CFR TITLE 47 PARTS
15.249 CERTIFICATION

FCC ID: M72129702593

EMI TEST REPORT

ON

PREMIER WIRELESS MIC

PREPARED FOR

POLYCOM, INC.
2584 JUNCTION AVE
SAN JOSE, CA 95134
TEL: (408)474-2864
FAX: (408)474-2945

PREPARED BY

ELECTRONIC COMPLIANCE LABORATORIES, INC.
1249 BIRCHWOOD DRIVE
SUNNYVALE, CA 94089
408/747-1490

TEST REPORT NUMBER: A804006

DATE OF TEST: APRIL 1, 1998

Table of Contents

1.0 Certification of Compliance

Description: A wireless microphone for the SoundStation Premier

Serial Number: 3303

Applicant: Polycom, Inc.

Type of Test: FCC-15, Class A (Certification) part 15.249

Date of Test: April 1, 1998

Tested By: Suresh Kondapalli

The above equipment was tested by Electronic Compliance Laboratories, Inc. and found to be in compliance with the requirements set forth in the FCC Rules and Regulations, Part 15, Subpart C (15.203, 15.205, 15.209, 15.249). The equipment, in the configuration described in this report, shows that the maximum emission levels emanating from this equipment are within the compliance requirements.

Chris Byleckie
Technical Director

4-28-98
Date

2.0 General Information

Applicant:	Polycom, Inc. 2584 Junction Ave San Jose, CA 95134-1902
Contact Person:	John Pearson
Equipment Under Test:	Premier Wireless Mic
Serial Number:	3303
FCC ID#:	**M72129702593**
Report Number:	A804006
Date of Test:	April 1, 1998
Manufacturer:	Polycom, Inc.
Type of Test:	FCC part 15, Subpart C, (15.203, 15.205, 15.207, 15.209, 15.247), Class B Digital Device.
Frequency Range:	30 MHz to 1000 MHz - Radiated Emissions, Class A 902 MHz to 928 MHz - part 15.249 Up to the 10th harmonic of the fundamental (9270 MHz) part 15.35(a)

Summary

Pass/Fail: Passed

15.209 Radiated Emissions:

The Premier Wireless Mic meet all the requirements for Part 15.209 Class A limit. **See Appendix D for Data Sheet and plots**.

15.249 Operation within the 902 - 928 MHz band:

The Premier Wireless Mic met all the requirements for 15.249. **See attached data and plots in Appendix A and Appendix B**.

3.0 Test Facility

Name: Electronic Compliance Laboratories

Location: 1249 Birchwood Drive
Sunnyvale, CA 94089

Site Filing: A site description is on file at the Federal Communications Commission
P.O. Box 429
Columbia, MD 21045

Types of Sites: Open Field Radiated and Indoor (Screen Room).
Line Conducted: All sites are constructed and calibrated to meet ANSI C63.4-1994 requirements.
Test facility is recognized by the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations.

NVLAP Code: 20089 effective through: March 31, 1999

4.0 Test Equipment

The following list contains equipment used at EC Laboratories, Inc. for compliance testing. The equipment conforms to the American National Standard Specifications for Electromagnetic Interference and Field Strength Instrumentation from 10 kHz to 1000 MHz.

Description	Manufacturer	S/N	Model No.	Cal. Due Date
EMI Receiver	HP	3325A00137	8456A	5/3/98
Pre-amp	HP	313A06829	8447F	5/10/98
Pre-amp	HP	3008A00527	8449B	4/5/99
LISN	EM	2532	ANS-25/2	6/12/98
Spectrum Analyzer	HP	3137A01183	8563A	5/22/98
Plotter	HP	2644V00365	7470A	N/A
Power Meter	HP	2342A07307	435B	4/4/99
Power Sensor	HP	N/A	8482A	4/12/99
Biconical Antenna	EM	677	EM-6912	3/3/99
Log-Periodic Antenna	EM	858	EM-6950	4/18/99
Horn Antenna	EM	6231	RGA-60	6/6/98
1.2 - 4GHz FIlter	FSY	001	HM1160-11SS	3/25/99
4 - 10 GHzFilter	FSY	001	HM2950-15SS	3/25/99
10 - 18 GHzFilter	FSY	001	HP8601-7SS	3/25/99

HP = Hewlett Packard
EM = Electro Metrics

The antenna used at the time the data was taken is indicated on each data page. The antenna height and polarization are also noted on the data pages.

The calibration of the measuring instruments, including any accessories that may effect such calibration, are checked frequently to assure their accuracy. Adjustments are made and correction factors applied in accordance with instructions contained in the manual for the measuring instrument.

5.0 Data Reporting Format

The measurement results are expressed in accordance with FCC Part-15, Subpart B Class B limits, where applicable, are presented in tabular or graphical form.

6.0 Detector Functions

On any frequency or frequencies below or equal to 1000 MHz, the limits shown below are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths.

On any frequency or frequencies above 1000 MHz, the radiated limits shown below are based on the use of measuring equipment employing an average detector function.

EC Laboratories uses the Peak detection mode for normal testing and initial screening of the Premier Wireless Mic. The Peak detection mode will produce a measurement value that is always greater than, or equal to, the quasi-peak or average detection mode. Whenever the measurement value is 6 dB below the applicable limit or greater, the appropriate detector function will be employed and recorded.

7.0 Frequency Range of Investigation

The spectrum was investigated up to the frequency specified in the following table according to the highest clock frequency generated in the device.

Highest Frequency Used (Clock)	Upper Limit of Range Measured
Below 1.705 MHz	30 MHz
1.705 to 108 MHz	1000 MHz
108 to 500 MHz	2000 MHz
500 to 1000 MHz	5000 MHz
Above 1000 MHz	5th Harmonic or 40 GHz (Whichever is Lower)

8.0 FCC Class Types

Class A Digital Device

A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

Class B Digital Device

A digital device that is marketed for use in a residential environment notwithstanding use in a commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a devices a Class B digital device, regardless of its intended use.
(Code of Federal Regulations, 47, Part 15, Subpart A, Sect. H&I)
(CFR 47, Parts 0 TO 19, Revised as of October 1,1990)

9.0 FCC Limits

9.1 Conducted Emission Limits

For a digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back into the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed the limits in the following table for the appropriate class. Compliance shall be based on the measurement of the Radio Frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

Frequency (MHz)	Class A Limit (μV)	Class A Limit (dBμV)	Class B Limit (μV)	Class B Limit (dBμV)
0.45 to 1.705	1000	60.0	250	48.0
1.705 to 30.0	3000	69.5	250	48.0

9.2 Radiated Emission Limits

The field strength of radiated emissions for a Class A Digital Device, when measured at a distance of 10 meters, shall not exceed the limits given in the table below. The lower limit applies at the band edge.

The field strength of radiated emissions for a Class B Digital Device, when measured at a distance of 3 meters, shall not exceed the limits given in the table below. The lower limit applies at the band edge.

Frequency (MHz)	Class A (3m) Limit (μV/m)	Class A (3m) Limit (dBμV/m)	Class A (10m) Limit (μV/m)	Class A (10m) Limit (dBμV/m)	Class B (3m) Limit (μV/m)	Class B (3m) Limit (dBμV/m)
30-88	300	49.6	90	39.1	100	40.0
88-216	500	54.0	150	43.5	150	43.5
216-960	700	56.0	210	46.4	200	46.0
Above 960	1000	60.0	300	49.5	500	54.0

10.0 Test Methods

10.1 Line Conducted Emissions Test Procedure

1. EUT and any other equipment and cables were placed on a wood table one meter above a ground screen.
2. The EUT's Input Power line cord was connected to a Line Impedance Stabilization Network (LISN) under the table.
3. All other (Non-EUT) equipment received power from a separate AC Power Source. The LISN assembly has two monitoring points: Line 1 (AC-Hot) and Line 2 (AC-Neutral). Each monitoring point was scanned by the measuring equipment (the other point was terminated in 50 ohms) over the frequency range of 450 kHz to 30 MHz for conducted emissions.
4. When an emission is found, the following takes place:
   a. The emission levels are maximized by equipment/cable placement.
   b. Frequency and emission level data are entered into computer in dBm.
   c. The monitoring point (Line 1 or 2) is entered into the computer.
   d. The computer converts dBm to micro volts and uses a look-up table to find cable losses (in dB) at that frequency, calculates a corrected emission level, and compares the corrected emission level to the appropriate limit. The data is then printed out in tabular form.

An example of the printout and definitions follows below.

10.1 Line Conducted Emissions Test Example

	Site	FCC Limit		EUT Level (L1)	
Freq	Reading	A	B	A	B
(MHz)	(dBµV)	(dBµV)		(dB)	
1.85	-57	69.5	48.0	-4.5	+17

Freq. = Frequency of emission in MHz
Reading dBµV = Reading at Spectrum Analyzer (Uncorrected)
FCC Limit A/B = Conducted Emission level limit in dBµV
EUT Level A* = Emission relative to the FCC Class A Limit
EUT Level B* = Emission relative to the FCC Class B Limit

Note = L1 is AC-Hot, L2 is AC-Neutral
QP is a Quasi-Peak value
AV is an average value

*A negative value indicates that the emission is below (or meets) the limit and a positive value indicates that the emission is above (or exceeds) the limit.

10.3 Radiated Emissions Test Procedure

1. EUT and any other equipment and cables used with the EUT were placed on a wood table one-meter above a ground screen.
2. The EUT receives the normal AC Power at the base of the table.
3. All equipment and cables are placed in a manner which tends to maximize their emission characteristics in a typical application.
4. The table was rotated 360 degrees to determine the maximum radial emissions.
5. The antenna was varied in height between 1 meter and 4 meters above the ground plane to determine the maximum emissions. Various antennas are used during the test in both the vertical and horizontal polarization.
6. The Spectrum Analyzer is scanned from 30 MHz to 1000 MHz for emissions. The applicable spectrum analyzer settings are:
   a. Resolution Bandwidth = 100 kHz,
   b. Normal Detector Mode = Peak (The Quasi-Peak is used when the emissions are near, or over the limit).
7. When an emission is found and maximized, the following actions are performed:
   a. The emission frequency is entered into the computer.
   b. The emission level is read from the spectrum analyzer in dBm and entered into the computer.
   c. The antenna polarization is entered into the computer.
   d. The computer converts the level in dBm to dBµV and uses lookup tables to determine the coax cable loss, antenna factor, and pre-amp gain. A site correction factor is calculated for that particular frequency, and the data is printed out in tabular form.

10.4 Radiated Test Example

	Site	FCC Limit		EUT Level (QP)	
Freq	Reading	A	B	A	B
(MHz)	(dBµV)	(dBµV)		(dB)	
65.4	-58	39.1	40.0	-4.6	-5.5

Freq. = Frequency of emission in MHz.
Reading dBµV = Reading at Spectrum Analyzer (Uncorrected)
FCC Limit A/B = Limit in dBµV as stated in Part-15, Subpart B
EUT Level A* = Emission level relative to the FCC Class A limit
EUT Level B* =Emission level relative to the FCC Class B limit.

Note = V/H is the antenna polarization (Vertical or Horizontal)
PK indicates a Peak Value
QP indicates the Quasi-Peak value.

*A negative value indicates that the emission is below (or meets) the limit and a positive value indicates that the emission is above (or exceeds) the limit.

11.0 Labeling Requirements

Product Label:

A Class A Digital Device subject to Certification by the FCC shall bear the following statement in a conspicuous location on the device.

(Name of Grantee)
FCC ID:
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The label is to be located in a "conspicuous location". This is any location readily visible to the user of the device without the use of tools.

The label is to be permanently attached to the equipment in such a manner that the label can normally be expected to remain fastened and legible during the equipment's expected useful life.

Where the device is constructed in two or more sections connected by wires and marketed together, the statement specified in this section is required to be affixed only to the main control unit.

When the device is so small or for such use that it is not practicable to place the statement specified above on it, this required information shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier must be displayed on the device.

Users Manual Statement:

For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the user's operation manual.

NOTE: This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense:

Sample Label Drawing and Label location drawing are in Appendix D.

12.0 Summary of Measurements

CFR Title 47, Part 15.249

Manufacturer: Ploycom, Inc.
2584 Junction Ave
Contact: John Pearson
FCC ID: **M72129702593**
Test Report Number: A804006

The SoundStation Premier Wireless Microphone is a low-power FM transmitter that operates in the ISM 902-928 MHz frequncy band. It can be programmed to any 200 kHz frequency slot from 902.2 to 928 MHz. See the Theory of Operation in the Appendix I.

15.249 foroperation withinthe 902-928 MHz band

15.249 (a) Maximum Peak Output Power

The Premier Wirelss Microphone has an antenna that is an integral part of the output circuit and cannot be removed without affecting the conducted output power. The EUT , constantly transmitting, was placed on the OATS with the recieve antenna 3 meters away.

Frequency (MHz)	Field Strength (dBuV)	15.249 Limit (dBuV)	Delta (dB)
910	79.1	93.9	-14.8
920	81.2	93.9	-12.7

15.249 (c) Out Of Band Emissions (Not Falling within Restricted Bands)

The Premier Wireless Mic was placed in transmit mode at the low (902.2 MHz) middle (915 MHz) and the high (927 MHz) channels. The spectrum analyzer was placed in the MAX HOLD mode. Out of Band emissions were investigated and found to be better than 20 dB (in power) below the highest in-band emission. In addition, out of band emissions (radiated) were below the limits specified in 15.209. **See Plots in Appendix A.**

Plot Title	Frequency Range of Plot, MHz	Purpose of Plot
Out Of band Emissions 902.2 MHz	0 - 1000 1000 - 2750 2750 - 26,500	Show Emissions are down by 20 dB
Out Of band Emissions 915 MHz	0 - 1000 1000 - 2750 2750 - 26,500	Show Emissions are down by 20 dB
Out Of band Emissions 927 MHz	0 - 1000 1000 - 2750 2750 - 26,500	Show Emissions are down by 20 dB

15.205 Restricted Bands - Emissions Within Restricted Bands

The Premier Wireless Mic was placed on a wooden table resting on a turntable. The wooden table was approximately 1 meter above the ground plane of the 3 meter portion of the 10 meter OATS test site.

The search antenna was located 3 meters from the Premier Wireless Mic . With the Premier Wireless Mic in the TRANSMIT mode and transmitting continuously, with the spectrum analyzer in the MAX HOLD mode, the turntable was rotated and the search antenna was raised and lowered in a attempt to maximize the received radiated emissions level. The DUT was set in the continuous transmit mode at the low (902.2MHz) middle (915 MHz) and the high (927 MHz) channels. The attached chart entitled "FCC Radiated Data Sheet" shows that emissions falling into restricted bands are below the limit of 54 dB_uV/m. Peak measurements were made using RBW = VBW = 1MHz. Avg measurements were made with an RBW = 1MHz and VBW=10Hz. **Data Sheets are in Appendix B**

15.209 Radiated Emissions

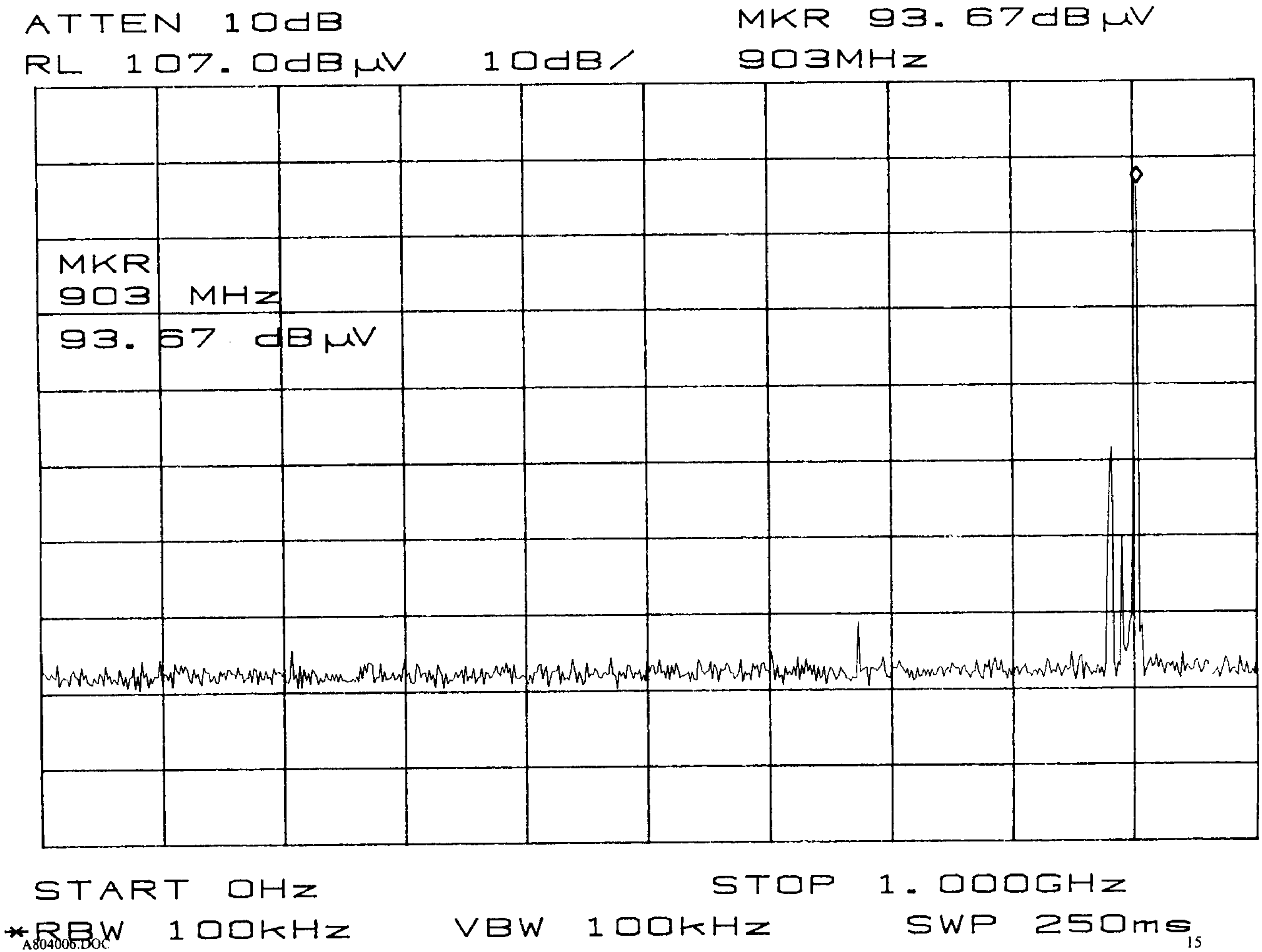
The attached table shows that the Class A radiated limits from 30 - 1000 MHz are not exceeded by the Premier Wireless Mic. The Premier Wireless Mic was operating normally during this test. The Premier Wireless Mic was placed near one edge of a wooden table resting on a turntable. The wooden table was approximately 1 meter above the groundplane of the 3 meter test site. The search antennas were located at 3 meters. Measurements were made in accordance with ANSI C63.4-1994. **Test Data is in Appendix C**.

15.203 Antenna Connector

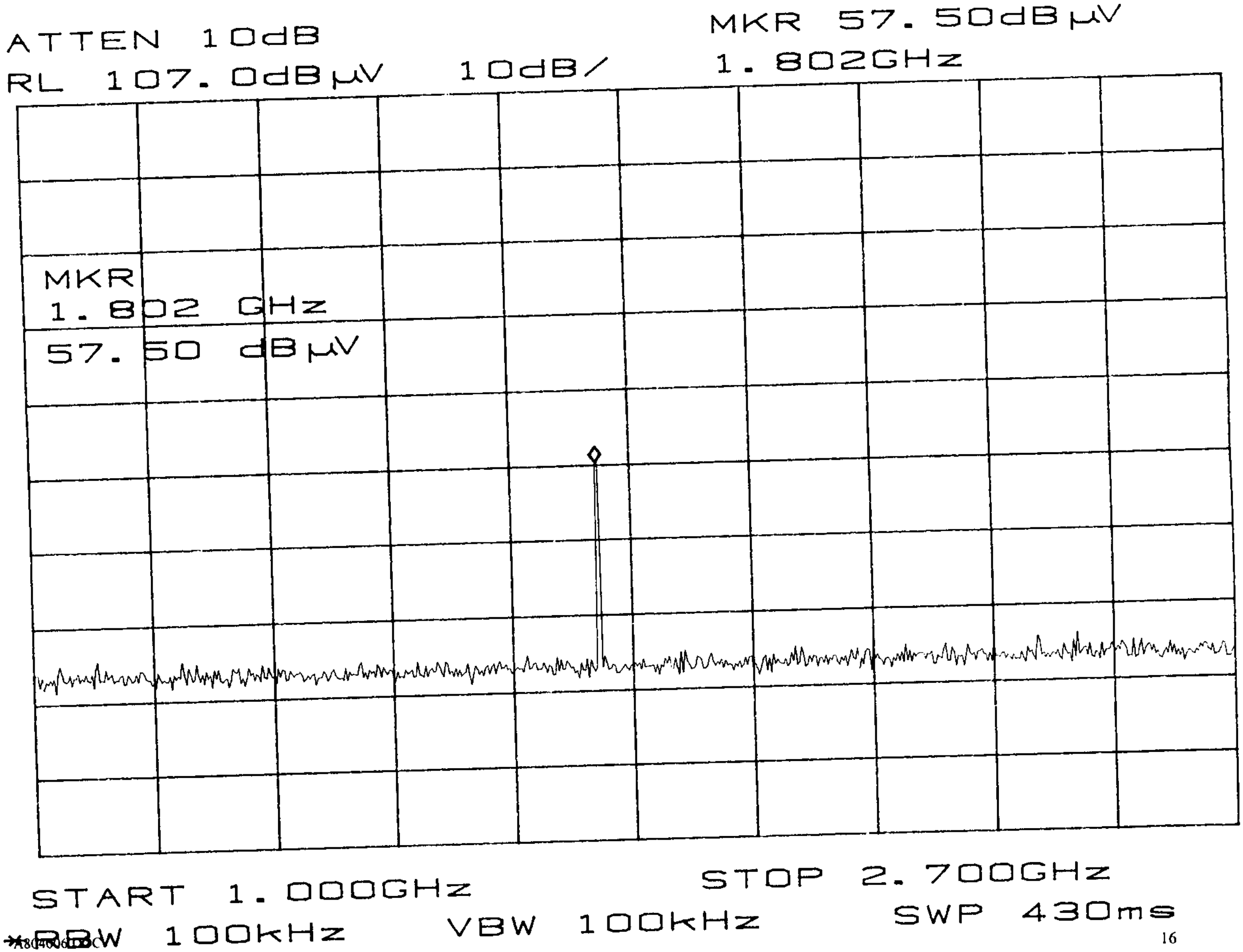
The Premier Wireless Mic uses an antenna that is soldered to the PC board and is not removeable.. **Manufacturers drawing for the antenna is in Appendix E.**

APPENDIX A
Data Plots

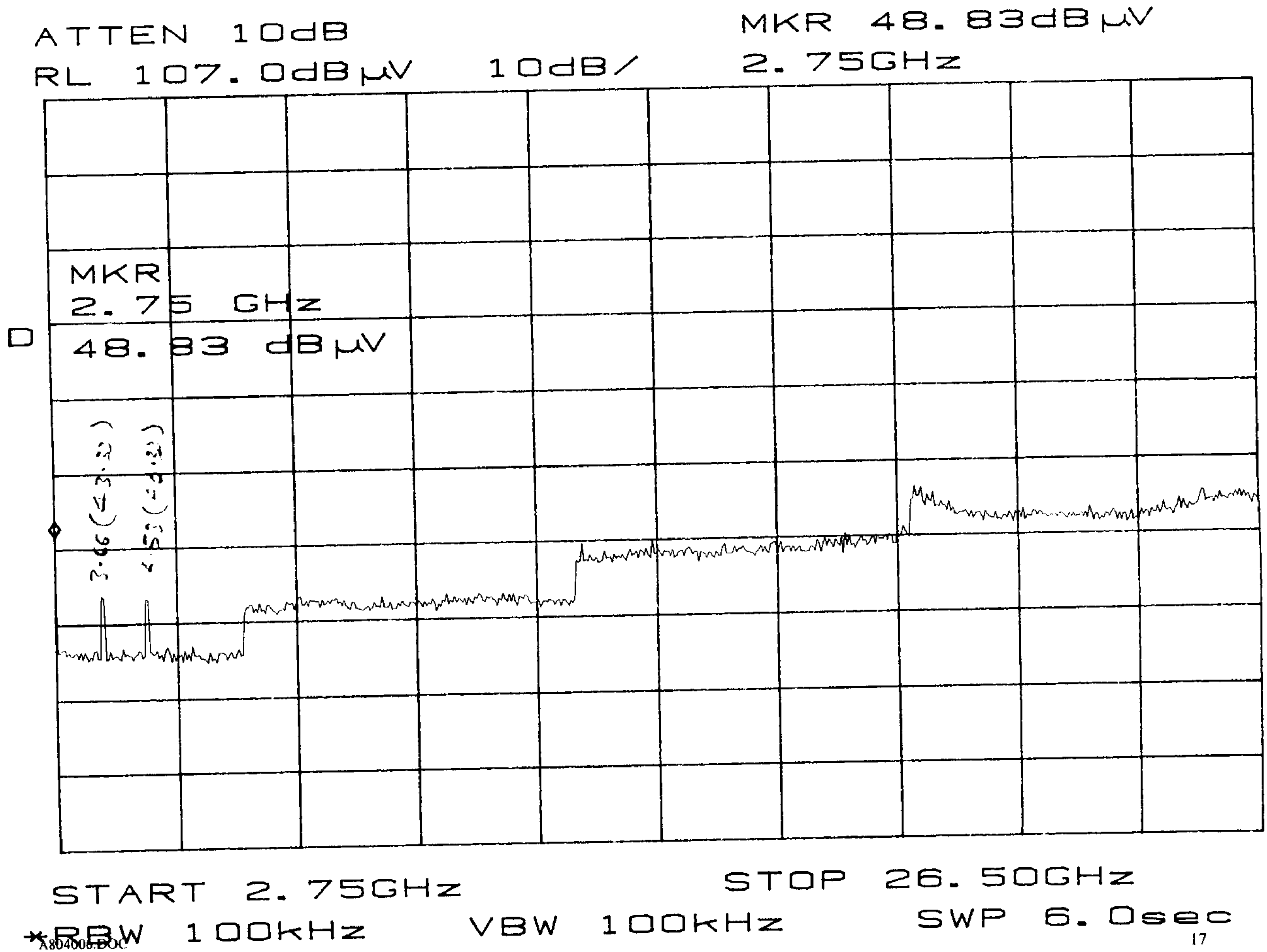
OUT OF BAND EMISSIONS 0Hz – 1 GHz (902.2 MHz)



OUT OF BAND EMISSIONS 1– 2.75 GHz (902.2 MHz)

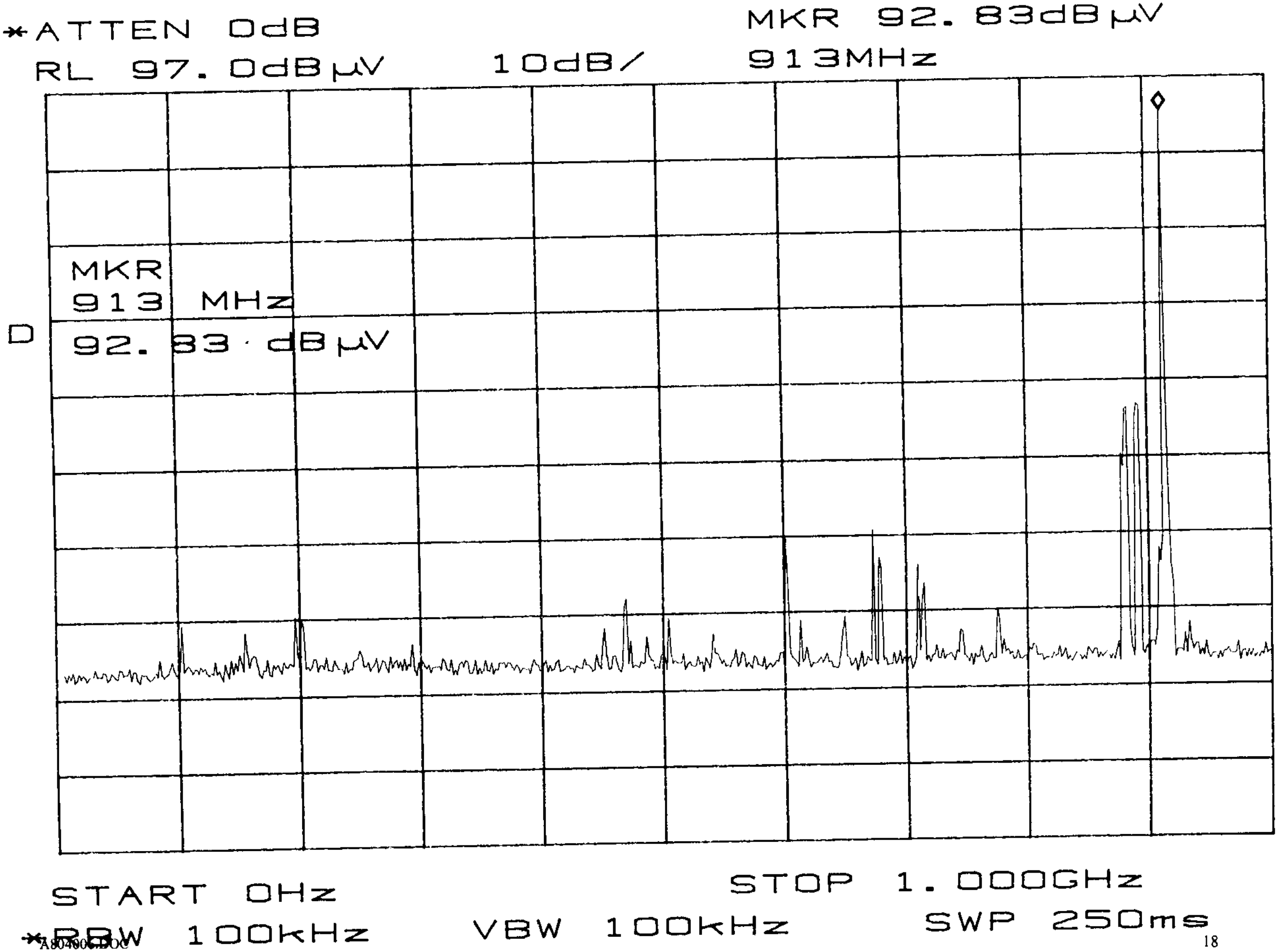


OUT OF BAND EMISSIONS 2.75 – 26.5 GHz (902.2 MHz)

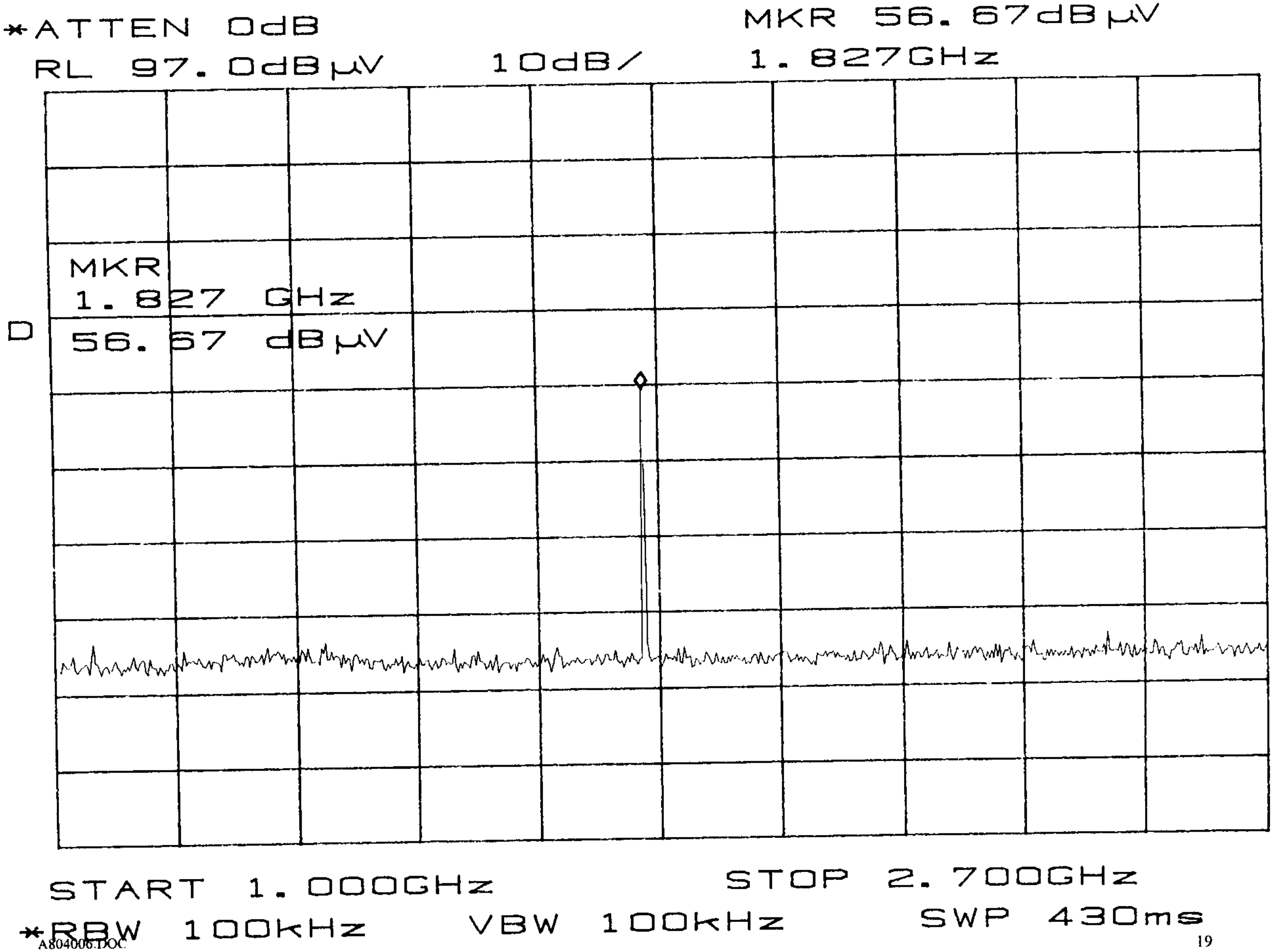


A804006.DOC

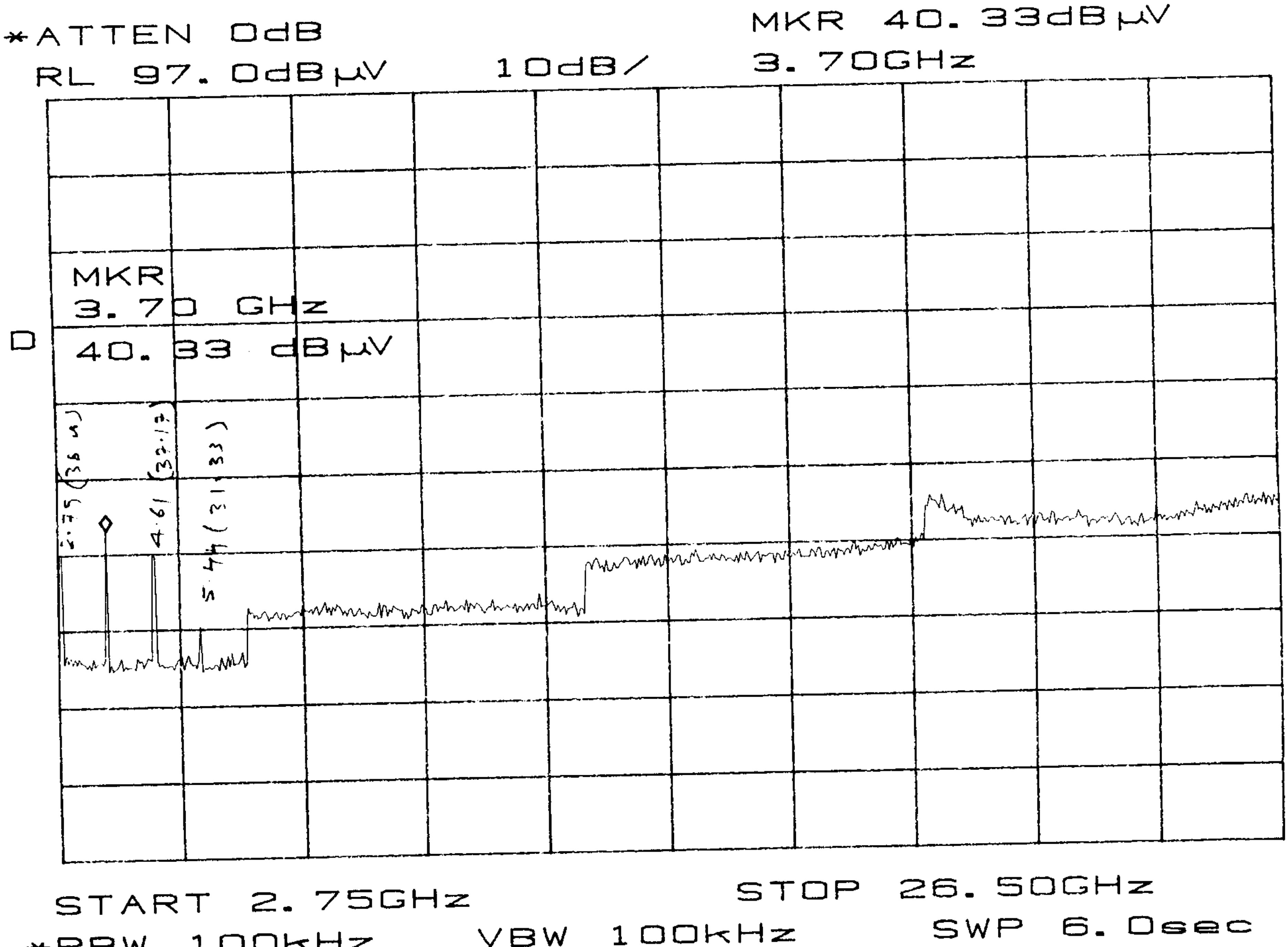
OUT OF BAND EMISSIONS 0Hz – 1 GHz (915 MHz)



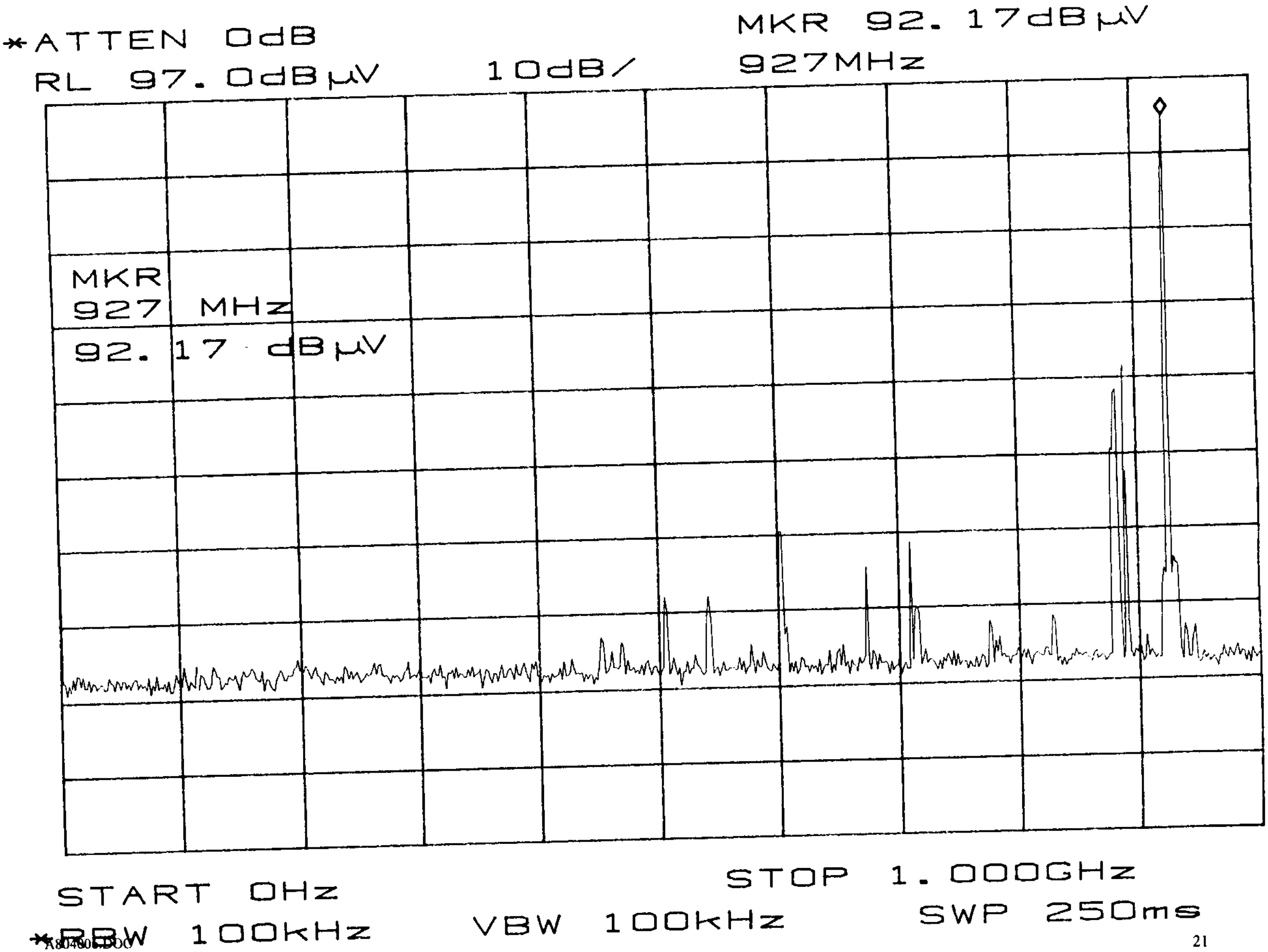
OUT OF BAND EMISSIONS 1– 2.75 GHz (915 MHz)



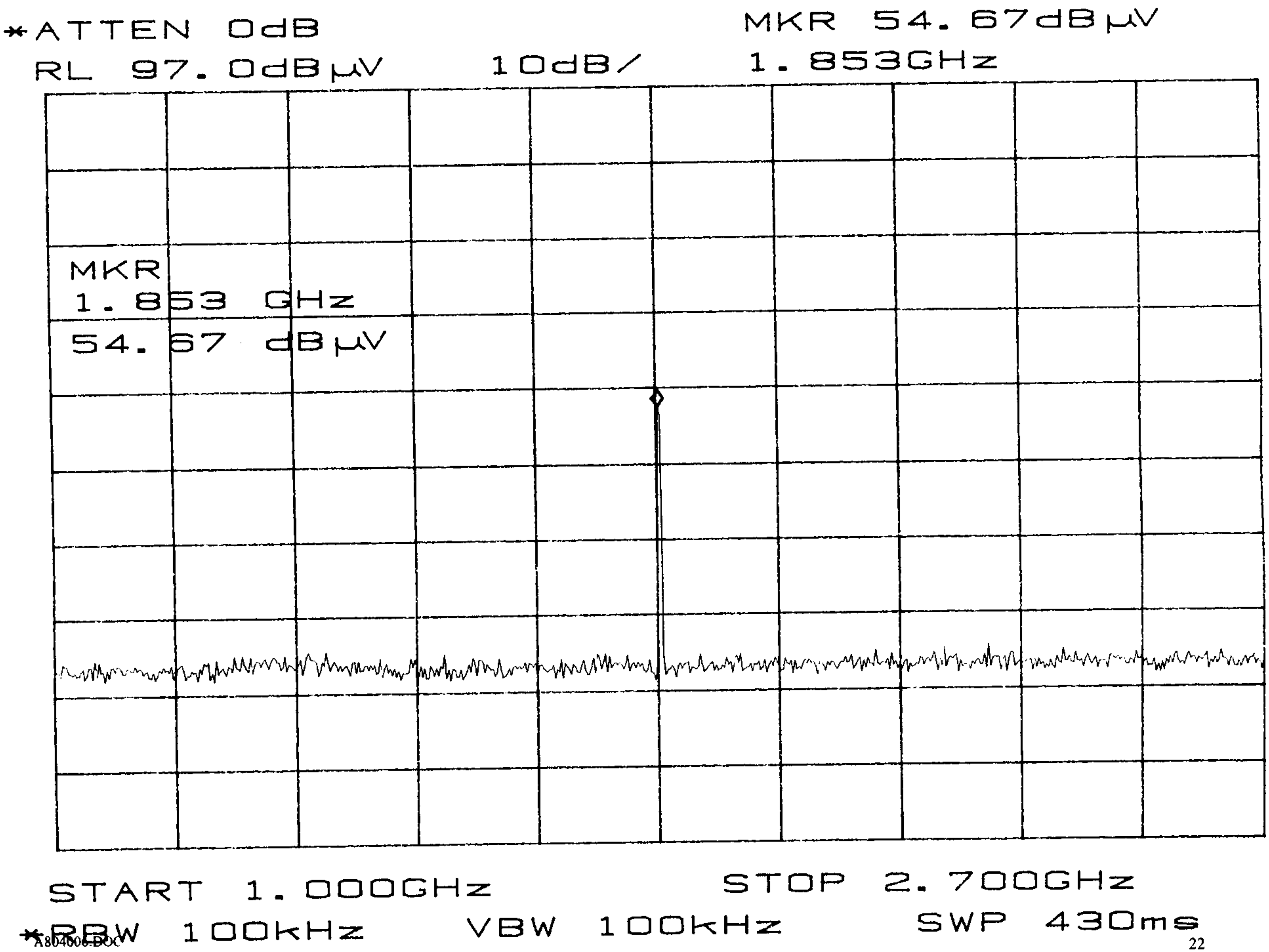
OUT OF BAND EMISSIONS 2.75 – 26.5 GHz (915 MHz)



OUT OF BAND EMISSIONS 0Hz – 1 GHz (927 MHz)

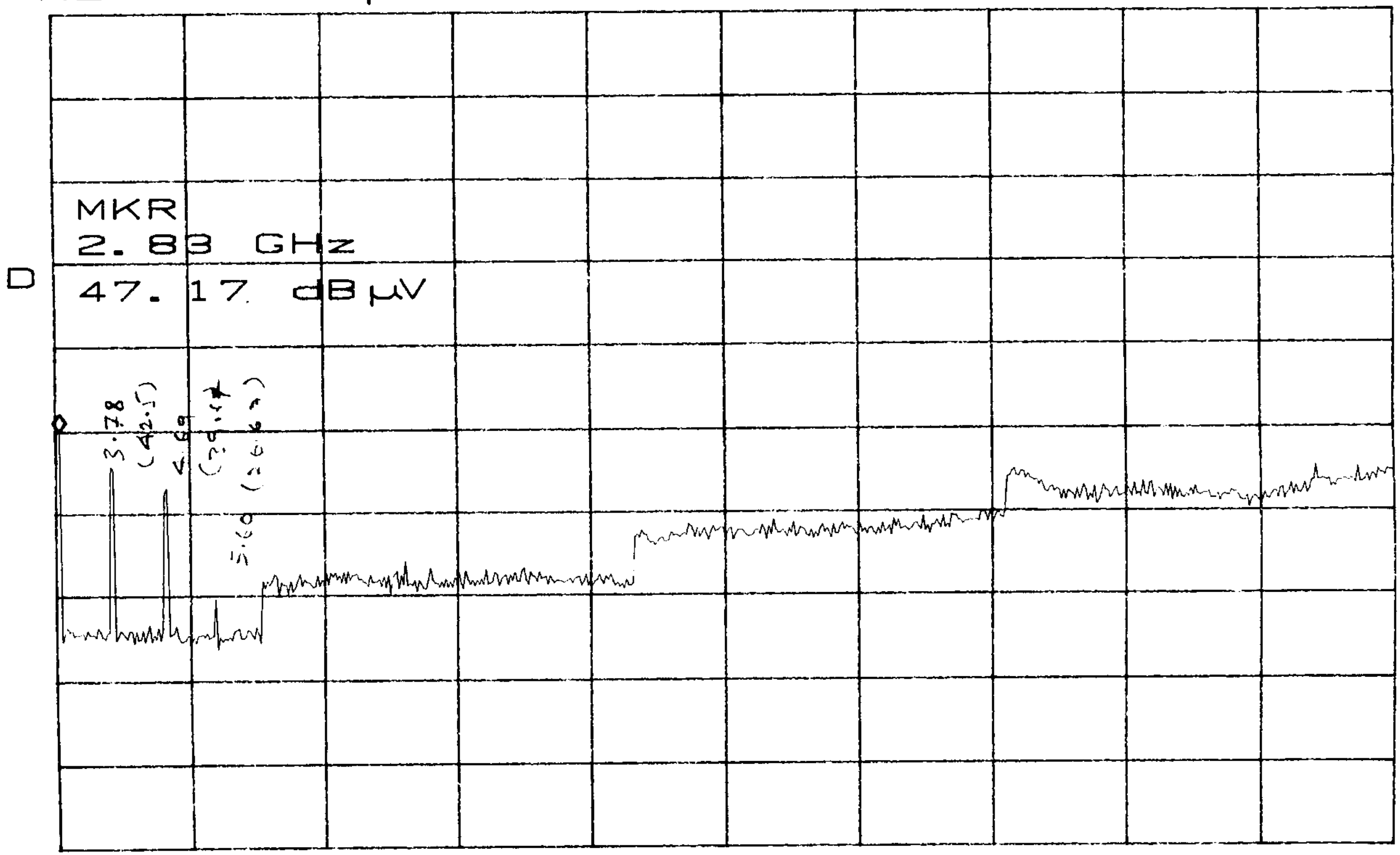


OUT OF BAND EMISSIONS 1– 2.75 GHz (927 MHz)



OUT OF BAND EMISSIONS 2.75 – 26.5 GHz (927 MHz)

*ATTEN 0dB MKR 47.17dB μV
RL 97.0dB μV 10dB/ 2.83GHz



START 2.75GHz STOP 26.50GHz
*RBW 100kHz VBW 100kHz SWP 6.0sec

APPENDIX B

15.205 Restricted Band Data

FCC RADIATED DATA SHEET

		DATE:	4/1/98
EUT:	PREMIER WIRELESS MICROPHONE	CUSTOMER NAME:	Polycom
S/N:	3303	WORK ORDER:	8040101
RULE PART:	15.205	FILE:	8040101.xls

ANTENNA:	HORN	OTHER CAL FACTORS:	ATTN dB:	0
MODULATION TYPE:			DUTY dB:	0
TESTED BY:	SURESH		HP IL dB:	0
COMMENTS:	BUILT IN ANTENNA		DIST dB:	10

FREQ. MHz	READING dB(uV)	Pk, QP, or Av	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
Fund = 902.2									
1804	44.2	Pk	25.1	4.5	35.0	10.0	28.7	74.0	-45.3
1804	32.7	Avg	25.1	4.5	35.0	10.0	17.2	54.0	-36.8
2706	43.2	Pk	28.6	5.3	35.0	10.0	32.0	74.0	-42.0
2706	31.7	Avg	28.6	5.3	35.0	10.0	20.5	54.0	-33.5
3608	39.5	Pk	32.4	6.2	35.0	10.0	33.1	74.0	-40.9
3608	28.0	Avg	32.4	6.2	35.0	10.0	21.6	54.0	-32.4
4510	38.7	Pk	32.8	7.0	35.0	10.0	33.5	74.0	-40.5
4510	27.0	Avg	32.8	7.0	35.0	10.0	21.8	54.0	-32.2
5413	38.5	Pk	33.6	8.1	35.0	10.0	35.2	74.0	-38.8
5413	24.8	Avg	33.6	8.1	35.0	10.0	21.5	54.0	-32.5
6315	34.7	Pk	34.9	9.8	35.0	10.0	34.4	54.0	-19.6
6315	23.3	Avg	34.9	9.8	35.0	10.0	23.1	54.0	-30.9
7218	38.2	Pk	36.0	10.6	35.0	10.0	39.8	54.0	-14.3
7218	27.8	Avg	36.0	10.6	35.0	10.0	29.4	54.0	-24.6
8120	38.7	Pk	37.0	11.4	35.0	10.0	42.1	54.0	-11.9
8120	38.7	Avg	37.0	11.4	35.0	10.0	42.1	54.0	-11.9
9022	37.7	Pk	37.8	12.1	35.0	10.0	42.5	54.0	-11.5
9022	38.5	Avg	37.8	12.1	35.0	10.0	43.4	54.0	-10.6
Fund = 915									
1830	35.5	Pk	25.1	4.5	35.0	10.0	20.1	74.0	-53.9
1830	29.0	Avg	25.1	4.5	35.0	10.0	13.6	54.0	-40.4
2745	47.2	Pk	28.6	5.3	35.0	10.0	36.0	74.0	-38.0
2745	36.2	Avg	28.6	5.3	35.0	10.0	25.0	54.0	-29.0
3660	39.5	Pk	32.4	6.2	35.0	10.0	33.1	74.0	-40.9
3660	28.0	Avg	32.4	6.2	35.0	10.0	21.6	54.0	-32.4
4575	41.0	Pk	32.8	7.0	35.0	10.0	35.8	74.0	-38.2
4575	29.2	Avg	32.8	7.0	35.0	10.0	24.0	54.0	-30.0
5489	34.2	Pk	33.6	8.1	35.0	10.0	30.9	74.0	-43.1
5489	24.3	Avg	33.6	8.1	35.0	10.0	21.0	54.0	-33.0
6405	34.7	Pk	34.9	9.8	35.0	10.0	34.4	54.0	-19.6
6405	23.5	Avg	34.9	9.8	35.0	10.0	23.2	54.0	-30.8
7320	39.3	Pk	36.0	10.6	35.0	10.0	40.9	54.0	-13.1
7320	28.0	Avg	36.0	10.6	35.0	10.0	29.6	54.0	-24.4
8235	38.2	Pk	37.0	11.4	35.0	10.0	41.6	54.0	-12.4
8235	28.3	Avg	37.0	11.4	35.0	10.0	31.7	54.0	-22.3
9150	37.3	Pk	37.8	12.1	35.0	10.0	42.2	54.0	-11.8
9150	27.7	Avg	37.8	12.1	35.0	10.0	32.5	54.0	-21.5

FCC RADIATED DATA SHEET

			DATE:	4/1/98
EUT:	PREMIER WIRELESS MICROPHONE		CUSTOMER NAME:	Polycom
S/N:	3303		WORK ORDER:	8040101
RULE PART:	15.205		FILE:	8040101.xls
ANTENNA:	HORN	OTHER CAL FACTORS:	ATTN dB:	0
MODULATION TYPE:			DUTY dB:	0
TESTED BY:	SURESH		HP IL dB:	0
COMMENTS:	BUILT IN ANTENNA		DIST dB:	10

FREQ. MHz	READING dB(uV)	Pk, QP, or Av	A.F. dB	Cable loss dB	AMP. dB	O.C.F. dB	TOTAL dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
Fund =928									
1856	38.0	Pk	25.1	4.5	35.0	10.0	22.6	74.0	-51.4
1856	27.2	Avg	25.1	4.5	35.0	10.0	11.7	54.0	-42.3
2784	43.5	Pk	28.6	5.3	35.0	10.0	32.4	74.0	-41.6
2784	33.3	Avg	28.6	5.3	35.0	10.0	22.2	54.0	-31.8
3712	37.0	Pk	32.4	6.2	35.0	10.0	30.6	74.0	-43.4
3712	26.3	Avg	32.4	6.2	35.0	10.0	19.9	54.0	-34.1
4640	40.7	Pk	32.8	7.0	35.0	10.0	35.5	74.0	-38.5
4640	28.7	Avg	32.8	7.0	35.0	10.0	23.5	54.0	-30.5
5568	34.5	Pk	0.0	0.0	35.0	10.0	-10.5	74.0	-84.5
5568	24.0	Avg	0.0	0.0	35.0	10.0	-21.0	54.0	-75.0
6496	39.2	Pk	34.9	9.8	35.0	10.0	38.9	54.0	-15.1
6496	28.3	Avg	34.9	9.8	35.0	10.0	28.1	54.0	-25.9
7424	38.8	Pk	36.0	10.6	35.0	10.0	40.4	54.0	-13.6
7424	28.2	Avg	36.0	10.6	35.0	10.0	29.8	54.0	-24.3
8352	38.3	Pk	37.0	11.4	35.0	10.0	41.7	54.0	-12.3
8352	28.3	Avg	37.0	11.4	35.0	10.0	31.7	54.0	-22.3
9280	37.8	Pk	37.8	12.1	35.0	10.0	42.7	54.0	-11.3
9280	27.8	Avg	37.8	12.1	35.0	10.0	32.7	54.0	-21.3

APPENDIX C

15.209 Radiated Emissions Data

Electronic Compliance Laboratories, Inc.
1249 Birchwood Ave.
Sunnyvale, CA

Radiated Emissions
Frequency range: 30MHz-1000MHz

3 Meter Open Site
Site Calibrated: June 1997

Government Agency and Limit: FCC Class B

QP = Quasi-Peak Note: Ignore peak readings when Quasi-Peak reading exists
PK = Peak

Customer: POLYCOM Operator: SURESH
Date: 04-01-1998 Time: 10:36:45
Temperature Range: 65 Deg F Percent Humidity: 50
E.U.T.: PREMIER WIRELESS MICROPHONE
Serial Number: 3303
Support Devices:
Serial Number:
FCC ID:
Exercise Program:
Modifications: None
Report File Name: F:\TESTDATA\8040101.RF

Antenna Type: BICONICAL

TEST FREQ	TEST dBuV	ACTUAL dBuV/m	CLASS B LIMIT	VERSUS B LIMIT	TABLE DEGREES	ANTENNA HEIGHT	POLAR-IZATION	DETECTOR Type
30.000	40.6	33.9	40.0	-6.1	180	1.0	V	PK

CHANGED ANTENNA TO LOG PERIODIC

NOTE: NO OTHER EMISSION WAS FOUND ABOVE NOISE FLOOR FOR BOTH VERTICAL & HORIZONTAL POLARIZATIONS

APPENDIX I

MAX2620 Data Sheet

19-1248; Rev 0; 7/97

MAXIM

650MHz to 1050MHz Integrated Oscillator with Buffered Outputs

MAX2620

General Description

The MAX2620 combines a low-noise oscillator with two output buffers in a low-cost, plastic surface-mount, ultra-small μMAX package. This device integrates functions typically achieved with discrete components. The oscillator exhibits low phase noise when properly mated with an external varactor-tuned resonant tank circuit. Two buffered outputs are provided for driving mixers or prescalers. The buffers provide load isolation to the oscillator and prevent frequency pulling due to load-impedance changes. Power consumption is typically just 27mW in operating mode (V_{CC} = 3.0V), and drops to less than 0.3μW in standby mode. The MAX2620 operates from a single +2.7V to +5.25V supply.

Applications

Analog Cellular Phones

Digital Cellular Phones

900MHz Cordless Phones

900MHz ISM-Band Applications

Land Mobile Radio

Narrowband PCS (NPCS)

Features

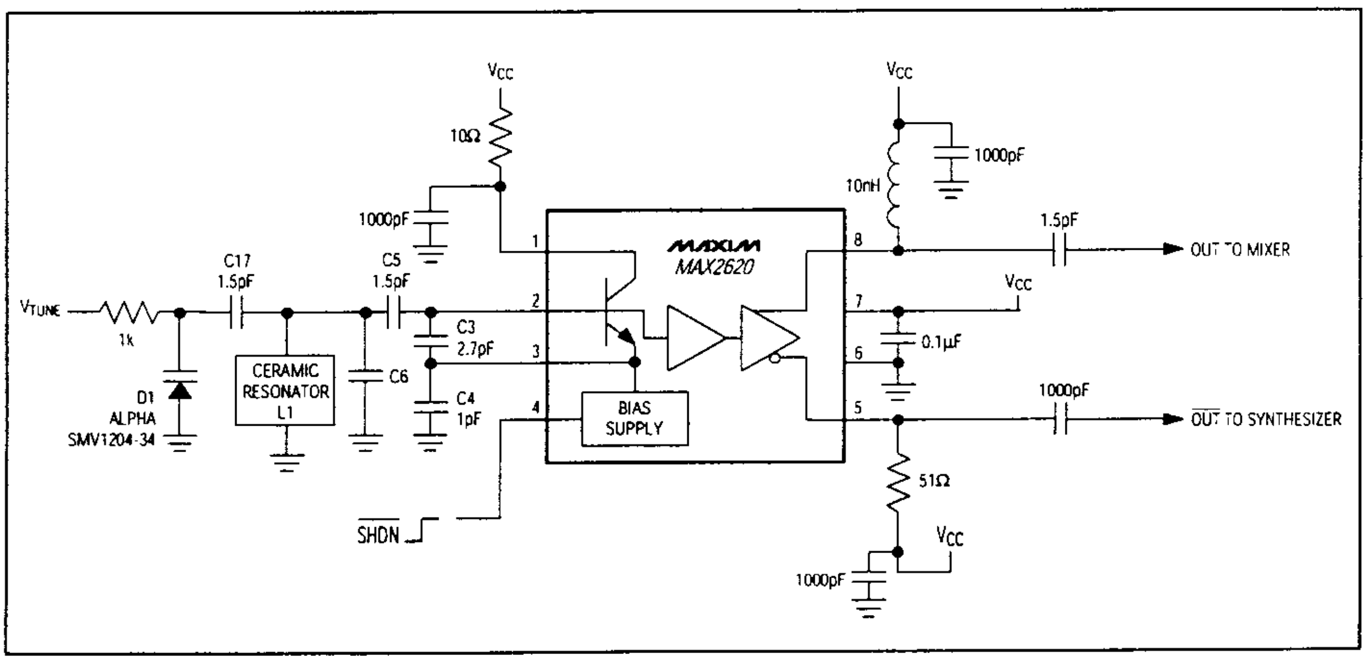
- ♦ Low-Phase-Noise Oscillator: -110dBc/Hz (25kHz offset from carrier) Attainable
- ♦ Operates from Single +2.7V to +5.25V Supply
- ♦ Low-Cost Silicon Bipolar Design
- ♦ Two Output Buffers Provide Load Isolation
- ♦ Insensitive to Supply Variations
- ♦ Low, 27mW Power Consumption (V_{CC} = 3.0V)
- ♦ Low-Current Shutdown Mode: 0.1μA (typ)

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX2620EUA	-40°C to +85°C	8 μMAX

Pin Configuration appears at end of data sheet.

Typical Operating Circuit



650MHz to 1050MHz Integrated Oscillator with Buffered Outputs

ABSOLUTE MAXIMUM RATINGS

$V_{CC}1$, $V_{CC}2$ to GND .... -0.3V to +6V
TANK, $\overline{SHDN}$, $\overline{OUT}$, OUT FDBK to GND ....-0.3V to (V_{CC} + 0.3V)
I_{FDBK} .... ±20mA
Continuous Power Dissipation (T_A = +70°C)
μMAX (derate 5.7mW/°C above +70°C) 457mW
Operating Temperature Range
MAX2620EUA .... -40°C to +85°C
Junction Temperature .... +150°C
Storage Temperature Range .... -65°C to +165°C
Lead Temperature (soldering, 10sec) .... +300°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC ELECTRICAL CHARACTERISTICS

(V_{CC1}, V_{CC2} = +2.7V to +5.25V, FDBK = open, TANK = open, OUT and $\overline{OUT}$ connected to V_{CC} through 50Ω, $\overline{SHDN}$ = 2V, T_A = -40°C to +85°C, unless otherwise noted. Typical values measured at V_{CC1} = V_{CC2} = 3.0V, T_A = +25°C.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current			9.0	12.5	mA
Shutdown Current	$\overline{SHDN}$ = 0.6V		0.1	2	μA
Shutdown Input Voltage High		2.0			V
Shutdown Input Voltage Low				0.6	V
Shutdown Bias Current High	$\overline{SHDN}$ = 2.0V		5.5	20	μA
Shutdown Bias Current Low	$\overline{SHDN}$ = 0.6V			0.5	μA

AC ELECTRICAL CHARACTERISTICS

(Per Test Circuit of Figure 1, V_{CC} = +3.0V, $\overline{SHDN}$ = V_{CC}, Z_{LOAD} = Z_{SOURCE} = 50Ω, P_{IN} = -20dBm (50Ω), f_{TEST} = 900MHz, T_A = +25°C, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Frequency Range	T_A = -40°C to +85°C (Note 1)	650		1050	MHz
Reverse Isolation	OUT or $\overline{OUT}$ to TANK; OUT, $\overline{OUT}$ driven at P = -20dBm		50		dB
Output Isolation	OUT to $\overline{OUT}$		33		dB

Note 1: Over this frequency range, the magnitude of the negative real impedance measured at TANK is greater than one-tenth the magnitude of the reactive impedances at TANK. This implies proper oscillator start-up when using an external resonator tank circuit with Q > 10.

TYPICAL OPERATING CIRCUIT PERFORMANCE—CERAMIC-RESONATOR-BASED TANK

(Per Typical Operating Circuit, V_{CC} = +3.0V, V_{TUNE} = 1.5V, $\overline{SHDN}$ = V_{CC}, load at OUT = 50Ω, load at $\overline{OUT}$ = 50Ω, L1 = coaxial ceramic resonator: Trans-Tech SR8800LPQ1357BY, C6 = 1pF, T_A = +25°C, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Tuning Range	V_{TUNE} = 0.5V to 3.0V		±13		MHz
Phase Noise	SSB @ Δf = 25kHz		-110		dBc/Hz
	SSB @ Δf = 300kHz		-132		
Output Power (single-ended)	At OUT (Note 2)	-6	-2		dBm
	At OUT, per test circuit of Figure 1. T_A = -40°C to +85° (Note 2).	-11	-8		
	At $\overline{OUT}$ (Note 2)	-16	-12.5		
Noise Power	f_O ± >10MHz		-147		dBm/Hz
Average Tuning Gain			11		MHz/V
Second-Harmonic Output			-29		dBc
Load Pull	VSWR = 1.75:1, all phases		163		kHzp-p
Supply Pushing	V_{CC} stepped from 3V to 4V		71		kHz/V

Note 2: Guaranteed by design and characterization.

TYPICAL OPERATING CIRCUIT PERFORMANCE—INDUCTOR-BASED TANK

(Per Typical Operating Circuit, V_{CC} = +3.0V, V_{TUNE} = 1.5V, $\overline{SHDN}$ = V_{CC}, load at OUT = 50Ω, load at $\overline{OUT}$ = 50Ω, L1 = 5nH (Coilcraft A02T), C6 = 1.5pF, T_A = +25°C, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Tuning Range	V_{TUNE} = 0.5V to 3.0V		±15		MHz
Phase Noise	SSB @ Δf = 25kHz		-107		dBc/Hz
	SSB @ Δf = 300kHz		-127		
Output Power (single-ended)	At OUT (Note 2)	-6	-2		dBm
	At OUT, per test circuit of Figure 1. T_A = -40°C to +85°C (Note 2).	-11	-8		
	At $\overline{OUT}$ (Note 2)	-16	-12.5		
Noise Power	f_O ± >10MHz		-147		dBm/Hz
Average Tuning Gain			13		MHz/V
Second-Harmonic Output			-29		dBc
Load Pull	VSWR = 1.75:1, all phase angles		340		kHzp-p
Supply Pushing	V_{CC} stepped from 3V to 4V		150		kHz/V

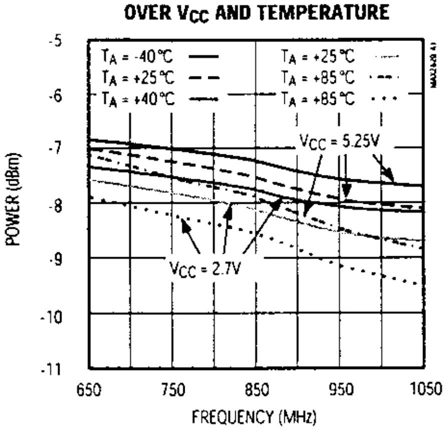
Note 2: Guaranteed by design and characterization.

650MHz to 1050MHz Integrated Oscillator with Buffered Outputs

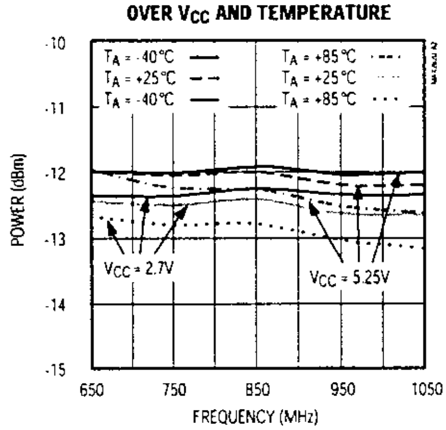
Typical Operating Characteristics

(Per test circuit of Figure 1, V_{CC} = +3.0V, $\overline{SHDN}$ = V_{CC}, Z_{LOAD} = Z_{SOURCE} = 50Ω, P_{IN} = -20dBm/50Ω, f_{TEST} = 900MHz, T_A = +25°C, unless otherwise noted.)

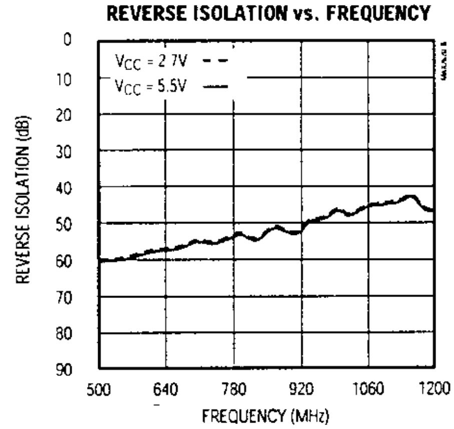
OUT OUTPUT POWER vs. FREQUENCY OVER V_{CC} AND TEMPERATURE



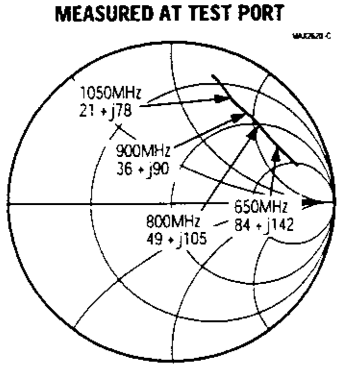
$\overline{OUT}$ OUTPUT POWER vs. FREQUENCY OVER V_{CC} AND TEMPERATURE



REVERSE ISOLATION vs. FREQUENCY



TYPICAL $1/S_{11}$ vs. FREQUENCY MEASURED AT TEST PORT



SUPPLY CURRENT vs. TEMPERATURE

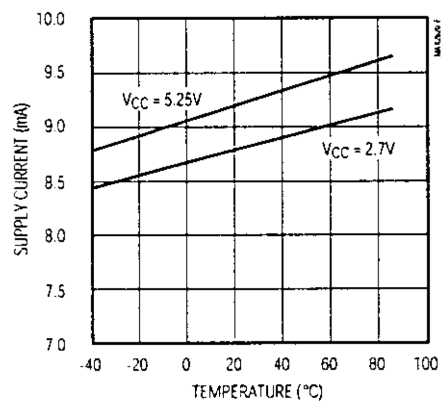


Table 1. Recommended Load Impedance at OUT or $\overline{OUT}$ for Optimum Power Transfer

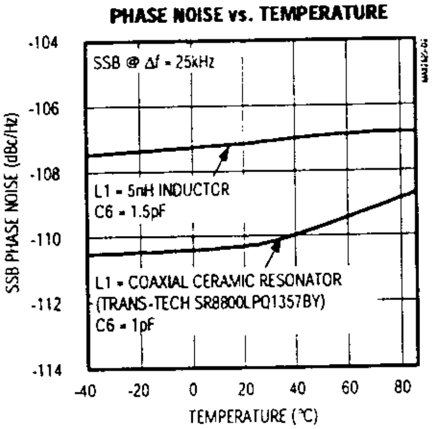
FREQUENCY (MHZ)	Real Component (R in Ω)	Imaginary Component (X in Ω)
650	17.5	62.3
750	17.2	50.6
850	10.9	33.1
950	7.3	26.3
1050	6.5	22.7

650MHz to 1050MHz Integrated Oscillator with Buffered Outputs

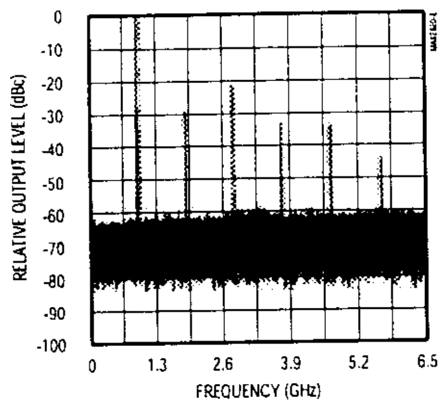
Typical Operating Characteristics (continued)

(Per *Typical Operating Circuit*, V_{CC} = +3.0V, V_{TUNE} = 1.5V, $\overline{SHDN}$ = V_{CC}, load at OUT = 50Ω, load at $\overline{OUT}$ = 50Ω, L1 = coaxial ceramic resonator: Trans-Tech SR8800LPQ1357BY, C6 = 1pF, T_A = +25°C, unless otherwise noted.)

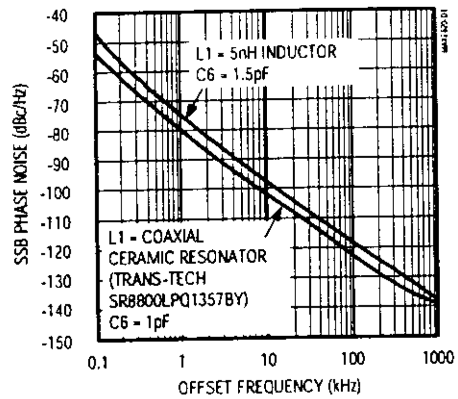
PHASE NOISE vs. TEMPERATURE



OUTPUT SPECTRUM FUNDAMENTAL NORMALIZED TO 0dB



SINGLE SIDEBAND PHASE NOISE



Pin Description

PIN	NAME	FUNCTION
1	$V_{CC}1$	Oscillator DC Supply Voltage. Decouple $V_{CC}1$ with 1000pF capacitor to ground. Use a capacitor with low series inductance (size 0805 or smaller). Further power-supply decoupling can be achieved by adding a 10Ω resistor in series from $V_{CC}1$ to the supply. Proper power-supply decoupling is critical to the low noise and spurious performance of any oscillator.
2	TANK	Oscillator Tank Circuit Connection. Refer to the *Applications Information* section.
3	FDBK	Oscillator Feedback Circuit Connection. Connecting capacitors of the appropriate value between FDBK and TANK and between FDBK and GND tunes the oscillator's reflection gain (negative resistance) to peak at the desired oscillation frequency. Refer to the *Applications Information* section.
4	$\overline{SHDN}$	Logic-Controlled Input. A low level turns off the entire circuitry such that the IC will draw only leakage current at its supply pins. This is a high-impedance input.
5	$\overline{OUT}$	Open-Collector Output Buffer (complement). Requires external pull-up to the voltage supply. Pull-up can be resistor, choke, or inductor (which is part of a matching network). The matching-circuit approach provides the highest-power output and greatest efficiency. Refer to Table 1 and the *Applications Information* section. $\overline{OUT}$ may be used with OUT in a differential output configuration.
6	GND	Ground Connection. Provide a low-inductance connection to the circuit ground plane.
7	$V_{CC}2$	Output Buffer DC Supply Voltage. Decouple $V_{CC}2$ with a 1000pF capacitor to ground. Use a capacitor with low series inductance (size 0805 or smaller).
8	OUT	Open-Collector Output Buffer. Requires external pull-up to the voltage supply. Pull-up can be resistor, choke, or inductor (which is part of a matching network). The matching-circuit approach provides the highest-power output and greatest efficiency. Refer to Table 1 and the *Applications Information* section. OUT may be used with $\overline{OUT}$ in a differential output configuration.

650MHz to 1050MHz Integrated Oscillator with Buffered Outputs

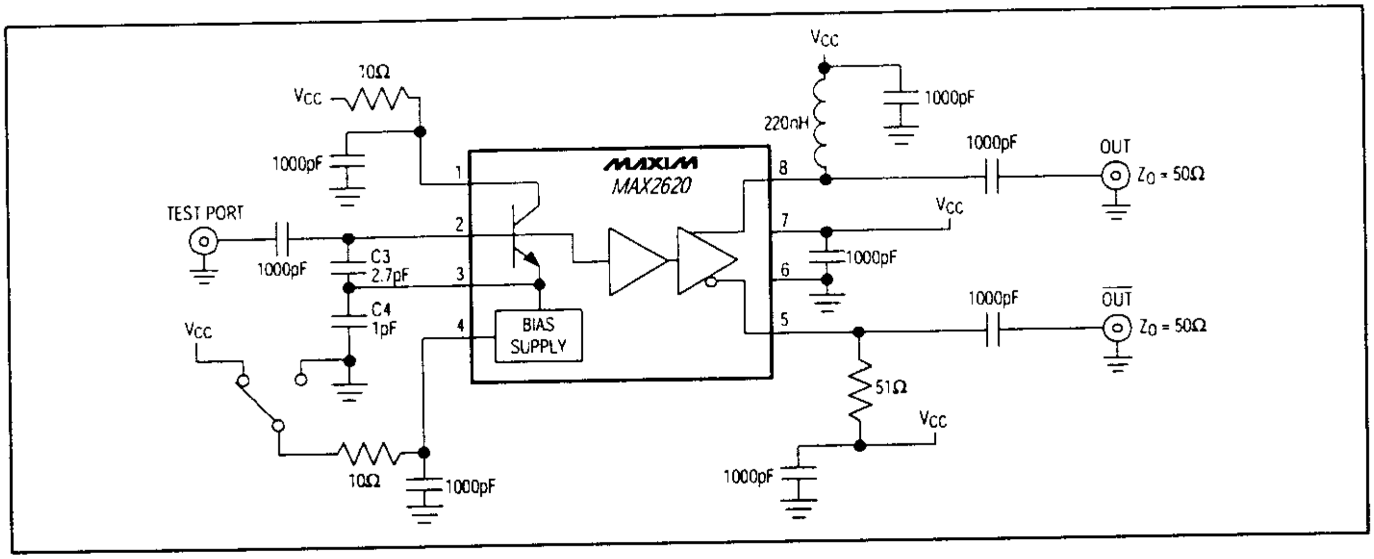


Figure 1. Test Circuit

Detailed Description

Oscillator

The oscillator is a common-collector, negative-resistance type that uses the IC's internal parasitic elements to create a negative resistance at the base-emitter port. The transistor oscillator has been optimized for low-noise operation. Base and emitter leads are provided as external connections for a feedback capacitor and resonator. A resonant circuit, tuned to the appropriate frequency and connected to the base lead, will cause oscillation. Varactor diodes may be used in the resonant circuit to create a voltage-controlled oscillator (VCO). The oscillator is internally biased to an optimal operating point, and the base and emitter leads need to be capacitively coupled due to the bias voltages present.

Output Buffers

The output buffers (OUT and $\overline{\text{OUT}}$) are an open-collector, differential-pair configuration and provide load isolation to the oscillator. The outputs can be used differentially to drive an integrated circuit mixer. Alternatively, isolation is provided between the buffer outputs when one output drives a mixer (either upconversion or downconversion) and the other output drives a prescaler. The isolation in this configuration prevents prescaler noise from corrupting the oscillator signal's spectral purity.

A logic-controlled $\overline{\text{SHDN}}$ pin turns off all bias to the IC when pulled low.

Applications Information

Tank Circuit Design

At the frequency of interest, the MAX2620 portion of Figure 2 shows the one-port circuit model for the TANK pin (test port in Figure 1).

For the circuit to oscillate at a desired frequency, the resonant tank circuit connected to TANK must present an impedance that is a complement to the network. This resonant tank circuit must have a positive real component that is one-third to one-half the magnitude of the negative real part of the oscillator device, as well as a reactive component that is opposite in sign to the reactive component of the oscillator device.

Keeping the resonant tank circuit's real component between one-third and one-half the magnitude of the negative real component ensures that oscillations will start. After start-up, the oscillator's negative resistance decreases, primarily due to gain compression, and reaches equilibrium with the real component (the circuit losses) in the resonant tank circuit. Making the resonant tank circuit reactance tunable (e.g., through use of a varactor diode) allows for tuneability of the oscillation frequency, as long as the oscillator exhibits negative resistance over the desired tuning range.

The MAX2620 provides an optimized negative-resistance device. The one-port characteristics of the device are given as a plot of 1/S11 in the *Typical Operating Characteristics.* 1/S11 is used because it maps inside the unit circle Smith chart when the device exhibits negative resistance (reflection gain).

Feedback Capacitors

To tune the negative-resistance characteristics, adjust the values of the feedback capacitors connected between TANK and FDBK (C3), and from FDBK to ground (C4). The capacitor valves to yield the desired TANK port impedance can be approximated as:

$$R_{TANK} = g_m X_{C3} X_{C4}$$

where g_m = 0.018mS, and X_{C3} and X_{C4} are the reactances of C3 and C4.

This tuning should be directly measured on a vector network analyzer performing a one-port measurement into TANK (test port in Figure 1). This measurement will establish more precisely what the tank characteristics need to be, such that the resonant tank network can be designed.

The MAX2620's oscillator is optimized for low-phase-noise operation. Achieving lowest phase-noise characteristics requires the use of high-Q (quality factor) components such as ceramic transmission-line type resonators or high-Q inductors. Also, keep C5 and C17 (see *Typical Operating Circuit*) as small a value as possible while still maintaining desired frequency and tuning range to maximize loaded Q.

There are many good references on the topic of oscillator design. An excellent reference is "The Oscillator as a Reflection Amplifier, an Intuitive Approach to Oscillator Design," by John W. Boyles, *Microwave Journal*, June 1986, pp. 83–98.

Output Matching Configuration

Both of the MAX2620's outputs (OUT and $\overline{OUT}$) are open collectors. They need to be pulled up to the supply by external components. An easy approach to this pull-up is a resistor. A 50Ω resistor value would inherently match the output to a 50Ω system. The *Typical Operating Circuit* shows $\overline{OUT}$ configured this way. Alternatively, a choke pull-up (Figure 1), yields greater output power (approximately -8dBm at 900MHz).

When maximum power is required, use an inductor as the supply pull-up, and match the inductor's output impedance to the desired system impedance. Table 1 in the *Typical Operating Characteristics* shows recommended load impedance presented to OUT and $\overline{OUT}$ for maximum power transfer. Using this data and standard matching-network synthesis techniques, a matching network can be constructed that will optimize power output into most load impedances. The value of the inductor used for pull-up should be used in the synthesis of the matching network.

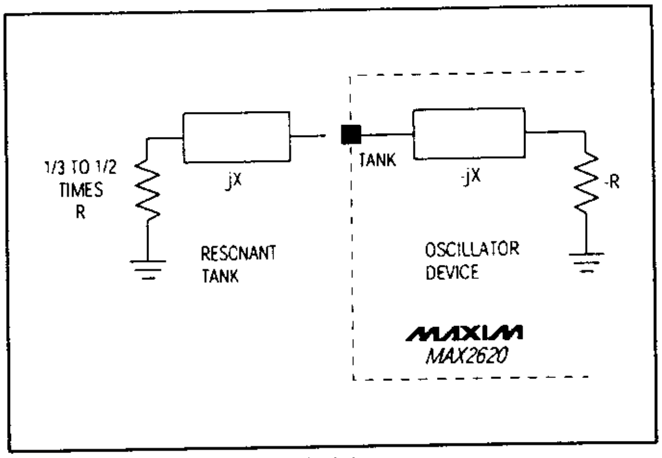
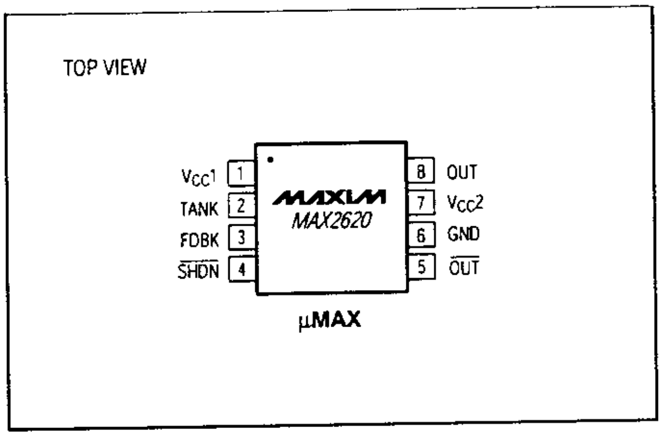
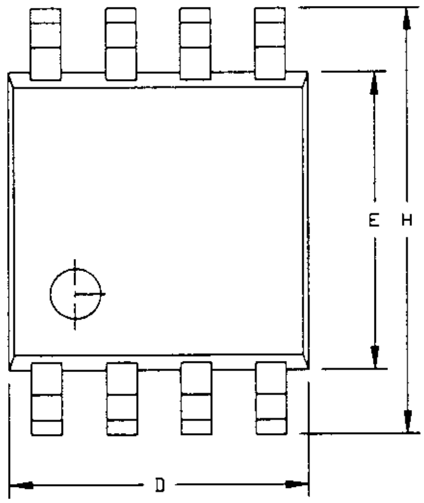


Figure 2. Oscillator Circuit Model

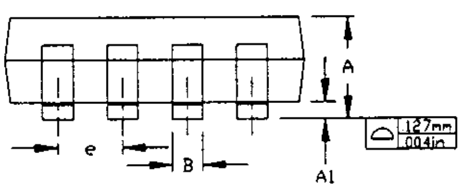
Pin Configuration

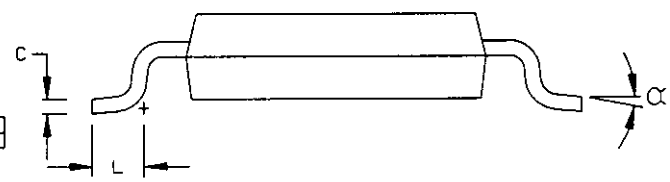


Package Information



	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.036	0.044	0.91	1.11
A1	0.004	0.008	0.10	0.20
B	0.010	0.014	0.25	0.36
C	0.005	0.007	0.13	0.18
D	0.116	0.120	2.95	3.05
e	0.0256		0.65	
E	0.116	0.120	2.95	3.05
H	0.188	0.198	4.78	5.03
L	0.016	0.026	0.41	0.66
α	0°	6°	0°	6°





NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15mm(.006").
3. CONTROLLING DIMENSION: INCHES

MAXIM
PROPRIETARY INFORMATION
TITLE:
8LD uMAX PACKAGE OUTLINE DWG.

APPROVAL	DOCUMENT CONTROL NO.	REV	
	21-0036	D	1/1