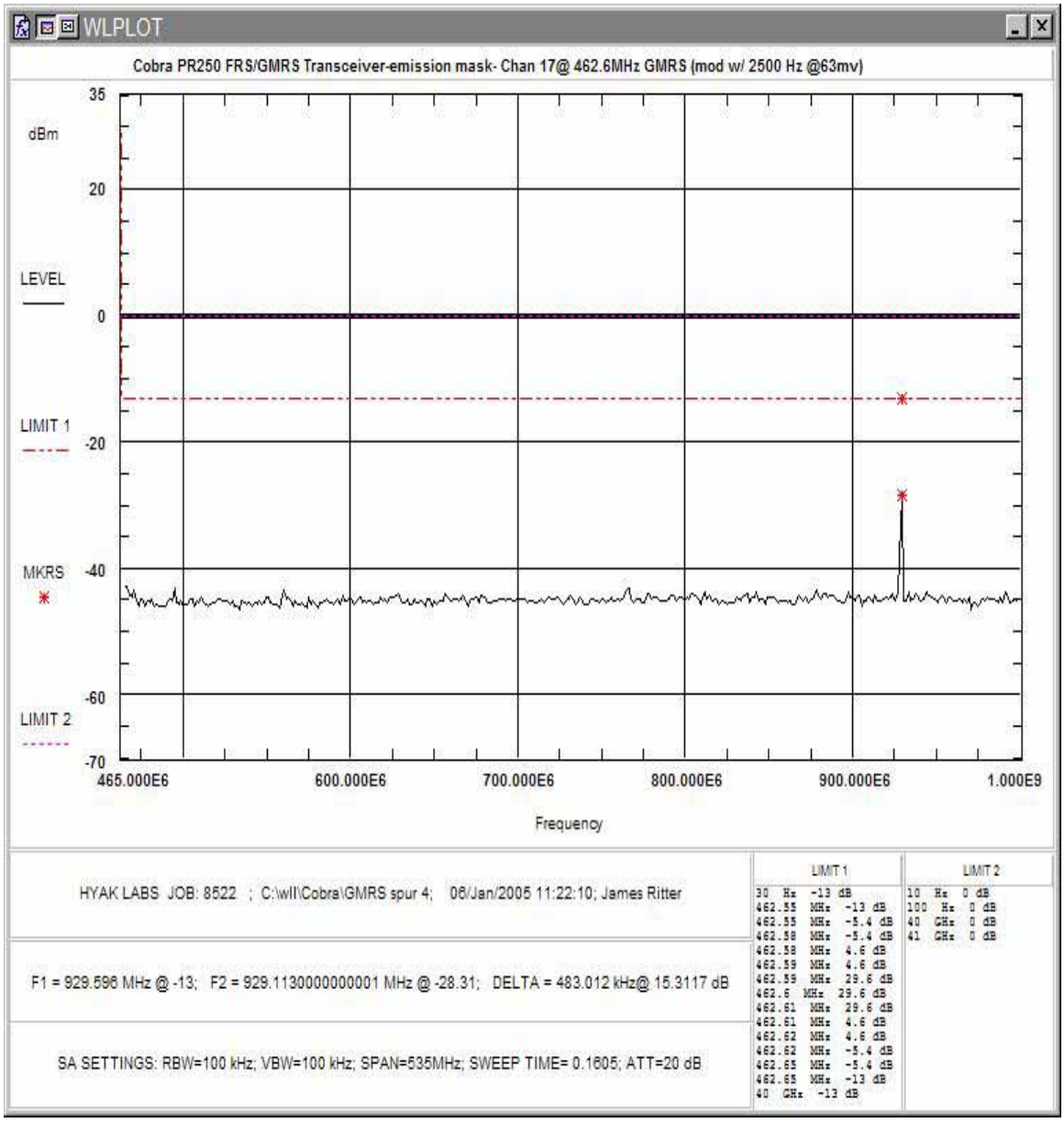


Figure 4-12. GMRS Mode Conducted Spurious Emissions, 465MHz – 1GHz

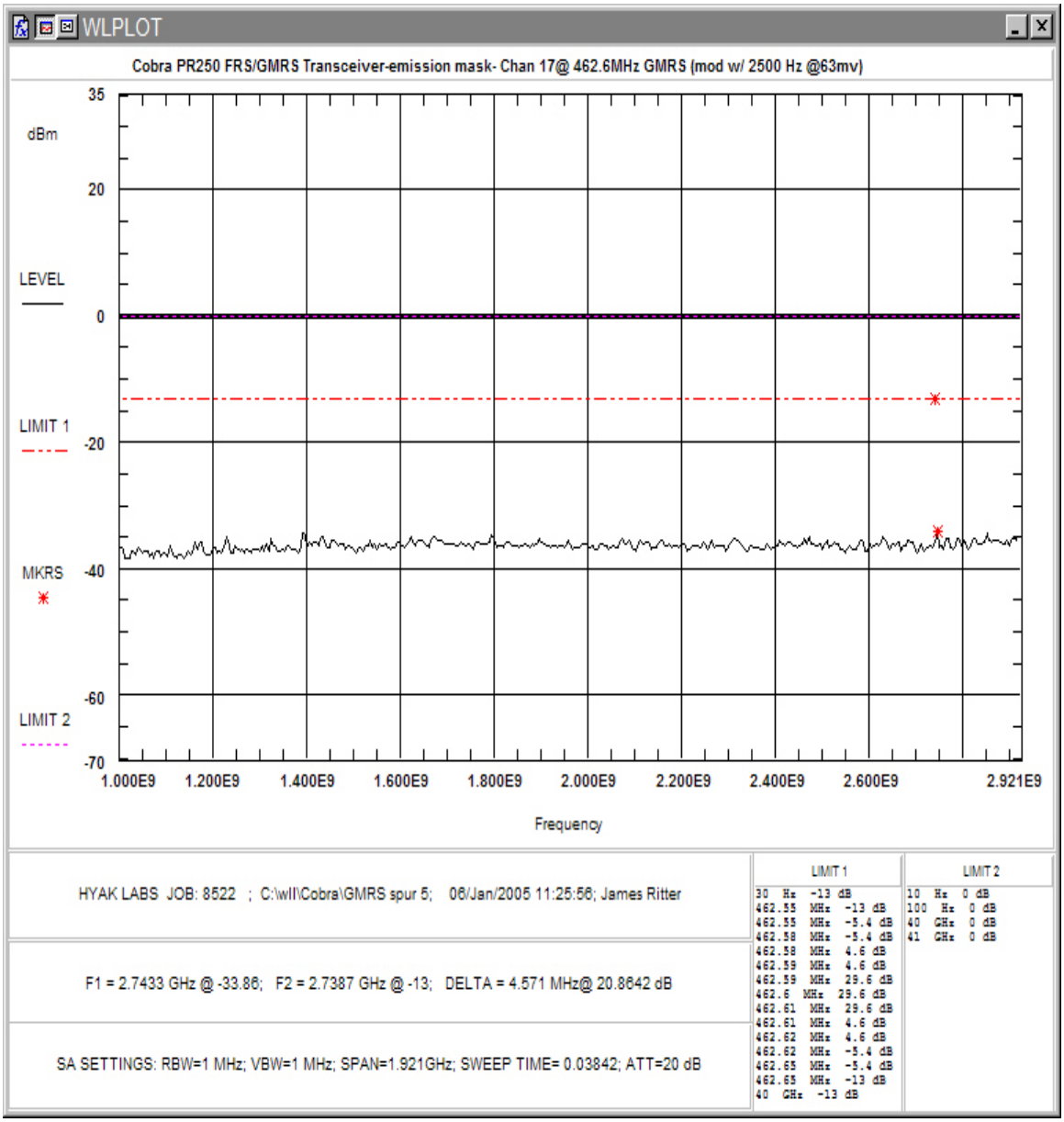


Figure 4-13. GMRS Mode Conducted Spurious Emissions, 1 – 2.921GHz

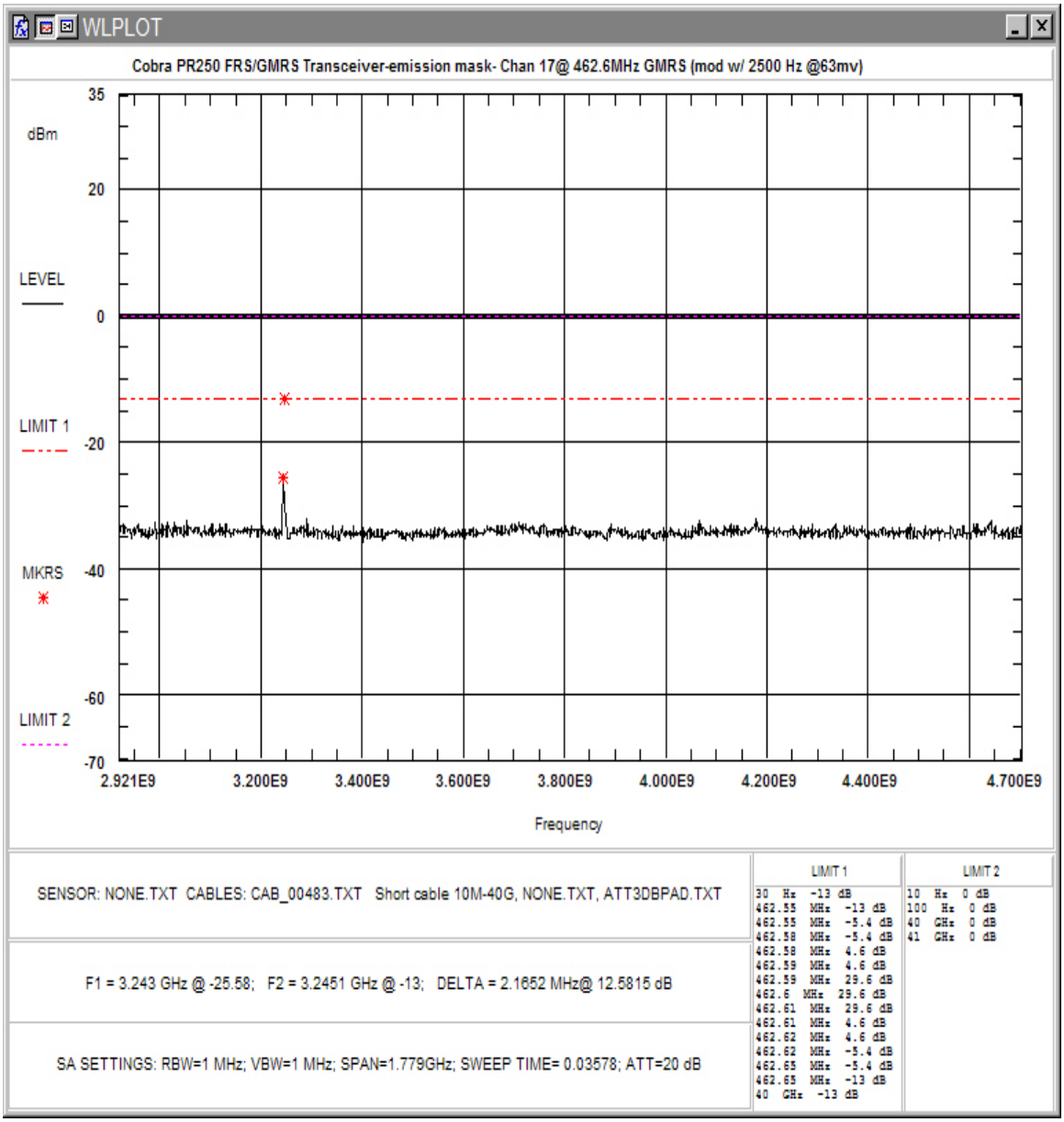


Figure 4-14. GMRS Mode Conducted Spurious Emissions, 2.921 – 4.7GHz

4.5 Spurious Emissions at Antenna Terminals: FRS Mode

4.5.1 FRS Mode

The EUT must comply with requirements for spurious emissions at antenna terminals pre the requirements of §95.635(b)(1)(3)(7). All emissions must be suppressed by:

§95.635(b)(1): at least 25dB 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 35dB 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)(7): at least 43 + 10Log(T) dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

The unit with the connector in place of the antenna was connected via an attenuator to the input of the spectrum analyzer. The conducted spurious emissions were measured through the 10^{th} harmonic of the fundamental.

Figure 4-15 through Figure 4-22 are plots of the conducted spurious emissions.

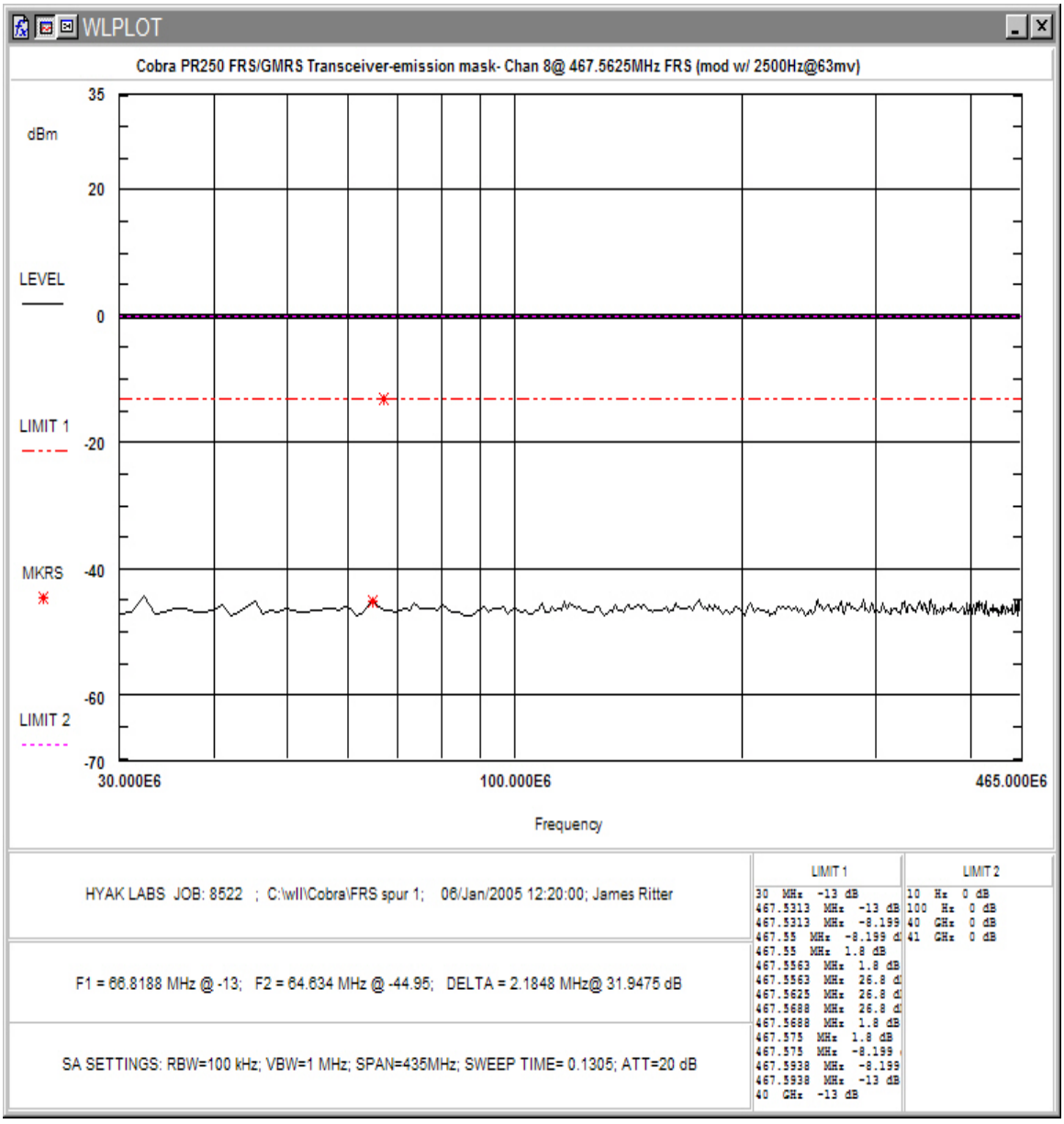


Figure 4-15. FRS Mode Conducted Spurious Emissions, 30 – 465MHz

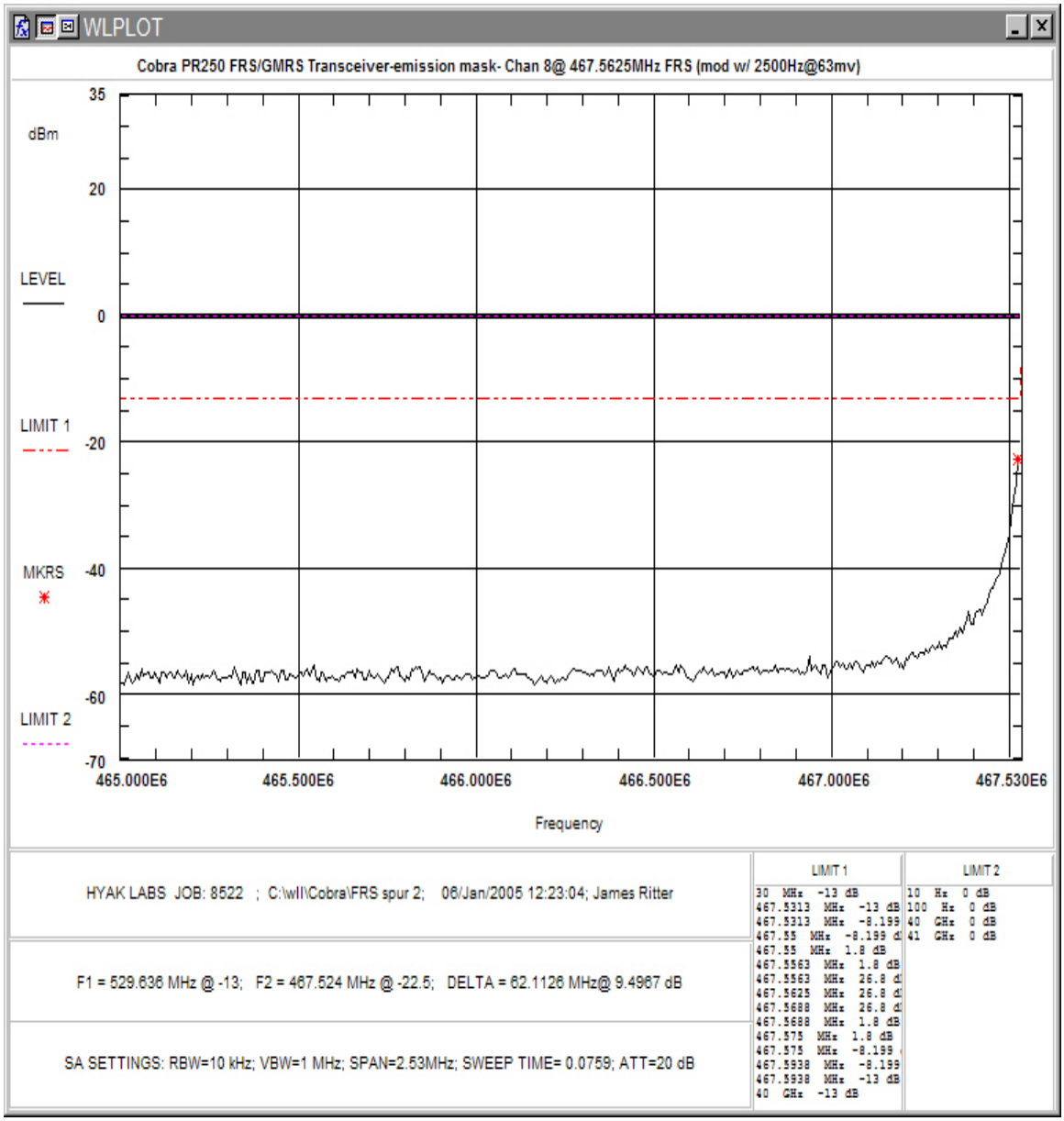


Figure 4-16. FRS Mode Conducted Spurious Emissions, 465 – 467.53MHz

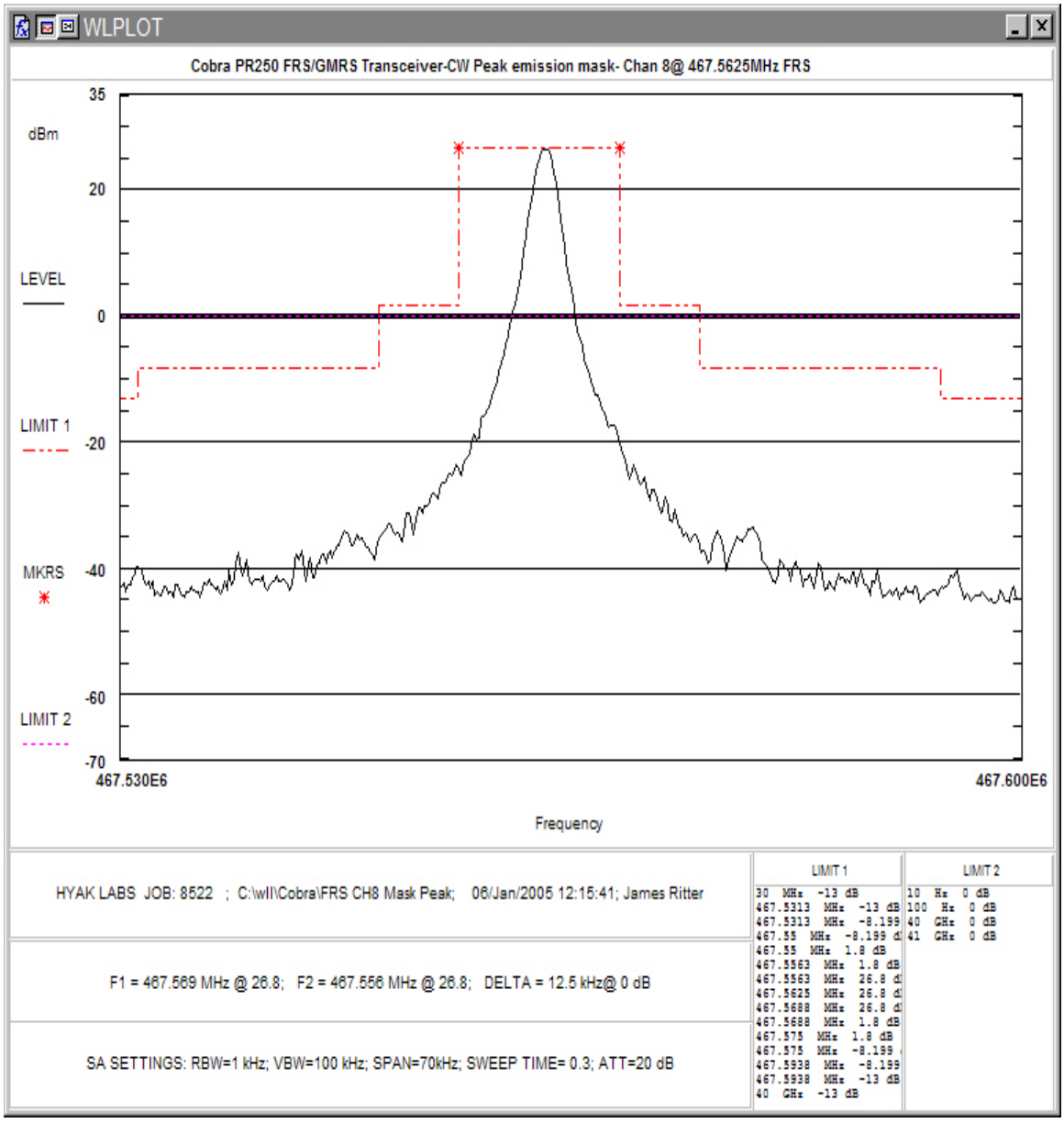


Figure 4-17. FRS Mode Conducted Spurious Emissions, 467.53 – 467.6MHz (Unmodulated)

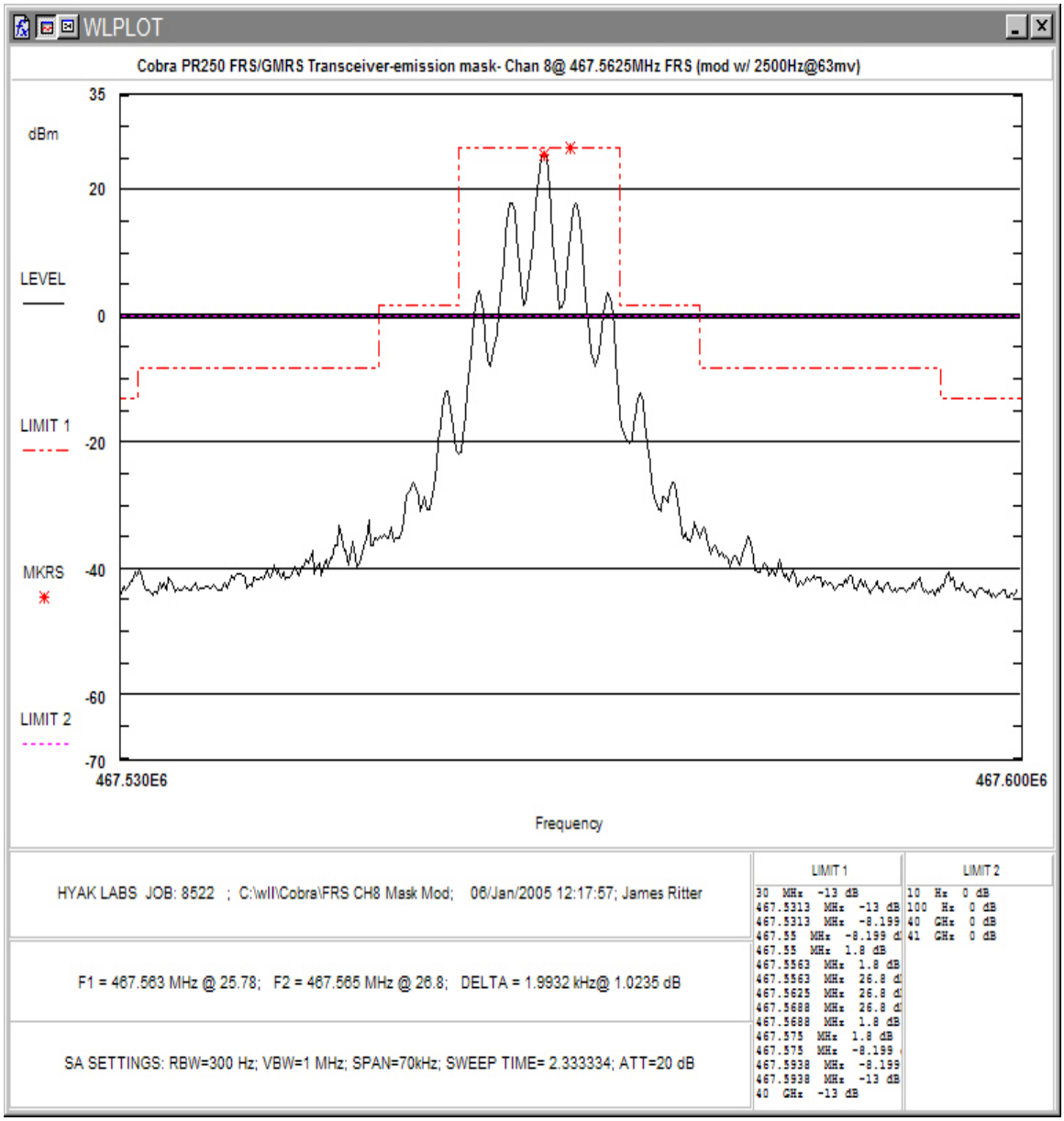


Figure 4-18. FRS Mode Conducted Spurious Emissions, Emission Mask

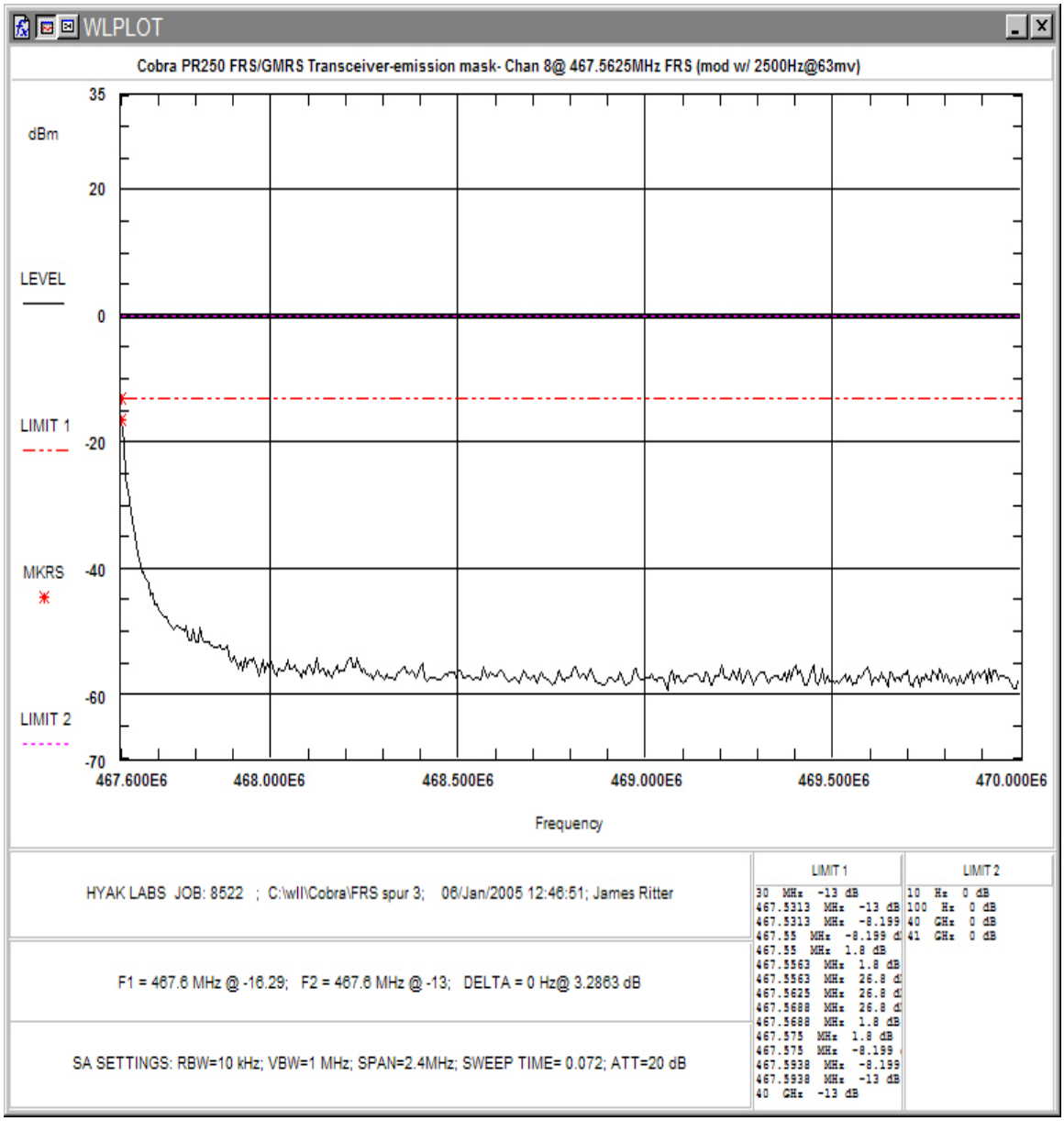


Figure 4-19. FRS Mode Conducted Spurious Emissions, 467.6 – 470MHz

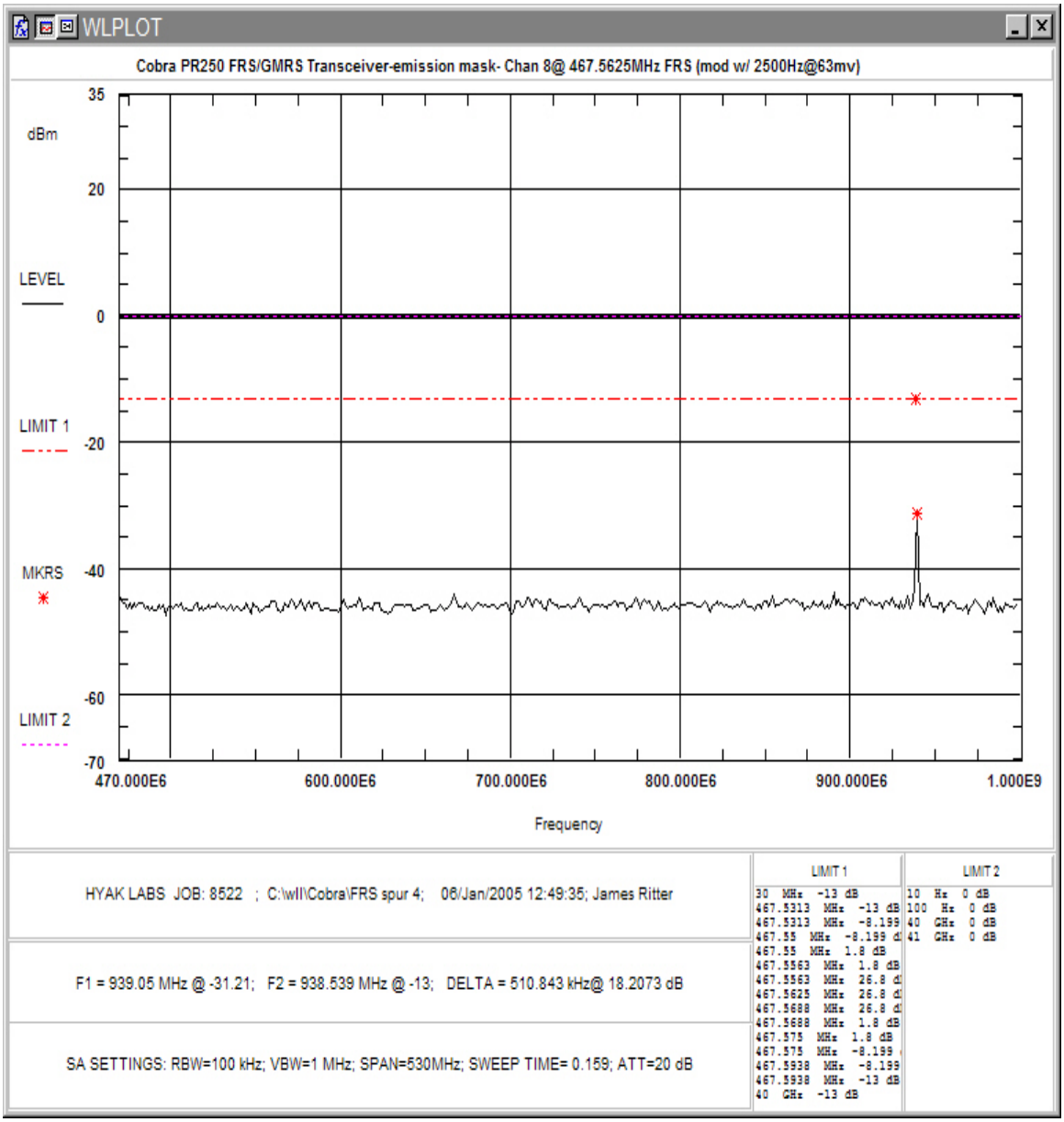


Figure 4-20. FRS Mode Conducted Spurious Emissions, 470MHz – 1GHz

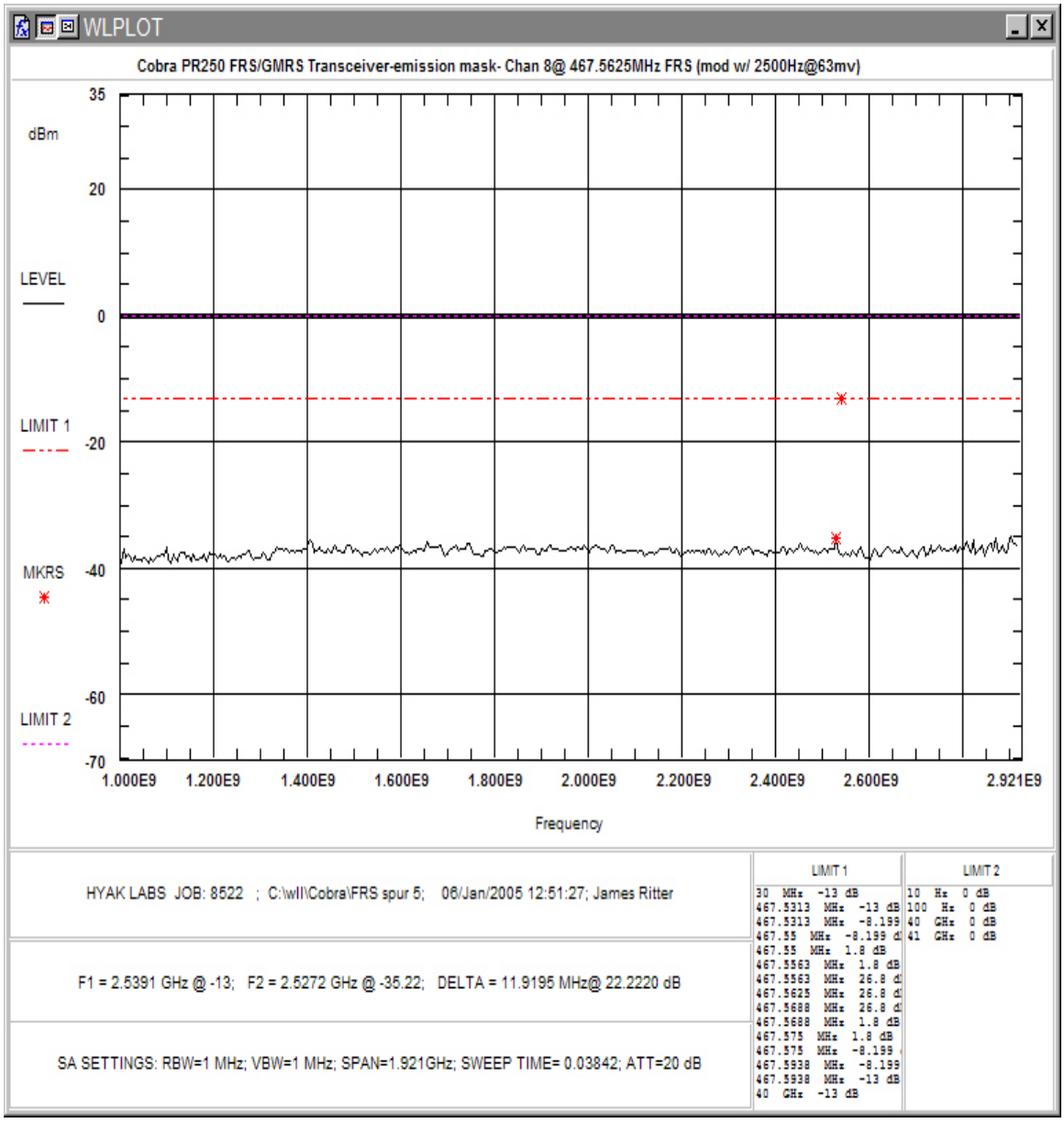


Figure 4-21. FRS Mode Conducted Spurious Emissions, 1 – 2.921GHz

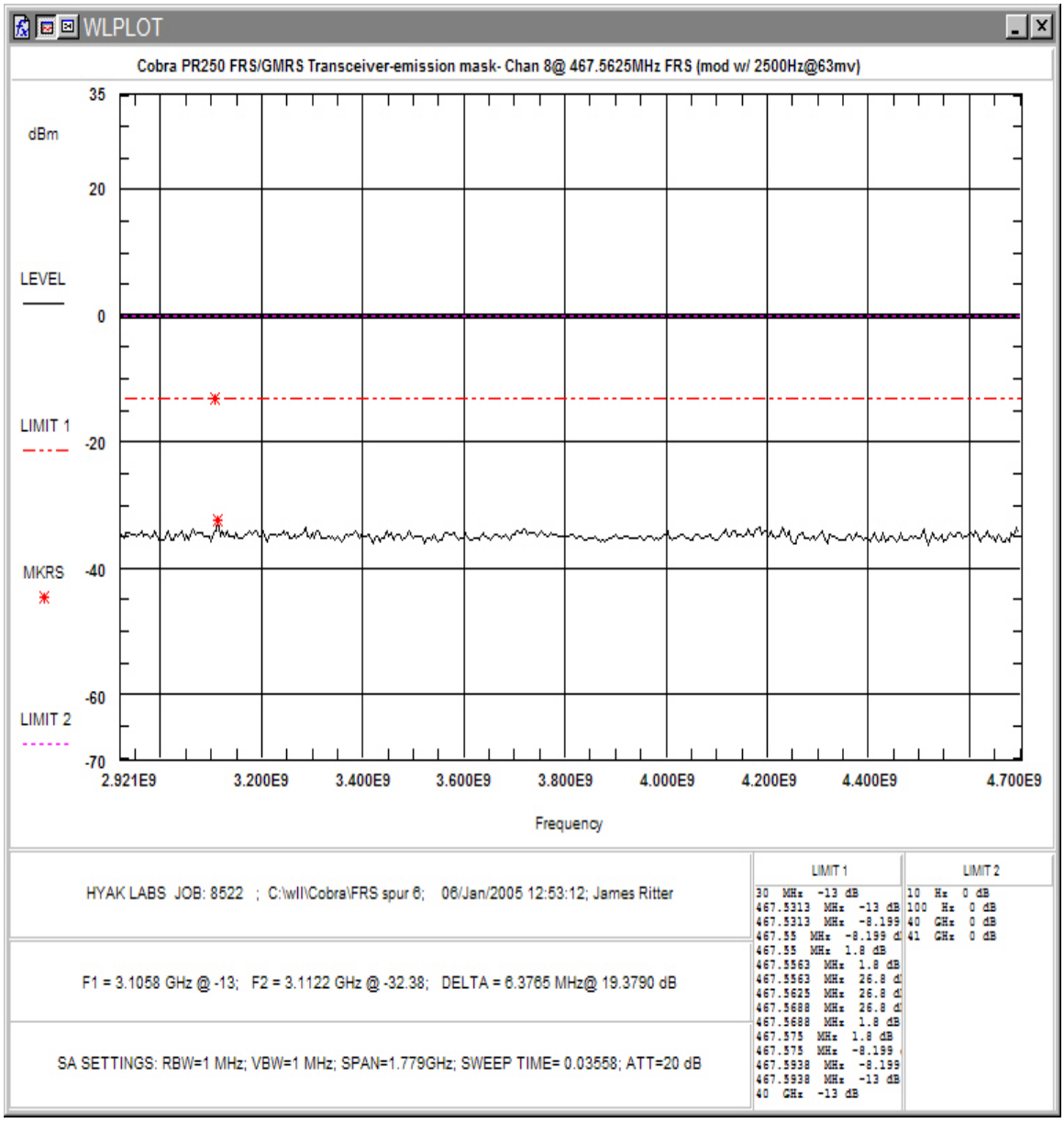


Figure 4-22. FRS Mode Conducted Spurious Emissions, 2.921 – 4.7GHz

4.6 Radiated Spurious Emissions (§2.1053)

4.6.1 GMRS Mode

The EUT must comply with requirements for radiated spurious emissions. The limits are as specified in Section 4.5.

4.6.1.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters.

The Effective Isotropic Radiated Power (EIRP) levels were measured and compared with the limit of §95.635(b). The limit of -13dB is derived from the formula of 43+10LOG(P) dB per §95.635(b)(7).

Emissions were scanned up to the 10^{th} harmonic of the fundamental. Worst case measurements are reported. The signal substitution method procedure as given in TIA-603 was used to obtain EIRP levels.

Table 13. Radiated Emission Test Data, GMRS Mode

CLIENT:	HYAK Labs	DATE:	1/7/05
TESTER:	James Ritter	JOB #:	8522
EUT Information:		**Test Requirements:**	
EUT:	PR250WX Transceiver	TEST STANDARD:	Pt 95/RSS210
CONFIGURATION:	TX chan 15 @ 462.6MHz	DISTANCE:	3m
S/N:	412000039		
Test Equipment/Limit:			
ANTENNA:	A_00007	LIMIT:	EIRP
CABLE:	CSITE1_3m	AMPLIFIER (dB)	#66 for above 1GHz

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level (dBµV)	Ant. Gain dBi	Sub. Sig. Gen. Level dBm	EIRP Level dBm	Limit (dBm)	Margin dB
409.27	H	90.0	1.4	20.0	7.8	-60.5	-52.7	-13.0	-39.7
431.82	H	100.0	1.6	20.9	7.5	-60.3	-52.8	-13.0	-39.8
442.08	H	90.0	1.7	22.1	7.5	-60.2	-52.7	-13.0	-39.7
925.13	H	270.0	1.0	52.0	7.2	-22.5	-15.3	-13.0	-2.3
1387.62	H	180.0	1.0	71.2	6.3	-38.5	-32.2	-13.0	-19.2
1850.22	H	180.0	1.0	68.7	7.1	-40.0	-32.9	-13.0	-19.9
2312.82	H	180.0	1.0	75.1	8.1	-37.1	-29.0	-13.0	-16.0
2775.42	H	190.0	1.0	72.8	8.8	-39.1	-30.3	-13.0	-17.3
3237.92	H	90.0	1.0	78.2	9.3	-33.0	-23.7	-13.0	-10.7
3700.65	H	45.0	1.0	66.3	10.2	-44.5	-34.3	-13.0	-21.3
4162.87	H	45.0	1.0	59.5	10.7	-61.0	-50.3	-13.0	-37.3
4625.47	H	0.0	1.0	54.3	11.0	-57.0	-46.0	-13.0	-33.0
409.27	V	90.0	1.3	23.3	7.8	-57.0	-49.2	-13.0	-36.2
431.82	V	270.0	1.6	21.4	7.5	-57.3	-49.8	-13.0	-36.8
442.08	V	45.0	1.5	23.7	7.5	-57.1	-49.6	-13.0	-36.6
925.13	V	90.0	1.2	46.7	7.2	-27.9	-20.7	-13.0	-7.7
1387.62	V	180.0	1.0	54.9	6.3	-53.0	-46.7	-13.0	-33.7
1850.22	V	90.0	1.0	53.0	7.1	-58.0	-50.9	-13.0	-37.9
2312.82	V	270.0	1.0	52.5	8.1	-62.5	-54.4	-13.0	-41.4
2775.42	V	0.0	1.0	50.1	8.8	-62.5	-53.7	-13.0	-40.7
3237.92	V	0.0	1.0	55.3	9.3	-53.0	-43.7	-13.0	-30.7
3700.65	V	90.0	1.0	49.3	10.2	-55.2	-45.0	-13.0	-32.0
4162.87	V	180.0	1.0	44.5	10.7	-57.0	-46.3	-13.0	-33.3
4625.47	V	0.0	1.0	43.8	11.0	-60.0	-49.0	-13.0	-36.0

4.7 Radiated Spurious Emissions: FRS Mode

4.7.1 FRS Mode

The EUT must comply with requirements for radiated spurious emissions. The limits are as specified in Section 4.5.

4.7.1.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters.

The Effective Isotropic Radiated Power (EIRP) levels were measured and compared with the limit of §95.635(b). The limit of -13dB is derived from the formula of 43+10LOG(P) dB per §95.635(b)(7).

Emissions were scanned up to the 10^{th} harmonic of the fundamental. Worst case measurements are reported. The signal substitution method procedure as given in TIA-603 was used to obtain EIRP levels.

Table 14: Radiated Emission Test Data, FRS Mode

CLIENT:	HYAK Labs	DATE:	1/7/05
TESTER:	James Ritter	JOB #:	8522
EUT Information:		**Test Requirements:**	
EUT:	PR250WX Transceiver	TEST STANDARD:	Pt 95, RSS210
CONFIGURATION:	TX chan 8 @ 467.5625 MHz	DISTANCE:	3m
S/N:	412000039	CLASS:	A
Test Equipment/Limit:			
ANTENNA:	A_00007	LIMIT:	EIRP
CABLE:	CSITE1_3m	AMPLIFIER (dB)	#66 for above 1 GHz

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level (QP) (dBµV)	Ant. Gain dBi	Sig. Gen. Level dBm	EIRP Level dBm	Limit (dBm)	Margin dB
379.91	H	290.0	3.0	22.8	7.2	-62.8	-55.6	-13.0	-42.6
387.23	H	200.0	3.2	30.8	7.2	-52.8	-45.6	-13.0	-32.6
395.84	H	0.0	3.0	20.7	7.5	-62.4	-54.9	-13.0	-41.9
406.08	H	0.0	3.0	22.3	7.7	-62.0	-54.3	-13.0	-41.3
416.34	H	0.0	2.6	21.6	7.3	-60.1	-52.8	-13.0	-39.8
426.59	H	45.0	2.8	23.6	7.3	-56.0	-48.7	-13.0	-35.7
436.85	H	80.0	2.7	23.7	7.5	-57.9	-50.4	-13.0	-37.4
447.09	H	180.0	1.3	30.2	7.5	-52.0	-44.5	-13.0	-31.5
457.35	H	200.0	1.2	34.6	5.3	-49.0	-43.7	-13.0	-30.7
459.57	H	200.0	1.2	27.1	7.1	-54.5	-47.4	-13.0	-34.4
935.15	H	250.0	1.0	49.5	6.7	-27.1	-20.4	-13.0	-7.4
1402.71	H	100.0	1.0	64.9	6.5	-46.0	-39.5	-13.0	-26.5
1870.27	H	250.0	1.0	63.6	7.2	-47.0	-39.8	-13.0	-26.8
2337.84	H	0.0	1.0	74.5	8.2	-37.0	-28.8	-13.0	-15.8
2805.40	H	160.0	1.0	70.6	8.9	-41.5	-32.6	-13.0	-19.6
3272.96	H	270.0	1.0	67.4	9.4	-41.5	-32.1	-13.0	-19.1
3740.52	H	180.0	1.0	58.3	10.3	-47.5	-37.2	-13.0	-24.2
4208.08	H	190.0	1.0	50.8	10.8	-58.0	-47.2	-13.0	-34.2
4675.64	H	90.0	1.0	51.6	11.1	-66.5	-55.4	-13.0	-42.4
	V								
379.91	V	90.0	1.6	20.4	7.2	-64.2	-57.0	-13.0	-44.0
387.23	V	90.0	1.6	27.2	7.2	-55.1	-47.9	-13.0	-34.9
395.84	V	90.0	1.8	21.4	7.5	-62.0	-54.5	-13.0	-41.5
406.08	V	0.0	1.4	22.4	7.7	-58.8	-51.1	-13.0	-38.1
416.34	V	0.0	1.5	24.3	7.3	-55.7	-48.4	-13.0	-35.4
426.59	V	350.0	1.6	26.7	7.3	-50.4	-43.1	-13.0	-30.1
436.85	V	10.0	1.4	31.8	7.5	-48.9	-41.4	-13.0	-28.4
447.09	V	45.0	1.7	35.9	7.5	-44.0	-36.5	-13.0	-23.5
457.35	V	10.0	1.0	28.5	5.3	-52.0	-46.7	-13.0	-33.7
459.57	V	180.0	1.3	22.5	7.1	-56.8	-49.7	-13.0	-36.7
935.15	V	180.0	1.2	38.2	6.7	-36.5	-29.8	-13.0	-16.8
1402.71	V	180.0	1.0	66.2	6.5	-41.0	-34.5	-13.0	-21.5

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level (QP) (dBµV)	Ant. Gain dBi	Sig. Gen. Level dBm	EIRP Level dBm	Limit (dBm)	Margin dB
1870.27	V	180.0	1.0	69.0	7.2	-42.5	-35.3	-13.0	-22.3
2337.84	V	170.0	1.0	72.0	8.2	-38.5	-30.3	-13.0	-17.3
2805.40	V	130.0	1.0	67.7	8.9	-41.0	-32.1	-13.0	-19.1
3272.96	V	180.0	1.0	63.5	9.4	-42.0	-32.6	-13.0	-19.6
3740.52	V	190.0	1.0	60.7	10.3	-48.0	-37.7	-13.0	-24.7
4208.08	V	190.0	1.0	52.1	10.8	-48.5	-37.7	-13.0	-24.7
4675.64	V	190.0	1.0	53.8	11.1	-57.0	-45.9	-13.0	-32.9

4.8 AC Line Conducted Emissions (FCC Part 15.107)

Not performed. The EUT is battery-powered.

4.9 Frequency Stability (§2.1055)

4.9.1 GMRS Mode (§95.621(b))

Frequency as a function of temperature and voltage variation shall be maintained within the 0.0005%, 5ppm limit for the GMRS transmitter.

The temperature stability was measured with the unit in an environmental chamber used to vary the temperature of the sample. The sample was held at each temperature step to allow the temperature of the sample to stabilize. Prior to testing the unit was placed into the temperature chamber and allowed to stabilize at ambient (19.8 degree C). The reference frequency was measured using a frequency counter.

The frequency stability of the transmitter was examined at the voltage extremes and for the temperature range of -30°C to +50°C. The temperature was incremented at 10 degree intervals and the unit was allowed to stabilize at the temperature for one hour.

Additionally, per §2.1055(d)(2), the EUT frequency stability was measured down to the battery operating end point (3.2Vdc) with the reference being measured at the nominal voltage (nominal = 6Vdc).

The test results are listed in the following table for the GMRS mode.

Tested at 462.55MHz

Limit: GMRS = 0.0005% =2312.75 Hz

Table 15. Frequency Deviation as a Function of Temperature

Temperature (Celsius)	Frequency (MHz)	Deviation (Hz)	Limit (Hz)
Ambient	462.550200	0.0	0
-30	462.549574	-626.0	2312.75
-20	462.549966	-234.0	2312.75
-10	462.550546	346.0	2312.75
0	462.550753	553.0	2312.75
10	462.550660	460.0	2312.75
20	462.550111	-89.0	2312.75
30	462.549920	-280.0	2312.75
40	462.549756	-444.0	2312.75
50	462.549818	-382.0	2312.75

Table 16. Frequency Deviation as a Function of Voltage

Voltage Volts	Frequency MHz	Difference Hz	Limit Hz	Voltage Volts
At rated	462.550200 462.549139	- -1061.0	- 2312.75	6VDC 3.2volts

4.9.2 FRS Mode (§95.627(b))

Frequency as a function of temperature and voltage variation shall be maintained within the 0.00025%, 2.5ppm limit for the FRS transmitter.

The temperature stability was measured with the unit in an environmental chamber used to vary the temperature of the sample. The sample was held at each temperature step to allow the temperature of the sample to stabilize. Prior to testing the unit was placed into the temperature chamber and allowed to stabilize at ambient (19.8 degree C). The reference frequency was measured using a frequency counter.

The frequency stability of the transmitter was examined at the voltage extremes and for the temperature range of -30°C to +50°C. The temperature was incremented at 10 degree intervals and the unit was allowed to stabilize at the temperature for one hour.

Additionally, per §2.1055(d)(2), the EUT frequency stability was measured down to the battery operating end point (3.2Vdc) with the reference being measured at the nominal voltage (nominal = 6Vdc).

The test results are listed in the following table for the FRS mode.

Test at 467.56MHz

Limit: FRS = 0.00025% = 1169 Hz

Table 17. Frequency Deviation as a Function of Temperature

Temperature (Celsius)	Frequency (MHz)	Deviation (Hz)	Limit (Hz)
Ambient	467.562605	0.0	1169
-30	467.561977	-628.0	1169
-20	467.562418	-187.0	1169
-10	467.563127	522.0	1169

0	467.563260	655.0	1169
10	467.562908	303.0	1169
20	467.562653	48.0	1169
30	467.562092	-513.0	1169
40	467.563440	835.0	1169
50	467.562326	-279.0	1169

Table 18. Frequency Deviation as a Function of Voltage

Voltage Volts	Frequency MHz	Difference Hz	Limit Hz	Voltage Volts
At rated	467.562692 467.561946	- -746.0	- 1169	6VDC 3.2 Volts

4.10 DC Voltages and Current into Final Amplifier , (§2.1033(c)(8))

Table 19. DC Power in Final Stage

Voltage and current in final stage:

Voltage in final stage	6.4	V
Power drawn in final stage	0.015	A
DC Power in Final	0.102	W

Measured voltage across R207; Measured 1.3V across 82 ohms

4.11 Emission Designator

The emission designator is determined from the necessary bandwidth, the type of modulation and the information conveyed in the signal.

For the subject unit, the following Emission Designator has been determined according to Section 2.201 of the FCC Rules.

- First Symbol, type of modulation of the main carrier: F-Frequency Modulation
- Second Symbol, nature of signal(s) modulating the main carrier: 3
- Third Symbol, type of information to be transmitted: E

The necessary bandwidth, Bn, is calculated as:

Bn = 2M +2DK

M = 3000

D = 2.5

K=1

Bn = (2 x 3000) + (2 x 2500) = 11k

Hence, the emission designator is: **11KOF3E**