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 OTC Telecom, Inc. Model: AirEzy 2405

FCC ID:	MKZAZY2405SWG
GRANTEE:	OTC Telecom, Inc. 2036 Bering Drive San Jose, CA 95131
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	January 11, 1999
FINAL TEST DATE:	November 13, 1998 and January 6, 1999

AUTHORIZED SIGNATORY: _____

David W. Bare
Principal Engineer

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SCOPE

An electromagnetic emissions test has been performed on the OTC Telecom, Inc. Spread Spectrum radio system model AirEzy 2405 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 as outlined in Elliott Laboratories test procedures.

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 OTC Telecom, Inc.model AirEzy 2405 and therefore apply only to the tested sample. The sample was selected and prepared by Weiming Ou of OTC Telecom, 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.

STATEMENT OF COMPLIANCE

The tested sample of OTC Telecom, Inc.model AirEzy 2405 complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators.

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.).

EMISSION TEST RESULTS

The following emissions tests were performed on the OTC Telecom, Inc.model AirEzy 2405. The actual test results are contained in an exhibit of this report.

LIMITS OF CONDUCTED INTERFERENCE VOLTAGE

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.207.

The following measurement was extracted from the data recorded during the conducted emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

120V, 60Hz

Frequency MHz	Level dBuV	Power Lead	FCC Limit	FCC Margin	Detector QP/Ave	Comments
1.3712	43.6	Neutral	48.0	-4.4	QP	

LIMITS OF ANTENNA CONDUCTED POWER

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247.

The highest out-of-band (Un-restricted) emission recorded in any 100 kHz band was more than 20 dB below the in-band level. The actual test data and any correction factors are contained an exhibit of this report.

LIMITS OF RADIATED INTERFERENCE FIELD STRENGTH

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247 and 15.209 in the case of emissions falling within the frequency bands specified in Section 15.205.

The following measurement was extracted from the data recorded during the radiated electric field emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

Frequency MHz	Level dBuV/m	Pol v/h	FCC Limit	FCC Margin	Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
2488.533	67.0	v	74.0	-7.1	Peak	252	1.0	Band Edge

LIMITS OF POWER AND BANDWIDTH

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247.

The maximum power output was 13.2 dBm on channel 1. The minimum 6 dB bandwidth was 8.1 Megahertz on channel 3. The actual test data and any correction factors are contained in an exhibit of this report.

MEASUREMENT UNCERTAINTIES

ISO Guide 25 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	30 to 1000	± 3.2

COMPLIANCE EXPLANATION

When the measurement uncertainties (see above section) associated with the emission test methods and equipment used are taken into consideration there are four possible results as detailed below:

Complied
All measurements recorded were below the specification limit by a margin greater than the measurement uncertainty.

Probably Complied
One or more measurements recorded were below the specification limit by a margin less than the measurement uncertainty. It is not possible to determine that the unit complied with a 95% confidence level from the results. There is a high probability that the product tested does comply.

Probably Did Not Comply
One or more measurements recorded were above the specification limit by a margin less than the measurement uncertainty. It is not possible to determine that the unit failed to comply with a 95% confidence level from the results. There is a high probability that the product tested does not comply.

Did Not Comply
One or more measurements recorded exceeded the specification limit by a margin greater than the measurement uncertainty.

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The OTC Telecom, Inc.model AirEzy 2405 is a Spread Spectrum radio system which utilizes direct sequence and is designed to use the allocated frequency band of 2400-2483.5 MHz. It has three channels located at 2422, 2442.5, and 2462 MHz. The sample was received on November 13, 1998 and tested on November 13, 1998 and January 6, 1999. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number	FCC ID Number
OTC Telecom AirEzy 2405 2.4GHz Radio	02	MKZAZY2405SWG

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
120V AC to 5V DC external power supply	AK Class II Power Supply	A10D1-05MP

PRINTED WIRING BOARDS

The EUT contained the following printed wiring boards during emissions testing:

Manufacturer/Description	Assembly #	Rev.	Serial #	Crystals (MHz)
RF PCB	1710-242001-07	07	-	10
Digital PCB	1710-2410BT-0D	OD	-	44

SUBASSEMBLIES

The EUT contained the following subassembly modules during emissions testing:

Manufacturer/Description	Assembly #	Rev.	Serial Number
RF/Digital subassembly	0010-240504-00	-	-

ENCLOSURE

The EUT enclosure is primarily constructed of molded plastic. It measures approximately 5 cm wide by 2 cm deep by 12 cm high.

SUPPORT EQUIPMENT

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

Manufacturer/Model/Description	Serial Number	FCC ID Number
HP Pavilion 8240 PC	US81200619	DoC
HP M-S34 Mouse	LZB81100298	DoC
HP 2225C+ Printer	2714S40166	DSI6XU2225
Gateway E0150US016-C Keyboard	J8240N0889	DoC
Gateway 500-069EV Monitor	15009A804758	BEJCS592

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
Parallel	1.5	Printer	Host PC / Parallel
Keyboard	1.5	Keyboard	Host PC
Serial	1.5	Mouse	Host PC
VGA	1.5	Monitor	Host PC
EtherNet	0.5	EUT RJ45	Host PC / EtherNet

TEST SOFTWARE

During emissions testing the EUT transmitter was set to continuous transmit mode, using OTC Telecom test program OTCFCC. Normally, this device transmits a maximum of 10msec in any 100msec interval.

TEST SITE

GENERAL INFORMATION

Final field strength and power line conducted emission measurements were taken on November 13, 1998 at the Elliott Laboratories Open Area Test Site #2 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. 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 CISPR 16-1 is used for emissions measurements. The receivers used 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 CISPR 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

The receivers utilize either a Rohde and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, 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. A personal computer is used to record all measurments made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the 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 LISN used also contains a 250 uH 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 thermister mount are used for all direct output power measurements from transmitters as they provide a broadband indication of the power output.

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 entire 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 exhibit 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 MHz up to the frequency required by the regulation specified on page 1. 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.

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer 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, SECTION 15.207

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

RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209

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

EXHIBIT 1: Test Equipment Calibration Data

Test Equipment List - SVOATS#2

	Manufacturer/Description		Model	Asset #	Interval	Last Cal	Cal Due
☐	Com-Power	Comb Generator, 1 / 5 MHz Step	CG-515	467	6	7/29/98	1/29/99
☐	Elliott Laboratories	FCC / CISPR LISN	LISN-4, OATS	362	12	6/30/98	6/30/99
☐	Elliott Laboratories	2 x (Solar 8028 LISN + 6512 Caps)	LISN-5,	379	12	6/26/98	6/26/99
☑	EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	487	12	6/18/98	6/18/99
☐	EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	786	12	11/13/97	5/13/99
☐	EMCO	Biconical Antenna	3110B	801		6/4/97	12/4/98
☐	EMCO	Antenna, Log Periodic	3146A	802	12	6/13/97	12/13/98
☐	EMCO	Horn Antenna, 1-18 GHz	3115		12	10/21/98	10/21/99
☐	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, 1-26.5GHz	8449B	263, (F303)	12	6/8/98	6/8/99
☐	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
☐	Hewlett Packard	Preamplifier, 1-26.5 GHz	8449B		12	9/15/98	9/15/99
☐	Hewlett Packard	Spectrum Analyzer, 9 KHz-6.5 GHz	8595E-041-103-		12	5/11/98	5/11/99
☑	Narda-West	EMI Filter 5.6 GHz, High Pass	60583 HXF370	247	12	8/10/98	8/10/99
☐	Narda-West	EMI Filter 2.4 GHz, High Pass	60583 HPF-161	248	12	8/10/98	8/10/99
☐	Rohde & Schwarz	Test Receiver	ESN	775	12	6/22/98	6/22/99
☐	Rohde& Schwarz	Pulse Limiter	ESH3Z2	811	12	2/5/98	2/5/99
☐	Solar Electronics	High Pass Filter, fc = 100 kHz	7930-100	222, (F336)	12	7/20/98	7/20/99

File Number: T29204

Date: 11/13/98

Engr: Jerry F. Lucy

All calibration of equipment is traceable to a national standard of measurement such as NIST.

Test Equipment List - SVOATS#2

January 5, 1999

	Manufacturer/Description		Model	Asset #	Interval	Last Cal	Cal Due
☐	A.H. Systems	D. Ridge Horn Antenna, .7-18GHz	SAS200-571	Metric, 135	12	12/28/98	12/28/99
☐	Elliott Laboratories	2 x (Solar 8028 LISN + 6512 Caps)	LISN-5,	379	12	6/26/98	6/26/99
☐	Elliott Laboratories	300-1000 MHz Log Periodic	EL300.1000	297, (F113)	12	11/30/98	11/30/99
☐	Elliott Laboratories	FCC / CISPR LISN	LISN-4, OATS	362	12	6/30/98	6/30/99
☐	EMCO	Biconical Antenna, 30-300 MHz	3110B	801	12	12/12/98	12/12/99
☐	EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	487	12	6/18/98	6/18/99
☐	EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	868	12	9/22/98	9/22/99
☐	Hewlett Packard	EMC Receiver /Analyzer	8595EM	780	12	1/4/99	1/4/2000
☐	Hewlett Packard	EMC Receiver /Analyzer	8595EM	787	12	11/23/98	11/23/99
☐	Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263, (F303)	12	6/8/98	6/8/99
☐	Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	12	11/25/98	11/25/99
☐	Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	12	11/12/98	11/12/99
☑	Hewlett Packard	Power Meter	432A	259, (F304)	12	3/10/98	3/10/99
☑	Hewlett Packard	Spectrum Analyzer	8563E	284, (F194)	12	1/14/98	1/14/99
☐	Hewlett Packard	Spectrum Analyzer, 9 KHz-6.5 GHz	8595E-041-103-	Metric, 885	12	5/11/98	5/11/99
☑	Hewlett Packard	Thermistor Mount	478A	652	12	3/10/98	3/10/99
☐	Narda-West	EMI Filter 2.4 GHz, High Pass	60583 HPF-161	248	12	4/27/98	4/27/99
☐	Narda-West	EMI Filter 5.6 GHz, High Pass	60583 HXF370	247	12	4/27/98	4/27/99
☐	Rohde& Schwarz	Pulse Limiter	ESH3Z2	811	12	12/8/98	12/8/99
☐	Rohde & Schwarz	Test Receiver	ESN	775	12	6/22/98	6/22/99

File Number: T29785

Date: 1-6-99

Engr: DW Baur

All calibration of equipment is traceable to a national standard of measurement such as NIST.

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T 29204 4 Pages
T29785 21 Pages

Elliott

EMC Test Log

Client:	OTC Telecom	Date:	11/13/98	Test Engr:	Jerry / Rudy
Product:	AirEzy 2405	File:	T29204	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #2	Contact:	Weiming Ou
Spec:	FCC Part 15	Page:	1 of 4	Approved:	
Revision	1.0				

Ambient Conditions	
Temperature:	6 ℃
Humidity:	85 %

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. Conducted emissions was done on 11/9/98 D29134 and radiated emissions below 1GHz. was done on 10/26/98 T28919.

Note: No signal was seen above the third Harmonic of the fundamental by probing the EUT with the 1-18GHz antenna in both polarizations.

Test Summary

Run #1 - Maximized Radiated Emissions Scan, 1-25 GHz, Center Channel

PASS Results: FCC -8.8 dB Pk @ 7327.790 MHz Vertical

Run #2 - Maximized Radiated Emissions Scan, 1-25 GHz, Low Channel

PASS Results: FCC -11.8 dB Pk @ 7267.370 MHz Horizontal

Run #3 - Maximized Radiated Emissions Scan, 1-25 GHz, High Channel

PASS Results: FCC -7.1 dB Pk @ 2488.533 MHz Vertical

Run #4 - Conducted Emissions Scan of EUT, 0.15-30.00 MHz, **120V, 60Hz**

PASS Results: FCC -4.4 dB QP @ 1.3712 MHz Neutral

Equipment Under Test (EUT) General Description

The EUT is a Spread Spectrum radio system which utilizes direct sequence and is designed to use the allocated frequency band of 2440-2483.5 MHz. Normally, the EUT would be attached to a PC Ethernet Port. The EUT was placed in the position during testing to simulate the end user environment. For the purpose of testing the EUT was treated as table top equipment.

Client:	OTC Telecom	Date:	11/13/98	Test Engr:	Jerry / Rudy
Product:	AirEzy 2405	File:	T29204	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #2	Contact:	Weiming Ou
Spec:	FCC Part 15	Page:	2 of 4	Approved:	
Revision	1.0				

Equipment Under Test (EUT)

Manufacturer/Model/Description	Serial Number	FCC ID Number
OTC Telecom AirEzy 2405 2.4GHz Radio	02	MKZAZY2405SWG

Power Supply and Line Filters

The EUT used the following external AC-DC adapter:

Description	Manufacturer	Model
120V AC to 5V DC external power supply	AK Class II Power Supply	A10D1-05MP

Printed Wiring Boards in EUT

The following information was provided by the manufacturer:

Manufacturer/Description	Assembly #	Rev.	Serial Number	Crystals (MHz)
RF PCB	1710-242001-07	07		10
Digital PCB	1710-2410BT-0D	OD		44

Subassemblies in EUT

The following information was provided by the manufacturer:

Manufacturer/Description	Assembly Number	Rev.	Serial Number
RF/Digital subassembly	0010-240504-00	-	-

EUT Enclosure(s)

The EUT enclosure is primarily constructed of molded plastic. It measures approximately 5 cm wide by 2 cm deep by 12 cm high.

Client:	OTC Telecom	Date:	11/13/98	Test Engr:	Jerry / Rudy
Product:	AirEzy 2405	File:	T29204	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #2	Contact:	Weiming Ou
Spec:	FCC Part 15	Page:	3 of 4	Approved:	
Revision	1.0				

EMI Suppression Devices (filters, gaskets, etc.)

The following information was provided by the manufacturer:

Description	Manufacturer	Part Number
None		

Local Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
HP Pavilion 8240 PC	US81200619	DoC
HP M-S34 Mouse	LZB81100298	DoC
HP 2225C+ Printer	2714S40166	DSI6XU2225
Gateway E0150US016-C Keyboard	J8240N0889	
Gateway 500-069EV Monitor	15009A804758	BEJCS592

Remote Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
None		

Interface Cabling

Cable Description	Length (m)	From Unit/Port	To Unit/Port
Parallel	1.5	Printer	Host PC / Parallel
Keyboard	1.5	Keyboard	Host PC
Serial	1.5	Mouse	Host PC
VGA	1.5	Monitor	Host PC
EtherNet	0.5	EUT RJ45	Host PC / EtherNet

Test Software

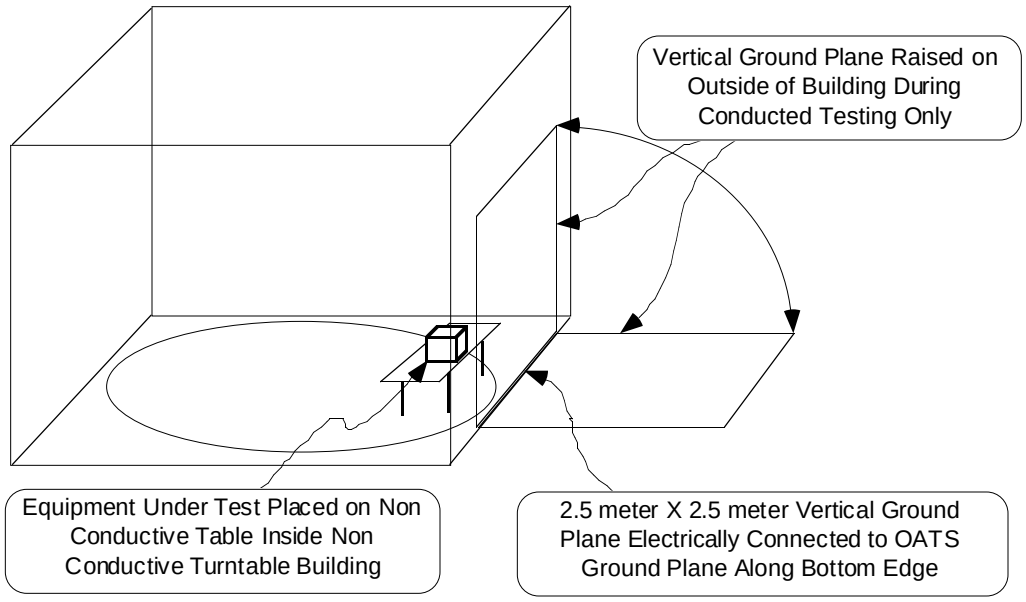
During emissions testing the EUT transmitter was set to continuous transmit and recieve mode, using OTC Telecom test program OTCFCC.

Client:	OTC Telecom	Date:	11/13/98	Test Engr:	Jerry / Rudy
Product:	AirEzy 2405	File:	T29204	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #2	Contact:	Weiming Ou
Spec:	FCC Part 15	Page:	4 of 4	Approved:	
Revision	1.0				

General Test Conditions

During radiated testing, the EUT was connected to 120V, 60Hz power input. The EUT and all local support equipment were located on the turntable for radiated testing and conducted testing.

During conducted emissions testing, the EUT was connected to 120V, 60Hz power input as noted. A 2.5 meter X 2.5 meter ground plane was raised to a vertical position 40 cm from the EUT as shown below:



Test Data Tables

See attached data

Emissions Test Data

Client:	OTC Telecom	Date:	11/13/98	Test Engr:	Jerry / Rudy
Product:	AirEzy 2405 (2.4GHz. Radio)	File:	T29204	Proj. Engr:	Mark Briggs
Objective	Final Qualification	Site:	SVOATS #2	Contact:	York
Spec:	FCC Part 15	Distance:	3m	Approved:	

Ambient Conditions

Temperature: 6 ℃
Humidity: 85 %

All readings have included AF, Cable Losses and Pre-Amp Gain.
Band Edge measurement was done only on the High Channel.

Run #1: Radiated Emissions 1-25GHz, Restricted Band Measurement
Center Channel, 2.44GHz.

Frequency	Level	Pol	FCC B	FCC B	Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7327.790	65.3	v	74.0	**-8.8**	Peak	250	1.8	
7327.790	65.3	h	74.0	**-8.8**	Peak	250	1.8	
7327.790	43.5	v	54.0	**-10.5**	Avg	250	1.8	
4885.058	59.3	h	74.0	**-14.7**	Peak	250	1.0	
4885.058	58.1	v	74.0	**-15.9**	Peak	290	1.0	
4885.058	37.6	v	54.0	**-16.4**	Avg	290	1.0	
4885.058	36.0	h	54.0	**-18.0**	Avg	250	1.0	
7327.790	32.7	h	54.0	**-21.3**	Avg	250	1.8	

Note 1. -10dB subtracted from Avg Reading for Duty Cycle correction factor.

Run #2: Radiated Emissions 1-25GHz, Restricted Band Measurement
Low Channel, 2.42GHz.

Frequency	Level	Pol	FCC B	FCC B	Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7267.370	62.2	h	74.0	**-11.8**	Peak	250	1.2	
7267.370	37.8	h	54.0	**-16.2**	Avg	250	1.2	
4843.975	57.2	h	74.0	**-16.8**	Peak	300	1.0	
4843.975	55.6	v	74.0	**-18.4**	Peak	240	1.0	
4843.975	34.4	v	54.0	**-19.6**	Avg	240	1.0	
7267.370	33.3	v	54.0	**-20.7**	Avg	228	1.0	
7267.370	53.2	v	74.0	**-20.8**	Peak	228	1.0	
4843.975	31.1	h	54.0	**-22.9**	Avg	300	1.0	

Note 1. -10dB subtracted from Avg Reading for Duty Cycle correction factor.

Run #3: Radiated Emissions 1-25GHz, Restricted Band Measurement
High Channel, 2.46GHz.

Frequency	Level	Pol	FCC B	FCC B	Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2488.533	67.0	v	74.0	**-7.1**	Peak	252	1.0	Band Edge
2488.724	66.8	h	74.0	**-7.2**	Peak	300	1.2	Band Edge
2488.533	43.7	v	54.0	**-10.4**	Avg	252	1.0	Band Edge
2488.724	43.0	h	54.0	**-11.0**	Avg	300	1.2	Band Edge
4924.640	61.4	h	74.0	**-12.7**	Peak	240	1.0	
7387.170	59.9	v	74.0	**-14.1**	Peak	280	1.2	
7387.170	38.5	v	54.0	**-15.5**	Avg	280	1.2	
4924.640	56.5	v	74.0	**-17.5**	Peak	300	1.0	
7386.100	56.4	h	74.0	**-17.6**	Peak	320	1.2	
4924.640	35.3	h	54.0	**-18.8**	Avg	240	1.0	
4924.640	34.6	v	54.0	**-19.4**	Avg	300	1.0	
7386.100	34.3	h	54.0	**-19.7**	Avg	320	1.2	

Note 1. -10dB subtracted from Avg Reading for Duty Cycle correction factor.

Elliott

Emissions Test Data

Client:	OTC Telecom	Date:	11/13/98	Test Engr:	Jerry / Rudy
Product:	AirEzy 2405 (2.4GHz. Radio)	File:	T29204	Proj. Engr:	Mark Briggs
Objective	Final Qualification	Site:	SVOATS #2	Contact:	York
Spec:	FCC Part 15	Distance:	3m	Approved:	

Run #4: Conducted Emissions, 120V/60Hz, Tested on 11/9/98 D29134
AK II Class II Power Supply 100-120V~/.02A
Model # A10D1-05MP, Serial # A971402594

Frequency	Level	Power	FCC B	FCC B	Detector	Comments
MHz	dBuV	Lead	Limit	Margin	QP/Ave	
1.3712	43.6	Neutral	48.0	**-4.4**	QP	Note 2
1.3316	41.7	Line	48.0	**-6.3**	QP	
0.4632	41.1	Line	48.0	**-6.9**	QP	
0.6780	40.5	Neutral	48.0	**-7.5**	QP	
22.1262	39.0	Line	48.0	**-9.0**	QP	Note 1
22.1620	36.9	Neutral	48.0	**-11.1**	QP	Note 1

Note 1	According to FCC part 15.207 (b) this emission is consider to be broadband. Therefore, this level measured with QP detector has been reduced by 13dB.
Note 2	According to FCC part 15.207 (b) this emission is not consider to be broadband.

Elliott

EMC Test Log

Client:	OTC Telecom	Date:	1-6-99	Test Engr:	David Bare
Product:	AirEZY 2405	File:	T29785	Proj. Eng:	David Bare
Objective:	Final Qualification	Site:	SV EMC Labs	Contact:	Weiming Ou
Spec:	FCC 15.247	Page:	1 of 3	Approved:	
Revision	1.0				

Test Objective

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

Test Summary

Run #1 - Conducted Emissions Scan, 30-25000 MHz

PASS Results: FCC See Graphs. No emissions with 20 dB of the fundamental were observed in any 100 kHz band on any channel.

Run #2 - Power Measurement

PASS Results: FCC 12.4 dBm at 2442.5 MHz. 12.1 dBm at 2462.0 MHz. 13.2 dBm at 2422.0 MHz.

Run #3 - Bandwidth Measurment (6 dB)

PASS* Results: FCC 8.4 MHz at 2442.5 MHz. 8.1 MHz at 2462.0 MHz. 8.9 MHz at 2422.0 MHz.

Equipment Under Test (EUT) General Description

The EUT is a Spread Spectrum radio system which utilizes direct sequence and is designed to use the allocated frequency band of 2440-2483.5 MHz. Normally, the EUT would be placed on a computer during operation. The EUT was, therefore, placed in this position during emissions testing to simulate the end user environment.

Equipment Under Test (EUT)

Manufacturer/Model/Description	Serial Number	FCC ID Number
OTC Telecom AirEzy 2405 2.4GHz Radio	02	MKZAZY2405SWG

Client:	OTC Telecom	Date:	1-6-99	Test Engr:	David Bare
Product:	AirEZY 2405	File:	T29785	Proj. Eng:	David Bare
Objective:	Final Qualification	Site:	SV EMC Labs	Contact:	Weiming Ou
Spec:	FCC 15.247	Page:	2 of 3	Approved:	
Revision	1.0				

Power Supply and Line Filters

The EUT used the following external AC-DC adapter:

Description	Manufacturer	Model
120V AC to 5V DC external power supply	AK Class II Power Supply	A10D1-05MP

Printed Wiring Boards in EUT

The following information was provided by the manufacturer:

Manufacturer/Description	Assembly #	Rev.	Serial Number	Crystals (MHz)
RF PCB	1710-242001-07	07	-	10
Digital PCB	1710-2410BT-0D	OD	-	44

Subassemblies in EUT

The following information was provided by the manufacturer:

Manufacturer/Description	Assembly Number	Rev.	Serial Number
RF/Digital subassembly	0010-240504-00	-	-

EUT Enclosure(s)

The EUT enclosure is primarily constructed of molded plastic. It measures approximately 5 cm wide by 2 cm deep by 12 cm high.

EMI Suppression Devices (filters, gaskets, etc.)

Description	Manufacturer	Part Number
None		

Local Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
None		

Client:	OTC Telecom	Date:	1-6-99	Test Engr:	David Bare
Product:	AirEZY 2405	File:	T29785	Proj. Eng:	David Bare
Objective:	Final Qualification	Site:	SV EMC Labs	Contact:	Weiming Ou
Spec:	FCC 15.247	Page:	3 of 3	Approved:	
Revision	1.0				

Remote Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
None		

Interface Cabling

Cable Description	Length (m)	From Unit/Port	To Unit/Port
Coax	0.1	EUT	Measurement Analyzer
DC	1.8	EUT	Power brick

Test Software

During testing the EUT transmitter was set to maximum duty cycle continuous transmit mode, using OTC Telecom test program.

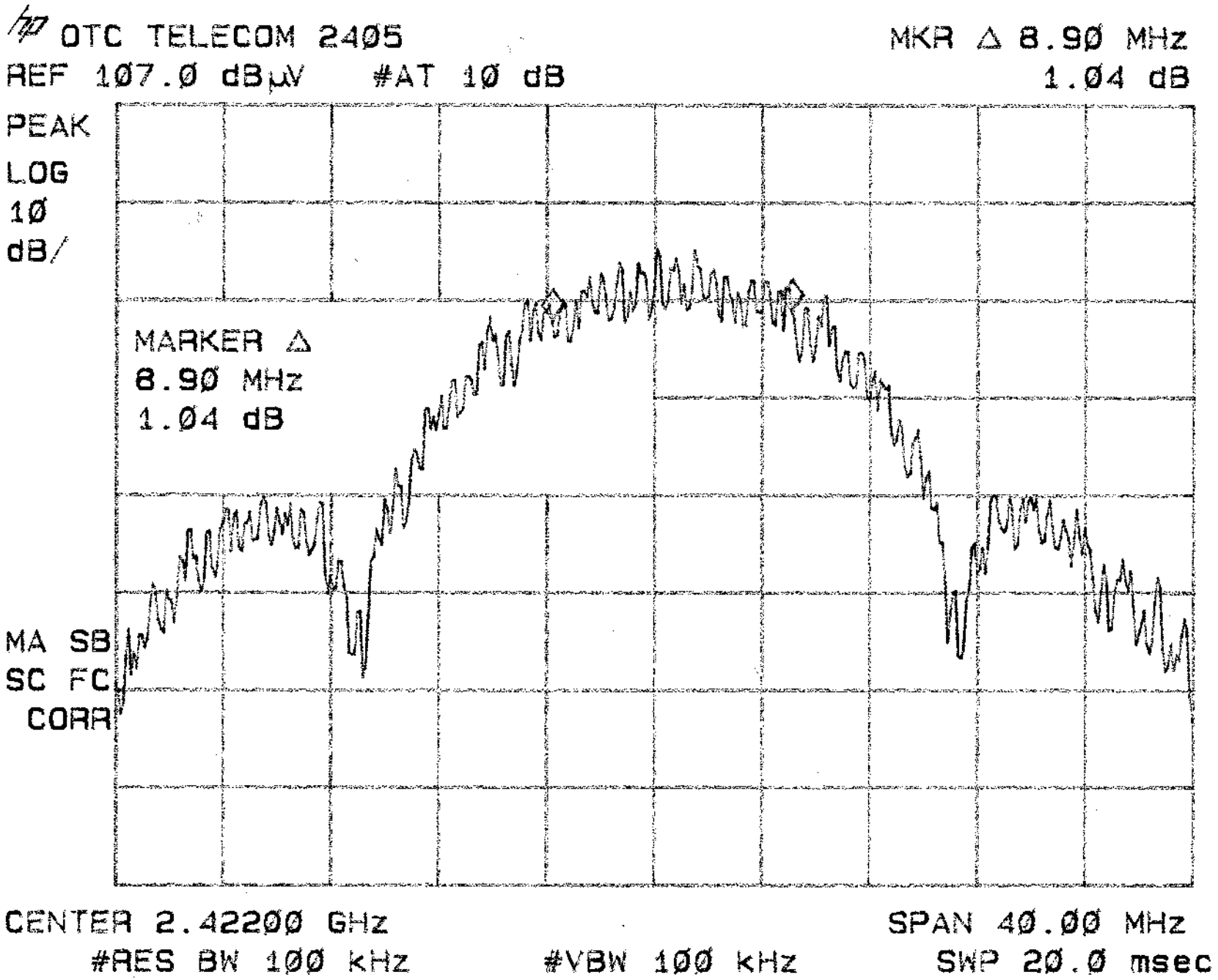
General Test Conditions

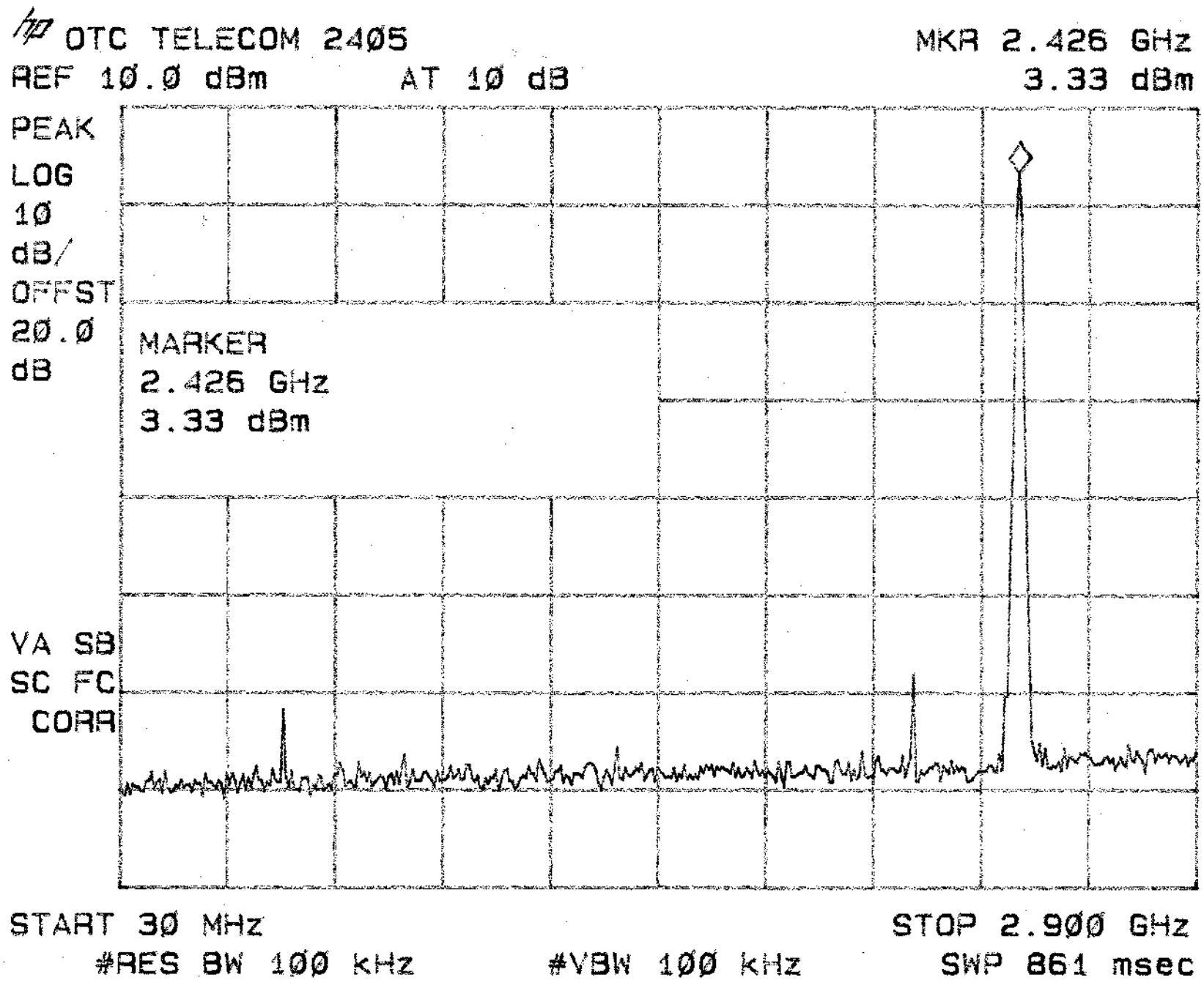
During testing, the EUT was connected to 120V, 60Hz power input.

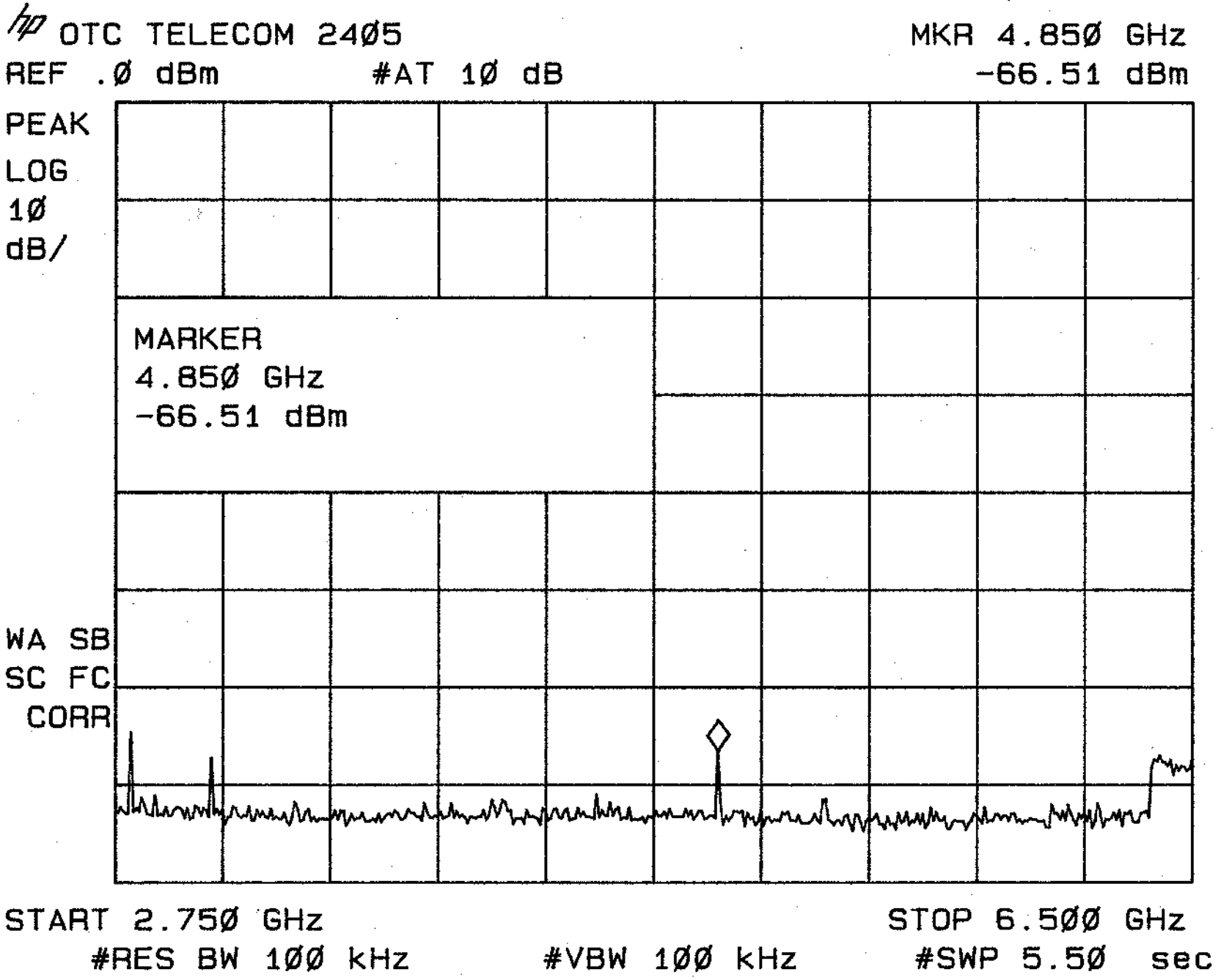
Test Data

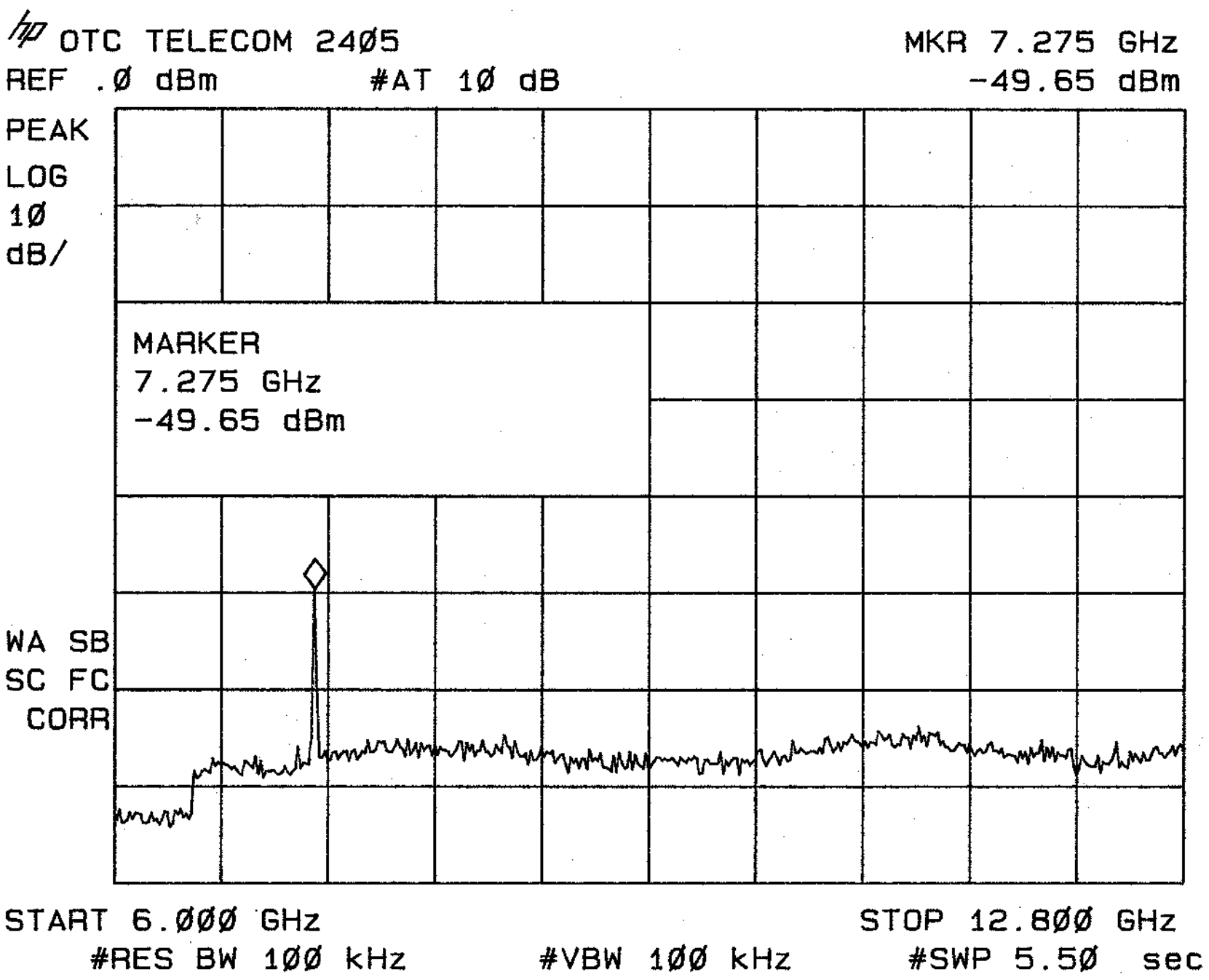
See attached graphical data

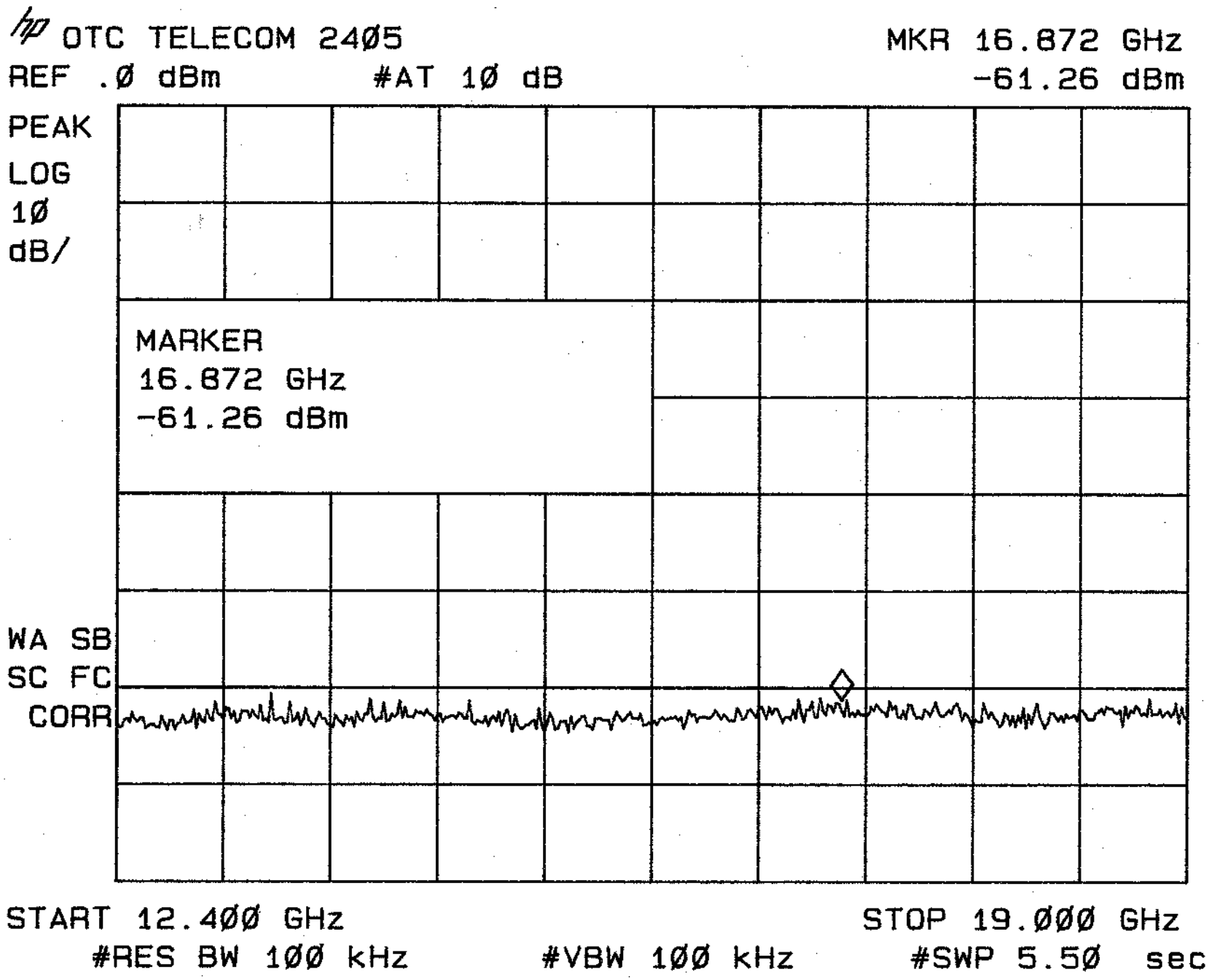
CH1
Pout = 13.2 dBm

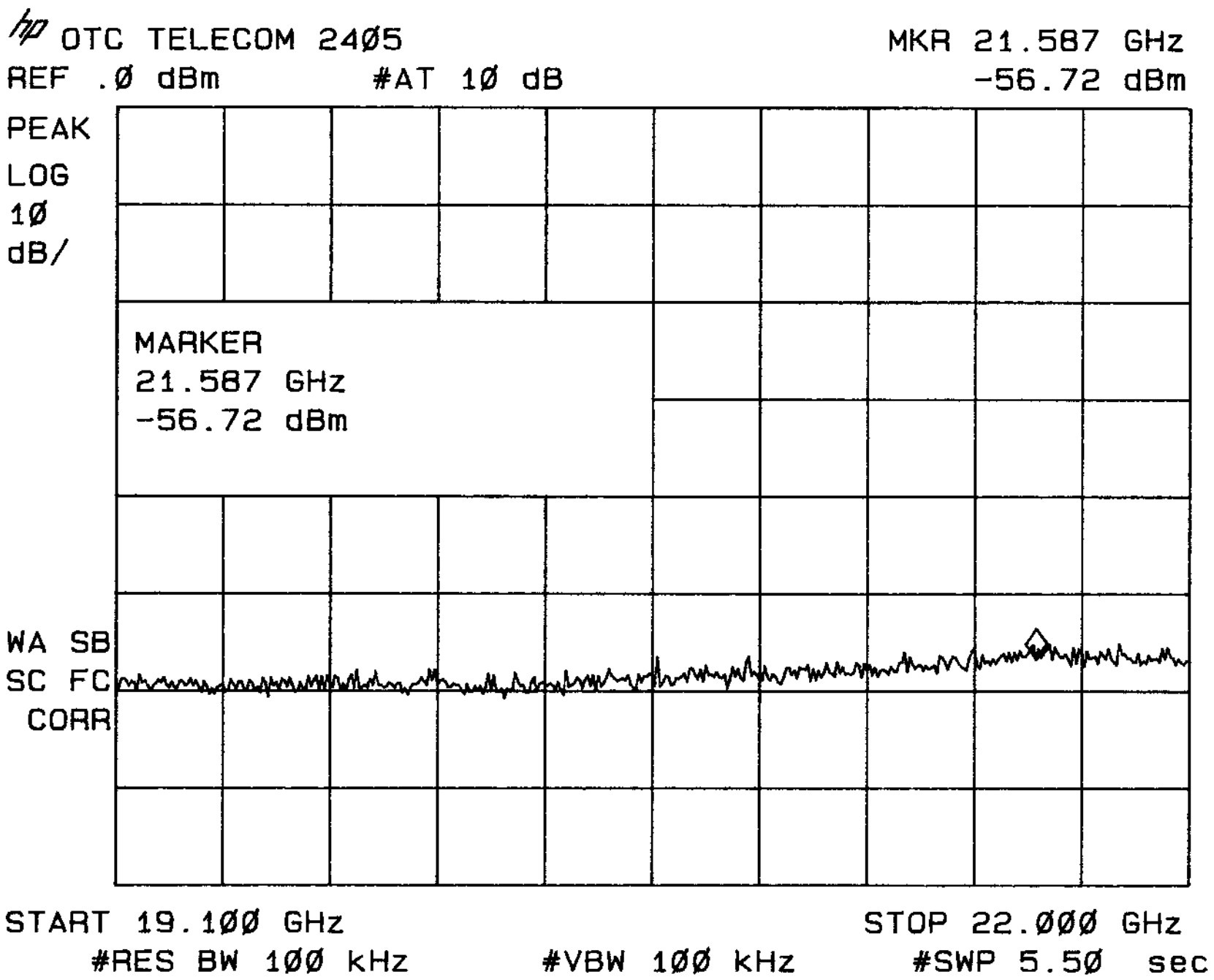



OTC TELECOM 2405
MKR 2.426 GHz
REF 10.0 dBm
AT 10 dB
3.33 dBm
PEAK
LOG
10
dB/
OFFST
20.0
dB
MARKER
2.426 GHz
3.33 dBm
VA SB
SC FC
CORR
START 30 MHz
STOP 2.900 GHz
#RES BW 100 kHz
#VBW 100 kHz
SWP 861 msec

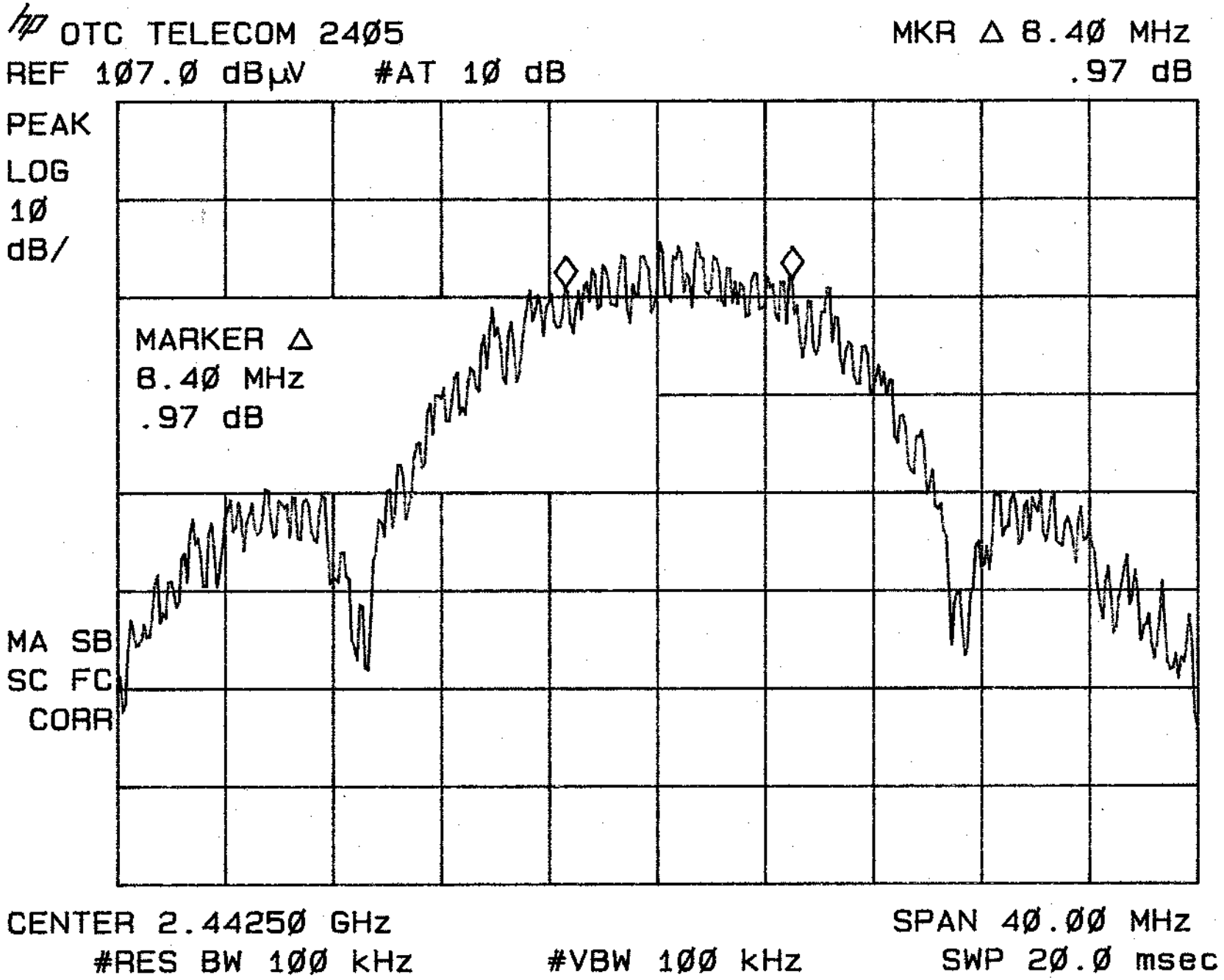

OTC TELECOM 2405
MKR 4.850 GHz
REF .0 dBm
#AT 10 dB
-66.51 dBm
PEAK
LOG
10
dB/
MARKER
4.850 GHz
-66.51 dBm
WA SB
SC FC
CORR
START 2.750 GHz
STOP 6.500 GHz
#RES BW 100 kHz
#VBW 100 kHz
#SWP 5.50 sec

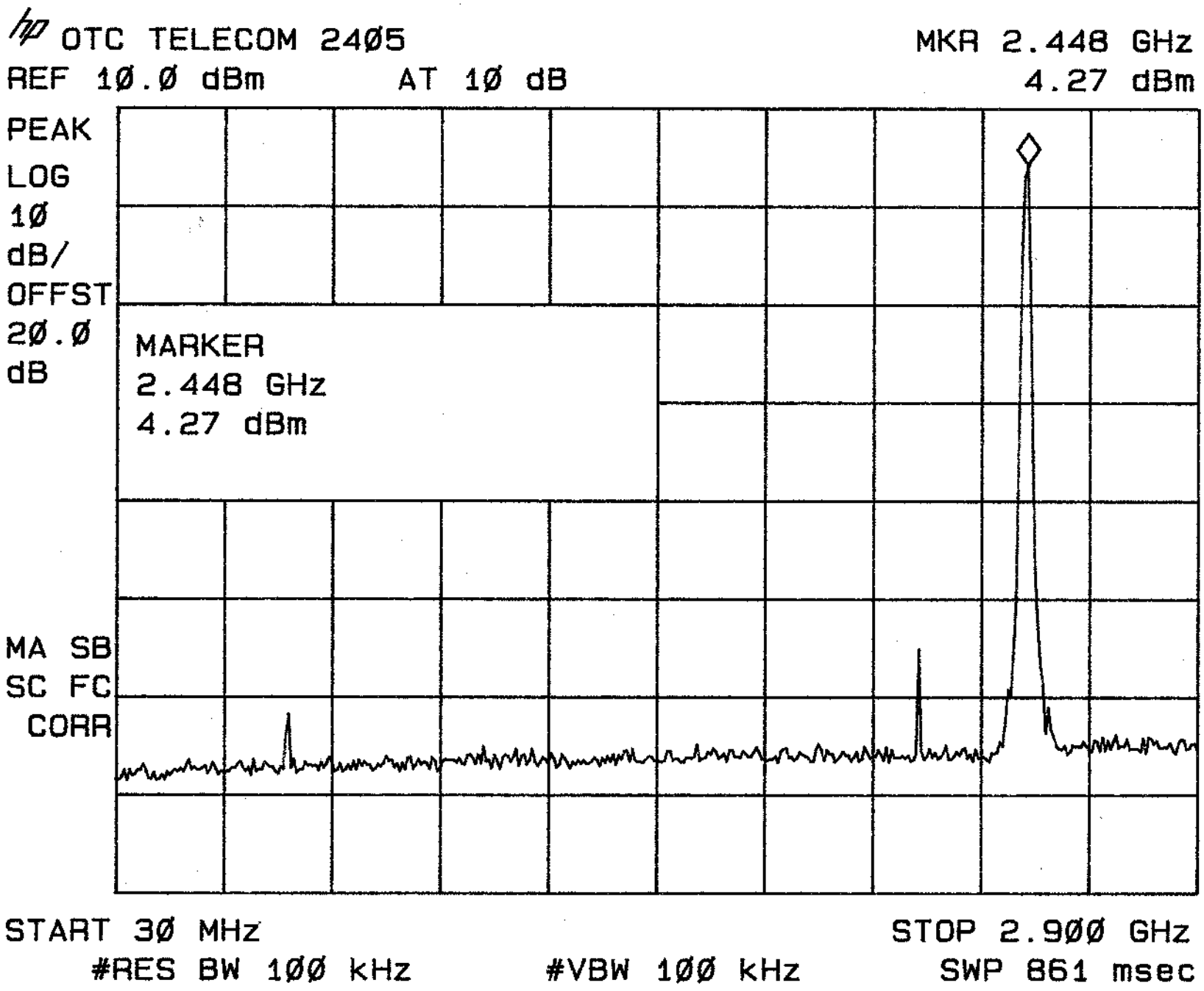

OTC TELECOM 2405
MKR 7.275 GHz
REF .0 dBm
#AT 10 dB
-49.65 dBm
PEAK
LOG
10
dB/
MARKER
7.275 GHz
-49.65 dBm
WA SB
SC FC
CORR
START 6.000 GHz
STOP 12.800 GHz
#RES BW 100 kHz
#VBW 100 kHz
#SWP 5.50 sec

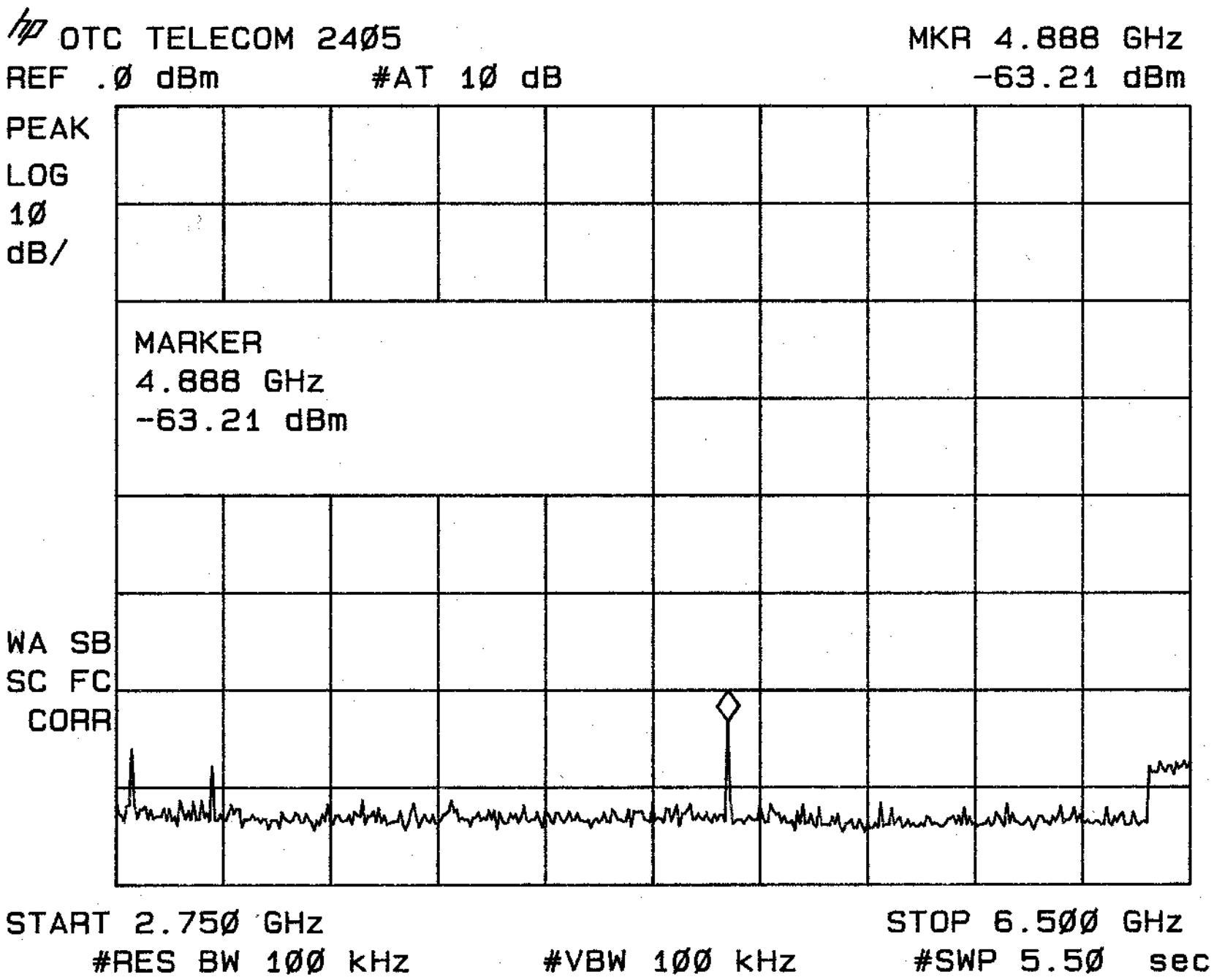

OTC TELECOM 2405
MKR 16.872 GHz
REF .0 dBm
#AT 10 dB
-61.26 dBm
PEAK
LOG
10
dB/
MARKER
16.872 GHz
-61.26 dBm
WA SB
SC FC
CORR
START 12.400 GHz
STOP 19.000 GHz
#RES BW 100 kHz
#VBW 100 kHz
#SWP 5.50 sec

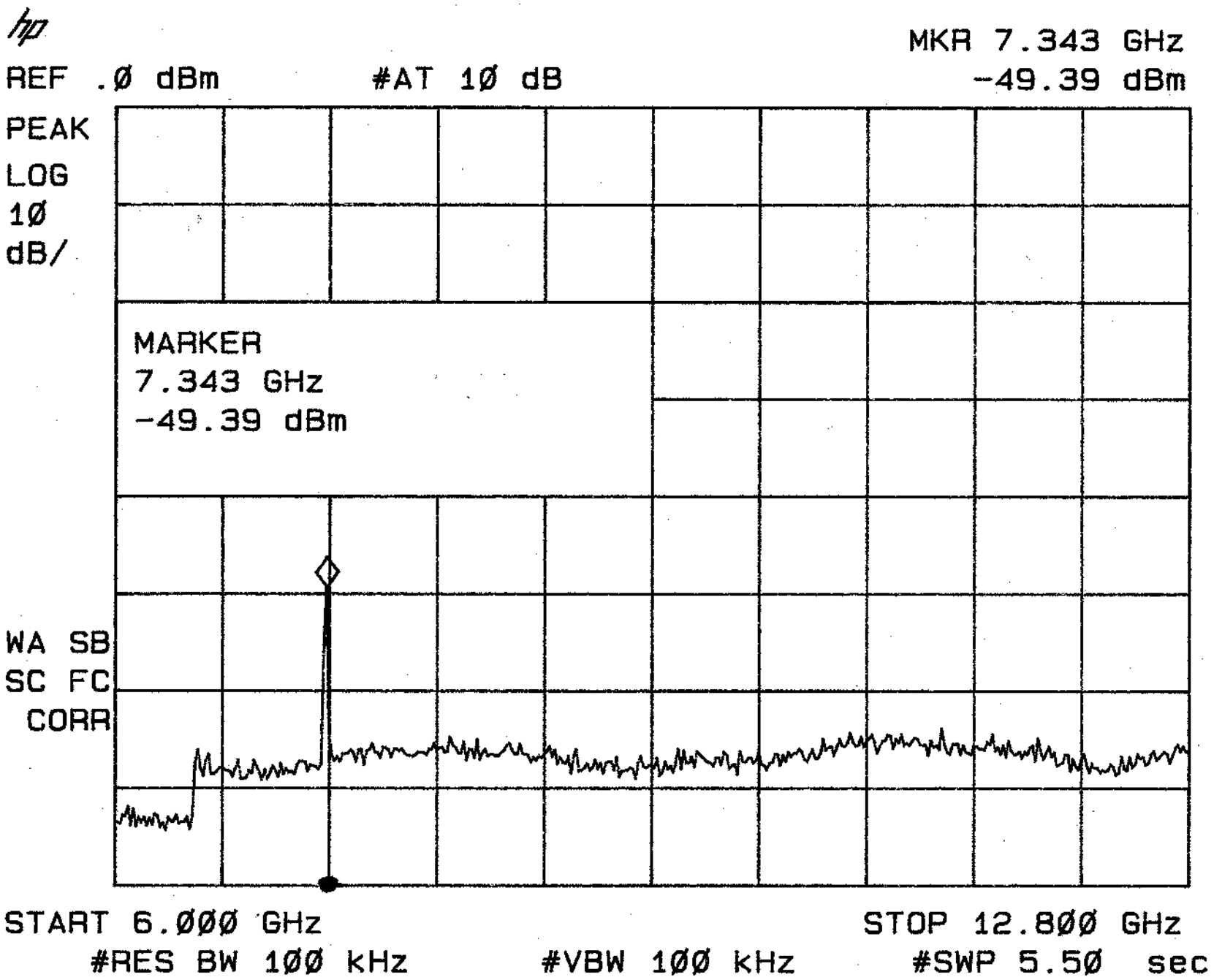

OTC TELECOM 24Ø5
MKR 21.587 GHz
REF .Ø dBm
#AT 1Ø dB
-56.72 dBm
PEAK
LOG
1Ø
dB/
MARKER
21.587 GHz
-56.72 dBm
WA SB
SC FC
CORR
START 19.1ØØ GHz
STOP 22.ØØØ GHz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 5.5Ø sec

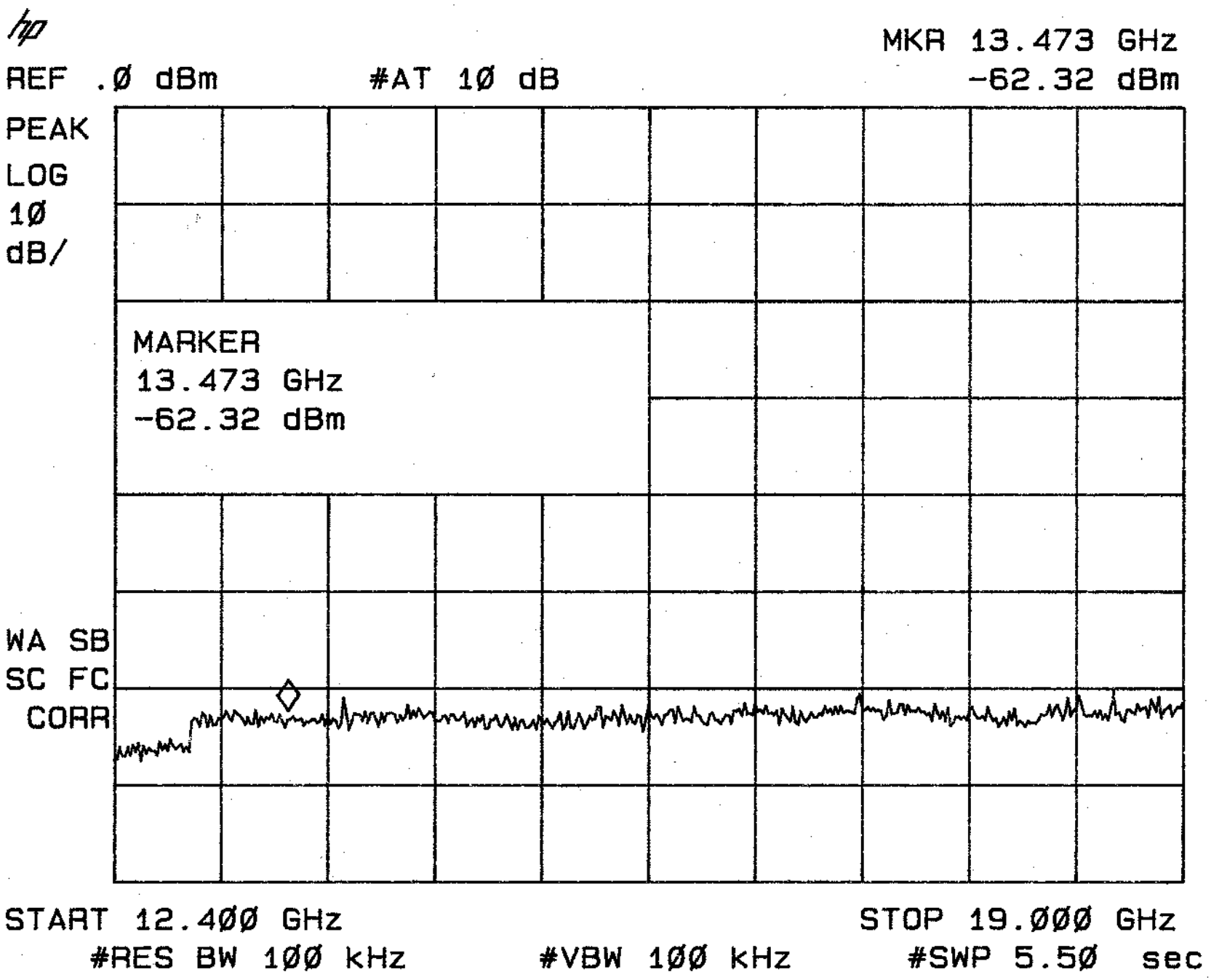
CH2 Pout = 12.4 dBm

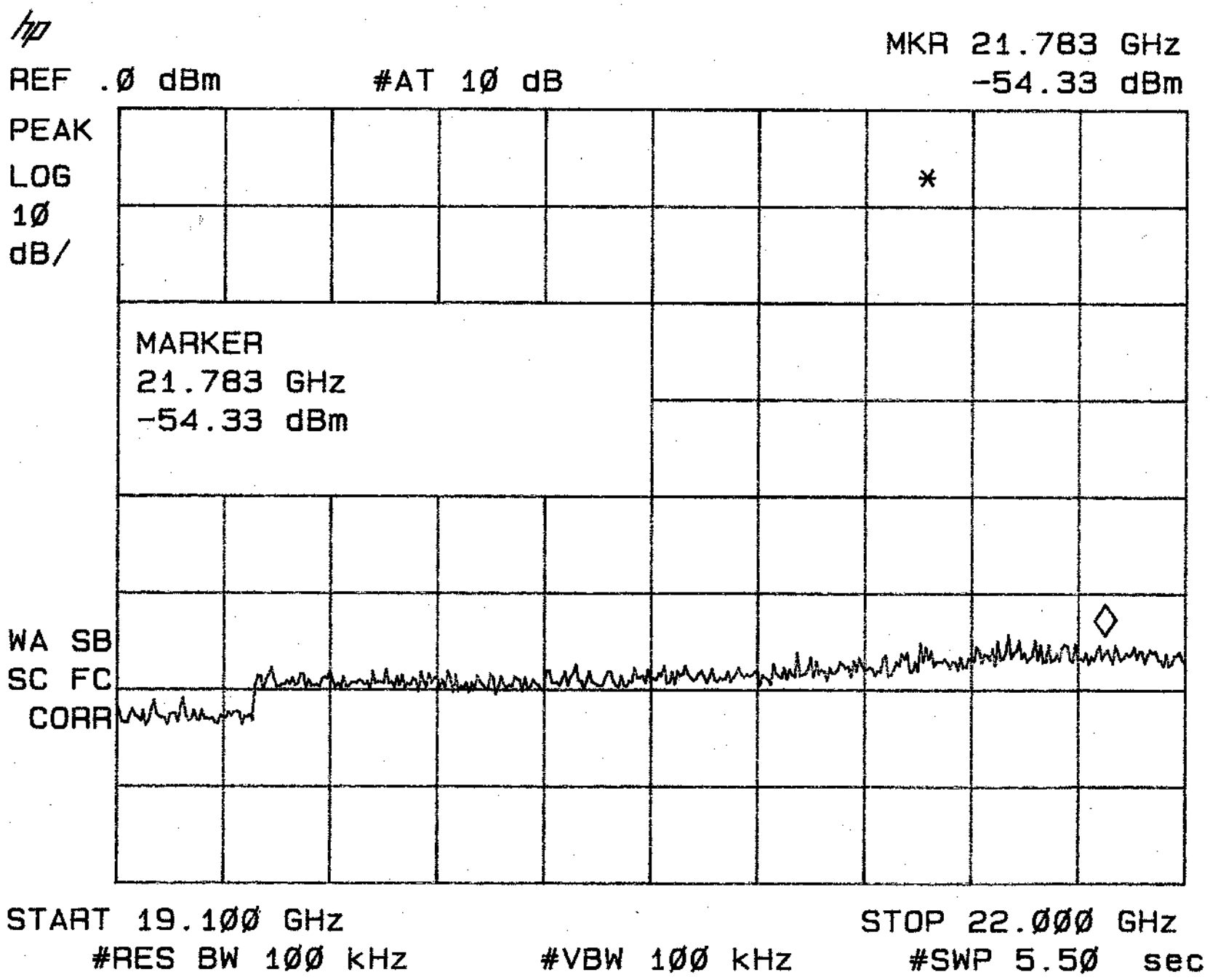



OTC TELECOM 24Ø5
MKR 2.448 GHz
REF 1Ø.Ø dBm
AT 1Ø dB
4.27 dBm
PEAK
LOG
1Ø
dB/
OFFST
2Ø.Ø
dB
MARKER
2.448 GHz
4.27 dBm
MA SB
SC FC
CORR
START 3Ø MHz
STOP 2.9ØØ GHz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
SWP 861 msec

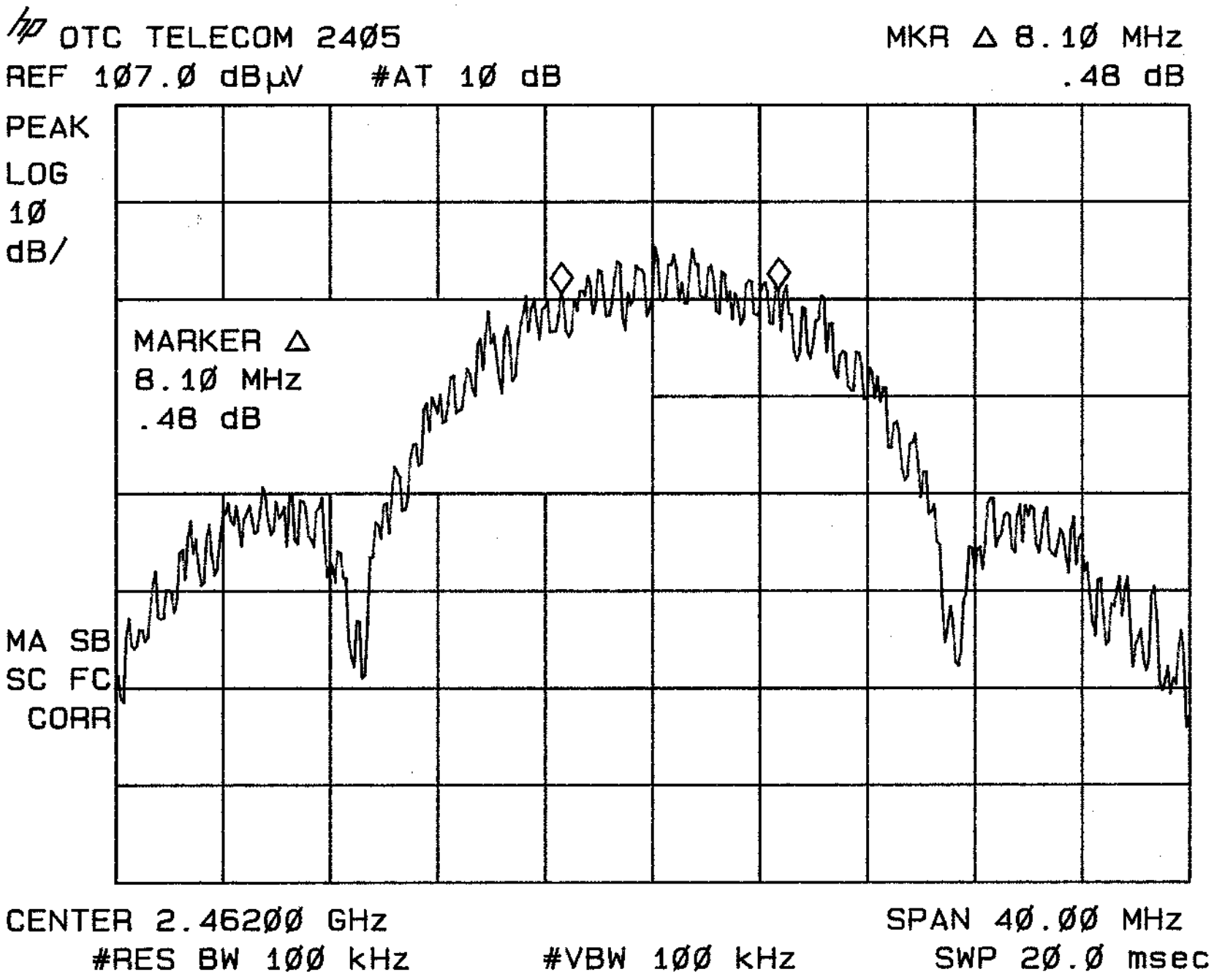

OTC TELECOM 2405
MKR 4.888 GHz
REF .0 dBm
#AT 10 dB
-63.21 dBm
PEAK
LOG
10
dB/
MARKER
4.888 GHz
-63.21 dBm
WA SB
SC FC
CORR
START 2.750 GHz
STOP 6.500 GHz
#RES BW 100 kHz
#VBW 100 kHz
#SWP 5.50 sec

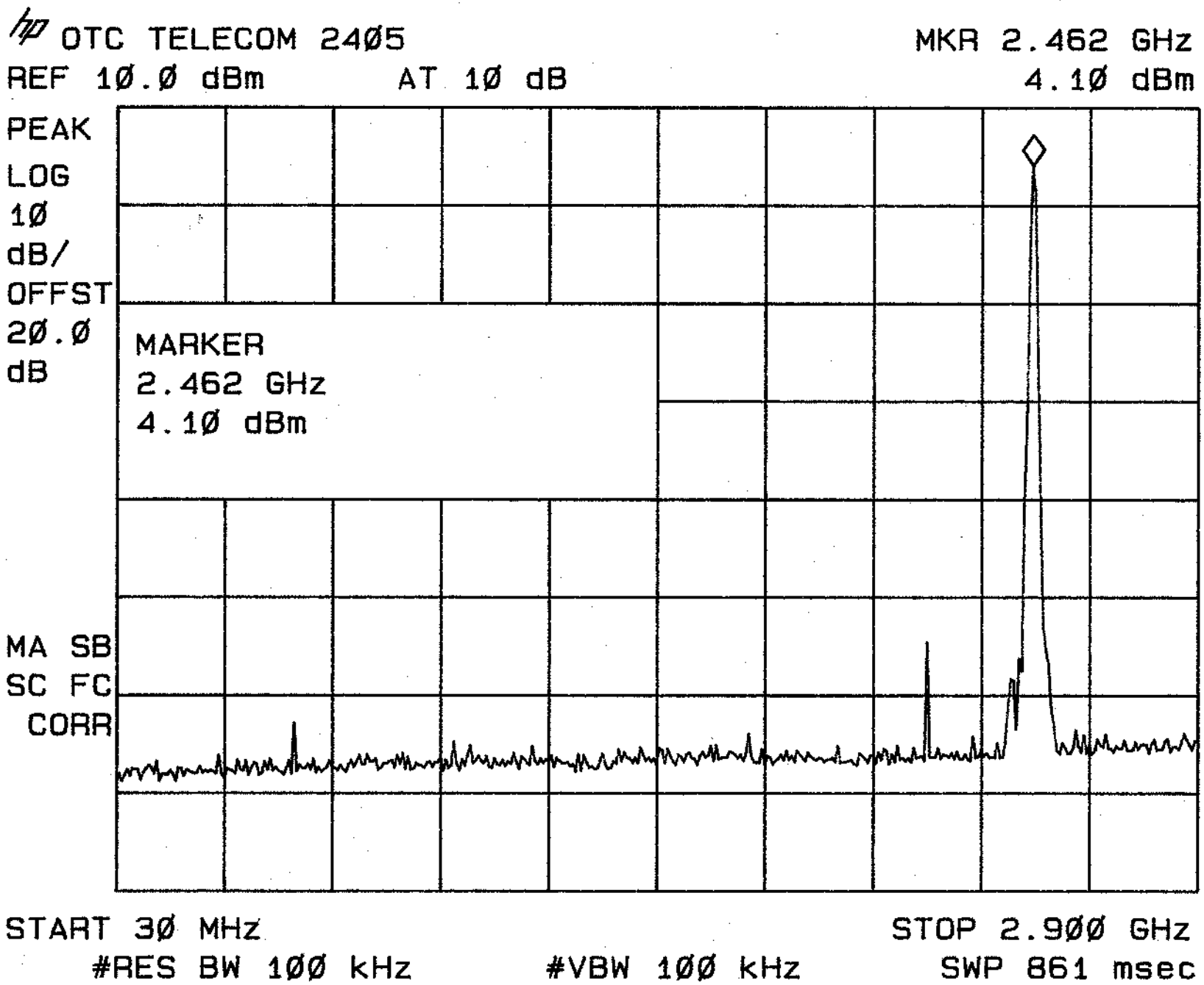

MKR 7.343 GHz
-49.39 dBm
REF .Ø dBm
#AT 1Ø dB
PEAK
LOG
1Ø
dB/
MARKER
7.343 GHz
-49.39 dBm
WA SB
SC FC
CORR
START 6.ØØØ GHz
STOP 12.8ØØ GHz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 5.5Ø sec

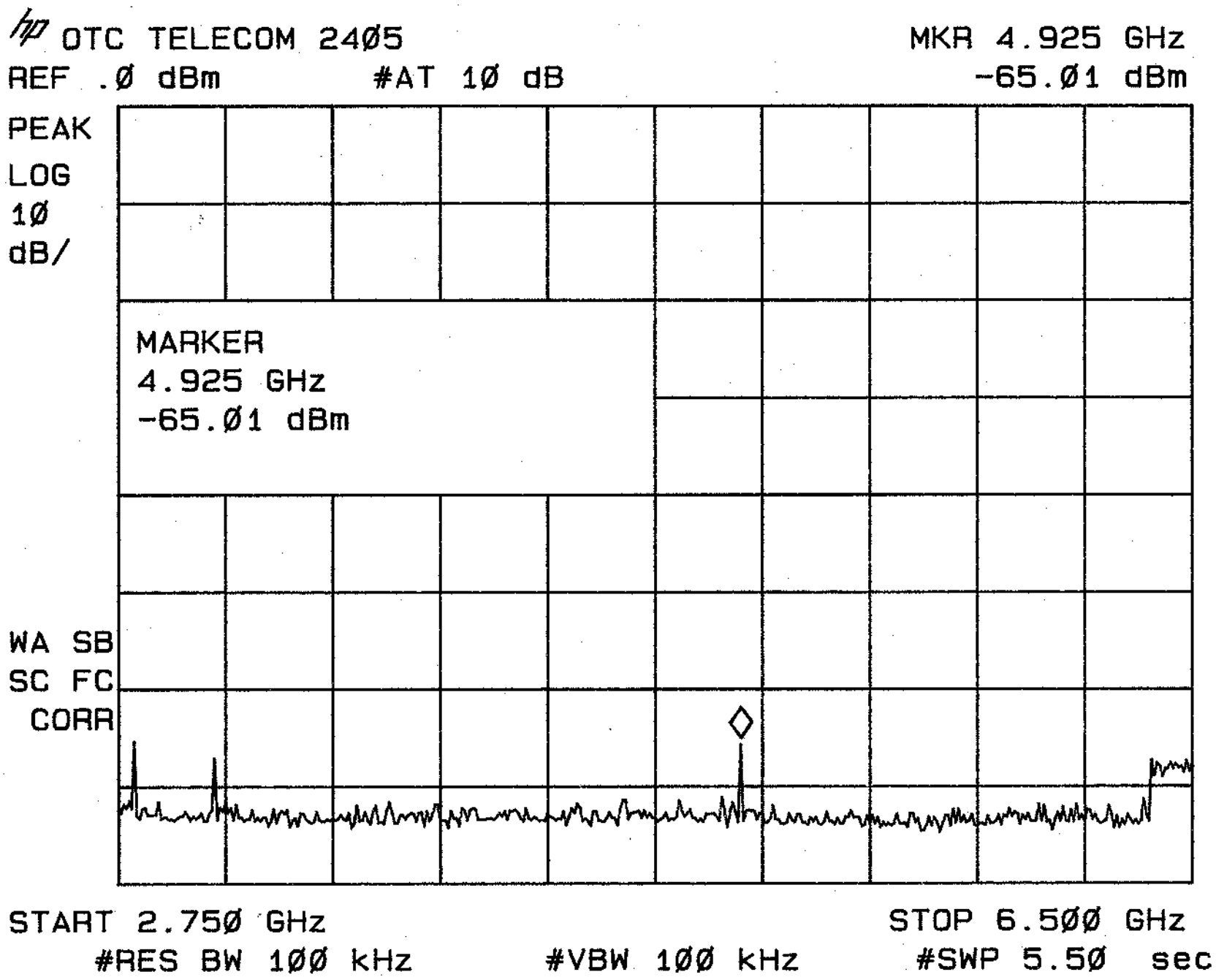

MKR 13.473 GHz
-62.32 dBm
REF .Ø dBm
#AT 1Ø dB
PEAK
LOG
1Ø
dB/
MARKER
13.473 GHz
-62.32 dBm
WA SB
SC FC
CORR
START 12.4ØØ GHz
STOP 19.ØØØ GHz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 5.5Ø sec

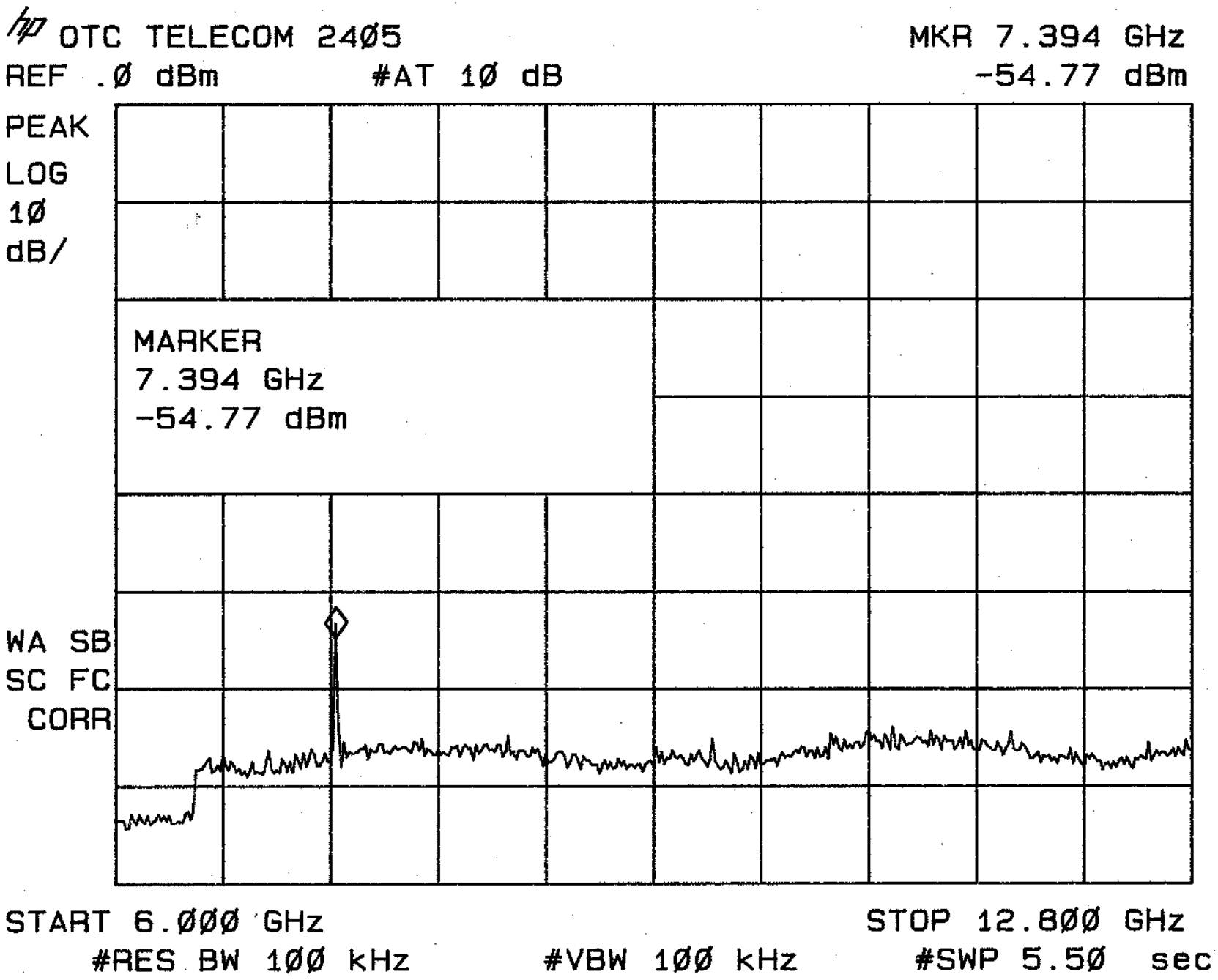

MKR 21.783 GHz
-54.33 dBm
REF .Ø dBm
#AT 1Ø dB
PEAK
LOG
1Ø
dB/
MARKER
21.783 GHz
-54.33 dBm
WA SB
SC FC
CORR
START 19.1ØØ GHz
STOP 22.ØØØ GHz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 5.5Ø sec

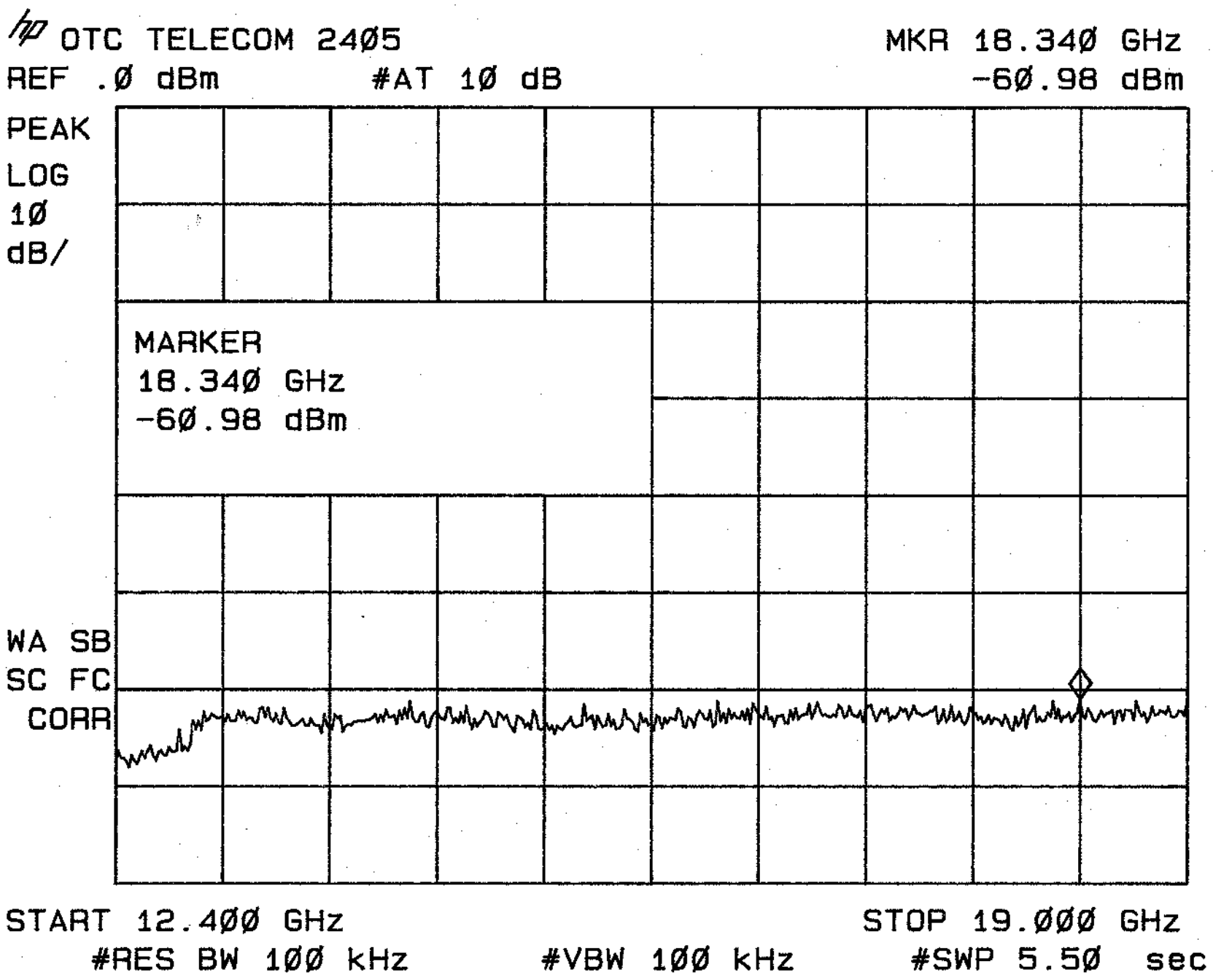
CH 3
Pout = 12.1 dBm

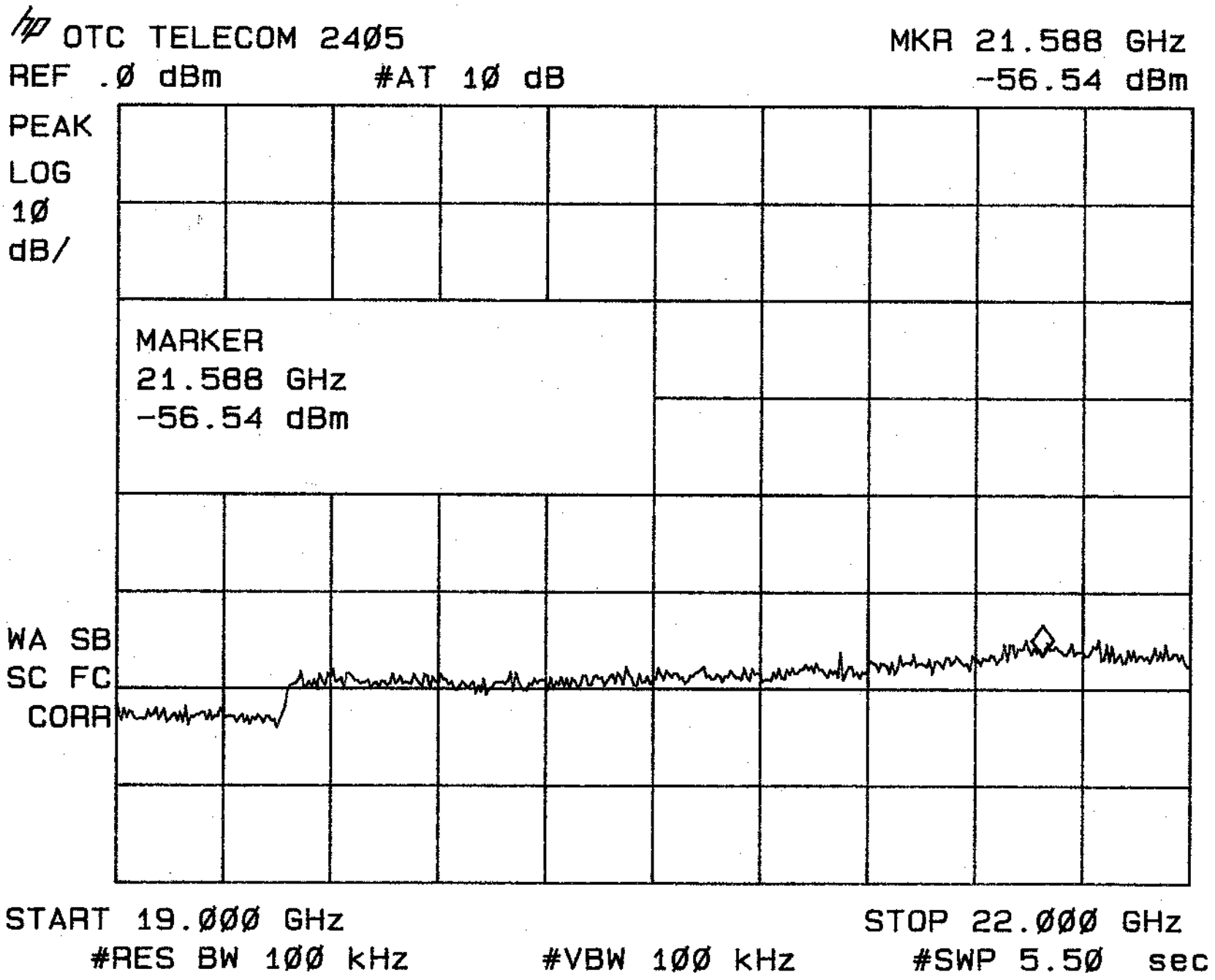



OTC TELECOM 2405
MKR 2.462 GHz
REF 10.0 dBm
AT 10 dB
4.10 dBm
PEAK
LOG
10
dB/
OFFST
20.0
dB
MARKER
2.462 GHz
4.10 dBm
MA SB
SC FC
CORR
START 30 MHz
STOP 2.900 GHz
#RES BW 100 kHz
#VBW 100 kHz
SWP 861 msec


OTC TELECOM 2405
MKR 4.925 GHz
REF .0 dBm
#AT 10 dB
-65.01 dBm
PEAK
LOG
10
dB/
MARKER
4.925 GHz
-65.01 dBm
WA SB
SC FC
CORR
START 2.750 GHz
STOP 6.500 GHz
#RES BW 100 kHz
#VBW 100 kHz
#SWP 5.50 sec


OTC TELECOM 24Ø5
MKR 7.394 GHz
REF .Ø dBm
#AT 1Ø dB
-54.77 dBm
PEAK
LOG
1Ø
dB/
MARKER
7.394 GHz
-54.77 dBm
WA SB
SC FC
CORR
START 6.ØØØ GHz
STOP 12.8ØØ GHz
#RES BW 1ØØ kHz
#VBW 1ØØ kHz
#SWP 5.5Ø sec


OTC TELECOM 2405
MKR 18.340 GHz
REF .0 dBm
#AT 10 dB
-60.98 dBm
PEAK
LOG
10
dB/
MARKER
18.340 GHz
-60.98 dBm
WA SB
SC FC
CORR
START 12.400 GHz
STOP 19.000 GHz
#RES BW 100 kHz
#VBW 100 kHz
#SWP 5.50 sec


OTC TELECOM 2405
MKR 21.588 GHz
REF .0 dBm
#AT 10 dB
-56.54 dBm
PEAK
LOG
10
dB/
MARKER
21.588 GHz
-56.54 dBm
WA SB
SC FC
CORR
START 19.000 GHz
STOP 22.000 GHz
#RES BW 100 kHz
#VBW 100 kHz
#SWP 5.50 sec

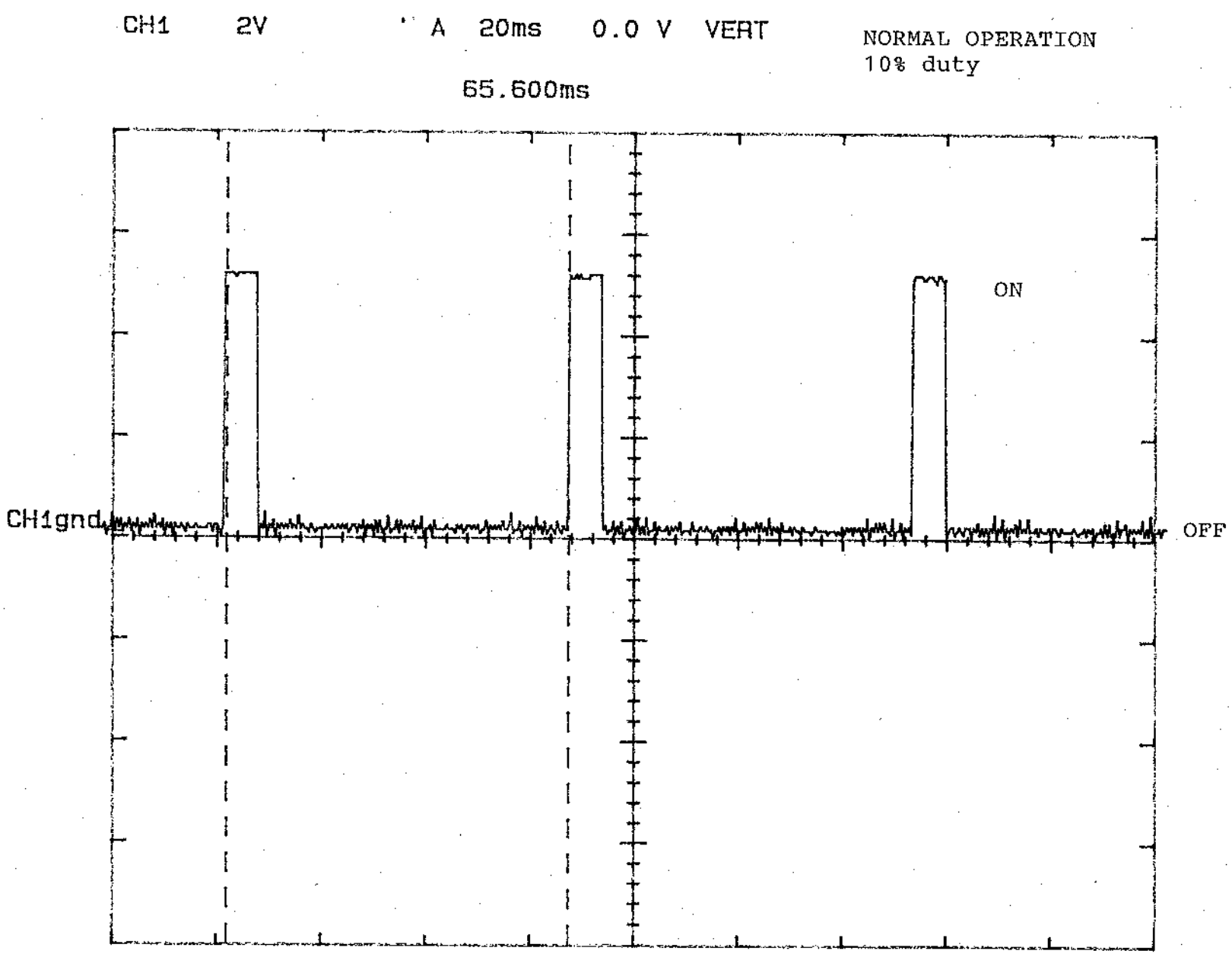

CH1 2V
A 20ms 0.0 V VERT
NORMAL OPERATION
10% duty
65.600ms
ON
CH1gnd
OFF

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

EXHIBIT 4: Conducted Emissions Test Configuration Photographs

EXHIBIT 5: Proposed FCC ID Label & Label Location

EXHIBIT 6:Detailed Photographs of OTC Telecom, Inc. Model AirEzy 2405 Construction

7 Pages

EXHIBIT 7:Operator's Manual for OTC Telecom, Inc.Model AirEzy 2405

14 Pages

EXHIBIT 8:Block Diagram of OTC Telecom, Inc.Model AirEzy 2405

1 Page

EXHIBIT 9:Schematic Diagrams for OTC Telecom, Inc.Model AirEzy 2405

3 Pages

EXHIBIT 10:Theory of Operation for OTC Telecom, Inc.Model AirEzy 2405

1 Page