



Nemko

Nemko USA, Inc.

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San Diego, CA 92121-1024

Test Report: 2004 110516 FCC

Applicant: **Broadcast Microwave Services**
12367 Crosthwaite Circle Dock 10
Poway, CA 92064
858-391-3050
858-391-3049- fax

Equipment Under Test: Model: CCII-7 Transmitter

FCC ID: CNVCCII-7

In Accordance With: **FCC PART 2, FCC PART 74.637, PART 90.209**

Tested By: Nemko USA Inc.
11696 Sorrento Valley Road
San Diego, CA 92121-1024

Date: 1-24-05

Total Number of Pages: 43

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Section 1. Summary of Test Results**General****All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 22, Subpart H.

DOCUMENT HISTORY

REVISION	DATE	COMMENTS
-	11-30-04	Prepared By: A. Laudani
-	1-24-05	Initial Release: R. L. Hill

NOTE: Nemko USA, Inc. hereby makes the following statements so as to conform to Chapter 10 (Test Reports) Requirements of ANSI C63.4 (1992) "Methods and Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz":

- The unit described in this report was received at Nemko USA, Inc.'s facilities on November 17, 2004. Testing was performed on the unit described in this report on November 17, 2004 to November 24, 2004 .
- The Test Results reported herein apply only to the Unit actually tested, and to substantially identical Units.
- This report does not imply the endorsement of the Federal Communications Commission (FCC), NVLAP or any other government agency.

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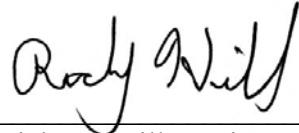
CERTIFICATION

Nemko USA, Inc., an independent Electromagnetic Compatibility (EMC) Test Laboratory, produced this Test Report and performed the Radio Frequency Interference (RFI) testing and data evaluation contained herein.

Nemko USA, Inc.'s measurement facility is currently registered with the United States Federal Communications Commission (FCC) in accordance with the provisions of 47 United States Code (CFR) Part 2, Subpart I, Section 2.948(a). A current description of Nemko USA, Inc.'s measurement facility is on file with the FCC. Nemko USA Inc. has additionally satisfied the FCC that it complies with the requirements set forth in 47 CFR Part 2, Subpart I, Section 2.948(d) regarding the accreditation of EMC laboratories. As a result, the FCC has placed Nemko USA Inc. on its list of EMC laboratories approved to perform Declaration of Conformity (DOC) procedure testing.

The RFI testing, test data collection and test data evaluation were accomplished in accordance with the ANSI C63.4-1992 Standard, and in accordance with the applicable sections of the FCC rules (47 CFR Parts 2 and 18)." digital devices. The testing was also accomplished in accordance with Industry Canada's ICES-003 standard for unintentional radiating device per EMCAB-3, Issue 3 (May 1998). The administrative summary of this test report provides a description of the test sample

I hereby certify that the test data, test data evaluation, and equipment configurations used to compile this test report are a true and accurate representation of the test sample's radio frequency interference characteristics as of the test date(s), and, for the design of the test sample.



Ricky L. Hill, Senior EMC Test Engineer

Summary Of Test Data

Name Of Test	Para. No.	Result
RF Power Output	2.1046	PASS
Modulation Characteristics	2.1047	AS REPORTED
Occupied Bandwidth	2.1049	PASS
Spurious Emissions at Antenna Terminals	2.1051	PASS
Field Strength of Spurious Emissions	2.1053	PASS
Frequency Stability	2.1055	PASS

Footnotes For N/A's: EUT is a digitally modulated transmitter. Parts 74 and 90 do not express limits or pass/fail criteria for Modulation Characteristics.

Test Conditions:

Indoor Temperature: 19--22 °C
 Humidity: 40-50 %

Outdoor Temperature: 15--24 °C
 Humidity: 40-50 %

Section 2. General Equipment Specification**Manufacturer:** Broadcast Microwave Services**Model No.:** CCII & CDII (Transmitter and Receiver)**Serial No.:** 226-31704**Date Received In Laboratory:** November 17, 2004**Nemko Identification No.:** 24-516-BRO

Section 3. RF Power Output**Para. No.: 2.1046(c)****Test Performed By: A. Laudani****Date of Test: 11-22-04****Minimum Standard:** Subpart F--Television Broadcast Auxiliary Stations

Sec. 74.636 Power limitations.

Transmitter peak output power shall not be greater than necessary, and in any event, shall not exceed the power listed in the table below:

Transmitter power	Fixed	Mobil
Frequency band (MHz)	(W)	(W)
1,990 to 2,110.....	20.0	12.0
2,450 to 2,500.....	20.0	12.0

Test Results: EUT complies**Test Conditions:**Tested by Peak Power meter thru a 40 dB attenuator at antenna terminal.
Digitally modulated by video camera, set at 64QAM, highest power setting.
Antenna Gain = 2 dBi**Measurement Data:**

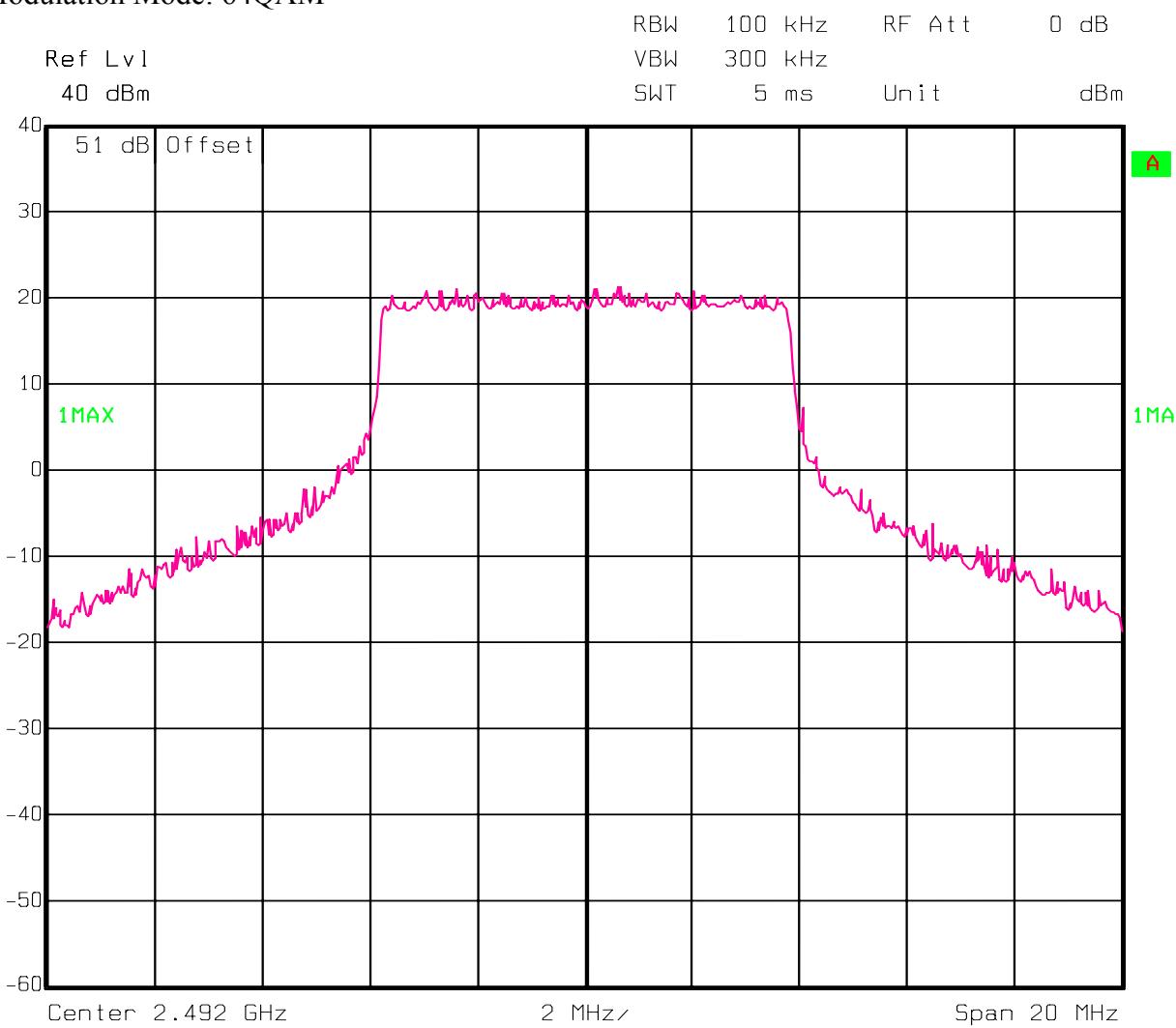
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (Watts)
1	1999.0	35.80	3.8
4	2050.5	36.13	4.1
7	2101.5	35.68	3.7
8	2458.5	35.19	3.3
9	2475.5	34.77	3.0
10	2492.0	34.47	2.8

Section 4.**Modulation Characteristics****Para. No.: 2.1047**

Test Performed By: Alan Laudani	Date of Test: 11-29-04
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Minimum Standard: Part 74, Part 90**Test Results:** As Reported. Conductive emission plots captured on the Spectrum Analyzer thru a 50 dB attenuator.**Measurement Data:** See attached plots to exemplify the three modes of modulation:
Modulation modes are QPSK, 16QAM, 64QAM.
Each mode was investigated and no one mode was a "worst-case" mode.
The Mode 16QAM was used for all tests as it provided under lower resolution bandwidth slightly wider bandwidth. Modulation mode had no effect for spurious, power or frequency stability measurements.

Modulation Mode: 64QAM



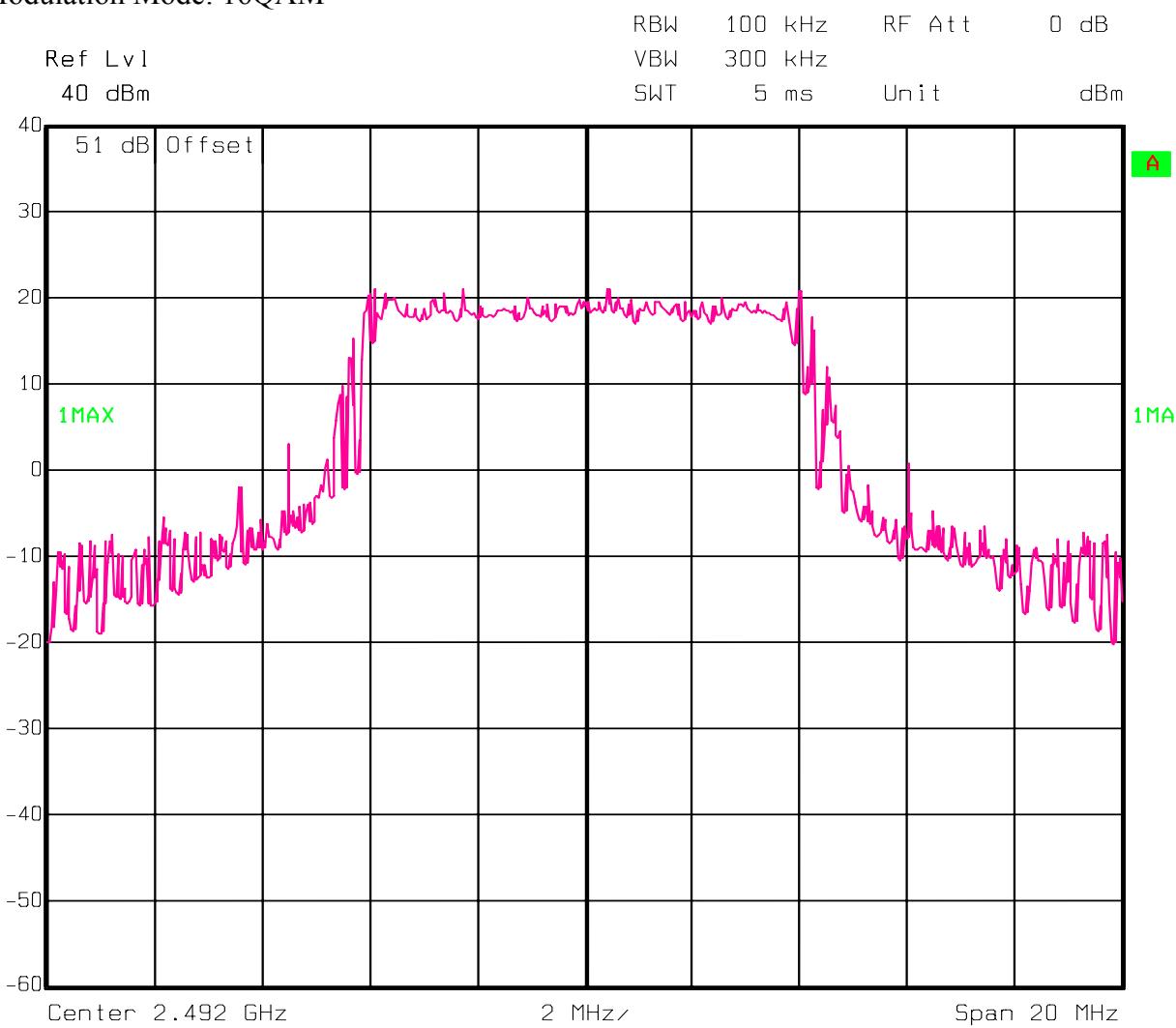
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EQUIPMENT: Transmitter CCII-7

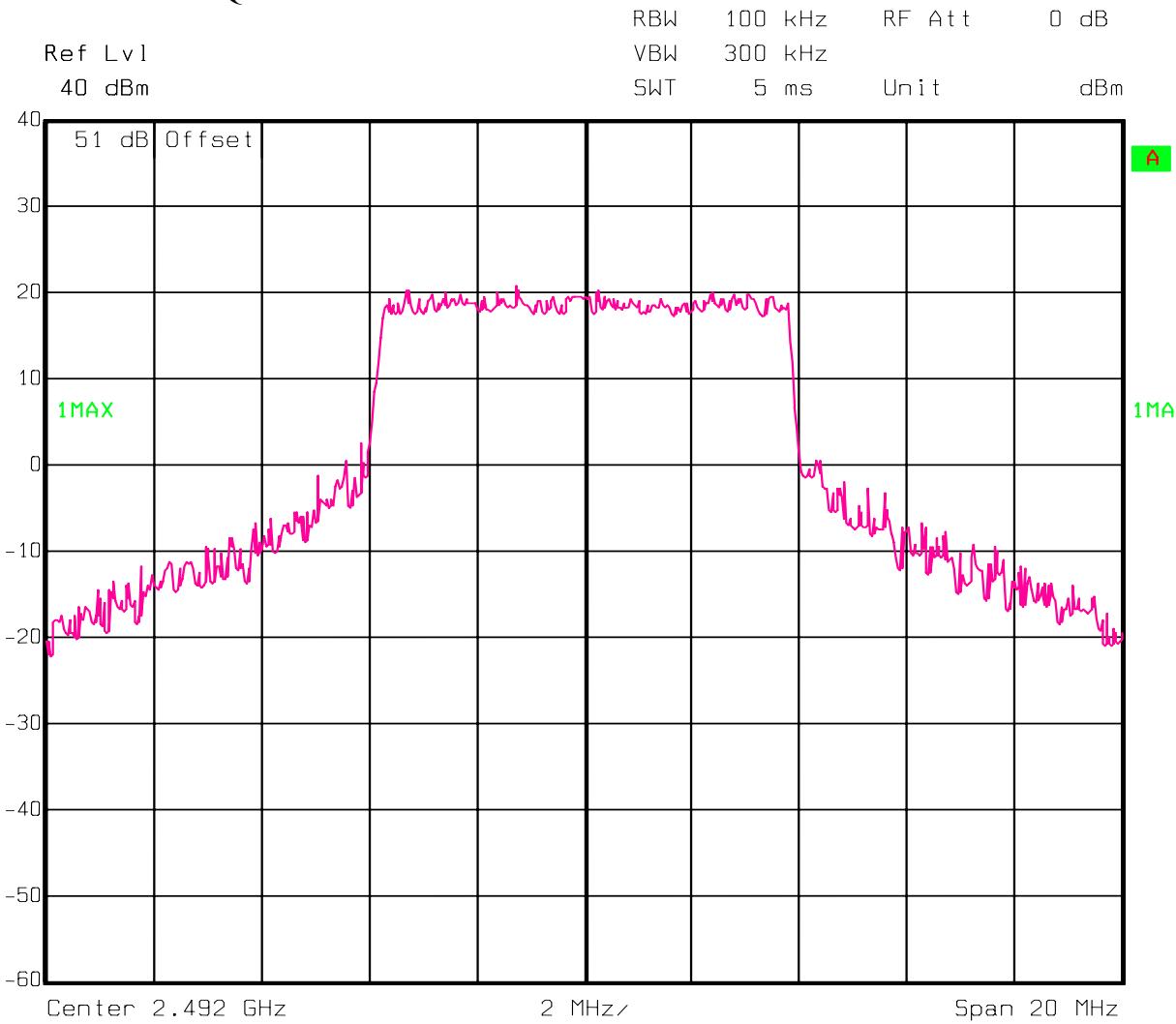
REPORT NO.: 2004 110516 FCC

Modulation Mode: 16QAM



Date: 29.NOV.2004 16:00:30

Modulation Mode: QPSK



Date: 29.NOV.2004 16:01:09

Section 5. Occupied Bandwidth**Para. No.: 2.1049****Test Performed By: Alan Laudani****Date of Test: 11-30-2004****Minimum Standard:** Part 74.637 (g) and 90.209 (a) Occupied/Authorized bandwidth.

Maximum authorized bandwidth

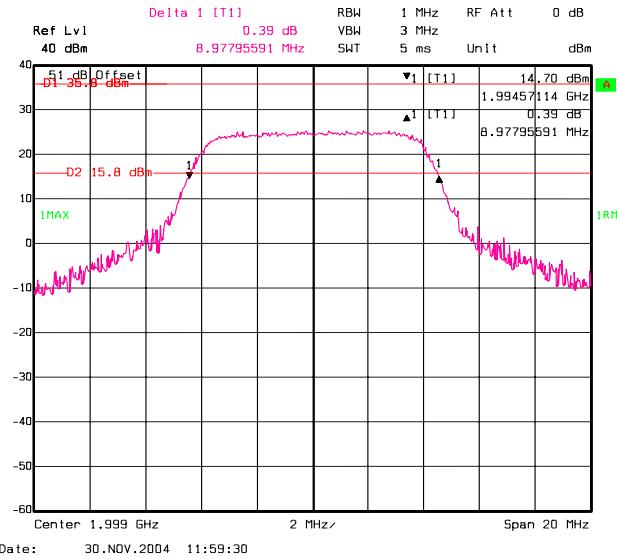
Frequency Band (MHz) (MHz)

1,990 to 2,110..... 18

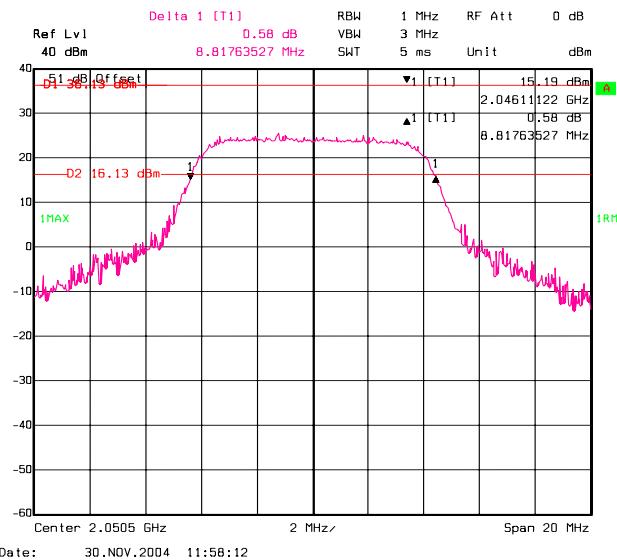
2,450 to 2,500..... Note 2 of 90.209(b)(5)

Test Results: EUT Complies. Conductive emission plots captured on the Spectrum Analyzer thru a 50 dB attenuator.**Test Data:** See attached plots.

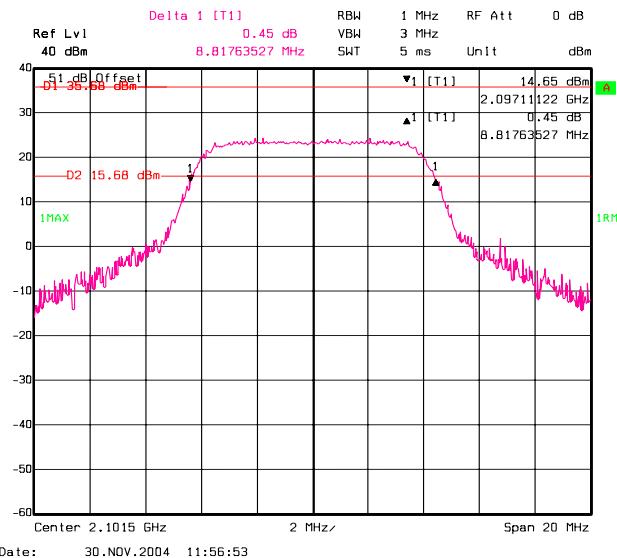
Channel 1 1999.0 MHz BW = 9 MHz



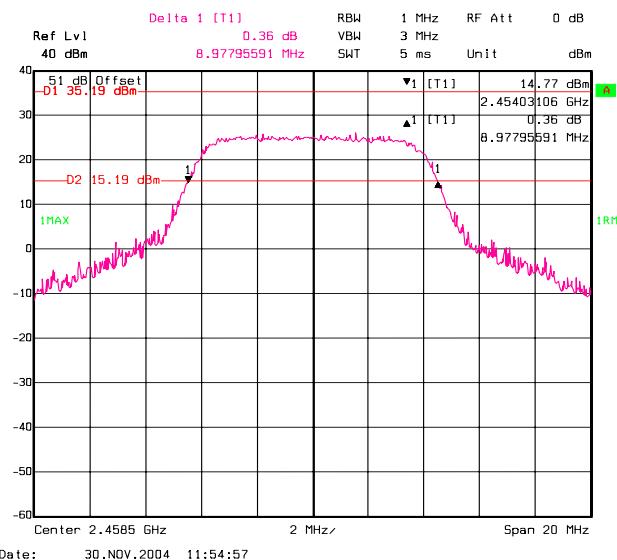
Channel 4 2050.5 MHz BW = 9 MHz



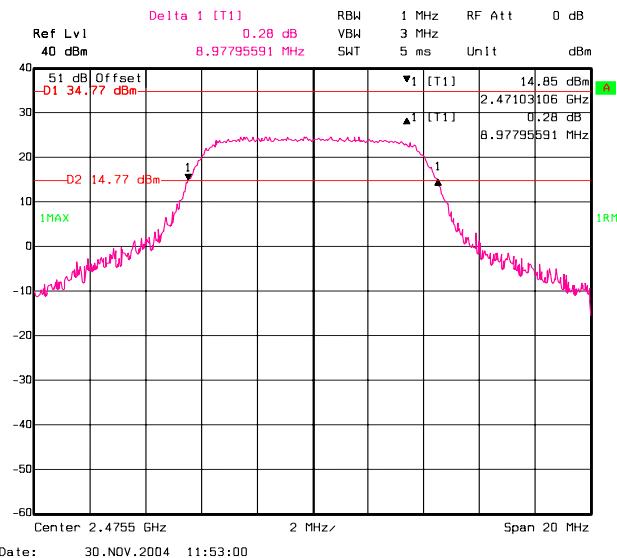
Channel 7 2101.5 MHz BW = 9 MHz



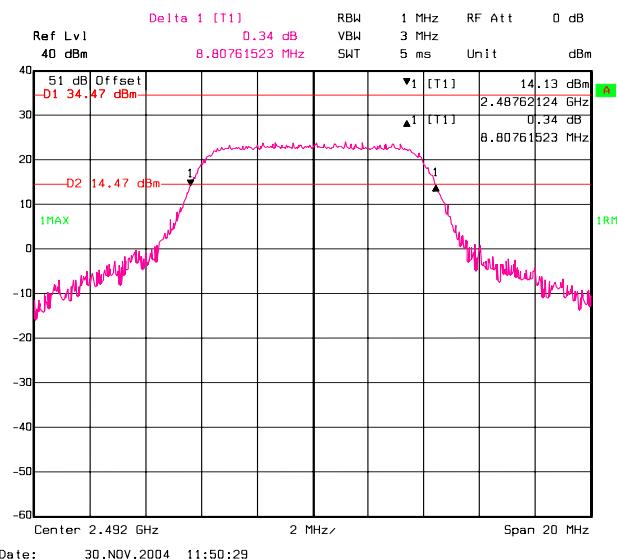
Channel 8 2458.5 MHz BW = 9 MHz



Channel 9 2475.5 MHz BW = 9 MHz



Channel 10 2492.0 MHz BW = 9 MHz



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Section 6. Spurious Emissions At Antenna Terminals

Para. No.: 2.1051

Test Performed By: Alan Laudani	Date of Test: 11-30-2004
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Minimum Standard: Part 74.637 Emissions and emission limitations

(2) When using digital modulation:

(i) In any 1 MHz band, the center frequency of which is removed from the assigned frequency by more than 50% up to and including 250% of the authorized bandwidth: As specified by the following equation but in no event less than 11 dB.

$$A = 11 + 0.4 (P-50) + 10 \log_{10}(B)$$

where:

A=Attenuation (in dB) below the mean output power level

P=Percent removed from the carrier frequency

B=Authorized bandwidth in MHz [Attenuation greater than 56 decibels is not required.]

(ii) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250% of the authorized bandwidth: At least $43 + 10 \log_{10} (M.O.P.) \dots$ (mean output power in watts) dB, or 80 dB, whichever is the lesser attenuation.

Test Results: EUT Complies. Conductive emission plots captured on the Spectrum Analyzer thru a 50 dB attenuator. 5 kHz Resolution Bandwidth measured the emissions closest to the limit (the second harmonic). Emissions were investigated from 1 GHz to 25 GHz .

Test Data: See table and attached Plots (balance in Appendix).

Frequency	Measured (dBm)	Limit	Margin
1999.0 MHz	-32.0	-13	-19.0
2050.5 MHz	-32.1	-13	-19.1
2101.5 MHz	-41.1	-13	-28.1
2458.5 MHz	-28.7	-13	-15.7
2475.5 MHz	-29.2	-13	-16.2
2492.0 MHz	-29.9	-13	-16.9

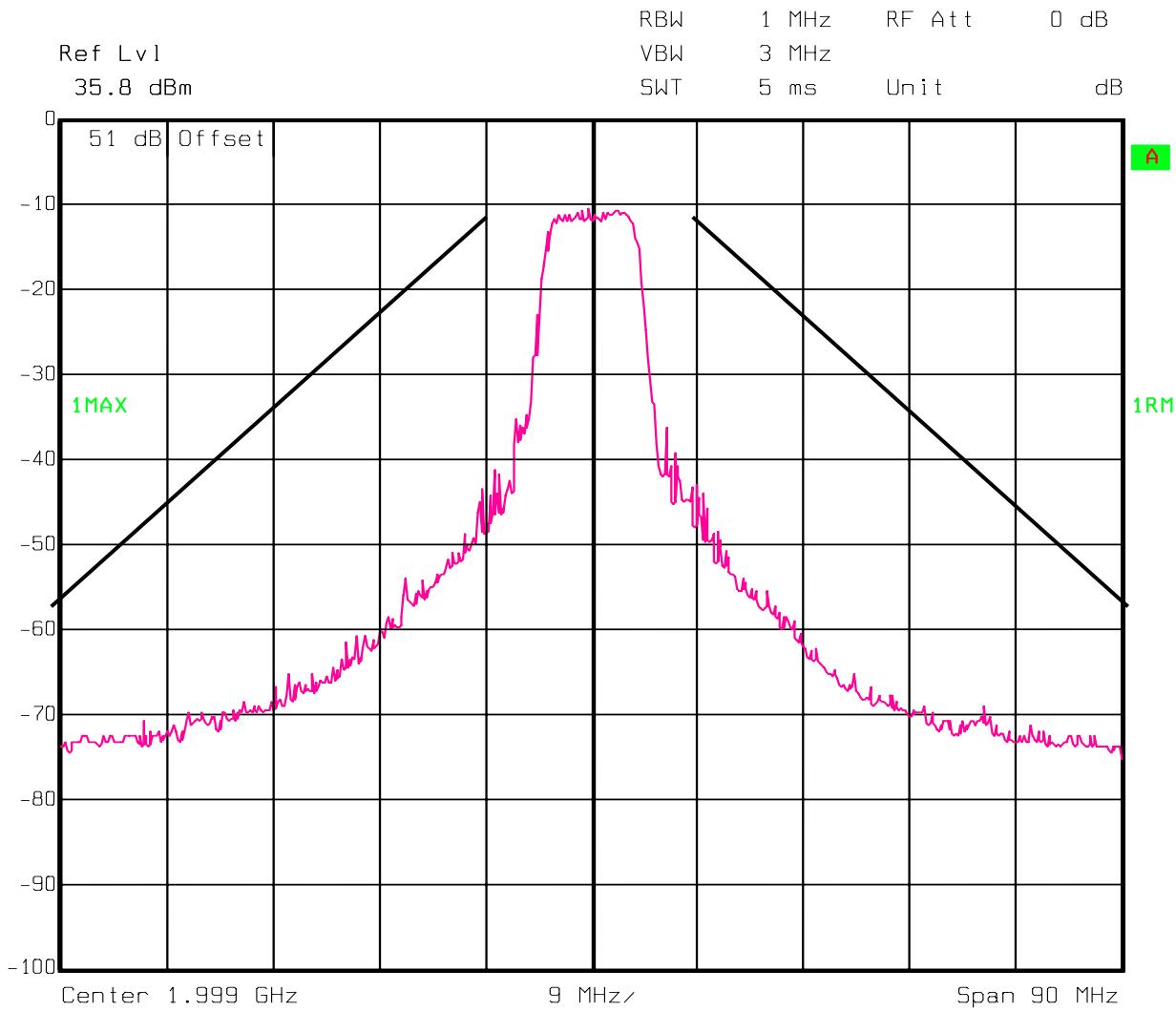
Emission Mask Endpoints:

BW = 18 MHz, REF LVL = Mean Output Power

50% of BW = 9 MHz -- down 11 dB from MOP

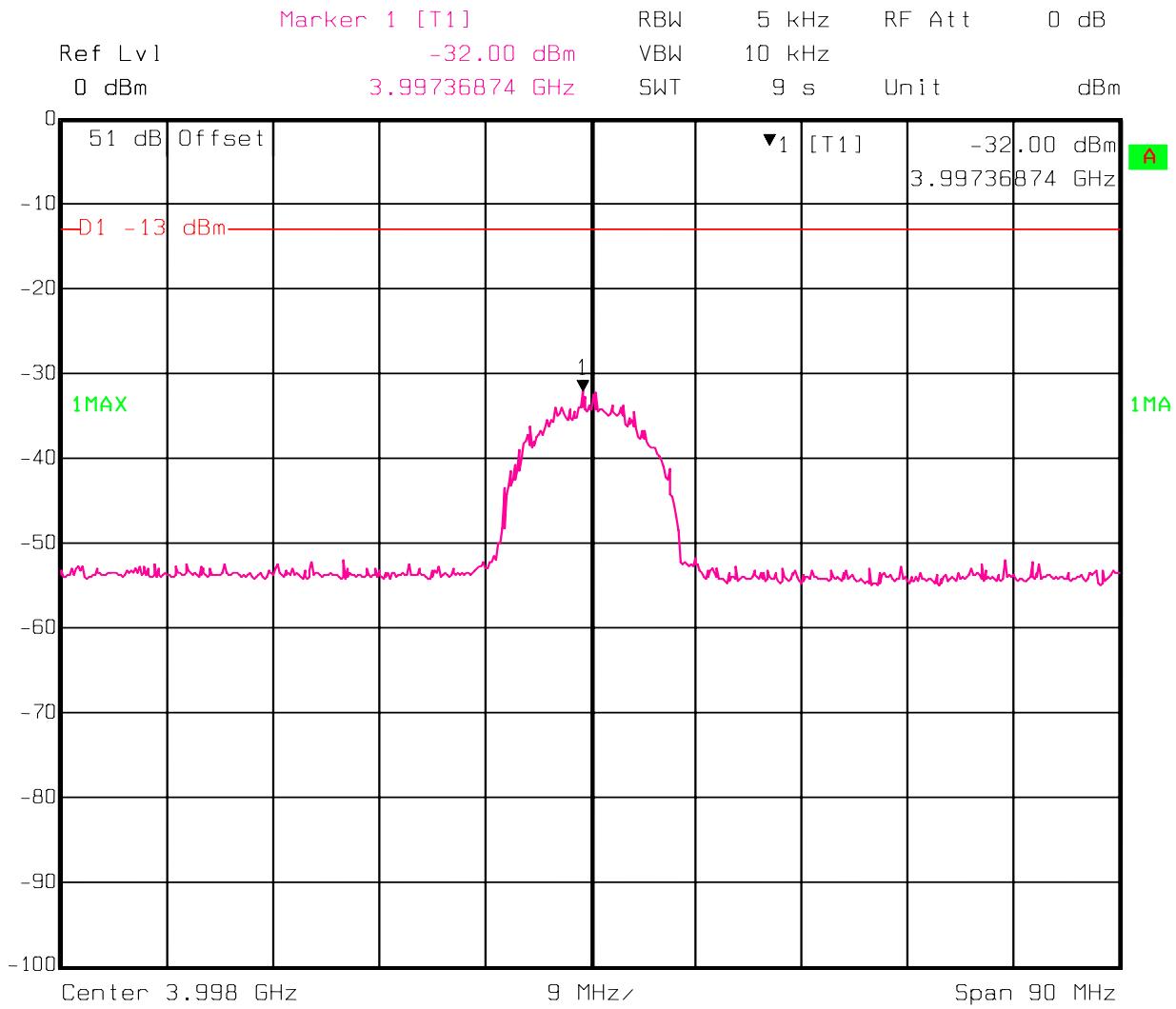
250% of BW = 45 MHz -- down 56 dB from MOP

Channel 1 1999.0 MHz



Date: 30.NOV.2004 15:40:11

The second Harmonic was closest to the limit. Display line = Limit = -13 dBm

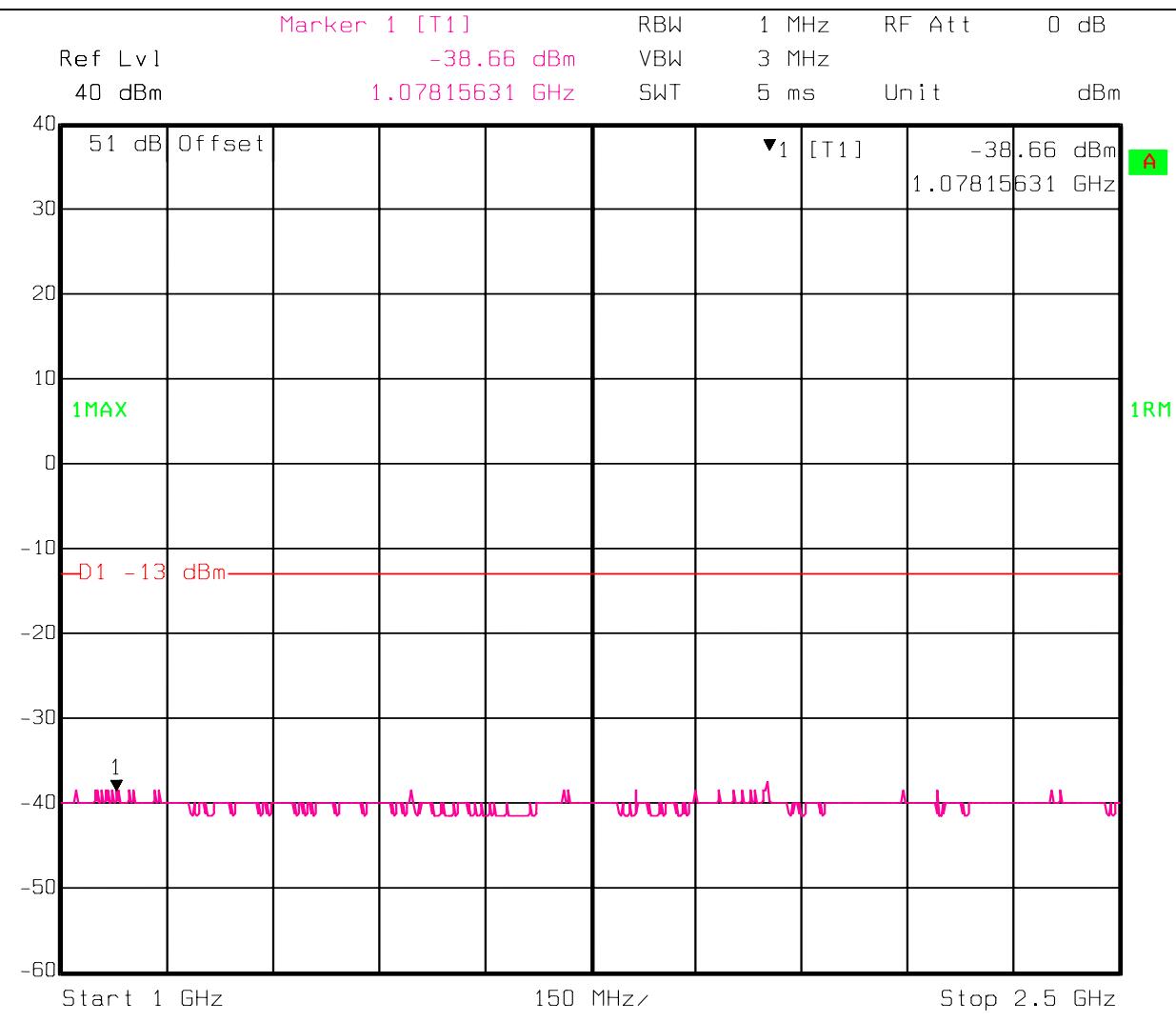


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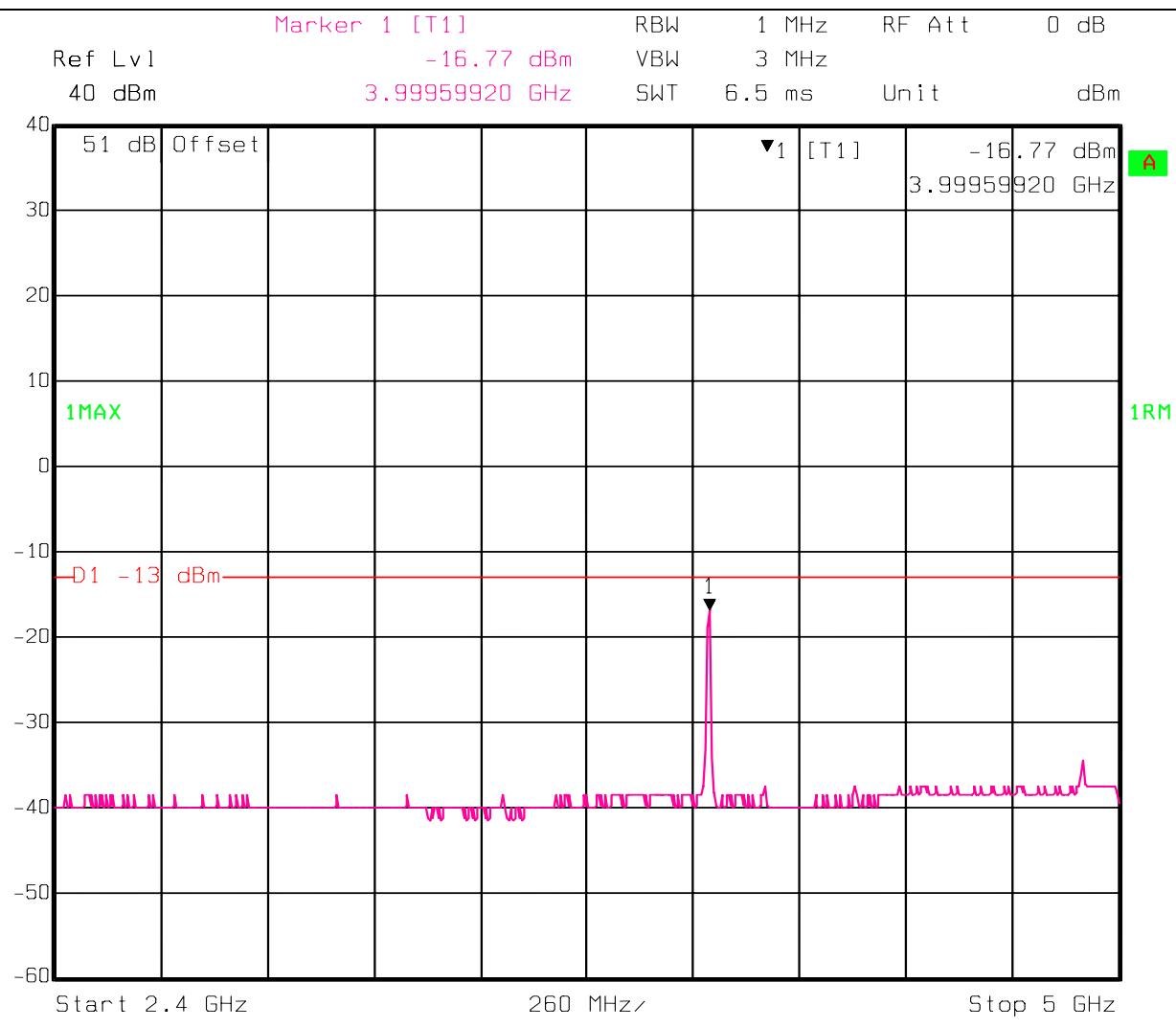


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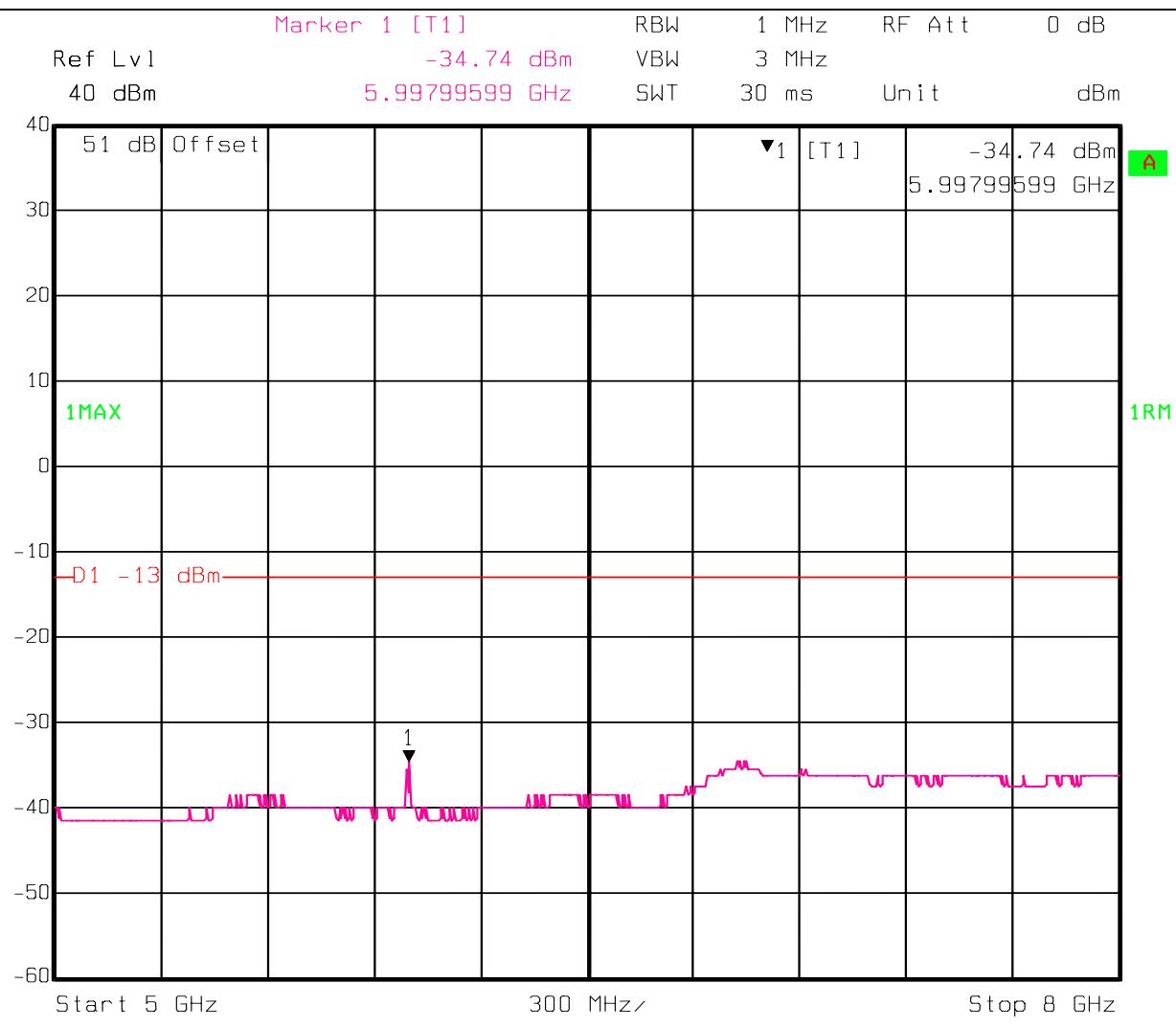


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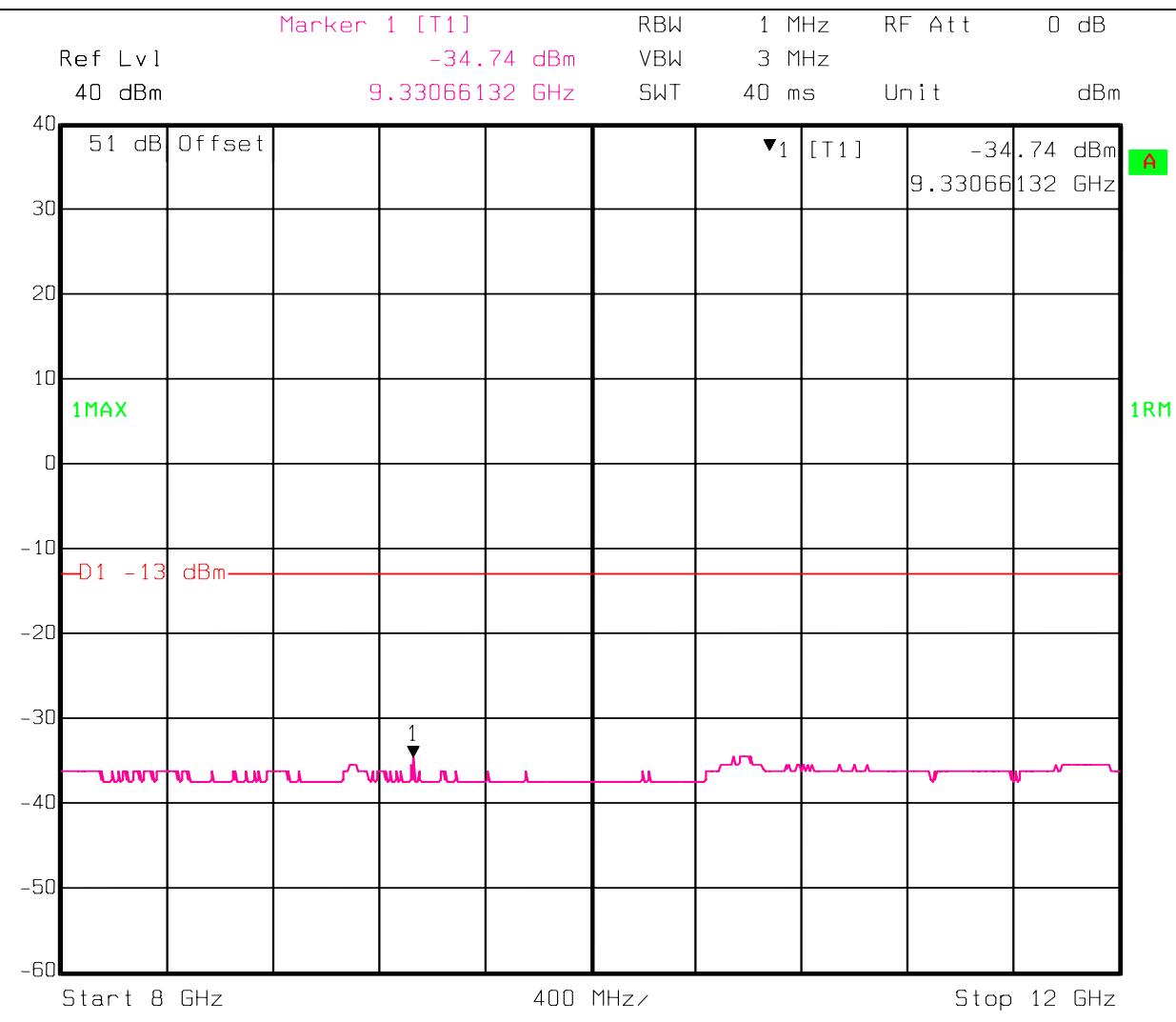


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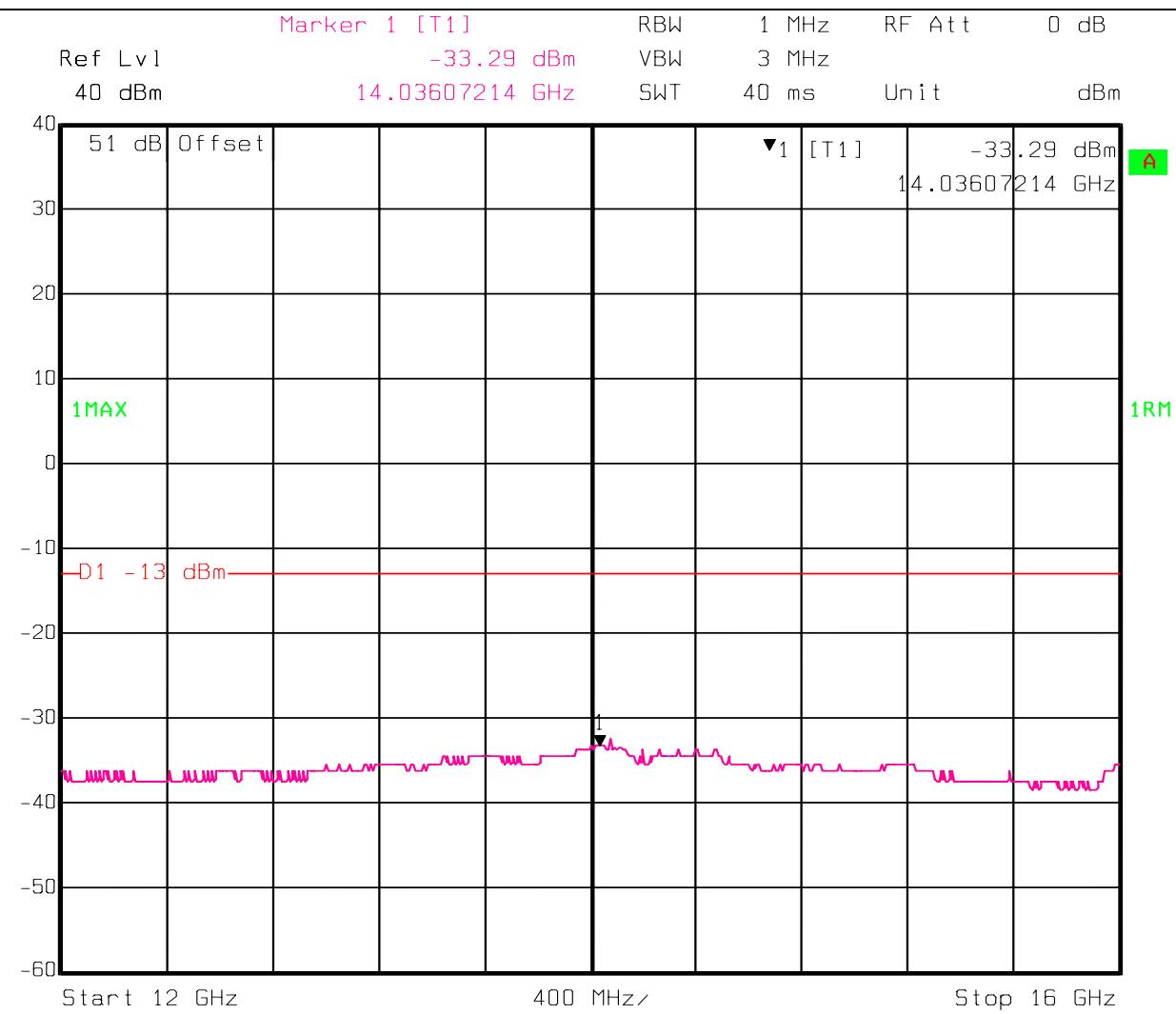


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REPORT NO.: 2004 110516 FCC

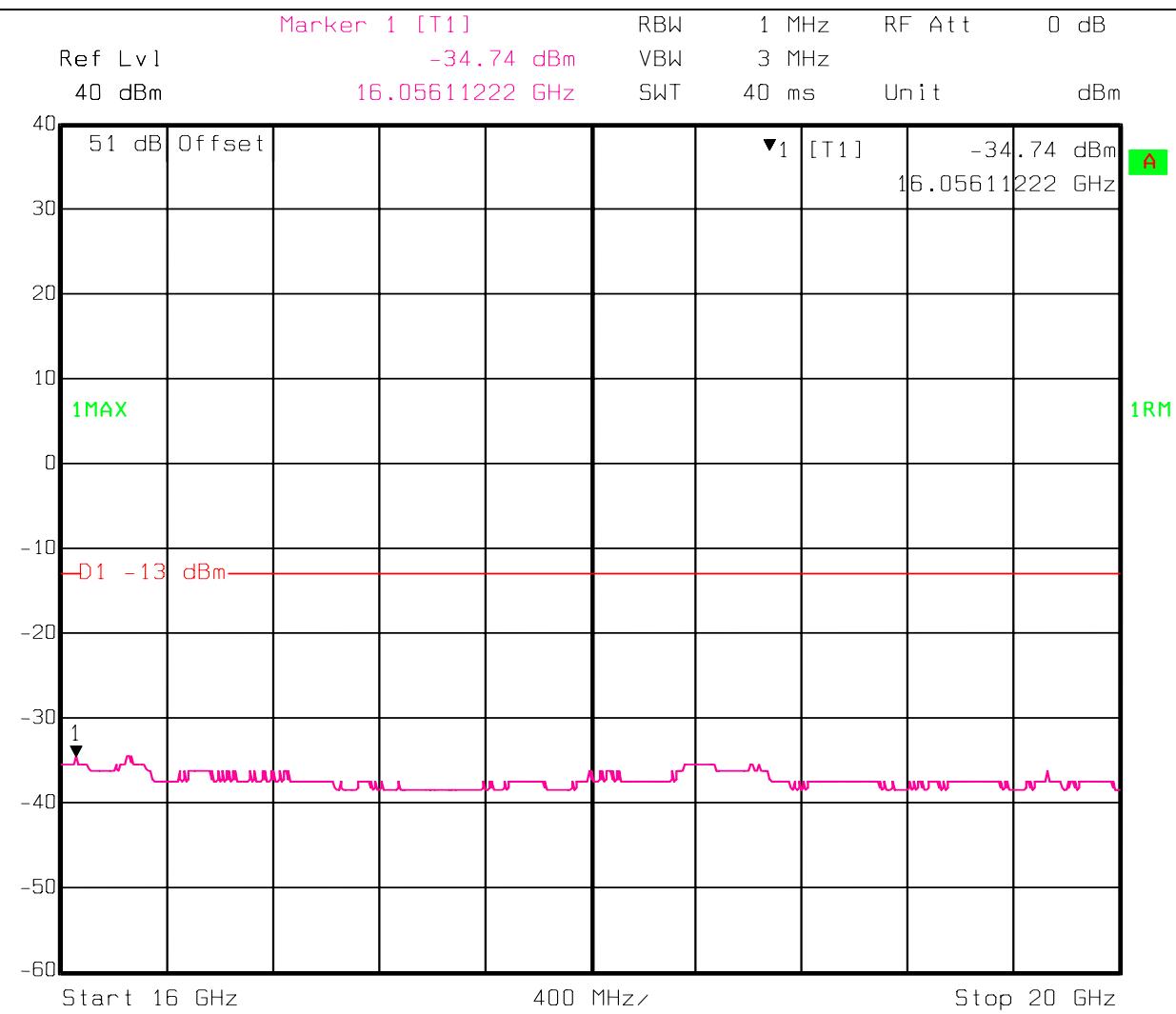


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EQUIPMENT: Transmitter CCII-7

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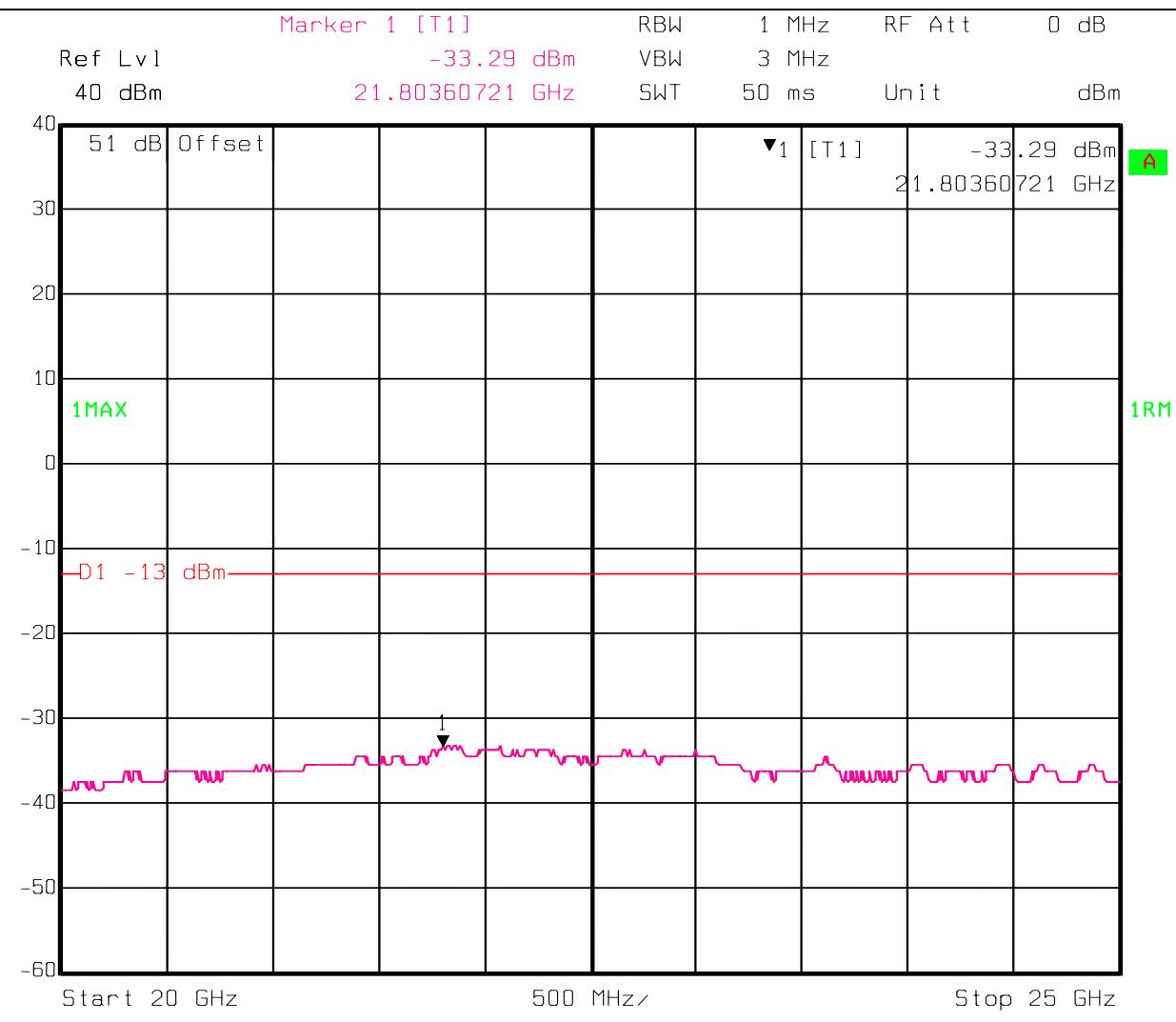


Date: 30.NOV.2004 09:36:01

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Date: 30.NOV.2004 09:36:52

This report just presented one channel of six to report. The results are typical of all. View the remaining five channels in the Appendix.

Section 12. Field Strength of Spurious**Para. No.: 2.1053**

Test Performed By: Alan Laudani	Date of Test: 11-20-2004
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Minimum Standard: Part 74.(2)(ii)**Test Results:** EUT Complies. Emissions were searched from 30 MHz to 25 GHz with the antenna port terminated into a 50 ohm load. No spurious emissions above 1 GHz within 20 dB of the limit were observed. Emissions between 30 MHz and 1 GHz were searched and two emissions were found and the results proved by substitution.**Test Data:** See attached tables.

Quasi-peak measurements with a RBW =VBW = 100 kHz.

Meas. Freq. (MHz)	Ant. Pol. (H/V)	Meter Reading (dBuV/m)	Comment
351	V	46.9	
490	V	37.7	

Results—Substitution

target Frequency mHz	level dBuV/m	dipole	cable loss dB	Signal Generator dBm	Total (EIRP) DBm	Spec dBm	Margin dBm
351	46.9	0	1	-38.1	-39.1	-13.0	-26.1
490	37.7	0	1	-41.3	-42.3	-13.0	-29.3

Location: North OATS, T = 22°C, 40% R.H. 3 meters

No other measurements within 20 dB of the limit noted.

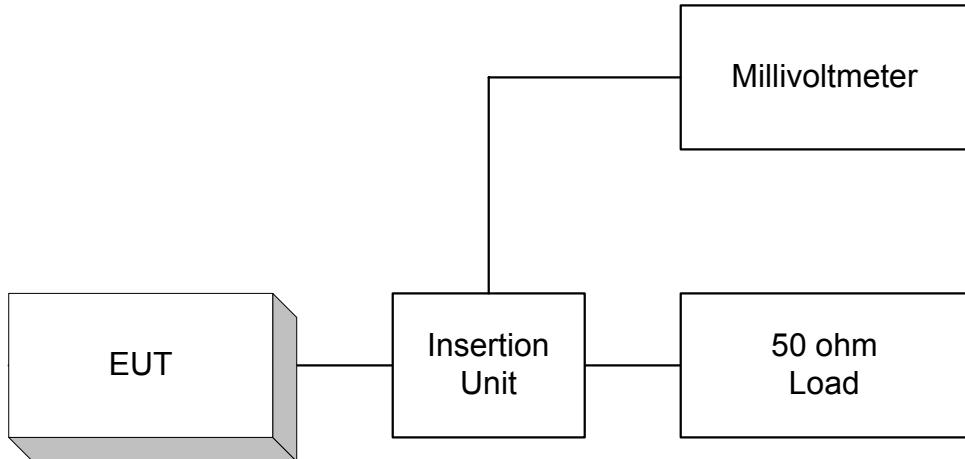
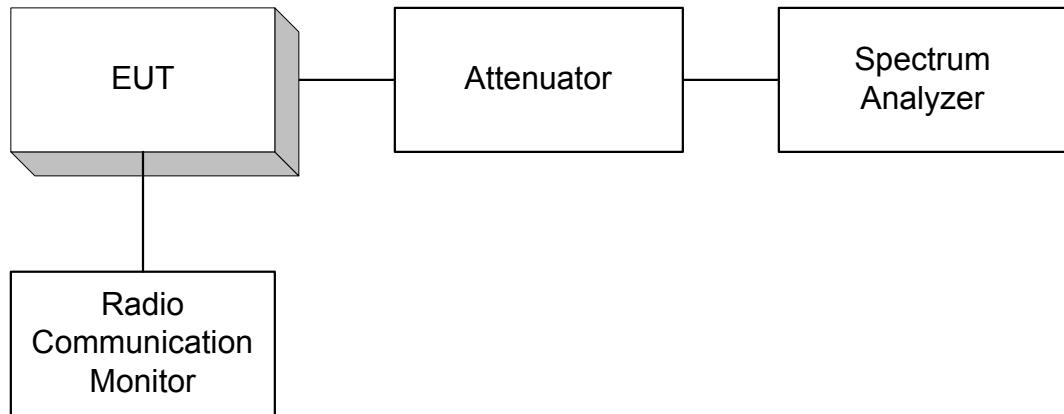
Section 13. Frequency Stability**Para. No.: 2.1055****Test Performed By: A. Laudani****Date of Test: Nov. 22, 2004**

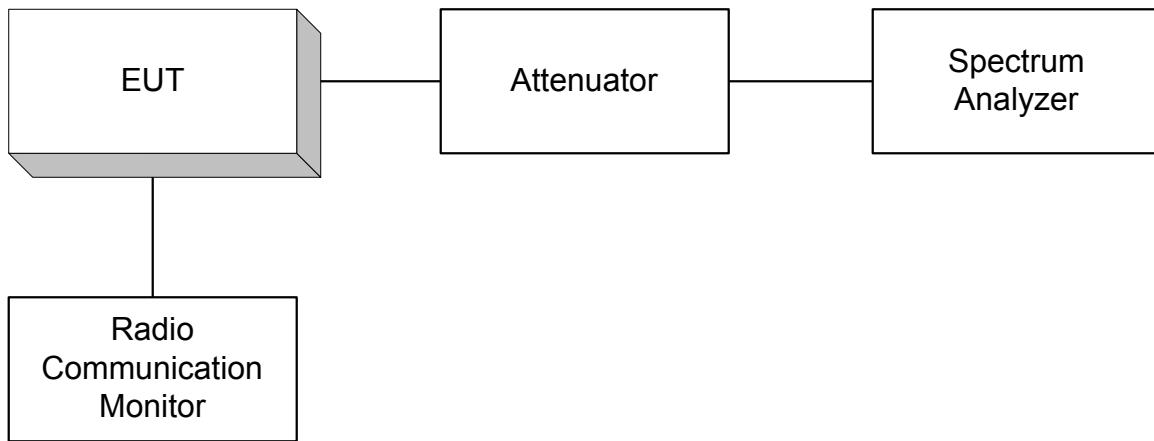
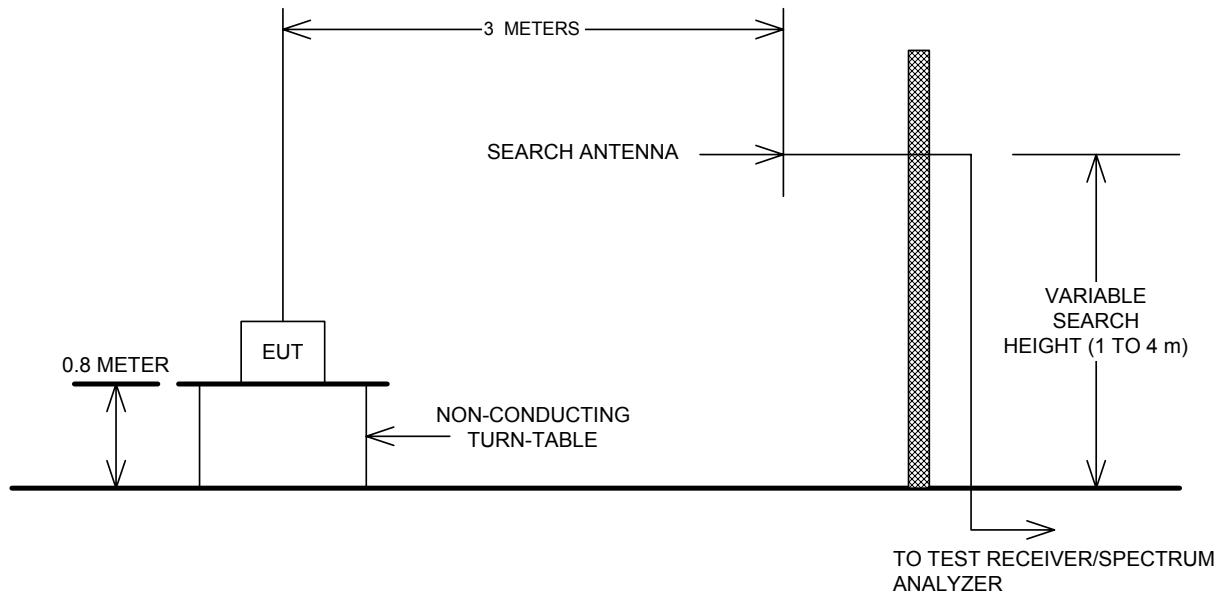
Minimum Standard: 2.1055 Frequency Stability vs Temperature Variation and Power Supply Voltage Variation.

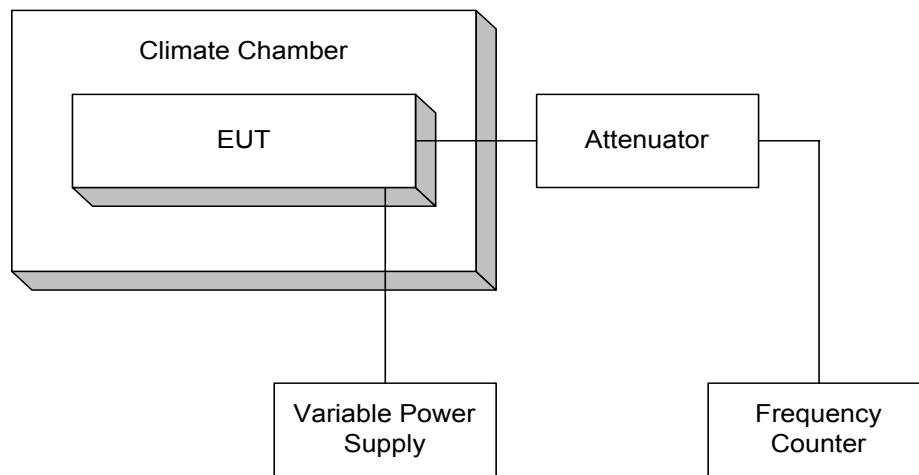
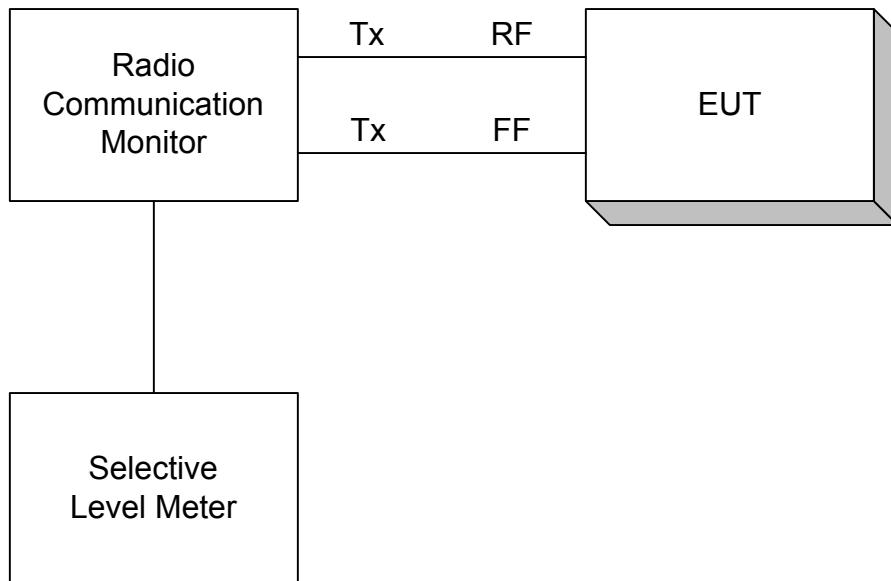
Test Results: 221 Hz difference which corresponds to 0.088 ppm
Limit = 0.01 % = 10 ppm or 24,920 Hz

Measurement Data:

		Part 2.1055 -30 --- +50 °C				Set Frequency MHz = 2491.9799575 Spectrum Analyzer @ 1 MHz VBW, 1 MHz RBW, Span = 20 MHz Worst case 220.5 Hz Variation				Frequencies are read one minute after turning on EUT, Frequencies are stable	
Temperature/ Time Setpoint °C	Actual Time	85% of Vnom		Vnom = 15 Vdc						with no variance in ten minutes of turning on. 115% of Vnom	
		Power Level dBm	Lower Frequency Higher Frequency	Frequency Variation Hz	Power Level dBm	Lower Frequency Higher Frequency	Frequency Variation Hz	Power Level dBm	Lower Frequency Higher Frequency	Frequency Variation Hz	Power Level dBm
-30	-30.3 4.45	31.59 2.485607210 2.498032064	2.491819637 -160.321		30.58 2.485687370 2.498152300	2.491919835 -60.122		31.64 2.485527054 2.498432870	2.491979962 0.004		
-20	-19.8 3.40	31.14 2.486128260 2.498272550	2.492200405 220.448		31.02 2.485767540 2.498232460	2.492000000 20.043		31.03 2.485967936 2.498112220	2.492040078 60.121		
-10	-9.9 2.35	31.39 2.485847695 2.498172550	2.492010123 30.165		31.22 2.486128260 2.498272550	2.492200405 220.448		31.31 2.485887780 2.497951900	2.491919840 -60.117		
0	0.0 1.36	31.17 2.486328660 2.497751500	2.492040080 60.122		30.92 2.486088180 2.498272550	2.492180365 200.407		31.46 2.486128260 2.497831660	2.491979960 0.003		
10	10.0 12.35	31.85 2.485807615 2.498152300	2.491979958 0.000		31.54 2.485527050 2.498392790	2.491959920 -20.037		31.13 2.486048096 2.498112224	2.492080160 100.203		
20	20.1 8.30	31.81 2.486208170 2.497711420	2.491959795 -20.163		31.46 2.485847695 2.498112220	2.491979958 0.000		31.43 2.486328657 2.497951900	2.492140279 160.321		
30	30.2 9.35	31.34 2.486088180 2.497831660	2.491959920 -20.037		31.33 2.485567130 2.498342710	2.491954920 -25.037		31.31 2.485967936 2.497991980	2.491979958 0.001		
40	40.9 10.35	30.67 2.486368737 2.497951900	2.492160319 180.361		30.55 2.486368737 2.497951900	2.492160319 180.361		30.10 2.485967936 2.497991980	2.491979958 0.001		
50	50.0 11.36	30.72 2.486163400 2.497791580	2.491977490 -2.467		30.88 2.485846950 2.497751500	2.491799225 -180.732		30.74 2.486248497 2.497631260	2.491939879 -40.079		

Section 14. Block Diagrams**Para. No. 2.1046 - R.F. Power Output****Para. No. 2.1049 - Occupied Bandwidth**

Para. No. 2.1051 Spurious Emissions at Antenna Terminals**Para. No. 2.1053 - Field Strength of Spurious Radiation**

Para. No. 2.1055 - Frequency Stability**Para. No. 2.1045 – Audio Frequency Response, Audio Low Pass Filter Response And Modulation Limiting**

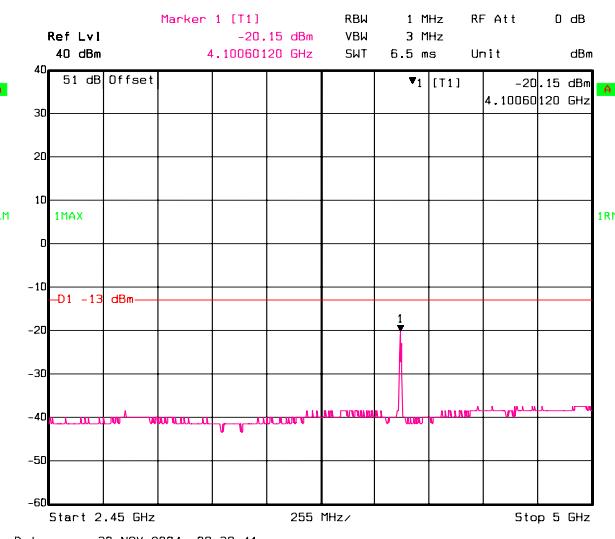
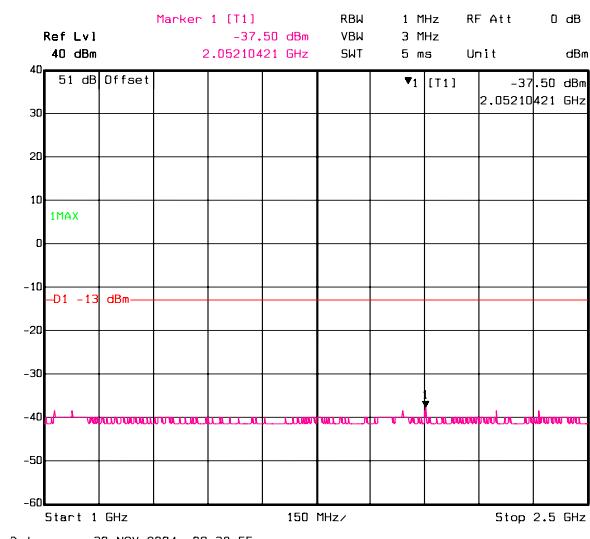
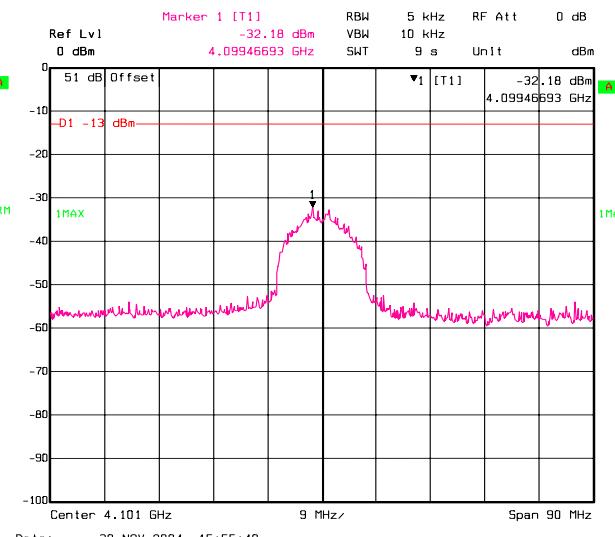
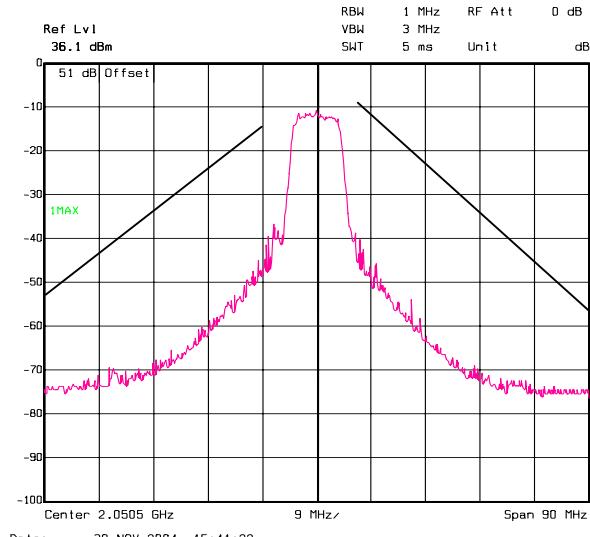
Section 15. Test Equipment List

<i>Device Type</i>	<i>Model #</i>	<i>MFG</i>	<i>Asset #</i>	<i>SN</i>	<i>Cal Due</i>
OATS #1 (North)					
Spectrum Analyzer	1088.3494.30	R & S	835	830320/002	12/11/04
Antenna, Ridged Guide	3115	EMCO	529	2505	3/30/04
Antenna, Ridged Guide	3116	EMCO	625	9611-2325	1/12/05
Preamplifier	40 dB	Miteq	171	NA	NCR
4 GHz High Pass Filter	9SH10-4000	K&L	NA	55	NCR
Antenna, Ridged Guide	3115	EMCO	752	9609-4943	12/19/04
Signal Generator	E8254A	Agilent	836	US41140229	11/6/05
Spectrum Analyzer	8568B	HP	422	2517A01757	3-22-05
Preamplifier	ZHL-2	MINICIR CUITS	635	091887-21	10-22-05
Antenna, Bi-conical	3110	EMCO	116	1287	8-30-05
Antenna, Log Periodic	3146	EMCO	112	9101-2988	10-28-05
Quasi-peak Detector	85650A	HP	533	3145A01672	9-22-05
10dB Attenuator	777C	Narda	na	31073	4-21-05
4GHz HP Filter	92h10-4000	K&L	na	55	NCR
Peak Power Meter	8900D	HP			11-28-04
Environmental Chamber	Thermotron		Na	34946	2-2-05

Appendix A.

The remaining five channels of Conductive Spurious:

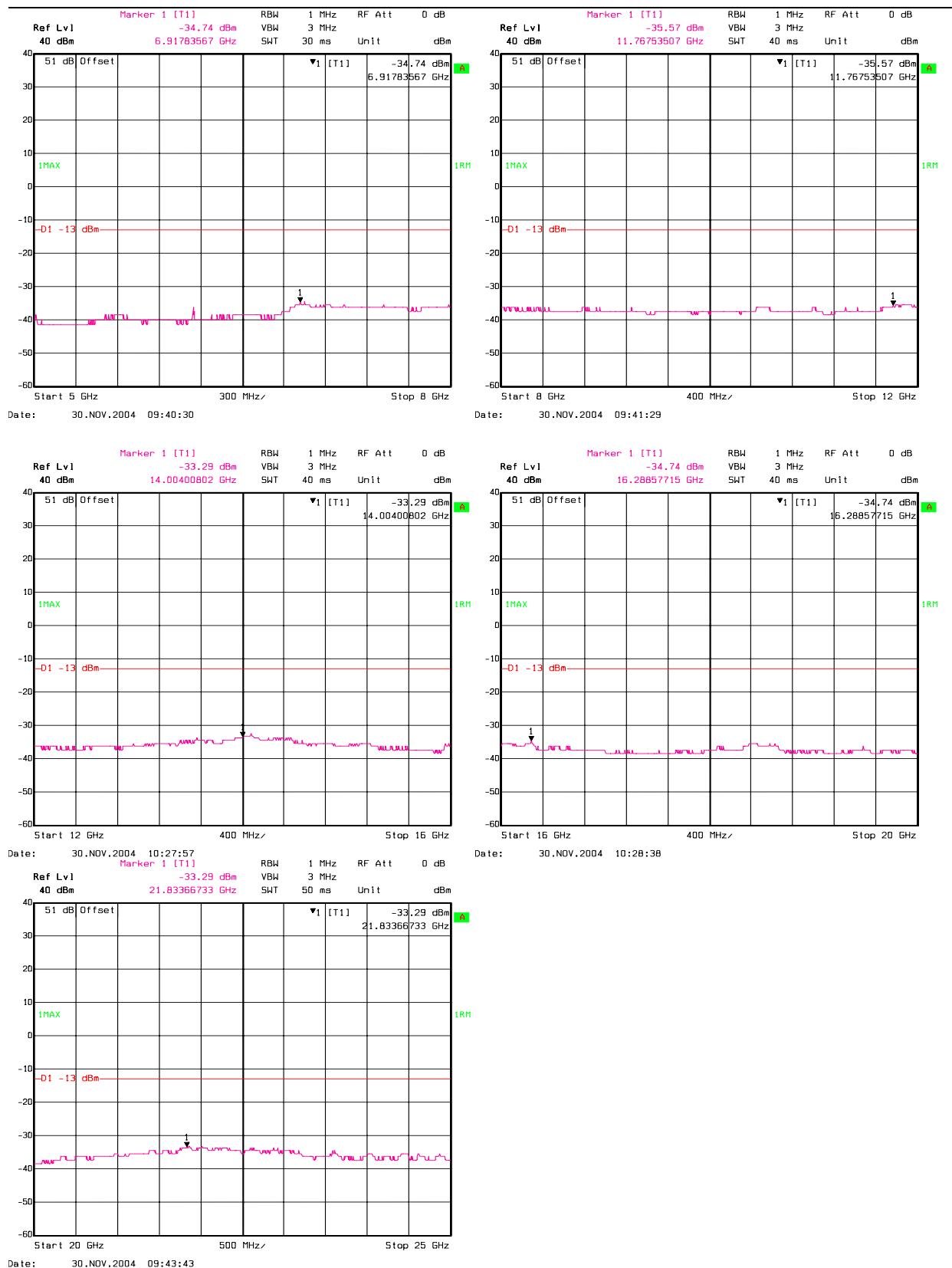
Channel 4: 2050.5 MHz



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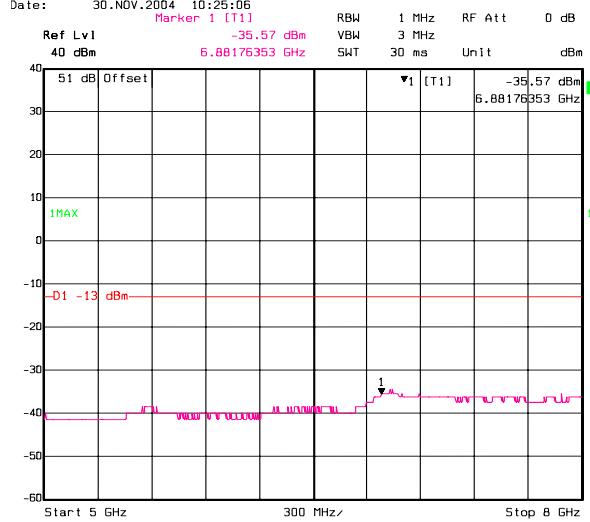
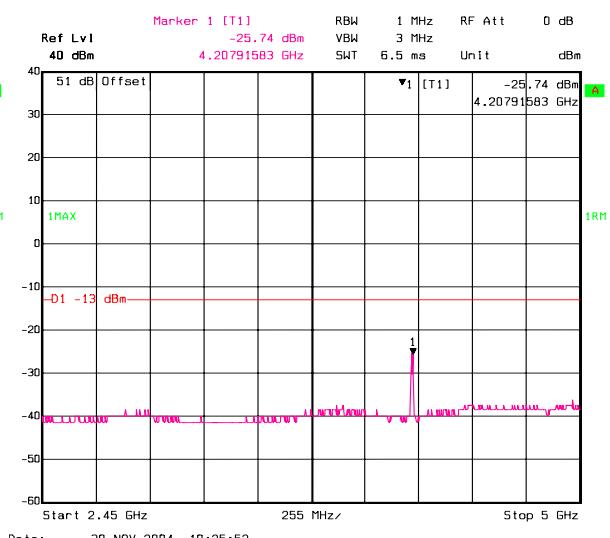
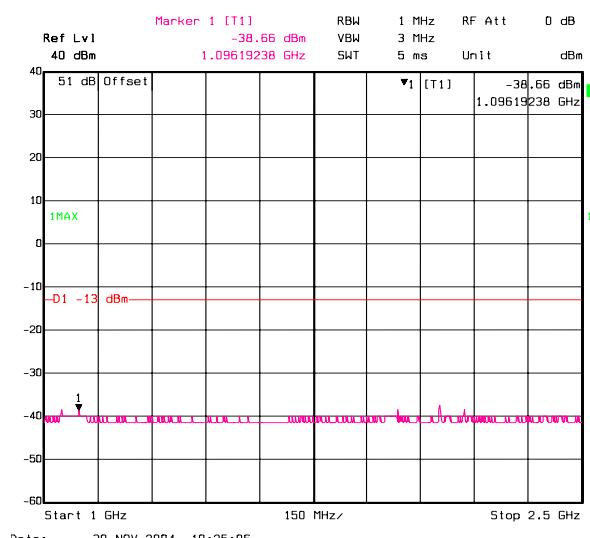
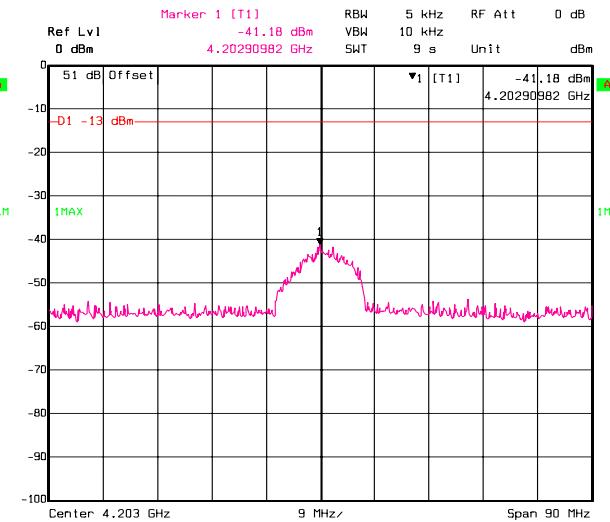
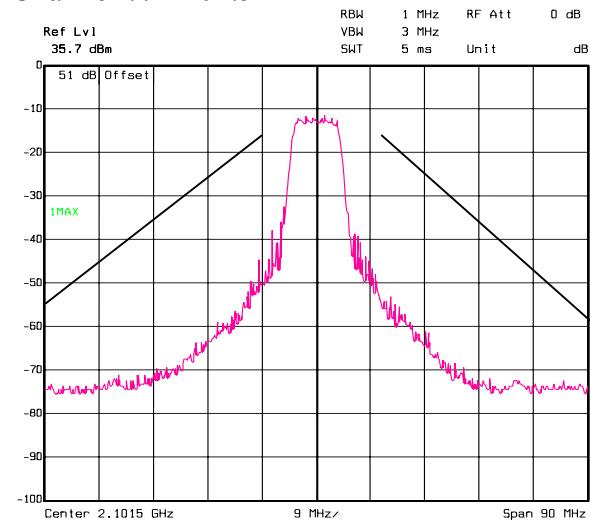


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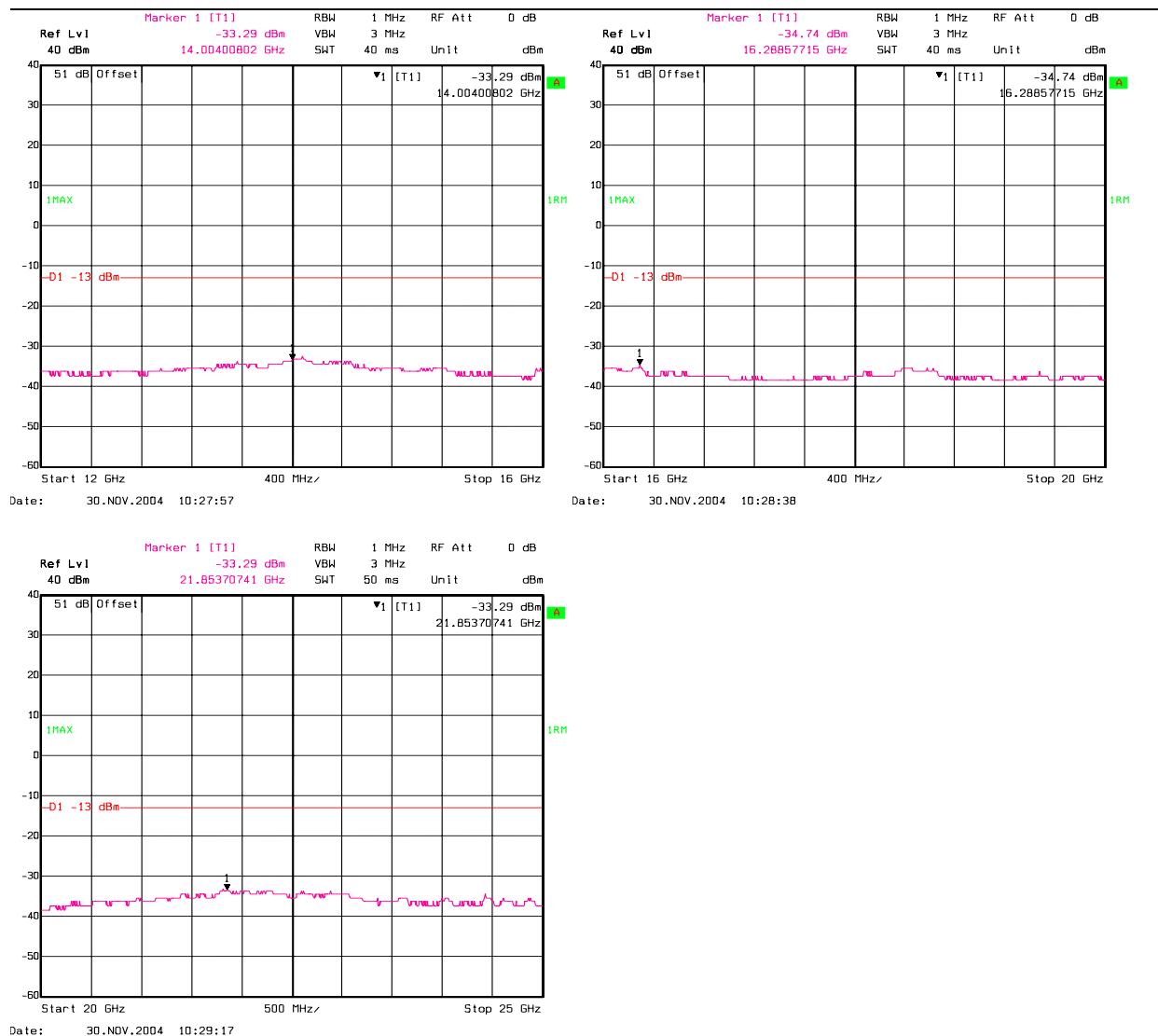
Channel 7: 2101.5 MHz



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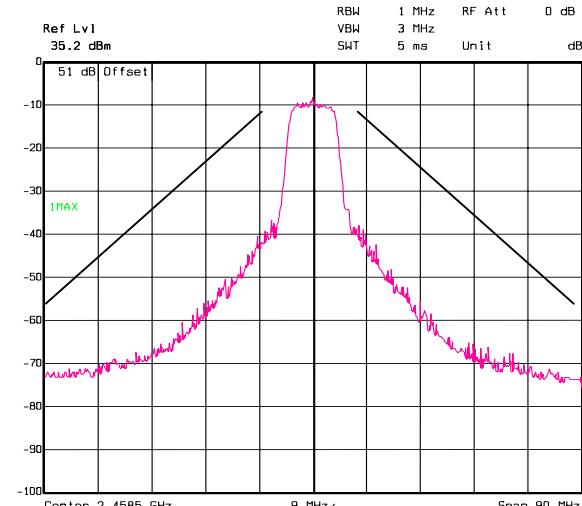


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Channel 8: 2458.5 MHz



Date: 30.NOV.2004 15:43:09

Marker 1 [T1] -26.32 dBm

RBW 1 MHz

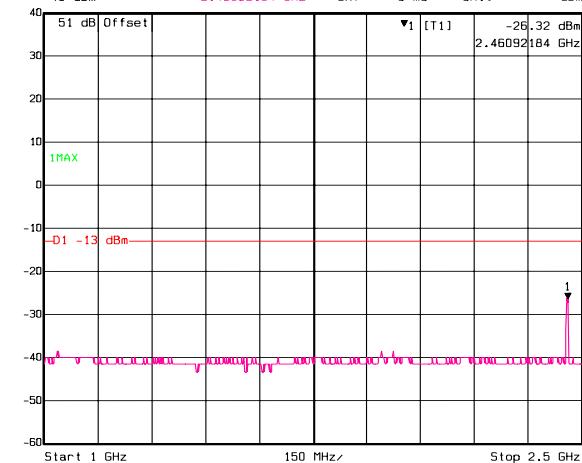
VBW 3 MHz

SWT 5 ms

RF Att 0 dB

Ref Lvl 40 dBm

2.46092184 GHz



Date: 30.NOV.2004 10:30:41

Marker 1 [T1] -34.74 dBm

RBW 1 MHz

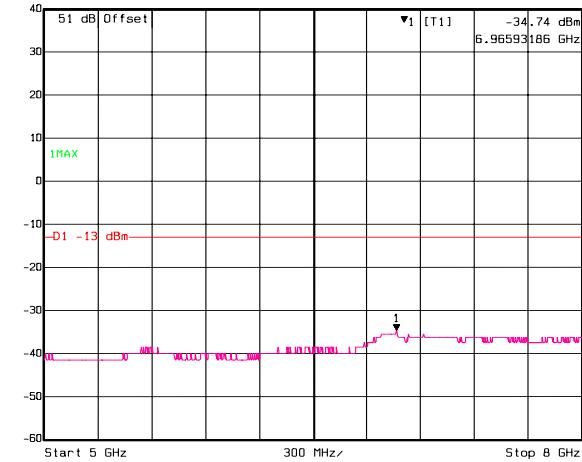
VBW 3 MHz

SWT 30 ms

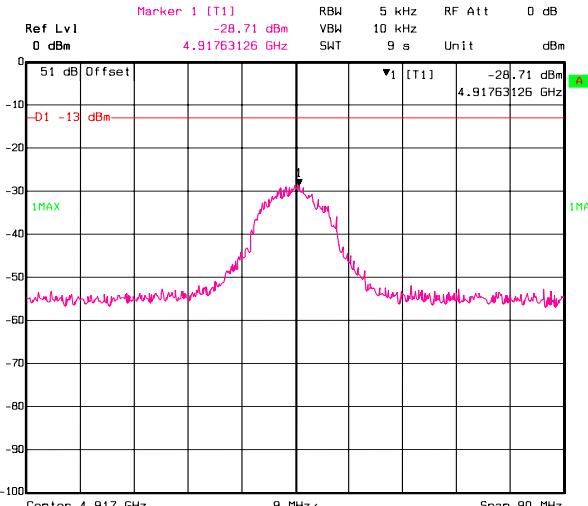
RF Att 0 dB

Ref Lvl 40 dBm

6.96593186 GHz



Date: 30.NOV.2004 10:32:09



Date: 30.NOV.2004 15:53:51

Marker 1 [T1] -14.35 dBm

RBW 1 MHz

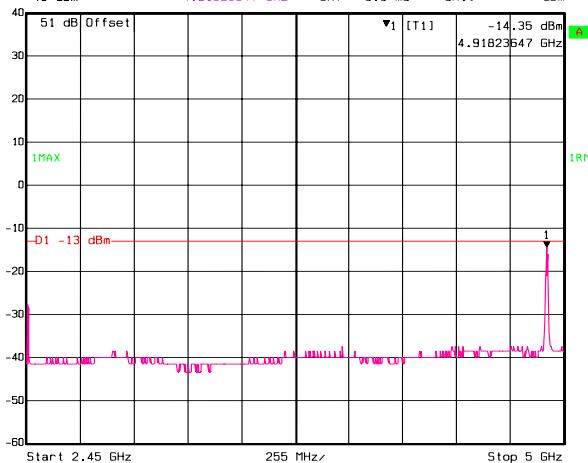
VBW 3 MHz

SWT 6.5 ms

RF Att 0 dB

Ref Lvl 40 dBm

4.91823647 GHz



Date: 30.NOV.2004 10:31:30

Marker 1 [T1] -35.57 dBm

RBW 1 MHz

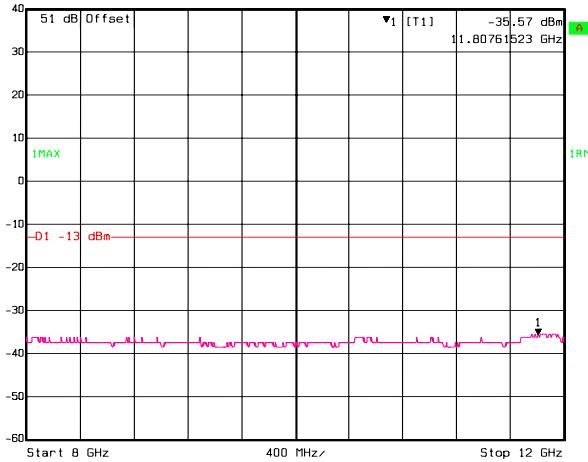
VBW 3 MHz

SWT 40 ms

RF Att 0 dB

Ref Lvl 40 dBm

11.80761523 GHz

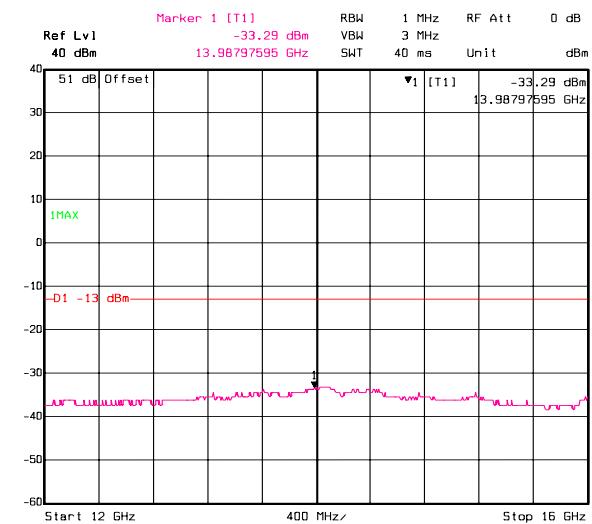


Date: 30.NOV.2004 10:50:22

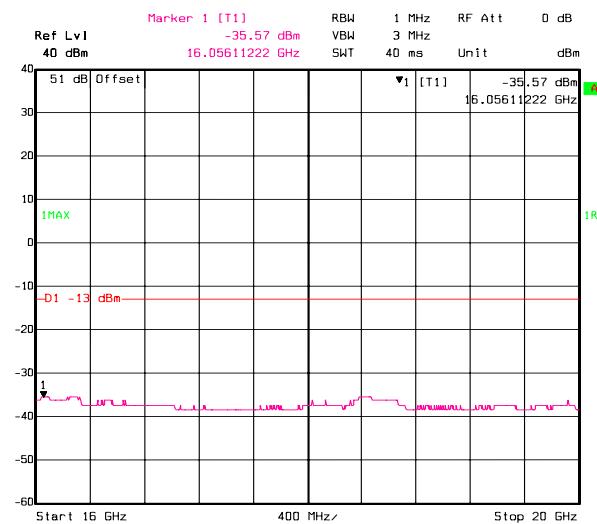
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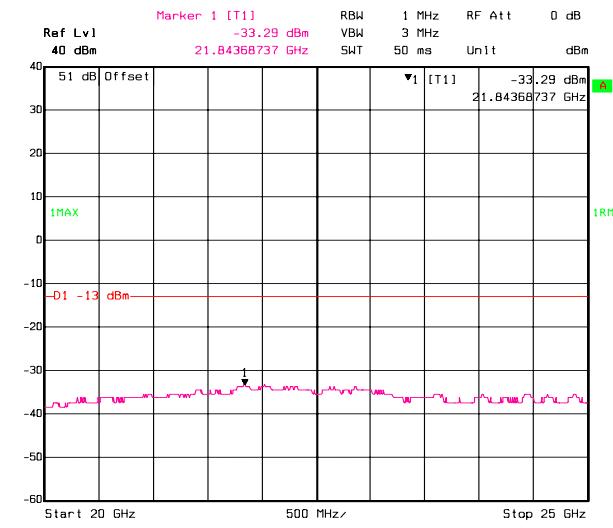
REPORT NO.: 2004 110516 FCC



Date: 30.NOV.2004 10:50:59



Date: 30.NOV.2004 10:51:43



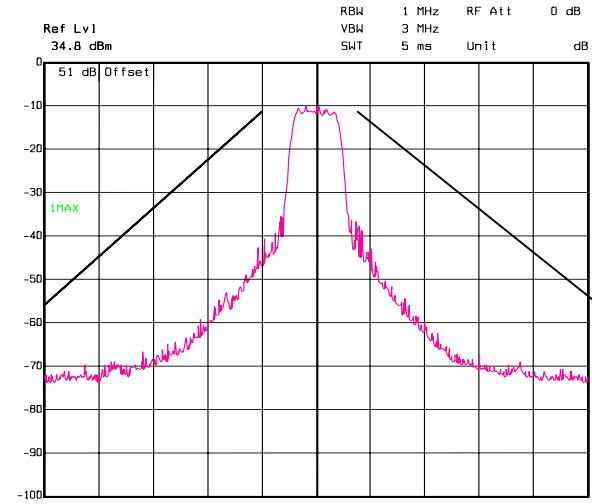
Date: 30.NOV.2004 10:52:24

Nemko USA Inc.

EQUIPMENT: Transmitter CCII-7

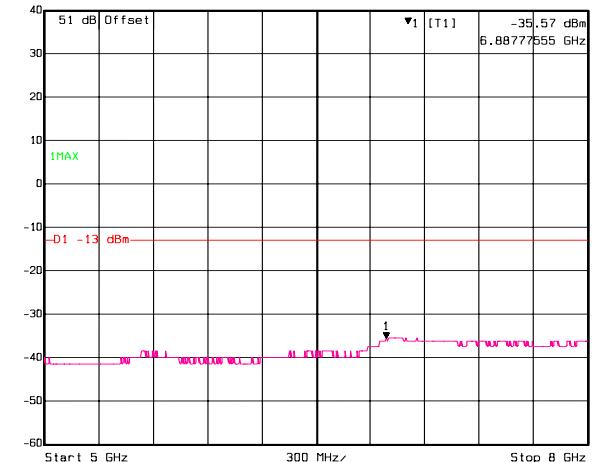
REPORT NO.: 2004 110516 FCC

Channel 9: 2475.5 MHz

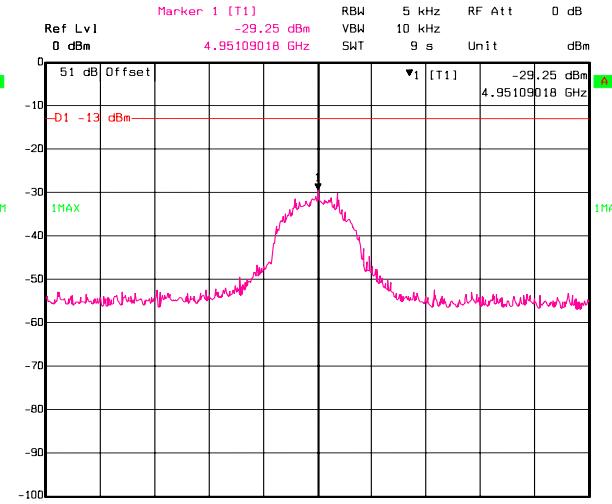


Date: 30-NOV-2004 15:44:33

Date: 30.NOV.2004 15:44:53
 Marker 1 [T1] RBW 1 MHz RF Att 0 dB
 Ref Lvl -35.57 dBm VBW 3 MHz
 40 dBm 6.88777555 GHz SWT 30 ms Unit dBm

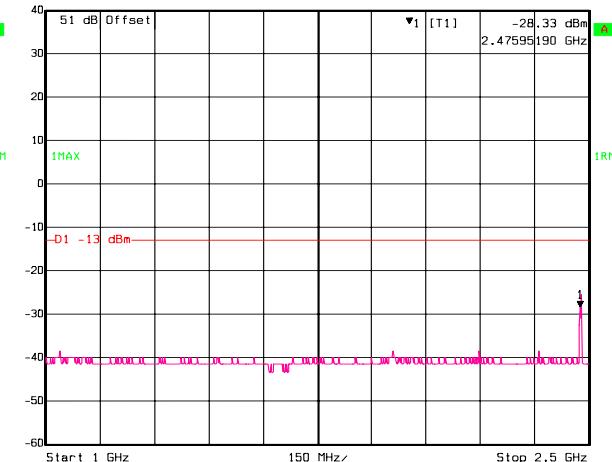


Date: 30.NOV.2004 11:03:50



Date: 30-NOV-2004 15:52:18

Marker 1 [T1]		RBW	1 MHz	RF Att	0 dB
Ref Lvl	-28.33 dBm	VBW	3 MHz		
40 dBm	2.47595190 GHz	SWT	5 ms	Unit	dBm

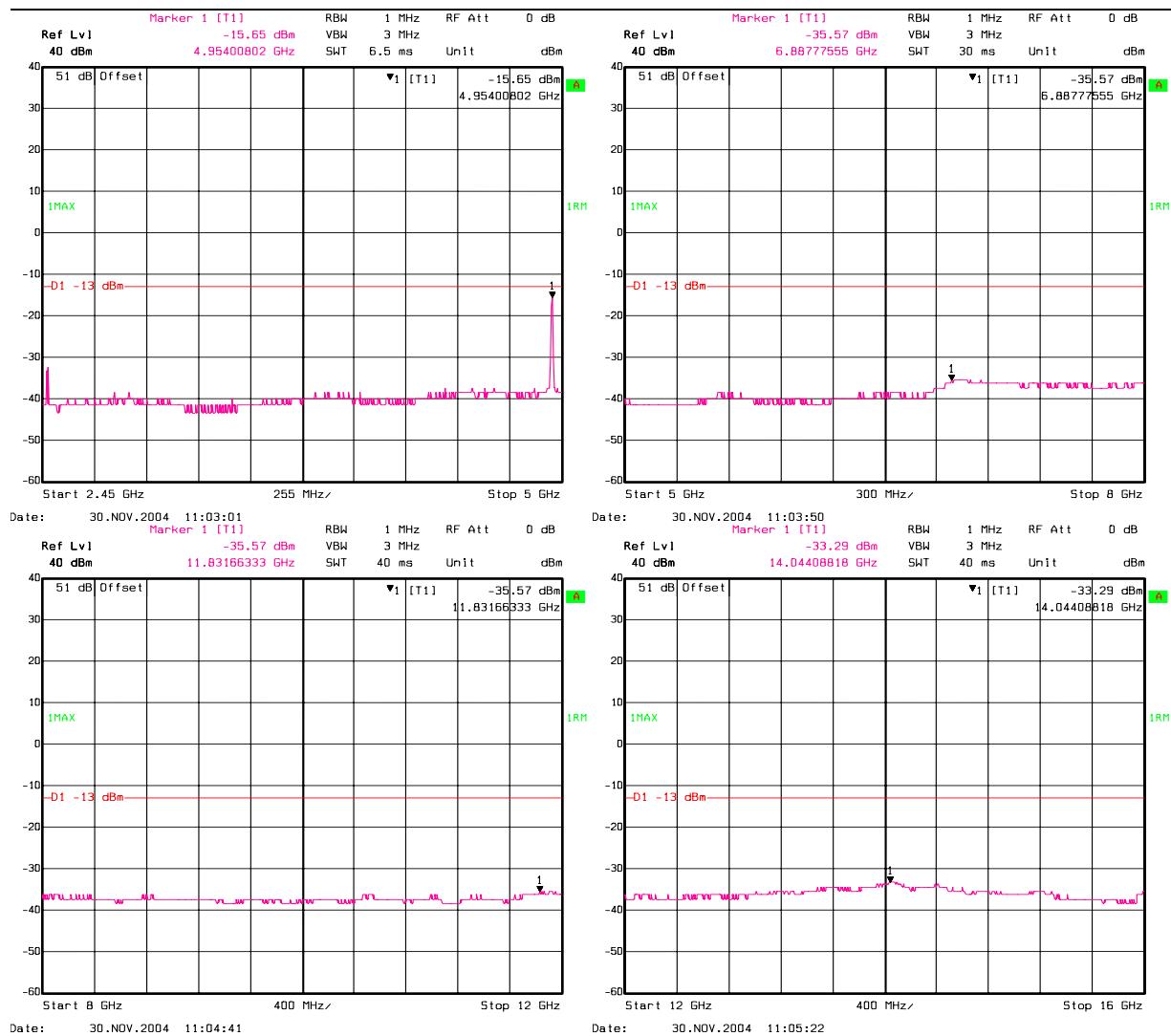


Date: 30.NOV.2004 11:00:59

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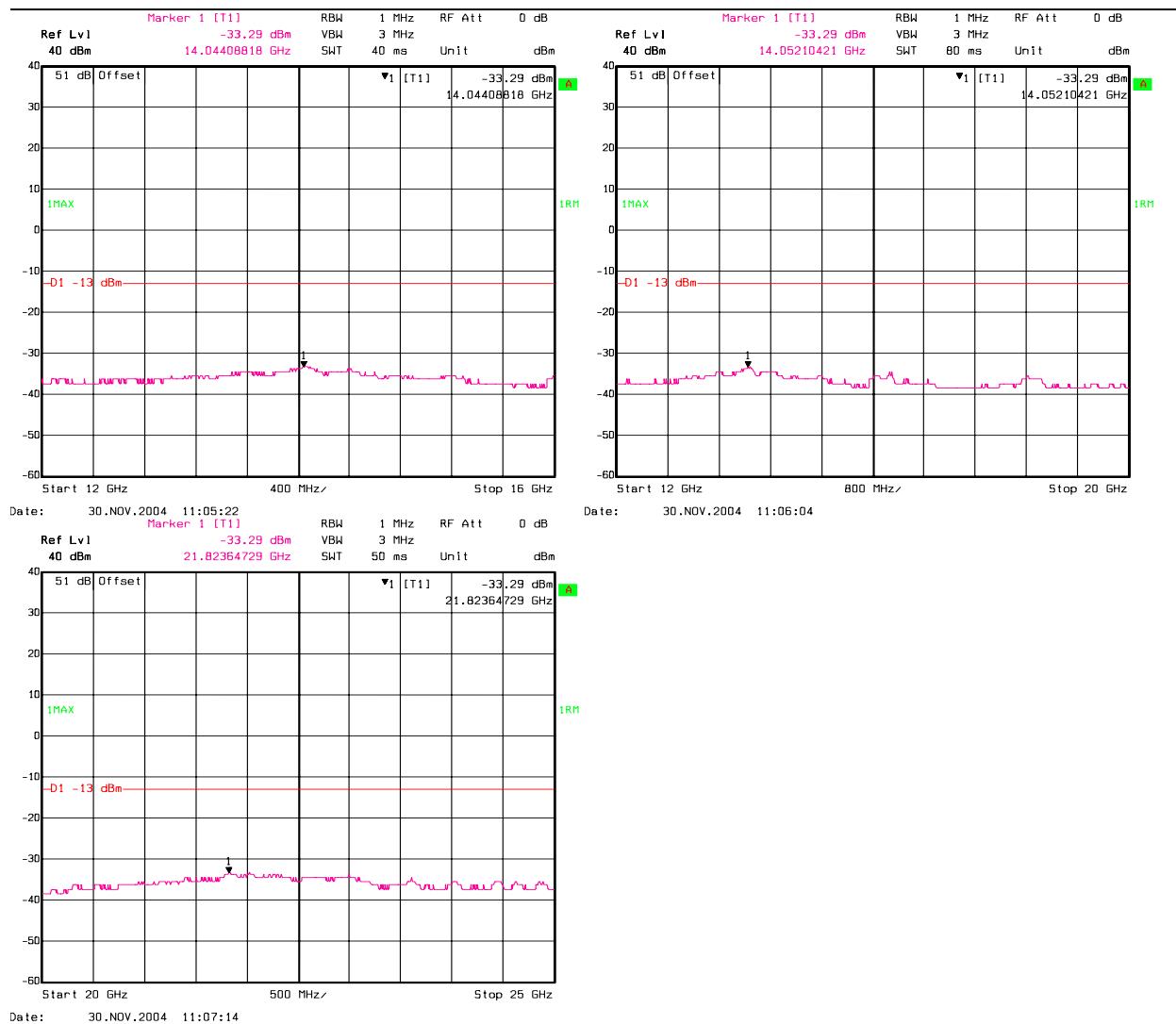
REPORT NO.: 2004 110516 FCC



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EQUIPMENT: Transmitter CCII-7

REPORT NO.: 2004 110516 FCC

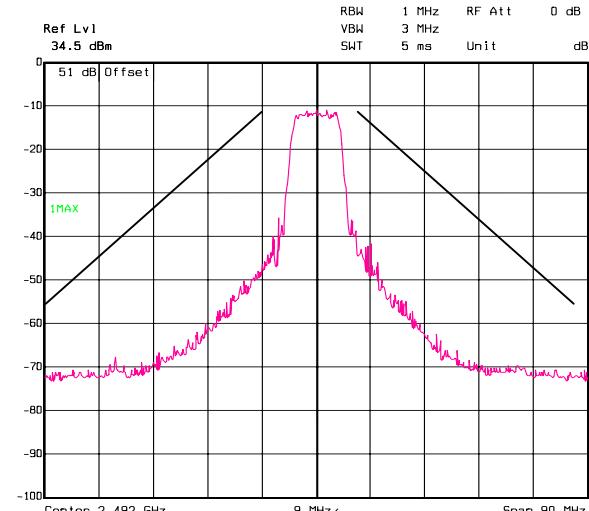


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REPORT NO.: 2004 110516 FCC

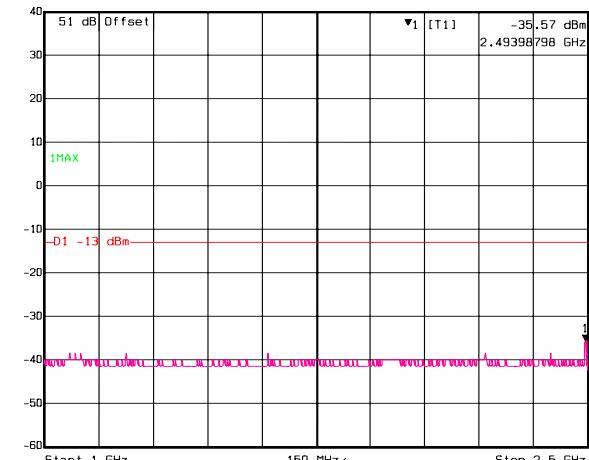
Channel 10: 2492.0 MHz



Date: 30.NOV.2004 15:45:18

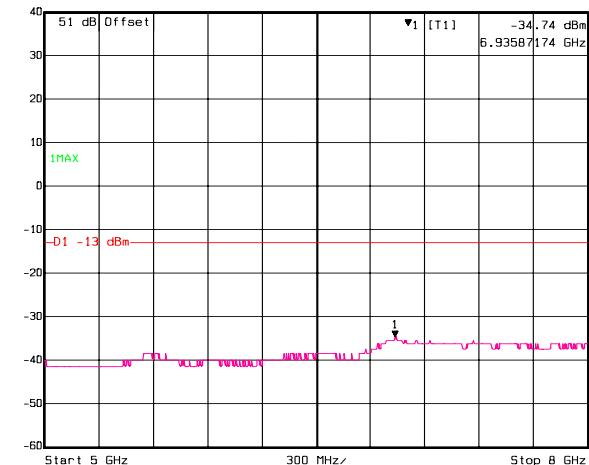
Date: 30.NOV.2004 13:43:18 Marker 1 [11] RBW 1 MHz RF Att 0 dB

Ref Lvl	-35.57 dBm	VBN	3 MHz		
40 dBm	2.49398798 GHz	SHT	5 ms	Unit	dBm

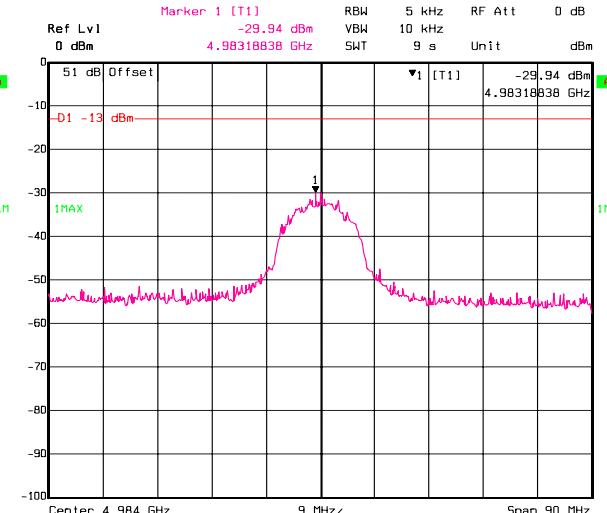


Date: 30.NOV.2004 11:08:24

Marker 1 [11]		RBW	1 MHz	RF Att	0 dB
Ref Lvl	-34.74 dBm	VBN	3 MHz		
40 dBm	6.93587174 GHz	SHT	30 ms	Unit	dBm

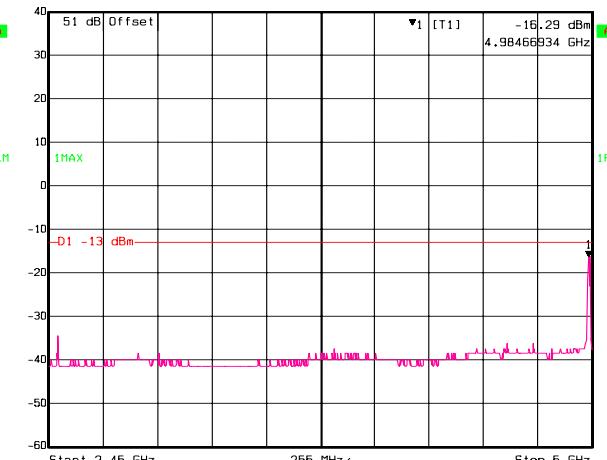


Date: 30.NOV.2004 11:15:34



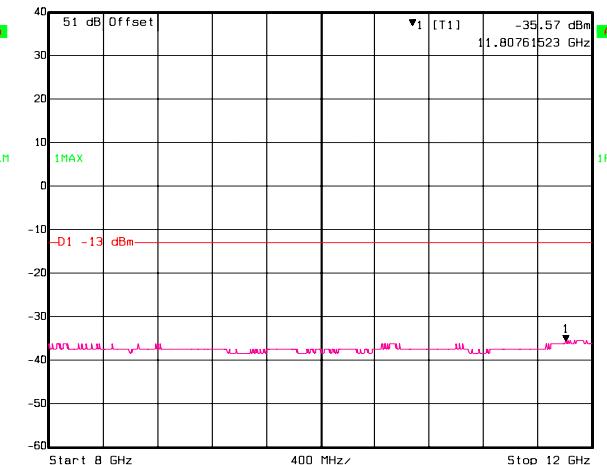
Date: 30-NOV-2004 15:47:47

Date: 30.NOV.2004	15:47:47	Marker 1 [T1]	RBW	1 MHz	RF Att	0 dB
Ref Lvl	-16.29 dBm	VBW	3 MHz			
40 dBm	4.98466934 GHz	SWT	6.5 ms	Unit		dBm



Date: 30.NOV.2004 11:14:45

Date:	30.NOV.2004	11:14:43	Marker 1 [T1]	RBW	1 MHz	RF Att	0 dB
Ref Lvl	-35.57	dBm	VBW	3 MHz			
40 dBm	11.80761523	GHz	SWT	40 ms	Unit		dBm



Date: 30.NOV.2004 11:16:17

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EQUIPMENT: Transmitter CCII-7

REPORT NO.: 2004 110516 FCC

