Elliott

Elliott Laboratories Inc.
www.elliottlabs.com

684 West Maude Avenue
Sunnyvale, CA 94086-3518

408-245-7800 Phone
408-245-3499 Fax

Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart C Specifications for an Intentional Radiator on the Advanced Fiber Communications, Inc. Model: UMC SSR-XCVR

FCC ID:	NJV0310-0952
GRANTEE:	Advanced Fibre Communications, Inc. 1 Willowbrook Court Petaluma, CA 94954
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	May 18, 1998
FINAL TEST DATE:	January 20, 1998 & April 1, 1998
TEST ENGINEER:	Rudy Suy
AUTHORIZED SIGNATORY:	Mark Briggs Manager, EMC Consulting Services

NVLAP

TABLE OF CONTENTS

COVER PAGE 1
TABLE OF CONTENTS 2
SCOPE 4
OBJECTIVE 4
TEST SITE 5
GENERAL INFORMATION 5
CONDUCTED EMISSIONS CONSIDERATIONS 5
RADIATED EMISSIONS CONSIDERATIONS 5
MEASUREMENT INSTRUMENTATION 6
RECEIVER SYSTEM 6
INSTRUMENT CONTROL COMPUTER 6
LINE IMPEDANCE STABILIZATION NETWORK (LISN) 6
POWER METER 7
FILTERS/ATTENUATORS 7
ANTENNAS 7
ANTENNA MAST AND EQUIPMENT TURNTABLE 7
INSTRUMENT CALIBRATION 7
TEST PROCEDURES 8
EUT AND CABLE PLACEMENT 8
CONDUCTED EMISSIONS 8
RADIATED EMISSIONS 8
DIRECT MEASUREMENTS - EMISSIONS FROM THE ANTENNA PORT . 8
SPECIFICATION LIMITS AND SAMPLE CALCULATIONS 9
CONDUCTED EMISSIONS SPECIFICATION LIMITS 9
RADIATED EMISSIONS SPECIFICATION LIMITS 9
SAMPLE CALCULATIONS - CONDUCTED EMISSIONS 10
SAMPLE CALCULATIONS - RADIATED EMISSIONS 11
EQUIPMENT UNDER TEST (EUT) DETAILS 12
GENERAL 12
ENCLOSURE 12
INPUT POWER 13
PRINTED WIRING BOARDS 13
SUBASSEMBLIES 13
SUPPORT EQUIPMENT 14
EXTERNAL I/O CABLING 14
TEST SOFTWARE/MODES 14
ANTENNA SYSTEM 15
TEST RESULTS 16
TEST DATA ANALYSIS - CONDUCTED 16
TEST DATA ANALYSIS - RADIATED 16
TEST DATA ANALYSIS - ANTENNA CONDUCTED 17
TEST DATA ANALYSIS - POWER AND BANDWIDTH 17
TEST DATA ANALYSIS - PROCESSING GAIN 17

EXHIBIT A Test Equipment Calibration
EXHIBIT B Test Measurement Data
EXHIBIT C Photographs of Test Configurations
EXHIBIT D Proposed FCC ID Label & Label Location
EXHIBIT E Detailed Photographs of the Construction
EXHIBIT F Block Diagram
EXHIBIT G Schematic Diagrams
EXHIBIT H Theory of Operation
EXHIBIT I Operator's Manual

SCOPE

An electromagnetic emissions test has been performed on the Advanced Fibre Communications transceiver model UMC SSR-XCVR pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Advanced Fibre Communications model UMC SSR-XCVR and therefore apply only to the tested sample. The sample was selected and prepared by Scott Pradels of Advanced Fibre Communications, Inc..

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units which are subsequently manufactured.

Maintenance of FCC compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on January 20, 1998 and April 1, 1998 at the Elliott Laboratories Open Area Test Site located at 684 West Maude Avenue, Sunnyvale, California. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

AN EMI receiver as specified in CISPER 16 is used for emissions measurements. The ESH3 receiver can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers, allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the particular detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

INSTRUMENT CONTROL COMPUTER

A Rohde and Schwarz EZM Spectrum Monitor/Controller is utilized to convert the receiver measurements to the field strength at the antenna, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate.

The EZM provides a visual display of the signal being measured. In addition, the EZM Spectrum Monitor runs the automated data collection programs which control both receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors, are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The 50 μH LISNs used were manufactured by Fischer Custom Communications, model LISN-3 in combination with a 250 μH Fischer Custom Communications LISN-3 CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

POWER METER

A power meter and thermistor mount are used for all output power measurements from transmitters as they provide a broadband indication of the power output. The power meter used was the Hewlett Packard model 432A, S/N 992-05509 and the thermistor mount was the Hewlett Packard model 478A, S/N 46397.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used.

The antenna calibration factors are included in site factors which are programmed into the test receivers

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An appendix of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 to 1000 MHz. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

DIRECT MEASUREMENTS OF EMISSIONS FROM THE ANTENNA PORT

Direct measurements are performed with the antenna port of the EUT connected to the power meter via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS

Frequency Range (MHz)	Limit (uV)	Limit (dBuV)
0.450 to 30.000	250	48

RADIATED EMISSIONS SPECIFICATION LIMITS

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level - Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20*LOG_{10}(D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Advanced Fibre Communications model UMC SSR-XCVR provides a standard PCM30 interface over a line-of-sight microwave link in the ISM frequency band of 5.725 to 5.850 GHz. The SSR consists of a modular UMC plug-in unit (SSR-XCVR), a transverter, antenna interface module (AIM), and a parabolic reflector antenna. The module contains both the transmit and receive functions necessary to establish a full-duplex E1 span over a microwave radio link.

The system contains the same SSR-XCVR that was approved for use by the FCC under FCC ID:NJV0310-0951. The main differences between this system and the NJV0310-0951 system is that a transverter is used to up-convert the output from the SSR-XCVR from a 2.4GHz-band into the 5.7 GHz band.

The SSR-XCVR employs a direct sequence spread spectrum (DSSS) coding combined with a QPSK modem. The DSSS coding applies an 11-bit PN sequence to the data, resulting in a processing gain of over 10 dB.

The sample was received and tested on January 20, 1998. Modifications were then made to the SSR-XCVR card (bias circuits for LOs altered) to reduce emissions from the LO circuits without affecting the fundamental signal and associated emissions. The system was re-tested on April 1, 1998 with these modifications in place. The modified SSR-XCVR card is identical to the one authorized by the FCC under FCC ID: NJV0310-0951 (by Richard Fabina). The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number	FCC ID Number
AFC / 8100-0210 / SSR-XCVR - Transceiver plug-in card *	AFC03130292	NJV0310-0952
AFC/ 8100-0210 / SSR-XCVR - Transceiver plug-in card *	AFC03130290	NJV0310-0952
AFC/ 8650-5678/ Antenna Interface Module (AIM)	AFC	NJV0310-0952
Micro source/ MSS020641301 / Transverter	DEMO-001	NJV0310-0052
AFC / 8100-0210 / SSR-XCVR - Transceiver plug-in card **	AFC03379747	NJV0310-0952

* Transceiver used for testing on 1/20/98
** Transceiver used for testing on 4/1/98

ENCLOSURE

The SSR-XCVR does not utilize an enclosure. It is designed to be installed in the BBA. In certain cases, the system is installed in environmental sealed remote subscriber cabinets manufactured by AFC. The AIM enclosure is primarily constructed of aluminum. It measures approximately 26cm x 13cm x 9cm. The Transverter enclosure is primarily constructed of sheet metal. It measures approximately 48cm x 33cm x 5cm.

INPUT POWER

The EUT input is rated at 120/240, 50/60 Hz. The EUT contained the following input power components during emissions testing:

Description	Manufacturer	Model
Universal Power Assembly (UPA)	AFC	0210-0012

In some cases, the Universal Power Assembly (UPA) is utilized to provide power for the UMC 1000. The UPA can be used as a charger/rectifier for terminals using local AC power, and Express power provider to other terminals, and a +/- 130 Vdc to -48 Vdc rectifier for terminals utilizing Express power.

PRINTED WIRING BOARDS

The Advanced Fibre Communications model UMC SSR-XCVR contained the following printed wiring boards during emissions testing:

Manufacturer/Description	Assembly #	Rev.	Serial #	Crystals (MHz)
AFC / SSR-XCVR	8100-0210	1E	AFC03130292	10, 22.528
AFC / SSR-XCVR	8100-0210	1E	AFC03130290	
AFC / SSR-XCVR **	8100-0210	1E	AFC03379747	10, 22.528

** Transceiver used for testing on 4/1/98

SUBASSEMBLIES

The Advanced Fibre Communications model UMC SSR-XCVR contained the following subassembly modules during emissions testing:

Manufacturer/Description	Assembly #	Rev.	Serial #
Microsource Low Noise Amplifier (in AIM)	MSS575841301	-	1044-50
Microsource Transverter	MSS020641303	-	DEMO-001
Lorch Microwave Diplexer Low/mid Channel	D7CF4-5745/5810-S	-	X8
Lorch Microwave Diplexer High Channel	D7CF4-5765/5830-S	-	X1

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for emissions testing:

Manufacturer/Model/Description	Serial #	FCC ID #
AFC/ 0210-0001/ Broad Band Assembly (BBA)	01153188	N/A
AFC/ 8100-0200 / CPU	01005837	N/A
AFC/ 8100-0016 / E1-XCVR	-	N/A
AFC/ 8100-0037 / POTS	-	N/A
TECOM / 508038DR / 1 meter dish (31 dB @ 5.7 GHz)	Proto	N/A

The Universal Modular Carrier (UMC) System 1000 is a modern and flexible digital loop carrier system. The UMC 1000 is capable of fitting into diverse networks, utilizing various transport mediums, in a virtually limitless number of configurations.
The BBA shelf is used at both the Central Office and at remote sites. The BBA can be equipped in a cabinet, or rack mounted in a building or controlled environmental vault.

The SSR-XCVR is one on many plug-in cards available for the UMC 1000. Additional cards must be utilized to operate the SSR-XCVR. A CPU which is responsible for overall control of the UMC, is required in any primary shelf in the UMC 1000. The provisioning of the SSR-XCVR is controlled by the CPU. An additional redundant CPU is utilized for the test. A Power Supply Unit is also required. For testing purpose, the R-PSU used in remote cabinets was utilized.

EXTERNAL I/O CABLING

The I/O cabling configuration during emissions testing was as follows:

Cable Description	Length (m)	From Unit/Port	To Unit/Port
Semflex SW-110 Coax	4'	SSR TX	Transverter 2.4 in
Semflex SW-110 Coax	4'	SSR-RX	Transverter 2.4 out
Semflex SW-110 Coax	4'	Transverter out	CAA TX
Semflex SW-110 Coax	4'	Transverter in	CAA RX
Semflex SW-110 Coax	4'	SSR Reference	Transverter Ref.
LMR-400	4'	CAA TX	AIM TX
LMR-400	4'	CAA RX	AIM RX
LMR-400	4'	AIIM Antenna	Antenna

TEST SOFTWARE/MODES

The UMC 1000 test software was CPU release 3.2.0. This software provides the common control for the entire system.

The SSR-XCVR was loaded with software release 1.0.8. The software monitors the operating frequency and provisions the card for proper output power.

The system was set to constantly transmit at either the low, center or high channel as detailed in the test run descriptions.

ANTENNA SYSTEM

The system can be installed with the following antennas:

1m - 31 dBi
2' - 28 dBi
4' - 35 dBi
6' - 38 dBi

The antennas connect to the AIM via a N-type connector. Since the system is professionally installed and is used for fixed point-to-point operation the antenna requirements of FCC Part 15 for spread spectrum radios are met.

During testing a 1 meter Telecom dish with 31 dBi of gain antenna was used. This configuration was agreed upon by Greg Czumak of the FCC as the only configuration that was required to be tested.

TEST RESULTS

TEST DATA ANALYSIS - CONDUCTED

The following measurements were extracted from the data recorded during the conducted emissions scan and represent the highest amplitude peaks relative to the specification limit. The actual test data and correction factors are contained in the appendices of this report.

Conducted Emissions, 0.45-30.0 MHz,
Sorted by Margin, 120 V, 60 Hz

Frequency	Level	Power	FCC B	FCC B	Detector	Comments
MHz	dBuV	Lead	Limit	Margin	QP/Ave	
10.0603	42.3	line	48.0	-5.7	QP	
3.3552	39.8	neutral	48.0	-8.2	QP	
3.3550	39.6	line	48.0	-8.4	QP	
29.6969	38.5	line	48.0	-9.5	QP	
29.6989	38.4	neutral	48.0	-9.6	QP	
0.4500	37.0	line	48.0	-11.0	QP	
0.4524	36.8	neutral	48.0	-11.2	QP	

TEST DATA ANALYSIS - RADIATED

The following measurements were extracted from the data recorded during the radiated electric field emissions scan and represent the highest amplitude peaks relative to the specification limit. The actual test data and correction factors are contained in the appendices of this report.

Maximized Radiated Emissions, Peak/Average Readings,
Restricted Bands 1- 40 GHz, Sorted by Margin. High Channel (worst case)

Frequency	Level	Pol	FCC	FCC	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	degrees	meters	
2290.000	53.6	v	54.0	-0.4	340	1.1	Ave.
2290.000	50.8	h	54.0	-3.2	320	1.1	Ave.
11616.000	46.9	v	54.0	-7.1	90	1.0	Ave. Reading
4580.000	45.8	h	54.0	-8.2	0	1.1	Ave.
11616.000	41.2	h	54.0	-12.8	0	1.0	Ave. Reading
4580.000	44.7	v	54.0	-9.3	340	1.1	Ave.
2270.000	42.8	h	54.0	-11.2	330	1.2	Ave.
11616.000	41.2	h	54.0	-12.8	0	1.0	Ave. Reading
2270.000	39.5	v	54.0	-14.5	0	1.1	Ave.
11616.000	56.9	v	74.0	-17.1	90	1.0	Peak Reading
2290.000	56.7	v	74.0	-17.3	340	1.1	Peak
4580.000	56.5	h	74.0	-17.5	0	1.1	Peak
4580.000	56.2	v	74.0	-17.8	340	1.1	Peak
2290.000	55.1	h	74.0	-18.9	320	1.1	Peak
11616.000	54.3	h	74.0	-19.7	0	1.0	Peak Reading
2270.000	50.0	h	74.0	-24.0	330	1.2	Peak
2270.000	48.6	v	74.0	-25.4	0	1.1	Peak

Note - the results above are taken from T24801 and T26014 and represent emissions related to the fundamnetal 5.7GHz band transmit signal and the LOs of receiver and transmitter on the SSR-XCVR board.

TEST DATA ANALYSIS - ANTENNA CONDUCTED

All out-of-band emissions were more than 20dB below the highest in-band level when measured using a 100 KHz bandwidth. The actual test data and any correction factors are contained in the appendices of this report.

TEST DATA ANALYSIS - POWER AND BANDWIDTH

The maximum power output was 20.0 dBm on the high channel.

The lowest 6 dB bandwidth was 8.5 Megahertz on the center channel.

The highest spectral density (power in a 3KHz bandwidth averaged over a 1 second period) was 2.1dBm on the high channel.

The actual test data and any correction factors are contained in the appendices of this report.

TEST DATA ANALYSIS - PROCESSING GAIN

The Processing Gain was calculated to be 14.9 dB. The actual calculations and test method description are contained in the appendices of this report.

EXHIBIT A

Test Equipment Calibration

Test Equipment List - SVOATS#1

	Manufacturer/Description		Model	Asset #	Interval	Last Cal	Cal Due
☑	Elliott Laboratories	FCC / CISPR LISN	LISN-3, OATS	304	12	6/5/97	6/5/98
☐	EMCO	Double Ridge Horn Antenna, 1-18	3115	487	12	6/3/97	6/3/98
☑	EMCO	Biconical Antenna, 30-300 MHz	3110B	363	12	4/8/98	4/8/99
☑	EMCO	Log Periodic Antenna, 0.3-1 GHz	3146A	364	12	4/8/98	4/8/99
☑	EMCO	Double Ridge Horn Antenna, 1-18	3115	786	12	11/13/97	5/13/99
☑	Hewlett Packard	Power Meter	432A	259, (F304)	12	3/10/98	3/10/99
☐	Hewlett Packard	Spectrum Analyzer	8563E	284, (F194)	24	1/14/98	1/14/2000
☑	Hewlett Packard	Microwave Preamplifier, 1-26.5	8449B	263, (F303)	12	6/6/97	6/6/98
☑	Hewlett Packard	Thermistor Mount	478A	652	12	3/10/98	3/10/99
☐	Hewlett Packard	EMC Receiver /Analyzer	8595EM	780	24	10/24/97	10/24/99
☐	Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	12	11/10/97	11/10/98
☐	Hewlett Packard	EMC Receiver /Analyzer	8595EM	787	12	10/27/97	10/27/98
☑	Narda-West	EMI Filter 5.6 GHz, High Pass	60583 HXF370	247	12	4/22/97	4/22/98
☐	Narda-West	EMI Filter 2.4 GHz, High Pass	60583 HPF-161	248	12	4/22/97	4/22/98
☐	Rohde & Schwarz	10 dB Pad / Pulse Limiter, 50W	ESH3 Z2	371	12	7/24/96	7/24/97
☐	Rohde & Schwarz	10 dB Pad / Pulse Limiter	ESH3 Z2	372	12	6/17/97	6/17/98
☑	Rohde & Schwarz	Test Receiver	ESN	775	12	6/30/97	6/30/98
☐	Solar Electronics	High Pass Filter, fc = 8 kHz	7930-8.0	277	12	7/18/97	7/18/98

File Number: ____________________

Date: ________________

Engr: ________________

EXHIBIT B

Test Measurement Data

The following data includes conducted emission measurements of the ?Advanced Fibre Communications model UMC SSR-XCVR and maximized radiated emissions measurements of the complete system.

ELLIOTT LABORATORIES

EMC Test Log

Client Name	Advanced Fiber Comm.	Date	1/20/98	Test Engineer	Rudy Suy
Product	SSR-XCVR 5.7 GHz	Page	1 of 8	Project Engineer	Mark Briggs
Test Type	Final Qualification	File	T24801	Client Contact	Scott Pradels
Specification	FCC	Site	SV OATS	Approved	MB

Test Objective

The objective of this test session is to perform final qualification testing of the EUT defined below relative to the specification defined above.

Test Summary

Run #1 Maximized Emissions Of Fundamnetal Harmonics Falling In Restricted bands Above 1 GHz

PASS Results: §15.209 -7.1 dB Ave @ 11616.000 MHz Vertical

All other harmonics of the fundamental 5.7GHz band transmit frequency falling in restricted bands were more than 20 dB below the FCC limit.

Run #2 - Transmitted Power Measurements In Accordance With 15.247 (b)

PASS Results: Using a Power Meter the power was measured to be 20.0 dBm, 10.0 dB below the maximum permitted output of 30 dBm (1 Watt).

Run #2b - Power Density Measurements In Accordance With 15.247 (d)

PASS Results: Output power density in 3 KHz bandwidth with direct measurement to EUT antenna port was to be 2.1 dBm, 5.9 dB below the maximum permitted density of 8 dBm/3KHz.

Run #3 - 6dB Bandwidth measurement In Accordance With §15.247 (a) (2)

PASS Results: 6dB bandwidth was 8.54 MHz, meeting the minimum requirement of 500 KHz.

Run #4 - Out of Band Emissions, 30-40000 MHz, Antenna Port Conducted Emissions

PASS All out of band emissions were more than 20dB below the fundamental.

Run #5 - Processing Gain

PASS Calculated by the client to be 14.9 dB.

Run #6 - Conducted Emissions Scan of EUT, 0.45-30.00 MHz, 120 V / 60 Hz. Low Channel was found to be the worst of all three channels.

PASS Results: §15.207 -5.7 dB QP @ 10.0603 MHz Line

Note: The EUT was ground to earth by a 1 meter breaded ground strap during conducted emissions testing.

Equipment Under Test (EUT) General Description

The UMC SSR-XCVR provides a standard PCM30 interface over a line-of-sight microwave link in the ISM frequency band of 5.725 to 5.850 GHz. The SSR consists of a modular UMC plug-in unit (SSR-XCVR), a transverter, antenna interface module (AIM), and a parabolic reflector antenna. The module contains both the transmit and receive functions necessary to establish a full-duplex E1 span over a microwave radio link.

The system contains the same SSR-XCVR that was approved for use by the FCC under FCC ID:NJV0310-0951. The main differences between this system and the NJV0310-0951 system is that a transverter is used to up-convert the output from the SSR-XCVR from a 2.4GHz-band into the 5.7 GHz band.

The SSR-XCVR employs a direct sequence spread spectrum (DSSS) coding combined with a QPSK modem. The DSSS coding applies an 11-bit PN sequence to the data, resulting in a processing gain of over 10 dB.

Equipment Under Test (EUT)

Manufacturer/Model/Description	Serial Number	FCC ID Number
AFC / 8100-0210 / SSR-XCVR - Transceiver plug-in card	AFC03130292	NJV0310-0952
AFC/ 8100-0210 / SSR-XCVR - Transceiver plug-in card	AFC03130290	NJV0310-0952
AFC/ 8650-5678/ Antenna Interface Module (AIM)	AFC	NJV0310-0952
Micro source/ MSS020641301 / Transverter	DEMO-001	NJV0310-0052

ELLIOTT
LABORATORIES

EMC Test Log

Client Name	Advanced Fiber Comm.	Date	1/20/98	Test Engineer	Rudy Suy
Product	SSR-XCVR 5.7 GHz	Page	3 of 8	Project Engineer	Mark Briggs
Test Type	Final Qualification	File	T24801	Client Contact	Scott Pradels
Specification	FCC	Site	SV OATS	Approved	MB

Local Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
AFC/ 0210-0001/ Broad Band Assembly (BBA)	01153188	N/A
AFC/ 8100-0200 / CPU	01005837	N/A
AFC/ 8100-0016 / E1-XCVR	-	N/A
AFC/ 8100-0037 / POTS	-	N/A
TECOM / 508038DR / 1 meter dish (31 dB @ 5.7 GHz)	Proto	N/A

The Universal Modular Carrier (UMC) System 1000 is a modern and flexible digital loop carrier system. The UMC 1000 is capable of fitting into diverse networks, utilizing various transport mediums, in a virtually limitless number of configurations.
The BBA shelf is used at both the Central Office and at remote sites. The BBA can be equipped in a cabinet, or rack mounted in a building or controlled environmental vault.

The SSR-XCVR is one on many plug-in cards available for the UMC 1000. Additional cards must be utilized to operate the SSR-XCVR. A CPU which is responsible for overall control of the UMC, is required in any primary shelf in the UMC 1000. The provisioning of the SSR-XCVR is controlled by the CPU. An additional redundant CPU is utilized for the test. A Power Supply Unit is also required. For testing purpose, the R-PSU used in remote cabinets was utilized.

Power Supply and Line Filters

Description	Manufacturer	Model
Universal Power Assembly (UPA)	AFC	0210-0012

In some cases, the Universal Power Assembly (UPA) is utilized to provide power for the UMC 1000. THe UPA can be used as a charger/rectifier for terminals using local AC power, and Express power provider to other terminals, and a +/- 130 Vdc to -48 Vdc rectifier for terminals utilizing Express power.

Client Name Advanced Fiber Comm.	Date 1/20/98	Test Engineer Rudy Suy	
Product SSR-XCVR 5.7 GHz	Page 4 of 8	Project Engineer Mark Briggs	
Test Type Final Qualification	File T24801	Client Contact Scott Pradels	
Specification FCC	Site SV OATS		Approved MB

Antennas

The system can be installed with the following antennas:

1m - 31 dBi
2' - 28 dBi
4' - 35 dBi
6' - 38 dBi

The antennas connect to the AIM via a N-type connector. Since the system is professionally installed and is used for fixed point-to-point operation the antenna requirements of FCC Part 15 for spread spectrum radios are met.

During testing a 1 meter Telecom dish with 31 dBi of gain antenna was used. This configuration was agreed upon by Greg Czumak of the FCC as the only configuration that was required to be tested. Initial testing showed that the levels of the spurious emissions were independent of antenna orientation (i.e. they were no higher when the antenna was directed at the measurement antenna. For stability the antenna was placed on its back during the remainder of the testing (when the antenna was standing upright it would jostle backwards as the turntable was rotated). This is further justified by the fact that none of the LO signals or harmonics of the transmit signal were observed on the output antenna port (refer to run #4).

Interface Cabling

Cable Description	Length (m)	From Unit/Port	To Unit/Port
Semflex SW-110 Coax	4'	SSR TX	Transverter 2.4 in
Semflex SW-110 Coax	4'	SSR-RX	Transverter 2.4 out
Semflex SW-110 Coax	4'	Transverter out	CAA TX
Semflex SW-110 Coax	4'	Transverter in	CAA RX
Semflex SW-110 Coax	4'	SSR Reference	Transverter Ref.
LMR-400	4'	CAA TX	AIM TX
LMR-400	4'	CAA RX	AIM RX
LMR-400	4'	AIIM Antenna	Antenna

All Semflex cables are standard and sold with the AFC system. The LMR-400 cables are not sold with the SSR-XCVR. The length of these cables vary with the height at which that AIM box is mounted. A 4' section of cable is used so that emissions and output power is maximized.

ELLIOTT LABORATORIES

EMC Test Log

Client Name: Advanced Fiber Comm.	Date: 1/20/98	Test Engineer: Rudy Suy
Product: SSR-XCVR 5.7 GHz	Page: 5 of 8	Project Engineer: Mark Briggs
Test Type: Final Qualification	File: T24801	Client Contact: Scott Pradels
Specification: FCC	Site: SV OATS	Approved: MB

Printed Wiring Boards in EUT

Manufacturer/Description	Assembly #	Rev.	Serial Number	Crystals (MHz)
AFC / SSR-XCVR	8100-0210	1E	AFC03130292	10, 22.528
AFC / SSR-XCVR	8100-0210	1E	AFC03130290	10, 22.528

Subassemblies in EUT

Manufacturer/Description	Assembly Number	Rev.	Serial Number
Microsource Low Noise Amplifier (in AIM)	MSS575841301	-	1044-50
Microsource Transverter	MSS020641303	-	DEMO-001
Lorch Microwave Diplexer Low/mid Channel	D7CF4-5745/5810-S	-	X8
Lorch Microwave Diplexer High Channel	D7CF4-5765/5830-S	-	X1

EUT Enclosure(s)

The SSR-XCVR does not utilize an enclosure. It is designed to be installed in the BBA. In certain cases, the system is installed in environmental sealed remote subscriber cabinets manufactured by AFC.

The AIM enclosure is primarily constructed of aluminum. It measures approximately 26cm x 13cm x 9cm.

The Transverter enclosure is primarily constructed of sheet metal. It measures approximately 48cm x 33cm x 5cm.

ELLIOTT LABORATORIES

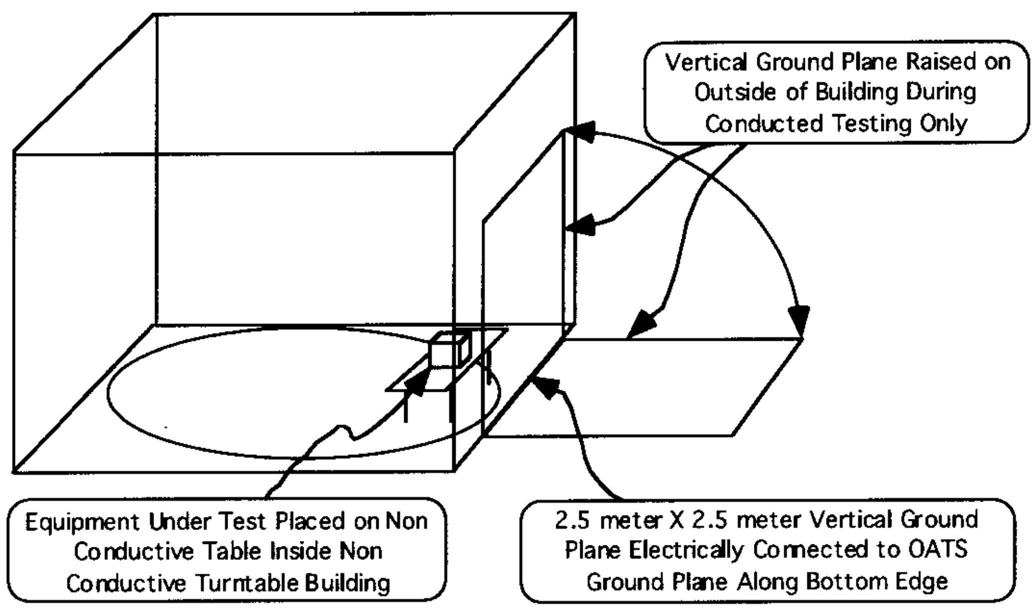
EMC Test Log

Client Name Advanced Fiber Comm.	Date 1/20/98	Test Engineer Rudy Suy	
Product SSR-XCVR 5.7 GHz	Page 6 of 8	Project Engineer Mark Briggs	
Test Type Final Qualification	File T24801	Client Contact Scott Pradels	
Specification FCC	Site SV OATS		Approved MB

General Test Conditions

During testing, the EUT was connected to 120V/60Hz power input. The EUT was located on the turntable for radiated testing and on the conducted bench for conducted testing.

During conducted emissions testing a 2.5 meter X 2.5 meter ground plane is raised to a vertical position 40 cm from the EUT as shown below:



Test Software/Operating Modes

The UMC 1000 test software was CPU release 3.2.0. This software provides the common control for the entire system.

The SSR-XCVR was loaded with software release 1.0.8. The software monitors the operating frequency and provisions the card for proper output power.

The system was set to constantly transmit at either the low, center or high channel as detailed in the test run descriptions.

ELLIOTT LABORATORIES

EMC Test Log

Client Name: Advanced Fiber Comm.	Date: 1/20/98	Test Engineer: Rudy Suy
Product: SSR-XCVR 5.7 GHz	Page: 7 of 8	Project Engineer: Mark Briggs
Test Type: Final Qualification	File: T24801	Client Contact: Scott Pradels
Specification: FCC	Site: SV OATS	Approved: MB

Test Data Tables

Run #1 - Maximized Radiated Emissions Scan, Harmonics Falling In Restricted Bands Above 1 GHz, Sorted by Margin

Frequency MHz	Level dBuV/m	Pol v/h	FCC Limit	FCC Margin	Azimuth degrees	Height meters	Comments
High Channel							
11616.000	46.9	v	54.0	**-7.1**	90	1.0	Ave. Reading
11616.000	41.2	h	54.0	**-12.8**	0	1.0	Ave. Reading
11616.000	56.9	v	74.0	**-17.1**	90	1.0	Peak Reading
11616.000	54.3	h	74.0	**-19.7**	0	1.0	Peak Reading
Middle Channel							
11616.000	45.2	v	54.0	**-8.8**	90	1.0	Ave. Reading
11616.000	41.4	h	54.0	**-12.6**	10	1.0	Ave. Reading
11616.000	56.4	v	74.0	**-17.6**	90	1.0	Peak Reading
11616.000	54.0	v	74.0	**-20.0**	10	1.0	Peak Reading
Low Channel							
11616.000	41.8	v	54.0	**-12.2**	0	1.0	Ave. Reading
11616.000	40.2	h	54.0	**-13.8**	0	1.0	Ave. Reading
11616.000	54.7	v	74.0	**-19.3**	0	1.0	Peak Reading
11616.000	54.6	h	74.0	**-19.4**	0	1.0	Peak Reading

No signals present in other restricted bands

Run #2 - Calculated Power and Power Density.

Power measured by using Power Meter. Power Density Measured Using Spectrum Analyzer

Channel	Output Power (dBm)	Power Density (dBm/3KHz)
Low	17.5	1.6
Center	18.0	1.7
High	20.0	2.1

Refer to graphs T24801/201 - 203 for power spectral density plots.

Run #3 - 6dB Bandwidth measurement In Accordance With §15.247 (a) (2)

Channel	Bandwidth
Low	8.7 MHz
Center	8.5 MHz
High	8.6 MHz

Refer to graphs T24801/301 - 303 for bandwidth plots.

Run #4 - Out of Band Emissions, 30-40000 MHz.

PASS All out of band emissions were more than 20dB below the fundamental when measured at the antenna port of the AIM. Graphs T24801/401-407 show the emissions on the low channel, T24801/411-417 show the emissions on the center channel and T24801/421-427 show the emissions on the high channel.

Run #5 - Processing Gain

The client provided calculation determined that the processing gain for the system is 14.94 dB, meeting the minimum requirement of 10dB.

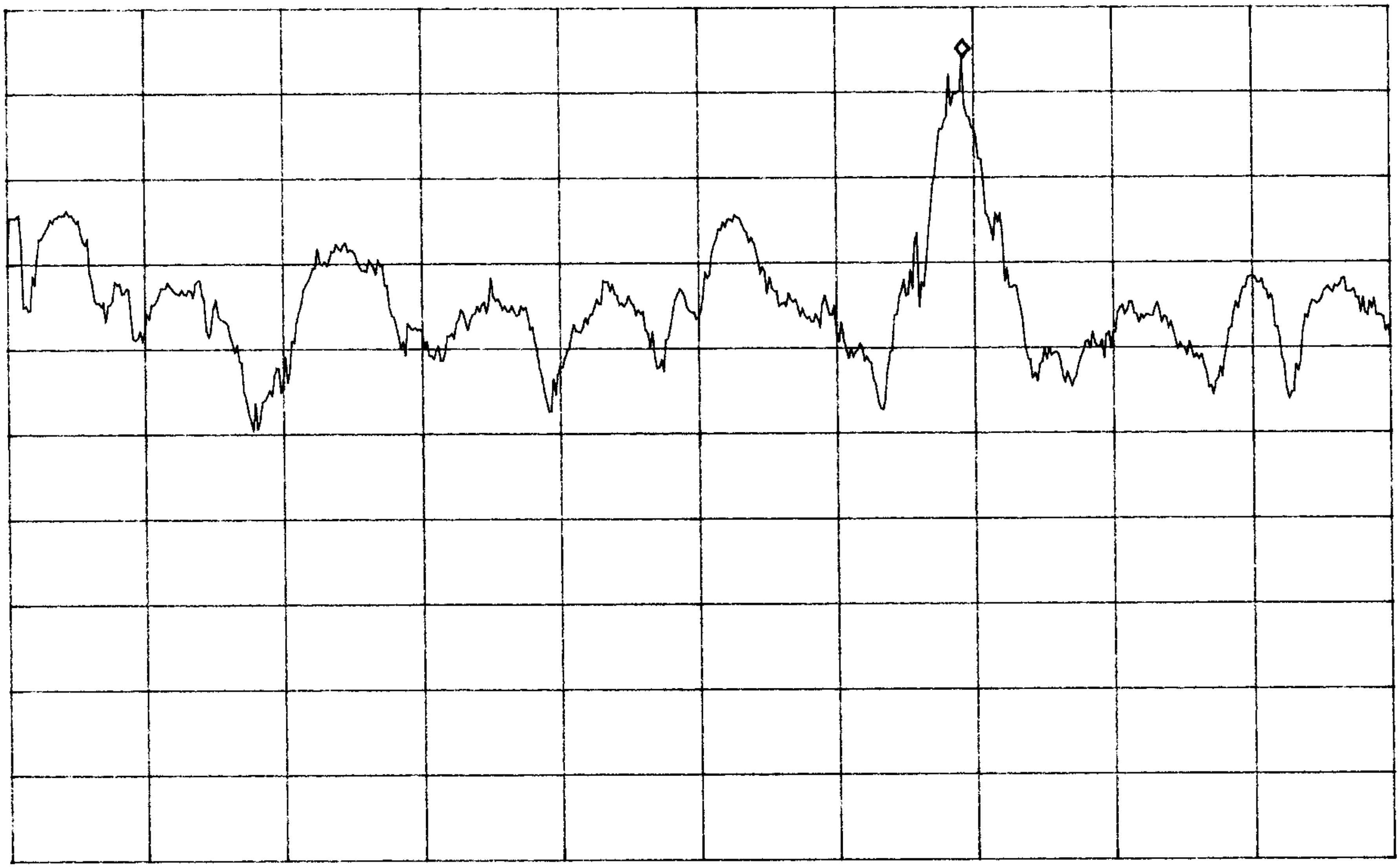
Run #6 - Conducted Emissions, 0.45-30.0 MHz, Sorted by Margin; 120 V / 60 Hz.
Low Channel was found to be the worst of all three channels.

Frequency MHz	Level dBuV	Power Lead	FCC B Limit	FCC B Margin	Detector QP/Ave	Comments
10.0603	42.3	line	48.0	-5.7	QP	
3.3552	39.8	neutral	48.0	-8.2	QP	
3.3550	39.6	line	48.0	-8.4	QP	
29.6969	38.5	line	48.0	-9.5	QP	
29.6989	38.4	neutral	48.0	-9.6	QP	
0.4500	37.0	line	48.0	-11.0	QP	
0.4524	36.8	neutral	48.0	-11.2	QP	

LOW CHANNEL

*ATTEN 60dB
RL 5.0dBm 5dB/

MKR 2.08dBm
5.7590358GHz



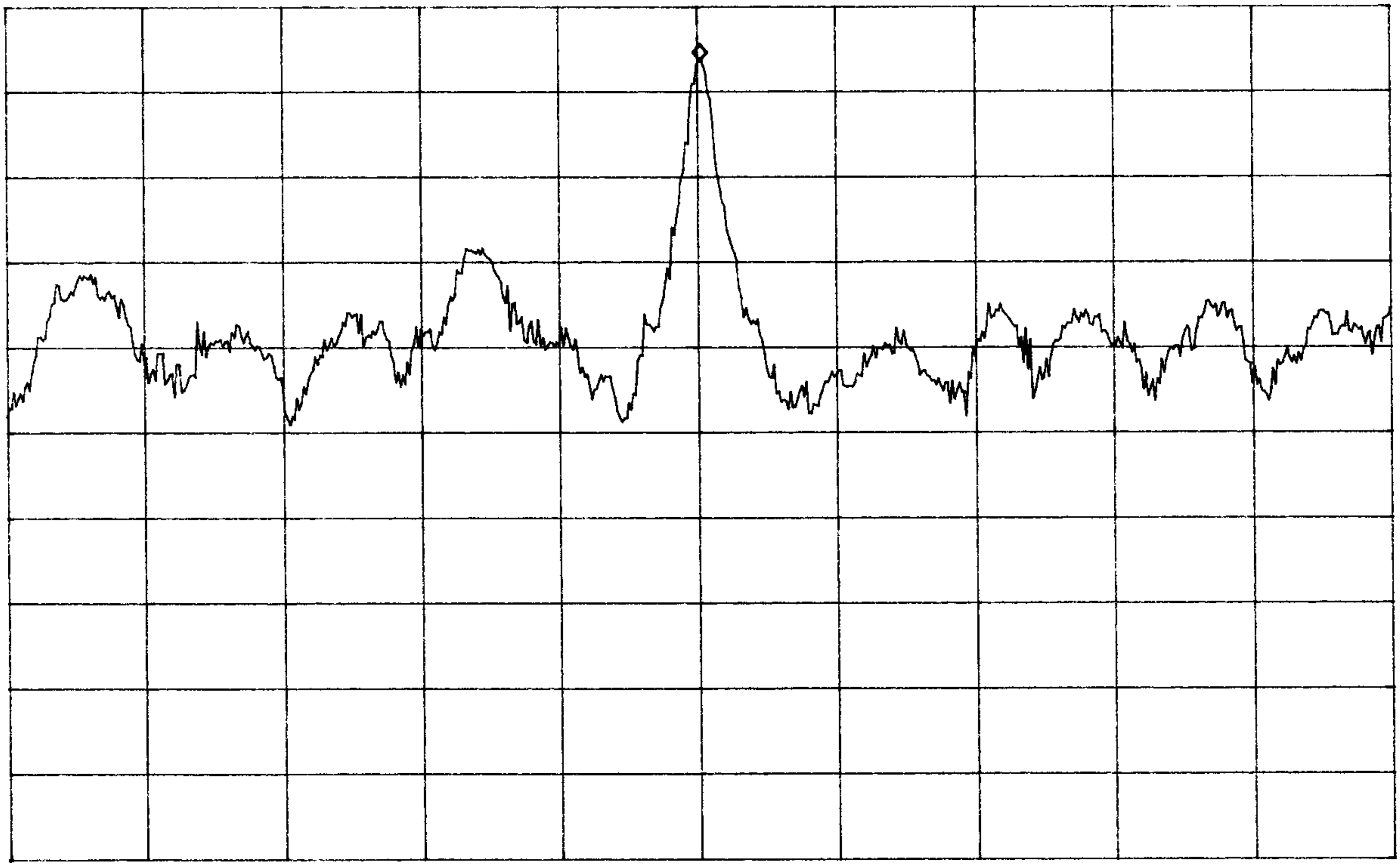
CENTER 5.7589783GHz SPAN 300.0kHz
*RBW 3.0kHz VBW 3.0kHz *SWP 100sec

T24801/201

POWER DENSITY

MIDDLE CHANNEL

*ATTEN 60dB　　　　MKR 1.73dBm
RL 4.9dBm　　5dB/　　5.7990372GHz



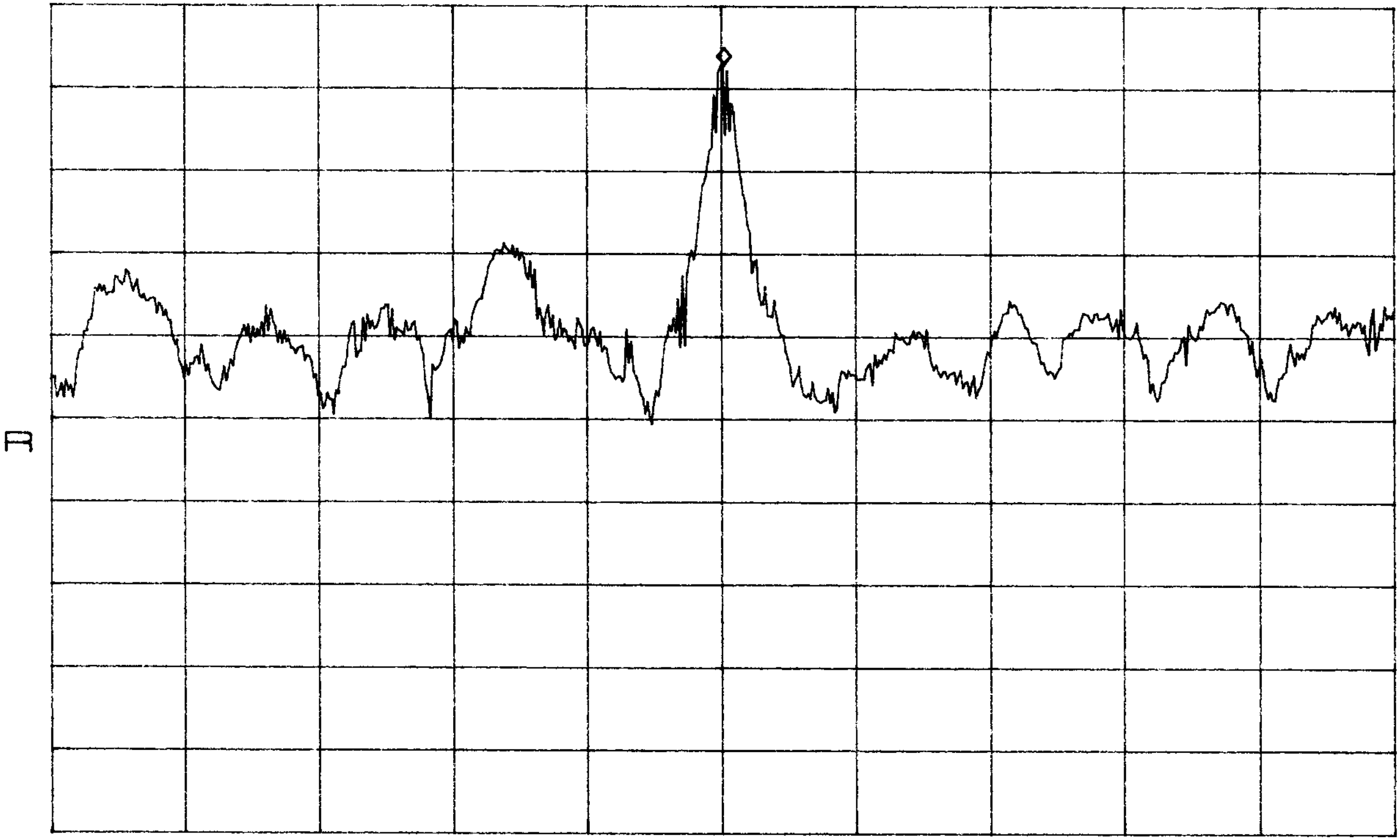
CENTER 5.7990367GHz　　　SPAN 300.0kHz
*RBW 3.0kHz　*VBW 3.0kHz　　*SWP 100sec

POWER DENSITY

T2H801/202

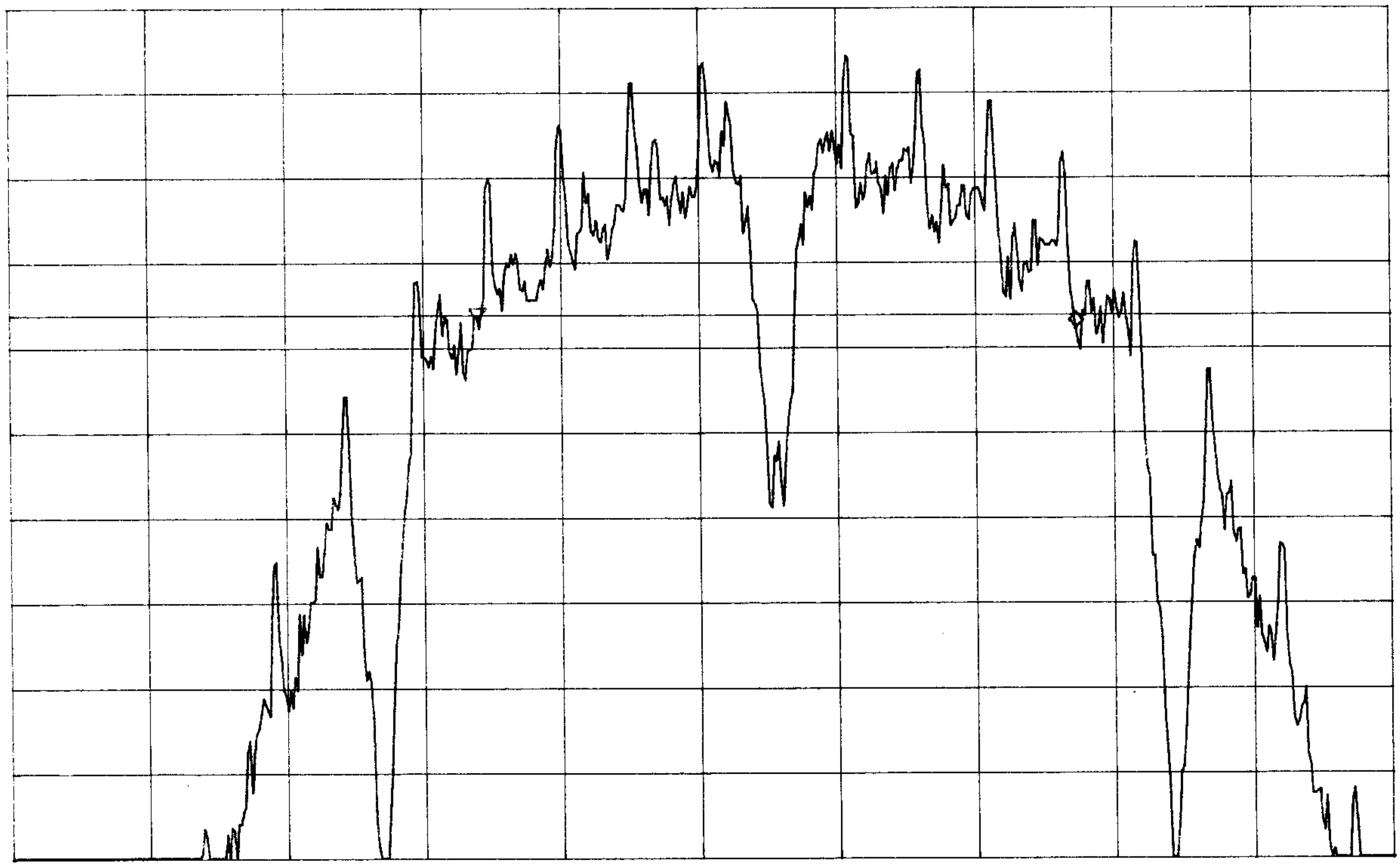
HIGH CHANNEL

*ATTEN 60dB   MKR 1.60dBm
RL 5.1dBm   5dB/   5.8190370GHz



CENTER 5.8190365GHz   SPAN 300.0kHz
*RBW 3.0kHz   *VBW 3.0kHz   *SWP 100sec

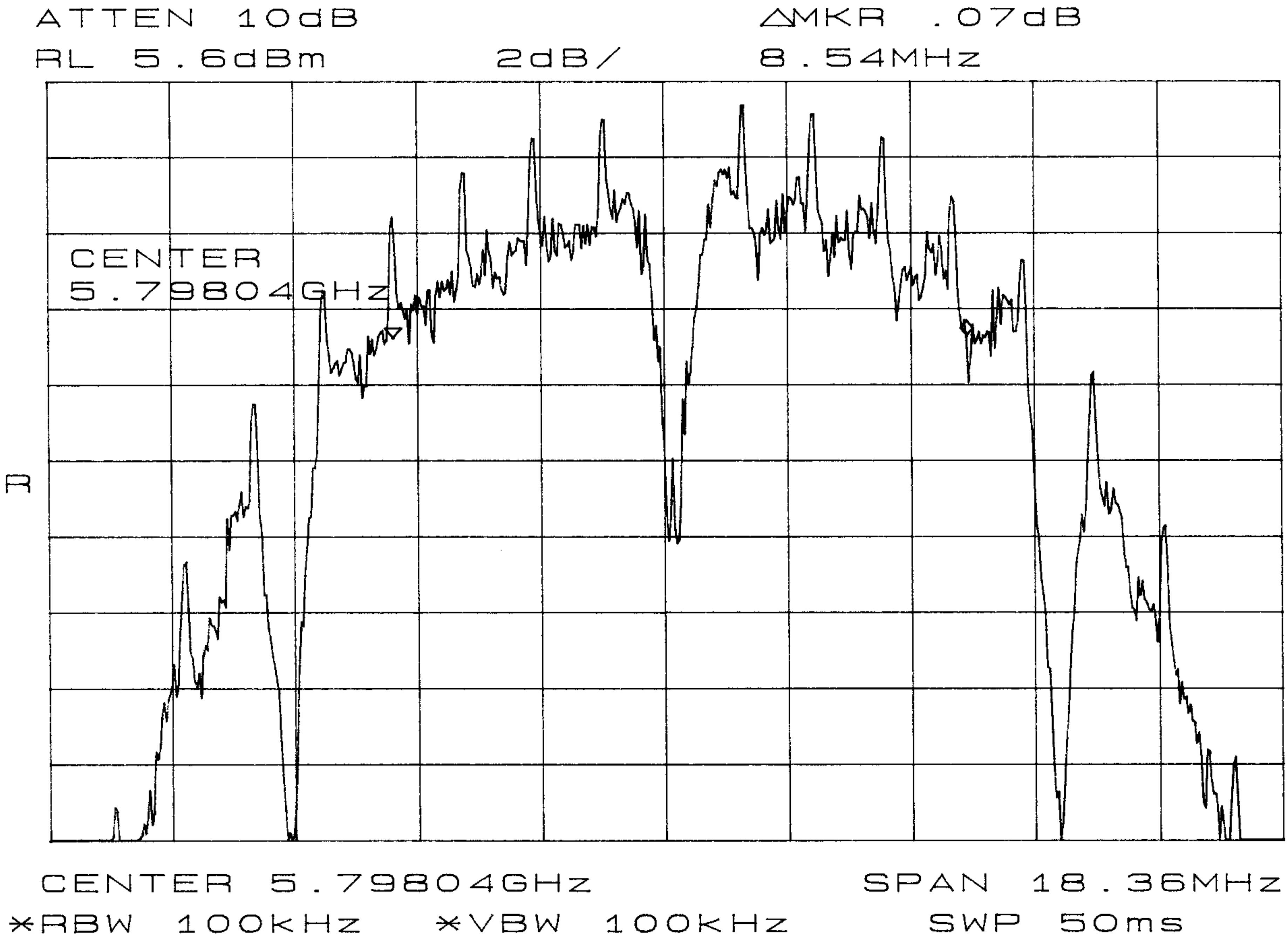
T2H801/203   POWER DENSITY



T24801/301

BANDWIDTH

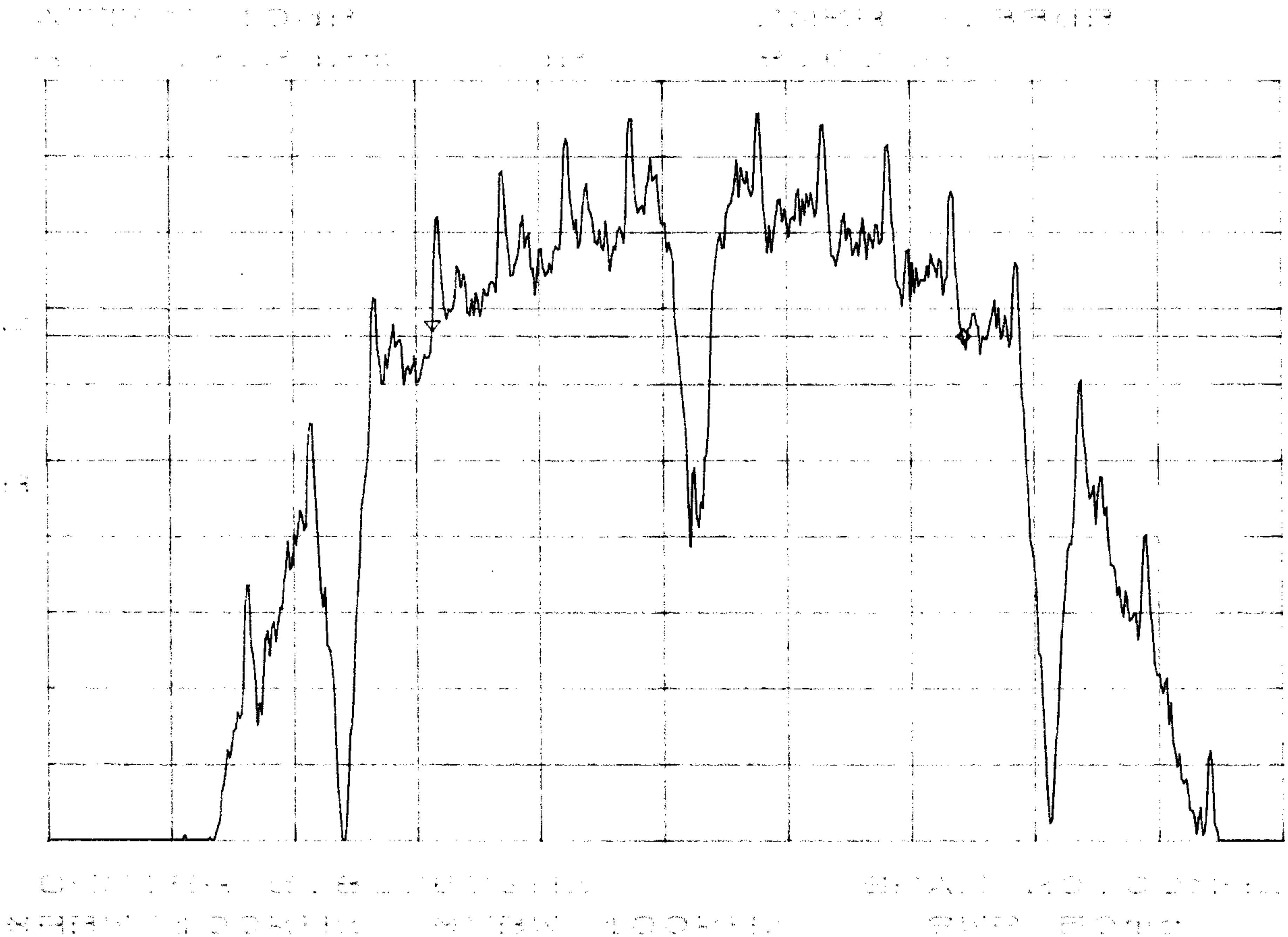
MIDDLE CHANNEL



T2H801/302

BANDWIDTH

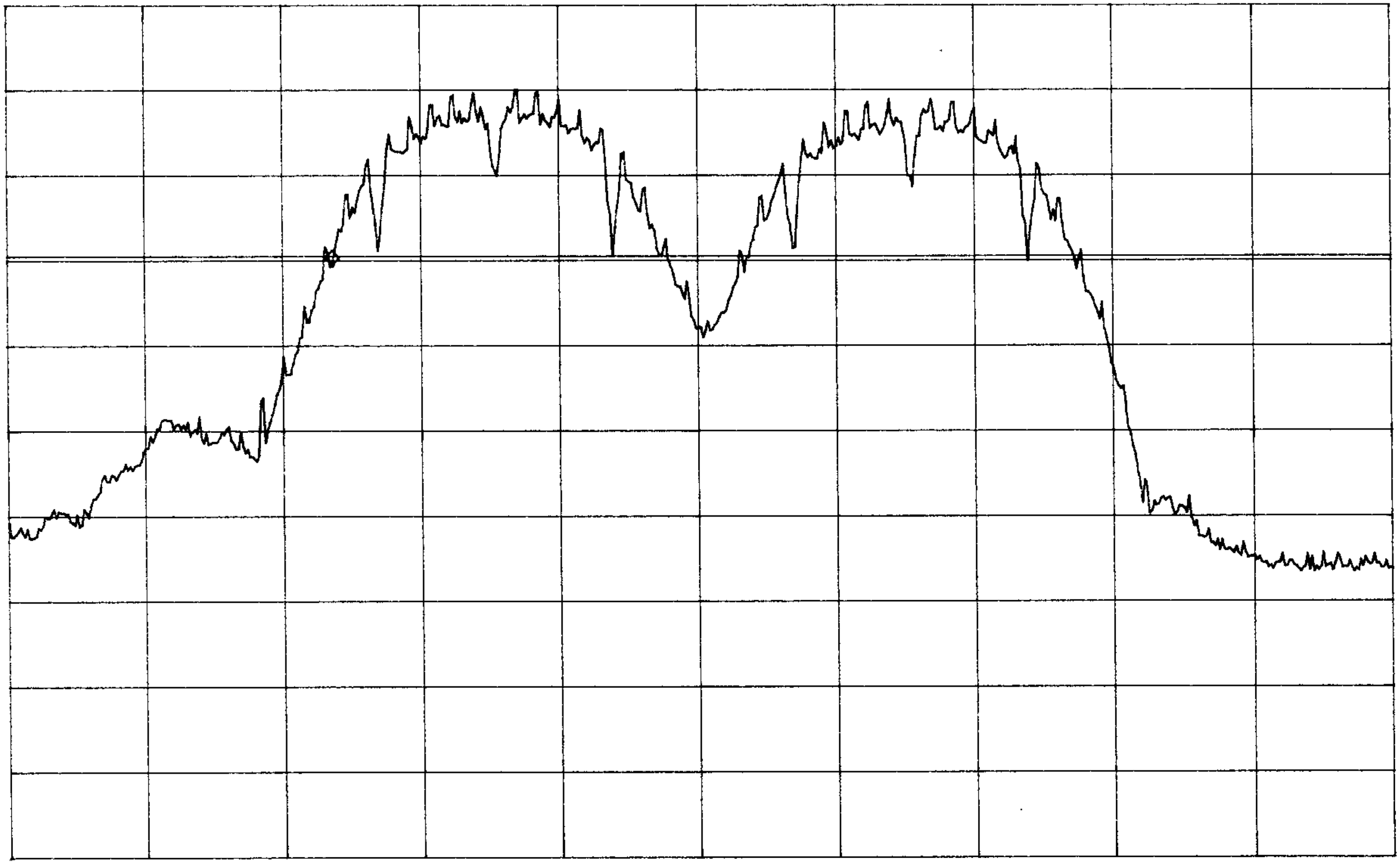
HIGH CHANNEL



T24801/303

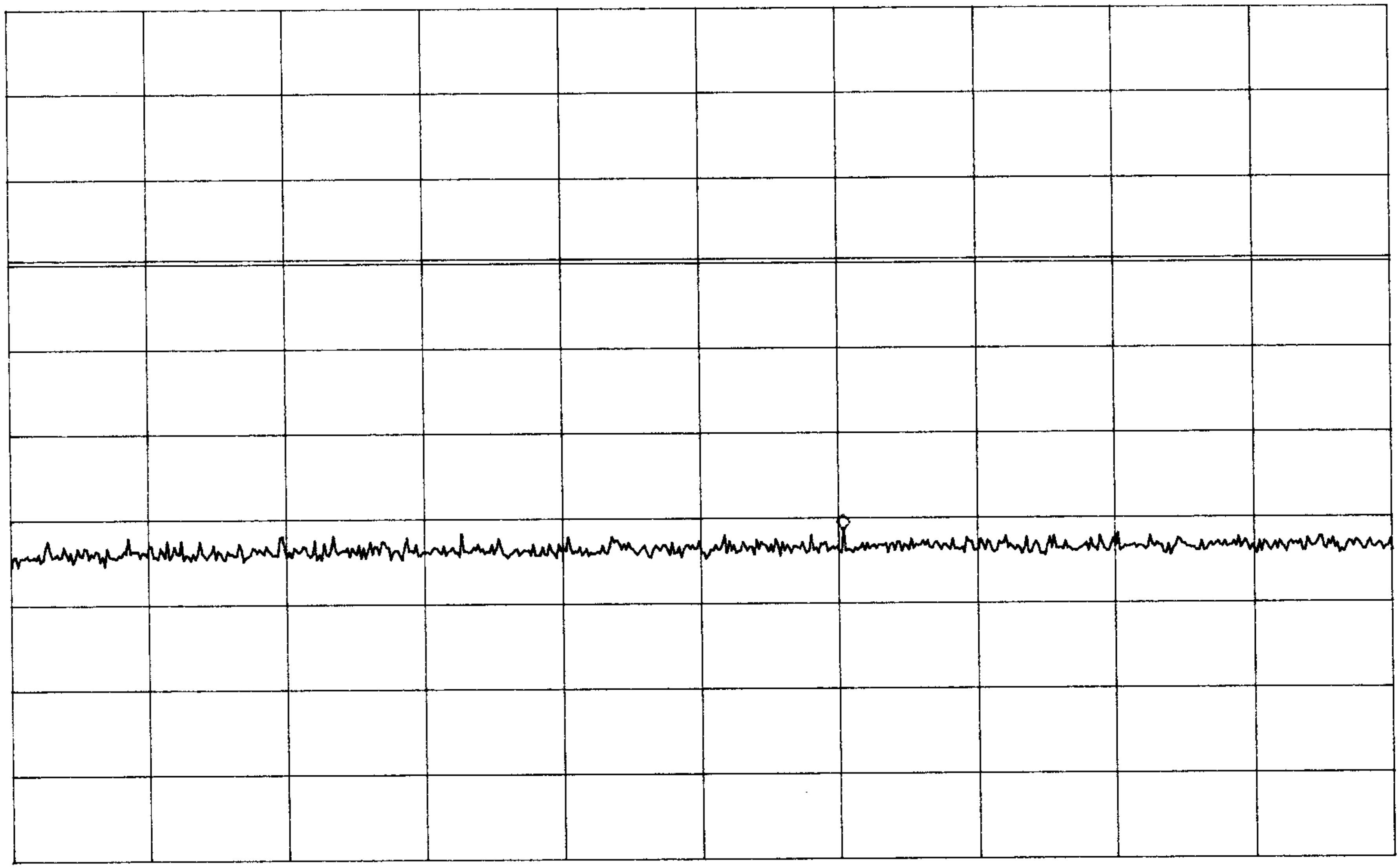
BANDWIDTH

LOW CHANNEL



T24801/401

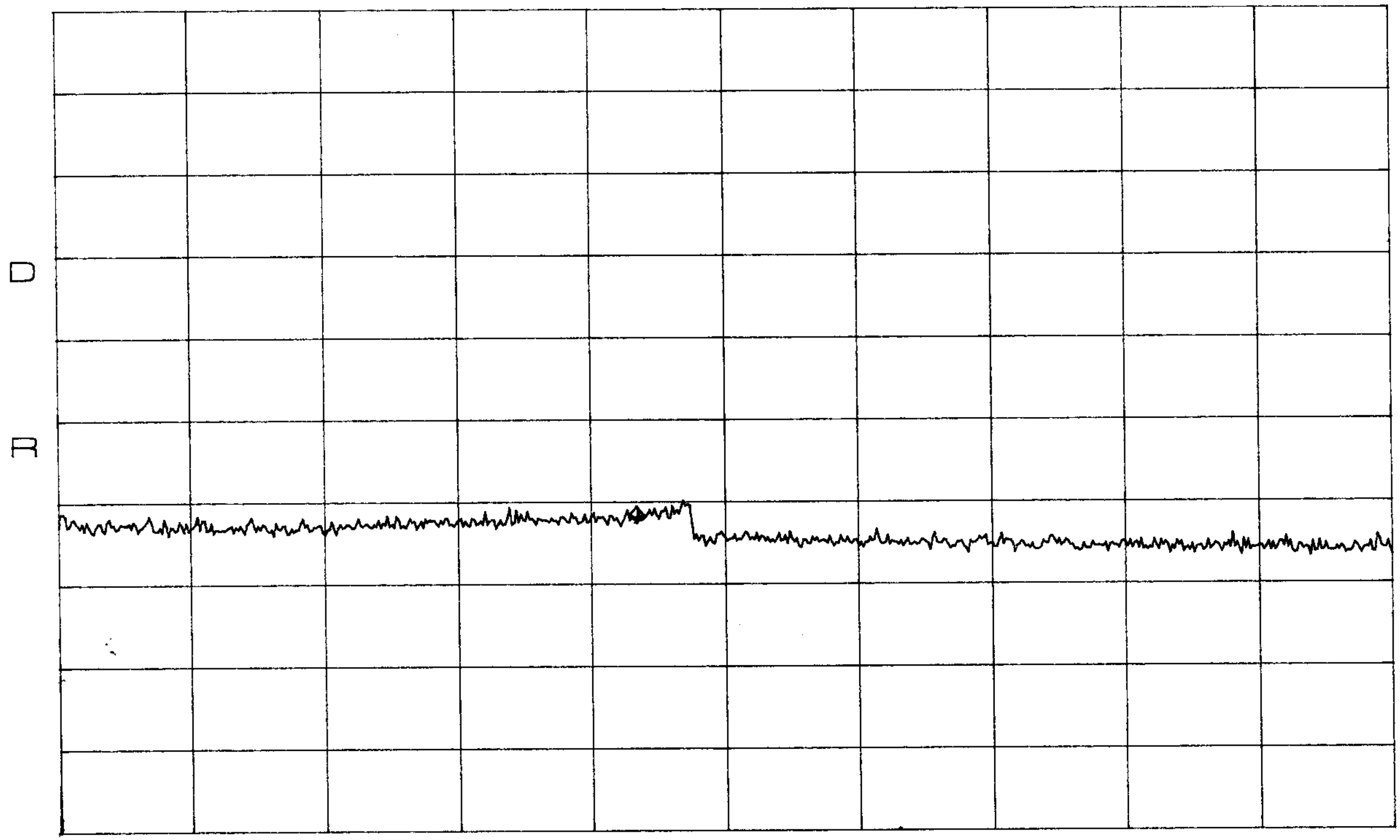
LOW CHANNEL



T24801/402

LOW CHANNEL

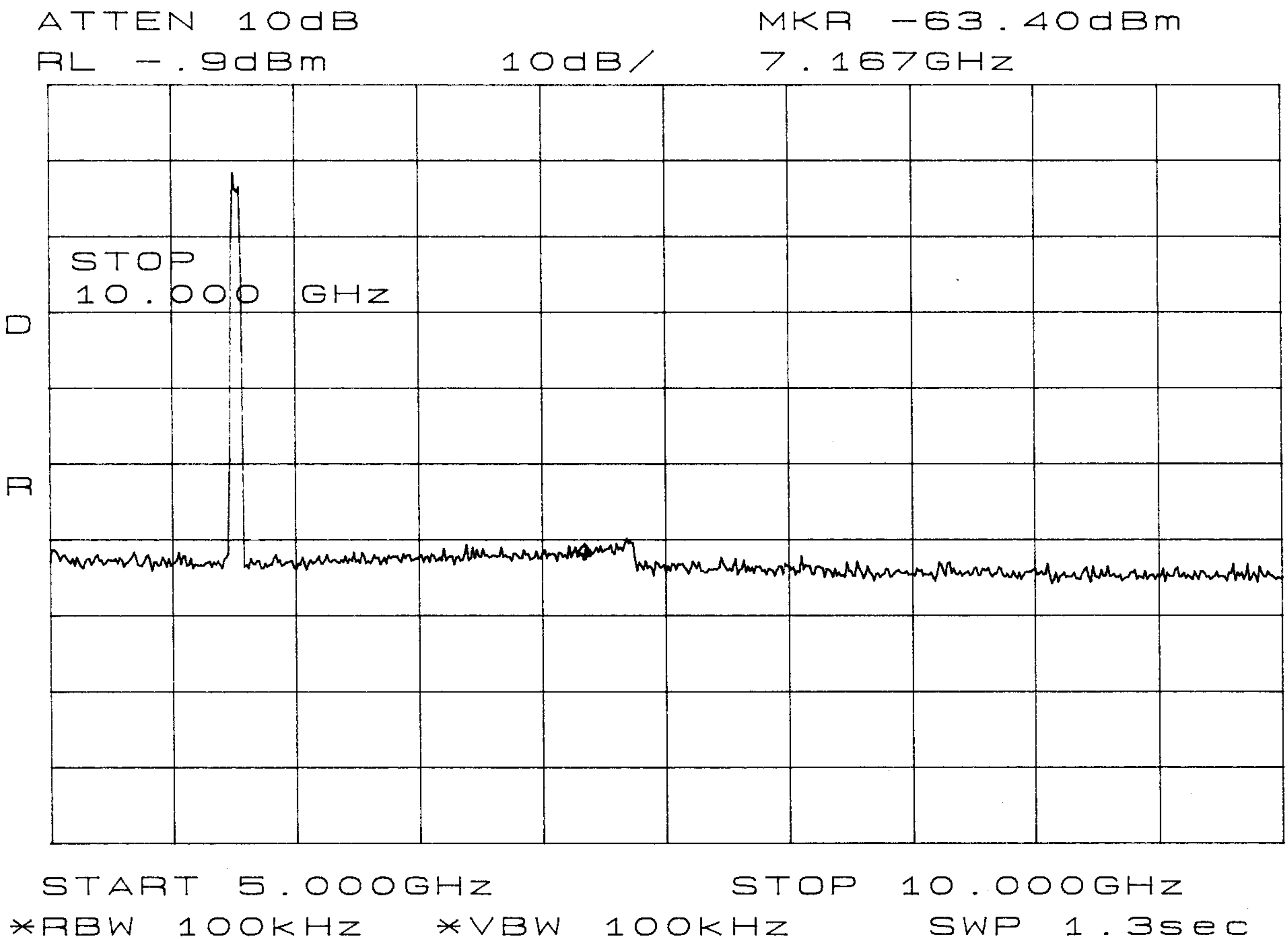
ATTEN 10dB MKR -63.40dBm
RL -.9dBm 10dB/ 2.733GHz



START 1.000GHz STOP 5.000GHz
*RBW 100kHz *VBW 100kHz SWP 1.0sec

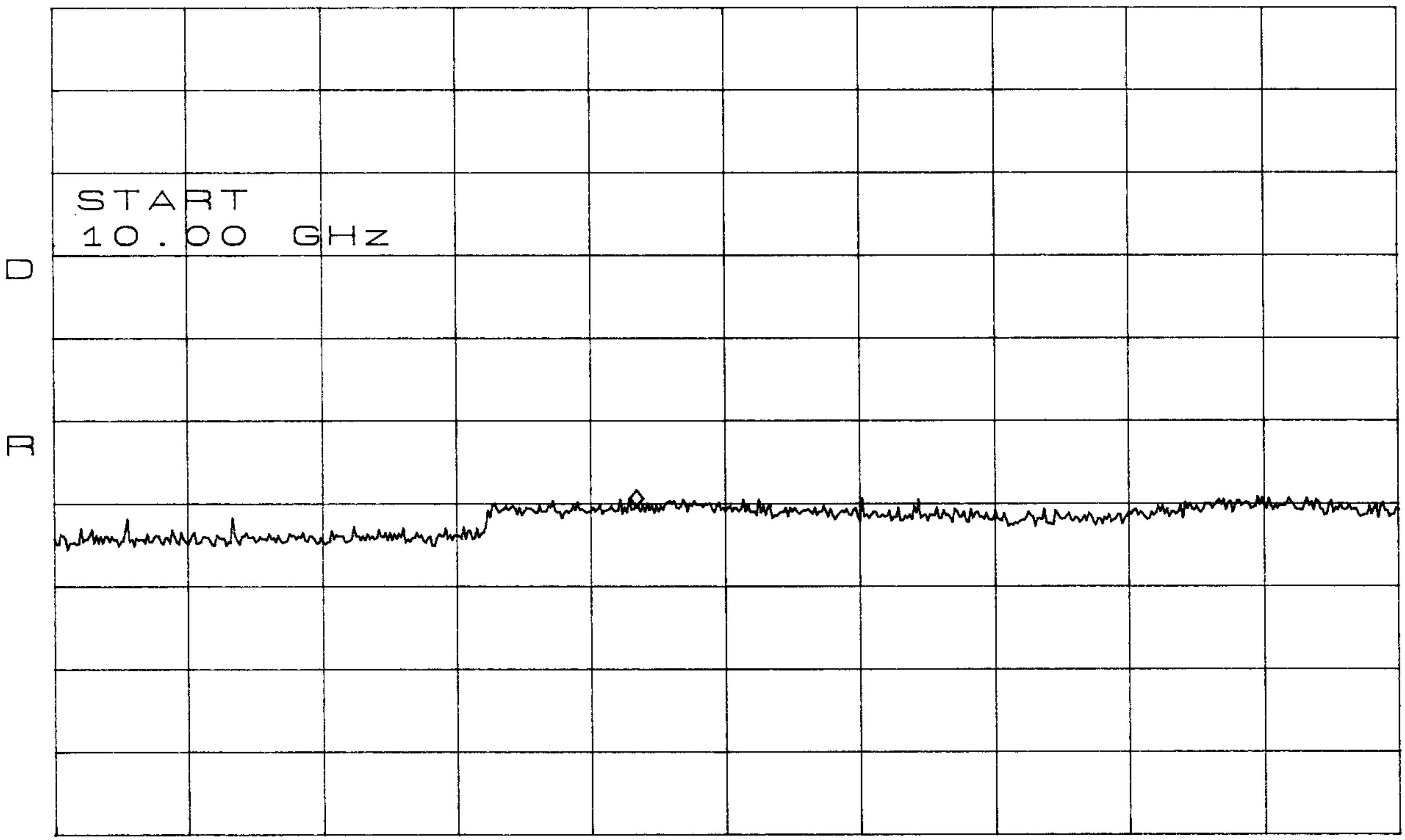
T24801/403

LOW CHANNEL

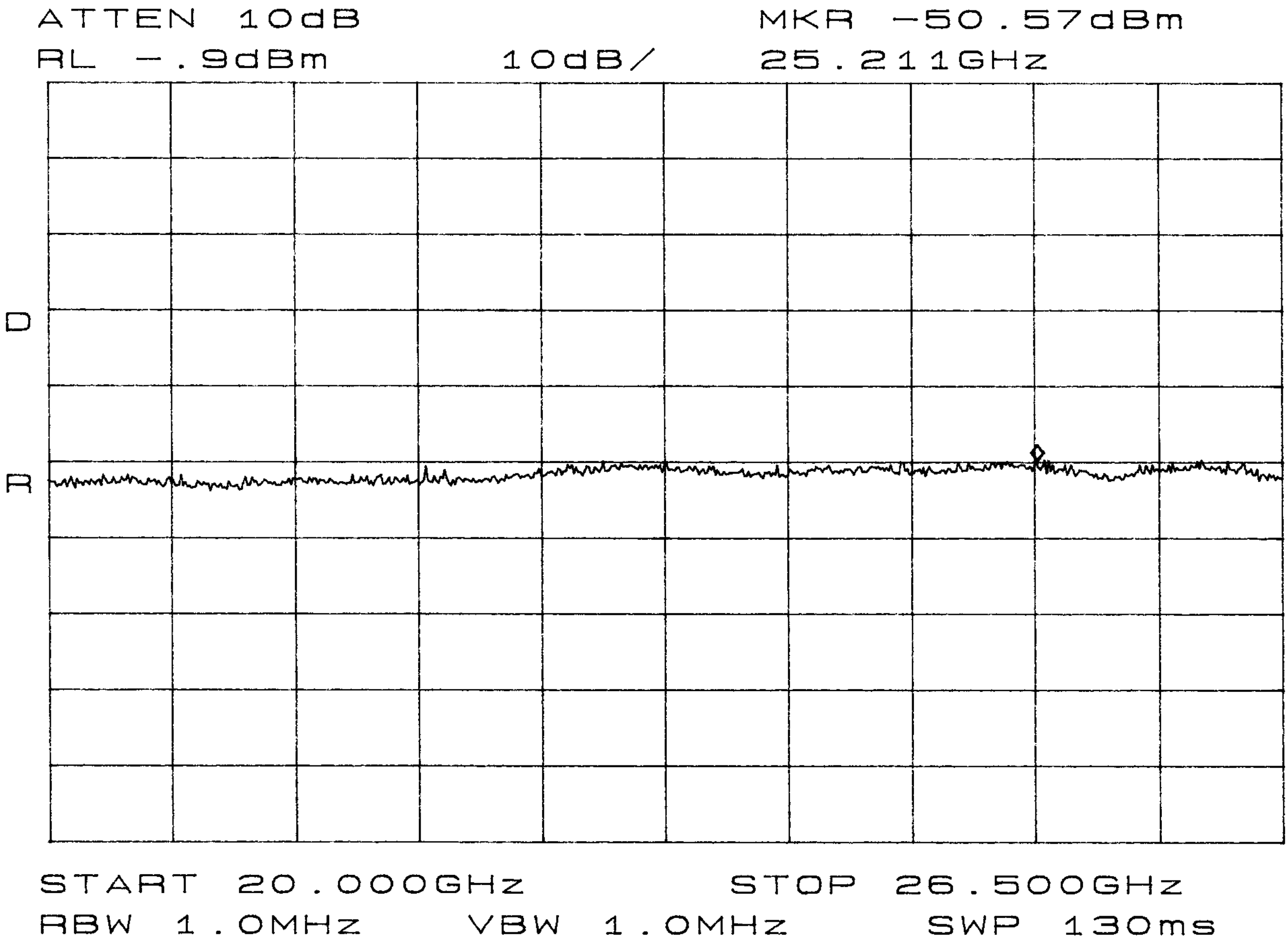


T24801/H04

ATTEN 10dB MKR −61.23dBm
RL −.9dBm 10dB/ 14.33GHz

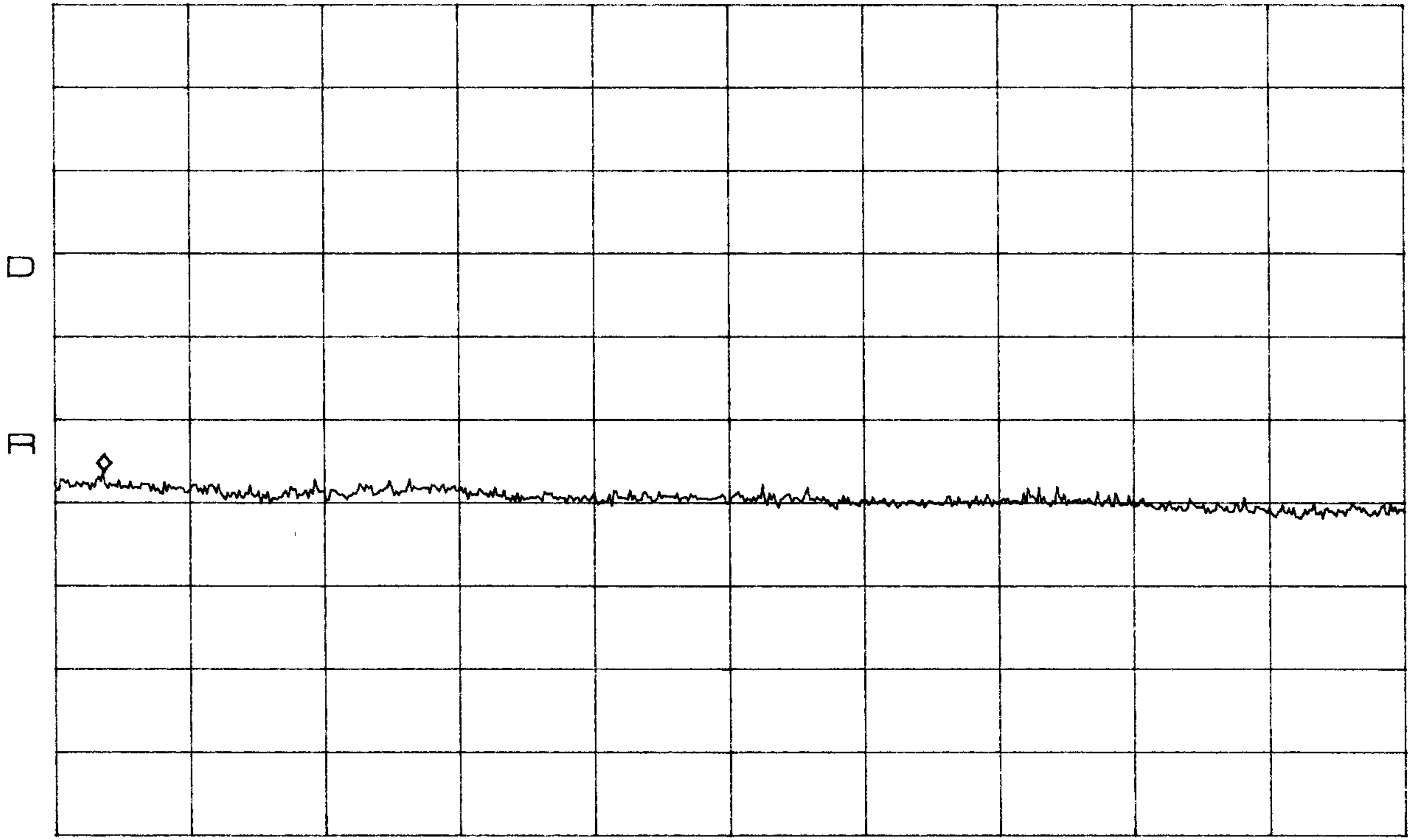


START 10.00GHz STOP 20.00GHz
*RBW 100kHz *VBW 100kHz SWP 2.5sec


ATTEN 10dB
RL -.9dBm
10dB/
MKR -50.57dBm
25.211GHz
D
R
START 20.000GHz
STOP 26.500GHz
RBW 1.0MHz
VBW 1.0MHz
SWP 130ms

T24801/#06

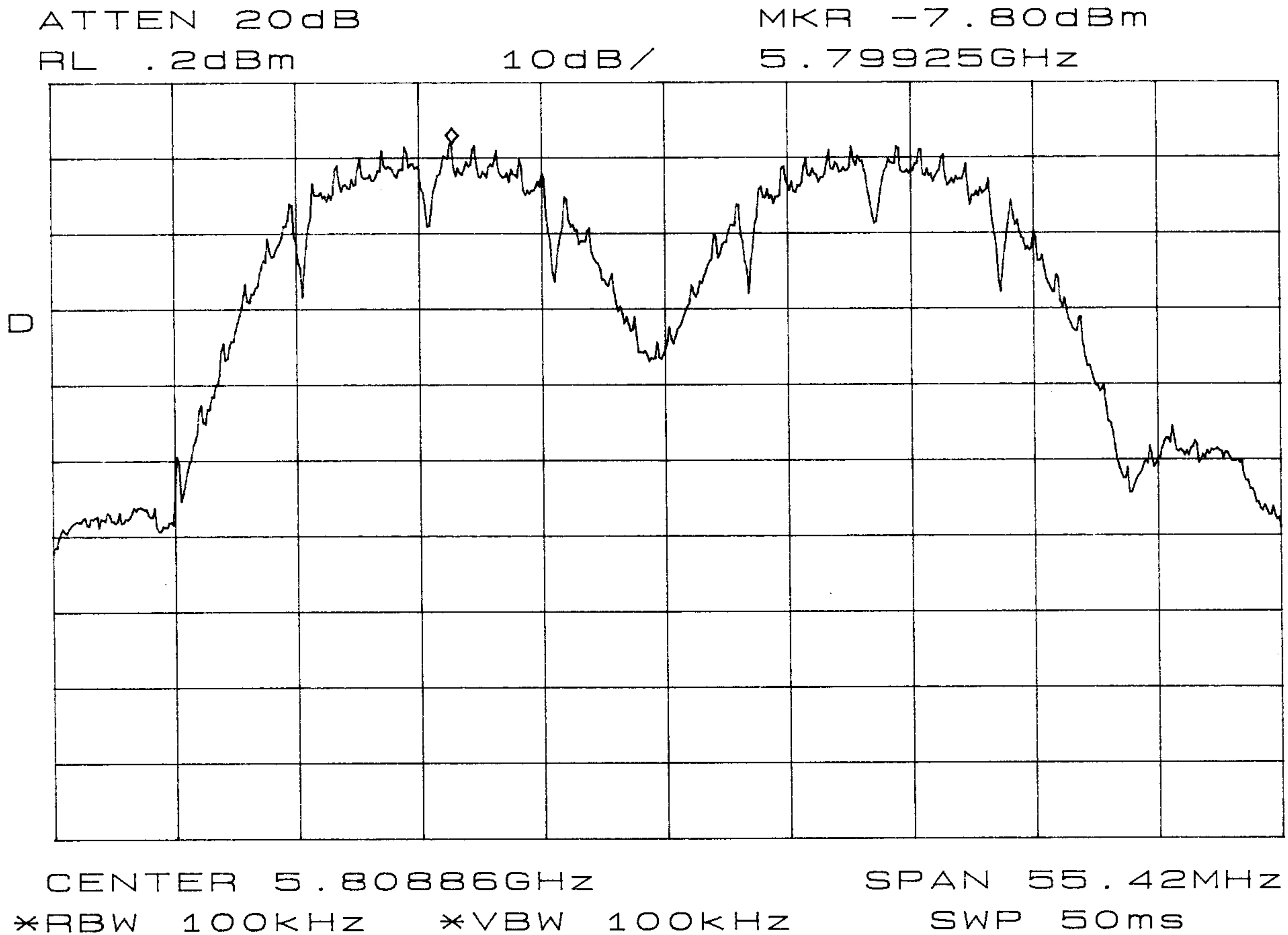
CL 22.0dB MKR -57.07dBm
RL -.9dBm 10dB/ 27.00GHz



START 26.50GHz STOP 40.00GHz
RBW 1.0MHz VBW 1.0MHz SWP 87ms

T24801/407

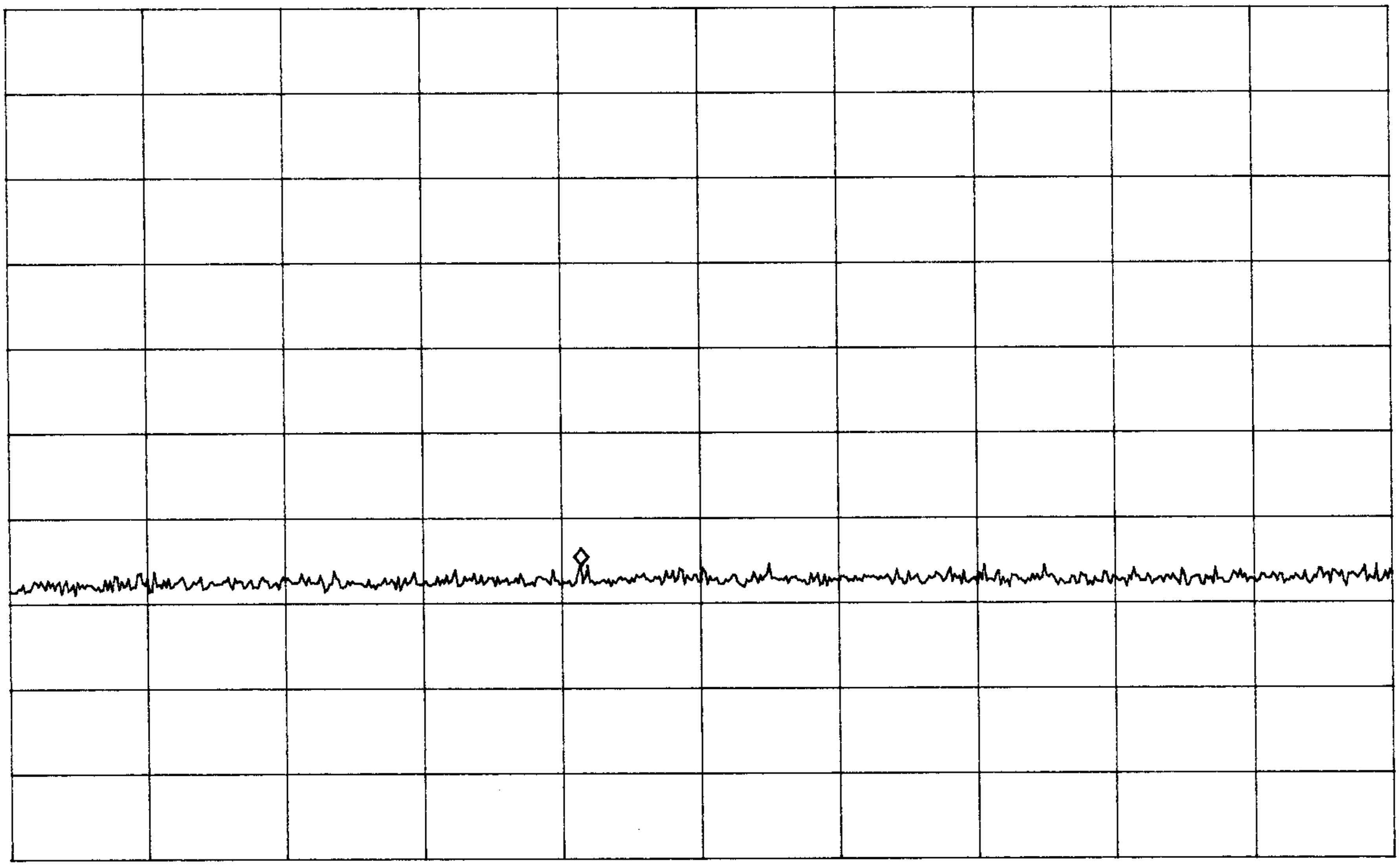
MIDDLE CHANNEL



T24801/411

ATTEN 20dB MKR -65.30dBm
RL .2dBm 10dB/ 430.9MHz

D

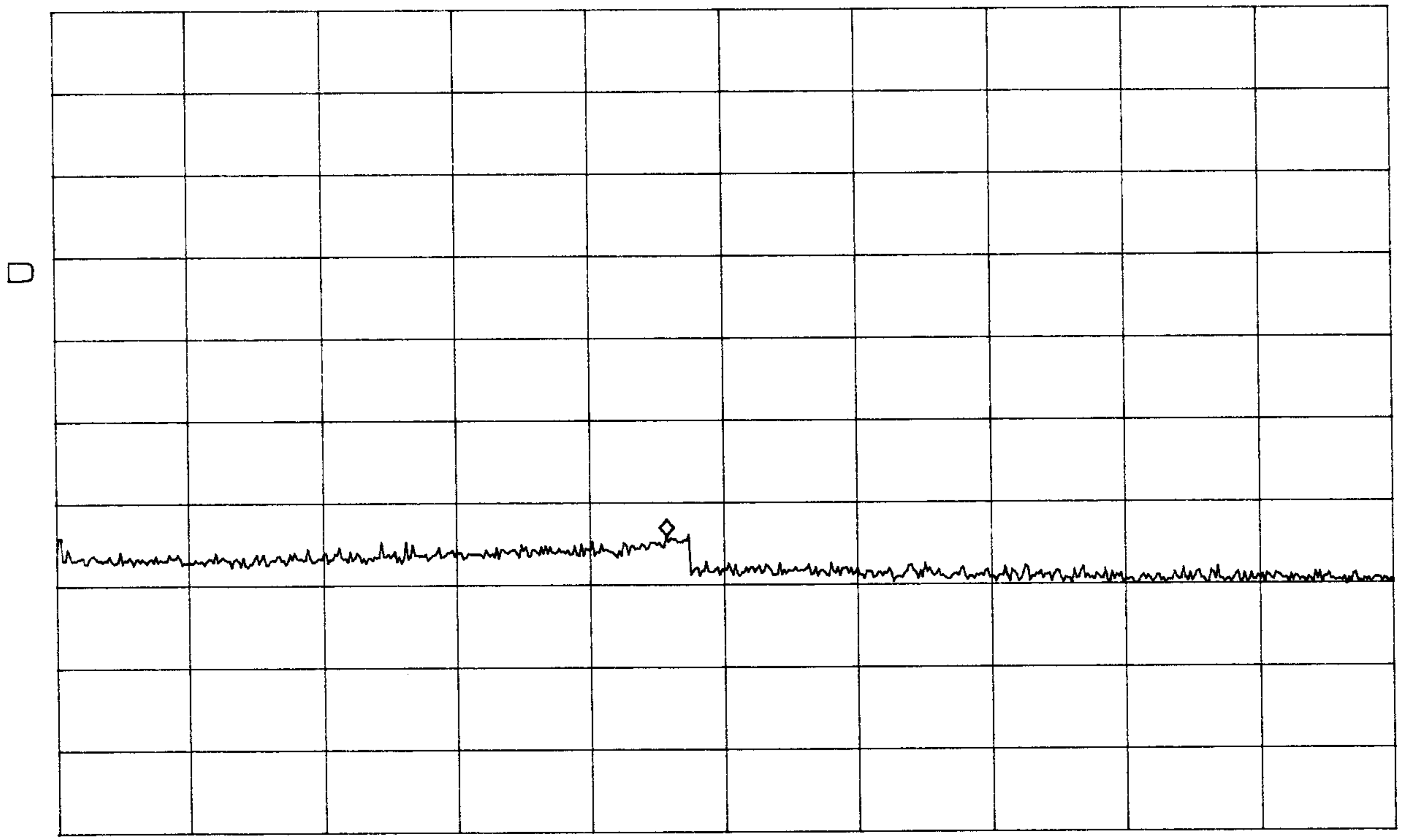


START 30.0MHz STOP 1.0000GHz
*RBW 100kHz *VBW 100kHz SWP 250ms

T24801/412

MIDDLE CHANNEL

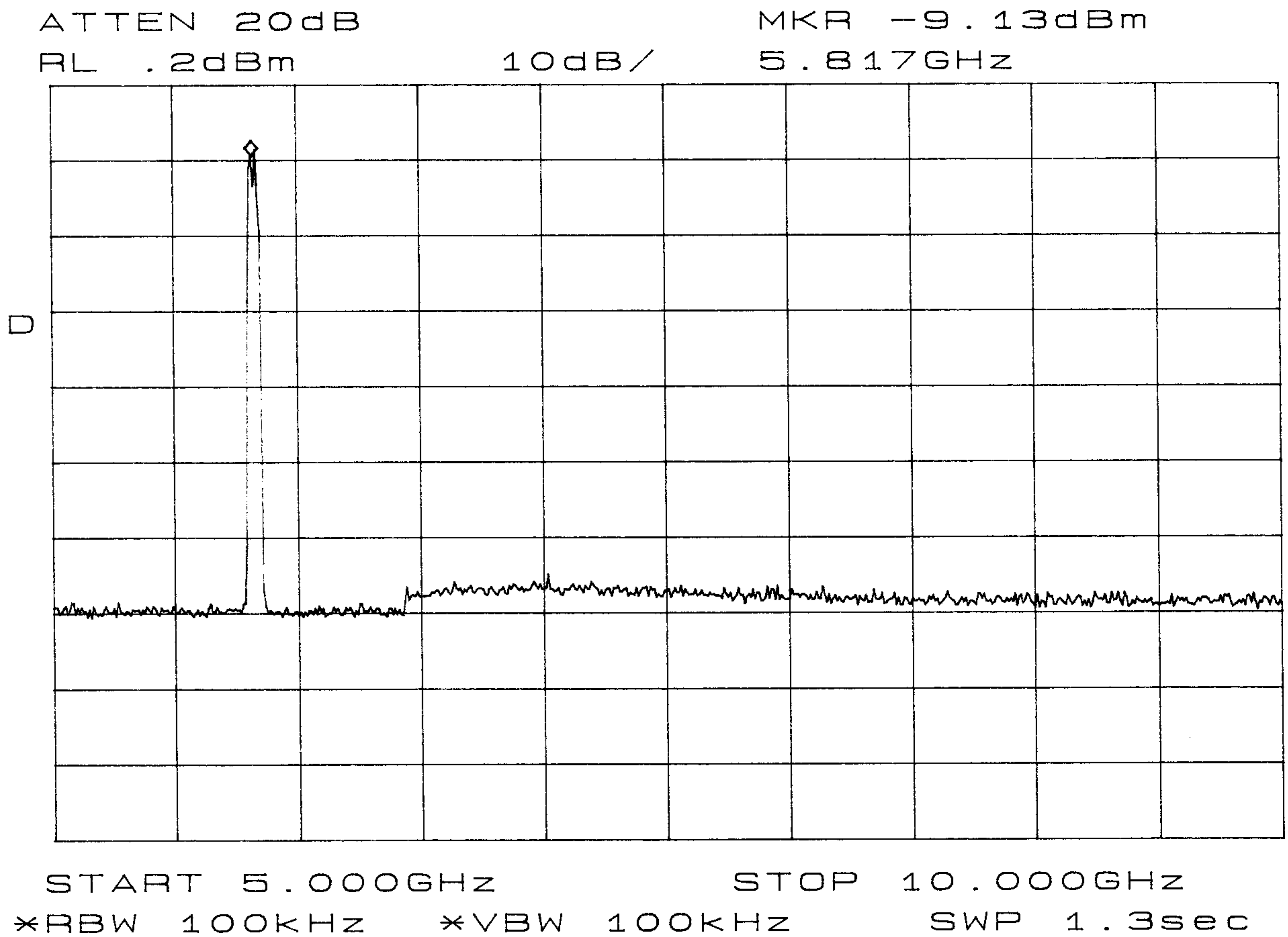
ATTEN 20dB MKR -63.80dBm
RL .2dBm 10dB/ 2.827GHz



START 1.000GHz STOP 5.000GHz
*RBW 100kHz *VBW 100kHz SWP 1.0sec

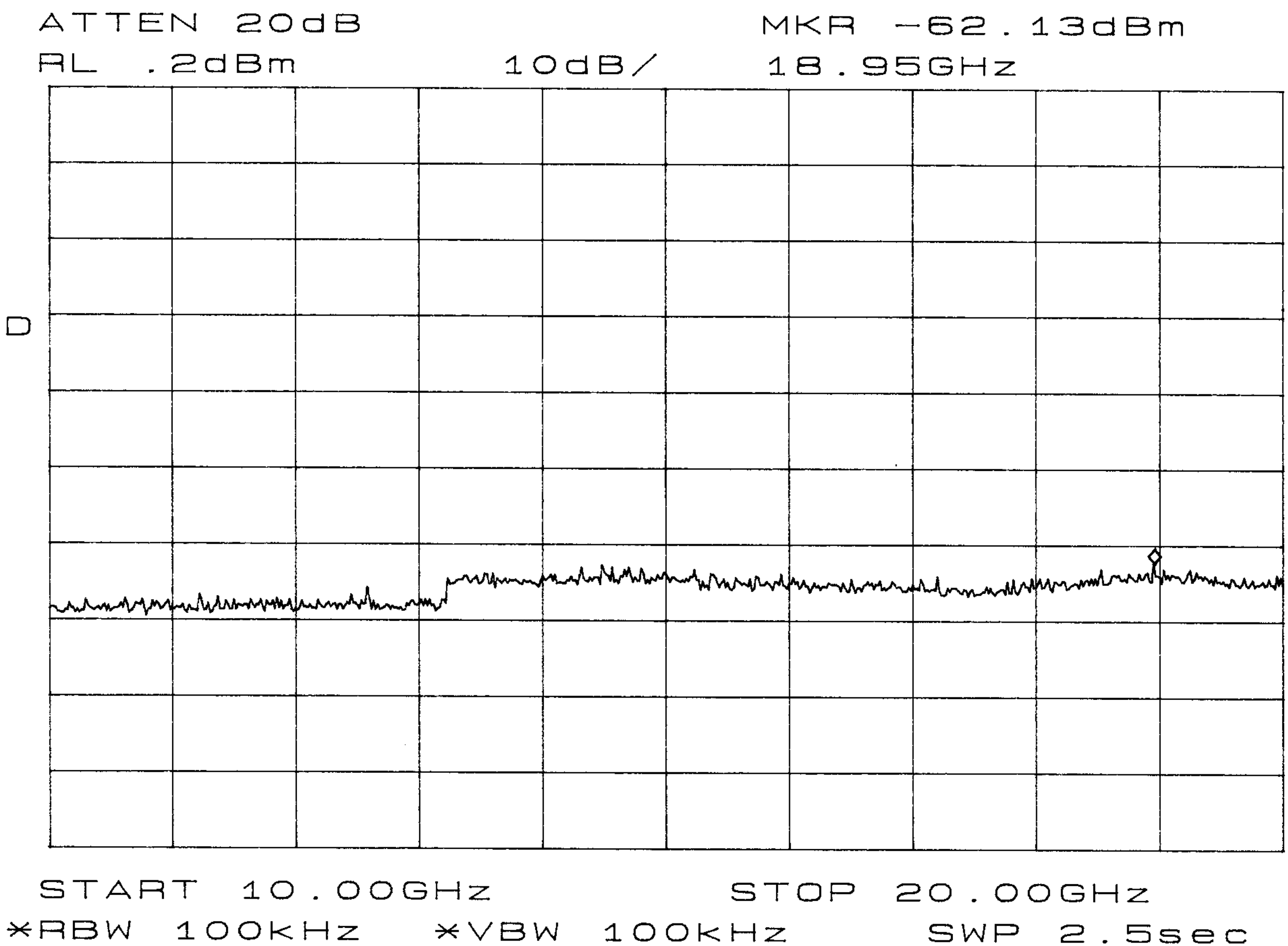
T2H801/413

MIDDLE CHANNEL



T24801/414

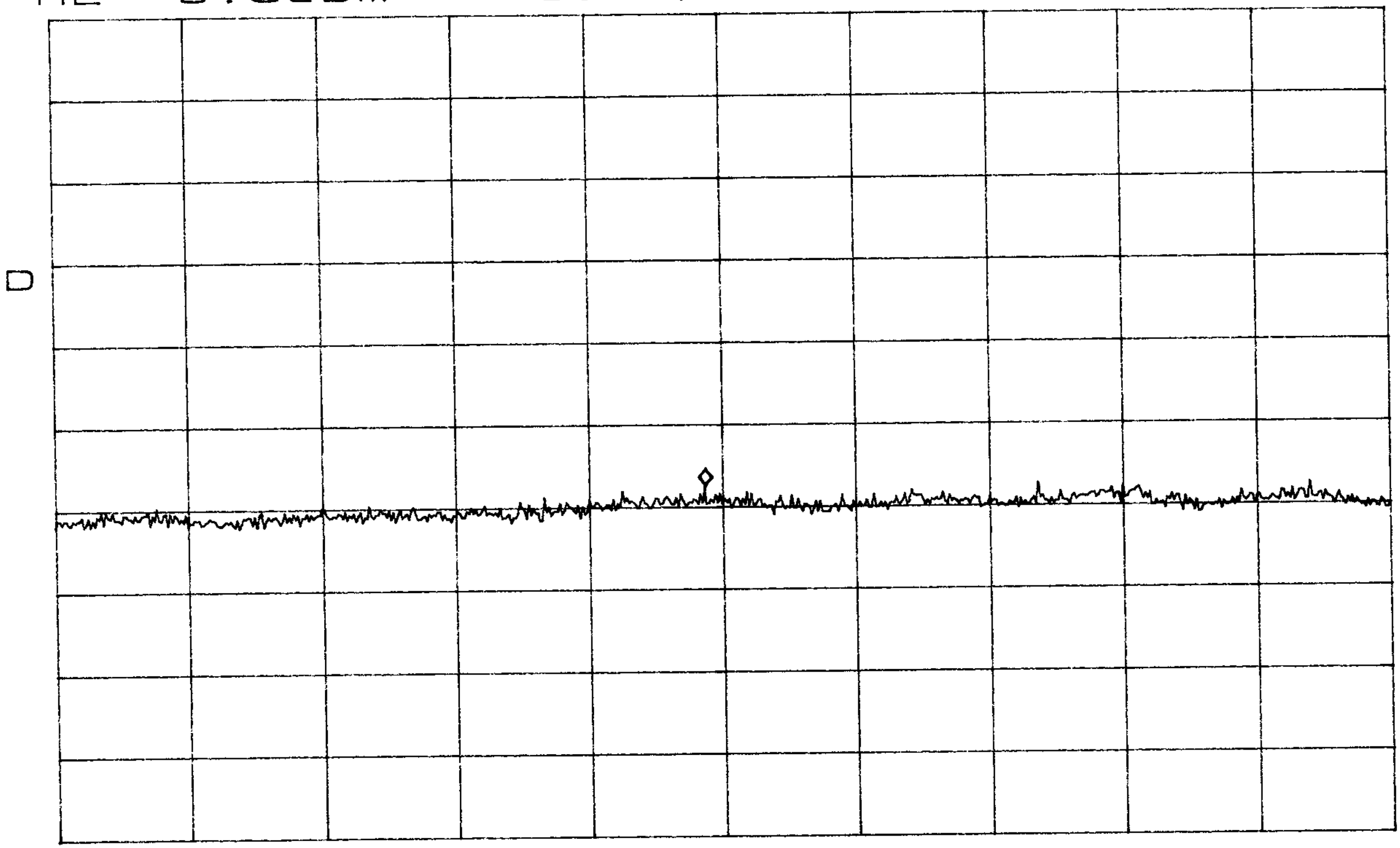
MIDDLE CHANNEL



T2H801/H15

ATTEN 10dB
RL -3.5dBm 10dB/

MKR -60.83dBm
23.163GHz

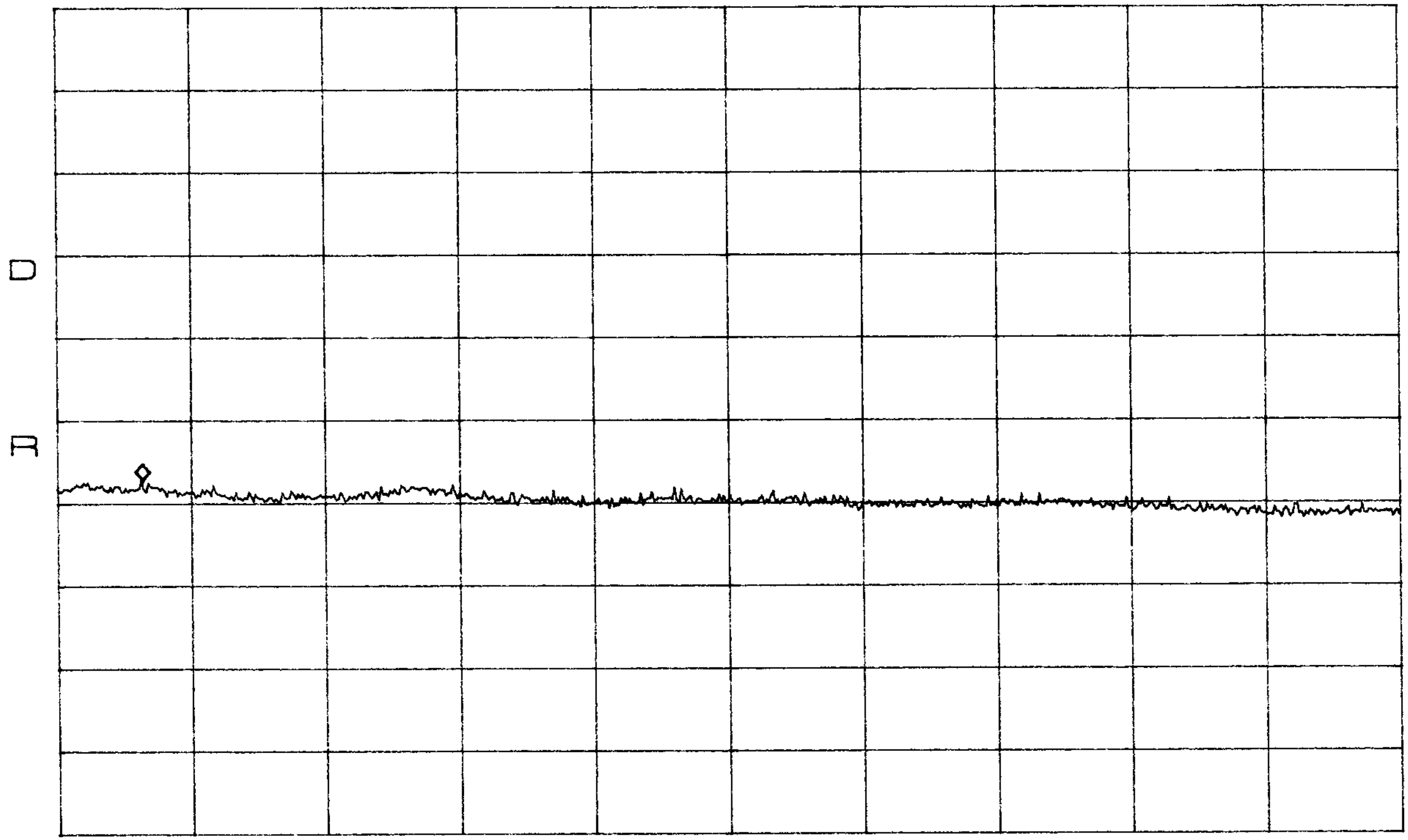


START 20.000GHz
RBW 1.0MHz VBW 1.0MHz

STOP 26.500GHz
SWP 130ms

T24801/416

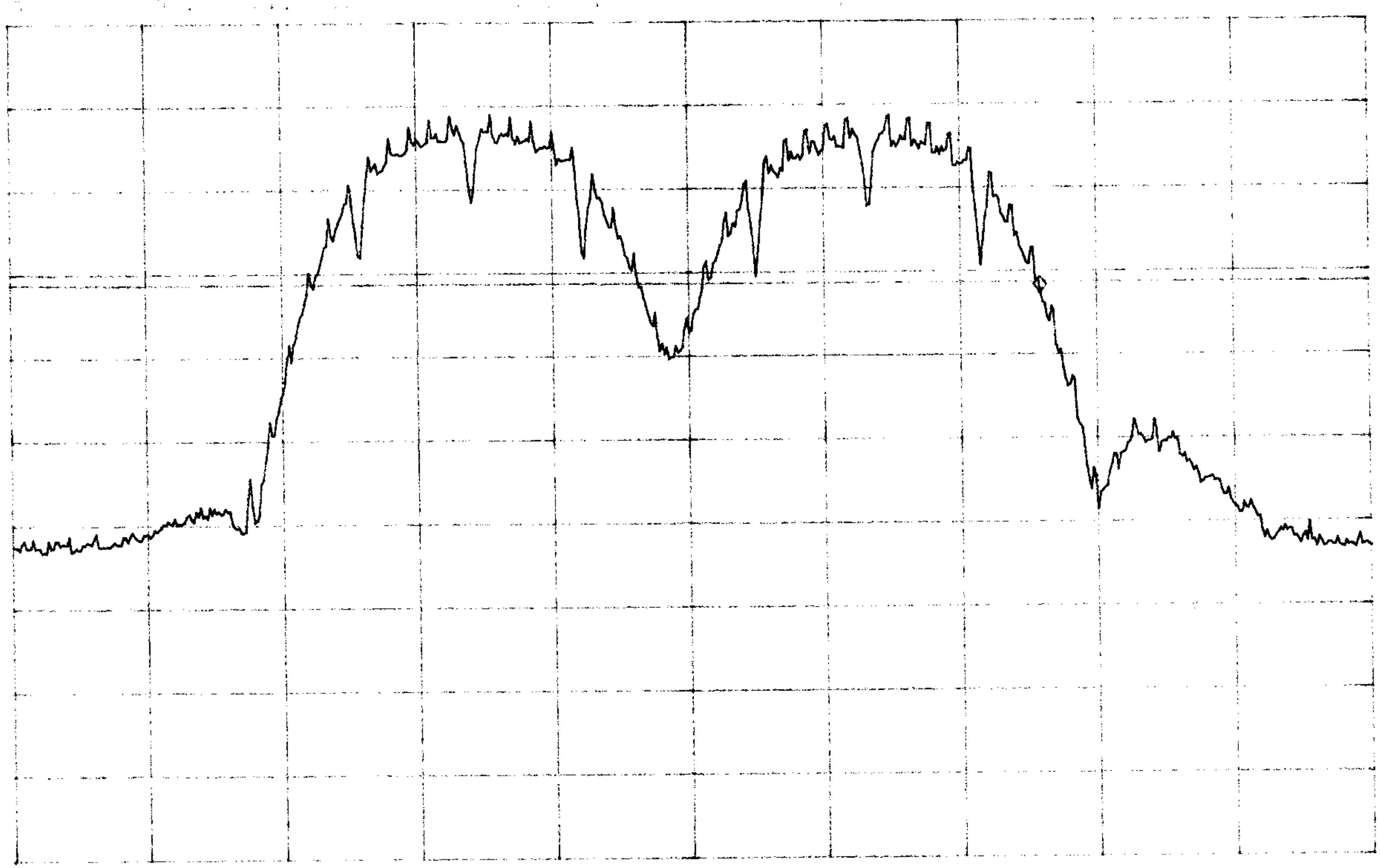
CL 22.0dB MKR -56.97dBm
RL .2dBm 10dB/ 27.36GHz



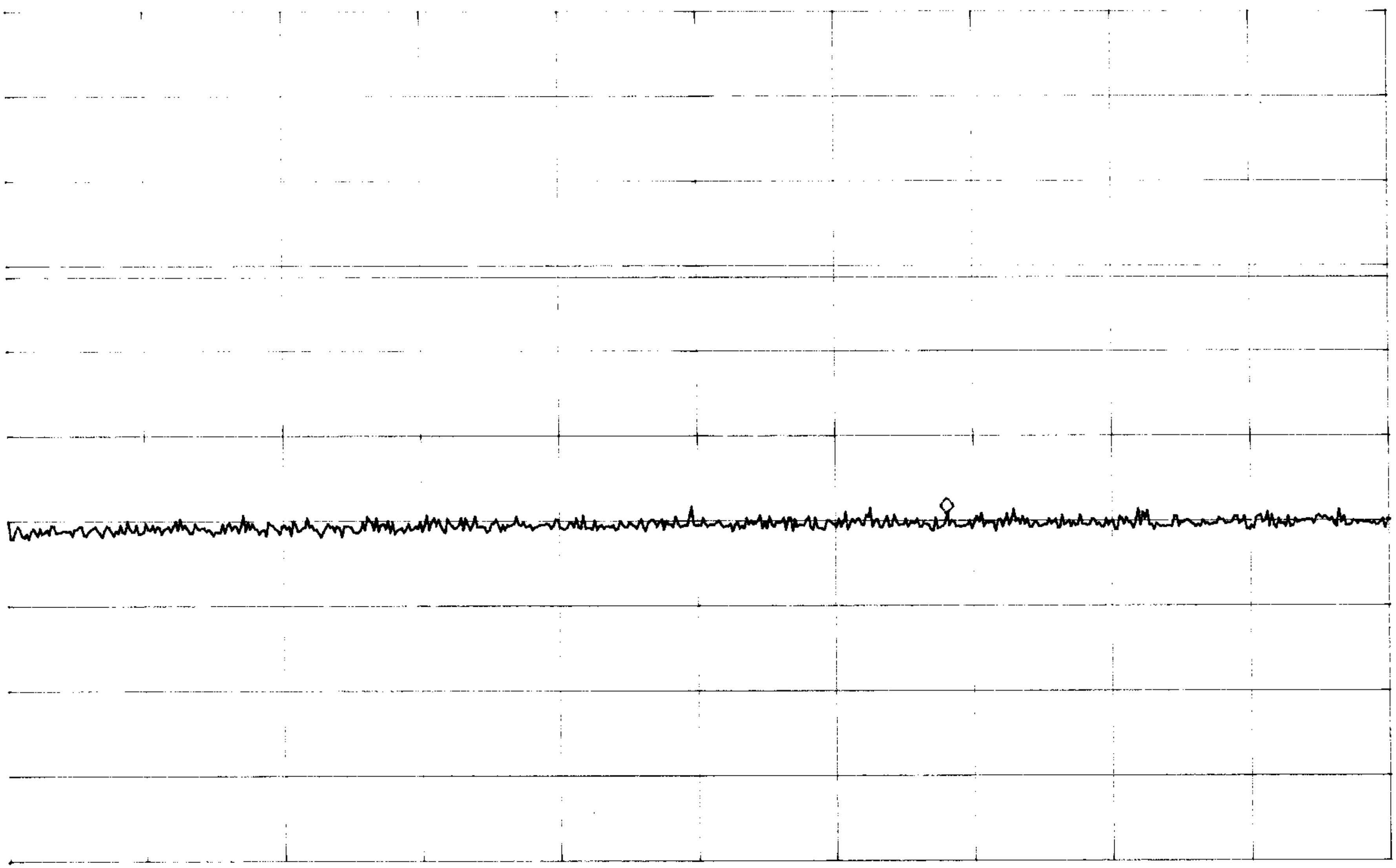
START 26.50GHz STOP 40.00GHz
RBW 1.0MHz VBW 1.0MHz SWP 87ms

T24801 / 417

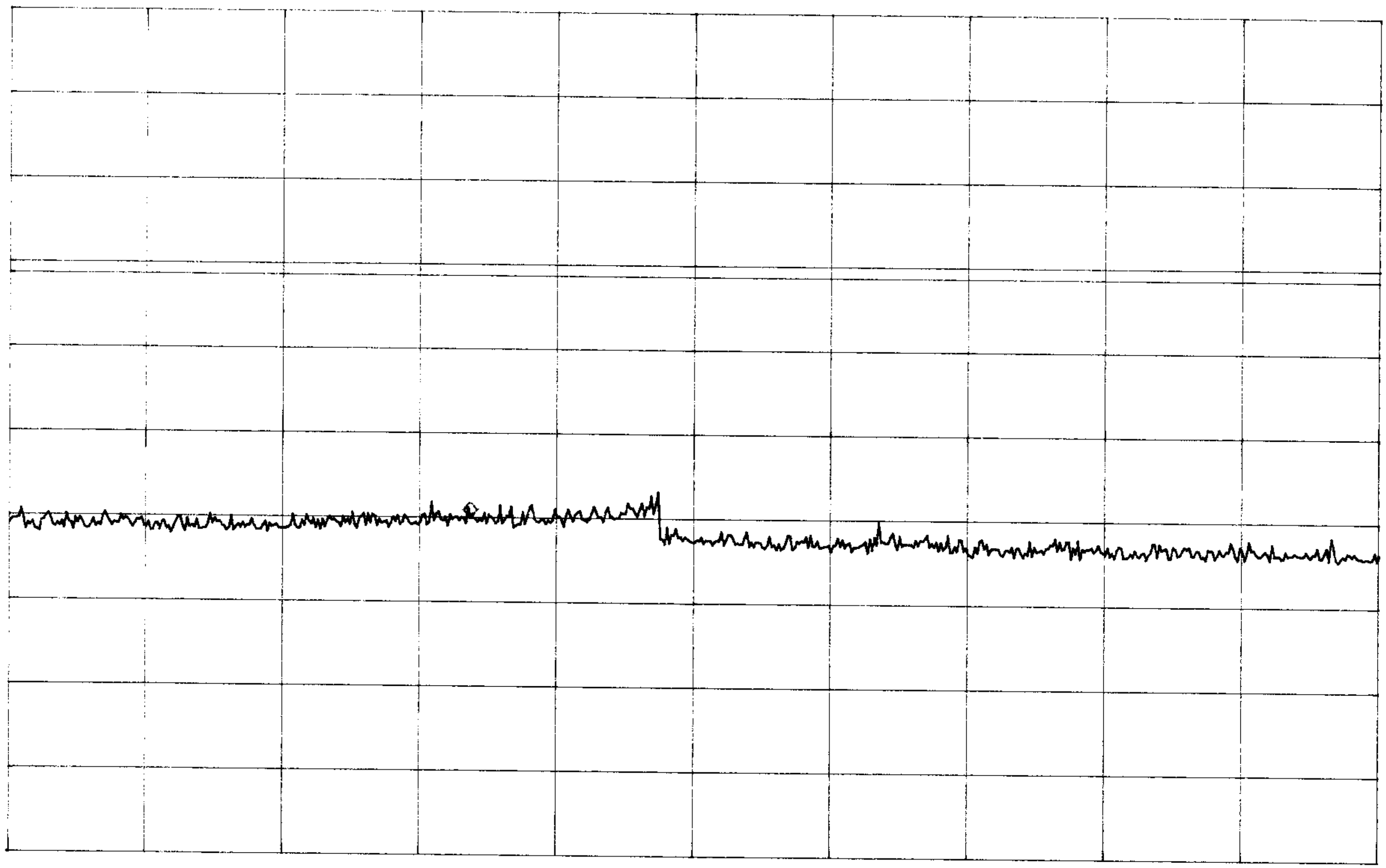
HIGH CHANNEL



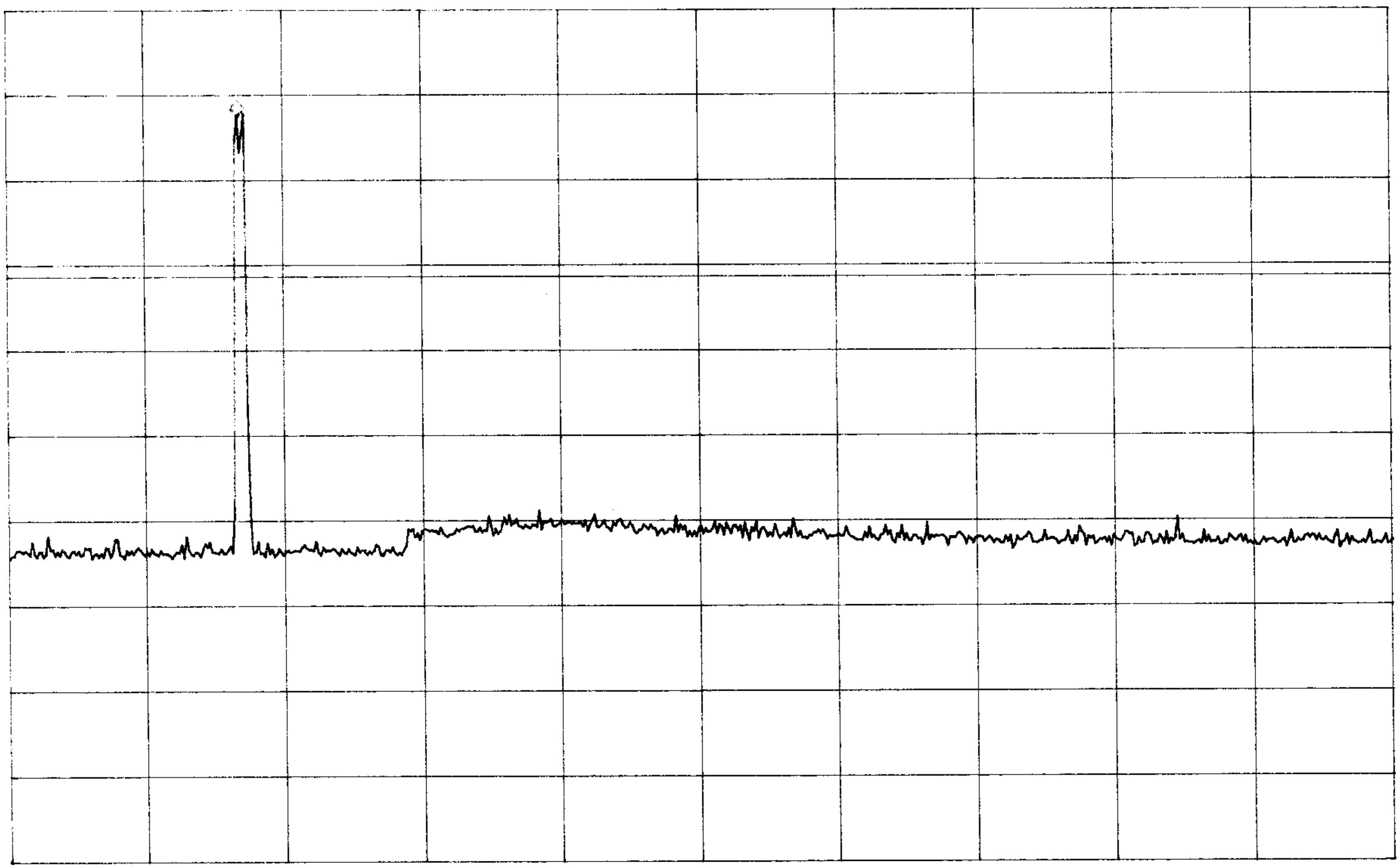
T24801/421



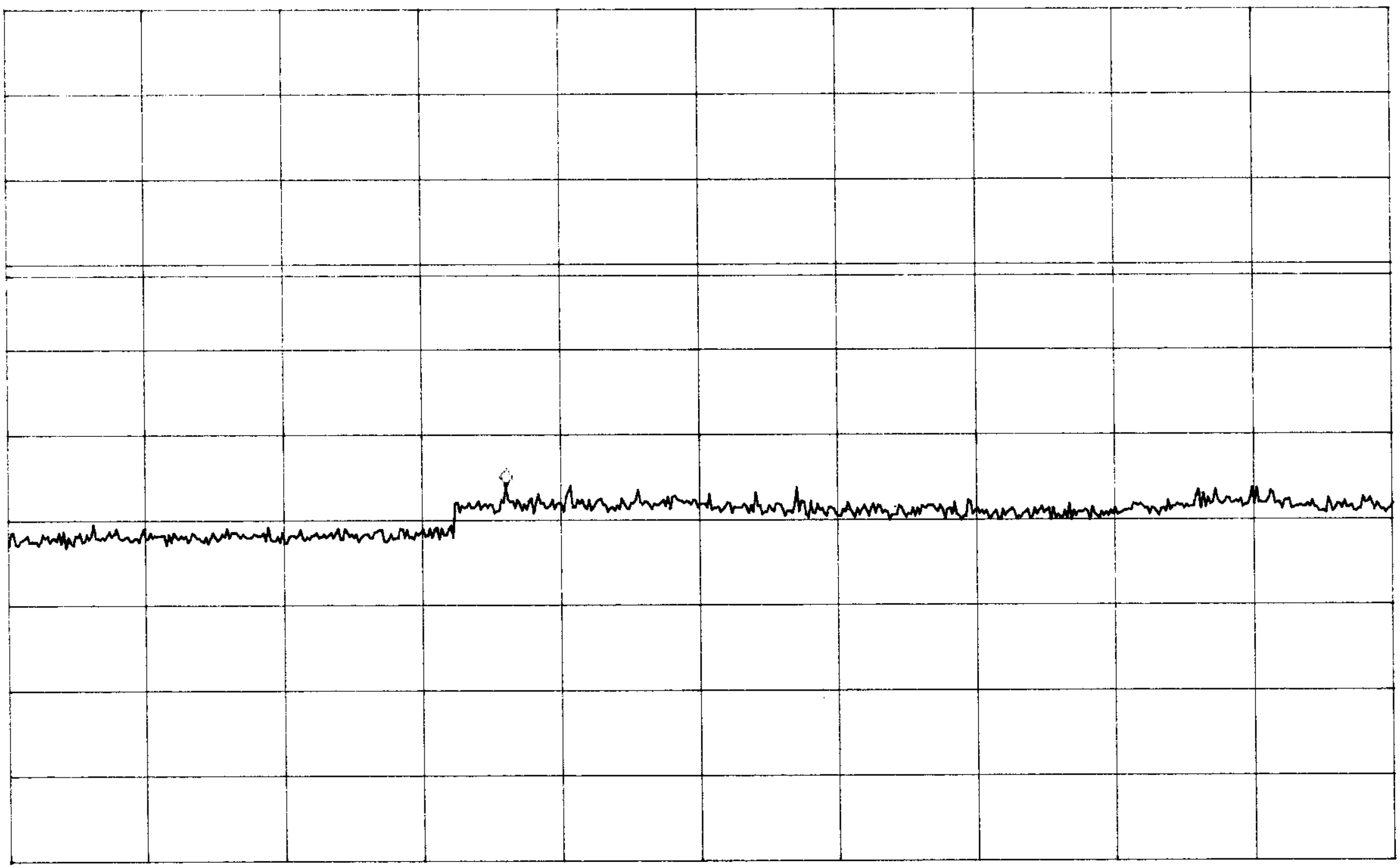
T24801/422



T24801/423

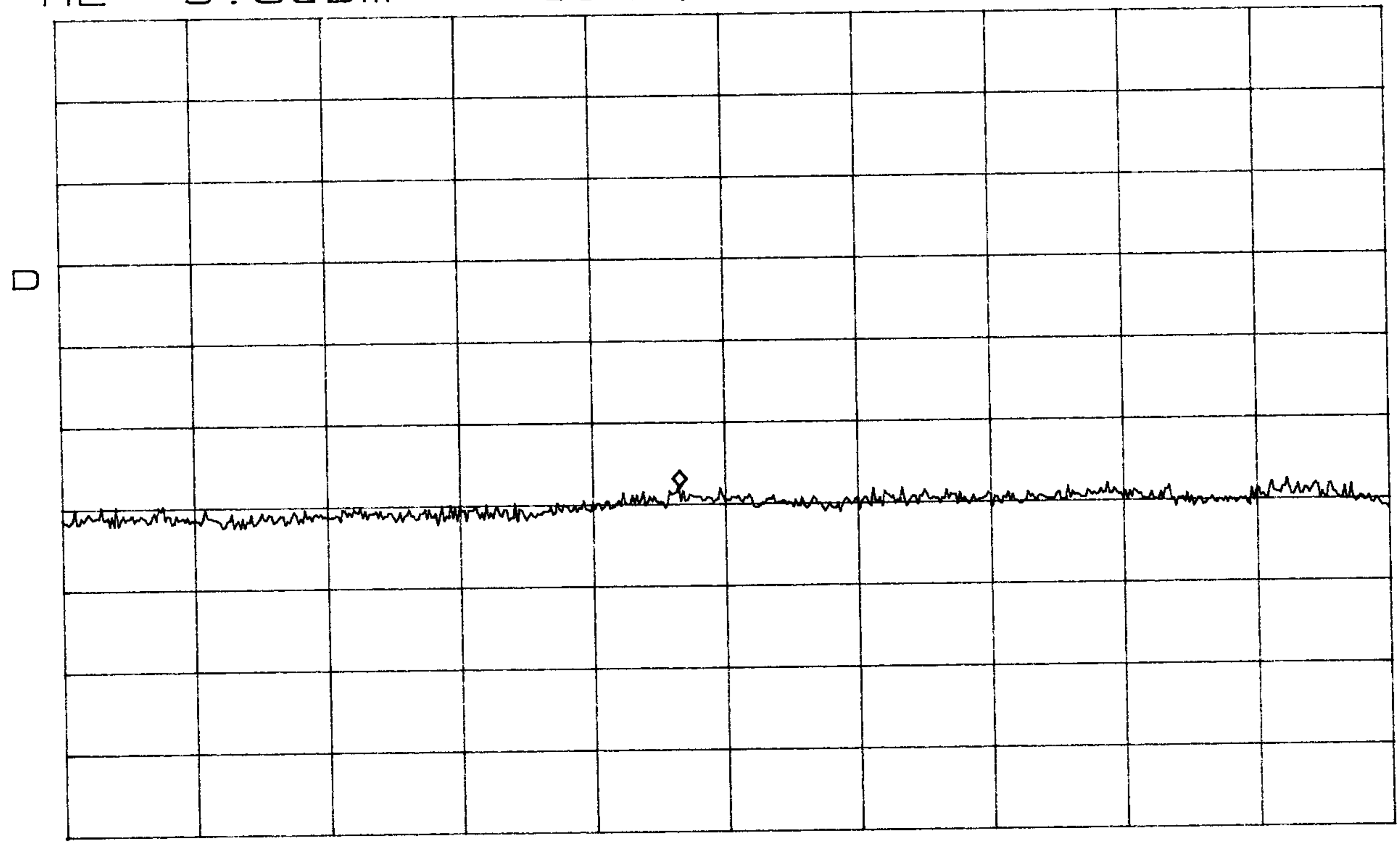


T24801/424



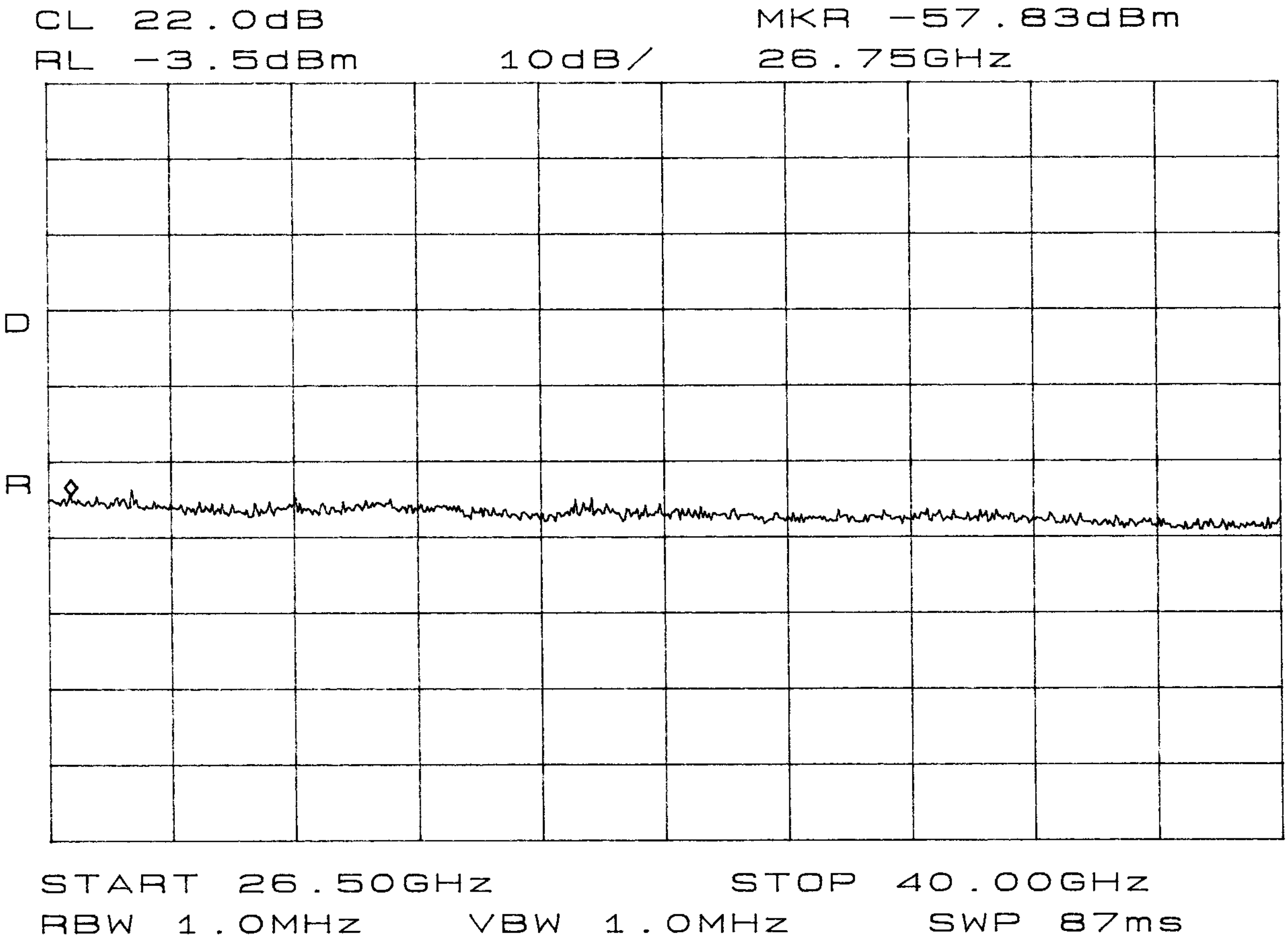
T24801/425

ATTEN 10dB   MKR -61.33dBm
RL -3.5dBm   10dB/   23.023GHz



START 20.000GHz   STOP 26.500GHz
RBW 1.0MHz   VBW 1.0MHz   SWP 130ms

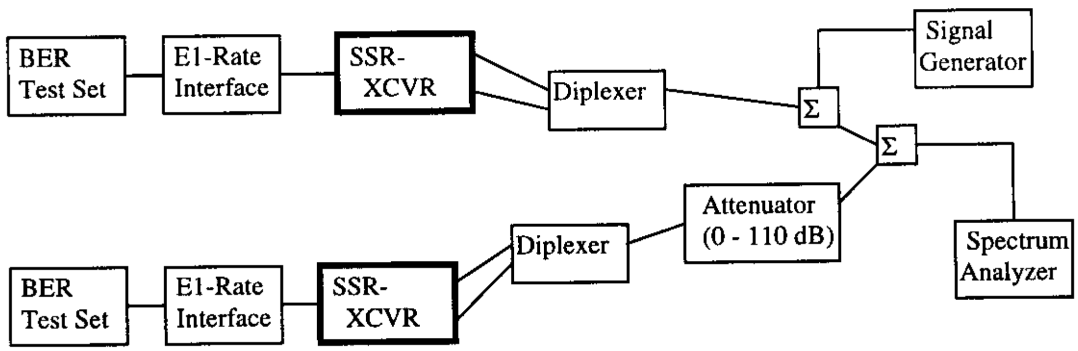
T24801/426


CL 22.0dB
RL -3.5dBm
10dB/
MKR -57.83dBm
26.75GHz
D
R
START 26.50GHz
STOP 40.00GHz
RBW 1.0MHz
VBW 1.0MHz
SWP 87ms

T24801/427

Determination of Processing Gain

The processing gain for the SSR-XCVR was measured using the following setup, as suggested in the FCC ET Docket No. 96-8, Appendix C.



The system was configured such that the SSR-XCVR under test is receiving a signal at its nominal receive signal level of -60 dBm. An HP8648C signal generator is used to inject a CW interference in the 20 MHz passband of the radio. Both the CW interference level and the receive signal levels are measured using the HP 8562E Spectrum Analyzer.

A total of 400 jammer-to-signal (J/S) measurements are made. For each measurement the CW interference level is increased until the SSR-XCVR under test exhibits a 10^{-6} BER consistently. The level of the CW interference is then measured and compared to the signal level at the same point to find the J/S ratio.

From the curve on the following page, we find the E_b/N_0 required for 10^{-6} BER to 10.8 dB. Using DEQPSK modulation we have a 3 dB difference in E_b/N_0 and S/N, making the S/N required for 10^{-6} BER, 13.8 dB. After taking the 400 points in 50 kHz steps across the 20 MHz receiver bandwidth and discarding the worst 20% of these data points we determine the J/S ratio for the SSR-XCVR to be -0.86 dB. Including 2 dB of margin for system losses we find the processing gain to be, 14.94 dB.

$$\text{Processing Gain} = (S/N)_0 + (J/S) + L_{SYS}$$

$$\text{Processing Gain} = 13.8 + (-0.86) + 2 = \mathbf{14.94\ dB.}$$

This measurement procedure gives a processing gain in excess of the 10 dB require under 15.247 but also exceeds theoretical processing gain calculations. A second method of

T24801

processing gain determination was used and found to give a more realistic measure of processing gain. The procedure and data regarding AFC's method is attached.

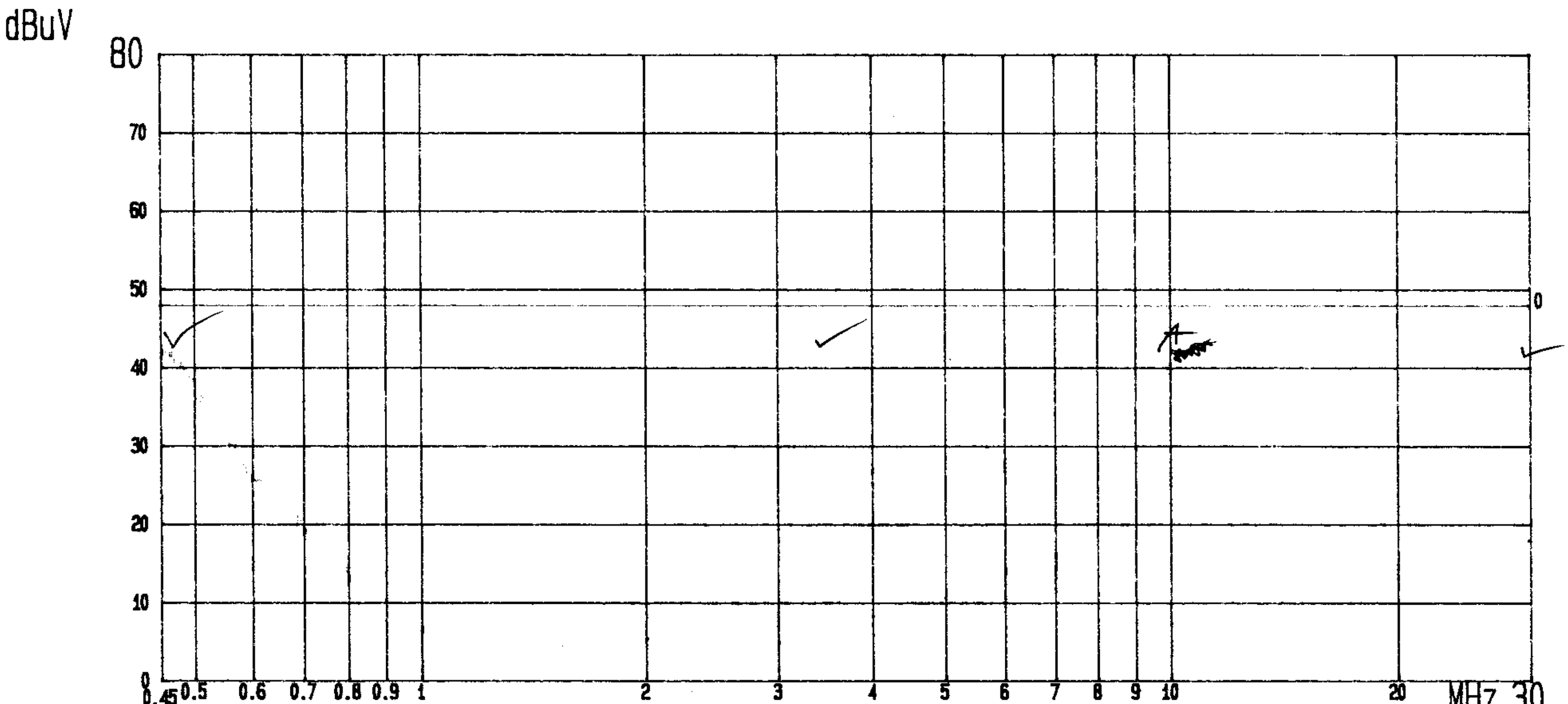
T24801

ELLIOTT LABORATORIES INC. (408) 245-7800
684 W. MAUDE AVE., SUNNYVALE, CA 94086

RFI Voltage Test

Customer: Advanceed Fibre Comm.
E.u.T.: SSR-XCVR 5.76
Run #: 6 T24801
Test Engineer: Rudy Suy
Test spec:
FCC PART 15 GENERAL, SINGLE PHASE, 0.45..30 MHz

Final evaluation: Quasi Peak
* = QUASI PEAK on phase: NEUTRAL



|--- Date 20.JAN.'98 Time 19:03:27
120V / 60Hz √ = EUT A = Ambient

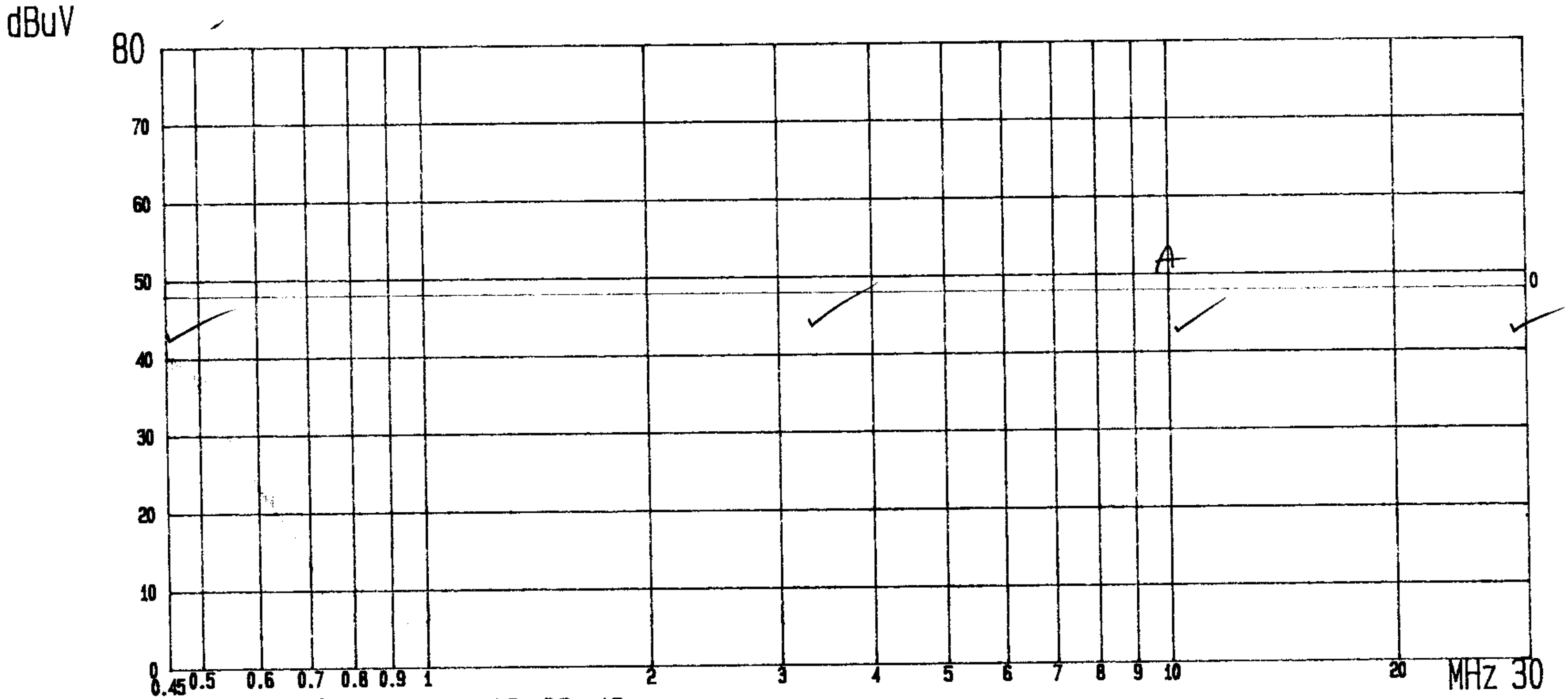
LOW CHANNEL

ELLIOTT LABORATORIES INC. (408) 245-7800
684 W. MAUDE AVE., SUNNYVALE, CA 94086

RFI Voltage Test

Customer: Advanceed Fibre Comm.
E.u.T.: SSR-XCVR 5.78
Run #: 6 T24801
Test Engineer: Rudy Suy
Test spec:
FCC PART 15 GENERAL, SINGLE PHASE, 0.45..30 MHz

Final evaluation: Quasi Peak
* = QUASI PEAK on phase: LINE



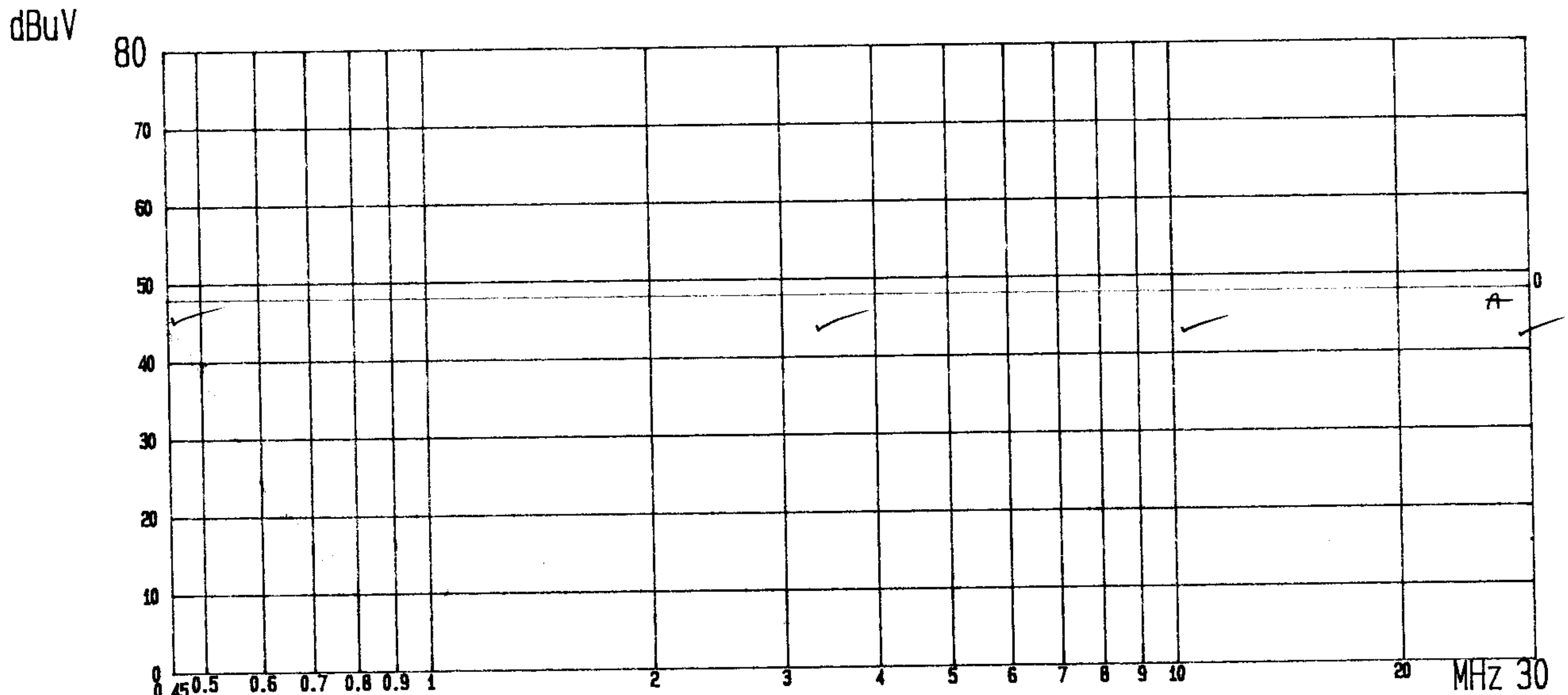
|--- Date 20.JAN.'98 Time 19:29:43
120V / 60Hz ✓ = EUT A = Ambient

LOW CHANNEL

ELLIOTT LABORATORIES INC. (408) 245-7800
684 W. MAUDE AVE.. SUNNYVALE, CA 94086
RFI Voltage Test

Customer: Advanceed Fibre Comm.
E.u.T.: SSR-XCVR 5.7G
Run #: *HIGH CHANNEL
Test Engineer: Rudy Suy
Test spec:
FCC PART 15 GENERAL, SINGLE PHASE, 0.45..30 MHz

Final evaluation: Quasi Peak
* = QUASI PEAK on phase: LINE

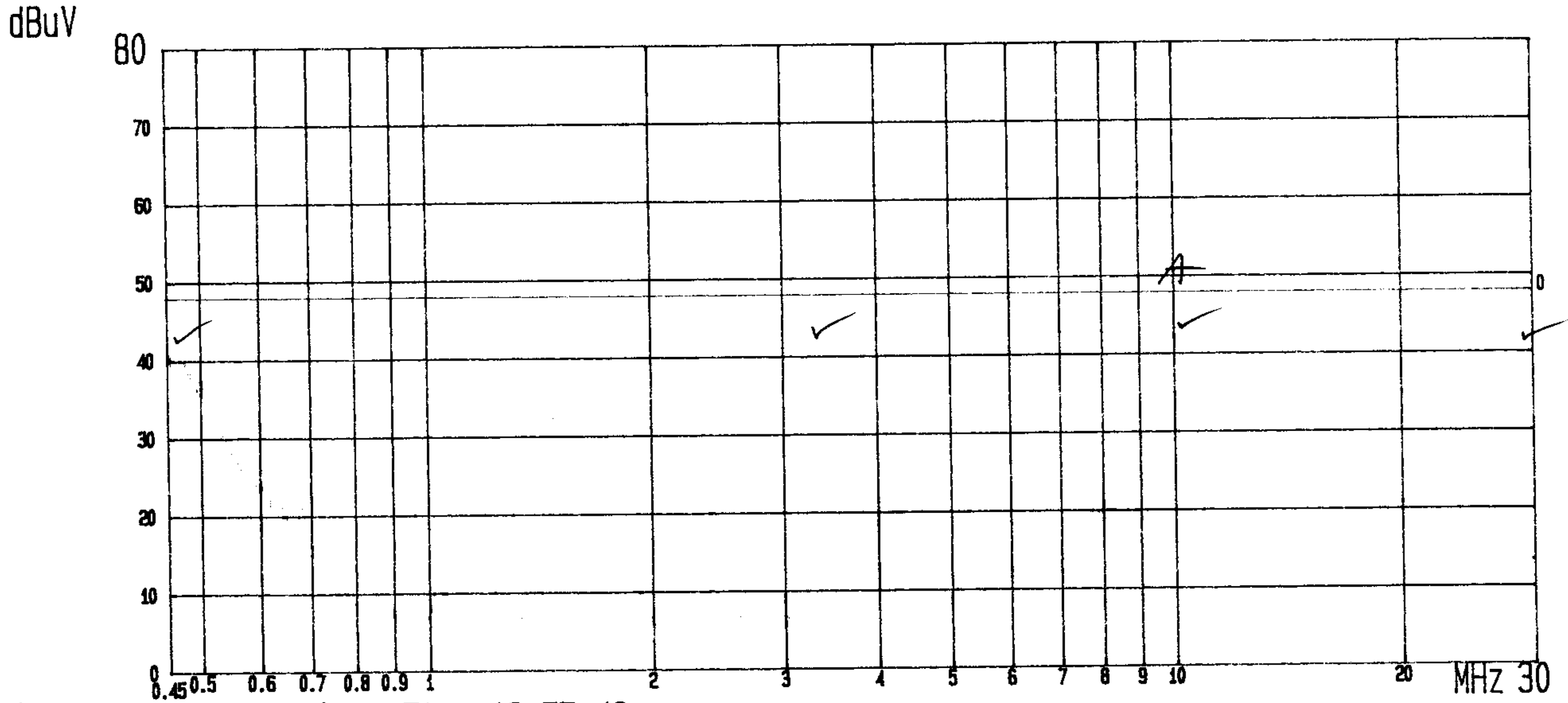


|---- Date 20.JAN.'98 Time 20:12:36
120V / 60Hz √ = EUT A = Ambient

ELLIOTT LABORATORIES INC. (408) 245-7800
684 W. MAUDE AVE., SUNNYVALE, CA 94086
RFI Voltage Test

Customer: Advanceed Fibre Comm.
E.u.T.: SSR-XCVR 5.7G
Run #: *MIDDLE CHANNEL
Test Engineer: Rudy Suy
Test spec:
FCC PART 15 GENERAL, SINGLE PHASE, 0.45..30 MHz

Final evaluation: Quasi Peak
* = QUASI PEAK on phase: LINE



|--- Date 20.JAN.'98 Time 19:57:42
120V / 60Hz √ = EUT A = Ambient

EMC Test Log

ELLIOTT LABORATORIES

Client Name	Advanced Fiber Comm.	Date	4/1/98	Test Engineer	Rudy Suy
Product	SSR-XCVR 5.7 GHz	Page	1 of 6	Project Engineer	Mark Briggs
Test Type	Final Qualification	File	T26014	Client Contact	Scott Pradels
Specification	FCC	Site	SV OATS	Approved	mB

Test Objective

The objective of this test session is to perform final qualification testing of the EUT defined below relative to the specification defined above.

Test Summary

Run #1 Maximized Spurious Emissions Falling In Restricted bands Above 1 GHz. Signals related to LOs of receiver and transmitter circuits.

PASS Results: §15.209 -0.4 dB Ave @ 2290.000 MHz Vertical

Refer to T24801 for details on emissions related to the fundamental transmit frequency. This test run was to measure emissions from the SSR-XCVR not accounted for in the original test. Changes were made to the RF LO bias circuits in order to reduce these emissions to a level below the FCC limit.

Equipment Under Test (EUT) General Description

The UMC SSR-XCVR provides a standard PCM30 interface over a line-of-sight microwave link in the ISM frequency band of 5.725 to 5.850 GHz. The SSR consists of a modular UMC plug-in unit (SSR-XCVR), a transverter, antenna interface module (AIM), and a parabolic reflector antenna. The module contains both the transmit and receive functions necessary to establish a full-duplex E1 span over a microwave radio link.

The system contains the same SSR-XCVR that was approved for use by the FCC under FCC ID:NJV0310-0951. The main differences between this system and the NJV0310-0951 system is that a transverter is used to up-convert the output from the SSR-XCVR from a 2.4GHz-band into the 5.7 GHz band.

The SSR-XCVR employs a direct sequence spread spectrum (DSSS) coding combined with a QPSK modem. The DSSS coding applies an 11-bit PN sequence to the data, resulting in a processing gain of over 10 dB.

Equipment Under Test (EUT)

Manufacturer/Model/Description	Serial Number	FCC ID Number
AFC / 8100-0210 / SSR-XCVR - Transceiver plug-in card	AFC03379747	NJV0310-0952
AFC/ 8650-5678/ Antenna Interface Module (AIM)	AFC	NJV0310-0952
Micro source/ MSS020641301 / Transverter	DEMO-001	NJV0310-0052

ELLIOTT LABORATORIES

EMC Test Log

Client Name	Advanced Fiber Comm.	Date	4/1/98	Test Engineer	Rudy Suy
Product	SSR-XCVR 5.7 GHz	Page	2 of 6	Project Engineer	Mark Briggs
Test Type	Final Qualification	File	T26014	Client Contact	Scott Pradels
Specification	FCC	Site	SV OATS	Approved	MB

Local Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
AFC/ 0210-0001/ Broad Band Assembly (BBA)	01153188	N/A
AFC/ 8100-0200 / CPU	01005837	N/A
AFC/ 8100-0016 / E1-XCVR	-	N/A
AFC/ 8100-0037 / POTS	-	N/A
TECOM / 508038DR / 1 meter dish (31 dB @ 5.7 GHz)	Proto	N/A

The Universal Modular Carrier (UMC) System 1000 is a modern and flexible digital loop carrier system. The UMC 1000 is capable of fitting into diverse networks, utilizing various transport mediums, in a virtually limitless number of configurations.
The BBA shelf is used at both the Central Office and at remote sites. The BBA can be equipped in a cabinet, or rack mounted in a building or controlled environmental vault.

The SSR-XCVR is one on many plug-in cards available for the UMC 1000. Additional cards must be utilized to operate the SSR-XCVR. A CPU which is responsible for overall control of the UMC, is required in any primary shelf in the UMC 1000. The provisioning of the SSR-XCVR is controlled by the CPU. An additional redundant CPU is utilized for the test. A Power Supply Unit is also required. For testing purpose, the R-PSU used in remote cabinets was utilized.

Power Supply and Line Filters

Description	Manufacturer	Model
Universal Power Assembly (UPA)	AFC	0210-0012

In some cases, the Universal Power Assembly (UPA) is utilized to provide power for the UMC 1000. THe UPA can be used as a charger/rectifier for terminals using local AC power, and Express power provider to other terminals, and a +/- 130 Vdc to -48 Vdc rectifier for terminals utilizing Express power.

Antennas

The system can be installed with the following antennas:

1m - 31 dBi
2' - 28 dBi
4' - 35 dBi
6' - 38 dBi

The antennas connect to the AIM via a N-type connector. Since the system is professionally installed and is used for fixed point-to-point operation the antenna requirements of FCC Part 15 for spread spectrum radios are met.

During testing a 1 meter Telecom dish with 31 dBi of gain antenna was used. This configuration was agreed upon by Greg Czumak of the FCC as the only configuration that was required to be tested. Initial testing showed that the levels of the spurious emissions were independent of antenna orientation (i.e. they were no higher when the antenna was directed at the measurement antenna. For stability the antenna was placed on its back during the remainder of the testing (when the antenna was standing upright it would jostle backwards as the turntable was rotated). This is further justified by the fact that none of the LO signals or harmonics of the transmit signal were observed on the output antenna port (refer to run #4 of T24801).

Interface Cabling

Cable Description	Length (m)	From Unit/Port	To Unit/Port
Semflex SW-110 Coax	4'	SSR TX	Transverter 2.4 in
Semflex SW-110 Coax	4'	SSR-RX	Transverter 2.4 out
Semflex SW-110 Coax	4'	Transverter out	CAA TX
Semflex SW-110 Coax	4'	Transverter in	CAA RX
Semflex SW-110 Coax	4'	SSR Reference	Transverter Ref.
LMR-400	4'	CAA TX	AIM TX
LMR-400	4'	CAA RX	AIM RX
LMR-400	4'	AIIM Antenna	Antenna

All Semflex cables are standard and sold with the AFC system. The LMR-400 cables are not sold with the SSR-XCVR. The length of these cables vary with the height at which that AIM box is mounted. A 4' section of cable is used so that emissions and output power is maximized.

ELLIOTT LABORATORIES

EMC Test Log

Client Name	Advanced Fiber Comm.	Date	4/1/98	Test Engineer	Rudy Suy
Product	SSR-XCVR 5.7 GHz	Page	4 of 6	Project Engineer	Mark Briggs
Test Type	Final Qualification	File	T26014	Client Contact	Scott Pradels
Specification	FCC	Site	SV OATS	Approved	MB

Printed Wiring Boards in EUT

Manufacturer/Description	Assembly #	Rev.	Serial Number	Crystals (MHz)
AFC / SSR-XCVR	8100-0210	1E	AFC03130292	10, 22.528
AFC / SSR-XCVR	8100-0210	1E	AFC03130290	10, 22.528

Subassemblies in EUT

Manufacturer/Description	Assembly Number	Rev.	Serial Number
Microsource Low Noise Amplifier (in AIM)	MSS575841301	-	1044-50
Microsource Transverter	MSS020641303	-	DEMO-001
Lorch Microwave Diplexer Low/mid Channel	D7CF4-5745/5810-S	-	X8
Lorch Microwave Diplexer High Channel	D7CF4-5765/5830-S	-	X1

EUT Enclosure(s)

The SSR-XCVR does not utilize an enclosure. It is designed to be installed in the BBA. In certain cases, the system is installed in environmental sealed remote subscriber cabinets manufactured by AFC.

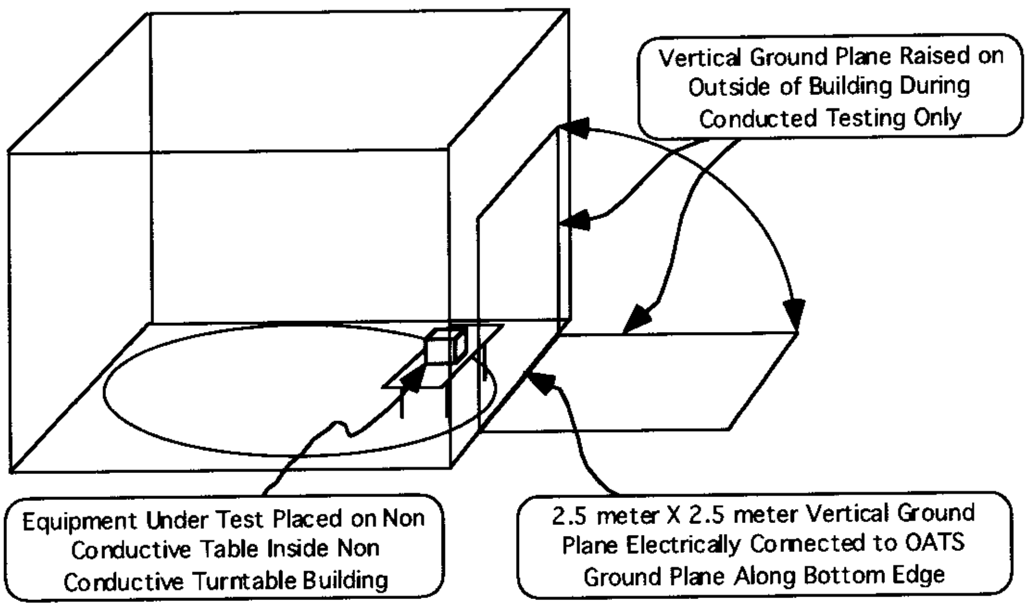
The AIM enclosure is primarily constructed of aluminum. It measures approximately 26cm x 13cm x 9cm.

The Transverter enclosure is primarily constructed of sheet metal. It measures approximately 48cm x 33cm x 5cm.

General Test Conditions

During testing, the EUT was connected to 120V/60Hz power input. The EUT was located on the turntable for radiated testing and on the conducted bench for conducted testing.

During conducted emissions testing a 2.5 meter X 2.5 meter ground plane is raised to a vertical position 40 cm from the EUT as shown below:



Test Software/Operating Modes

The UMC 1000 test software was CPU release 3.2.0. This software provides the common control for the entire system.

The SSR-XCVR was loaded with software release 1.0.8. The software monitors the operating frequency and provisions the card for proper output power.

The system was set to constantly transmit at either the low, center or high channel as detailed in the test run descriptions.

ELLIOTT LABORATORIES

EMC Test Log

Client Name: Advanced Fiber Comm.	Date: 4/1/98	Test Engineer: Rudy Suy	
Product: SSR-XCVR 5.7 GHz	Page: 6 of 6	Project Engineer: Mark Briggs	
Test Type: Final Qualification	File: T26014	Client Contact: Scott Pradels	
Specification: FCC	Site: SV OATS		Approved: mb

Test Data Tables

Run #1 - Maximized Radiated Emissions Scan, Fundamental and Harmonics of Local Oscillators (Receiver and transmitter) Falling In Restricted Bands Above 1 GHz, Sorted by Margin. Test performed on 4/1/98

Frequency MHz	Level dBuV/m	Pol v/h	FCC Limit	FCC Margin	Azimuth degrees	Height meters	Comments
High Channel							
2290.000	53.6	v	54.0	-0.4	340	1.1	Ave.
2290.000	50.8	h	54.0	-3.2	320	1.1	Ave.
4580.000	45.8	h	54.0	-8.2	0	1.1	Ave.
4580.000	44.7	v	54.0	-9.3	340	1.1	Ave.
2270.000	42.8	h	54.0	-11.2	330	1.2	Ave.
2270.000	39.5	v	54.0	-14.5	0	1.1	Ave.
2290.000	56.7	v	74.0	-17.3	340	1.1	Peak
4580.000	56.5	h	74.0	-17.5	0	1.1	Peak
4580.000	56.2	v	74.0	-17.8	340	1.1	Peak
2290.000	55.1	h	74.0	-18.9	320	1.1	Peak
2270.000	50.0	h	74.0	-24.0	330	1.2	Peak
2270.000	48.6	v	74.0	-25.4	0	1.1	Peak
Middle Channel							
2250.000	52.3	v	54.0	-1.7	340	1.1	Ave.
4500.000	51.4	h	54.0	-2.6	340	1.1	Ave.
2250.000	49.3	h	54.0	-4.7	320	1.1	Ave.
4500.000	48.1	v	54.0	-5.9	30	1.1	Ave.
2330.000	40.7	h	54.0	-13.3	330	1.2	Ave.
4500.000	59.3	h	74.0	-14.7	340	1.1	Peak
2330.000	38.7	v	54.0	-15.3	350	1.1	Ave.
2350.000	38.0	h	54.0	-16.0	320	1.1	Ave.
4500.000	57.8	v	74.0	-16.2	30	1.1	Peak
2350.000	36.7	v	54.0	-17.3	350	1.1	Ave.
2250.000	56.0	v	74.0	-18.0	340	1.1	Peak
2250.000	54.1	h	74.0	-19.9	320	1.1	Peak
2330.000	51.0	h	74.0	-23.0	330	1.2	Peak
2330.000	49.1	v	74.0	-24.9	350	1.1	Peak
2350.000	48.9	h	74.0	-25.1	320	1.1	Peak
2350.000	48.2	v	74.0	-25.8	350	1.1	Peak

Note: LO signals for low channel do not fall in restricted bands.

EXHIBIT C

Photographs of Test Configurations

(Please refer to the note in the test data found in Exhibit B regarding the orientation of the system's transmit antenna during radiated emissions testing)