

**NCR Corporation
FCC Part 15, Certification Application
Class 7730**

April 12, 2001

MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: **NCR Corporation**

MODEL: **7730**

FCC ID: **JEH7730GAI**

DATE: **April 12, 2001**

This report concerns (check one): Original grant X
Class II change

Equipment type: **2.4 GHz Frequency Hopping Spread Spectrum**

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes No X

If yes, defer until:
date

N.A. agrees to notify the Commission by N.A.
date

of the intended date of announcement of the product so that the grant can be issued on that date.

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SECTION 1

GENERAL INFORMATION

GENERAL INFORMATION

1.1 Product Description

The Equipment Under Test (EUT) is a NCR Corporation, Class 7730 price label system. The system consists of the following components:

- 1) Computer (remote location)
- 2) Communications Base Station (CBS)
with 1 transmit antenna, 4 receive antennas, and power supply
- 3) Shelf Label Tags (remote location)

Each system component is not considered to be located near the other. The Communications Base Station is considered to be the EUT.

The system is designed to operate on the following channels:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2400.410	50	2415.041	100	2429.673	150	2444.304
1	2400.703	51	2415.334	101	2429.965	151	2444.596
2	2400.995	52	2415.626	102	2430.258	152	2444.889
3	2401.288	53	2415.919	103	2430.550	153	2445.182
4	2401.580	54	2416.212	104	2430.843	154	2445.474
5	2401.873	55	2416.504	105	2431.136	155	2445.767
6	2402.166	56	2416.797	106	2431.428	156	2446.060
7	2402.458	57	2417.090	107	2431.721	157	2446.352
8	2402.751	58	2417.382	108	2432.014	158	2446.645
9	2403.044	59	2417.675	109	2432.306	159	2446.937
10	2403.336	60	2417.967	110	2432.599	160	2447.230
11	2403.629	61	2418.260	111	2432.891	161	2447.523
12	2403.921	62	2418.553	112	2433.184	162	2447.815
13	2404.214	63	2418.845	113	2433.477	163	2448.108
14	2404.507	64	2419.138	114	2433.769	164	2448.401
15	2404.799	65	2419.431	115	2434.062	165	2448.693
16	2405.092	66	2419.723	116	2434.355	166	2448.986
17	2405.385	67	2420.016	117	2434.647	167	2449.278
18	2405.677	68	2420.308	118	2434.940	168	2449.571
19	2405.970	69	2420.601	119	2435.232	169	2449.864
20	2406.262	70	2420.894	120	2435.525	170	2450.156
21	2406.555	71	2421.186	121	2435.818	171	2450.449
22	2406.848	72	2421.479	122	2436.110	172	2450.742
23	2407.140	73	2421.772	123	2436.403	173	2451.034
24	2407.433	74	2422.064	124	2436.696	174	2451.327
25	2407.726	75	2422.357	125	2436.988	175	2451.619
26	2408.018	76	2422.649	126	2437.281	176	2451.912
27	2408.311	77	2422.942	127	2437.573	177	2452.205
28	2408.603	78	2423.235	128	2437.866	178	2452.497
29	2408.896	79	2423.527	129	2438.159	179	2452.790
30	2409.189	80	2423.820	130	2438.451	180	2453.083
31	2409.481	81	2424.113	131	2438.744	181	2453.375
32	2409.774	82	2424.405	132	2439.037	182	2453.668
33	2410.067	83	2424.698	133	2439.329	183	2453.960
34	2410.359	84	2424.991	134	2439.622	184	2454.253
35	2410.652	85	2425.283	135	2439.914	185	2454.546
36	2410.944	86	2425.576	136	2440.207	186	2454.838
37	2411.237	87	2425.868	137	2440.500	187	2455.131
38	2411.530	88	2426.161	138	2440.792	188	2455.424
39	2411.822	89	2426.454	139	2441.085	189	2455.716
40	2412.115	90	2426.746	140	2441.378	190	2456.009
41	2412.408	91	2427.039	141	2441.670	191	2456.301
42	2412.700	92	2427.332	142	2441.963	192	2456.594
43	2412.993	93	2427.624	143	2442.255	193	2456.887
44	2413.285	94	2427.917	144	2442.548	194	2457.179
45	2413.578	95	2428.209	145	2442.841	195	2457.472
46	2413.871	96	2428.502	146	2443.133	196	2457.765
47	2414.163	97	2428.795	147	2443.426	197	2458.057
48	2414.456	98	2429.087	148	2443.719	198	2458.350
49	2414.749	99	2429.380	149	2444.011	199	2458.642

Channel	Frequency (MHz)	Channel	Frequency (MHz)
200	2458.935	250	2473.566
201	2459.228	251	2473.859
202	2459.520	252	2474.152
203	2459.813	253	2474.444
204	2460.106	254	2474.737
205	2460.398	255	2475.030
206	2460.691	256	2475.322
207	2460.983	257	2475.615
208	2461.276	258	2475.907
209	2461.569	259	2476.200
210	2461.861	260	2476.493
211	2462.154	261	2476.785
212	2462.447	262	2477.078
213	2462.739	263	2477.371
214	2463.032	264	2477.663
215	2463.324	265	2477.956
216	2463.617	266	2478.248
217	2463.910	267	2478.541
218	2464.202	268	2478.834
219	2464.495	269	2479.126
220	2464.788	270	2479.419
221	2465.080	271	2479.712
222	2465.373	272	2480.004
223	2465.666	273	2480.297
224	2465.958	274	2480.589
225	2466.251	275	2480.882
226	2466.543	276	2481.175
227	2466.836	277	2481.467
228	2467.129	278	2481.760
229	2467.421	279	2482.053
230	2467.714	280	2482.345
231	2468.007	281	2482.638
232	2468.299	282	2482.930
233	2468.592		
234	2468.884		
235	2469.177		
236	2469.470		
237	2469.762		
238	2470.055		
239	2470.348		
240	2470.640		
241	2470.933		
242	2471.225		
243	2471.518		
244	2471.811		
245	2472.103		
246	2472.396		
247	2472.689		
248	2472.981		
249	2473.274		

The EUT is similar in functionality to a previously approved CBS with the following exceptions:

The major change relative to previous releases is in the communications interface (Air Interface) between the Electronic Shelf Label (ESL) and the Communications Base Station. The key difference is that the V3 system uses a higher data rate which results in a large reduction of actual transmit time. The change is driven by interoperability requirements in the radio environment in the store, increased functionality in the ESL and lower ESL cost. Other changes in the architecture, such as using Ethernet communications between the ISP and the CBS are required to support the increased system performance provided by the new Air Interface.

1.2 Related Submittal(s)/Grant(s)

The EUT will be used with part of a system to send/receive data. The Communications Base Station portion of the product is similar to a previously approved version except that it has been redesigned for cost reductions and functionality purposes. NCR is submitting this application as a new certification for the CBS portion of the system.

The EUT is subject to the following authorizations:

- a) Certification for transmitter portion of CBS
- b) Class A Verification for digital device portion of CBS

The information contained in this report is presented for the Certification (transmitter) & Verification (digital device) authorization(s) for the EUT.

SECTION 2

TESTS AND MEASUREMENTS

TEST AND MEASUREMENTS

2.1 Configuration of Tested System

The sample was tested per ANSI C63.4, Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (1992). Conducted and radiated emissions data were taken with the test receiver or spectrum analyzer's resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and digital device emissions are shown in Figure 2.

The system is similar to a previously certified system. The Communications Base Station portion of the product has been redesigned for cost reduction and functionality purposes. Due to the nature of the changes, it was deemed necessary to perform a complete retest of the CBS.

2.2 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and submitted to the FCC, and accepted in their letter marked 31040/SIT. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number IC2982.

2.3 Test Equipment

Table 2 describes test equipment used to evaluate this product.

2.4 Modifications

Various modifications were required by NCR in order to bring the EUT into compliance with FCC Part 15 Limits for the transmitter portion of the EUT and the Class A Digital Device Requirements. Please refer to the following information from NCR regarding these modifications:

7730-1011 rework instructions

RF Board Figure 1

Location 1

- Cut a small opening in the trace located directly to the right and under R2.
- remove solder mask material on both sides of the cut to provide sufficient area to mount the inductor in the next step and the capacitor in location 2 (to the white outline line on the PCB for J5).
- Insert a 2.7nH inductor (Toko brand) to bridge open made in step 2.

Location 2

- remove solder mask on the ground plane next to the connector .
- Solder 1.0pF capacitor (AVX AQ12EM1R0CAJME) on left (connector) side of the inductor soldered in step location 1 from the trace to ground.

Location 3

- Remove C7 and replace it with a 0.3pF capacitor (AVX AQ12EM0R3BAJME) Note: the AVX capacitor is oversized for the existing footprint.

Location 4

- Step Insert a 2.0pF capacitor (NCR part # 0068602163, Murata GRM706COG2R0C200AL)
- from A1 of CR1 to the via in the ground plane on the left of CR1.

Unit assembly:

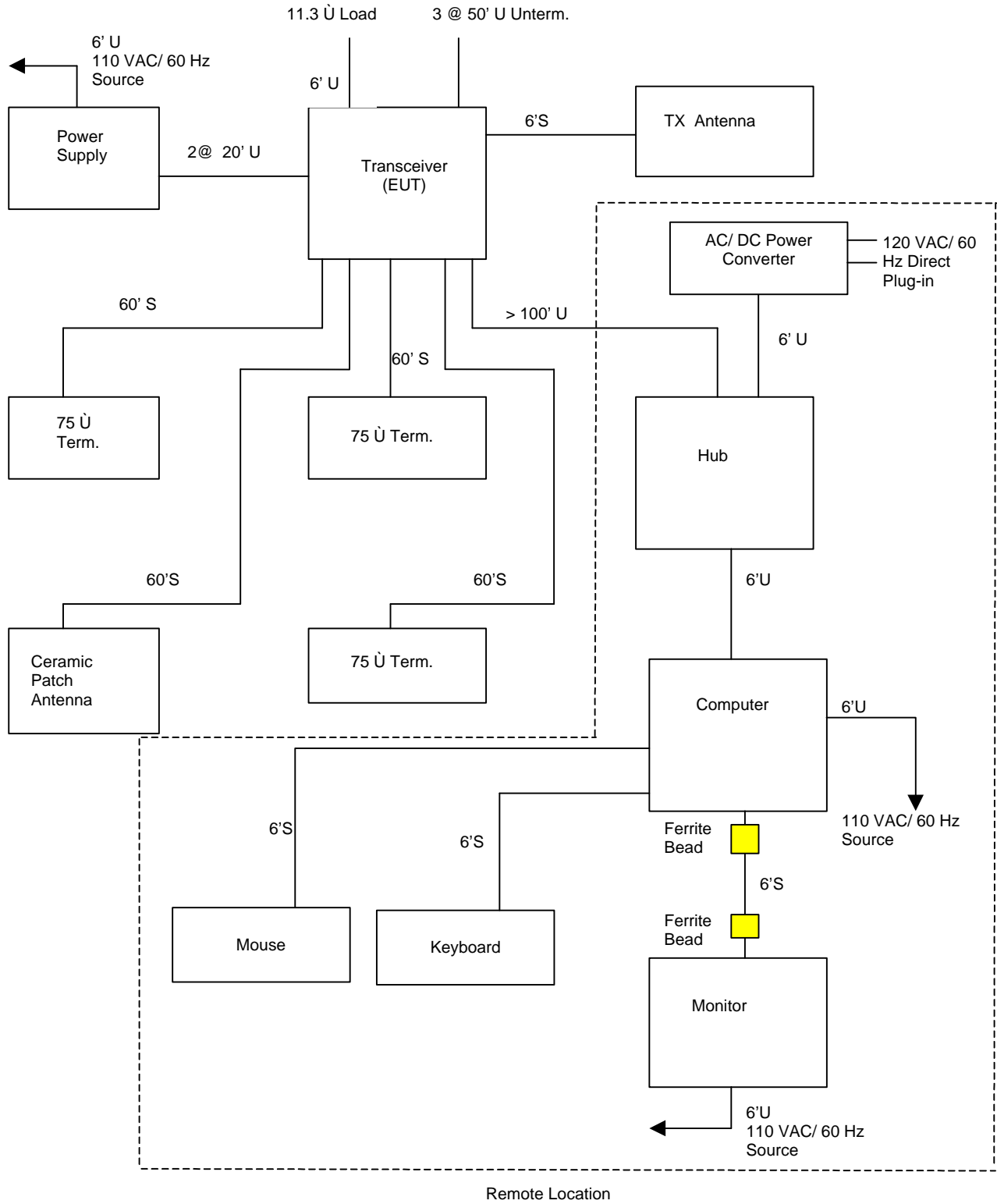
RF absorbing foam:

Double up the RF absorbing foam (from .25 inch to .5 inch) at the 96 pin DIN connector, on the top side of the RF board.

Completely cover the absorbing foam with copper or aluminum foil on the controller board (Digital board side) of the DIN connector.

FIGURE 1

TEST CONFIGURATION



Test Date: March 22 - March 29, 2001
UST Project: 01-0220
Customer: NCR Corporation
Model: 7730

FIGURE 2a

Photograph(s) for Spurious and Digital Device Emissions



Test Date: March 22 - March 29, 2001
UST Project: 01-0220
Customer: NCR Corporation
Model: 7730

FIGURE 2b

Photograph(s) for Spurious and Digital Device Emissions



Test Date: March 29, 2001
UST Project: 01-0220
Customer: NCR Corporation
Model: 7730

FIGURE 2c

Photograph(s) for Conducted Emissions



TABLE 1

EUT and Peripherals

PERIPHERAL MANU.	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Transceiver NCR (EUT)	Class 7730	None	JEH7730GAI (Pending)	6' U 11.3 Load 3@ 50' U Unterm. 3@ 60' S 75 Term. >100' U
Ceramic Patch Antenna (TX) Macom (EUT)	3395-8015- 0083	None	None	6' S
Power Supply Lead Year Enterprise, Co. Ltd. (EUT)	SYM04-3	None	None	2@ 20' U 6' U 110 VAC / 60 Hz
Ceramic Patch Antenna (RX) Macom (EUT)	3395-8015- 0048	None	None	60' S
AC / DC Converter Bay Networks	PWR-002- 004	9911	None	6' U
Hub Bay Networks	DS108	DS18F9BO81957	None	60' U
Computer AT & T	3349-4070	49-31439922	EJMMTASKA	6' U 110 VAC / 60 Hz
Monitor NCR	3498-2290- 8090	90-34019363	CKLB790	6' S 6' U 110 VAC / 60 Hz
Keyboard NMB Technologies	RT6656TW	21280082	AQ6- MTN4XZ15	6' S
Mouse Logitech	M-S34-6MD	LZA53160776	DZL210472	6' S

**TABLE 2
TEST INSTRUMENTS**

TYPE	MANUFACTURER	MODEL	SN.
SPECTRUM ANALYZER	HEWLETT-PACKARD	8593E	3205A00124
SPECTRUM ANALYZER	HEWLETT-PACKARD	8558B	2332A09900
S A DISPLAY	HEWLETT-PACKARD	853A	2404A02387
COMB GENERATOR	HEWLETT-PACKARD	8406A	1632A01519
RF PREAMP	HEWLETT-PACKARD	8447D	2944A07436
RF PREAMP	HEWLETT-PACKARD	8449B	3008A00480
HORN ANTENNA	EMCO	3115	3723
HORN ANTENNA	EMCO	3116	9505-2255
BICONICAL ANTENNA	EMCO	3110	9307-1431
LOG PERIODIC ANTENNA	EMCO	3146	9110-3600
BILOG	CHASE	CBL6112A	2238
LISN	SOLAR ELE.	8012	865577
LISN	SOLAR ELE.	8028	910494
LISN	SOLAR ELE.	8028	910495
THERMOMETER	FLUKE	52	5215250
MULTIMETER	FLUKE	85	53710469
FUNCTION GENERATOR	TEKTRONIX	CFG250	CFG250TW15059
PLOTTER	HEWLETT-PACKARD	7475A	2325A65394

2.6 Antenna Description (Paragraph 15.203)

An intentional radiator shall be designed to ensure that no transmit antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The Model NCR Corporation 7730 incorporates the following antennas:

Function	Type	Model #	Manufacturer	Gain	Type of Connector
Transmit	ceramic patch	NCR 7730-K053-V001 Macom 3395-8015-0083	Macom	2.0 dBi	reverse polarity SMA jack on Patch Antenna, TNC jack on 7730
Receive	patch with LNA	NCR 7730-K050-V001 Macom 3395-8015-0048	Macom	4.0 dBi	BNC jack

Note:

The 7730 is not for sale to the general public. Additionally, due to the unique nature of this system, this system requires professional installation.

2.7 Peak power within the band 2400 – 2483.5 GHz per FCC Section 15.247(b)

Peak power within the band 2400-2483.5 GHz has been measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable to the antenna output terminals or across the antenna leads on the PCB as specified by the manufacturer. The spectrum analyzer was set for a $50\ \Omega$ impedance with the $VBW \geq RBW$ 6 dB bandwidth. The results of the measurements are given in Table 3 and Figure 3a through Figure 3c.

The EUT did not incorporate any antennas of directional gain greater than 6 dBi, therefore the output power has not been reduced as required by 15.247(b)(3).

**TABLE 3
PEAK POWER OUTPUT**

Test Date: March 29, 2001
UST Project: 01-0220
Customer: NCR Corporation
Model: 7730

Frequency of Fundamental (MHz)	Measurement (dBm)*	Measurement (Watt)*	FCC Limit (Watt)
2400.0	27.1	0.512	1.0
2440.0	24.1	0.257	1.0
2483.5	23.9	0.245	1.0

* Measurement includes 0.6 db cable loss
(loss not known for special connector used)

Tester
Signature: _____ **Name:** Tim R. Johnson

Figure 3a.
Peak Power per FCC Section 15.247(b) (Low)

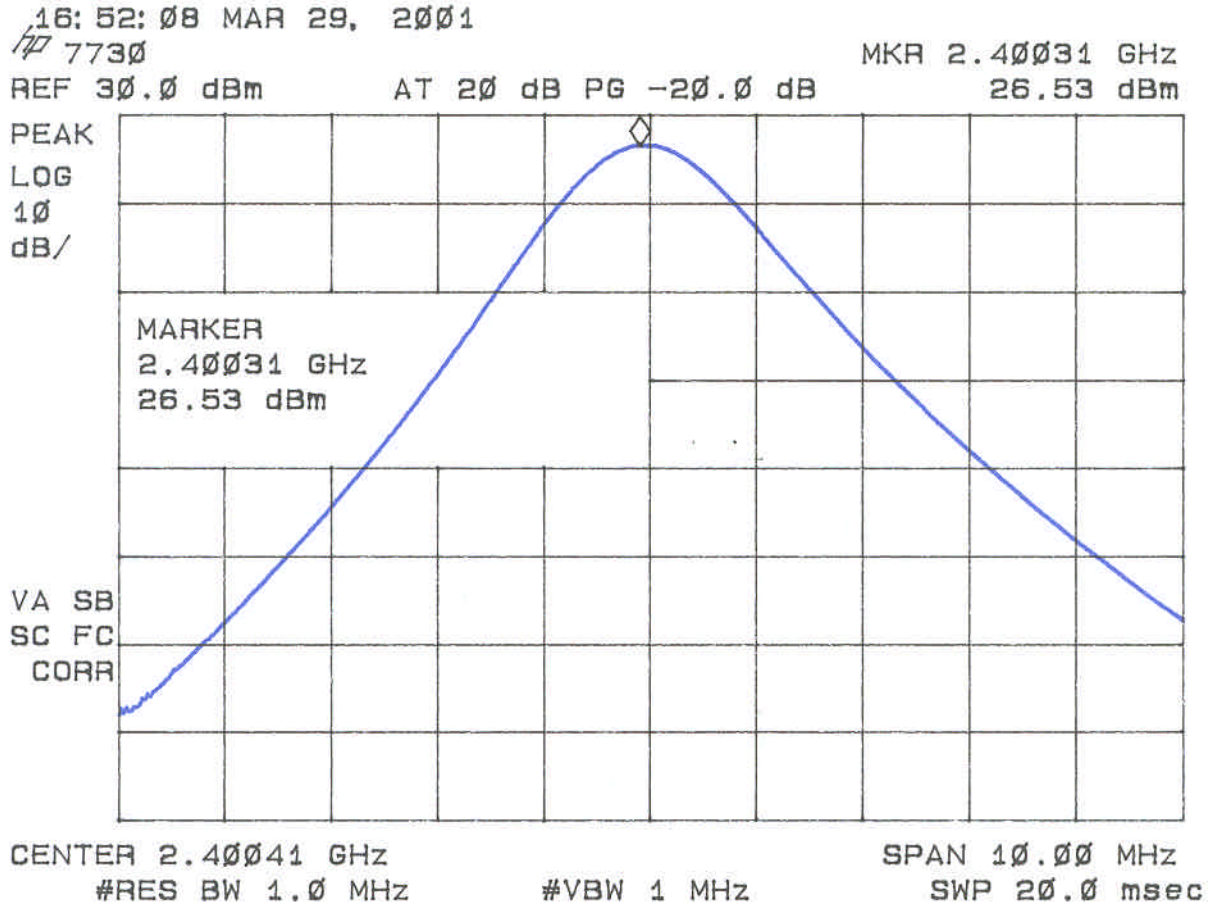


Figure 3b.
Peak Power per FCC Section 15.247(b) (Mid)

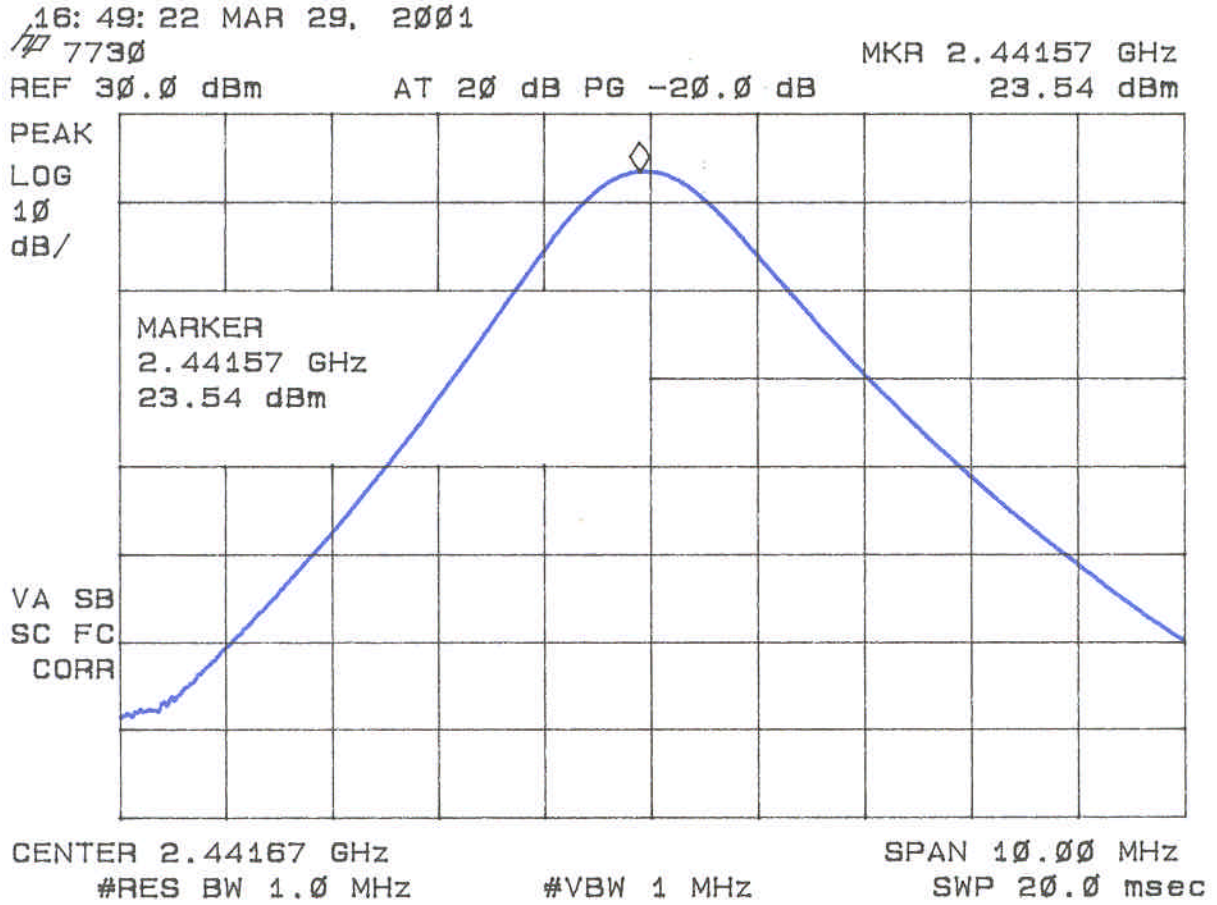
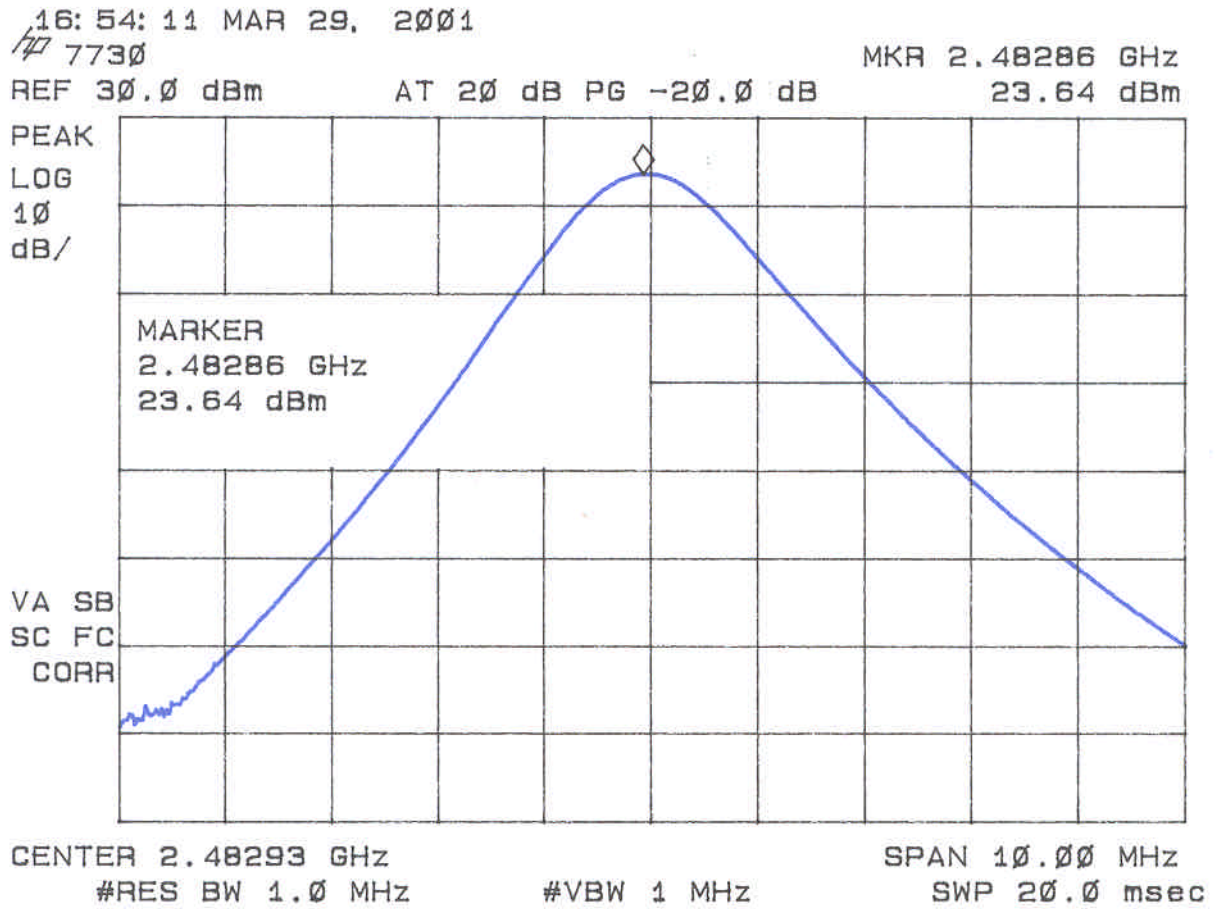


Figure 3c.
Peak Power per FCC Section 15.247(b) (High)



2.8 Antenna Conducted Spurious Emission in the Frequency Range 30 - 25000 MHz (FCC Section 15.247(c))

Spurious emissions in the frequency range 30 - 25000 have been measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable to the antenna output terminals or across the antenna leads on the PCB as specified by the manufacturer. The spectrum analyzer was set for a 50 Ω impedance with the RBW = 100 kHz. All spurious emissions were measured to be greater than 20 dB down from the fundamental. The results of conducted spurious emissions are given in Figure 4a through Figure 4l.

Figure 4a
Antenna Conducted Spurious Emissions 15.247(c) Low

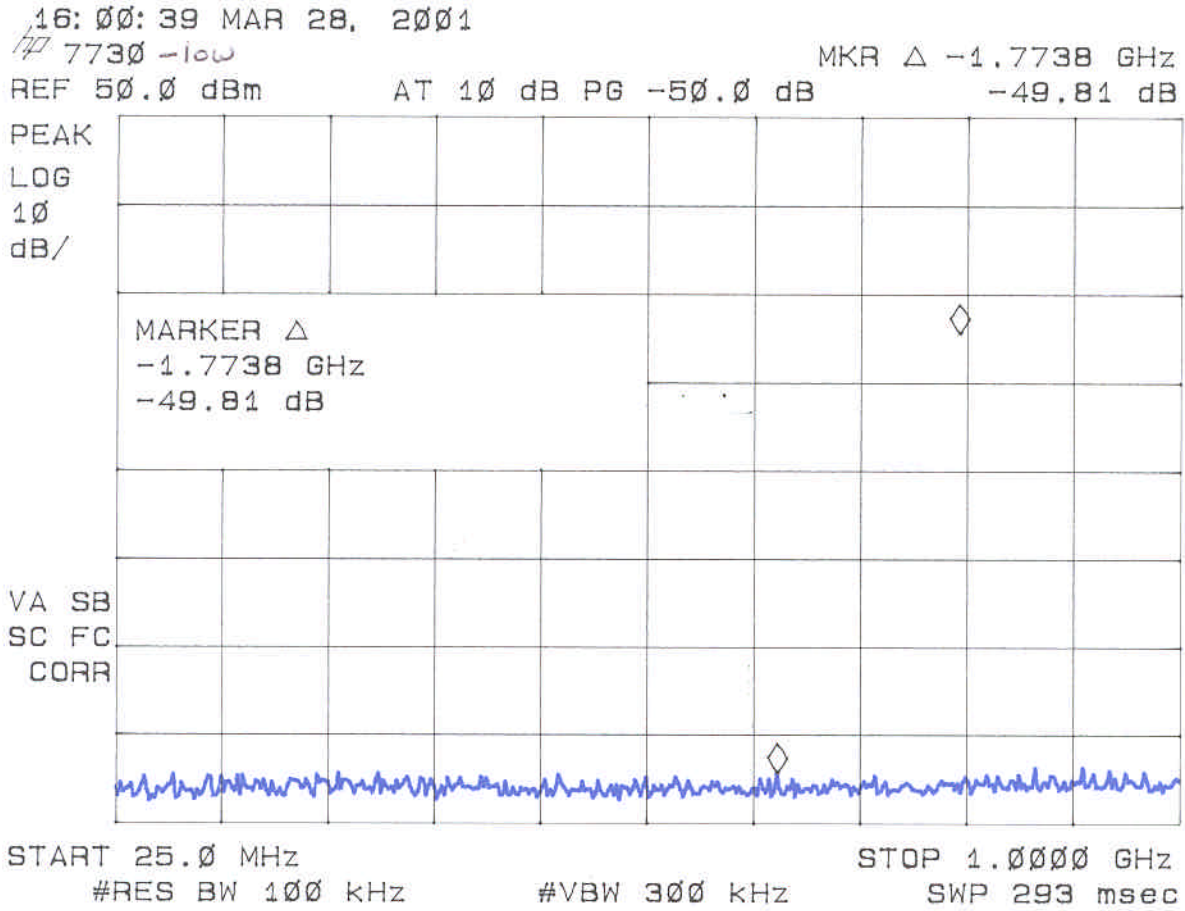


Figure 4b
Antenna Conducted Spurious Emissions 5.247(c) Low

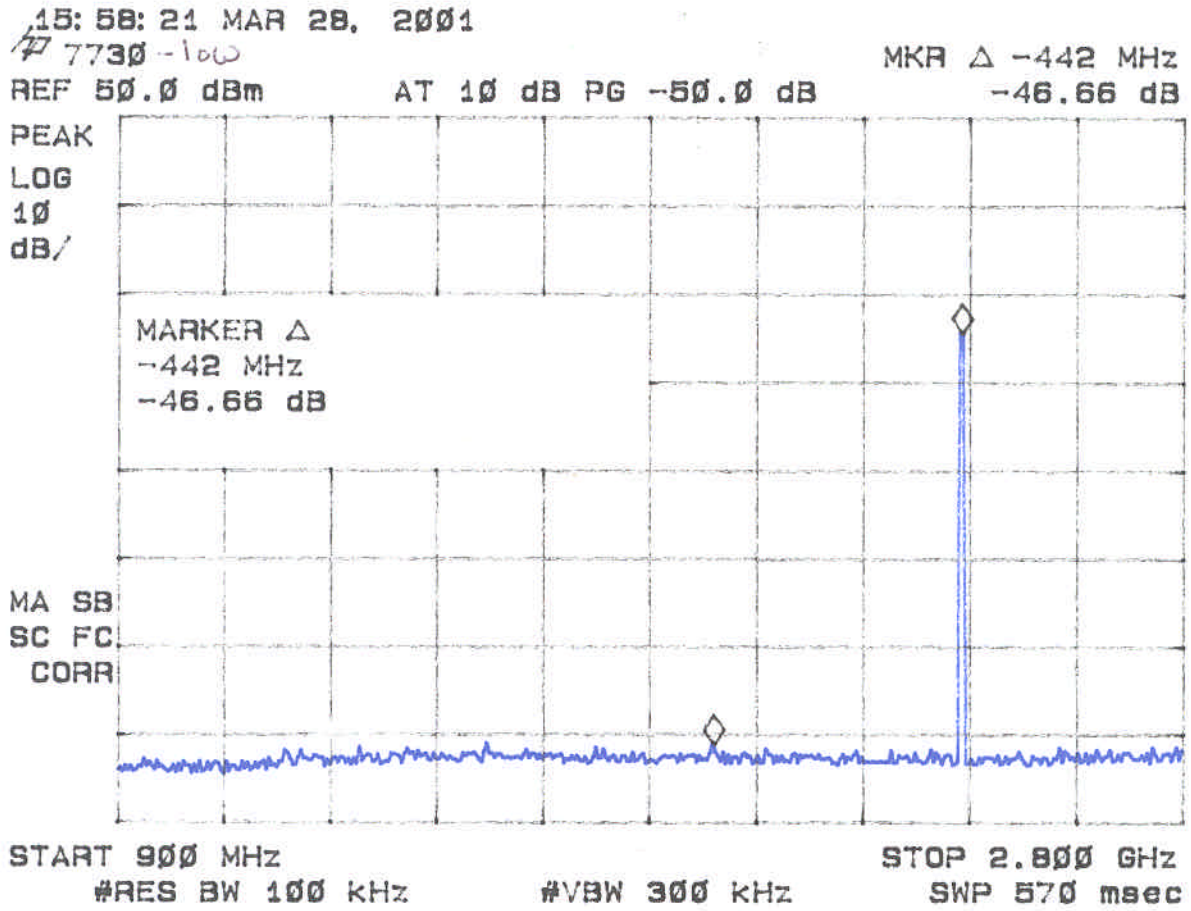


Figure 4c
Antenna Conducted Spurious Emissions 15.247(c) Low

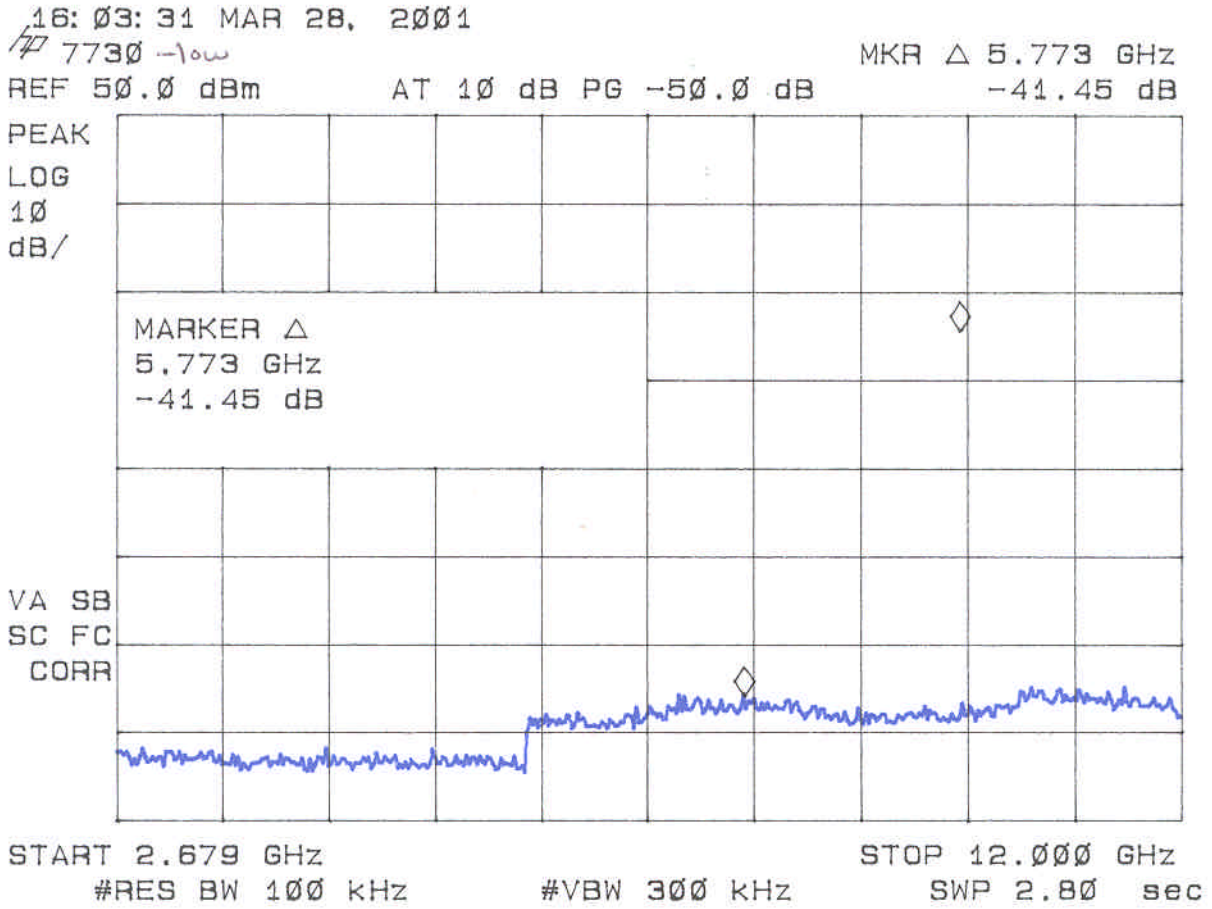


Figure 4d
Antenna Conducted Spurious Emissions 15.247(c) Low

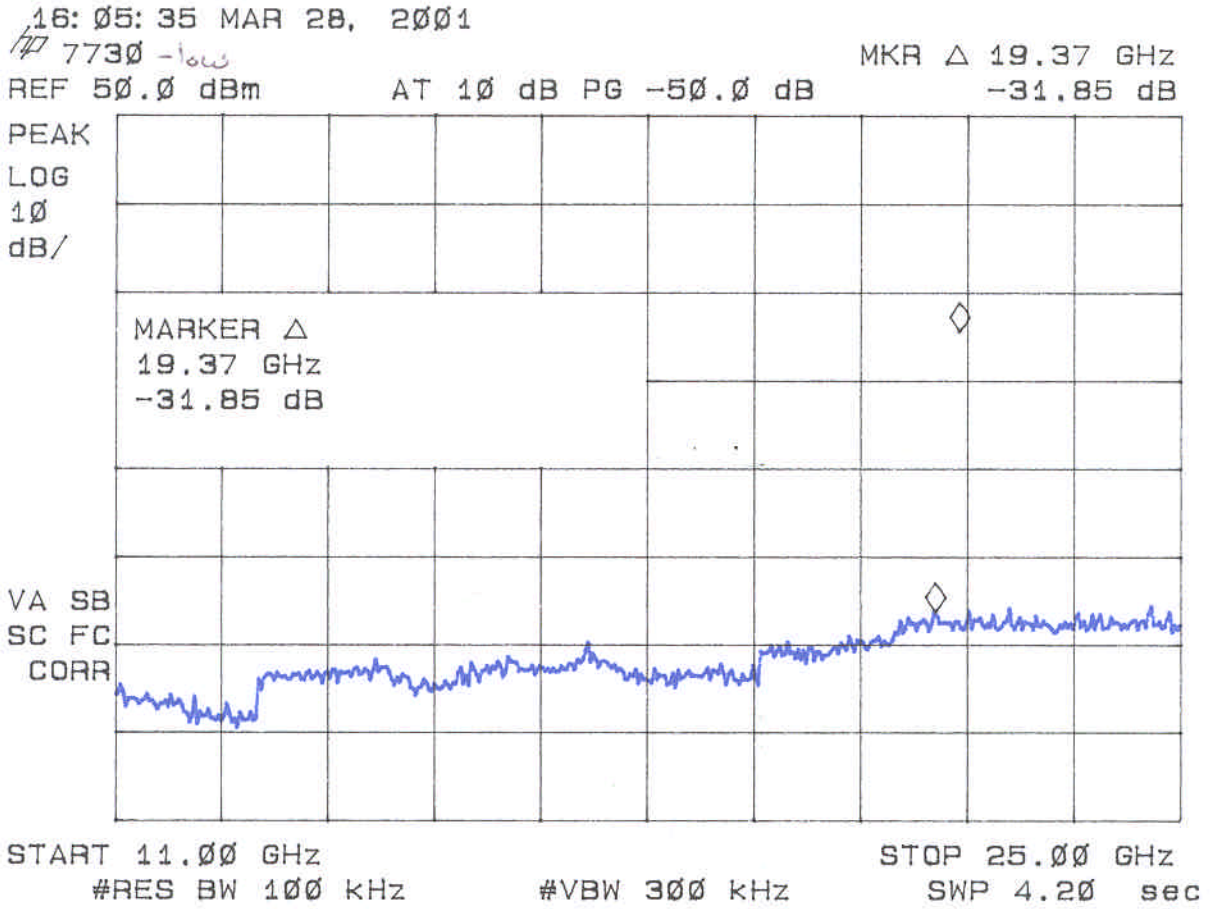


Figure 4e
Antenna Conducted Spurious Emissions 15.247(c) Mid

16:10:23 MAR 28, 2001

7730 MID

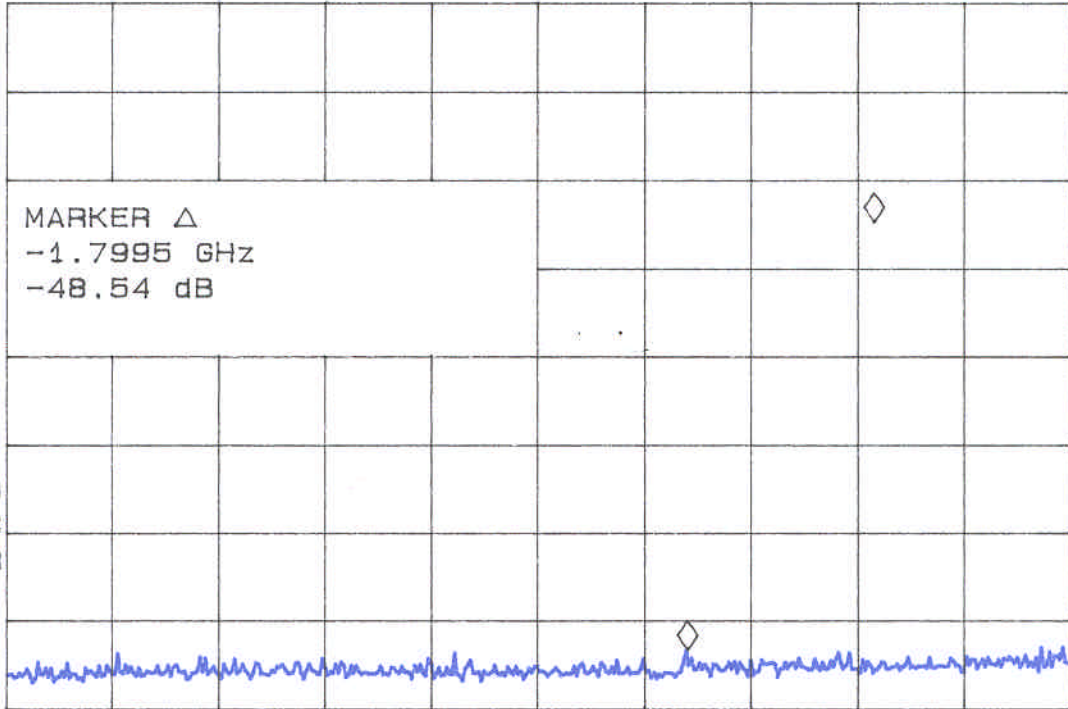
MKR Δ -1.7995 GHz

REF 50.0 dBm

AT 10 dB PG -50.0 dB

-48.54 dB

PEAK
LOG
10
dB/



START 25.0 MHz

#RES BW 100 kHz

#VBW 300 kHz

STOP 1.0000 GHz

SWP 293 msec

Figure 4f
Antenna Conducted Spurious Emissions 15.247(c) Mid

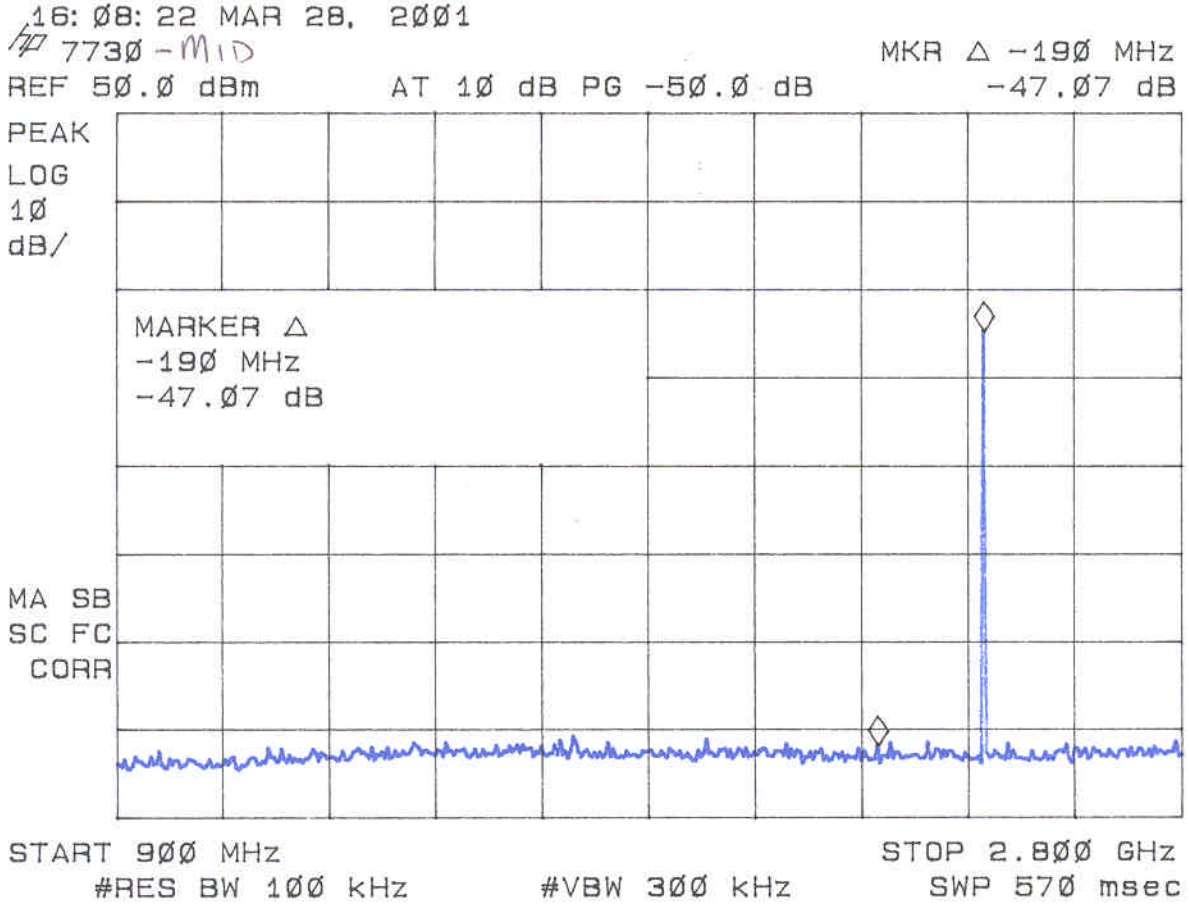


Figure 4g
Antenna Conducted Spurious Emissions 15.247(c) Mid

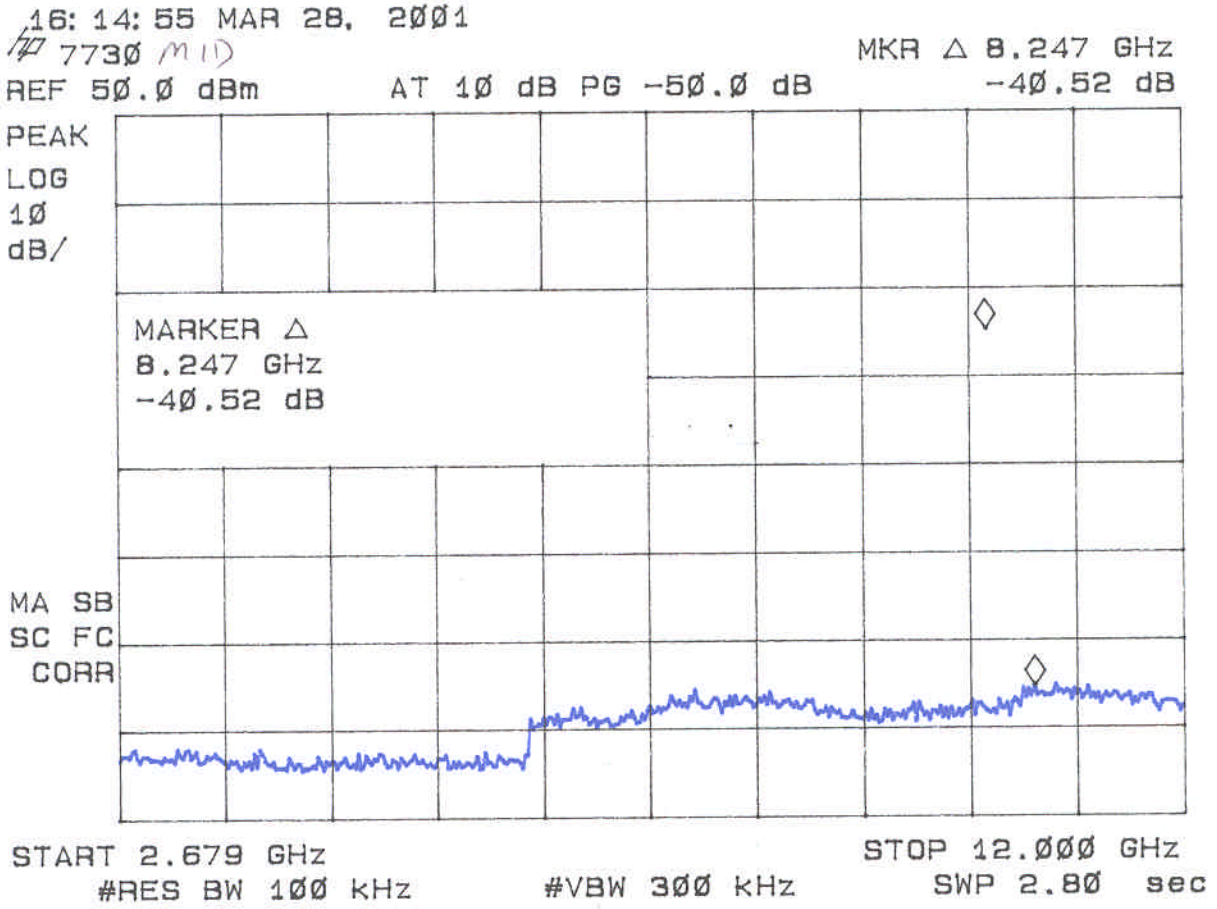


Figure 4h
Antenna Conducted Spurious Emissions 15.247(c) Mid

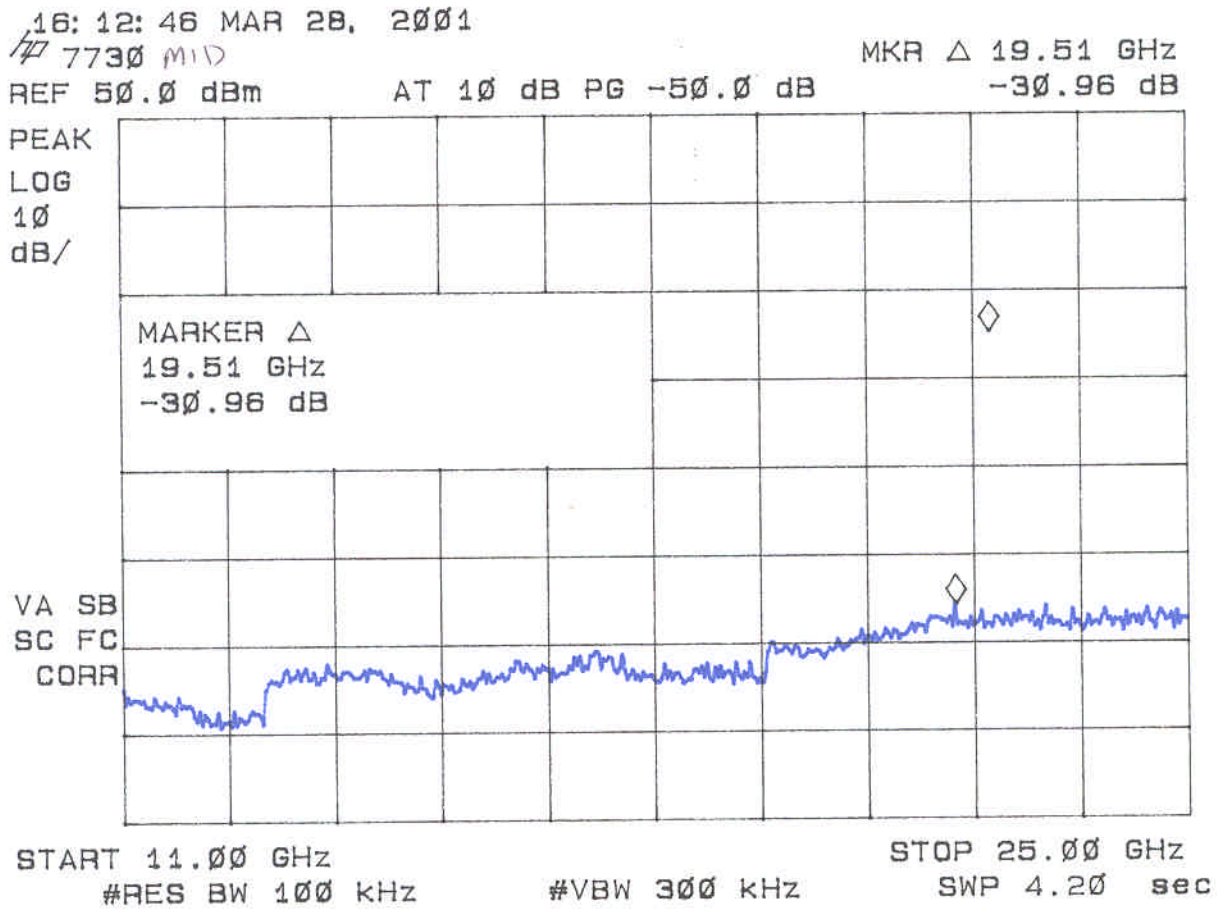


Figure 4i
Antenna Conducted Spurious Emissions 15.247(c) High

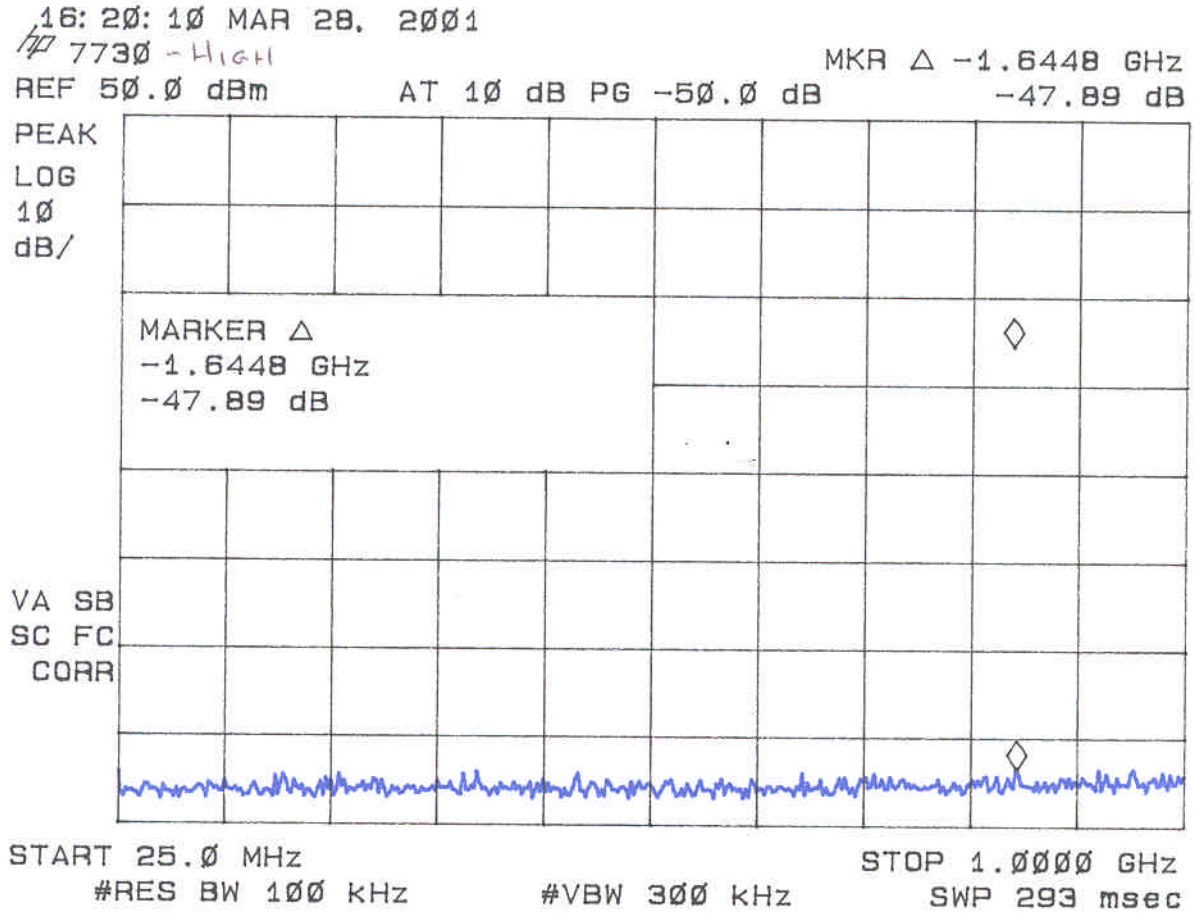


Figure 4j
Antenna Conducted Spurious Emissions 15.247(c) High

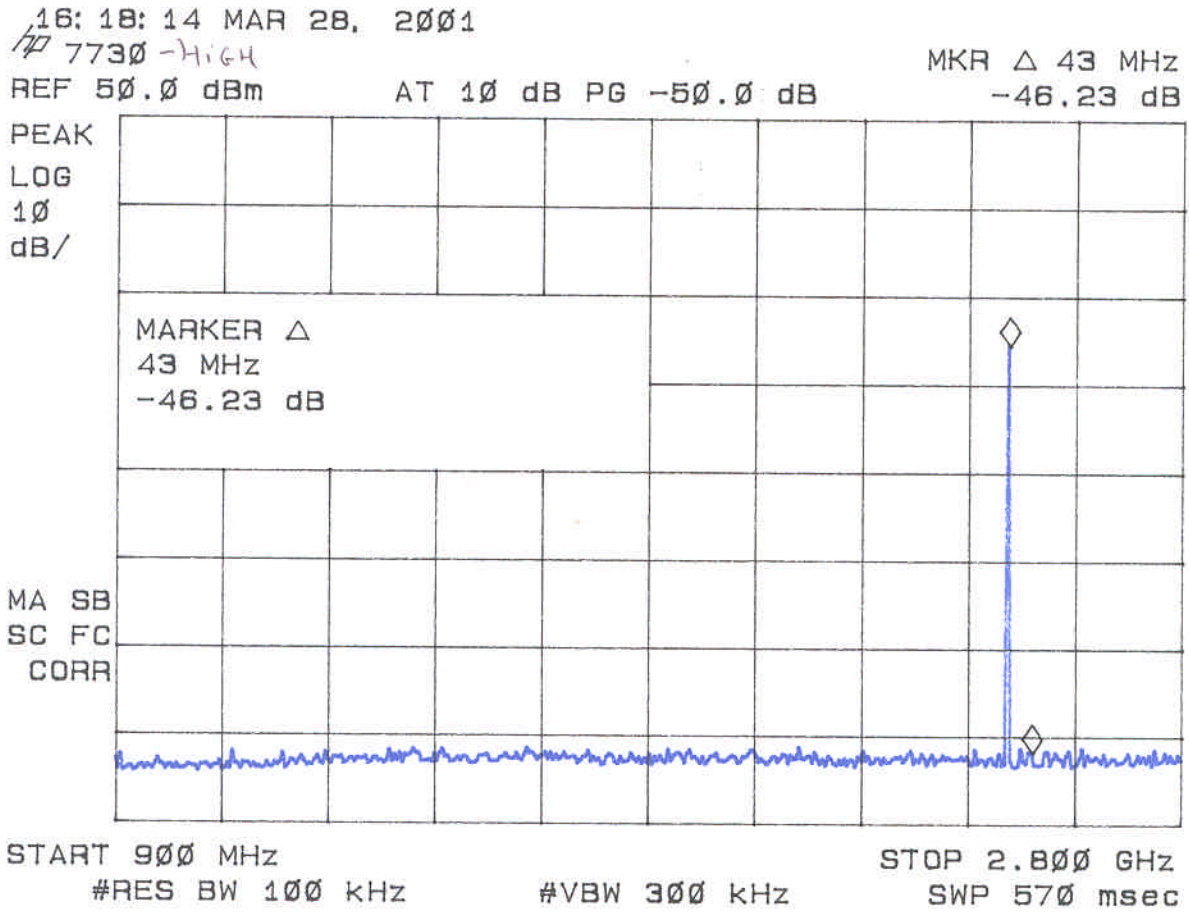


Figure 4k
Antenna Conducted Spurious Emissions 15.247(c) High

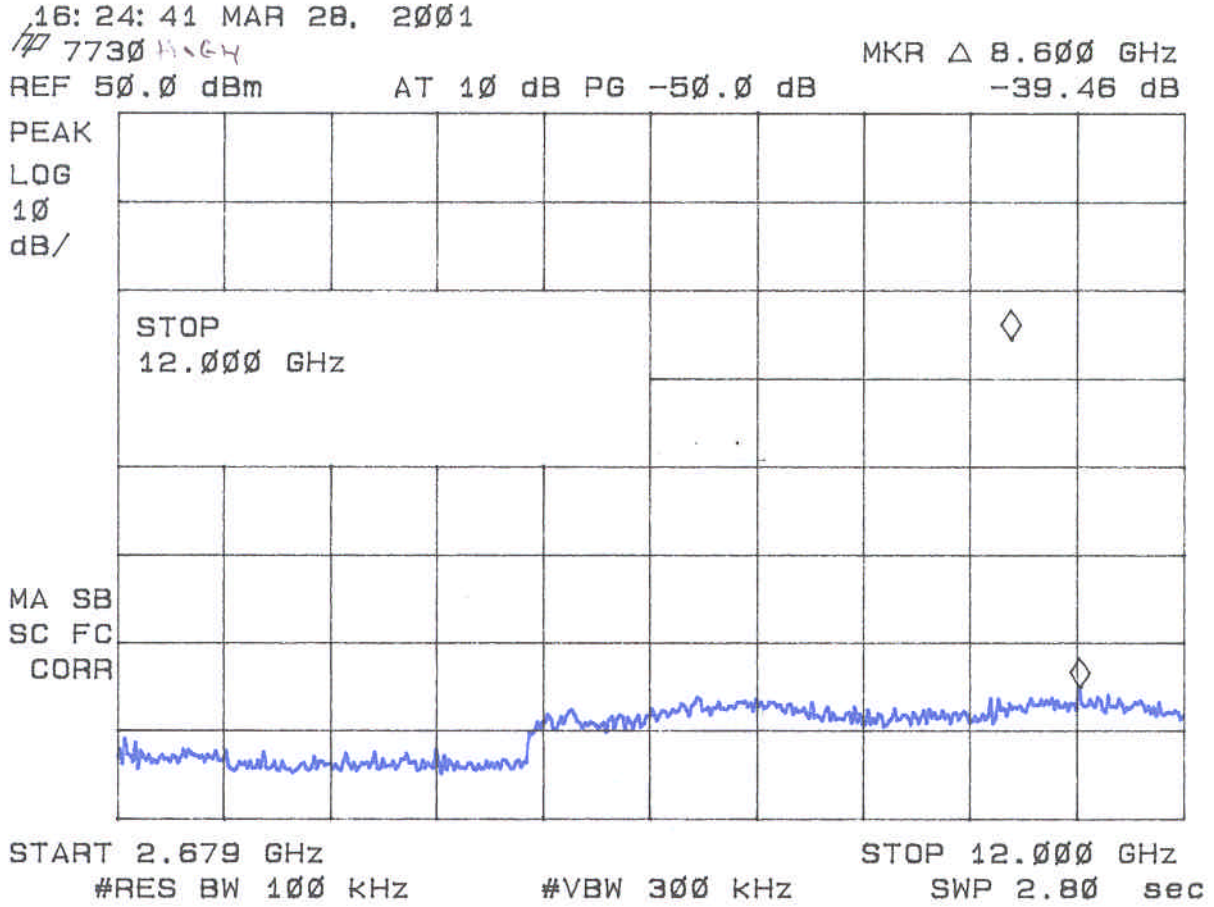


Figure 4l
Antenna Conducted Spurious Emissions 15.247(c) High

