FCC PART 22, 74, 80 & 90 TYPE APPROVAL
EMI MEASUREMENT AND TEST REPORT

For

RELM Communications Inc.

7100 Technology Drive
West Melbourne, FL 32904

FCC ID: ARURPV599A

September 9, 2002

This Report Concerns:	**Equipment Type:**
☒ Original Report	VHF Portable Two-way Radio

Test Engineer:	Benjamin Jin
Report No.:	R0207165
Test Date:	July 18, 2002
Reviewed By:	Jeff Lee
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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Applicant:	RELM Communications Inc.
Product Description:	VHF Portable Two-way Radio
Product Name:	RPV599A
FCC ID:	ARURPV599A
Serial Number:	None
Transmitter Frequency:	148~174MHz
Maximum Output Power:	4.37W
Dimension:	3.8” L x 2.5”W x 0.2”H approximately
Power Supply:	RELM AC/DC Adapter, M/N: 48-12-900D
Applicable Standard	FCC CFR 47, Part 22, 74, 80 & 90

1.2 Objective

This type approval report is prepared on behalf of *RELM Communications Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A and B, Part 22 Subpart H, Part 74, Part 80 and Part 90 of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for output power, modulation characteristic, occupied bandwidth, spurious emission at antenna terminal, band edge, conducted and radiated margin.

1.3 Related Submittal(s)/Grant(s)

No Related Submittals

1.4 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 15 – Unintentional
Part 22 – Public Mobile Service
Part 74 Subpart H – Low Power Auxiliary Stations
Part 80 – Stations in the Maritime Service
Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA EIA 137-A, TIA EIA 98-C, TIA/EIA-603, ANSI 63.4-2000, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.5 Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2000.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, IEC/CISPR 22: 1998, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167.

1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Date
HP	Spectrum Analyzer	8568B	2610A02165	12/6/02
HP	Spectrum Analyzer	8593B	2919A00242	12/20/02
HP	Amplifier	8349B	2644A02662	12/20/02
HP	Quasi-Peak Adapter	85650A	917059	12/6/02
HP	Amplifier	8447E	1937A01046	12/6/02
A.H. System	Horn Antenna	SAS0200/571	261	12/27/02
Com-Power	Log Periodic Antenna	AL-100	16005	11/2/02
Com-Power	Biconical Antenna	AB-100	14012	11/2/02
Solar Electronics	LISN	8012-50-R-24-BNC	968447	12/28/02
Com-Power	LISN	LI-200	12208	12/20/02
Com-Power	LISN	LI-200	12005	12/20/02
BACL	Data Entry Software	DES1	0001	12/20/02

*** Statement of Traceability: Bay Area Compliance Laboratory Corp.** certifies that all calibration has been performed using suitable standards traceable to the NATIONAL INSTITUTE of STANDARDS and TECHNOLOGY (NIST).

2 - SYSTEM TEST CONFIGURATION

2.1 Justification

The EUT was configured for testing in a typical fashion (as normally used in a typical application).

The final qualification test was performed with the EUT operating at normal mode.

1) Justification for FCC22:

Per 22.501 Scope & 22.561 Channels for one-way and two-way mobile operations. The frequency range of VHF are from 157.77 to 158.67 MHz. Per 22.701 & 22.725 Channels for rural radiotelephone stations. The frequency of VHF channels are from 152.03 to 158.07MHz. The power will be below 100W. The RPV599 as a two-way radio may operate within the above frequency range.

2) Justification for FCC74:

Per 74.701 & 74.402 Remote Pickup Broadcast Station and Frequency assignment. Per 74.801. 74.802 & 74.861d)1), Low power auxiliary station, Frequency & Power. Frequency band 152.837 – 153.355 MHz and 161.625 – 161.775 may be used. As a broadcast station, the power will be below 100W, as a low power auxiliary station, the max. power is 1W.

The RPV599 may work as the above stations, and operate within the above frequency range. Its power can be controlled below 1W if as a low power station.

2.2 Block Diagram

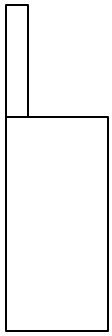
Please refer to Exhibit D.

2.3 Equipment Modifications

No modifications were necessary for the EUT to comply with the applicable limits and requirements.

2.4 Test Setup Block Diagram

The EUT is a standalone device.



EUT

3 - SUMMARY OF TEST RESULTS

FCC RULE	DESCRIPTION OF TEST	RESULT
§ 2.1046, § 22.565 (f) § 74.461 § 80.215 § 90.205	RF power output	Compliant
§ 2.1047, § 22.915 (a) § 74.463 § 80.213 § 90.205	Modulation Characteristics	Compliant
§ 2.1049 § 22.359 § 74.462 § 80.211 § 90.210	Emission, Occupied Bandwidth	Compliant
§ 2.1051 § 22.359 § 74.462 § 80.211 § 90.210	Spurious emissions at antenna terminals	Compliant
§ 2.1053 § 22.539 § 74.462 § 80.211 § 90.210	Field strength of spurious radiation	Compliant
§ 2.1055 § 22.355 § 74.464 § 80.209 § 90.213	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant
§ 90.214	Transient Frequency Behavior	Compliant
§ 2.1093 § 24.52	Radiofrequency radiation exposure evaluation Portable Device	Compliant
§ 15.107	AC Line Conducted emission	Compliant
§ 15.109	Radiated Emission Limit (Digital Portion)	Compliant
§ 15.205	Antenna Requirement	Compliant

4 - RF POWER OUTPUT

4.1 Applicable Standard

§2.1046
§22.565 (f): <150Watts
§74.461: <100Watts
§80.215: <50Watts
§90.205: Power dependent upon station's antenna HAAT and required service area and may be from 1 to 500 watts.

4.2 Test Procedure

1. The EUT was placed at 1.5m height turnaround table and in a position for normal use declared by the manufacturer.
2. The test antenna was oriented initially for vertical position with 3m away from EUT.
3. The output of the antenna was connected to the measuring receiver and the quasi-peak detector is used for the measurement.
4. The transmitter was turned on and the measuring receiver was tuned to the frequency of the transmitter under the testing.
5. The test antenna was raised and lowered through specified ranged of height until the maximum signal level was detected by the measuring receiver.
6. The transmitter was rotated through 360˚ in the horizontal plane until the maximum signal level was detected.
7. The transmitter was then replaced by a horn antenna which is a substitution antenna.
8. The substitution antenna was oriented for vertical polarization and then connected to a calibrated signal generator.
9. The input attenuator of measuring receiver was adjusted to increased the sensitivity.
10. The substitution antenna was raised and lowered to ensure the maximum signal level was detected.
11. The input signal to the substitution antenna was adjusted to the level to produce a level which was equal to the level noted while the transmitter radiated power was measured, corrected for the change of the input attenuator of the measuring receiver.
12. The input level to the substitution antenna was recorded as power level in dBm, corrected for any change of input attenuator of the measuring receiver.
13. The measurement was repeated with the test antenna and the substitution antenna oriented for horizontal polarization.
14. The measure of the radiated output power is the larger one of the two level recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.

4.3 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
HP8920A RF Communications Test Set (Calibration Date: 7/27/2003)

4.4 Test Results

Channel	Output Power in W	Standard (W)
148.05	4.37	Varies
162.05	4.07	Varies
173.95	3.89	Varies

Note: The power output may depend on the intended use of the EUT. For all tests, the EUT was set to maximum conditions.

5 - MODULATION CHARACTERISTIC

5.1 Applicable Standard

§2.1047:

(a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000Hz. for equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.

(b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

§22: Not applicable

§74.463:
Each new remote pickup broadcast station with a power output in excess of 3 watts shall be equipped with a device which will automatically prevent modulation in excess of the limits. If frequency modulation is employed, the emissions shall conform to the emission requirement of 74.462.

§80.213:

(a) When phase of frequency modulation s used in the 156-162MHz and 216-220MHz bands, the peak modulation must be maintained between 75 and 100 percent. A frequency deviation of ±5kHz is defined as 100 percent peak modulation.

(b) Transmitters using F3E emission must have a modulation limiter to prevent any modulation over 100 percent.

(d) Ship and coast station transmitters operating in the 156-162MHz an 216-220MHz bands must be capable of proper operation with a frequency deviation of ±5kHz.

(e) Coast station transmitters operated in the 156-162MHz band must be equipped with an audio low-pass filter. The filter must be installed between the modulation limiter and the modulated radio frequency stage. At frequencies between 3 kHz and 20 kHz it must have an attenuation greater than at 1kHz by at least 60log(f/3) dB. At frequencies above 20kHz the attenuation must at least 50 dB greater than at 1kHz.

§90.205
Transmitters utilizing analog emissions that are equipped with an audio low-pass filter must meet the emission limitations and must meet proper emissions mask of 90.210.

5.2 Test Procedure

Test Method: TIA/EIA-603 2.2.3

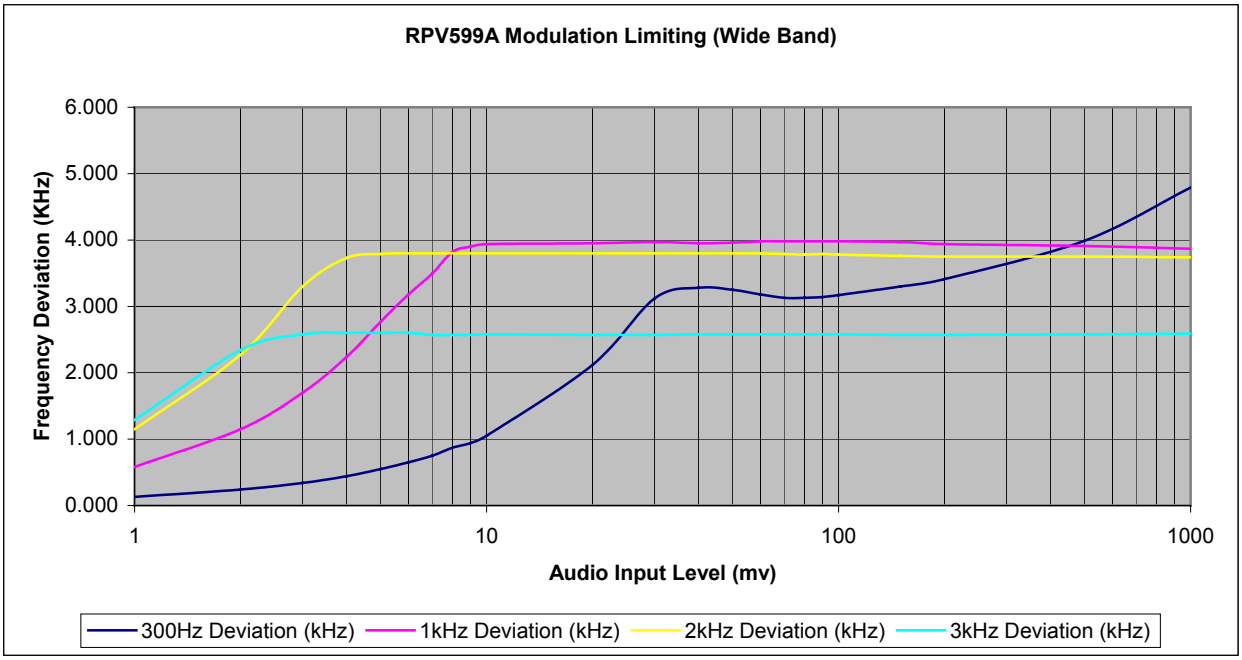
5.3 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
HP8920A RF Communications Test Set (Calibration Date: 7/27/2003)

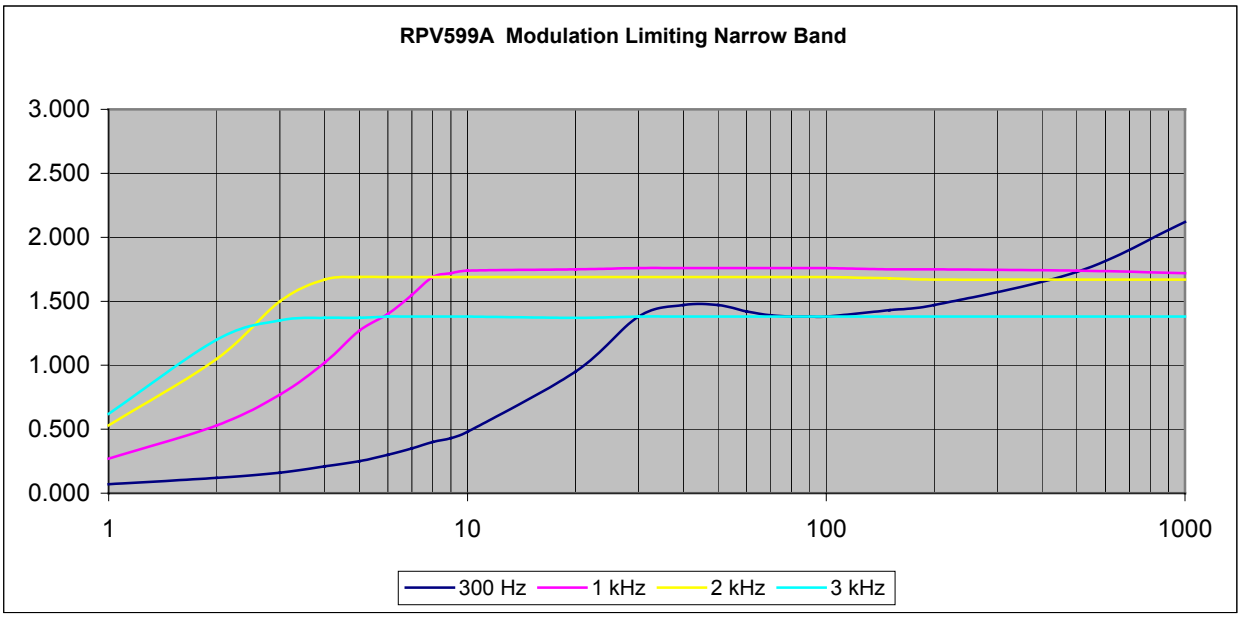
5.4 Test Results

148.05	+ Peak		- Peak	
	Wide (KHz)	Narrow (KHz)	Wide (KHz)	Narrow (KHz)
Instant	4.065	1.83	3.9	1.82
Steady	4.02	1.76	3.86	1.81
Highest	4.61	2.02	4.63	2.2
162.5 MHz				
	Wide (KHz)	Narrow (KHz)	Wide (KHz)	Narrow (KHz)
Instant	3.73	1.65	3.73	1.68
Steady	3.68	1.63	3.69	1.67
Highest	4.08	1.82	4.11	1.95
173.95 MHz				
	Wide (KHz)	Narrow (KHz)	Wide (KHz)	Narrow (KHz)
Instant	3.74	1.63	3.6	1.72
Steady	3.66	1.6	3.55	1.67
Highest	3.96	1.73	3.92	1.86

Please refer to the hereinafter plots.



RPV599A Modulation Limiting in Wide-Band Mode



RPV599A Modulation Limiting in Narrow-Band Mode

6 - OCCUPIED BANDWIDTH

6.1 Applicable Standard

§2.1049, §22.359, §74.462, §80.211 and §90.210 (25kHz bandwidth only):

For any frequency removed from the center of the assigned channel by more than 50 percent up to and including 100 percent of the authorized bandwidth, at least 25 dB.

On any frequency removed from the center of the assigned channel by more than 100 percent up to and including 250 percent, at least 35 dB.

On any frequency removed from the center of the assigned channel by more than 250 percent at least:

Low: 43+l0logP=43+10log(4.4)=49.4dB
Middle: 43+10logP=43+10log(4.1)=49.1dB
High: 43+10logP=43+10log(3.9)=48.9dB

The resolution bandwidth was 300Hz or greater for measuring up to 250kHz from the edge of the authorized frequency segment, and 30kHz or greater for measuring more than 250kHz from the authorized frequency segment.

§90.210 (12.5kHz bandwidth only)
For any frequency removed from the center of the authorized bandwidth f_0 to 5.625kHz removed from f_0, 0dB.

On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.626kHz but no more than 12.5kHz, at least 7.27 (f_d –2.88kHz) dB.

On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5kHz at least:

Low: 50+l0logP=50+10log(4.4)=56.4dB
Middle: 50+10logP=50+10log(4.1)=56.1dB
High: 50+10logP=50+10log(3.9)=55.9dB

6.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

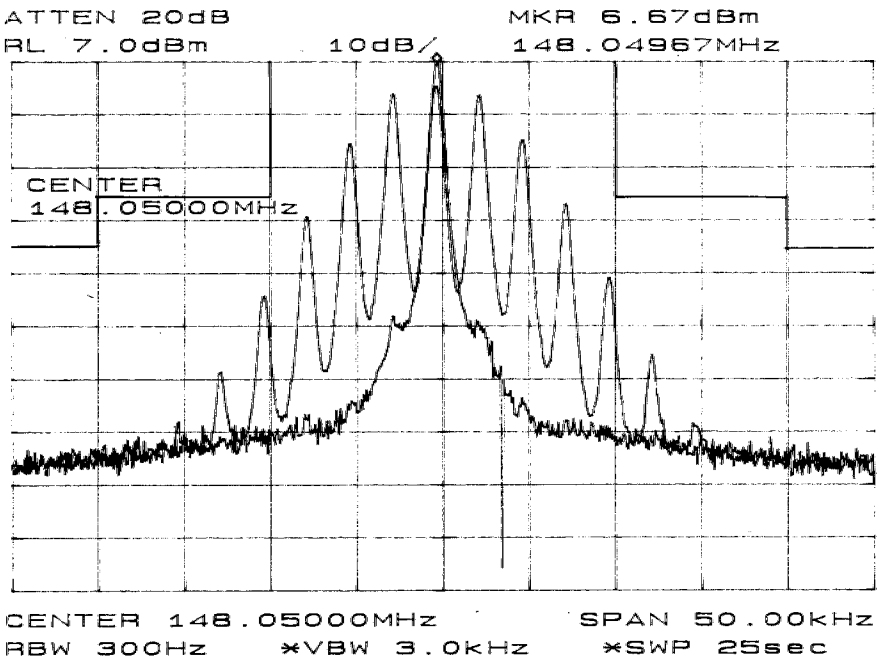
The resolution bandwidth of the spectrum analyzer was set at 30 KHz and the spectrum was recorded in the frequency band ±50 KHz from the carrier frequency.

6.3 Test Equipment

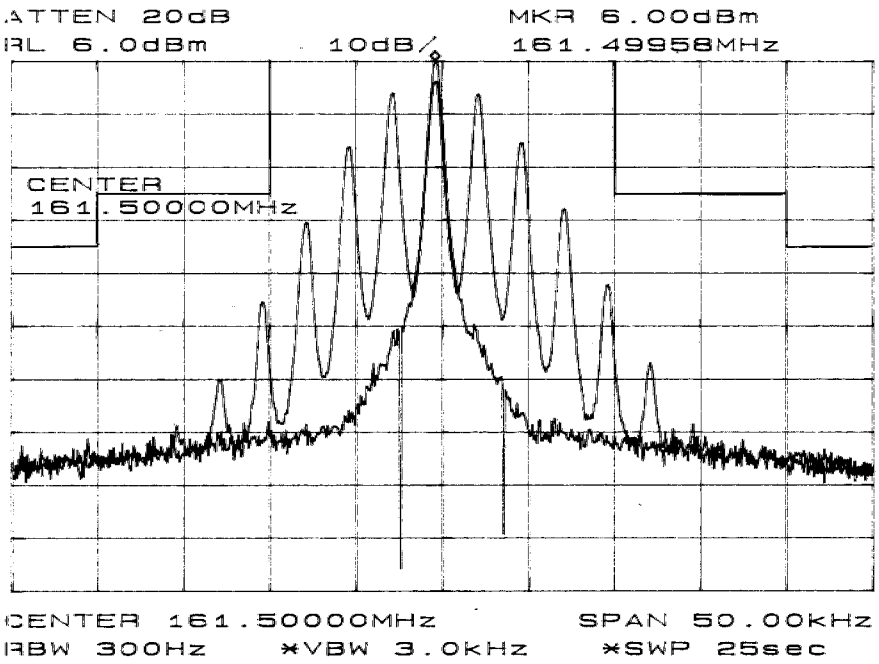
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
HP8920A RF Communications Test Set (7/27/2003)
HP8561A Spectrum Analyzer (8/24/03)

6.4 Test Results

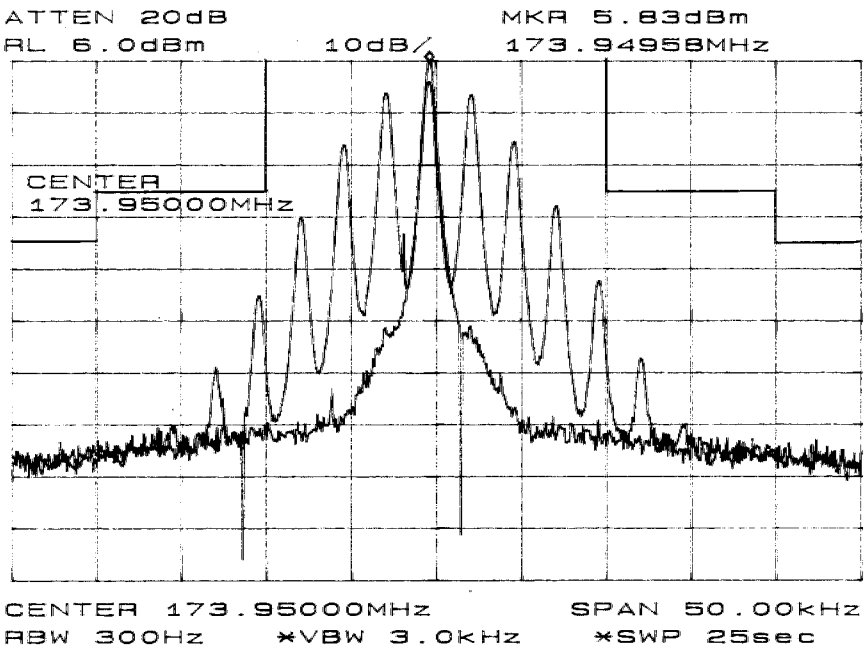
Please refer to the hereinafter plots.



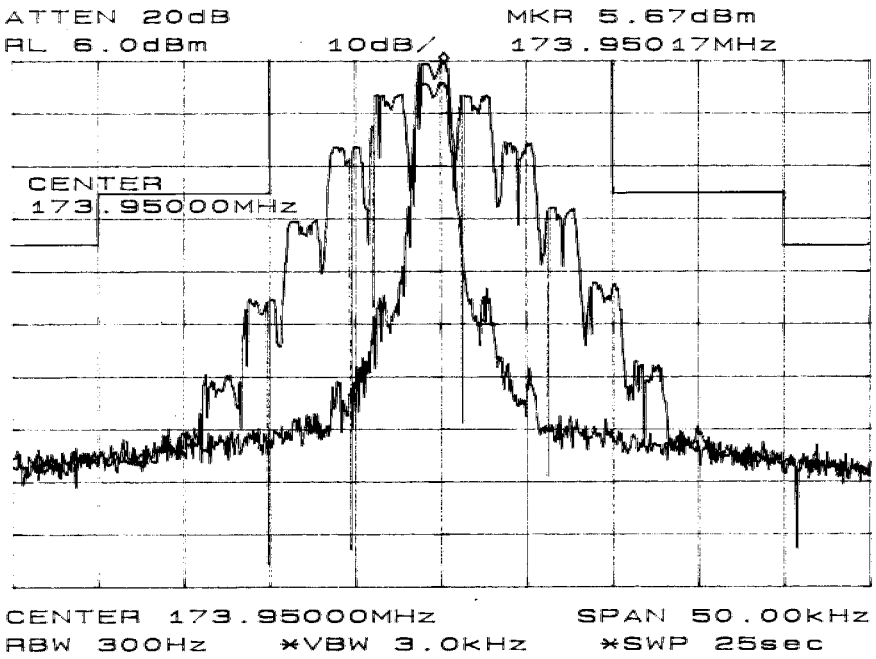
Occupied Bandwidth in Wide Band mode (25 KHz) at 148.050 MHz



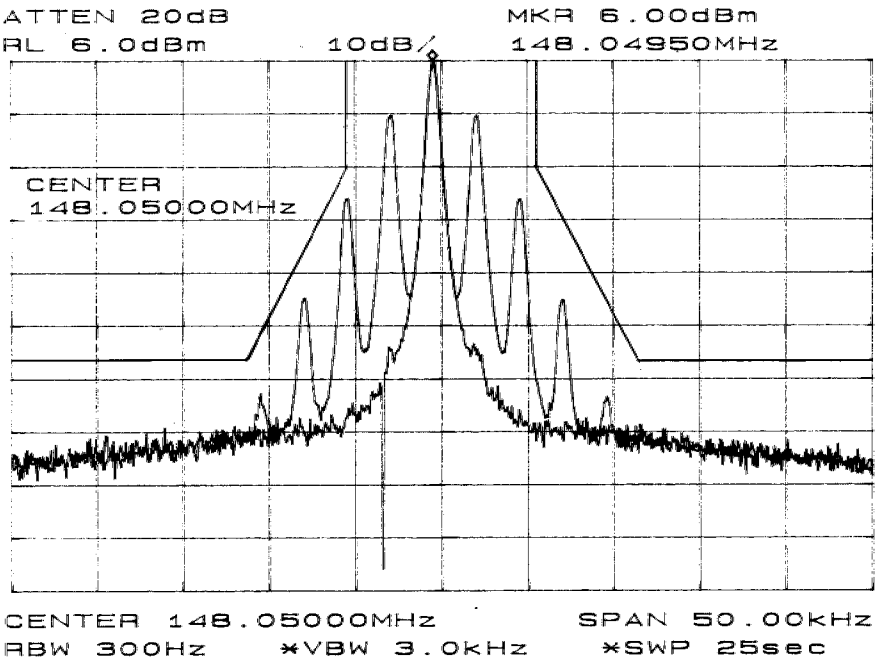
Occupied Bandwidth in Wide Band mode (25 KHz) at 161.500 MHz



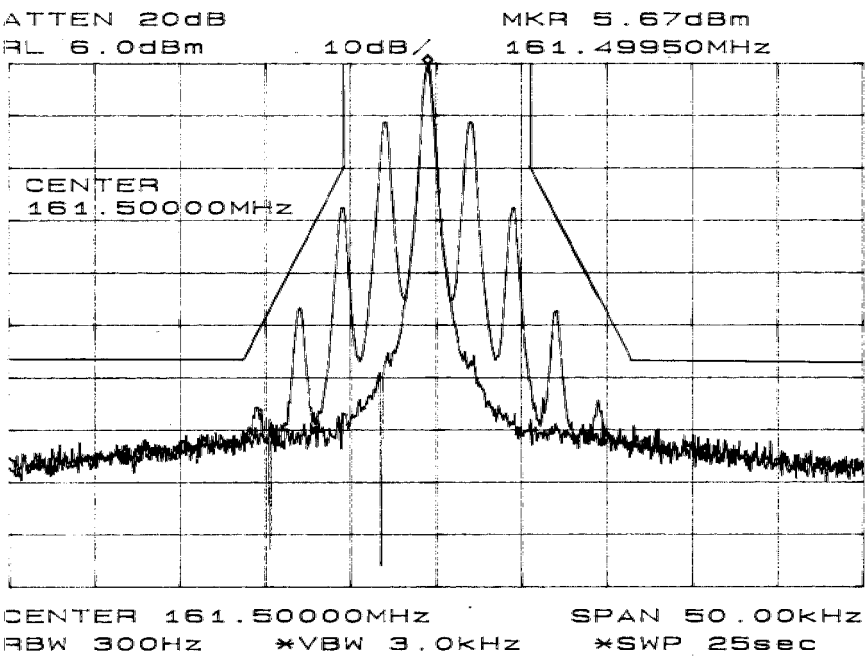
Occupied Bandwidth in Wide Band mode (25 KHz) at 173.950 MHz



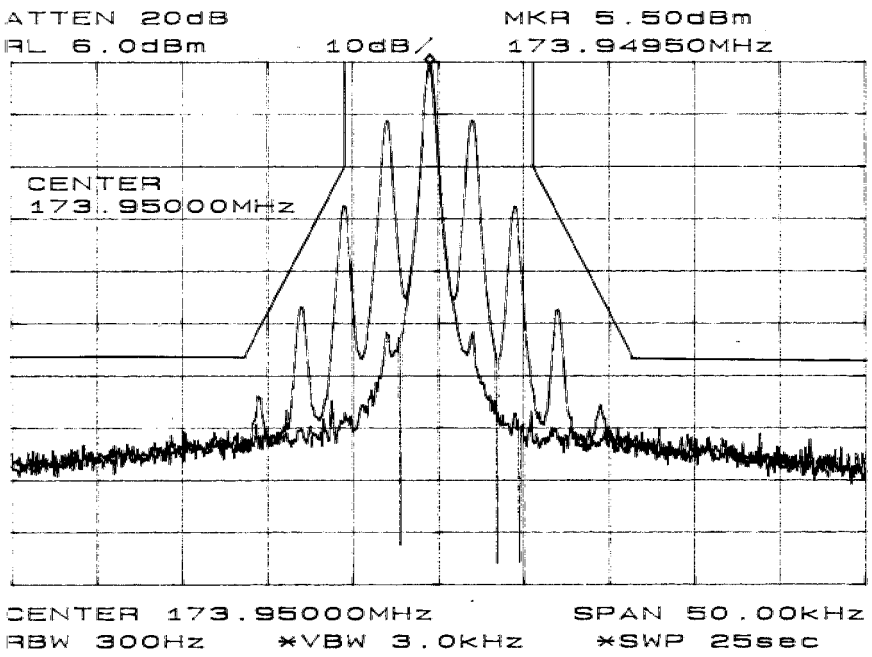
Occupied Bandwidth with DCS in Wide Band mode (25 KHz) at 173.950 MHz



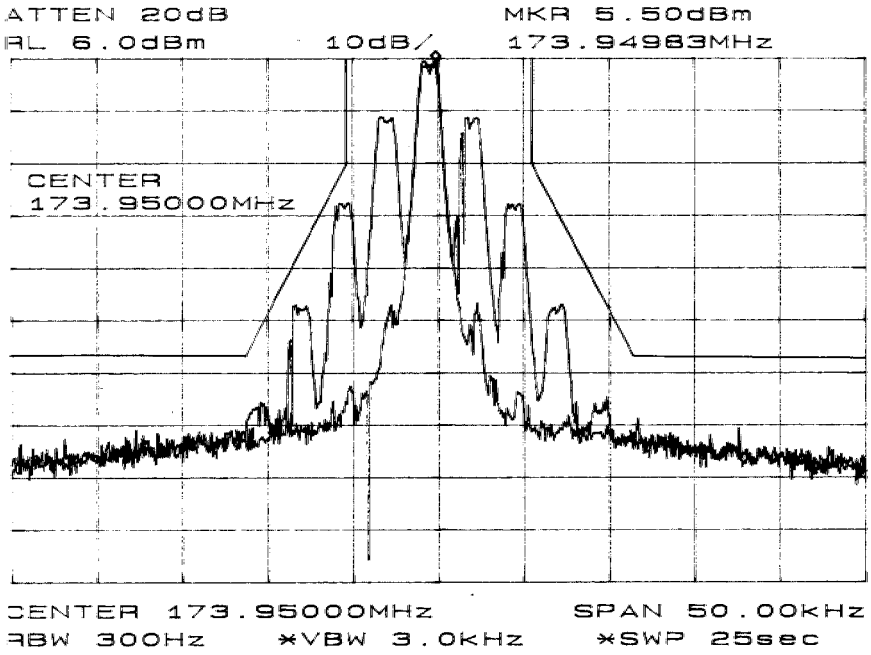
Occupied Bandwidth in Narrow Band mode (12.5 KHz) at 148.050 MHz



Occupied Bandwidth in Narrow Band mode (12.5 KHz) at 161.500 MHz



Occupied Bandwidth in Narrow Band mode (12.5 KHz) at 173.950 MHz



Occupied Bandwidth with DCS in Narrow Band mode (12.5 KHz) at 173.950 MHz

7 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

7.1 Test Procedure

§2.1051, §22.359, §74.462, §80.211 and §90.210 (25kHz bandwidth only)

On any frequency removed from the center of the assigned channel by more than 250 percent at least:

Low: 43+l0logP=43+10log(4.4)=49.4dB
Middle: 43+10logP=43+10log(4.1)=49.1dB
High: 43+10logP=43+10log(3.9)=48.9dB

§90.210 (12.5kHz bandwidth only)

On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5kHz at least:

Low: 50+l0logP=50+10log(4.4)=49.4dB
Middle: 50+10logP=50+10log(4.1)=49.1dB
High: 50+10logP=50+10log(3.9)=48.9dB

7.2 Test Procedure

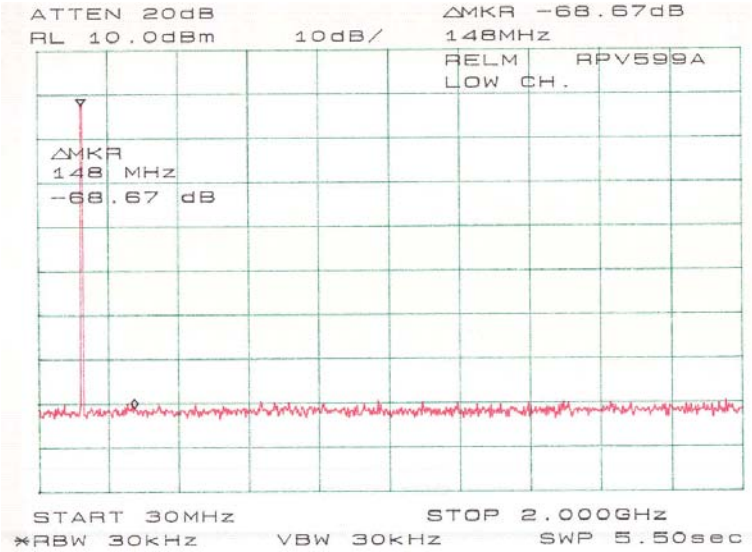
The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

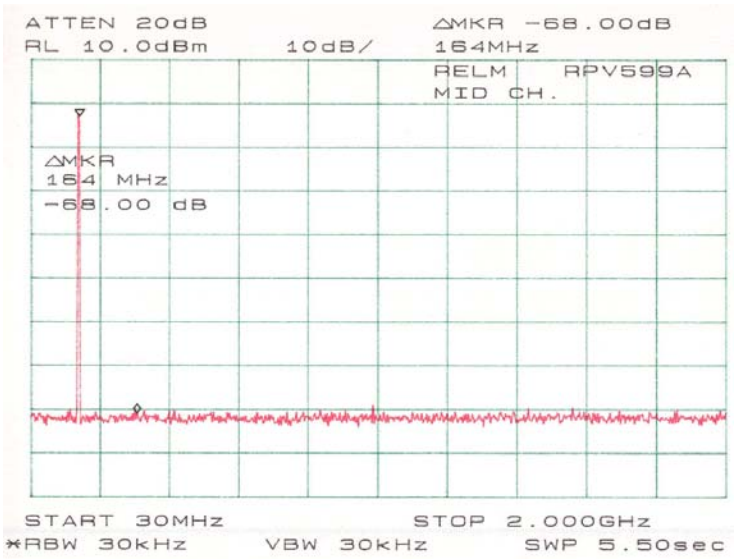
7.3 Test Equipment

HP 8566B Spectrum Analyzer
HP 7470A Plotter
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter

7.4 Test Results

Please refer to the hereinafter plots.


ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -68.67dB
148MHz
RELM RPV599A
LOW CH.
ΔMKR
148 MHz
-68.67 dB
START 30MHz
STOP 2.000GHz
*RBW 30kHz
VBW 30kHz
SWP 5.50sec


ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -68.00dB
164MHz
RELM RPV599A
MID CH.
ΔMKR
164 MHz
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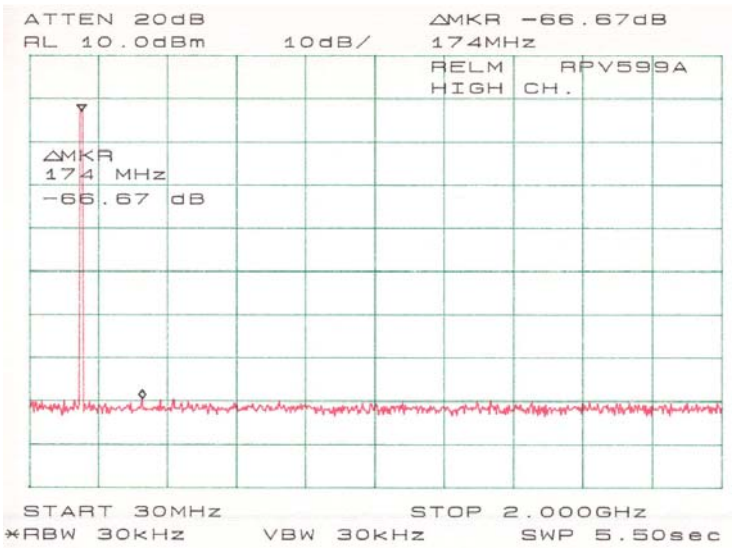
START 30MHz
STOP 2.000GHz
*RBW 30kHz
VBW 30kHz
SWP 5.50sec


ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -66.67dB
174MHz
RELM RPV599A
HIGH CH.
ΔMKR
174 MHz
-66.67 dB
START 30MHz
STOP 2.000GHz
*RBW 30kHz
VBW 30kHz
SWP 5.50sec

8 - RADIATED SPURIOUS EMISSION

8.1 Test Procedure

§2.1053, §22.359, §74.462, §80.211 and §90.210 (25kHz bandwidth only)

8.2 Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts)

8.3 Test Equipment

CDI B100/200/300 Biconical Antennas
EMCO Bi-logcon Antenna
EMCO 3115 Horn Antenna
HP 8566B Spectrum Analyzer
HP8640 Generator
Non-radiating Load

8.4 Test Result

Low Frequency: -30.9dB at 444.15MHz
Mid Frequency: -31.5dB at 487.50MHz
High Frequency: -31.9dB at 521.85MHz

Run #1 :30-2000MHz. (Low Frequency)

EUT					GENERATOR							FCC	
Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavel. cm	Polar H/V	Gain Corrected	Loss dB	Leval dBm	dBm	dB
148.05	107.8	0	2.2	v	148.05	34.6	80	v	2.1	-0.3	36.4		
148.05	105.6	30	1.8	h	148.05	33.7	80	h	2.1	-0.3	35.5		
444.15	35.1	160	1.2	h	444.15	-45.1	70	h	2.1	-0.9	-43.9	-13	-30.9
444.15	34.9	310	1.5	v	444.15	-45.7	70	v	2.1	-0.9	-44.5	-13	-31.5
296.1	33.1	210	1.5	h	296.1	-52.2	75	h	2.1	-0.5	-50.6	-13	-37.6
296.1	32.4	260	1.2	v	296.1	-53.5	75	v	2.1	-0.5	-51.9	-13	-38.9
592.2	29.2	90	1.5	v	592.2	-55.8	55	v	2.1	-1.1	-54.8	-13	-41.8
592.2	27.8	120	1.5	h	592.2	-57.3	55	h	2.1	-1.1	-56.3	-13	-43.3

Run #2 :30-2000MHz. (Mid Frequency)

EUT					GENERATOR							FCC	
Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavel. cm	Polar H/V	Gain Corrected	Loss dB	Leval dBm	dB	dB
162.5	107.4	310	1.5	v	162.5	34.3	80	v	2.1	-0.3	36.1		
162.5	105.3	0	1.8	h	162.5	33.4	80	h	2.1	-0.3	35.2		
487.5	34.6	250	1.5	h	487.5	-45.7	70	h	2.1	-0.9	-44.5	-13	-31.5
487.5	33.8	160	1.2	v	487.5	-46.1	70	v	2.1	-0.9	-44.9	-13	-31.9
325	32.9	30	1.5	h	325	-52.8	75	h	2.1	-0.5	-51.2	-13	-38.2
325	32.3	90	1.2	v	325	-53.7	75	v	2.1	-0.5	-52.1	-13	-39.1
650	29.1	270	1.5	v	650	-56.2	55	v	2.1	-1.1	-55.2	-13	-42.2
650	27.5	310	1.8	h	650	-57.5	55	h	2.1	-1.1	-56.5	-13	-43.5

Run #3 : 30-2000MHz. (High Frequency)

EUT					GENERATOR							FCC	
Indicated		Table	st Antenna		Substituted		Substitution Antenna		Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavel. cm	Polar H/V	Gain Corrected	Loss dB	Leval dBm	dB	dB
173.95	107.1	310	1.5	v	173.95	34.1	80	v	2.1	-0.3	35.9		
173.95	104.8	0	1.8	h	173.95	32.8	80	h	2.1	-0.3	34.6		
521.85	34.2	250	1.5	h	521.85	-46.1	70	h	2.1	-0.9	-44.9	-13	-31.9
521.85	33.4	160	1.2	v	521.85	-47.3	70	v	2.1	-0.9	-46.1	-13	-33.1
347.9	32.5	30	1.5	h	347.9	-53.1	75	h	2.1	-0.5	-51.5	-13	-38.5
347.9	32.1	90	1.2	v	347.9	-53.9	75	v	2.1	-0.5	-52.3	-13	-39.3
695.8	28.8	270	1.5	v	695.8	-56.8	55	v	2.1	-1.1	-55.8	-13	-42.8
695.8	27.3	310	1.8	h	695.8	-57.9	55	h	2.1	-1.1	-56.9	-13	-43.9

9 - FREQUENCY STABILITY

9.1 Applicable Standard

§2.1055 (d)

§22.355, §74.464
For mobile and output power > 3 watts, the limit is 5.0ppm, for output power ≤ 3 watts the limit is 50ppm

§80.209
For Coast Station and output power > 3 watts, the limit is 5.0ppm.
For output power ≤ 3 watts, the limit is 100ppm.

§90.213
For output power > 2 watts, the limit is 5.0ppm.

9.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

Frequency Stability vs. Voltage: An external variable DC power supply was connected to the battery terminals of the equipment under test. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the battery end point. The output frequency was recorded for each battery voltage.

9.3 Test Equipment

Temperature Chamber -50^0 to $+100^0$C
Hewlett Packard 5383A Frequency Counter
Goldstar DC Power Supply, GR303

9.4 Test Results

PMS: Frequency Stability Versus Temperature

Reference Frequency: 148.00 MHz, Limit: 5.0ppm			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed	
		MCF (MHz)	PPM Error
60	New Batt.	147.9996	-2.86
50	New Batt.	147.9996	-2.80
40	New Batt.	147.9997	-1.75
30	New Batt.	147.9998	-0.97
20	New Batt.	148.0000	0.02
10	New Batt.	148.0001	1.00
0	New Batt.	148.0003	1.90
-10	New Batt.	148.0004	2.80
-20	New Batt.	148.0003	2.14
-30	New Batt.	147.9999	-0.09

PMS: Frequency Stability Versus Input Voltage

Reference Frequency: 148.00 MHz, Limit: 5.0ppm						
Power Supplied (Vdc)	Frequency Measure with Time Elapsed					
	2 Minutes		5 Minutes		10 Minutes	
	MHz	PPM	MHz	PPM	MHz	PPM
115% of 7.5Vdc	148.0003	2.14	147.9998	-1.0	147.9998	-1.0
100% of 7.5Vdc	148.0000	0.0	148.0000	0.0	148.0003	2.1
85% of 7.5Vdc	148.0000	0.02	148.0003	1.9	148.0004	2.8

Conclusion: The EUT complied with the applicable Frequency Stability Limits.

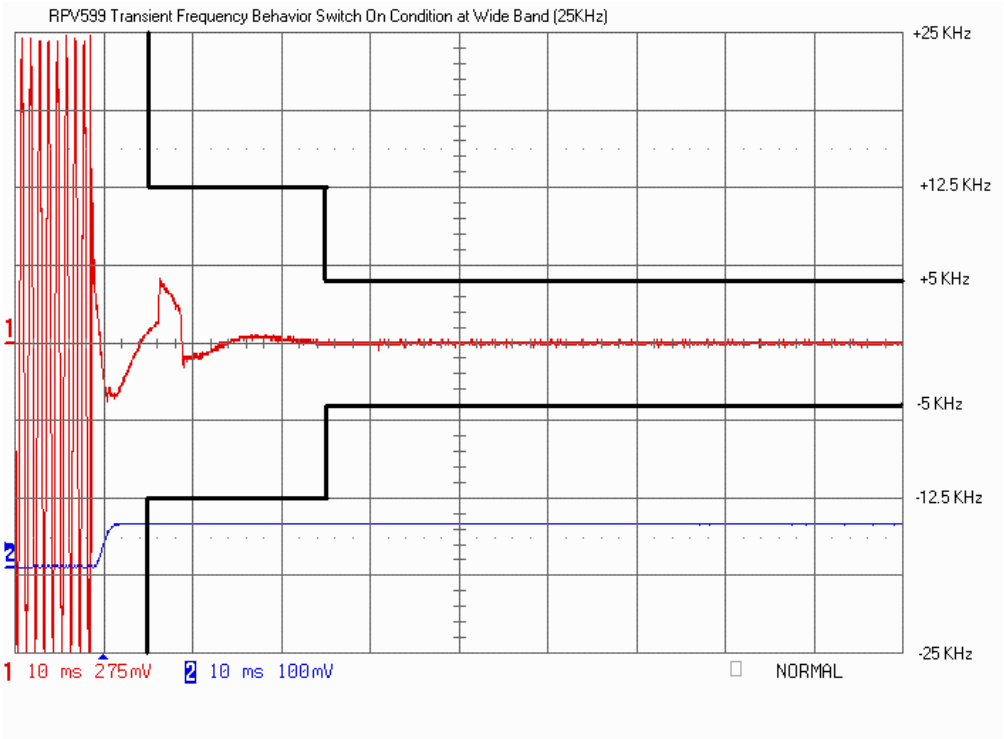
10 - TRANSIENT FREQUENCY BEHAVIOR

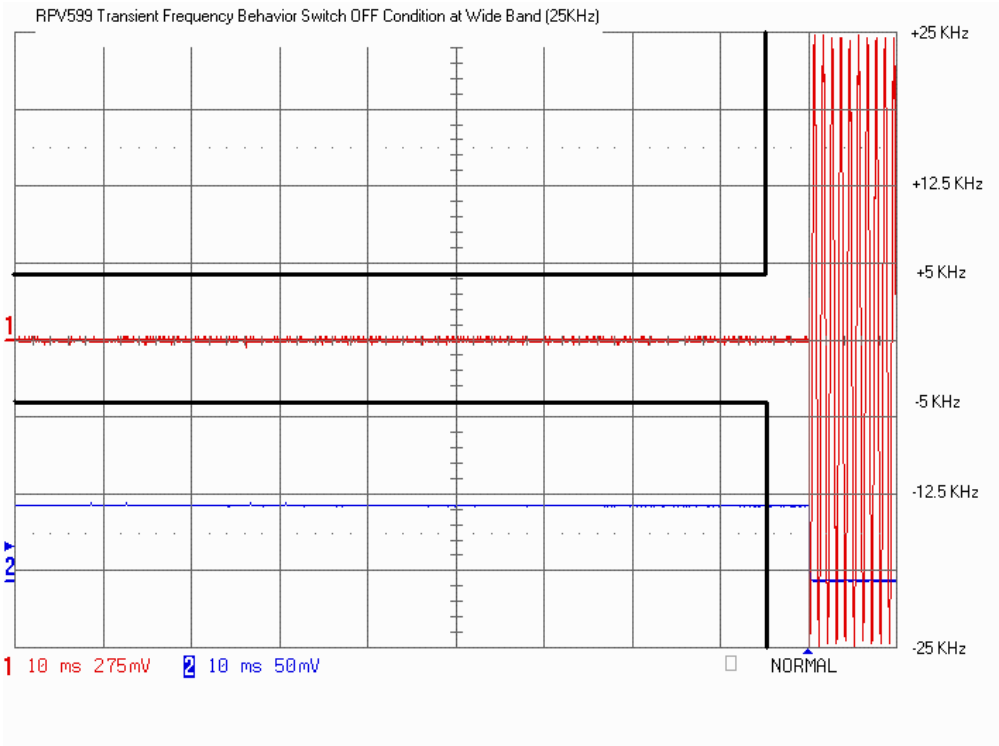
10.1 Test Method

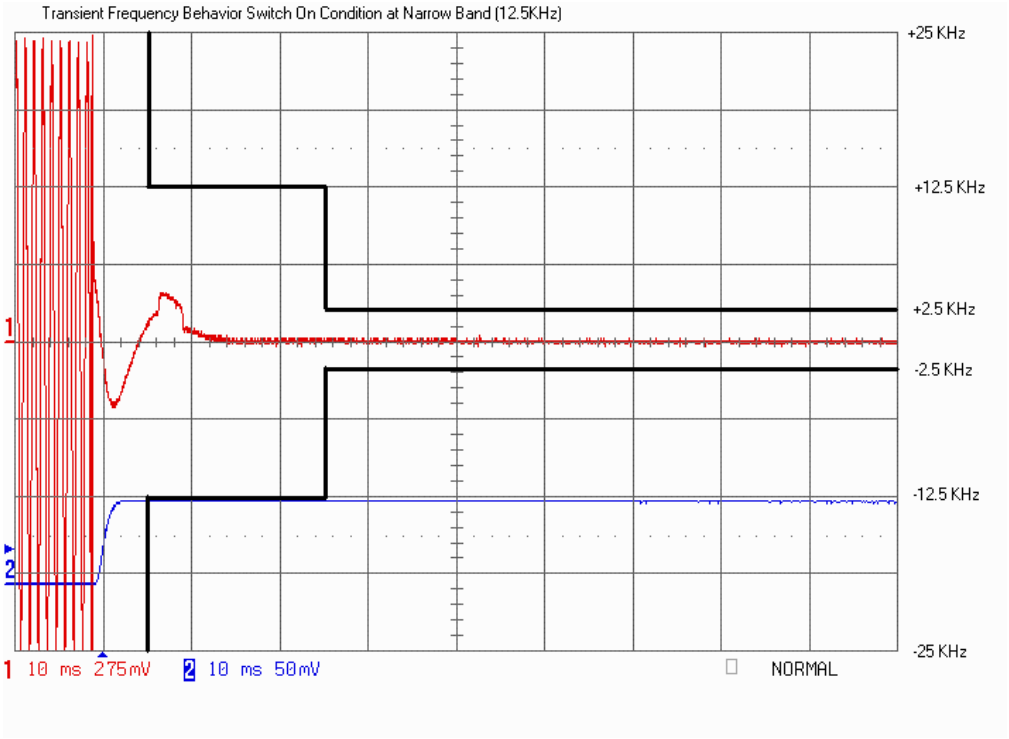
TIA/EIA-603 2.2.19

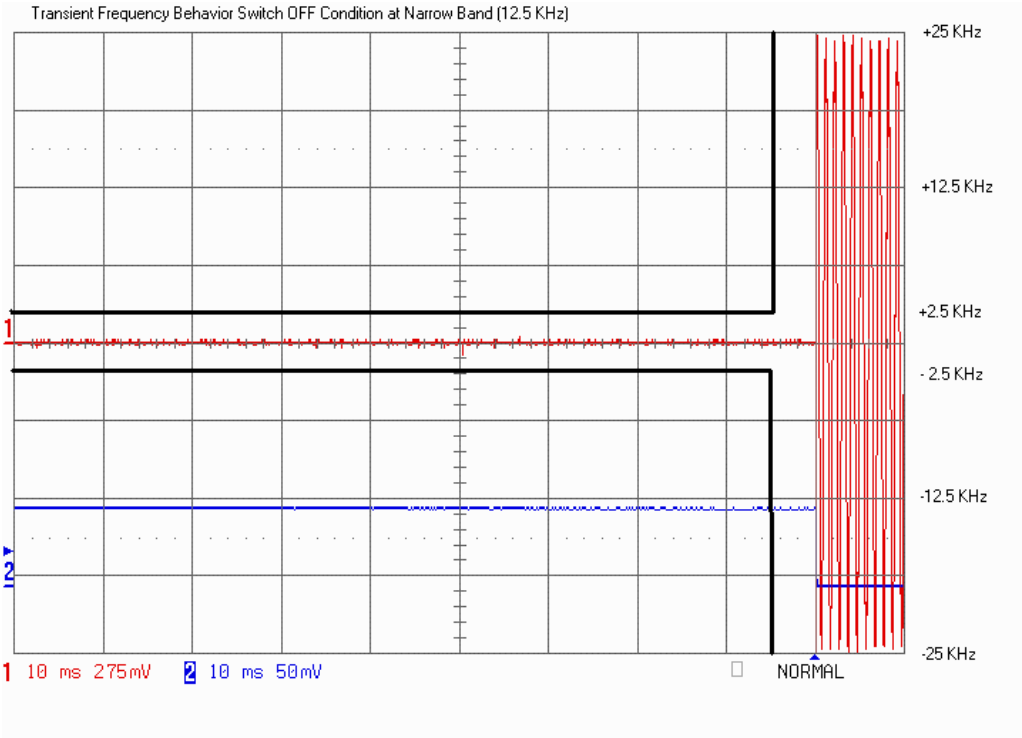
10.2 Test Equipment

Model	Calibration Due Date
HP8920A RF Communications Test Set	4/2/03
SME 02 Rhodes & Schwarz Signal Generator	3/21/03
LC334A Le Croy Digital Storage Scope	6/21/02


RPV599 Transient Frequency Behavior Switch On Condition at Wide Band (25KHz)
+25 KHz
+12.5 KHz
+5 KHz
-5 KHz
-12.5 KHz
-25 KHz
1
2
1 10 ms 275mV
2 10 ms 100mV
NORMAL


RPV599 Transient Frequency Behavior Switch OFF Condition at Wide Band (25KHz)
+25 KHz
+12.5 KHz
+5 KHz
-5 KHz
-12.5 KHz
-25 KHz
1
2
1 10 ms 275mV
2 10 ms 50mV
NORMAL


Transient Frequency Behavior Switch On Condition at Narrow Band (12.5KHz)
+25 KHz
+12.5 KHz
+2.5 KHz
-2.5 KHz
-12.5 KHz
-25 KHz
1
2
1 10 ms 275mV
2 10 ms 50mV
NORMAL


Transient Frequency Behavior Switch OFF Condition at Narrow Band (12.5 KHz)
+25 KHz
+12.5 KHz
+2.5 KHz
- 2.5 KHz
-12.5 KHz
-25 KHz
1
2
1 10 ms 275mV
2 10 ms 50mV
NORMAL

11 - CONDUCTED EMISSIONS

11.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is ±2.4 dB.

11.2 EUT Setup

The measurement was performed at the **O**pen **A**rea **T**est **S**ite, using the same setup per ANSI C63.4-2000 measurement procedure. The specification used was with FCC Class B limits.

The spacing between peripheral was 10cm.

The external I/O cables were draped and bundled when necessary.

The EUT utilized 110Vac/60Hz power source.

11.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configurations during the conduction test:

Start Frequency	450 kHz
Stop Frequency	30 MHz
Sweep Speed	Auto
IF Bandwidth	10 kHz
Video Bandwidth	10 kHz
Quasi-Peak Adapter Bandwidth	9 kHz
Quasi-Peak Adapter Mode	Normal

11.4 Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within -4 dBµV of specified limits). Quasi-peak readings are distinguished with a "**Qp**".

11.5 Summary of Test Results

According to the data in section 3.6, the EUT complied with the FCC Conducted margin for a Class B device and these test results is deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, with the *worst* margin reading of:

-1.5 dBµV at 0.69 MHz in the Neutral mode

11.6 Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency MHz	Amplitude dBµV	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dBµV	Margin dB
0.69	46.5	QP	N	48	-1.5
0.71	43.7	QP	L	48	-4.3
4.98	21.3	QP	N	48	-26.7
1.53	37.5	QP	L	48	-10.5
19.07	16.67	QP	N	48	-31.3
15.57	18.2	QP	L	48	-29.8

11.7 Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented hereinafter as reference.