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: R74TC3000

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

Test Engineer:	Benjamin Jin
Report No.:	R0405064
Report Date:	2004-06-02
Reviewed By:	Ling Zhang
Prepared By:	Bay Area Compliance Laboratory Corporation 230 Commercial Street Sunnyvale, CA 94085 Tel: (408) 732-9162 Fax: (408) 732 9164

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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Shenzhen HYT Science&Technology Co.,Ltd's* Model: *TC3000* or the "EUT" as referred to in this report is a Two-way Radio, which measured approximately 5.8cmL x 3.2cmW x 19cmH.

The EUT operates at 440 - 470 MHz with maximum power of 4.29 W, frequency tolerance 2.5ppm, emission designator 11K0F3E, 16K0F3E.

**The test data gathered are from production sample serial number TC3000-001 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, transcient 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 63.4-2001, 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 C63.4-2001.

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.

SYSTEM TEST CONFIGURATION

Justification

The host system was configured for testing according to ANSI C63.4-2001.

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

Block Diagram

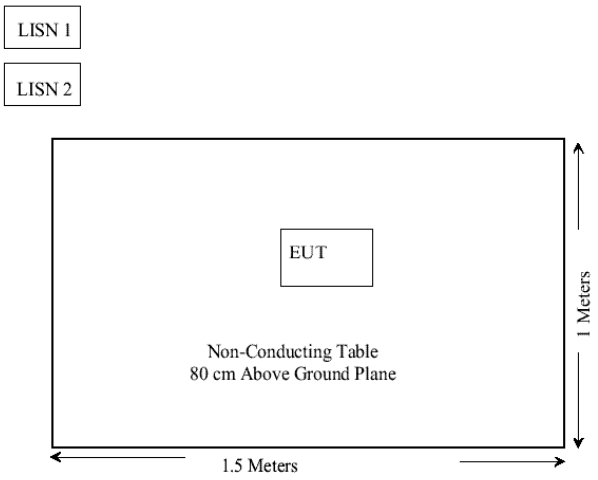
Please refer to Exhibit D.

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
§ 2.1046	Conducted Output Power	Compliant
§ 2.1046, § 90.205	RF 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
Hewlett Packard	Spectrum Analyzer	HP8565C	06042	2004-05-03
Hewlett Packard	Plotter	HP7470A	N/A	N/A

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

Environmental Conditions

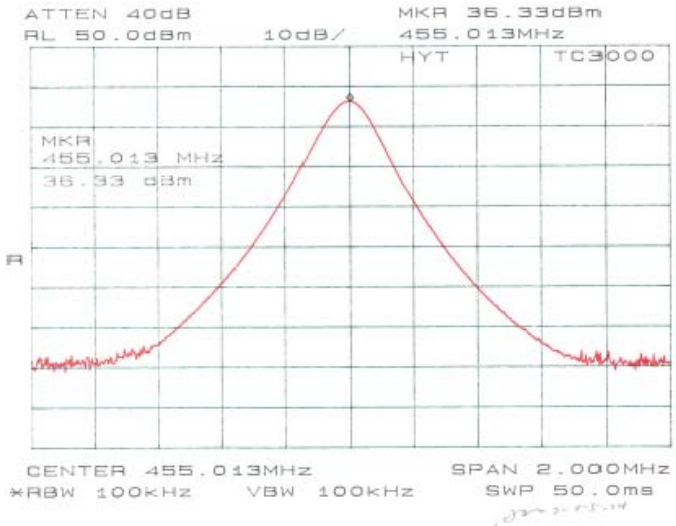
Temperature:	24° C
Relative Humidity:	72%
ATM Pressure:	1015 mbar

The testing was performed by Benjamin Jin on 2004-05-24.

Test Results

Freqyency	Output Power in dBm	Output Power in W
455.013	36.33	4.295

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



§2.1046 and §90.205 – RF 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

1. On a test site, the EUT shall be placed at 1.5m height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3m from EUT to correspond to the frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the quasi-peak detector is used for the measurement.
4. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6. The transmitter shall then the rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a substitution antenna.
10. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

17. The measure of the effective radiated power is the large of the two levels recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	8568B	2601A02165	2003-07-03
HP	Amplifier	8447E	2944A10187	2003-09-23
HP	Quasi-Peak Adapter	85650A	3019A05393	2004-06-13
EMCO	Biconical Antenna	3110B	9309-1165	2003-10-11
EMCO	Log Periodic Antenna	3146	2101	2003-10-11
AH System	Horn Antenna	SAS-200/511	261	2003-08-02

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

Environmental Conditions

Temperature:	24° C
Relative Humidity:	72%
ATM Pressure:	1015 mbar

The testing was performed by Benjamin Jin on 2004-05-24.

Test Results

For 25kHz Channel Bandwidth:

FREQUENCY (MHZ)	SUBSTITUTION READING (dBm)	SUBSTITUTION ANTENNA GAIN	SUBSTITUTION CALBE LOSS (dB)	ERP (dBm)
455.0125	36.9	0.0	0.1	36.8
455.0125	28.7	0.0	0.1	28.6

For 12.5kHz Channel Bandwidth:

FREQUENCY (MHZ)	SUBSTITUTION READING (dBm)	SUBSTITUTION ANTENNA GAIN	SUBSTITUTION CALBE LOSS (dB)	ERP (dBm)
455.0125	36.6	0.0	0.1	36.5
455.0125	28.5	0.0	0.1	28.4

Sample calculation:

Absolute level = substitution reading + antenna gain - cable loss

For example:

36.9 + 0.0 – 0.1 = 36.8

§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
Agilent	Spectrum Analyzer	8565EC	3946A00131	2003-06-30
Hewlett Packard	Modulation Analyzer	8901A	2026A00847	2003-08-19

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

Environmental Conditions

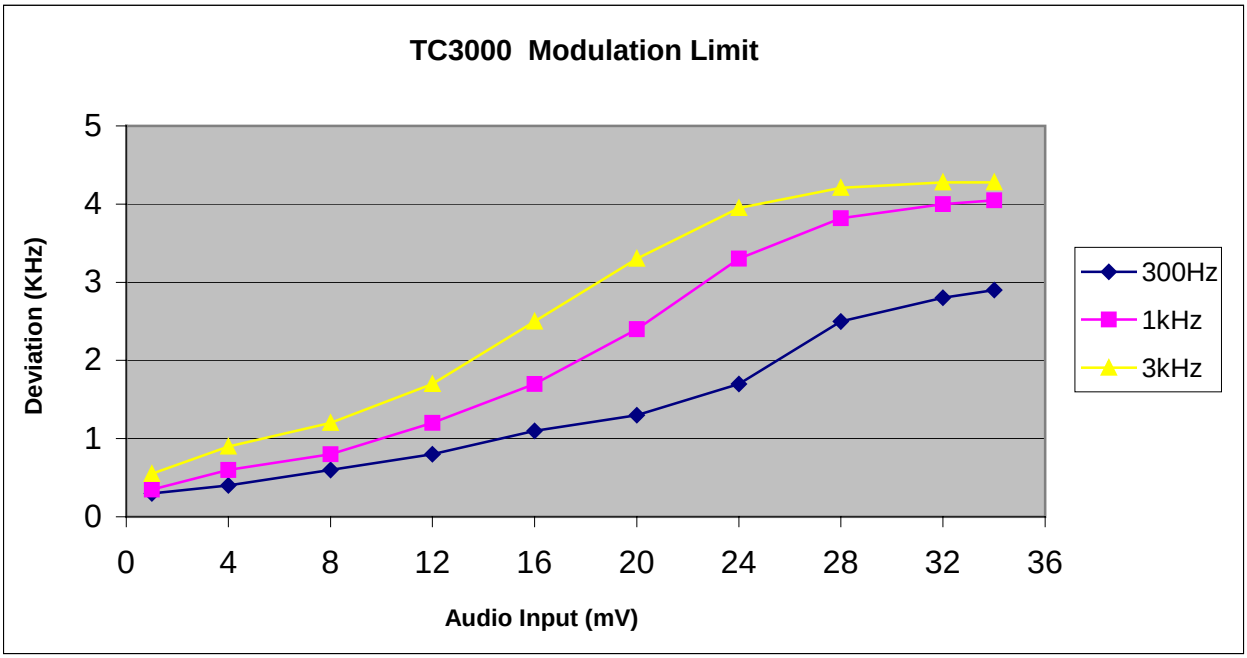
Temperature:	24° C
Relative Humidity:	72%
ATM Pressure:	1015 mbar

The testing was performed by Benjamin Jin on 2004-05-24.

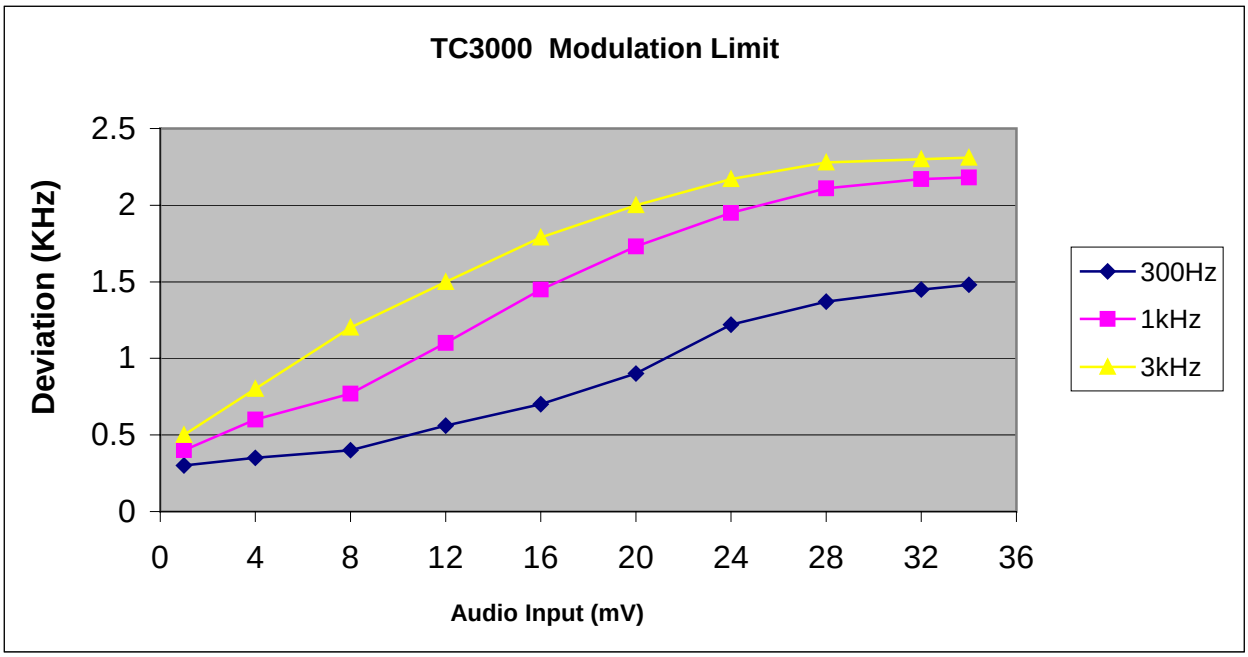
Test Results

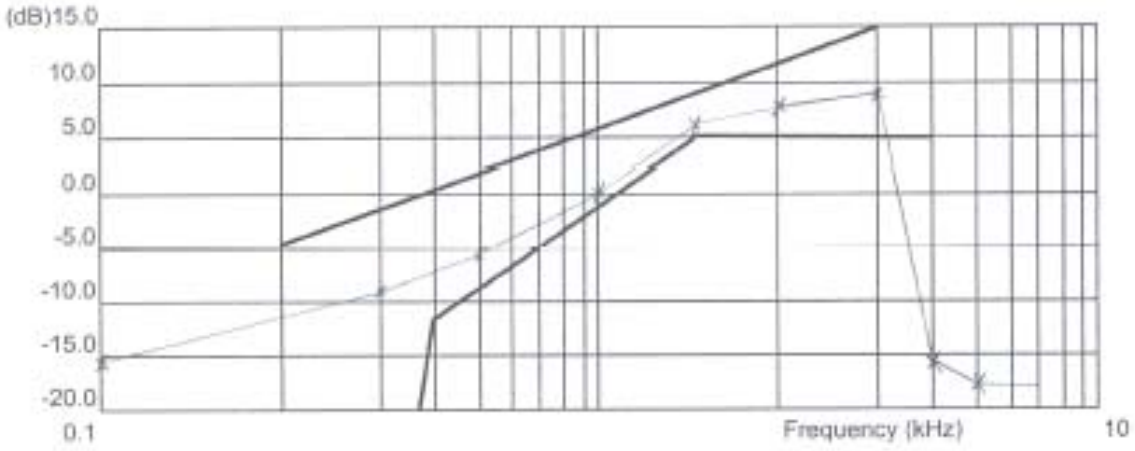
The plot(s) of modulation characteristic is presented hereinafter as reference.

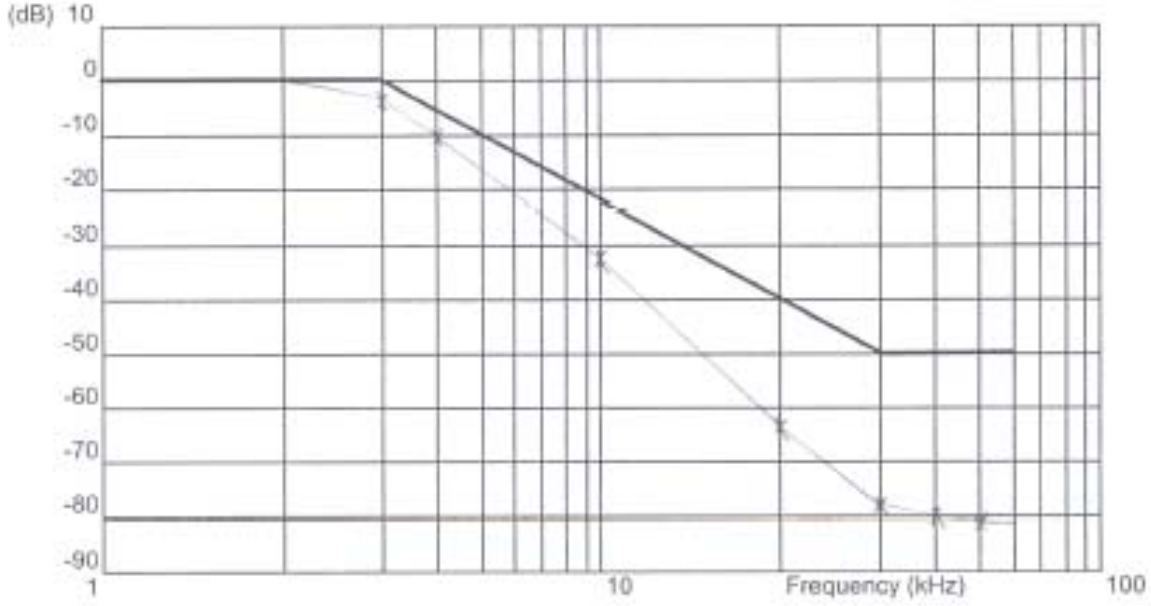
For 25KHz Channel Spacing:



For 12.5KHz Channel Spacing:




(dB)15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
0.1
Frequency (kHz)
10


(dB) 10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
1
10
Frequency (kHz)
100

§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 –2.88kHz) 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:

50+10logP=50+10log(4.295)=56.33dB

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+10logP=43+10log(4.295)=49.33dB

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
Agilent	Spectrum Analyzer	8565EC	3946A00131	2003-06-30
Hewlett Packard	Plotter	HP7470A	N/A	N/A
NAAYAN	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:	72%
ATM Pressure:	1015 mbar

The testing was performed by Benjamin Jin on 2004-05-24.

Test Results

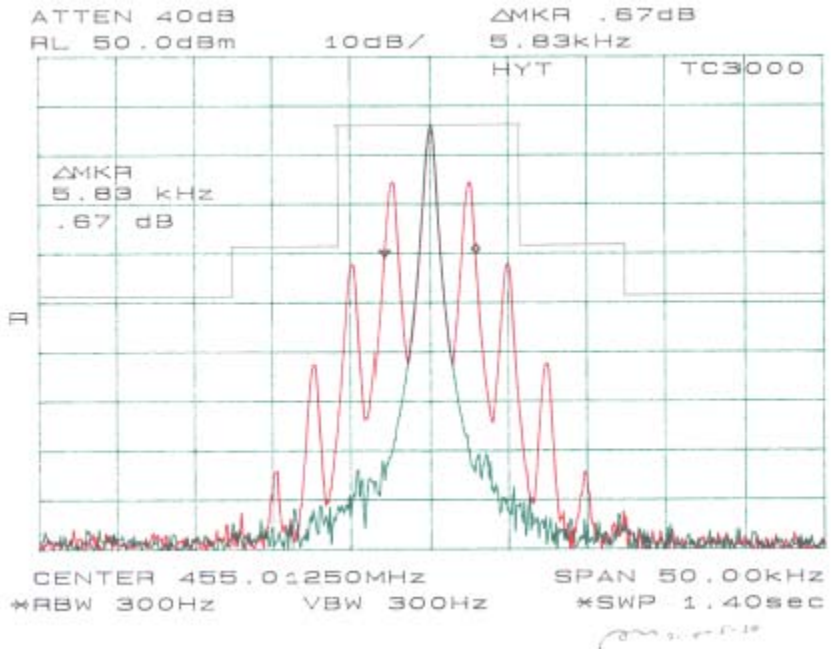
Please refer to the hereinafter plots.

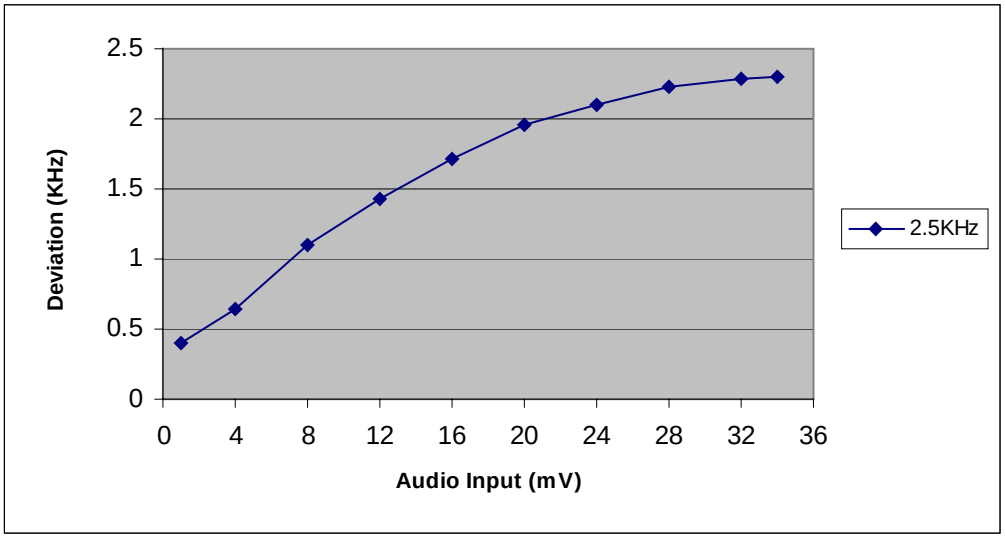
Emission Designator:

For 12.5KHz Channel Spacing: 2M+2D = 2x3+2x2.5 = 11K0F3E, 11K0F9W

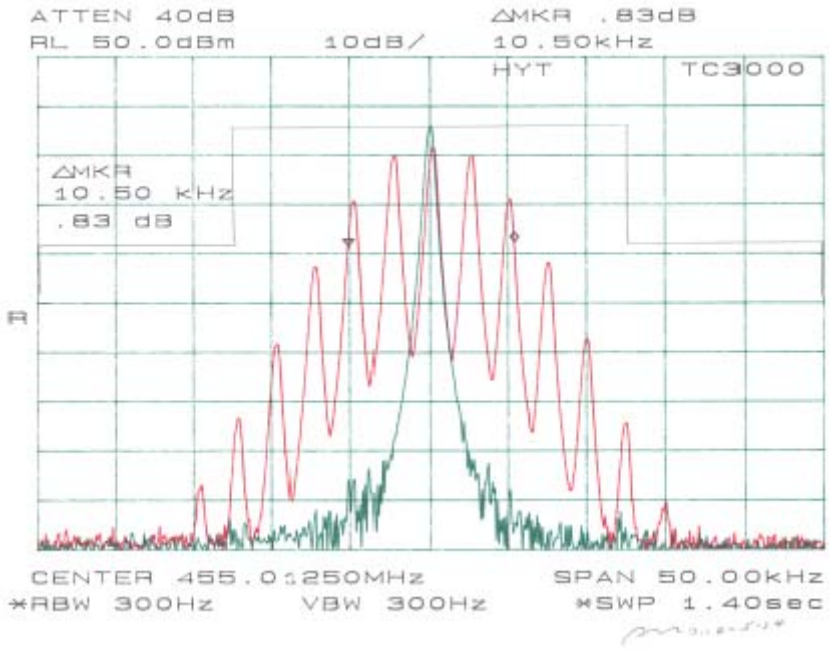
For 25 KHz Channel Spacing: 2M+2D = 2x3+2x5 = 16K0F3E, 16K0F9W

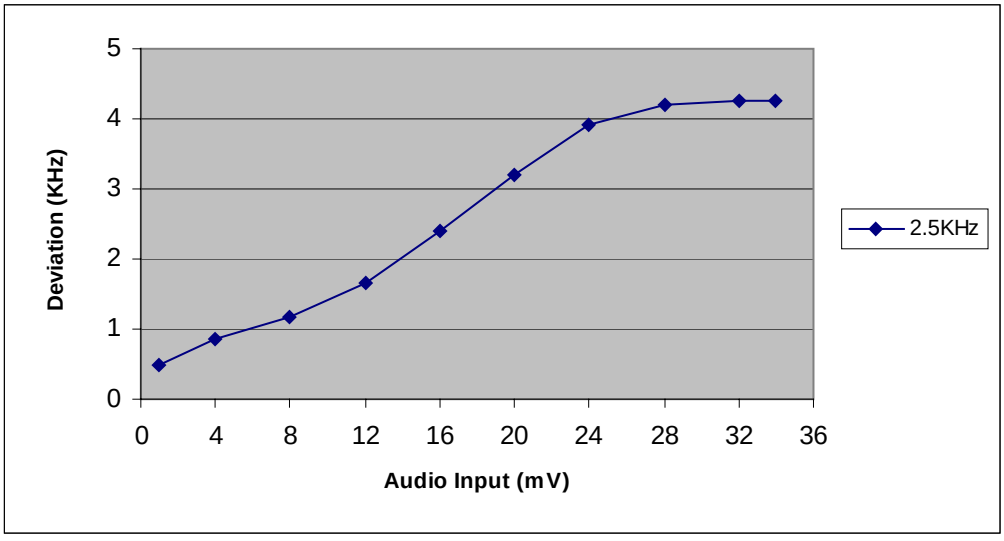
For 12.5 KHz Channel Spacing:





For 25 KHz Channel Spacing:





§2.1051 and §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

§2.1051and §90.210 (25kHz bandwidth only)

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

43+10logP=43+10log(4.295)=49.33dB

§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+10logP=50+10log(4.295)=56.33dB

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
Agilent	Spectrum Analyzer	8565EC	3946A00131	2003-06-30

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

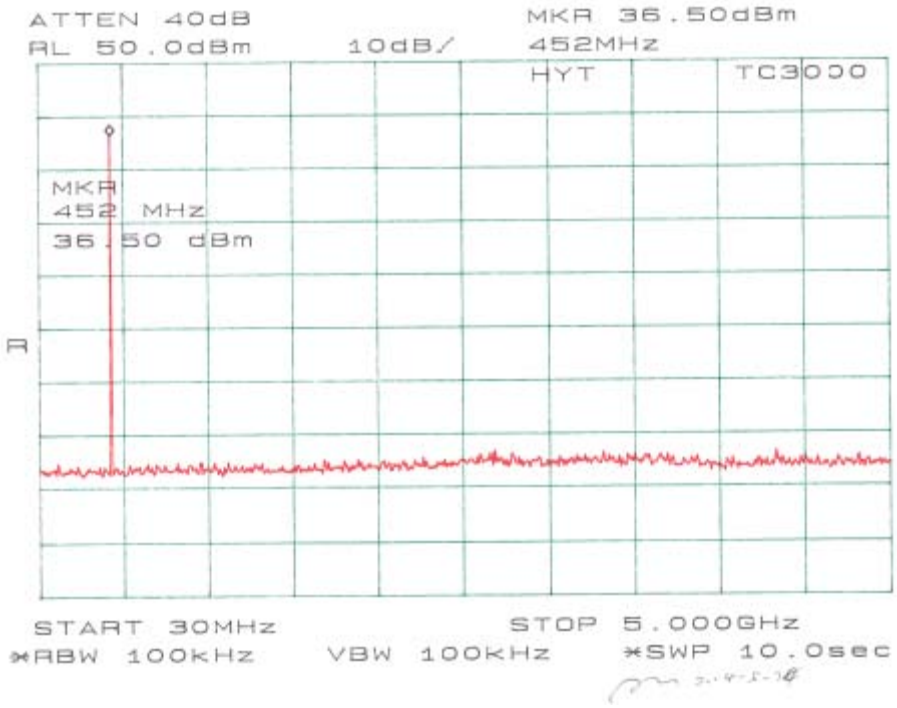
Environmental Conditions

Temperature:	24° C
Relative Humidity:	72%
ATM Pressure:	1015 mbar

The testing was performed by Benjamin Jin on 2004-05-24.

Test Results

Please refer to the hereinafter plots.


ATTEN 40dB
RL 50.0dBm
10dB/
MKR 36.50dBm
452MHz
HYT
TC3000
MKR
452 MHz
36.50 dBm
A
START 30MHz
STOP 5.000GHz
*RBW 100KHz
VBW 100KHz
*SWP 10.0sec

§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 (TXpwr in Watts/0.001) – the absolute level

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

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

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
EMCO	Biconical Antennas	3110B	9603-2315	2003-10-11
EMCO	Log-Periodic Antenna	3148	0004-1155	2003-10-11
A.H. System	Horn Antenna	SAS-200/571	2455-261	2003-08-02
Agilent	Spectrum Analyzer	8565EC	3946A00131	2003-06-30
Signal Generator	Rohde & Schwarz	SMIQ03	DE23746	2003-07-03
Rohde & Zchwarz	Signal Generator	SMIQ03B	1084.8004.03	2003-12-03

* **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:	72%
ATM Pressure:	1015 mbar

The testing was performed by Benjamin Jin on 2004-05-24.

Test Result

-33.3 at 194.9200MHz, for 25KHz channel bandwidth
-26.5 at 194.9200MHz, for 12.5KHz channel bandwidth

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss DB	Level dBm	Limit dBm	Margin DB
For transmitter with 25KHz ch. Bandwidth. Primary scan at 455.0125MHz (CH3)												
455.0125	109.2	30	1.5	v	455.0125	36.9	v	0	0.1	36.8		
455.0125	101.3	0	1.6	h	455.0125	28.7	h	0	0.1	28.6		
194.9200	41.3	230	1.5	v	194.9200	-46.2	v	0	0.1	-46.3	-13	-33.3
1365.0375	31.5	270	1.5	v	1365.0375	-53.7	v	6.8	0.5	-47.4	-13	-34.4
571.2600	40.7	230	1.5	v	571.2600	-47.4	v	0	0.2	-47.6	-13	-34.6
435.0600	39.6	0	16	h	435.0600	-48.1	h	0	0.2	-48.3	-13	-35.3
1365.0375	30.4	120	1.8	h	1365.0375	-54.9	h	6.8	0.5	-48.6	-13	-35.6
910.0250	30.7	180	1.8	v	910.0250	-55.2	v	4.9	0.3	-50.6	-13	-37.6
910.0250	29.6	310	1.5	h	910.0250	-56.3	h	4.9	0.3	-51.7	-13	-38.7
For transmitter with 12.5KHz ch. Bandwidth. Primary scan at 455.0125MHz (CH3)												
455.0125	108.8	30	1.5	v	455.0125	36.6	v	0	0.1	36.5		
455.0125	101.2	0	1.6	h	455.0125	28.5	h	0	0.1	28.4		
194.9200	41.2	230	1.5	v	194.9200	-46.4	v	0	0.1	-46.5	-20	-26.5
1365.0375	31.3	270	1.5	v	1365.0375	-53.9	v	6.8	0.5	-47.6	-20	-27.6
571.2600	40.7	230	1.5	v	571.2600	-47.4	v	0	0.2	-47.6	-20	-27.6
435.0600	39.6	0	16	h	435.0600	-48.1	h	0	0.2	-48.3	-20	-28.3
1365.0375	30.2	120	1.8	h	1365.0375	-55.1	h	6.8	0.5	-48.8	-20	-28.8
910.0250	30.5	180	1.8	v	910.0250	-55.4	v	4.9	0.3	-50.8	-20	-30.8
910.0250	29.4	310	1.5	h	910.0250	-56.5	h	4.9	0.3	-51.9	-20	-31.9

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 2.5ppm.

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	2004-04-23
Agilent	Spectrum Analyzer	8565EC	3946A00131	2003-06-30

* **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:	72%
ATM Pressure:	1015 mbar

The testing was performed by Benjamin Jin on 2004-05-24.

Test Results

Reference Frequency: 455.0125 MHz, Limit: 2.5 ppm			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed	
		MCF (MHz)	PPM Error
50	7.2	455.01217	-0.73
40	7.2	455.01231	-0.42
30	7.2	455.01239	-0.24
20	7.2	455.01242	-0.18
10	7.2	455.01245	-0.11
0	7.2	455.01257	0.07
-10	7.2	455.01301	1.12
-20	7.2	455.01318	1.49
-30	7.2	455.01325	1.65

Frequency Stability Versus Input Voltage

Reference Frequency: 455.0125 MHz, Limit: 2.5 ppm		
Power Supplied (Vdc)	Frequency Measure with Time Elapsed	
	Frequency (MHz)	Error (ppm)
6.2	455.01241	-0.19

Note: 1) Limit 2.5ppm is for EUT operating with 12.5KHz channel bandwidth.
2) The end point is 6.2Vdc.

§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	2003-10-09
NAA YAN	Audio Generator	NY2201	00042	N/A
HP	Modulation Analyzer	8901A	2026A00847	2003-08-09

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

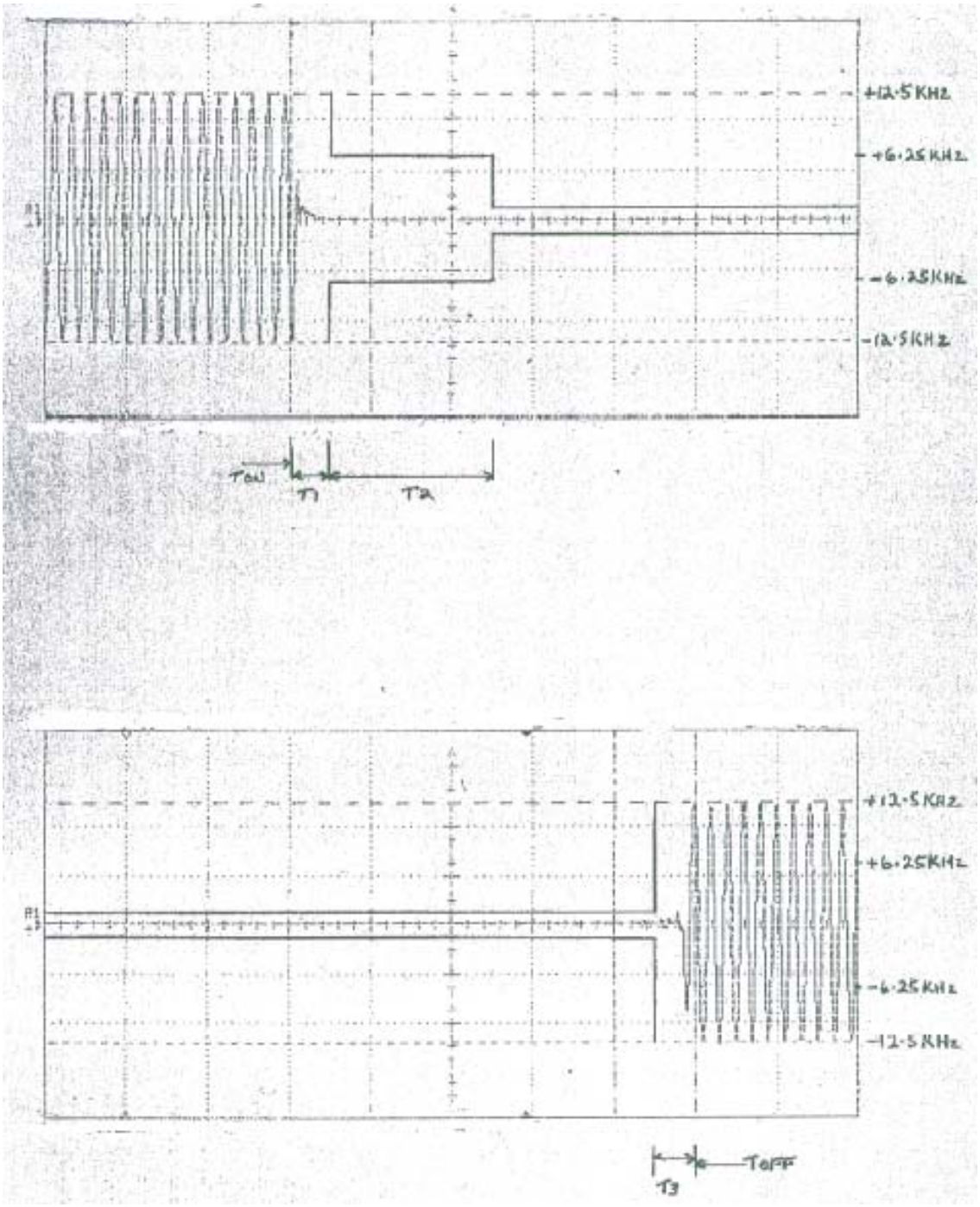
Environmental Conditions

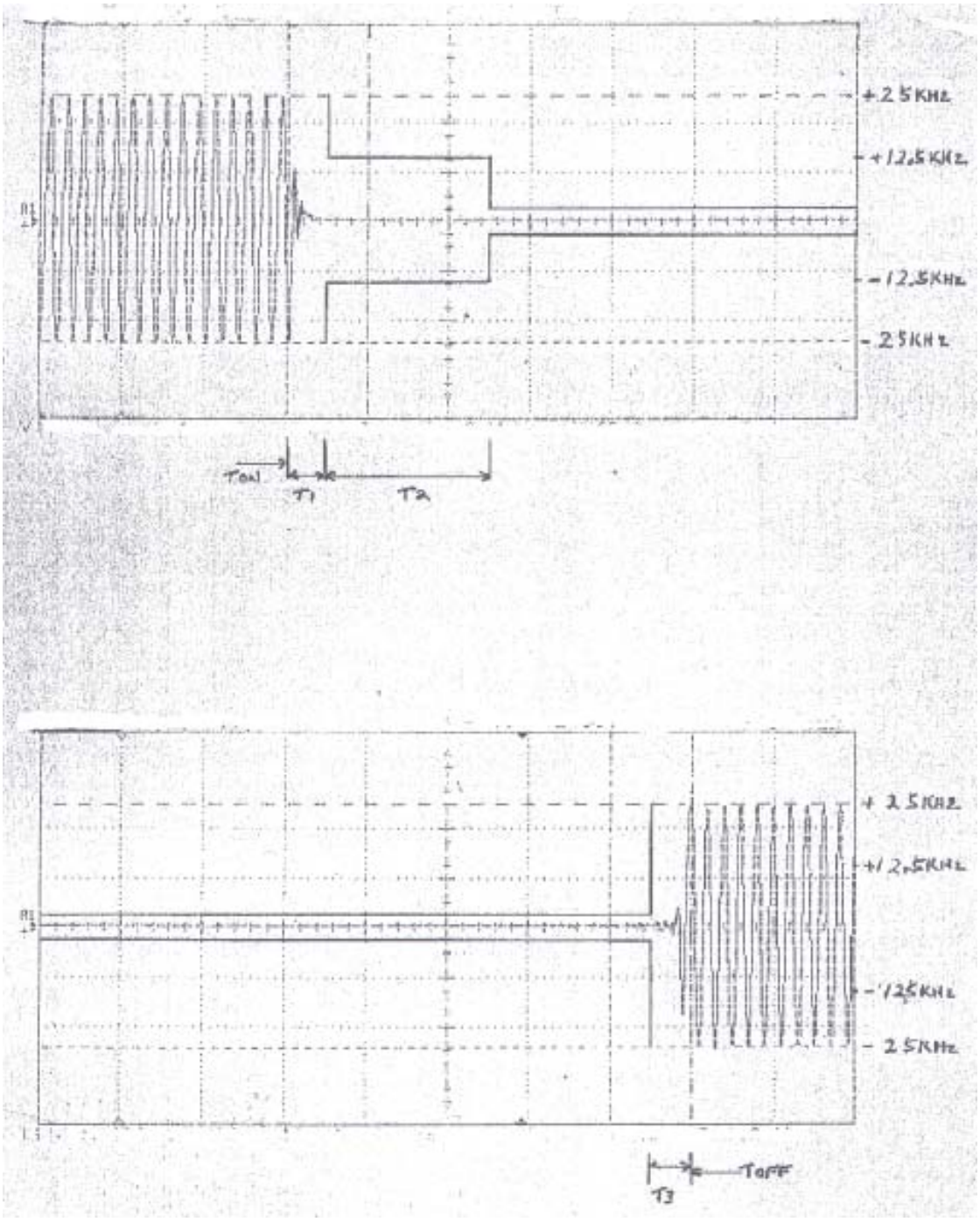
Temperature:	24° C
Relative Humidity:	72%
ATM Pressure:	1015 mbar

The testing was performed by Benjamin Jin on 2004-05-24.

Test Result

Please refer to the plot hereinafter.


+12.5KHz
+6.25KHz
-6.25KHz
-12.5KHz
T1
T2
+12.5KHz
+6.25KHz
-6.25KHz
-12.5KHz
T3


+2.5KHz
+12.5KHz
-12.5KHz
-2.5KHz
Ton
T1
T2
+2.5KHz
+12.5KHz
-12.5KHz
-2.5KHz
T3
Toff