

FCC PART 90 TYPE APPROVAL EMI MEASUREMENT AND TEST REPORT

For

SHENZHEN HYT SCIENCE&TECHNOLOGY CO., LTD

R2-High-Tech Industrial Park
ShenZhen, China

FCC ID: R74TM-800V

This Report Concerns: ☒ Original Report	Equipment Type: Mobile Radio
Test Engineer: Hang Tan 	
Report No.: R0505025	
Report Date: 2005-06-08	
Reviewed By: Daniel Deng 	
Prepared By: Bay Area Compliance Laboratory Corporation 230 Commercial Street Sunnyvale, CA 94085 Tel: (408) 732-9162 Fax: (408) 732 9164	

Note: The test report is specially limited to the above company and this particular sample only. It may not be duplicated without prior written consent of Bay Area Compliance Laboratory Corporation. This report **must not** be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the US Government.

TABLE OF CONTENTS

GENERAL INFORMATION.....	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY	4
TEST FACILITY	4
SYSTEM TEST CONFIGURATION.....	6
JUSTIFICATION	6
BLOCK DIAGRAM.....	6
EQUIPMENT MODIFICATIONS	6
TEST SETUP BLOCK DIAGRAM	6
SUMMARY OF TEST RESULTS	7
§2.1046 - CONDUCTED OUTPUT POWER.....	8
PROVISION APPLICABLE.....	8
TEST PROCEDURE	8
TEST EQUIPMENT	8
ENVIRONMENTAL CONDITIONS	8
TEST RESULTS	8
§2.1047, §90.207 - MODULATION CHARACTERISTIC	10
APPLICABLE STANDARD	10
TEST PROCEDURE	10
TEST EQUIPMENT	10
ENVIRONMENTAL CONDITIONS	10
TEST RESULTS	10
§2.1049, AND § 90.209 – OCCUPIED BANDWIDTH	14
APPLICABLE STANDARD	14
TEST PROCEDURE	14
TEST EQUIPMENT	14
ENVIRONMENTAL CONDITIONS	15
TEST RESULTS	15
§2.1051 AND §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS	19
APPLICABLE STANDARD	19
TEST PROCEDURE	19
TEST EQUIPMENT	19
ENVIRONMENTAL CONDITIONS	19
TEST RESULTS	19
§2.1053 AND §90.210 - RADIATED SPURIOUS EMISSION	21
APPLICABLE STANDARD	21
TEST PROCEDURE	21
TEST EQUIPMENT	21
ENVIRONMENTAL CONDITIONS	21
TEST RESULT	22
§2.1055 (D) AND §90.213- FREQUENCY STABILITY	23
APPLICABLE STANDARD	23
TEST PROCEDURE	23
TEST EQUIPMENT	23
ENVIRONMENTAL CONDITIONS	23
TEST RESULTS	24
§90.214 - TRANSIENT FREQUENCY BEHAVIOR.....	25
STANDARD APPLICABLE	25

TEST METHOD	25
TEST EQUIPMENT	25
ENVIRONMENTAL CONDITIONS	25
TEST RESULT	25

GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Shenzhen HYT Science&Technology Co.,Ltd*'s FCC ID: *R74TM-800V* or the "EUT" as referred to in this report is a Two-way Radio, which measures approximately 17.8cmL x 17.5cmW x 5.6cmH.

**The test data gathered are from production sample serial number 6927404380023 provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *Shenzhen HYT Science&Technology Co.,Ltd* in accordance with Part 2 and Part 90 of the Federal Communication Commissions rules.

The objective of the manufacturer is to determine compliance with FCC rules for output power, modulation characteristic, occupied bandwidth, spurious emission at antenna terminal, frequency stability, transient frequency behavior and radiated margin.

Related Submittal(s)/Grant(s)

No Related Submittals

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 90 – Private Land Mobile Radio Service

Applicable Standards: TIA EIA 137-A, TIA EIA 98-C, TIA/EIA-603, ANSI 63.4-2003, 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.

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 C63.4-2003.

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, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations is attached hereinafter and can also be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>

SYSTEM TEST CONFIGURATION

Justification

The host system was configured for testing according to TIA/EIA-603.

The EUT was tested in the normal (native) operating mode to represent *worst-case* results during the final qualification test.

Block Diagram

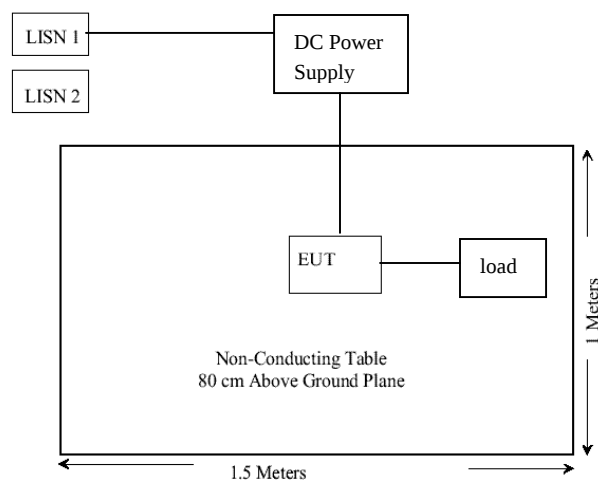
Please refer to Exhibit D.

Equipment Modifications

No modifications were made to the EUT.

Test Setup Block Diagram

The EUT is a standalone device.



SUMMARY OF TEST RESULTS

FCC RULE	DESCRIPTION OF TEST	RESULT
§1.1310 §2.1093	RF Output Power	N/A
§ 2.1046	Conducted Output Power	Compliant
§ 2.1047 § 90.207	Modulation Characteristics	Compliant
§ 2.1049 § 90.209	Emission, Occupied Bandwidth	Compliant
§ 2.1051 § 90.210	Spurious emissions at antenna terminals	Compliant
§ 2.1053 § 90.210	Field strength of spurious radiation	Compliant
§ 2.1055 § 90.213	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant
§ 90.214	Transient Frequency Behavior	Compliant

§2.1046 - CONDUCTED OUTPUT POWER

Provision Applicable

Per FCC §2.1046 and §90.205: maximum ERP is dependent upon the station's antenna HAAT and required service area.

Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuator.

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Analyzer, Spectrum	8565EC	3946A00131	2004-08-06
Hewlett Packard	Plotter	HP7470A	N/A	N/R

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

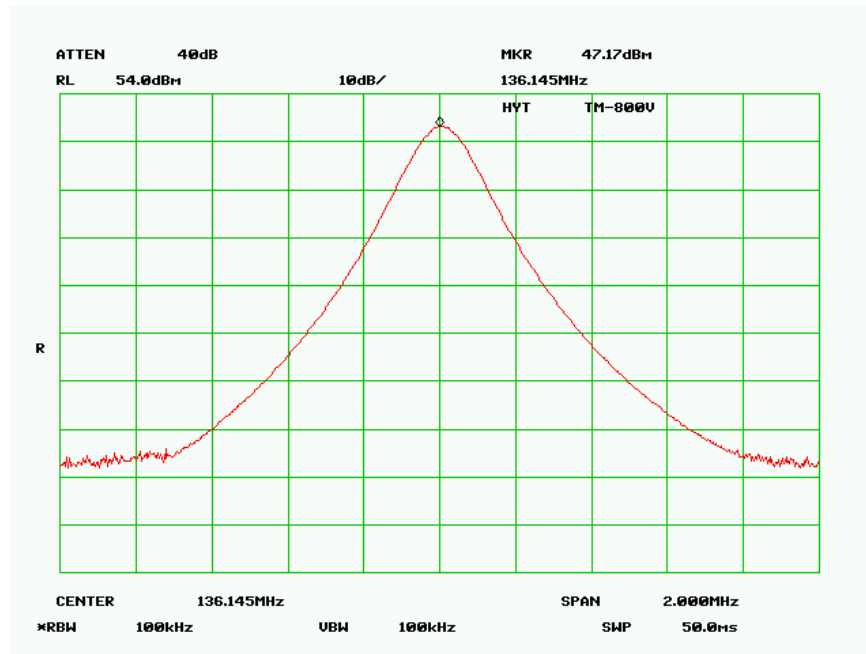
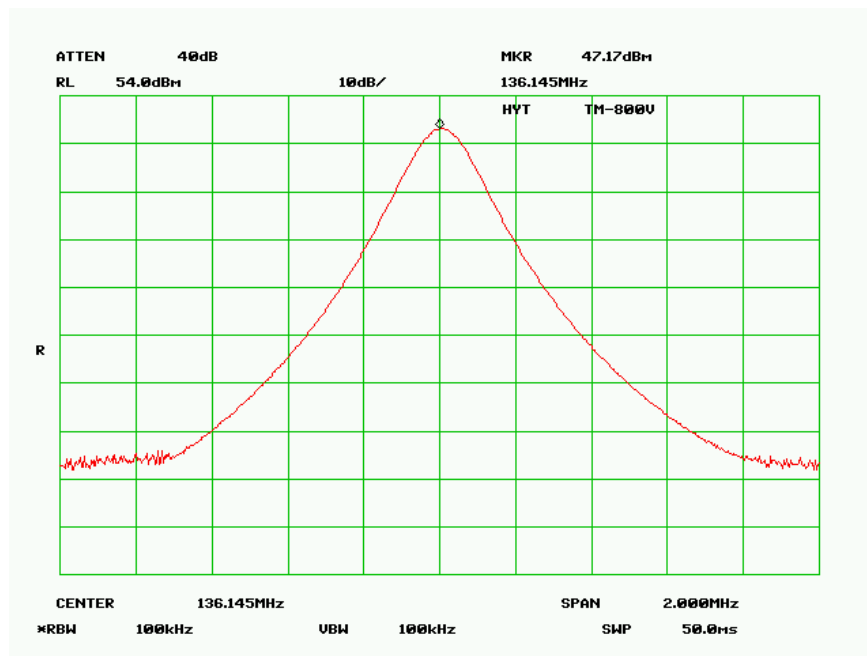
Temperature:	23° C
Relative Humidity:	55%
ATM Pressure:	1021 mbar

The testing was performed by Hang Tan on 2005-05-13.

Test Results

CH	Frequency Spacing (kHz)	Frequency (MHz)	Output Power in dBm	Output Power in W
4	12.5	136.145	47.17	52.119
1	25	136.145	47.17	52.119

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



§2.1047, §90.207 - MODULATION CHARACTERISTIC

Applicable Standard

§2.1047 & §90.205:

- (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.

Test Procedure

Test Method: TIA/EIA-603 2.2.3

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	8565EC	3946A00131	2004-08-06
Hewlett Packard	Modulation Analyzer	8901A	2026A00847	2004-08-19
Nanyan	Audio Generator	NY2201	420	N/R

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

Temperature:	24° C
Relative Humidity:	40%
ATM Pressure:	1010mbar

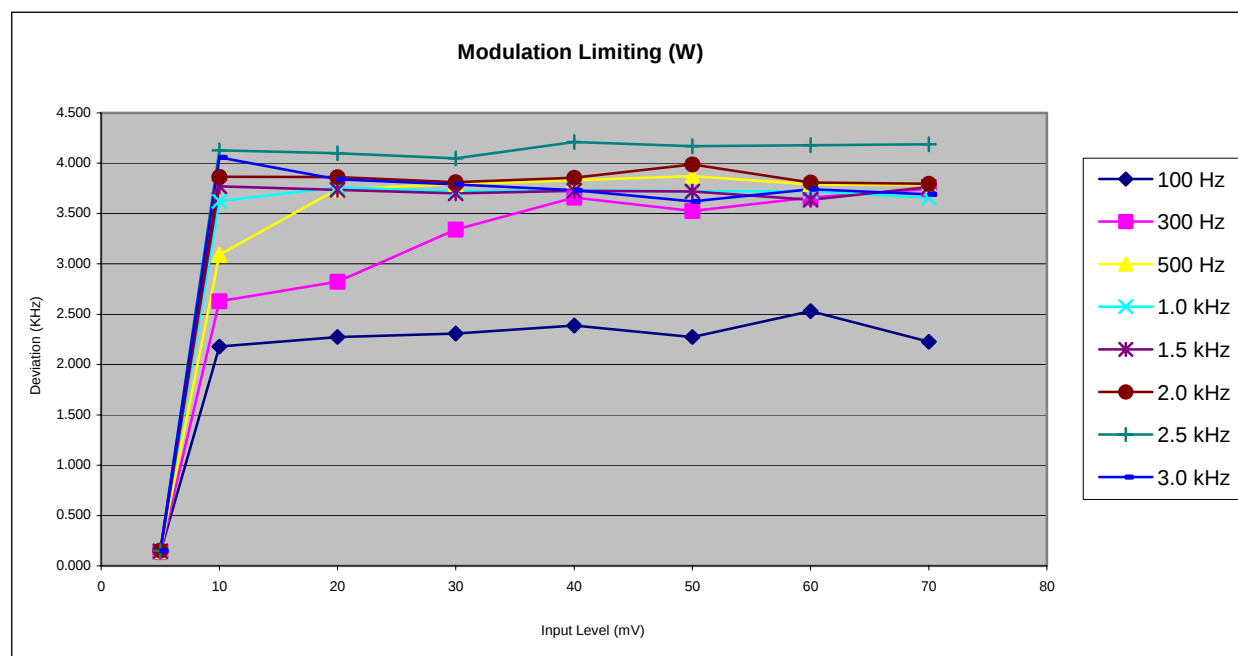
The testing was performed by Hang Tan on 2005-06-01.

Test Results

The plot(s) of modulation characteristic is presented hereinafter as reference.

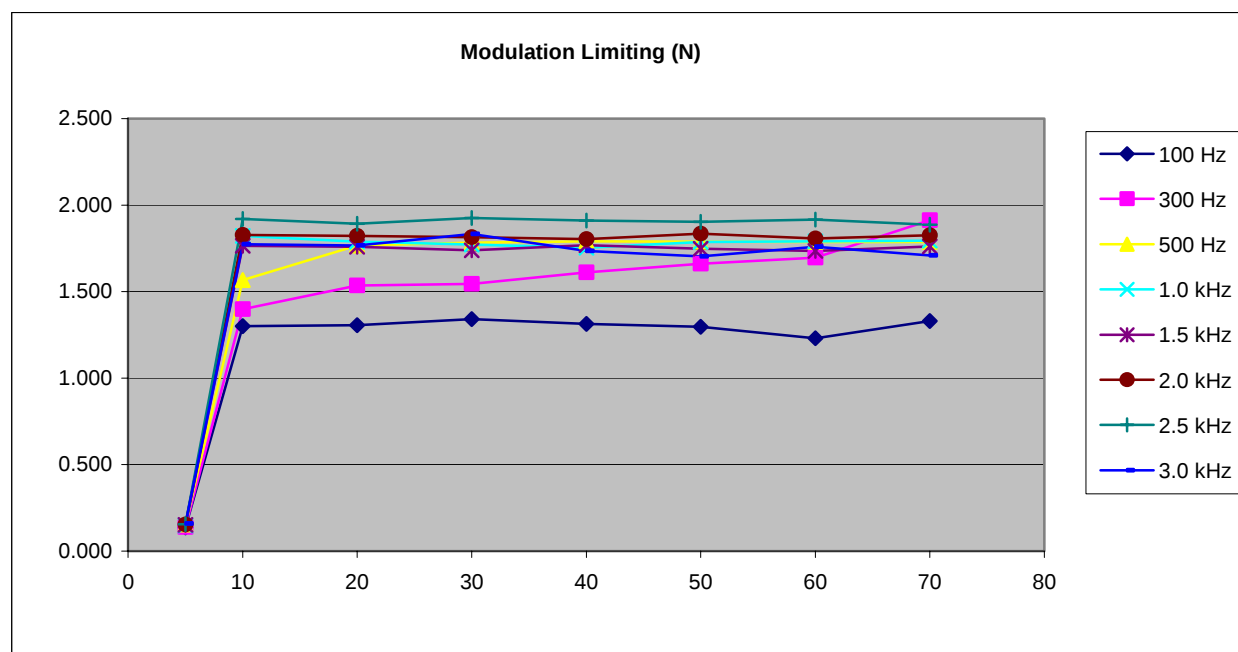
Channel 2 - 155.15 MHz, High power, Wide

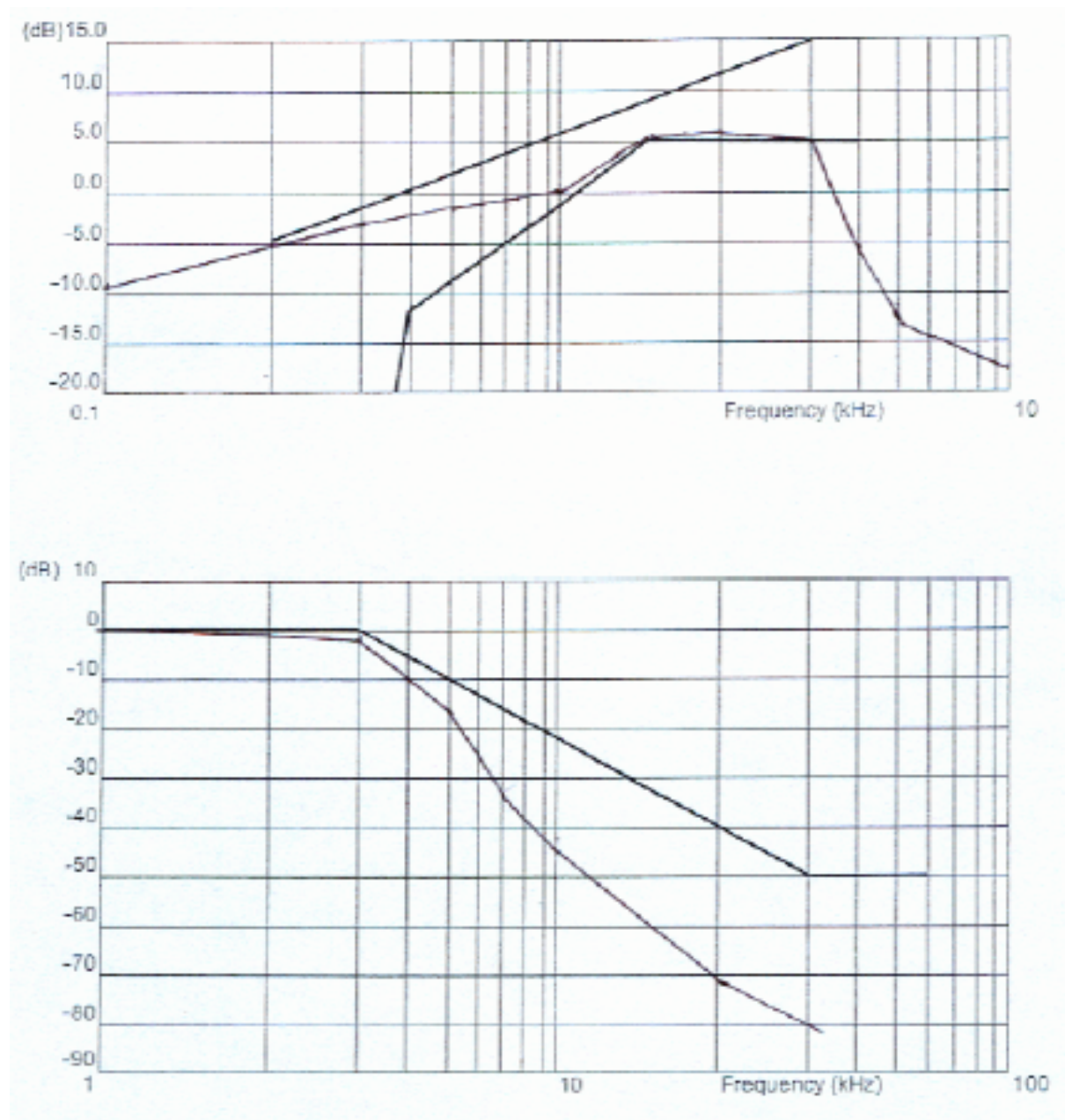
Input (mV)	100 Hz	300 Hz	500 Hz	1.0 kHz	1.5 kHz	2.0 kHz	2.5 kHz	3.0 kHz
5	0.136	0.137	0.145	0.140	0.146	0.152	0.149	0.148
10	2.179	2.630	3.091	3.623	3.769	3.864	4.130	4.060
20	2.275	2.822	3.742	3.759	3.734	3.863	4.100	3.840
30	2.310	3.342	3.792	3.720	3.700	3.810	4.050	3.790
40	2.389	3.660	3.831	3.733	3.724	3.855	4.210	3.730
50	2.274	3.524	3.870	3.718	3.720	3.990	4.170	3.620
60	2.530	3.658	3.789	3.722	3.636	3.807	4.180	3.740
70	2.226	3.743	3.782	3.655	3.764	3.795	4.190	3.690



Channel 5 - 155.15 MHz, High power, Narrow

Input (mV)	100 Hz	300 Hz	500 Hz	1.0 kHz	1.5 kHz	2.0 kHz	2.5 kHz	3.0 kHz
5	0.137	0.138	0.153	0.148	0.152	0.154	0.156	0.158
10	1.301	1.399	1.567	1.822	1.765	1.828	1.920	1.774
20	1.306	1.535	1.767	1.789	1.759	1.822	1.892	1.767
30	1.341	1.545	1.783	1.772	1.738	1.815	1.925	1.833
40	1.313	1.612	1.790	1.754	1.768	1.803	1.911	1.735
50	1.297	1.662	1.789	1.787	1.748	1.835	1.904	1.704
60	1.230	1.697	1.787	1.790	1.735	1.807	1.916	1.759
70	1.330	1.912	1.787	1.794	1.760	1.825	1.887	1.710





§2.1049, and § 90.209 – OCCUPIED BANDWIDTH

Applicable Standard

§2.1049, §90.209 and §90.210

12.5kHz bandwidth:

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 ($f_d - 2.88$ kHz) 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:

$$50 + 10 \log P = 50 + 10 \log(5.21) = 57.17 \text{ dB}$$

25kHz bandwidth:

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:

$$43 + 10 \log P = 43 + 10 \log(5.21) = 50.17 \text{ dB}$$

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.

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 300 Hz and the spectrum was recorded in the frequency band ± 50 KHz from the carrier frequency.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
HP	Spectrum Analyzer	8565EC	3946A00131	2004-08-06
Hewlett Packard	Plotter	HP7470A	N/A	N/A
Nanyan	Audio Generator	NY2201	00042	N/A

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

Temperature:	24° C
Relative Humidity:	40%
ATM Pressure:	1010mbar

The testing was performed by Hang Tan on 2005-06-01.

Test Results

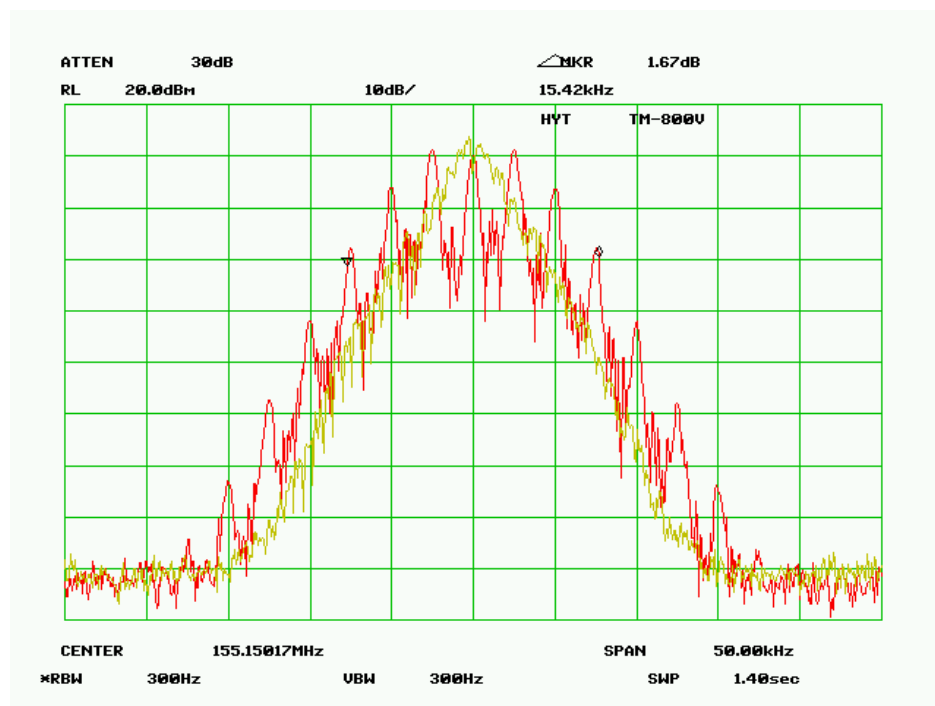
Please refer to the hereinafter plots.

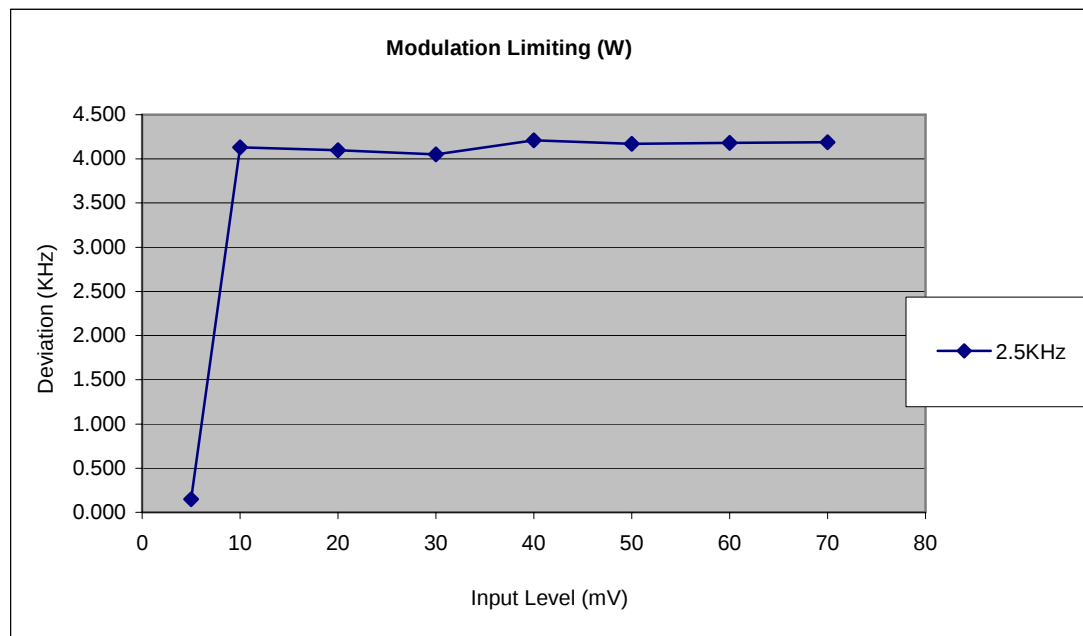
Emission Designator:

For 12.5KHz Channel Spacing: $2M+2D = 2x3+2x2.5 = 11K0F3E$

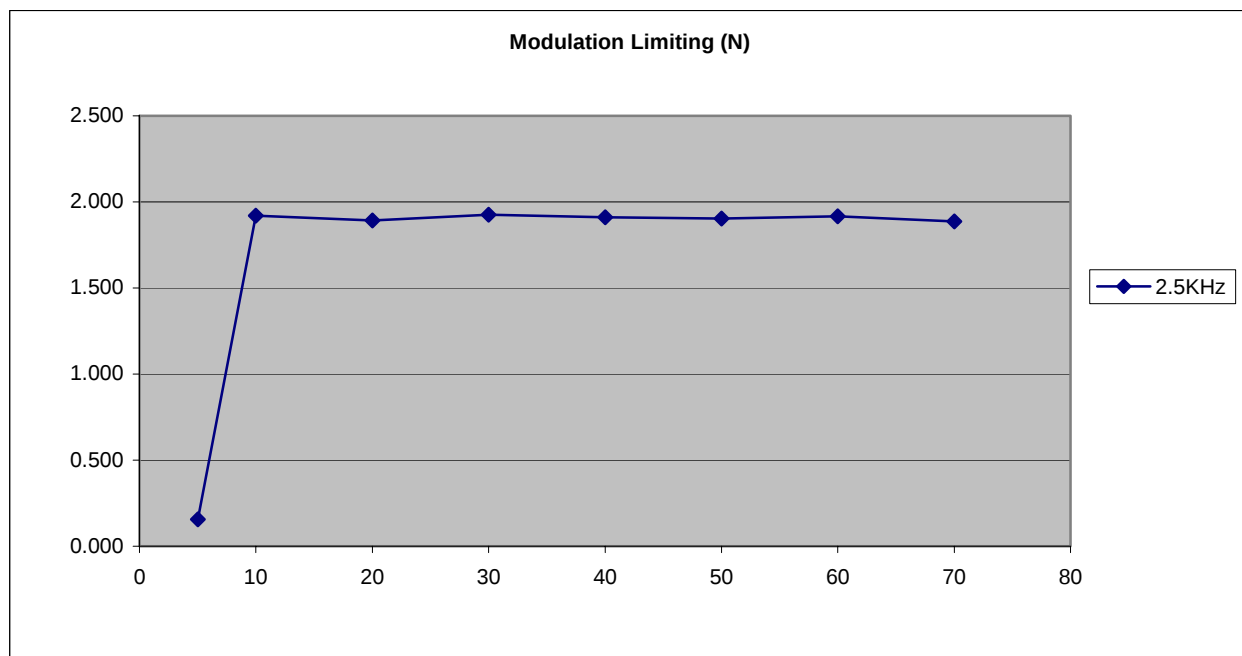
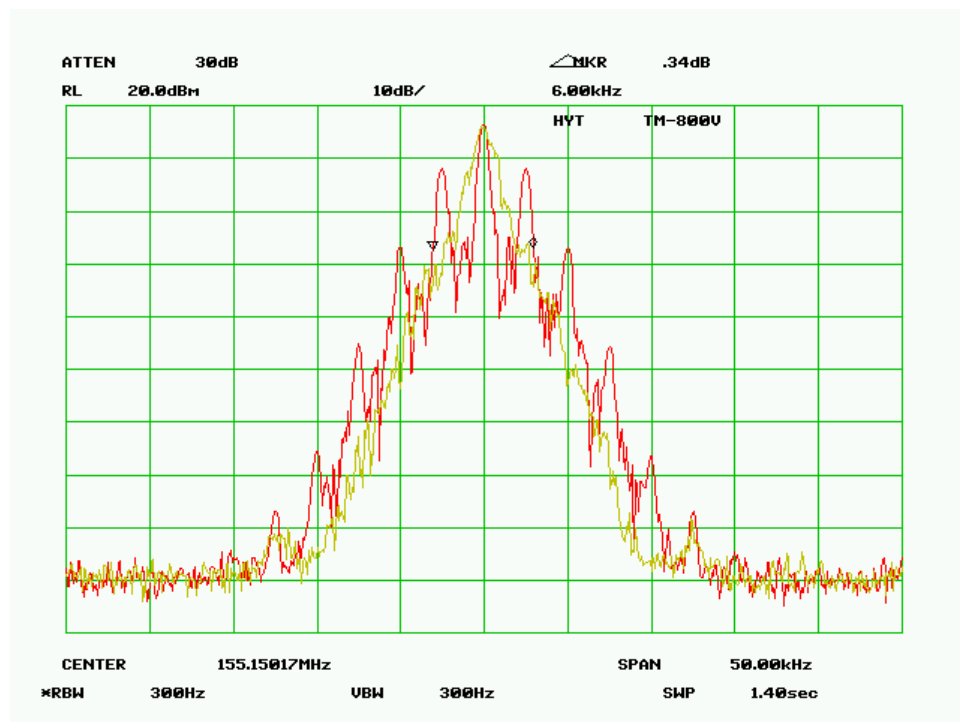
For 25 KHz Channel Spacing: $2M+2D = 2x3+2x5 = 16K0F3E$

Channel 2 - 155.15 MHz, High power, Wide





Input (mV)	2.5KHz
5	0.149
10	4.130
20	4.100
30	4.050
40	4.210
50	4.170
60	4.180
70	4.190

Channel 5 - 155.15 MHz, High power, Narrow

Input (mV)	2.5KHz
5	0.156
10	1.920
20	1.892
30	1.925
40	1.911
50	1.904
60	1.916
70	1.887

§2.1051 and §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

§2.1051 and §90.210 (25kHz bandwidth only)

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

$$43+10\log P=43+10\log(5.21)=50.17\text{dB}$$

§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:

$$50+10\log P=50+10\log(5.21)=57.17\text{dB}$$

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 10th harmonic.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
HP	Spectrum Analyzer	8565EC	3946A00131	2004-08-06

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

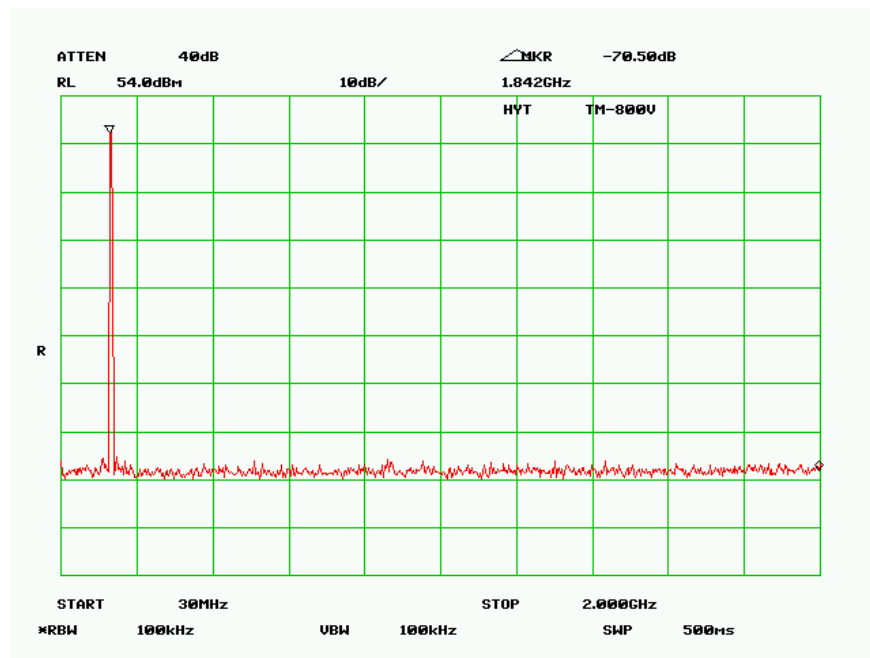
Temperature:	23° C
Relative Humidity:	55%
ATM Pressure:	1021 mbar

The testing was performed by Hang Tan on 2005-05-13.

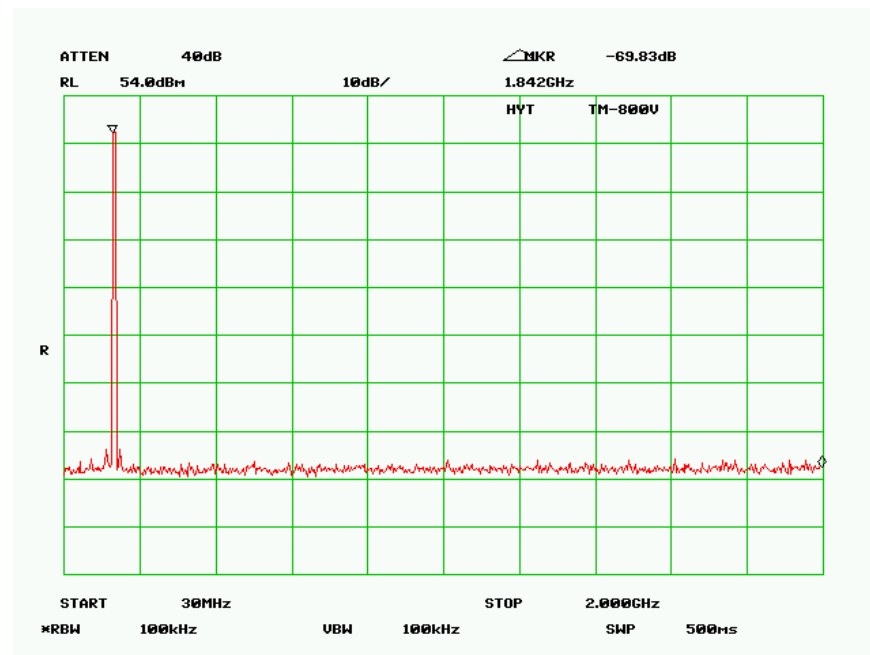
Test Results

Please refer to the hereinafter plots.

Channel 2 - 155.15 MHz, High power, Wide



Channel 5 - 155.15 MHz, High power, Narrow



§2.1053 and §90.210 - RADIATED SPURIOUS EMISSION

Applicable Standard

§2.1053 and §90.210

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 = $10 \lg (\text{TXpwr in Watts}/0.001)$ – the absolute level

Spurious attenuation limit in dB = $43 + 10 \log_{10} (\text{power out in Watts})$ for EUT with a 25KHz channel bandwidth.

Spurious attenuation limit in dB = $50 + 10 \log_{10} (\text{power out in Watts})$ for EUT with a 12.5KHz channel bandwidth.

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
Sunol Sciences	Antenna	JB1	A013105-3	2005-02-11
A.H. System	Horn Antenna	SAS-200/571	2455-261	2004-08-02
HP	Signal Generator	8648C	3426A01345	2004-05-17
Com-Power	Antenna, Dipole	AD-100	2219	2004-09-26
Rohde & Schwarz	Test Receiver	ESCI	100044	2004-09-29
HP	Pre Amplifier	8447D	2944A10187	2004-08-25

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

Temperature:	23° C
Relative Humidity:	55%
ATM Pressure:	1021 mbar

The testing was performed by Hang Tan on 2005-05-13.

Test Result

-2.84 at 310.28MHz, for 25KHz channel bandwidth
 -0.91 at 310.28MHz, for 12.5KHz channel bandwidth

EUT					Substitution				Absolute Power	FCC 90	
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Half- wavel cm	Reading dBm	Antenna Gain dB	Cable Loss dB		Limit dBm	Margin dB
Mid Channel, High Power (Wide 25kHz)											
310.28	86.5	0	1.2	V	24.2	-17.03	1.4	0.2	-15.8	-13	-2.84
620.58	84.0	270	2.5	V	12.1	-17.95	1.4	0.5	-17.1	-13	-4.09
310.28	80.1	0	1.5	H	24.2	-19.80	1.4	0.2	-18.6	-13	-5.61
930.88	76.5	180	1.1	V	8.1	-19.80	1.1	0.7	-19.4	-13	-6.42
620.58	74.2	0	1.6	H	12.1	-21.03	1.4	0.5	-20.2	-13	-7.17
775.73	72.4	0	2.3	V	9.7	-22.83	1.3	0.7	-22.3	-13	-9.28
930.88	70.9	180	1.3	H	8.1	-24.33	1.1	0.7	-23.9	-13	-10.94
775.73	65.8	180	1.0	H	9.7	-29.43	1.3	0.7	-28.9	-13	-15.88
Mid Channel, High Power (Narrow 12.5kHz)											
310.28	78.3	0	2.0	V	24.2	-22.10	1.4	0.2	-20.9	-20	-0.91
620.58	78.0	270	2.4	V	12.1	-22.03	1.4	0.5	-21.2	-20	-1.17
310.28	77.5	0	1.3	H	24.2	-22.70	1.4	0.2	-21.5	-20	-1.51
620.58	73.8	0	1.7	H	12.1	-24.60	1.4	0.5	-23.7	-20	-3.74
775.73	71.4	0	2.2	V	9.7	-25.83	1.3	0.7	-25.3	-20	-5.28
930.88	70.3	180	1.1	V	8.1	-26.50	1.1	0.7	-26.1	-20	-6.12
930.88	70.7	180	1.0	H	8.1	-26.53	1.1	0.7	-26.1	-20	-6.15
775.73	66.4	180	1.0	H	9.7	-28.83	1.3	0.7	-28.3	-20	-8.28

Note:

- 1) No preamplifier used.
- 2) Test in three orthogonal plane.
- 3) Normal condition

§2.1055 (d) and §90.213- FREQUENCY STABILITY

Applicable Standard

§2.1055 (d)

§90.213

For output power > 2 watts, the limit is 5ppm for 150-174 MHz.

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.

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
Tenney	Temperature Chamber -50 ⁰ to +100 ⁰ C	Versa	12.222-193	2004-05-23
HP	Spectrum Analyzer	8565EC	3946A00131	2004-08-06
HP	DC Power Supply	6236B	2003A05705	N/A
HP	Microwave Frequency Counter	5342A	2232A06383	2004/09/07

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

Temperature:	22° C
Relative Humidity:	63%
ATM Pressure:	1017 mbar

The testing was performed by Hang Tan on 2005-05-14.

Test Results

	Temperature C	Measured Frequency MHz	Frequency Error PPM	Limit PPM
Normal Voltage (12.0V)	-30	155.150130	0.837899	5.0
	-20	155.150128	0.825008	5.0
	-10	155.150173	1.115050	5.0
	0	155.150195	1.256848	5.0
	10	155.150221	1.424428	5.0
	20	155.150200	1.289075	5.0
	30	155.150212	1.366420	5.0
	40	155.150161	1.037705	5.0
	50	155.150143	0.921689	5.0
	60	155.150100	0.644538	5.0
Low Voltage (8.0V)	-30	155.150170	1.095714	5.0
	-20	155.150136	0.876571	5.0
	-10	155.150168	1.082823	5.0
	0	155.150182	1.173058	5.0
	10	155.150198	1.276184	5.0
	20	155.150230	1.482436	5.0
	30	155.150224	1.443764	5.0
	40	155.150246	1.585562	5.0
	50	155.150321	2.068966	5.0
	60	155.150400	2.578150	5.0

Ref freq: 155.15000 MHz

Normal voltage: 12.0V

§90.214 - TRANSIENT FREQUENCY BEHAVIOR

Standard Applicable

§90.214

Test Method

TIA/EIA-603 2.2.19

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
Tektronix	Oscilloscope	TDS7104	B020557	2004-10-09
HP	Modulation Analyzer	8901A	2026A00847	2004-08-09
Rohde & Schwarz	Generator, Signal	SMIQ03	DE23746	2004-07-03

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

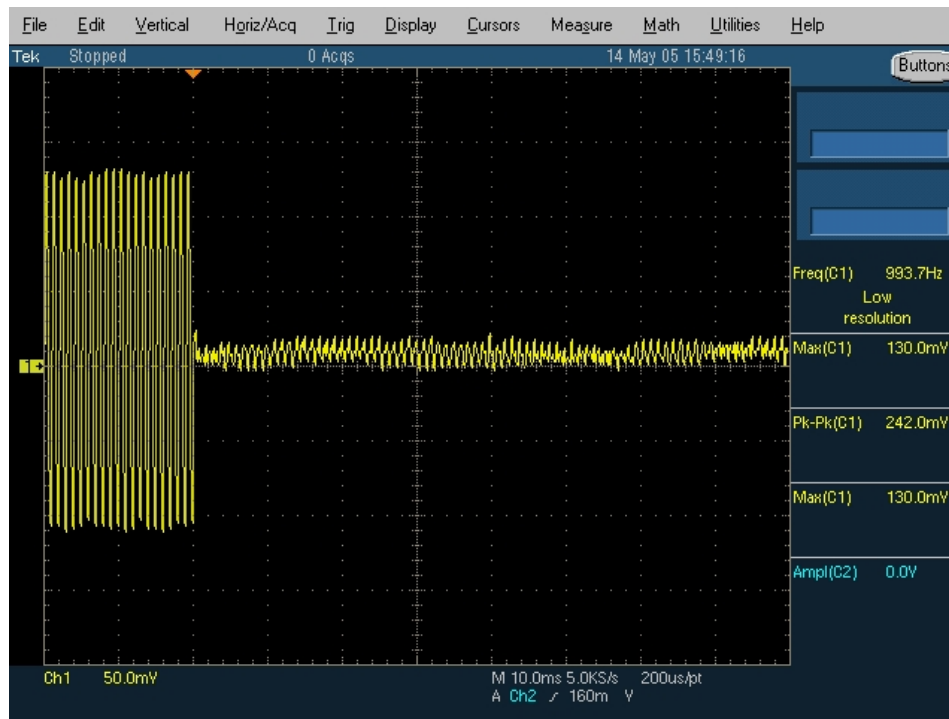
Temperature:	23° C
Relative Humidity:	55%
ATM Pressure:	1021 mbar

The testing was performed by Hang Tan on 2005-05-13.

Test Result

Please refer to the plot hereinafter.

Turn On:



Turn Off:

