TÜV PRODUCT SERVICE

# MEASUREMENT AND TECHNICAL REPORT

SONIK TECHNOLOGIES CORPORATION
2310 Cousteau Court
Vista, CA 92083

**DATE: 27 February 2002**

**This Report Concerns:** Original Grant: X Class II Change:

**Equipment Type:** Three Channel RFO Paging Station, Model PT 1055

**Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?** Yes: No: X
**Defer until:**

*Company Name* **agrees to notify the Commission by:** N/A
**of the intended date of announcement of the product so that the grant can be issued on that date.**

**Transition Rules Request per 15.37?** Yes: *No: X

*(*) FCC Part 2, Paragraphs 2.1046; 2.1049; 2.1051; 2.1053; 2.1055; Part 24, Paragraph 24, Paragraphs 24.132©; 24.133(a)(1)(i) and 24.133(a)(1)(ii)*

***Report Prepared by:***

**TÜV PRODUCT SERVICE**
**10040 Mesa Rim Road**
**San Diego, CA 92121-2912**
**Phone: 858 546 3999**
**Fax: 858 546 0364**

**PREFACE**

This report documents product testing conducted to verify compliance of the specified EUT with applicable standards and requirements as identified herein. The reader is referred to the applicable test standards for detailed procedures. The following table summarizes the test results obtained during this evaluation.

**SUMMARY**

Purpose of Test: To demonstrate compliance with the ANSI C63.4 setup.

| TEST | STANDARD | FREQUENCY RANGE | RESULT |
|---|---|---|---|
| RF Power | Part 2, Para. 2.1046; Part 24, Para. 24.132(c) | 929.02 – 940.98 | Pass |
| Occupied Bandwidth | Part 2, Para 2.1049; Part 24, Para. 24.131 | 929.02 – 940.98 | Pass |
| Spurious Emissions at Antenna Terminals | Part 2, Para. 2.1051, Part 24, Para. 24.133(a)(1)(i); (ii) | 30 MHz – 10 GHz | Pass |
| Field Strength of Spurious Radiation | Part 2, Para. 2.1053; Part 24, Para. 24.133(a)(1)(ii) | 929.02 - 940.98 | Pass |



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# 1 GENERAL INFORMATION

## 1.1 Product Description

EUT Description: RF Orchestra Paging Station

EUT Name: Three Channel RFO! Paging Station

Model No.: PT 1055 Serial No.: 11023NV

Configurations to be tested: Transmitter (Power Amplifiers, Power Supplies, Interface Control)

**EUT Specifications and Requirements**

Length: 25 " Width: 23.5 " Height: 83.5" Weight: 680 lbs.

**Power Requirements**

***Regulations require testing to be performed at typical power ratings in the countries of intended use. (i.e., European power is typically 230 VAC 50 Hz or 400 VAC 50 Hz, single and three phase, respectively)***

Voltage: 196-254 VAC @ 60 Hz (If battery powered, make sure battery life is sufficient to complete testing.)

\# of Phases: 1

Current (Amps/phase(max)): 20 Current (Amps/phase(nominal)): 7.5

**Typical Installation and/or Operating Environment**

Remote unattended indoor Site

**EUT Power Cable**

Permanent OR ☐ Removable Length (in meters): 3.56

☐ Shielded OR ☐ Unshielded

☐ Not Applicable

**EUT Software**.

Revision Level: N/A

Description: Standard Hyperterminal

**EUT Operating Modes to be Tested --**

1. Low/High Power Transmission with single Carrier
2. Low/High Power Transmission with 3 Carriers.

**EUT System Components --**

| Description | Model # | Serial # | FCC ID # |
|---|---|---|---|
| Motorola EX(Orchestra) | 912EX2GBT01 | | |
| Motorola EX(Baton) | N/A | N/A | |
| Sonik Power Amplifier #1 | 4B467-2 | 0151-212 | |
| Sonik Power Amplifier #2 | 4B467-2 | 0151-116 | |
| Sonik Power Amplifier #3 | 4B467-2 | 0151-118 | |
| Sonik 3-Way Combiner | 3C490-1 | N/A | |
| Sonik SPI Spoofer | 6A628 | N/A | |
| Detector | O180503R06 | 260459-189 | |
| Detector | O180503R06 | 258477-056 | |
| Harmonic Filter | LB-1367 | 002691 | |
| 3-Way Splitter (Mini-Circuits) | 15542 | N/A | |
| Celwave Coupler | 5882568WO4 | 388733-063 | |
| Celwave Coupler | 5882568WO3 | 195029-017 | |
| Sonik Power Supply #1 | 4B466-1 | N/A | |
| Sonik Power Supply #2 | 4B466-1 | N/A | |
| Sonik Power Supply #3 | 4B466-1 | N/A | |
| Sonik Rack Shelf, rectifier | 4B466-2 | N/A | |

**Support Equipment --** List and describe all support equipment which is not part of the EUT. (i.e. peripherals, simulators, etc)

| *Description* | *Model #* | *Serial #* | *FCC ID #* |
|---|---|---|---|
| 500 Watt RF Load Termaline Coaxial Resistor | 8431 | 380 | |
| HP Single Channel Power Meter | HP E4418B(437B) | 3125U21450 | |
| HP 8591E Spectrum Analyzer | | 3639A05688 | |
| HP 8481H Power Sensor -15 TO 35 dBm | | 1926AC1157 | |
| Celwave Characterized Coupler (attenuation: -40.30 Reverse, -40.47 Forward) | 5882568U03 | 192079-007 | |

| **Oscillator Frequencies** | | | |
|---|---|---|---|
| ***Frequency*** | ***Derived Frequency*** | ***Component # / Location*** | ***Description of Use*** |
| VCO | 929-941 mHz | Local Oscillator/Exciter Module | Provides the RF Carrier Frequencies to each of (3) Amplifiers. |
| 2.1 mHz | -6.25 kHz, -12.5 kHz | Synthesizer/Exciter Module | Provides base modulation frequencies. |

| **Power Supply** | | | |
|---|---|---|---|
| ***Manufacturer*** | ***Model #*** | ***Serial #*** | ***Type*** |
| Magnetek (28V @ 50 AMP) (3) | 901PS6 | 0024<br>0010<br>0044 | ☐ Switched-mode: (Frequency) ______<br>**X** Linear ☐ Other: |
| | | | ☐ Switched-mode: (Frequency) ______<br>Linear ☐ Other: |

# 1 GENERAL INFORMATION (continued)

## 1.2 Related Submittal/Grant

**None**

## 1.3 Tested System Details

The FCC IDs for all equipment, plus descriptions of all cables used in the tested system are:

None

## 1.4 Test Methodology

Both Conducted and radiated testing were performed according to the procedures in FCC/ANSI C63.4 and CSA 108.8 - M1983. Radiated testing was performed at an antenna-to-EUT distance of 3 meters (1 - 10 GHz).

## 1.5 Test Facility

The open area test site and conducted measurement data were tested by:

TÜV PRODUCT SERVICE
10040 Mesa Rim Road
San Diego, CA 92121-2912
Phone: 858 546 3999
Fax: 858 546 0364

The Test Site Data and performance comply with ANSI 63.4 and are registered with the FCC, 7435 Oakland Mills Rd, Columbia Maryland 21046. All Measurement Data is acquired according to the content of FCC Measurement Procedure and ANSI C63.4, unless supplemented with additional requirements as noted in the test report.

### 1.6 Part 2 Requirements

**Names and Addresses.**

(The full name and mailing address of the manufacturer of the device and the applicant for certification.)
Mr. John Sonnenberg
Sonik Technologies Corporation
2310 Costeau Court
Vista, CA 92083

**Equipment Specifications.**

| | |
|---|---|
| Frequency Range on MHz: | **929-941** |
| Rated RF Power in Watts: | **400 Total Avg Power** |
| Frequency Tolerance: | **+/- 1%** |
| Microprocessor Model #: | **MC68EN36CRC25C** |

**Type or types of emission.**

8K00F1D
**6K40F1D**

**Frequency Range.**

(Range of Operating Power values or specific operating power levels;
and description of any means provided for variation of operating power.)

**40-155 watts per subchannel. Power control is accomplished via RF output levels of the exciter module during the active keyed state depending on the RF output of the Power Amplifiers through the internal wattmeter sensor.**

**Maximum power rating.**

**400 Watts Total Avg Power, 1200 Watts Peak Power**

**DC voltages.**

(List of DC voltages applied to and dc currents into the several elements of the final Radio frequency amplifying device for normal operation over the power range.)

28 VDC @ 8-96 Amperes

**Schematic diagram and a description(s).**
….of all circuitry and devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation, and for limiting power.
Submit a Parts List if not visible on the schematics.

**<u>Means for frequency stabilization:</u>** The station reference circuitry consists of a phase-locked loop comprised of a high stability VCXO(16.8 MHz), an ultra high stability oscillator (UHSO) (10 MHz), ans a PLL IC. The VCXO and the PLL IC are located on the Station Control Module and the UHSO is located on the reference module. The VCXO(16.8 MHz) operates in a closed loop mode and the frequency is continually being controlled by the control voltage of the PLL IC referenced to the 10 MHz UHSO source. The output of this loop is a 16.5 MHz square wave signal which is fed to the divide-by-8 counter on the Station Control Module where it is divided down to 2.1 MHz. The 2.1 MHz square wave signal is routed to the Exciter Module as the station reference.

**<u>Means for limiting modulation:</u>** The FSK (frequency shift keying) baseband modulation signal is created in a digital signal processor (DSP) using a table lookup algorithm. The AM based modulation is processed in the digital domain through a peak-to-average limiting algorithm that prevents the modulation from exceeding 100%. This baseband signal is also passed through a low pass filter to ensure compliance with the occupied bandwidth requirements. The transmitter uses a Cartesian feedback system which samples the transmitted signal and feeds it back to the transmitter linearization IC. This IC automatically performs phase and amplitude training by continually adjusting the attenuators internal to the IC to maintain the required occupied bandwidth and output power level.

**<u>Means for limiting power:</u>** The transmitter Power Control incorporates a built in power monitoring system and a set of attenuators to continuously monitor and regulate transmitter output power. The power metering is factory calibrated to 5% accuracy and cannot be adjusted in the field. The power metering system consists of a bi-directional coupler, an RF detector module, and a DSP/Host control module. The coupler/detector pair located near the transmitter output generates as DC voltage which is directly proportional to the transmitter output power. This voltage (VF internal) is fed back to the control module, digitized and processed back to the Host. The host compares the monitored power level to the desired and adjusts attenuators in the Exciter Module to change the output level of the Exciter. These attenuators have a minimum resolution of 0.1 dB. This controlled output of the Exciter module drives the Power Amplifier Chain (PAC) . The PAC amplifies the Exciter Module output and the coupler couples a small portion of that signal to the detector module which, in turn, provides a DC level back to the DCP/Host control module. This feedback system continually limits the transmitter output power.

The UHSO steering line will be adjusted to verify that the station 10 MHz reference can be disciplined by the GPS. GPS disciplining will be monitored, then the UHSO will be steered to 10 MHz +/- 5ppb.

<u>Execute the following commands via the BCM FIPS session</u>:

Check steering line.

**w 800 0**; verify 10,000,002 Hz < reference frequency < 100,000,006 Hz
**w 800 4095**; verify 9,999,993 Hz < reference frequency < 9,999,997 Hz

Monitor the GPS steering activity.

**a 192 SASM 34**

Watch the UHSO frequency and the BCM FIPS session. Verify that after 2 minutes maximum the UHSO frequency changes and the BCM FIPS session displays that the steering line has been adjusted down towards 1900. This verifies that UHSO is being disciplined by the GPS

Align the UHSO to 10,000,000.00 +/- .05 Hz adjusting **w 800** between **0** and **4095**; typical level is 1890. Eventually the GPS will discipline the UHSO better than 1 ppb stability (10 MHz +/- 0.01 Hz)

Turn off trace by executing the BCM command : **a 193 SASM 34**

**GPS Operation Verification**

***Verify that LED 6 (GPS okay) is active.***

The following BCM commands should be should be executed to record GPS status:

**a 200**: Latitude
**a 201**: Longitude
**a 202**: Height
**a 203**: XDOP type.
**a 204**: XDOP value.
**a 207**: application type
**a 208**: records GPS receiver status and satellite condition.
**a 213**: Position hold mode.
**a 214**: Date
**a 215**: Time (GMT Time Zone – London)
**a 218**: Self test should show "PASS" after each test (Note: Reset the station after self-test has been performed).

**Power Out Set**

***Consult Chart 2.0 "STD" column for the appropriate power level to set the station. These are pre-cavity settings. The Power Reference must be connected to the pre-cavity point.***

Generate an FM transmission 10/11 frames. (BCM) **a 195 1 2 3 4**
(BCM) **a 196 1**
(BCM) **a 176 0 8 0 0 0 1 10 4 1**

Measure Power Out and adjust register 974 until Chart 2.0 STD value +/- 3 Watts is achieved. Use the following 974 equation: 974(new) = 974(old) + { 10 log(P(old)/P(new)) * 26 counts/dB}. Increment or decrement 974 until Chart 2.0 STD value +/- # Watts is achieved. Record pre-cavity panel power. Note that decreasing 974 increases power out.

Leave transmitter keyed for next measurement.

**Internal Power Meter Alignment**

This procedure will align the RFO! Power meter to a reference power meter. The reference must be at least 3% accurate and traceable to the National Institute of Standards (NIST). Any errors in the reference will be passed on to the RFO! Power meter.

All connections will be referenced to Figure 1.

Initialize the cal factor on the OCM with the command : **a 72 0 0 0 0 0.**
Reset the OCM
Connect the reference power meter to the RF cable at the cavity input. If no X263 Option, then connect to the antenna port at the top of the station.
Key the transmitter for 10/11 blocks with the BCM command : **a 176 0 8 0 0 0 1 10 5 1**
Power should be set to 75 watts with the above command.
Increase the power to 200 watts by adjusting the OCM register 2054 to [11680 *(200/Po) $^{1/2}$](19200). The power meter must be calibrated at 200 watts +/- 5%.

Read the RFO! Power meter using the OCM command: **a 79 0**.
Using the "Last power read" verify that the RFO! Power meter and the reference power meter are within +/- 20%.
Align the internal power meter to the reference power meter by sending the OCM command: **a 71 0 xxx**, where xxx is the reading of the reference power meter and "0" indicates the internal power meter.
Calibration takes a maximum of 75 seconds. Verify that calibration takes place by noting the calibration factor.
Dekey radio using the BCM command: **a 117**
Return OCM register 2054 to 11680: **w 2054 11680**
Reset OCM ( **a 117**). The RFO! Internal power meter will be calibrated on the return from reset.

**Transmitter Frequency Check and Microphonic Screen**

The Spectrum Analyzer will be used to verify that the transmitter is on the desired frequency. It must be using an external reference with a stability > .5 pbb. Switch the Spectrum Analyzer to "external reference" via the "Aux cntl/Rear panel" key.

Set deviation to 0 Hz by executing OCM command: "**w 2053 0**". The default is 4800.
Set analyzer RBW, VBW and Sweep to "auto".
Set analyzer center frequency and marker to subchannel frequency.
Transmitter should be keyed from the previous test. If not, execute the BCM command: **a 177** to stop data from the last key and then execute the key command "**a 176 0 8 0 0 0 1 11 4 1**".
Hit "Marker Delta" and then "Peak Search" when the Tx is keyed.
Set analyzer span to 500 Hz.
The indicated Delta frequency should be < +/- 10 Hz.
Verify that discrete spurious signals (not noise) are at least 30 dB below carrier > +/- 100 Hz from the carrier.
Leave the transmitter keyed for the next measurement.

**Carrier Feed-through (CFT) and Image Null**

**The carrier feed-through** is an undesired by-product of the I/Q modulator. The carrier is nulled by alternately adjusting the DC-offset on the I cahnnel and the DC offset on the Q channel via the OCM FIPS using the **w 979** and **w 980** commands respectively.

1) Using the OCM command **w 2053 1** set this value to 1.
2) Set the analyzer span to 20 kHz and RBW to 300 Hz; center remains on Tx center.
3) Transmitter should be keyed from previous test. If not, execute the OCM command: "**a 177**. To stop the data from the last key and then execute the key command :**176 0 8 0 0 0 1 11 4 1**.
4) Hit "Marker Normal" then "Peak Search" while transmitting to capture the +0 Hz deviated subchannel. This is used as a level reference.
5) Move the "Marker Delta" over to the carrier by pressing "Mkr Delta " and then "Next Peak Left" Verify that this is the center of the channel. If not, dial over to the carrier feed through spur. This is approximately –6.25 to –6.27 kHz from the subchannel.
6) Adjust the I DC offset using "**w 979**" until a minimum point is achieved. Default is 0 and the optimum point could be between -3000 and + 3000. Try increments of 200. If outside of this range, fail the exciter.
7) Adjust the Q-channel offset using the "**w 980**" command until a minimum is achieved and then go back a re-adjust the I offset at smaller increments. Try initial increments of 200.
8) Continue adjustment until CFT is < -60 dBc. Record CFT level, 979 setting, 980 setting, and 974 setting.
9) Small changes in ambient temperature can cause large changes in the carrier feed-thru. Any subsequent testing using the same r 974, r 779, r 980 values will be needed to meet the minimum spec of –45 dBc.

**Image Null**- An image of the desired channel is also an undesired by-product. This image is reduced by the "w 981" command between –5.0 and +5.0.

1) Set Marker Delta over-to image(-12.5 kHz)
2) Adjust "w 981" until image is < -40 dBc. Record image and 981 value.
3) If further measurements are desired leave transmitter keyed.

**Equipment employing digital modulation techniques.**

Detailed description of the modulation system to be used, including the response characteristics (frequency, phase and amplitude) of any filters provided.

Description of the modulating wave train for the maximum rated conditions under which the equipment will be operated.

**Digital modulation techniques:** The linear transmitter modulates at any particular instant one of two types of signals: FSK(Frequency Shift Keyed) signals that are used to communicate with and control the messaging unit, or AM that contains the message information. Three channels of FSK data can be transmitted simultaneously within the 45 Khz of authorized bandwidth. The FSK data can be transmitted as much as 3200 symbols/second with symbol deviations of 2400, 800, -8, and –2400 Hz. Independent AM signals will be transmitted simultaneously in up to four of the seven available 6.25 kHz sub-channels. Both the FSK and AM signals are modulated at baseband by DSP,s and provided to the exciter D/A converter as I/Q data streams. Significant filtering is undertaken by the DSPs to help ensure that the transmitted signal remains within spectral limits.

## 2. SYSTEM TEST CONFIGURATION

### 2.1 Justification

The EUT was initially tested for FCC emission in the following configuration:

See Block Diagram.

### 2.2 EUT Exercise Software

None

### 2.3 Special Accessories

None

### 2.4 Modification

None

### 2.5 Configuration of Tested System

See Block Diagram.



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## 3 RF POWER OTUPUT. FCC PART 2, PARAGRAPH 2.1046 and PART 24, PARAGRAPH 24.132(c)

See following page(s).

FCC CFR 47 PART 2.1046 RF POWER OUTPUT

FCC CFR 47 PART 24.132 (c) POWER LIMITS

Base stations transmitting into the 930--931 MHz and 940--941 MHz bands are limited to 3500 watts e.r.p. per authorized channel…Power measured is less than Power Limit allowed.

| | Power In | Power Out | Gain (dB) |
|---|---|---|---|
| 930--931 MHz | | | |
| 930.5 MHz | 10.2 mW | 400 W | 45.9 |
| 940--941 MHz | | | |
| 940.5 MHz | 9.3 mW | 400 W | 46.3 |

**EQUIPMENT USED**

| | | | | |
|---|---|---|---|---|
| Power Meter | | | | |
| | Hewlett Packard | hp437B | sn: 4236U21450 | Due for Cal. 2/10/02 |
| Power Sensor | | | | |
| | Hewlett Packard | hp8481H | sn: 1926A01157 | Due for Cal. 9/24/02 |
| Directional Coupler | | | | |
| #1 | Cellwave | 588256B1J03 | sn: 192079-007 | |
| #2 | Hewlett Packard | 778D | sn: 1144A07633 | |

Tech: A. Laudani
TR2 TEST Room 2/ photos taken of this setup
Feb. 18, 2002



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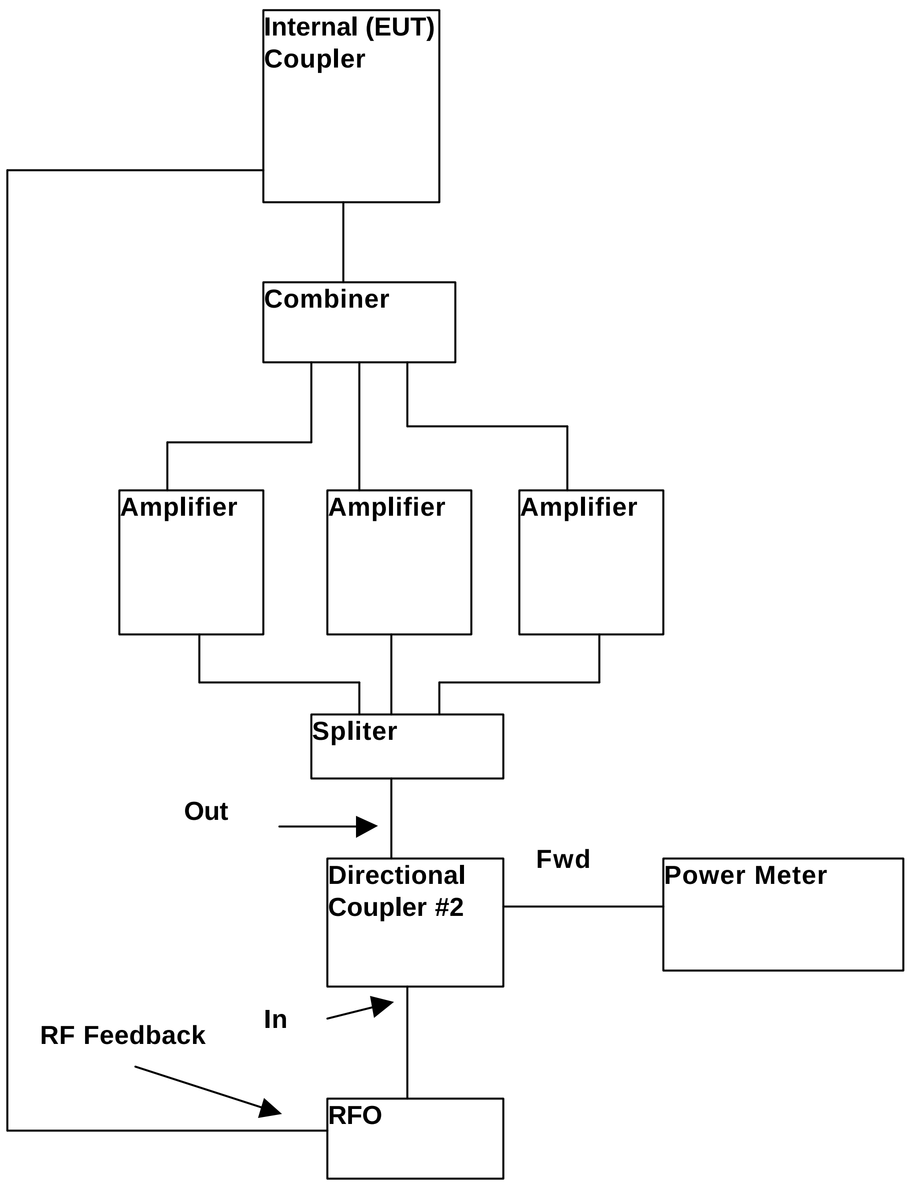
## Input Setup

**4**



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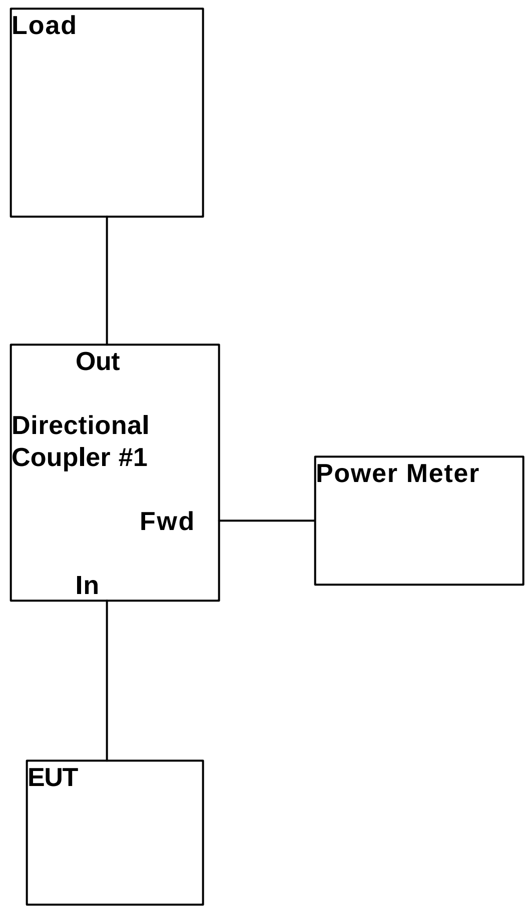
## Output Setup



# 4 OCCUPIED BANDWIDTH, FCC PART 2, PARAGRAPH 2.1049 and PART 24, PARAGRAPH 24.131

See following page(s).

The authorized bandwidth for the RFO PAGING STATION is 45 kHz as it has a 50 kHz channel.
This is evident as the -26 dB points are less than 40 kHz.

**EQUIPMENT USED**

| | | | | |
|---|---|---|---|---|
| Spectrum Analyzer | Hewlett Packard | hp8566B | sn: 2610A02913 | Cal. 11/17/2002 |
| Directional Coupler #1 | Cellwave | 588256B1J03 | sn: 192079-007 | |

Tech: A. Laudani
TR2 TEST Room 2/ photos taken of this setup
Feb. 18, 2002



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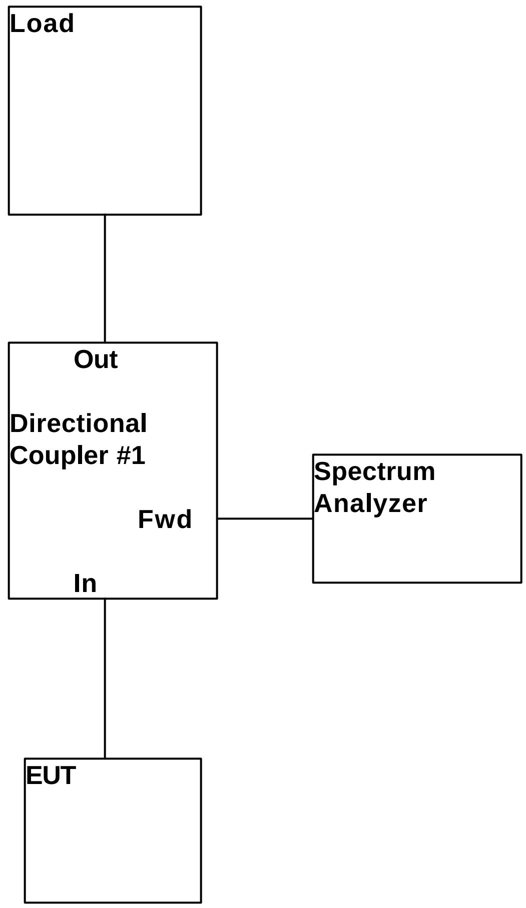
## Occupied Bandwidth Setup




**NOTES:**

1. **1.** FWD insertion loss of coupler at measured frequencies is 40.5 dB.
2. 2. Offset included coupler insertion loss plus cable loss(coupler to spectrum analyzer).



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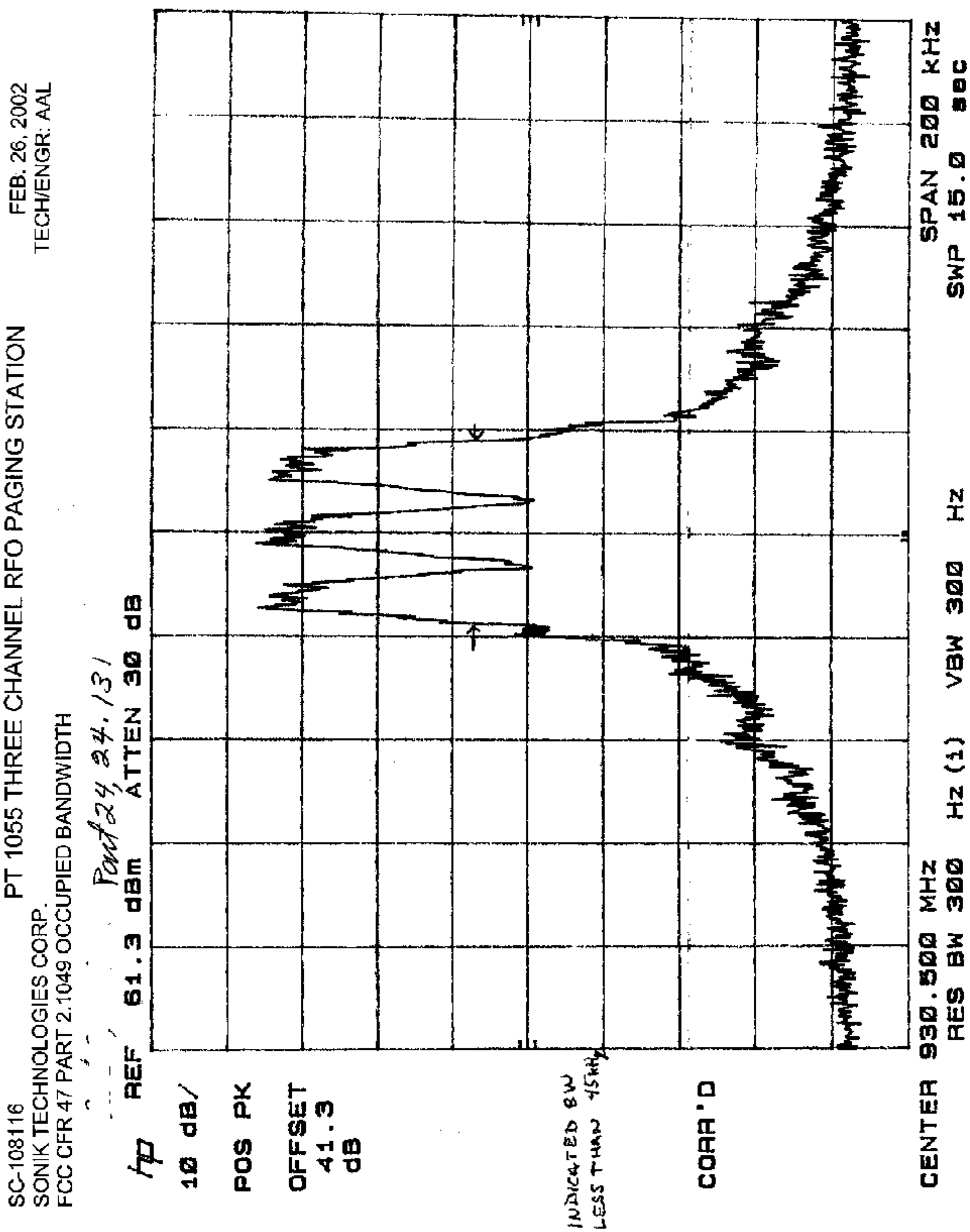
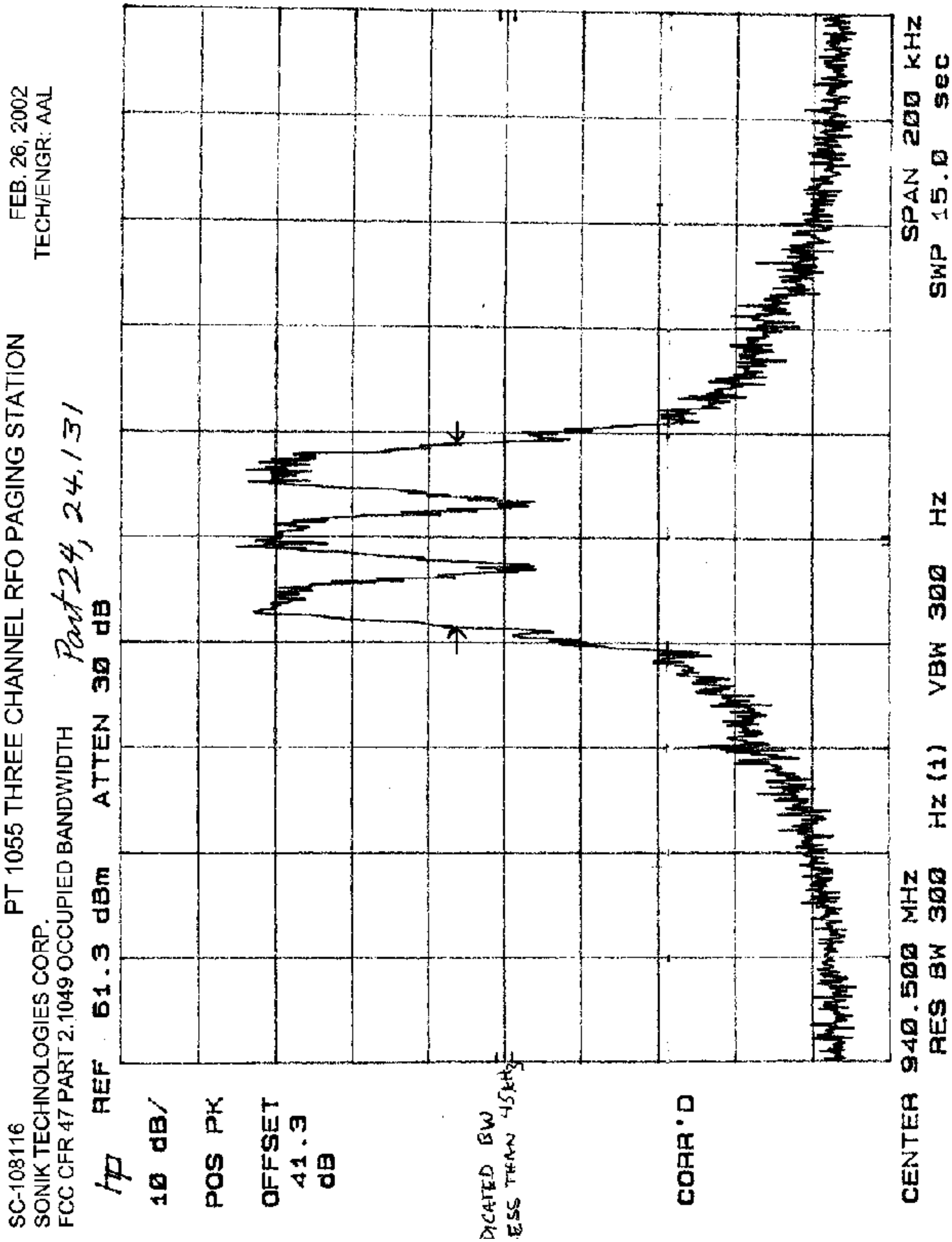

SC-108116
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 2.1049 OCCUPIED BANDWIDTH
PT 1055 THREE CHANNEL RFO PAGING STATION
FEB. 26, 2002
TECH/ENGR: AAL
REF 61.3 dBm ATTEN 30 dB
10 dB/
POS PK
OFFSET 41.3 dB
INDICATED BW LESS THAN 45kHz
CORR'D
CENTER 930.500 MHz SPAN 200 kHz
RES BW 300 Hz (1) VBW 300 Hz SWP 15.0 sec



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## 5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS, FCC PART 2, PARAGRAPH 2.1051 and PART 24, PARAGRAPH 24.133(a)(1)(i); (ii)

See following page(s).

The RFO modulation is all data for Narrowband PCS paging only.
The carrier consists of three sub-channels modulated in time--lock, four-level FSK within a 45 kHz bandwidth.
The transmitter is only capable of servicing a single 50 kHz channel.
The RFO's signal is split into 3 and fed into 3 equivalent amplifiers whose output is combined into a coupler which samples the RF for feedback for the RFO before feeding the filter and then to the antenna.

| | Fd | = 60 - 116 LOG((Fd+10)/6.1) |
|---|---|---|
| Emission Mask: For frequencies outside the authorized bandwidth (45 kHz) and removed from the edge of the authorized bandwidth by a displacement frequency Fd up to and including 40 kHz. | 0 | 35.1 |
| | 2 | 25.9 |
| | 4 | 18.1 |
| | 6 | 11.4 |
| For Fd greater than 14 kHz, attenuation was 70 dB, see display line (-10 dB). | 8 | 5.5 |
| | 10 | 0.2 |
| For Fd between 0 and 14 kHz the table at right was used to sketch an emission mask. | 12 | -4.6 |
| | 14 | -9.0 |

Emissions were found to be well within the masked values

equipment used

| | | | | |
|---|---|---|---|---|
| Spectrum Analyzer | Hewlett Packard | hp8566B | sn: 2610A02913 | Due for Cal. 11/17/2002 |
| Directional Coupler #1 | Cellwave | 588256B1J03 | sn: 192079-007 | |

Tech: A. Laudani
TR2 TEST Room 2/ photos taken of this setup
Feb. 26, 2002

The carrier consists of three sub-channels modulated in time--lock, four-level FSK within a 45 kHz bandwidth. Emissions were investigated from 30 MHz through 10 GHZ, enough to demonstrate 10 harmonics of the operating frequency. The second harmonic was found and featured below the limit.
For Fd greater than 14 kHz, attenuation was 70 dB, see display line (-10 dB).

Emissions were found to be well within the masked values

equipment used

| | | | | |
|---|---|---|---|---|
| Spectrum Analyzer | Hewlett Packard | hp8566B | sn: 2311A02209 | Cal. 12/17/2002 |
| RF Preselector | Hewlett Packard | 85685A | sn: 2610A02913 | Cal. 2/14/03 |
| Directional Coupler #1 | Cellwave | 588256B1J03 | sn: 192079-007 | |

Tech: A. Laudani
TR2 TEST Room 2/ photos taken of this setup
Feb. 26, 2002



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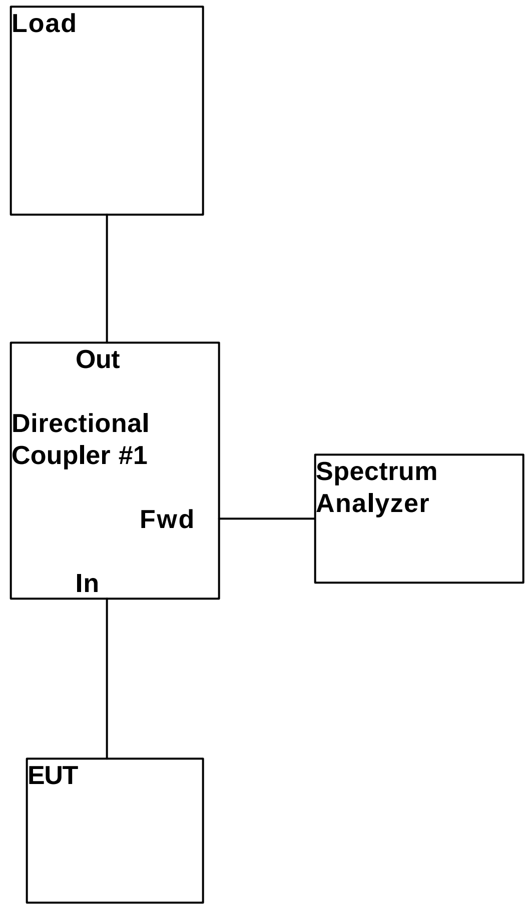
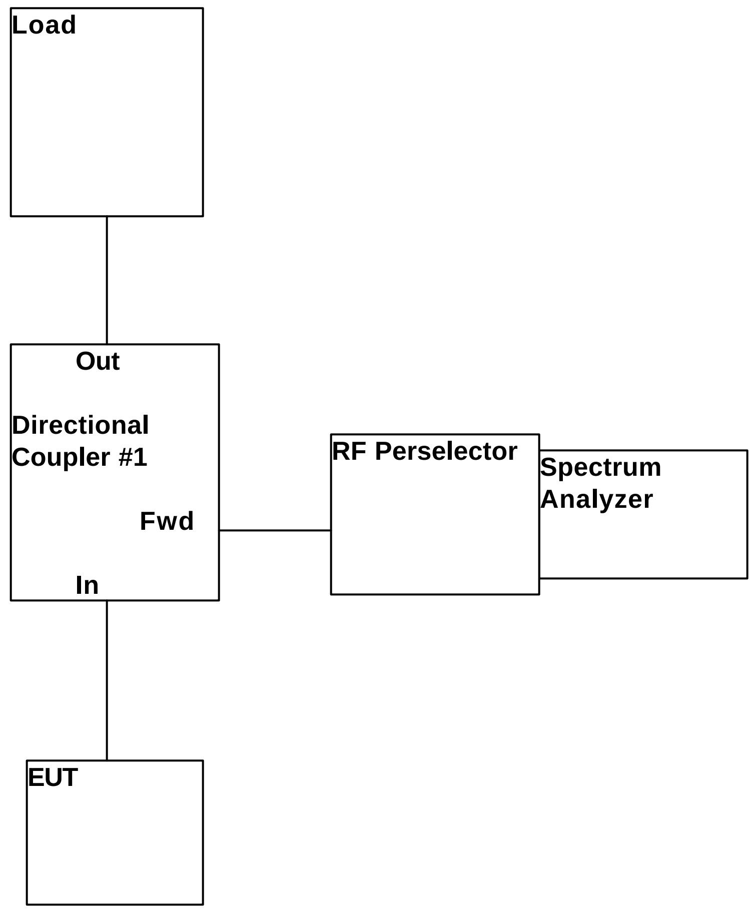
## RF Conducted Emissions Setup1




**NOTES:**

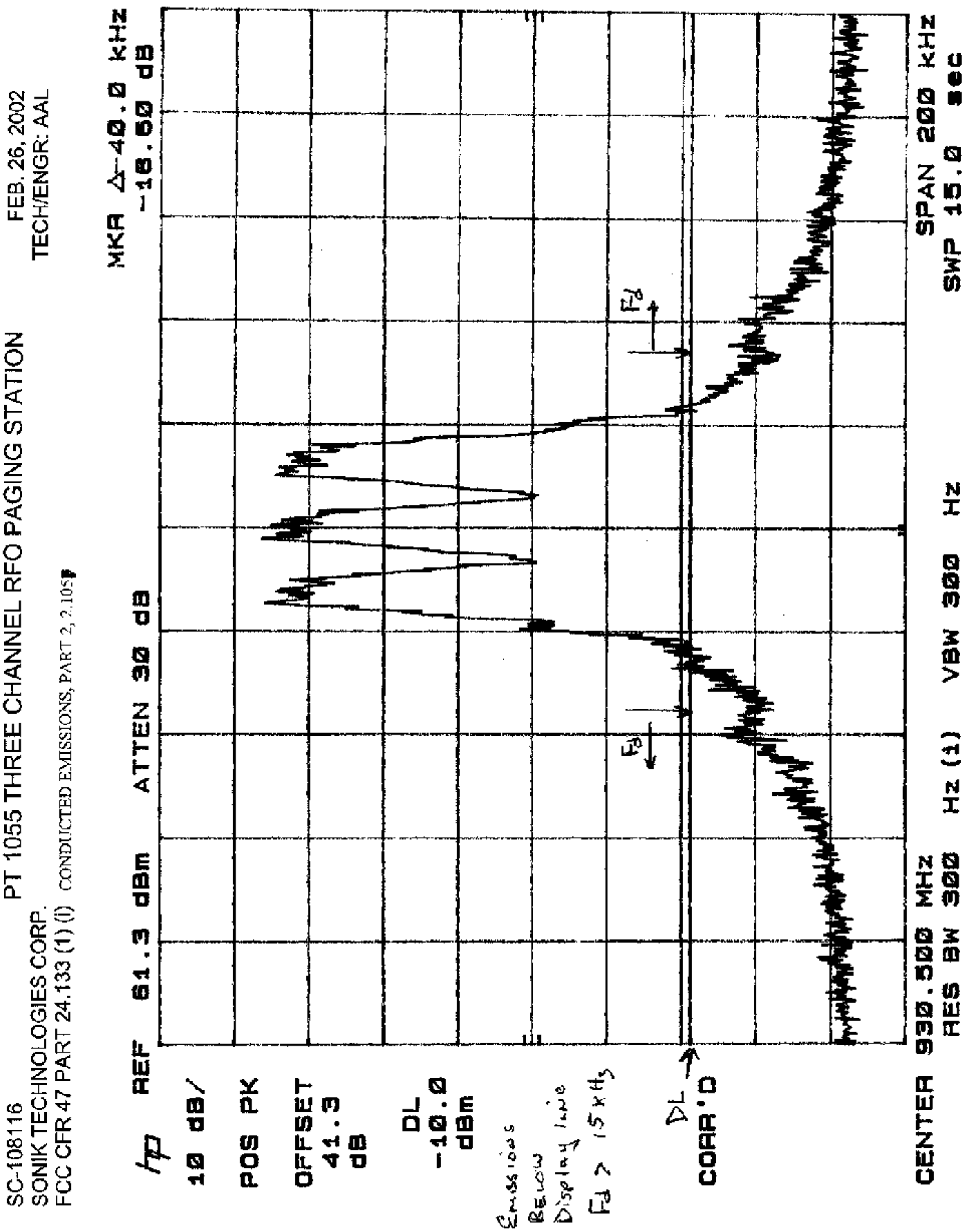
1. **5.** FWD insertion loss of coupler at measured frequencies is 40.5 dB.
2. 6. Offset included coupler insertion loss plus cable loss(coupler to spectrum analyzer).

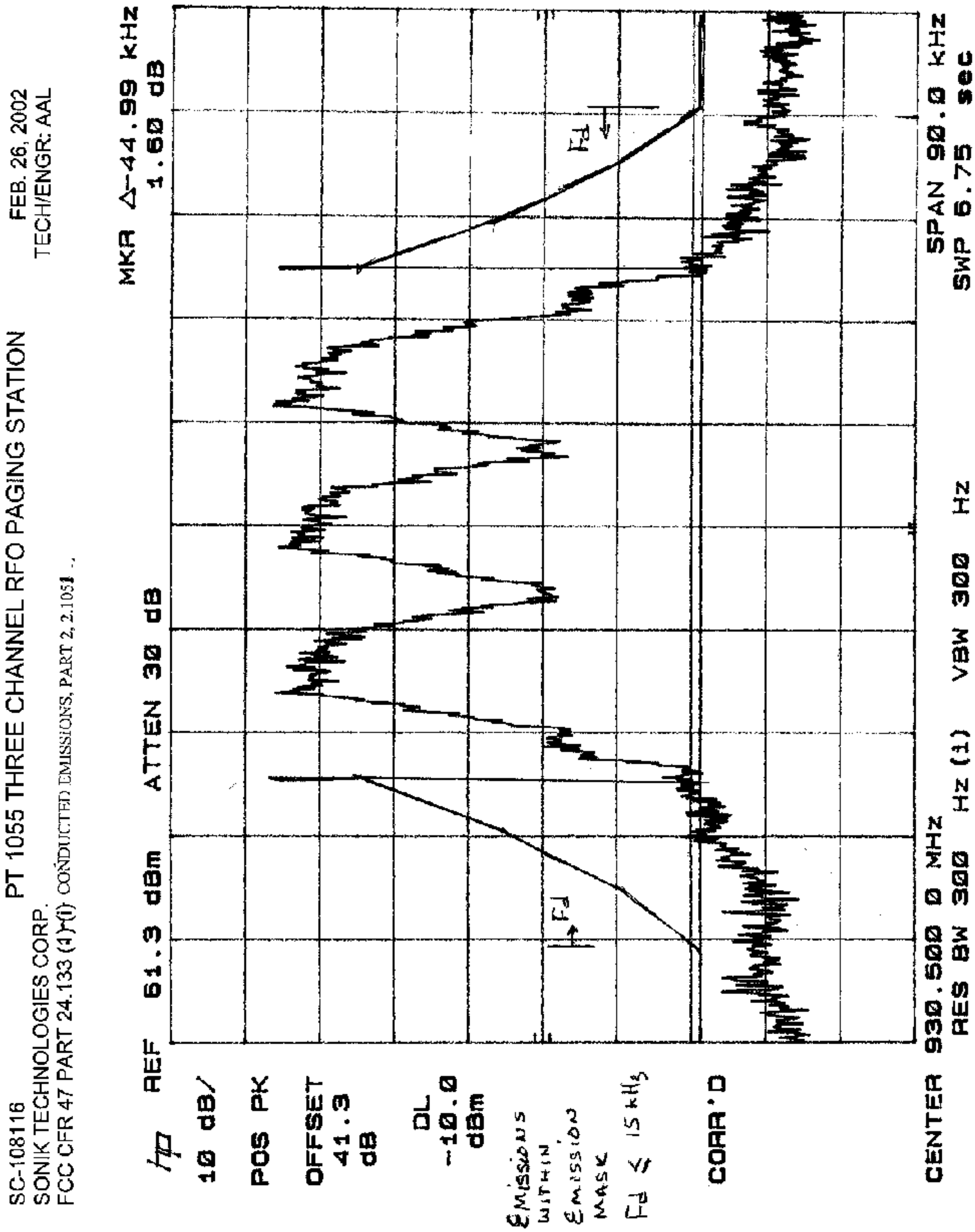
## RF Conducted Emissions Setup2

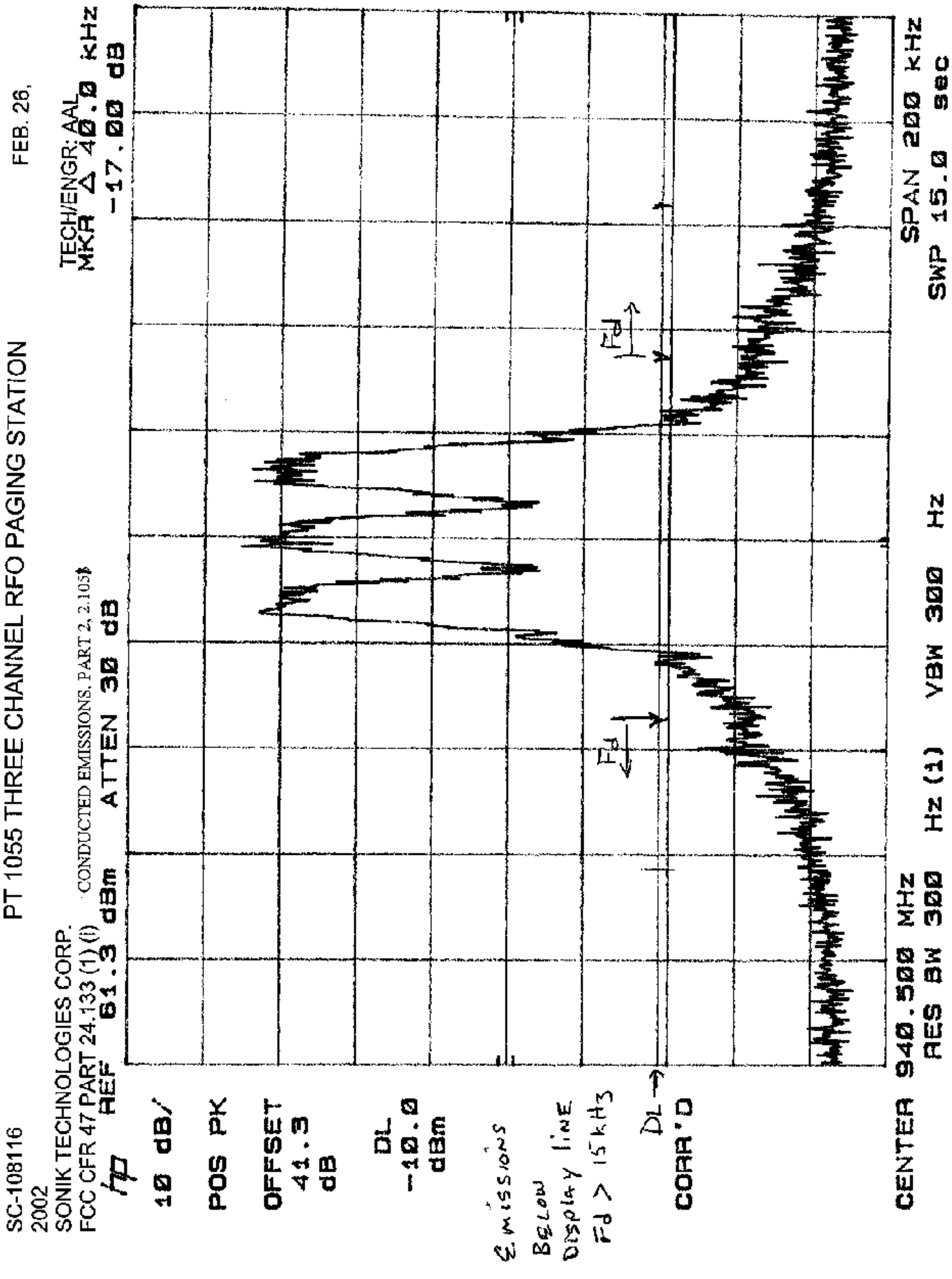



**NOTES:**

1. **3.** FWD insertion loss of coupler at measured frequencies is 40.5 dB.
2. 4. Offset included coupler insertion loss plus cable loss (coupler to preselector).

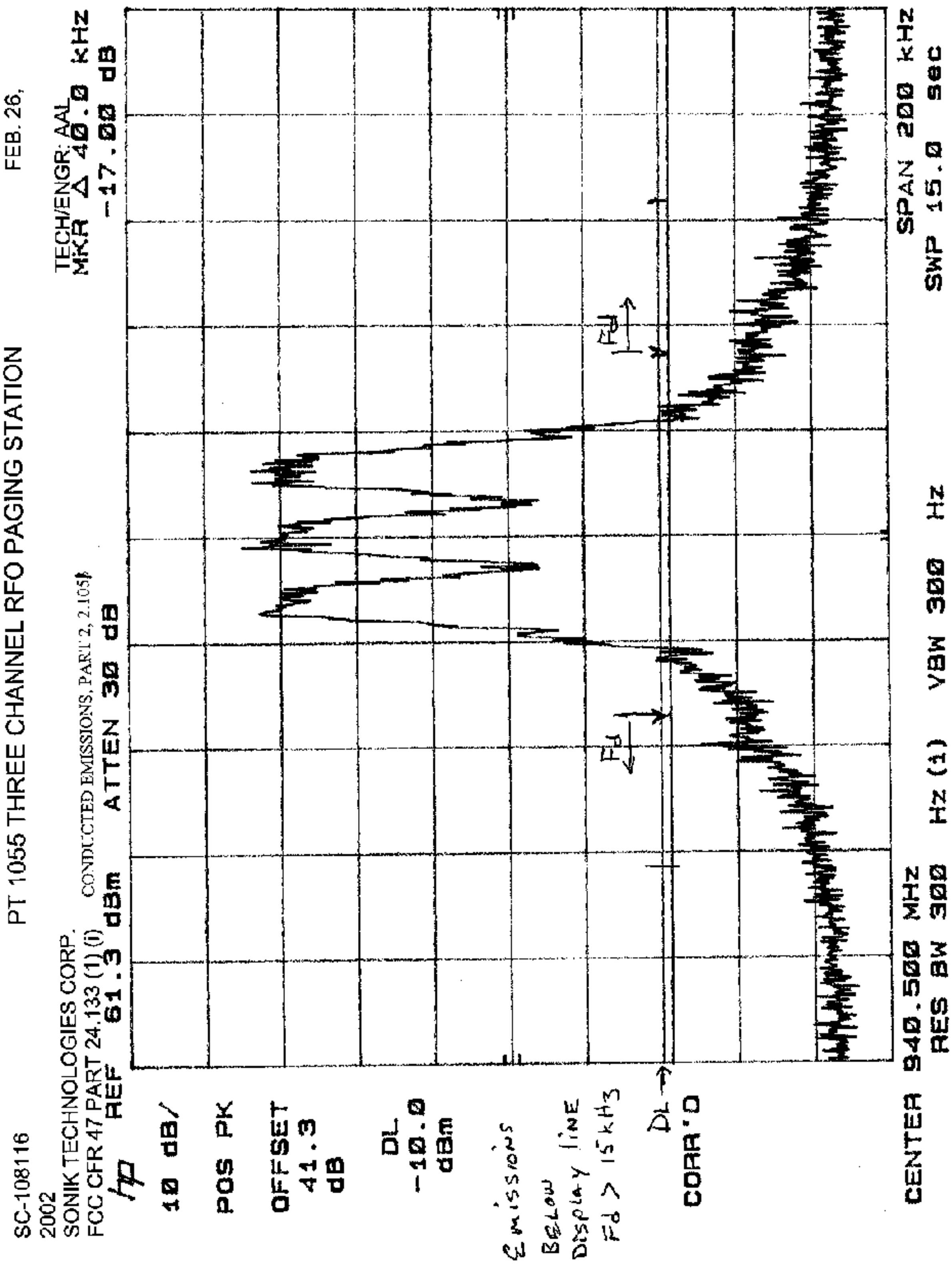

SC-108116
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 24.133 (1) (i) CONDUCTED EMISSIONS, PART 2, 2.1051
PT 1055 THREE CHANNEL RFO PAGING STATION
FEB. 26, 2002
TECH/ENGR: AAL
REF 61.3 dBm
ATTEN 30 dB
MKR Δ-40.0 kHz
-18.50 dB
10 dB/
POS PK
OFFSET
41.3
dB
DL
-10.0
dBm
Emissions
Below
Display line
Fd > 15 kHz
DL
CORR'D
Fd
Fd
CENTER 930.500 MHz
RES BW 300 Hz (1)
VBW 300 Hz
SPAN 200 kHz
SWP 15.0 sec

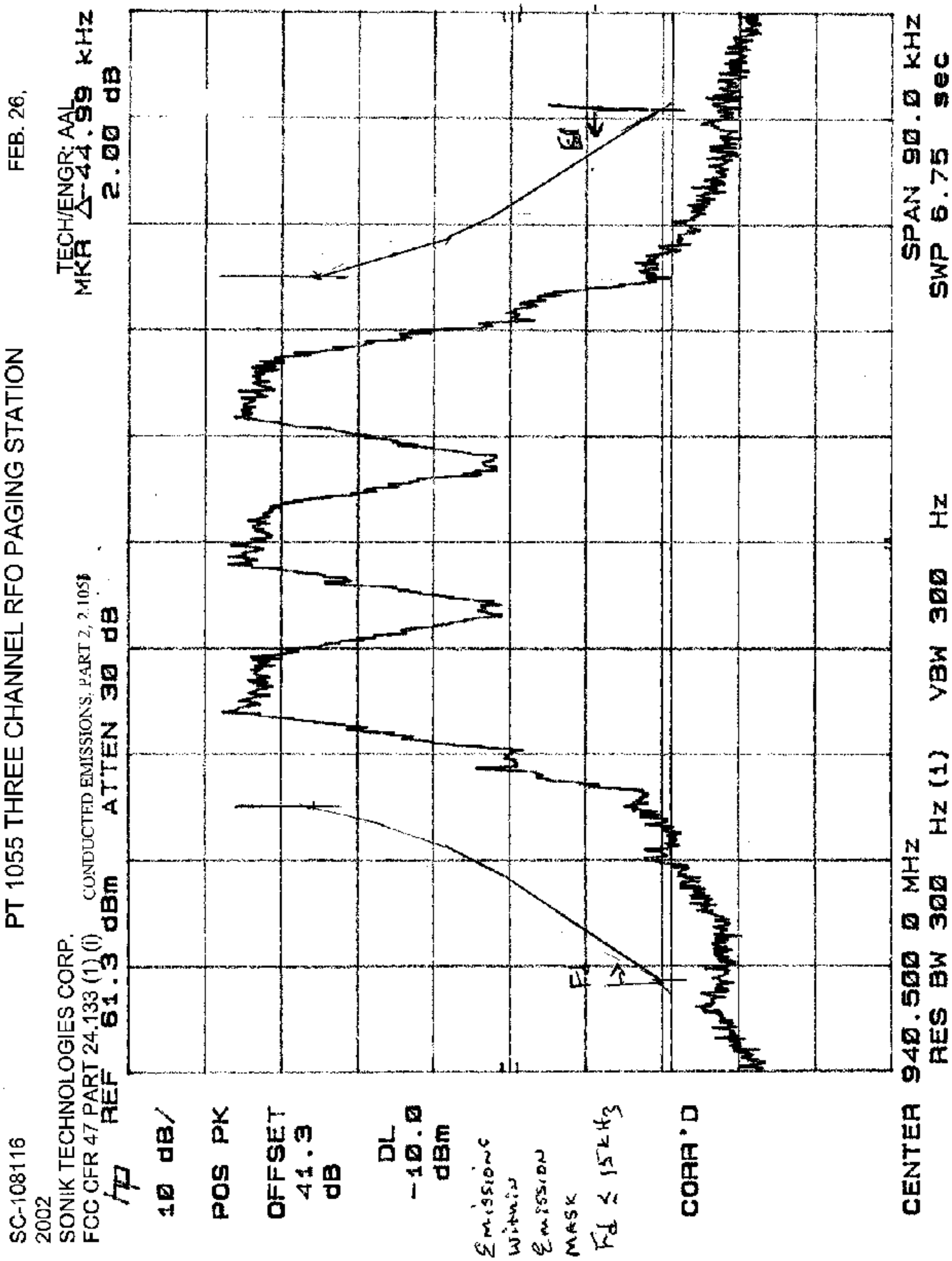

SC-108116
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 24.133 (1)(i) CONDUCTED EMISSIONS, PART 2, 2.1051
PT 1055 THREE CHANNEL RFO PAGING STATION
FEB. 26, 2002
TECH/ENGR: AAL
REF 61.3 dBm ATTEN 30 dB
MKR Δ-44.99 kHz
1.60 dB
10 dB/
POS PK
OFFSET
41.3
dB
DL
-10.0
dBm
Emissions within emission mask
Fd ≤ 15 kHz
Fd
Fd
CORR'D
CENTER 930.500 0 MHz
RES BW 300 Hz (1)
VBW 300 Hz
SPAN 90.0 kHz
SWP 6.75 sec



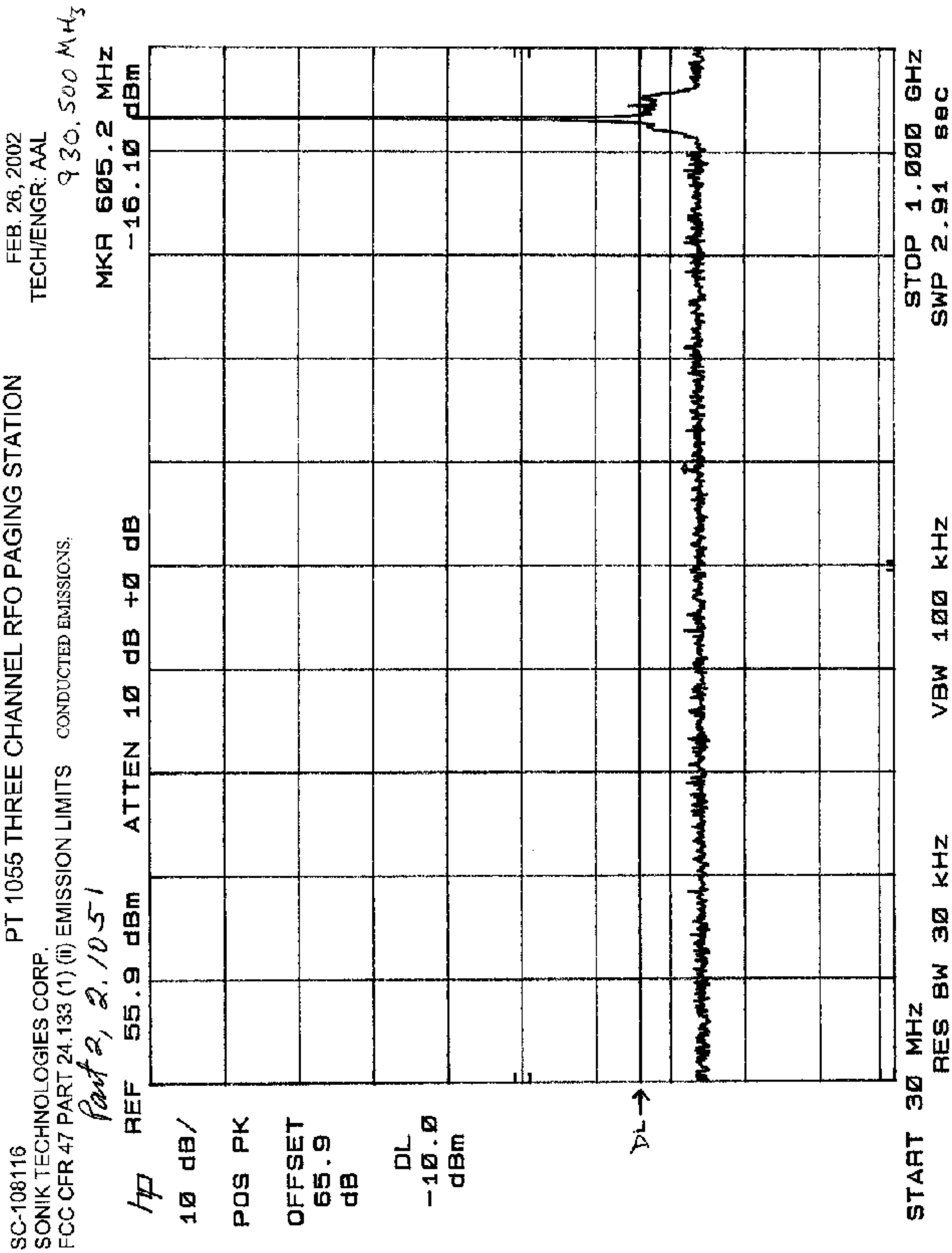



TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364


PT 1055 THREE CHANNEL RFO PAGING STATION
FEB. 26,
SC-108116
2002
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 24.133 (1) (i)
CONDUCTED EMISSIONS, PART 2, 2.1051
TECH/ENGR: AAL
MKR Δ 40.0 kHz
-17.00 dB
REF 61.3 dBm
ATTEN 30 dB
10 dB/
POS PK
OFFSET
41.3
dB
DL
-10.0
dBm
CORR'D
CENTER 940.500 MHz
SPAN 200 kHz
RES BW 300 Hz (1)
VBW 300 Hz
SWP 15.0 sec
Emissions
Below
Display line
Fd > 15kHz
DL →
Fd
Fd

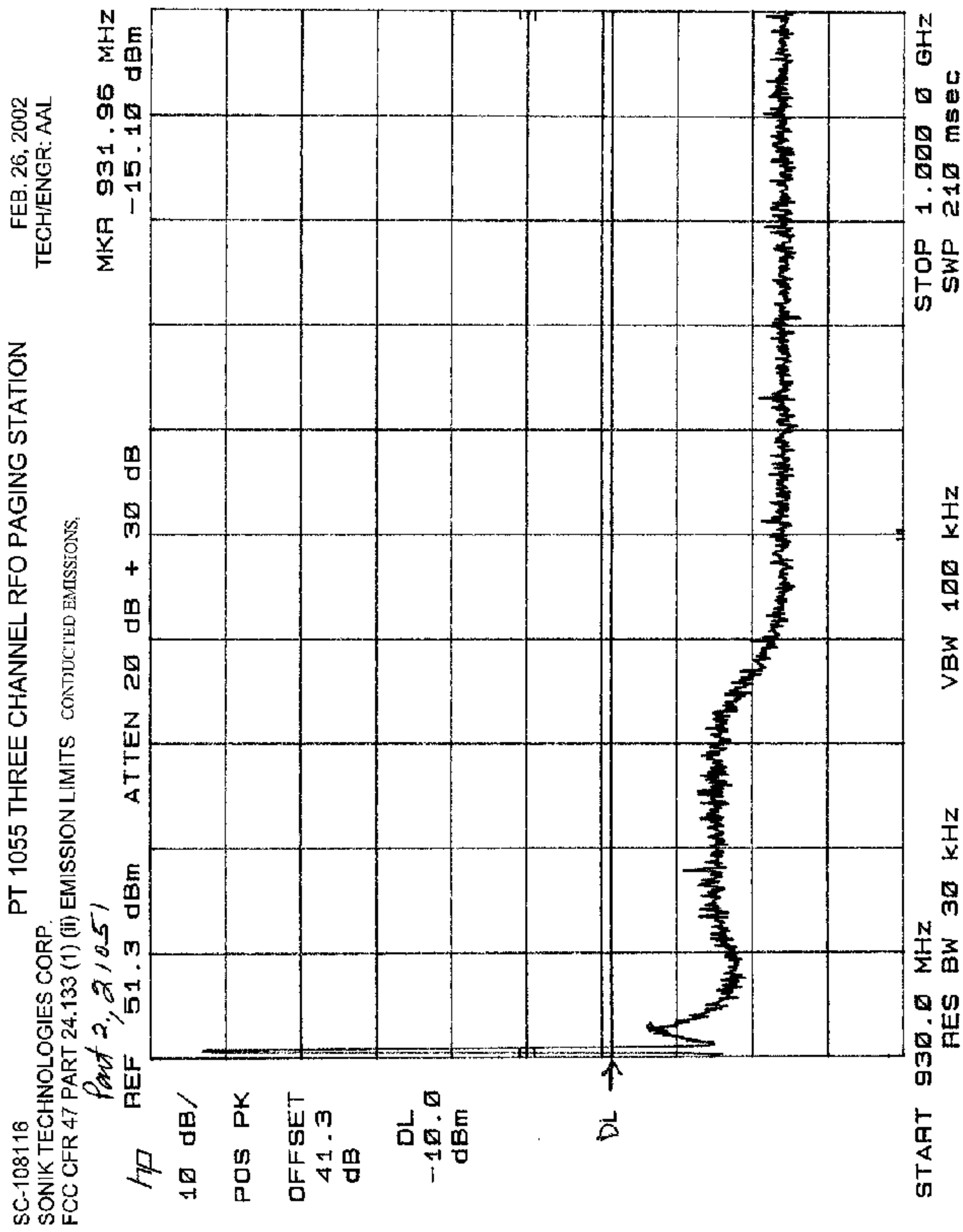

PT 1055 THREE CHANNEL RFO PAGING STATION
SC-108116
FEB. 26,
2002
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 24.133 (1) (i)
CONDUCTED EMISSIONS, PART 2, 2.1051
TECH/ENGR: AAL
MKR Δ-44.99 kHz
2.00 dB
REF 61.3 dBm
ATTEN 30 dB
10 dB/
POS PK
OFFSET
41.3
dB
DL
-10.0
dBm
Emissions within emission mask
Fd ≤ 15kHz
CORR'D
CENTER 940.500 0 MHz
SPAN 90.0 kHz
RES BW 300 Hz (1)
VBW 300 Hz
SWP 6.75 sec

TÜV PRODUCT SERVICE






TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364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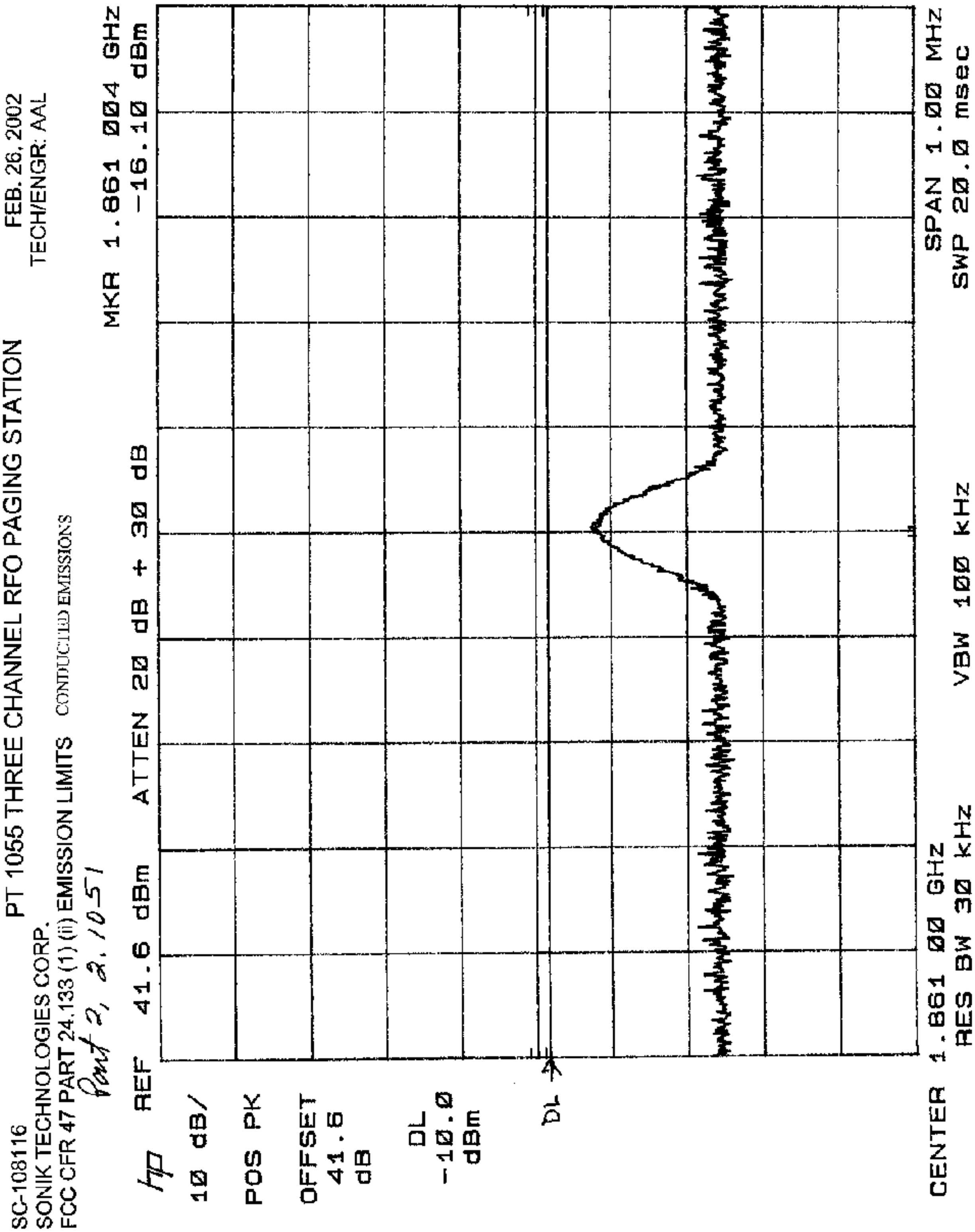
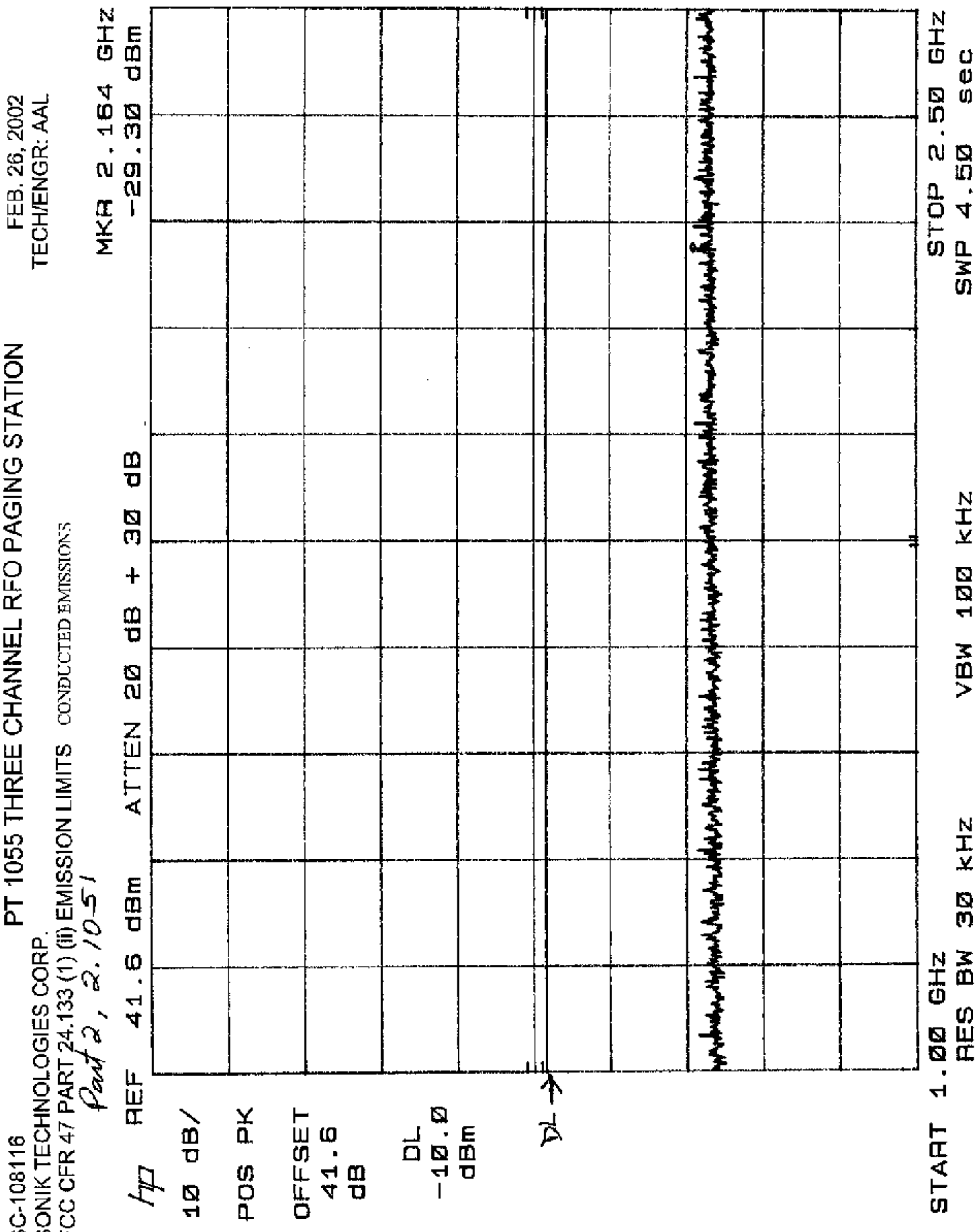
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 24.133 (1) (ii) EMISSION LIMITS CONDUCTED EMISSIONS.
PT 1055 THREE CHANNEL RFO PAGING STATION
FEB. 26, 2002
TECH/ENGR: AAL
Part 2, 2.1051
hp
REF 51.3 dBm
ATTEN 20 dB + 30 dB
MKR 931.96 MHz
-15.10 dBm
10 dB/
POS PK
OFFSET
41.3
dB
DL
-10.0
dBm
DL
START 930.0 MHz
RES BW 30 kHz
VBW 100 kHz
STOP 1.000 0 GHz
SWP 210 msec


SC-108116
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 24.133 (1) (ii) EMISSION LIMITS CONDUCTED EMISSIONS
PT 1055 THREE CHANNEL RFO PAGING STATION
FEB. 26, 2002
TECH/ENGR: AAL
Part 2, 2.1051
REF 41.6 dBm
ATTEN 20 dB + 30 dB
MKR 1.861 004 GHz
-16.10 dBm
10 dB/
POS PK
OFFSET
41.6
dB
DL
-10.0
dBm
DL
CENTER 1.861 00 GHz
SPAN 1.00 MHz
RES BW 30 kHz
VBW 100 kHz
SWP 20.0 msec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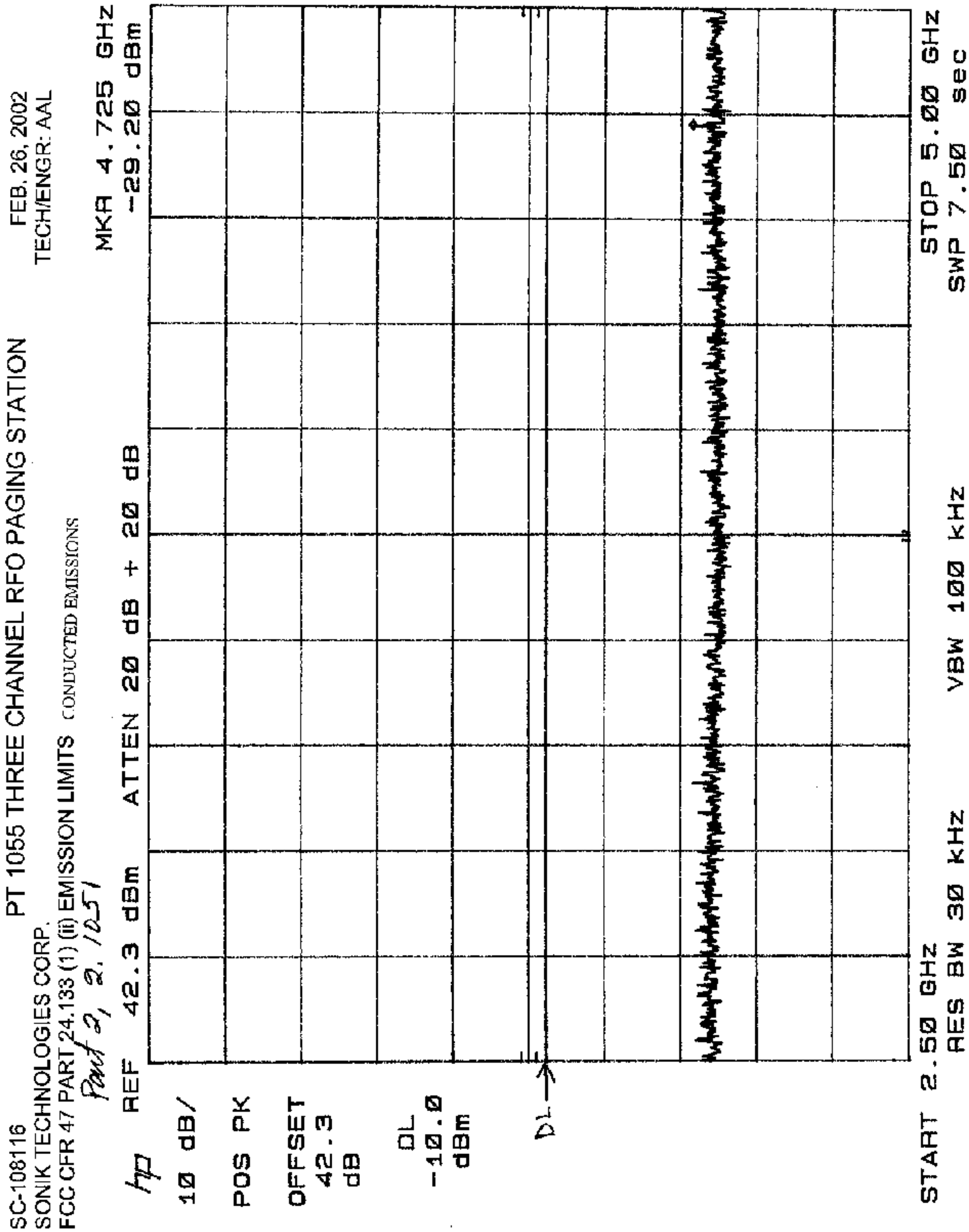
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 24.133 (1) (ii) EMISSION LIMITS CONDUCTED EMISSIONS
Part 2, 2.1051
PT 1055 THREE CHANNEL RFO PAGING STATION
FEB. 26, 2002
TECH/ENGR: AAL
hp
REF 41.6 dBm
ATTEN 20 dB + 30 dB
MKR 2.164 GHz
-29.30 dBm
10 dB/
POS PK
OFFSET
41.6
dB
DL
-10.0
dBm
DL →
START 1.00 GHz
STOP 2.50 GHz
RES BW 30 kHz
VBW 100 kHz
SWP 4.50 sec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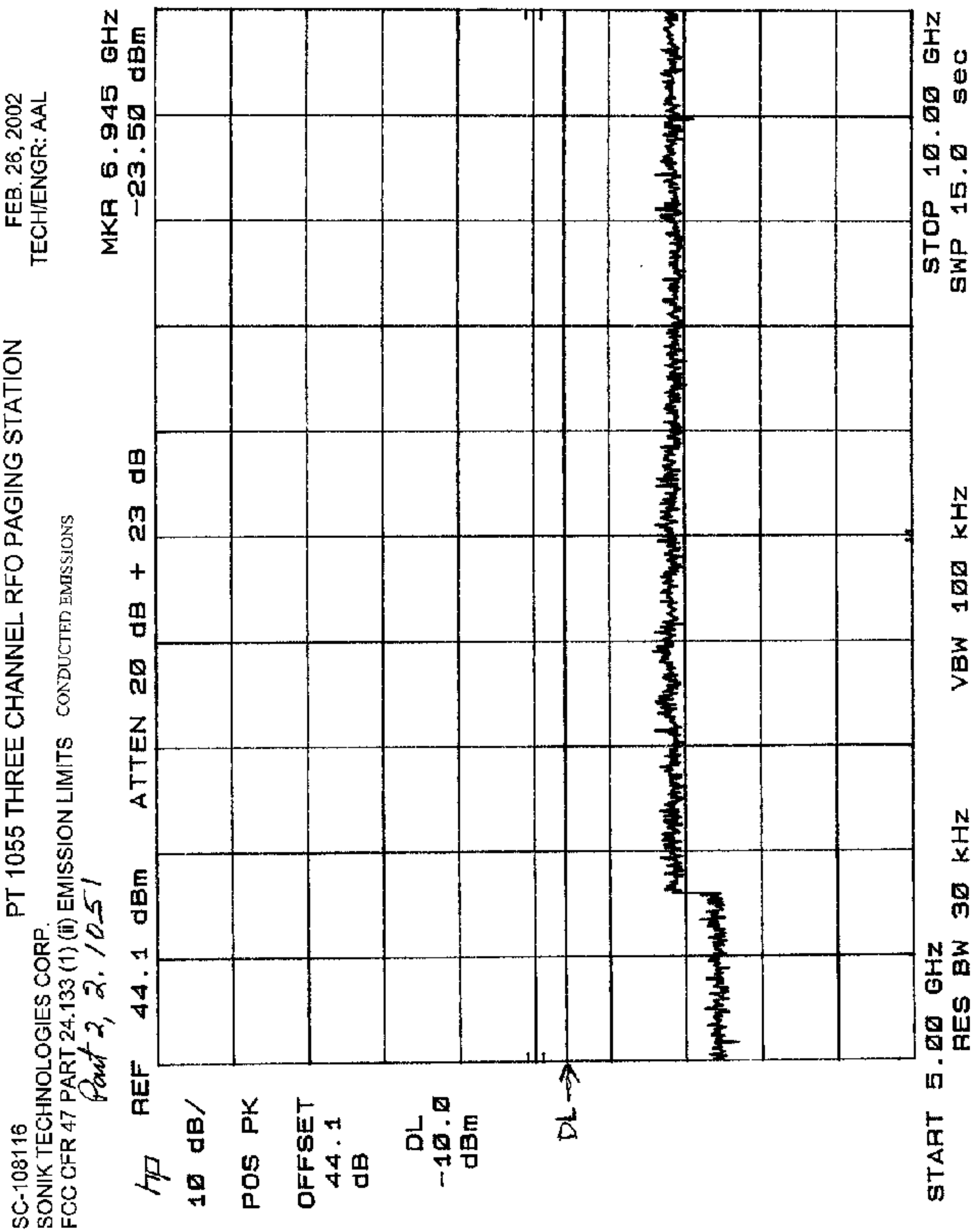
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 24.133 (1) (ii) EMISSION LIMITS CONDUCTED EMISSIONS
PT 1055 THREE CHANNEL RFO PAGING STATION
FEB. 26, 2002
TECH/ENGR: AAL
Part 2, 2.1051
hp
REF 42.3 dBm
ATTEN 20 dB + 20 dB
MKR 4.725 GHz
-29.20 dBm
10 dB/
POS PK
OFFSET
42.3
dB
DL
-10.0
dBm
DL
START 2.50 GHz
RES BW 30 kHz
VBW 100 kHz
STOP 5.00 GHz
SWP 7.50 sec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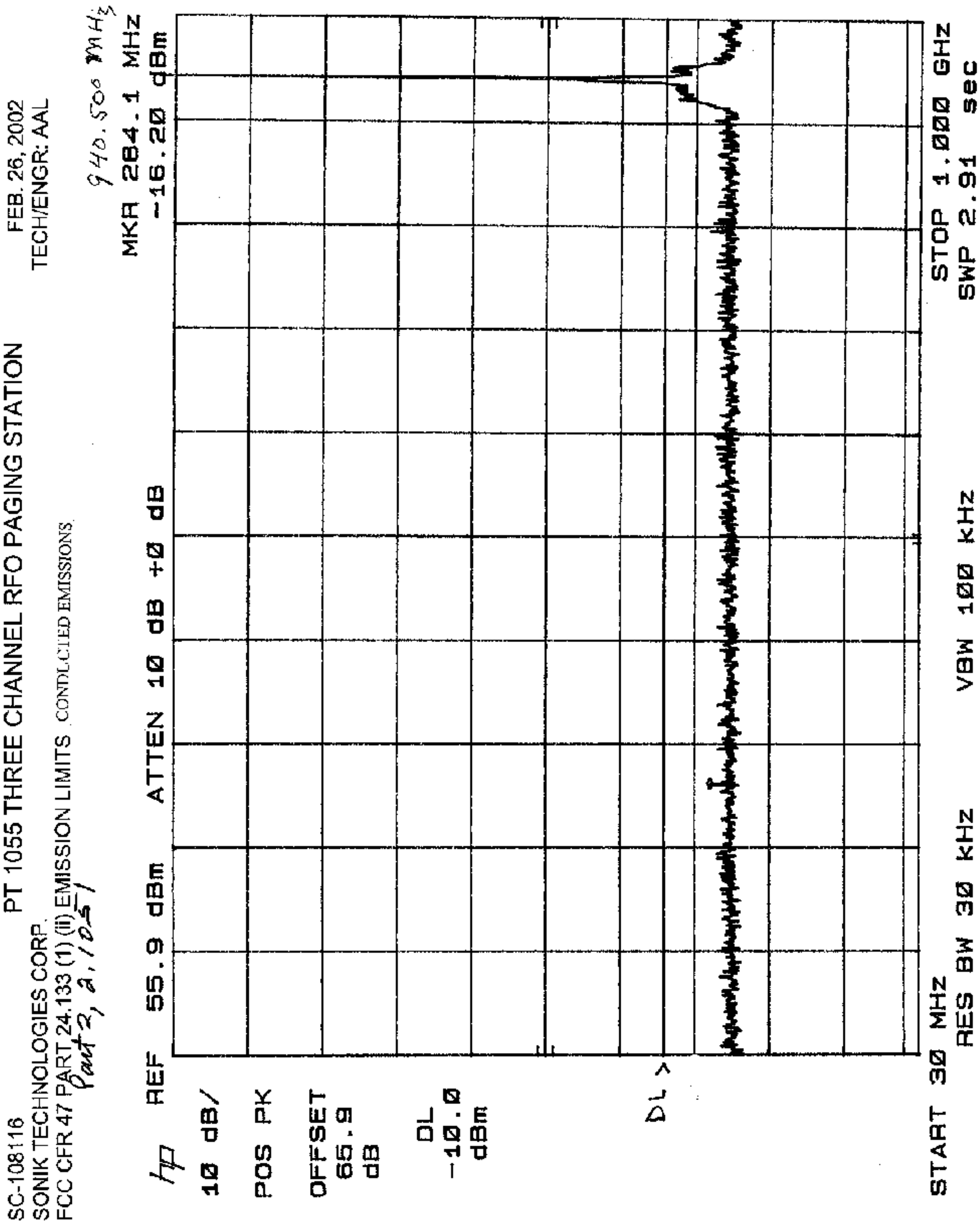
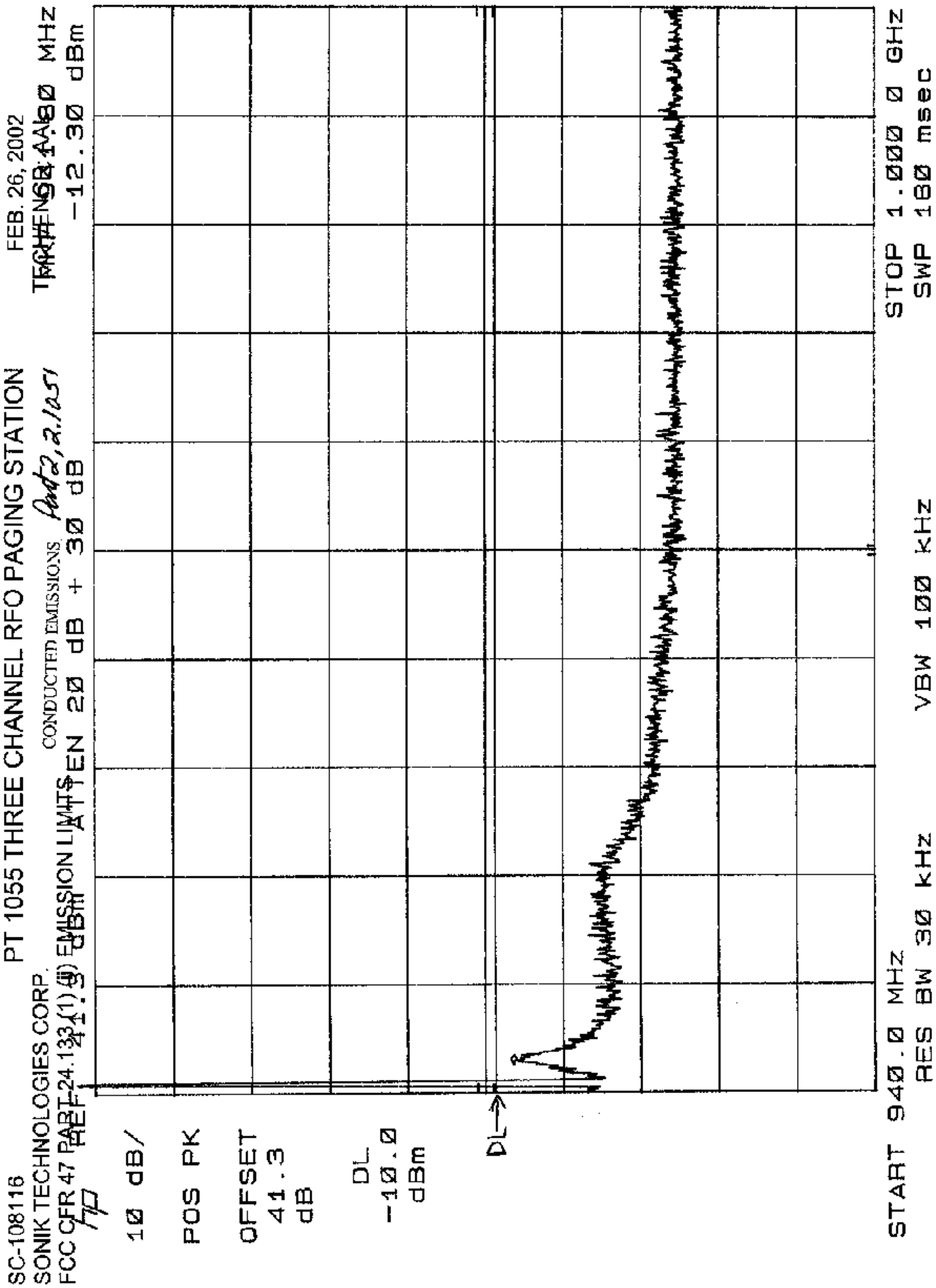
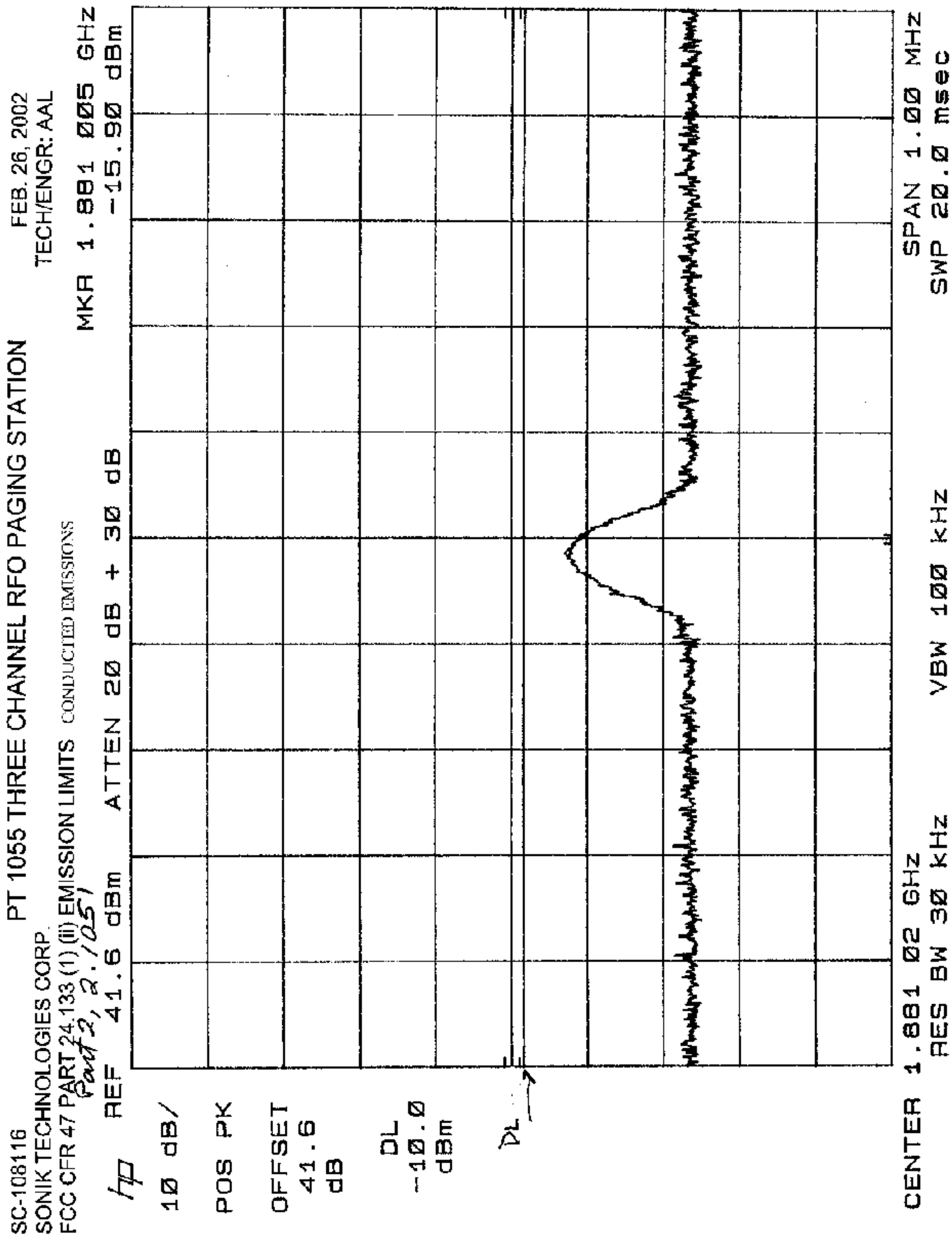
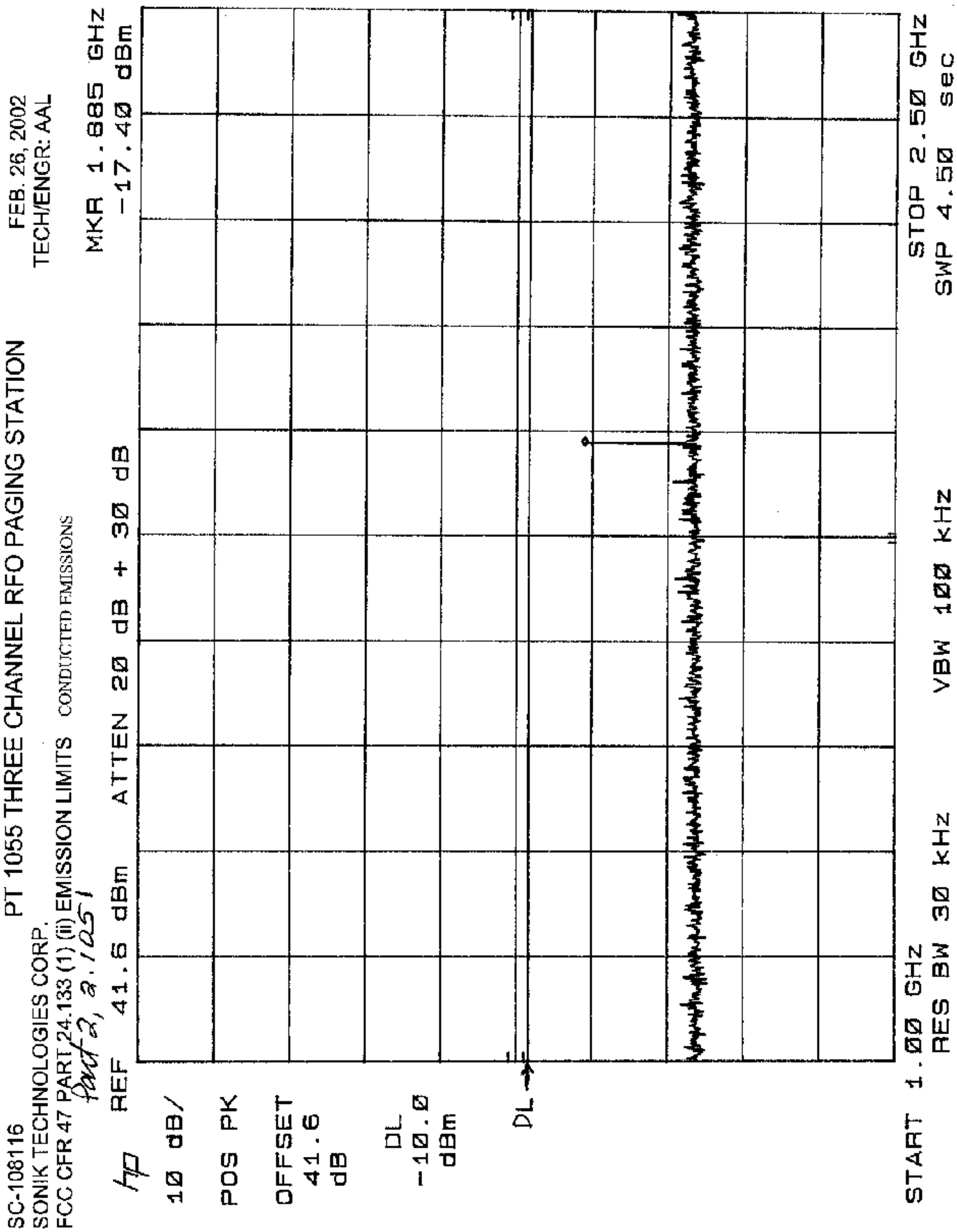
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 24.133 (1) (ii) EMISSION LIMITS CONDUCTED EMISSIONS
Part 2, 2.1051
PT 1055 THREE CHANNEL RFO PAGING STATION
FEB. 26, 2002
TECH/ENGR: AAL
REF 44.1 dBm ATTEN 20 dB + 23 dB
MKR 6.945 GHz
-23.50 dBm
10 dB/
POS PK
OFFSET
44.1
dB
DL
-10.0
dBm
DL
START 5.00 GHz
RES BW 30 kHz
VBW 100 kHz
STOP 10.00 GHz
SWP 15.0 sec

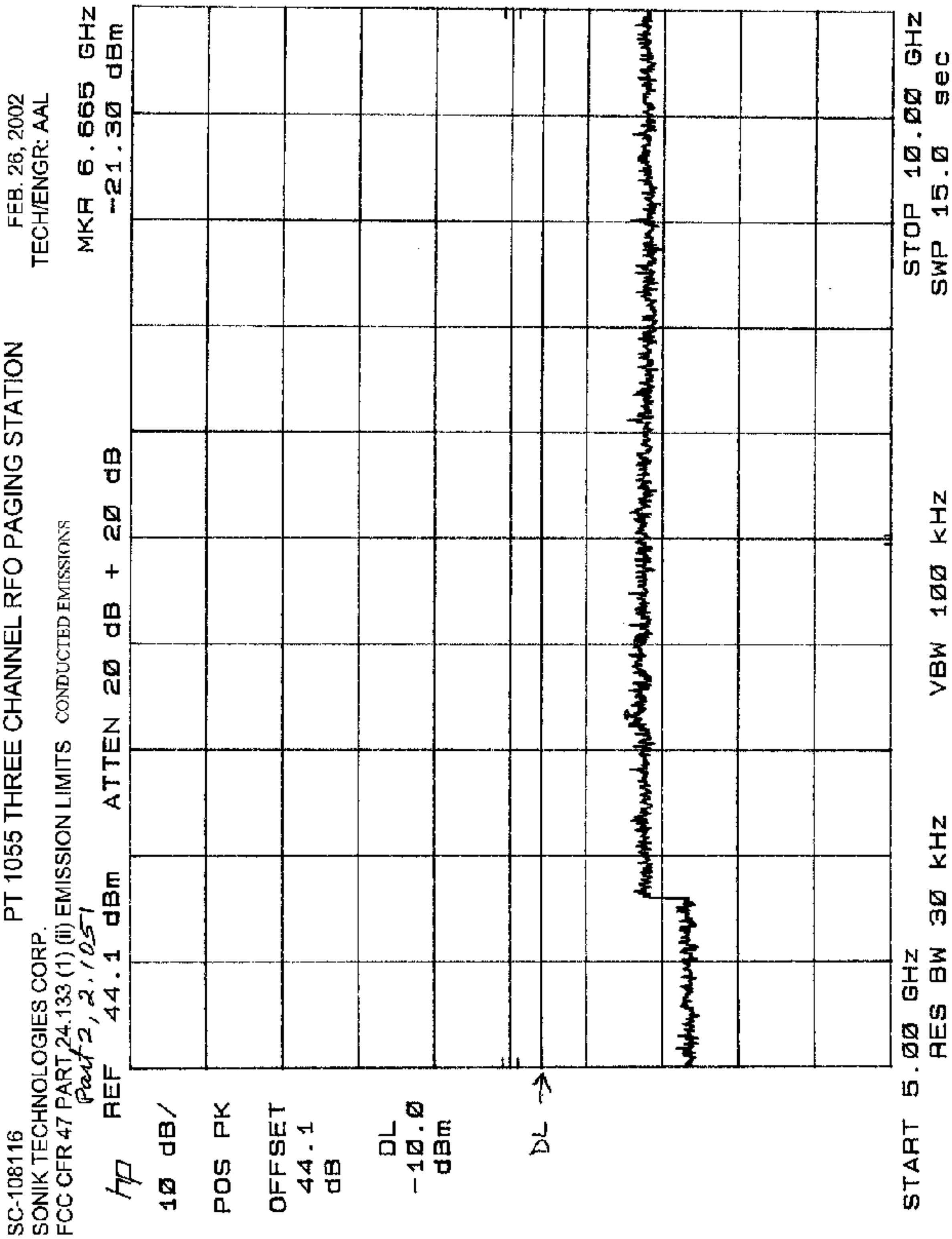

SC-108116
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 24.133 (1) (ii) EMISSION LIMITS CONDUCTED EMISSIONS
Part 2, 2.1051
PT 1055 THREE CHANNEL RFO PAGING STATION
FEB. 26, 2002
TECH/ENGR: AAL
940.500 MHz
MKR 284.1 MHz
-16.20 dBm
REF 55.9 dBm
ATTEN 10 dB +0 dB
10 dB/
POS PK
OFFSET 65.9 dB
DL -10.0 dBm
DL >
START 30 MHz
STOP 1.000 GHz
RES BW 30 kHz
VBW 100 kHz
SWP 2.91 sec


SC-108116
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 24.133(1)(ii) EMISSION LIMITS
PT 1055 THREE CHANNEL RFO PAGING STATION
CONDUCTED EMISSIONS
FEB. 26, 2002
REF 41.3 dBm ATTEN 20 dB + 30 dB
MKR 914.0 MHz
-12.30 dBm
10 dB/
POS PK
OFFSET
41.3
dB
DL
-10.0
dBm
DL
START 940.0 MHz
STOP 1.000 0 GHz
RES BW 30 kHz
VBW 100 kHz
SWP 180 msec

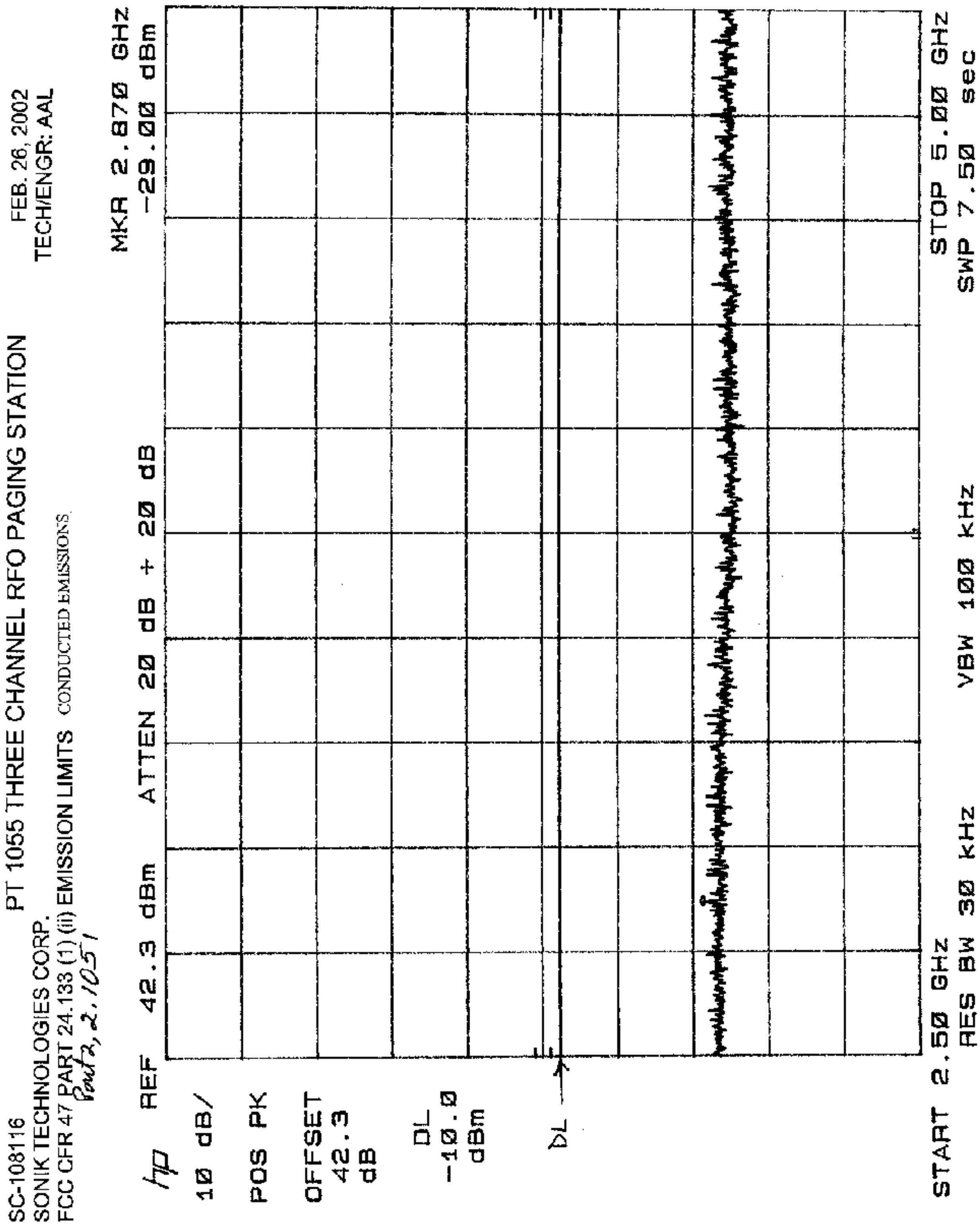
TÜV PRODUCT SERVICE




SC-108116
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 24.133 (1) (ii) EMISSION LIMITS CONDUCTED EMISSIONS
Part 2, 2.1051
PT 1055 THREE CHANNEL RFO PAGING STATION
FEB. 26, 2002
TECH/ENGR: AAL
hp
REF 41.6 dBm ATTEN 20 dB + 30 dB
MKR 1.885 GHz
-17.40 dBm
10 dB/
POS PK
OFFSET
41.6
dB
DL
-10.0
dBm
DL
START 1.00 GHz
RES BW 30 kHz
VBW 100 kHz
STOP 2.50 GHz
SWP 4.50 sec


SC-108116
SONIK TECHNOLOGIES CORP.
FCC CFR 47 PART 24.133 (1) (ii) EMISSION LIMITS CONDUCTED EMISSIONS
Part 2, 2.1051
PT 1055 THREE CHANNEL RFO PAGING STATION
FEB. 26, 2002
TECH/ENGR: AAL
hp
REF 44.1 dBm
ATTEN 20 dB + 20 dB
MKR 6.665 GHz
-21.30 dBm
10 dB/
POS PK
OFFSET
44.1
dB
DL
-10.0
dBm
DL
START 5.00 GHz
STOP 10.00 GHz
RES BW 30 kHz
VBW 100 kHz
SWP 15.0 sec

TÜV PRODUCT SERVICE



## 4 FIELD STRENGTH OF SPURIOUS RADIATION, FCC PART 2, PARAGRAPH 2.1053 and PART 24, PARAGRAPH 24.133(a)(1)(ii)

See following page(s).

SIGNAL SUBSTITUTION METHOD

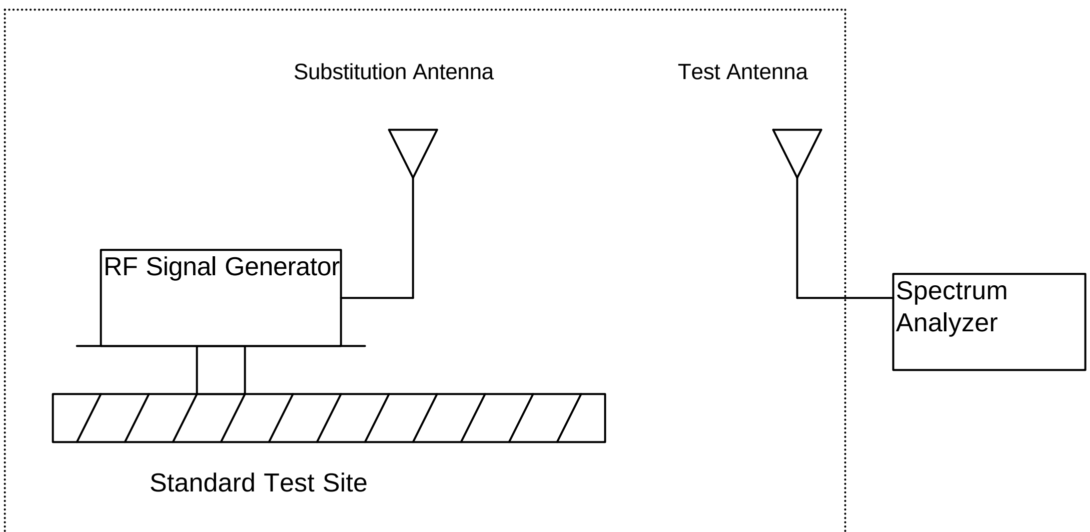
1. Place the transmitter to be tested on the turntable in the standard test site. The transmitter is transmitting into a non-radiating load which is placed on the turntable. The RF cable to this load should be of minimum length.

2. For each spurious measurement the test antenna should be adjusted to the correct length for the frequency involved. This length may be determined from a calibration ruler supplied with the equipment. Measurements shall be made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier, except for the region close to the carrier equal to ± the test bandwidth.

3. For each spurious frequency, raise and lower the test antenna from one meter to 4 meters to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Then the turntable should be rotated 360 degrees to determine the maximum reading. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.

4. Repeat step 3 for each spurious frequency with the test antenna polarized vertically.

5. Reconnect the equipment as illustrated.



6. Keep the spectrum analyzer adjusted as in step 2.

7. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At the lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 meter above the ground.

8. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.

9. Repeat step 8 with both antennas vertically polarized for each spurious frequency.

10. Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps 8 and 9 by the power loss in the cable between the generator and the antenna and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna.

11. The levels record in step 10 are the absolute levels of radiated spurious emissions in dBm. The radiated spurious emission in dB can be calculated by the following:

    Radiated spurious emissions (dB) =

$$10 \log_{10} \left[ \frac{TXpowerinwatts}{0.001} \right] \text{ - the levels in step 10)}$$

NOTE: It is permissible to use other antennas provided they can be referenced to a dipole.

TÜV PRODUCT SERVICE

Report No. 108116

## Test Conditions: FCC 2/24

Photos taken? Yes

■ SR-5, Shielded Room, 16' x 28' x 15', Metal, Semi-Anechoic Chamber
■ Canyon 2, Open Site ■ 3 meter ☐ 10 meter

**Test Equipment Used:**

| Model Number | Prop. # | Description | Manufacturer | Serial No. | Cal. Date | 2.1046 | 2.1047 | 2.1049 | 2.1051 | 2.1055 | 2.1053 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| hp8586B | 407 | Spectrum Analyzer | Hewlett Packard | 2311A02209 | 2/15/02 | ■ | | ■ | ■ | | ■ |
| ESVS20 | 427 | EMI Receiver | Rohde & Schwarz | 830350/006 | 12/8/02 | | | | | | ■ |
| PreAmp 2-20 GHZ | 719 | PreAmp | TUV Product Service | 719 | 3/26/02 | | | | | | ■ |
| 3115 | 251 | Antenna, Horn | Electro Mechanics Co | 2595 | 12/1/03 | | | | | | ■ |
| LPB2520/A | 739 | Antenna | Antenna Research | 1170 | 3/21/02 | | | | | | ■ |

**CUSTOMER'S EQUIPMENT:**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 588256B1J03 | | 40 dB Coupler | CellWave | 192079-007 | cal not req'd. | ■ | | ■ | ■ | | |
| hp437B | | Power Meter | Hewlett Packard | 3125U21450 | 2/10/02 | | | | | | ■ |
| hp8481H | | Power Sensor | Hewlett Packard | 1926A01137 | 9/24/02 | | | | | | ■ |

Note:

1. ~~CellWave coupler insertion loss at frequencies 929--941 MHz as 40.5 dB.~~
2. EUT was measured by Power Meter/Sensor at 383 Watts as confirmation of Average Power at 940.975 MHz. Measured at forward port of CellWave coupler into Customer's 50 Ohm Load

REPORT No: SC-108116 TESTER: Alan Laudani SPEC: FCC 24.133 (a) 1.ii 2.1053

CUSTOMER: Sonik Corporation TEST DIST: 3 Meters

E U T: RFO-A TEST SITE: Canyon 2

EUT MODE: Transmit BICONICAL: 739

DATE: Dec.28, 2001 ERP/EIRP Factor 7 LOG: 739

NOTES: HORN: 251

above 1GHz: RBW & VBW 1 MHz for Pk; RBW 1MHz and VBW 10Hz for AVG

below 1GHz: RBW & VBW 100 kHz for Pk; RBW 100kHz and VBW 10Hz for AVG

CF = Antenna Factor + Cable Loss - Preamplifier Gain + Preselector Loss

| FREQ (MHz) | VERTICAL (dBuv) pk | av | HORIZONTAL (dBuv) pk av | | CF (dB/m) | MAX LEVEL (dBm(d)) pk | av | SPEC LIMIT (dBm) pk | av | MARGIN (dB) pk | av |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 929.025 | 80.6 | 79.4 | 81.2 | 79.3 | 32.2 | 16.1 | 14.3 | | | | |
| 1858.050 | 57.0 | 52.5 | 50.7 | 44.9 | -10.7 | -51.0 | -55.5 | -13.0 | -13.0 | -38.0 | -42.5 |
| 2787.075 | 65.6 | 48.0 | 69.2 | 56.0 | -7.3 | -35.5 | -46.6 | -13.0 | -13.0 | -22.5 | -33.6 |
| 3716.100 | 52.0 | 40.6 | 50.0 | 36.1 | -5.2 | -50.6 | -59.9 | -13.0 | -13.0 | -37.6 | -46.9 |
| 4645.125 | 46.1 | 26.2 | 59.9 | 37.2 | -5.5 | -42.9 | -63.5 | -13.0 | -13.0 | -29.9 | -50.5 |
| 5574.150 | 39.1 | 21.6 | 46.1 | 27.8 | -0.6 | -51.9 | -68.1 | -13.0 | -13.0 | -38.9 | -55.1 |
| 6503.175 | 27.0 | 16.1 | 49.8 | 29.4 | -0.1 | -47.6 | -66.0 | -13.0 | -13.0 | -34.6 | -53.0 |
| 7432.200 | 29.3 | 13.6 | 40.1 | 25.5 | 2.4 | -54.9 | -67.4 | -13.0 | -13.0 | -41.9 | -54.4 |
| 8361.225 | 24.3 | 12.5 | 40.0 | 25.1 | 3.2 | -54.2 | -67.0 | -13.0 | -13.0 | -41.2 | -54.0 |
| 9290.250 | 24.6 | 12.8 | 35.5 | 23.8 | 3.2 | -58.7 | -68.3 | -13.0 | -13.0 | -45.7 | -55.3 |
| | | | | | | | | | | | |
| 935.5 | 76.2 | 67.2 | 68.3 | 61.4 | 32.3 | 11.2 | 2.2 | | | | |
| 1871.00 | 57.8 | 50.0 | 54.0 | 61.4 | -10.6 | -50.2 | -46.6 | -13.0 | -13.0 | -37.2 | -33.6 |
| 2806.50 | 62.2 | 49.4 | 51.6 | 45.7 | -7.3 | -42.4 | -55.2 | -13.0 | -13.0 | -29.4 | -42.2 |
| 3742.00 | 60.9 | 44.6 | 57.1 | 41.9 | -5.2 | -41.6 | -57.9 | -13.0 | -13.0 | -28.6 | -44.9 |
| 4677.50 | 56.0 | 44.0 | 50.9 | 35.7 | -5.4 | -46.7 | -58.7 | -13.0 | -13.0 | -33.7 | -45.7 |
| 5613.00 | 34.5 | 20.0 | 30.3 | 14.8 | -0.5 | -63.4 | -77.9 | -13.0 | -13.0 | -50.4 | -64.9 |
| 6548.50 | 30.2 | 15.5 | 26.4 | 14.4 | 0.1 | -67.1 | -81.8 | -13.0 | -13.0 | -54.1 | -68.8 |
| 7484.00 | 27.2 | 13.5 | 25.5 | 14.0 | 2.5 | -67.7 | -80.9 | -13.0 | -13.0 | -54.7 | -67.9 |
| 8419.50 | 26.3 | 13.0 | 22.9 | 12.7 | 3.3 | -67.8 | -81.1 | -13.0 | -13.0 | -54.8 | -68.1 |
| 9355.00 | 25.7 | 13.0 | 23.9 | 12.4 | 2.9 | -68.7 | -81.4 | -13.0 | -13.0 | -55.7 | -68.4 |
| | | | | | | | | | | | |
| 940.975 | 79.3 | 73.3 | 80.8 | 77.4 | 32.4 | 15.9 | 12.5 | | | | |
| 1881.950 | 69.5 | 64.2 | 60.2 | 55.2 | -10.5 | -38.4 | -43.7 | -13.0 | -13.0 | -25.4 | -30.7 |
| 2822.925 | 63.2 | 48.6 | 70.0 | 57.4 | -7.3 | -34.6 | -47.2 | -13.0 | -13.0 | -21.6 | -34.2 |
| 3763.900 | 58.0 | 39.3 | 52.4 | 41.9 | -5.1 | -44.5 | -60.6 | -13.0 | -13.0 | -31.5 | -47.6 |
| 4704.875 | 54.5 | 35.4 | 54.7 | 37.7 | -5.3 | -48.0 | -65.0 | -13.0 | -13.0 | -35.0 | -52.0 |
| 5645.850 | 46.5 | 24.3 | 48.1 | 24.8 | -0.4 | -49.7 | -73.0 | -13.0 | -13.0 | -36.7 | -60.0 |
| 6586.825 | 38.6 | 25.2 | 45.9 | 30.4 | 0.2 | -51.3 | -66.8 | -13.0 | -13.0 | -38.3 | -53.8 |
| 7527.800 | 36.7 | 23.4 | 52.6 | 25.5 | 2.5 | -42.3 | -69.4 | -13.0 | -13.0 | -29.3 | -56.4 |
| 8468.775 | 33.0 | 22.2 | 44.7 | 27.3 | 3.4 | -49.3 | -66.7 | -13.0 | -13.0 | -36.3 | -53.7 |
| 9409.750 | 34.0 | 22.5 | 36.6 | 24.3 | 2.7 | -58.0 | -70.3 | -13.0 | -13.0 | -45.0 | -57.3 |

**Field Strength Calculation**

If a preamplifier was used during the Radiated Emission Testing, it is required that the amplifier gain must be subtracted from the Spectrum Analyzer (Meter) Reading. In addition, a correction factor for the antenna , cable used and a distance factor, if any, must be applied to the Meter Reading before a true field strength reading can be obtained. In the automatic measurement, these considerations are automatically presented as a part of the print out. In the case of manual measurements and for greater efficiency and convenience, instead of using these correlation factors for each meter reading, the specification limit was modified to reflect these correlation factors at each frequency value so that the meter readings can be compared directly to the modified specification limit. This modified specification limit is referred to as the "Corrected Meter Reading Limit" or simply the CMRL, which is the actual field strength present at the antenna. The quantity can be derived in the following manner:

Corrected Meter Reading Limit (CMRL) = SAR + AF + CL - AG - DC

Where, SAR = Spectrum Analyzer Reading
AF = Antenna Factor
CL = Cable Loss
AG = Amplifier Gain (if any)
DC = Distance Correction (if any)

Assume the following situation: A meter reading of 29.4 dBuV was obtained from a Class A computing device measured at 83 MHz. Assume an antenna factor of 9.2 dB, a cable loss of 1.4 dB and amplifier gain of 20.0 dB at 83 MHz. The final field strength would be determined as follows:

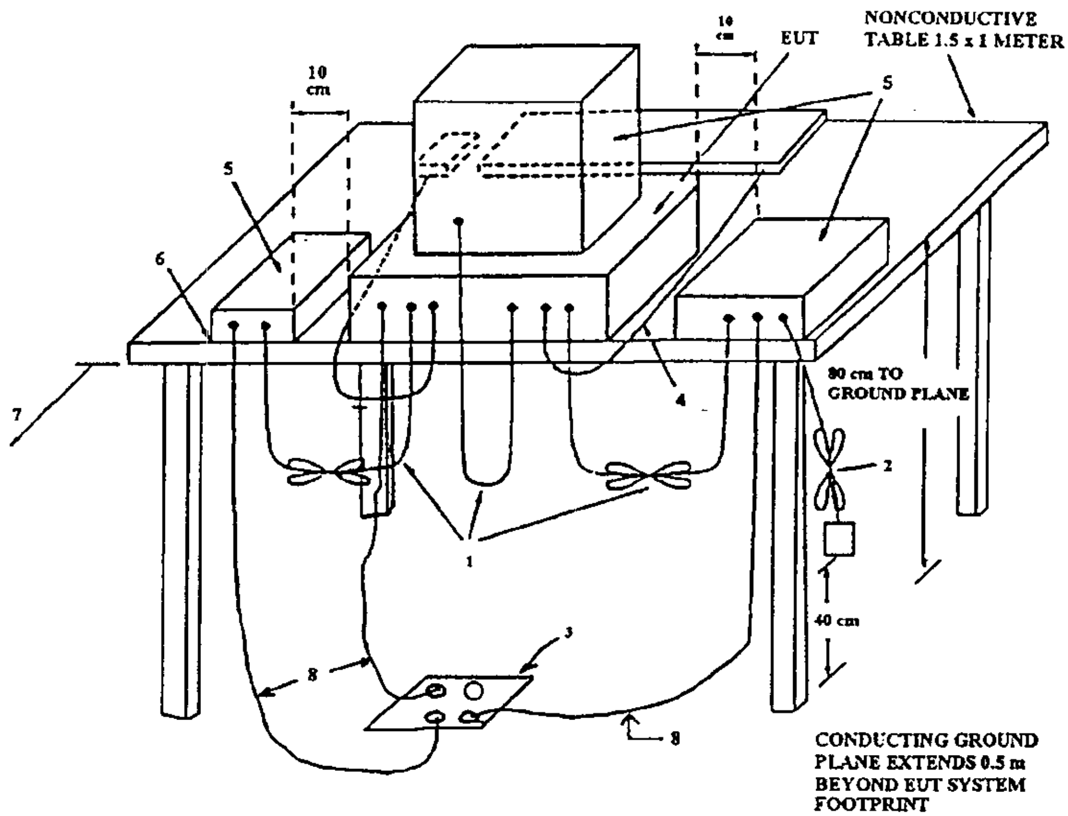
CMRL = 29.4 dBuV + 9.2dB = 1.4 dB - 20 dB/M - 0.0 dB

CMRL = 20.0 dBuV/M

This result is well below the FCC and CSA Class A limit of 29.5 dbuV/m at 83 MHz.

For the manual mode of measurement, a table of corrected meter reading limit was used to permit immediate comparison of the meter reading to determine if the measure emission amplitude exceeded the specification limit at that specific frequency.

Radiated Emissions Test Setup, 30 to 1000 MHz




LEGEND:

1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.
2. I/O cables that are connected to a peripheral shall be bundled in center. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.
3. If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground plane with the receptacle flush with the ground plane.
4. Cables of hand-operated devices, such as keyboards, mouses, etc., have to be placed as close as possible to the controller.
5. Non-EUT components of EUT system being tested.
6. The rear of all components of the system under test shall be located flush with the rear of the table.
7. No vertical conducting wall used.
8. Power cords drape to the floor and are routed over to receptacle.

## ATTESTATION STATEMENT

## GENERAL REMARKS:

## SUMMARY:

All tests were performed per CFR 47, *Part 2, Paragraphs 2.1046; 2.1049; 2.1051; 2.1053; 2.1055; Part 24, Paragraph 24, Paragraphs 24.132(c); 24.132(c); 24.133(a)(1)(i) and 24.133(a)(1)(ii).*

■ - Performed

The Equipment Under Test

■ - **Fulfills** the requirements of CFR 47, *Part 2, Paragraphs 2.1046; 2.1049; 2.1051; 2.1053; 2.1055; Part 24, Paragraph 24, Paragraphs 24.132(c); 24.133(a)(1)(i) and 24.133(a)(1)(ii).*

- TÜV PRODUCT SERVICE, INC. -

Responsible Engineer:

(EMC Engineer)



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