FCC Certification Test Report of *450MHz to 470MHz Transmitter*

Applicant	:	Gold Apollo Co., Ltd. Rm 1, 3rd F1., No. 77, Sec. 1, Hsin Tai Wu Rd., His-Chih, Taipei Hsien, Taiwan, R.O.C.
Model No.	:	T-200, TE-205, TE205R, 210
EUT	:	Transmitter
FCC ID	:	NDATX200XU
Report No.	:	G1590184

Tested by :

Training Research Co., Ltd.

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No. 15, Lane 530, Pa-Lian RD., Sec. 1, Hsichih City, Taipei Hsien, Taiwan, R.O.C.

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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(Jason Yeh)

Authorized by: Jacob Lin **V. General Manager**
(Jacob Lin)

Test date: November 12, 2003
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Ⅰ. 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

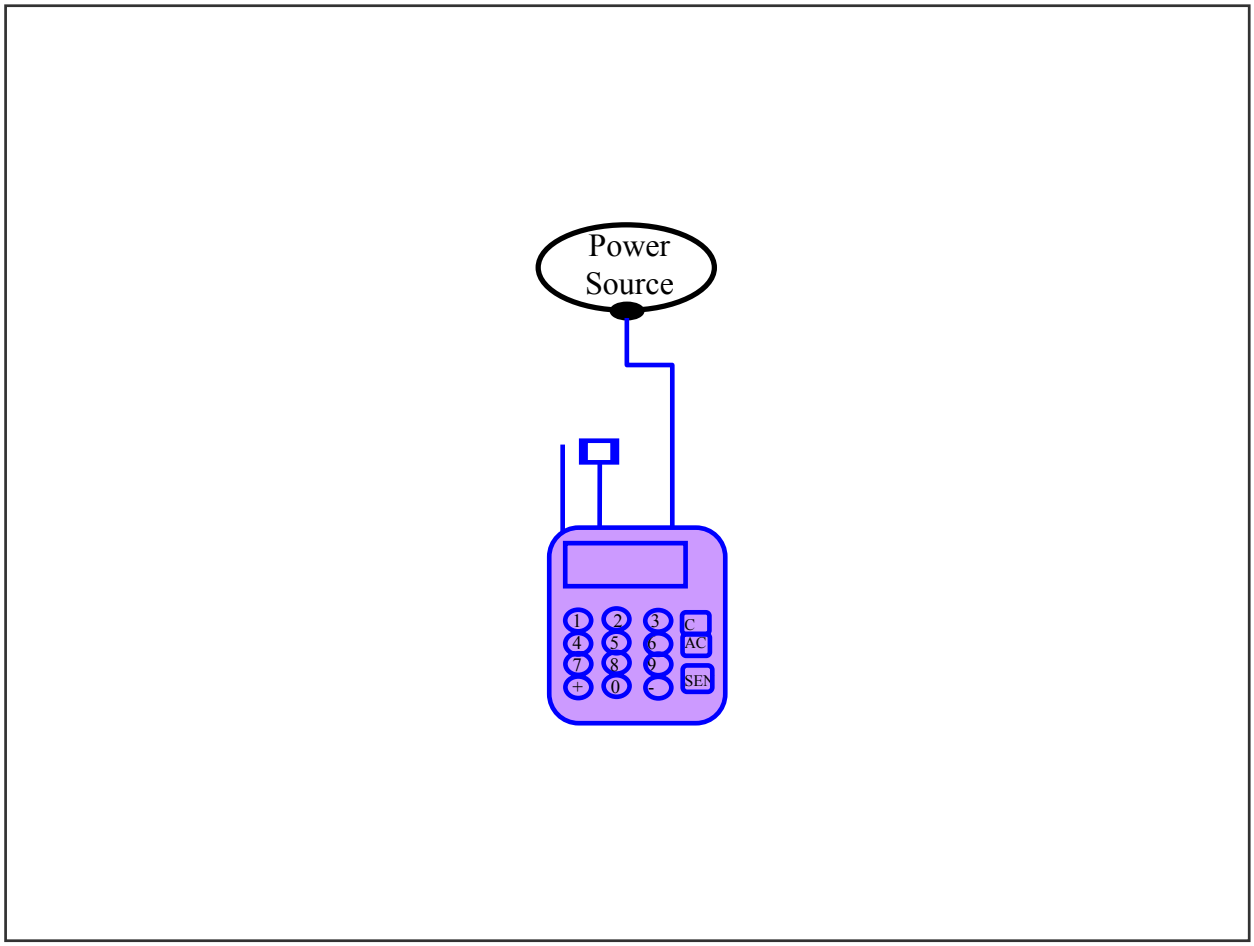
RF

Frequency range TX	450MHz ~ 470MHz
Modulation type	FSK.
Channel spacing	12.5kHz
Output power(ERP)	+26dBm
Maximum deviation	± 2.5kHz
Harmonic Radiation	less - 25 dBm
Frequency stability	2.5 ppm at –30°C ~ 60°C
Output Connect	BNC (F)

GENERAL

Active Voltage range	DC 5V
Current consumption	Standby : 120mA
	Transmit : 420mA
Dimensions	150(W)×42.6(H)×201.5(D) mm (Without Antenna)
Weight	770g (Without Antenna)

1.4 Configuration of System Under Test



Connections of EUT:

*Power jack --- via a 1.78 m length power cable (with a ferrite core) with a power adaptor.
*Serial port --- with a 1.90 m length data cable that terminated.
*Antenna port --- with a 22.5cm length external antenna.

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.

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

Baud rate = 1200 baud

M = Baud / 2 = 1200 / 2 = 600

D = 2.5 KHz and using K = 1

For the 2.5 KHz deviation:

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

Emission Designator:

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

Final emission designator: 6K20F1D

III. Modulation Characteristics: (Part 2.1047)

The device is set to 2.5KHz 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 = 100KHz, SPAN = 100KHz, OFFSET = 20dB, ATT = 50dB

4.2 Test Result:

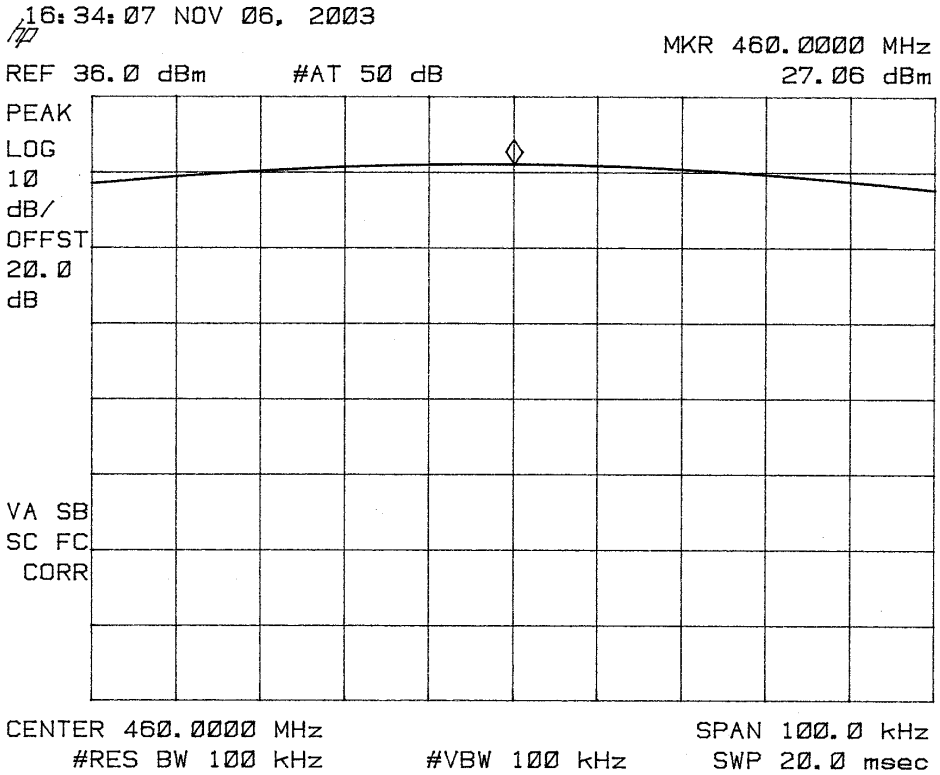
Deviation	Frequency (MHz)	Output power (dBm)	Power (mW)	Figure
2.5KHz	460.0000	27.06	508.159	Figure 1

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.



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 2.5KHz, Set spectrum, RBW = 100Hz, VBW = 100Hz, SPAN = 50KHz, OFFSET = 20dB, AT= 50dB.
(4) Set the EUT at modulation mode.

5.2 Test Result:

Deviation	Frequency (MHz)	Occupied BW (KHz)	Limit (KHz)	Figure
2.5KHz	460.0000	7.25	11.25	Fig. 2~3

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 2

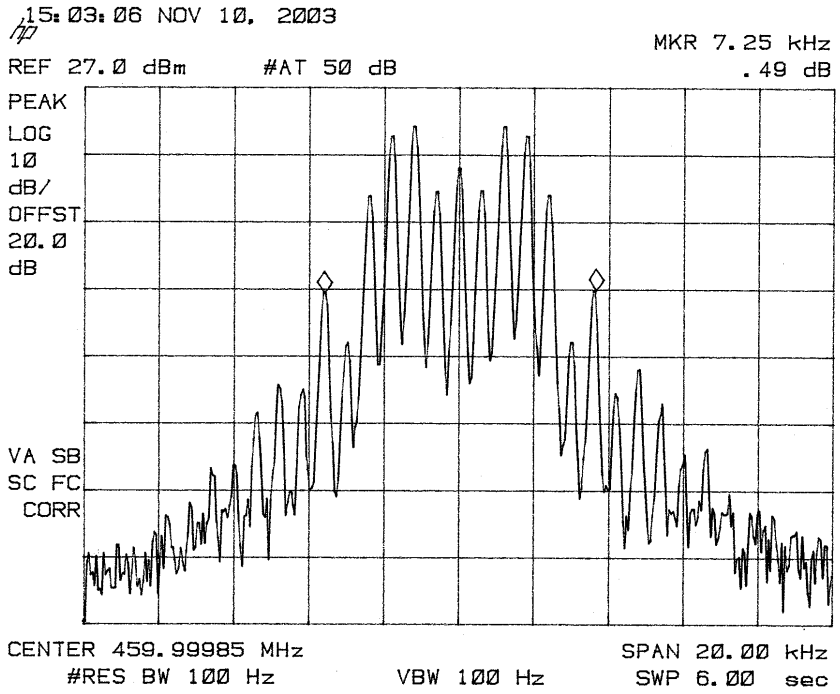
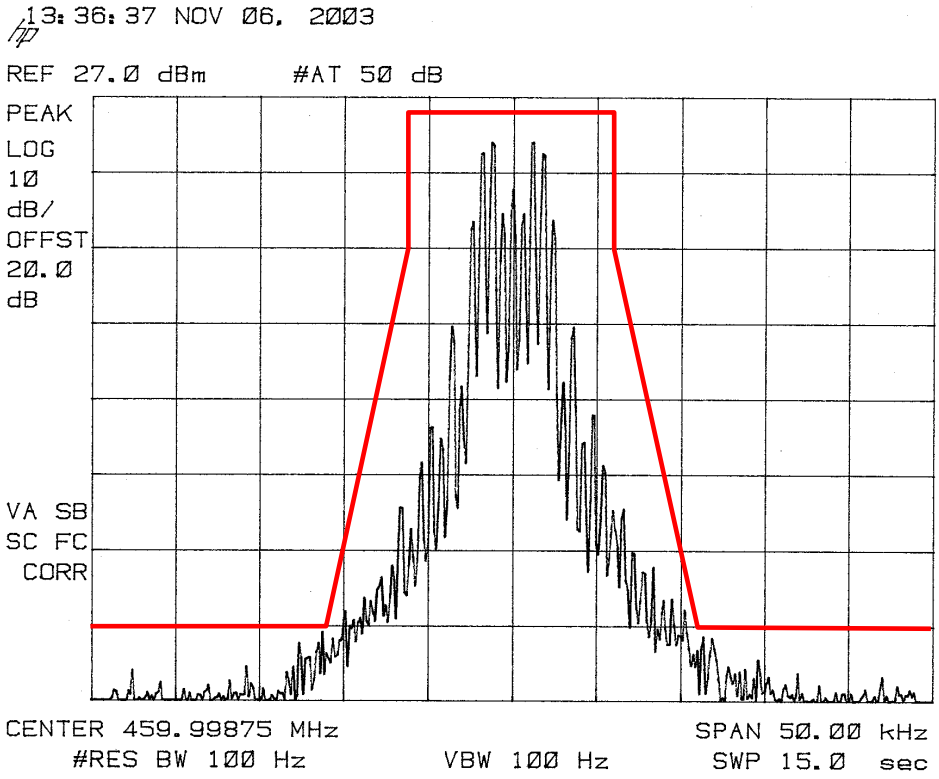


Figure 3



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 2.5KHz, set spectrum Frequency start from 30MHz to 480MHz, RBW = 100Hz, VBW = 100Hz, OFFSET = 20dB, AT= 20dB. To record the spurious emissions.

(4) Then set Frequency from 480MHz to 1GHz, 1GHz to 3.0GHz, 3.0GHz to 5.0GHz. RBW = 1MHz, VBW = 1MHz, OFFSET = 20dB, AT= 20dB Record all the spurious emissions.

(5) For deviation 2.5kHz, repeat step (5) to (6).

6.2 Test Result:

Deviation	Spurious (dBm)	Limit (dBm)	Figure
2.5KHz	Under limit	-20	Fig. 4~7

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 4

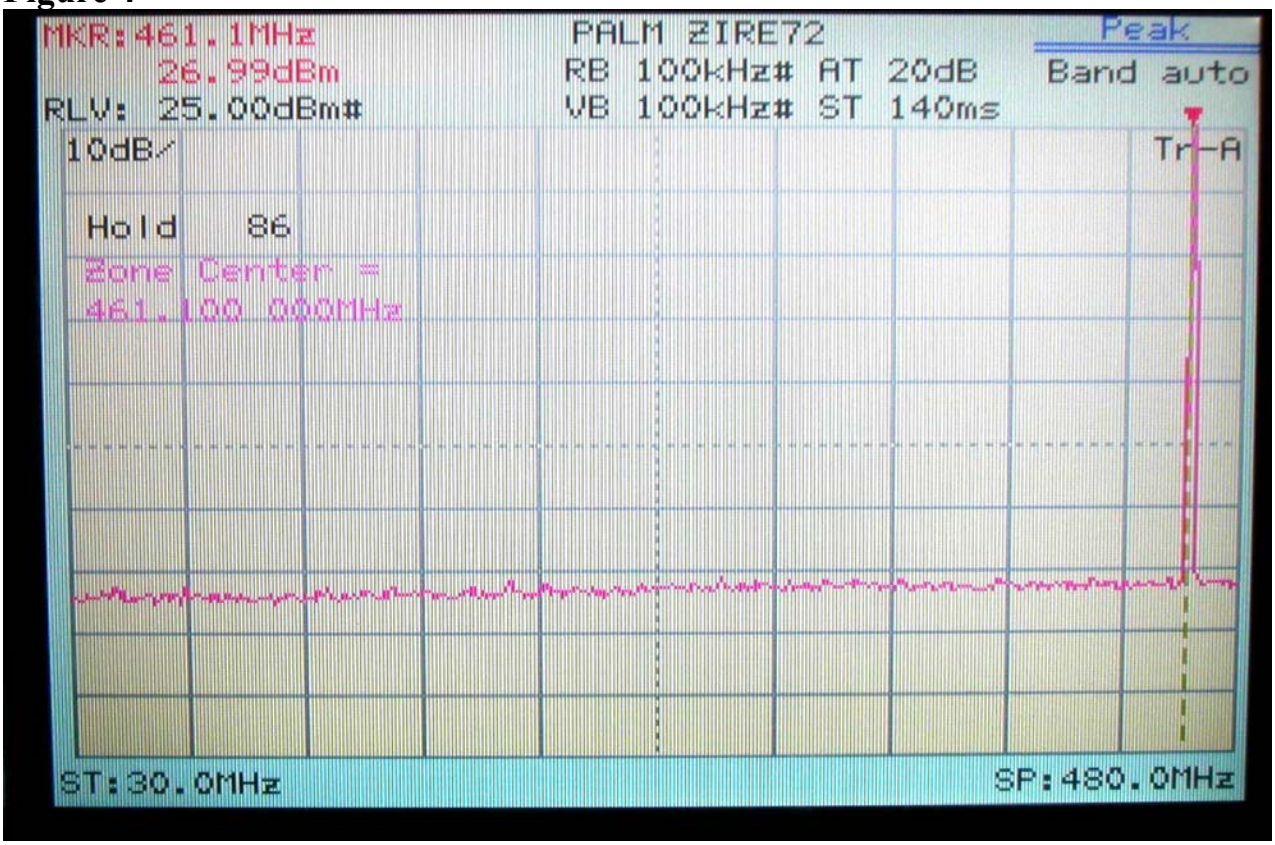
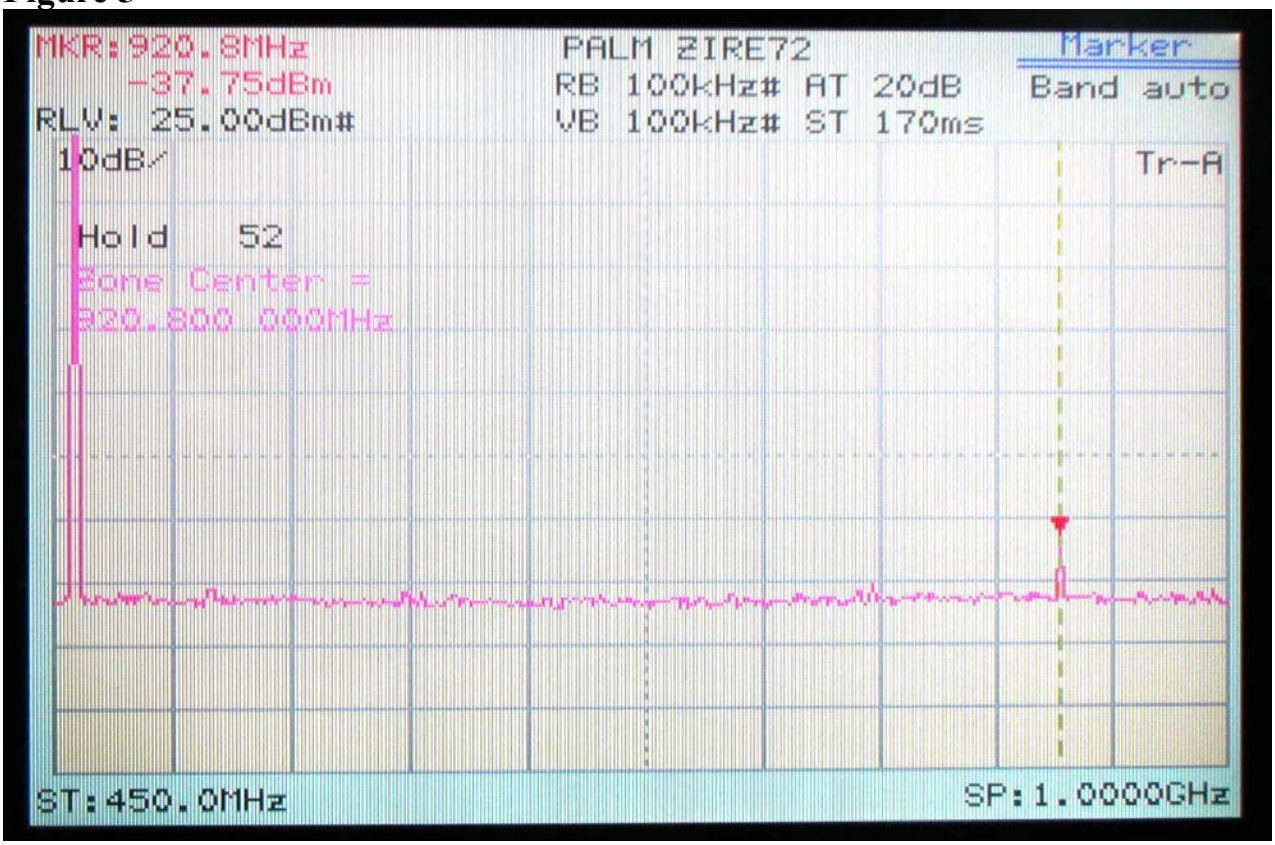


Figure 5



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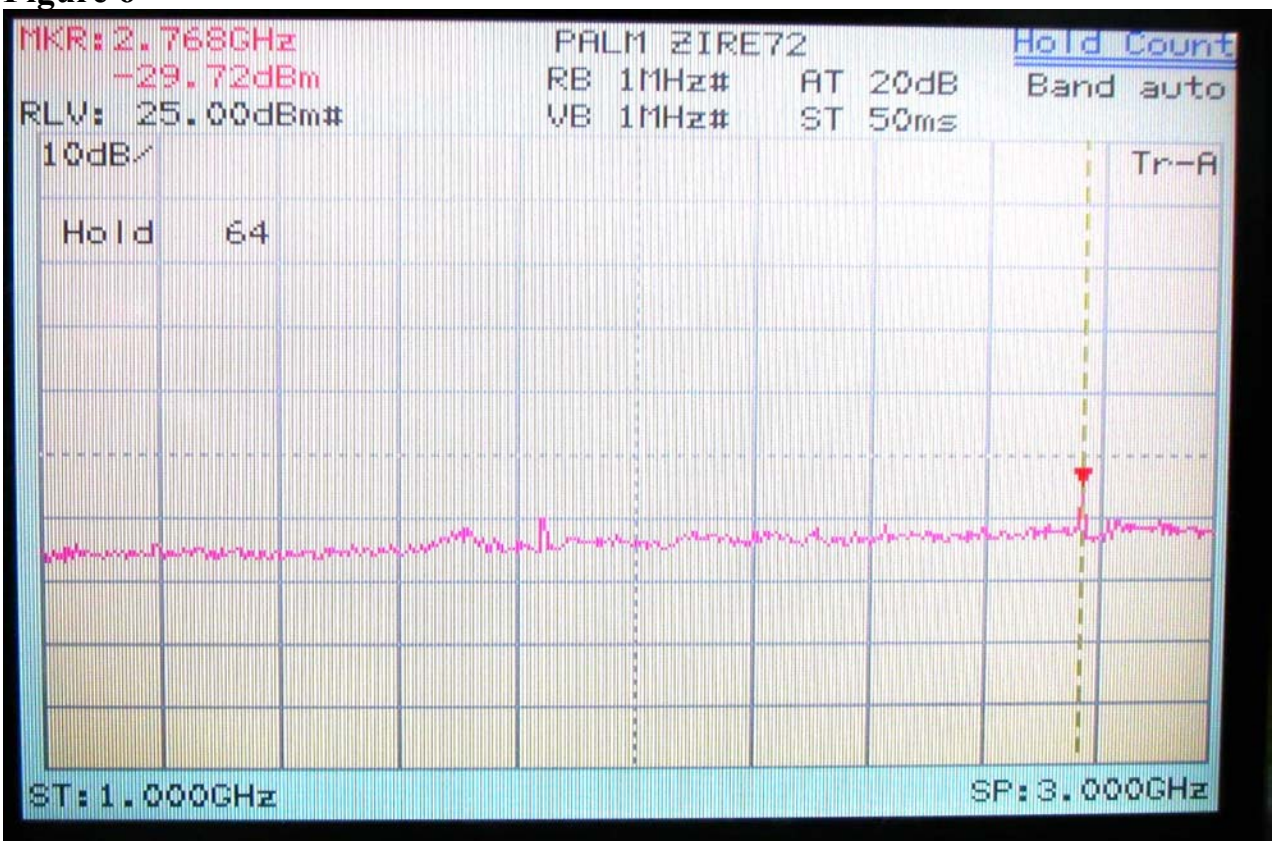
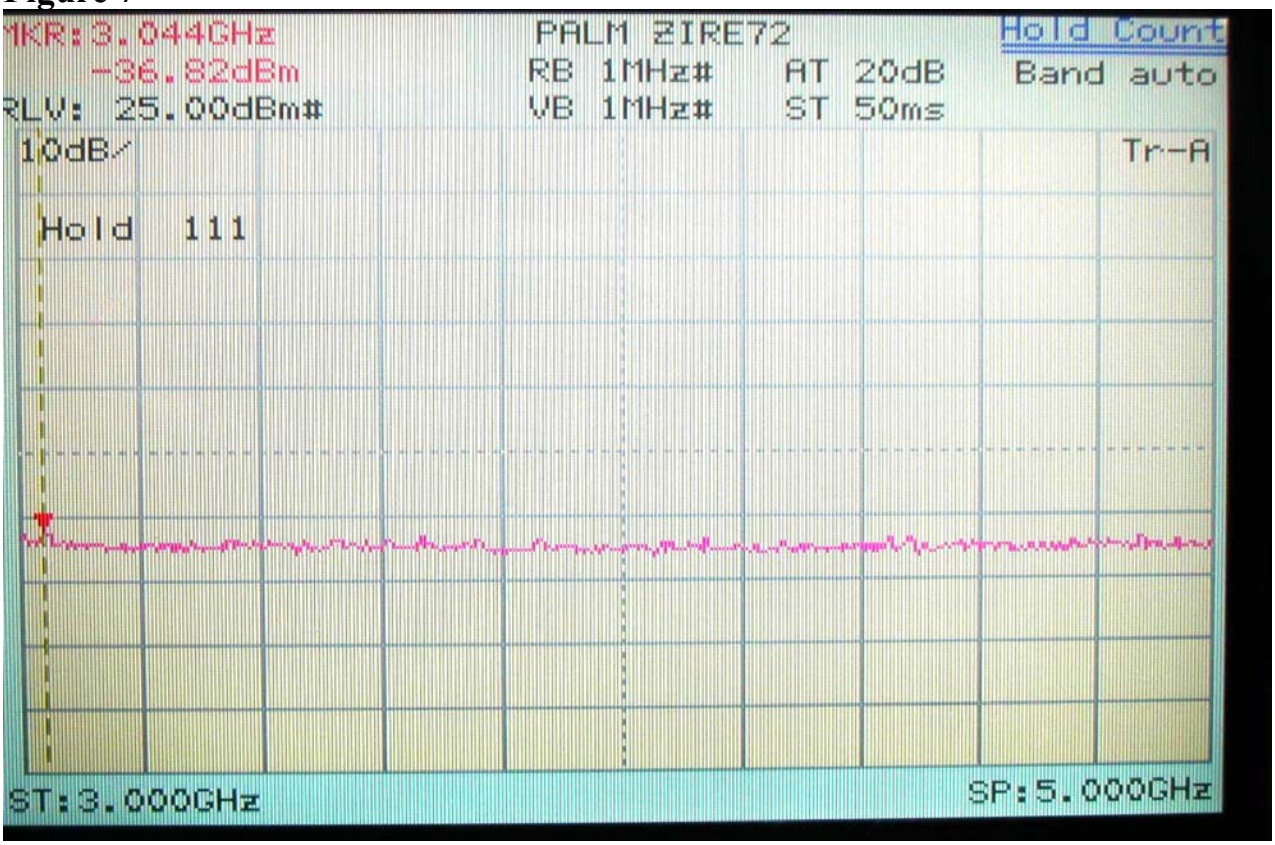


Figure 7



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) Pd (dBm) ＝ Pg (dBm) － Cable loss (dB) ＋ antenna gain (dB)

(where, Pd is the equivalent power and Pg is the generator output into the substitution antenna)

Antenna Polarity: Vertical Bandwidth: 12.5K

Frequency [MHz]	Signal Gen Level [dBm]	Cable Loss [dBm]	Tx Antenna Gain	Emission Level [dBm]
460.00	20.9	0.27	6.7	27.33

Antenna Polarity: Horizontal Bandwidth: 12.5K

Frequency [MHz]	Signal Gen Level [dBm]	Cable Loss [dBm]	Tx Antenna Gain	Emission Level [dBm]
460.00	20.72	0.27	6.7	27.15

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)				05/16/03	05/15/04
Spectrum Analyzer	8564E	HP	US36433002	11/03/03	11/03/04
Microwave Preamplifier	83051A	HP	3232A00347	08/01/03	08/01/04
Horn Antenna	3115	EMCO	9704 - 5178	12/27/02	12/27/03
Signal Generator	8648D	HP	3613A00117	05/24/03	05/23/04
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 ± 3.44dB .

7.3 Test Result:

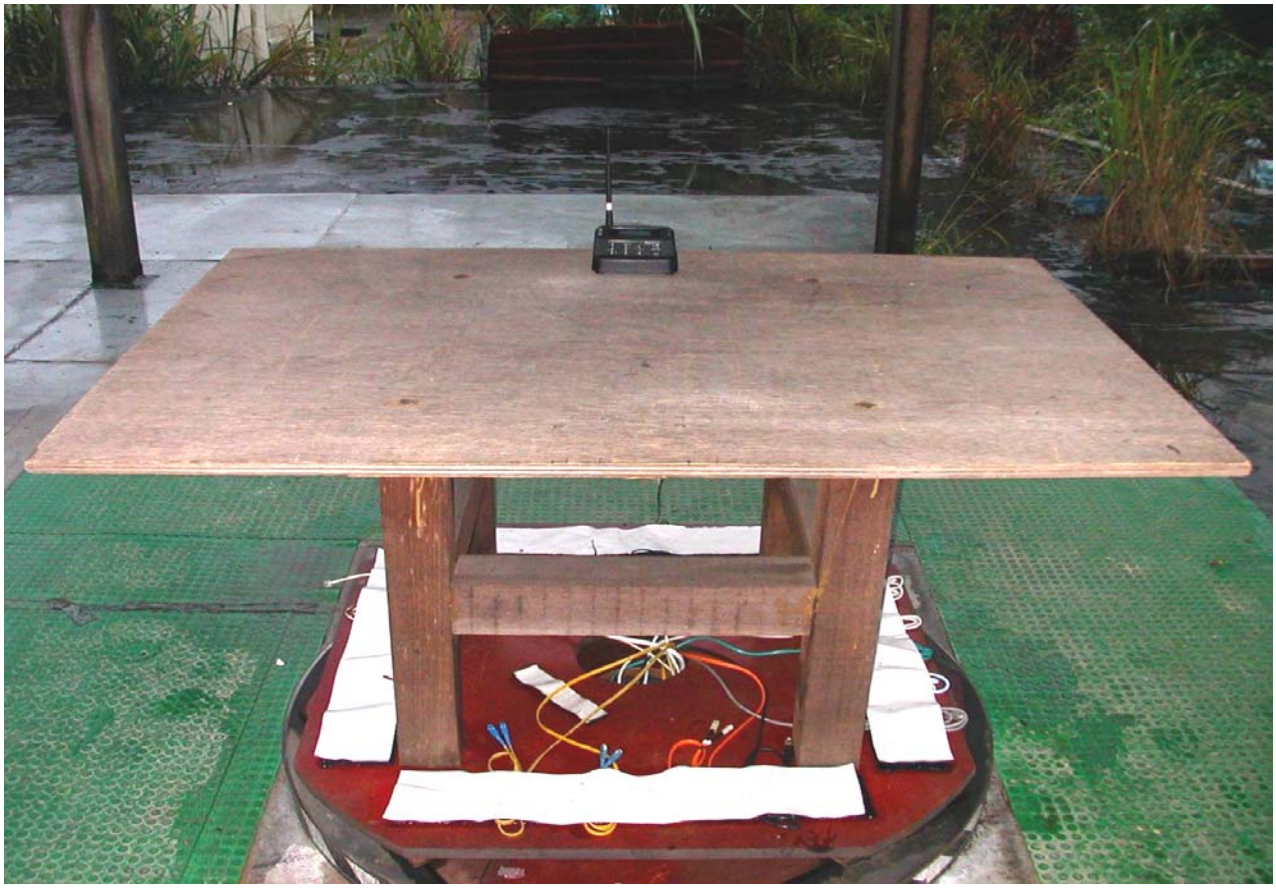
Antenna Polarity: Vertical Bandwidth: 12.5K

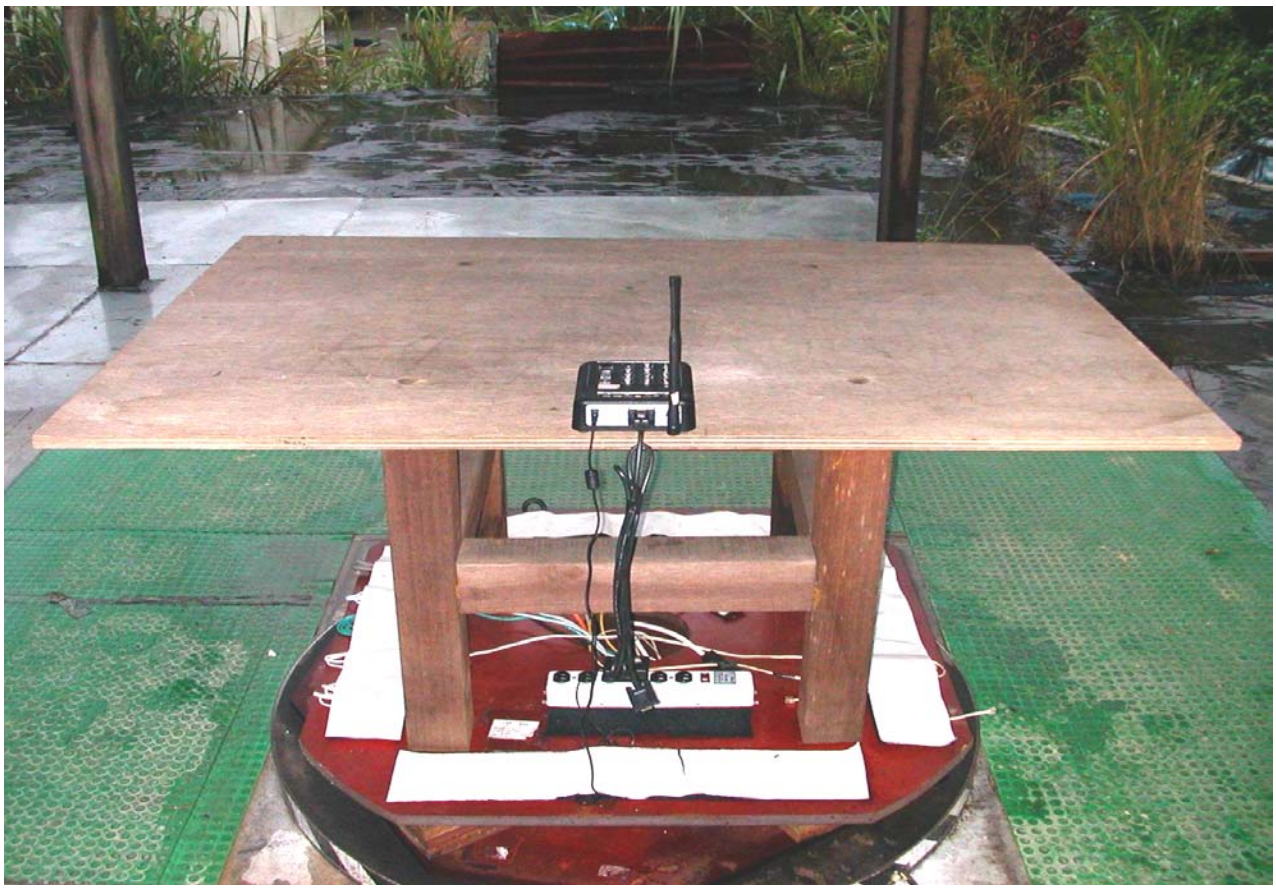
Frequency [MHz]	Signal Gen Level [dBm]	Cable Loss [dBm]	Tx Antenna Gain	Emission Level [dBm]	Limit [dBm]	Margin [dB]
919.99	-33.8	0.37	6.1	-28.07	-20	-8.07
1380.00	-62.47	0.46	7.5	-55.43	-20	-35.43
1825.00	-56.19	0.48	8.2	-48.47	-20	-28.47
2300.00	-48.87	0.58	8.9	-40.55	-20	-20.55
2758.33	-56.94	0.64	9.2	-48.38	-20	-28.38
3220.00	-49.04	0.71	9.2	-40.55	-20	-20.55
3680.00	-54.64	0.76	9.3	-46.10	-20	-26.10
4140.00	-58.64	0.77	9.5	-49.91	-20	-29.91
4601.67	-59.12	0.94	10.4	-49.66	-20	-29.66

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]
919.99	-30.1	0.37	6.1	-24.37	-20	-4.37
1380.00	-61.64	0.46	7.5	-54.60	-20	-34.60
1840.00	-59.35	0.48	8.2	-51.63	-20	-31.63
2300.00	-46.70	0.58	8.9	-38.38	-20	-18.38
2758.33	-54.118	0.64	9.2	-45.55	-20	-25.05
3220.00	-49.54	0.71	9.2	-41.05	-20	-21.05
3680.00	-58.848	0.76	9.5	-50.10	-20	-30.10

7.4 Test Placement





VIII. Frequency Stability (Part 2.1055, 90.213)

8.1 Test procedure:(Temperature)

(1) Frequency shift vs. temperature:
The nominal room temperature 20℃, and the reference frequency is 460.0000MHz.

(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.

8.2 Test Result:

Nominal Frequency: 460.002810MHz Bandwidth: 12.5K

Temperature [℃]	Ferquency [MHz]	Frequency Error [Hz]	Limit (2.5PPM)	Error in PPM
-30℃	460.002010	800	1147	1.74
-20℃	460.002130	680	1147	-1.48
-10℃	460.002380	430	1147	-0.93
0.0℃	460.002270	540	1147	1.17
10℃	460.002510	300	1147	0.65
20℃	460.002960	-150	1147	-0.33
30℃	460.003120	-310	1147	-0.67
40℃	460.002840	-30	1147	-0.07
50℃	460.002890	-80	1147	-0.17
60℃	460.003300	-210	1147	-0.47

8.3 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	09/15/03	09/14/04

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

IX. Conducted Emission Test (ANSI C63.4 1992)

9.1 Test procedure:

All the equipment is placed and setup according to the ANSI C63.4 1992.

The EUT is assembled on a wooden table which is 80 cm high, is placed 40 cm from the back-wall which is a vertical conducting plane. One LISN is for EUT, the other LISN is for support equipment. They are all placed on the conductive ground. The EUT's LISN connect a line switch box for selecting L1 or L2, then connect to a preamplifier and spectrum.

The spectrum measured from 150KHz to 30MHz. Conducted emission levels are detected at max. peak mode. But if the max. peak mode failed or over average limit, it will be measured by QP and average detection mode using the Receiver.

Final AC Power line Conducted Emission Measurement set the measurement equipment in Average Detector mode, Re-test all the frequencies that conducted emission level over the limit, if the Quasi-Peak Detector measurement result higher than the Average Detector measurement result 6 dB above at same frequency, than that frequency emission type category as Broad Band Noise. The Quasi-Peak Detector measure result will minus 13dB. As measured result.

While testing, there is the worst-emission plot printed at peak detection mode, and there are more than 6 highest emissions relative to limit recorded. The plot is kept as the original data, not included in test report.

9.2 Test Equipment:

				Calibration Date	
Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Receiver	SCR3102	SCHAFFNER	012	04/22/03	04/21/04
LISN (EUT)	3825/2	EMCO	9411-2284	07/21/03	07/20/04
LISN (Support E.)	3825/2	EMCO	9210-2007	09/03/03	09/02/04
Preamplifier	CB-001	TRC	98-02	05/29/03	05/28/04
Line switch box	CB-01	TRC	98-04	05/29/03	05/28/04
1dB Attenuator	CAT-1	mini-circuits	- - - - - - - - -	05/29/03	05/28/04
FTB-1-6 Attenuator	15542	mini-circuits	9620 03	05/29/03	05/28/04
20dB Attenuator	CAT-20	mini-circuits	9620 13	05/29/03	05/28/04
3dB Attenuator	CAT-3	mini-circuits	9620 14	05/29/03	05/28/04
Coixal Cable	BNC3200B-0058	Jyebao	CL-05	05/29/03	05/28/04
Coixal Cable	BNC31VB-0316	Jyebao	IF-01ca0069-036	05/29/03	05/28/04
50ohm terminator	370BNM	NARDA	PWR5W	07/21/03	07/20/04
50ohm terminator	370BNM	NARDA	PWR5W	07/21/03	07/20/04
50ohm terminator	370BNM	NARDA	PWR5W	09/03/03	09/02/04
50ohm terminator	370BNM	NARDA	PWR5W	09/03/03	09/02/04

The level of confidence of 95% , the uncertainty of measurement of conducted emission is +3.1/-4.84 dB .

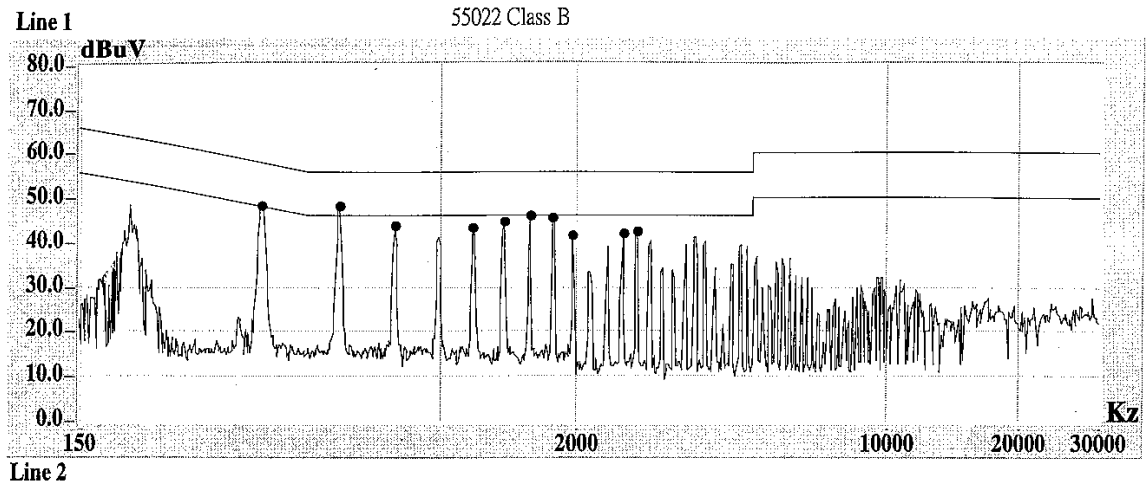
Test Result : Pass

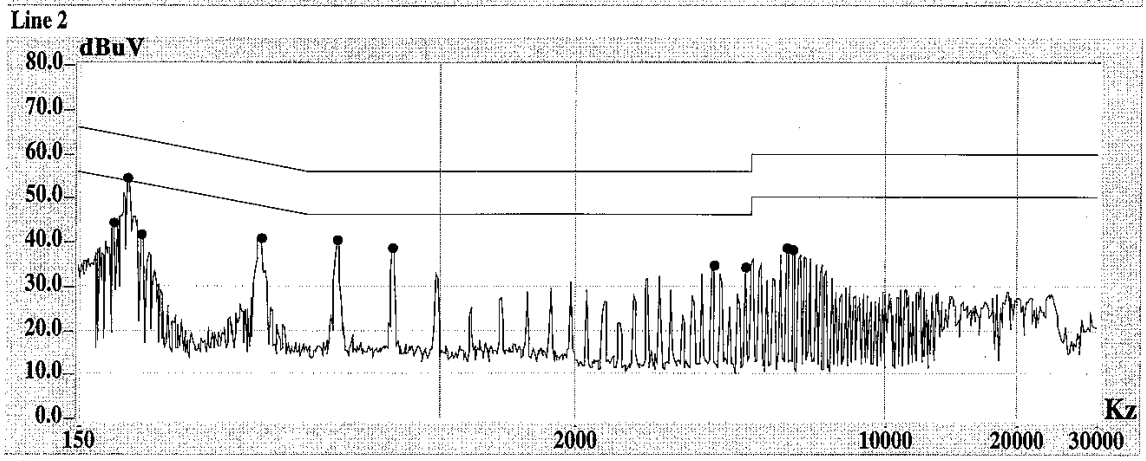
9.3 Test Placement

9.4 Test Result:

Test Mode: 230Vac/50Hz

Testing room : Temperature : 23 ° C Humidity : 72 % RH





Line 1

Frequency(KHz)	Peak Amptd(dBuV)	QP Amptd(dBuV)	Avg Amptd(dBuV)	QP Limit(dBuV)	Avg Limit(dBuV)	Margin(dB)
394.00	48.53	###.##	###.##	59.03	49.03	-0.50
590.00	48.20	45.01	43.01	56.00	46.00	-0.99
788.00	44.13	###.##	###.##	56.00	46.00	-1.87
1177.00	43.47	###.##	###.##	56.00	46.00	-2.53
1374.00	44.81	###.##	###.##	56.00	46.00	-1.19
1574.00	46.35	43.00	39.24	56.00	46.00	-3.00
1769.00	45.84	###.##	###.##	56.00	46.00	-0.16
1961.00	41.80	###.##	###.##	56.00	46.00	-4.20
2540.00	42.30	###.##	###.##	56.00	46.00	-3.70
2750.00	42.58	###.##	###.##	56.00	46.00	-3.42

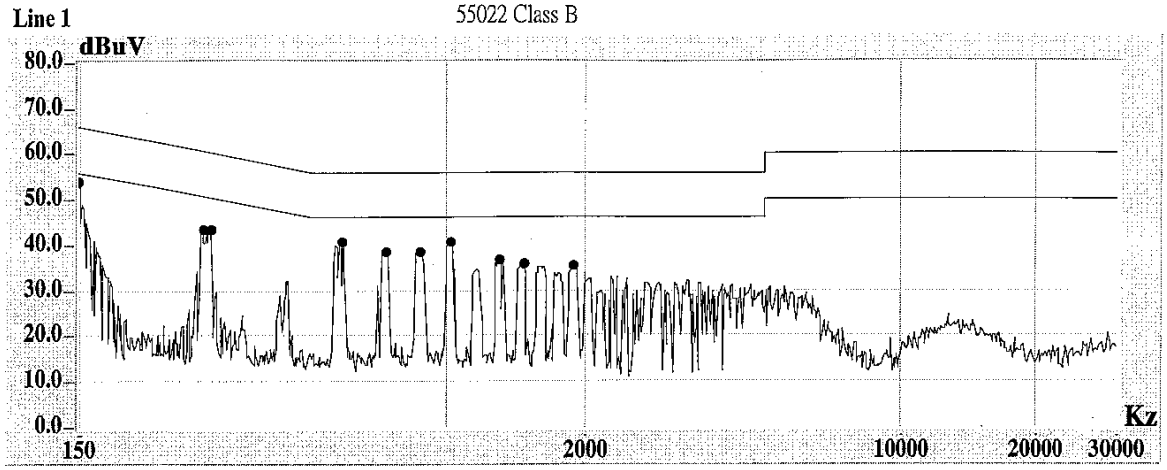
Line 2

Frequency(KHz)	Peak Amptd(dBuV)	QP Amptd(dBuV)	Avg Amptd(dBuV)	QP Limit(dBuV)	Avg Limit(dBuV)	Margin(dB)
180.00	44.39	###.##	###.##	65.14	55.14	-10.75
194.00	54.59	###.##	###.##	64.74	54.74	-0.15
208.00	41.64	###.##	###.##	64.34	54.34	-12.70
394.00	41.06	###.##	###.##	59.03	49.03	-7.97
586.00	40.32	###.##	###.##	56.00	46.00	-5.68
778.00	38.57	###.##	###.##	56.00	46.00	-7.43
4110.00	34.80	###.##	###.##	56.00	46.00	-11.20
4880.00	34.37	###.##	###.##	56.00	46.00	-11.63
6020.00	38.77	###.##	###.##	60.00	50.00	-11.23
6220.00	38.28	###.##	###.##	60.00	50.00	-11.72

Test Mode: 117Vac/60Hz

Testing room : Temperature : 23 ° C Humidity : 72 % RH

Line 1



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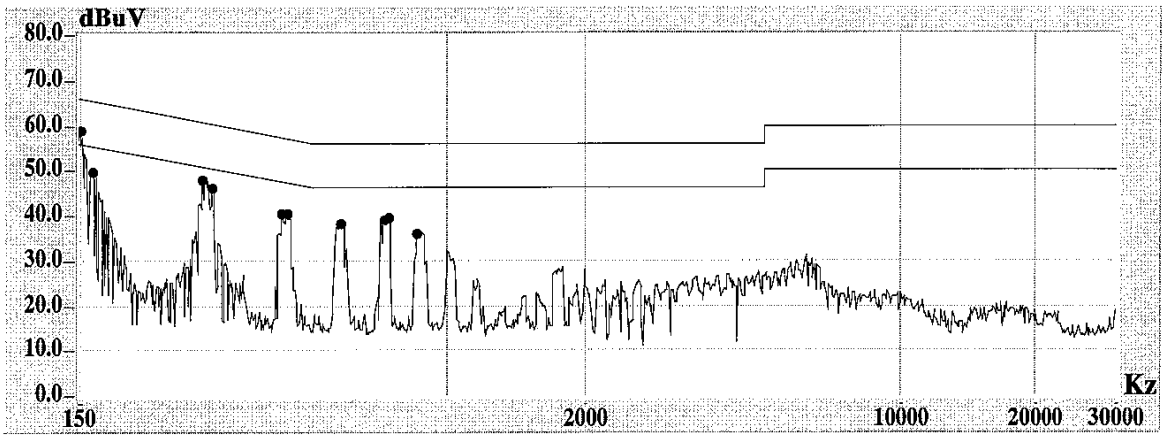


Line 1

Frequency(KHz)	Peak Amptd(dBuV)	QP Amptd(dBuV)	Avg Amptd(dBuV)	QP Limit(dBuV)	Avg Limit(dBuV)	Margin(dB)
150.00	54.25	###.##	###.##	66.00	56.00	-1.75
285.00	43.64	###.##	###.##	62.14	52.14	-8.50
297.00	43.66	###.##	###.##	61.80	51.80	-8.14
582.00	40.70	###.##	###.##	56.00	46.00	-5.30
734.00	38.80	###.##	###.##	56.00	46.00	-7.20
868.00	38.86	###.##	###.##	56.00	46.00	-7.14
1015.00	40.73	###.##	###.##	56.00	46.00	-5.27
1299.00	37.02	###.##	###.##	56.00	46.00	-8.98
1468.00	36.04	###.##	###.##	56.00	46.00	-9.96
1882.00	35.69	###.##	###.##	56.00	46.00	-10.31

Line 2

Frequency(KHz)	Peak Amptd(dBuV)	QP Amptd(dBuV)	Avg Amptd(dBuV)	QP Limit(dBuV)	Avg Limit(dBuV)	Margin(dB)
151.00	58.90	57.32	45.29	65.97	55.97	-10.68
161.00	49.68	###.##	###.##	65.69	55.69	-6.01
283.00	47.74	###.##	###.##	62.20	52.20	-4.46
299.00	46.18	###.##	###.##	61.74	51.74	-5.56
427.00	40.36	###.##	###.##	58.09	48.09	-7.73
438.00	40.39	###.##	###.##	57.77	47.77	-7.38
579.00	38.28	###.##	###.##	56.00	46.00	-7.72
724.00	39.32	###.##	###.##	56.00	46.00	-6.68
739.00	39.49	###.##	###.##	56.00	46.00	-6.51
857.00	35.96	###.##	###.##	56.00	46.00	-10.04

X. Transient Frequency Behavior (Part 90.214)

10.1 Test procedure:

(1) Set-up followed by TIA/EIA 603. Section 1.2.19

(2) Turn on the EUT and Record the plot.

(3) Turn off the EUT and Record the plot.

(4) Let the EUT modulated and repeat step (3) (4).

(5) Use the EUT 2 with BW 12.5KHz, repeat step (3) ~ (5).

10.2 Test Result:

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

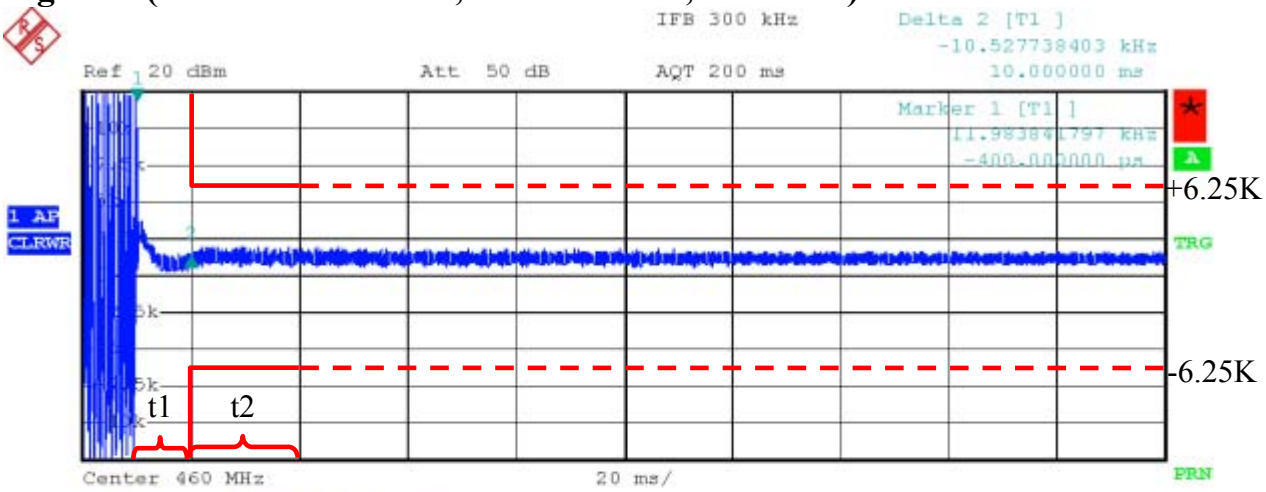
* See Figures 8－11

10.3 Test Equipment:

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Signal Generator	2030	MARCONI	119665/027	07/12/03	07/11/04
Oscilloscope	FSP13	ROHD&SCHWARZ	100126	05/25/03	05/24/04

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

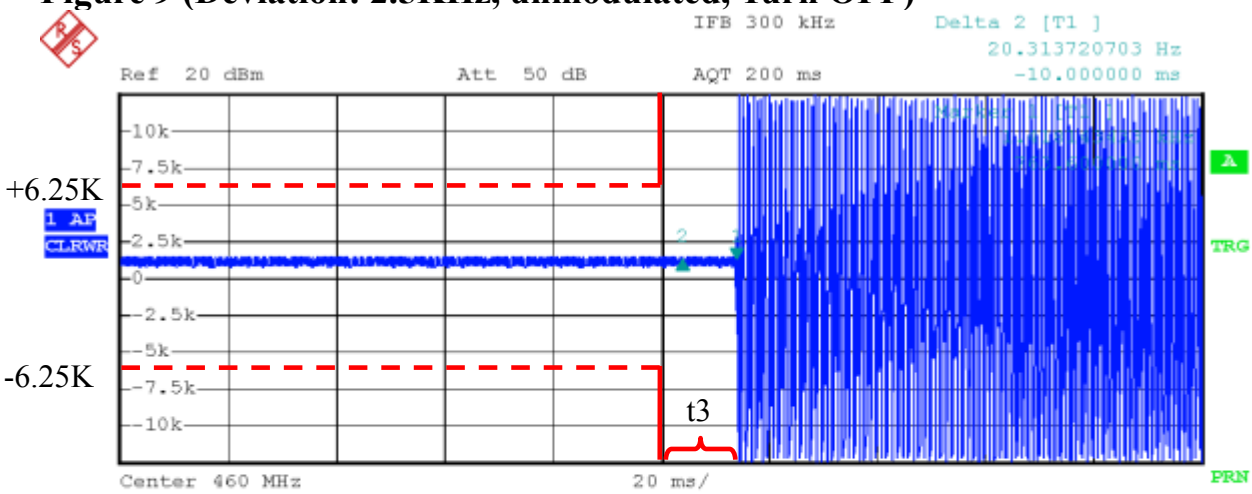
Figure 8 (Deviation: 2.5KHz, unmodulated, Turn ON)



Frequency Modulation Summary

Coupling	DC		Carrier Offset	1.1766 kHz
Deviation	+peak	12.38 kHz	Carrier Power	2.65 dBm
	-peak	-12.42 kHz	Modulation Frequency	999.98 Hz
	ûpeak/2	12.40 kHz	Sampling Rate	31.25 kHz
	RMS	2.286 kHz	Record Length	6251
			Demod Bandwidth	25 kHz

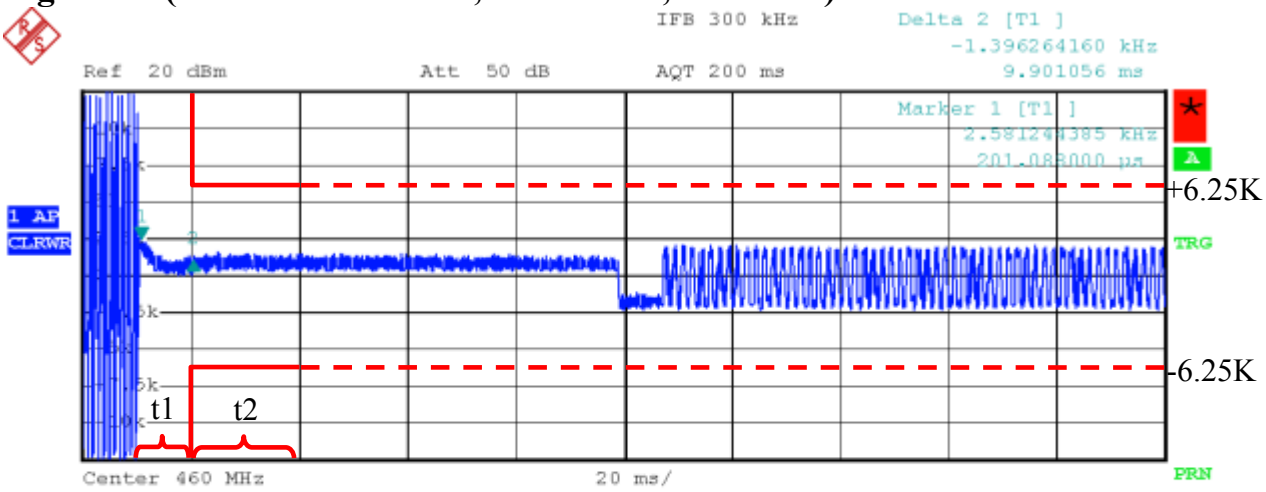
Figure 9 (Deviation: 2.5KHz, unmodulated, Turn OFF)



Frequency Modulation Summary

Coupling	DC		Carrier Offset	723.73 Hz
Deviation	+peak	19.74 kHz	Carrier Power	0.84 dBm
	-peak	-12.61 kHz	Modulation Frequency	--- Hz
	ûpeak/2	16.18 kHz	Sampling Rate	31.25 kHz
	RMS	5.757 kHz	Record Length	6251
			Demod Bandwidth	25 kHz

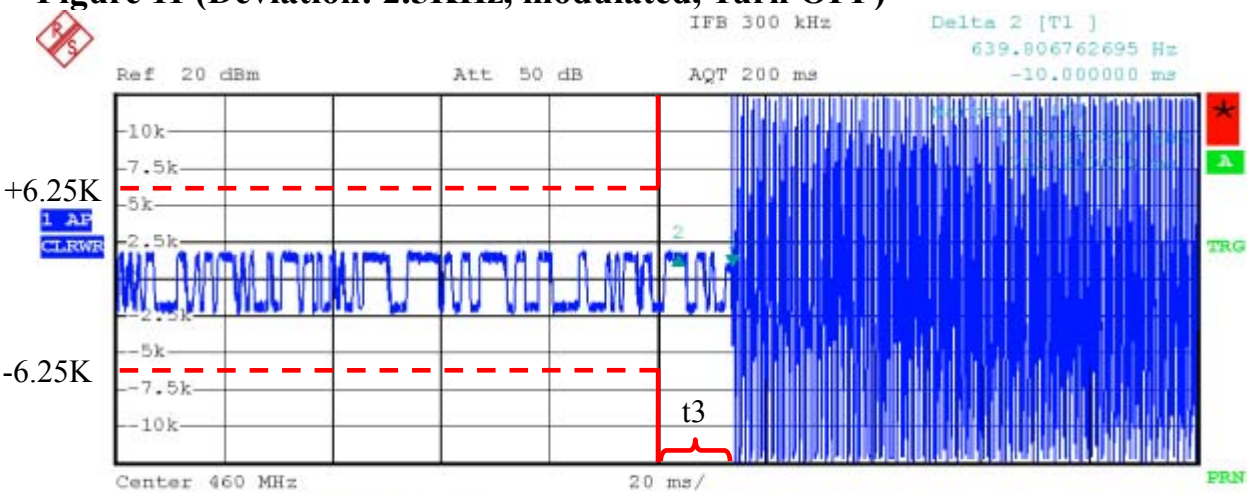
Figure 10 (Deviation: 2.5KHz, modulated, Turn ON)



Frequency Modulation Summary

Coupling	DC		Carrier Offset	184.61 Hz
Deviation	+peak	12.51 kHz	Carrier Power	2.66 dBm
	-peak	-19.21 kHz	Modulation Frequency	1.0183 kHz
	⌀peak/2	15.86 kHz	Sampling Rate	31.25 kHz
	RMS	2.327 kHz	Record Length	6251
			Demod Bandwidth	25 kHz

Figure 11 (Deviation: 2.5KHz, modulated, Turn OFF)



Frequency Modulation Summary

Coupling	DC		Carrier Offset	-95.412 Hz
Deviation	+peak	12.84 kHz	Carrier Power	0.83 dBm
	-peak	-19.67 kHz	Modulation Frequency	--- Hz
	⌀peak/2	16.26 kHz	Sampling Rate	31.25 kHz
	RMS	5.827 kHz	Record Length	6251
			Demod Bandwidth	25 kHz