

FCC Certification Test Report of 450MHz to 470MHz Transmitter

Applicant : Gold Apollo Co., Ltd.
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His-Chih, Taipei Hsien, Taiwan, R.O.C.

Model No. : TE-100

EUT : Transmitter

FCC ID : NDATX100XU

Report No. : G1515395

Tested by :

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CERTIFICATION

We here by verify that:

The test data, data evaluation, test procedures and equipment configurations shown in this report were made mainly in accordance with the procedures given in ANSI C63.4 (1992) as a reference and ANSI/TIA/EIA-603. All test were conducted by *Training Research Co., Ltd.*, No. 15, Lane 530, Pa-Lian RD., Sec. 1, Hsichih City, Taipei Hsien, Taiwan, R.O.C.. Also, we attest to the accuracy of each.

We further submit that the energy emitted by the sample EUT tested as described in the report is in compliance with the technical requirements set forth in the FCC Rules Part 90.

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Tables of Contents

I. GENERAL	5
1.1 Introduction	5
1.2 Description of EUT	5
1.3 Specification of EUT	5
1.4 Configuration of System Under Test	4
1.5 Location of the Test Site	7
1.6 General Test Condition	7
 II. Emissions Designator: (Part 2.201)	 8
 III. Modulation Characteristics: (Part 2.1047)	 9
 IV. RF Power Output (Part 2.1046, 90.205)	 9
4.1 Test Procedure	9
4.2 Test Result	9
4.3 Test Equipment	9
 V. Occupied Bandwidth: (Part 2.1049, 90.209).....	 11
5.1 Test Procedure	11
5.2 Test Result	11
5.3 Test Equipment	11
 VI. Spurious Emissions at Antenna Terminals (Part 2.1051, 90.210)	 13
6.1 Test Procedure	13
6.2 Test Result	13
6.3 Test Equipment	13
 VII. Filed Strength of Spurious Radiation (Part 90.210)	 18
7.1 Test Procedure	18
7.2 Test Equipment	18
7.3 Test Result	19
7.4 Test Placement	21

VIII. Frequency Stability (Part 2.1055, 90.213)	22
8.1 Test Procedure (Voltage)	22
8.2 Test Result	22
8.3 Test procedure (Temperature)	23
8.4 Test Result	23
8.5 Test Equipment	24
IX. Transient Frequency Behavior (Part 90.214)	25
9.1 Test Procedure	25
9.2 Test Result	25
9.3 Test Equipment	25

. GENERAL

1.1 Introduction

The following measurement report is submitted on behalf of applicant in support that the certification in accordance with Part 2 Subpart J and Part 90 of the Commission's Rules and Regulations.

1.2 Description of EUT

The Gold Apollo TE-100 is a POCSAG paging transmitters suitable for messaging or remote control applications. The units are designed for hand-held operation or fixing to a flat surface, such as a wall.

1.3 Specification of EUT

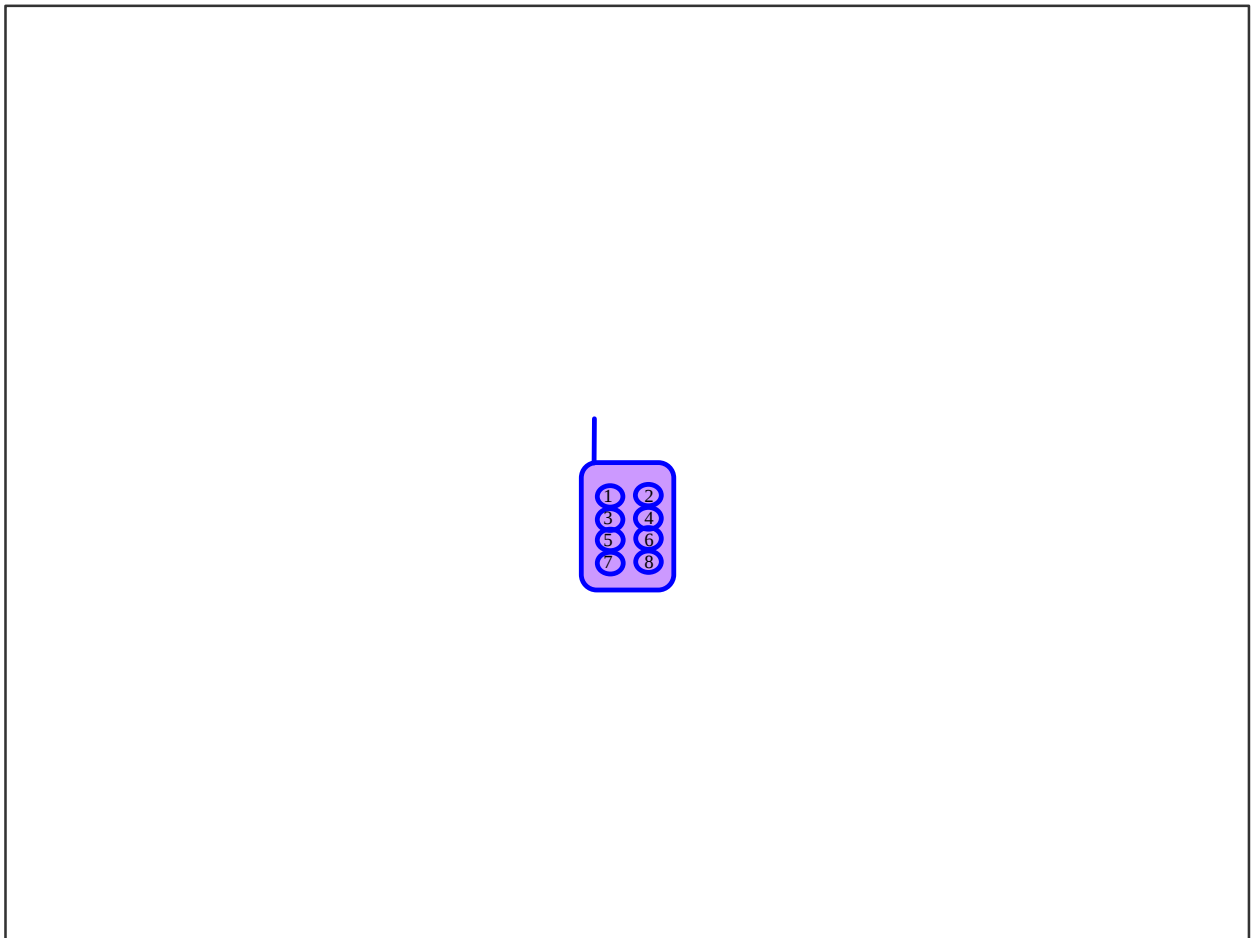
RF

.Frequency range	TX : 450MHz ~ 470MHz
.Modulation type	: FSK.
.Channel spacing	: 12.5kHz or 25KHz
.Output power(ERP)	: +26dBm
.Maximum deviation	: $\pm 2.5\text{kHz}$ or $\pm 4.5\text{kHz}$
.Harmonic Radiation	: less - 25 dBm
.Frequency stability	: 2.5 ppm at $-30^{\circ}\text{C} \sim 60^{\circ}\text{C}$
.Output Connect	: SMA (F)

GENERAL

.Active Voltage range	: 3.45 ~ 4.5V (AAA size battery $\times$ 3)
.Current consumption	: Standby : 30 μ A Transmit : 350mA
.Dimensions	: 58(W) $\times$ 112.8(H) $\times$ 22.5(D) mm (Without Antenna)
.Weight	: 85g (Without Battery & Antenna)
.1, 4 or 8 buttons provides multiple messaging capability	
max alpha character	: 1200
max numeral	: 2000
tone only	
.Built-in battery check	

1.4 Configuration of System Under Test



Connections of EUT:

*Put three AA size, 1.5V battery into the battery cell of EUT.
The EUT does not be connected with any product.

1.5 Location of the Test Site

The radiated emissions measurements (above 1GHz) required by the rules were performed on the **three-meter, Anechoic Chamber (Registration Number: 93906)** maintained by *Training Research Co., Ltd.* 1F, No. 255 Nanyang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C. Complete description and measurement data have been placed on file with the commission. The conducted power line emissions tests and radiated emissions measurements below 1 GHz were performed in an OATS located at Pa-Lian His-chih Training Research Co., Ltd.

No. 15, Lane 530, Pa-Lian RD., Sec. 1, Hsichih City, Taipei Hsien, Taiwan, R.O.C. (Registration No.: 91035) *Training Research Co., Ltd.* is listed by the FCC as a facility available to do measurement work for others on a contract basis.

1.6 General Test Condition

The conditions under which the EUT operates were varied to determine their effect on the equipment's emission characteristics. The final configuration of the test system and the mode of operation used during these tests were chosen as that which produced the highest emission levels. However, only those conditions, which the EUT was considered likely to encounter in normal use were investigated.

While testing, device was set in high power and continuously transmitting mode. There are two 460MHz-devices with the different deviation, 2.5KHz and 4.5KHz, to be measured.

II. Emissions Designator (Part 2.201)

Referencing Part 2.201 and 2.202 of the FCC Rules and Regulation and using the following formula the Emissions Designator(s) and Necessary Bandwidths were calculated.

Necessary Bandwidth:

$$B = 2M + 2DK$$

Frequency deviation (D) = 2.5 KHz to 4.5 KHz

Baud rate = 1200 baud

$$M = \text{Baud} / 2 = 1200 / 2 = 600$$

D = 2.5 KHz or 4.5 KHz and using K = 1

For the 2.5 KHz deviation:

$$B = 2 (600) + (2) (2500) (1) = 6200$$

For the 4.5 KHz deviation:

$$B = 2 (600) + (2) (4500) (1) = 10200$$

Emission Designator:

The EUT is an FM device containing digital information for data transmission therefore the emission designator is F1D.

Final emission designator: 6K20F1D and 10K2F1D

III. Modulation Characteristics: (Part 2.1047)

The device is set to 4.5KHz deviation as default value. It can be tuned up down to a 2.5KHz deviation. To Tuned up can not be made by end user. The procedure to tune up was attached when this application was submitted. Also, the modulation description as **Section 2.1033(C)(13)** requested was attached.

IV. RF Power Output (Part 2.1046, 90.205)

4.1 Test procedure:

- (1) Antenna was replaced with a short connector which was connected with an attenuator.
- (2) The spectrum offset was adjusted to compensate the attenuator and losses caused by the connection.
- (3) Set the spectrum., RBW = 100KHz, VBW = 30KHz, SPAN = 100KHz, OFFSET = 20dB, ATT = 30dB

4.2 Test Result:

Deviation	Frequency (MHz)	Output power (dBm)	Power (mW)	Figure
4.5KHz	460.0000	25.91	389.941	Figure 1
2.5KHz	460.0000	25.10	323.594	Figure 2

4.3 Test Equipment:

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Spectrum	8594EM	HP	3619A00198	03/21/03	03/20/04

The level of confidence of 95% , the uncertainty of measurement of conducted emission is ± 1.55 dB .

Figure 1.

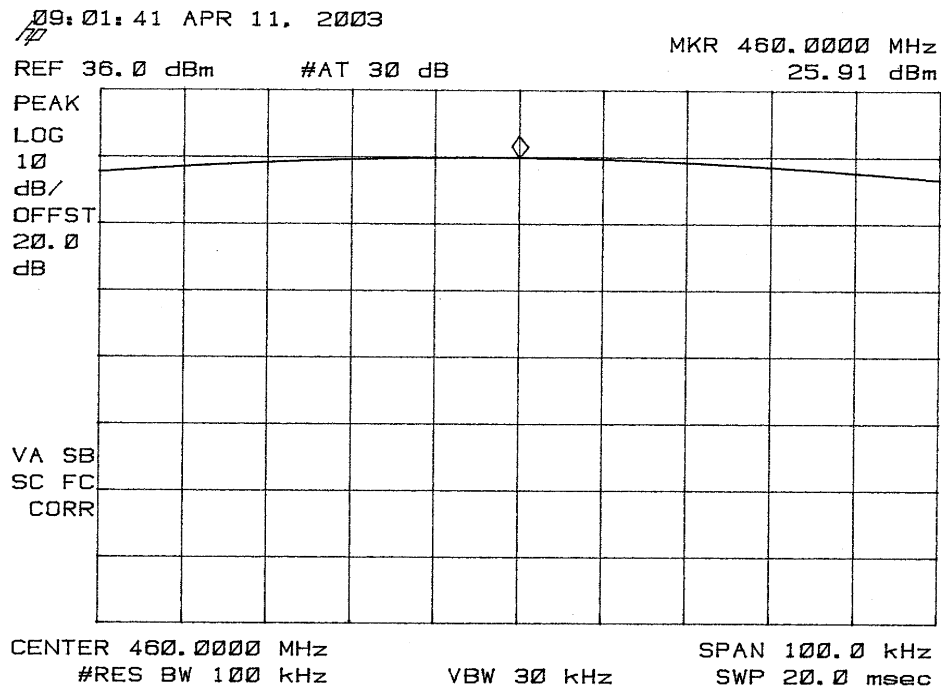
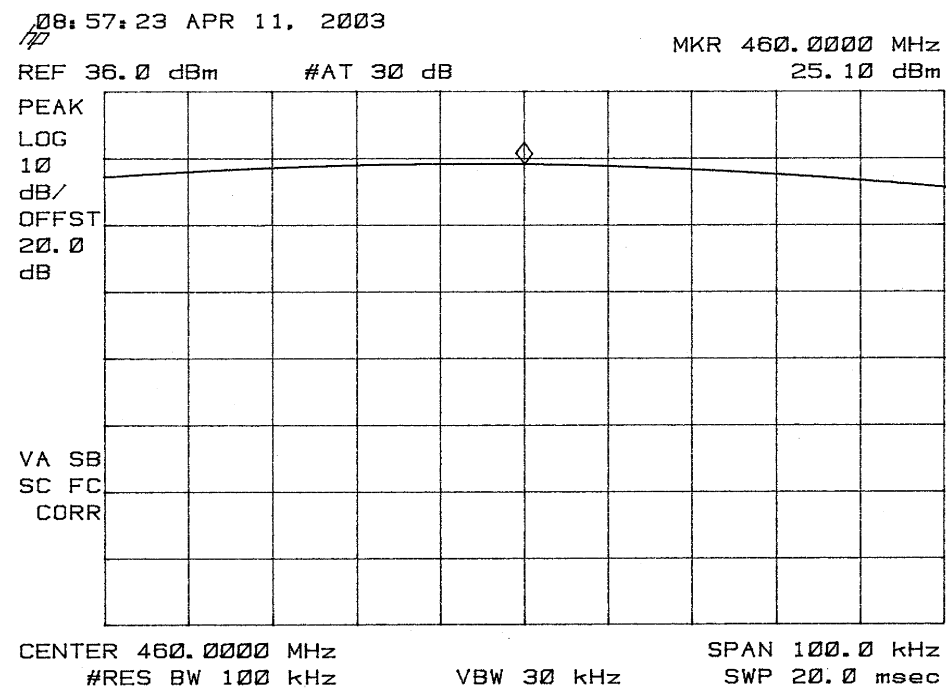


Figure 2.



V. Occupied Bandwidth: (Part 2.1049, 90.209)

5.1 Test procedure:

- (1) Set the ref level to the RF power output.
- (2) Connect the EUT as procedure 4.1 (1) (2)
- (3) For deviation 4.5KHz, Set spectrum, RBW = 100Hz, VBW = 100Hz, SPAN = 50KHz, OFFSET = 20dB, AT = 50dB.
- (4) For deviation 2.5KHz, Set spectrum, RBW = 300Hz, VBW = 300Hz, SPAN = 100KHz, OFFSET = 20dB, AT= 50dB.
- (5) Set the EUT at modulation mode.

5.2 Test Result:

Deviation	Frequency (MHz)	Occupied BW (KHz)	Limit (KHz)	Figure
4.5KHz	460.0000	Under limit	25.0	Fig. 3
2.5KHz	460.0000	Under limit	12.5	Fig. 4

5.3 Test Equipment:

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Spectrum	8594EM	HP	3619A00198	03/21/03	03/20/04

The level of confidence of 95% , the uncertainty of measurement is ± 12 Hz .

Figure 3

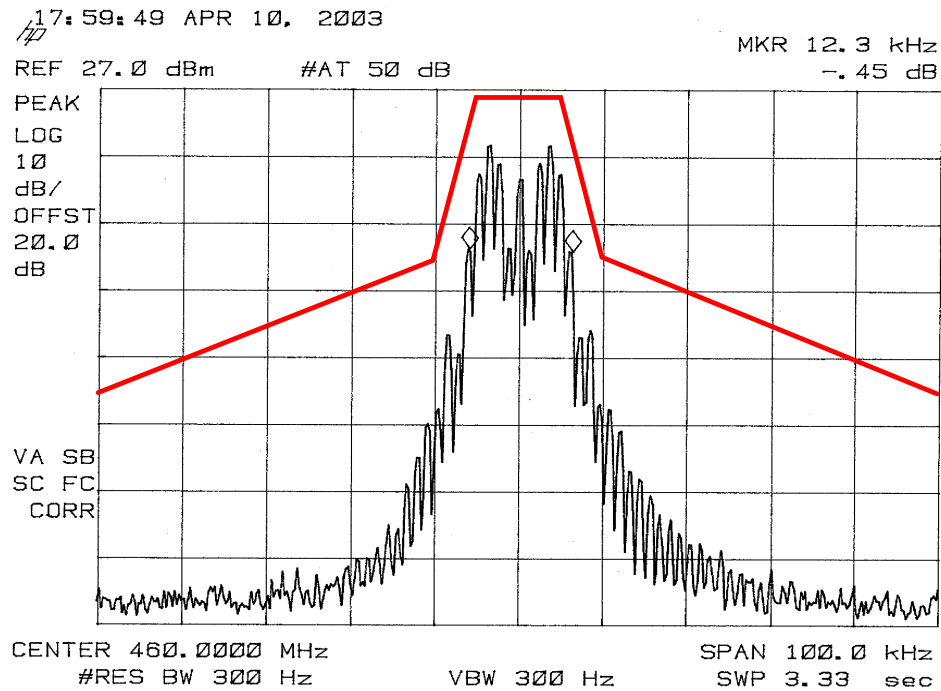
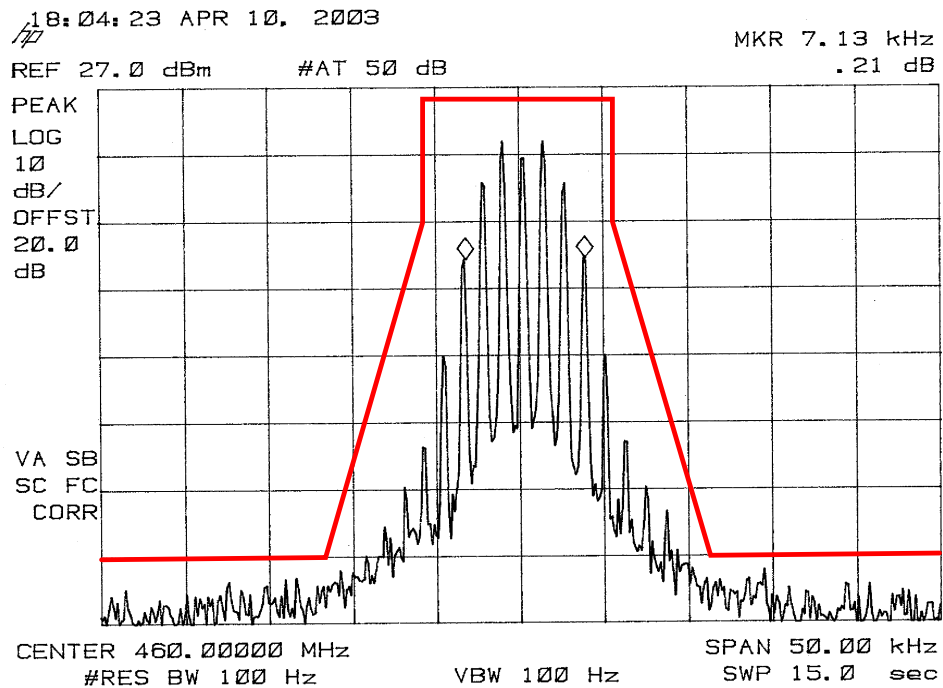


Figure 4



VI. Spurious Emissions at Antenna Terminals (Part 2.1051, 90.210)

6.1 Test procedure:

- (1) Set the ref level to the RF power output.
- (2) Connect the EUT as procedure 4.1 (1) (2)
- (3) For deviation 4.5KHz.
- (4) For deviation 2.5KHz.
- (5) For deviation 4.5KHz, Set spectrum Frequency start from 30MHz to 470MHz, RBW = 100Hz, VBW = 100Hz, OFFSET = 20dB, AT= 40dB. To record the spurious emissions.
- (6) Then set Frequency from 470MHz to 1GHz, 1GHz to 2.7GHz, 2.7GHz to 5.0GHz. RBW = 1MHz, VBW = 1MHz, OFFSET = 20dB, AT= 40dB Record all the spurious emissions.
- (7) For deviation 2.5kHz, repeat step (5) to (6).

6.2 Test Result:

Deviation	Spurious (dBm)	Limit (dBm)	Figure
4.5KHz	Under limit	-13	Fig. 5~8
2.5KHz	Under limit	-20	Fig. 9~12

6.3 Test Equipment:

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Spectrum	8594EM	HP	3619A00198	03/21/03	03/20/04
Spectrum	8592A	HP	3003A01401	05/29/02	05/29/03

The level of confidence of 95% , the uncertainty of measurement of conducted emission is ± 2.02 dB .

Figure 5

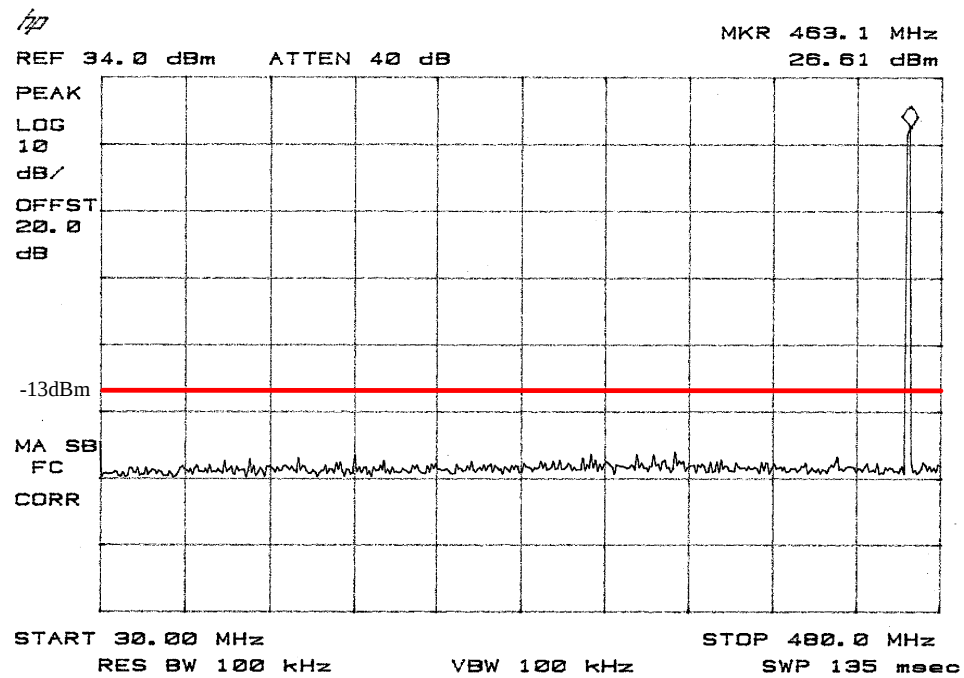


Figure 6

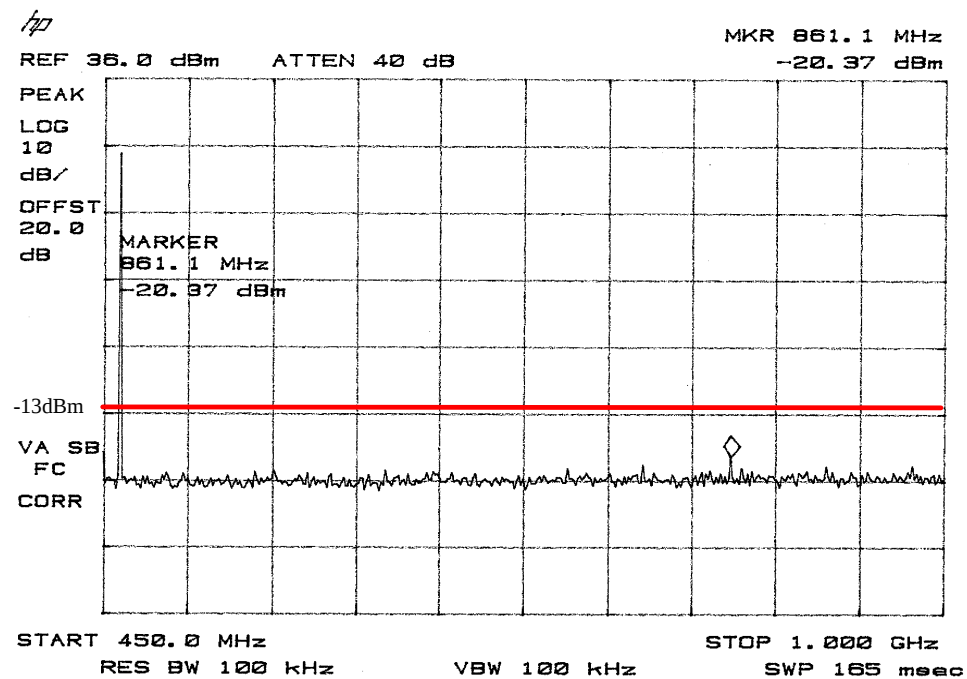


Figure 7

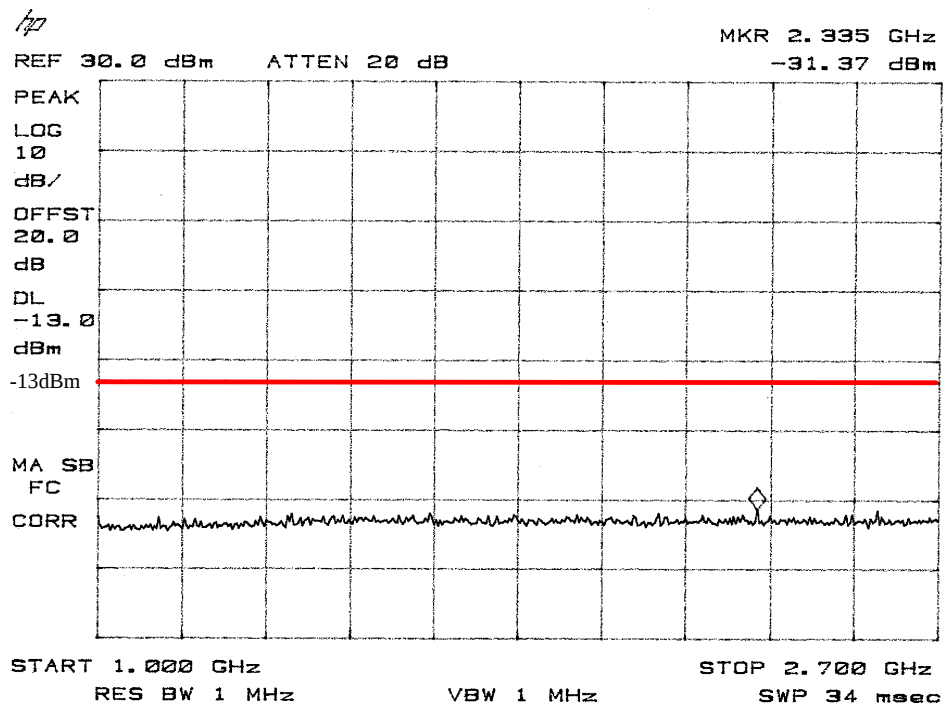


Figure 8

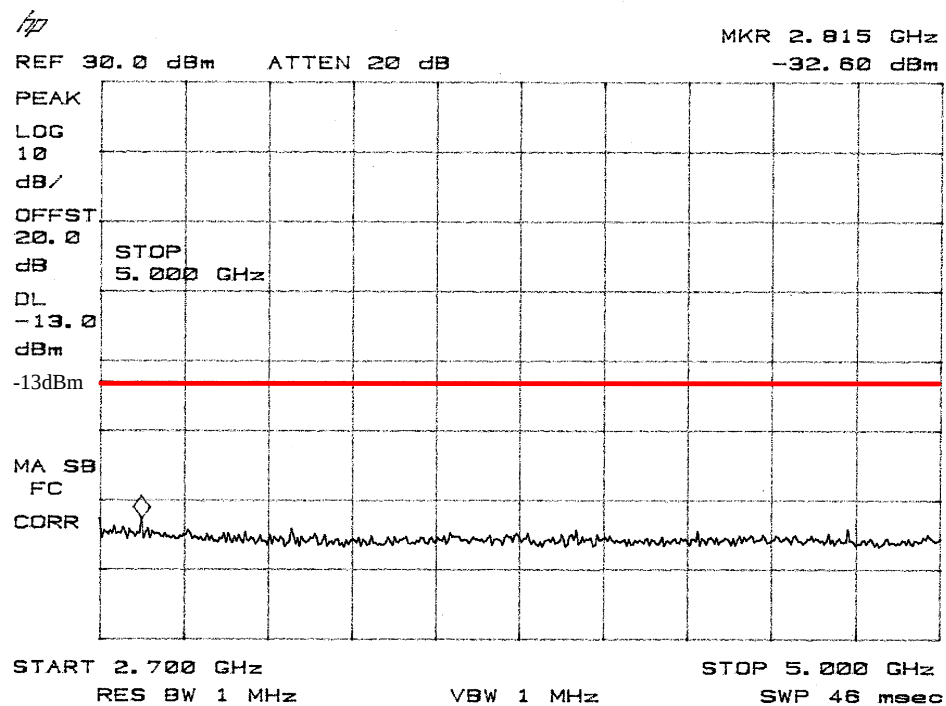


Figure 9

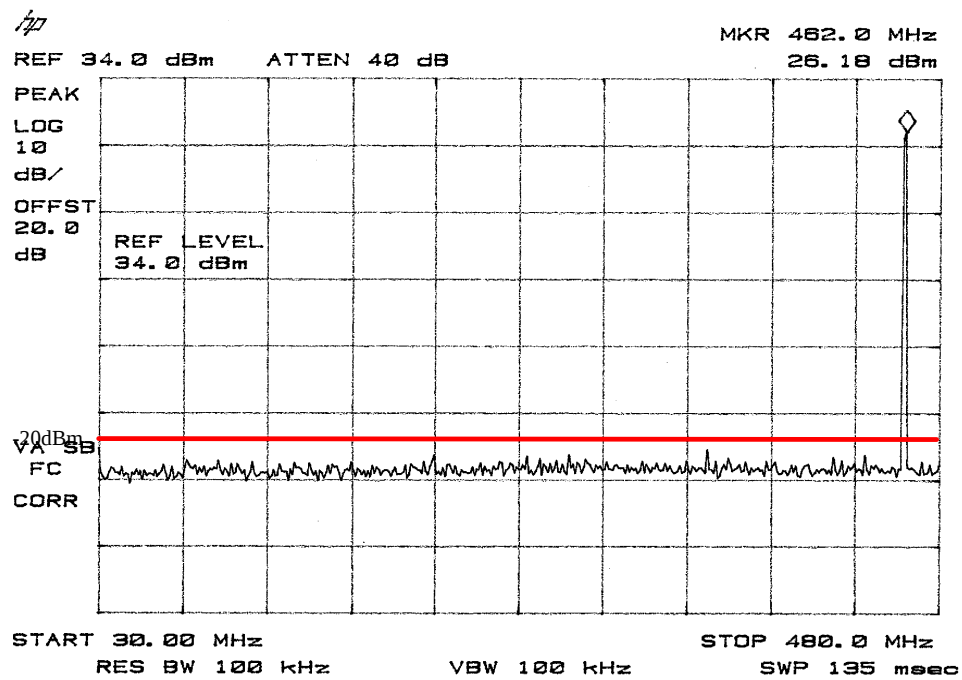


Figure 10

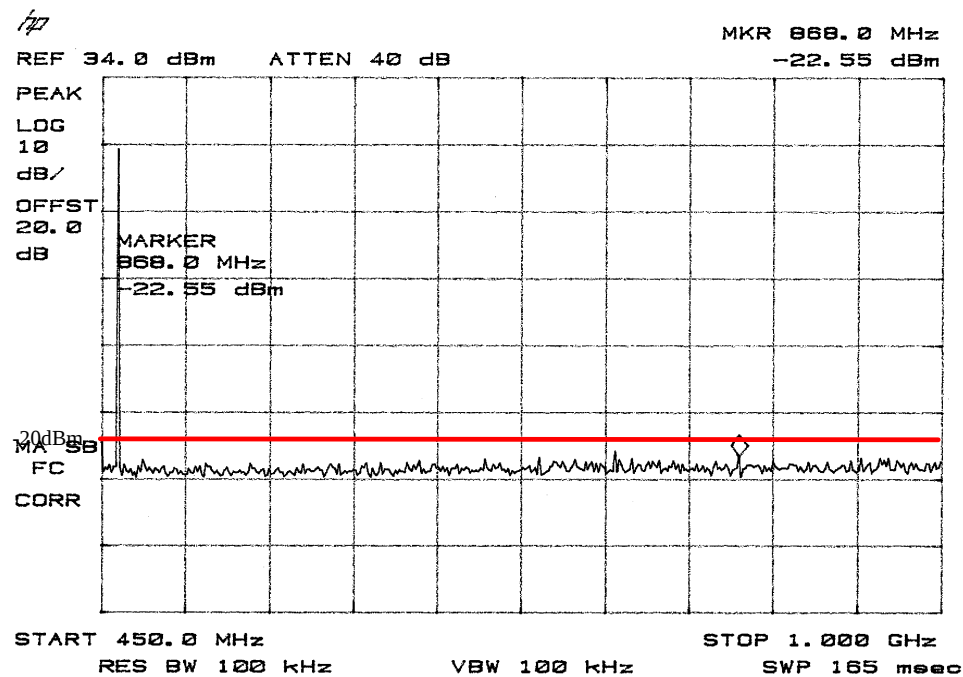


Figure 11

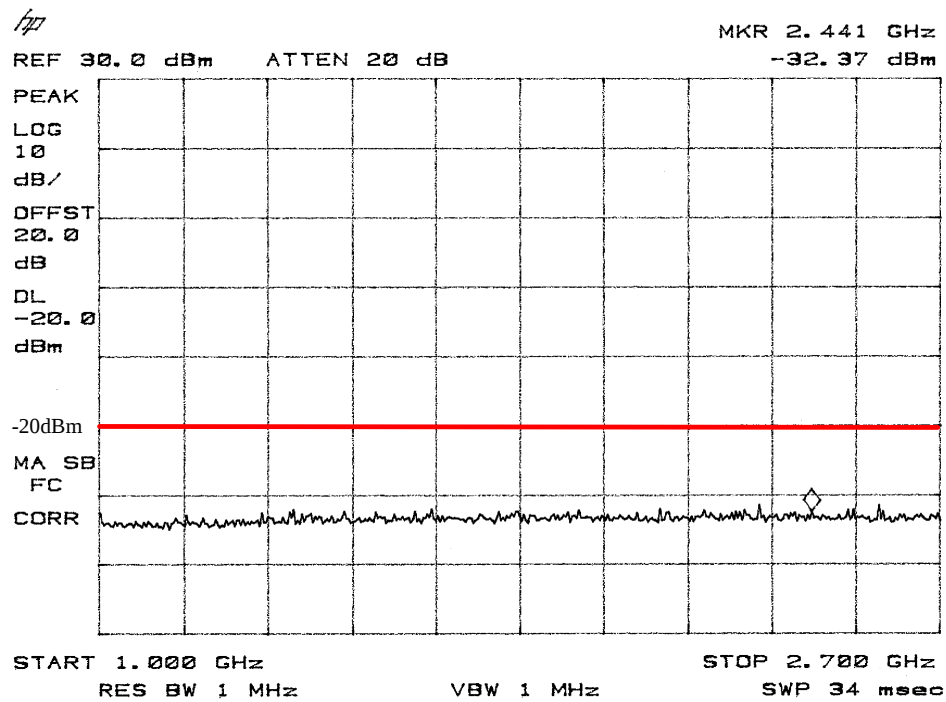
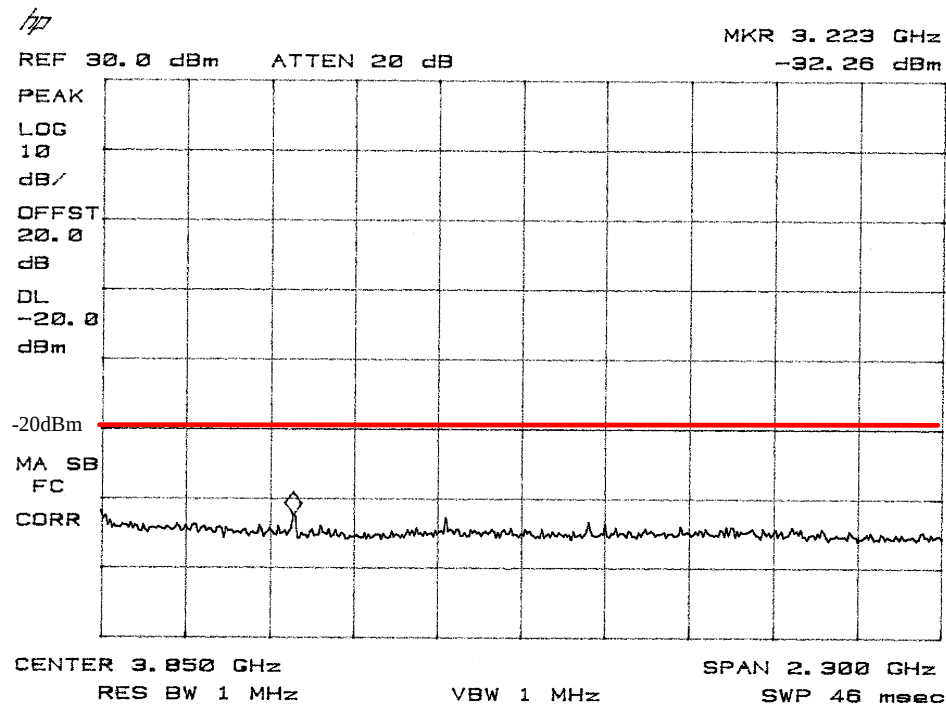


Figure 12



VII. Field Strength of Spurious Radiation (Part 90.210)

7.1 Test procedure:

- (1) Set-up followed by TIA/EIA-603 2.2.12 (Substitution Method)
- (2) $P_d \text{ (dBm)} = P_g \text{ (dBm)} - \text{Cable loss (dB)} + \text{antenna gain (dB)}$
 (where, P_d is the equivalent power and P_g is the generator output into the substitution antenna)

7.2 Test Equipment:

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Receiver	SCR3102	SCHAFFNER	012	03/29/03	03/28/04
Antenna	CBL6141A	SCHAFFNER	4188	11/29/02	11/29/03
Open test side (Antenna, Amplify, cable calibrated together)				05/16/02	05/15/03
Spectrum Analyzer	8564E	HP	US36433002	11/03/02	11/03/03
Microwave	83051A	HP	3232A00347	08/01/02	08/01/03
Preamplifier					
Horn Antenna	3115	EMCO	9704 – 5178	12/27/02	12/27/03
Signal Generator	8648D	HP	3613A00117	05/24/02	05/23/03
Dipole Antenna	3121C	EMCO	9707-1311	12/26/02	12/25/03

The level of confidence of 95% , the uncertainty of measurement of radiated emission is $\pm 3.44\text{dB}$.

7.3 Test Result:

Antenna Polarity: Vertical

Bandwidth: 25K

Frequency [MHz]	Signal Gen Level [dBm]	Cable Loss [dBm]	Tx Antenna Gain	Emission Level [dBm]	Limit [dBm]	Margin [dB]
460.00	24.63	0.27	1.3	25.26		
919.99	-27.42	0.37	1.2	-25.85	-13	-10.75
1380.00	-47.46	0.46	7.5	-39.50	-13	-26.50
1840.00	-45.56	0.48	8.2	-36.88	-13	-23.88
2300.00	-55.16	0.58	8.9	-45.68	-13	-32.68
2758.33	-54.82	0.64	9.2	-44.98	-13	-31.98
3220.00	-55.94	0.71	9.2	-46.03	-13	-33.03
3680.00	-56.09	0.76	9.3	-46.21	-13	-33.21
4140.00	-61.89	0.77	9.5	-51.62	-13	-38.62
4601.67	-62.41	0.94	10.4	-51.07	-13	-38.07

Antenna Polarity: Horizontal

Bandwidth: 25K

Frequency [MHz]	Signal Gen Level [dBm]	Cable Loss [dBm]	Tx Antenna Gain	Emission Level [dBm]	Limit [dBm]	Margin [dB]
460.00	22.10	0.27	1.3	23.57		
919.99	-35.08	0.37	1.2	-33.51	-13	-18.41
1380.00	-47.46	0.46	7.5	-39.50	-13	-26.50
1840.67	-45.90	0.48	8.2	-37.22	-13	-24.22
2300.00	-55.99	0.58	8.9	-46.51	-13	-33.51
2760.00	-56.48	0.64	9.3	-46.54	-13	-33.54
3220.00	-59.27	0.71	9.2	-49.36	-13	-36.36
3680.00	-56.61	0.76	9.3	-46.55	-13	-33.55
4140.00	-56.39	0.77	9.5	-46.12	-13	-33.12
4601.67	-61.41	0.94	10.4	-50.07	-13	-37.07

Antenna Polarity: Vertical

Bandwidth: 12.5K

Frequency [MHz]	Signal Gen Level [dBm]	Cable Loss [dBm]	Tx Antenna Gain	Emission Level [dBm]	Limit [dBm]	Margin [dB]
460.00	22.13	0.27	1.3	23.70		
919.99	-28.89	0.37	1.2	-27.32	-20	-5.22
1380.00	-53.63	0.46	7.5	-45.67	-20	-25.67
1825.00	-61.64	0.48	8.2	-52.96	-20	-32.96
2300.00	-59.99	0.58	8.9	-50.51	-20	-30.51
2758.33	-57.72	0.64	9.2	-47.88	-20	-27.88
3220.00	-63.44	0.71	9.2	-53.53	-20	-33.53
3680.00	-59.11	0.76	9.3	-49.05	-20	-29.05
4140.00	-63.39	0.77	9.5	-53.12	-20	-33.12
4601.67	-62.08	0.94	10.4	-50.74	-20	-30.74

Antenna Polarity: Horizontal

Bandwidth: 12.5K

Frequency [MHz]	Signal Gen Level [dBm]	Cable Loss [dBm]	Tx Antenna Gain	Emission Level [dBm]	Limit [dBm]	Margin [dB]
460.00	18.21	0.27	1.3	19.78		
919.99	-36.24	0.37	1.2	-34.67	-20	-12.57
1380.00	-53.96	0.46	7.5	-46.00	-20	-26.00
1821.67	-62.02	0.48	8.2	-53.34	-20	-33.34
2300.00	-59.99	0.58	8.9	-50.51	-20	-30.51
2758.33	-60.48	0.64	9.3	-50.54	-20	-30.54
3680.00	-60.77	0.76	9.3	-50.71	-20	-30.71
4140.00	-61.39	0.77	9.5	-51.12	-20	-30.12
4601.67	-60.75	0.94	10.4	-49.41	-20	-29.41

7.4 Test Placement



VIII. Frequency Stability (Part 2.1055, 90.213)

8.1 Test procedure:(voltage)

(1) Frequency shift vs. voltage:

The nominal power is 4.5 Vdc and the reference Frequency is 460.0000MHz

(2) The EUT was powered from 6V, 5.7V, ... to 2.7V (endpoint)

8.2 Test Result:

Nominal Frequency: 460.001838MHz

Nominal Voltage: 4.5V

Bandwidth: 12.5K

Voltage [V]	Ferquency [MHz]	Frequency Error [Hz]	Limit (2.5PPM)	Error (PPM)	Pass/Fail
6	460.001863	-25	1147	-0.054	PASS
5.7	460.001853	-15	1147	-0.033	PASS
5.5	460.001826	-2	1147	0.026	PASS
5	460.001851	-13	1147	-0.028	PASS
4.5	460.001838	0	1147	0.000	PASS
4	460.001826	12	1147	0.026	PASS
3.5	460.001801	37	1147	0.080	PASS
3	460.001688	150	1147	0.326	PASS
2.8	460.001563	275	1147	0.598	PASS
2.7	460.001538	300	1147	0.652	PASS

Nominal Frequency: 460.001838MHz

Nominal Voltage: 4.5V

Bandwidth: 12.5K

Voltage [V]	Ferquency [MHz]	Frequency Error [Hz]	Limit (2.5PPM)	Error (PPM)	Pass/Fail
6	460.004150	-200	1147	-0.435	PASS
5.7	460.004113	-163	1147	-0.137	PASS
5.5	460.004050	-100	1147	-0.217	PASS
5	460.004038	-88	1147	-0.191	PASS
4.5	460.003950	0	1147	0.000	PASS
4	460.003963	13	1147	0.028	PASS
3.5	460.003925	25	1147	0.054	PASS
3	460.003713	233	1147	0.507	PASS
2.8	460.003538	412	1147	0.896	PASS
2.7	460.003450	500	1147	1.09	PASS

8.3 Test procedure:(Temperature)

(1) Frequency shift vs. temperature:

The nominal room temperature 20 , and the reference frequency is 460.0000MHz.The EUT was powered from 6V, 5.7V, ... to 2.7V (endpoint)

(2) The EUT was put in an environmental chamber and set up the temperature of this chamber from -30 to +60 and recorded the frequency has been shift.

8.4 Test Result:

Nominal Frequency: 460.002046MHz

Bandwidth: 12.5K

Temperature []	Ferquency [MHz]	Frequency Error [Hz]	Limit (2.5PPM)	Error in PPM
-30	460.002362	-316	1147	-0.67
-20	460.002350	-304	1147	-0.66
-10	460.002200	-154	1147	-0.33
0.0	460.002150	-104	1147	-0.23
10	460.002838	-792	1147	-1.72
20	460.002225	-179	1147	-0.39
30	460.002143	-37	1147	-0.08
40	460.002463	-417	1147	-0.91
50	460.002663	-617	1147	-1.34
60	460.003050	-1004	1147	-2.19

Nominal Frequency: 460.002046MHz

Bandwidth: 25K

Temperature []	Ferquency [MHz]	Frequency Error [Hz]	Limit (2.5PPM)	Error in PPM
-30	460.004462	-512	1147	-1.11
-20	460.004874	-924	1147	-2.01
-10	460.004937	-987	1147	-2.15
0.0	460.004387	-437	1147	-0.95
10	460.004100	-150	1147	-0.33
20	460.003987	-37	1147	-0.08
30	460.004524	-574	1147	-1.25
40	460.004624	-674	1147	-1.47
50	460.004987	-1037	1147	-2.25
60	460.005037	-1087	1147	-2.36

8.5 Test Equipment:

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Spectrum	8594EM	HP	3619A00198	03/21/03	03/20/04
DC Power Supply	GPC-3030D	LABORATORY		02/03/03	02/02/04
Temperature & Humidity Chamber	THS-ML1	King Son	240	09/15/02	09/14/03

The level of confidence of 95% , the uncertainty of measurement is $\pm 12\text{Hz}$.

IX. Transient Frequency Behavior (Part 90.214)

9.1 Test procedure:

- (1) Set-up followed by TIA/EIA 603. Section 1.2.19
- (2) Use the EUT 1 with BW 25KHz and let it be unmodulated.
- (3) Turn on the EUT and Record the plot.
- (4) Turn off the EUT and Record the plot.
- (5) Let the EUT modulated and repeat step (3) (4).
- (6) Use the EUT 2 with BW 12.5KHz, repeat step (3) ~ (5).

9.2 Test Result:

Deviation Time Intervals		4.5KHz		2.5KHz	
		Max Frequency Difference	Result	Max Frequency Difference	Result
t1	10ms	± 25.0KHz	Pass	± 12.5KHz	Pass
t2	25ms	± 12.5KHz	Pass	± 6.25KHz	Pass
t3	10ms	± 25.0KHz	Pass	± 12.5KHz	Pass

* See Figures 13 - 20

9.3 Test Equipment:

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Signal Generator	2030	MARCONI	119665/027	07/12/02	07/11/03
Spectrum	8591E	HP	3501A03584	05/25/02	05/24/03
Oscilloscope	84622D	Angilant	MY40008270	06/30/02	06/29/03

The level of confidence of 95% , the uncertainty of measurement is ± 0.5KHz .

Figure 13 (Deviation: 4.5KHz, unmodulated, Turn ON)

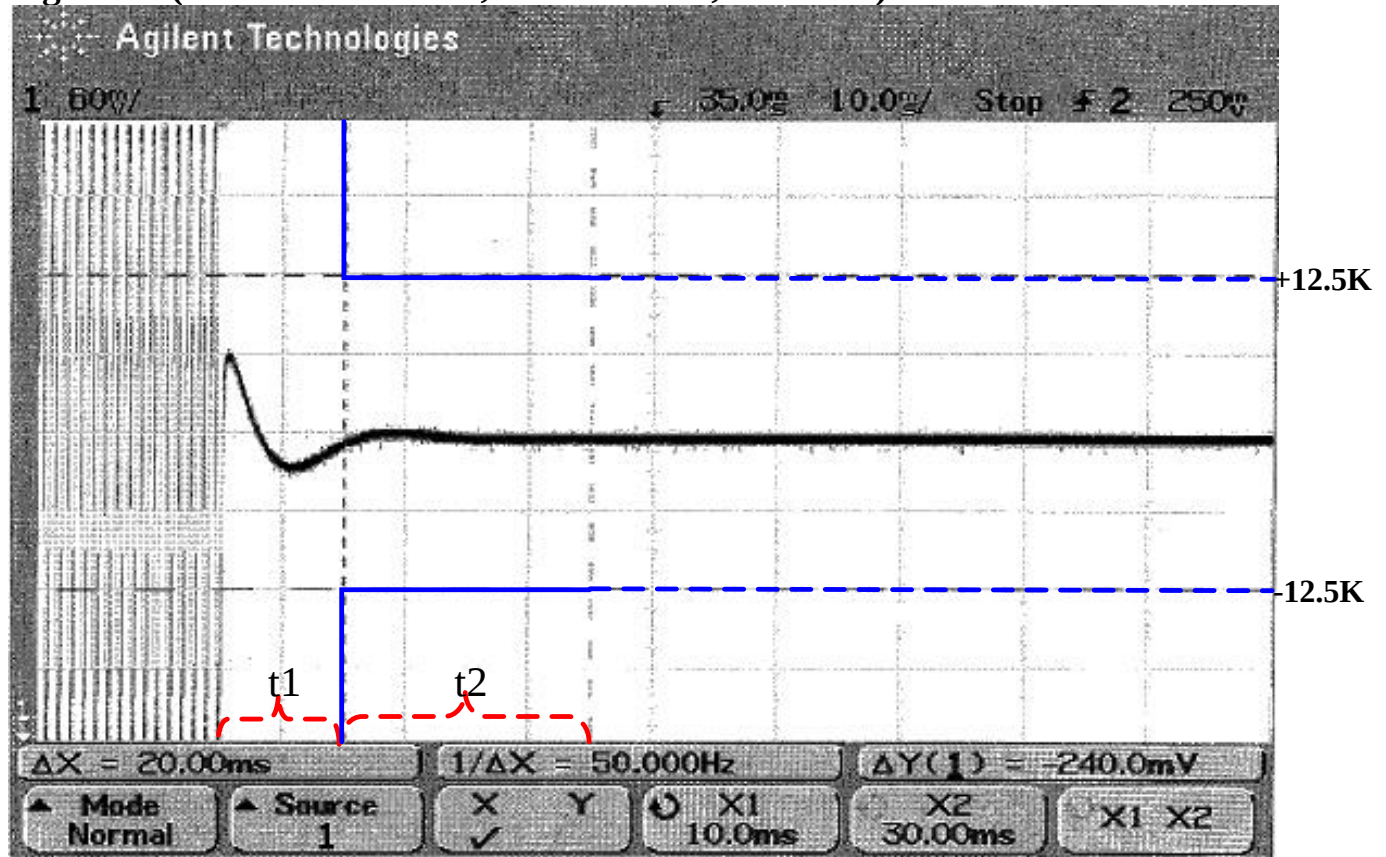


Figure 14 (Deviation: 4.5KHz, unmodulated, Turn OFF)

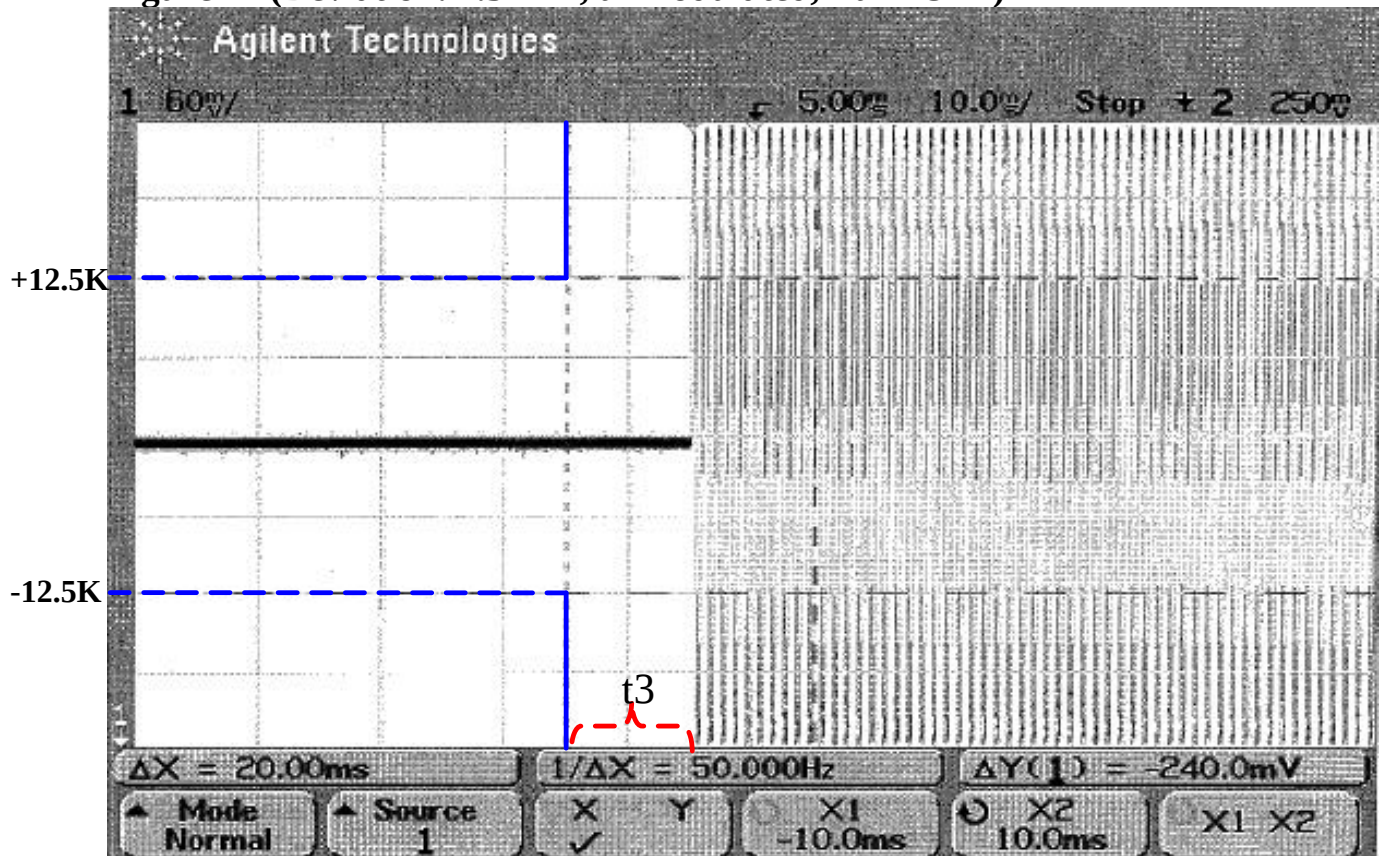


Figure 15 (Deviation: 4.5KHz, modulated, Turn ON)

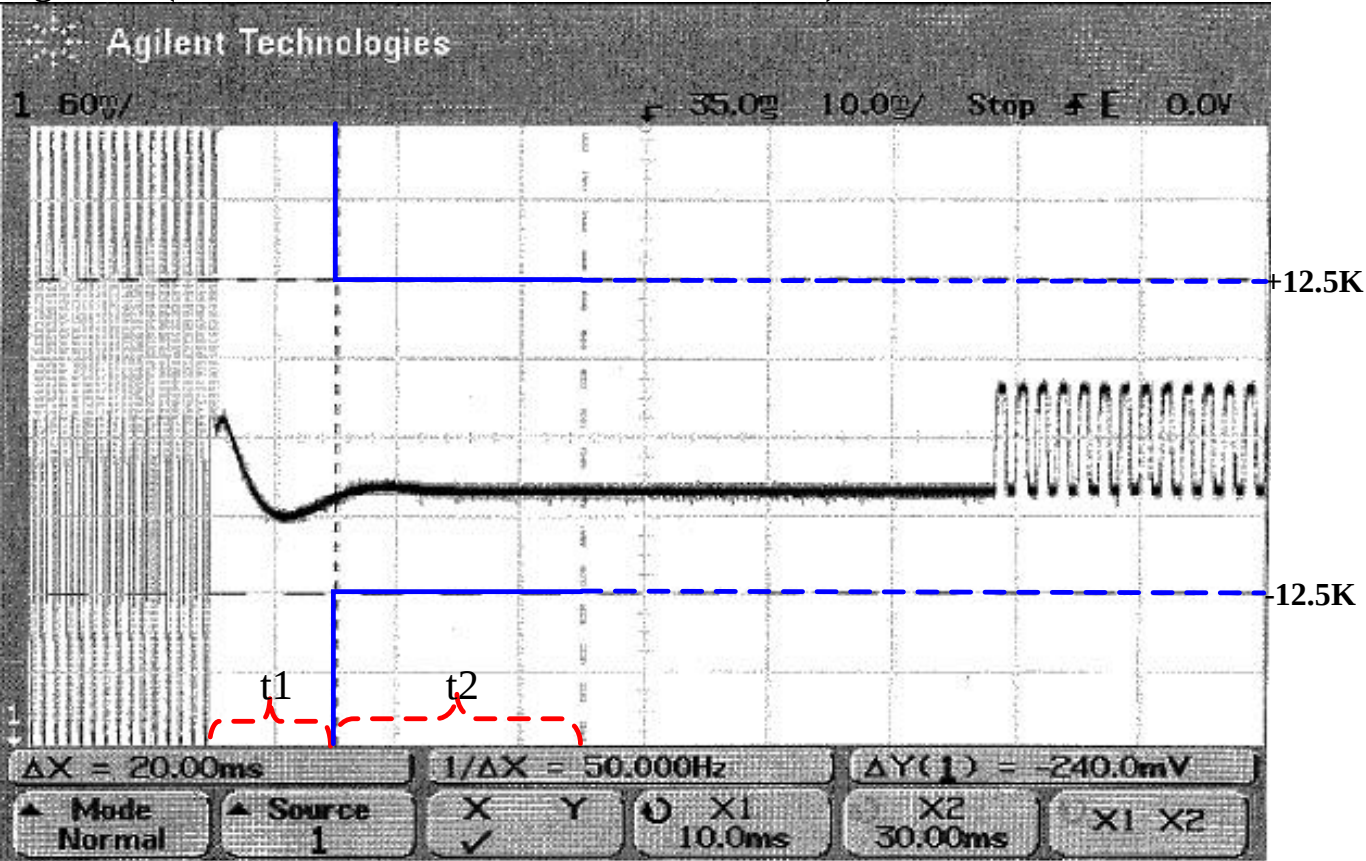


Figure 16 (Deviation: 4.5KHz, modulated, Turn OFF)

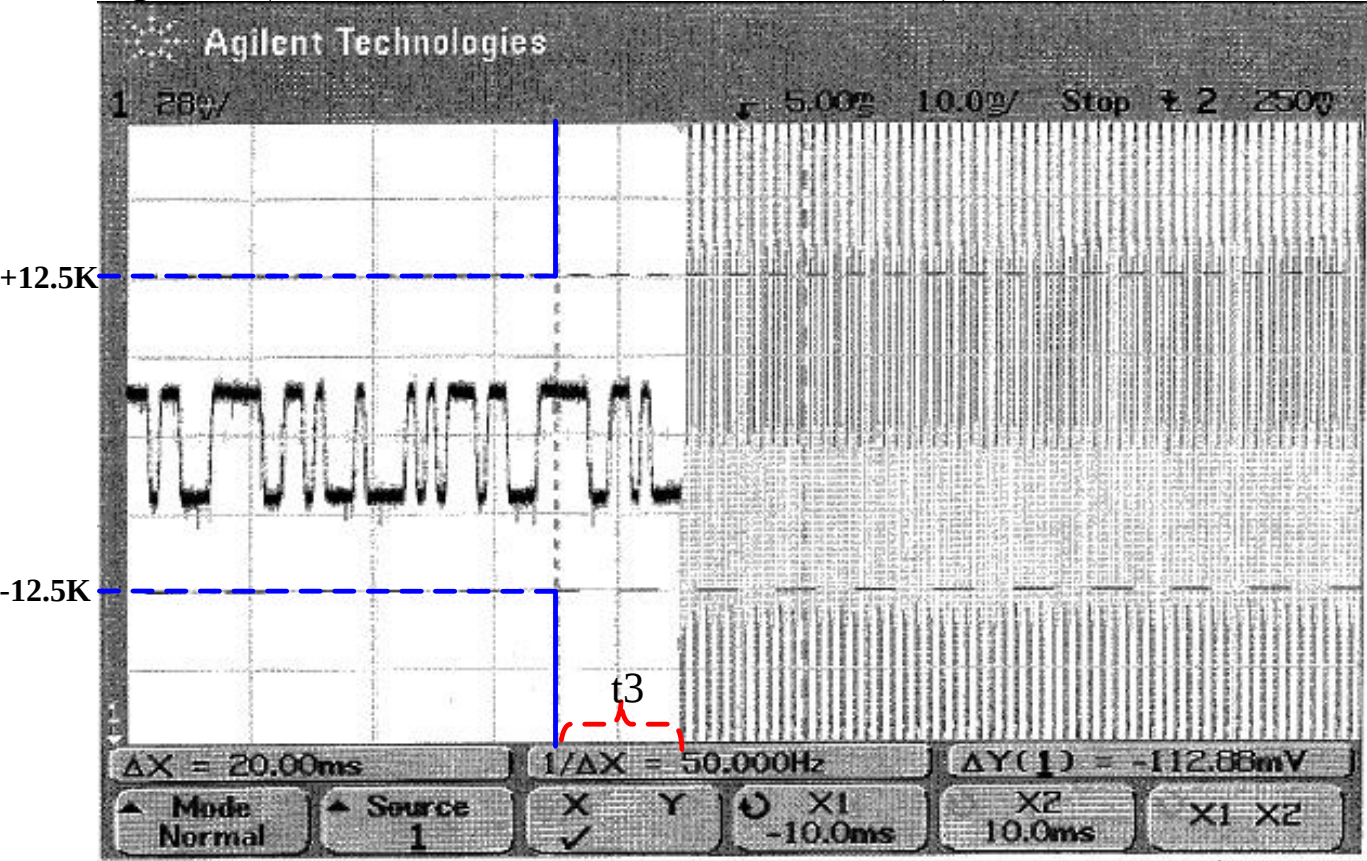


Figure 17 (Deviation: 2.5KHz, unmodulated, Turn ON)

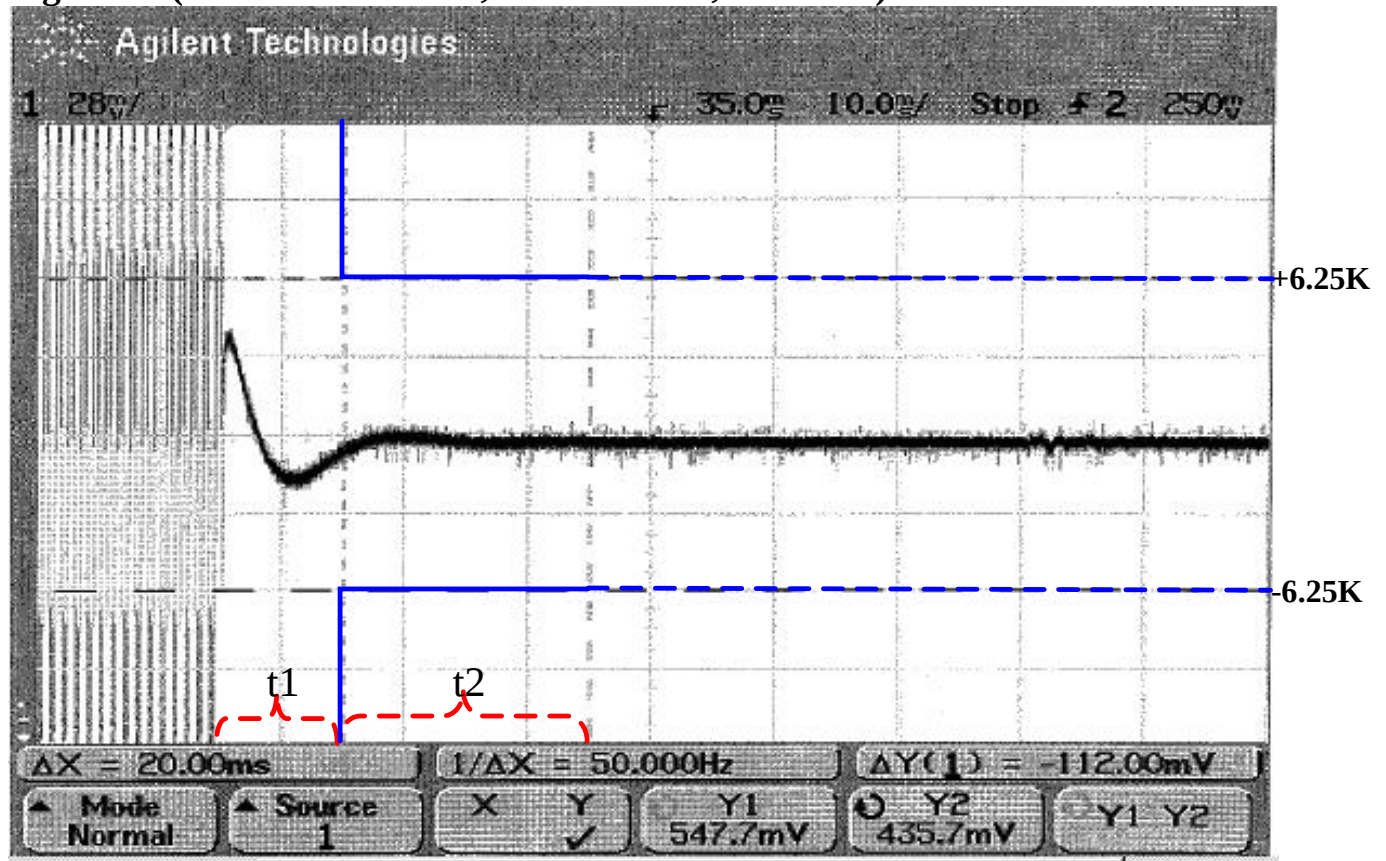


Figure 18 (Deviation: 2.5KHz, unmodulated, Turn OFF)

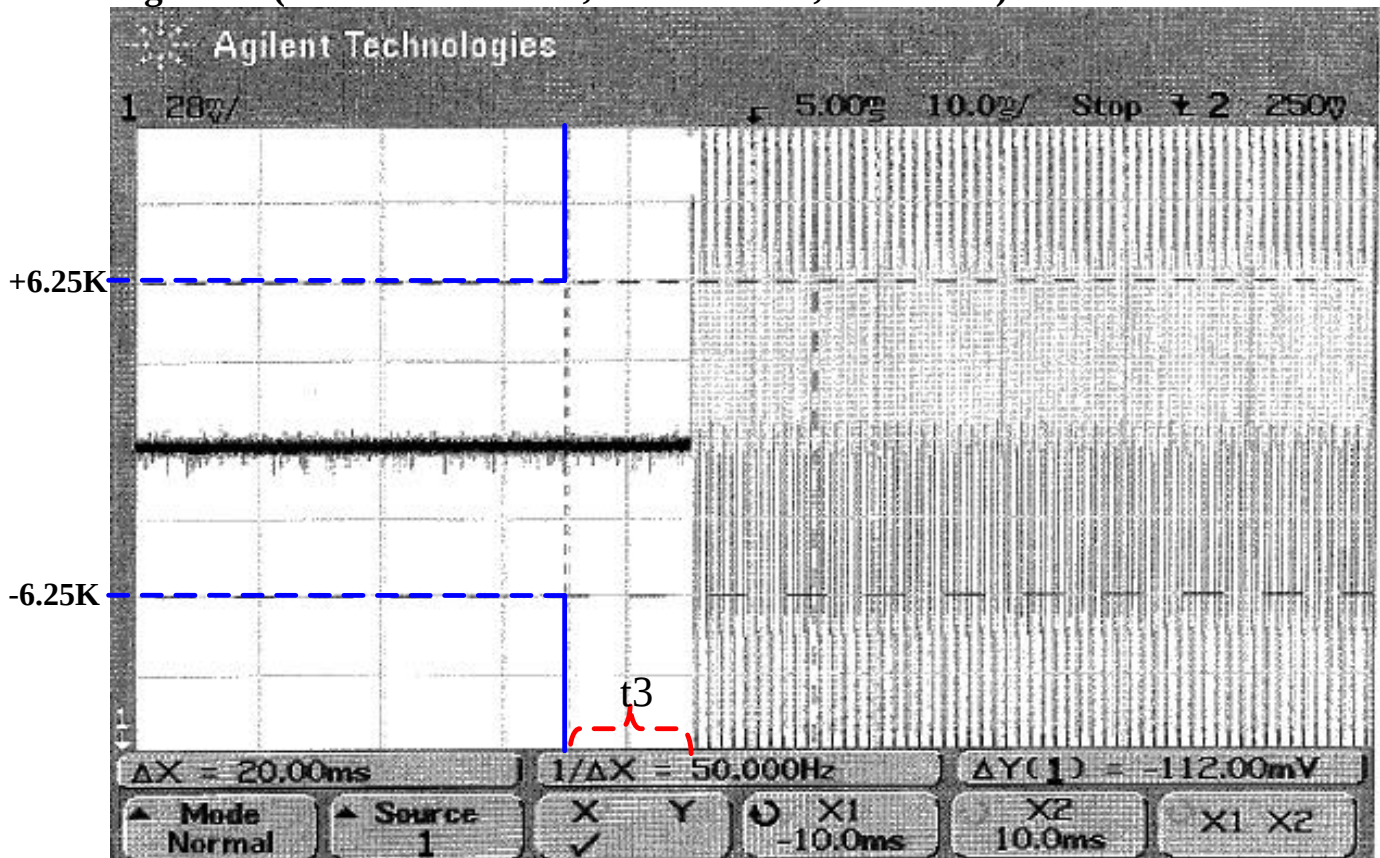


Figure 19 (Deviation: 2.5KHz, modulated, Turn ON)

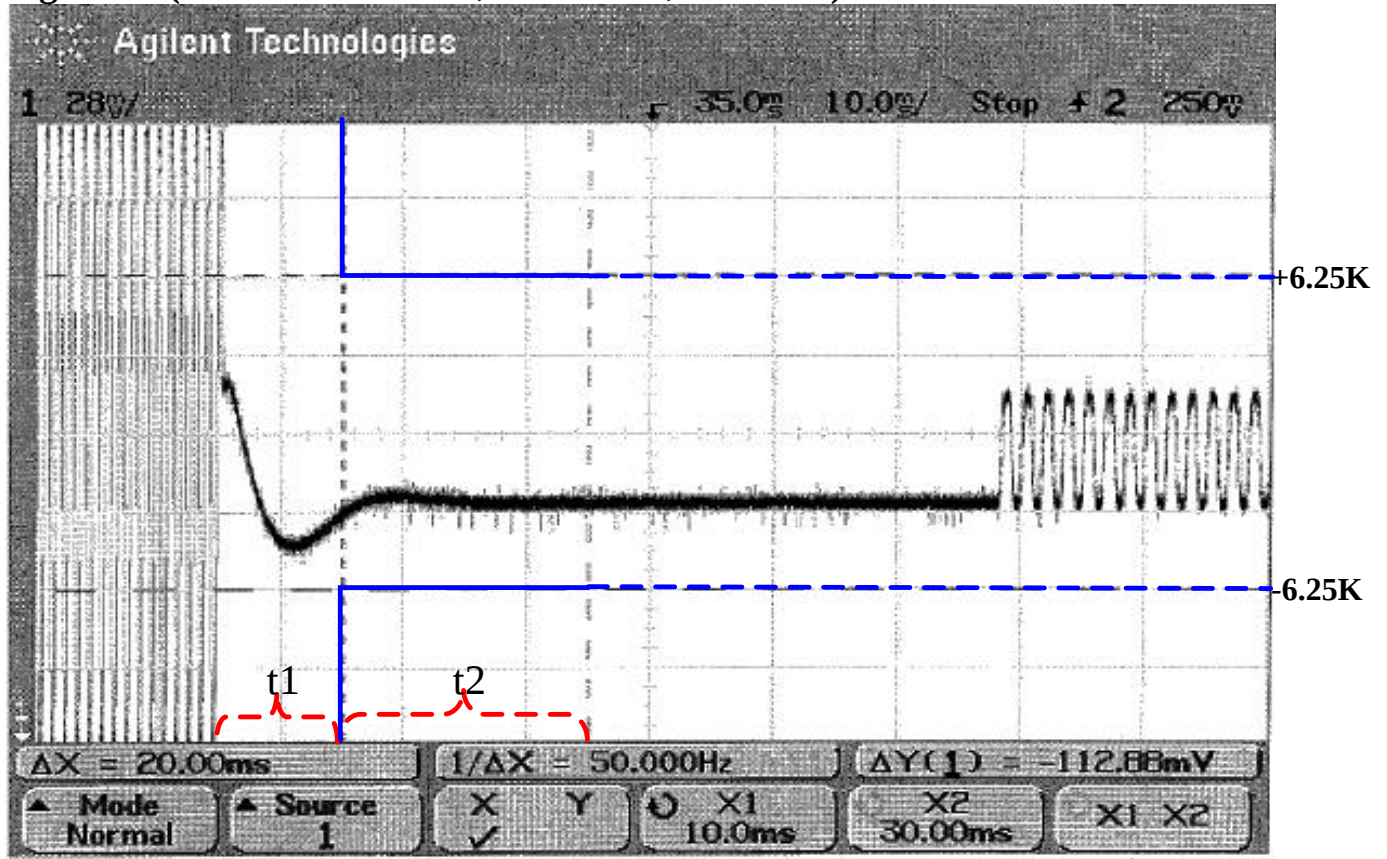


Figure 20 (Deviation: 2.5KHz, modulated, Turn OFF)

