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## CERTIFICATION TEST REPORT

**Report Number:** 2009 09135005 COM400 FCC 90.217

**Project Number:** 34493-1

**Nex Number:** 135005

**Applicant:** HME  
14110 STOWE DR.  
POWAY, CA 92064


**Equipment Under Test (EUT):** COMMUNICATOR

**Model:** COM 400

**FCC ID:** BYMCOM400

**In Accordance With:** FCC Part 90 Subpart I, 90.217(b)

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

**Authorized By:**   
Alan Laudani, EMC/RF Test Engineer

**Date:** October 5, 2009

**Total Number of Pages:** 44



## **Section1: 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 15; Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

<b>Apparatus Assessed:</b>	Communicator
<b>Model:</b>	COM 400
<b>Serial:</b>	9
<b>Specification:</b>	FCC Part 90 Subpart I, 90.217(b)
<b>Date Received in Laboratory:</b>	September 15, 2009
<b>Compliance Status:</b>	Complies
<b>Exclusions:</b>	None
<b>Non-compliances:</b>	None





**1.1 Report Release History**

REVISION	DATE	COMMENTS
-	October 5, 2009	Prepared By: Ferdinand Custodio
-	October 5, 2009	Initial Release: Alan Laudani

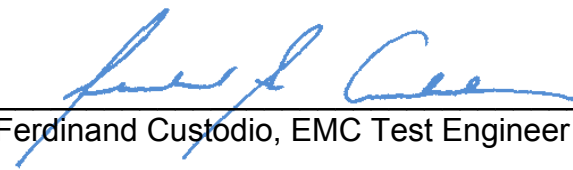
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Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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TESTED BY:   
Ferdinand Custodio, EMC Test Engineer

Date: October 5, 2009



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## Section 2: Equipment Under Test

### 2.1 Product Identification

The Equipment Under Test was identified as follows:

**HME COM 400 SN 9**



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### 2.2 Samples Submitted for Assessment

The following sample of the apparatus has been submitted for type assessment:

Sample No.	Description	Serial No.
135005-1	COM 400	9





### 2.3 Theory of Operation

The COM 400 is part of a wireless audio system (HME Wireless Drive-Thru Audio System 400). The EUT consists of a belt-pac transceiver unit and a lightweight headset, The EUT is worn around the user's waist, and the headset plugs into a connector on the transceiver unit.

### 2.4 Technical Specifications of the EUT

<b>Manufacturer:</b>	HME
<b>Transmit Frequency:</b>	468.4875 to 469.8875 MHz
<b>Receive Frequency:</b>	457.5125 to 457.6125 MHz
<b>Rated Power:</b>	54.1mW
<b>Modulation:</b>	FM
<b>Emission Designator:</b>	11K4F3E
<b>Antenna Connector:</b>	Internal/Integral
<b>Power Source:</b>	4.8VDC Battery (HME K104030)

### 2.5 Emission Designator Calculation - §2.2002 (b) and §2.2002 (g)(2)

$$B_n = 2M + 2DK$$

Where

$B_n$	= Necessary Bandwidth
$M$	= Maximum modulation frequency
$D$	= Peak frequency deviation
$K$	= 1

$$= 2(2.5) + 2(3.2 \times 1)$$

$$B_n = 11.4\text{kHz}$$

Emission Designator = 11K4F3E (FM-Telephony(Commercial Quality))



## **Section 3: Test Conditions**

### **3.1 Specifications**

The apparatus was assessed against the following specifications:

***FCC Part 90 Subpart I, 90.217(b)***

Private Land Mobile Radio Services. General Technical Standards. Exemption from technical standards.

### **3.2 Deviations from Laboratory Test Procedures**

No deviations from Laboratory Test Procedure

### **3.3 Test Environment**

All tests were performed under the following environmental conditions:

Temperature range	:	21-31 °C
Humidity range	:	18-70 %
Pressure range	:	101.2 kPa
Power supply range	:	4.8VDC (Batteries)



### 3.4 Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
128	Antenna, Bicon	EMCO	3104	2882	2/9/2009	2/9/2011
111	Antenna, LPA	EMCO	3146	1382	10/20/2008	10/20/2010
877	Antenna, DRG Horn, .7-18GHz	AH Systems	SAS-571	688	7/28/2008	7/28/2010
317	Preamplifier	HP	8449A	2749A00167	4/16/2009	4/16/2010
911	Spectrum Analyzer	Agilent	E4440A	US41421266	11/6/2008	11/6/2009
902	pre amp	Sonoma	310 N	185803	8/4/2009	8/4/2010
926	Microwave Frequency Counter	Anritsu	MF2412B	6200229301	1/30/2009	1/30/2010
815	Multimeter	Fluke	111	78130066	8/4/2009	8/4/2010
936	DC Power Supply 0-50V 0-10A 200W	Hewlett Packard	6002A		Verified by 815	
-	RF Communication Test Set	HP	8920A	3507A06044	9/16/2009	9/16/2010
765	Antenna, LPA	EMCO	3147	1246	7/23/2009	7/23/2010
529	Antenna, DRWG	EMCO	3115	2505	9/30/2008	9/30/2010
746	Signal Generator	HP	8648B	3642U1905	1/22/2009	1/22/2010

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## **Section 4: Observations**

### **4.1 Modifications Performed During Assessment**

Please see section 2.1047(b) – Modulation Limiting for details.

### **4.2 Record Of Technical Judgements**

No technical judgements were made during the assessment.

### **4.3 EUT Parameters Affecting Compliance**

The user of the apparatus could not alter parameters that would affect compliance.

### **4.4 Test Deleted**

No Tests were deleted from this assessment.

### **4.5 Additional Observations**

There were no additional observations made during this assessment.





## Section 5: Results Summary

This section contains the following:

FCC Part 2 Subpart J: Test Results  
 Frequency Allocations and Radio Treaty Matters; General Rules and Regulations.  
 Equipment Authorization Procedures.

FCC Part 90 Subpart I: (Limits)  
 § 90.217(b) Private Land Mobile Radio Services. General Technical Standards.  
 Exemption from technical standards.

The column headed “Required” indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

- N No: not applicable / not relevant
- Y Yes: Mandatory i.e. the apparatus shall conform to these test.
- N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

### 5.1 Test Results

Part 2	Test/Requirement Description	Required	Result/Action
2.1049(c)(1)	Input Modulation Requirement	Y	Applied
2.1046(a)	RF Power Output	Y	Pass
2.1047(a)	Audio Frequency Response	Y	Verified
2.1047(b)	Modulation Limiting	Y	Verified
2.1049(c)(1)	Occupied Bandwidth	Y	Pass
2.1051	Spurious Emissions at the Antenna Terminals	Y	Pass
2.1053	Field Strength of Spurious Radiation	Y	Pass
2.1055	Frequency Stability	Y	Verified





## Appendix A: Test Results

### 2.1049(c)(1) – Input Modulation Requirement

§2.1049(c). Radiotelephone transmitters equipped with a device to limit modulation or peak envelope power shall be modulated as follows. For single sideband and independent sideband transmitters, the input level of the modulating signal shall be 10 dB greater than that necessary to produce rated peak envelope power.

(1) Other than single sideband or independent sideband transmitters—when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

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#### Conditions:

Sample Number:	COM 400	Temperature:	22°C
Date:	September 17, 2009	Humidity:	70%
Modification State:		Tester:	FSCustodio
		Laboratory:	Nemko

#### Observations:

- The EUT will be modulated according to this requirement for tests requiring such test condition.
- EUT maximum transmit deviation is 3.3kHz (EUT specification).
- This requirement was performed independently of the channel being investigated.
- The input signal was modulated with 1kHz tone at 50% maximum frequency deviation. Since maximum frequency deviation is 3.3kHz, the level was adjusted until 1.65kHz deviation was reached (first plot next page).
- Once established, the signal level is then increased by 16dB and the frequency changed to 2.5kHz (second plot next page).





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HP 8920A RF Communications Test Set: 09/17/09 12:12:00 PM  
 Measurements HELD. Enter HOLD again to resume.

TX TEST				
TX Frequency <b>MHz</b> <b>469.887430</b>		FM Deviation <b>kHz</b> <b>1.652</b>		
TX Power <b>W</b> <b>0.0550</b>		AF Freq <b>kHz</b> <b>0.99926</b>		
Tune Mode 1 <b>Auto/Manual</b>	Input Port <b>RF In/Ant</b>	AF Anl In 3 <b>FM Demod</b>	AFGen1 Freq 4 <b>1.0000</b> kHz	To Screen RF GEN RF ANL AF ANL SCOPE SPEC ANL ENCODER DECODER RADIO INT <b>More</b>
Tune Freq 2 <b>469.887500</b> MHz	IF Filter <b>15 kHz</b>	Filter 1 <b>&lt;20Hz HPF</b>	AFGen1 Lvl 5 <b>67.0</b> dBuV	
TX Pwr Zero <b>Zero</b>	Ext TX Key <b>On/Off</b>	Filter 2 <b>15kHz LPF</b>		
		De-Emphasis <b>750 us/Off</b>		
		Detector <b>Pk+-Max</b>		

### High Channel

HP 8920A RF Communications Test Set: 09/17/09 12:17:00 PM  
 Measurements HELD. Enter HOLD again to resume.

TX TEST				
TX Frequency <b>MHz</b> <b>469.887325</b>		FM Deviation <b>kHz</b> <b>3.260</b>		
TX Power <b>W</b> <b>0.0541</b>		AF Freq <b>kHz</b> <b>2.50050</b>		
Tune Mode 1 <b>Auto/Manual</b>	Input Port <b>RF In/Ant</b>	AF Anl In 3 <b>FM Demod</b>	AFGen1 Freq 4 <b>2.5000</b> kHz	To Screen RF GEN RF ANL AF ANL SCOPE SPEC ANL ENCODER DECODER RADIO INT <b>More</b>
Tune Freq 2 <b>469.887500</b> MHz	IF Filter <b>15 kHz</b>	Filter 1 <b>&lt;20Hz HPF</b>	AFGen1 Lvl 5 <b>83.0</b> dBuV	
TX Pwr Zero <b>Zero</b>	Ext TX Key <b>On/Off</b>	Filter 2 <b>15kHz LPF</b>		
		De-Emphasis <b>750 us/Off</b>		
		Detector <b>Pk+-Max</b>		

### High Channel (Final Test Modulation Configuration)



**2.1046(a) – Measurement Required:RF Power Output**

§2.1046(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

§2.1033(c)(8). The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range.

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**Test Conditions:**

<b>Sample Number:</b>	COM 400	<b>Temperature:</b>	22°C
<b>Date:</b>	September 17, 2009	<b>Humidity:</b>	70%
<b>Modification State:</b>	Modulated as per 2.1049(c)(1)	<b>Tester:</b>	FSCustodio
		<b>Laboratory:</b>	Nemko

**Test Results:**

See attached plots

**Additional Observations:**

- This is a conducted test. The EUT was connected to the RF communication test set (HP8920A) via a very low loss cable. The EUT has a test antenna port switchable inside the EUT disabling the integral antenna.
- The EUT was modulated as per §2.1049(c)(1).
- Detector was set to peak (max).

Frequency (MHz)	RF Power (mW)
468.4875 – Low Channel	49.9
469.1375– Mid Channel	53.4
469.8875– High Channel	54.1



HP 8920A RF Communications Test Set: 09/17/09 12:36:00 PM  
 Measurements HELD. Enter HOLD again to resume.

TX TEST				
TX Frequency <b>MHz</b> <b>468.487245</b>		FM Deviation <b>kHz</b> <b>3.170</b>		
TX Power <b>W</b> <b>0.0499</b>		AF Freq <b>kHz</b> <b>2.50119</b>		
Tune Mode 1 <b>Auto/Manual</b>	Input Port <b>RF In/Ant</b>	AF Anl In 3 <b>FM Demod</b>	AFGen1 Freq 4 <b>2.5000</b> kHz	To Screen <b>RF GEN</b>
Tune Freq 2 <b>468.487500</b> MHz	IF Filter <b>15 kHz</b>	Filter 1 <b>&lt;20Hz HPF</b>	AFGen1 Lvl 5 <b>83.5</b> dBuV	<b>RF ANL</b>
TX Pwr Zero <b>Zero</b>	Ext TX Key <b>On/Off</b>	Filter 2 <b>15kHz LPF</b>		<b>AF ANL</b>
		De-Emphasis <b>750 us/Off</b>		<b>SCOPE</b>
		Detector <b>Pk+-Max</b>		<b>SPEC ANL</b>
				<b>ENCODER</b>
				<b>DECODER</b>
				<b>RADIO INT</b>
				<b>More</b>

**Low Channel**

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HP 8920A RF Communications Test Set: 09/17/09 12:29:00 pm  
 Measurements HELD. Enter HOLD again to resume.

TX TEST				
TX Frequency <b>MHz</b> <b>469.137204</b>		FM Deviation <b>kHz</b> <b>3.273</b>		
TX Power <b>W</b> <b>0.0534</b>		AF Freq <b>kHz</b> <b>2.49905</b>		
Tune Mode 1 <b>Auto/Manual</b>	Input Port <b>RF In/Ant</b>	AF An1 In 2 <b>FM Demod</b>	AFGen1 Freq <b>2.5000</b> kHz	To Screen <b>RF GEN</b>
Tune Freq 2 <b>469.137500</b> MHz	IF Filter <b>15 kHz</b>	Filter 1 <b>&lt;20Hz HPF</b>	AFGen1 Lvl <b>80.0</b> dBuV	<b>RF ANL</b>
TX Pwr Zero <b>Zero</b>	Ext TX Key <b>On/Off</b>	Filter 2 <b>15kHz LPF</b>		<b>AF ANL</b>
		De-Emphasis <b>750 us/Off</b>		<b>SCOPE</b>
		Detector <b>Pk+-Max</b>		<b>SPEC ANL</b>
				<b>ENCODER</b>
				<b>DECODER</b>
				<b>RADIO INT</b>
				<b>More</b>

**Mid Channel**

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HP 8920A RF Communications Test Set: 09/17/09 12:17:00 pm  
 Measurements HELD. Enter HOLD again to resume.

TX TEST				
TX Frequency <b>MHz</b> <b>469.887325</b>		FM Deviation <b>kHz</b> <b>3.260</b>		
TX Power <b>W</b> <b>0.0541</b>		AF Freq <b>kHz</b> <b>2.50050</b>		
Tune Mode 1 <b>Auto/Manual</b>	Input Port <b>RF In/Ant</b>	AF An1 In 2 <b>FM Demod</b>	AFGen1 Freq 4 <b>2.5000</b> kHz	To Screen RF GEN RF ANL AF ANL SCOPE SPEC ANL ENCODER DECODER RADIO INT <b>More</b>
Tune Freq 2 <b>469.887500</b> MHz	IF Filter <b>15 kHz</b>	Filter 1 <b>&lt;20Hz HPF</b>	AFGen1 Lvl 5 <b>83.0</b> dBuV	
TX Pwr Zero <b>Zero</b>	Ext TX Key <b>On/Off</b>	Filter 2 <b>15kHz LPF</b>		
		De-Emphasis <b>750 us/Off</b>		
		Detector <b>Pk+-Max</b>		

**High Channel**

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**§2.1033(c)(8) – DC voltages and currents applied to the several elements of the final radio frequency amplifying device.**

**Frequency Range: Transmit:** 468.4875 to 469.8875 MHz

**Receive:** 457.5125 to 467.6125 MHz

**Maximum Power Rating:** 50 mW

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**DC Voltages applied to dc currents into the final radio frequency amplifying device for normal operation over the power range:**

Final gain stage on the transmit strip is Q3.

Q3 collector is 5 Vdc

Q3 collector current is 20 mA

Q3 base is 3.5 Vdc

Q3 base current is 1 mA

**Description of all circuitry and devices provided for determining and stabilizing frequency:**

Transmit frequency is determined by phase locked loop on the 1<sup>st</sup> mixer (IC2) IC on the transceiver board.

**Description of circuits or devices employed for suppression of spurious radiation, for limiting modulation, and for limiting power:**

Modulation is limited by the AK2345 tone chip IC6 on the transceiver board. The IC has an internal limiter circuit. Power is limited by the supply voltage. Spurious signals are suppressed by saw filter (FL2) and by out filter (L9, L10, L11, C167, C158, C40, C41, C42).





**2.1047(a) – Audio Frequency Response**

§2.1047(a) *Voice modulated communication equipment.* A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

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**Conditions:**

Sample Number:	COM 400	Temperature:	21°C
Date:	September 18, 2009	Humidity:	65%
Modification State:		Tester:	FSCustodio
		Laboratory:	Nemko

**Observations:**

- Test procedure is per Section 2.2.6.2.2 Constant Input Test Method (300Hz to 3000Hz) of TIA-603-B:2002 Land Mobile FM or PM Communications Equipment. Measurement and Performance Standards.
- Due to sub audible tones used for control (CTCSS Continuous Tone Controlled Squelch System) the EUT has a lower end frequency of 300Hz for audio.
- Evaluation was made from 100Hz to 5000Hz.
- Evaluation was performed on High channel.

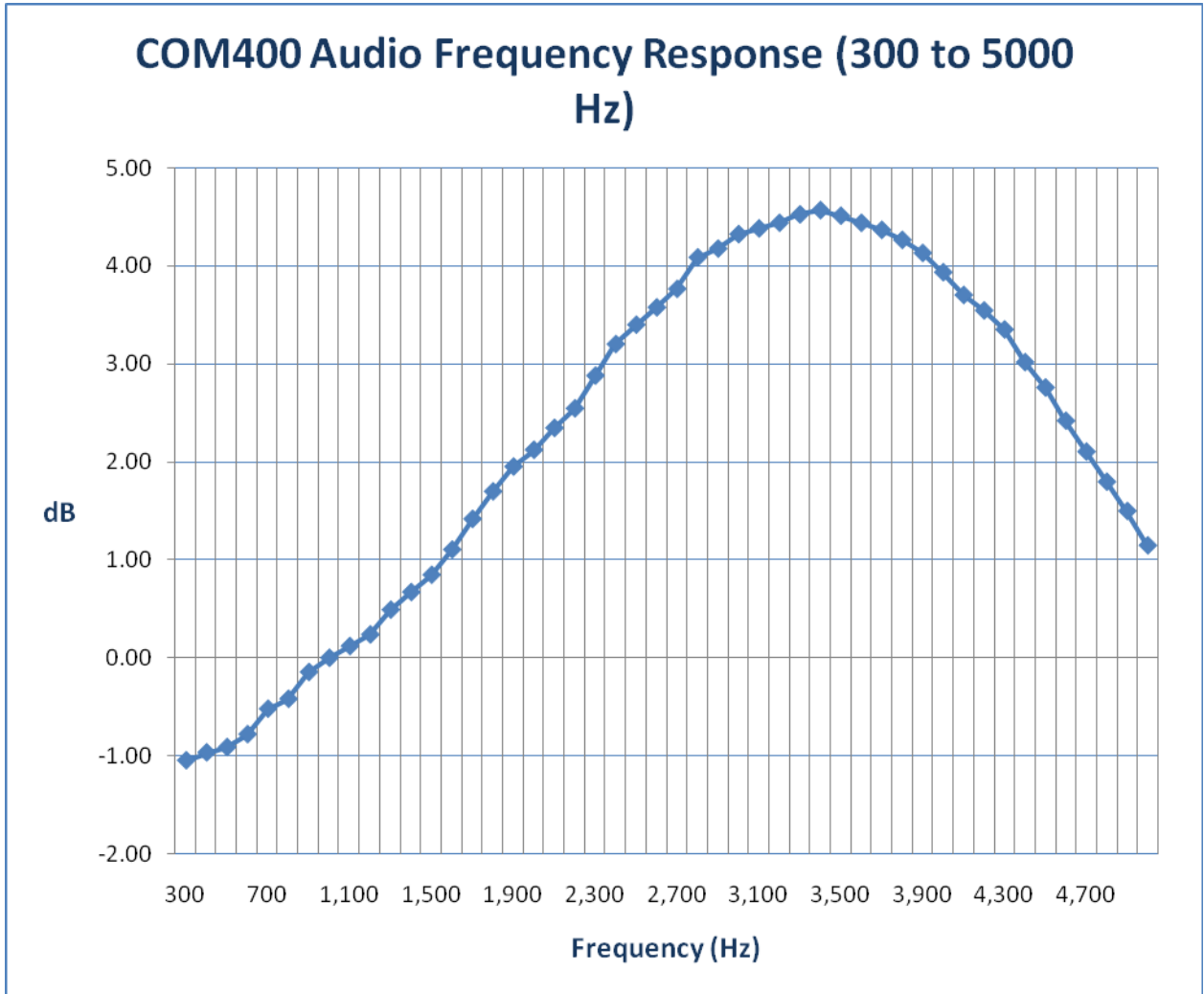
Frequency (Hz)	FM Deviation (Hz)	Audio Frequency Response (dB)
100	<320	<-1dB
200	<320	<-1dB
300	320	-1.05
400	323	-0.97
500	325	-0.91
600	330	-0.78
700	340	-0.52
800	344	-0.42
900	355	-0.15
<b>1000 (Reference)</b>	<b>361</b>	<b>0.00</b>
1100	366	0.12
1200	371	0.24
1300	382	0.49
1400	390	0.67



1500	398	0.85
1600	410	1.11
1700	425	1.42
1800	439	1.70
1900	452	1.95
2000	461	2.12
2100	473	2.35
2200	484	2.55
2300	503	2.88
2400	522	3.20
2500	534	3.40
2600	545	3.58
2700	557	3.77
2800	578	4.09
2900	584	4.18
3000	594	4.33
3100	598	4.38
3200	602	4.44
3300	608	4.53
3400	611	4.57
3500	607	4.51
3600	602	4.44
3700	597	4.37
3800	590	4.27
3900	581	4.13
4000	568	3.94
4100	553	3.70
4200	543	3.55
4300	531	3.35
4400	511	3.02
4500	496	2.76
4600	477	2.42
4700	460	2.11
4800	444	1.80
4900	429	1.50
5000	412	1.15



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**2.1047(b) – Modulation Limiting**

(b) *Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.*

**Conditions:**

Sample Number:	COM 400	Temperature:	21°C
Date:	September 21 and 22, 2009	Humidity:	64%
Modification State:	High Channel	Tester:	FSCustodio
		Laboratory:	Nemko

**Observations:**

- Test procedure is per Section 2.2.3 Modulation Limiting of TIA-603-B:2002 Land Mobile FM or PM Communications Equipment. Measurement and Performance Standards.
- Item (e) of test procedure was updated by increasing the audio input level 1dB at a time until 16dB above 50% of full rated system deviation is achieved.
- Measurements were made using 300Hz, 1000Hz and 2500Hz family of curves.
- Measurements were performed using both peak positive and peak negative deviation detector.
- The resulting data were plotted using frequency deviation versus input level graph.
- Investigation was made on high channel only.





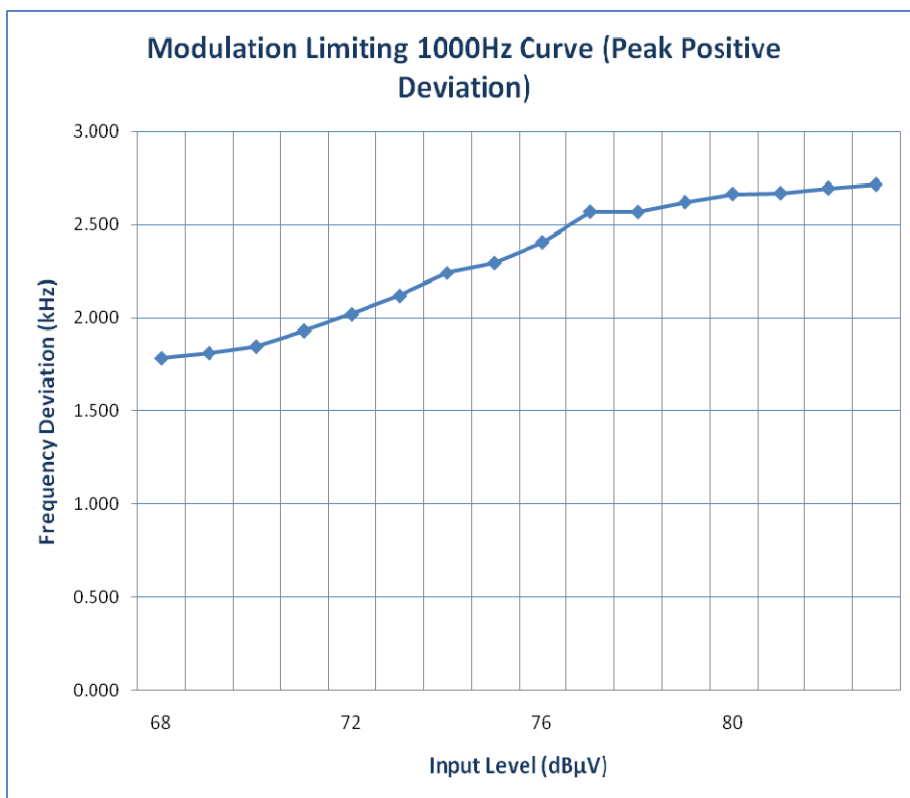
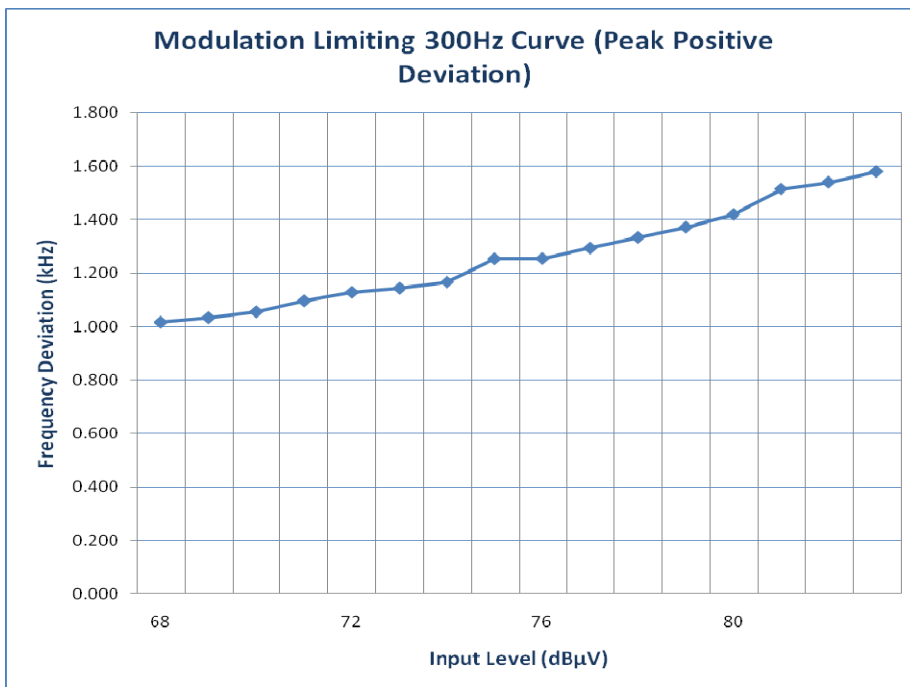
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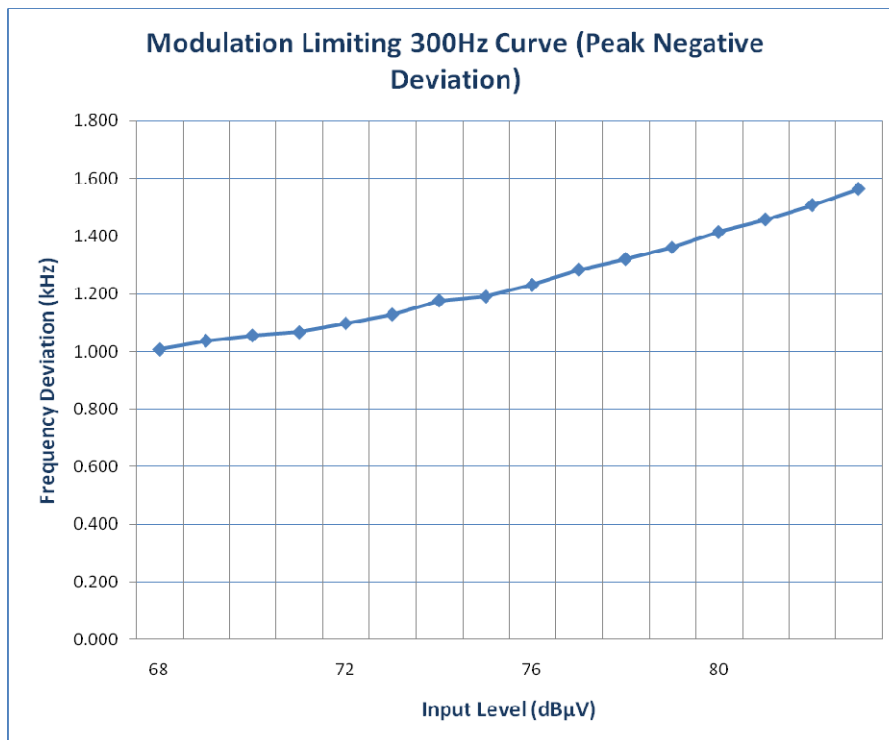
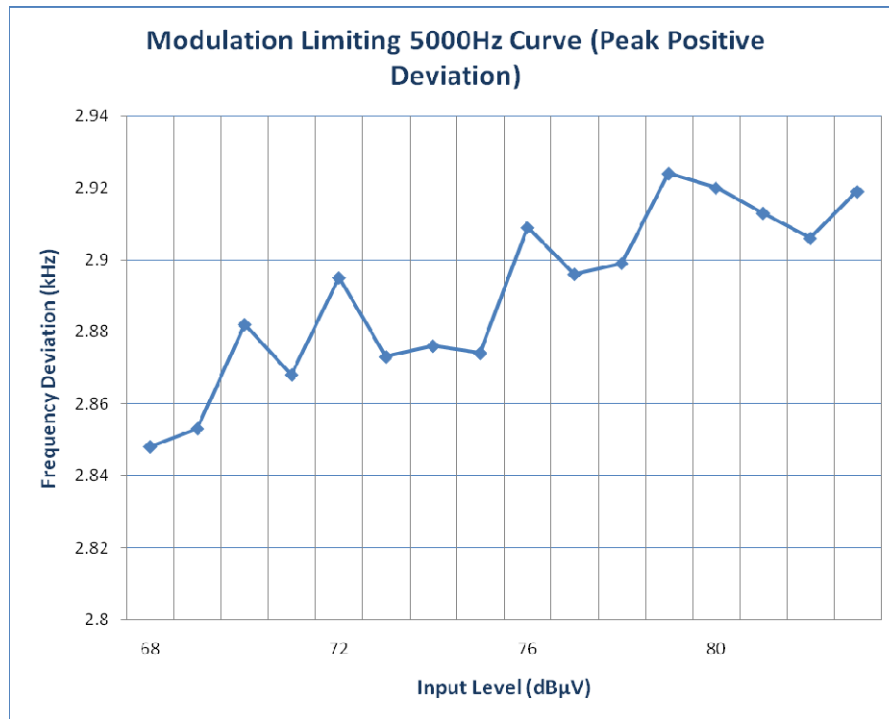
Audio Input Level (dBμV)	Peak Positive Deviation (300Hz)	Peak Positive Deviation (1000Hz)	Peak Positive Deviation (2500Hz)
68	1.017	1.786	2.848
69	1.034	1.814	2.853
70	1.056	1.849	2.882
71	1.097	1.933	2.868
72	1.129	2.020	2.895
73	1.144	2.120	2.873
74	1.167	2.241	2.876
75	1.254	2.295	2.874
76	1.255	2.407	2.909
77	1.294	2.570	2.896
78	1.334	2.568	2.899
79	1.372	2.622	2.924
80	1.420	2.666	2.92
81	1.515	2.670	2.913
82	1.540	2.696	2.906
83	1.580	2.716	2.919

Audio Input Level (dBμV)	Peak Negative Deviation (300Hz)	Peak Negative Deviation (1000Hz)	Peak Negative Deviation (2500Hz)
68	1.008	1.750	3.195
69	1.038	1.804	3.147
70	1.056	1.860	3.151
71	1.067	1.937	3.157
72	1.098	2.016	3.169
73	1.129	2.097	3.197
74	1.177	2.232	3.22
75	1.191	2.330	3.208
76	1.231	2.422	3.216
77	1.284	2.550	3.24
78	1.321	2.586	3.221
79	1.361	2.658	3.243
80	1.414	2.679	3.231
81	1.458	2.712	3.249
82	1.508	2.728	3.241
83	1.564	2.747	3.277

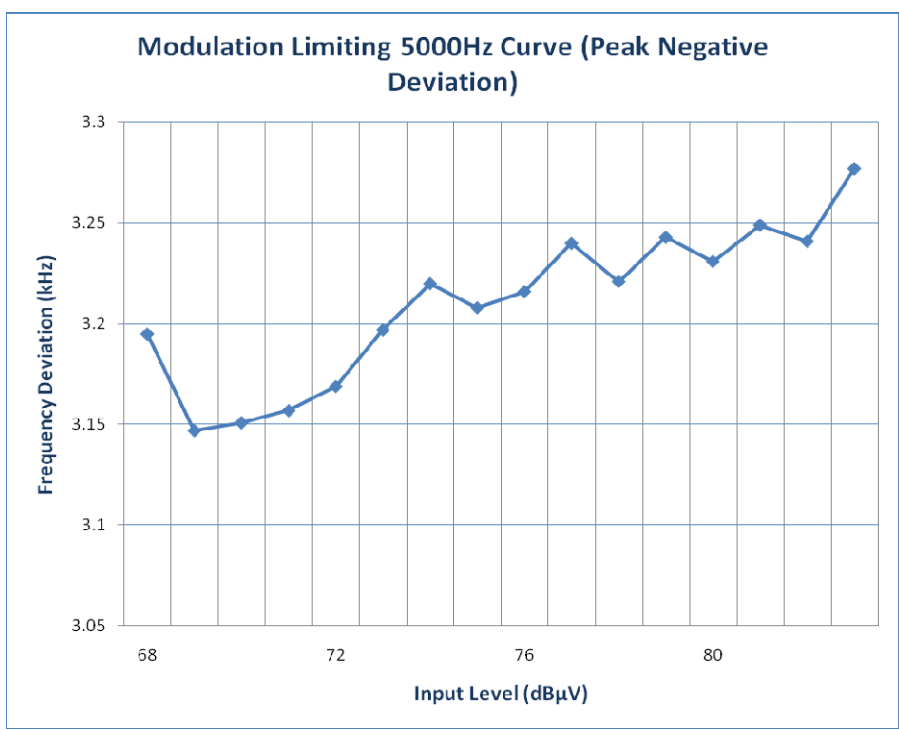
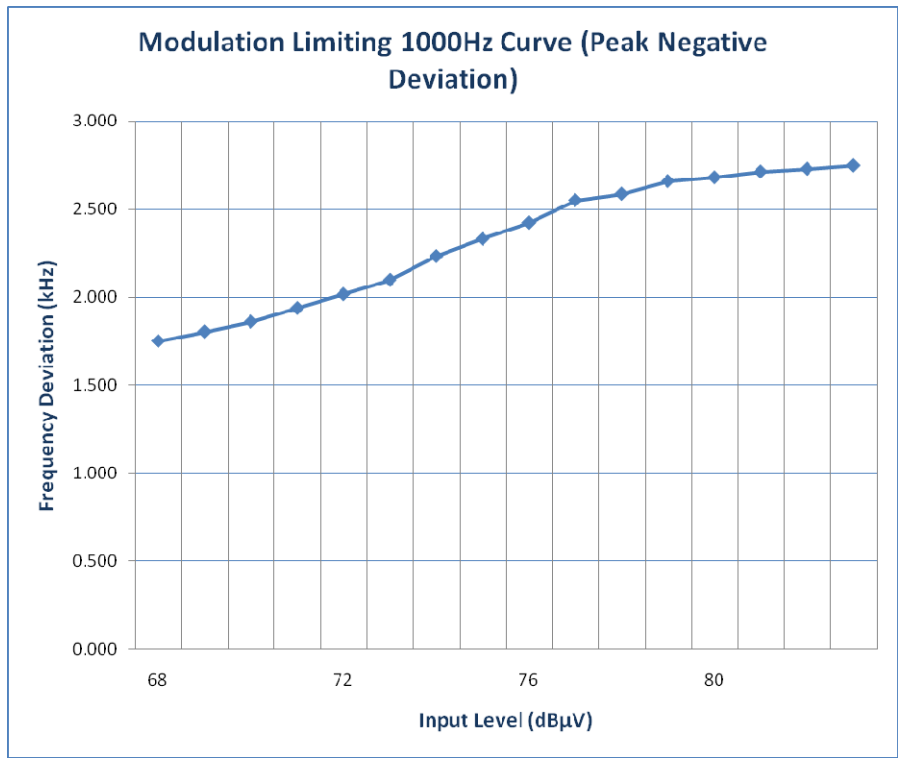


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### 2.1049(c)(1) – Occupied Bandwidth

§2.1049(c). Radiotelephone transmitters equipped with a device to limit modulation or peak envelope power shall be modulated as follows. For single sideband and independent sideband transmitters, the input level of the modulating signal shall be 10 dB greater than that necessary to produce rated peak envelope power.

(1) Other than single sideband or independent sideband transmitters—when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

§90.217 (b) For equipment designed to operate with a 12.5 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 25 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.

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#### Test Conditions:

Sample Number:	COM 400	Temperature:	22°C
Date:	September 21, 2009	Humidity:	70%
Modification State:		Tester:	FSCustodio
		Laboratory:	Nemko

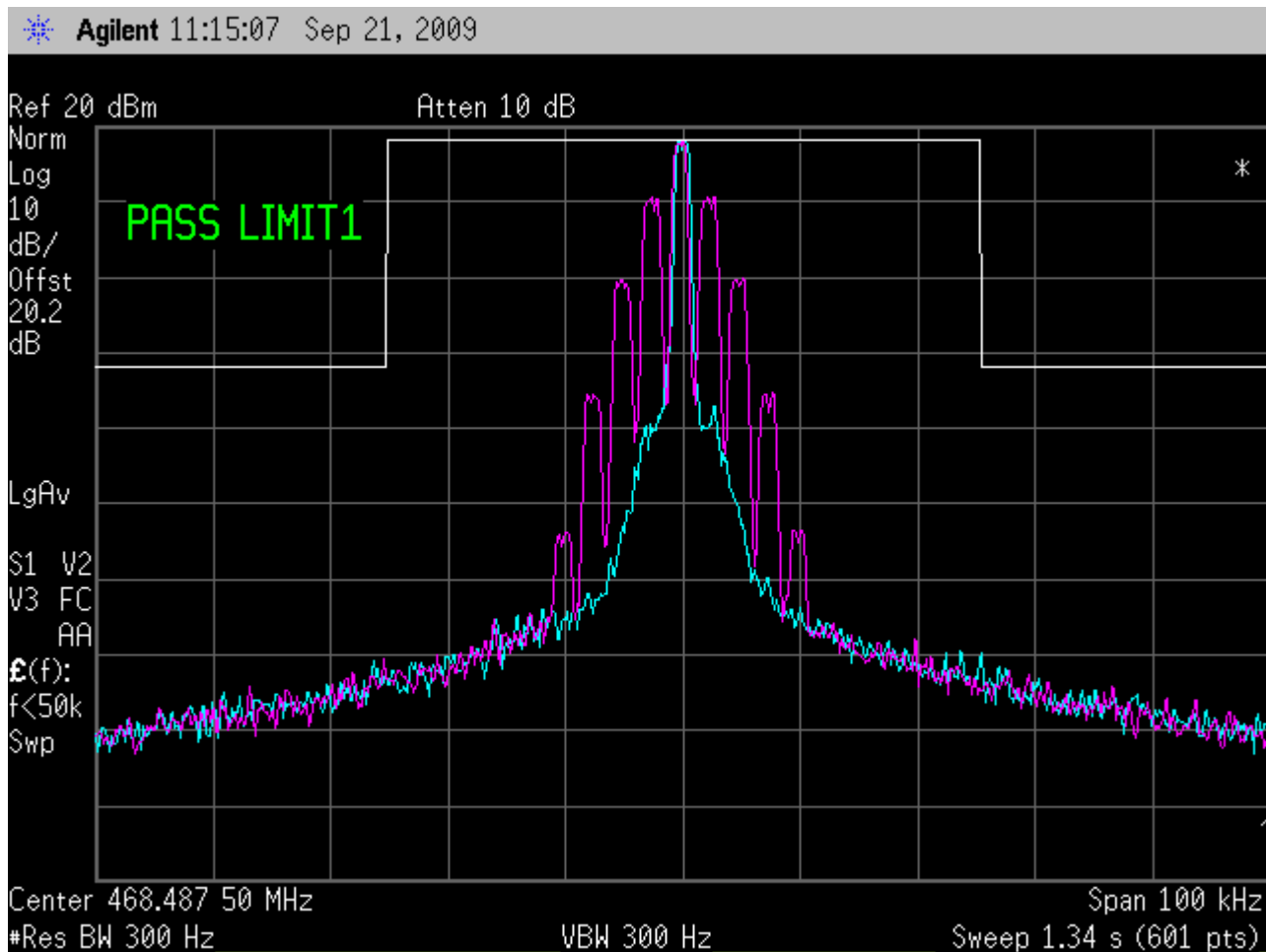
#### Test Results:

See attached plots

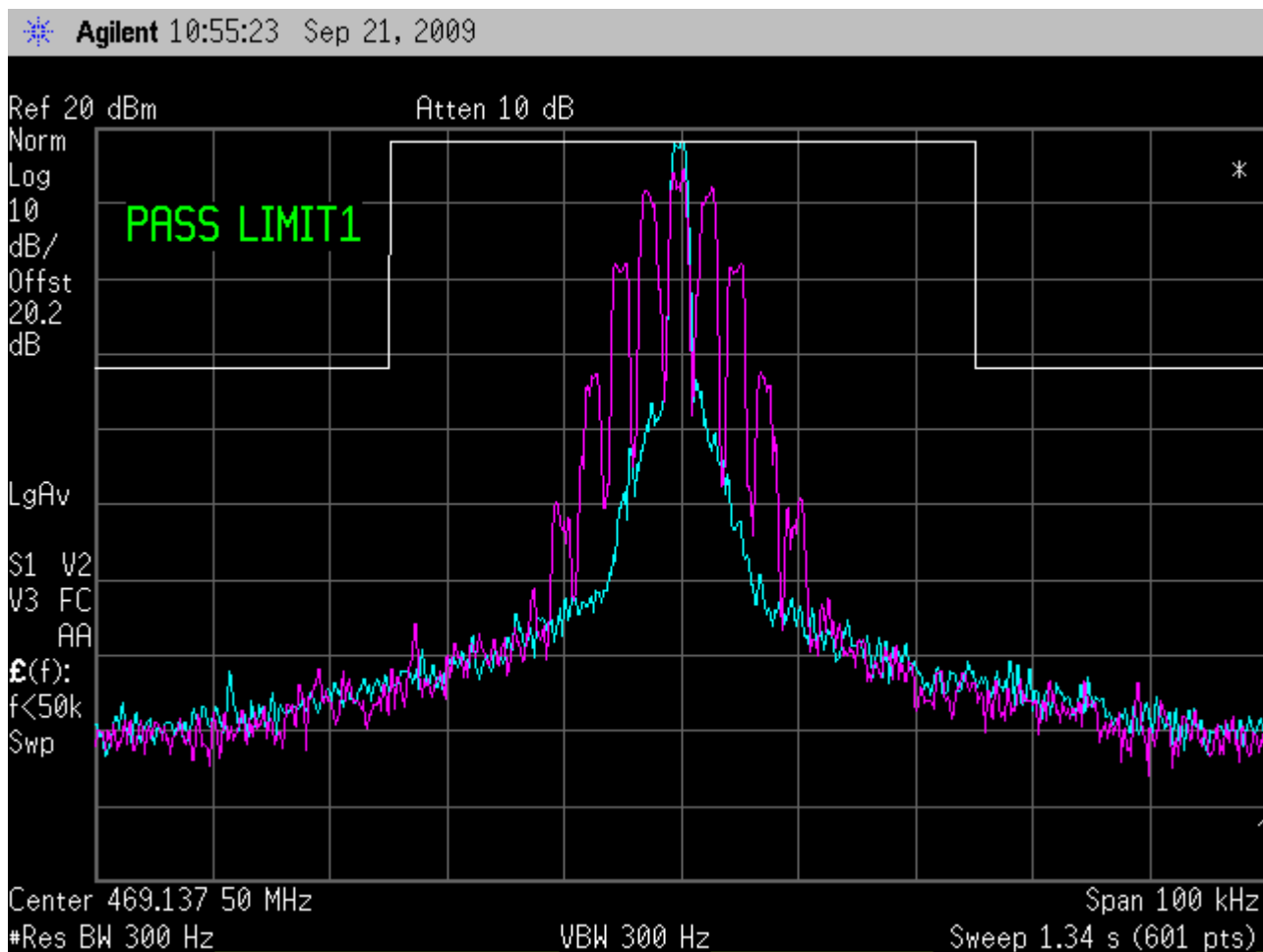
#### Additional Observations:

- RBW set to 300Hz with a span of 100 kHz.
- Off-set is from external attenuator and cable used.
- Set the EUT to transmit unmodulated. The peak of this trace will be the reference level when the emission mask of §90.217(b) is applied.
- Apply the modulation requirement as per §2.1049(c)(1).
- Set the trace to max hold and verify that it complies with the emission mask.

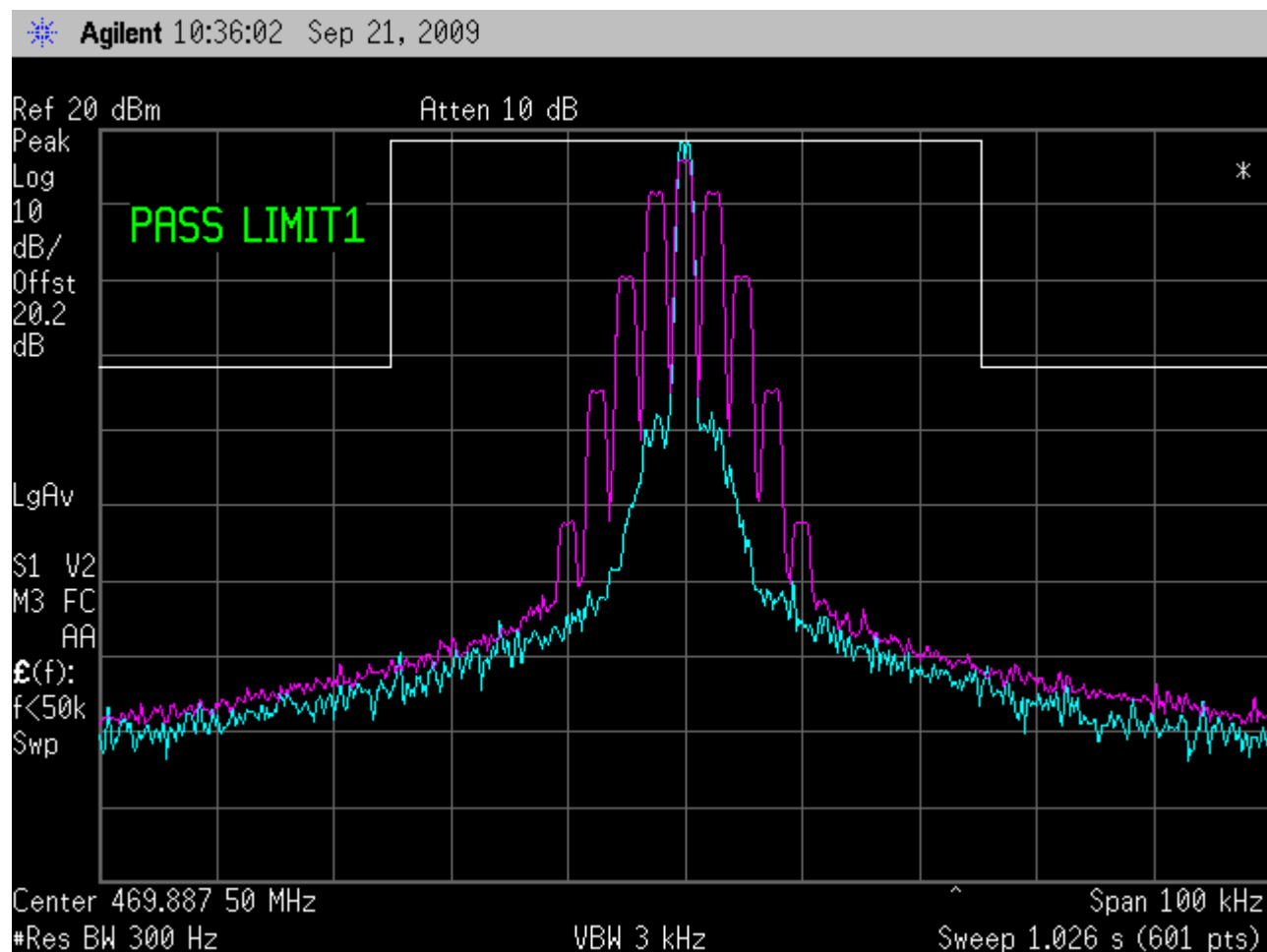




Low Channel



Mid Channel



High Channel



**2.1051 – Measurements required: Spurious emissions at antenna terminals.**

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

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**Test Conditions:**

Sample Number:	COM 400	Temperature:	22°C
Date:	September 17, 2009	Humidity:	70%
Modification State:		Tester:	FSCustodio
		Laboratory:	Nemko

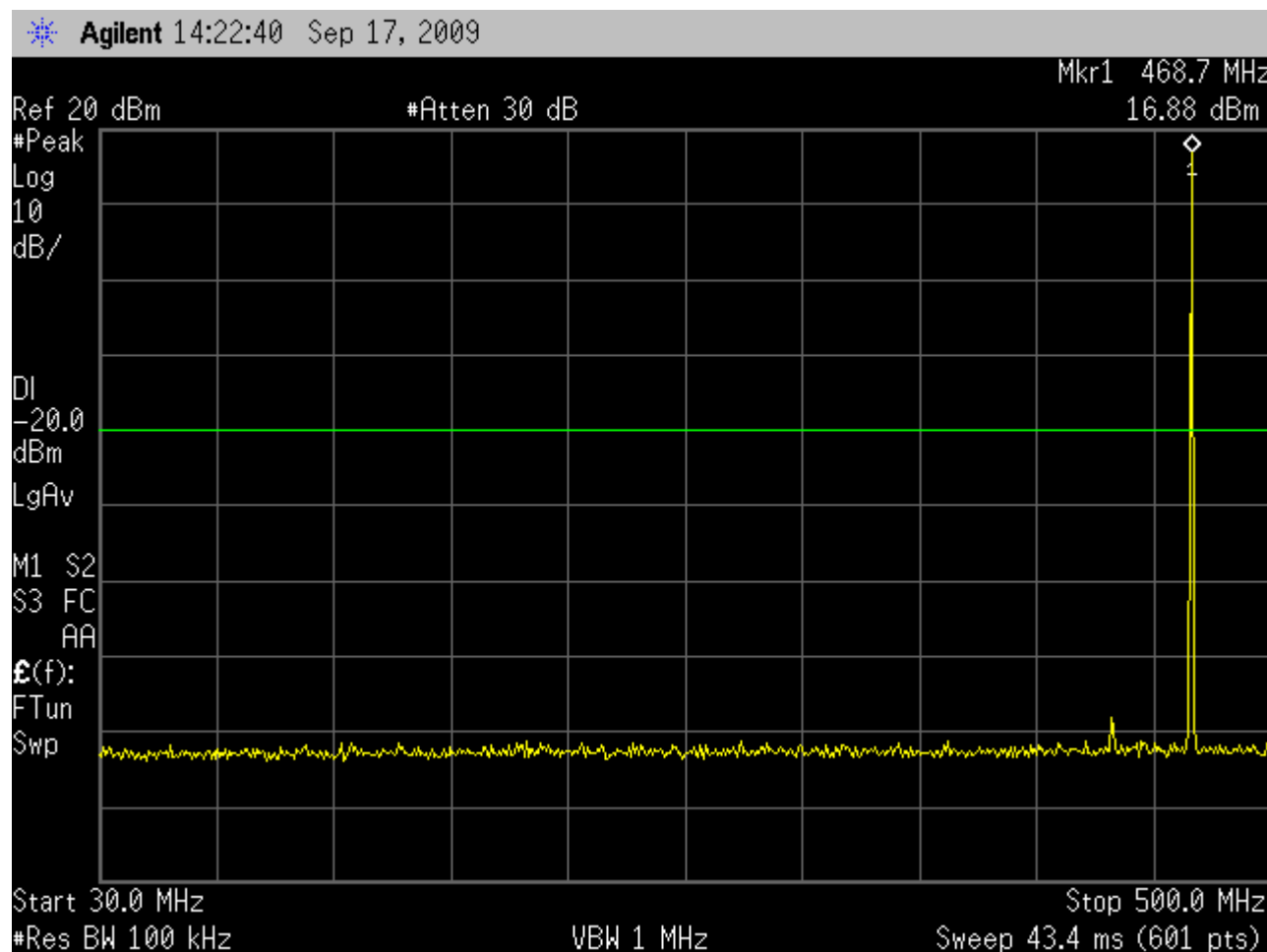
**Test Results:**

See attached plots (Mid and High channel data are located at Appendix B)

**Additional Observations:**

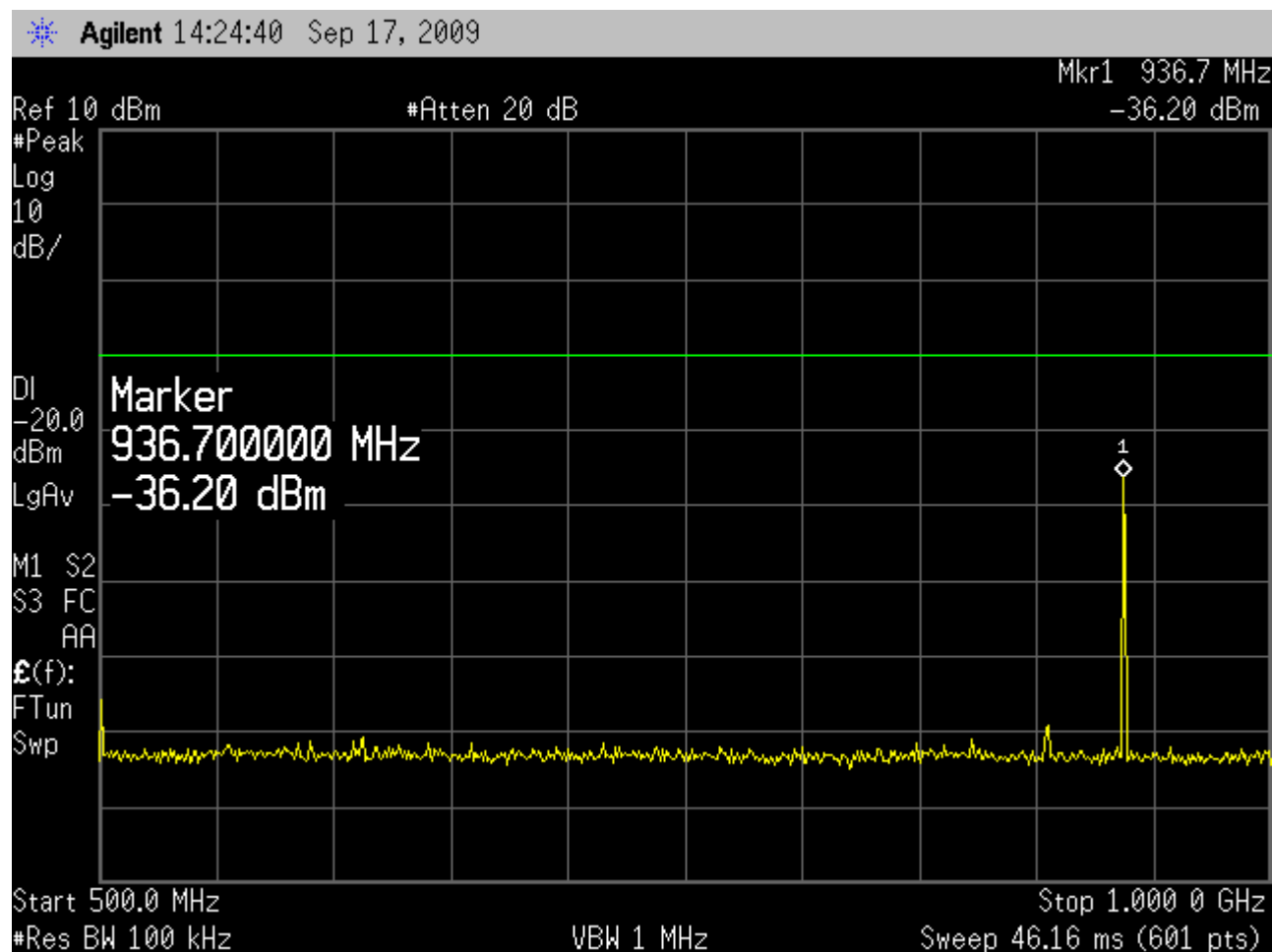
- RBW set to 100kHz.
- Spectrum investigated from 30MHz to 5000MHz.
- The modulation requirement as per §2.1049(c)(1) was used for this investigation.
- The EUT was connected to the spectrum analyzer via a very low loss cable.
- Limit is 30dB below the peak of the carrier frequency as per §90.217(b). There are no emissions within 20dB below the limit. For low channel (presented), limit will be -13.12dBm. The highest spurious emission observed was the second harmonic @ -36.2dBm.
- For mid channel, limit is -12.88dBm and the highest spurious observed was the second harmonic @ -35.29dBm.
- For high channel, limit is -12.88dBm and the highest spurious observed was the second harmonic @ -35.75dBm.





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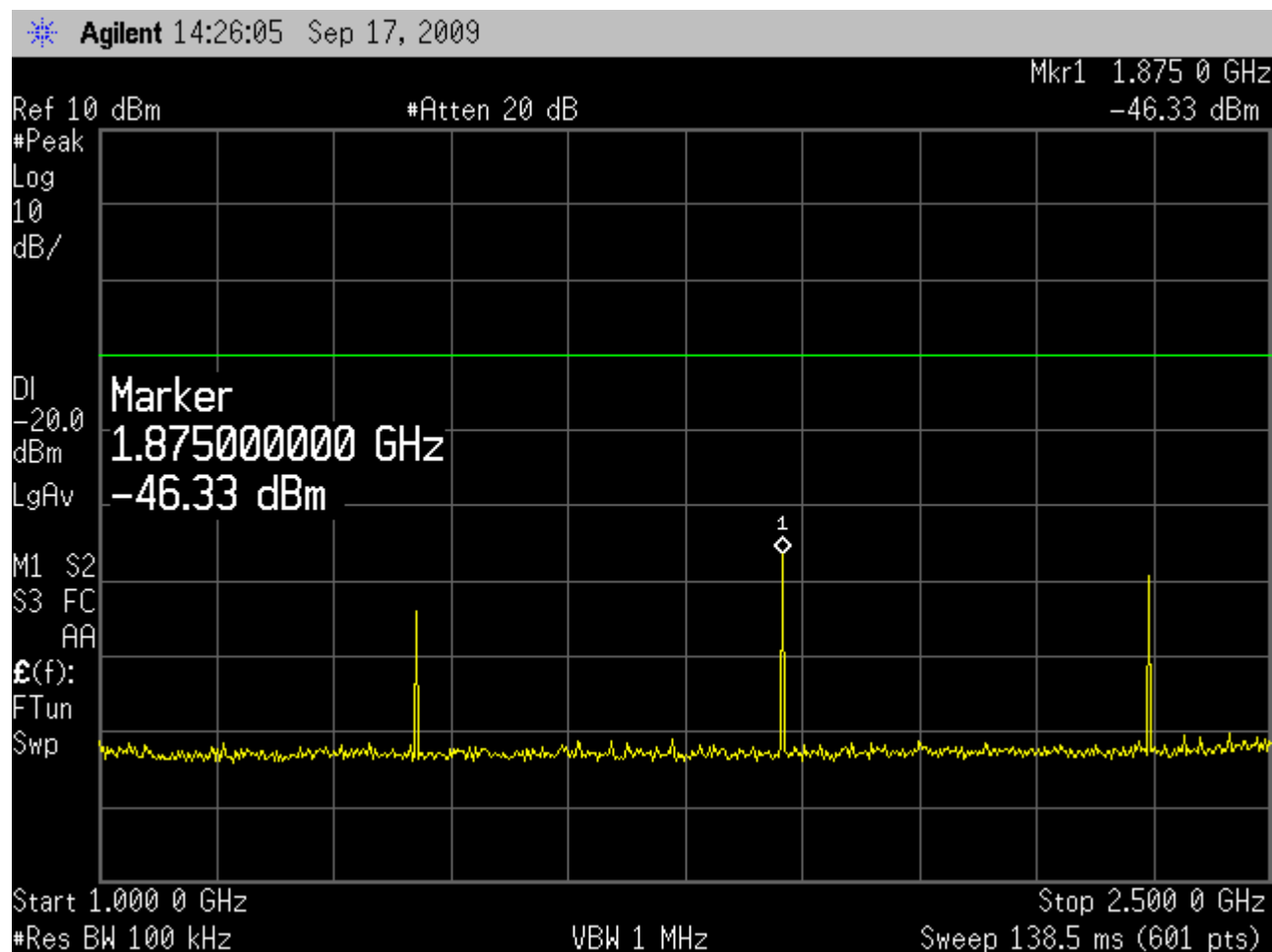
Low Channel (30 to 500MHz plot)



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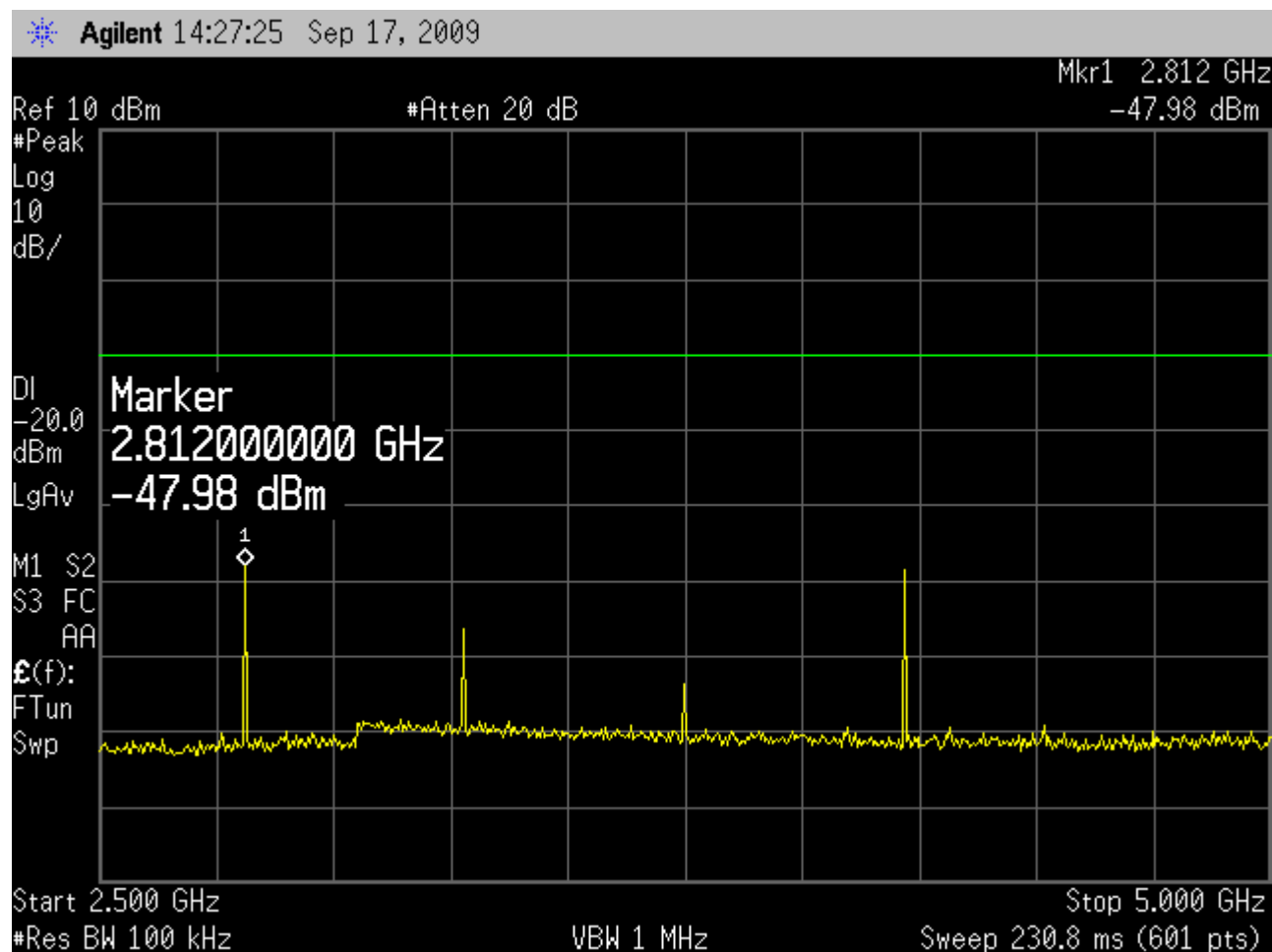
Low Channel (500 to 1000MHz plot)





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Low Channel (1000 to 2500MHz plot)



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Low Channel (2500 to 5000MHz plot)



**2.1053 – Measurements required: Field strength of spurious radiation.**

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

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**Test Conditions:**

Sample Number:	COM 400	Temperature:	31°C
Date:	September 24, 2009 and October 5, 2009	Humidity:	18%
Modification State:	High Channel	Tester:	FSCustodio
		Laboratory:	SOATS

**Test Results:**

See attached plots

**Additional Observations:**

- Spectrum investigated from 30MHz to 5000MHz.
- The Field Strength of Spurious Radiation Limit is obtained by the following:
  1. Reference level is the carrier level. Therefore P=0.0541 Watts.
  2. It is assumed this power is to be fed to a half-wave tuned dipole. Therefore dBi gain is 2.15.
  3. Using the formula:  $V/m = \sqrt{(30 \times P \times 10^{(dBi/10)})} / \text{distance in meters}$ , we get  $V/m_{3m} = 0.5439 \text{ V/m}$  or  $114.7 \text{ dB}\mu\text{V/m}$
  4. However according to §90.217(b), all signals must be attenuated by 30dB below the unmodulated carrier, therefore the limit for spurious emissions for a test distance of 3 meters is:  $114.7 - 30 = 84.7 \text{ dB dB}\mu\text{V/m}$
- Emissions detected within 20dB of the limit were proved by substitution.





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**Radiated Emissions Data**

Job # : 135005 Date : Sept. 24, 2009 Page 1 of 1  
 NEX# : 127346 Time : 8AM  
 Staff : FSC

Client Name : HM Electronics EUT Voltage : 4.8VDC  
 EUT Name : Communicator EUT Frequency : \_\_\_\_\_  
 EUT Model # : COM 400 Phase: \_\_\_\_\_  
 EUT Serial # : 9 NOATS \_\_\_\_\_  
 EUT Config : Transmit @ max power (High Channel) SOATS X  
 Distance < 1000 MHz: 3 m  
 Distance > 1000 MHz: 3 m

Specification : FCC §90.217 and §90.217(b)  
 Loop Ant. # : NA  
 Bicon Ant.# : 128\_3m Temp. (°C) : 31.3  
 Log Ant.# : 111\_3m Humidity (%) : 18  
 DRG Ant. # : 877 Spec Analyzer # : 911  
 Cable LF# : SOATS Analyzer Display # : N/A  
 Cable HF# : SOATS Quasi-Peak Detector # : 911  
 Preamp LF# : 902 Preselector # : N/A  
 Preamp HF# : 317

Quasi-Peak	RBW: 120 kHz
	Video Bandwidth 300 kHz
Peak	RBW: 1 MHz
	Video Bandwidth 3 MHz
Average	RBW: 1 MHz
	Video Bandwidth 10 Hz

Meas. Freq. (MHz)	Meter Reading Vertical	Meter Reading Horizontal	Det.	EUT Side F/L/R/B	Ant. Height m	Max. Reading (dBµV)	Corrected Reading (dBµV/m)	Spec. limit (dBµV/m)	CR/SL Diff. (dB)	Pass Fail	Comment
939.8	33.7	38.3	P	B	1.0	38.3	67.2	84.7	-17.5	Pass	No preamp
1409.6	27.9	31.9	P	B	1.0	31.9	61.8	84.7	-22.9	Pass	No preamp
1879.6	52.8	57.9	P	B	1.0	57.9	59.0	84.7	-25.7	Pass	
2349.3	47.1	51.5	P	B	1.0	51.5	55.9	84.7	-28.8	Pass	
2819.3	51.45	56.6	P	B	1.0	56.6	64.1	84.7	-20.6	Pass	
3289.3	46.3	51.3	P	B	1.0	51.3	60.1	84.7	-24.6	Pass	
3759.1	49.8	49.8	P	B	1.0	49.8	60.3	84.7	-24.4	Pass	Noise Floor
4229.0	48.3	48.3	P	B	1.0	48.3	61.2	84.7	-23.5	Pass	Noise Floor



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**Substitution Method For Radiated Emissions**

Client Name :	<u>HM Electronics</u>	Date :	<u>10/5/2009</u>
EUT Name :	<u>Communicator</u>	Time :	<u>0:00</u>
EUT Model # :	<u>COM 400</u>	Staff :	<u>FSC</u>
EUT Serial # :	<u>9</u>		
EUT Config. :	<u>Transmit @ max power (High Channel)</u>		
Specification :	<u>FCC §90.217 and §90.217(b)</u>		
Log Ant.RX#:	<u>111_3m</u>	Temp. (deg. C)	<u>20</u>
Dipole Ant TX#:	<u>765</u>	Humidity (%)	<u>39</u>
DRG Ant. RX #	<u>877</u>	Location:	<u>SOATS</u>
DRG Ant. TX #	<u>529</u>	Distance:	<u>3m</u>
Cable TX #:	<u>60ft Blue</u>		
Cable RX #:	<u>SOATS</u>		
Preamp#:	<u>317 ( on 2819.3MHz only)</u>	Peak Bandwidth < 1 GHz:	<u>RBW-100kHz, VBW-300kHz</u>
Spec An.#:	<u>911</u>	Peak Bandwidth > 1 GHz:	<u>RBW-1MHz, VBW-1MHz</u>

Frequency mHz	Target		Gain relative to half-wave dipole	cable loss dB	Signal Generator dBm	Total (ERP) dBm	Limit dBm	Margin dBm
	level dBuV/m	Orientation						
938.8	38.3	H	0	7.0	-26.20	-33.17	-12.7	-20.5
1409.6	31.9	H	5.42	8.6	-36.00	-39.14	-12.7	-26.4
2819.3	56.6	H	7.41	12.2	-30.50	-35.29	-12.7	-22.6

**Test Notes:** Reference level is from the transmitter power as radiated by a half wave dipole antenna:

= 10 Log 54.1mW

= 17.3 dBm

Limit is -30 dBc, therefore final limit is:

= 17.3 – 30

= -12.7 dBm



**2.1055 – Measurements required: Frequency stability..**

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30° to +50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

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**Test Conditions:**

Sample Number:	COM 400	Temperature:	21°C
Date:	September 22, 2009	Humidity:	64%
Modification State:	High Channel	Tester:	FSCustodio
		Laboratory:	Nemko

**Test Results:**

See attached graph

**Additional Observations:**

- Frequency stability was investigated from -30°C up to 50°C with 10°C increments.
- Test procedure is per Section 2.2.2 Carrier Frequency Stability of TIA-603-B:2002 Land Mobile FM or PM Communications Equipment. Measurement and Performance Standards.
- The EUT was powered from an external power supply using nominal battery voltage of 4.8VDC.
- A separate measurement at 20°C was also made using the low battery end point voltage of 4.5VDC as specified by the manufacturer.
- PPM Error is computed from the formula:

$$PPM = ((MCF/ACF) - 1) \times 1000000$$

Where:      ACF = Assigned Center Frequency  
                   MCF = Measured Center Frequency  
                   PPM = Parts Per Million

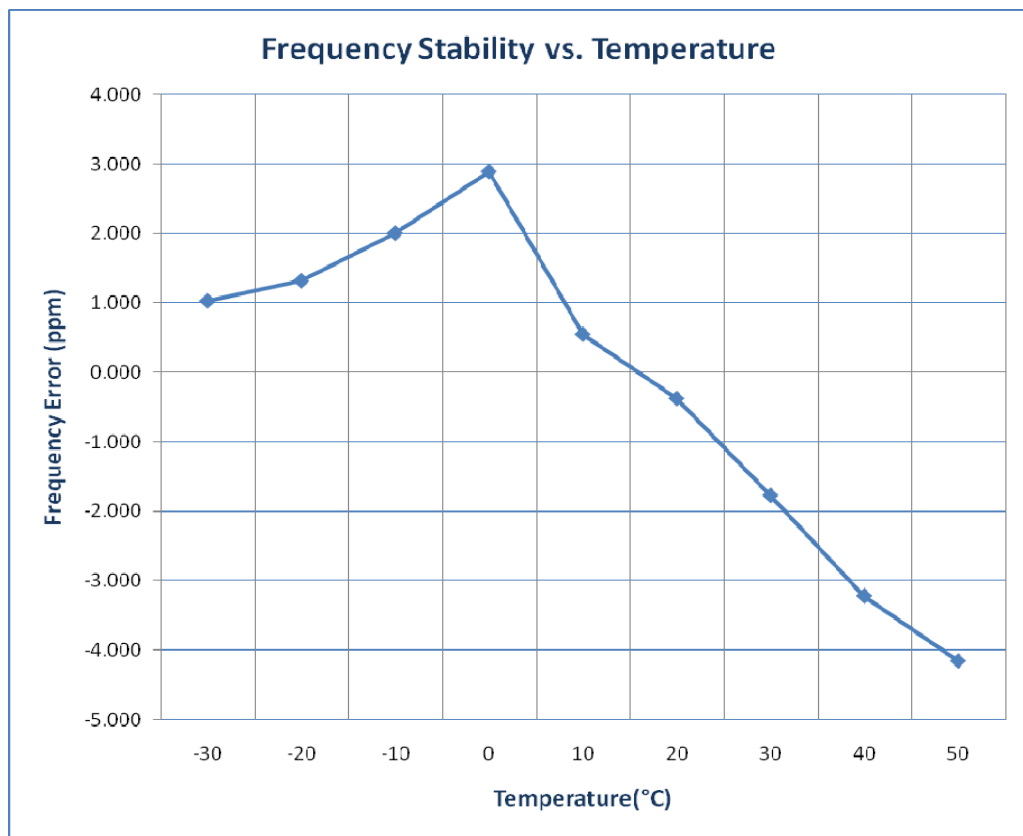




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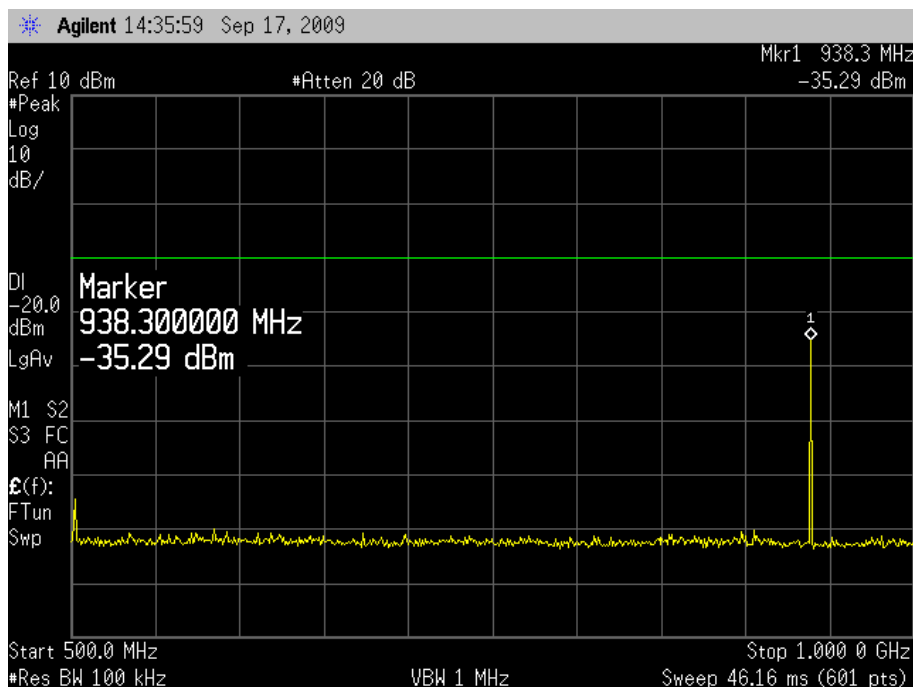
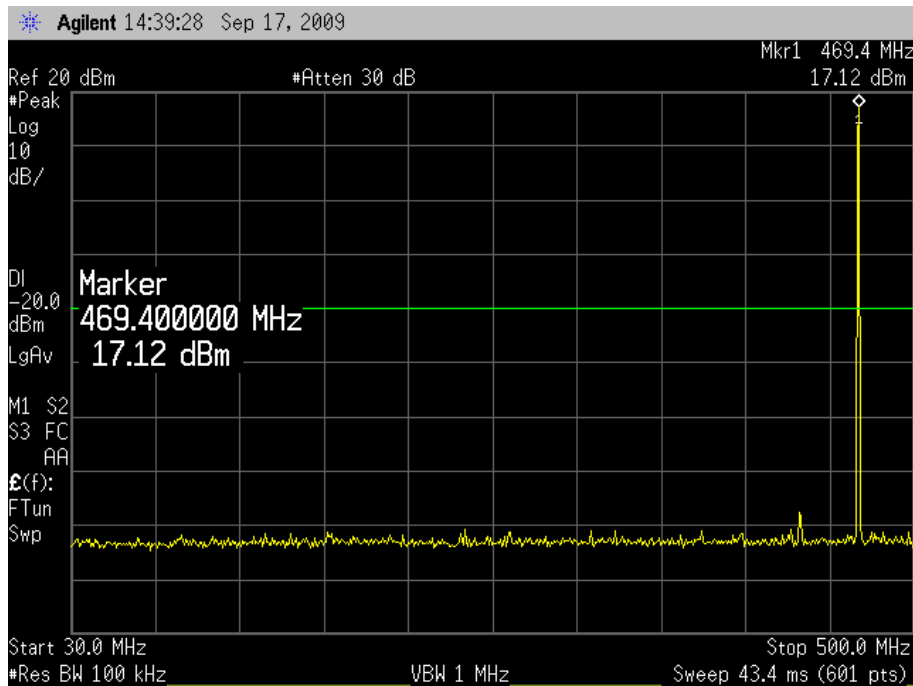
Temperature (°C)	ACF (Hz)	MCF (Hz) @ 4.8VDC	PPM Error
-30	469887500	469887985.000	1.032
-20	469887500	469888121.000	1.322
-10	469887500	469888443.000	2.007
0	469887500	469888859.000	2.892
10	469887500	469887759.000	0.551
20	469887500	469887325.000	-0.372
30	469887500	469886670.000	-1.766
40	469887500	469885990.000	-3.214
50	469887500	469885550.000	-4.150

Temperature (°C)	ACF (Hz)	MCF (Hz) @ 4.5VDC	PPM Error
20	469887500	469887325.000	-0.372



## Appendix B: Spurious Emissions at Antenna Terminals

### Mid Channel Data

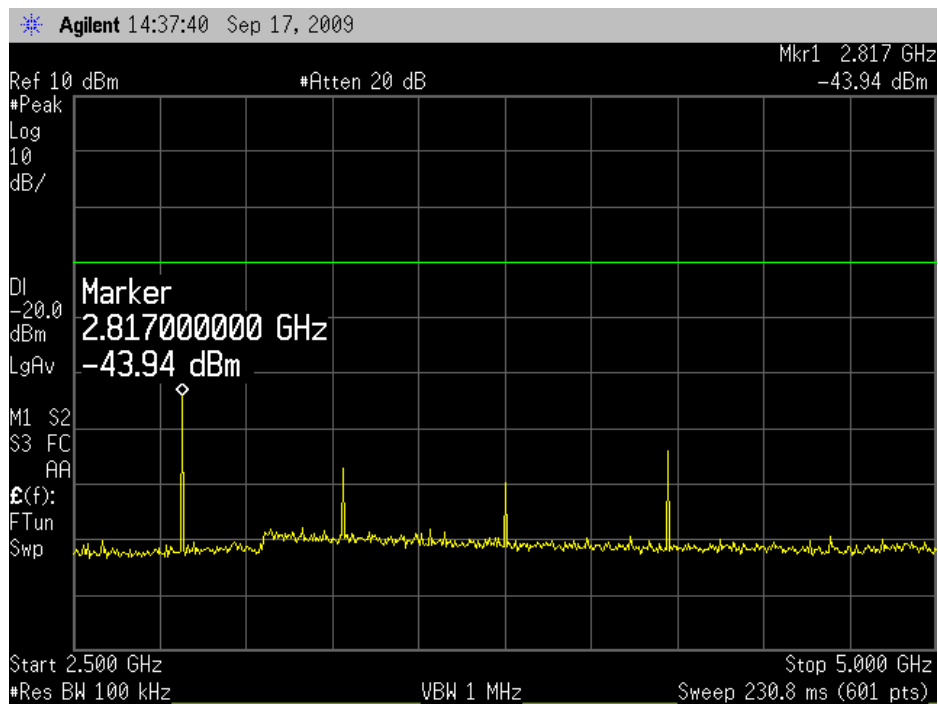
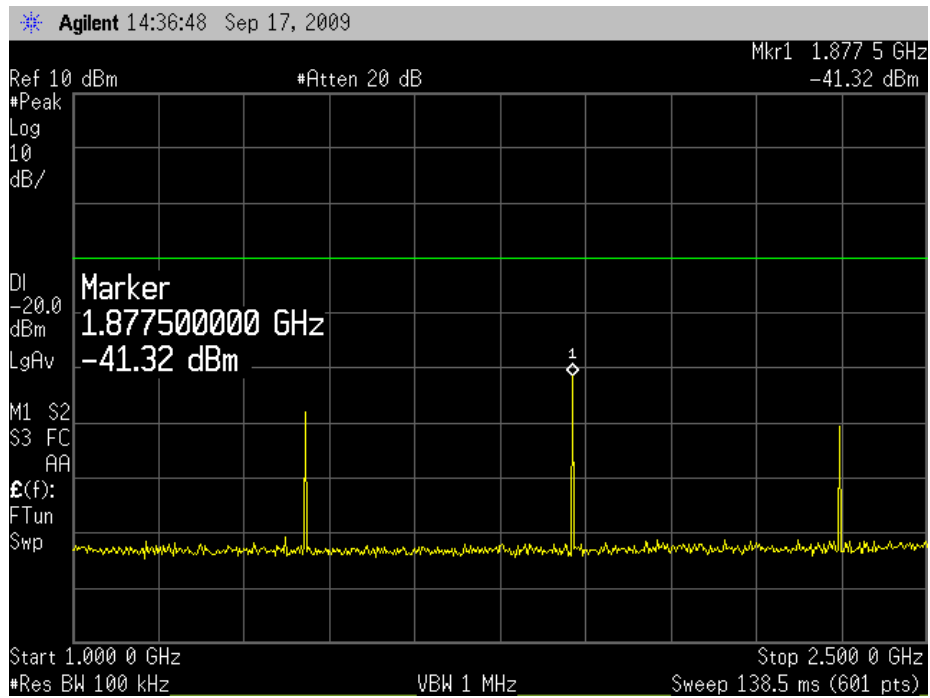


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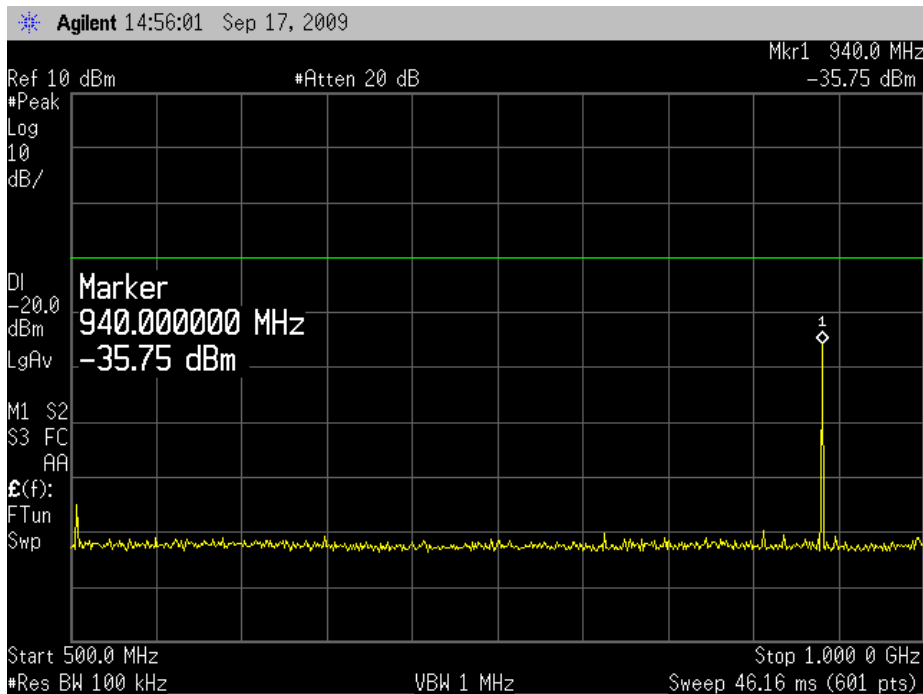
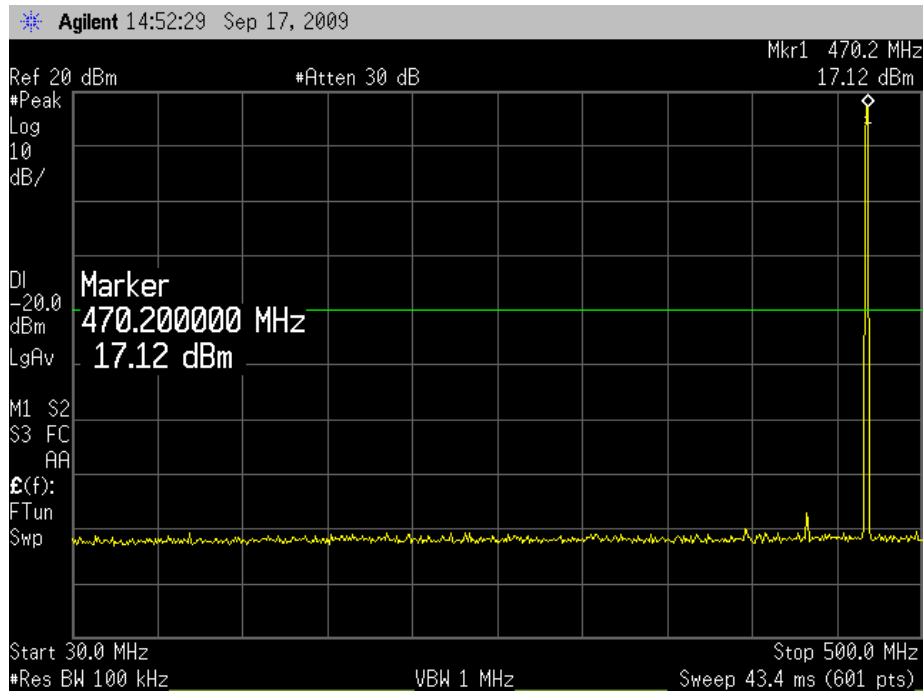




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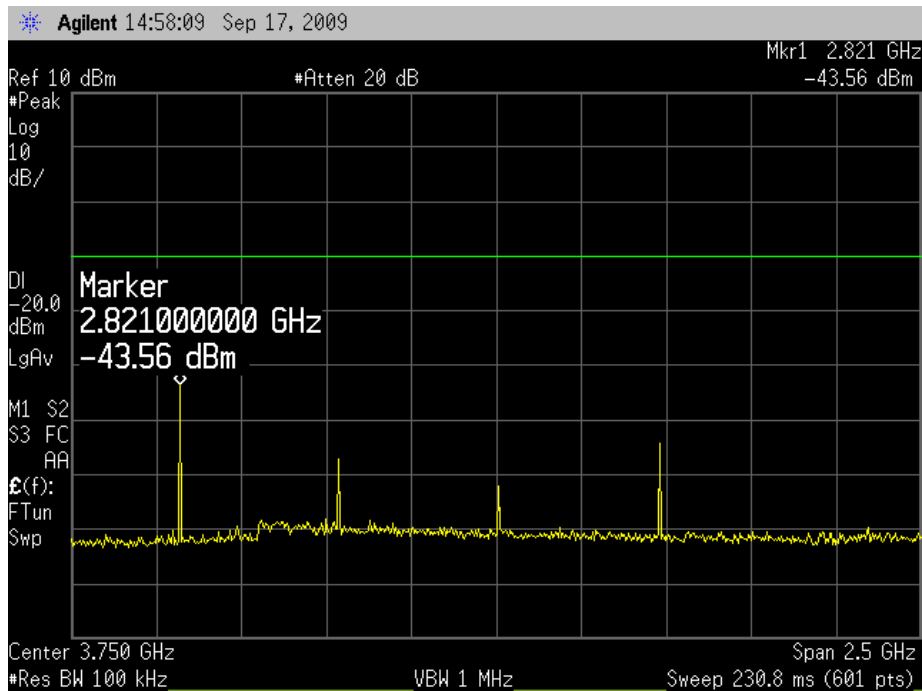
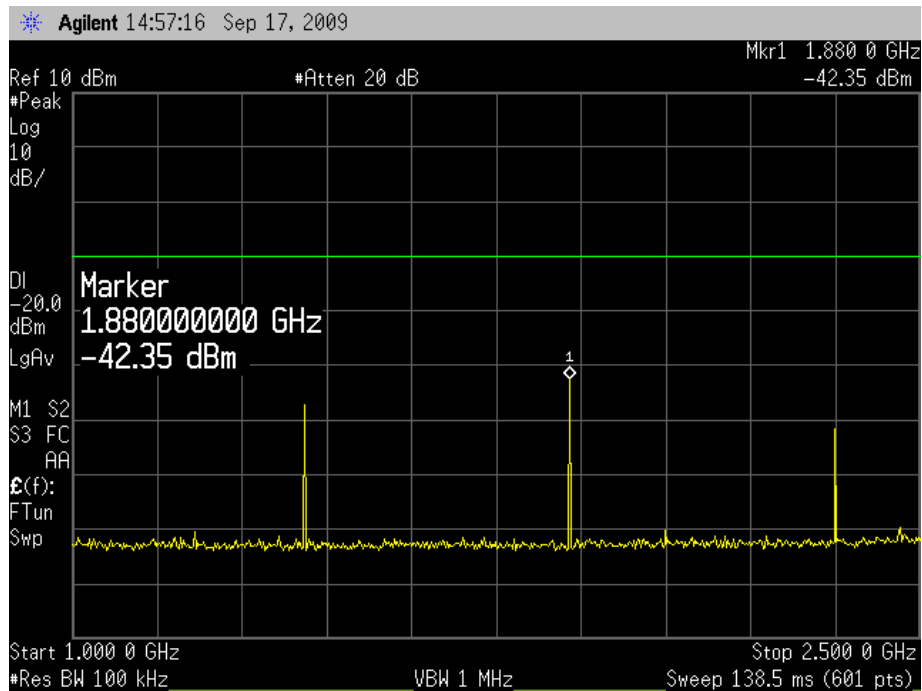
### High Channel Data



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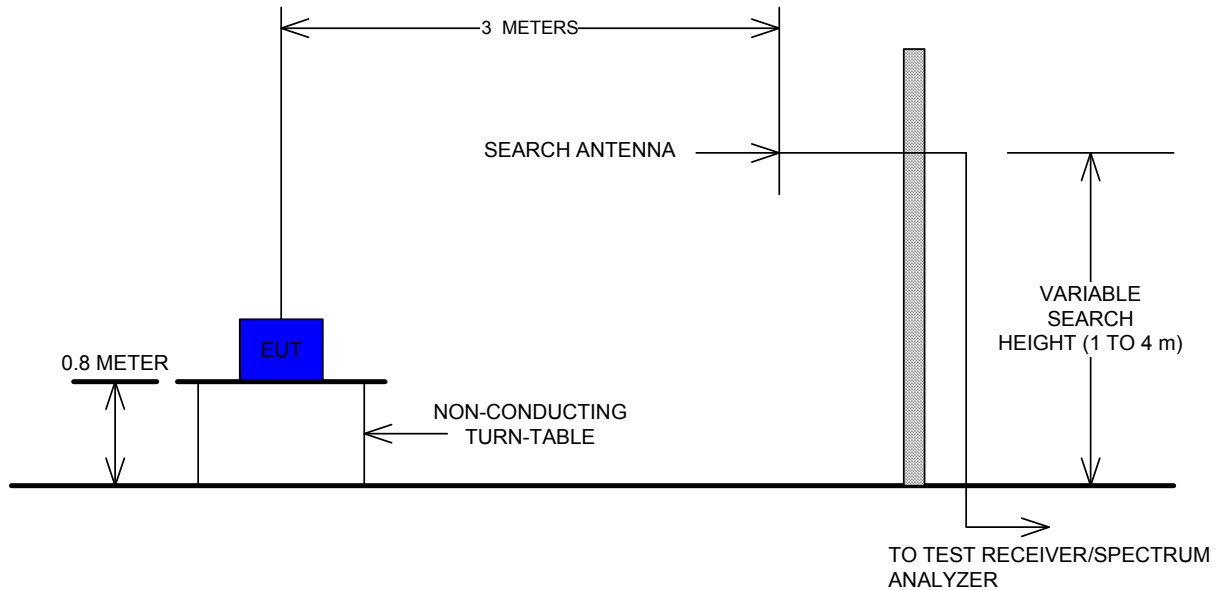


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## Appendix C: Block Diagram of Test Setups

### Test Site For Radiated Emissions



**Test Notes:** Block diagrams for conducted tests are based from ANSI / TIA -60 -B -2002: Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.