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Computer Electronics Research Group

STD-302

2.10. Field Strength of Spurious Radiation (FCC Section 2.1053, 90.217)

Spurious emissions were evaluated from 30 MHz to 1.8 GHz at an EUT to antenna distance of 3 meters. The EUT was tested with modulation from its own internal sources.

The EUT was placed on an open area test site and the spurious emissions tested with the EUT antenna terminated with a 50 Ohm load. Measurements for 30 to 1000 MHz were made with the analyzer's bandwidth at 10 kHz and video bandwidth set to 300 kHz.

The EUT's emissions were recreated with a signal generator and transmit antenna and the power was measured and recorded by the substitution method. Measurements above 1 GHz were made with the analyzer's resolution bandwidth set to 1 MHz.

Per FCC 90.217, in all cases signals will be attenuated by at least 30dB below the unmodulated carrier.

2.11 Frequency Stability (FCC 2.1055, 90.213(a))

The EUT RF output was measured as its input bias voltages were changed from 4.5 VDC to 5.0 VDC and to 5.5 VDC while the temperature was varied from -30°C to +50 °C. Each soak period was 10 minutes. The EUT frequency stability versus temperature and DC bias variation was within the FCC 2.1055 requirements. Frequency change was less than 1 PPM per minute. Paragraph 90.213(a) specifies that the transmitter frequency stability be < 5 PPM over the temperature range of -30 °C to +50 °C. Test data in parts per million are found in Figure 6a. Test data raw values are found in Figure 6b.

Per Figure 6a, the worst case occurred at temperature of +50 degrees and bias voltage set for 4.5 volts after 5 minutes of test time. The change was 3.85 PPM which is <5 PPM.

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CFR 47.2.1055

1 ppm = 458.50

Frequency change per min. = PPM

458.5XX.XXX Hz

low freq. = 458502125.00

Date: 1/3/4/06

Temp = -30	1 min	2 min	3 min	4 min	5 min	6 min	7 min	8 min	9 min	10 min
4.50	3.68593	3.49400	3.38713	3.32170	3.27371	3.23227	3.22137	3.20610	3.22137	3.19956
voltage	5.00	3.69902	3.47873	3.37622	3.27808	3.22573	3.19302	3.15994	3.14503	3.13849
5.50	3.55507	3.38931	3.23882	3.15376	3.09487	3.07306	3.06215	3.04689	3.02726	3.02726
Temp = -20	4.50	0.26172	0.18539	0.14395	0.10033	0.07415	0.04362	0.04798	0.03708	0.03272
voltage	5.00	0.28135	0.24427	0.15703	0.10905	0.07634	0.05016	0.03053	0.02617	0.00654
5.50	0.22246	0.11341	0.01963	-0.01091	-0.05889	-0.09815	-0.11123	-0.13086	-0.12432	-0.15267
Temp = -10	4.50	-1.49181	-1.55506	-1.58996	-1.62922	-1.63576	-1.65757	-1.67284	-1.67284	-1.67720
voltage	5.00	-1.47436	-1.55506	-1.57033	-1.61177	-1.63358	-1.63358	-1.64448	-1.65539	-1.65103
5.50	-1.50272	-1.57687	-1.62049	-1.64230	-1.65321	-1.66411	-1.66810	-1.69246	-1.69246	-1.69901
Temp = -00	4.50	-1.90838	-1.91493	-1.87567	-1.87567	-1.87567	-1.88657	-1.89748	-1.90184	-1.90184
voltage	5.00	-1.91275	-1.91929	-1.91929	-1.92365	-1.92365	-1.92365	-1.93456	-1.93456	-1.93882
5.50	-1.96073	-1.97163	-1.98254	-1.99781	-2.02616	-2.02616	-2.04361	-2.05233	-2.05669	-2.05669
Temp = +10	4.50	-1.71864	-1.69028	-1.66847	-1.64884	-1.63794	-1.63794	-1.63794	-1.63794	-1.64230
voltage	5.00	-1.69901	-1.68156	-1.65539	-1.62267	-1.62267	-1.61395	-1.61831	-1.60741	-1.60741
5.50	-1.68156	-1.64884	-1.61613	-1.59650	-1.58560	-1.58123	-1.56597	-1.56597	-1.56597	-1.55506
Temp = +20	4.50	-0.85278	-0.80043	-0.76335	-0.73064	-0.71755	-0.70665	-0.69356	-0.68920	-0.68484
voltage	5.00	-0.76335	-0.72410	-0.70229	-0.67175	-0.66621	-0.64994	-0.64558	-0.64122	-0.63467
5.50	-0.39476	-0.37950	-0.37295	-0.38822	-0.39913	-0.42094	-0.44275	-0.45365	-0.47982	-0.48073
Temp = +30	4.50	0.92039	0.99018	1.03162	1.07524	1.08397	1.10796	1.11886	1.12977	1.12977
voltage	5.00	0.91603	0.97055	1.03162	1.07524	1.10141	1.11232	1.12322	1.13413	1.14503
5.50	0.92911	1.00981	1.08997	1.11232	1.12322	1.13631	1.15376	1.17567	1.19084	1.18647
Temp = +40	4.50	2.95747	3.00327	3.02508	3.04689	3.05997	3.07960	3.07960	3.09051	3.09051
voltage	5.00	2.89203	2.94056	2.99018	3.02290	3.04471	3.07088	3.07742	3.09467	3.09705
5.50	2.83751	2.92475	2.96183	3.00545	3.04253	3.06215	3.06870	3.07960	3.07960	3.08833
Temp = +50	4.50	3.79062	3.81897	3.82333	3.82988	3.85168	3.84078	3.84078	3.82551	3.81461
voltage	5.00	3.81461	3.82551	3.82551	3.81897	3.81461	3.81897	3.81897	3.81461	3.79924
5.50	3.77971	3.79834	3.78844	3.78844	3.78189	3.77317	3.77753	3.77317	3.77317	3.76663

Figure 6a. Transmitter Frequency Stability.

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Figure 6b. Transmitter Frequency Stability.

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2.9. Field Strength of Spurious Radiation (Cont'd)**Table 4. Field Strength of Spurious Radiation.**

Radiated Emissions							
Test By:	Test: FCC			Client: CERG			
	2.1053						
	Project: 08-0244	Class: N/A		Model: 458 MHz Transmitter			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarity	Margin (dB)	PK / QP
Tested from 30 MHz to 5 GHz							
917.0	53.0	-11.0	42.0	73.9	3m/VERT	31.9	PK
1375.6	44.3	-10.0	34.3	73.9	3m/VERT	39.6	PK
2292.5	46.6	-6.0	40.6	73.9	3m/VERT	33.3	PK
2751.0	52.1	-5.0	47.1	73.9	3m/VERT	26.8	PK
3209.5	58.1	-4.5	53.6	73.9	3m/VERT	20.3	PK
3668.08	52.1	-3.0	49.1	73.9	3m/HORZ	24.8	PK
4126.5	43.1	-1.8	41.3	73.9	3m/VERT	32.6	PK
4585.2	44.1	-1.2	42.9	73.9	3m/HORZ	31.0	PK

No spurious signals seen from 30 MHz to 917 MHz.

Limit: From $P = ((E_d)^2)/30G$, $E = (30PG)^{1/2}/d$ $E = 0.155 \text{ V/m} = 103.9 \text{ dBuV/m}$ $103.9-30 \text{ down} = 73.9 \text{ dBuV/m}$ Where: $d=3\text{m}$; $P=0.00721 \text{ W}$; $G=1.0$

SAMPLE CALCULATIONS:

Results at 917 MHz; = 53.0 dBuV + (-11.0) dB/m= 42.0 dBuV/m @3 m

Test Date: January 4, 2006

Tested by

Signature: 

Name: Paul Picard

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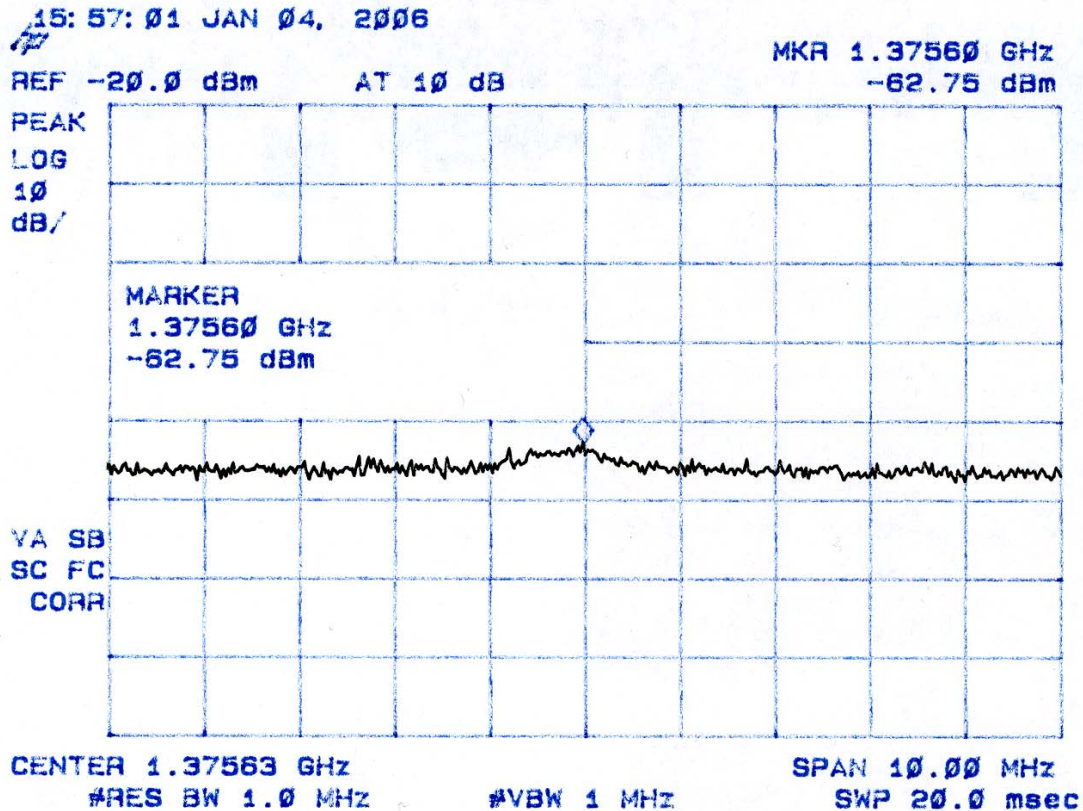


Figure 7a. Field Strength of Spurious Radiation, 1375.6 MHz.

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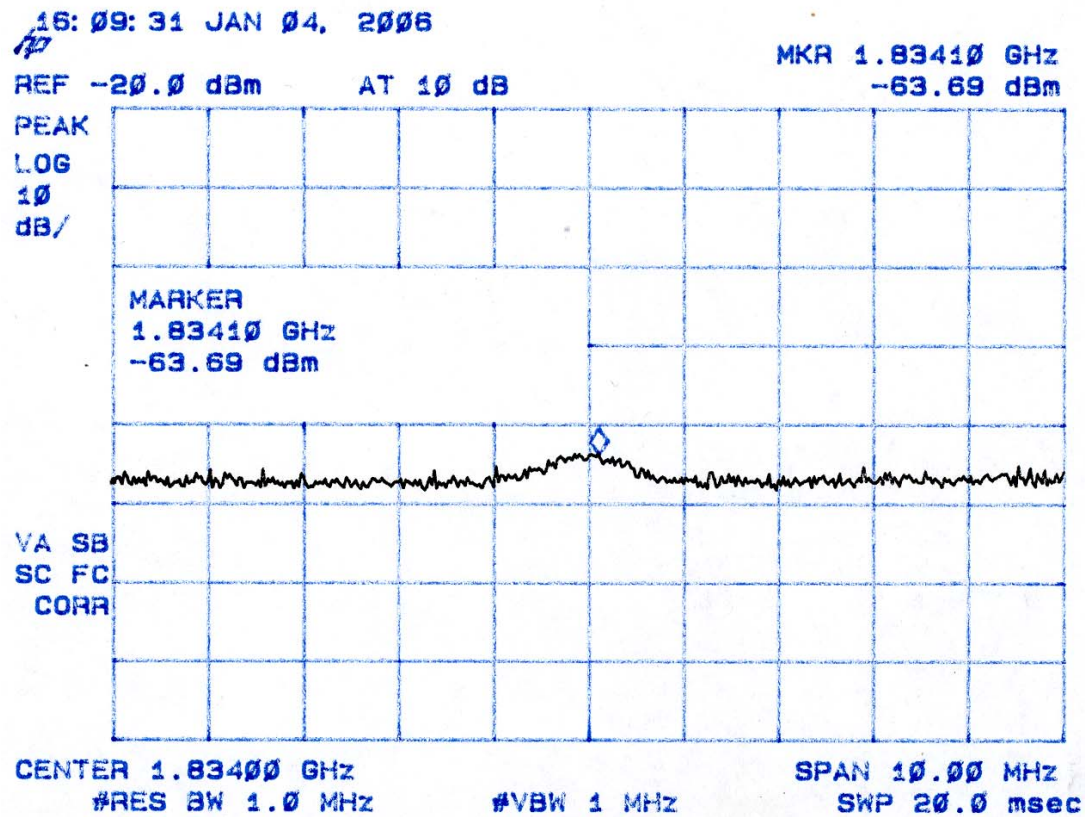


Figure 7b. Field Strength of Spurious Radiation, 1834.0 MHz.

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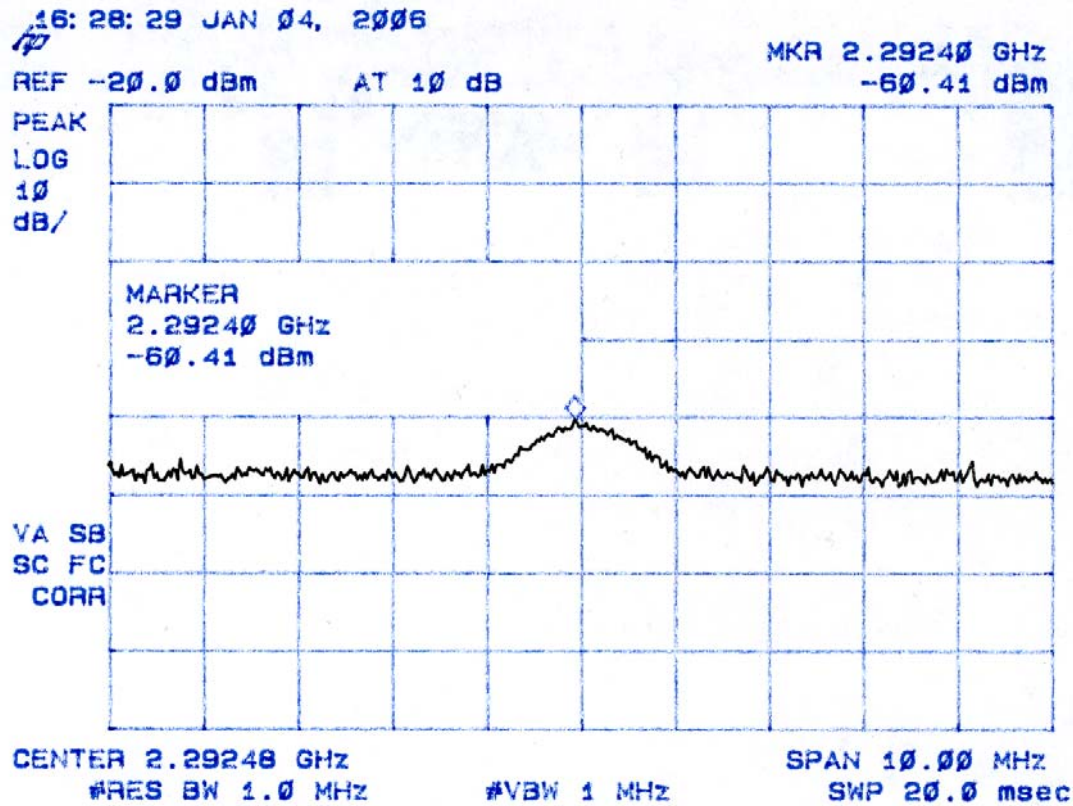


Figure 7c. Field Strength of Spurious Radiation, 2292.5 MHz.

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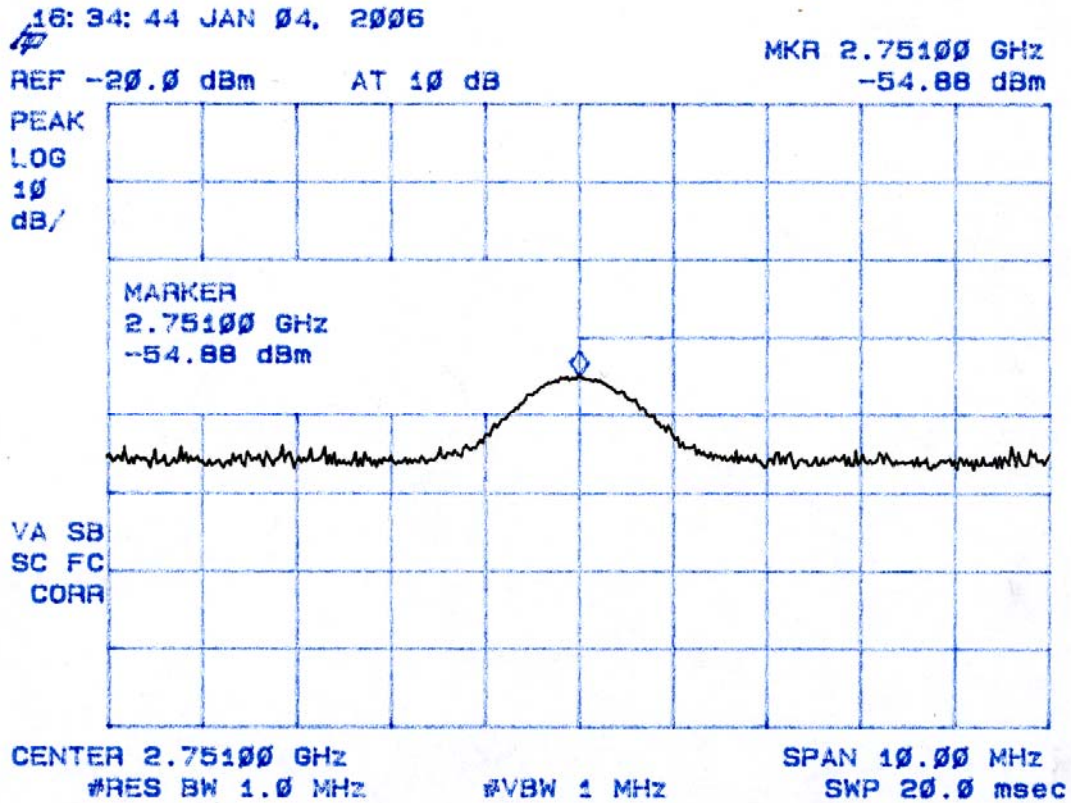


Figure 7d. Field Strength of Spurious Radiation, 2751.0 MHz.

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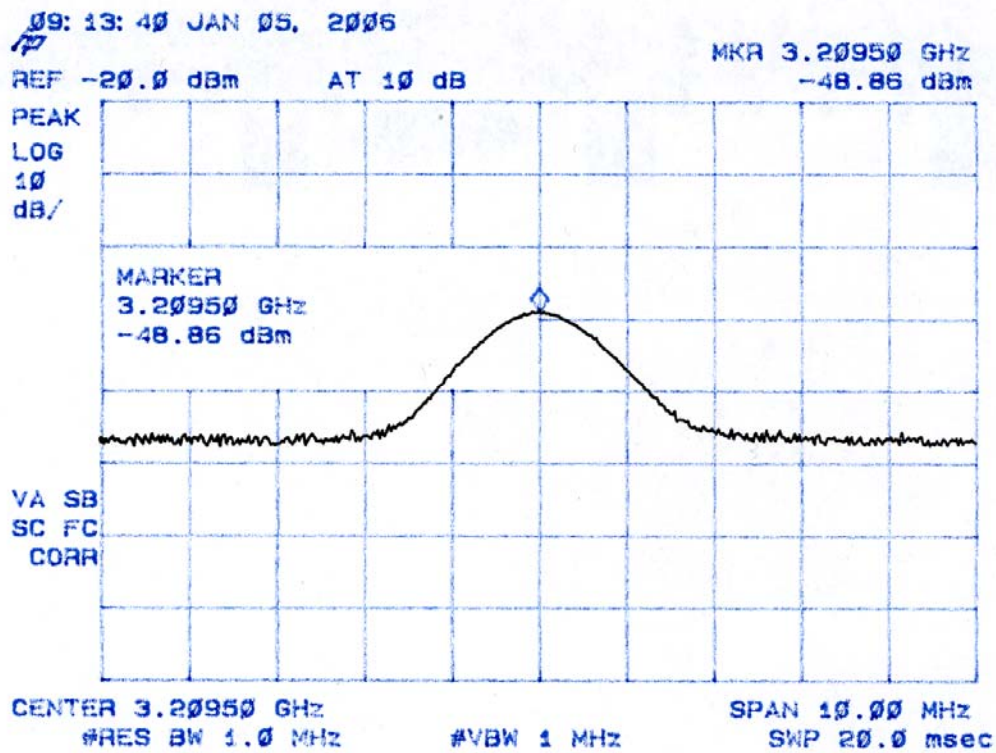


Figure 7e. Field Strength of Spurious Radiation, 3209.5 MHz.

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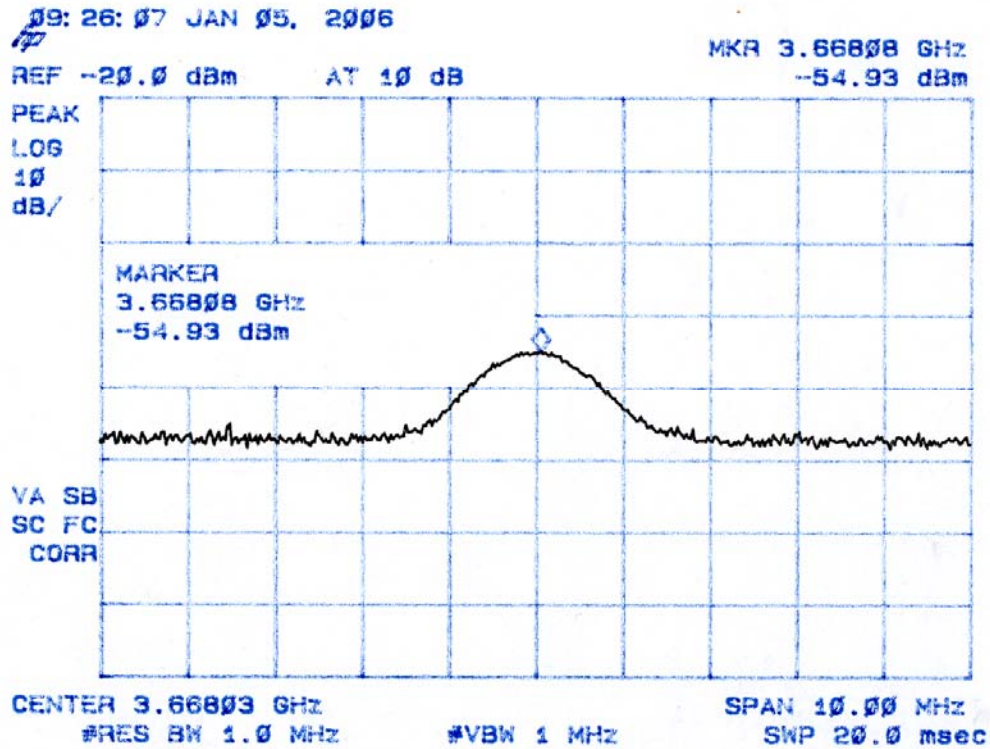


Figure 7f. Field Strength of Spurious Radiation, 3668.0 MHz.

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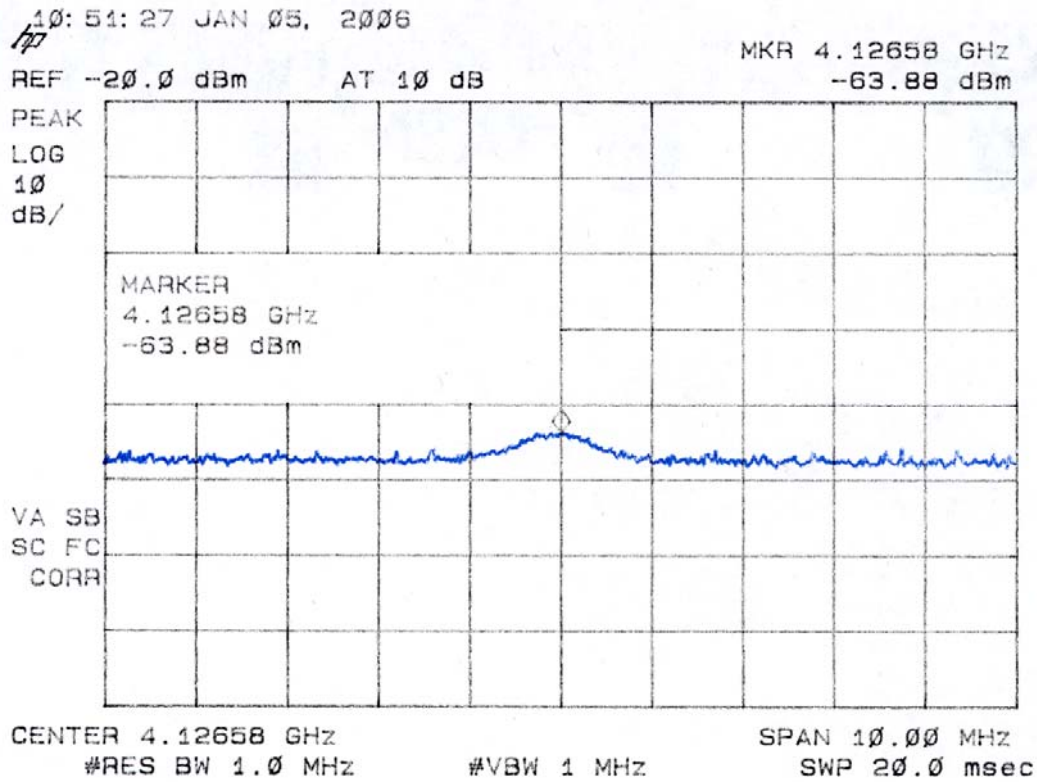


Figure 7g. Field Strength of Spurious Radiation, 4126.6 MHz.

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10:37:25 JAN 05, 2006

REF -20.0 dBm AT 10 dB

MKR 4.58485 GHz
-62.92 dBmPEAK
LOG
10
dB/MARKER
4.58485 GHz
-62.92 dBmVA SB
SC FC
CORRCENTER 4.58503 GHz
#RES BW 1.0 MHz

#VBW 1 MHz

SPAN 10.00 MHz
SWP 20.0 msec

Figure 7h. Field Strength of Spurious Radiation, 4585.0 MHz.