



*Nemko USA, Inc.*  
*Phone (858) 755-5525 Fax (858) 452-1810*  
*11696 Sorrento Valley Rd., Suite F*  
*San Diego, CA 92121-1024*

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**Test Report:** 2007 129154 FCC

**Applicant:** Broadcast Microwave Services  
12367 Crosthwaite Circle Dock 10  
Poway, CA 92064  
(858) 391-3050 x107  
(858) 391-3049 - fax

**Equipment Under Test:** 5W Linear Power Amplifier Model: BPA-5CC-7

**FCC ID:** CNVHCII-5-7

**In Accordance With:** FCC PART 2, FCC PART 74 Subpart F and FCC PART 90  
Subpart I

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

**Date:** December 11, 2007

**Total Number of Pages:** 36

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## DOCUMENT HISTORY

REVISION	DATE	COMMENTS
-	December 11, 2007	Prepared By: F.S.Custodio
-	December 11, 2007	Initial Release: Alan Laudani

NOTE: Nemko USA, Inc. hereby makes the following statements so as to conform to Chapter 10 (Test Reports) Requirements of ANSI C63.4: 2003 "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 21, 2007. Testing was performed on the unit described in this report on November 21, 2007 to December 10, 2007.
- 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: 2003 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.



Alan Laudani, RF/EMC Test Specialist

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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 2, FCC PART 74 Subpart F and FCC Part 90 Subpart I . The EUT is a linear power amplifier used with a transmitter in mobile digital video links, generally from air to ground for helicopter or fixed wing installations. Applications include Electronic News Gathering (ENG) and Law Enforcement. Channel assignments are specific to the exciter. The 5W PA is excited by a low power variant of the BMS Carry Coder II (CCII) specifically configured for this application. Channel assignments are programmed into the CCII. For ENG applications the user may select the BAS 17 MHz or BAS 12 MHz channel plan adopted by US Broadcasters. For Law enforcement applications, the user may program the frequency directly in 0.25 MHz steps. Modulation formats are 6, 7, and 8 MHz Digital OFDM. This is a synchronous multicarrier modulation format. Each carrier is capable of QPSK, 16QAM, and 64QAM. These components are part of the Heli-Coder II (HCII) system, which is a COFDM microwave transmitter intended to downlink live video from an aircraft.

### Summary Of Test Data

Name Of Test	Para. No.	Result
RF Power Output	2.1046/74.636/90.205	PASS
Modulation Characteristics	2.1047/74/90	AS REPORTED
Occupied Bandwidth	2.1049/74.637(g)/90.209	PASS
Spurious Emissions at Antenna Terminals	2.1051/74.637	PASS
Field Strength of Spurious Emissions	2.1053/74.637	PASS
Frequency Stability	2.1055/74.661/90.213	PASS

**Footnotes for 2.1047:** EUT is a linear power amplifier. Parts 74 and Part 90 do not express limits or pass/fail criteria for Modulation Characteristics.

### Test Conditions:

**Indoor**                      Temperature: 23.3—24.4 °C  
Humidity:                    58-60 %

**Outdoor**                    Temperature: 16 °C  
Humidity:                    32 %.

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## Section 2. General Equipment Specification

**Manufacturer:** Broadcast Microwave Services

**Part No.:** 8014079070

**Model No.:** BPA-5CC-7 (5W Linear Power Amplifier)

**Serial No.:** Engineering sample

**FCC ID:** CNVHCII-5-7

**Emission Designators**  
6M00W7D  
7M00W7D  
8M00W7D

**Rated Power:** 5W

**Test Voltage:** 28VDC to EUT

**Frequency Range:** 1990 MHz to 2110 MHz (Part 74)  
2450 MHz to 2483.5 MHz (Part 74 and 90)

**Date Received In Laboratory:** November 21, 2007

**Nemko Identification No.:** 9154-1

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### Section 3. RF Power Output

Para. No.: 2.1046(c)

<b>Test Performed By:</b> F. S. Custodio	<b>Date of Test:</b> 12-6-07
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**Minimum Standard:** Sec 74 Subpart F--Television Broadcast Auxiliary Stations and Sec 90.205 Power and Antenna Height Limits

**Section 74.636(a)** On any authorized frequency, transmitter peak output power and the average power delivered to an antenna in this service must be the minimum amount of power necessary to carry out the communications desired and shall not exceed the values listed in the following table. Application of this principle includes, but is not to be limited to, requiring a licensee who replaces one or more of its antennas with larger antennas to reduce its antenna input power by an amount appropriate to compensate for the increased primary lobe gain of the replacement antenna(s). In no event shall the average equivalent isotropically radiated power (EIRP), as referenced to an isotropic radiator, exceed the values specified in the following table. In cases of harmful interference, the Commission may, after notice and opportunity for hearing, order a change in the effective radiated power of this station. The table follows:

Frequency Band (MHz)	Maximum allowable transmitter power Mobile (W)	Maximum allowable EIRP <sup>2</sup>	
		Fixed (dBW)	Mobile (dBW)
2,025 to 2,110	12.0	+45	+35
2,450 to 2,483.5	12.0	+45	+35
6,425 to 6,525	12.0		+35
6,875 to 7,125	12.0	+55	+35
12,700 to 13,250	1.5	+55	+35
17,700 to 18,600		+55	
18,600 to 18,800 <sup>1</sup>		+35	
18,800 to 19,700		+55	

<sup>1</sup> The power delivered to the antenna is limited to -3 dBW.

<sup>2</sup> Stations licensed based on an application filed before April 16, 2003, for EIRP values exceeding those specified above, may continue to operate indefinitely in accordance with the terms of their current authorizations, subject to periodic renewal.

**Section 90.205 (o)** 2450–2483.5 MHz. The maximum transmitter power is **5 watts**.

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**Test Results:** EUT complies

**Test Conditions:**

A Carry-Coder II (CCII) 2 - 2.5 GHz Heli-Coder portable COFDM transmitter with SN 391-16006 was connected to the EUT during this test. Measured at low, mid and high channel, RF setting set to Max using internal source via ASI (Asynchronous Serial Interface) option. Signal bandwidth is set to 8MHz, all modulation (QPSK, 16QAM and 64QAM) were measured but only the worst is reported which is 64QAM. External attenuators and cable used were verified at 40.2dB between 1990MHz and 2483.5MHz. Peak and average measurements were made using the Spectrum Analyzer's Channel Power Measurement feature. RBW and VBW are instrument controlled at RBW 100kHz/VBW 300kHz for peak and RBW 100kHz/VBW 1MHz for average. Measurement bandwidth is set to signal bandwidth.

**Measurement Data (watts):**

**1990 to 2110 MHz Band**

Modulation	Low Channel		Mid Channel		High Channel	
	Peak	Average	Peak	Average	Peak	Average
<b>QPSK</b>	25.88	4.29	25.76	4.30	24.43	4.07
<b>16QAM</b>	26.00	4.37	26.06	4.35	24.83	4.12
<b>64QAM</b>	26.42	4.39	26.49	4.38	25.35	4.18

*Low Channel = 2029.25MHz  
Mid Channel = 2031.5MHz  
High Channel = 2106.5MHz*

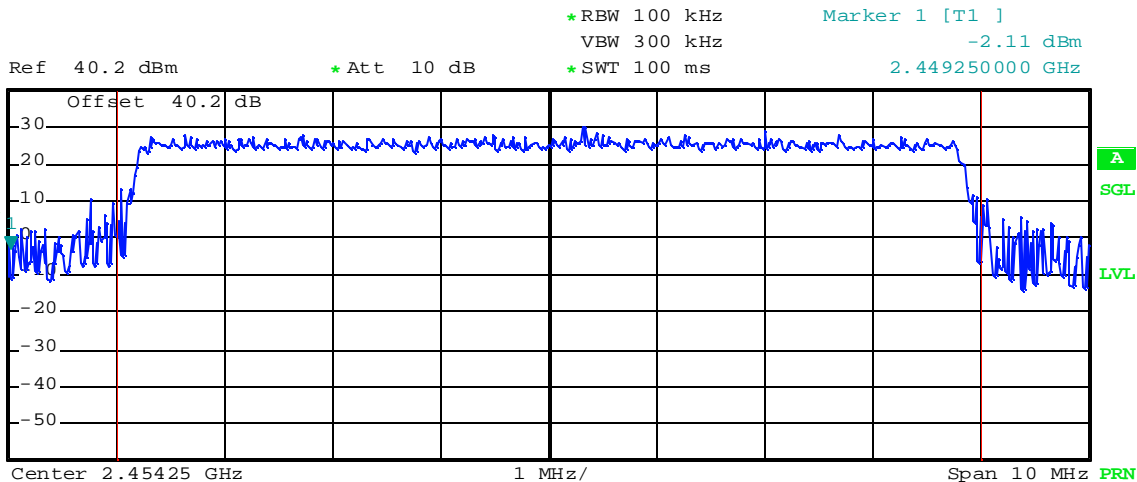
**2450 to 2483.5 MHz Band**

Modulation	Low Channel		Mid Channel		High Channel	
	Peak	Average	Peak	Average	Peak	Average
<b>QPSK</b>	24.83	4.51	23.66	4.09	22.80	3.84
<b>16QAM</b>	25.82	4.53	23.93	4.13	23.01	3.89
<b>64QAM</b>	27.29	4.59	24.15	4.18	23.23	3.94

*Low Channel = 2454.25MHz  
Mid Channel = 2471.25MHz  
High Channel = 2479.75MHz*



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**Tx Channel**  
 Bandwidth                              8 MHz      Power                              44.36 dBm

Date:              6 .DEC. 2007      12:23:25

**Peak Measurement (64QAM Low Channel 2450 to 2483.5 MHz Band)**  
**Plots Shown Typical of Highest Output Power Measured**  
**44.36 dBm = 27.29 Watts**



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**Section 4. Modulation Characteristics**

**Para. No.: 2.1047**

<b>Test Performed By: Ferdinand S. Custodio</b>	<b>Date of Test: 12-06-2007</b>
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**Minimum Standard:** Part 74 Subpart F

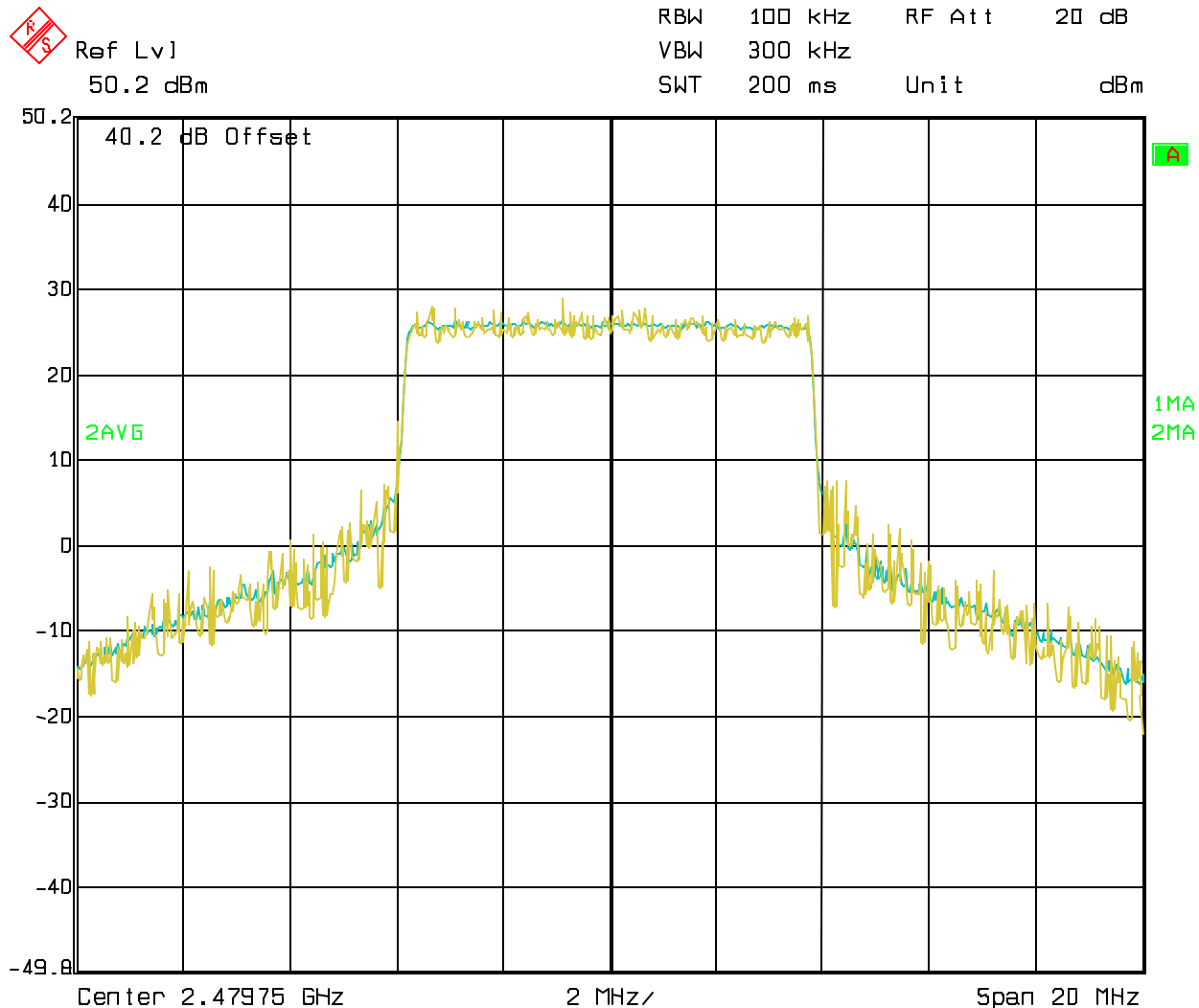
**Test Results:** As Reported. Conducted emission plots captured on the Spectrum Analyzer thru a 40.2 dB attenuator.

**Measurement Data:** See attached plots to exemplify the three modes of modulation:

Modulation modes used are QPSK, 16QAM and 64QAM. All measurements are done on QPSK modulation (unless otherwise stated) as it offers the highest Tx robustness among the three. Modulation mode has no evident effect on spurious, power or frequency stability measurements.

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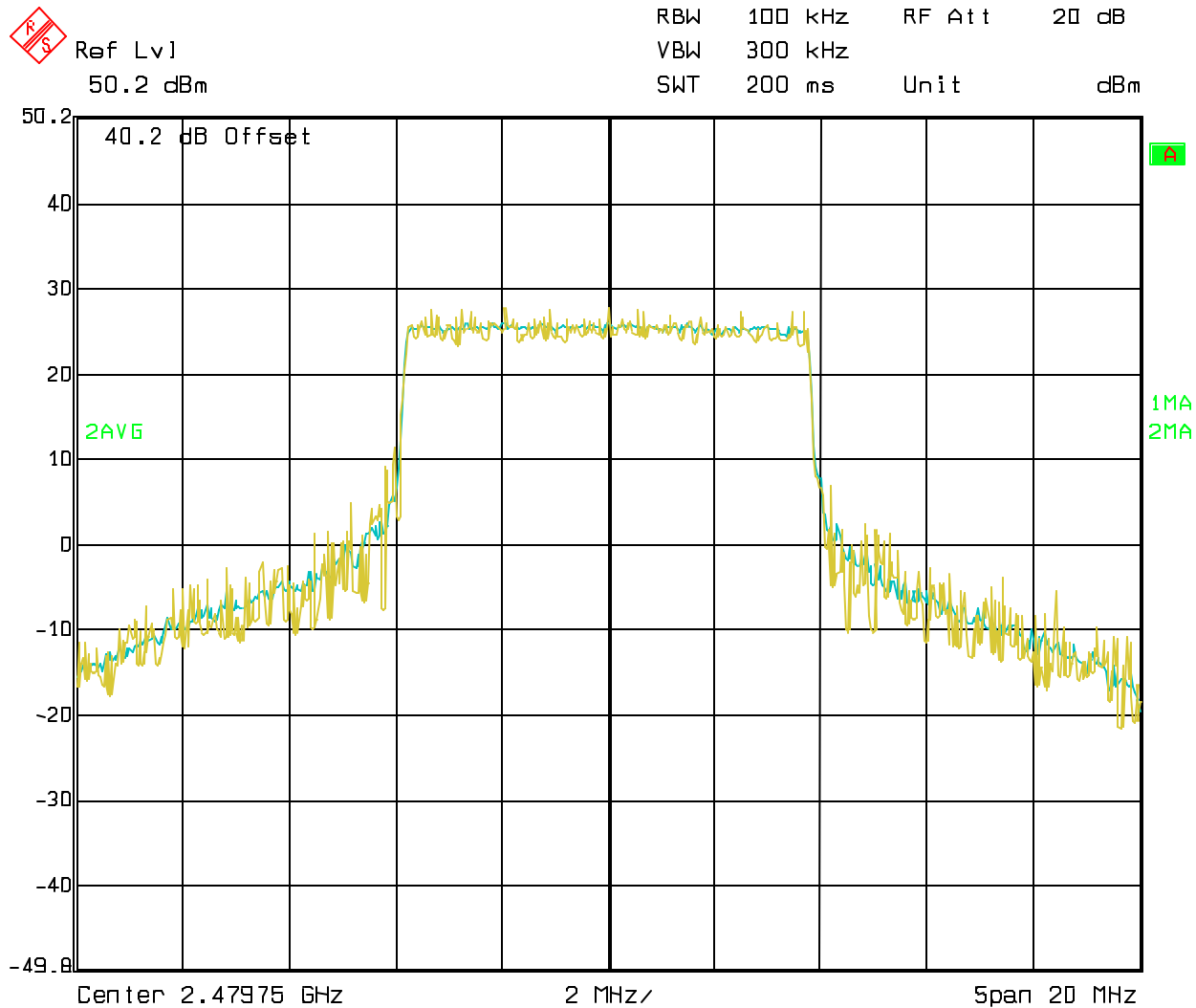
Modulation Mode: 64QAM



Date: 06.DEC.2007 16:55:53

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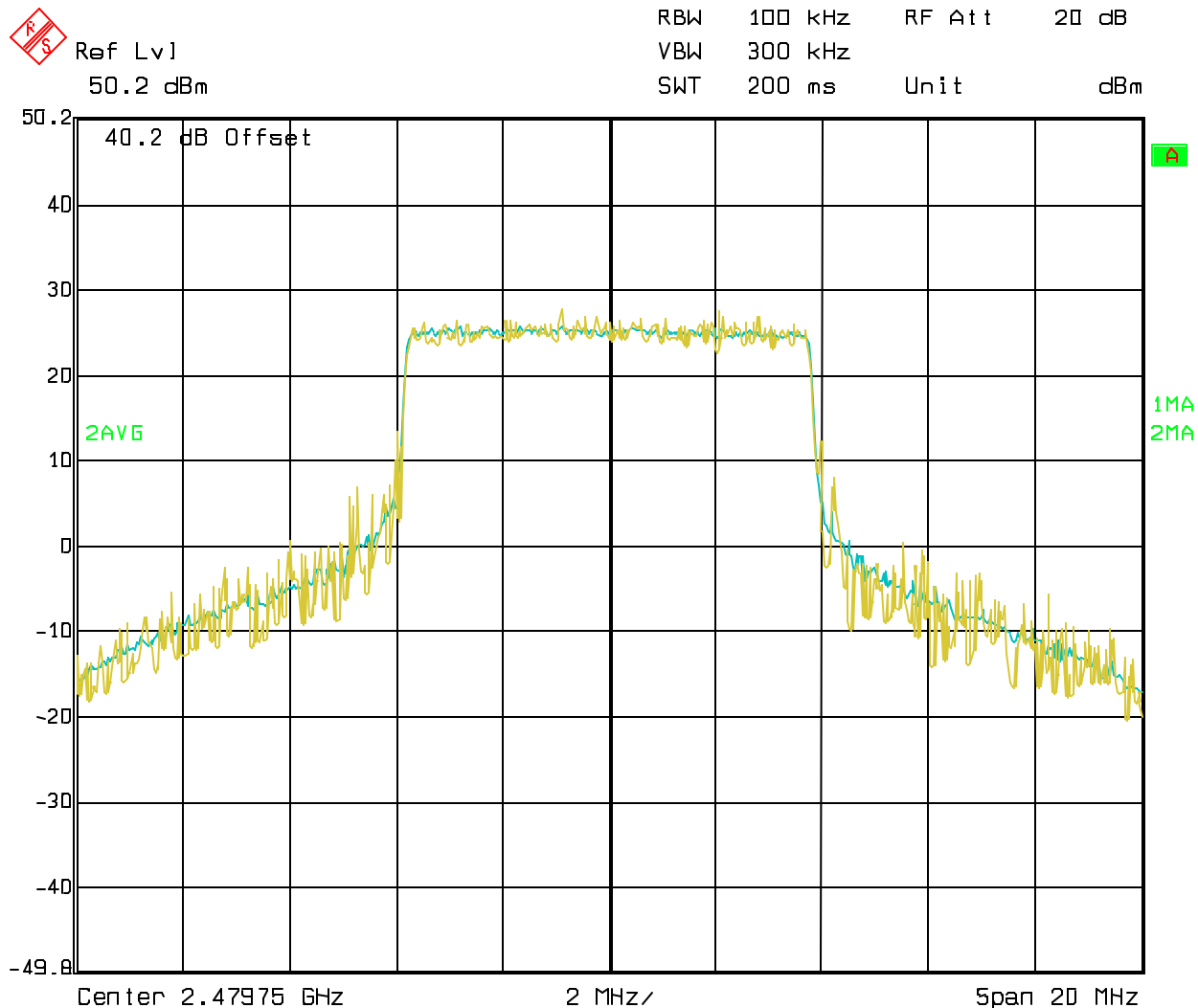
**Modulation Mode: 16QAM**



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Modulation Mode: QPSK



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**Section 5. Occupied Bandwidth**

**Para. No.: 2.1049**

<b>Test Performed By: Ferdinand Custodio</b>	<b>Date of Test: 12-07-2007</b>
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**Minimum Standard:** Part 74.637 (g)  
Occupied/Authorized bandwidth.

*(g) The maximum bandwidth which will be authorized per frequency assignment is set out in the table which follows. Regardless of the maximum authorized bandwidth specified for each frequency band, the Commission reserves the right to issue a license for less than the maximum bandwidth if it appears that less bandwidth would be sufficient to support an applicant's intended communications.*

<b>Frequency Band (MHz)</b>	<b>Maximum authorized bandwidth (MHz)</b>
1,990 to 2,110	18
6,425 to 6,525	25
6,875 to 7,125	25
12,700 to 13,250	25
17,700 to 19,700	80

**Test Results:** EUT Complies. Conductive emission plots captured on the Spectrum Analyzer thru a 40.2 dB attenuator.

**Test Data:** See attached plots. The EUT was tested with an RF Bandwidth of 6, 7 and 8MHz (Digital COFDM). The EUT was investigated using low, mid and high channel on all modulations (QPSK, 16QAM and 64QAM). The resulting plots submitted here represent each bandwidth since identical results were obtained on all configurations represented. The bandwidth is determined by support equipment and not affected by the amplifier.

8 MHz	7.57 MHz
7 MHz	6.65 MHz
6 MHz	5.71 MHz

***Nemko USA, Inc.***

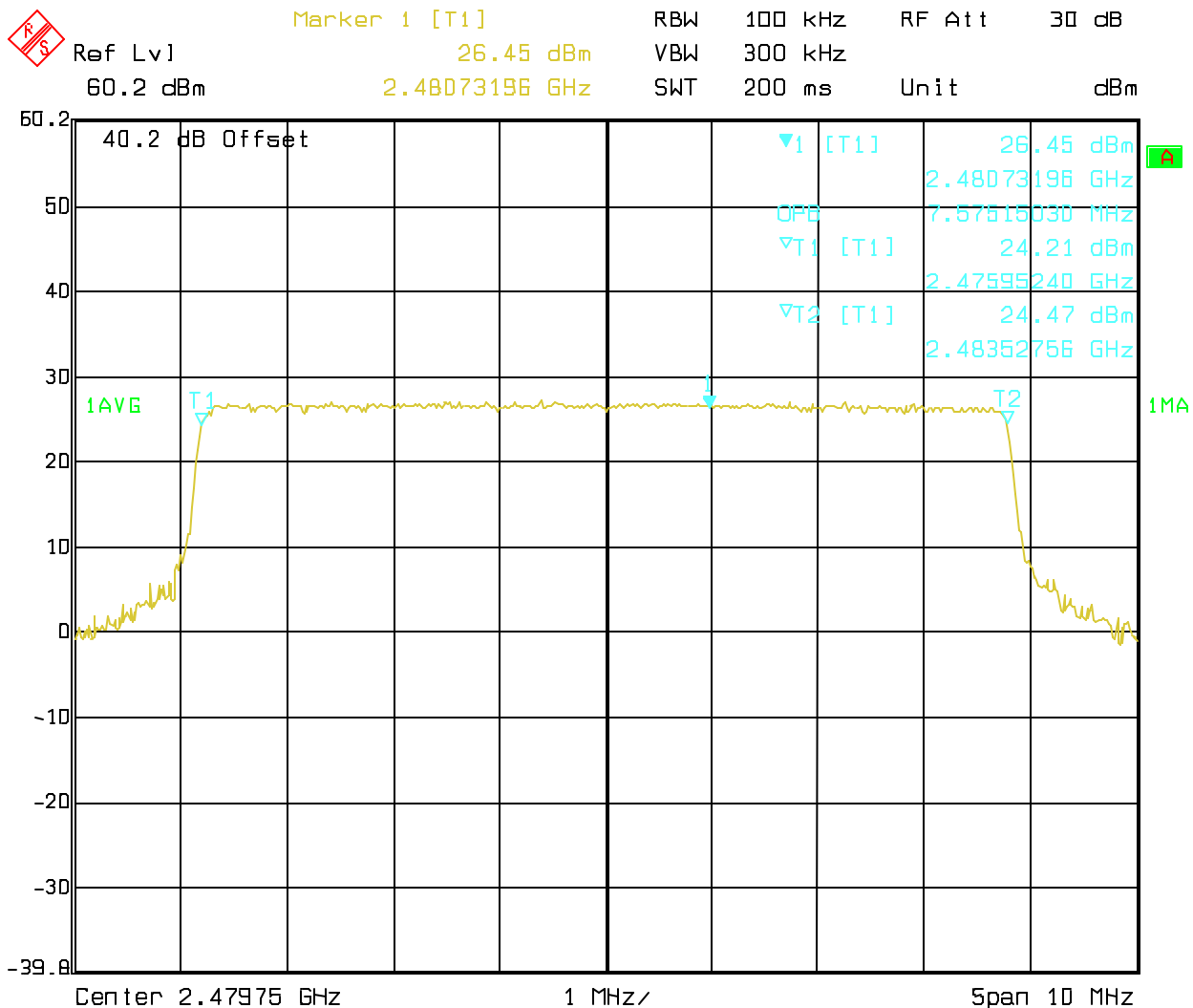
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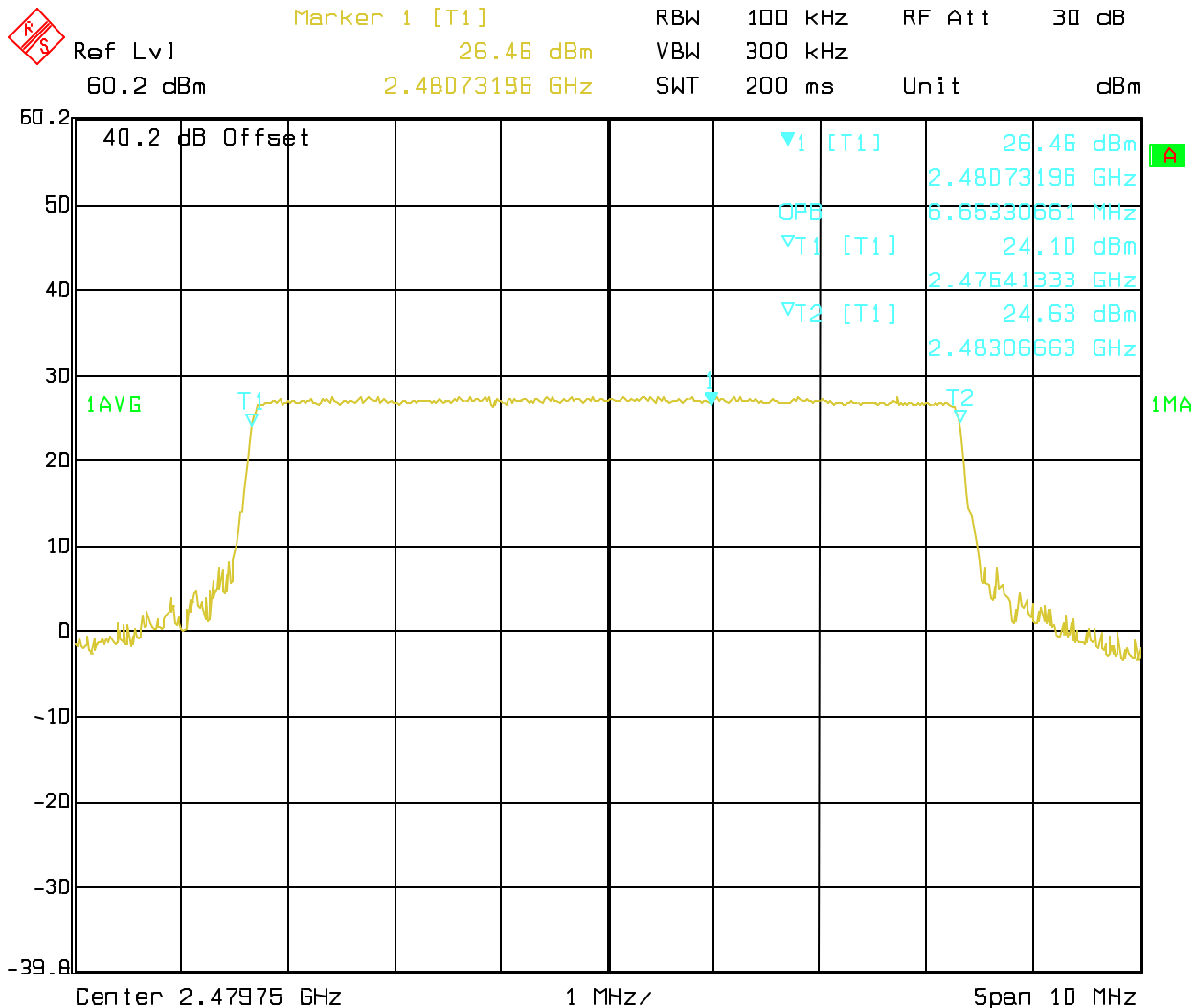
### QPSK 8MHz Bandwidth



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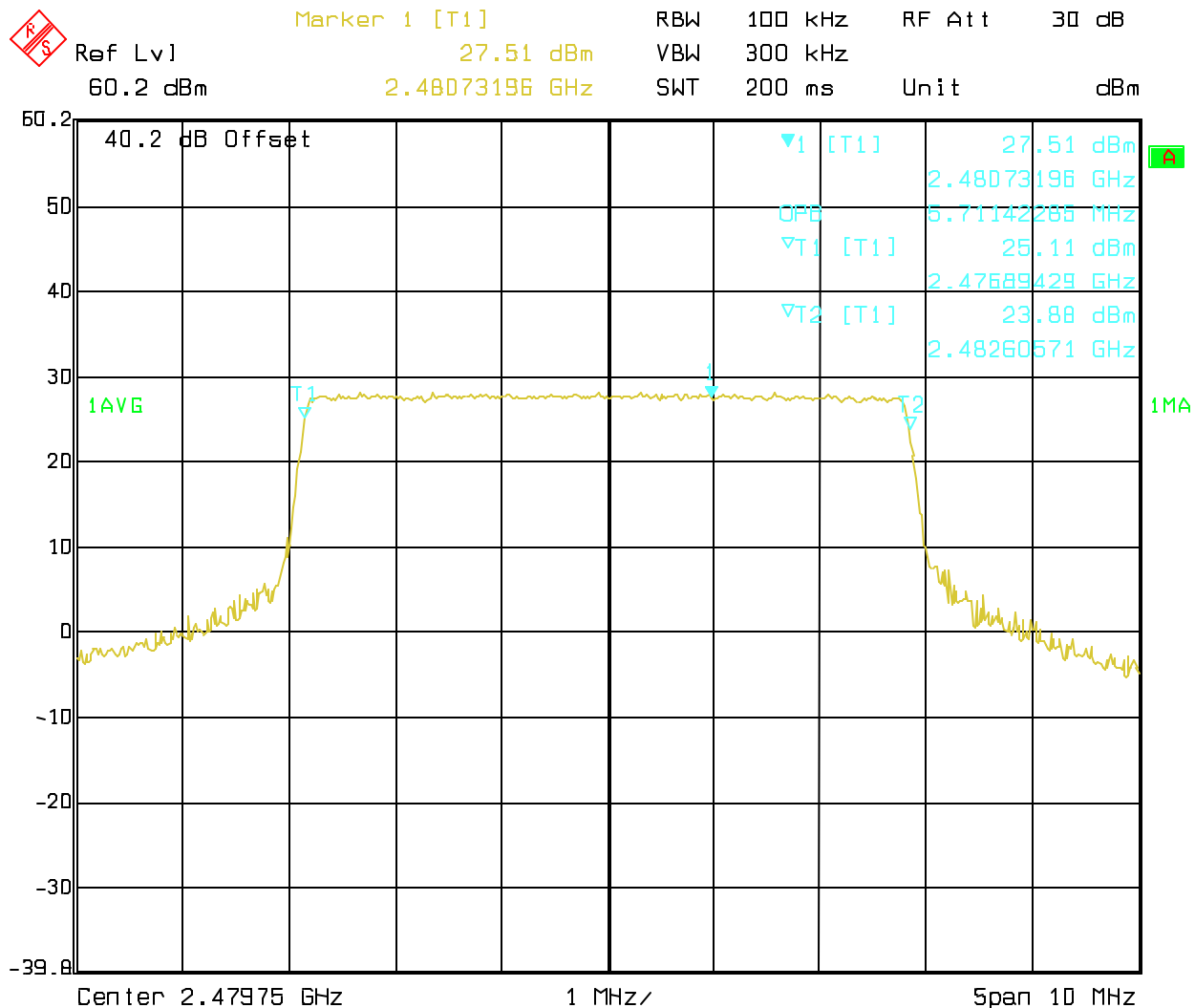
### QPSK 7MHz Bandwidth



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**QPSK 6MHz Bandwidth**



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## Section 6. Spurious Emissions At Antenna Terminals

Para. No.: 2.1051

<b>Test Performed By: Ferdinand Custodio</b>	<b>Date of Test: 12-07-2007</b>
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**Minimum Standard:** Part 74.637 Emissions and emission limitations

(a) *The mean power of emissions shall be attenuated below the mean transmitter power ( $P_{MEAN}$ ) in accordance with the following schedule:*

(1) *When using frequency modulation:*

(i) *On any frequency removed from the assigned (center) frequency by more than 50% up to and including 100% of the authorized bandwidth: At least 25 dB in any 100 kHz reference bandwidth ( $B_{REF}$ );*

(ii) *On any frequency removed from the assigned (center) frequency by more than 100% up to and including 250% of the authorized bandwidth: At least 35 dB in any 100 kHz reference bandwidth;*

(iii) *On any frequency removed from the assigned (center) frequency by more than 250% of the authorized bandwidth: At least  $43 + 10 \log_{10} (P_{MEAN}$  in watts) dB, or 80 dB, whichever is the lesser attenuation, in any 100 kHz reference bandwidth.*

(2) *When using transmissions employing digital modulation techniques:*

(i) *For operating frequencies below 15 GHz, in any 4 kHz reference bandwidth ( $B_{REF}$ ), the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 250 percent of the authorized bandwidth: As specified by the following equation but in no event less than 50 decibels:*

$$A = 35 + 0.8 (G - 50) + 10 \text{Log}_{10} B.$$

*(Attenuation greater than 80 decibels is not required.)*

*Where:*

*A = Attenuation (in decibels) below the mean output power level.*

*G = Percent removed from the carrier frequency.*

*B = Authorized bandwidth in megahertz.*

(c) *For purposes of compliance with the emission limitation requirements of this section:*

(3) *For demonstrating compliance with the attenuation requirements for frequency modulation and digital modulation in paragraph (a) of this section, the resolution bandwidth ( $B_{RES}$ ) of the*

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*measuring equipment used for measurements removed from the center frequency by more than 250 percent of the authorized bandwidth shall be 100 kHz for operating frequencies below 1 GHz, and 1 MHz for operating frequencies above 1 GHz. The resolution bandwidth for frequencies removed from the center frequency by less than 250 percent of the authorized bandwidth shall be the reference bandwidth ( $B_{REF}$ ) specified in the individual emission limitations, but may be reduced to not less than one percent of the authorized bandwidth ( $B$ ), adjusted upward to the nearest greater resolution bandwidth available on the measuring equipment. In all cases, if  $B_{RES}$  and  $B_{REF}$  are not equal, then the attenuation requirement must be increased (or decreased) as determined by a factor of  $10 \log_{10} [(B_{REF} \text{ in megahertz}) / (B_{RES} \text{ in megahertz})]$  decibels, where a positive factor indicates an increase in the attenuation requirement and a negative factor indicates a decrease in the attenuation requirement.*

**Test Results:** EUT Complies. Conductive emission plots captured on the Spectrum Analyzer thru a 40.2 dB attenuator.. Emissions were investigated from 30 MHz to 26 GHz .

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

EUT setup is similar to Section 3: RF Power Output measurements.

RF setting on CCII set to Max using internal source via ASI (Asynchronous Serial Interface) option. Signal bandwidth is set to 8MHz. External attenuators and cable used were verified at 40.2dB between 1990MHz and 2483.5MHz

For each channel investigated, the reference level used is the Mean Output Power (Average) measured under RF Power Output Test. A compliance factor of  $10 \log (B_{ref}/B_{res})$  was used for using 100kHz RBW to calculate the mask:

$$\begin{aligned}
 A &= 35 + 0.8(G - 50) + 10 \log 12 + 10 \log (4/100) \\
 &= 80 + (-13.98) \\
 &= 66 \text{ db attenuation @ 100kHz RBW}
 \end{aligned}$$

The EUT was investigated using all three modulation schemes but identical results were obtained for all mode of operations.

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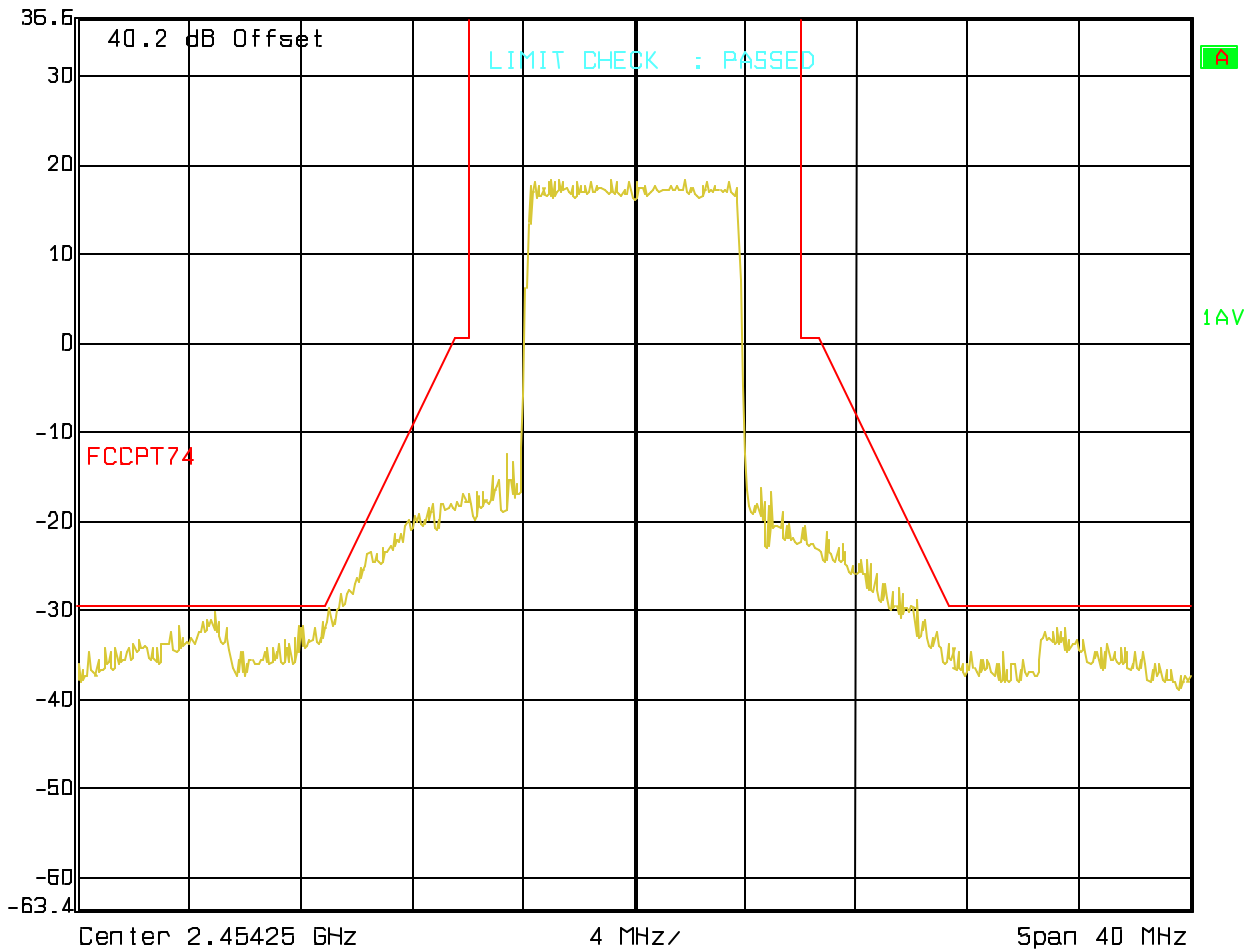
**Emission Mask Endpoints Part 74.637(C)(3):**  
 BW = 12 MHz, REF LVL = Mean Output Power

**High Channel 2454.25MHz 64QAM**



Ref Lvl  
 36.6 dBm

RBW 100 kHz RF Att 20 dB  
 VBW 1 MHz  
 SWT 100 ms Unit dBm



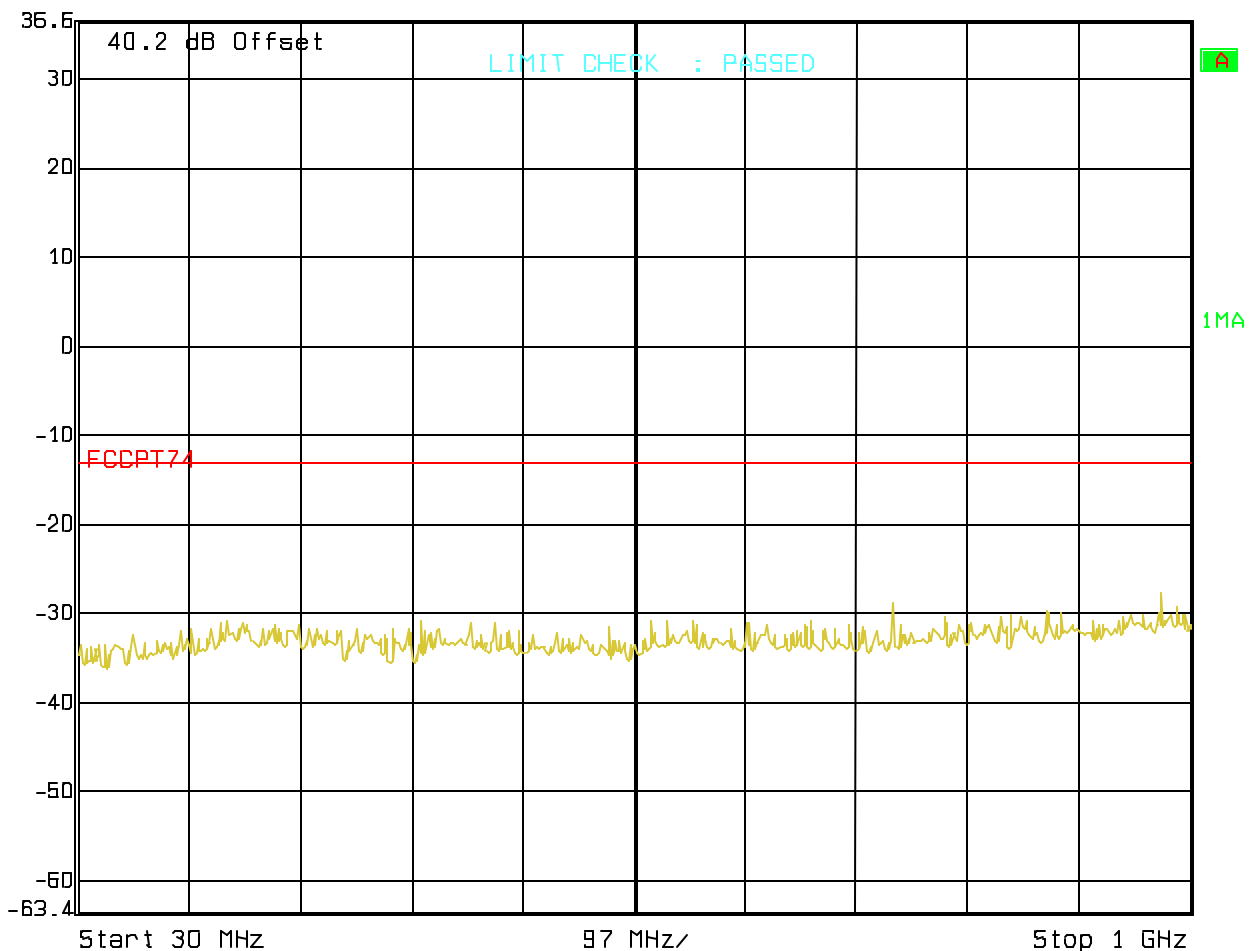
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Ref Lvl  
36.6 dBm

RBW 100 kHz RF Att 20 dB  
VBW 1 MHz  
SWT 245 ms Unit dBm

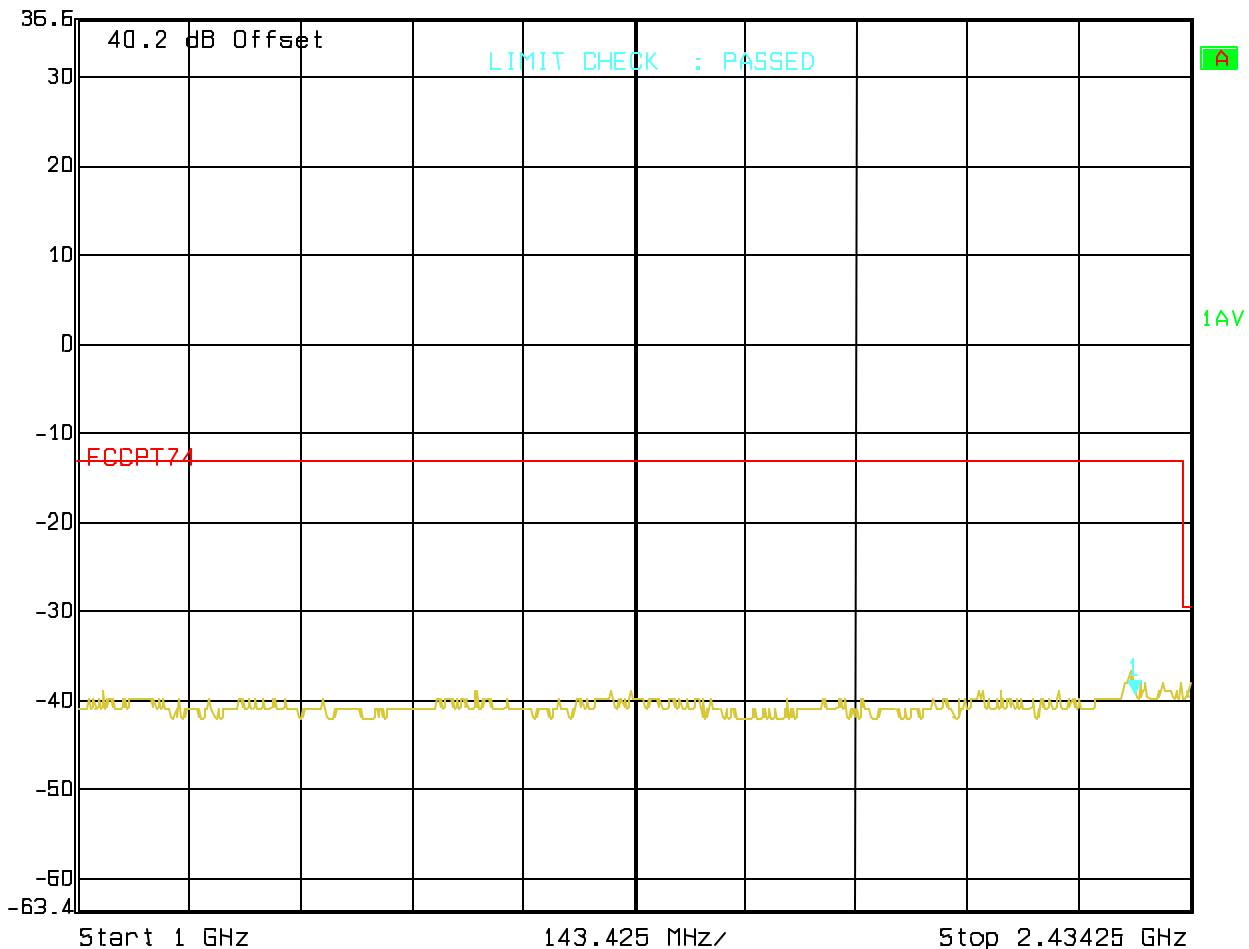


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Marker 1 [T1]      RBW 100 kHz      RF Att 20 dB  
 Ref Lvl      -38.97 dBm      VBW 1 MHz  
 36.6 dBm      2.36239379 GHz      SWT 360 ms      Unit dBm



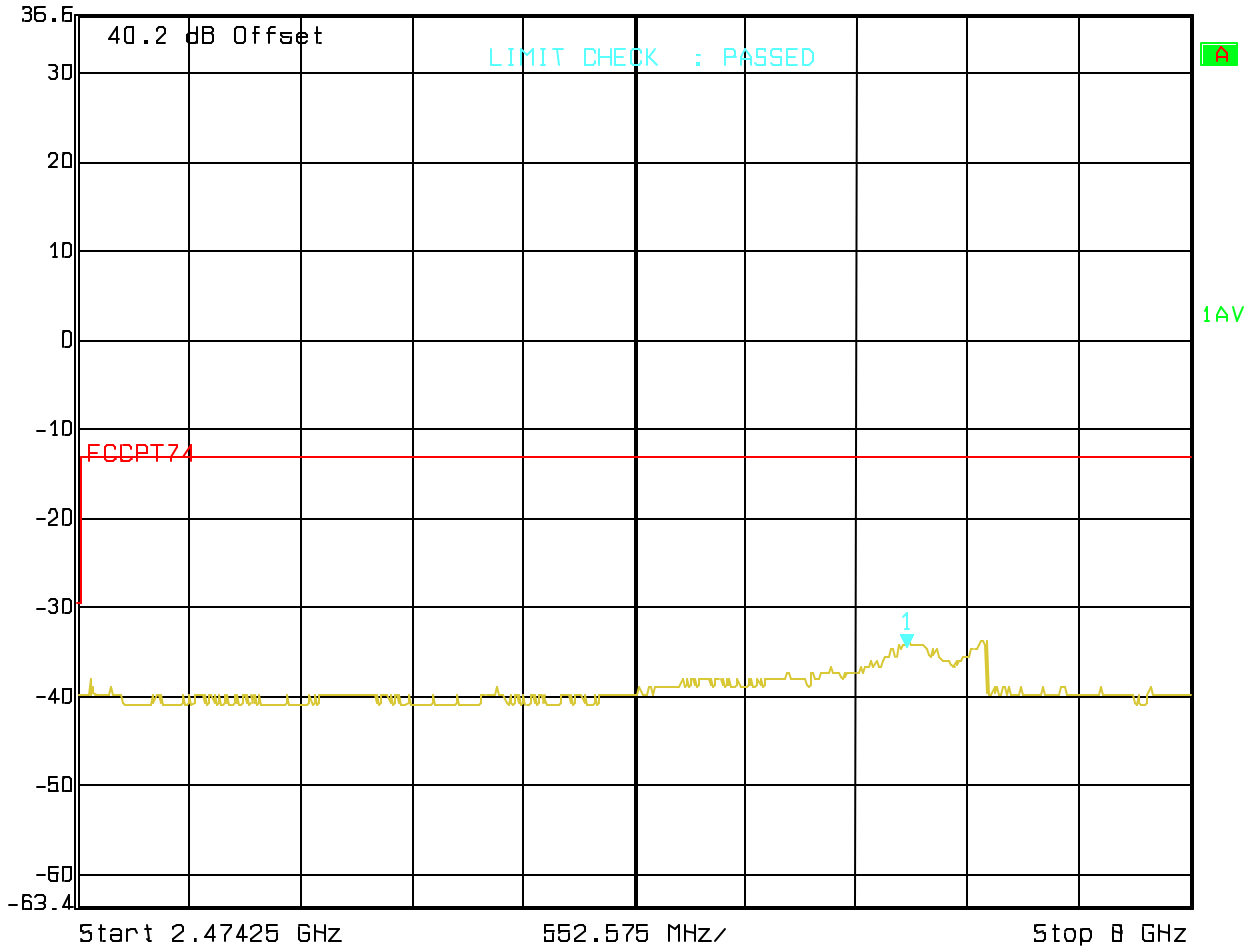
Date: 11.DEC.2007 11:54:05



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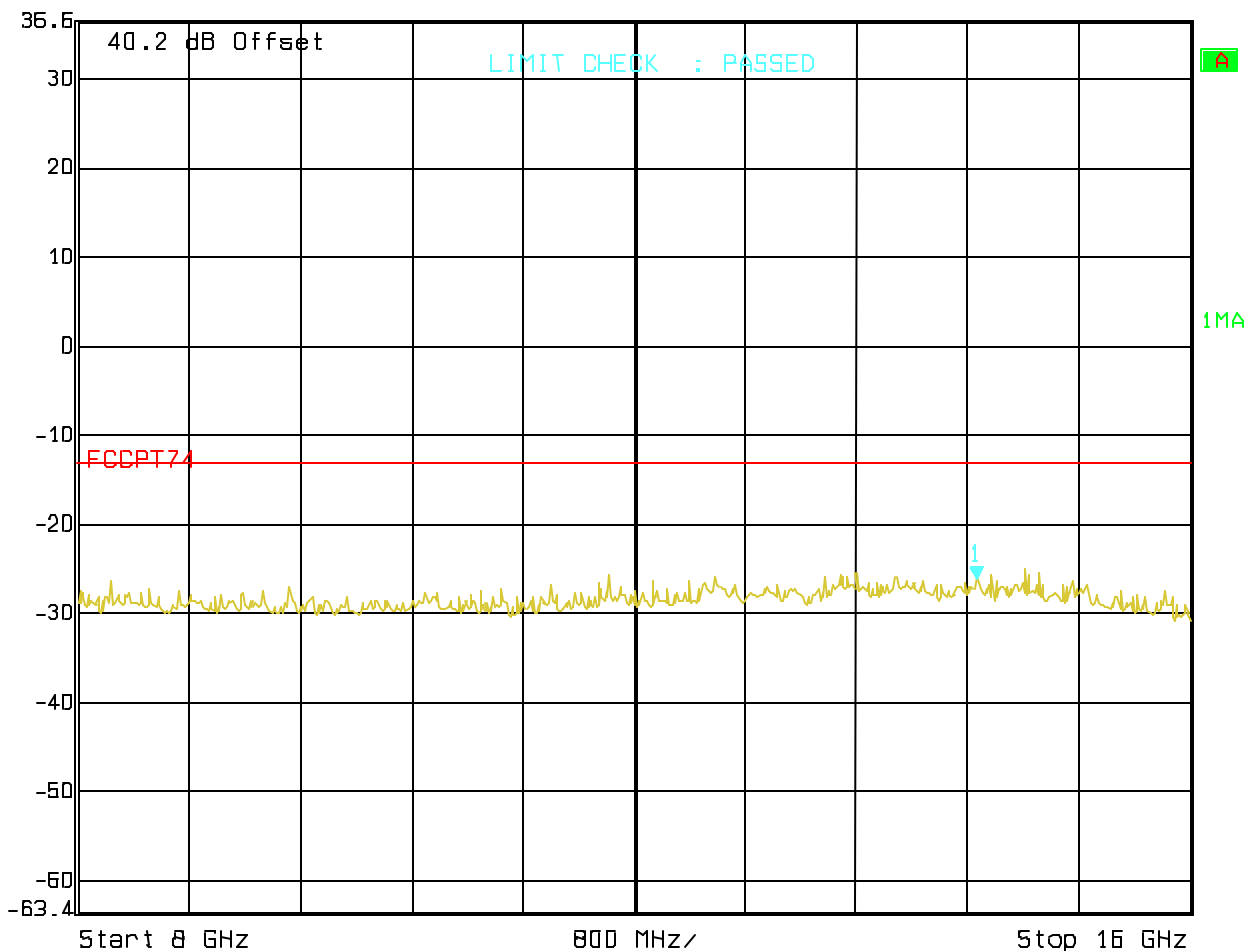
Marker 1 [T1] RBW 100 kHz RF Att 20 dB  
 Ref Lvl -34.36 dBm VBW 1 MHz  
 36.6 dBm 6.58364679 GHz SWT 1.4 s Unit dBm



Date: 11.DEC.2007 11:55:04


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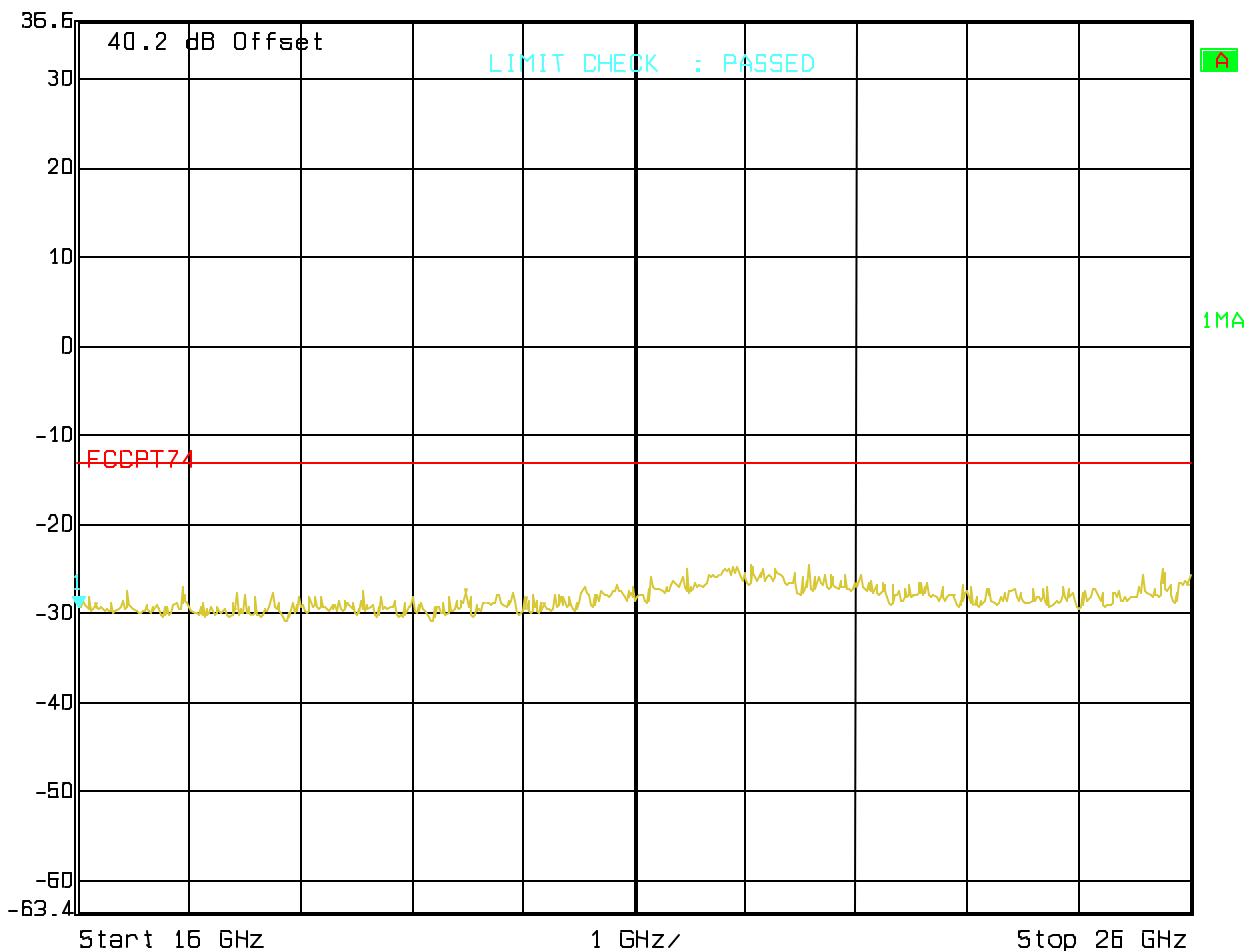
⚠ Marker 1 [T1] RBW 100 kHz RF Att 20 dB  
 Ref Lvl -26.06 dBm VBW 1 MHz  
 36.6 dBm 14.46092184 GHz SWT 2 s Unit dBm



Date: 11.DEC.2007 11:55:53

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 Marker 1 [T1] RBW 100 kHz RF Att 20 dB  
Ref Lvl -29.32 dBm VBW 1 MHz  
36.6 dBm 16.00000000 GHz SWT 2.5 s Unit dBm



Date: 11.DEC.2007 11:58:18

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## Section 7. Field Strength of Spurious

Para. No.: 2.1053

<b>Test Performed By: Ferdinand Custodio</b>	<b>Date of Test: 12-11-2007</b>
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**Minimum Standard:** Part 74.637

**Test Results:** EUT Complies. Emissions were searched from 30 MHz to 26 GHz with the antenna port terminated into a 50 ohm load. No spurious emissions level within 20dB of the limit was observed. All emissions measured were proved by substitution method.

**Test Data:** See attached tables.

Quasi-peak measurements with a RBW =VBW = 100 kHz below 1GHz otherwise RBW =VBW = 1MHz.

Measured Frequency (MHz)	Antenna Polarization (H/V)	Meter Reading (dBuV)
39.37	V	43.3
43.59	V	40.7
56.81	V	39.1
59.72	V	38.3
70.03	H	29.2
159.1	V	29.6

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### Results—Substitution Method

Target Frequency	Target Level (dBuV/m)	Antenna Gain (dipole)	Cable Loss	Signal Generator (dBm)	Total (EIRP) dBm	Specs (dBm)	Margin (dBm)
39.37	43.3	0	1	-50.76	-51.76	-13	38.76
43.59	40.7	0	1	-52.26	-53.26	-13	40.26
56.81	39.1	0	1	-55.32	-56.32	-13	43.32
59.72	38.3	0	1	-55.54	-56.54	-13	43.54
70.03	29.2	0	1	-63.06	-64.06	-13	51.06
159.1	29.6	0	1	-62.67	-63.67	-13	50.67

Location: South OATS, T = 16°C, 32% R.H. 3 meters

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## Section 8. Frequency Stability

Para. No.: 2.1055

<b>Test Performed By: F.S.Custodio</b>	<b>Date of Test: 12-07-2007</b>
--	---------------------------------

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

**Minimum Standard:** Part 74.661

**Test Results:** 19410 Hz difference which corresponds to **7.84 ppm**  
Limit = 0.005 % = 50 ppm (2025 to 2110) MHz  
= **0.001 % = 10 ppm (2450 to 2483.5) MHz**

### Measurement Data:

Part 2.1055 (-30°C to +50°C)		Spectrum Analyzer @ 100KHz RBW, 1MHz VBW		High Channel	
Worst case variation:		19410.0 Hz (>Set freq.)	19410.0 Hz (<Set freq.)	Monitored Frequency:	2.47587733 GHz
Temp.Set Point	Time	85% of Vnom Frequency ? (GHz)	Vnom=28VDC Frequency ? (GHz)	*Red are negative numbers	
Temp.Actual		Difference (GHz)	Difference (GHz)	115% of Vnom Frequency ? (GHz)	Difference (GHz)
-30 -29.9	8:30AM	2.47585792 0.000019410	2.47585792 0.000019410	2.47585792 0.000019410	2.47585792 0.000019410
-20 -20	9:30AM	2.47585792 0.000019410	2.47585792 0.000019410	2.47585792 0.000019410	2.47585792 0.000019410
-10 -9.9	10:30AM	2.47587733 0.000000000	2.47587733 0.000000000	2.47587733 0.000000000	2.47587733 0.000000000
0 0	11:30AM	2.47587733 0.000000000	2.47587733 0.000000000	2.47587733 0.000000000	2.47587733 0.000000000
10 10	12:30PM	2.47587733 0.000000000	2.47587733 0.000000000	2.47587733 0.000000000	2.47587733 0.000000000
20 20.1	1:30PM	2.47587733 0.000000000	2.47587733 0.000000000	2.47587733 0.000000000	2.47587733 0.000000000
30 30	2:30PM	2.47587733 0.000000000	2.47587733 0.000000000	2.47587733 0.000000000	2.47587733 0.000000000
40 39.9	3:30PM	2.47587733 0.000000000	2.47587733 0.000000000	2.47587733 0.000000000	2.47587733 0.000000000
50 49.9	4:30PM	2.47589674 0.000019410	2.47589674 0.000019410	2.47589674 0.000019410	2.47589674 0.000019410

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## Section 9. Test Equipment List

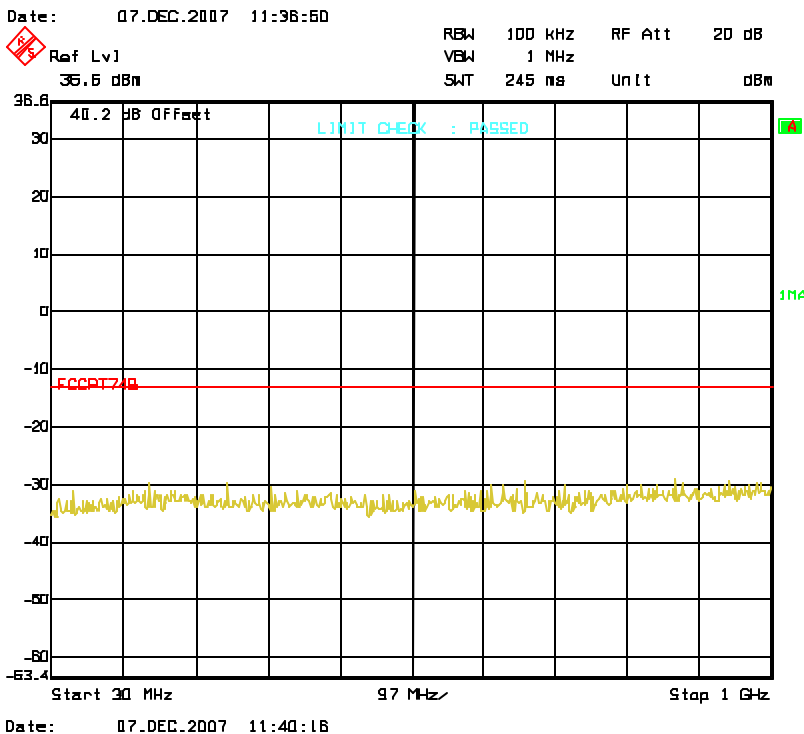
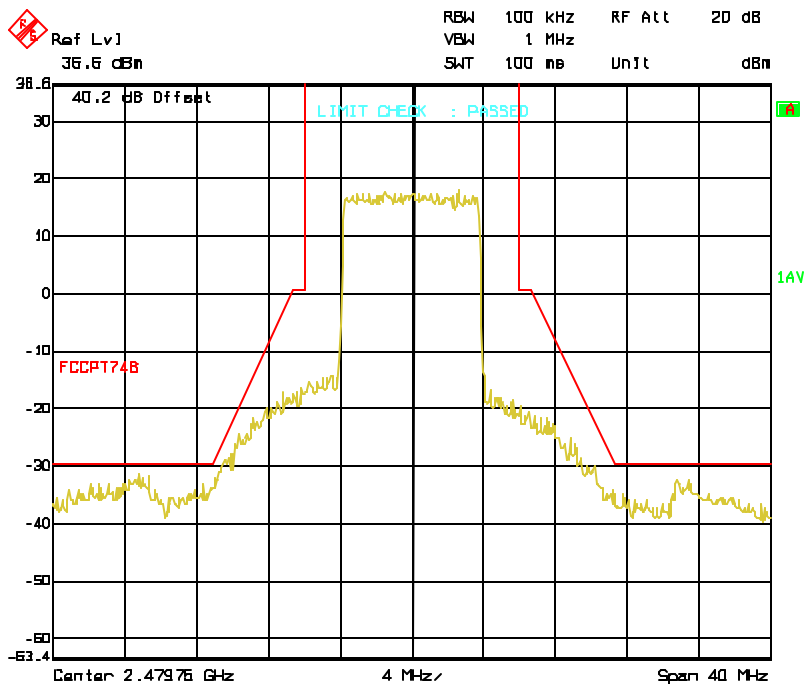
Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
115	Antenna, Bicon	EMCO	3104	3020	8/28/2007	08/28/08
111	Antenna, LPA	EMCO	3146	1382	10/3/2007	10/03/08
898	EMI Receiver & filter set	HP	8546A	3625A00348	1/18/2007	01/18/08
897	Spectrum Analyzer	Rohde & Schwarz	FSP7	837620/009	9/14/2007	09/14/08
836	Signal Generator	Agilent	E8254A	US41140229	12/4/2007	12/04/08
N149	Environmental Chamber	Cincinnati Sub-Zero	ZPHS-32-2-2-H/AC	ZP0552665	5/30/2007	5/30/2008
765	Antenna Set, Dipole	EMCO	3121C	1214	7/12/07	7/12/08
877	Antenna, DRG Horn, .7-18GHz	AH Systems	SAS-571	688	7/10/2007	07/10/08
835	EMI Test Receiver 20 Hz - 26.5	Rohde & Schwarz	1088.7490.26	837491/0002	2/6/2007	02/06/08
902	pre amp	Sonoma	310 N	185803	7/10/2007	07/10/08
SOATS	South Outside Area Test Site			RN 90579		

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### Appendix A.

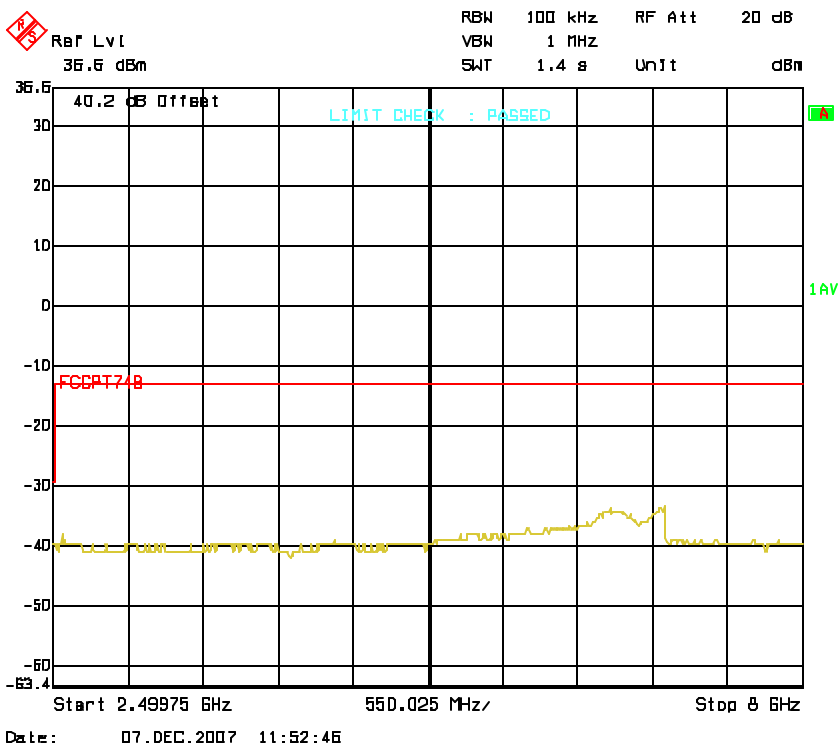
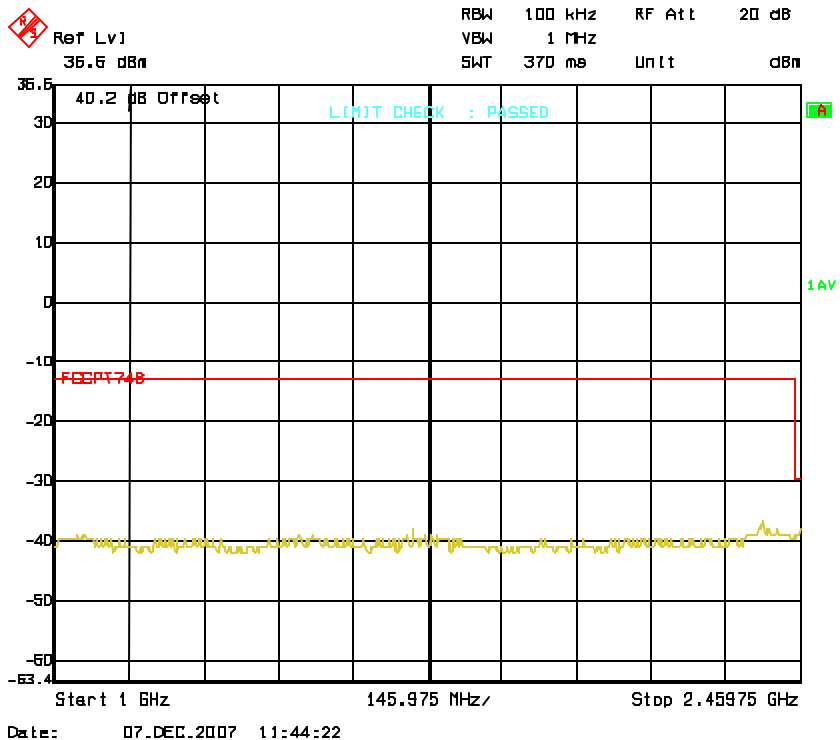
### Section 6. Spurious Emissions At Antenna Terminals

#### High Channel (2479.75MHz) QPSK

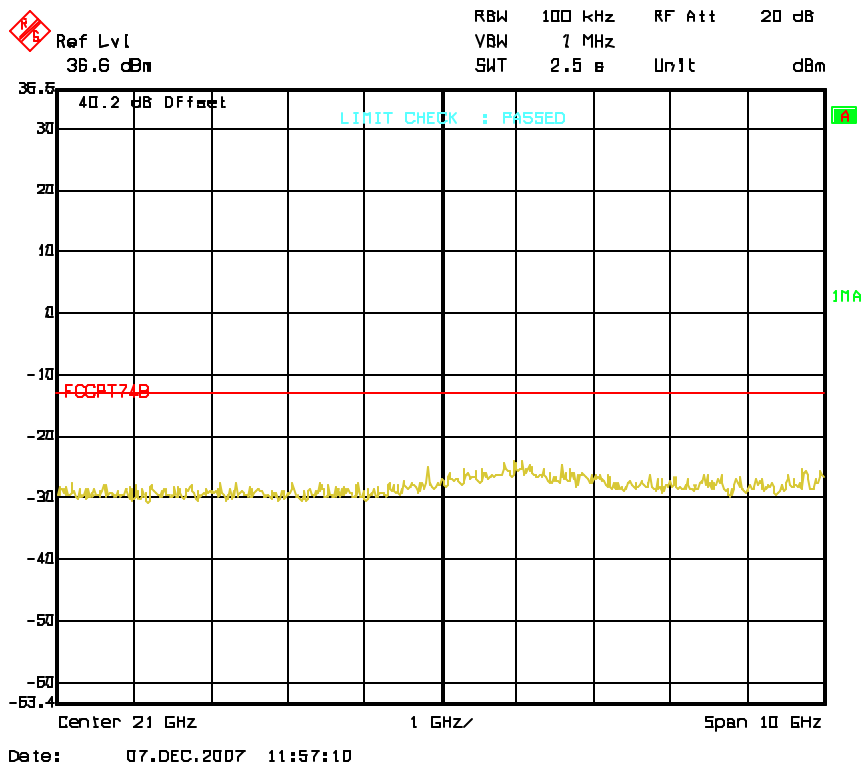
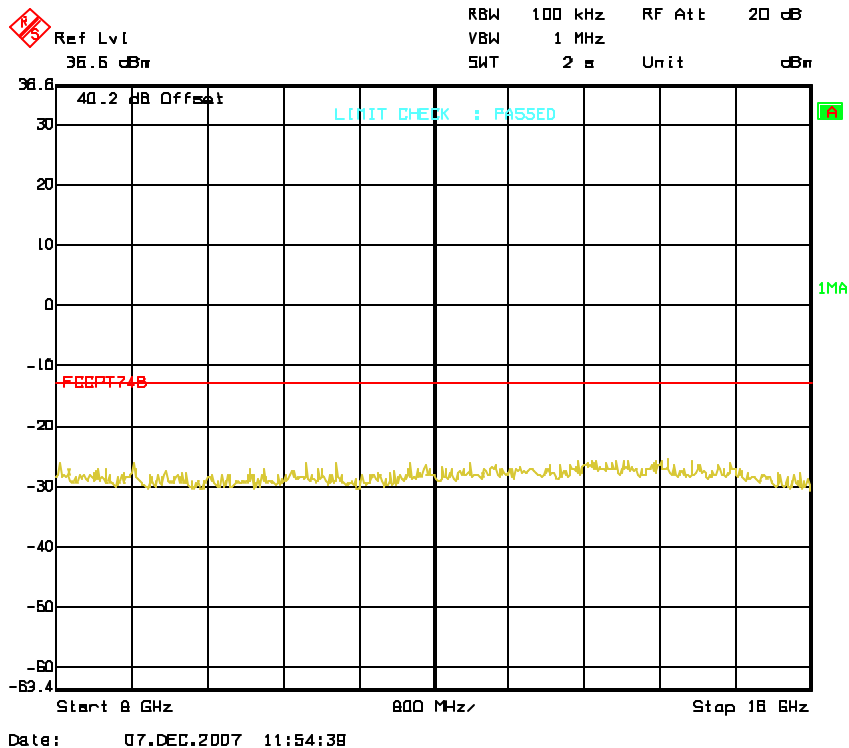




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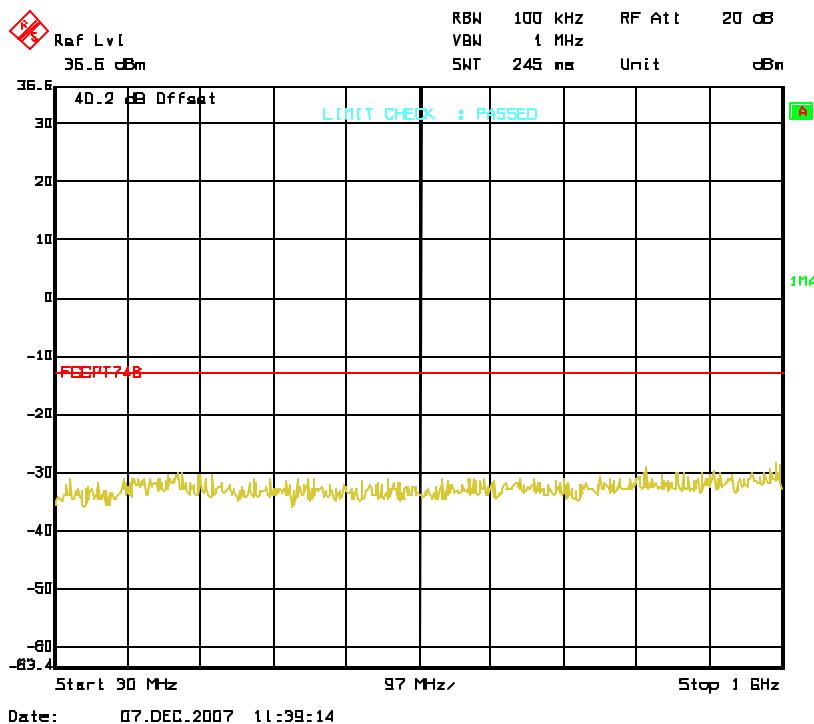
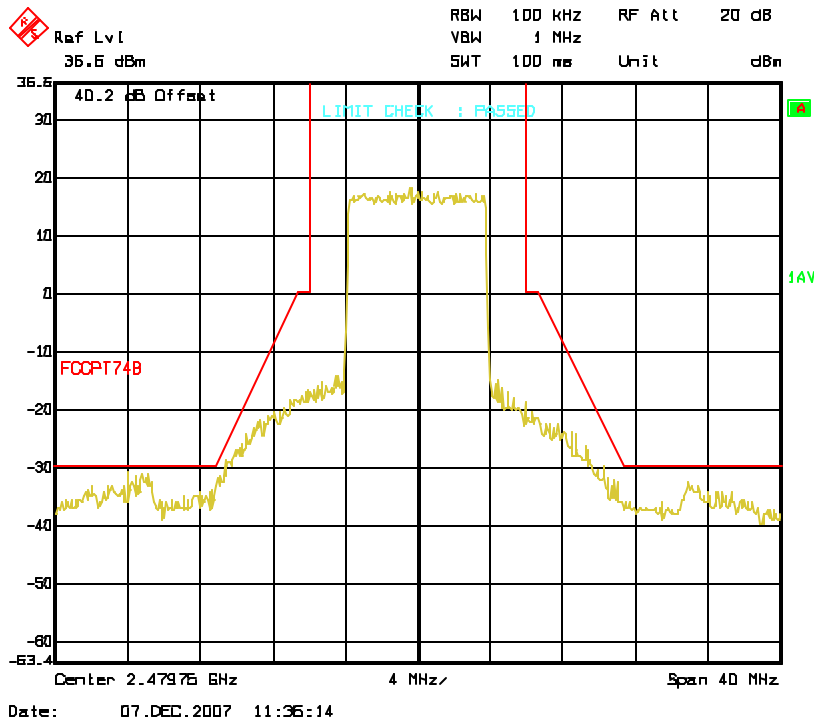


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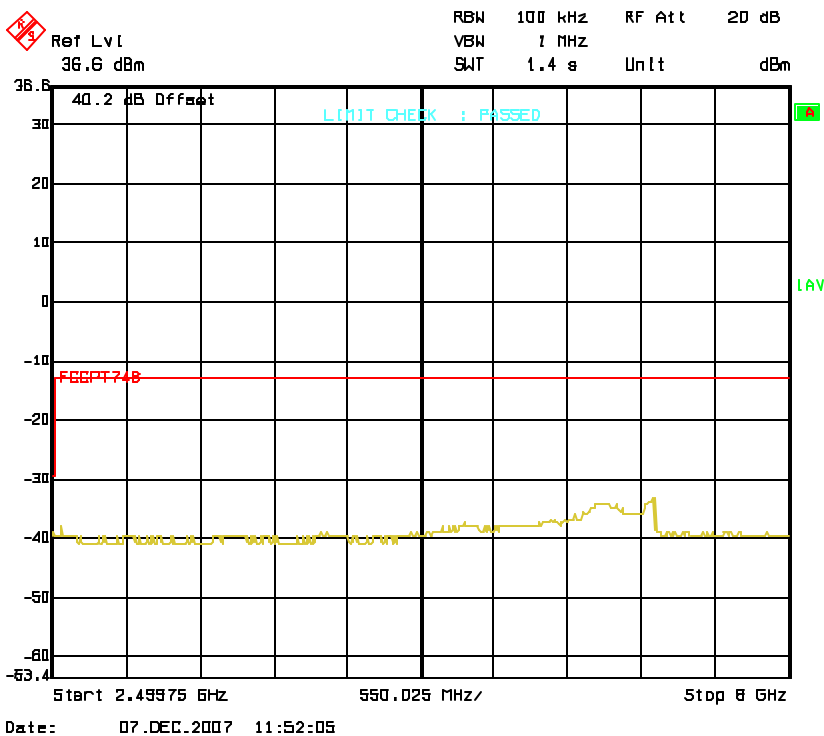
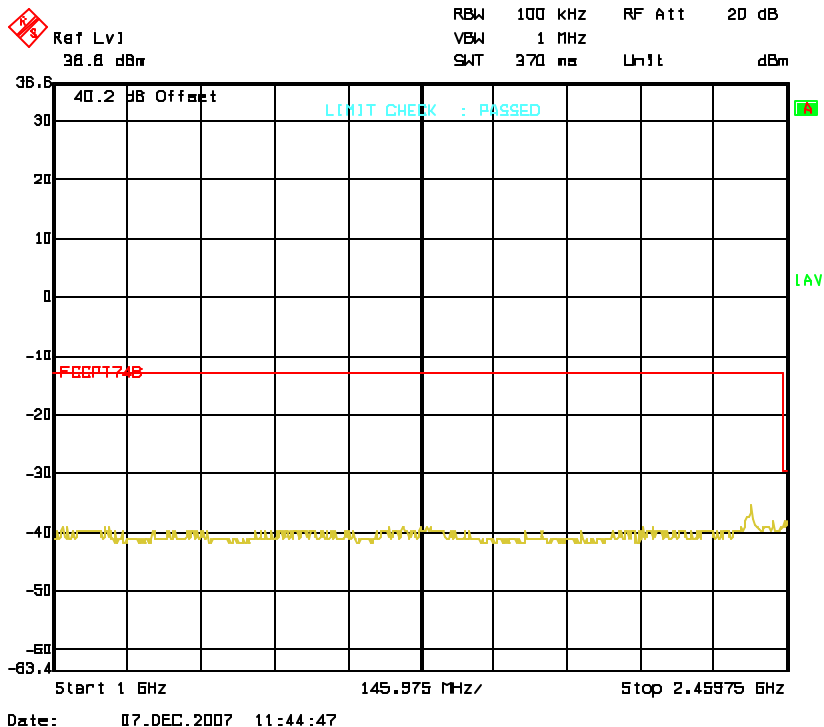


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### High Channel (2479.75MHz) 16QAM



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