NRSC REPORT

NATIONAL RADIO SYSTEMS COMMITTEE

NRSC-R52

Report of the Field Test Task Group; Field Test Data Presentation

Working Group B "Testing" of the CEMA-DAR Subcommittee

December 1996

Part III – Appendices

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FOREWORD

NRSC-R52, Report of the Field Test Task Group; Field Test Data Presentation Working Group B "Testing" of the CEMA-DAR Subcommittee, documents the results of the digital radio field test program conducted in the 1995-96 time frame by the Digital Audio Radio (DAR) Subcommittee of the Electronic Industries Association (EIA) Consumer Electronics Manufacturers Association (CEMA, precursor to the Consumer Electronics Association).

The NRSC is jointly sponsored by the Consumer Electronics Association and the National Association of Broadcasters. It serves as an industry-wide standards-setting body for technical aspects of terrestrial over-the-air radio broadcasting systems in the United States.

INDEX PAGE - APPENDIX A

NOTE: Appendix contents will be supplied on request

DIGITAL AUDIO RADIO FIELD TEST PLAN; METHODS AND PROCEDURES

rev. 5.0
May 30, 1995

The NRSC DAB Subcommittee - Field Test Task Group has adopted a statement of Objectives and Goals for field testing, a copy of which is attached to this plan as Appendix A. The Methods and Procedures presented here incorporate those basic objectives and goals and are presented below. Each of the outlined areas and items of testing must be considered and refined to yield a suitable test program that fits within the needs of the EIA/NRSC-DAR test program, its time and budget constraints. The following describes the major types of measurements that are anticipated, followed by an outline of the steps by which they would be conducted and the type of test and data extracted.

Field testing may be conducted on those DAR systems tested in the Laboratory and not withdrawn from field testing. The systems include seven (7) proponent systems and one special mode of one of the systems. The seven systems are: IBAC system AT&T; IBOC systems AT&T/AMATI, USADR-1, USADR-2, USADR-AM; Other band system EUREKA-147; Satellite system VOA-JPL. The special mode is the IBAC system of AT&T operating in IBRC (In Band Reserved Channel) mode, replacing the analog transmissions completely. Because of its replacement mode it will be tested for a limited time and only during experimental early morning hours. Each of the systems and modes of operation is described in detail in Appendix B attached to this document, a compilation of system descriptions supplied by the system proponent (where available). Attached as Appendix C are block diagrams of the terrestrial transmission systems.

The general areas and paths over which testing is planned are outlined below. The paths and the Qualitative Characteristics found along each path are described in Appendix D attached to this document.

(L) "Long" path testing will be conducted over a path many kilometers long and taking 30 or more minutes to drive. The path may be open or a closed loop, around an area where a continuous observation of reception is desired. The general path areas will be selected to represent the various propagation conditions in the test area. They will include a variety of terrain, vegetation, construction, etc. and generally must provide a choice of path routes. The areas and resulting paths may be classified as "City", "Suburban", "Rural", "Mountainous", Etc. The individual particular paths must be accessible and suitable for continuous testing and will be selected to expose the systems under test to typical environments and driving conditions in the area. The usable path (lane), speed, pauses and turns will all be as identical as possible for each system under test but will also be determined by the accessible path and traffic conditions at the time and therefore will contain considerable random variations.

For the IBOC hosted systems no special or particular audio test segment can be used on the analog channel. Therefore, when simultaneous audio comparison is desired, only the normal "programming of opportunity" transmitted on the host radio station at the time could be used on the digital channel. Other systems could use this same audio feed. For all systems, when testing only the digital channel, special programming of a "typical" program or "special test" audio segment could be used for testing without direct analog to digital comparison.

Testing will be conducted sequentially among the systems under test with the minimum practical time between systems so as to maintain nearly identical propagation conditions. In the event of rapidly changing conditions, testing may be delayed or repeated on following days to test under similar conditions or attempt to average the results. When all systems have been tested along one path, the next successive path will be tested until all systems have been tested along all paths.

The digital audio received during the Long path tests will be continuously monitored for audio reception "events" which will be marked in the computer log as they are noted by the test crew. The log will reveal where the events occurred and will be an aid in determining where additional testing should be conducted. Two observation decision points will be identified as events. The first is described as the transition between listenable and un-listenable audio and the second is the transition from unlistenable to no audio. Audio samples encompassing these decision points will be demonstrated to the test crew who will then identify the decision point events and use the demonstrations to train themselves in their recognition. This process is further described in following parts of the test plan.

(S) "Short" path tests will be conducted over a path up to several hundred meters long and requiring a 30 to 60 second test at the speed dictated by the "environment" in which it is driven. The environment typical speed may range from a slow 10 to 30 KPH for city center, to 100 KPH for highways. The corresponding path length could range from 100 meters to 1.5 kilometers. The path must be precisely repeatable (same traffic lane) and not subject to any interruptions during a test (no stop signs, heavy traffic, etc.) therefore the paths must be chosen accordingly. The start and stop points will be marked by suitable means; such as noting existing landmarks or using surveying tape or paint. Critical audio segments, selected from the laboratory testing candidate segments, will be recorded and monitored for audio events. The audio transmission must be closely coordinated with the start of a path. A uniform speed, yielding nearly the same location vs. time, should be maintained between runs. Recording a time code and distance event marks along with other data will make checking position with audio events possible. Maintaining the controllable parameters with as little variation as practical leaves only one main test variable, the propagation to the test location. Analysis will therefore report digital system performance verses propagation path.

(P) The "Point" location is really a very short path mobile run. Because of the position variability found in VHF signals, measurements or observations should not be made at stationary locations but must be made over some area (path distance) to arrive at an average value or indication of the signal and its reception. Most likely the short path would be a small circle measured at a very slow velocity of about 1 or 2 meters per second, for a 10 to 50 meter total distance. This measurement serves as a basis for estimating ambient Field Intensity and propagation character in an area, particularly the signal margin above system failure and the presence of multipath propagation. This information will be associated with "Short" and "Inside" measurements.

(I) The "Inside" building tests will be conducted at several locations inside representative building structures including residential, commercial, industrial,

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parking garages, etc. Moving all of the DAR receivers under test into a building is not expected to be possible. Therefore, this test requires a remote antenna (with band pass filter and preamplifier) with a hundred meters or more of coaxial line. The remote antenna will be moved in a consistent manner over a limited building path (area). A moderate preamplifier gain and attenuator at the receiver input will be used to overcome the line loss and to swamp out any noise pickup in the line. Design of this item is a critical component of the inside building measurement program.

The various possible modes of testing, parallel and sequential have been discussed in the Field Test Task Group and a sequential mode has been selected. Each of the systems will be tested sequentially at each test site. For the Long paths, the one hour plus test time will limit testing to one path per day, possibly longer. For the Short paths, with the seven systems and several audio segments and related tests, it is anticipated that one or more sites can be completed in a day. Following is the test program outline.

I. CALIBRATION AND FIELD TEST SYSTEM VERIFICATION

A. DAILY
1. CHECK TRANSMITTER SITE AND TRUCK SUPPORT SYSTEMS (FUEL, POWER, HVAC, ETC.).
2. TEST DAR SYSTEMS; MAKE SPECTRAL PLOTS WITH AN OPEN AND/OR CLOSED LOOP (TX OUT / RX IN) CONNECTION.
3. TEST OPEN LOOP SYSTEM POF'S AND/OR TOA'S (AT "DAILY SETUP"
4. TEST THE DATA AND AUDIO COLLECTION SYSTEMS USING A STANDARD "TEST" AUDIO AND DATA FILE.
5. TEST COMPUTER CONTROL SYSTEMS USING TEST FILE.
6. TEST TRUCK TO TRANSMITTER 2-WAY COMMUNICATIONS.

B. WEEKLY
1. TEST BED CLOSED AND OPEN LOOP PARTIAL PROOF
2. CHECK CRITICAL CALIBRATIONS

C. START AND END OF PROJECT
1. FULL TEST SYSTEM CALIBRATION / POST PROJECT CHECK

II. FIELD TESTING DAR SYSTEM AUDIO CHARACTERISTICS, QUALITY, COVERAGE AND ANCILLARY DATA

A. DAILY CHECK AT TRANSMITTER AND/OR FIELD "SETUP SPOT"; The received audio quality and data channel for all systems will be observed with the test vehicle at the transmitter and/or a common daily check site / setup spot. The transmitter power and/or receiver input level will be measured and suitable tests will be conducted to confirm the following;
1. Digital R.F. signal level
2. Relative analog/digital signal ratio (where appropriate)
3. Analog modulation levels (where appropriate)
4. System TOA and/or POF as a check on proper system operation

The "Daily" checks will be designed to be sufficient to spot any trend toward improper operation of the equipment under test or the test bed. The daily checks must also be practical, taking a short time to complete at an easily accessible location. The use of a field "Setup Spot", remote from the transmitter site is suggested.

B. FIELD PROCEDURE; each DAR system will be tested sequentially at each test point using the following general procedure.

1. MEASUREMENT LOCATION SELECTION; Choose and document a well defined, easily accessible path and location at which to begin both Long path observations, limited Short runs and "Point" location runs. Buildings for "Inside" measurements should be chosen near Long path critical areas and the resulting Short path locations if possible. This will maximize the amount of "ambient" system performance data for comparison with the resulting "Inside" performance. Paths should be scouted to determine the conditions to be encountered and the proper procedure to accommodate them. Excessive disruptions should be avoided. A navigator will maintain the necessary path description to guide the driver and act as observer to spot landmarks and potential hazards.

a. LONG PATH; The choice of the "General" area or description of the type of area to be considered for the long and short paths has been made in advance by the Field Test Task Group. The basis is the general knowledge of the area, type of locations to be sought and by area inspections prior to actual testing. Six long paths have been selected by the Field Test Task Group to include a variety of propagation Qualitative Characteristics. The precise route that will be driven along each path will be subject to traffic and driving conditions found at the start and during testing. Modifications to the route will be made by the test crew as necessary so as to accommodate unforseen conditions but also to remain within the general route chosen by the Field Test Task Group.

b. SHORT, POINT AND INSIDE MEASUREMENT LOCATION; The experience during the longer loop path observations is expected to indicate areas or actual locations in which to conduct other measurements. Each location will be determined by desirable character, accessibility, safety and the ability to conduct the test within the adopted procedures. The test crew will document the location or path, description of surrounding area, time, date, weather, precise travel path, start-stop points, velocity, etc. For short paths, since several passes may be necessary when determining signal level margins, paths should be chosen that allow easy forward motion, looping back to the start point in a small circle; do not back-up for efficiency and safety reasons in crowded areas.

2. SET-UP AT MEASURING LOCATION; Conduct the pre-measurement documentation (described above). Setup the measurement system for a particular session including general setup; data collection files and procedure,

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etc. and system specific setup. Check the equipment under test for proper operation.

3. DETERMINE SIGNAL LEVEL AND MARGIN; At a Point near the start of a short or Inside path, conduct a "Point" measurement to determine the approximate DAR system operating threshold level. The operating threshold will be determined by reducing input signal level and/or injecting R.F. noise to the point of system failure by muting, while driving the Point small mobile continuous loop path. This level, when compared to an unaltered signal, indicates the approximate signal margin at that location.

4. PREPARE TO MEASURE; Return the signal level and injected noise to their starting conditions (maximum signal and no noise) and prepare for Long, Short or Inside path measurements. Data collected in each run will include;

   a. R.F. SIGNAL; Measure the analog AM/FM/L-Band/S-Band R.F. voltage (F.I.) simultaneously with DAR signal reception by computer automated method. Measurements are anticipated to use a tuned RF meter or spectrum analyzer with samples taken at frequent distance intervals (approximately 1/10 wavelength, shorter or longer as frequency and variations dictate) along a path. The R.F. signal measurements will be processed and displayed as follows;

      (1) Continuous Long path measurements will be analyzed to yield statistics in segment lengths relevant to the paths. The analysis will report the R.F. signal maximum, minimum, median and deviation values, over the length of analysis chosen.

      (2) Continuous Short path measurements will be similarly analyzed over their entire length if sufficiently short or several lengths if necessary.

      (3) Spot measurements will be analyzed over a short length representing several circuits around the "spot" movement loop. The R.F. signal strength values returned from that will be used as the basis against which to gauge the "margin" of signal above point of failure (threshold of muting) for a system at locations where Short of Inside measurements are made.

   b. DISTANCE; Measure the distance along the path using the trigger and software from Delco (if available) or similar "5th. wheel" device. The F.I. data will be processed to return point-by-point fast signal fading data. A sliding window of adjustable length (number of sample points) along the path will be used to calculate and display the "slow" fading signal along a path. The F.I. will be computer processed and displayed (while the test is in progress if possible) to aid in identifying and differentiating between multipath frequency selective fades (fast) and obstruction or attenuation fades (slow).

c. LOCATION; Determine and store on the computer the geographic coordinates at significant landmarks, street intersections and path turns. Prepare a script of landmarks for the path, including the start and stop points and several intermediate points, and record these in the computer and mark the passage of each as an event mark in the computer data log.

d. R.F. SPECTRUM; Record the R.F. spectrum by either or both of two methods; by frequent snap-shots stored on the computer and/or by a continuous video tape recording of the spectrum analyzer display along a path. The snap shot interval should be set to approximately every few seconds on the short mobile runs to yield several snapshots, and every minute or so on the long loop paths generating 30 to 60 displays per long run. The spectrum analyzer parameters should be set to display any signal within a few percent of the frequency under test and within 20 dB of the average range of the signal under test.

e. RECORD DIGITAL & ANALOG AUDIO; Record the test Audio segments for each run, including both the analog and digital audio, on DAT. The audio for testing the digital IBOC systems on the long runs will be the audio of opportunity (the actual host station programming). For non-IBOC systems the test audio could be continuous "typical" audio, audio of opportunity and special critical audio samples (2 to 4 segments as used in the lab testing) as appropriate. Simultaneous analog channel audio will also be recorded. For IBOC tests this will be the host station audio. For non-IBOC tests the analog audio could be different than the digital audio and could be the IBOC host audio of opportunity <u>without</u> any digital transmission at the time. This becomes the baseline analog audio reference. A time delay circuit will be used in the analog audio channel at the transmitter to compensate for the digital transmission system audio delay with a second time delay used with the analog receiver to compensate for the digital receiver time delay. This technique will roughly align the transmission and propagation of the same audio segment and then align the audio recording for comparison. The recorded audio will be available for post measurement analysis.

f. RECEPTION OBSERVATIONS - DECISION POINT "EVENTS"; Conduct a continuous monitoring of the digital audio characteristics and mark decision points in the computer file. The two decision point "events" are defined as the transition from "listenable" to "unlistenable" audio and the transition from "unlistenable" to no audio, the onset of muted audio. This observation will be conducted by the test crew members in the van who will listen to the digital audio channel on headphones and mark the computer event file as a path is driven. The crew will be trained in advance to identify and properly mark the audio decisions points. From this training and marking the crew will define by example the agreed uniform thresholds and provide examples and a written definition of both. The digital audio characteristic events will be tallied by pressing and holding an appropriate button as long as the event is taking place, with the result that the computer records the marks verses time and distance along a path traveled. The areas along a path with a concentration of event marks will then be candidates for more detailed observations.

g. ANCILLARY DATA CHANNEL; Receive and decode the ancillary data file and compare it bit-by-bit to the digital reference file in the computer. Tally the bit errors and calculate the bit error data rate vs. time (distance). Display the real time values if possible. Format and record the results in the computer file for each run.

h. MAIN CHANNEL OPERATION; Observe the Equipment Under Test for main channel operating indicators or "Stress" flags as provided by the proponent if possible. Such indicators will be voluntarily provided by the system proponent and recorded and reported if the proponent so requests. Otherwise, they will be observed and recorded only for calibration and test purposes, but not generally included in the test report. Recording will be automatically made in the computer file for each run. This information will be used to check proper system operation and for later analysis relative to system performance.

i. NAVIGATION LANDMARKS; Log the manual path landmarks chosen by van crew in the computer file (start, stop and intermediate point descriptions, etc). Mark the event of crossing major land marks on longer runs by pressing an event mark button for the computer file.

j. UNUSUAL FINDINGS; Log any unusual results and extra investigation undertaken.

k. VIDEO RECORDING - PATH AND EQUIPMENT; Record the video output of a fixed forward facing camera with a wide angle lens to show the general area of the path. The audio channel of the video recorder will contain voice input from a "cockpit" microphone to record land marks or other comments spoken along a path. The video recorder will also contain time code information which will be duplicated in the computer file and on the DAT recorders so that data can be synchronized. Other video recordings will also be made as necessary, for example from a video output of an R.F. spectrum analyzer.

5. REPEAT steps 3 and 4 for the next audio segments [1 to 3 repeats]

6. REPEAT steps 3 and 4 for next DAR system [7+1 proponent systems]

NOTE; It is estimated that after the crew becomes familiar and efficient with the procedures, 2 or 3 "Short" path or "Inside" locations can be measured per day; 15+ locations per week (6 plus days); 65+ locations per month.

C. END OF LOCATION PROCEDURE

1. IMMEDIATE "AS COLLECTED" PROCESSING (SEE DETAILS IN SEC. V.A.); Conduct real time or immediate post measurement processing and display the results to confirm location character, quality of data and assist in notes to describe the location.

2. MANUAL NOTES; Finish recording the location documentation and measurement notes in computer log; start/stop time, weather conditions, point identification - file record No., DAT index No., Video tape No. and index, unusual conditions and investigation, etc.

3. BACK-UP DATA; Transfer computer data to backup tape or floppy disc.

4. AUDIO RECORDINGS; As appropriate; remove, record disable and label DAT. Pre-label, enable and insert new DAT. (this may involve marking segments of one DAT used for an extended period, ie. one day)

5. PREPARE FOR ROAD; Prepare van for road travel to next point; secure equipment and personnel, etc.

III. DAR IN BUILDING MEASUREMENTS (same setup and field procedures as above except;)

A. PREPARE REMOTE ANTENNA AND CABLE FOR USE,
1. Test remote amplifier/cable by closed loop measurement at start and end of each location measurements. Log the total cable attenuation and amplifier gain. Note and repair any intermittent or significant gain change. Log "repairs".

B. AMBIENT R.F. CONDITIONS; Document reception conditions outside of building by "fixed" short path circle DAR system quality tests.
1. Establish R.F. signal strength and system margin above failure.
2. Document multipath environment and rating.

C. SELECT INSIDE PATH; Layout and document inside path and building parameters (typical 2 locations per building)
1. Building type, size, layout, location, etc.
2. Construction methods and materials
3. Floor(s) measured
4. Path length and % displacement relative to building center and walls, draw a rough floor plan and path.
5. Film and narrate a short video tape segment; inside along the proposed path(s) and outside around the building, preferably from the "fixed" measurement perspective, to display its type and surroundings. This may be accomplished by video taping a slow walk along the path and loop around the fixed point while narrating the tape, particularly with location comments.

D. MEASURE; Move the remote antenna along a path and record data.

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1. Position antenna on standard "carrier".
2. Coordinate recording and audio sample transmission with van via. radio or cable intercom.
3. Move the carrier and antenna along a path while marking distance by marking paces, wheel counter, wheel clicker with audio recording, etc.

E. END OF MEASUREMENT LOCATION PROCEDURES (same as II. C.)

IV. END OF DAY PROCEDURES

A. FOLLOW-UP CALIBRATION CHECKS
B. COPY DATA TO SECOND BACKUP FLOPPY DISCS OR TAPE
C. CATALOG THE AUDIO SAMPLES AND COPY TO BACKUP DAT (UNLESS SECOND DAT IS RECORDED SIMULTANEOUSLY DURING MEASUREMENTS)
D. CATALOG THE VIDEO TAPE, REMOVE, RECORD DISABLE, AND LABEL FOR THAT DAY; PREPARE A NEW TAPE FOR NEXT DAY (TAPE MAY SPAN MORE THAN ONE DAY BUT SHOULD BE COPIED TO BACKUP DAILY!)
E. CLOSE THE WRITTEN LOG
F. SECURE EQUIPMENT AND VAN FOR STORAGE

V. PRELIMINARY DATA PROCESSING

A. IMMEDIATE "AS COLLECTED" PROCESSING
1. Analog AM, FM, L-Band and S-Band R.F. signal F.I. data
a. Automatic collection of data made at constant distance steps.
b. Calculate maximum, minimum, median and S.D. values of F.I. within an appropriate test distance along a run (all of the shortest short runs and short segments of a long run). The values will be calculated by averaging over a constant (but variable) distance sliding window. A short length (1 step, 0.3 meter or 1/10 wavelength) window will show multipath fast fades and enable an estimate of the multipath severity or "rating" of a path segment. The rating would reflect multipath characteristics such as the depth and repetition of fades and establish rough descriptions such as slight, moderate and severe multipath. A longer 3 to 30 meter (10 to 100 step, 1 to 10 wavelength) window will show propagation blockage and long term "slow" fades, those not due to fast multipath fading.
c. Store data in computer file
d. Generate computer video display of instantaneous short and long window F.I. Vs. distance. Crew evaluation of the instantaneous R.F. graph Vs. path distance will reveal the multipath character of the path and result in a "multipath rating" of the path to add to computer log. The multipath "rating" used in this reporting will be formulated by the test crew based on in field training observations. A written description of the multipath conditions and the "rating" will also be supplied by the crew.

2. Digital auxiliary data file BER
   a. Decode auxiliary data channel and pass data to computer
   b. Compare data as received to the fixed known data file and calculate data rate, bit error count, BER and other characteristics (maximum error length, etc.).

3. Other data; Generate computer displays and composites of as many of the other parameters as possible to assist in classifying the measurement, the location and the selection of other measurement spots.

B. END OF RUN PROCESSING
   1. Identify and label all computer processed raw data, attach notes as needed.
   2. Log any unusual findings and investigations.
   3. Complete and close computer "notes" file; assign a label and apply to DAT and computer file id., log characteristic evaluation notes, identify start/stop date-time, identify location descriptions, path, landmarks, weather, etc.
   4. Confirm computer automatic transfer of all files to hard disc and backup floppy and tape.
   5. Review parts of video log to check quality and correct operation of the logging system. Set tape position with 5 second black picture to begin next segment.

C. END OF DAY PROCESSING
   1. Transfer all DAT recordings to daily backup DAT tape and move off site (option is to run parallel DAT's).
   2. Transfer all computer data files to daily backup tape or floppy and move off site.
   3. Process the days work to view "results". Use a series of graphical and tabular presentations to look for anomalous or unusual results, watch for equipment problems and plan for further tests. Check the r.f. signal level recordings, the data bit error data, the characteristic event marker files, etc.

VI. POST PROCESSING (OFF SITE PROCESSING)

A. Digital Audio quality analysis will rank performance for comparison to other parameters such as; analog audio quality, signal level, multipath "rating", bit error file, characteristic event file, etc.
B. Compile analog F.I. vs. location, terrain, foliage, etc.
C. Compile "reception observation" comments vs. test environment and other parameters (F.I., etc.)

VII. DISTRIBUTION OF RAW (POST PROCESSED) DATA;
A. Distribute to others by a procedure and at dates T.B.D.

VIII. REPORT GENERATION;
A. Field test group to prepare test reports for distribution to EIA and NRSC. Format and distribution T.B.D.

APPENDICES TO DAR FIELD TEST PLAN

APPENDIX A. DAB SUBCOMMITTEE - FIELD TEST TASK GROUP
Objectives and Goals (1 page, undated)

TRANSMIT & RECEPTION

APPENDIX B. DAR SYSTEM DESCRIPTIONS - Provided by proponents
(to be provided by proponents)

APPENDIX C. BLOCK DIAGRAMS - TRANSMISSION AND MOBILE RECEIVE SYSTEM

APPENDIX D. EIA - NRSC DAB Subcommittee - Field Test Task Group (May 18, 1995)
"Long Path" Test Routes (10 pages; Figures 1A, 1B, 2A-F, 3A & 3B.

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DAB SUBCOMMITTEE - FIELD TEST TASK GROUP
Objectives and Goals

The Field Test Task Group of the NRSC's DAB Subcommittee is charged with developing and conducting field tests of all proposed digital broadcasting systems under consideration by either the NRSC DAB Subcommittee or the EIA DAR Subcommittee. These field tests are intended to provide both the NRSC DAB Subcommittee and the EIA DAR Subcommittee with the information they will need to determine which, if any, of the systems under test should be recommended as a standard for the United States.

TASK GROUP OBJECTIVES

(a) To determine if the systems under test provide users with a signal quality and durability that is significantly greater than the AM and FM analog systems that presently exist in the United States.

(b) To provide broadcasters and receiver manufacturers with the information they need to make an informed decision on the future of digital audio broadcasting in the United States.

TASK GROUP GOALS

To meet its objectives, the task group will work towards achieving the following goals:

(a) To provide a direct comparison between the systems under test and existing audio broadcasting and, where applicable, between the systems under test and the host analog signal, over a wide variation of terrain and under all adverse conditions that could be expected to be found throughout the United States.

(b) To develop a testing process and measurement criteria that will be conclusive, believable and acceptable to all segments of the industry.

(c) To develop field testing that, when coupled with the results of laboratory tests, will provide a complete picture of the magnitude of improvement that each tested system can be expected to offer over existing broadcast systems.

(d) To perform its field tests, and reach a conclusion concerning its objectives, as early and economically as reasonably and practically possible.

EIA-DAR Field Test, Audio Test Segments

TR.	DESCRIPTION	START	STOP	RUN TIME
ALL	- -	00:00:00:00	01:02:29:03	01:02:29:04
1	KEIA STATION I.D.	00:00:00:00	00:00:42:10	00:00:42:11
2	SOFT ROCK VOCAL	00:00:43:11	00:02:50:08	00:02:06:28
3	LT. ROCK - C&W/BLUES	00:02:51:08	00:04:56:10	00:02:05:03
4	EFFECTS + HEAVY INST. & VOCAL	00:04:57:10	00:07:05:25	00:02:08:16
5	SLOW START - INST. & VOCAL	00:07:06:26	00:09:16:11	00:02:09:16
6	GUITAR & VOCAL	00:09:17:12	00:11:24:04	00:02:06:23
7	CLASSICAL GUITAR TO HEAVY ROCK	00:11:25:04	00:13:32:27	00:02:07:24
8	SYNTH. EASTERN TO ROCK	00:13:33:29	00:14:45:15	00:01:11:17
9	SYNTH. & PERCUSSION	00:14:46:15	00:16:52:25	00:02:06:11
10	FEMALE VOCAL BALLAD, JAZZ	00:16:53:25	00:19:01:07	00:02:07:13
11	INDIANA JONES - POPS.	00:19:02:07	00:21:10:04	00:02:07:28
12	BAND MARCH	00:21:11:05	00:22:41:20	00:01:30:16
13	CLASSICAL - LIKE BOLERO	00:22:42:20	00:24:50:23	00:02:08:04
14	JAZZ-SYNTH / STRONG BEAT	00:24:51:24	00:26:57:25	00:02:06:02
15	OPERA / FUNICULI FUNICULA	00:26:58:25	00:29:04:24	00:02:06:00
16	KEIA STATION I.D.	00:29:05:25	00:29:47:23	00:00:41:29
17	SOFT POP	00:29:48:23	00:31:56:00	00:02:07:08
18	SYNTH. - LATIN - VOCAL	00:31:57:00	00:34:05:13	00:02:08:14
19	LATIN - INST.	00:34:06:13	00:36:13:24	00:02:07:12
20	ORCHESTRAL - MOZART	00:36:14:24	00:38:20:22	00:02:05:29
21	SYNTH. - FEMALE VOCALS	00:38:21:22	00:40:16:22	00:01:55:01
22	SYNTH. - SOFT INSTRUMENTAL	00:40:17:23	00:45:19:08	00:05:01:16
23	CLASSICAL ORCHESTRAL	00:45:20:08	00:48:59:25	00:03:39:18
24	ACAPELLA VOCAL - S. VERA	00:49:00:25	00:51:05:21	00:02:04:27
25	VOCAL - FEMALE LITE ROCK	00:51:06:22	00:55:01:10	00:03:54:19
26	ORCHESTRAL - POPULAR	00:55:02:10	00:59:04:26	00:04:02:17
27	INSTRUMENTAL - SYNTH & GUITAR	00:59:05:26	01:02:29:02	00:03:23:07

INDEX PAGE - APPENDIX B

B-1 NRSC DAB Subcommittee - Field Test Task Group "Long Path" test routes (final version Fall, December 11, 1996) Description of routes, overall map, detail maps and route propagation characteristics.

Note: Specific route maps included with appropriate route data graphs.

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"Long Path" Test Routes

General Information

Described below are revised long path test routes. The chosen starting points are arbitrary, as are the directions of travel around the loops, although they were chosen in some cases for best anticipated traffic flow. Traffic patterns or road conditions occasionally necessitated minor revisions to the actual routes driven.

The path of each route is described below and shown graphically on attached Figure 2, while route landmarks and RF environment designators are described in Figure 3. Figure 4 is a grid that compares some of the terrain characteristics of each route. Estimated driving times shown below do not consider traffic delays.

Specific Route Descriptions

Route P - San Francisco Perimeter: Begin just south of Golden Gate Bridge on Highway 101; take Highway 1 (19th Avenue) exit south through Golden Gate Park, continuing south to Brotherhood Way; take Brotherhood Way east to I-280 north; transition to Highway 101 north; transition to I-80 east; take I-80 east to 4th Street (last San Francisco exit); at end of exit ramp, turn left on Bryant Street to The Embarcadero; turn left on The Embarcadero and travel into Wharf area; turn left on Bay Street at Pier 31; turn right onto Laguna Street; travel two blocks to Marina Boulevard (Marina District); turn left onto Marina Boulevard, which becomes Highway 101 north. Approximate driving time: 45 minutes

Route D - San Francisco Downtown: Begin at easternmost end of Market Street; take Market Street southwest; transition to Portola Avenue, then to Woodside Avenue; at the end of Woodside Avenue, turn right on Laguna Honda at Dewey; take next right onto Clarendon; travel up Clarendon, which becomes Twin Peaks Boulevard, Clayton Street, then Ashbury Street; turn right on Frederick Street; travel two blocks to Masonic Avenue; turn left on Masonic Avenue and travel to Bush Street; turn left after one block onto Presidio Avenue; turn right after two blocks onto California Street; take California Street east to Sansome Street; take Sansome Street north to Jackson Street; take Jackson Street east to Battery Street; take Battery Street south to Pine Street; take Pine Street west to Sansome Street; take Sansome Street north to Jackson Street; take Jackson Street east to Battery Street; take Battery Street south to Market Street. Approximate driving time: 1 hour

Route W - San Francisco Peninsula: Take I-280 to Highway 1 south, near Pacifica; continue south on Highway 1 along coast to Half Moon Bay; turn left on Highway 92, heading east, crossing under I-280 to Highway 101; take Highway 101 north to I-380, then I-380 west to I-280 north, back to the starting point. Approximate driving time:
1 hour, 15 minutes

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"Long Path" Test Routes

Route E - East Bay: Begin on I-80 at San Francisco side of Bay Bridge; cross bridge (lower deck) to I-580; take I-580 east to Highway 24; take Highway 24 east to I-680; take I-680 south to I-580, near Dublin; take I-580 west to Bay Bridge (Oakland side); cross bridge (upper deck) and end on San Francisco side. Approximate driving time:
1 hour

Route N - North Bay: Begin at junction of Highway 101 and I-580 in San Rafael; take Highway 101 north to Highway 37; take Highway 37 east to Highway 29 south; connect to I-80 in Vallejo, then south to Central Avenue west, one block to I-580 west; take I-580 west across the Richmond Bridge; transition to Highway 101. Approximate driving time: 1 hour, 15 minutes

Route S - South Bay: Begin at junction of Highway 101 and Highway 84 (Dumbarton Bridge exit) east; cross Dumbarton Bridge to Fremont, then travel south on I-880; transition to Highway 237; take Highway 237 west to Lawrence Expressway (also known as County Road G2); take Lawrence Expressway south to I-280; take I-280 north to Highway 85 north; take Highway 85 north to Highway 101 north, back to Dumbarton Bridge exit. Approximate driving time: 1 hour

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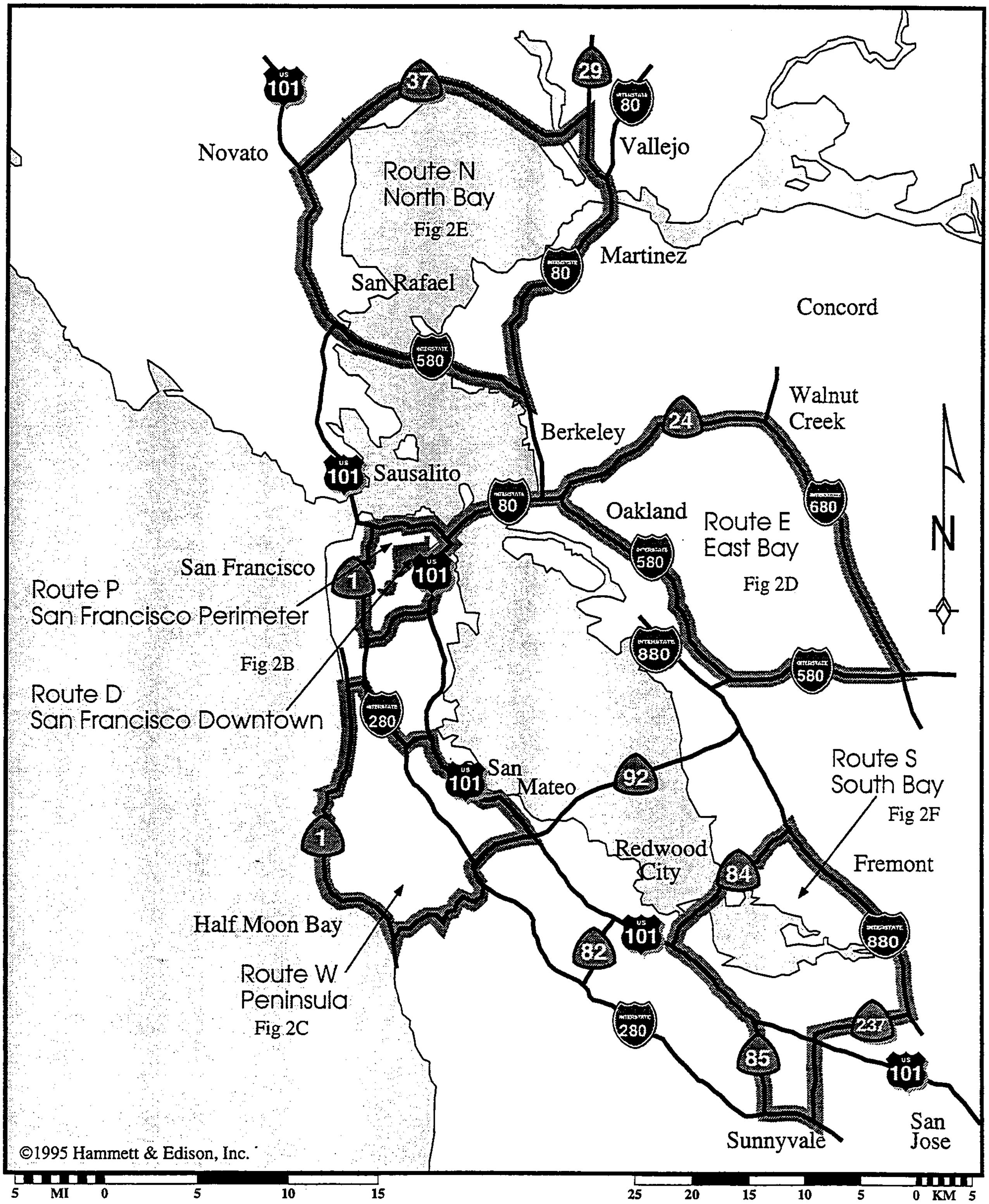
"Long Path" Test Routes



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CONSULTING ENGINEERS
SAN FRANCISCO

961210
Figure 2A

285

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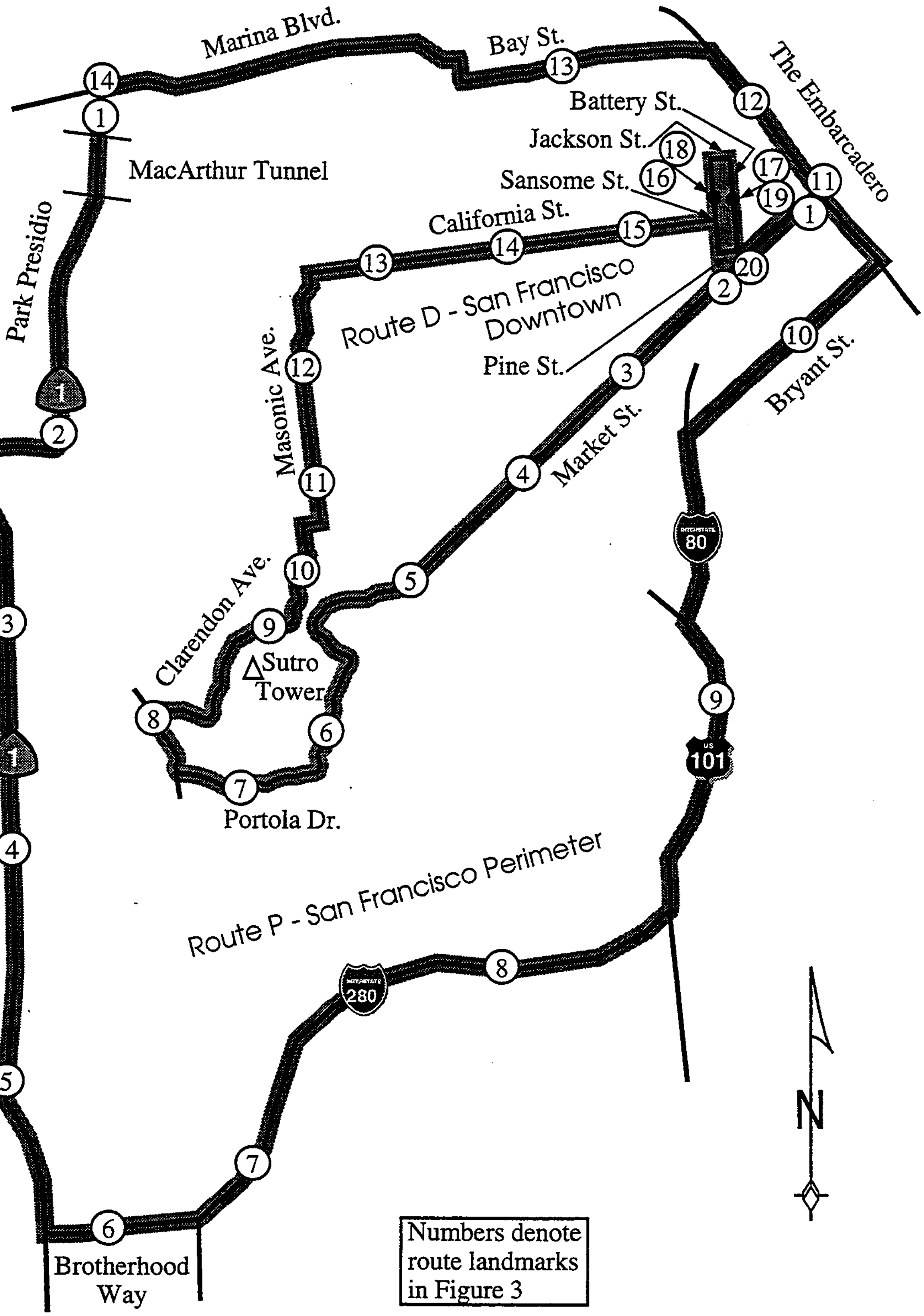
"Long Path" Test Routes

Routes D & P • San Francisco



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961210
Figure 2B

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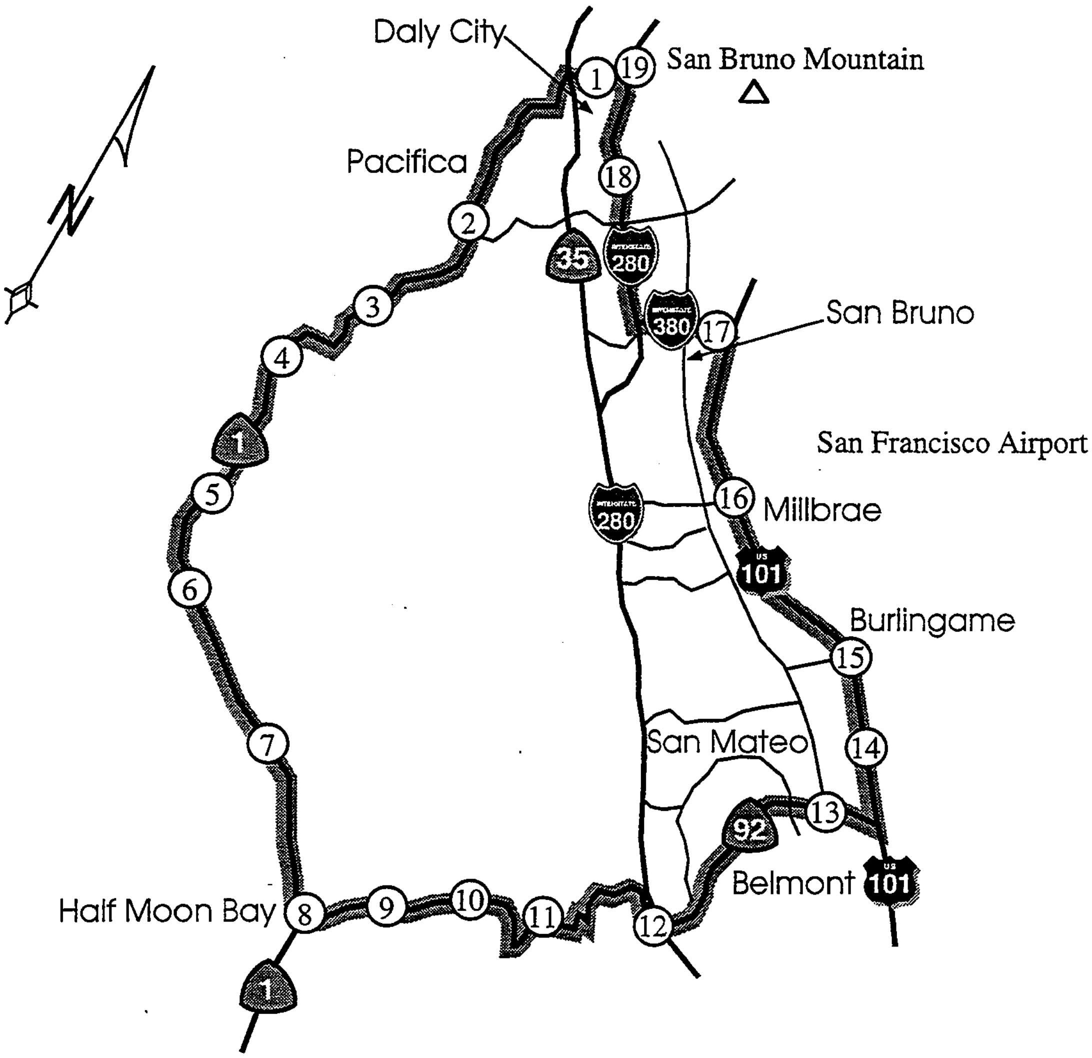
"Long Path" Test Routes

Route W • San Francisco Peninsula



Numbers denote route landmarks in Figure 3

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"Long Path" Test Routes

Route E • East Bay

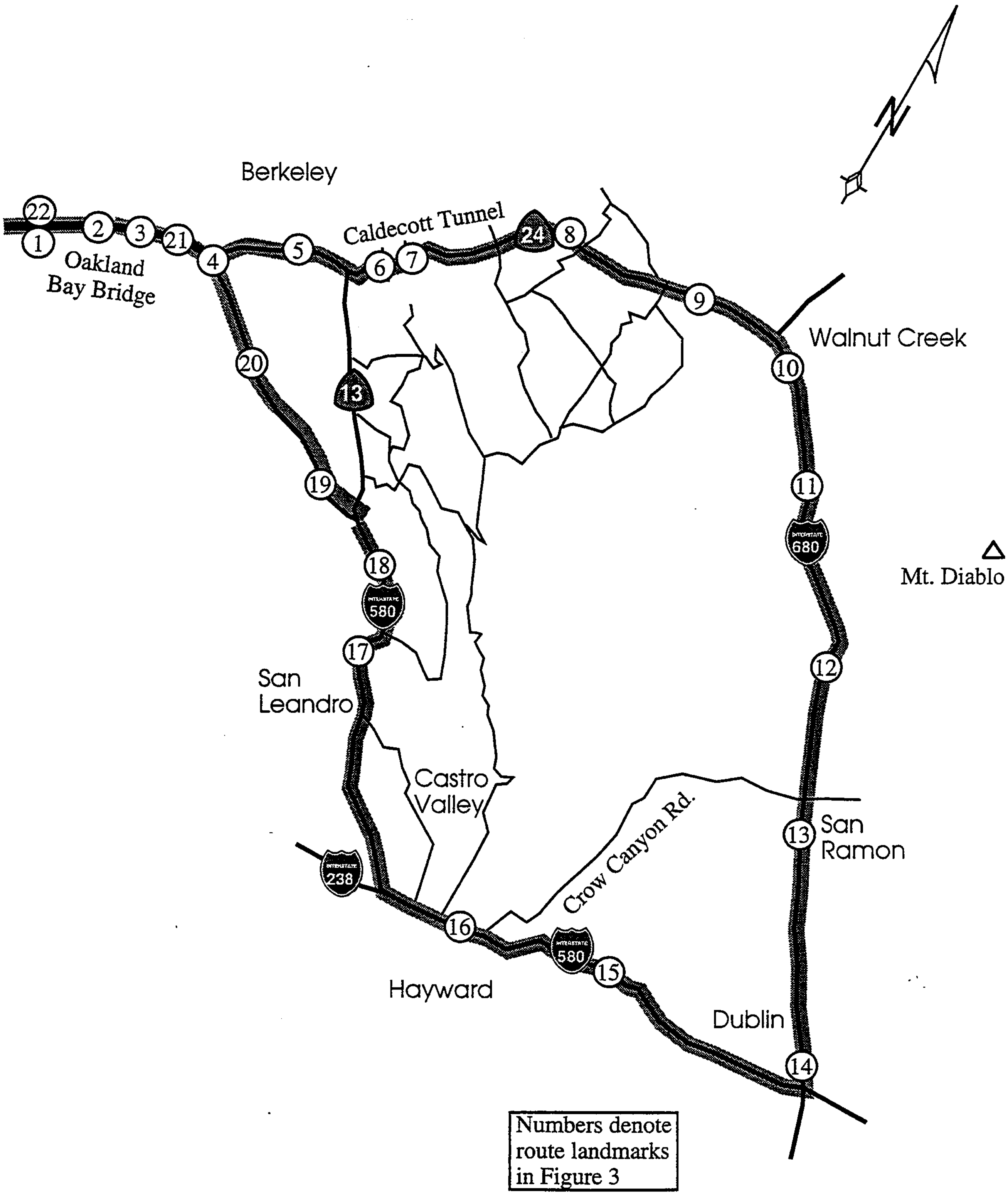

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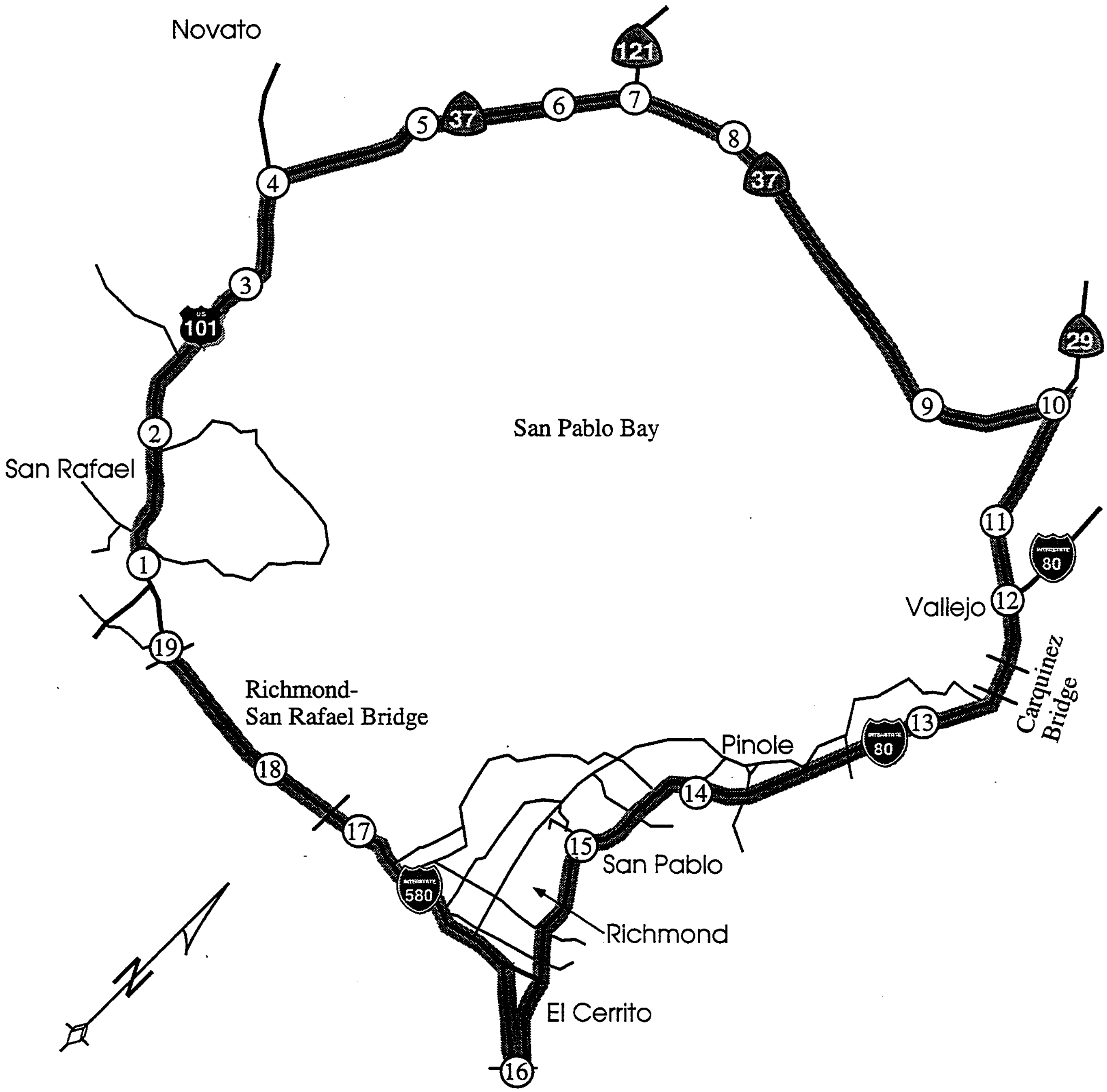
Figure 2D

2.88

"Long Path" Test Routes
Route N • North Bay

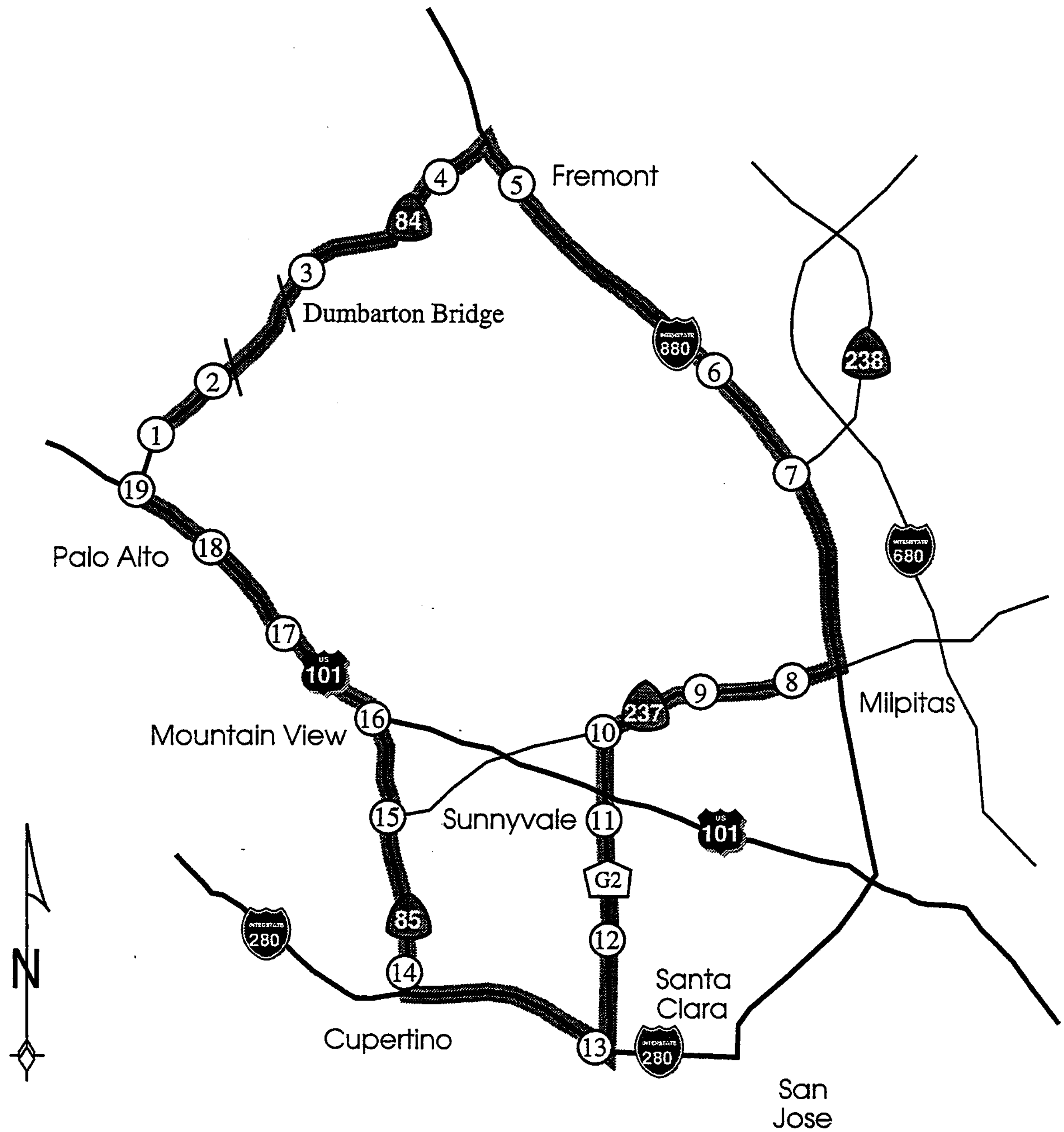


Numbers denote route landmarks in Figure 3

Electronic Industries Association • Consumer Electronics Manufacturers Association

"Long Path" Test Routes

Route S • South Bay



Numbers denote route landmarks in Figure 3

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Figure 2F

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"Long Path" Test Routes
Landmark Descriptions

Route P

Landmark Number	Environment Designator	Landmark Description
1	FSD	Call box on 19th before tunnel
2	HSD	Intersection of 19th & Fulton
3	HSL	Intersection of 19th & Noriega
4	HSL	Intersection of 19th & Vincente
5	FUM	Intersection of 19th & Holloway
6	FUM	Arch stop light
7	FUL	Stop light under BART tracks before 280 onramp
8	HUL	"I-280 Downtown" sign at Alemany exit
9	FUL	"I-80 Bay Bridge/Downtown" sign on overpass
10	HUL	2nd Street stop light
11	FUL	Clock tower at World Trade Center
12	FUM	Stop light at Battery
13	HUL	Stop light at Columbus & Bay
14	END	"19th Avenue Exit" sign

Route D

Landmark Number	Environment Designator	Landmark Description
1	FDL	Left turn on Market from Steuart (center of intersection)
2	FDL	"American Savings Bank" blue and white sign on building
3	FDL	Red and White Levi's "House of Blue Jeans" sign on building past 5th
4	HDL	Central Skyway (Hwy 101) overpass
5	HUM	Intersection of Castro, 17th and Market
6	HUM	Pedestrian overpass after Argent and Market
7	HUD	Right turn on Woodside Avenue
8	HSD	Blank yellow diamond sign at right turn on Clarendon
9	HUM	Mailbox past intersection of Clarendon and Twin Peaks
10	HUM	"15 MPH" turn sign at corner of Clifford Terrace and Ashbury
11	HUM	"No Left Turn 4-7pm Everyday" sign at Fell and Masonic
12	FUL	"Recycling Center" sign at Anza/O'Farrell and Masonic
13	HUL	Stop light at intersection of Scott and California
14	HUL	"Trucks use Van Ness Avenue" sign at California and Gough
15	HDL	Blue and White "Parking" sign marking garage at California and Taylor
16	FDL	Federal Reserve Bank of SF after Sacramento and Sansome (statue) (1st)
17	FDL	Pedestrian walkway over Battery Street before Sacramento (1st)
18	FDL	Federal Reserve Bank of SF after Sacramento and Sansome (statue) (2nd)
19	FDL	Pedestrian walkway over Battery Street before Sacramento (2nd)
20	END	Entrance to intersection of Market and Battery

"Long Path" Test Routes
Landmark Descriptions

Route W

Landmark Number	Environment Designator	Landmark Description
1	HSM	I-280 to Hwy 1 South—Clarinada Blvd exit sign
2	HSM	"End Freeway" sign at Sharp Park Blvd
3	MRD	Linda Mar Drive stop light
4	MRM	Devil's Slide winding road (S) sign
5	HSM	Montara Chart House restaurant
6	FSM	Half Moon Bay/San Mateo Airport entrance sign
7	FSM	Gin Wan Chinese restaurant
8	VSD	Junction of Hwy 1 & Hwy 92 east
9	VRD	"Obester Winery" sign
10	MRM	"Lombardi Spring" well sign
11	MRD	"S" Sign after Hwy 35 junction
12	HSM	I-280 overcrossing at 92—280 north sign at onramp
13	FUM	"El Camino Real North/South" sign
14	FUM	"3rd Ave Next Right" sign
15	FUL	Peninsula Ave overpass
16	FUL	Millbrae Ave overpass
17	FSM	"San Bruno/El Camino Real" exit sign after 380 onramp
18	HSM	"Daly City" city limit sign
19	END	"Hwy 1 Pacifica/Mission Street Exit" sign

Route E

Landmark Number	Environment Designator	Landmark Description
1	FBN	"50 MPH" sign immediately after last SF entrance to I-80 (Battery)
2	FBN	"15 MPH" sign with U-shaped arrow at entrance to tunnel
3	FUL	Hwy 80/580/680 direction sign immediately after bridge
4	FUL	"Walnut Creek 24" sign at end of entrance ramp
5	HSM	"Tunnel Road 1 1/2 mi" sign
6	FTN	Entrance to Caldecott Tunnel
7	HRM	End of Caldecott Tunnel
8	HRD	"St. Stephens Road/Hidden Valley Road Next Exit" sign
9	HRM	"Pleasant Hill Rd 1 mi/Jct 680 2 1/4 mi" sign
10	HRM	"So Main Street Next Exit" sign
11	HRM	"Stone Valley Road East/West" sign
12	FRM	Overpass after Sycamore Valley Road exit
13	FRM	Overpass with "Bollinger Canyon Road Next Exit" sign
14	HRM	"Oakland/Stockton 580" sign above beginning of onramp to 580
15	HRM	"Eden Canyon Road/Palomares Road 3/4 mi" sign
16	HSM	"Castro Valley Next Right" sign
17	HSM	"Oakland Zoo-Park/Oakland Airport Next Right" sign
18	HSD	Large green water tank on hill immediately past Keller Avenue exit
19	FSM	Overpass with "Coolidge/Fruitvale Avenue" and "Bay Bridge" signs
20	FUM	Overpass with "Lakeshore/Grand Avenue/Harrison Street" sign
21	FBN	"Toll Crossing 1/2 mi Auto Toll $1.00" sign
22	END	Railing over west end of Bay Bridge

"Long Path" Test Routes
Landmark Descriptions

Route N

Landmark Number	Environment Designator	Landmark Description
1	HUM	Central San Rafael Exit sign (north end of exit lane)
2	HSM	Frank Lloyd Wright Building at Marin Center Sign
3	HSM	Alameda del Prado overpass
4	FRM	Intersection of Highway 101 and Highway 37, double arrow sign
5	FRL	Marin/Sonoma County line on Bridge
6	FRL	Lakeville Highway stop light
7	FRL	Highway 121 stop light
8	FRL	"Solano County Line" sign
9	FSL	"Welcome to Vallejo" sign
10	HUM	Intersection of Highway 37 and Highway 29 at "T" sign
11	HSM	Veer left at Curtola Pkwy
12	HSM	"I-80 Freeway Entrance" sign
13	HEM	"Hercules Next Two Exits" sign
14	HSM	First Appian Way overpass
15	HSM	"San Pablo City Limit" sign
16	HSM	"Freeway Entrance" sign at onramp to 580 north from Central Avenue
17	FBN	"Toll Crossing Entrance 1/4 Mile" sign
18	FBN	"Marin County Line" sign on bridge
19	END	I-580 and Highway 101/Exit sign for Sir Francis Drake

Route S

Landmark Number	Environment Designator	Landmark Description
1	FSM	"Sun Microsystems" sign at intersection of 84 and Willow
2	FBN	"Dumbarton Bridge Toll Crossing Entrance" sign
3	FRL	South KGO tower (closest to 84)
4	FSM	Overpass with "Newark Blvd/Ardenwood Blvd Next Right" sign
5	FSM	Railroad overcrossing past Thornton Avenue exit
6	FSL	Overpass after Auto Mall Parkway exit
7	FSL	Overpass with "Dixon Landing Road 1 3/4 mi" sign
8	FSL	Overpass with "McCarthy Blvd/Ranch Dr" sign past McCarthy Ranch mall
9	FSL	Overpass past North First Street exit
10	FSM	Hwy 237/Milpitas Freeway Entrance sign on Lawrence Expwy (overpass)
11	FSM	"Fry's Electronics" sign on Lawrence
12	FSM	"El Camino Real Right Lane" sign on Lawrence
13	FSM	"North 280 Freeway Entrance" sign
14	FSM	Overpass with "Fremont Ave/Los Altos 3/4 mi" sign on 85
15	FSM	"Mountain View City Limit" sign on 85
16	FSM	North 101 San Francisco" sign at Moffett Blvd exit
17	FSM	Overpass after San Antonio Road exit/Palo Alto city limit
18	FSM	"East Palo Alto City Limit/San Mateo County Line" signs
19	END	"Willow Rd/Fremont East 84" sign

"Long Path" Test Routes
Landmark Descriptions

RF Environment Designators

RF Environment Designators are three-letter codes representing typical landscape features encountered along each section of a long path test route. The code associated with each landmark pertains to the segment of the route beginning at that point and continuing to the next mark; for the last landmark on a path the designator "END" is always used. Where one path section contains very different landscape features, the codes denoting features typical of the majority of that section are used. The codes used are as follows:

First Letter - Terrain

F	Flat	Little or no change in elevation
H	Hilly	Gradual changes in elevation
M	Mountainous	Steep changes in elevation
V	Valley	Roadway between regions of consistently greater elevation

Second Letter - Urbanization

R	Rural	Open space with occasional buildings typically less than 3 stories tall
S	Suburban	Some space between buildings typically less than 3 stories tall
U	Urban	Many closely-spaced buildings less than 10 stories tall
D	Dense	Many closely-spaced buildings 10 stories tall or greater
B	Bridge	No urbanization; roadway above water
T	Tunnel	No urbanization; roadway underground

Third Letter - Foliage

N	None	No foliage; roadway above water or underground
L	Light	Grasses and low bushes, occasional short trees
M	Moderate	Bushes and stands of short trees, occasional tall trees
D	Dense	Many closely-spaced, tall trees

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"Long Path" Test Routes - Qualitative Information

The long path test routes described in Figures 1 and 2 were selected to allow system evaluation under differing terrain and line-of-sight conditions. Described below are some of the qualitative characteristics of each proposed route.

Route P - San Francisco Perimeter: This route circles virtually the entire City of San Francisco. It includes travel on popular commute routes and through popular tourist areas. The northern part of the route is line-of-sight with the Mt. Beacon transmitter site, while the southern part of the route is shielded by terrain. The northeastern part of the route, that on I-80, is shielded in part by tall city buildings. The western part of the route travels through city residential areas, through the MacArthur Tunnel, and through Golden Gate Park.

Route D - San Francisco Downtown: The San Francisco downtown route covers central parts of San Francisco, including both downtown city and nearby residential areas. All of Market Street is covered, which includes travel between tall buildings and under trolley power cables in the city area, and up commonly traveled mountain roads in the residential areas near Mt. Sutro and Twin Peaks. The route also includes travel through the Financial District, the low-rise Haight-Ashbury District, and up and down travel on the hills of California Street, which is shared in part with cable car traffic.

Route W - San Francisco Peninsula: The Peninsula route (western Bay Area) covers parts of the heavily traveled Route 101 and I-280 corridors, as well as the San Mateo County coastline. Travel on Highway 92 is included; this two-lane road is a popular commute route that connects residential Half Moon Bay with San Mateo. It winds up and down hills, and much of it is terrain-shielded to the Mt. Beacon transmitter site (and the other L-band transmitter sites, as well).

Route E - East Bay: The East Bay route includes travel on both the upper and lower decks of the Bay Bridge, which is the major link between San Francisco and Oakland. Travel is also included along Highway 24 and I-680. Highway 24 travel includes the Caldecott Tunnel, east of which is shielded from most Bay Area FM stations. Most of I-680 is also heavily terrain shielded. A large number of residential communities are located immediately adjacent to Highway 24, I-580, and I-680. The route includes travel immediately east of Oakland, along Highway 580.

Electronic Industries Association

"Long Path" Test Routes - Qualitative Information

Route N - North Bay: This route includes both line-of-sight (over the San Francisco and San Pablo Bays) and terrain-shielded areas. The part of the route that includes travel on I-80 and I-580 is nearly all line-of-sight to Mt. Beacon, while some travel on parts of Highways 101 and 37 is terrain-shielded. As with the Peninsula route, residential areas are adjacent along many parts of the route. Travel across two major bridges is included.

Route S - South Bay: This route is nearly all over flat terrain and on well-established roads and major commute highways. Line-of-sight conditions exist over most of the route; such propagation is all over water, consisting of almost the entire length of the San Francisco Bay. Travel also includes the heart of the Silicon Valley area, through Sunnyvale. As with the other routes, residential areas are adjacent, especially along the Lawrence Expressway. Travel across the Dumbarton Bridge is included in the route. The southernmost part of this route is sometimes considered to be a fringe coverage area for the FM stations on Mt. Beacon.

Some of the key qualitative characteristics of each route are summarized in the table below:

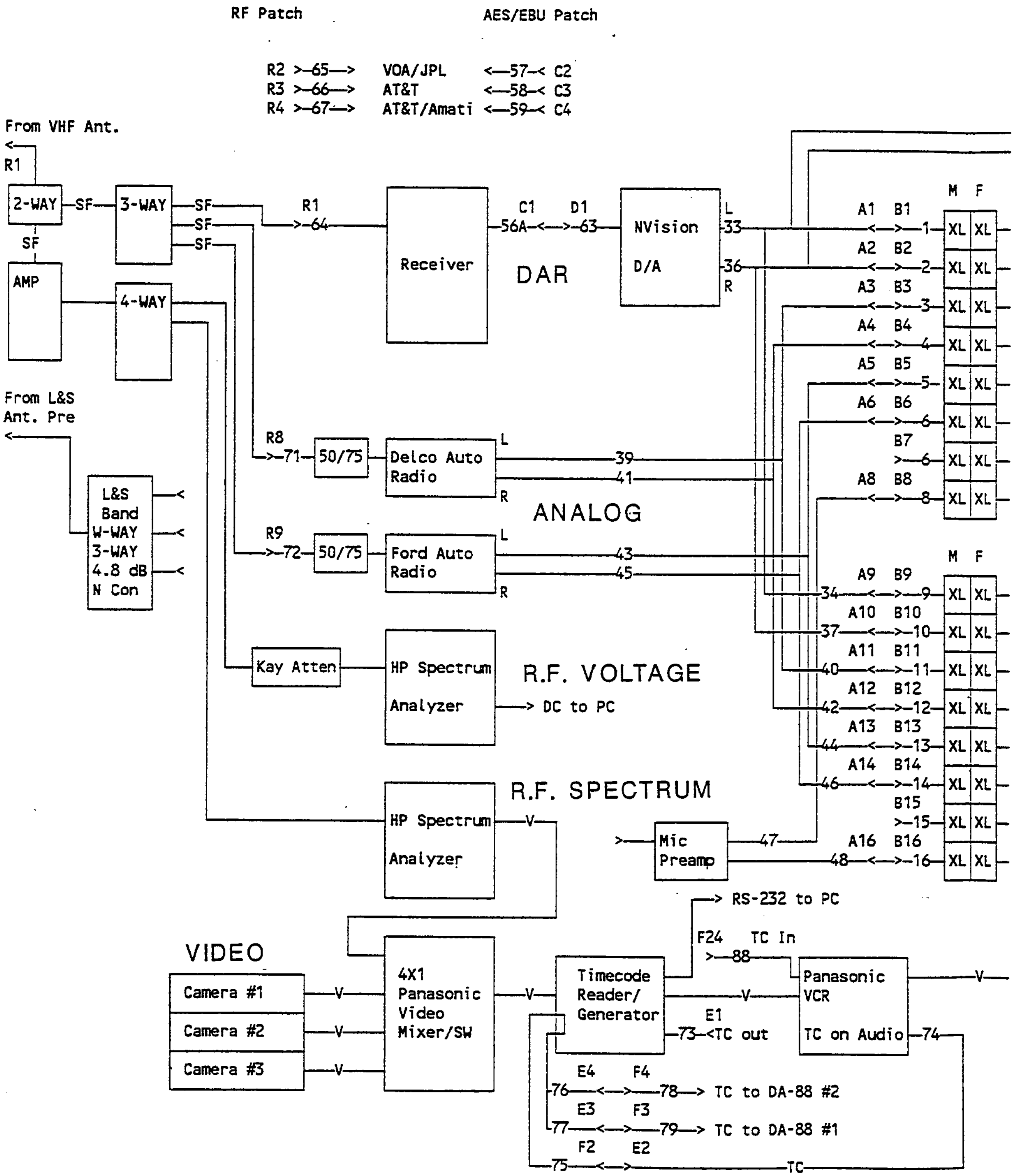
	Route					
Qualitative Characteristic	P	D	W	E	N	S
A. Some line-of-sight conditions exist	✓	✓	✓	✓	✓	✓
B. Terrain shielding conditions exist	✓	✓	✓	✓	✓	✓
C. Significant shielding by buildings	✓	✓		✓		✓
D. Vertical shielding (tunnels/wires)	✓	✓		✓		
E. Major over-water path	✓	✓		✓	✓	✓
F. Travel along waterfront areas	✓		✓	✓	✓	✓
G. Significant foliage along part of path	✓	✓	✓	✓		
H. Rural area(s) covered			✓		✓	
J. Primarily highway travel				✓		✓
K. Residential areas covered/directly adjacent	✓	✓	✓	✓	✓	✓
L. (More) residential areas optional			✓	✓	✓	✓
M. "Fringe" FM reception area			✓	✓		✓
N. Co-channel interferers (IBAC only)[1]	✓	✓	✓	✓	✓	✓
O. Adjacent-channel interferers (IBAC only)[2]	✓	✓			✓	

1 KSEG, Sacramento, and KWAV, Monterey (both 96.9 MHz).

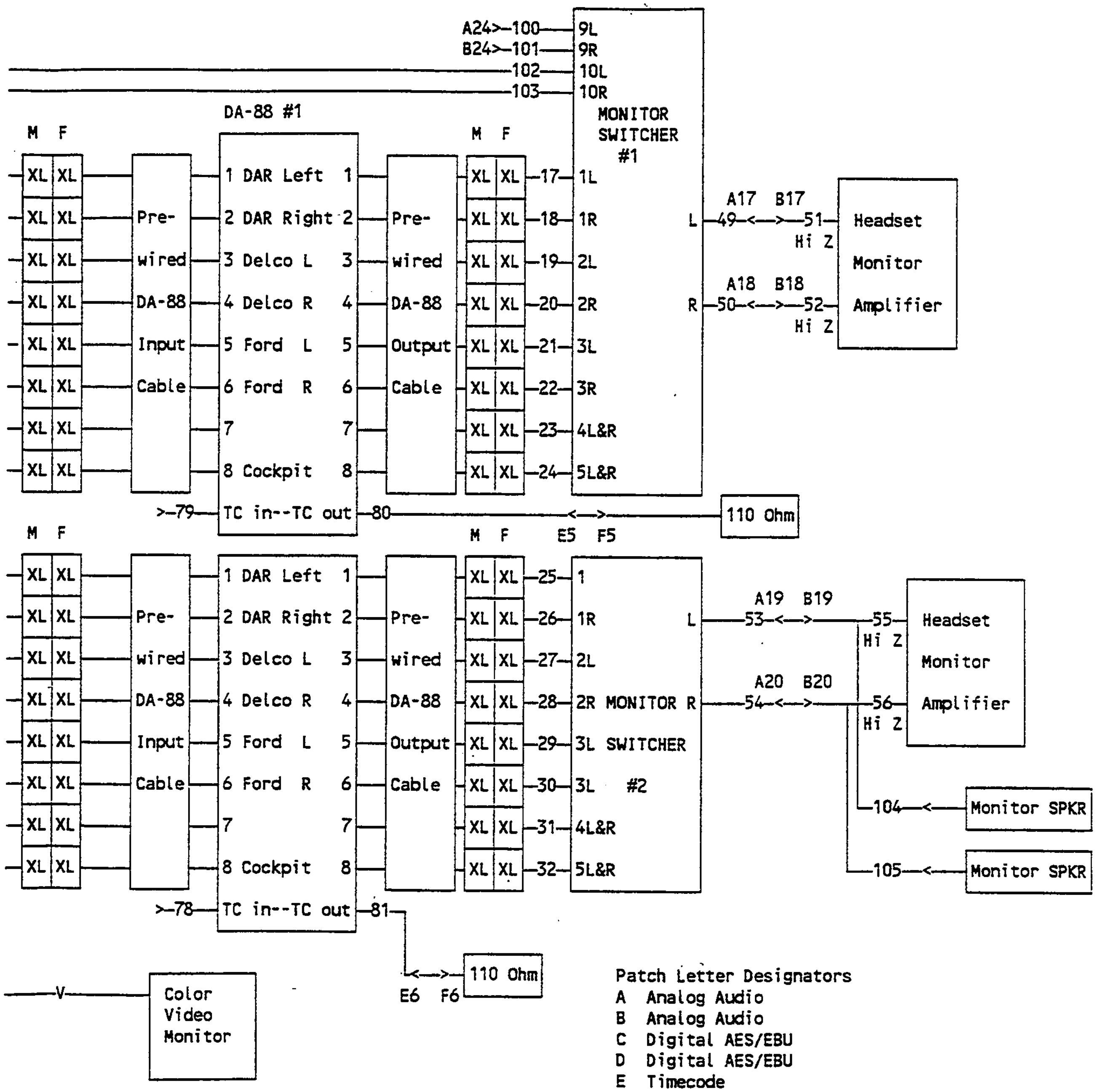
2 KLLC, 97.3 MHz, San Francisco, and KOIT, 96.5 MHz, San Francisco.

INDEX PAGE - APPENDIX C

Field Test R.F. testbed data



EIA-DAR FIELD TEST; TESTBED BLOCK DIAGRAM
R.F. SECTION (DETAIL)



Patch Letter Designators

- A Analog Audio
- B Analog Audio
- C Digital AES/EBU
- D Digital AES/EBU
- E Timecode
- F Timecode
- R Radio Frequency

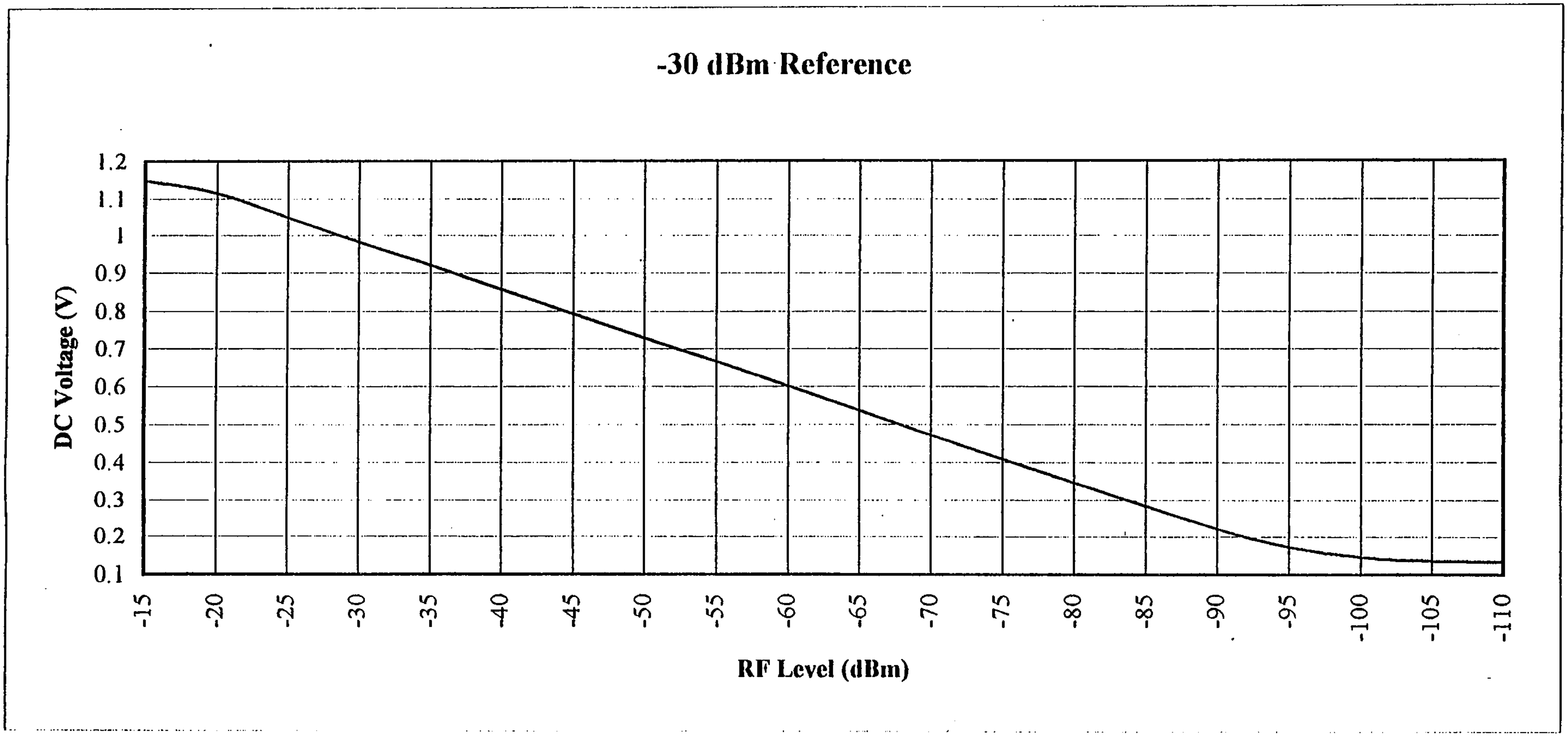
EIA-DAR FIELD TEST; TESTBED BLOCK DIAGRAM
AUDIO SECTION (DETAIL)

299

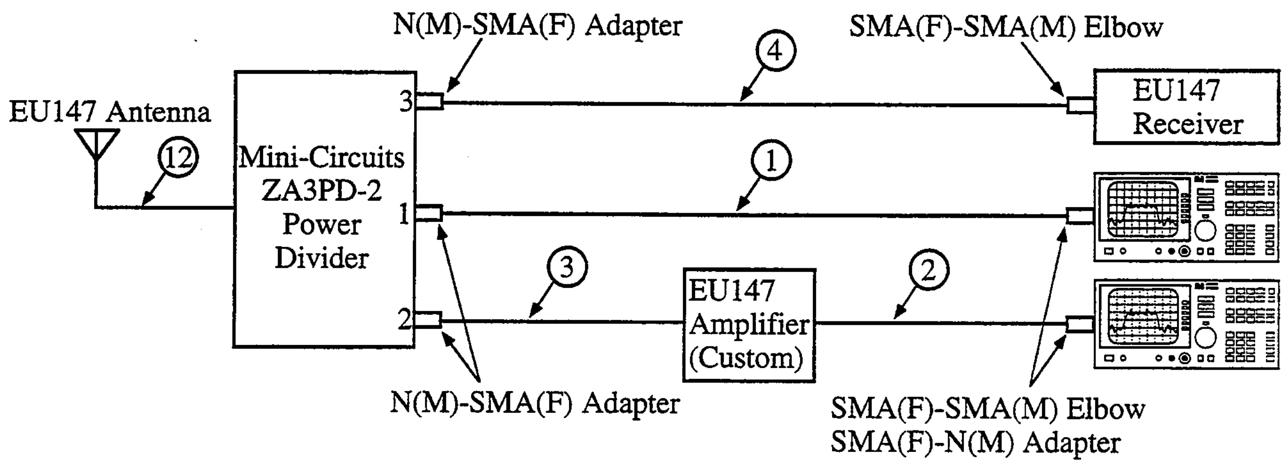
Digital Radio Test Laboratory

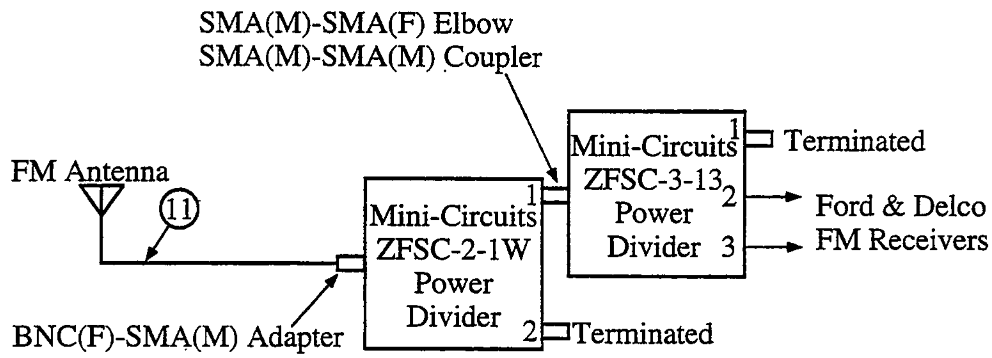
-30 dBm Ref		AT&T
-15	1.148	
-20	1.114	
-25	1.049	
-30	0.982	0.950
-35	0.921	
-40	0.857	0.822
-45	0.793	
-50	0.729	0.694
-55	0.666	
-60	0.601	0.566
-65	0.538	
-70	0.473	0.438
-75	0.410	
-80	0.346	0.315
-85	0.284	
-90	0.222	0.234
-95	0.173	
-100	0.146	
-105	0.136	
-110	0.133	

Digital Radio Test Laboratory

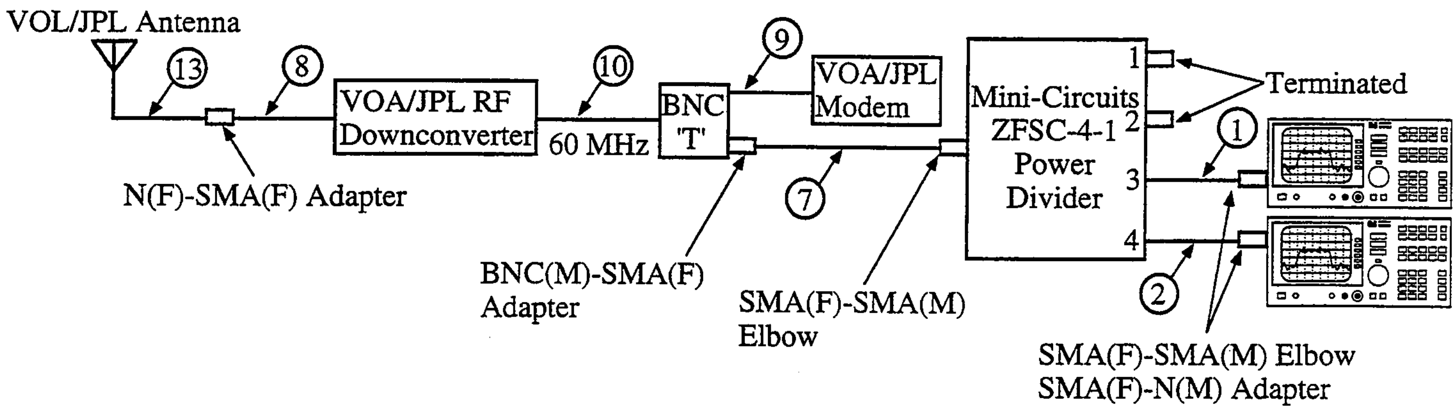


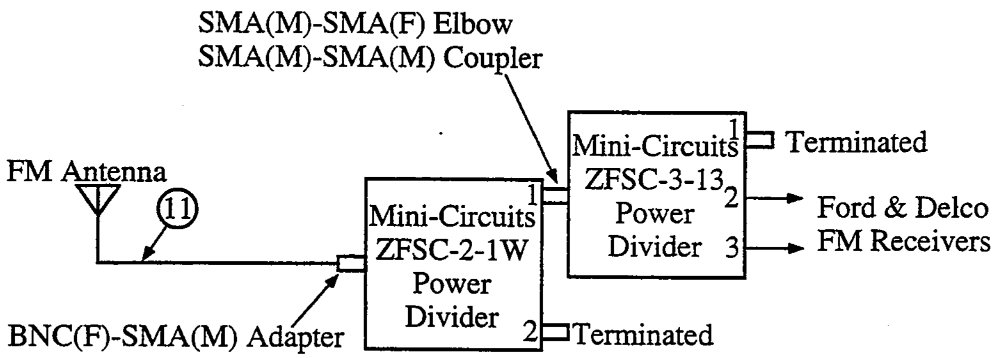
DAR RF Test Bed Configuration
Eureka 147 System



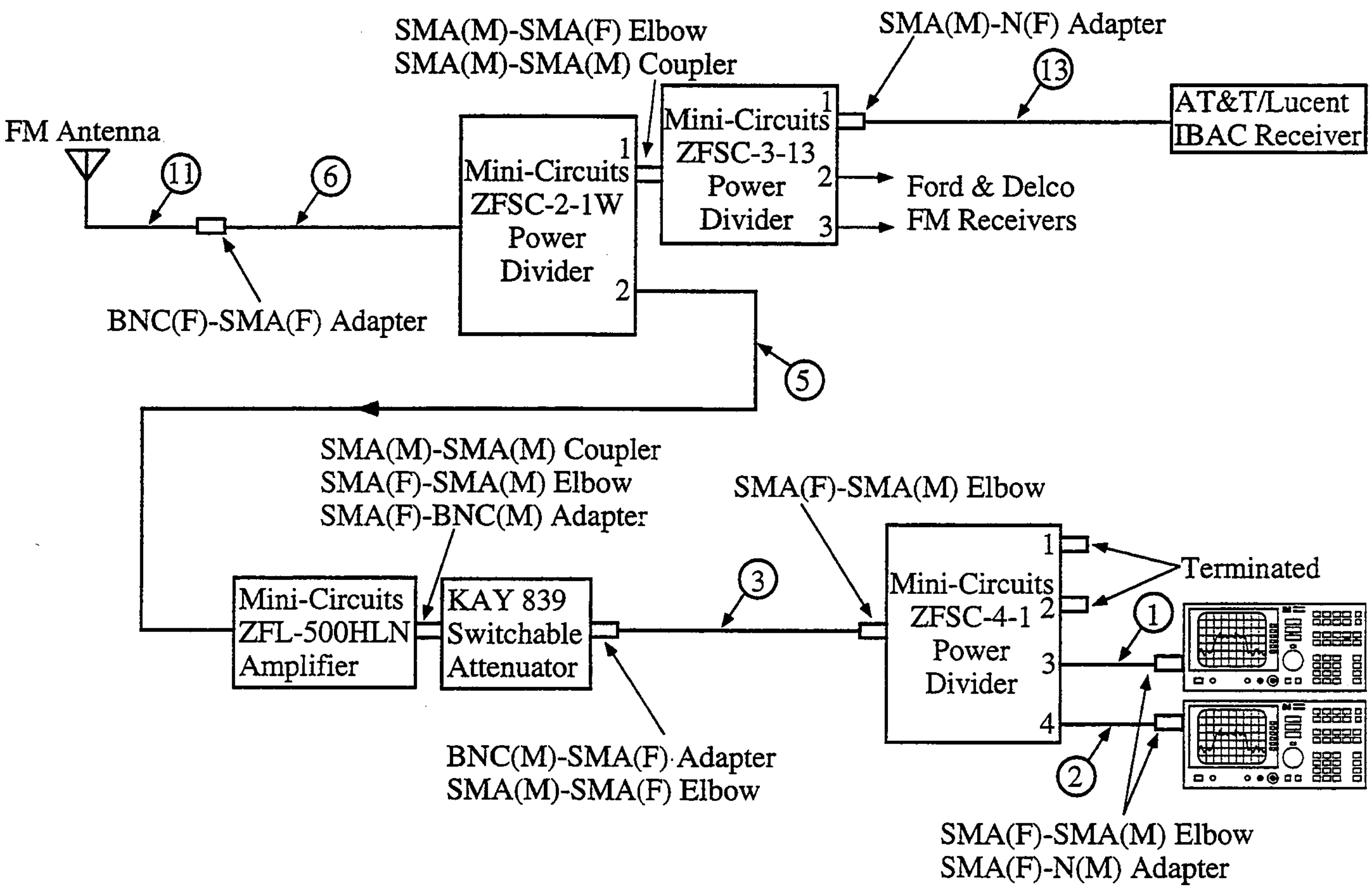


DAR RF Test Bed Configuration
VOA/JPL System





DAR RF Test Bed Configuration
AT&T/Lucent IBAC System



DAR RF Test Bed Components

Cables

No.	Description	Length	Loss VHF	Loss L-Band	Loss S-Band
1	QMI metal shielded semi-rigid coax SMA(M)-SMA(M)	36 in	0.45 dB	0.65 dB	—
2	QMI metal shielded semi-rigid coax SMA(M)-SMA(M)	36 in	0.45	0.65	—
3	QMI metal shielded semi-rigid coax SMA(M)-SMA(M)	12 in	0.19	0.26	—
4	QMI metal shielded semi-rigid coax SMA(M)-SMA(M)	18 in	—	0.36	—
5	QMI metal shielded semi-rigid coax SMA(M)-SMA(M)	18 in	0.26	—	—
6	QMI metal shielded semi-rigid coax SMA(M)-SMA(M)	18 in	0.26	—	—
7	M17/60-RG142 MIL-C-17G 12814 THERMAX SMA(M)-SMA(M)	36 in	0.09	—	—
8	SWC 507-142B RG142B/U SMA(M)-SMA(M)	11.5 in	—	—	0.24
9	RG59/U type CL2 22 AWG BNC(M)-BNC(M)	19 in	0.04	—	—
10	VOA/JPL coax signal cable BNC(M)-SMA(M)	15.5 in	0.03	—	—
11	Tandy Wire & Cable Type RG-58/U BNC(M)-BNC(M)	16 ft	0.72	—	—
12	Belden Type 9914 RG-8 N(M)-N(M)	8 ft	—	0.53	—
13	Belden Type 9914 RG-8 N(M)-N(M)	25 ft	0.42	—	2.05

Devices

Description		Gain/Loss
Mini-Circuits ZFL-500HLN Amplifier		+ 20.7 dB (VHF)
Mini-Circuits ZFSC-2-1W Power Divider	Port 1	-3.24
	Port 2	-3.25
Mini-Circuits ZFSC-3-13 Power Divider	Port 1	-5.13
	Port 2	-5.12*
	Port 3	-5.13*
Mini-Circuits ZFSC-4-1 Power Divider	Port 3	-6.51
	Port 4	-6.52
EU147 Custom Amplifier		+ 32.3 (L-Band)
Mini-Circuits ZA3PD-2 Power Divider	Port 1	-4.87
	Port 2	-4.99
	Port 3	-5.04

* Provided for information only. Used to feed Delco and Ford FM receivers.

DAB FIELD TEST PROJECT ANTENNA CHARACTERIZATION REPORT

submitted to:

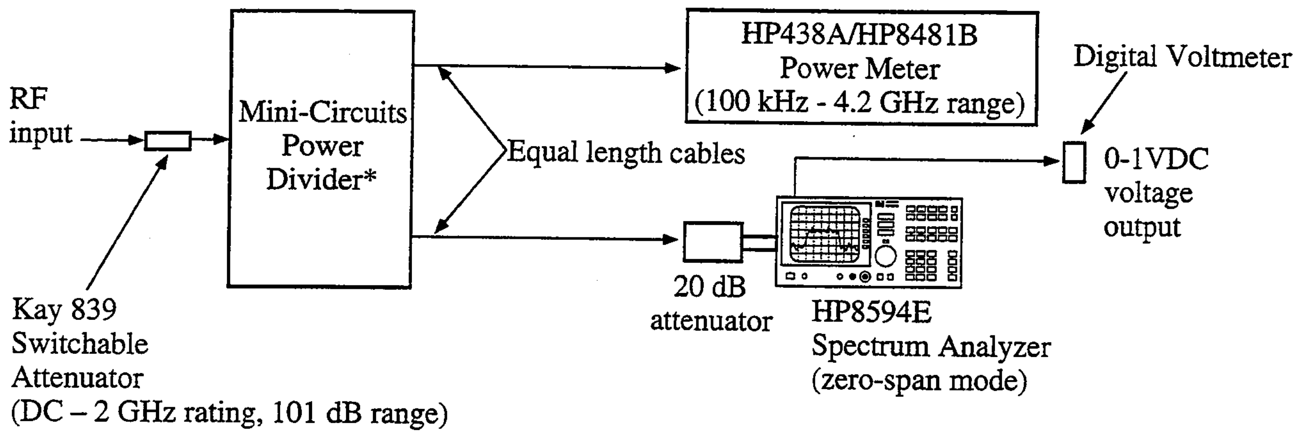
NRSC/EIA/NAB Field Test Task Force

July 9, 1996

prepared by:
Ford Motor Company
Audio Systems Engineering
Michael Chrysochoos (313) 594-3684 mchrysoc@e-mail.com
Richard Zerod (313) 323-2526

NOTE: Copies of this report are available from Ralph Justus at EIA.

DAR Power Calibration
Block Diagram



RF Input Characteristics

System	Frequency	Source
AT&T/Lucent IBAC	96.9 MHz	Output of system rack through IPA
Eureka 147	1468	EU147 Itis/Telefunken encoder/modulator
VOA/JPL	60	Modem IF output (using VOA/JPL S-band upconverter as source; internal generator mode)

* Mini-circuits Type ZFSC-2-1W power divider used for AT&T/Lucent and VOA/JPL; Type ZA3PD-2 power divider used for Eureka 147, with unused output terminated.

DAR Power Calculation
Collected Data

Attenuator Setting	AT&T/Lucent IBAC Power-meter Reading	AT&T/Lucent IBAC Zero-Span Analyzer	AT&T/Lucent IBAC DC voltage	Eureka 147 Power-meter Reading	Eureka 147 Zero-Span Analyzer	Eureka 147 DC voltage	VOA/JPL Power-meter Reading	VOA/JPL Zero-Span Analyzer	VOA/JPL DC voltage
0 dB	-12.6 dBm	-33 dBm	0.921 V	-7.04 dBm	-37 dBm	0.819 V			
3	-15.6	-36	0.882	-10.1	-40	0.780			
6	-18.6	-39	0.844	-13.1	-43	0.742			
9	-21.6	-43	0.803	-16.0	-46	0.705			
12	-24.5	-46	0.766	-19.4	-49	0.663	-9.55 dBm	-31 dBm	0.943 V
15	-27.4	-49	0.728	-22.2	-52	0.627	-12.6	-34	0.905
18	-30.3	-52	0.690	-25.1	-55	0.588	-15.6	-37	0.867
20	-31.9	54	0.664				-17.6	-39	0.833
21				-27.9	-58	0.553	-18.6	-40	0.827
24				-30.8	-61	0.515	-21.6	-43	0.789
27				-34.0	-64	0.474	-24.4	-46	0.750
30	-37.8	-64	0.536	-36.7	-67	0.435	-27.3	-49	0.712
40		-74	0.408		-70	0.316		-59	0.583
50		-84	0.283		-80	0.232		-69	0.455
60		-94	0.172		-90	0.208		-79	0.328
70		-97	0.119		-90	0.205		-89	0.210
80								-95	0.131

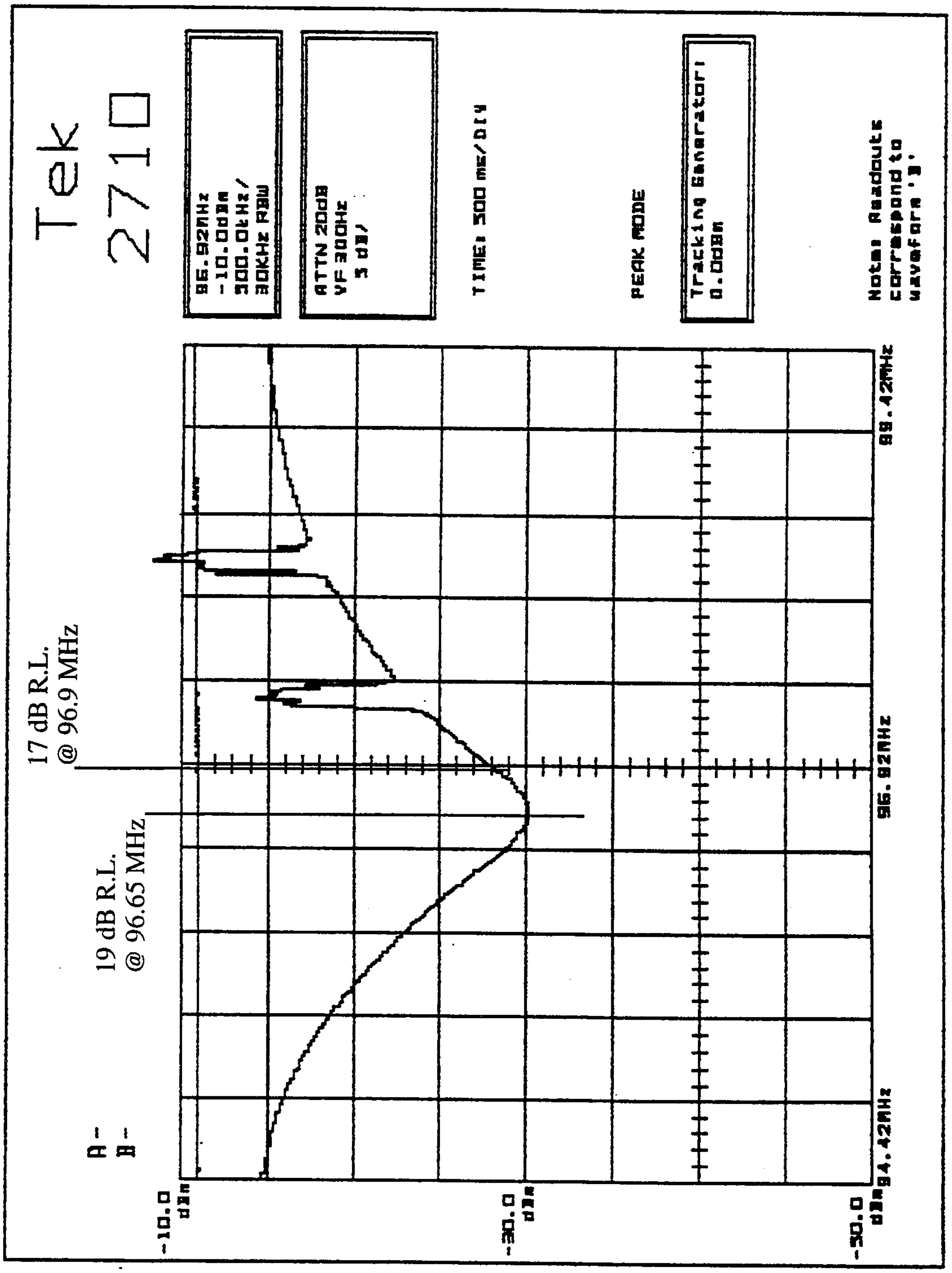
Notes

1. Power meter readings are not adjusted to reflect the 20 dB attenuator in the zero span spectrum analyzer path. Subtract 20 dB from power meter readings to equalize.
2. Power meter readings become inaccurate/unstable for levels below about -25 dBm, as reported above.
3. Zero-span spectrum analyzer readings become inaccurate/unstable for levels below about -90 dBm, as reported above.

Electronic Industries Association • Consumer Electronics Manufacturers Association

Swept Return Loss Measurement of KEIA Transmitting Antenna

Measurement conducted on November 11, 1996 by William Ruck
using Tektronix Model 2710 Spectrum Analyzer
and custom directional coupler



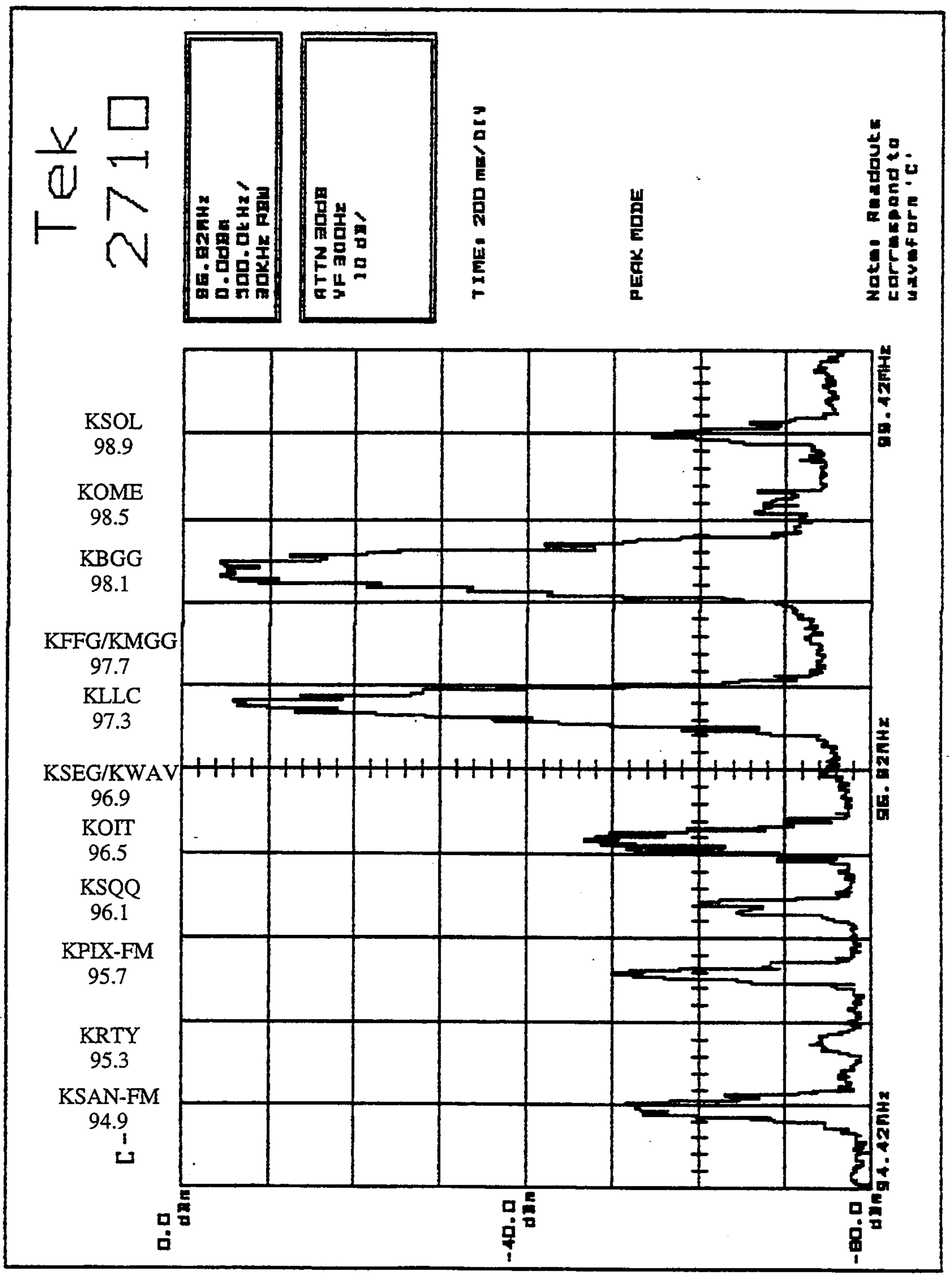
961214
Figure 1

309

Electronic Industries Association • Consumer Electronics Manufacturers Association

KEIA Transmitting Antenna Used for Reception through 30 dB Attenuator

Measurement conducted on November 11, 1996 by William Ruck
using Tektronix Model 2710 Spectrum Analyzer



961214
Figure 2

INDEX PAGE - APPENDIX D

TRANSCRIBED FROM;

DAB SUBCOMMITTEE - FIELD TEST TASK GROUP
Approved Minutes of May 11, 1995 Meeting, Page 3.

"Signal Quality Assessment by Test Personnel. After replaying some of the discussion from the last meeting for the benefit of Messrs. Goldman and Justus, who were absent at that meeting, the Group agreed on the following:

Reception notes will have two decision points (as indicated by two buttons) between listenable and unlistenable, and between unlistenable and no audio. The two buttons used to indicate that the unlistenable or no audio conditions exist will be of the momentary contact type, and the assessor will keep a finger on the appropriate button throughout the duration of the "unlistenable" or "no audio" condition. "Listenable" was defined to mean a signal that an average listener would continue listening to and "unlistenable" was defined to mean a signal that an average listener would tune out (because of poor signal quality)."

DAR Field Test Observer Training Script

The following text was read at the beginning of each field test day to persons acting as DAR observers. All observer questions were resolved before the commencement of test runs.

We've asked you here to help us test digital radio systems. Digital radio is different than the analog AM and FM radio that you're used to–instead of hearing the signal gradually fade away into static or interference, a digital radio may just cut out completely when it's not receiving a strong enough signal. Generally, this means that with digital radios, you're either receiving perfect audio or nothing at all. With some systems, however, the program audio can become garbled if the receiver gets confused when trying to make sense of the digital information it's picking up. These defects can sound like gurgling, scratches, popping, or a brief repeat of the program audio.

So what we need you to do is mark the points where these two kinds of events occur: audio dropouts and audio defects. We've set up these two game pads for you to use as markers; as we drive around, press the red button when you hear the audio drop out and the yellow button when you hear some kind of defect in the audio. The dropouts should be fairly easy to catch, but the defects may be a bit tricky depending on the kind of music that's playing at the time. If you're not sure if something you hear is part of the music or an event, mark it and ask me about it, because I'll be listening as well. Try to mark the events as close as possible after you hear them, but we understand that there will be some delay. Above all, try to mark every defect that you hear.

This tape is from an actual run that we've made, and it shows fairly clearly the things that you'll be listening for. Listen through these headphones; you each have an independent control so you can adjust the volume to a comfortable level.

(Play first 2-3 minutes of training tape; discuss differences between defects and dropouts, ask for any questions.)

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Field Test Procedure

Pre-Test System Startup and Calibration

Prior to the start of each day's field testing, the test van was removed from the staging area while connected to shore power, any prestriped tapes from the previous night were removed from the data recorders, and the equipment and UPS units were shut down. Antennas required for the proponent system under test were installed and the configuration of the RF test bed and audio patch bays were modified accordingly. The shore power cable was then stowed in its compartment, the staging area was secured, and the test van was driven to a nearby service station. The van's fluid levels and tire pressure were checked and the fuel tank was filled.

The van was then driven to a nearby parking lot where the generators and UPS units were started. All test equipment was then powered up and checked for proper operation. At this time, if necessary, the observers were read the training text and listened to a sample tape of the system under test. Since the parking lot has a clear line-of-sight to the transmission site, it was also used as a calibration point for the Eureka 147 system in both SFN and single transmitter modes. The Eureka 147 receiver was activated and checked for proper operation, and then a fixed attenuator provided by DRRI/CBC technicians was inserted before the input to the receiver, reducing the signal level to a point where defects begin to occur in the audio and confirming a consistent power level.

Calibration of the AT&T/Lucent IBAC system was performed at the base of Mt. Beacon immediately after the receiver power-up routine conducted by Lucent technicians. The switchable attenuator included in the RF test bed was used to add increasing attenuation until the system began to fail.

Due to limited satellite time, locations that had a relatively unobstructed view to the west were selected near the beginning of each route to be used as calibration points for the VOA/JPL system. At each scheduled satellite transmission event start time, the VOA/JPL modem and audio decoder were activated and the modem signal level display was monitored for a consistent signal level indication.

Test System Operation

After the individual system calibrations, the van was driven to the beginning of a long path test route. Before reaching the beginning of the route, the test operator would insert SMPTE timecode prestriped Hi-8 tapes into the two DA-88 8-track digital audio recorders and a prestriped SVHS tape into the main video recorder. A blank standard VHS tape was also inserted into the backup VCR. The EIA data collection software was then started and menu selections were made to specify the system under test, test route, current weather conditions, and operator group.

The main VCR was then set to output the mono audio track (containing the SMPTE timecode) and the "Play" button was pressed. When the timecode reader began to display incrementing timecode, the "Pause" button on the VCR was pressed. The "Start" button on the software was clicked, the landmark file selection confirmed, and a filename was entered for the collected data. The software would then begin collecting RF level data with each pulse of the shaft encoder and display each block of records in the on-screen strip chart as it was written to the hard drive.

The "Insert" button on the software was then clicked, and the VCR would begin to record video while playing the existing timecode track. The timecode reader, keyer display on the video monitor, and timecode window on the computer monitor were then checked for proper display and synchronization, and recording was started on the backup VCR. Both DA-88 "Play" buttons were pressed and the units were set in chase mode. When the DA-88s locked up with the timecode on the other devices, all track record buttons were enabled and the "Record" button was pressed. The recording system was then ready to record test data.

Observers were then asked to check the red and yellow event buttons on their control paddles for proper operation, which the operator confirmed by observing the event indicators on the computer software. The route was driven while the observers listened to the decoded digital audio on headphones and marked audio defects and dropouts. The operator incremented landmarks with the computer software and took notes on any odd occurrences or problems with the recording system.

Once the route was completed, the "Stop" button on the software was clicked and all tapes were stopped and rewound. The tapes were checked for data and proper playback synchronization, then labeled and write-protected.

Post-Test System Shutdown

Upon returning to the staging area, the van was connected to shore power and the generators were shut down. The computer data files written during the day's test runs were then backed up onto two separate data tapes, and blank SVHS and Hi-8 tapes were prestriped with SMPTE timecode. Once the backups were completed, all tapes containing test data were removed for shipping to the data analysis location. Finally, all antennas were removed and the vehicle was parked in the garage bay and secured.

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Field Test transmission facilities

F-1 FCC FM Band experimental application (revised), October, 1995. COVER PAGE ONLY, full text supplied on request.

F-2 FCC L-Band experimental application, January, 1995 COVER PAGE ONLY, full text supplied on request.

F-3 VOA-JPL S-Band system description.

F-4 Transmission site logs (samples).

EXHIBIT E
ENGINEERING STATEMENT RE:
APPLICATION FOR CONSTRUCTION PERMIT
EXPERIMENTAL EIA DAR VHF FM BAND RADIO
FIELD TEST - SAN FRANCISCO, CA.
ELECTRONIC INDUSTRIES ASSOCIATION
WASHINGTON, D.C.
JANUARY, 1995

INTRODUCTION

This statement is prepared on behalf of the Electronic Industries Association (EIA) in support of an application for Construction Permit to operate an Experimental Broadcast Station, under Part 74 Subpart A of the Rules of the Federal Communications Commission (FCC Rules), in association with its ongoing investigation into Digital Audio Radio (DAR). All information contained in or attached to this statement is provided as specified in Part 74 Subpart A of the FCC Rules, or as required by FCC application Form 309, unless specifically stated otherwise herein.

NAME OF APPLICANT / OPERATOR

This request is made by, and the resulting experimental operation will be conducted by, the Electronic Industries Association. The full correspondence address is: EIA DAR Subcommittee, Attn. Ralph Justus, 2500 Wilson Blvd., Arlington, Va. 22201-3884, Phone: 703-907-7638, Fax: 703-907-7601.

NEED FOR EXPERIMENTAL OPERATION / BACKGROUND

The EIA is presently conducting laboratory tests and is planning to conduct field tests of various proposed Digital Audio Radio (broadcast) systems. The laboratory testing is designed to simulate actual operation to the extent possible but all proponents

EXHIBIT E
ENGINEERING STATEMENT RE:
AMENDMENT TO APPLICATION FOR EXPERIMENTAL PERMIT
EIA-DAR L-BAND RADIO CHANNEL FIELD TEST
FCC FILE NO.4615-EX-PL-95, SAN FRANCISCO, CA.
ELECTRONIC INDUSTRIES ASSOCIATION
WASHINGTON, D.C.
OCTOBER, 1995

INDEX

FIGURES

Prepared by
Lohnes and Culver Washington, D.C.
October, 1995

LINK BUDGET FOR LINE-OF-SIGHT DIGITAL AUDIO BROADCASTING RECEPTION AT S-BAND (2.05 GHZ)

AUDIO BIT RATE (Stereo)		160.00	kbps
Satellite transmitter power		7.00	watts
Satellite transmitter power		8.45	dBW
Frequency		2.05	GHz
Satellite antenna diameter		5.00	m
Satellite antenna gain		38.02	dBi
Satellite antenna beamwidth		2.05	deg
EIRP		46.47	dBW
Satellite Elevation Angle		25.00	deg
Slant Range		39262	km
Free space loss		-190.51	dB
Atmospheric losses		0.25	dB
(Total PFD in 200 kHz BW)		-116.40	dBW/m2
PFD in 4 kHz		-133.39	dBW/m2
Signal at Antenna		-144.29	dBW
Receive Antenna gain		8.00	dBi
Receive Antenna Pointing Loss		1.00	dB
Received Signal		-137.29	dBW
Antenna Temperature		150	K
Receiver Noise Figure		1.50	dB
Receive System noise temperature		274	K
Receive System G/T (On Antenna Axis)		-16.37	dB/K
C/No		66.94	dBHz
Bit Rate		52.04	dB
Eb/No Available		14.89	dB
Theoretical Eb/No, B.E.R.=10E-6		3.50	dB
Receiver implementation loss		1.00	dB
Interference degradation		0.50	dB
Receiver Eb/No Requirement		5.00	dB
LINK MARGIN, Beam Center		9.89	dB
LINK MARGIN, Beam Edge		6.89	dB

(Distributed with data to FCC, 2/97)

APPENDIX F-4
Transmission Site Logging and Access Control

During periods when proponent personnel were present at the Mt. Beacon test site, secured equipment was continuously attended by the test site manager or his designee. Secured equipment consisted of the encoders/modulators at the Mt. Beacon site and the system receivers, which were installed in the test van. Proponents were required to receive prior permission from the test site manager before supervised adjustments or repairs could be made to any of the secured equipment. During times when the secured equipment was not in use, it was locked in the Mt. Beacon test room or in the test van, which was parked in a garage near the test site.

Logs were kept during times when the Eureka 147 and AT&T/Lucent IBAC transmission systems were operated. Operation of the Eureka 147 system required prior and real-time coordination with the National Telecommunications and Information Administration (NTIA), the Aerospace & Flight Test Radio Coordinating Council (AFTRCC), and the National Aeronautics and Space Administration (NASA). A monitoring station at NASA/Ames Research Center in Sunnyvale, California, was set up for continuous monitoring of the Eureka 147 L-band transmissions during periods when the system was active. Operation of the Eureka 147 system was limited to weekdays between 8:00 am and 4:00 pm local time. Operating power of the Eureka 147 system was monitored at the test site by persons designated by the test site manager, as well as remotely using a dial-up modem for the single frequency network sites, when they were operated, to ensure that the FCC-authorized power for each site was not exceeded.

Operation of the AT&T/Lucent DAR system was conducted entirely from the Mt. Beacon test site. During each day of initial testing and during days when test data was being gathered, the proponent activated the equipment approximately one hour before it was used, to allow the system to stabilize. After the initial stabilization period, power readings of the intermediate power amplifier (IPA) and the power amplifier (PA) were recorded. Additional readings were taken and recorded generally twice more during each day to ensure that the system was operating within established power tolerances; minor power adjustments were made as needed.

Operation of the VOA/JPL transmission uplink equipment was handled entirely by the staff at the White Sands Test Center, near Las Cruces, New Mexico. A prior schedule was arranged with the proponent and the equipment was activated during the coordinated time periods. Other than the actual times of operation, no other information about operation of the VOA/JPL system was recorded at the test site.

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R.F. - graphical information detail and unusual events
(specific samples and expanded view series)
Item; Path & Span; Description

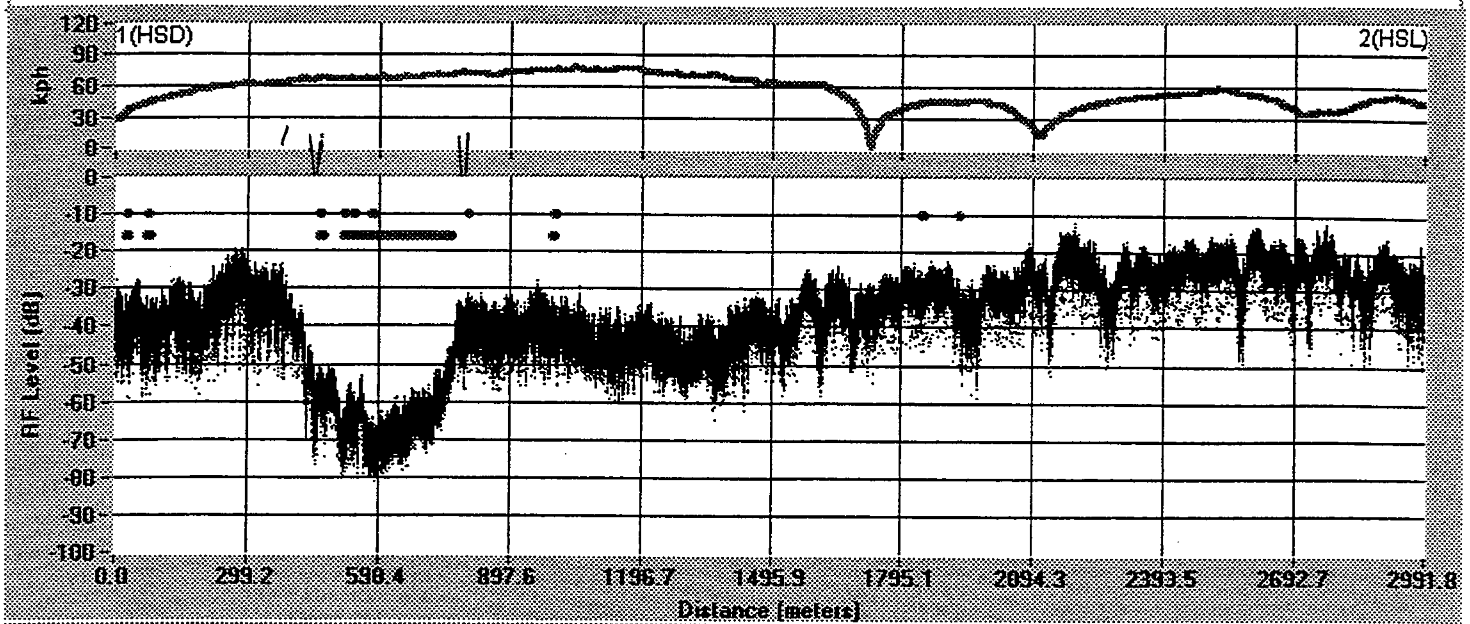
G-1 VHF System; Route P Landmark 1-2 and sections; Multipath standing waves with expansion showing detail, data structure and unusual event at entrance to tunnel.

G-2 L-Band System; Route P Landmark 1-2 and sections; Expansion showing event at entrance to tunnel.

G-3 VHF System; Route D Landmark 18-19 and sections; Multipath standing waves with expansion showing details.

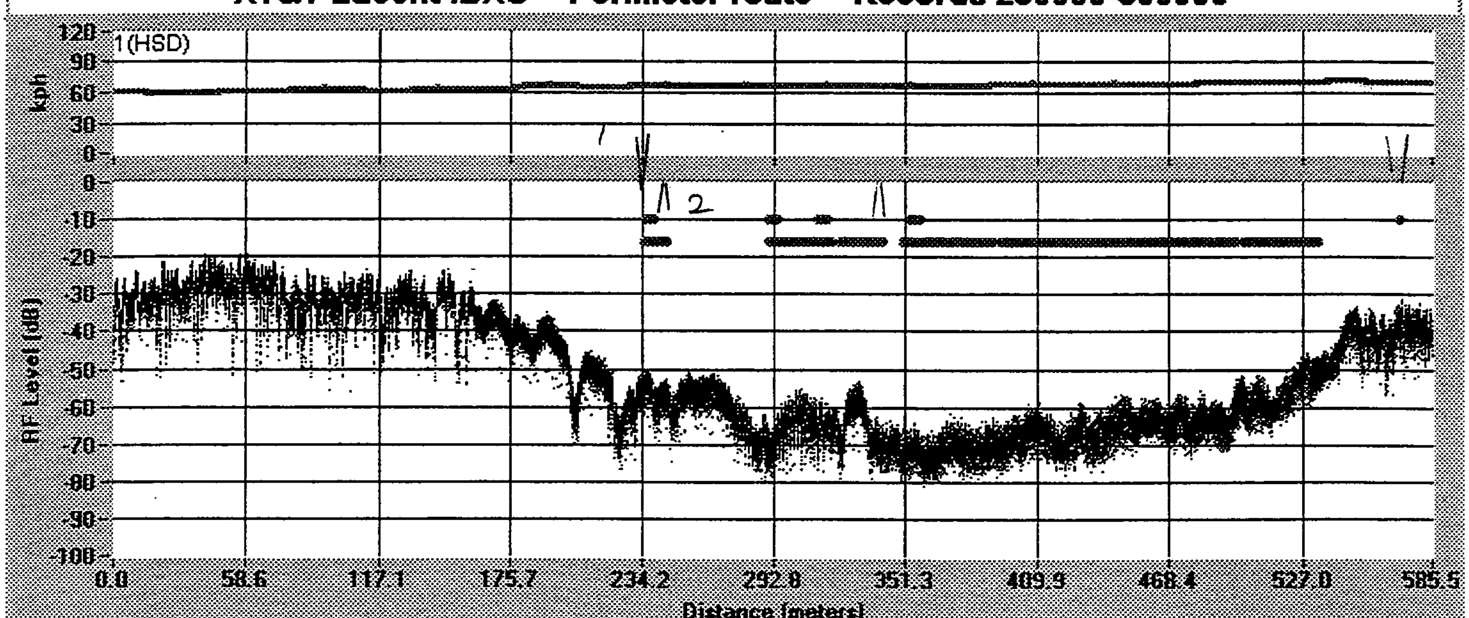
G-4 L-Band System; Route S Landmark 2-3 central section; Over water path with R.F. fading event.

AT&T Lucent IBAC -- Perimeter route -- Landmarks 1-2



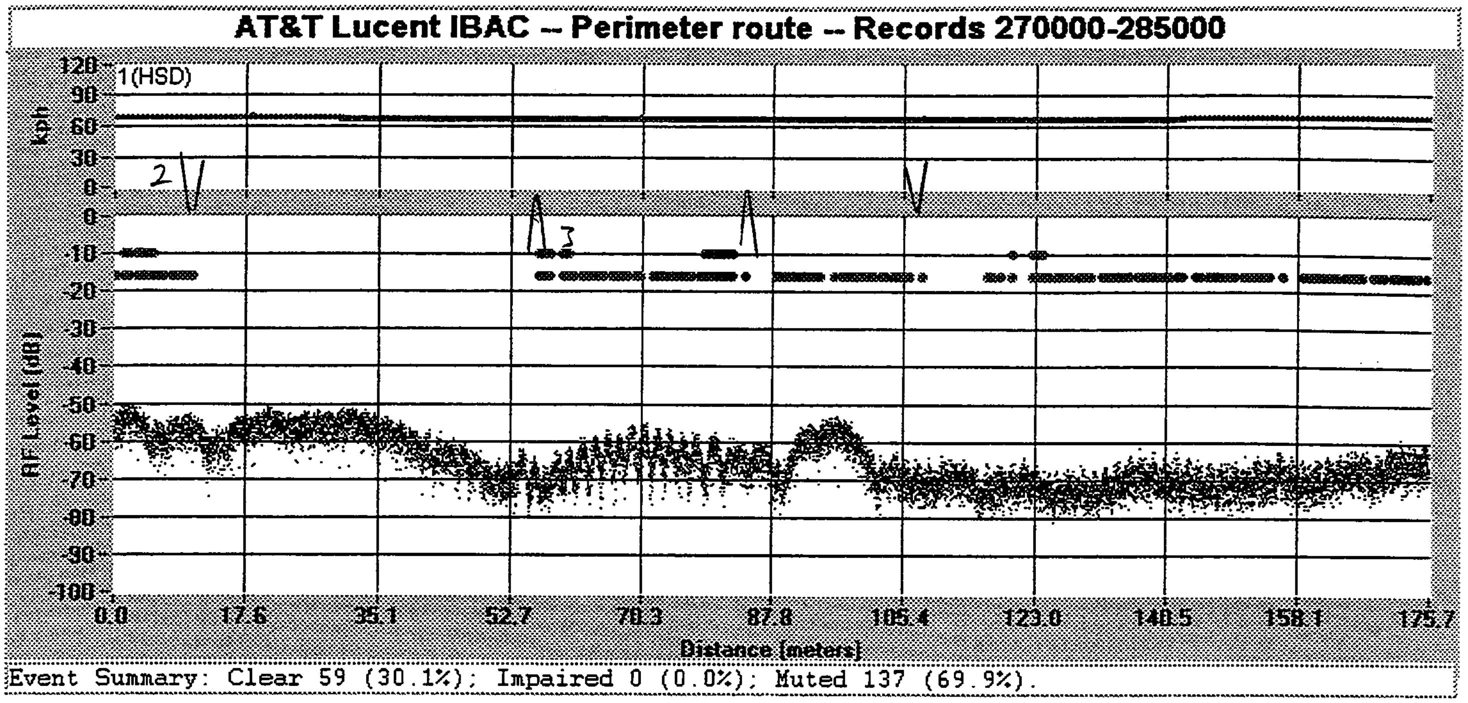
Event Summary: Clear 4488 (93.3%); Impaired 0 (0.0%); Muted 321 (6.7%).

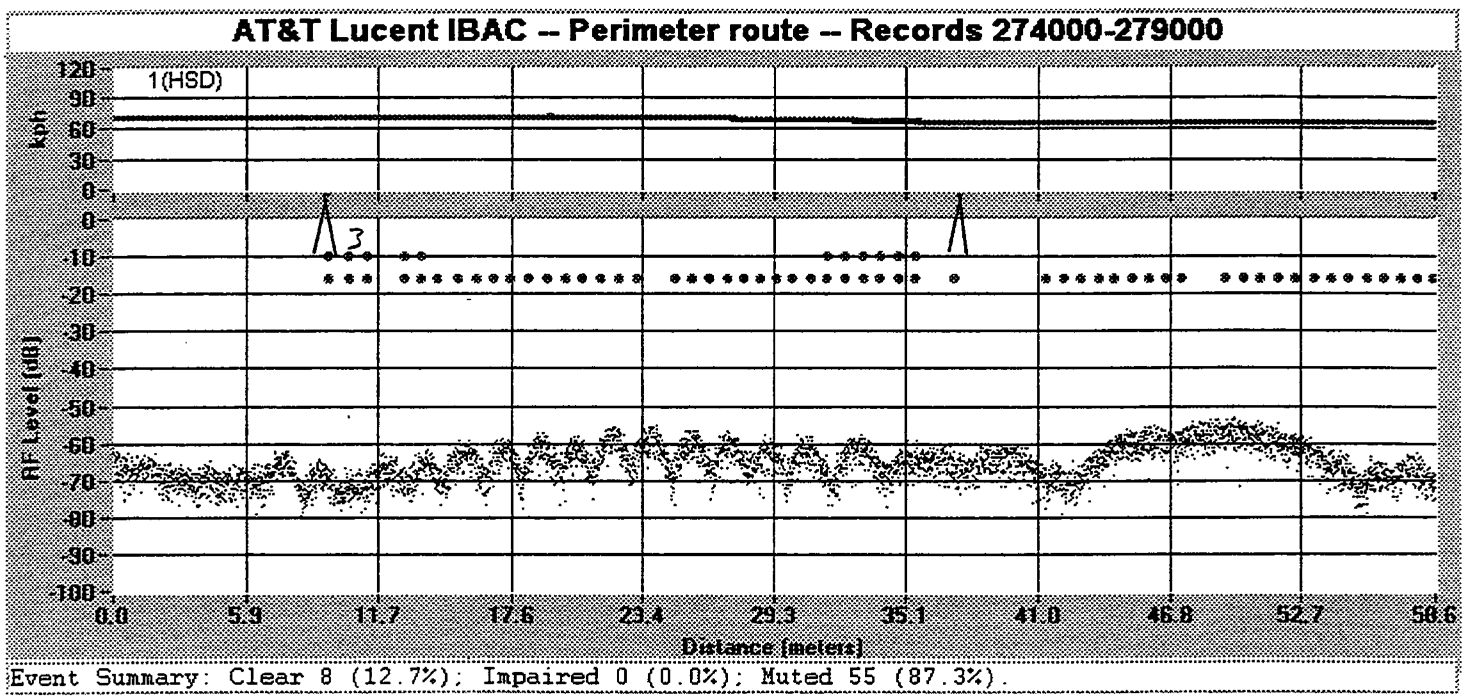
AT&T Lucent IBAC -- Perimeter route -- Records 250000-300000

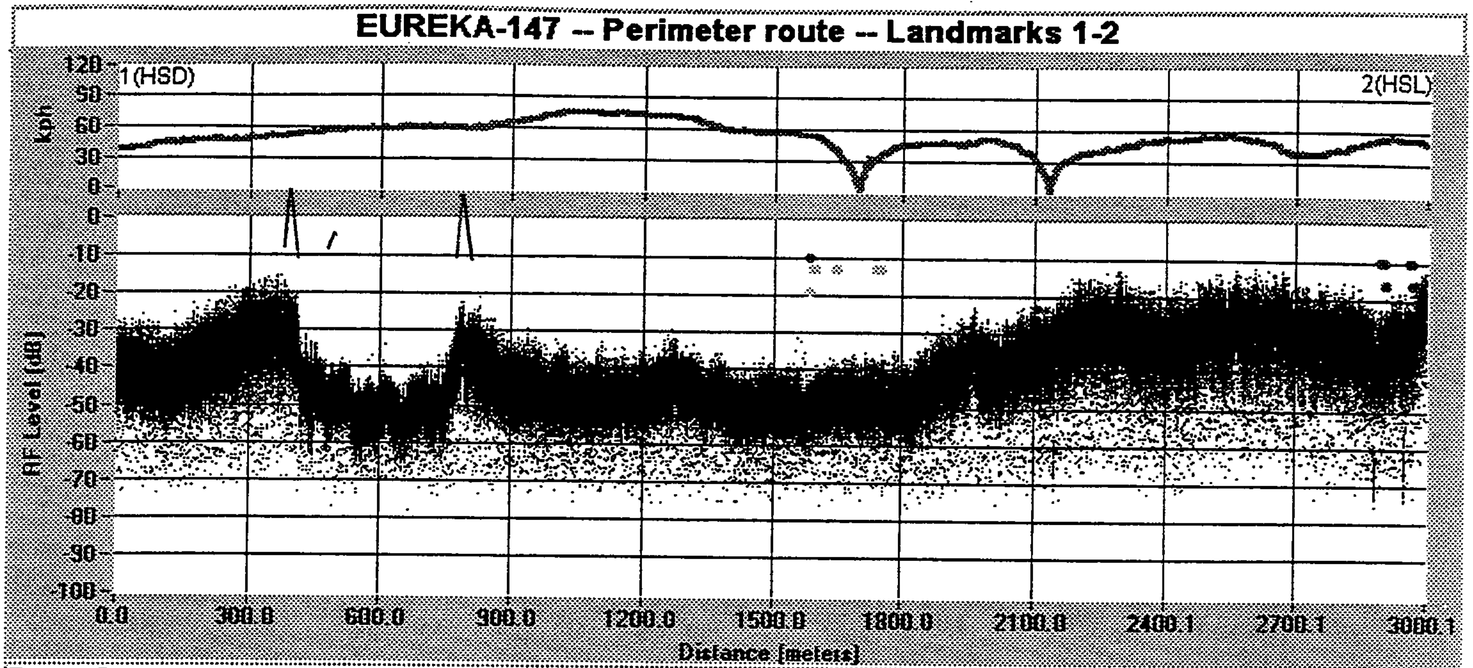


Event Summary: Clear 397 (59.2%); Impaired 0 (0.0%); Muted 274 (40.8%).

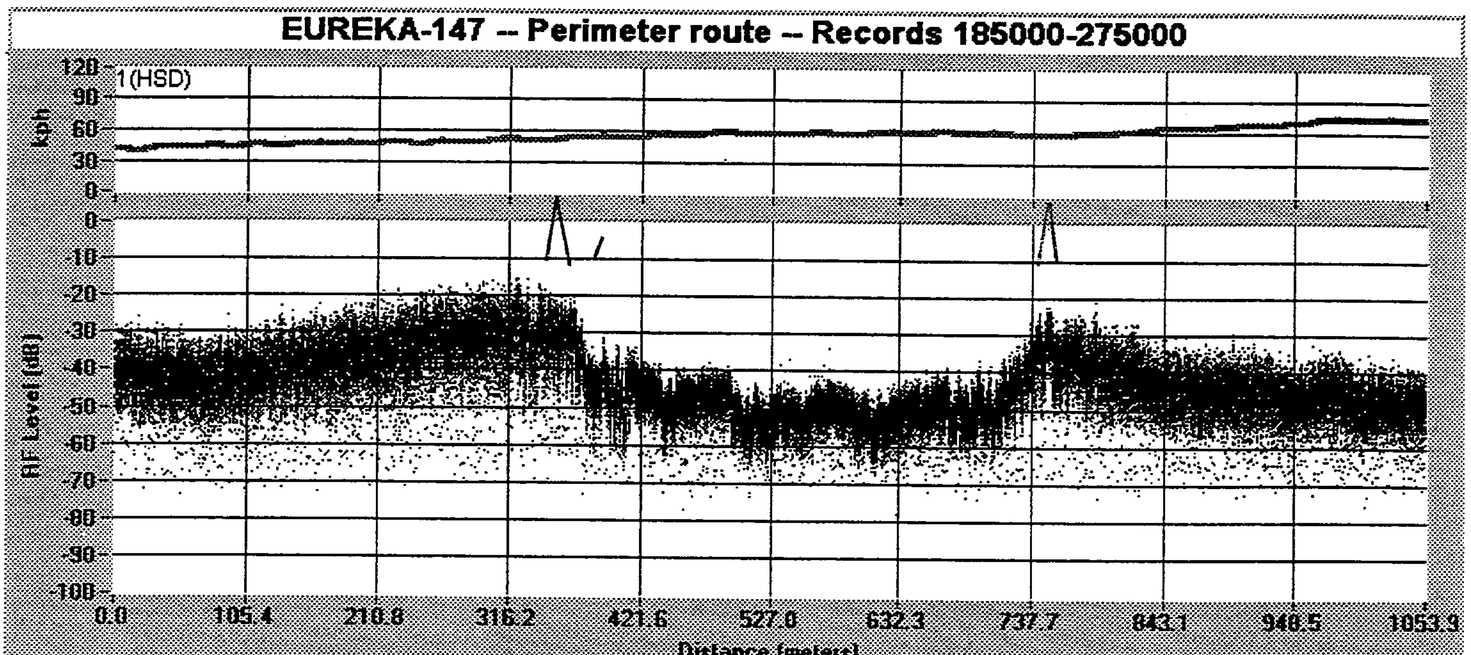
323


AT&T Lucent IBAC -- Perimeter route -- Records 270000-285000
1(HSD)
kph
RF Level [dB]
Distance [meters]
Event Summary: Clear 59 (30.1%); Impaired 0 (0.0%); Muted 137 (69.9%).

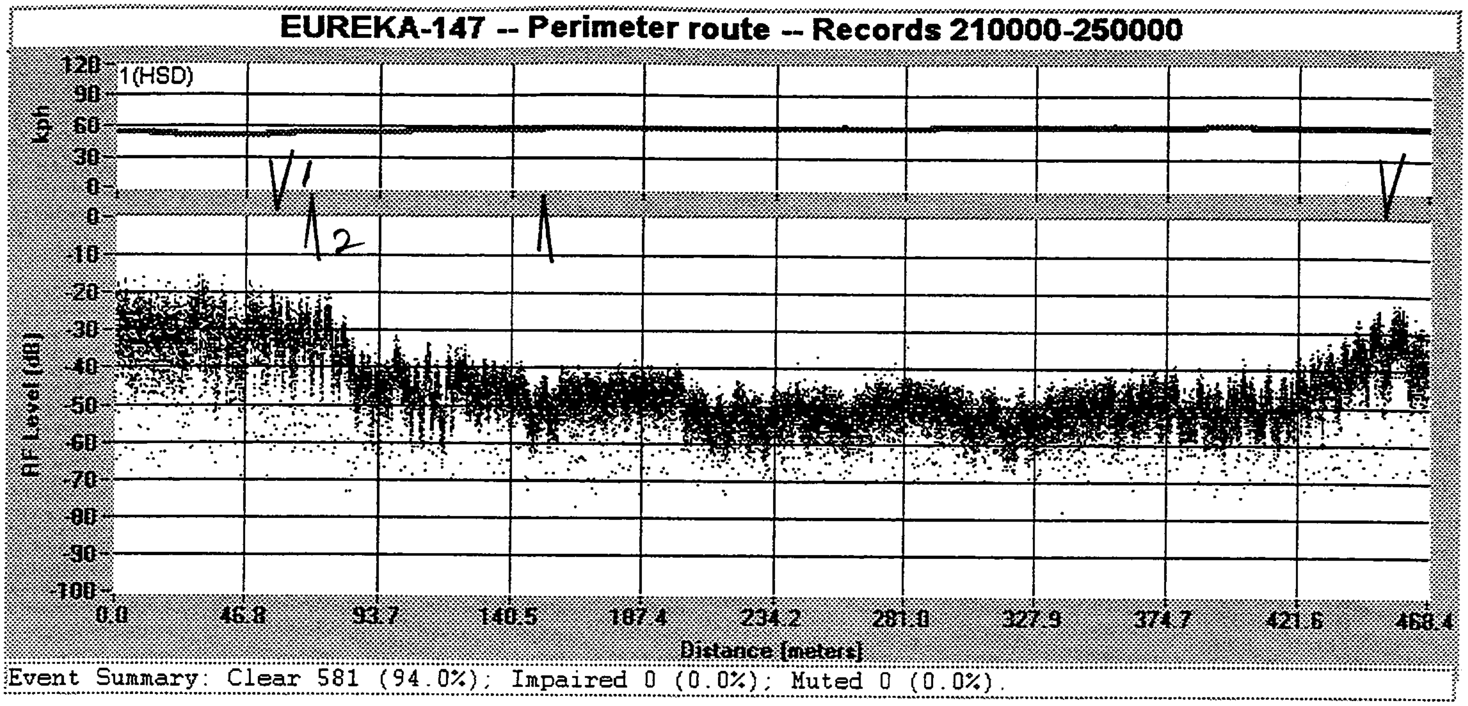

AT&T Lucent IBAC -- Perimeter route -- Records 274000-279000
1(HSD)
kph
RF Level [dB]
Distance [meters]
Event Summary: Clear 8 (12.7%); Impaired 0 (0.0%); Muted 55 (87.3%).

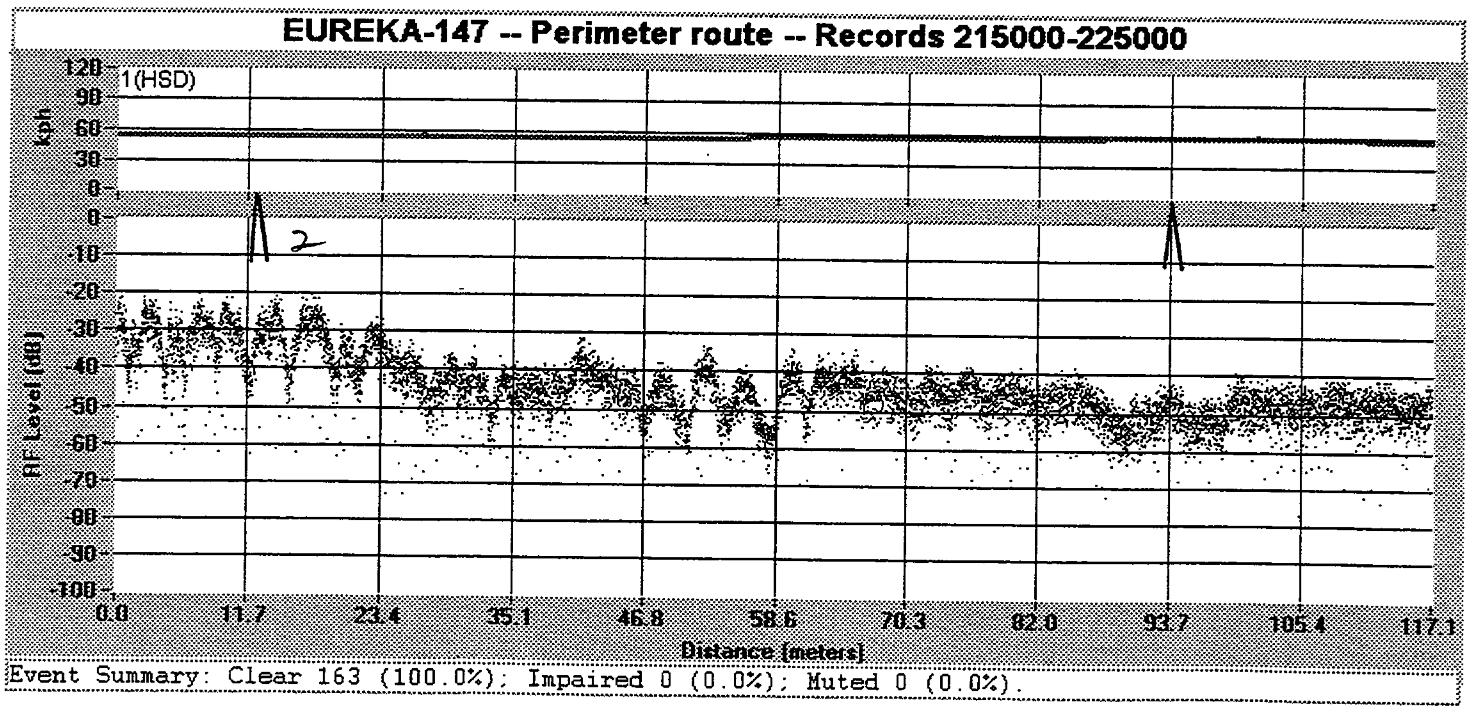


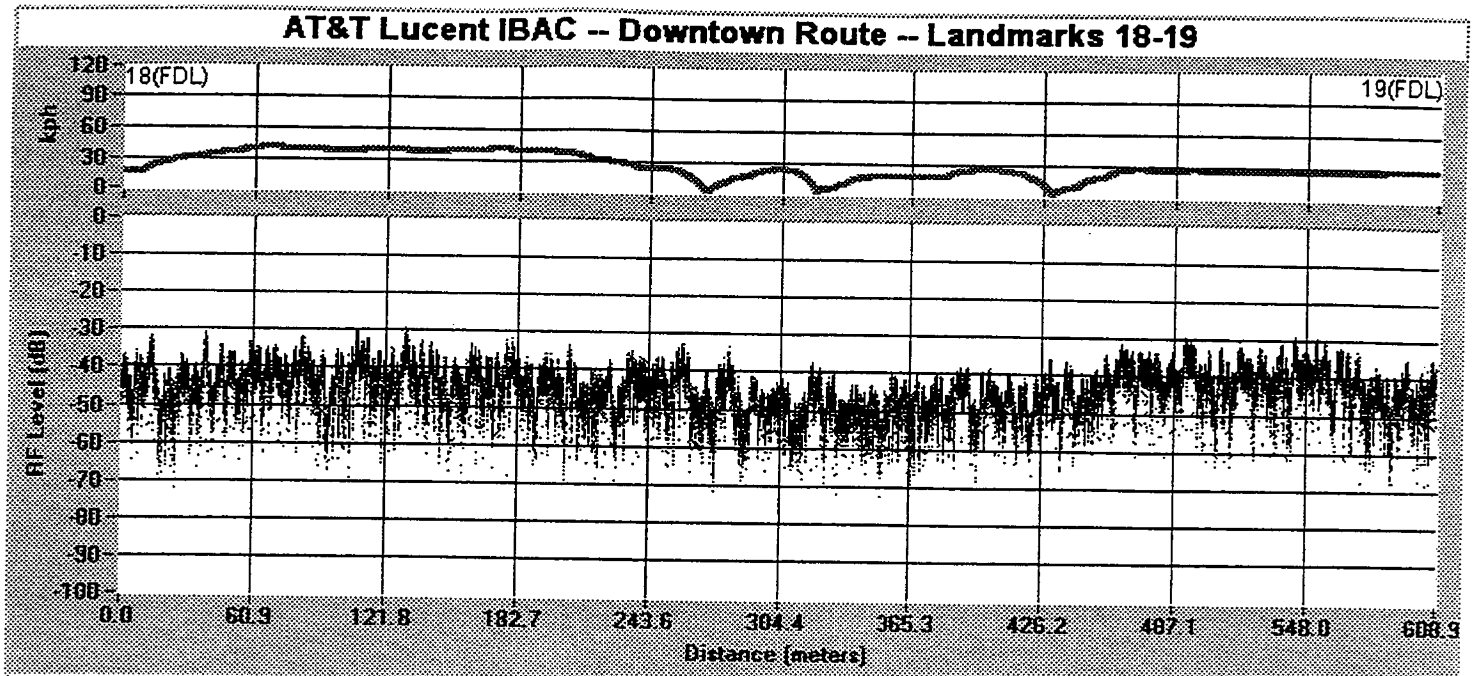
Event Summary: Clear 5230 (97.8%); Impaired 35 (0.7%); Muted 49 (0.9%).



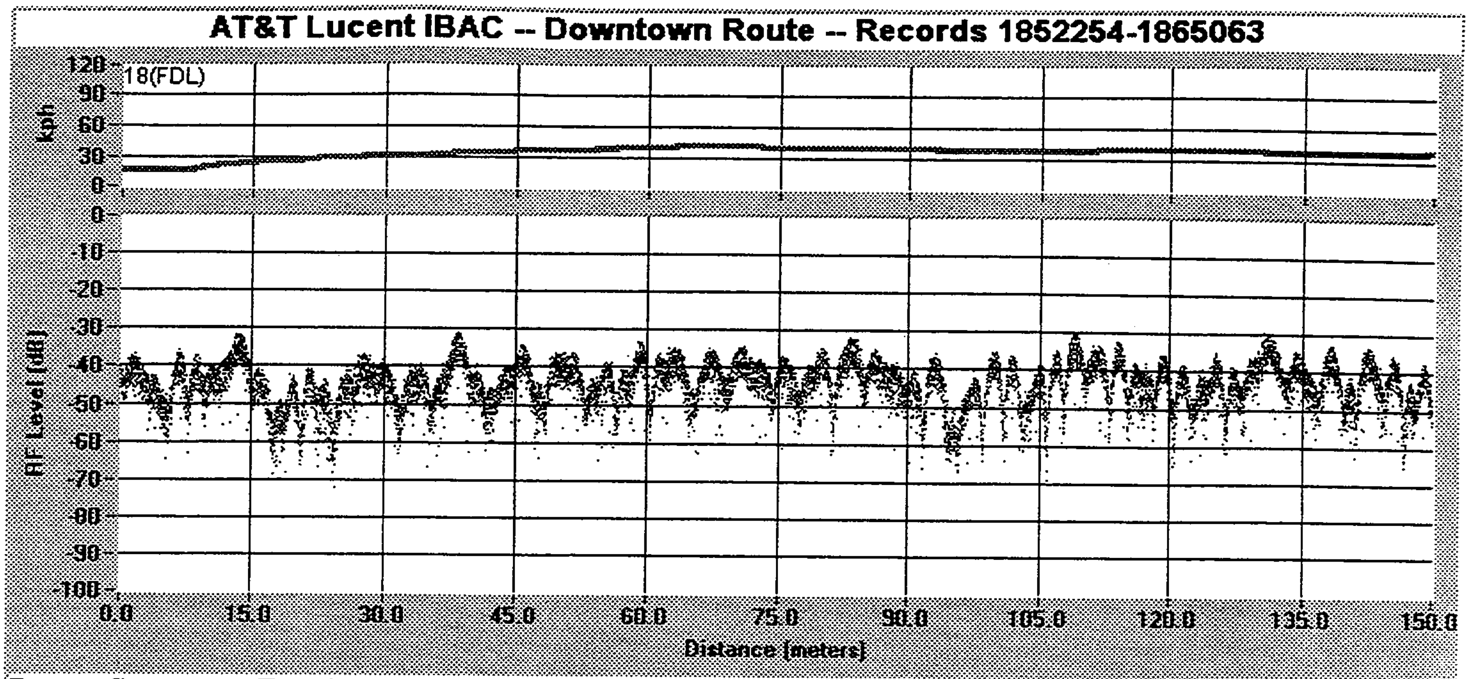
Event Summary: Clear 1412 (97.4%); Impaired 0 (0.0%); Muted 0 (0.0%).


EUREKA-147 -- Perimeter route -- Records 210000-250000
1(HSD)
kph
120
90
60
30
0
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
RF Level [dB]
0.0
46.8
93.7
140.5
187.4
234.2
281.0
327.9
374.7
421.6
468.4
Distance [meters]
Event Summary: Clear 581 (94.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

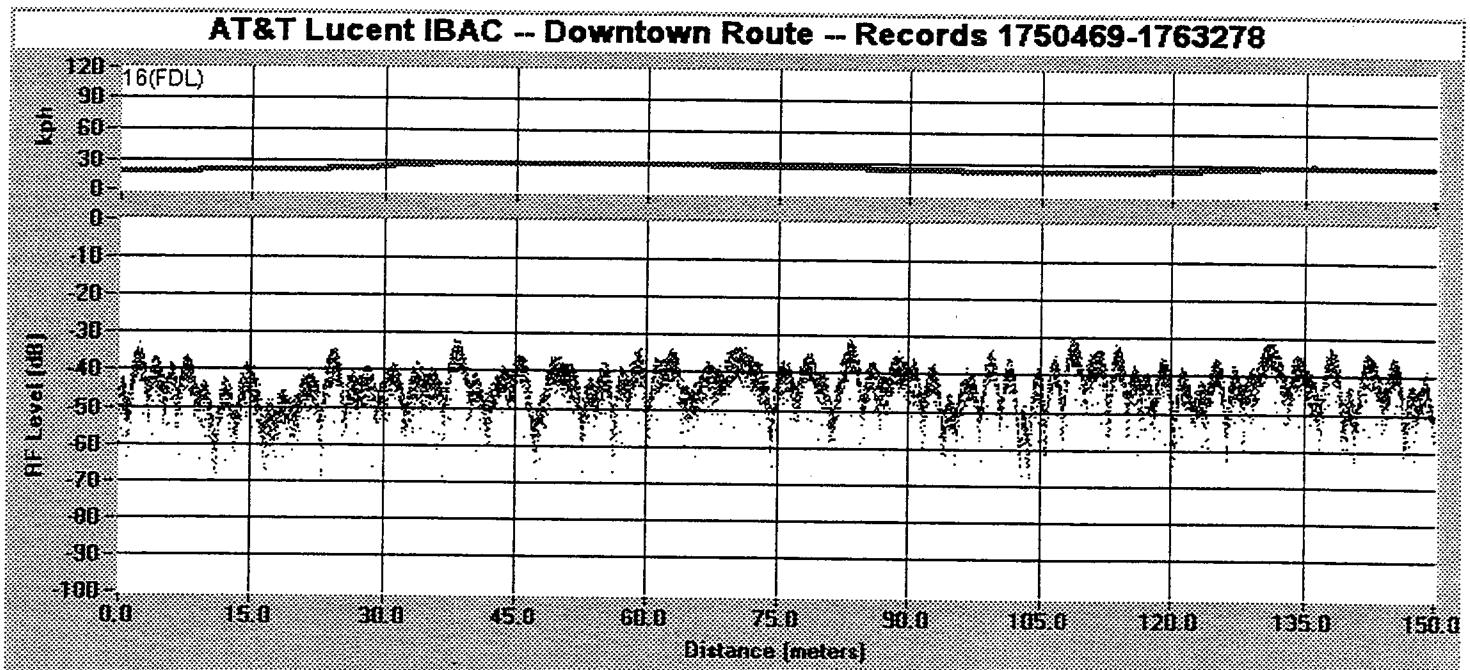

EUREKA-147 -- Perimeter route -- Records 215000-225000
1(HSD)
kph
120
90
60
30
0
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
RF Level [dB]
0.0
11.7
23.4
35.1
46.8
58.6
70.3
82.0
93.7
105.4
117.1
Distance [meters]
Event Summary: Clear 163 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).



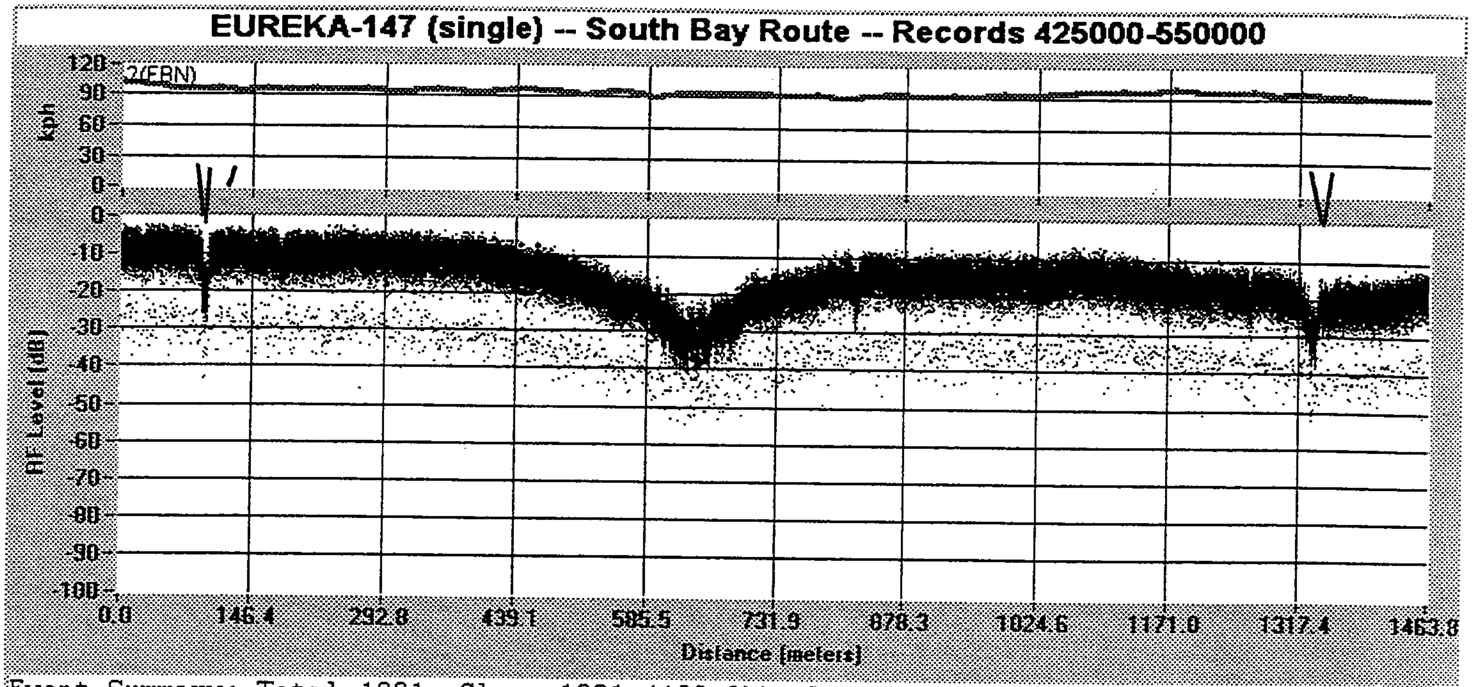
Event Summary: Total 2621; Clear 2621 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).



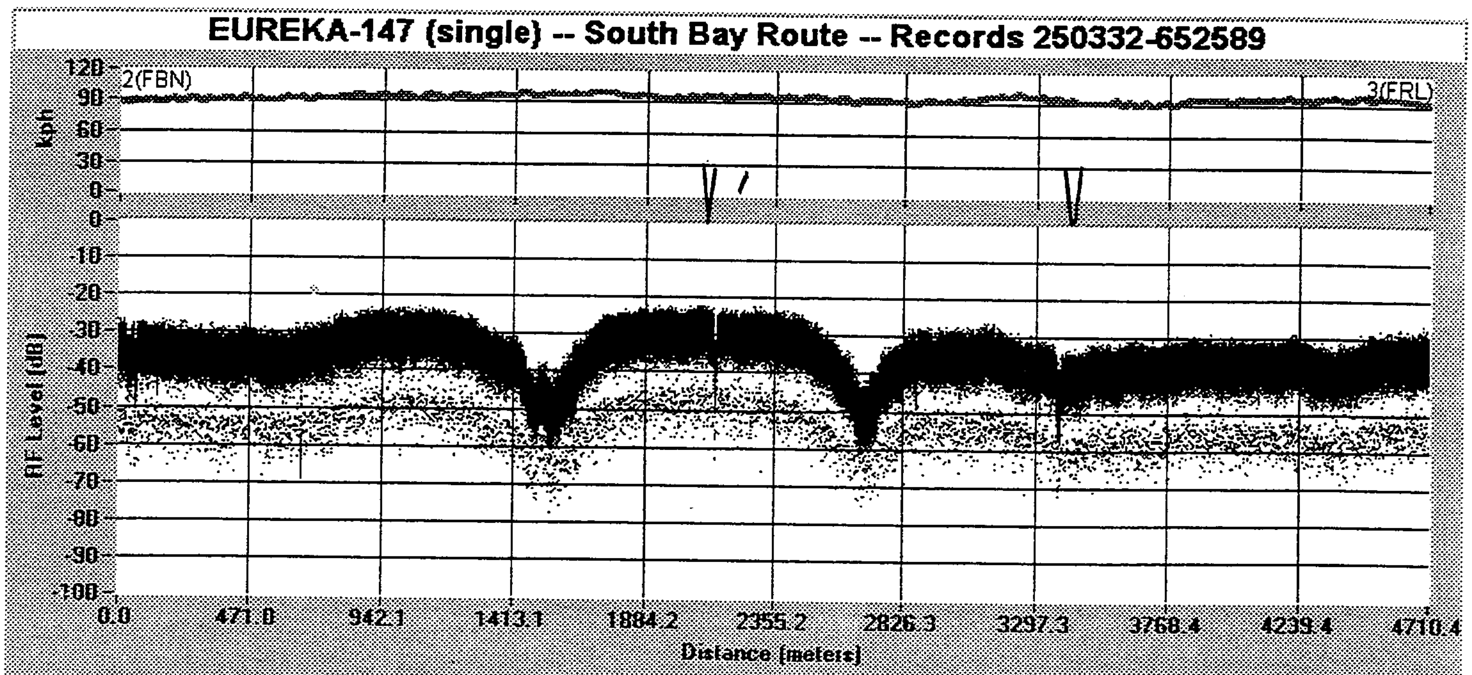
Event Summary: Total 360; Clear 360 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).



Event Summary: Total 521; Clear 521 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).



Event Summary: Total 1091; Clear 1091 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).



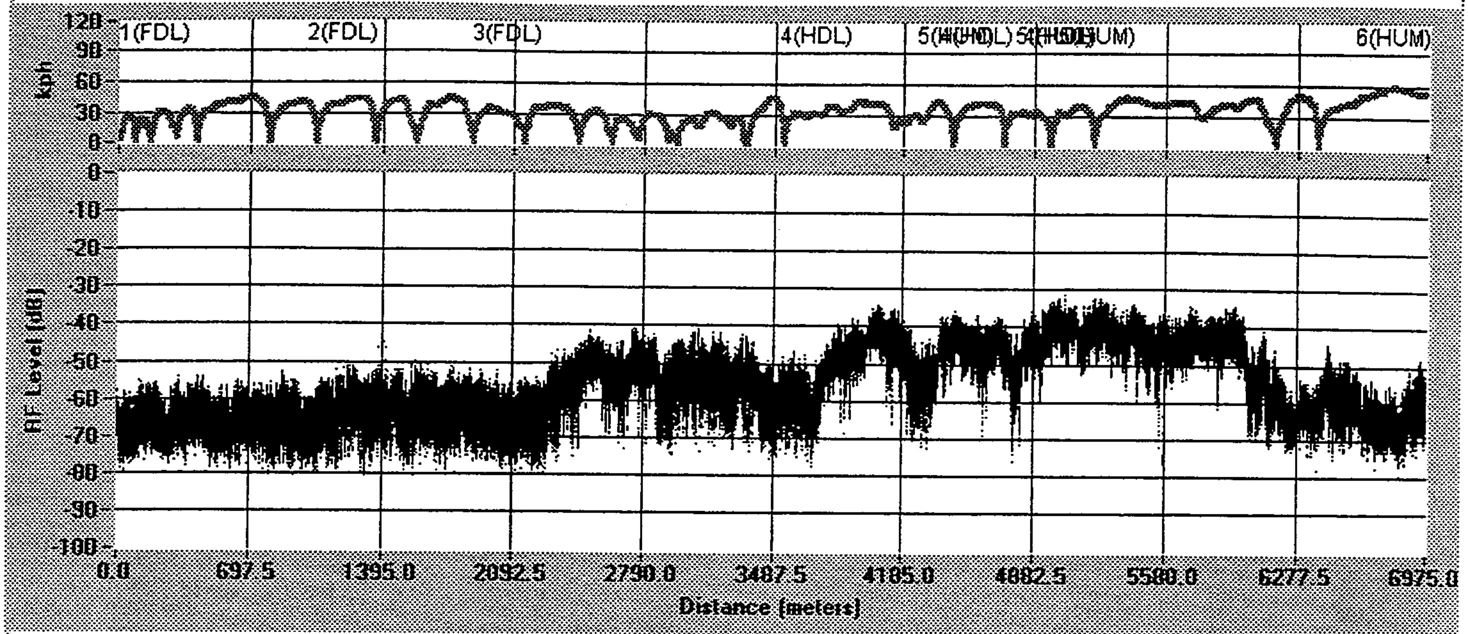
Event Summary: Total 3517; Clear 3512 (99.9%); Impaired 5 (0.1%); Muted 0 (0.0%).

INDEX PAGE - APPENDIX H

VHF Interference Survey

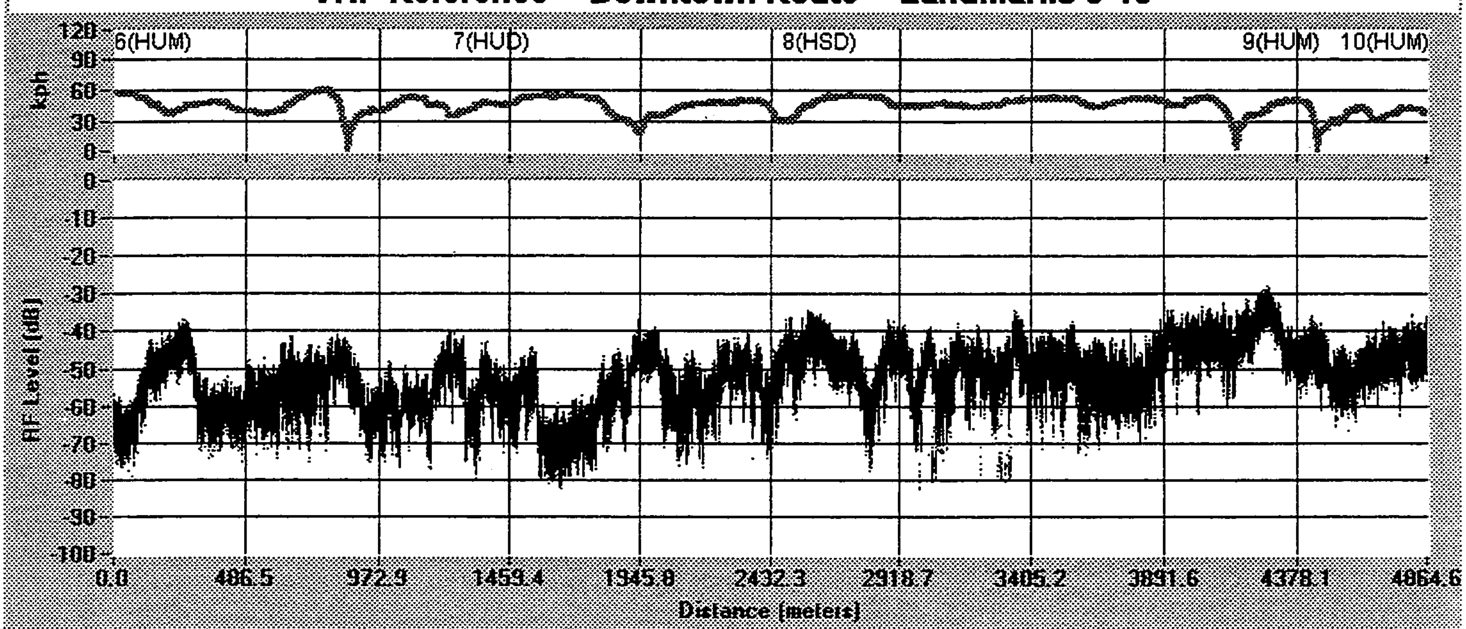
Continuous recording of the background R.F. at the VHF test frequency, using the same equipment and method as for the VHF proponent testing, without the VHF test transmitter active.

VHF Reference -- Downtown Route -- Landmarks 1-6



Event Summary: Total 22924; Clear 22924 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

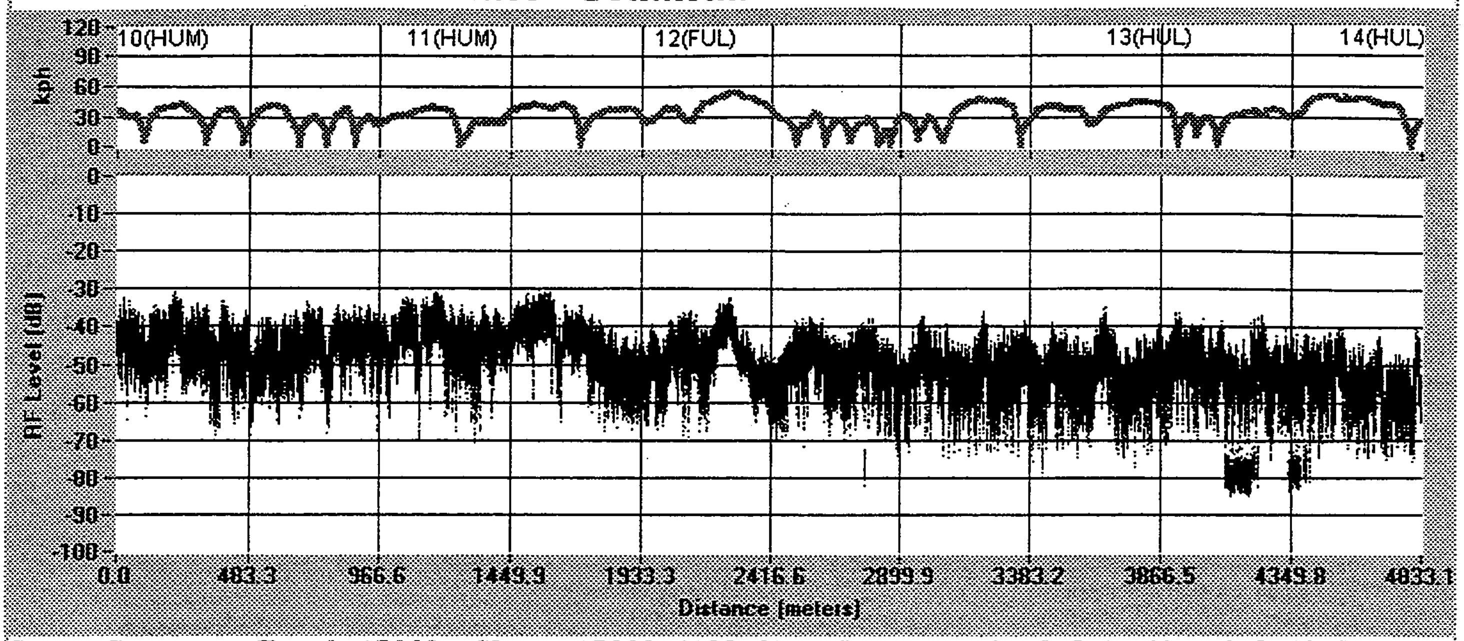
VHF Reference -- Downtown Route -- Landmarks 6-10



Event Summary: Total 9323; Clear 9323 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

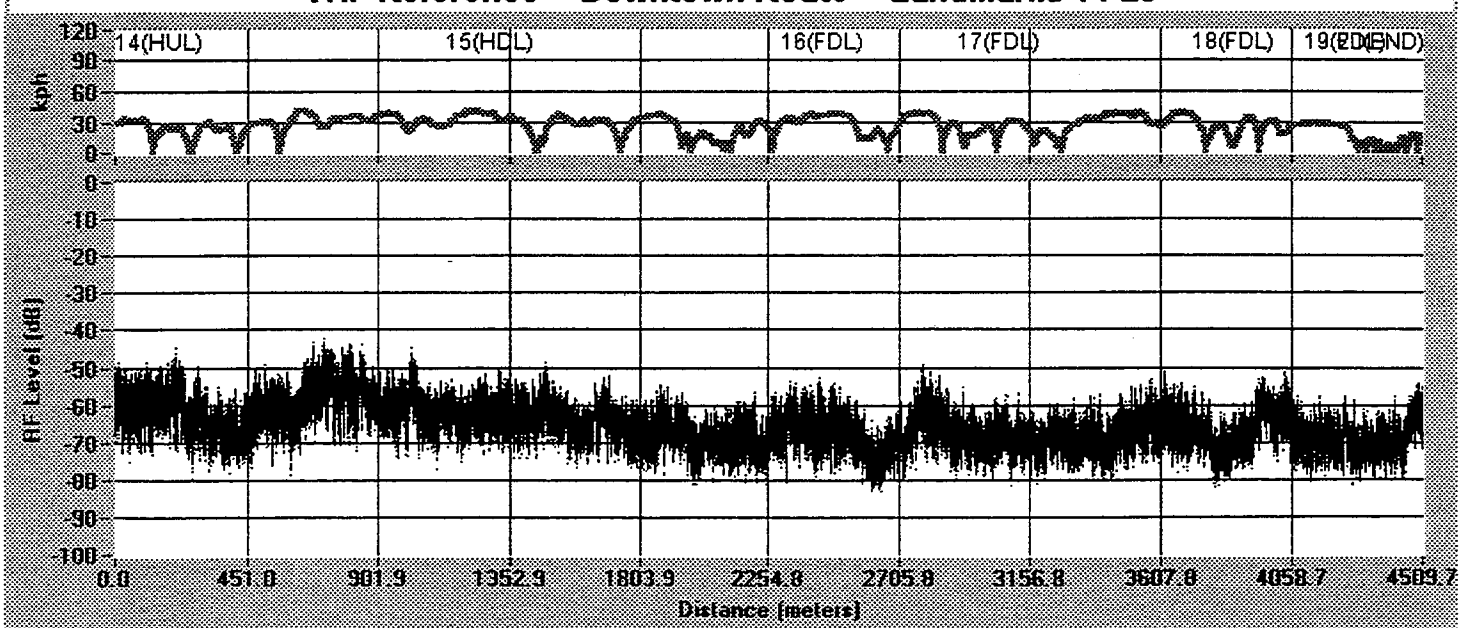
331

VHF Reference -- Downtown Route -- Landmarks 10-14



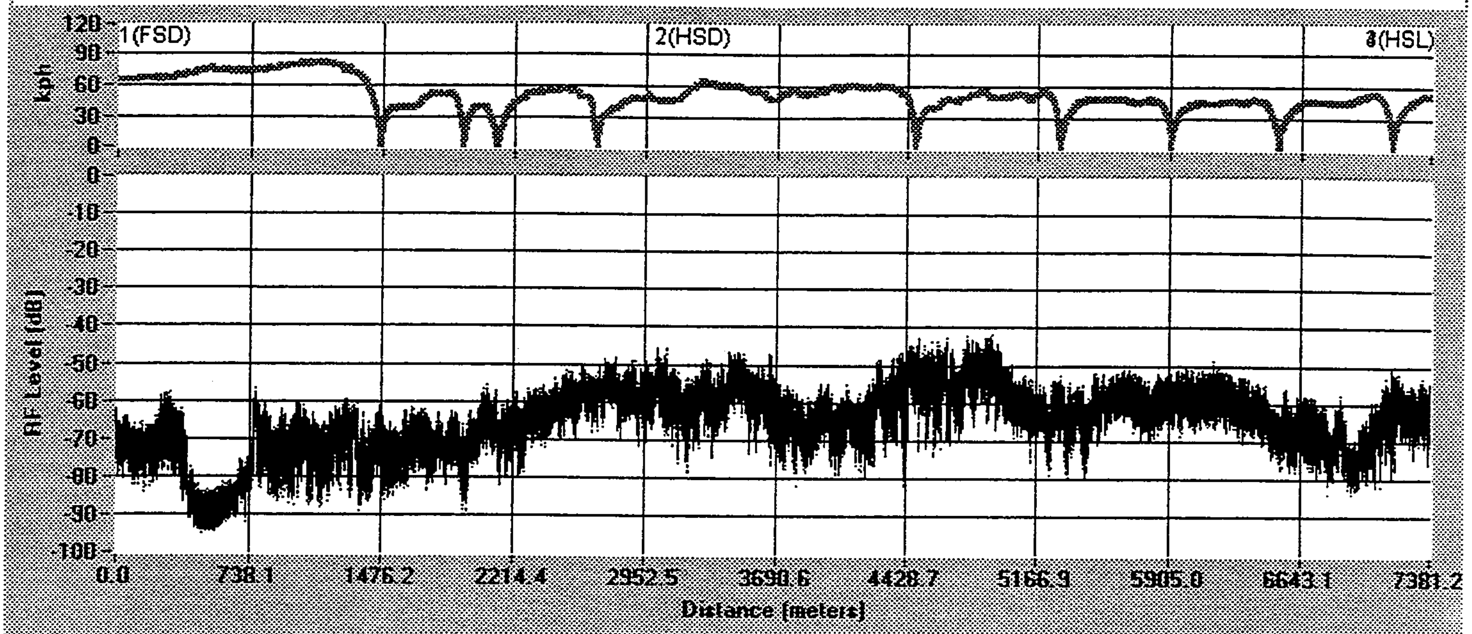
Event Summary: Total 15660; Clear 15660 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

VHF Reference -- Downtown Route -- Landmarks 14-20



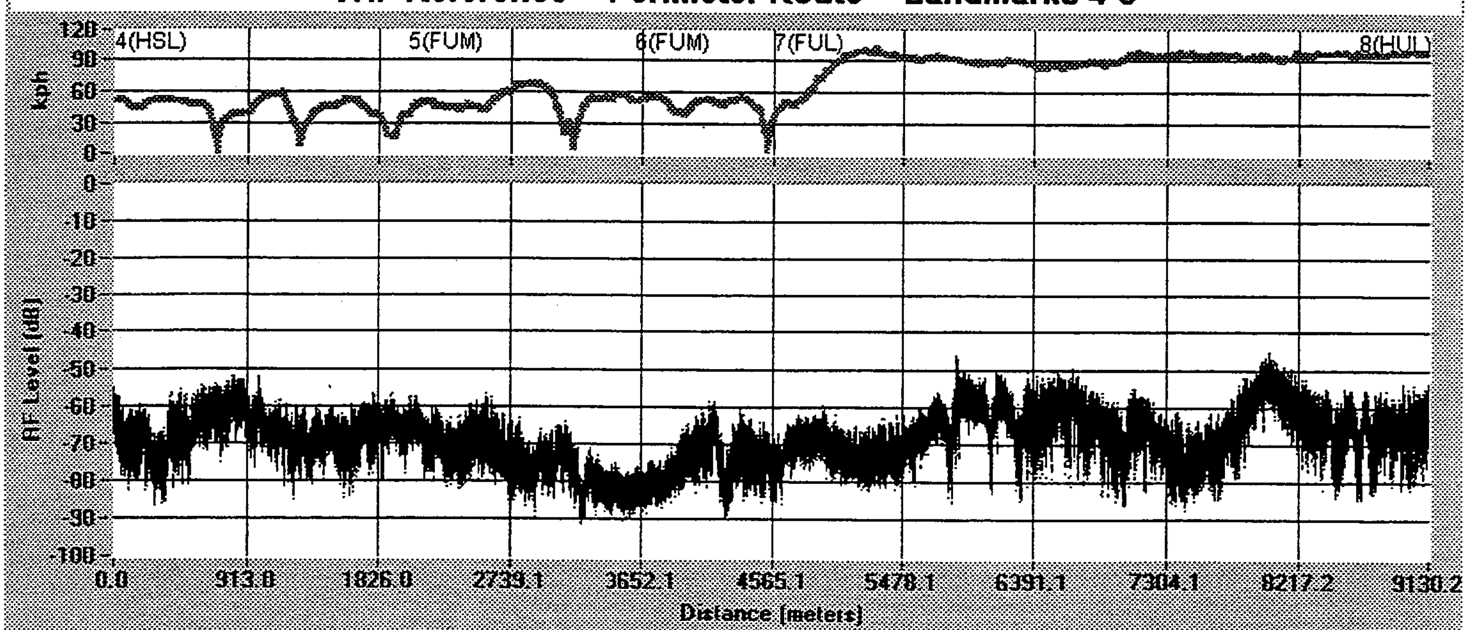
Event Summary: Total 21518; Clear 21518 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

VHF Reference -- Perimeter Route -- Landmarks 1-4



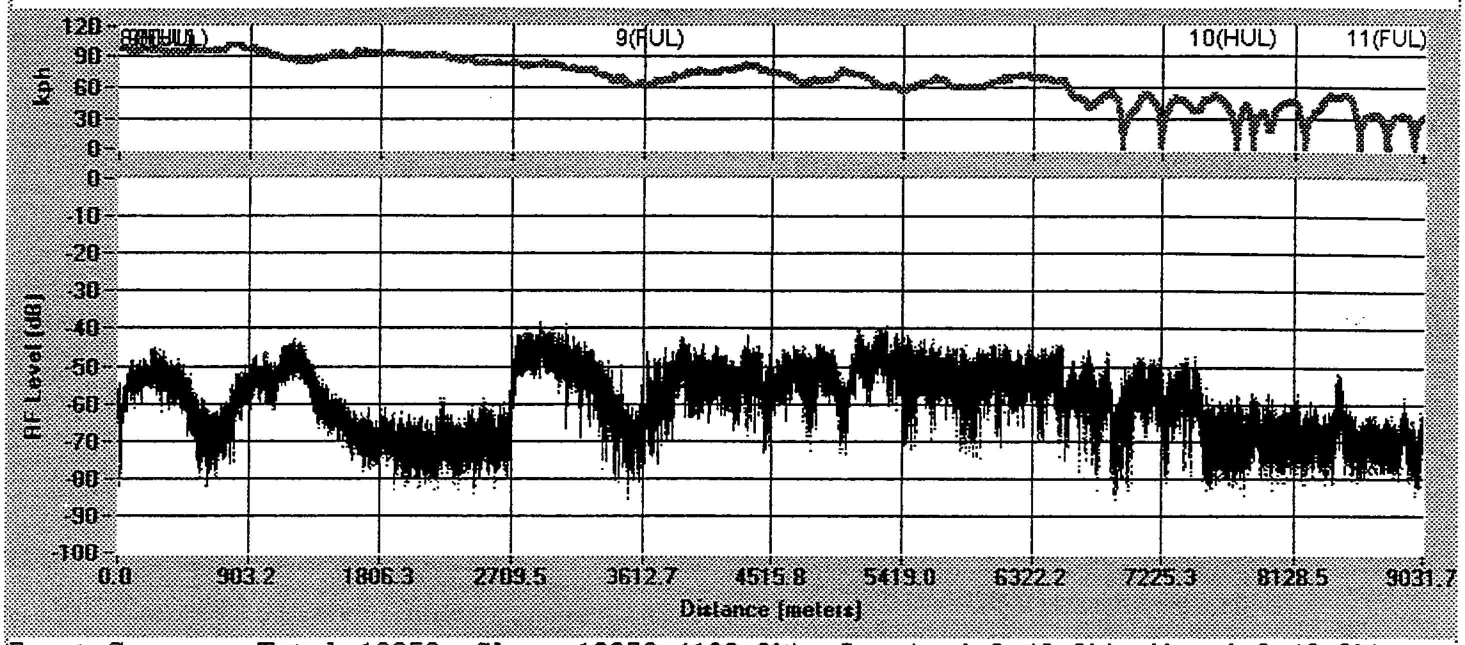
Event Summary: Total 14163; Clear 14163 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

VHF Reference -- Perimeter Route -- Landmarks 4-8



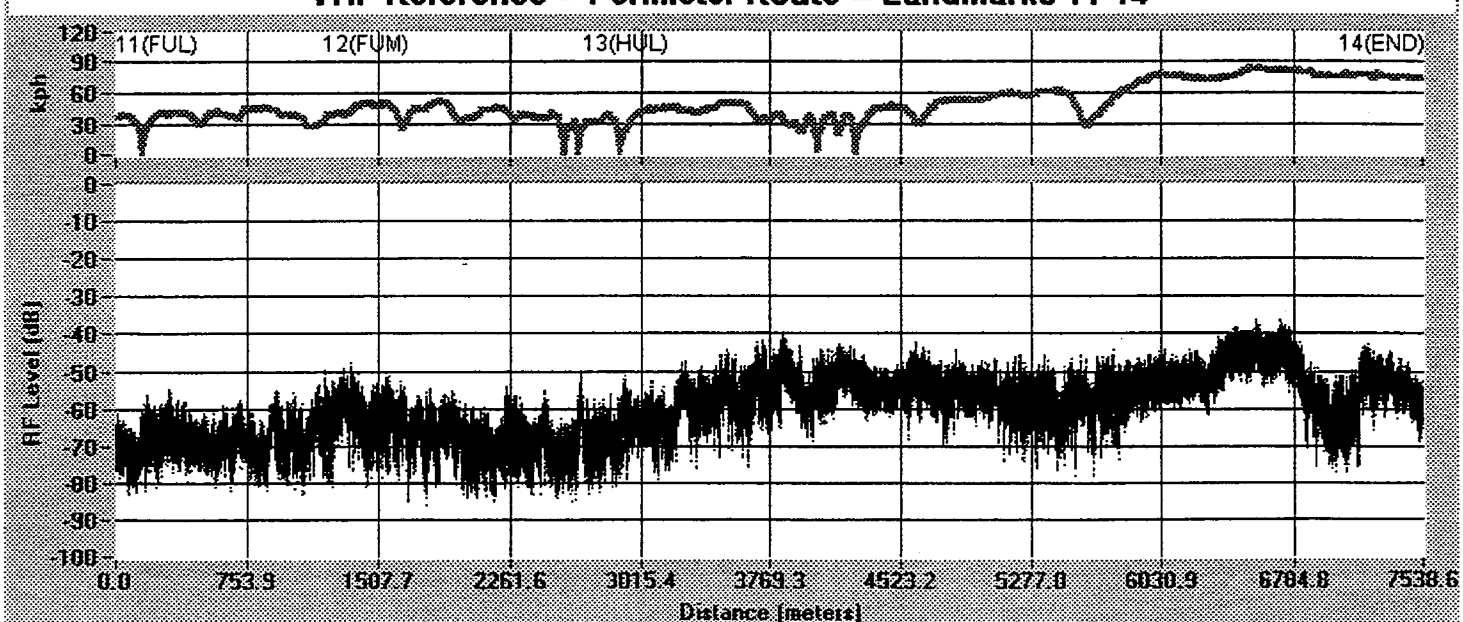
Event Summary: Total 12658; Clear 12658 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

VHF Reference -- Perimeter Route -- Landmarks 8-11

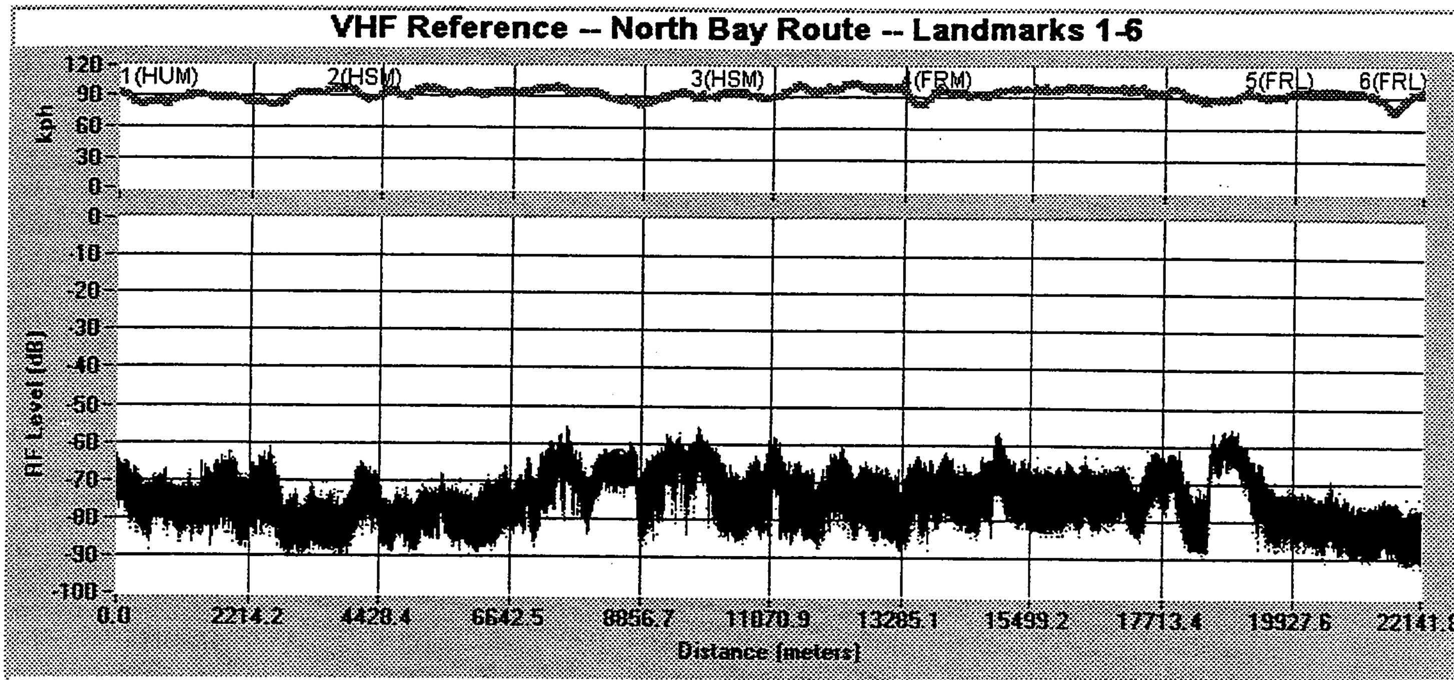


Event Summary: Total 13058; Clear 13058 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

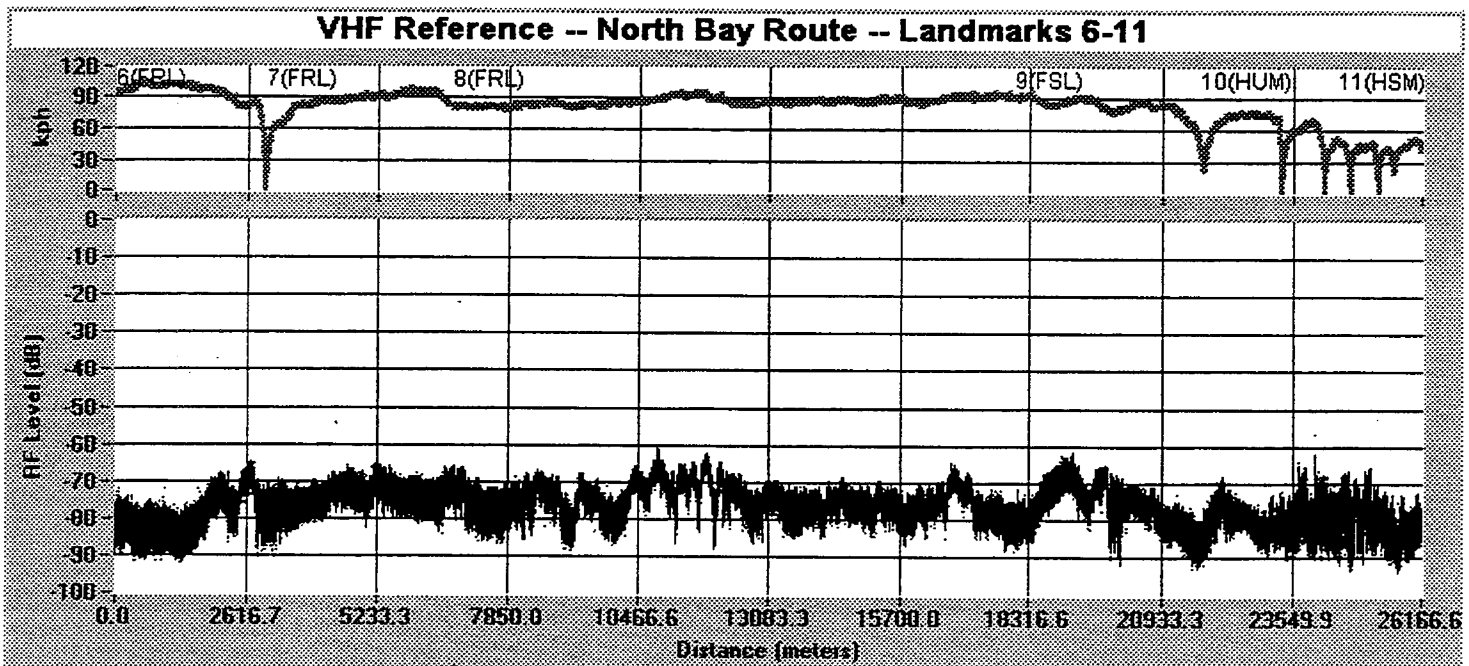
VHF Reference -- Perimeter Route -- Landmarks 11-14



Event Summary: Total 14683; Clear 14683 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

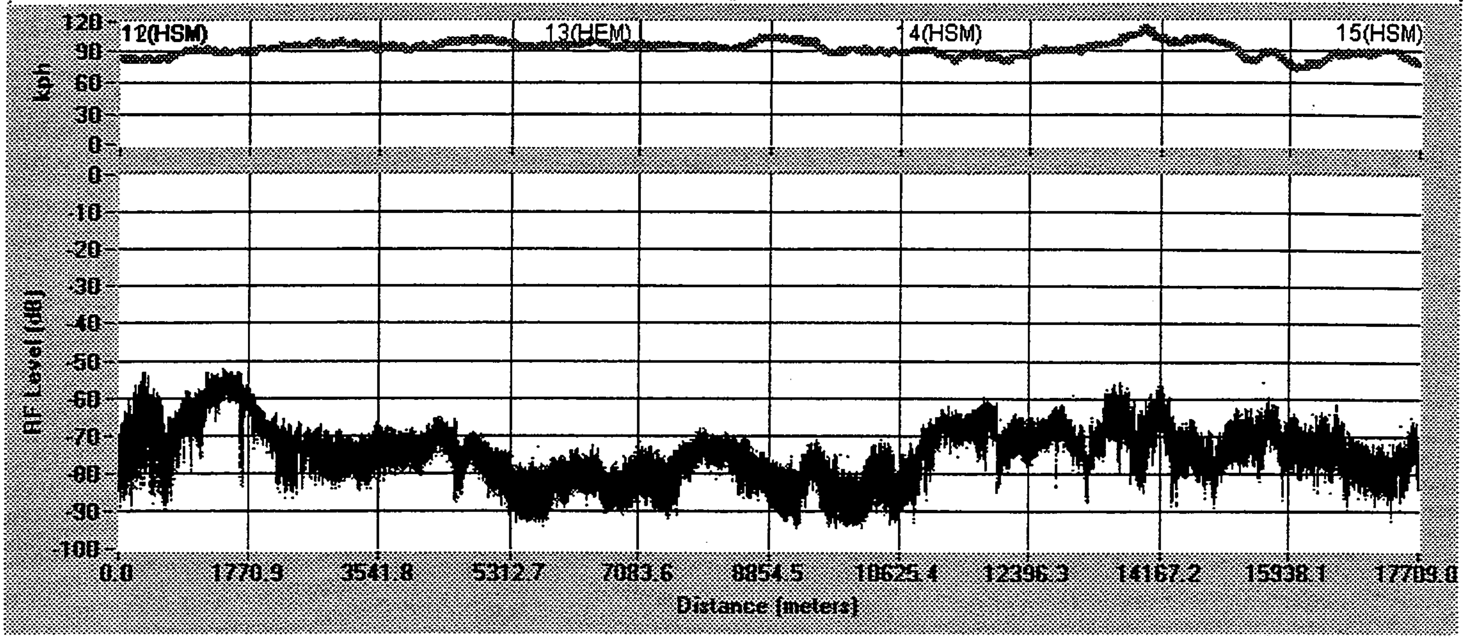


Event Summary: Total 17185; Clear 17185 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).



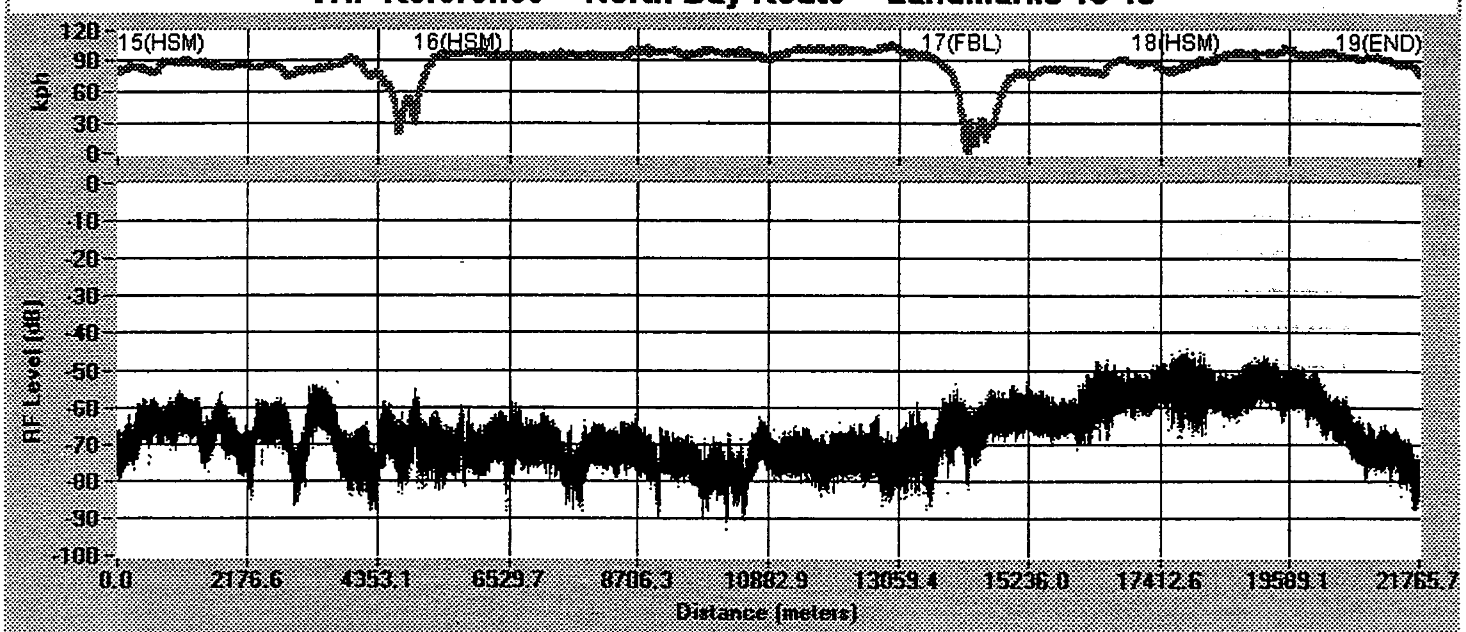
Event Summary: Total 26450; Clear 26450 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

VHF Reference -- North Bay Route -- Landmarks 11-15



Event Summary: Total 13836; Clear 13836 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

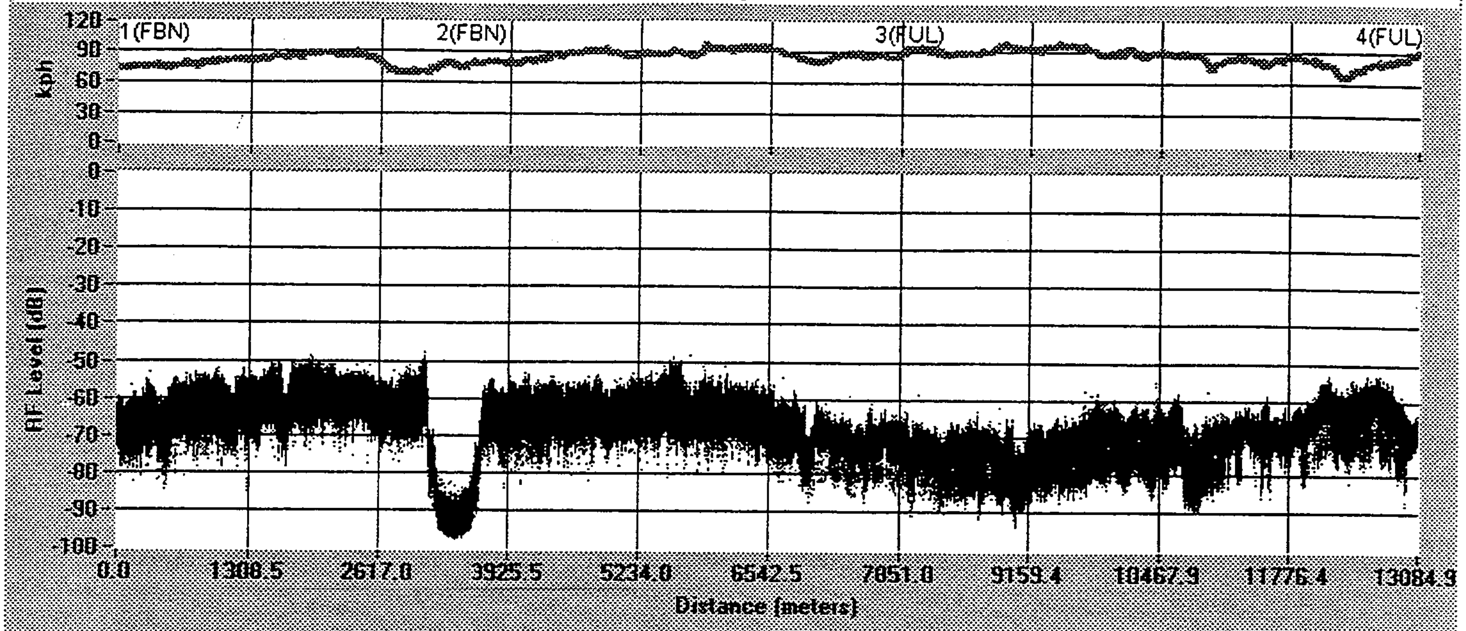
VHF Reference -- North Bay Route -- Landmarks 15-19



Event Summary: Total 20805; Clear 20805 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

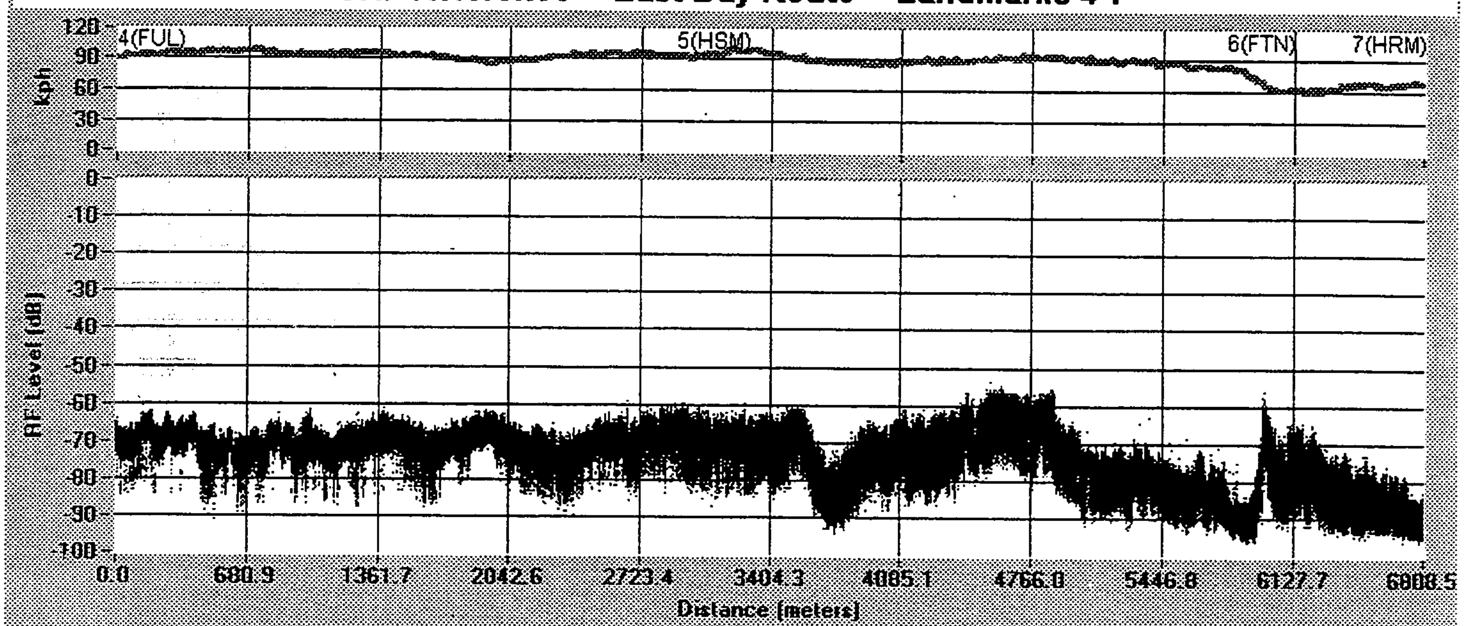
336

VHF Reference -- East Bay Route -- Landmarks 1-4



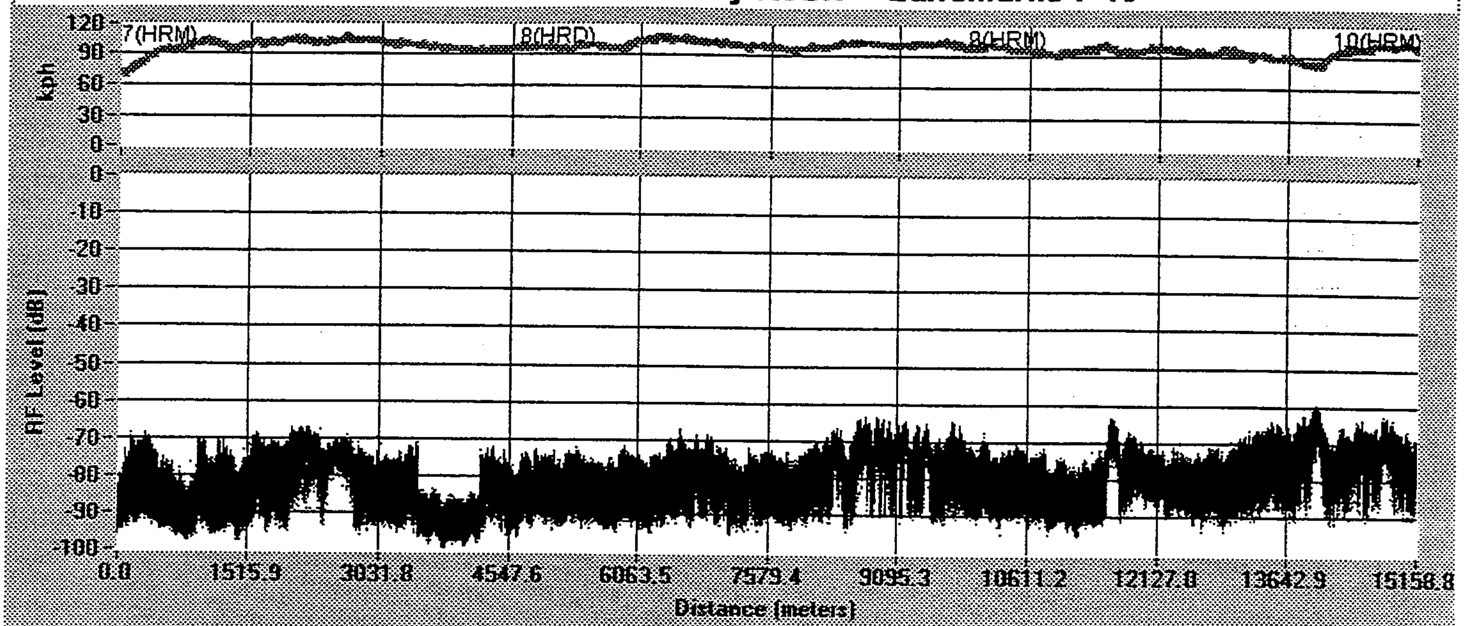
Event Summary: Total 11427; Clear 11427 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

VHF Reference -- East Bay Route -- Landmarks 4-7



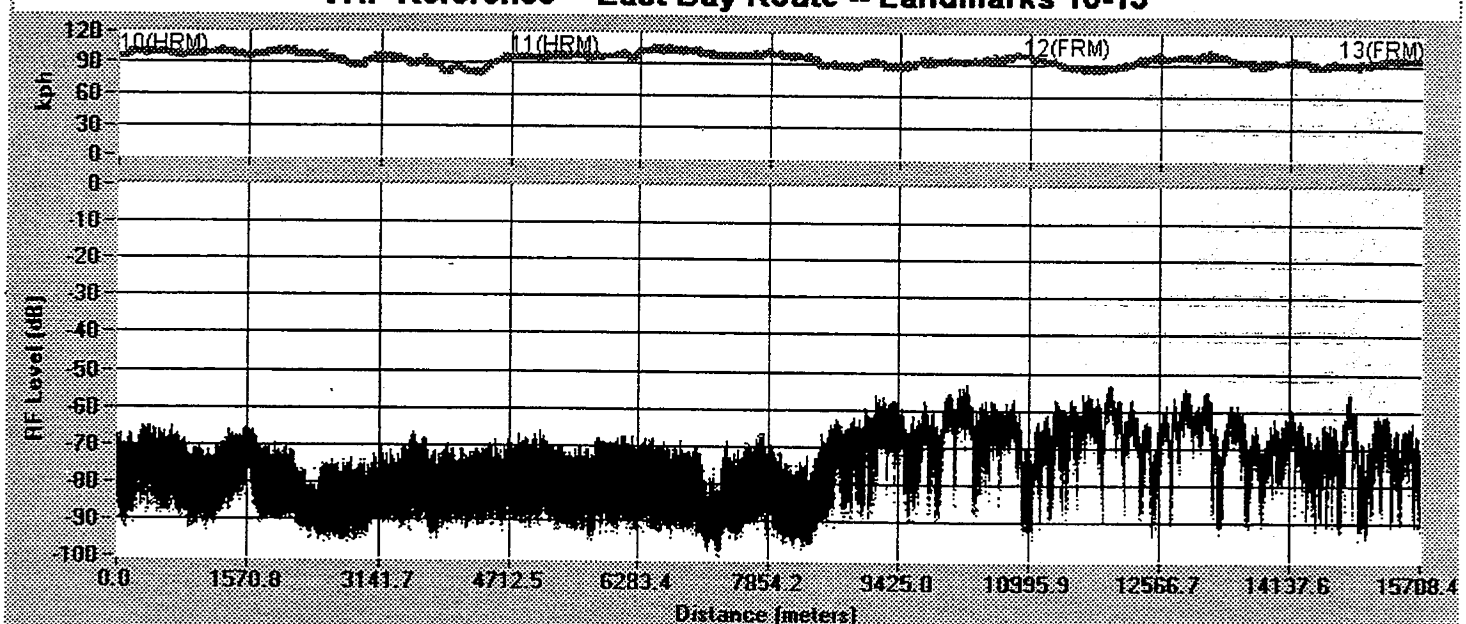
Event Summary: Total 5737; Clear 5737 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

VHF Reference -- East Bay Route -- Landmarks 7-10



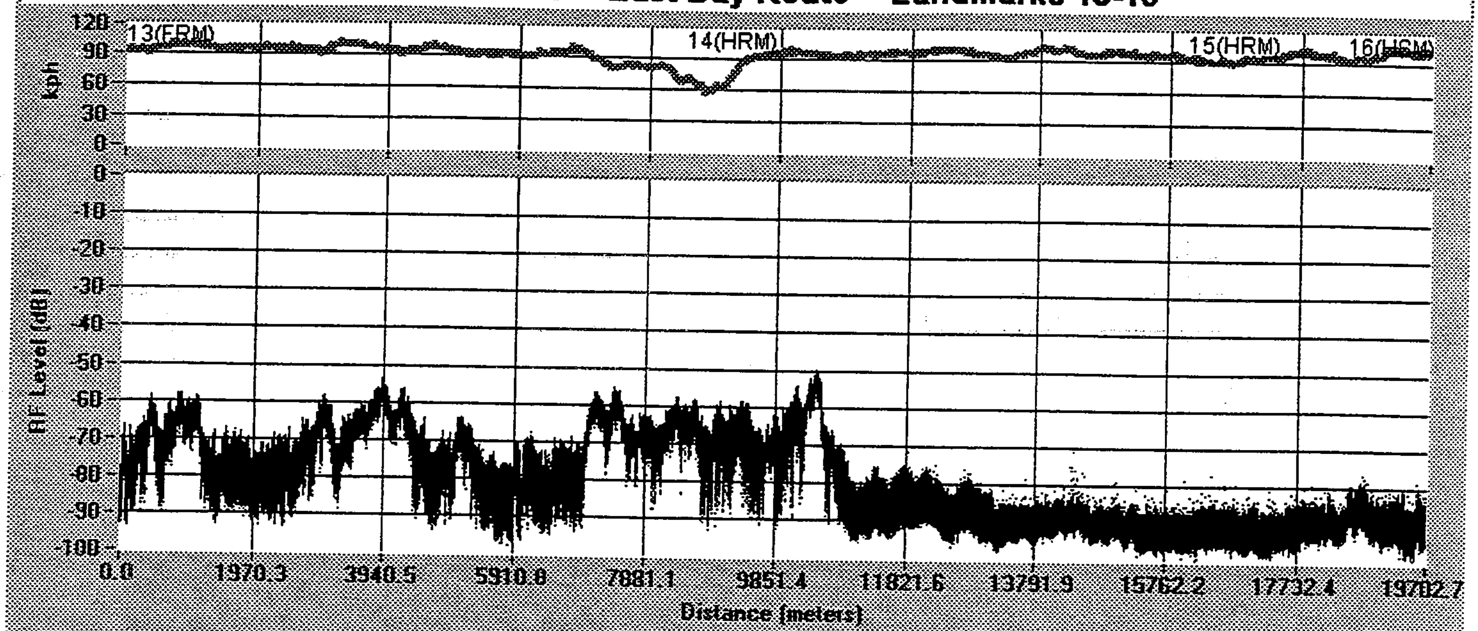
Event Summary: Total 11070; Clear 11070 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

VHF Reference -- East Bay Route -- Landmarks 10-13



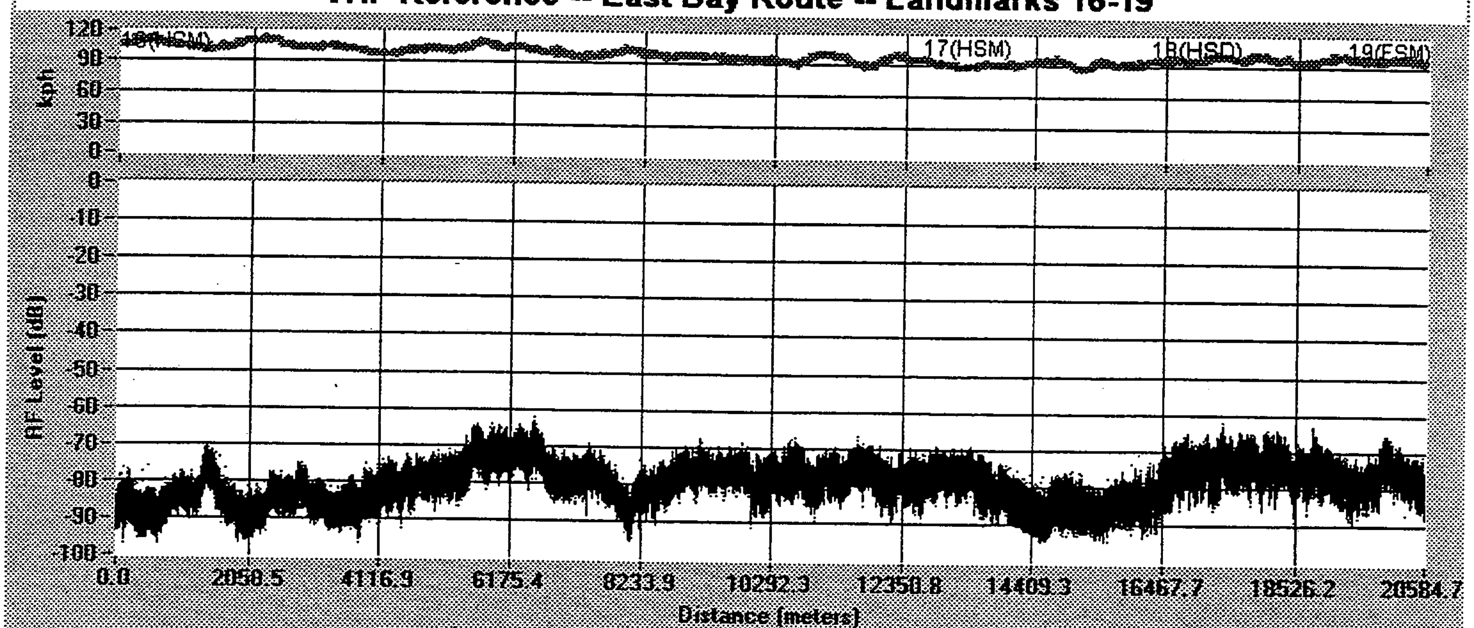
Event Summary: Total 11536; Clear 11536 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

VHF Reference -- East Bay Route -- Landmarks 13-16



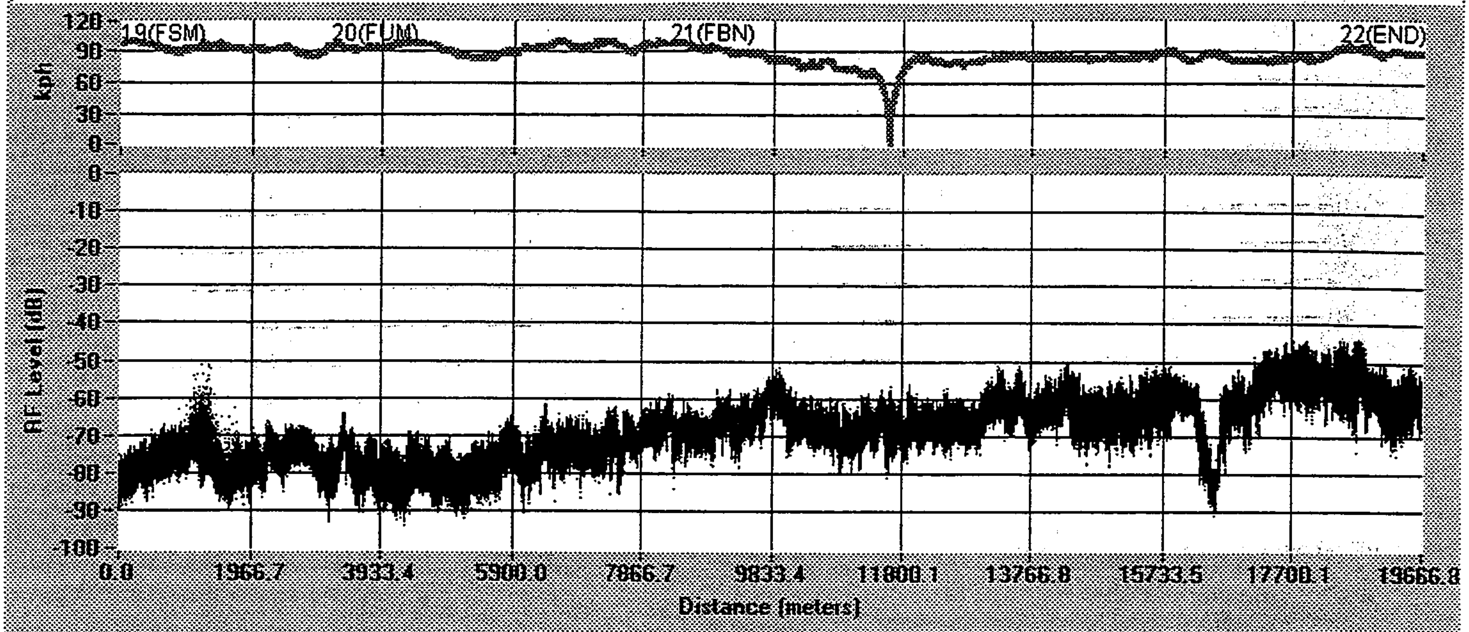
Event Summary: Total 15008; Clear 15008 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

VHF Reference -- East Bay Route -- Landmarks 16-19

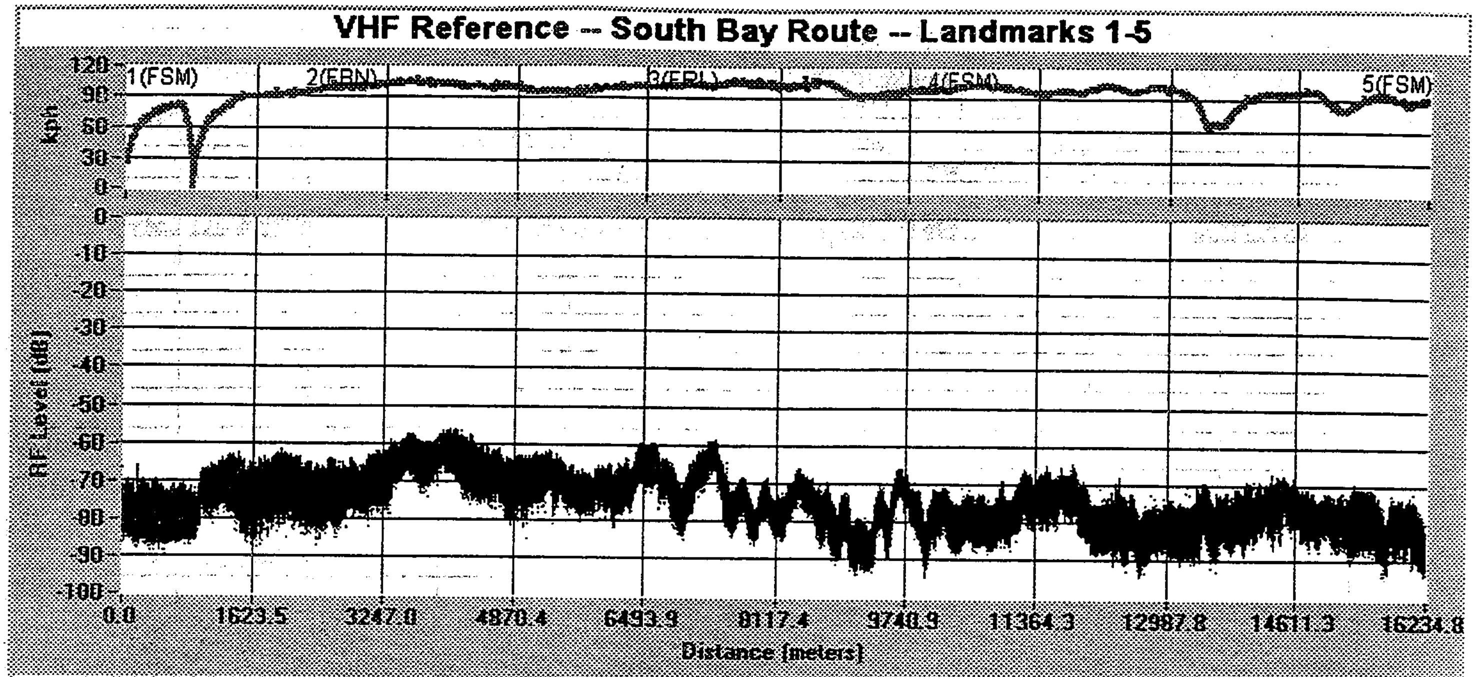


Event Summary: Total 14652; Clear 14652 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

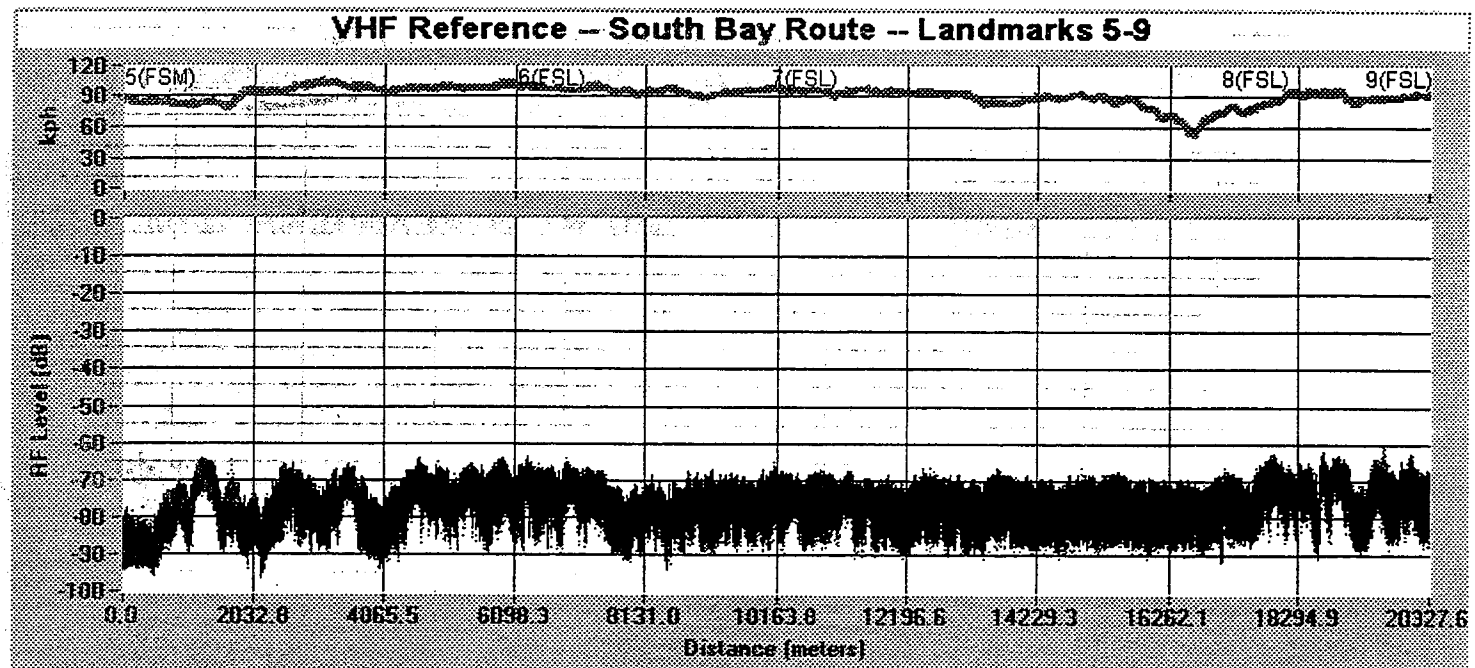
VHF Reference -- East Bay Route -- Landmarks 19-22



Event Summary: Total 16582; Clear 16582 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).



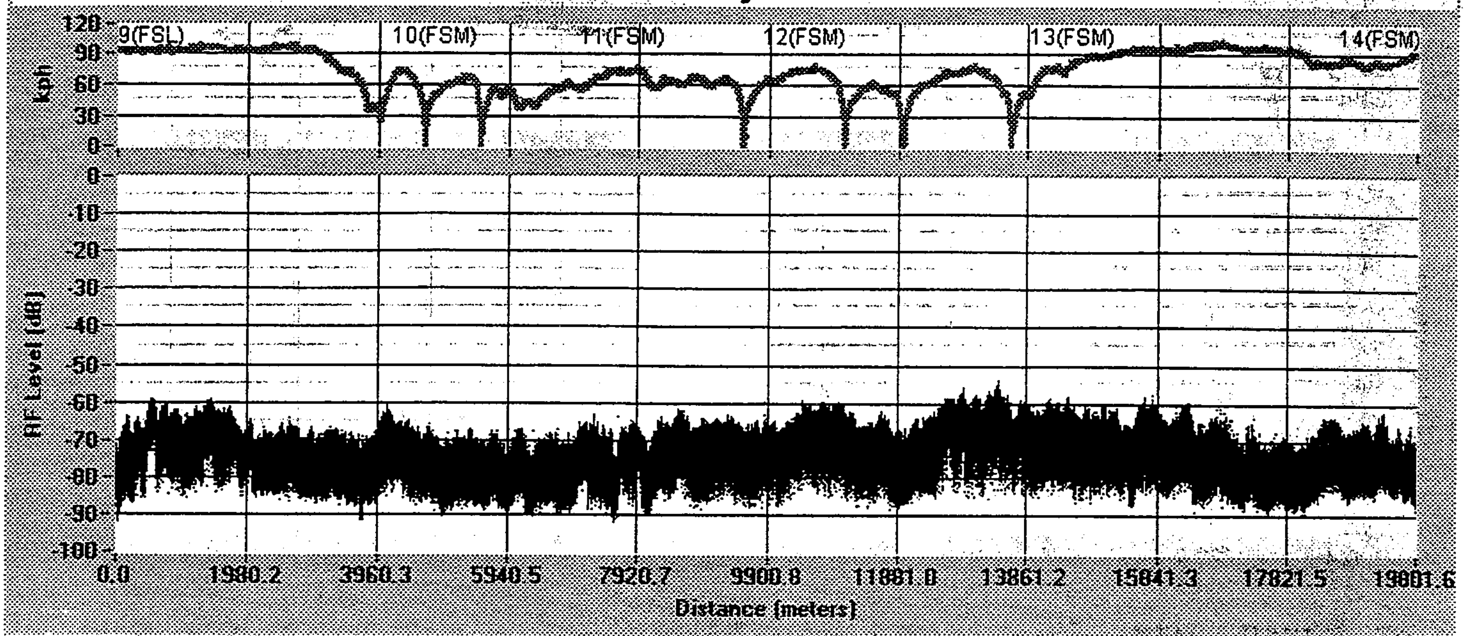
Event Summary: Total 12913; Clear 12913 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).



Event Summary: Total 16462; Clear 16462 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

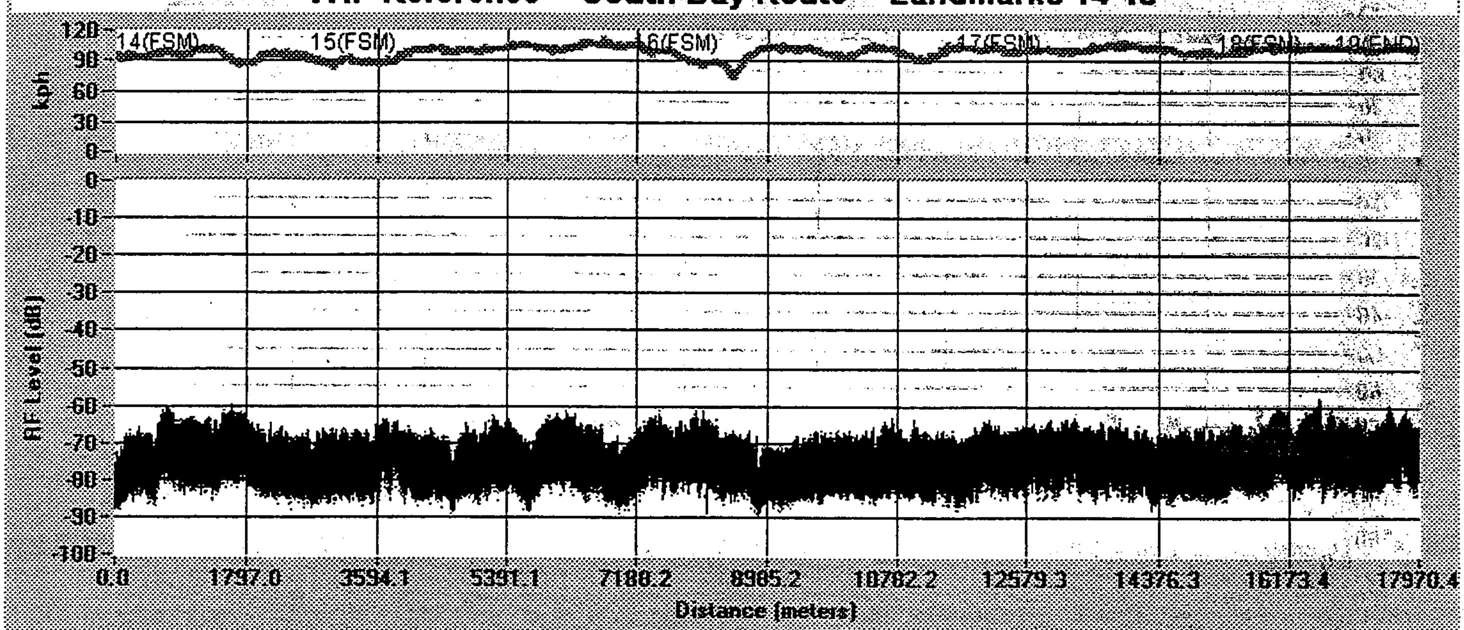
341

VHF Reference -- South Bay Route -- Landmarks 9-14

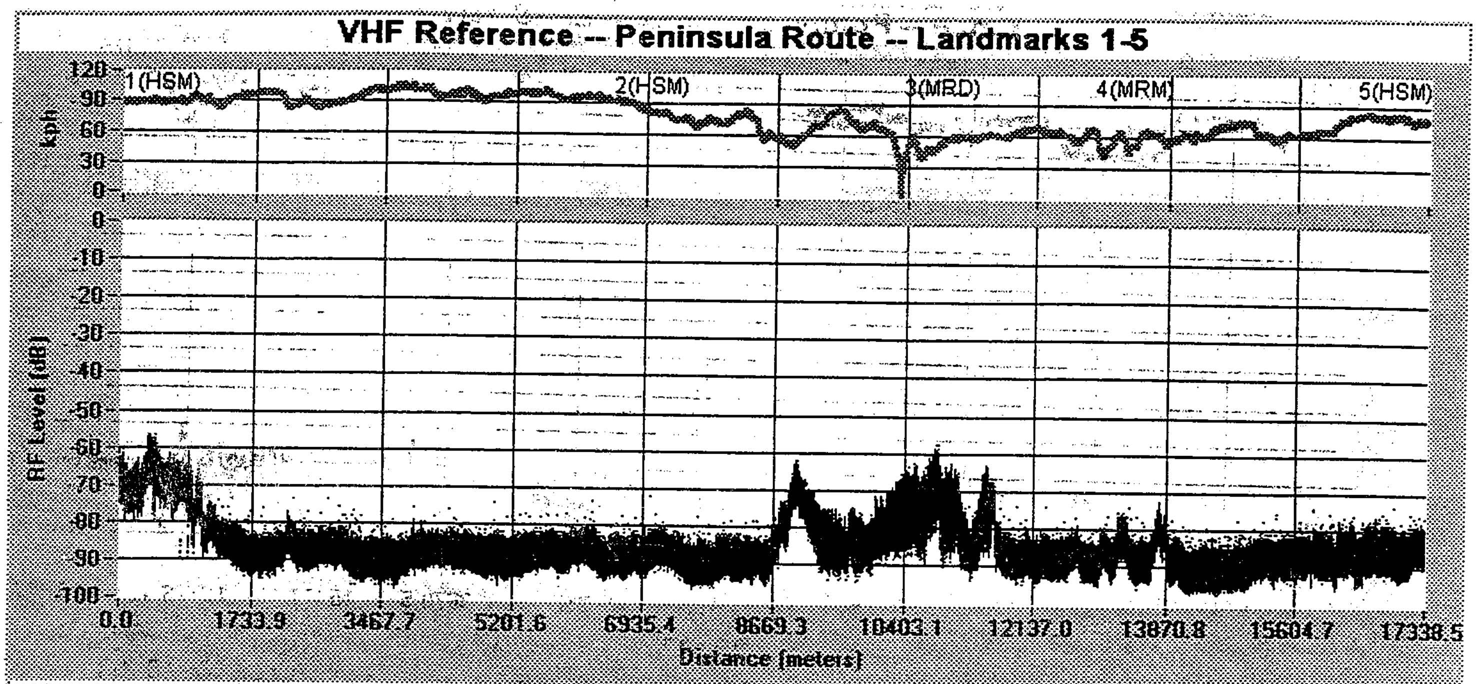


Event Summary: Total 24062; Clear 24062 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

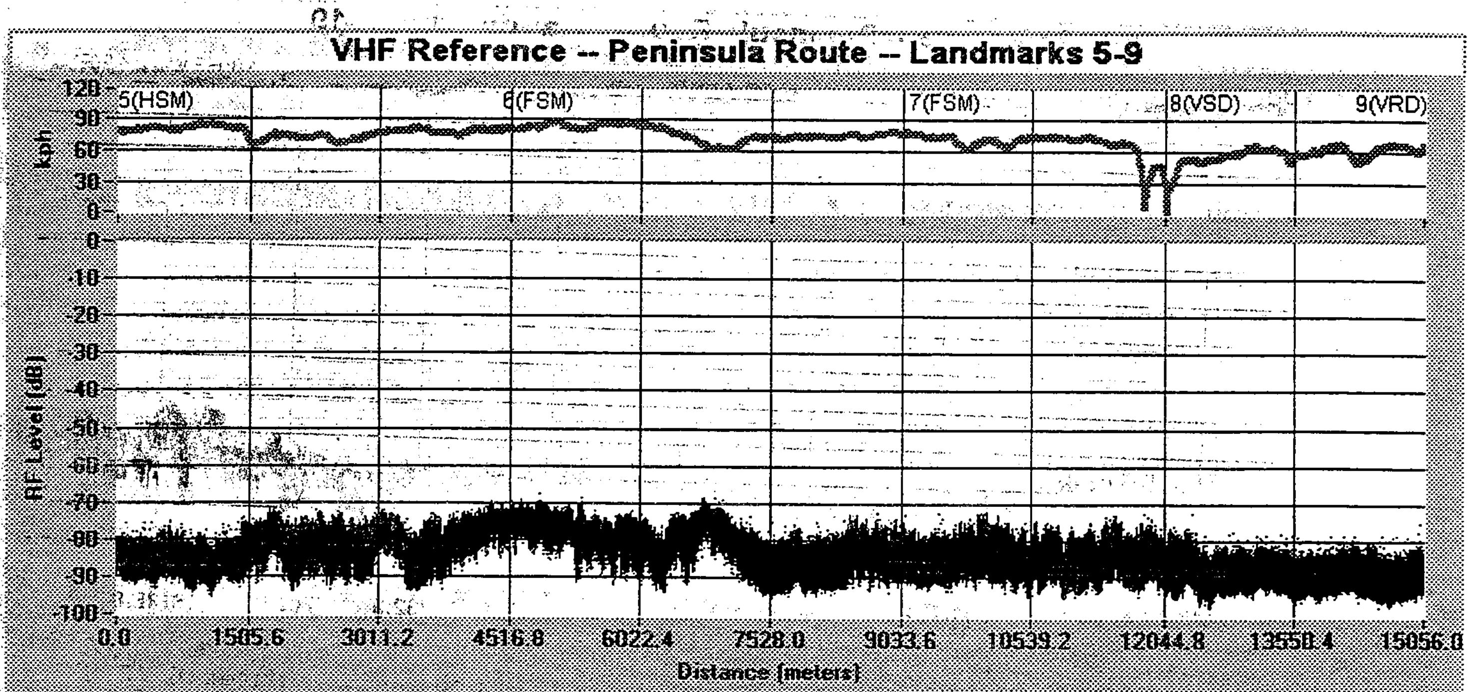
VHF Reference -- South Bay Route -- Landmarks 14-19



Event Summary: Total 12896; Clear 12896 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).



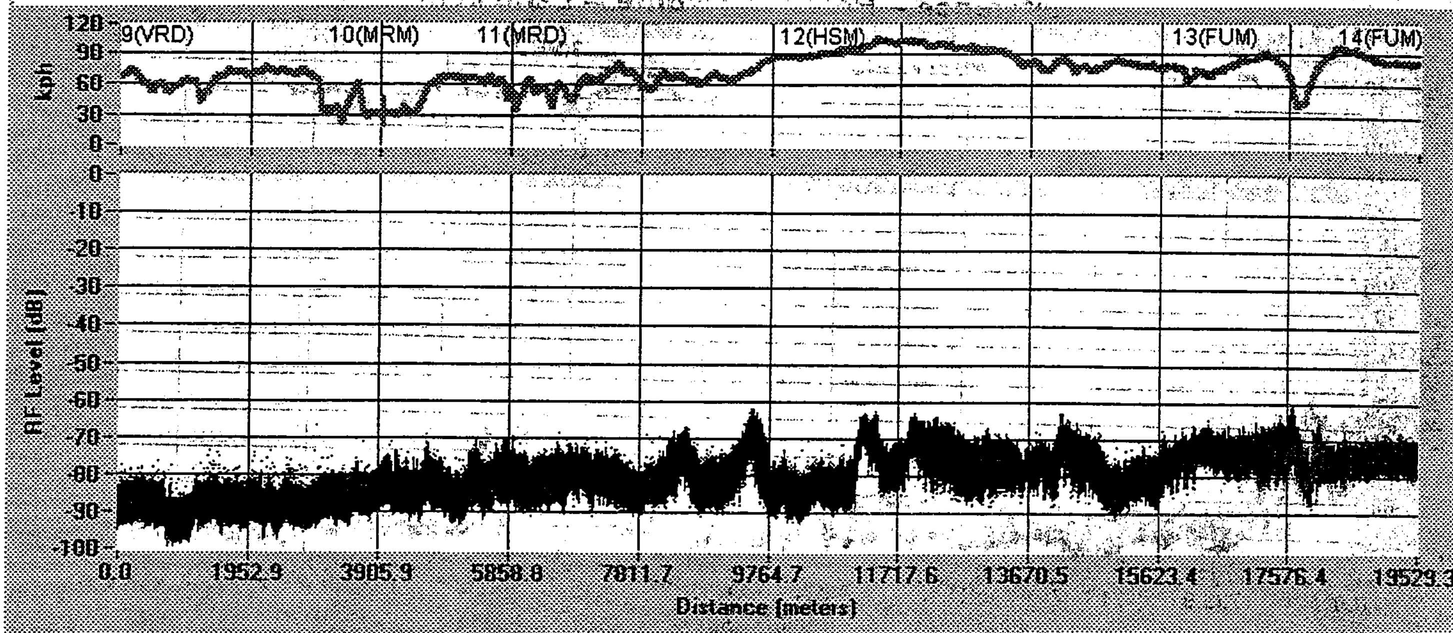
Event Summary: Total 17937; Clear 17937 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).



Event Summary: Total 16979; Clear 16979 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

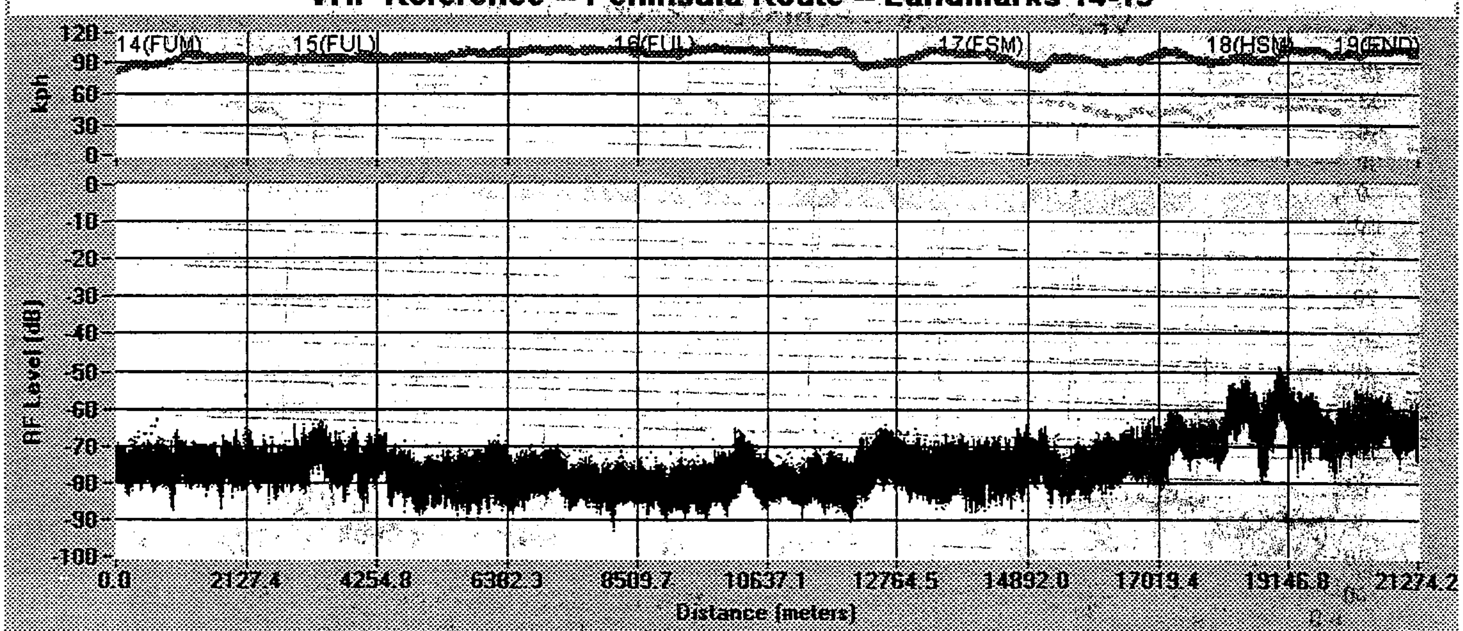
343

VHF Reference -- Peninsula Route -- Landmarks 9-14



Event Summary: Total 21980; Clear 21980 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

VHF Reference -- Peninsula Route -- Landmarks 14-19



Event Summary: Total 15332; Clear 15332 (100.0%); Impaired 0 (0.0%); Muted 0 (0.0%).

NRSC Document Improvement Proposal

If in the review or use of this document a potential change appears needed for safety, health or technical reasons, please fill in the appropriate information below and email, mail or fax to:

National Radio Systems Committee
c/o Consumer Electronics Association
Technology & Standards Department
1919 S. Eads St.
Arlington, VA 22202
FAX: 703-907-4190
Email: standards@ce.org

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URGENCY OF CHANGE: ______ Immediate	______ At next revision
PROBLEM AREA (ATTACH ADDITIONAL SHEETS IF NECESSARY): a. Clause Number and/or Drawing: b. Recommended Changes: c. Reason/Rationale for Recommendation:	
ADDITIONAL REMARKS:	
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