



**NRSC
REPORT**



NATIONAL RADIO SYSTEMS COMMITTEE

**NRSC-R34
High-speed Subcarrier (Digital)
HSSC Field Test Report
August 7, 1997**

Part I - Report



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NRSC-R34

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NRSC-R34

FOREWORD

NRSC-R34, High-speed Subcarrier (Digital) HSSC Field Test Report, is the second of three test reports submitted to the NRSC's High-Speed FM Subcarrier (HSSC) Subcommittee. Three digital FM subcarrier systems were evaluated during these tests—DARC (submitted by Digital DJ, Inc.), STIC (submitted by Mitre Corporation), and HSDS (submitted by Seiko, Inc.). The co-chairmen of the HSSC Subcommittee at the time of the submission of NRSC-R34 were Michael Rau and David Kelly. The NRSC Chairman at the time of the submission of NRSC-R34 was Charles Morgan.

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.

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HIGH-SPEED FM SUBCARRIER SUBCOMMITTEE

High-speed Subcarrier

(Digital)

HSSC

Field Test Report

August 7, 1997

Thomas B. Keller, Consultant
David M. Londa, RF Test Manager
Robert W. McCutcheon, System Test Engineer

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Appendices:

- Appendix A SCA Connection Overview

2. Field Test Procedures

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High-speed FM Subcarrier Subcommittee

Field Test Procedures (Rev. 3)

(As adopted by the Subcommittee on March 21, 1997)

TEST VAN

The receiving antenna will be a quarter wave vertical with the ground plane mounted on the roof of the van. The antenna with ground plane has been characterized on a calibrated antenna test range. To compensate for the test vehicle antenna height and high antenna gain over a typical automobile installation, the RF signal will be attenuated by at least 8 dB in power dividers.

A Hewlett Packard RF spectrum analyzer operating in the zero span mode will monitor the desired FM station signal level. The spectrum analyzer DC output, representing the host station signal level, will be plotted against time and distance by the onboard PC. The signal level will be recorded on the computer hard drive with time code and message errors.

A second HP spectrum analyzer will monitor the signal level of adjacent channel stations within ± 1 MHz of the host station.

The video outputs of both spectrum analyzers and the two forward looking cameras will be mixed into four quadrants of a single video frame and recorded on VHS tape. During the field tests SMPTE time code previously recorded on the video tape will be used to synchronize the computer and eight track audio recorders.

Video Display

Spectrum analyzer #1 2 MHz span	Spectrum analyzer #2 Zero span DC Signal Level
Van camera #1 video front left window	Van camera #2 video front right window

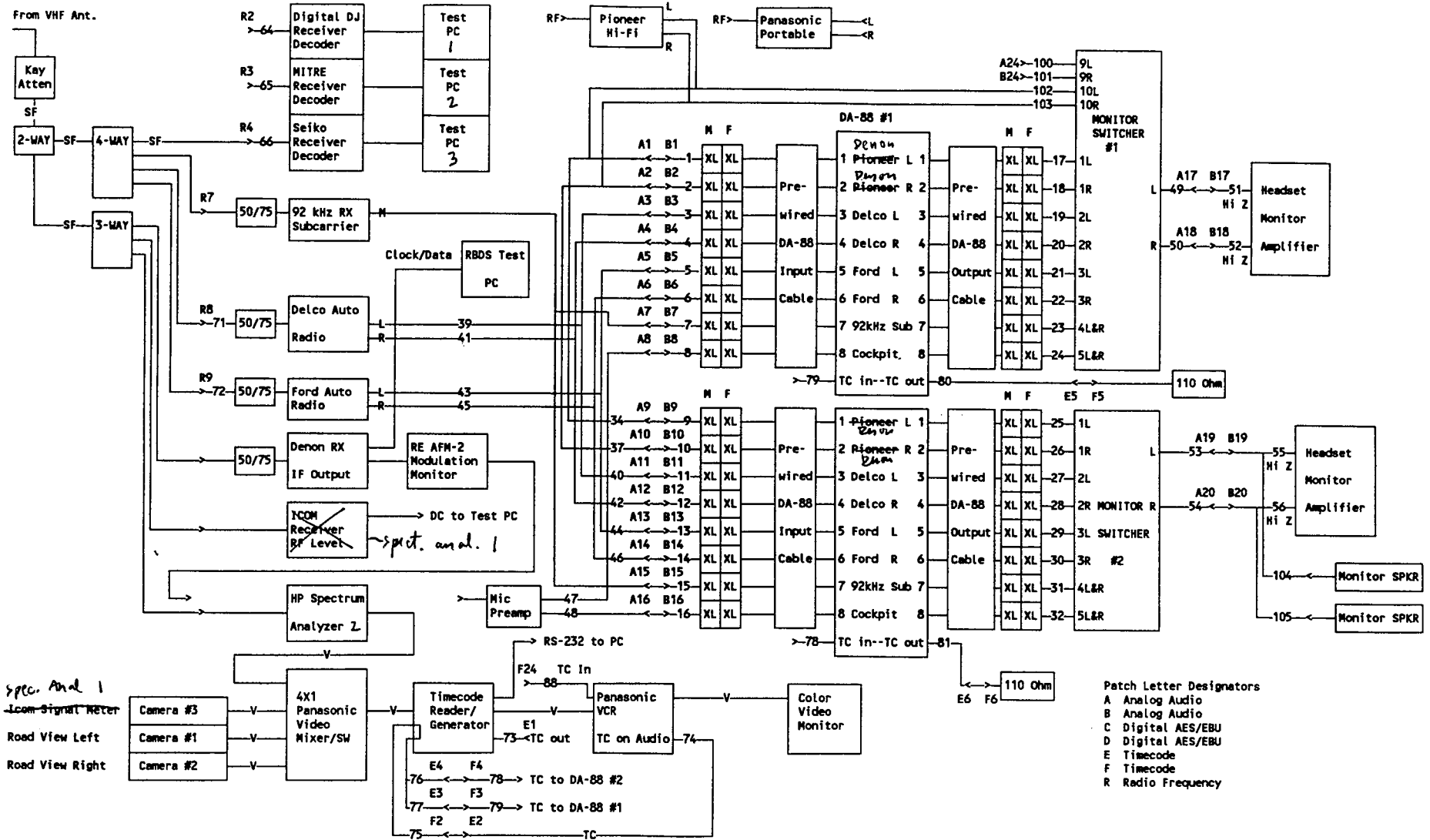
The short and long message errors will be recorded on the computer hard drive along with the time code and host RF signal level.

The eight track audio tape recorder will record the program audio from the compatibility consumer type receivers. The home receiver will be used only for evaluating non-motion tests. The audio output of the 92 kHz subcarrier receiver will also be recorded.

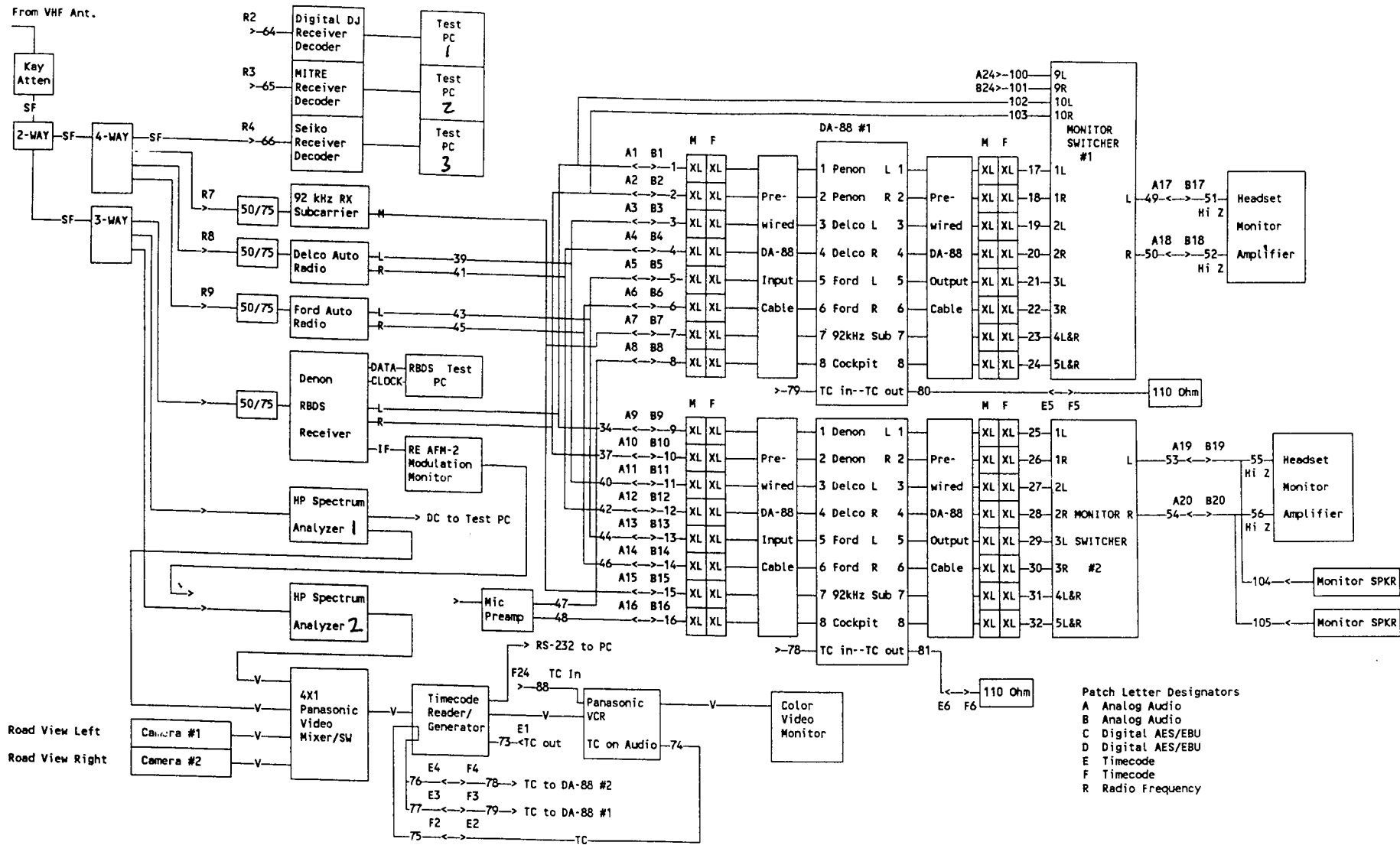
At least two operators, a driver and test engineer, will conduct the field tests. The engineer will listen for HSSC data interference on the host analog program channel. Comments made by the operators will be recorded on one of the audio tracks. If available a volunteer from the local SBE Chapter will assist the van staff.

March 21, 1997

(see updated drawing)



HSSC FIELD TRUCK BLOCK DIAGRAM MARCH 31, 1997



HSSC FIELD TRUCK BLOCK DIAGRAM SEPTEMBER 17, 1997

602

Digital Radio Test Laboratory

EIA SCA MIXER III

Nov-96

RMc

(see updated sheet)

SCA Group Chart

Dial numbers are selected telephone numbers (DTMF tones) for use with the Conex DT 55 remote control unit

Relays in the remote control unit control the select lines of the SCA Mixer

Dial numbers correspond to Group numbers (in block dia.)

No entry (in chart) = OFF

	Group No. Dial Number	Off	1	2	3	4	5	6	7	8	9	10	
		###	#1	#2	#3	#4	#5	#6	#7	#8	#9	#0	
TOTAL SCA Inject. (%)		0	13	10	13	10	13	20	10	13	20	NA	
AUX 1	10											ON	AUX 1
Digital DJ	10 4-10			ON	ON								Digital DJ
MITRE	10					ON	ON	ON					MITRE
Seiko	10								ON	ON	ON		Seiko
57KHz	3		ON		ON		ON	ON		ON	ON	ON	57KHz
92KHz	7		ON					ON			ON	ON	92KHz

Procedure:

- 1) Mixer must be in Remote Mode
- 2) Dial up remote control
- 3) Enter Password (EIA1)
- 4) Enter ### (turns all relays OFF)
- 5) Enter (#) + (desired group number)
When test is complete;
- 6) Enter ### (turns all relays OFF)
- 7) At the completion of all tests;
Enter *** for hang up

Dial up Phone Codes:

- (No.) Number only = momentary relay ON (for duration of key depression)
 (#) + (No.) = Relay ON
 (##) + (No.) = Relay OFF
 (###) = All relays OFF
 (***) = Unconditional Hang Up
 (*) = Clear command
 (***) + (No.) will return the status of the associated relay with tones

Note:

DT 55 is configured for "Interlock Mode" of operation.
 Only one relay (Group) at a time is permitted to be on

SCA MIXER III 1/97 RMc

Digital Radio Test Laboratory

EIA SCA MIXER III

Nov-96

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		###	#1	#2	#3	#4	#5	#6	#7	#8	#9	#0	
		TOTAL SCA Inject. (%)	0	10	10	13	10	13	20	10	13	20	
AUX 1	10											ON	AUX 1
Digital DJ	10			ON	ON								Digital DJ
MITRE	10					ON	ON	ON					MITRE
Seiko	10								ON	ON	ON		Seiko
57KHz	3		ON		ON		ON	ON		ON	ON	ON	57KHz
92KHz	7		ON					ON			ON	ON	92KHz

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SCA MIXER III

1/97

RMc

Test Runs

Two geographically separated FM stations will be used for the field tests. Each station will have a ERP of 50 kW. To facilitate the investigation of the effect of main program modulation on the HSSC subcarriers performance, one of the field test stations will be programmed with processed contemporary music. To aid in the compatibility evaluations the second station will program classical music with minimal processing. Every effort will be made to test each proponent system with the host FM station broadcasting similar program material with identical signal processing.

Each station will allow the switching on and off of all subcarriers. Because of modulation restrictions, the 92 kHz subcarrier will only be transmitted on the classical station.

Five test runs lasting from 25 to 50 minutes will be selected for each station. The test runs will have the characteristics similar to the four laboratory multipath simulation scenarios.

Route Number	Test route characteristics
1	Urban Slow
2	Urban Fast
3	Rural fast to failure (weak signal)
4	Rural to failure (weak signal)
5	Terrain obstructed

After completing the in-motion tests, the vehicle will retrace the route making stops at preselected locations for the fixed measurements. A maximum of seven sites per route will be selected with a minimum distance separation of 0.1 mile between fixed sites.

The following parameters will be recorded either on the computer hard drive or on the VCR tape for each path:

1. Signal level will be recorded on computer hard drive.
2. Short and long message error will be recorded on computer hard drive.
3. Spectrum analyzers #1 and #2 plots on VCR tape.
4. Two route video cameras on VCR tape.
5. Compatible audio on eight track digital audio recorder.

Data analysis

The number of short and long message errors for each route will be computed. The length of failures will be plotted.

The video taped runs will be available for inspection.

March 21, 1997

HIGH SPEED DATA FIELD TESTS

Test Group	Test & Impairment	TEST PROCEDURE	Type of Eval	System Seiko	System Digital DJ	System MITRE	RBDS 57 kHz	92 kHz (No 92 kHz Digital-DJ)	Purpose and Data to be Recorded
A Calibration	1. Subcarrier injection (beginning of proponent test day)		Objective at transmitter	X 10%	X 10%	X 10%	3%	7%	Precise injection
	2. FM Subcarrier injection (daily)	The baseband subcarrier levels will be monitored with a spectrum analyzer.	Objective at transmitter site	X 10%	X 10%	X 10%	3%	7%	Monitor injection
	3. RF Spectrum (daily)	An RF plot of each system will be taken daily. Baseband spectrum analyzer settings: Sweep 100 kHz, resolution bandwidth 300 Hz, Video 30 Hz, and 30 second sweep. RF spectrum analyzer settings: Sweep 200 kHz or 500 kHz, resolution bandwidth 1000 Hz, and video 30 Hz.	Objective in test van	X 10%	X 10%	X 10%	3%	7%	Record spectrum
	4. Weak signal (daily)	Using the test van spectrum analyzer that is in parallel with the receiver input, the signal will be reduced in one dB steps until the onset of message errors is observed.	Objective in test van	X 10%	X 10%	X 10%	3%	7%	Signal level at the onset of message errors
	5. Proof host transmitters (monthly)	A proof of performance will be conducted on the analog transmitters. The test will include the analog system performance with and without subcarrier group A. A high quality demodulator will be used for the test.	Objective	NA	NA	NA			Record of frequency response, separation, and distortion
	6. Monitor calibration (monthly)	The FM analog modulation monitors will be calibrated monthly.	Objective	NA	NA	NA			Calibration record in lab log

HIGH SPEED DATA FIELD TESTS

Test Group	Test	<p style="text-align: center;">TEST PROCEDURE</p> <p>General</p> <p>Two stations with different formats will be used.</p> <ol style="list-style-type: none"> 1. Classical with low audio processing. 2. Contemporary with high audio processing. <p>Test route description. This sequence is to be repeated for each station:</p> <ul style="list-style-type: none"> Urban slow Urban fast Rural fast to failure Rural to failure Terrain obstructed <p>During the in-motion tests the operators will listen to the host station's program channel on the Delco and Ford auto radios for HSSC interference. If interference is suspected the HS data will be remotely switched off and the interference assessed.</p>	Type of Eval	System Seiko	System Digital DJ	System MITRE	RBDS 57 kHz	92 kHz FM Subcarrier (only operated on the classical station)	Purpose and Data to be Recorded
<p>B</p> <p>Short and Long Message Errors</p>	<p>1. Message error measured in motion</p>	<p>1. Short and long message error will be measured on each station.</p> <p>2. Signal level and message error will be recorded on the PC hard drive. The two spectrum analyzers' video will be recorded on the VHS tape. The audio from Delco and Ford compatibility receivers will be recorded on the eight track digital tape.</p>	<p>Objective data in van</p> <p>Subjective analog program</p>	<p>X</p> <p>10%</p>	<p>X</p> <p>10%</p>	<p>X</p> <p>10%</p>	<p>3%</p>	<p>7%</p> <p>Switched off for Digital-DJ tests</p>	<p>Message errors for low & high compression</p> <p>Monitor compatibility</p>
	<p>2. Message error measured at fixed sites</p>	<p>1. Short and long message error will be measured on each station.</p> <p>2. Errors will be measured over a 5 minute period. Data will be recorded in the field test log.</p> <p>3. Spectrum analyzer plots of the spectrum including the first two adjacent channels (1.0 MHz) will be made at each fixed site.</p> <p>4. RBDS message errors will be measured.</p>	<p>Objective data in van</p>	<p>X</p> <p>10%</p>	<p>X</p> <p>10%</p>	<p>X</p> <p>10%</p>	<p>3%</p>	<p>7%</p> <p>Switched off for Digital-DJ tests</p>	<p>Message errors for low & high compression</p> <p>Monitor compatibility</p> <p>RBDS errors</p>
	<p>3. Compatibility monitored at fixed sites</p>	<p>After completing the HSSC-data measurements at each fixed site, the HSSC-data will be remotely turned off while listening for changes in the noise floor or artifacts caused by the HSSC on the host program audio. All five compatibility receivers will be used.</p>	<p>Subjective in test van</p>	<p>X</p> <p>10%</p>	<p>X</p> <p>10%</p>	<p>X</p> <p>10%</p>	<p>3%</p>	<p>7%</p> <p>Switched off for Digital-DJ tests</p>	<p>Changes in program audio (noise floor)</p>

3. Test Stations' Facilities and Predicated Coverage

Section 3

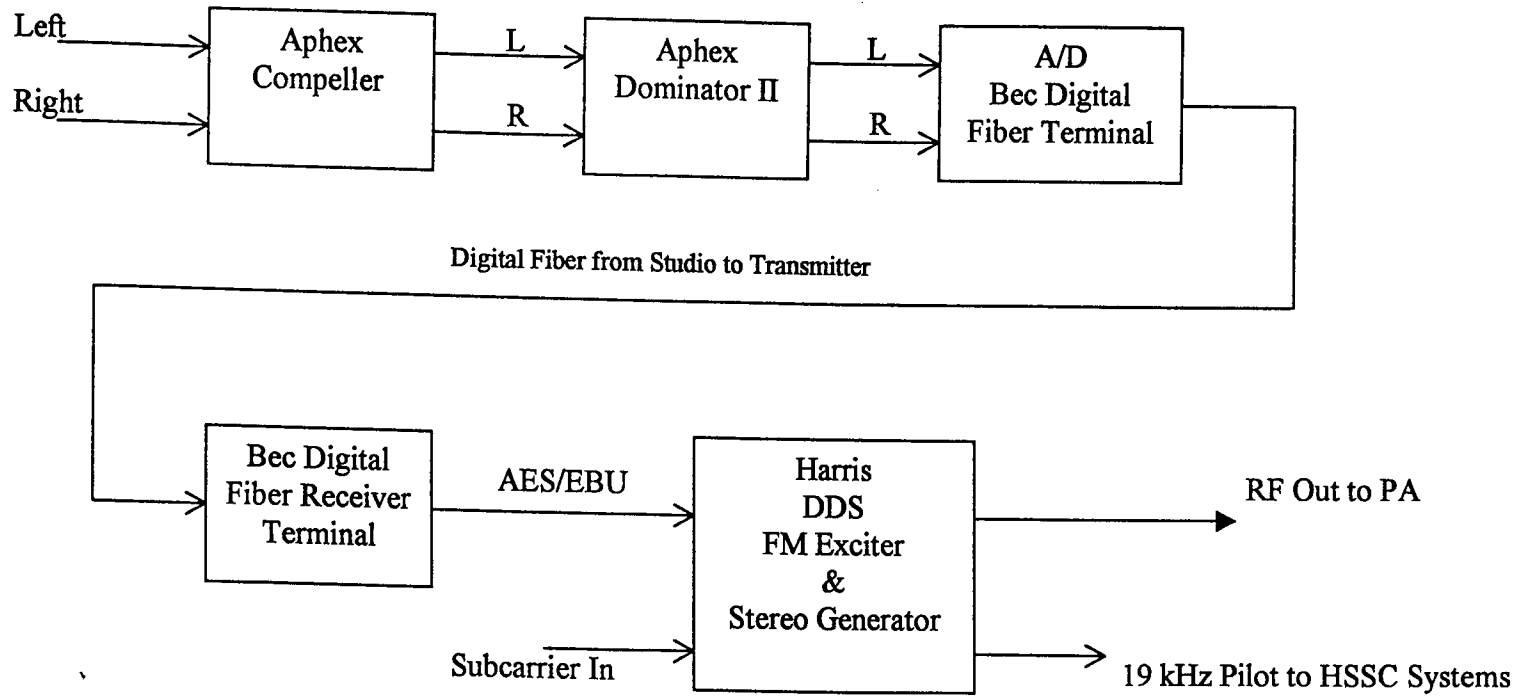
Test Stations' Facilities and Predicted Coverage

The two stations selected for the tests are WGAR, a commercial station owned by Nationwide, and WKSU, the Kent State University station. WGAR is located about eight miles south of downtown Cleveland, and WKSU is located in Kent, Ohio with the transmitting facilities about 30 miles southeast of Cleveland. WGAR is a commercial class B station (50 kw at 500 ft. above av. terrain). The WGAR format is country, and the audio is aggressively processed. WKSU is a noncommercial university station transmitting 50 kw at 390 ft above average terrain. The format is varied with conservative audio processing.

In this section of this laboratory report a list of each station's transmission parameters and maps showing the predicted contour for a mobile reception is included. ITS in Boulder, Colorado supplied the map and station data.

Five in motion test routes were used for testing each proponent system. Each system was tested on each route with both stations. Routes #1, #2, and #3 are located within the Cleveland City limits. Route # 4 in the northeast part of the greater Cleveland area and route #5 in the southwest.

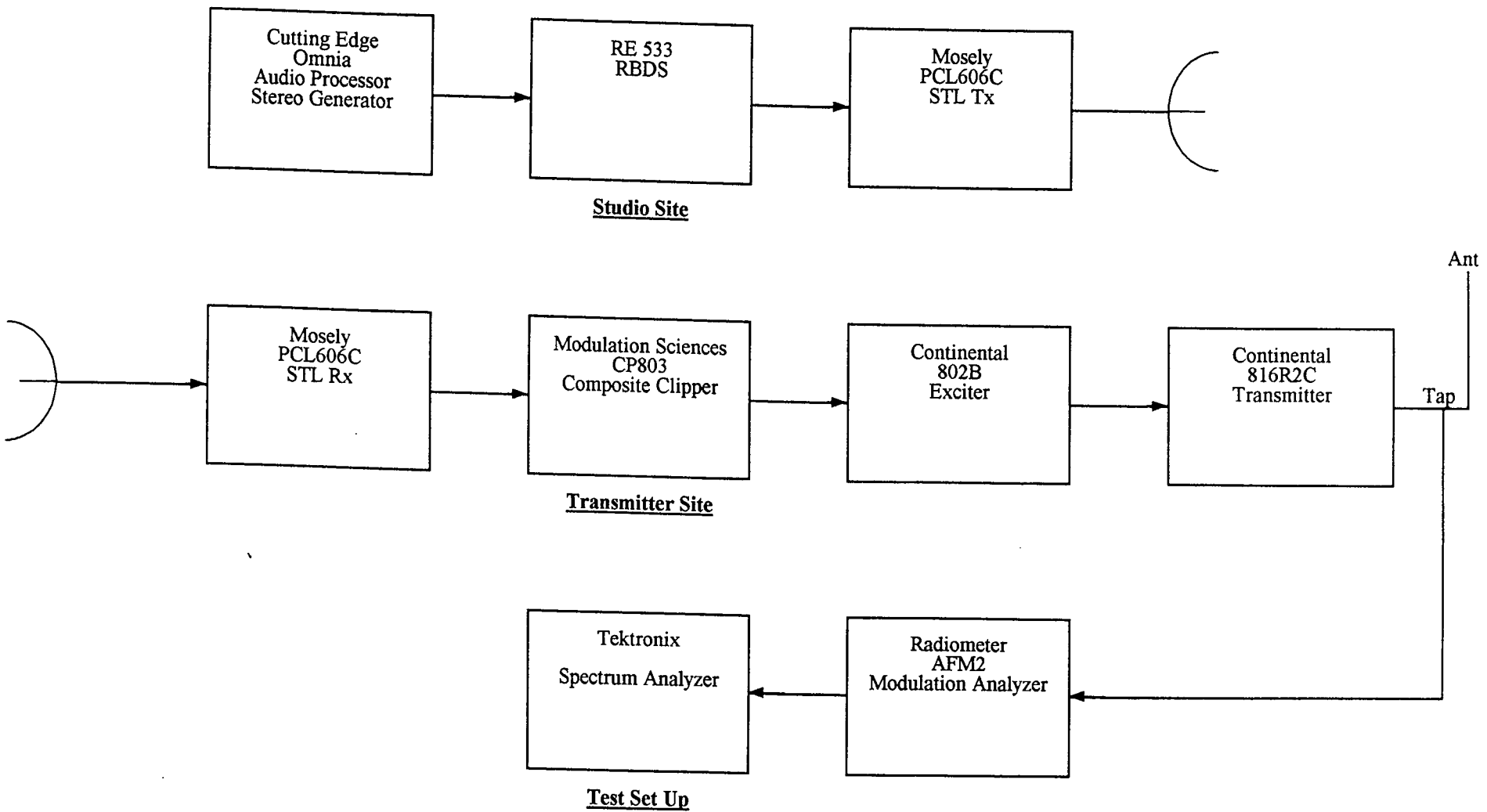
Audio Input



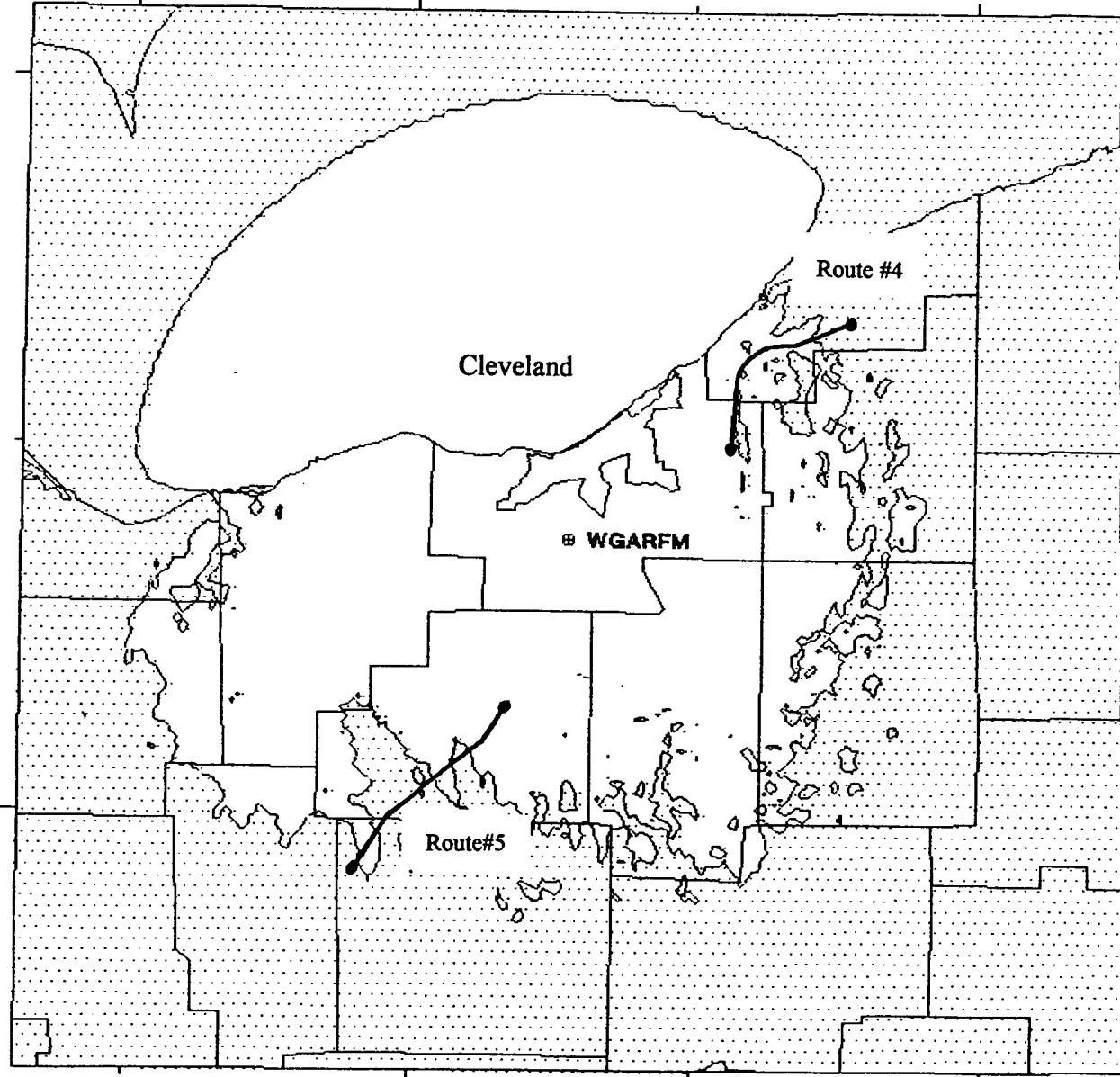
^u
WKS~~W~~ Audio

Studio to RF

DIGITAL RADIO TEST LABORATORY



12b



T.Keller Corp
 Tom Keller
 Cleveland OH
 1-Aug-97 16:28:55
 CS000Aug0197D.quea

Field Intensity(dBUV/m)

□	Greater than 57.00
	Area: 3800. sq mi
	Population: 2520000.
	Households: 970000.
□	Less than 57.0000
	Area: 6210. sq mi
	Population: 1251000.
	Households: 464000.



WGAR

Message Segment (/taservice/output/cspm/CS000Aug0197C.sum):

Communications System Performance Model
Input Summary
1-Aug-97 16:24:34

Process Filename: CS000Aug0197C.ques

- 1) Model: Point-to-point irregular terrain model
- 2) Output option: Field intensity
- 3) Length units: English (mi and ft)
- 4) Service Application: Broadcast
- 5) Results option: FAX only
- FAX number: 703-569-3370
- 6) Location variability: 50.00 %
- 7) Time availability: 50.00 %
- 8) Situation variability: 50.00 %
- 10) Frequency: 99.500 MHz
- 11) Polarization: Vertical
- 12) Conductivity: .005 S/m
- 13) Dielectric constant: 15.0
- 14) Climate zone: Continental temperate
- 20) Transmitter name: WGARFM
- 21) Transmitter location:

	Latitude		Longitude
	Deg N		Deg W

	41.3717		81.7178
	41,22,18.0		81,43, 4.0

- 22) Xmtr site elevation: 320.0 m 1049.9 ft
- 23) Xmtr ant ht AMSL: 422.00 m 1384.51 ft
- 23) Xmtr ant ht AGL: 102.00 m 334.65 ft
- 24) Transmitter radiation option: ERP
- 24) Effective Radiated Power: 50000.0 W
- Effective Isotropic Radiated Power: 82034.5 W
- 30) Transmitter ant horiz pattern: Omnidirectional
- 32) Transmitter ant vert pattern: Omnidirectional
- 40) Rcvr ant ht above ground: 9.10 m 29.86 ft
- 56) Corporate name: T.Keller Corp
- 57) Color option: B & W
- 58) Scale option: No Scale
- 59) Quality option: B & W
- 60) Plot name: Cleveland OH
- 62) Plot center:

	Latitude		Longitude
	Deg N		Deg W

	41.3717		81.7178
	41,22,18.0		81,43, 4.0

- 63) Plot size: 160.93 km 100.00 mi
- 64) Plot Roads option: No Roads
- 66) Field intensity contour levels:

 - 1) 57.00 dBuV/m

WGAR

66) Contour Legend label: Field Intensity(dBuV/m)

66) Contour labels and colors:

	Contour levels		Labels		Colors
	-----		-----		-----
	1	Less than 57.00	Less than 57.0000		N/A(B & W
	2	Greater than 57.00	Greater than 57.00		Clear
67)	Political boundaries:		County and State		
68)	Landmarks:	None			

Route #4

TA Services
Tom Keller
Kent OH
22-Apr-97 14:06:49

Cleveland

⊕ WKSUFM

30'

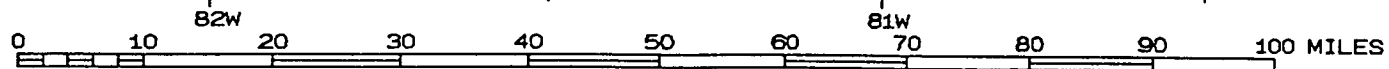
41N

30'

Route #5

Field Intensity(dBUV/m)

- Greater than 57.00
Area: 2480. sq mi
Population: 1656000.
Households: 622000.
- Less than 57.0000
Area: 7520. sq mi
Population: 2546000.
Households: 874000.



Communications System Performance Model

Input Summary

22-Apr-97 14:06:49

 Process Filename: CS000Apr2297A.ques

- 1) Model: Point-to-point irregular terrain model
- 2) Output option: Field intensity
- 3) Length units: English (mi and ft)
- 4) Service Application: Mobile
- 5) Results option: Mail only
- FAX number: 000-000-0000
- 9) Reliability: 90.00 %
- 8) Situation variability: 50.00 %
- 10) Frequency: 89.700 MHz
- 11) Polarization: Vertical
- 12) Conductivity: .005 S/m
- 13) Dielectric constant: 15.0
- 14) Climate zone: Continental temperate
- 20) Transmitter name: WKSUFM
- 21) Transmitter location:

Latitude

Longitude

Deg N

Deg W

41.1508 41, 9, 3.0

81.3386 81,20,19.0

- 22) Xmtr site elevation: 347.7 m 1140.6 ft
- 23) Xmtr ant ht AMSL: 454.00 m 1489.50 ft
- 23) Xmtr ant ht AGL: 106.34 m 348.89 ft
- 24) Transmitter radiation option: ERP
- 24) Effective Radiated Power: 50000.0 W
- Effective Isotropic Radiated Power: 82029.5 W
- 30) Transmitter ant horiz pattern: Omnidirectional
- 32) Transmitter ant vert pattern: Omnidirectional
- 40) Rcvr ant ht above ground: 9.10 m 29.86 ft
- 56) Corporate name: TA Services
- 57) Color option: Color
- 58) Scale option: No Scale
- 59) Quality option: High
- 60) Plot name: Kent OH
- 62) Plot center:

Latitude

Longitude

Deg N

Deg W

41.1508 41, 9, 3.0

81.3386 81,20,19.0

- 63) Plot size: 160.93 km 100.00 mi
- 64) Plot Roads option: No Roads
- 66) Field intensity contour levels:

1) 57.00 dBuV/m

66) Contour Legend label: Field Intensity(dBuV/m)

66) Contour labels and colors:

Contour levels

Labels

Colors

1 Less than 57.00

Less than 57.0000

Blue

2 Greater than 57.00

Greater than 57.00

Green

67) Political boundaries:

County and State

68) Landmarks:

None

4. Transmitter HSSC Injection Calibration

Date: 6/20/97

Location: WGAR-FM Transmitter site

EIA Personnel: DML, TK, RMc

WGAR Personnel: Mark Kreiger

Objective: Set up and calibration of HSSC Field Test SCA transmit equipment
Off air test of the HSSC proponent receivers and Field Test Vehicle (FTV) test equipment.

Transmitter Site Equipment

Exciter: Continental 802B

Power amp.: None

Transmitter: Continental 816R-2C (21.5KW)

Measurement equipment

Belar Wizard modulation monitor

AFM-2 modulation measurement receiver

HP 8590 spectrum analyzer

Audio Precision audio analyzer

Tektronix 335 oscilloscope (battery powered)

Spectrum Analyzer settings: Amplitude: -14dBm
Frequency: 55kHz
Span: 90kHz
RBW: 1kHz
VBW: 1kHz

Set Up

Measurements made at Exciter output cabled into the FTV RF test bed with 100' of RG8 (duo-bond) cable.

Transmitter is off for SCA set up.

RF test bed feeds spectrum analyzer and AFM-2 modulation receiver.

Audio from modulation receiver is fed to spectrum analyzer for plots of composite baseband signature.

Audio (70kHz) from Audio Precision for SCA calibration is fed to the Exciter with 100' of RG8 (duo-bond) cable.

Pilot signal required for Seiko operation is cabled into the SCA transmit rack from the output of the station Belar modulation monitor.

Composite line from studio (pilot only) is connected to the exciter for Seiko. All other calibration is performed without the composite line connected.

Procedure

1) Besel Null

13.586kHz tone at 1.039Vrms into Continental exciter results in null with modulation measured at 100.7% (using Belar Wizard)
 Audio output from AFM-2 at 100%; 529.6mVrms = 0dBr (using Audio Precision audio analyzer)

Note; the Belar Wizard normally indicates 0.7% with a CW signal

(wideband setting.)

2) Frequency Response

Not performed. Station engineer did not request this test

3) Distortion

Not performed. Station engineer did not request this test

4) Set up of SCA levels

A 70kHz tone from the Audio Precision audio generator is used as a SCA source for set up at 10% deviation
 (70kHz @ 1.3Vrms at Audio Precision source) through 100' of RG8

70kHz tone at 3.5Vpp (oscilloscope measurement at the Continental SCA input) gives 10.4% deviation as indicated on Belar Wizard

This then becomes the Vpp reference for all SCA voltage levels as viewed on an oscilloscope

Peak-to-peak SCA voltages correlate directly with main carrier peak to peak deviation and are therefore the priority when measuring non-sinusoidal signals and groups of signals.

Reference Figures:

Modulation (%)	Deviation (kHz)	Reference (dB)	SCA Level (Vpp)	Modulation (Indicated)
10	7.5	0	3.5	10.4
7	5.25	-3.09	2.45	
3	2.25	-10.45	1.05	

Notes:

When the proper (70kHz) level required for 10% injection (as indicated on the Belar Wizard) is found, the signal is measured with an oscilloscope at the SCA input of the exciter.

The Peak-to-Peak voltage is then entered into the blue cell of the Chart (at left) and the PP target levels for 7 and 3% are calculated Chart (at left) and the PP target levels for 7 and 3% are calculated

5) Measurements

Digital Radio Test Laboratory

SCA Mixer ratios (relative to each other) are calibrated in the laboratory.

The overall output level of the Mixer is adjusted to the reference level found above, and individual SCAs are checked against the references. Measurements, observed on an oscilloscope, for Volts peak-to-peak (Vpp) and peak deviation in percent, made with the Belar Wizard, are recorded in the chart below.

(See updated data sheet)

SCA Measurements:

Group No.	Proponent		57kHz Only		92kHz Only		Total (all SCAs)	
	(Vpp)	(%)	(Vpp)	(%)	(Vpp)	(%)	(Vpp)	(%)
1 (57+92)	Not Used							
2 (DDJ)	3.45	10.50	NA		NA		3.45	10.50
3 (DDJ+)	3.40	10.40	1.10	3.90	NA		4.50	13.30
4 (MIT)	3.50	10.70	NA		NA		3.50	10.70
5 (MIT+)	3.50	10.60	1.10	3.90	NA		4.60	13.50
6 (MIT+)	Not Used							
7 (Seik)	3.50	19.30	NA		NA		3.50	19.30
8 (Seik+)	3.50	19.10	1.10	12.70	NA		4.50	21.50
9 (SEIK+)	Not Used							
10 (AUX+)	Not Used							

pilot included

not incl. pilot

Notes: Individual measurements of an SCA signal in groups containing two or more SCA signals are made by removing the undesired SCA signals at the rear of the SCA Mixer.

^{percent}
Seiko measurements reflect the inclusion of the Pilot signal necessary for Seiko operation.
Seiko phase (relative to the Pilot) adjusted to 63.3 degrees.

- % numbers are read from Belar
- Total # does not add up since superposition does not apply.

Calibration Check Prior to Equipment Removal

Digital Radio Test Laboratory


SCA Mixer ratios (relative to each other) are calibrated in the laboratory. The overall output level of the Mixer is adjusted to the reference level found above, and individual SCAs are checked against the references. Measurements, observed on an oscilloscope, for Volts peak-to-peak (Vpp) and peak deviation in percent, made with the Belar Wizard, are recorded in the chart below.

SCA Measurements:

Group No.	Proponent		57kHz Only		92kHz Only		Total (all SCAs)	
	(Vpp)	(%)	(Vpp)	(%)	(Vpp)	(%)	(Vpp)	(%)
1 (57+92)								
2 (DDJ)	3.45	10.50					3.45	10.50
3 (DDJ+)	3.40	10.40	1.10	3.90			4.50	13.30
4 (MIT)	3.50	10.70					3.50	10.70
5 (MIT+)	3.50	10.60	1.10	3.90			4.60	13.50
6 (MIT+)								
7 (Seik)	3.50	19.30					3.50	19.30
8 (Seik+)	3.50	19.10	1.10	12.70			4.50	21.50
9 (SEIK+)								
10 (AUX+)								

Notes: Individual measurements of an SCA signal in groups containing two or more SCA signals are made by removing the undesired SCA signals at the rear of the SCA Mixer.

Seiko measurements reflect the inclusion of the Pilot signal necessary for Seiko operation. Seiko phase (relative to the Pilot) adjusted to 63.3 degrees.

 Shaded Cells indicate pilot on the carrier and included in the measurement.

Accuracy of injection levels is within .25 dB based upon measurements made in Appendix B.

Calibration Check Prior to Equipment Removal

Date: 2-Jul-97
Personnel: DML, RMc

Connect AFM-2 to 1V RF tap
Plot composite baseband for each group on HP spectrum analyzer

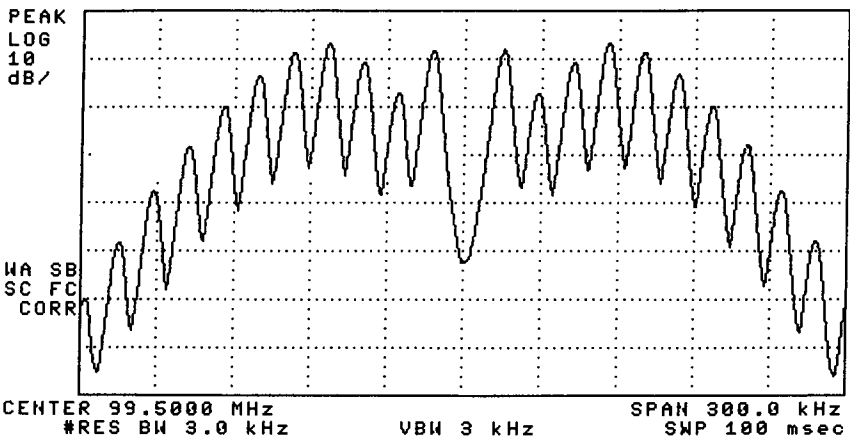
Spectrum Analyzer settings;

Amplitude: -14dBm
Frequency: 55kHz
Span: 90kHz
RBW: 1kHz
VBW: 1kHz

Page	Plot	Description
23	a	Bessel Null of RF Carrier Frequency at WGAR 99.5 MHz
	b	70 kHz Sine Injected at 10 % at WGAR 99.5 MHz
24	a	Digital DJ proponent only baseband from AFM-2 directly connected to RF tap.
	b	Digital DJ with RBDS baseband from AFM-2 directly connected to RF tap.
25	a	Mitre proponent only baseband from AFM-2 directly connected to RF tap.
	b	Mitre with RBDS baseband from AFM-2 directly connected to RF tap.
26	a	Seiko proponent only baseband from AFM-2 directly connected to RF tap.
	b	Seiko with RBDS baseband from AFM-2 directly connected to RF tap.
27	a	Baseband from AFM-2 directly connected to RF tap without studio program material.
28		Digital DJ with RBDS baseband from AFM-2 directly connected to RF tap.
29		Mitre with RBDS baseband from AFM-2 directly connected to RF tap.
30		Seiko with RBDS baseband from AFM-2 directly connected to RF tap.

Note: Pages 23-27 were plotted when equipment was installed and pages 28-30 were plotted when equipment was removed.

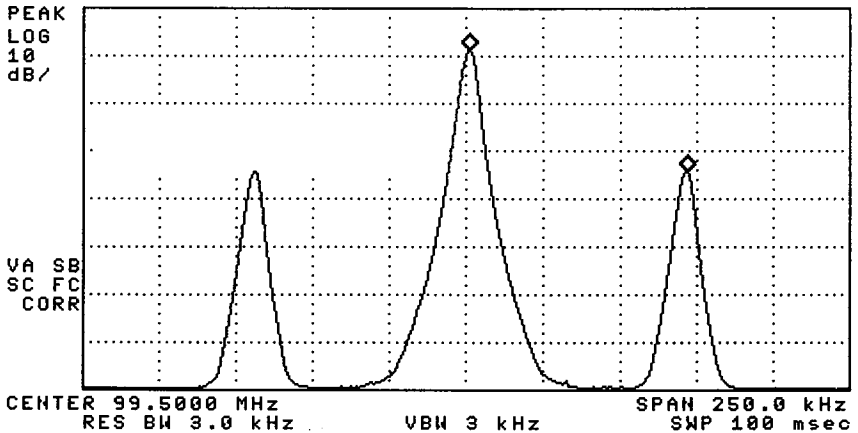
00:18:44 JUN 20, 1997
NRSC WGAR Bessel Null
REF -20.0 dBm AT 10 dB



MARKER NORMAL
 MARKER Δ
 MARKER AMPTD
 SELECT 1 2 3 4
 MARKER 1 ON OFF
 More 1 of 2

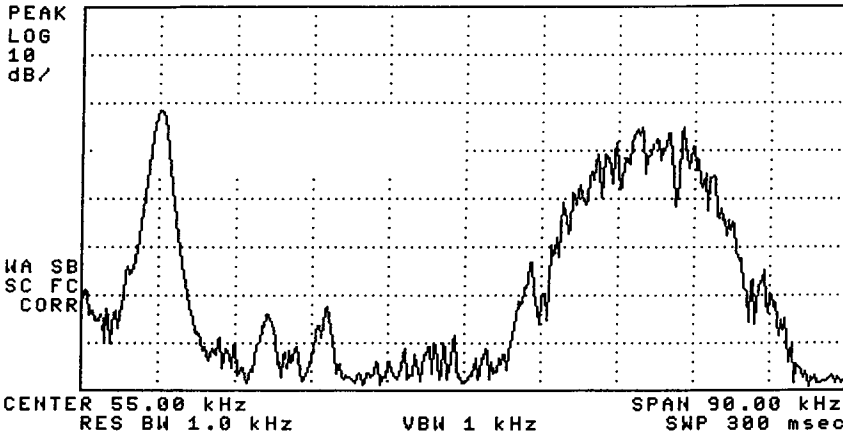
00:34:36 JUN 20, 1997
NRSC 70 kHz at 10 Percent
REF -10.0 dBm AT 10 dB

MKR Δ 70.6 kHz
-25.50 dB



CLEAR WRITE A
 MAX HOLD A
 VIEW A
 BLANK A
 Trace A B C
 More 1 of 3

02:08:55 JUN 20, 1997
NRSC Group 2
REF -14.0 dBn AT 10 dB



MARKER
NORMAL

MARKER
▲

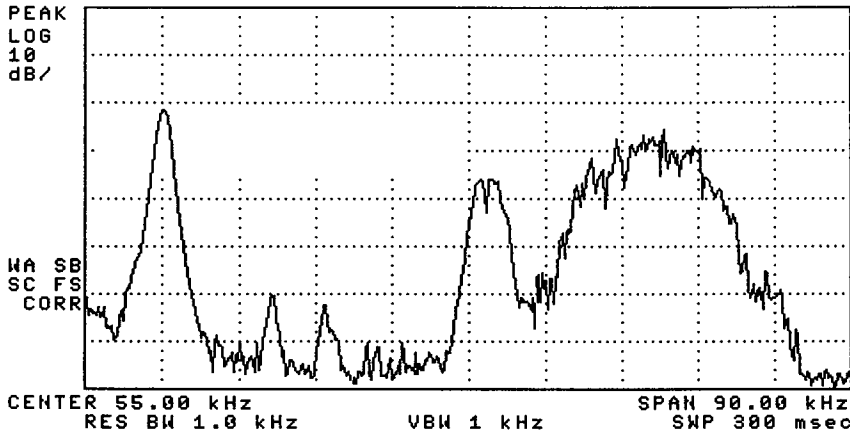
MARKER
AMPTD

SELECT
1 2 3 4

MARKER 1
ON OFF

More
1 of 2

02:09:47 JUN 20, 1997
NRSC Group 3
REF -14.0 dBn AT 10 dB



MARKER
NORMAL

MARKER
▲

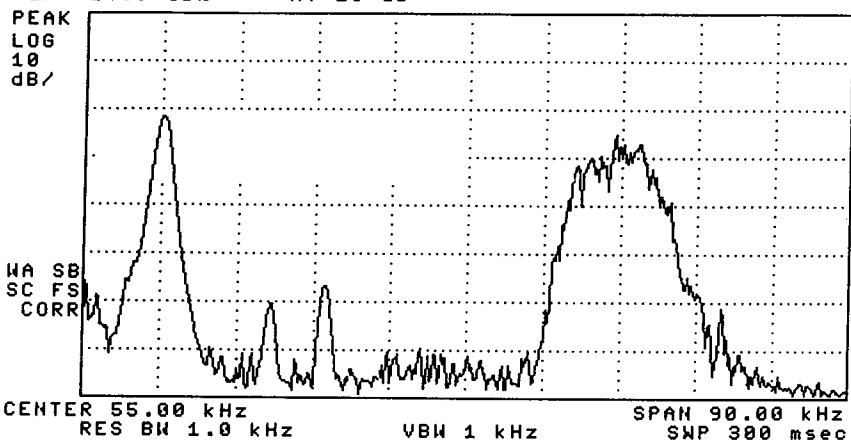
MARKER
AMPTD

SELECT
1 2 3 4

MARKER 1
ON OFF

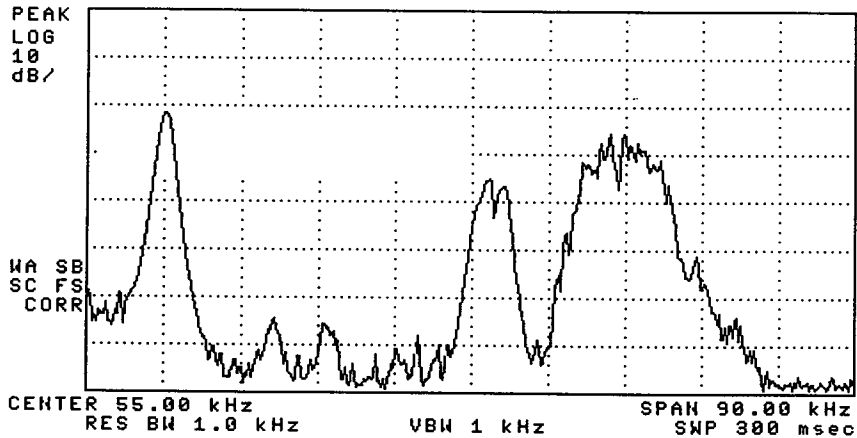
More
1 of 2

02:10:30 JUN 20, 1997
NRSC Group 4
REF -14.0 dBm AT 10 dB



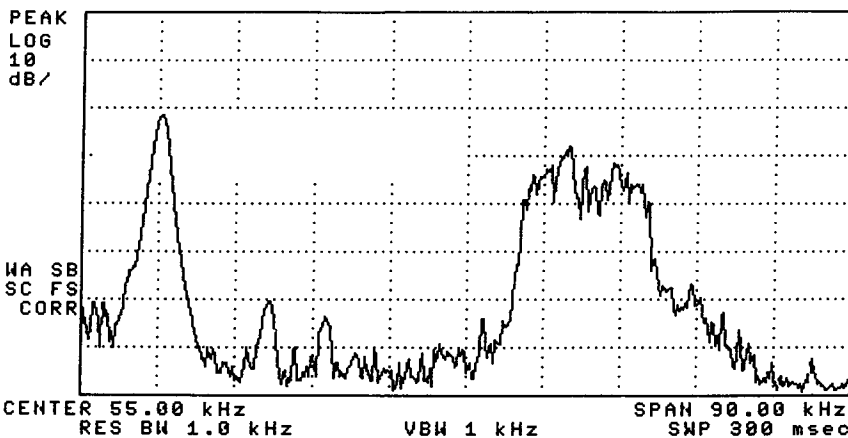
MARKER NORMAL
 MARKER Δ
 MARKER AMPTD
 SELECT 1 2 3 4
 MARKER 1 ON OFF
 More 1 of 2

02:10:59 JUN 20, 1997
NRSC Group 5
REF -14.0 dBm AT 10 dB



MARKER NORMAL
 MARKER Δ
 MARKER AMPTD
 SELECT 1 2 3 4
 MARKER 1 ON OFF
 More 1 of 2

02:12:13 JUN 20, 1997
NRSC Group 7
REF -14.0 dBm AT 10 dB



MARKER
NORMAL

MARKER
Δ

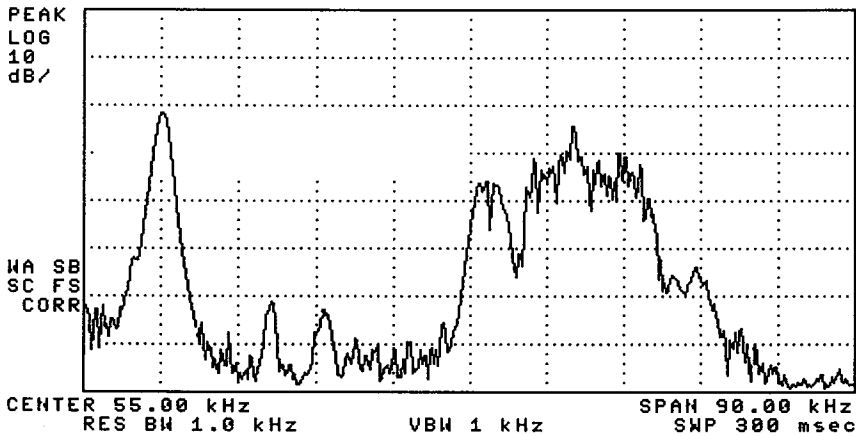
MARKER
AMPTD

SELECT
1 2 3 4

MARKER 1
ON OFF

More
1 of 2

02:15:44 JUN 20, 1997
NRSC Group 8
REF -14.0 dBm AT 10 dB



MARKER
NORMAL

MARKER
Δ

MARKER
AMPTD

SELECT
1 2 3 4

MARKER 1
ON OFF

More
1 of 2

02:17:09 JUN 20, 1997
NRSC All Off
REF -14.0 dBn AT 10 dB

PEAK
LOG
10
dB/

HA SB
SC FS
CORR

CENTER 55.00 kHz RES BW 1.0 kHz VBW 1 kHz SPAN 90.00 kHz SNP 300 msec

MARKER
NORMAL

MARKER
▲

MARKER
AMPTD

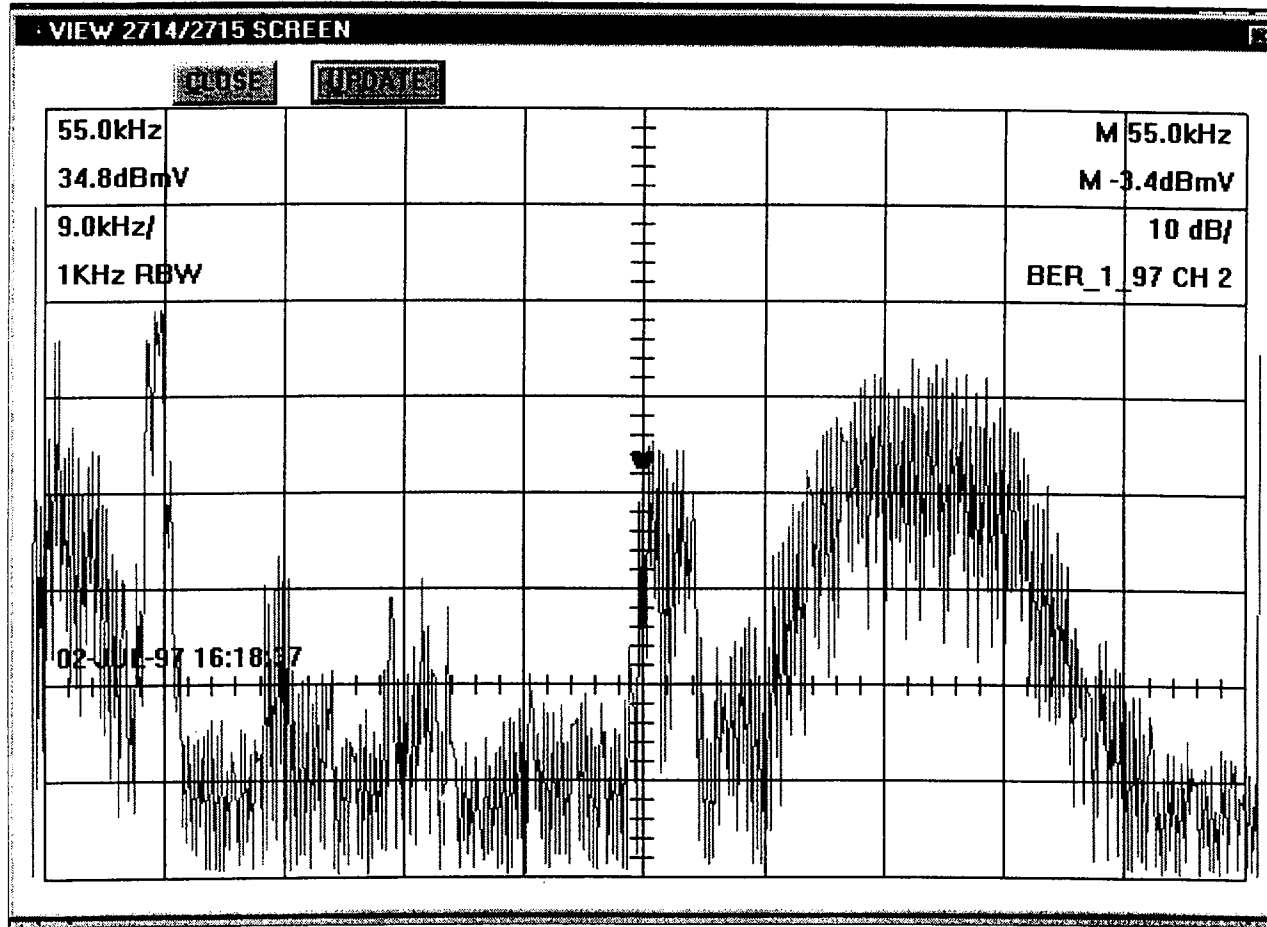
SELECT
1 2 3 4

MARKER 1
ON OFF

More
1 of 2

10 19 28 37 46 55 64 73 82 91 100

this appears to be
an interfering signal.

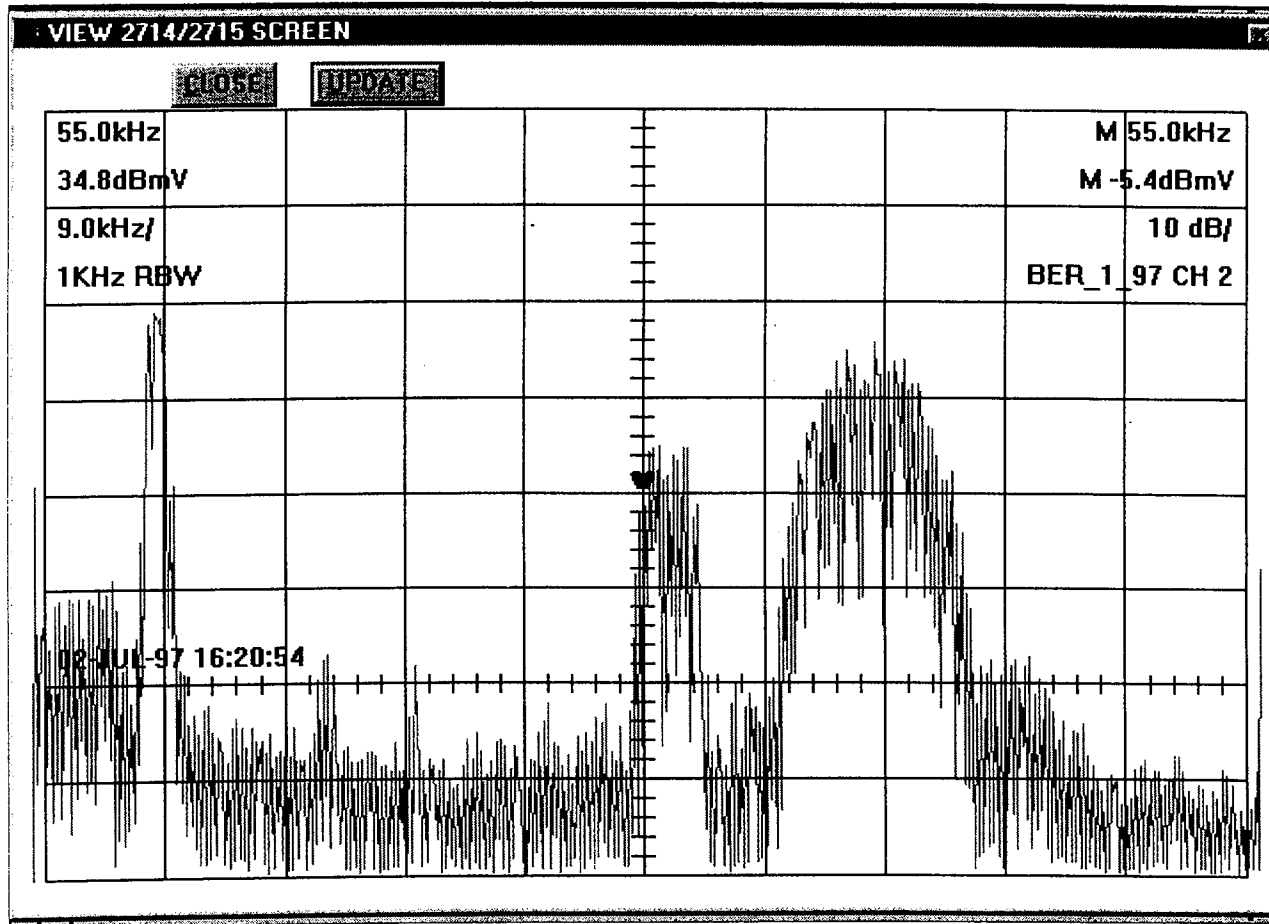


Exit plots

Tek
2715

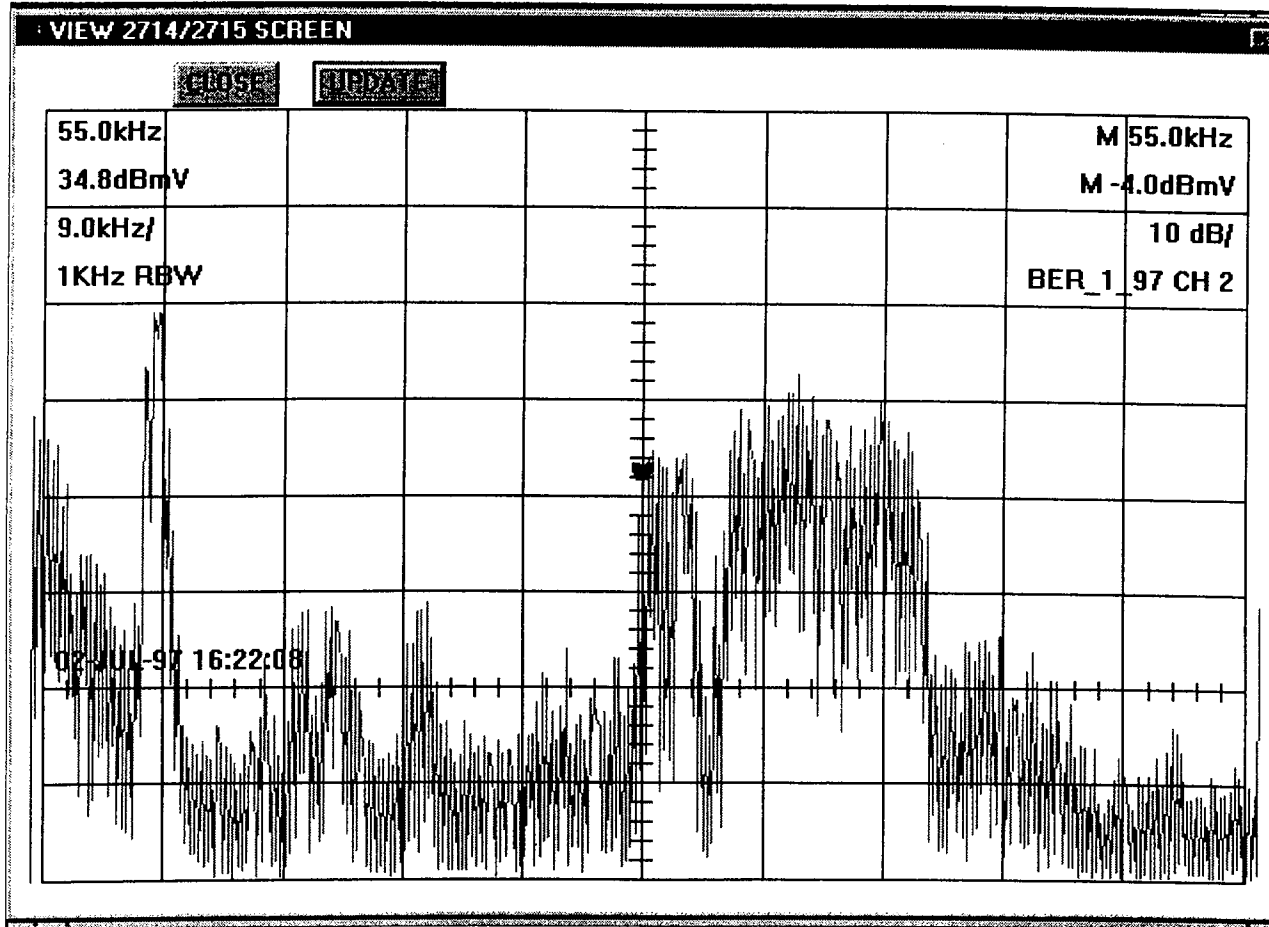
at
XMTA
(not a
dummy load)

Date: 7/2/97



Exit plots

76k
2715



Exit plots

Tek
2715

Date: 5/12/97

Location: WKSU-FM Transmitter site; Kent Ohio

EIA Personnel: DML, TK, RMc

WKSU Personnel:

Objective:

Station Proof

Set up and calibration of HSSC Field Test transmitting equipment

Off air test of the HSSC proponent receivers and Field Test Vehicle (FTV) test equipment.

Transmitter Site Equipment;

Exciter: Harris Digit

Power amp.:

Transmitter: Harris

Harris Digit must be reconfigured for proofing; internal stereo generator needs to be disabled.

Audio into SCA 2 input.

Measurement equipment;

Belar Wizard modulation monitor

AFM-2 modulation measurement receiver

HP 8590 spectrum analyzer

Audio Precision audio analyzer

Tektronix 335 oscilloscope (battery powered)

Measurements made at transmitter RF tap cabled into the FTV RF test bed.

RF test bed feeds spectrum analyzer and AFM-2 modulation receiver.

Audio from modulation receiver is fed to spectrum analyzer for plots of composite baseband signature.

Procedure;

1) Besel Null

13.586kHz tone at 5.115Vrms into Harris Digit results in null with modulation measured at 100.7% (using Belar Wizard)

Audio output from AFM-2 at 100%; 527.7mVrms = 0dB (using Audio Precision audio analyzer)

Note: the Belar Wizard normally indicates 0.7% with a CW signal

2) Frequency Response

Frequency response from 15kHz to 20Hz is measured and plotted using the audio precision audio analyzer.

3) Distortion

THD VS Frequency at 80% modulation is measured and plotted using the audio precision audio analyzer..

4) Set up of SCA levels

Due to the configuration of the Harris Digit, the audio Vpp reference measurement into the transmitter is not applicable and is not related to the SCA input sensitivity. After proofing, Exciter is re-configured for internal stereo generator and the SCA 2 input is recalibrated for the proper gain

A 70kHz tone from the Audio Precision audio generator is used as a SCA source for set up at 10% deviation

70kHz tone at 1.58Vpp (oscilloscope measurement at the Harris input) gives 10.7% deviation as indicated on Belar Wizard

This then becomes the Vpp reference for all SCA voltage levels as viewed on an oscilloscope

Peak-to-peak SCA voltages correlate directly with main carrier peak to peak deviation and are therefore the priority when measuring non-sinusoidal signals and groups of signals.

Reference Figures:

Modulation (%)	Deviation (kHz)	Reference (dB)	SCA Level (Vpp)	Modulation (Indicated)
10	7.5	0	1.58	10.7
7	5.25	-3.09	1.11	7.6
3	2.25	-10.45	0.47	3.7

5) Measurements

SCA Mixer ratios (relative to each other) are calibrated in the laboratory.

The overall output level of the Mixer is adjusted to the reference level found above on site, and individual SCAs are checked against the references. Recorded measurements are made with an oscilloscope for Volts peak-to-peak (Vpp) and the Belar Wizard is used for the peak deviation in percent (%).

(See updated data sheet)

Group Measurements:

Group No.	Proponent		57kHz Only		92kHz Only		Total (all SCAs)	
	(Vpp)	(%)	(Vpp)	(%)	(Vpp)	(%)	(Vpp)	(%)
1 (57+92)	Not Used		0.47	3.80	1.15	7.50	1.55	10.30
2 (DDJ)	1.58	10.70	NA		NA		1.58	10.70
3 (DDJ+)	1.58	10.70	0.47	3.70	NA		1.90	13.40
4 (MIT)	1.56	10.50	NA		NA		1.56	10.50
5 (MIT+)	1.56	10.50	0.47	3.70	NA		1.85	13.20
6 (MIT+)	1.56	10.50	0.47	3.70	1.15	7.10	2.80	19.30
7 (Seik)	1.58	11.00	NA		NA		1.58	11.00
8 (Seik+)	1.58	11.00	0.46	3.60	NA		1.80	13.10
9 (SEIK+)	1.59	11.00	0.47	3.70	1.15	7.10	2.80	19.30
10 (AUX+)	Not used							

(could remove pilot unlike at WGAH) (so seiko's % data does not include pilot here)

Calibration Check Prior to Equipment Removal

Date: 17-Jun-97

Personnel: DML, RMc, TK

Connect AFM-2 to 1V RF tap

Plot composite baseband for each group on HP spectrum analyzer

Spectrum Analyzer settings;

Amplitude: -14dBm

Frequency: 55kHz

Span: 90kHz

RBW: 1kHz

VBW: 1kHz

Digital Radio Test Laboratory

SCA Mixer ratios (relative to each other) are calibrated in the laboratory. The overall output level of the Mixer is adjusted to the reference level found above on site, and individual SCAs are checked against the references. Recorded measurements are made with an oscilloscope for Volts peak-to-peak (Vpp) and the Belar Wizard is used for the peak deviation in percent (%).

Group Measurements:

Group No.	Proponent		57kHz Only		92kHz Only		Total (all SCAs)	
	(Vpp)	(%)	(Vpp)	(%)	(Vpp)	(%)	(Vpp)	(%)
1 (57+92)	Not Used		0.47	3.80	1.15	7.50	1.55	10.30
2 (DDJ)	1.58	10.70	NA		NA		1.58	10.70
3 (DDJ+)	1.58	10.70	0.47	3.70	NA		1.90	13.40
4 (MIT)	1.56	10.50	NA		NA		1.56	10.50
5 (MIT+)	1.56	10.50	0.47	3.70	NA		1.85	13.20
6 (MIT+)	1.56	10.50	0.47	3.70	1.15	7.10	2.80	19.30
7 (Seik)	1.58	11.00	NA		NA		1.58	11.00
8 (Seik+)	1.58	11.00	0.46	3.60	NA		1.80	13.10
9 (SEIK+)	1.59	11.00	0.47	3.70	1.15	7.10	2.80	19.30
10 (AUX+)	Not used							

Pilot was not on the carrier for any of the above measurements.

Accuracy of injection levels is within .25 dB based upon measurements made in Appendix B.

Calibration Check Prior to Equipment Removal

Date: 17-Jun-97
Personnel: DML, RMc, TK

Connect AFM-2 to 1V RF tap
Plot composite baseband for each group on HP spectrum analyzer

Spectrum Analyzer settings;

Amplitude: -14dBm
Frequency: 55kHz
Span: 90kHz
RBW: 1kHz
VBW: 1kHz

Digital Radio Test Laboratory

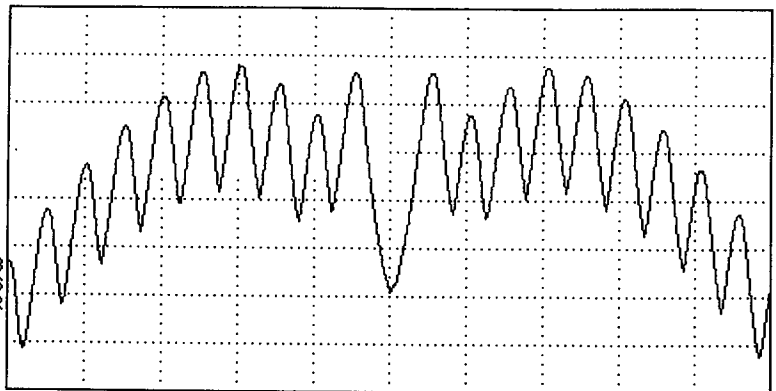
Page	Plot	Description
34		Bessel Null of RF Carrier Frequency at WKSU 89.7 MHz
35	a	RBDS with analog 92kHz subcarrier baseband from AFM-2 directly connected to RF tap.
	b	Digital DJ proponent only baseband from AFM-2 directly connected to RF tap.
	c	Digital DJ with RBDS baseband from AFM-2 directly connected to RF tap.
36	a	Mitre proponent only baseband from AFM-2 directly connected to RF tap.
	b	Mitre with RBDS baseband from AFM-2 directly connected to RF tap.
	c	Mitre with RBDS and analog 92 kHz subcarrier baseband from AFM-2 directly connected to RF tap.
37	a	Seiko proponent only baseband from AFM-2 directly connected to RF tap.
	b	Seiko with RBDS baseband from AFM-2 directly connected to RF tap.
	c	Seiko with RBDS and analog 92 kHz subcarrier baseband from AFM-2 directly connected to RF tap.
39	a	RBDS with analog 92kHz subcarrier baseband from AFM-2 directly connected to RF tap.
	b	Digital DJ proponent only baseband from AFM-2 directly connected to RF tap.
	c	Digital DJ with RBDS baseband from AFM-2 directly connected to RF tap.
40	a	Mitre proponent only baseband from AFM-2 directly connected to RF tap.
	b	Mitre with RBDS baseband from AFM-2 directly connected to RF tap.
	c	Mitre with RBDS and analog 92 kHz subcarrier baseband from AFM-2 directly connected to RF tap.
41	a	Seiko proponent only baseband from AFM-2 directly connected to RF tap.
	b	Seiko with RBDS baseband from AFM-2 directly connected to RF tap.
	c	Seiko with RBDS and analog 92 kHz subcarrier baseband from AFM-2 directly connected to RF tap.
42		Baseband from AFM-2 directly connected to RF tap without subcarriers.

Note: Pages 34-37 were plotted when equipment was installed and pages 39-42 were plotted when equipment was removed

00:31:30 MAY 12, 1997
EIA Bessel Null
REF 20.0 dBm AT 30 dB

PEAK
LOG
10
dB/

WA SB
SC FS
CORR



CENTER 89.7000 MHz SPAN 272.0 kHz
RES BW 3.0 kHz VBW 3 kHz SWP 100 msec

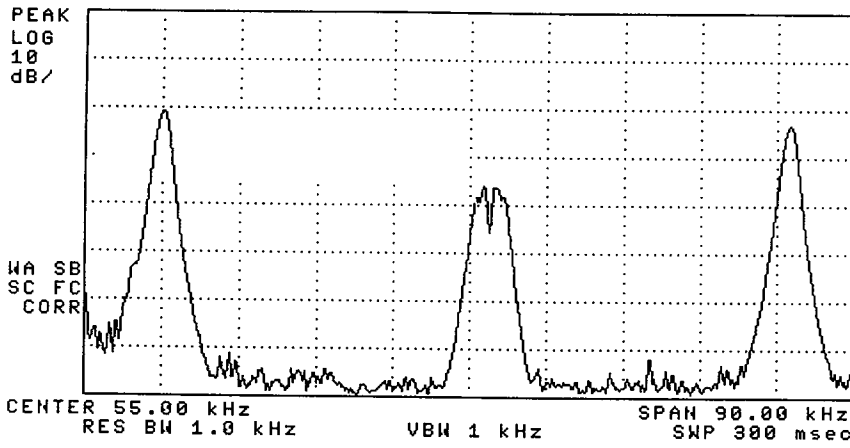
REF LVL

ATTEN
AUTO MAN

SCALE
LOG LIN

More
1 of 3
L

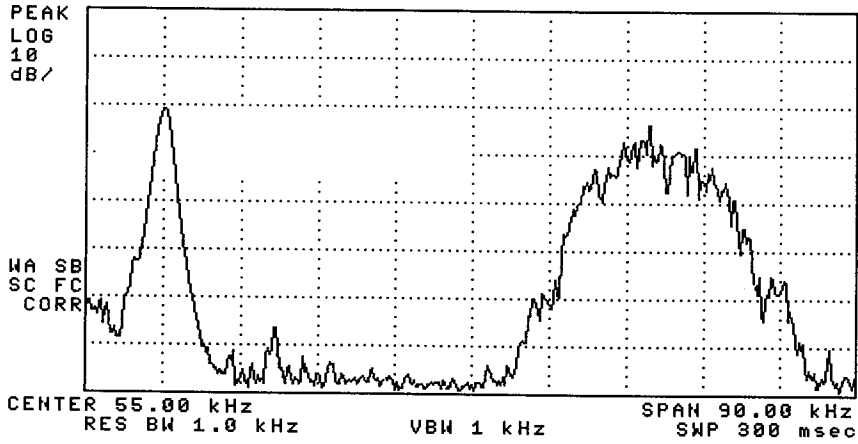
03:11:09 MAY 12, 1997
EIA Group 1
REF -14.0 dBm AT 10 dB



MARKER NORMAL
 MARKER Δ
 MARKER AMPTD
 SELECT 1 2 3 4
 MARKER 1 ON OFF
 More 1 of 2
 L

20.1
 ↑
 Relat
 measurements

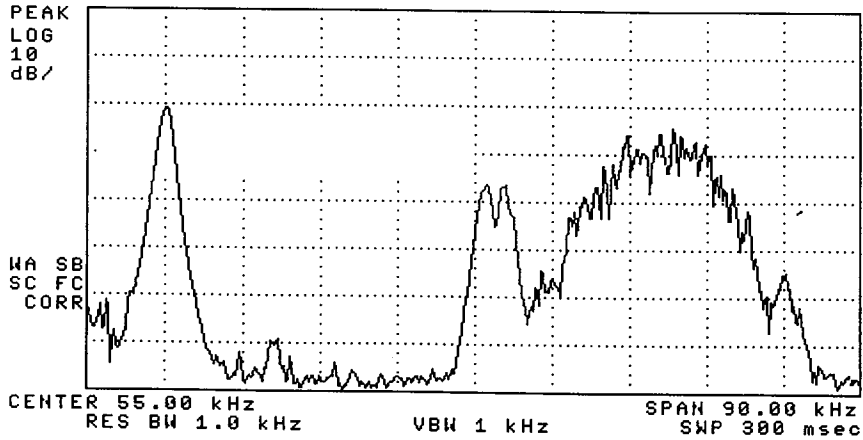
03:15:48 MAY 12, 1997
EIA Group 2
REF -14.0 dBm AT 10 dB



MARKER NORMAL
 MARKER Δ
 MARKER AMPTD
 SELECT 1 2 3 4
 MARKER 1 ON OFF
 More 1 of 2
 L

20.1

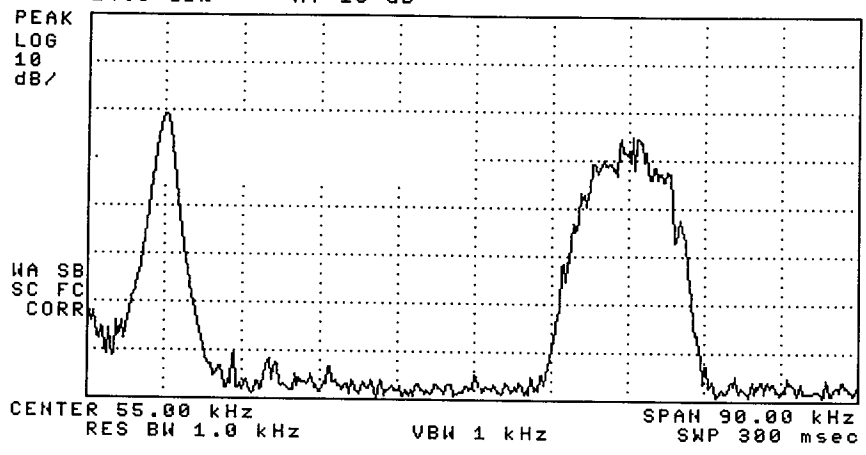
03:16:26 MAY 12, 1997
EIA Group 3
REF -14.0 dBm AT 10 dB



MARKER NORMAL
 MARKER Δ
 MARKER AMPTD
 SELECT 1 2 3 4
 MARKER 1 ON OFF
 More 1 of 2
 L

23.2

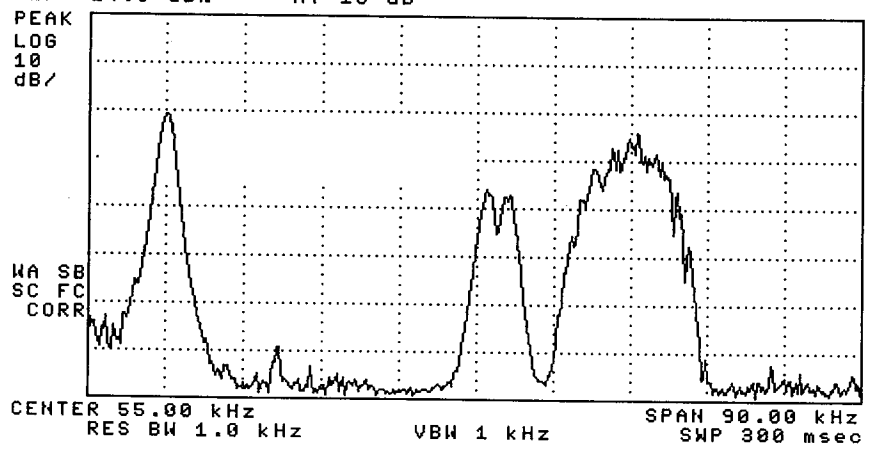
03:19:01 MAY 12, 1997
EIA Group 4
REF -14.0 dBm AT 10 dB



MARKER NORMAL
MARKER Δ
MARKER AMPTD
SELECT 1 2 3 4
MARKER 1 ON OFF
More 1 of 2
L

20.2

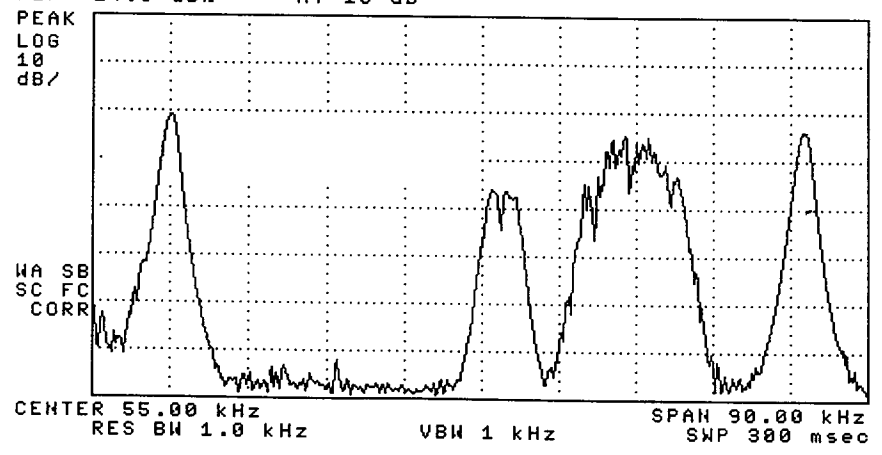
03:19:36 MAY 12, 1997
EIA Group 5
REF -14.0 dBm AT 10 dB



MARKER NORMAL
MARKER Δ
MARKER AMPTD
SELECT 1 2 3 4
MARKER 1 ON OFF
More 1 of 2
L

22.8

03:19:57 MAY 12, 1997
EIA Group 6
REF -14.0 dBm AT 10 dB



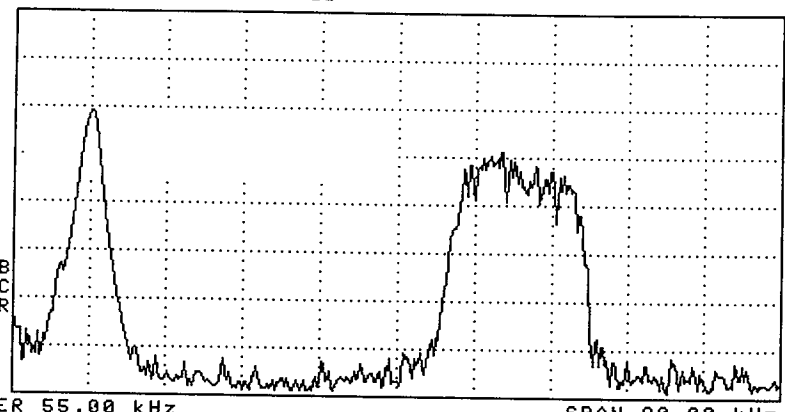
MARKER NORMAL
MARKER Δ
MARKER AMPTD
SELECT 1 2 3 4
MARKER 1 ON OFF
More 1 of 2
L

29.1

03:22:02 MAY 12, 1997
EIA Group 7
REF -14.0 dBm AT 10 dB

PEAK
LOG
10
dB/

WA SB
SC FC
CORR



CENTER 55.00 kHz
RES BW 1.0 kHz VBW 1 kHz SPAN 90.00 kHz
SWP 300 msec

MARKER
NORMAL

MARKER
Δ

MARKER
AMPTD

SELECT
1 2 3 4

MARKER 1
ON OFF

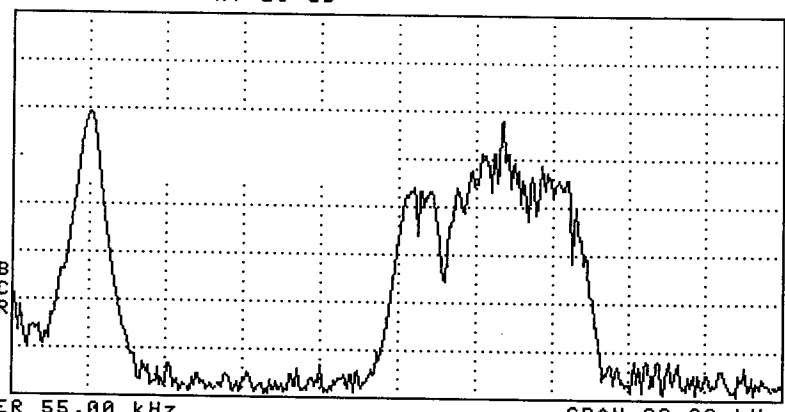
More
1 of 2
L

20.3

03:22:27 MAY 12, 1997
EIA Group 8
REF -14.0 dBm AT 10 dB

PEAK
LOG
10
dB/

WA SB
SC FC
CORR



CENTER 55.00 kHz
RES BW 1.0 kHz VBW 1 kHz SPAN 90.00 kHz
SWP 300 msec

MARKER
NORMAL

MARKER
Δ

MARKER
AMPTD

SELECT
1 2 3 4

MARKER 1
ON OFF

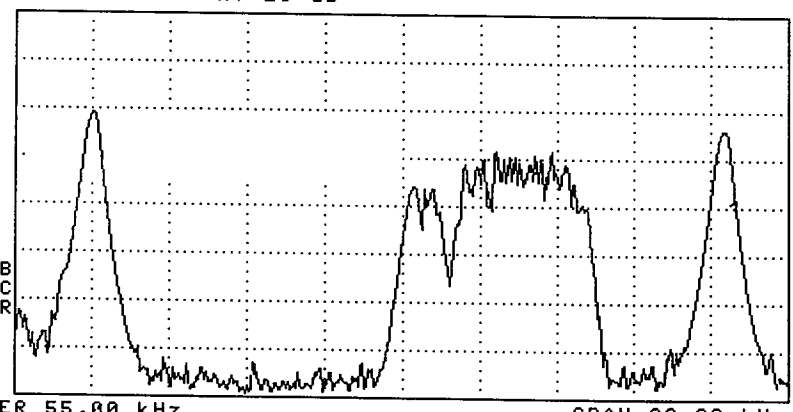
More
1 of 2
L

22.8

03:22:50 MAY 12, 1997
EIA Group 9
REF -14.0 dBm AT 10 dB

PEAK
LOG
10
dB/

WA SB
SC FC
CORR



CENTER 55.00 kHz
RES BW 1.0 kHz VBW 1 kHz SPAN 90.00 kHz
SWP 300 msec

MARKER
NORMAL

MARKER
Δ

MARKER
AMPTD

SELECT
1 2 3 4

MARKER 1
ON OFF

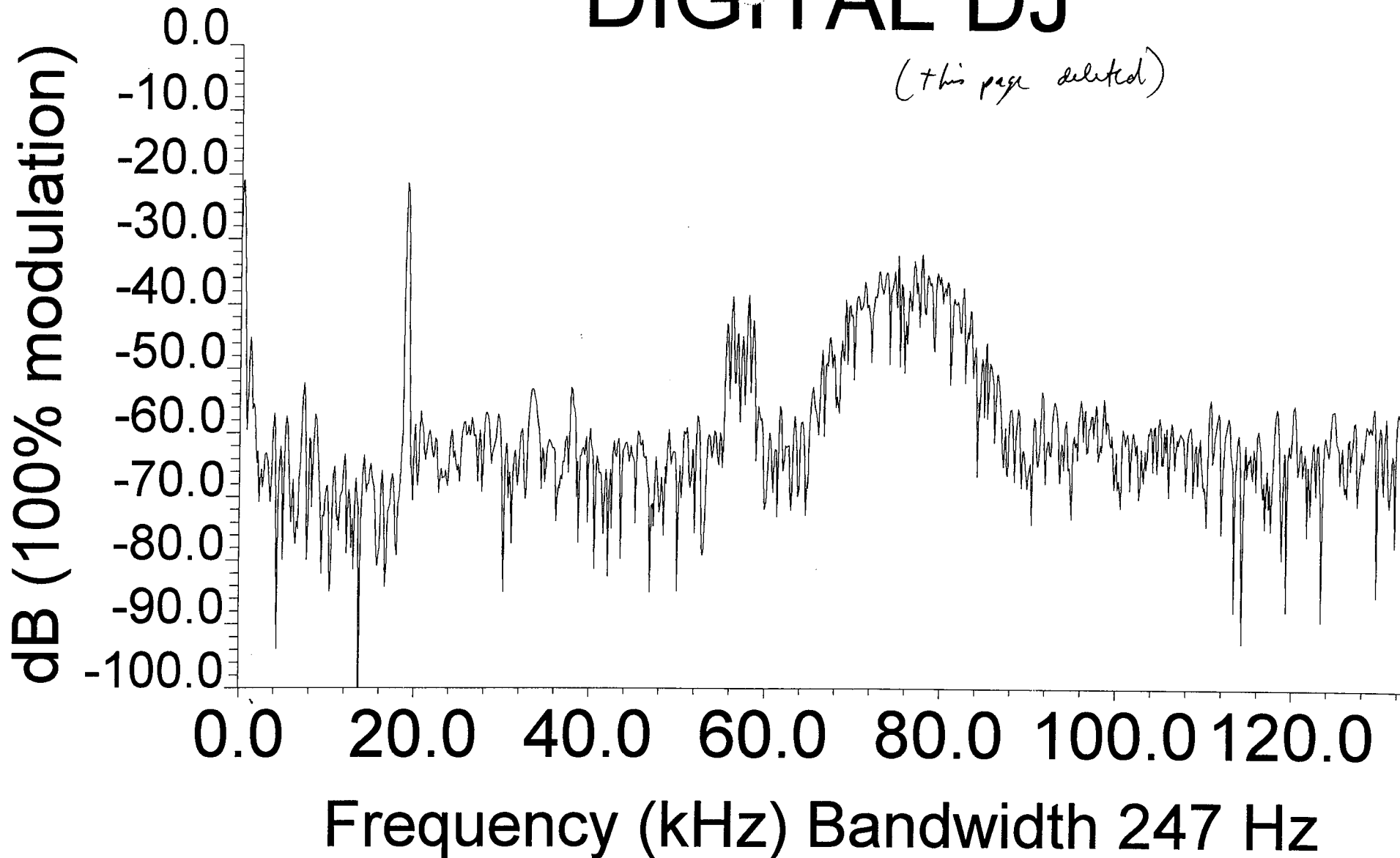
More
1 of 2
L

29.1

(This page intentionally left blank)
(Replaces pp. 38a-c in original release of report)

DIGITAL DJ

(this page deleted)



(From sico receiver utility)

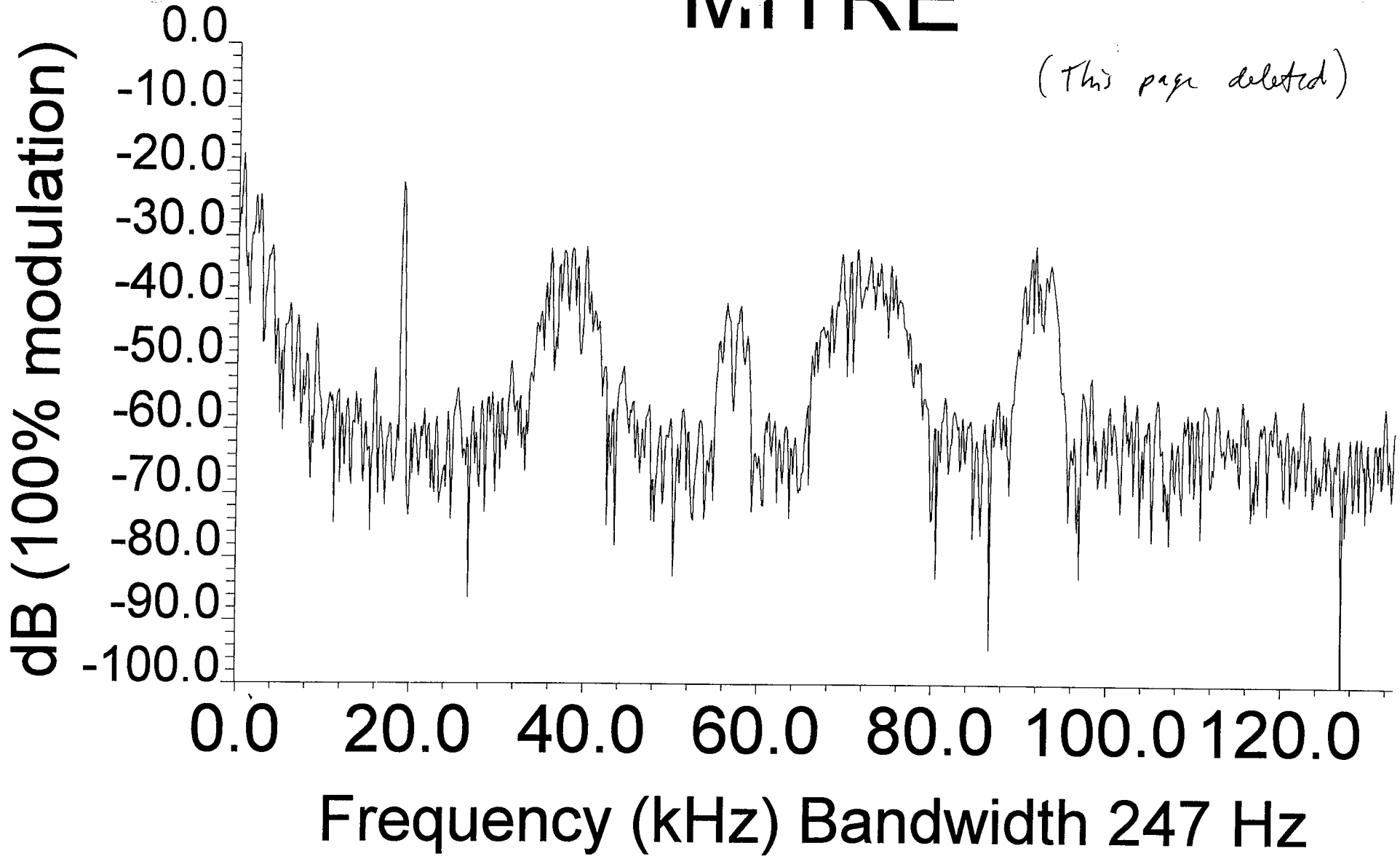
RF input
-66.3 dBm

Frequency
89.7 WKSU

Attenuator
0 dB

MITRE

(This page deleted)



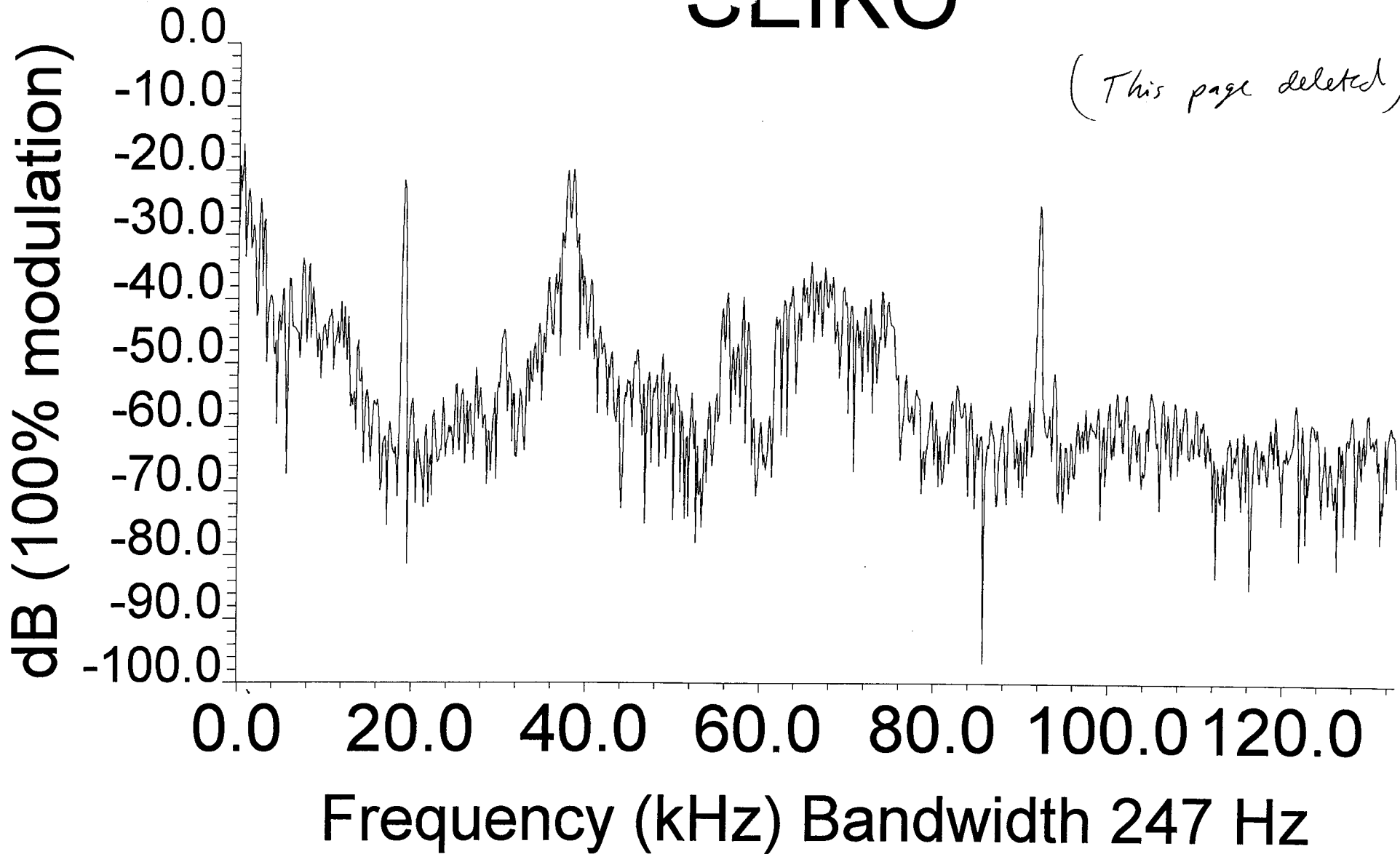
RF input
-66.3 dBm

Frequency
89.7 WKSU

Attenuator
0 dB

SEIKO

(This page deleted)



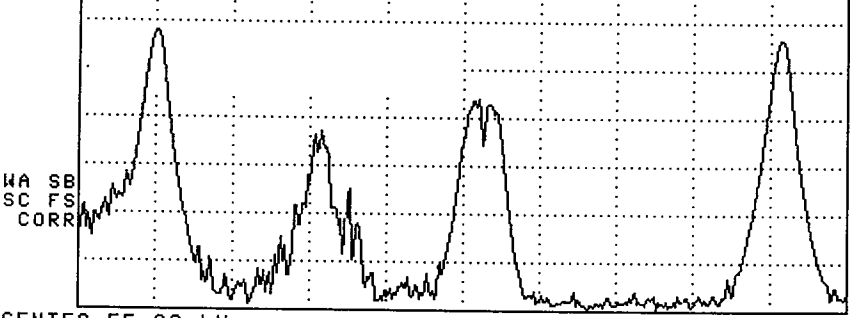
RF input
-66.1 dBm

Frequency
89.7 WKSU

Attenuator
0 dB

18:30:09 JUN 17, 1997
NRSC Group 1
REF -14.0 dBn AT 10 dB

PEAK
LOG
10
dB/



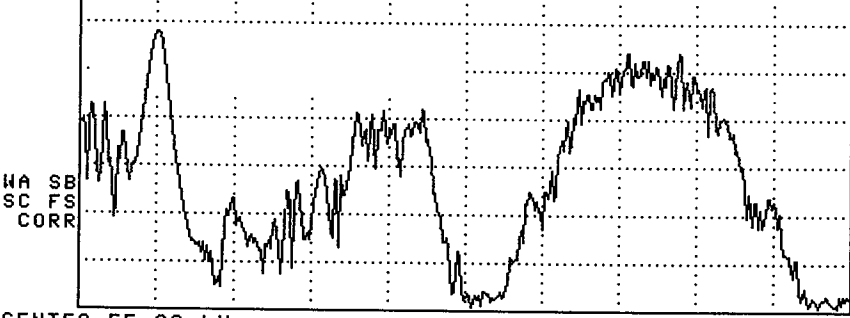
CENTER 55.00 kHz #RES BW 1.0 kHz VBW 1 kHz SPAN 90.00 kHz SWP 300 msec

MARKER NORMAL
MARKER Δ
MARKER AMPTD
SELECT 1 2 3 4
MARKER 1 ON OFF
More 1 of 2

Exit plots

18:31:44 JUN 17, 1997
NRSC Group 2
REF -14.0 dBn AT 10 dB

PEAK
LOG
10
dB/

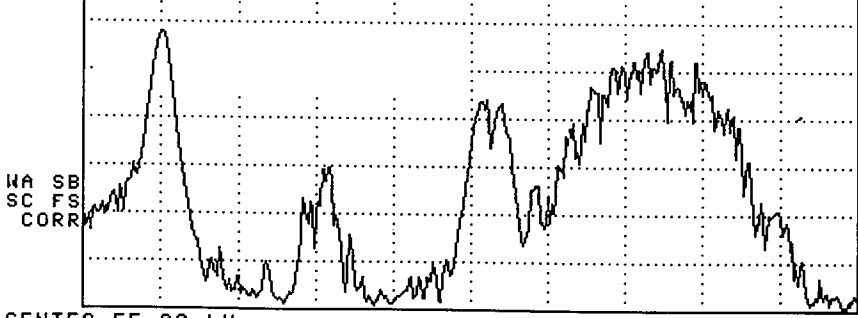


CENTER 55.00 kHz #RES BW 1.0 kHz VBW 1 kHz SPAN 90.00 kHz SWP 300 msec

MARKER NORMAL
MARKER Δ
MARKER AMPTD
SELECT 1 2 3 4
MARKER 1 ON OFF
More 1 of 2

18:32:14 JUN 17, 1997
NRSC Group 3
REF -14.0 dBn AT 10 dB

PEAK
LOG
10
dB/



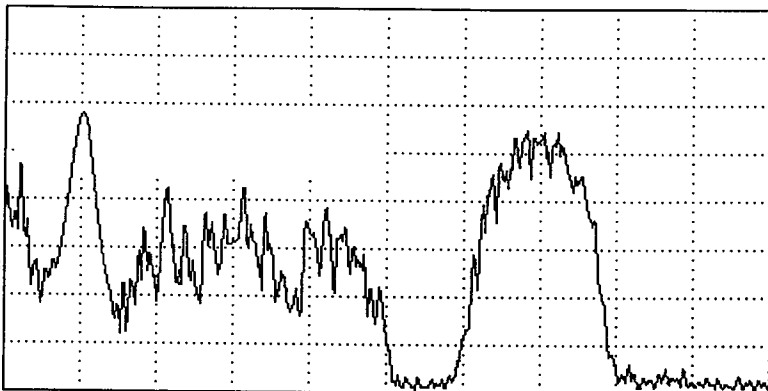
CENTER 55.00 kHz #RES BW 1.0 kHz VBW 1 kHz SPAN 90.00 kHz SWP 300 msec

MARKER NORMAL
MARKER Δ
MARKER AMPTD
SELECT 1 2 3 4
MARKER 1 ON OFF
More 1 of 2

18:35:05 JUN 17, 1997
NRSC Group 4
REF -14.0 dBm AT 10 dB

PEAK
LOG
10
dB/

WA SB
SC FS
CORR



CENTER 55.00 kHz #RES BW 1.0 kHz VBW 1 kHz SPAN 90.00 kHz SWP 300 msec

MARKER NORMAL

MARKER Δ

MARKER AMPTD

SELECT 1 2 3 4

MARKER 1 ON OFF

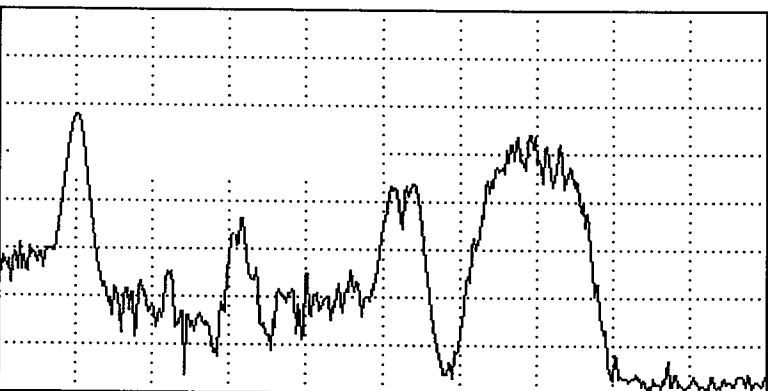
More 1 of 2

Exit plots

18:36:17 JUN 17, 1997
NRSC Group 5
REF -14.0 dBm AT 10 dB

PEAK
LOG
10
dB/

WA SB
SC FS
CORR



CENTER 55.00 kHz #RES BW 1.0 kHz VBW 1 kHz SPAN 90.00 kHz SWP 300 msec

MARKER NORMAL

MARKER Δ

MARKER AMPTD

SELECT 1 2 3 4

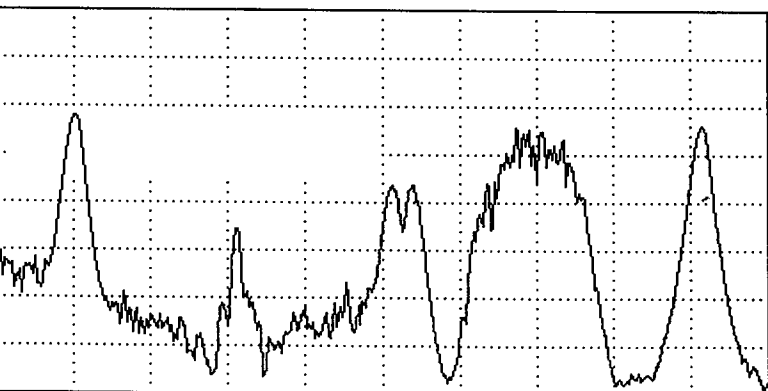
MARKER 1 ON OFF

More 1 of 2

18:37:17 JUN 17, 1997
NRSC Group 6
REF -14.0 dBm AT 10 dB

PEAK
LOG
10
dB/

WA SB
SC FS
CORR



CENTER 55.00 kHz #RES BW 1.0 kHz VBW 1 kHz SPAN 90.00 kHz SWP 300 msec

MARKER NORMAL

MARKER Δ

MARKER AMPTD

SELECT 1 2 3 4

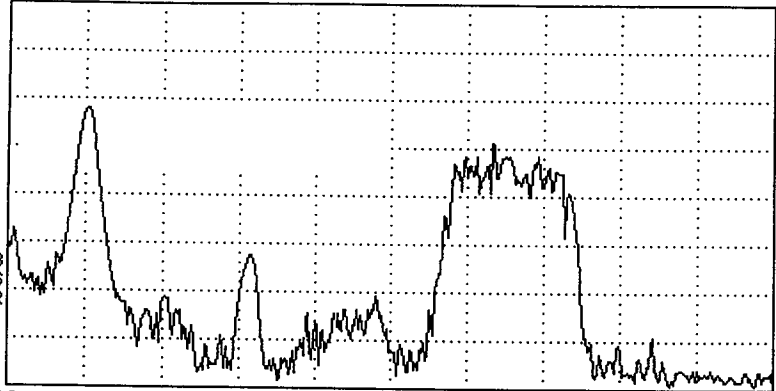
MARKER 1 ON OFF

More 1 of 2

18:38:59 JUN 17, 1997
NRSC Group 7
REF -14.0 dBn AT 10 dB

PEAK
LOG
10
dB/

WA SB
SC FS
CORR



CENTER 55.00 kHz
#RES BW 1.0 kHz VBW 1 kHz SPAN 90.00 kHz
SWP 300 msec

MARKER
NORMAL

MARKER
Δ

MARKER
AMPTD

SELECT
1 2 3 4

MARKER 1
ON OFF

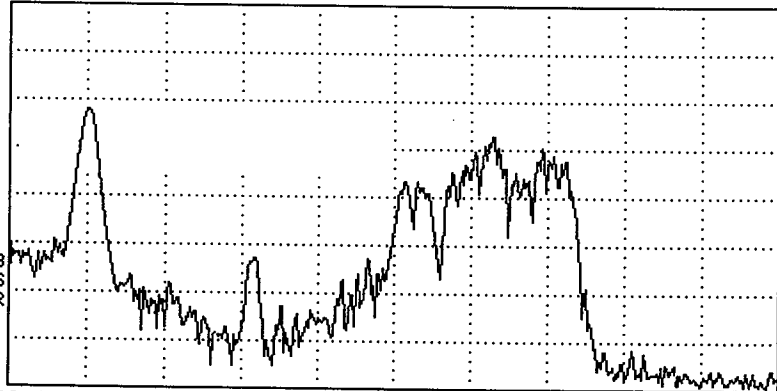
More
1 of 2

Exit plots

18:39:30 JUN 17, 1997
NRSC Group 8
REF -14.0 dBn AT 10 dB

PEAK
LOG
10
dB/

WA SB
SC FS
CORR



CENTER 55.00 kHz
#RES BW 1.0 kHz VBW 1 kHz SPAN 90.00 kHz
SWP 300 msec

MARKER
NORMAL

MARKER
Δ

MARKER
AMPTD

SELECT
1 2 3 4

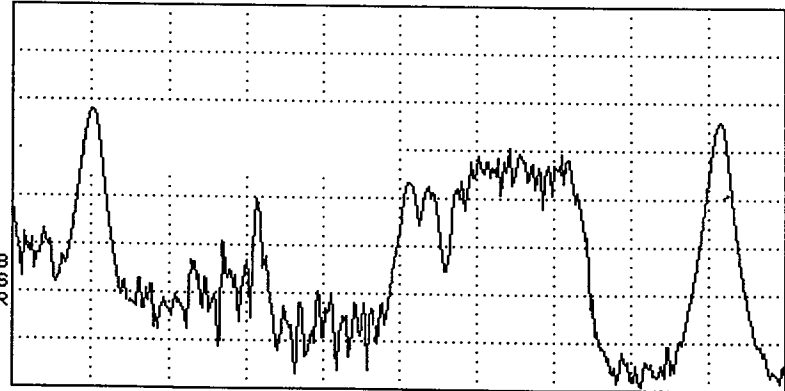
MARKER 1
ON OFF

More
1 of 2

18:39:53 JUN 17, 1997
NRSC Group 9
REF -14.0 dBn AT 10 dB

PEAK
LOG
10
dB/

WA SB
SC FS
CORR



CENTER 55.00 kHz
#RES BW 1.0 kHz VBW 1 kHz SPAN 90.00 kHz
SWP 300 msec

MARKER
NORMAL

MARKER
Δ

MARKER
AMPTD

SELECT
1 2 3 4

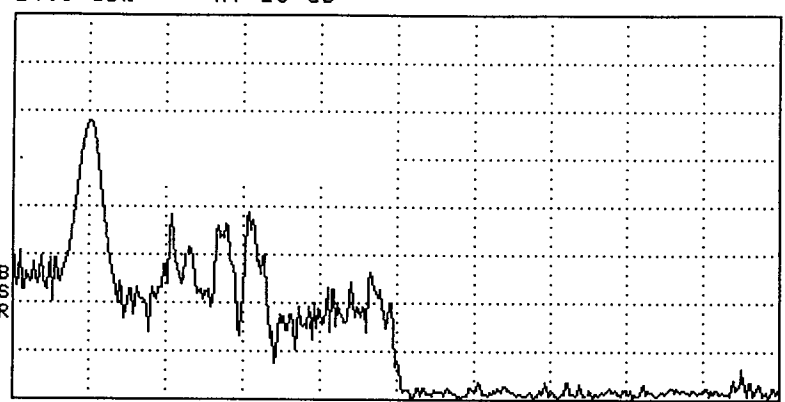
MARKER 1
ON OFF

More
1 of 2

18:41:41 JUN 17, 1997
NRSC Group 0
REF -14.0 dBm AT 10 dB

PEAK
LOG
10
dB/

WA SB
SC FS
CORR

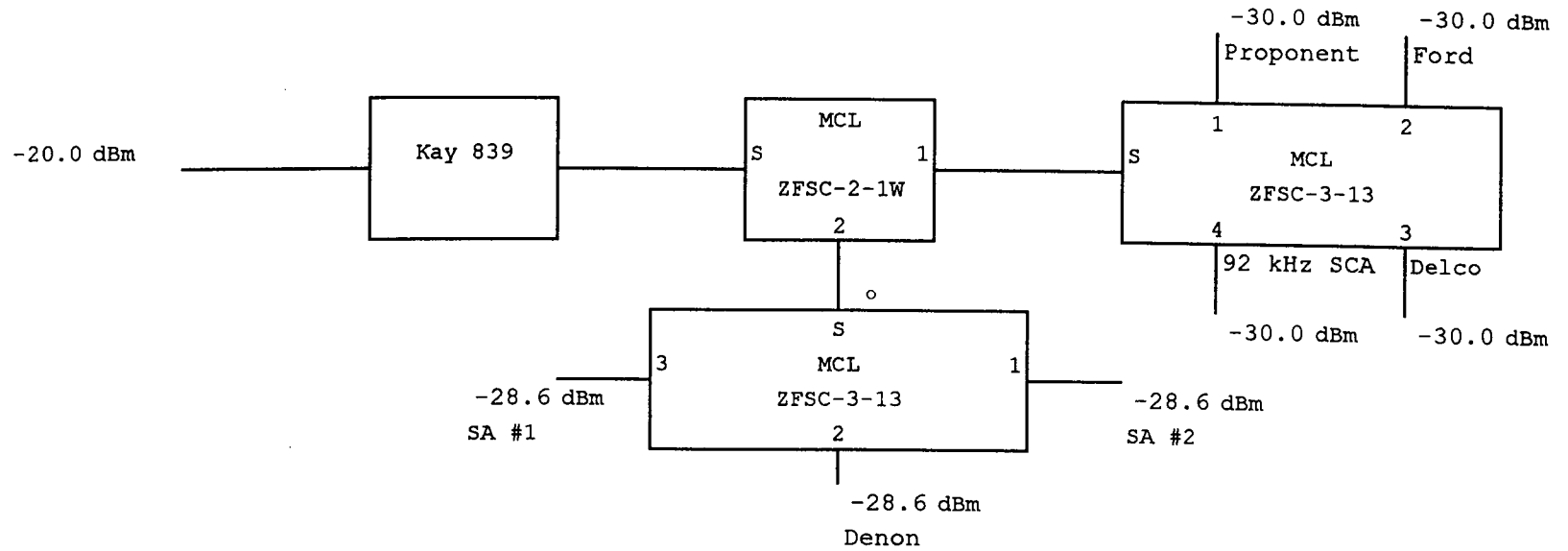


Exit plots.

↑
Rapid fall off is
due to STL (AES/EBU)
and digit exciter.

5. Test Van Hardware and Level Calibration

- 5.1 RF Loss
- 5.2 RF Level to 12 ADC
- 5.3 Computer Interface



SA#2 -40.26 dBm
 Proponent Tap
 Cable
 N-BNC Adapter -41.52 dBm

RF Level at Proponent Receiver is 1.26 dB lower than level at Spectrum Analyzer #2.

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Figures 1 and 2 and the following relationships are established using spectrum analyzer settings as follow: Resolution BW 100 kHz, Span 0 Hz and Sweep Time 20us.

The Analog to Digital Converter has 12 bit resolution and 10 V full scale range.

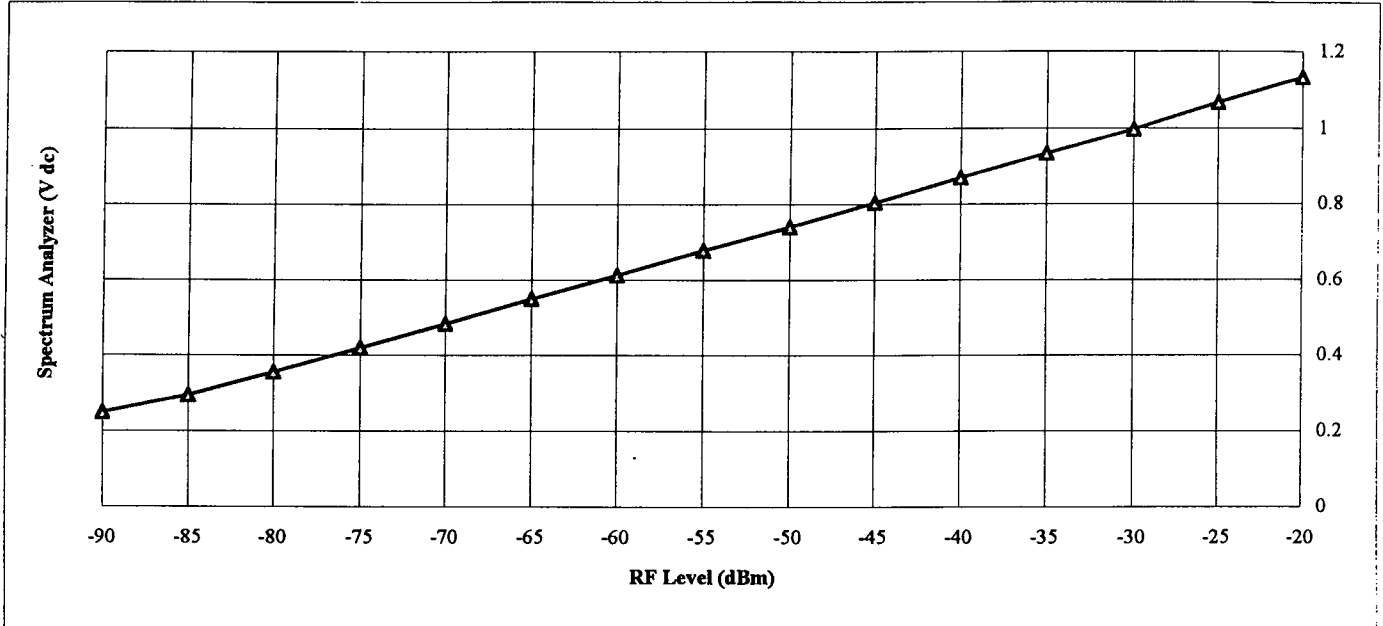
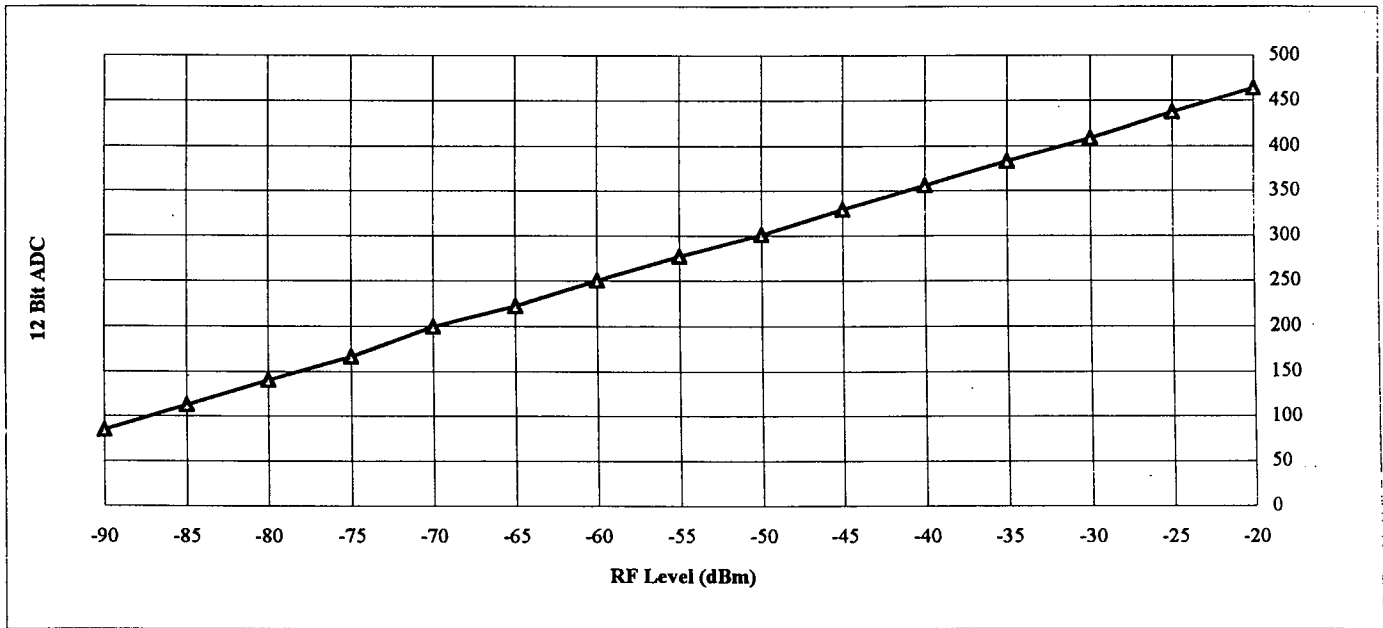


Figure 1: DC Voltage as a function of RF Level.



Recorded on PC

Figure 2: 12 bit ADC as a function of RF Level

Relationships

$$\frac{\text{Integer Value}}{4096} = \frac{\text{DC Voltage}}{10 \text{ V}}$$

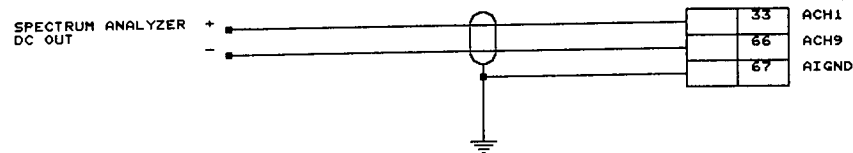
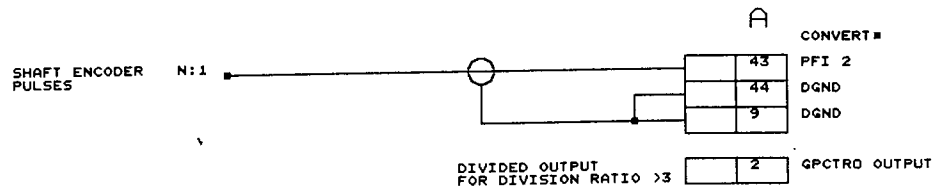
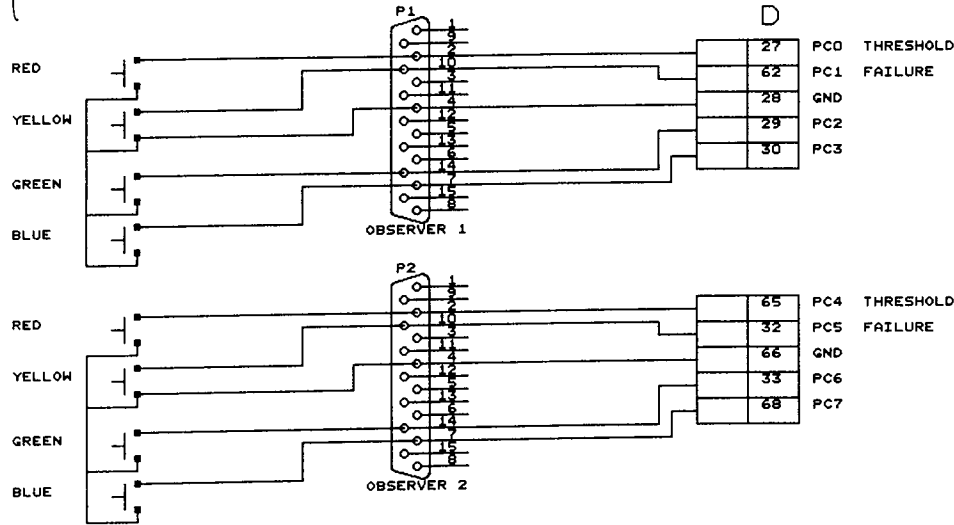
$$\text{RF Level} = \text{Integer Value} \cdot \frac{65}{350} - 106 \text{ dBm.}$$

FIELD TEST VEHICLE COMPUTER INTERFACE

one button used to indicate landmarks.

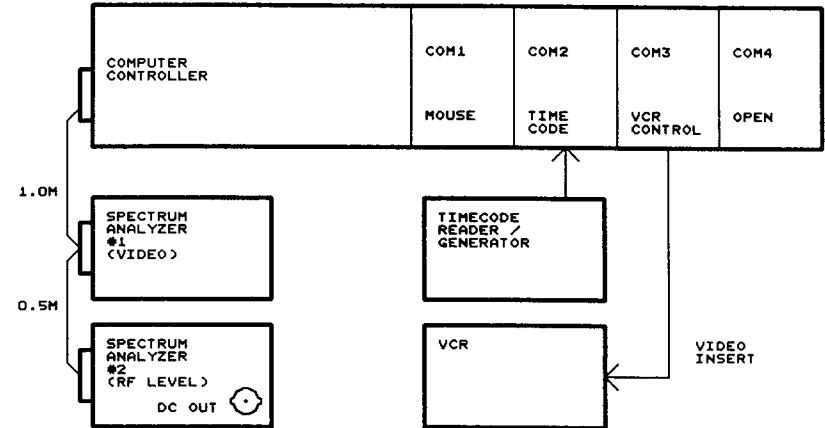
Audio Events or Land Mark Indexing

AT-MIO-16DE-10



GPIB

RS-232



NOTES:

Proponent Utility:
Computer synchronized to SMPTE Time Code.
Provides Time Stamps, BER, 20 byte and 220 byte Message Error rate data.

Digital Radio Test Laboratory
NASA Lewis Research Center
Communications System Branch
21000 Brookpark Road MS 54-2
Cleveland, OH 44135

Title		
Field Test Vehicle Interface		
Size	Document Number	REV
A	H560100.SCH	B
Date:	August 4, 1987	Sheet 1 of 1

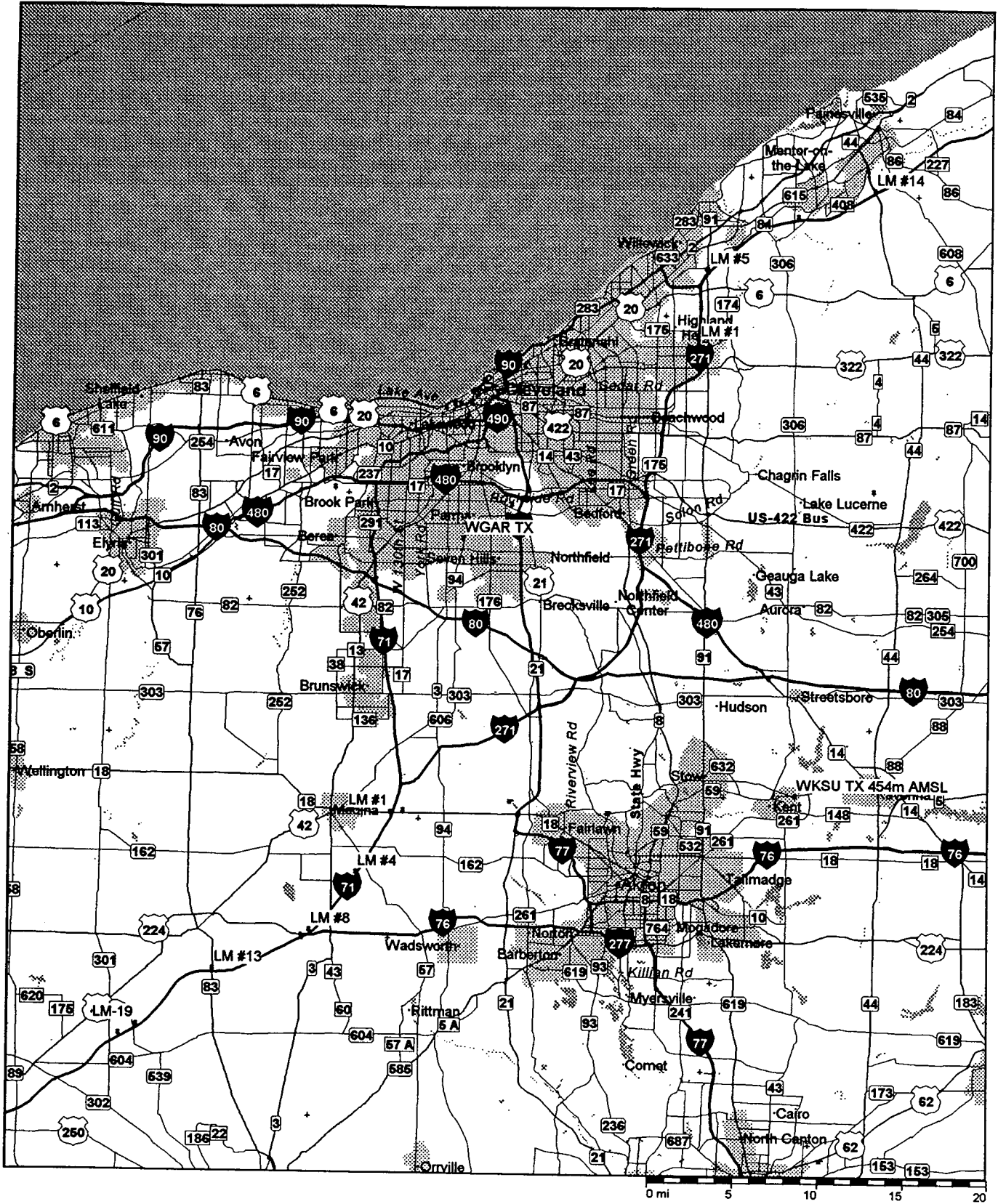
6. Test Route Maps

measured in map program

(this page revised)

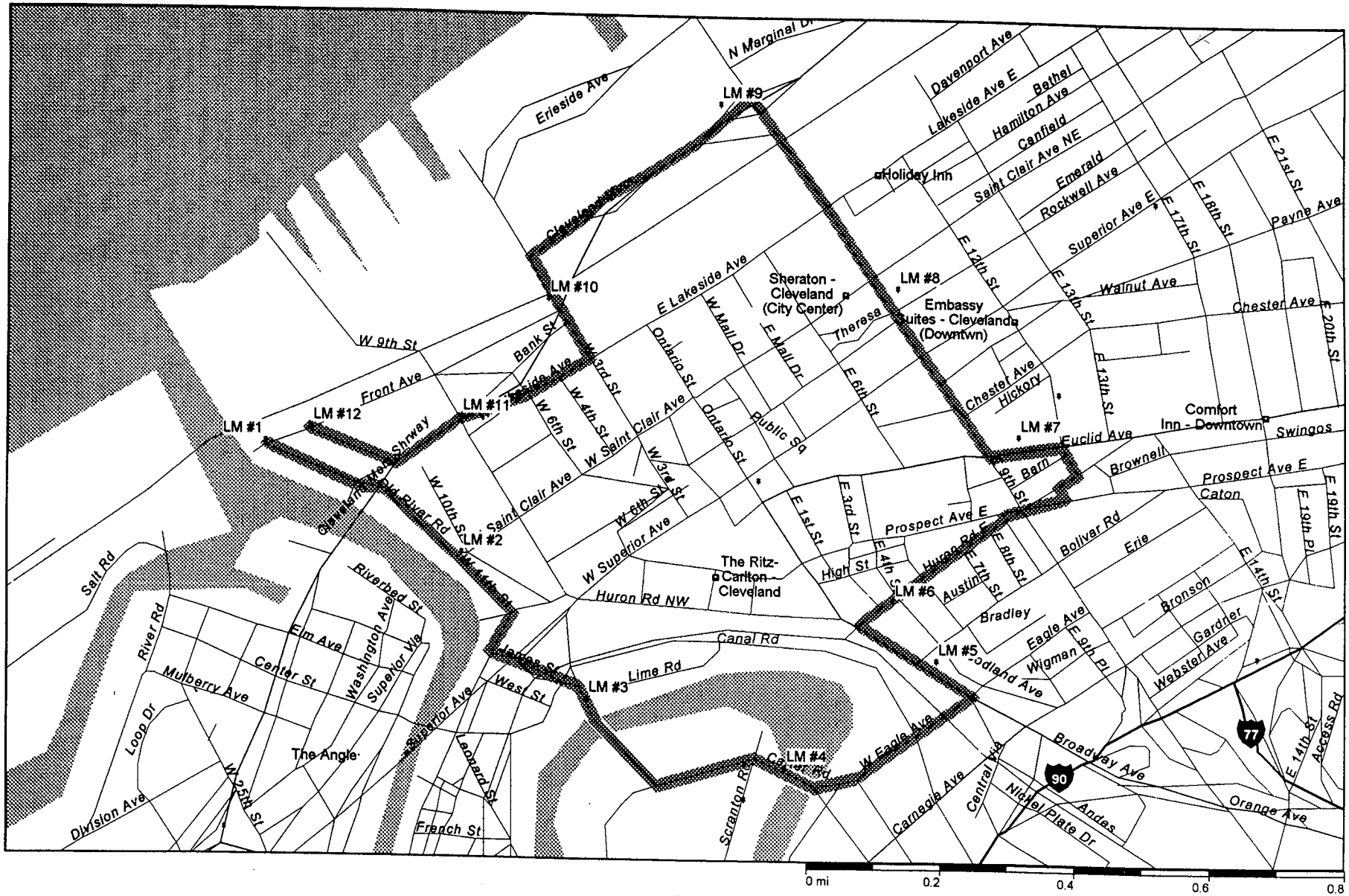
HSSC Test Route Description				
Map	Route	Route Length	Distance to Transmitter	Description
M-2	NE Ohio Test Area	NA	NA	Routes 1,2,& 3 are all in the central Cleveland area. The NE route #4 starts on I 271 and ends on I 90, and the SW route #5 is all on I 71.
M-3 M-4	Route 1 WKSU OK City <i>WKSU OK</i>	3.9 mi	30.5 miles (from route center)	This route circles the tall buildings in downtown Cleveland. This route starts in the Cuyahoga River Valley just south of Lake Erie. Between LM 4 and LM-5 the route leaves the river valley. From LM 5 through LM 6 the route goes through the city canyons created by the tall building.
M-4 M-3	Route 1 WGAR City <i>WKSU OK</i>	4.0 mi	9.0 miles (from route center)	Because of a change in weekend versus weekday traffic patterns, it was necessary to make a change at the eastern extremity of the route for the WGAR tests.
M-5	Route 2 Urban slow	3.4 mi	WKSU LM- 1 31.0 mi LM- 8 30.0 mi WGAR LM- 1 8.0 mi LM- 8 9.5 mi	This route starts on the near west side of Cleveland, goes through the center of the downtown area, and ends on the near east side.
M-6	Route 3 Urban fast	7.3 mi	WKSU LM- 3 30.8 mi LM 7 29.8 mi WGAR LM- 3 10.7 mi LM- 7 9.5 mi	This route transmission path has a combination of urban fast and terrain obstructed multipath. The route circles the city downtown area on expressways.
M-7	Route 4 Rural fast with terrain obstructions	15.7 mi	WKSU LM- 1 28.0 mi LM-14 36.0 mi WGAR LM- 1 18.0 mi LM-14 32.0 mi	This test route is entirely on interstate highways. The landmarks are highway mile markers. Not all mile markers were used. The end of the route has terrain obstructions.
M-8	Route 5 Rural fast	21.0 mi	WKSU LM- 1 24.0 mi LM-19 41.0 mi WGAR LM- 1 17.0 mi LM-19 37.0 mi	This test route is entirely on interstate highways. The landmarks are highway mile markers. Not all mile markers were used. This route has slow rolling hills.

HSSC Test Route Description				
Map	Route	Route Length	Distance to Transmitter	Description
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M-6	Route 3 Urban fast	7.3 mi	WKSU LM- 3 30.8 mi LM 7 29.8 mi WGAR LM- 3 10.7 mi LM- 7 9.5 mi	This route transmission path has a combination of urban fast and terrain obstructed multipath. The route circles the city downtown area on expressways.
M-7	Route 4 Rural fast with terrain obstructions	15.7 mi	WKSU LM- 1 28.0 mi LM-14 36.0 mi WGAR LM- 1 18.0 mi LM-14 32.0 mi	This test route is entirely on interstate highways. The landmarks are highway mile markers. Not all mile markers were used. The end of the route has terrain obstructions.
M-8	Route 5 Rural fast	21.0 mi	WKSU LM- 1 24.0 mi LM-19 41.0 mi WGAR LM- 1 17.0 mi LM-19 37.0 mi	This test route is entirely on interstate highways. The landmarks are highway mile markers. Not all mile markers were used. This route has slow rolling hills.



MICROSOFT CORPORATION
Streets Plus

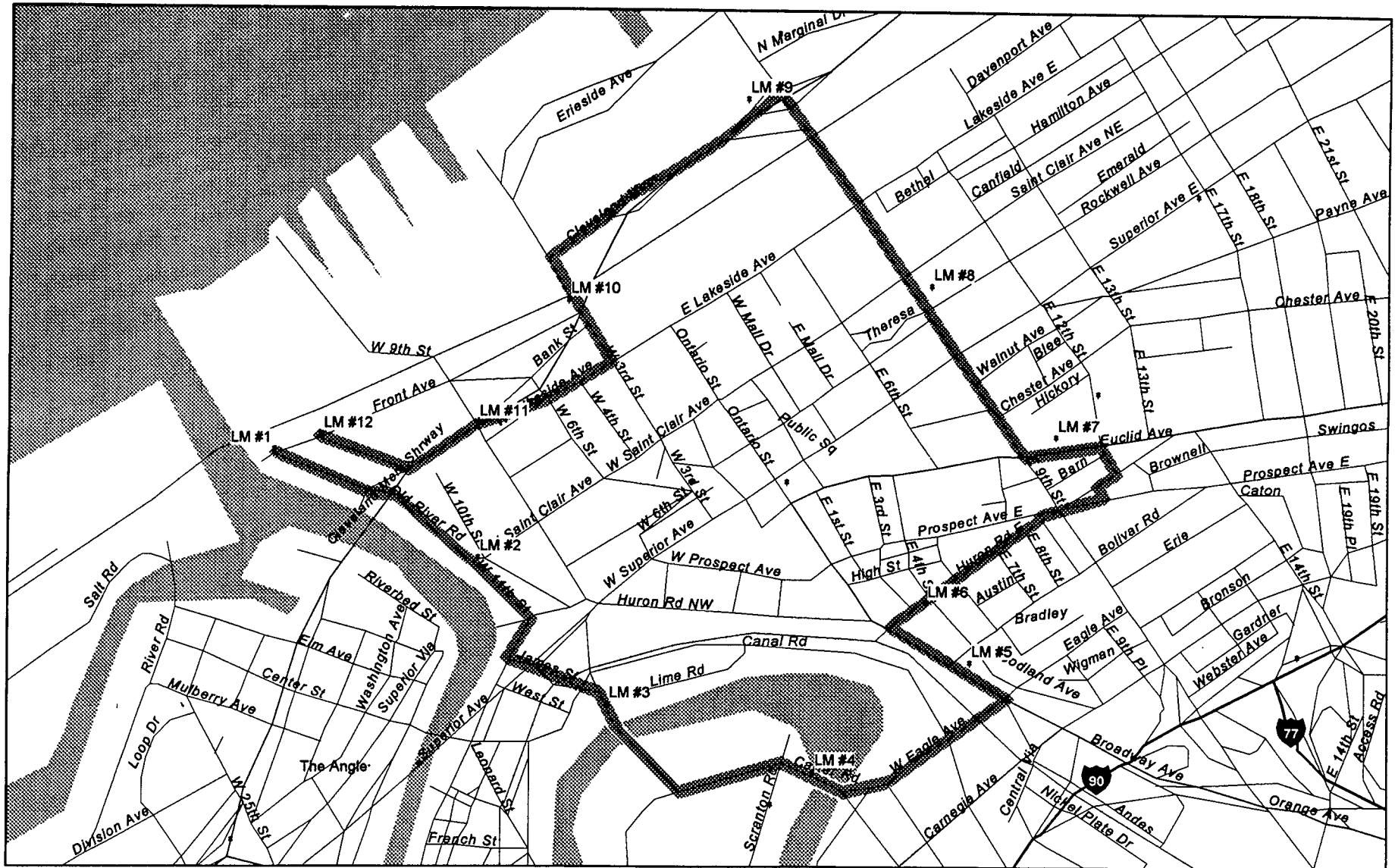
HSSC Field Test Route Area
 Map M-2



MICROSOFT CORPORATION
Streets Plus

HSSC Field Test Route #1 (WKSU)
 Map M-3

50a

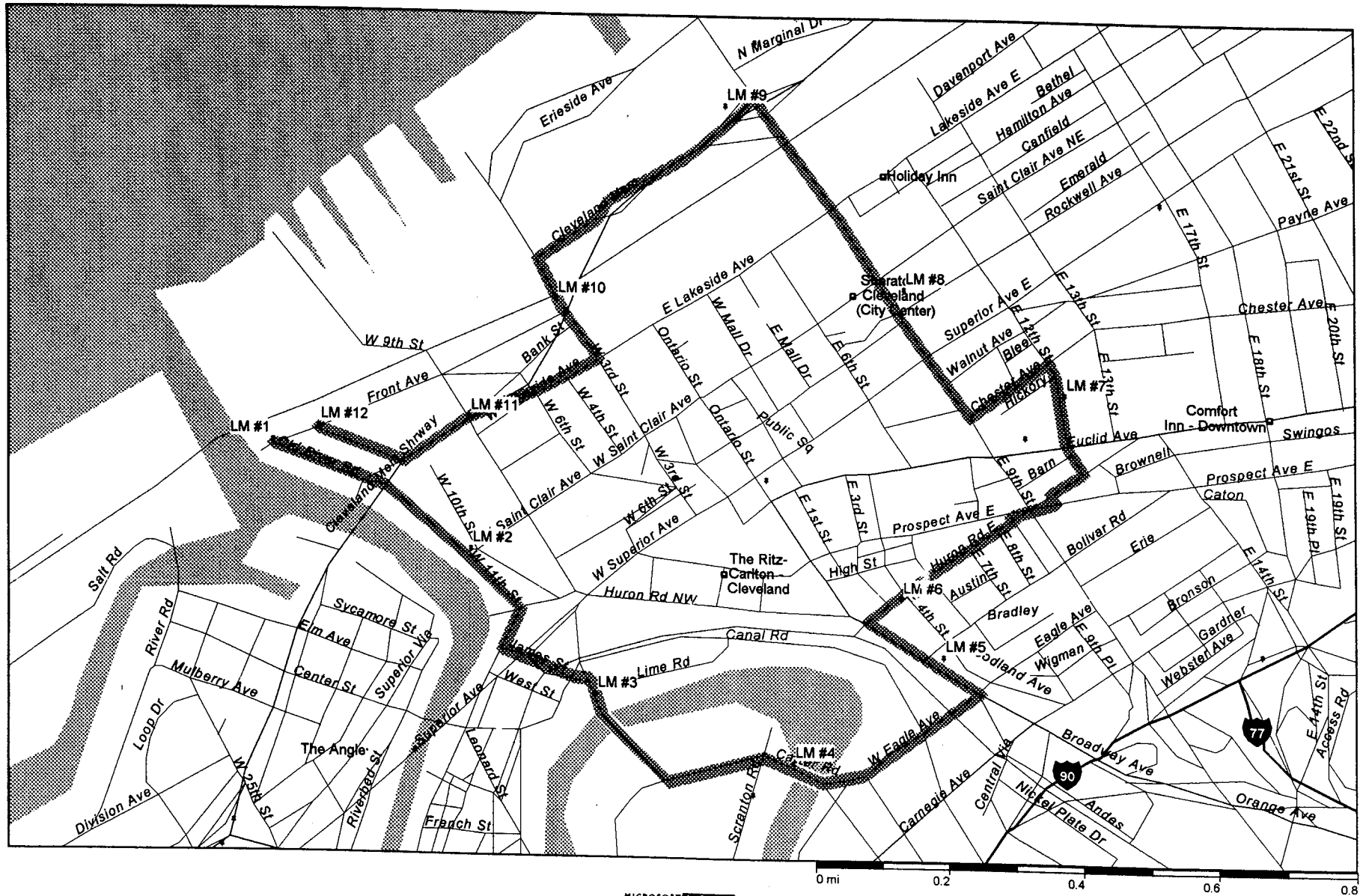


MICROSOFT ~~STREETMAP~~
Streets Plus

HSSC Field Test Route #1 (WGAR)
 Map M-4

WKSU

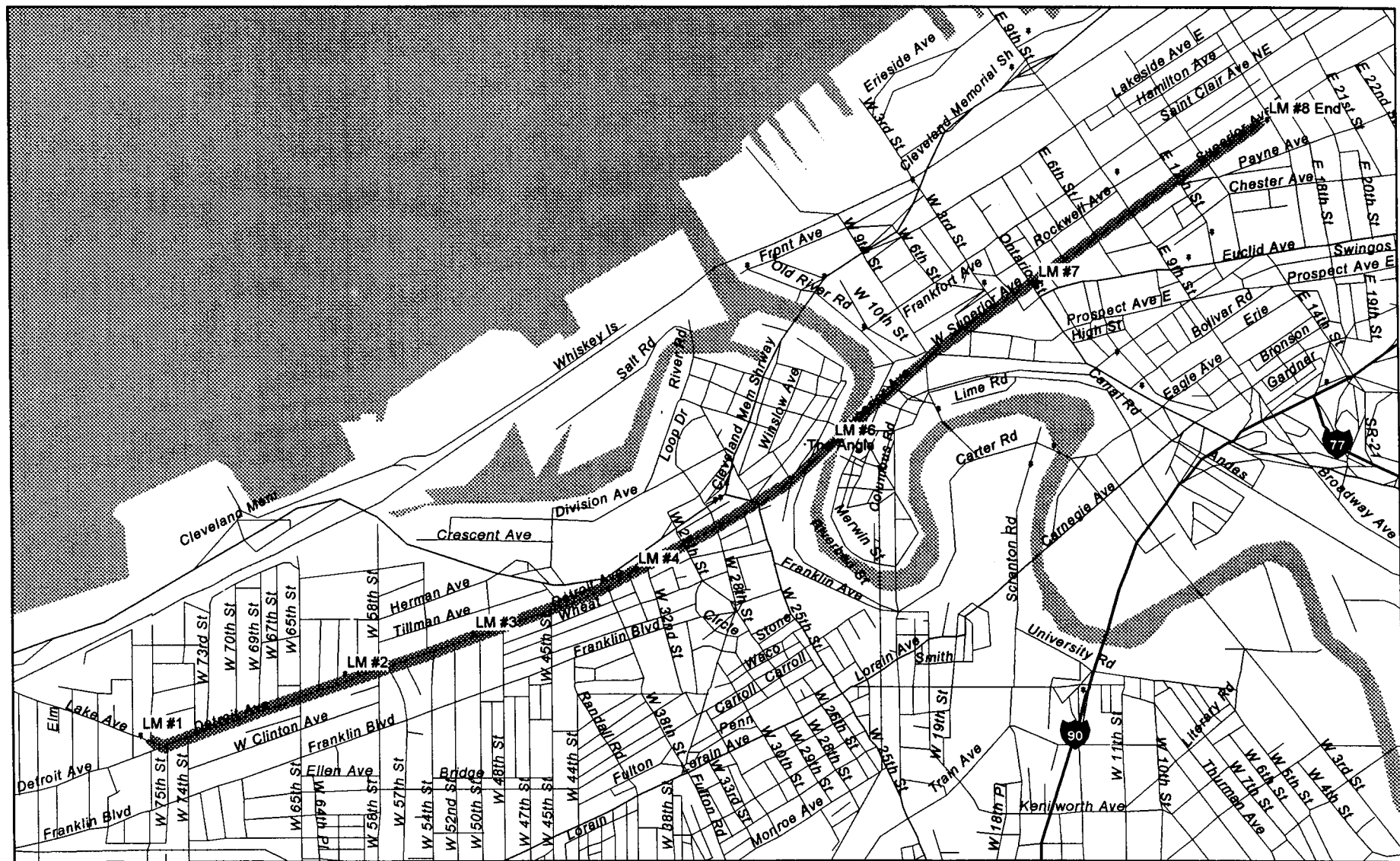
(This page revised)



MICROSOFT CORPORATION
Streets Plus

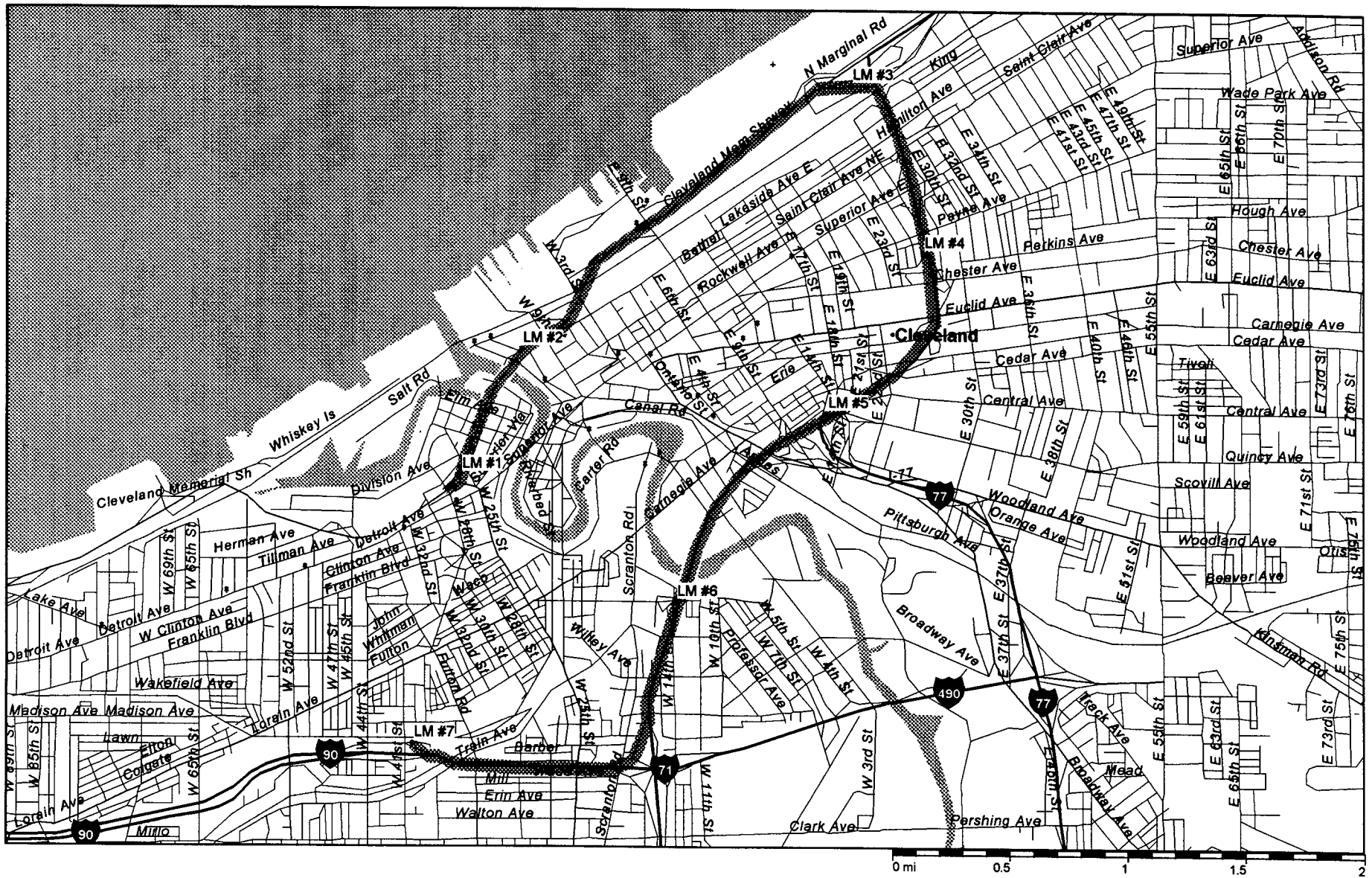
HSC Field Test Route #1A (WGAR)
 Map M-4

5/1a



MICROSOFT
Streets Plus
 HSSC Field Tests Route #2
 Map M-5

Very level route - lots of stops
 Tall buildings near LM 6 - 8 (urban canyon)
 Turn onto at LM 1-3



MICROSOFT CORPORATION
Streets Plus

HSSC Field Test Route #3
 Map M-6

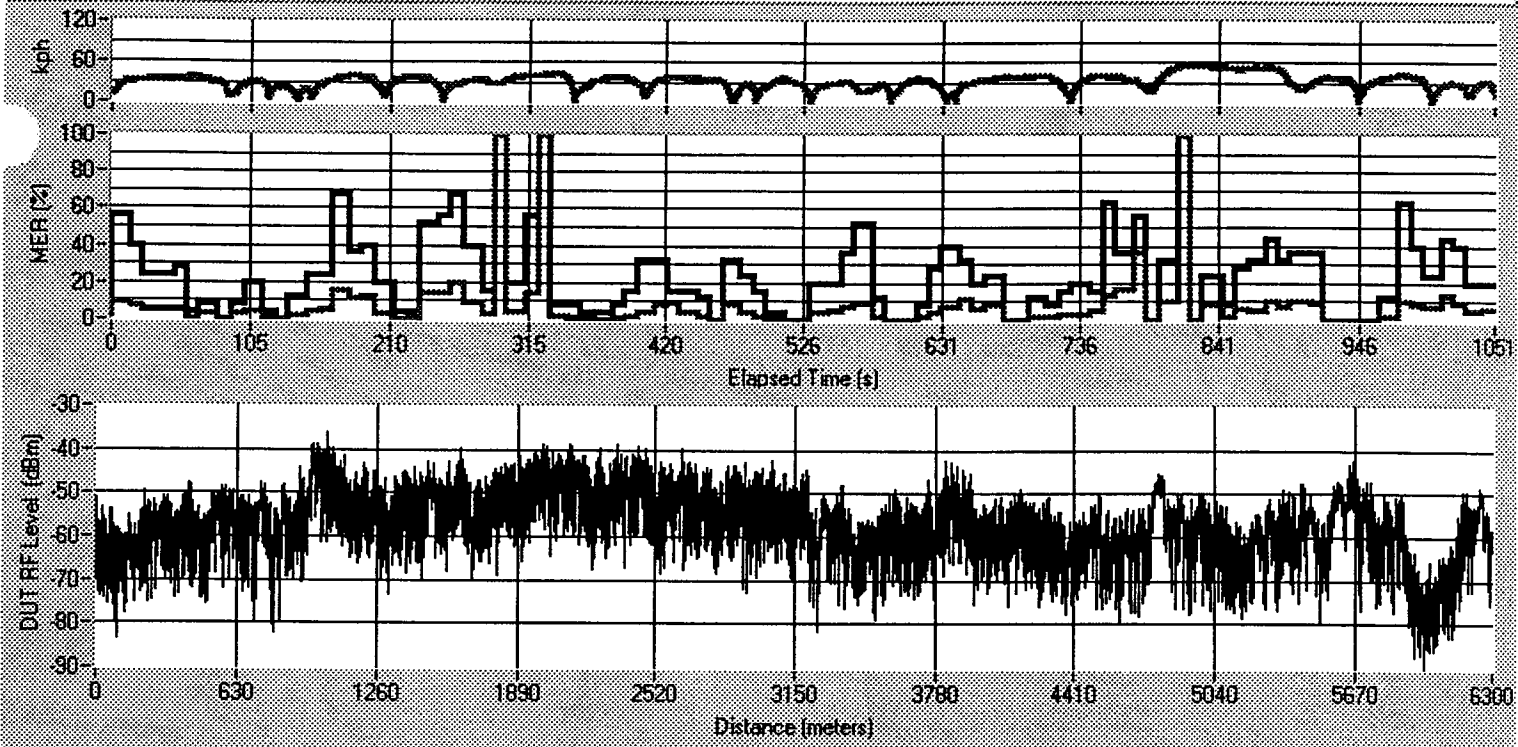
LM 3-4 "sunken highway"

- All freeway - urban fast
- strong signal for one station,
 weak " " the other.

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7. Data Collection Mobile Routes

Digital DJ -- Route 1 Flats -- Landmarks 1-12

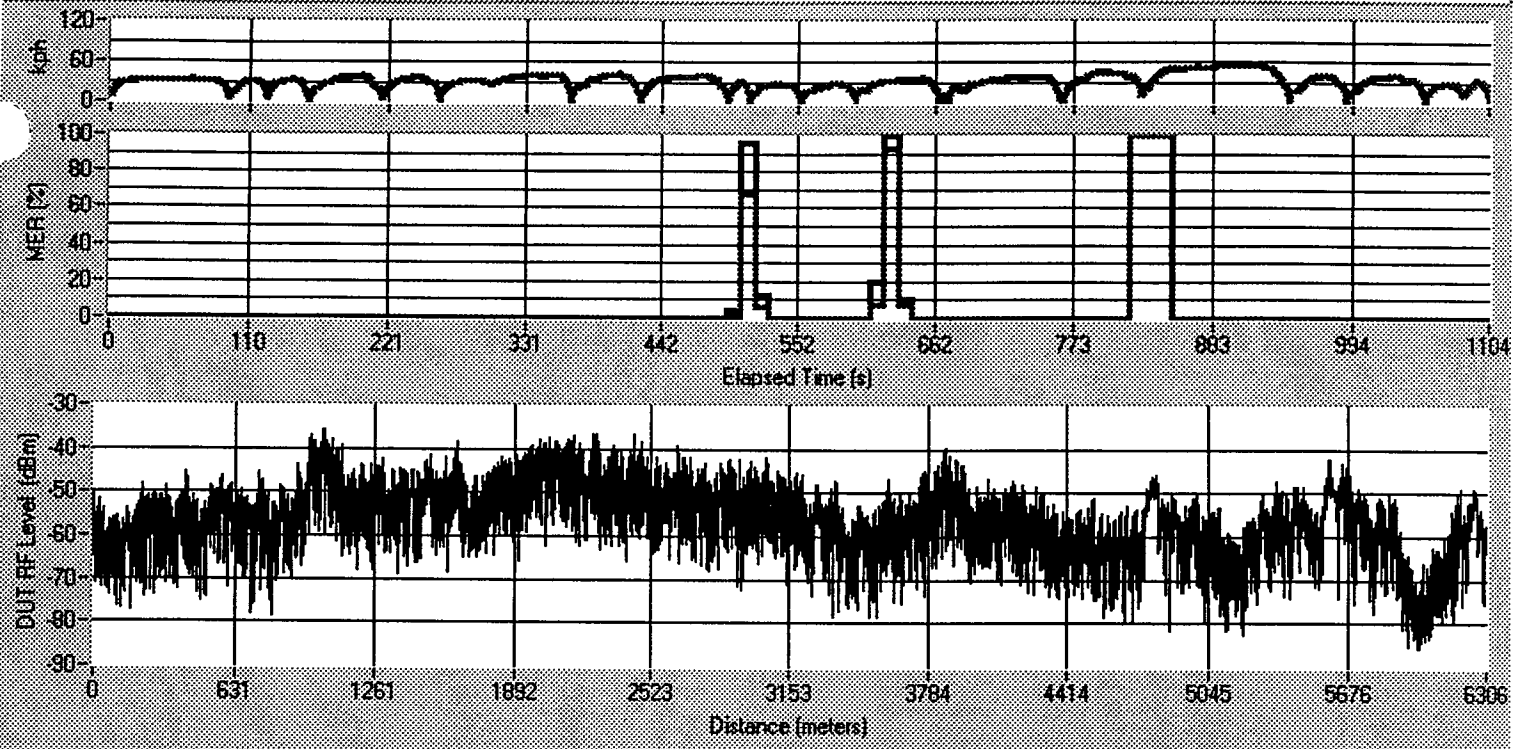


00:02:42:07 NRSC © 1997 HSSC Field Test @ WGAR 00:20:16:04

20: Frames 96: MER=0% 15 (15.6%): 0<MER<=10% 62 (64.6%): 10<MER<=50% 16 (16.7%): MER>50% 3 (3.1%)

220: Frames 96: MER=0% 15 (15.6%): 0<MER<=10% 16 (16.7%): 10<MER<=50% 52 (54.2%): MER>50% 13 (13.5%)

MITRE -- Route 1 Flats -- Landmarks 1-12



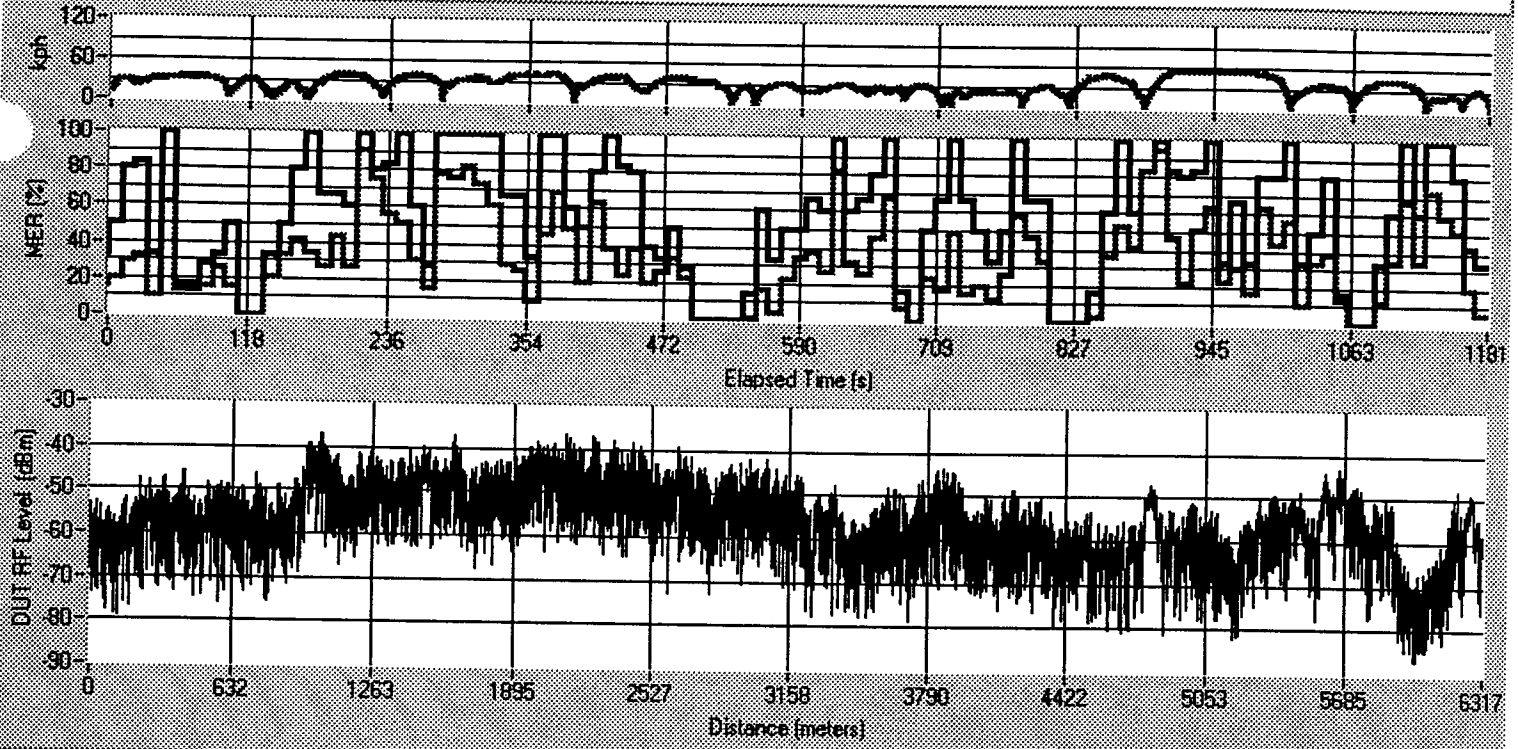
00:22:22:24	NRSC © 1997 HSSC Field Test @ WGAR	00:40:46:23
20: Frames 97: MER=0% 88 (90.7%); 0<MER<=10% 4 (4.1%); 10<MER<=50% 0 (0.0%); MER>50% 5 (5.2%)		
220: Frames 97: MER=0% 88 (90.7%); 0<MER<=10% 2 (2.1%); 10<MER<=50% 2 (2.1%); MER>50% 5 (5.2%)		

SMPT
TIME
CODE
Start

SMPT
TIME
CODE
Finish

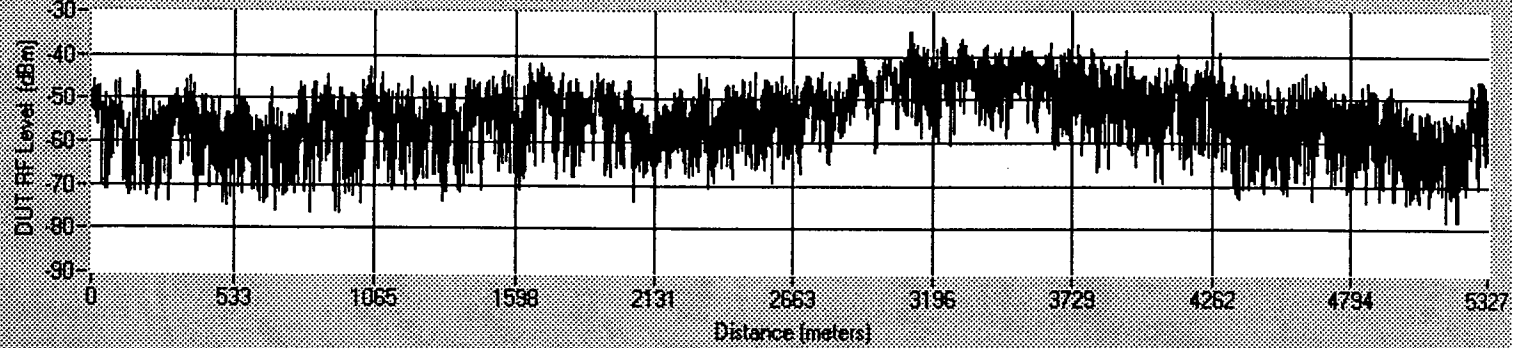
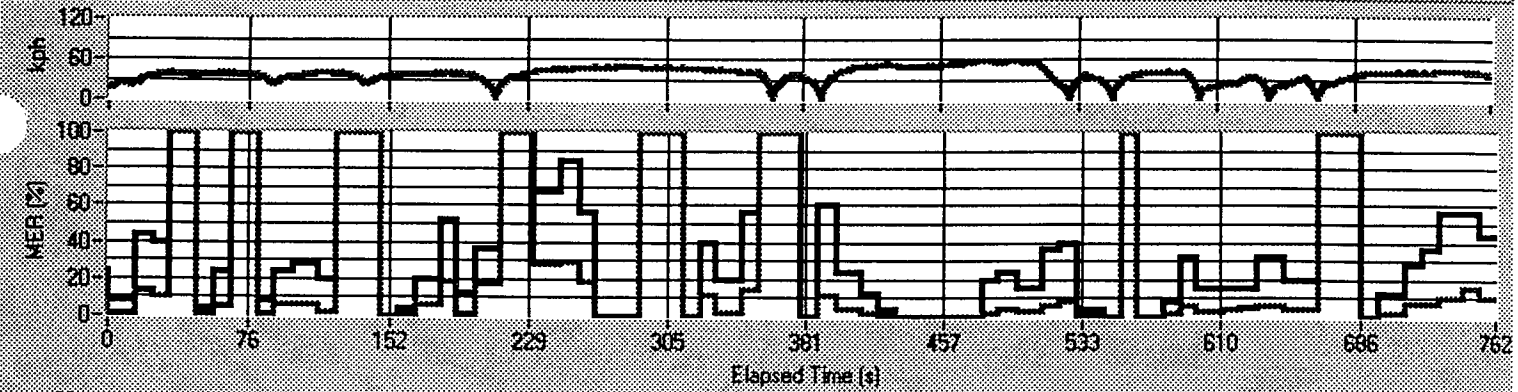
RF level
measured in
100 kHz BW

Seiko -- Route 1 Flats -- Landmarks 1-12



00:43:59:23	NRSC © 1997 HSSC Field Test @ WGAR	01:03:49:20
20: Frames 108: MER=0% 12 (11.1%): 0<MER<=10% 6 (5.6%): 10<MER<=50% 64 (59.3%): MER>50% 26 (24.1%)		
220: Frames 108: MER=0% 12 (11.1%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 35 (32.4%): MER>50% 61 (56.5%)		

Digital DJ -- Route 2 Urban Slow -- Landmarks 1-8

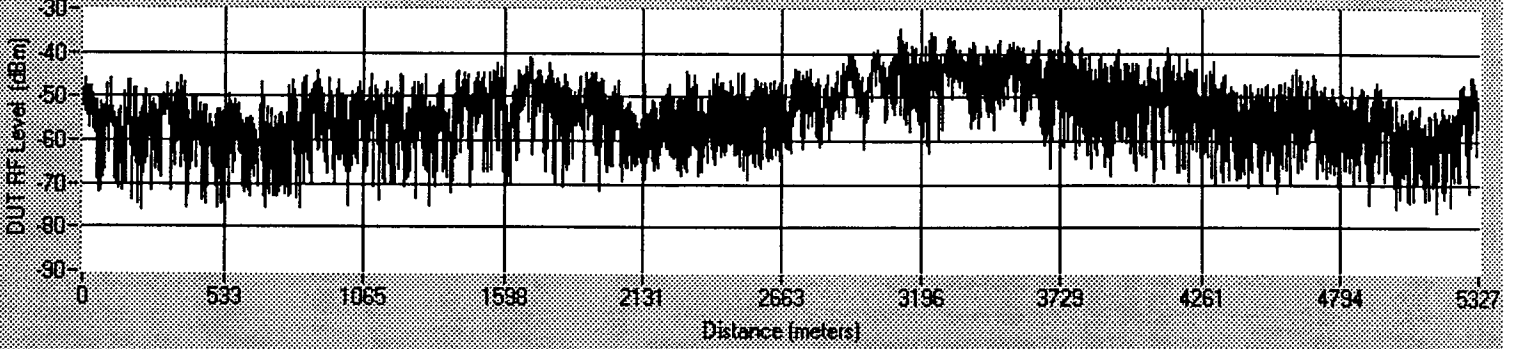
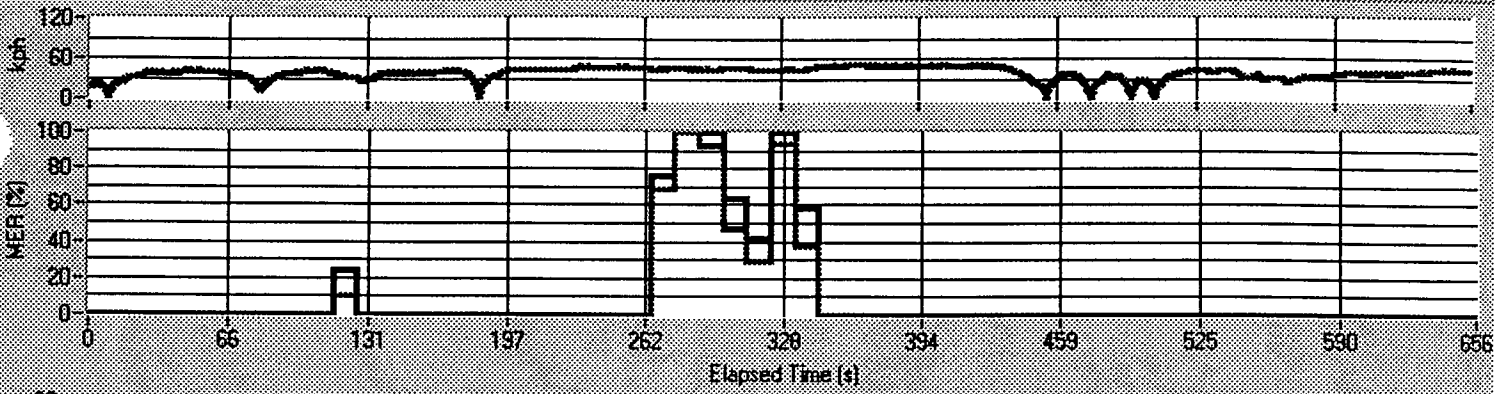


00:35:43:11 NRSC © 1997 HSSC Field Test @ WGAR 00:48:29:04

20: Frames 70: MER=0% 12 (17.1%): 0<MER<=10% 32 (45.7%): 10<MER<=50% 13 (18.6%): MER>50% 13 (18.6%)

220: Frames 70: MER=0% 12 (17.1%): 0<MER<=10% 7 (10.0%): 10<MER<=50% 30 (42.9%): MER>50% 21 (30.0%)

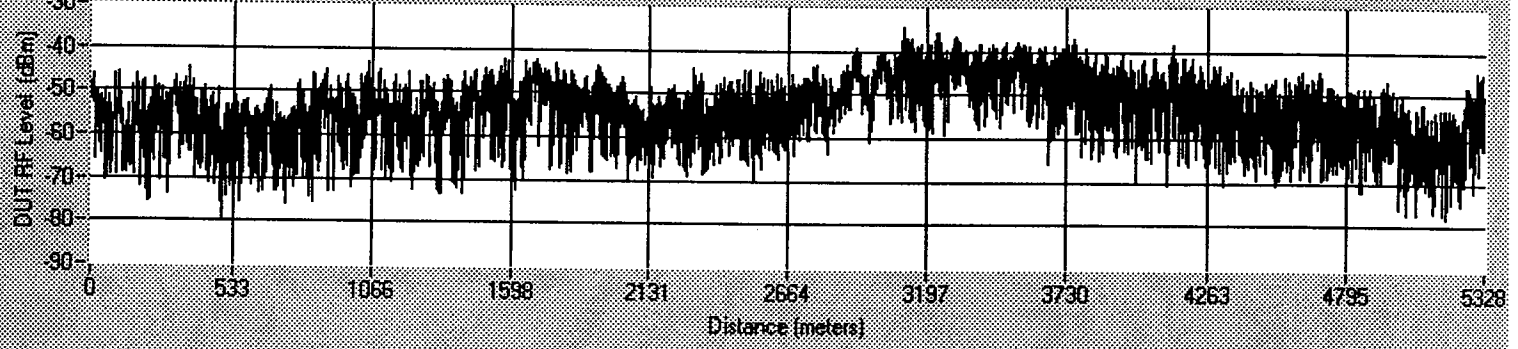
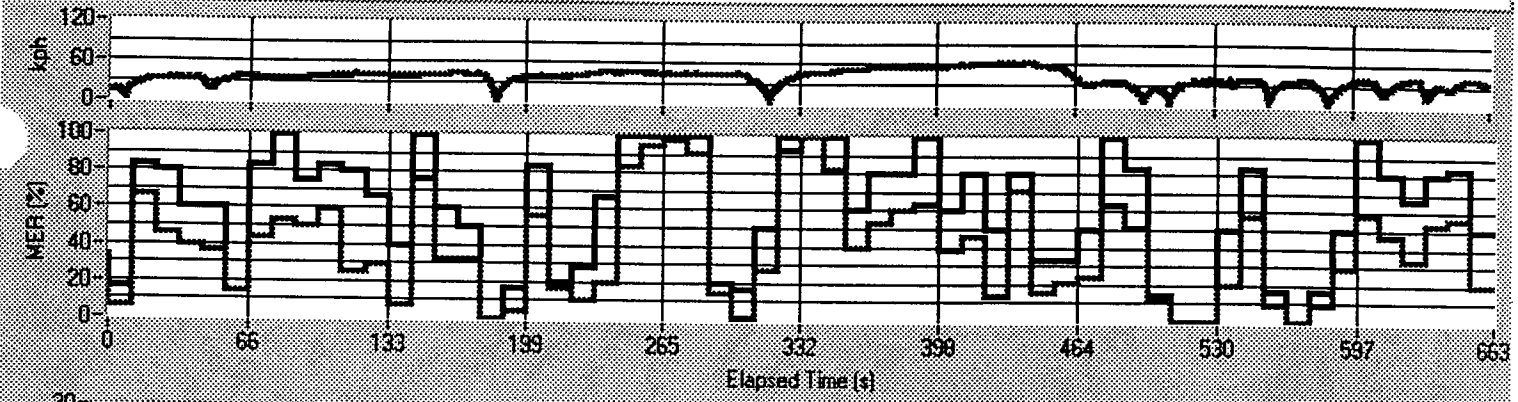
MITRE -- Route 2 Urban Slow -- Landmarks 1-8



00:21:46:29	NRSC @ 1997 HSSC Field Test @ WGAR	00:32:41:11
20: Frames 58: MER=0% 50 (86.2%); 0<MER<=10% 0 (0.0%); 10<MER<=50% 4 (6.9%); MER>50% 4 (6.9%)		
220: Frames 58: MER=0% 50 (86.2%); 0<MER<=10% 0 (0.0%); 10<MER<=50% 2 (3.4%); MER>50% 6 (10.3%)		

L
 may be
 due in
 part to
 impulse noise.

Seiko -- Route 2 Urban Slow -- Landmarks 1-8

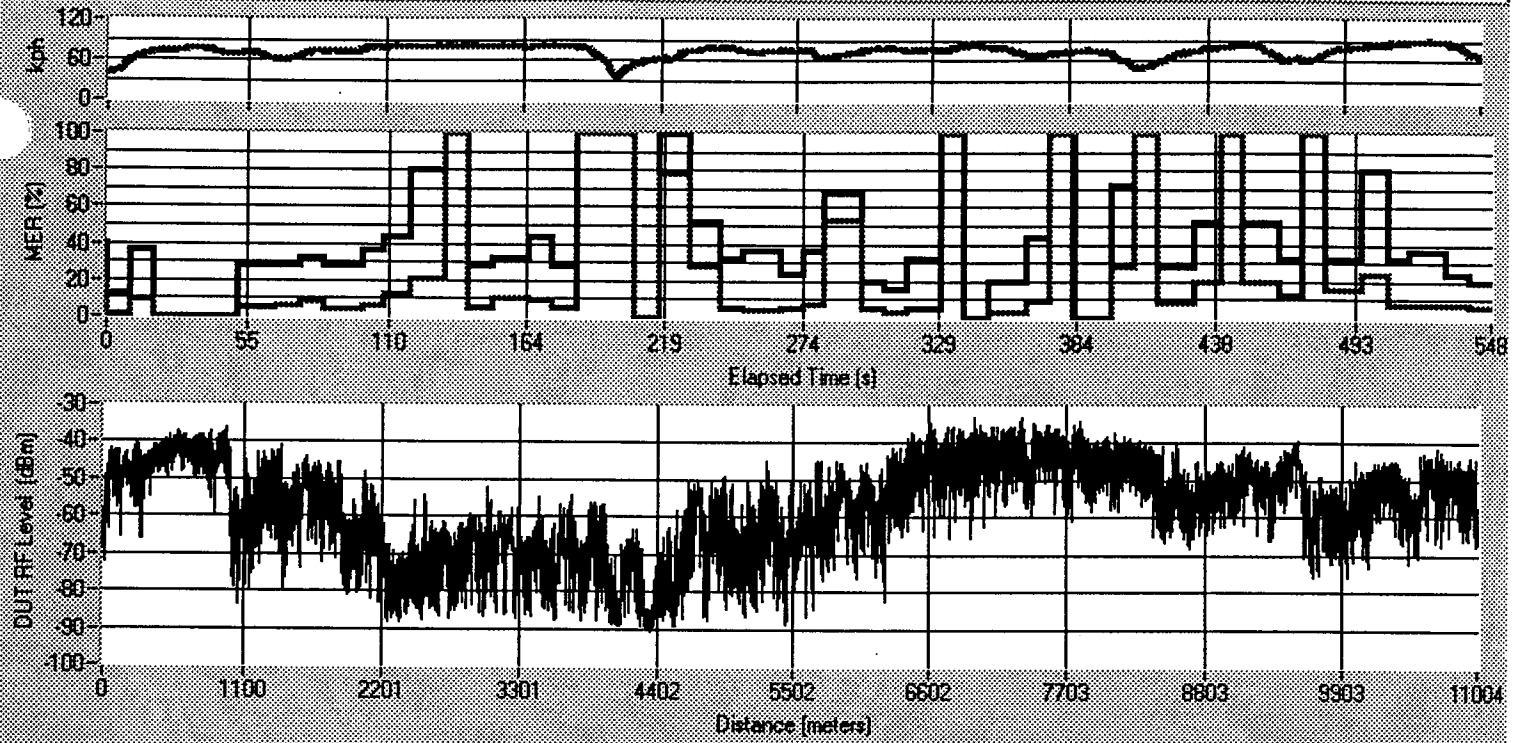


00:05:50:19 NRSC © 1997 HSSC Field Test @ WGAR 00:16:50:01

20: Frames 61: MER=0% 4 (6.6%): 0<MER<=10% 6 (9.8%): 10<MER<=50% 29 (47.5%): MER>50% 22 (36.1%)

220: Frames 61: MER=0% 4 (6.6%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 21 (34.4%): MER>50% 36 (59.0%)

Digital DJ -- Route 3 Urban Fast -- Landmarks 1-7



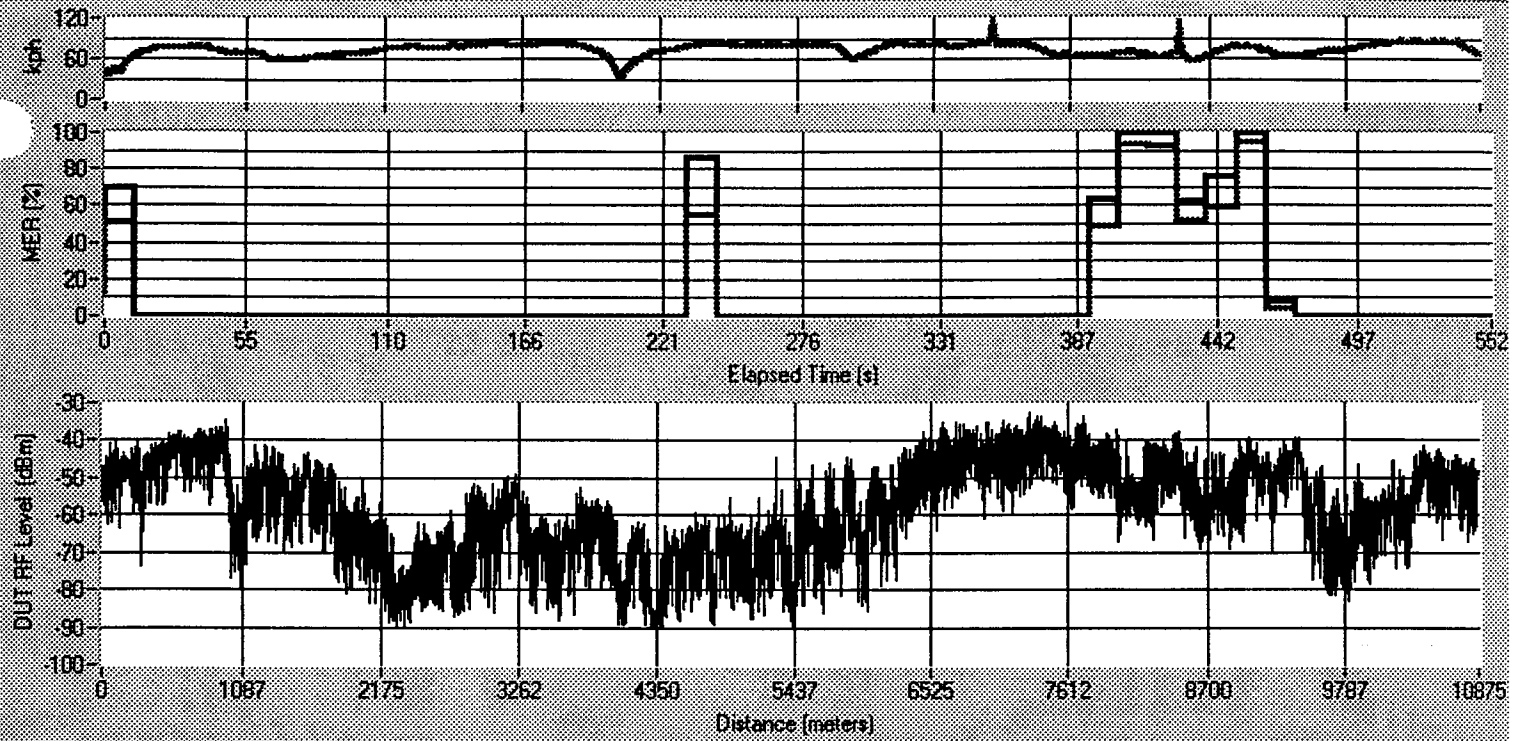
00:02:56:20

NRSC © 1997 HSSC Field Test @ WGAR

00:12:07:07

20: Frames 51: MER=0% 6 (11.8%): 0<MER<=10% 24 (47.1%): 10<MER<=50% 11 (21.6%): MER>50% 10 (19.6%)
220: Frames 51: MER=0% 6 (11.8%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 29 (56.9%): MER>50% 16 (31.4%)

MITRE -- Route 3 Urban Fast -- Landmarks 1-7



00:16:46:25

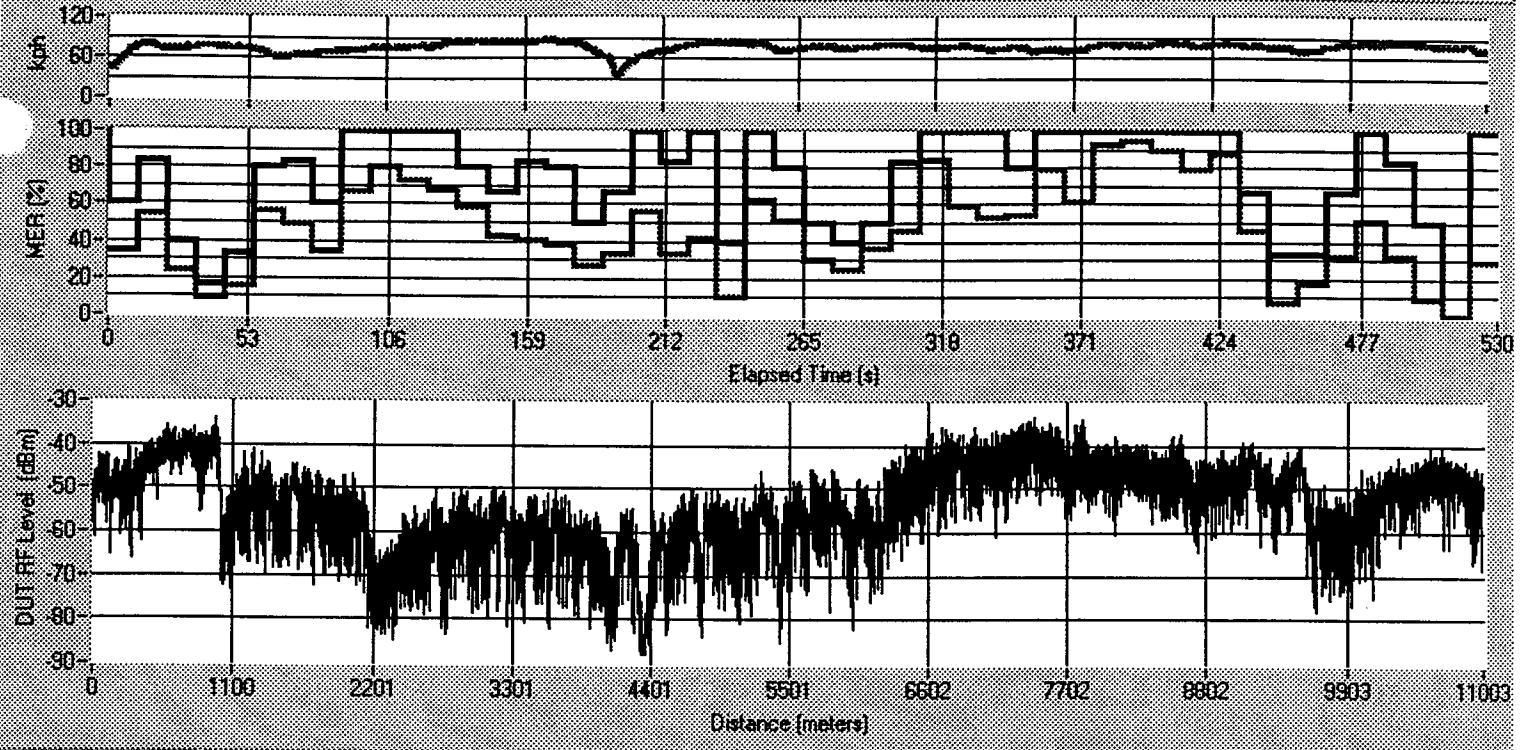
NRSC © 1997 HSSC Field Test @ WGAR

00:25:50:03

20: Frames 49: MER=0% 39 (79.6%): 0<MER<=10% 1 (2.0%): 10<MER<=50% 2 (4.1%): MER>50% 7 (14.3%)

220: Frames 49: MER=0% 39 (79.6%): 0<MER<=10% 1 (2.0%): 10<MER<=50% 1 (2.0%): MER>50% 8 (16.3%)

Seiko -- Route 3 Urban Fast -- Landmarks 1-7



00:29:42:13

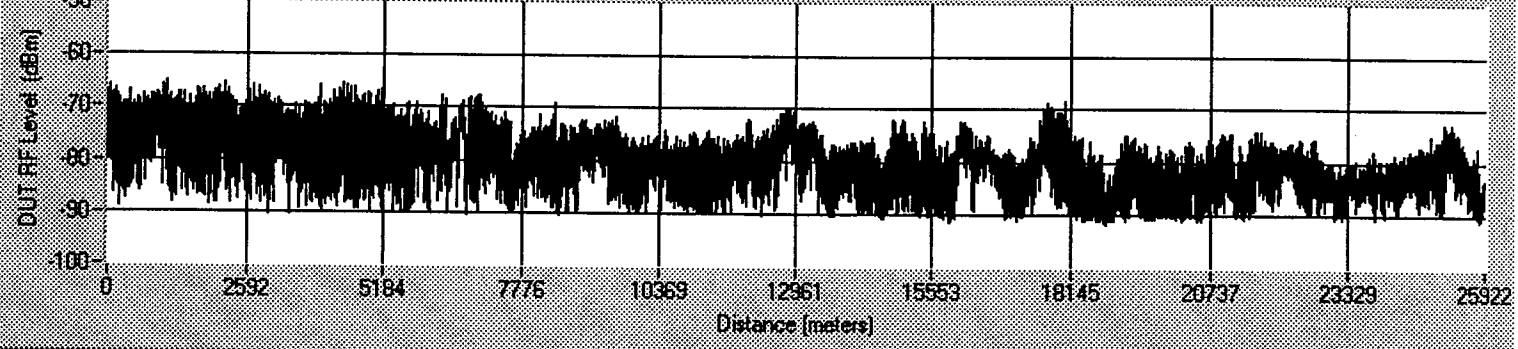
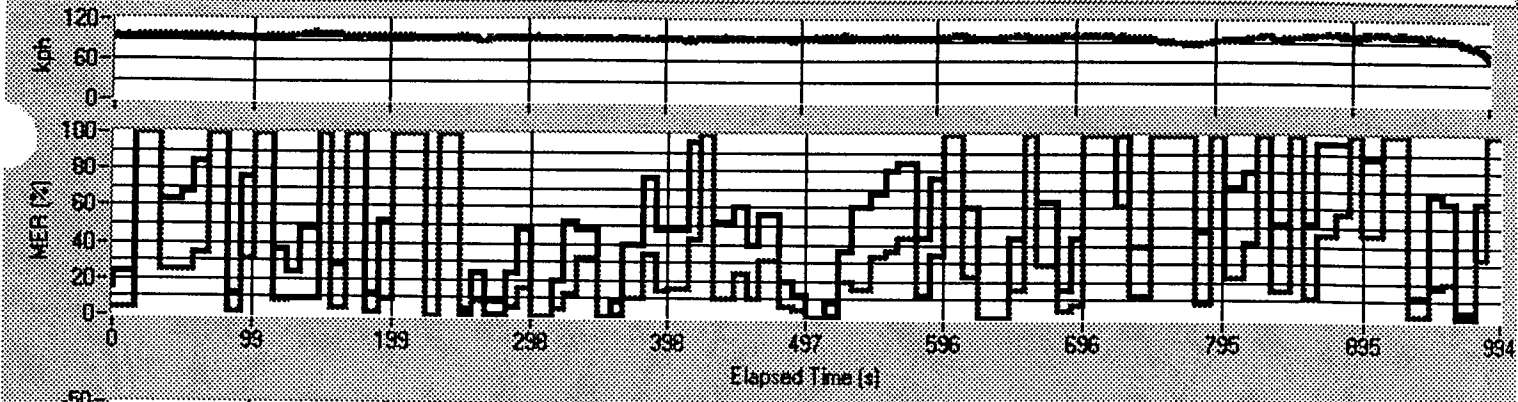
NRSC © 1997 HSSC Field Test @ WGAR

00:38:27:27

20: Frames 49: MER=0% 1 (2.0%): 0<MER<=10% 3 (6.1%): 10<MER<=50% 23 (46.9%): MER>50% 22 (44.9%)

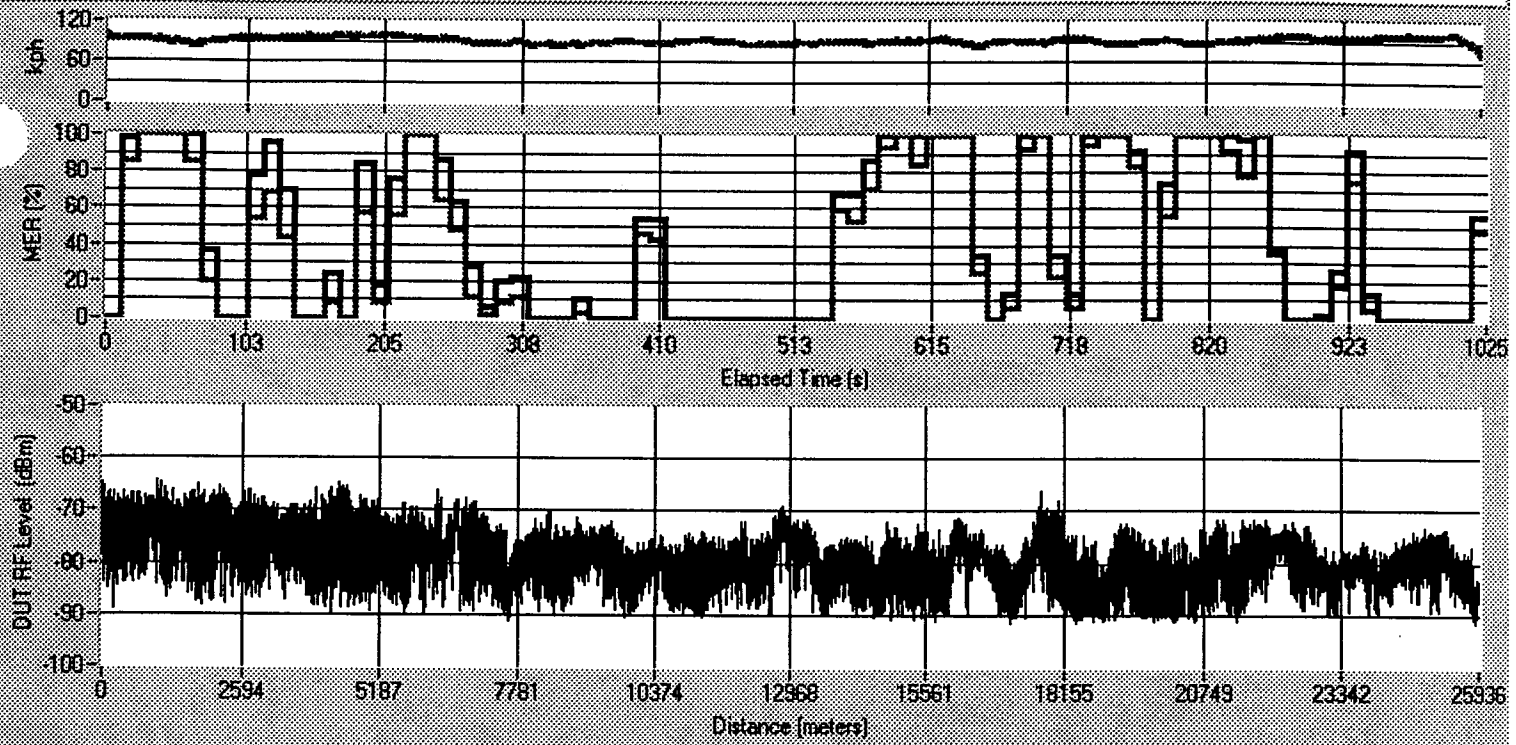
220: Frames 49: MER=0% 1 (2.0%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 11 (22.4%): MER>50% 37 (75.5%)

Digital DJ -- Route 4 I-90 East -- Landmarks 1-14



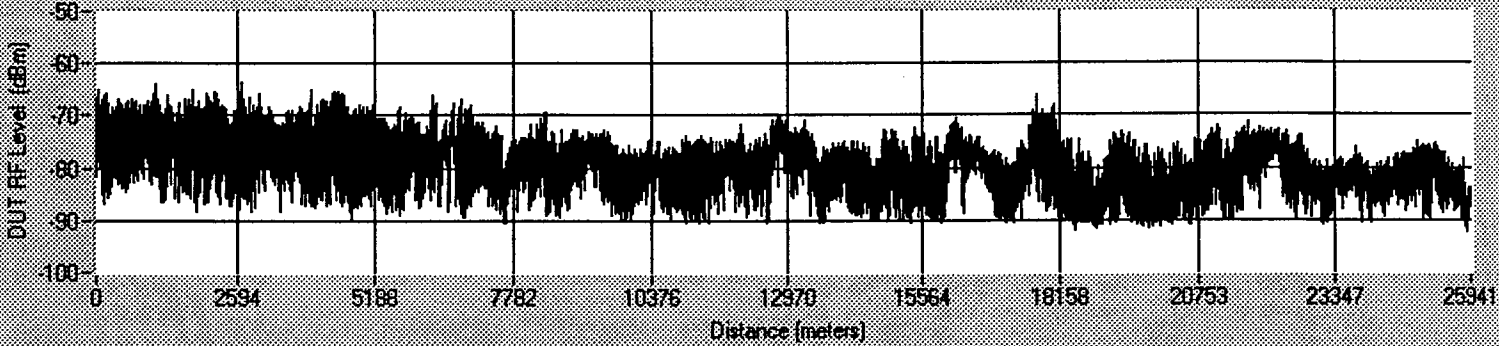
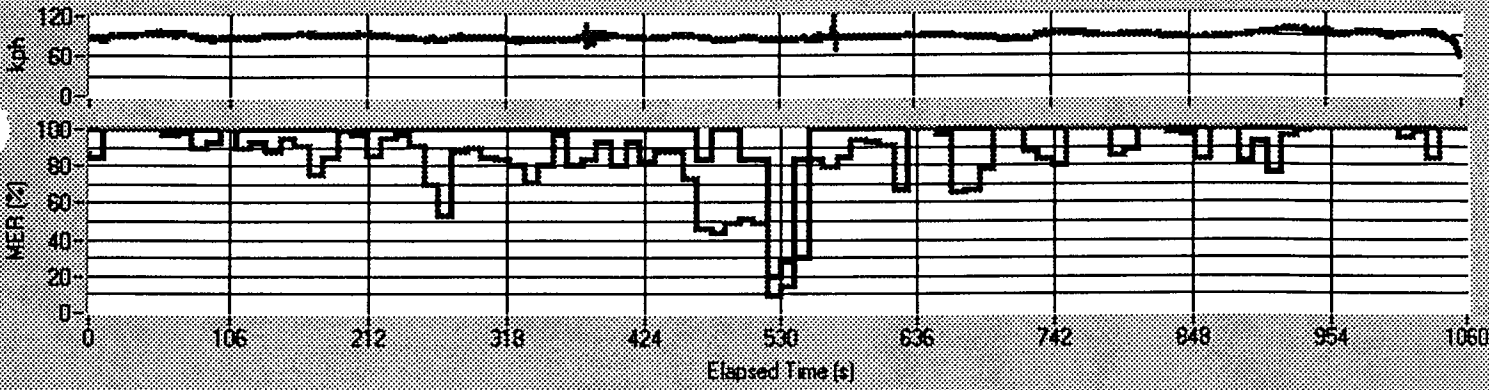
00:55:44:01	NRSC © 1997 HSSC Field Test @ WGAR	01:12:13:05
20: Frames 91: MER=0% 6 (6.6%): 0<MER<=10% 23 (25.3%): 10<MER<=50% 36 (39.6%): MER>50% 26 (28.6%)		
220: Frames 91: MER=0% 6 (6.6%): 0<MER<=10% 5 (5.5%): 10<MER<=50% 27 (29.7%): MER>50% 53 (58.2%)		

MITRE -- Route 4 I-90 East -- Landmarks 1-14



00:31:45:08	NRSC © 1997 HSSC Field Test @ WGAR	00:48:46:23
20: Frames 90: MER=0% 34 (37.8%): 0<MER<=10% 9 (10.0%): 10<MER<=50% 12 (13.3%): MER>50% 35 (38.9%)		
220: Frames 90: MER=0% 34 (37.8%): 0<MER<=10% 3 (3.3%): 10<MER<=50% 13 (14.4%): MER>50% 40 (44.4%)		

Seiko -- Route 4 I-90 East -- Landmarks 1-14



00:08:30:20

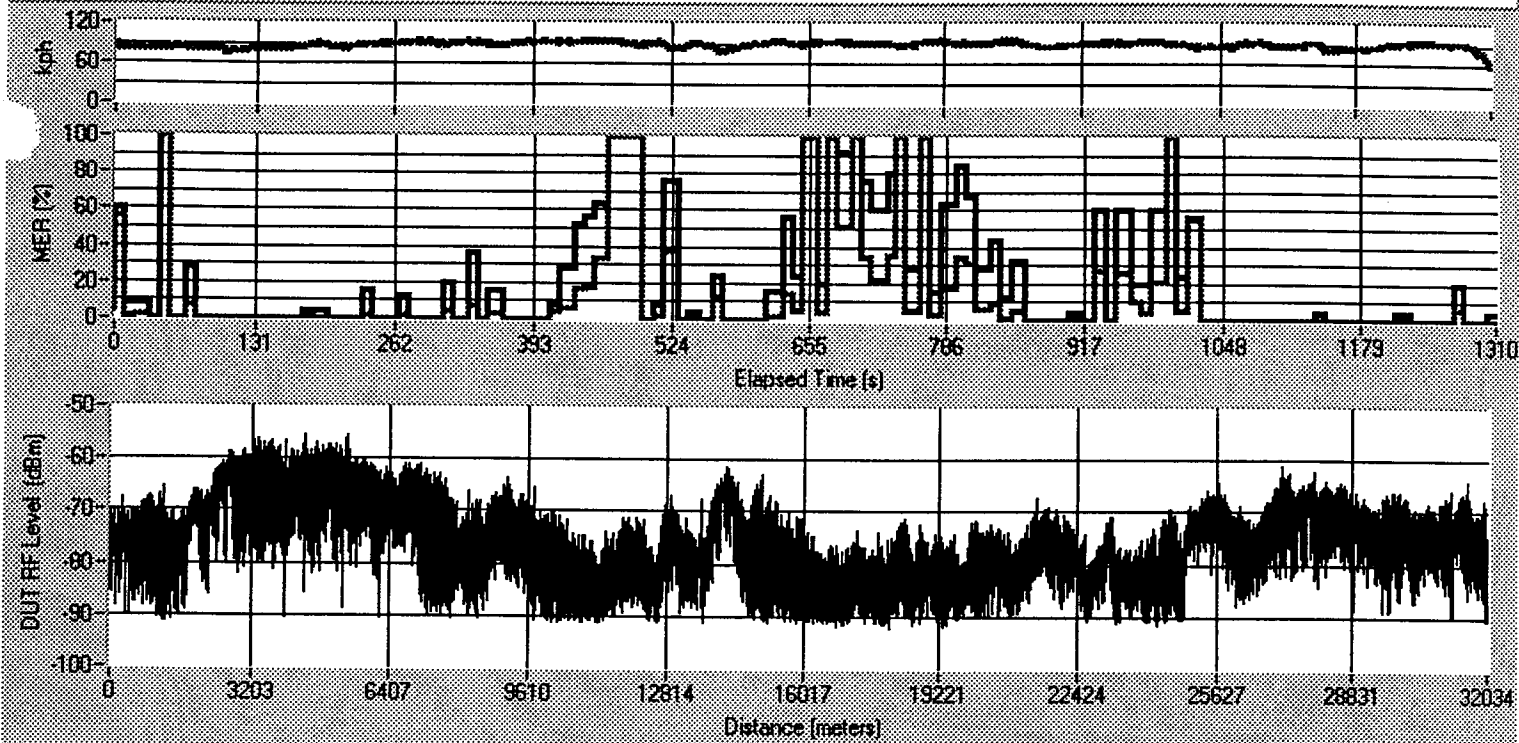
NRSC © 1997 HSSC Field Test @ WGAR

00:26:06:08

20: Frames 97: MER=0% 0 (0.0%): 0<MER<=10% 1 (1.0%): 10<MER<=50% 6 (6.2%): MER>50% 90 (92.8%)

220: Frames 97: MER=0% 0 (0.0%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 2 (2.1%): MER>50% 95 (97.9%)

Digital DJ -- Route 5 I-71 South -- Landmarks 1-19



00:05:24:20

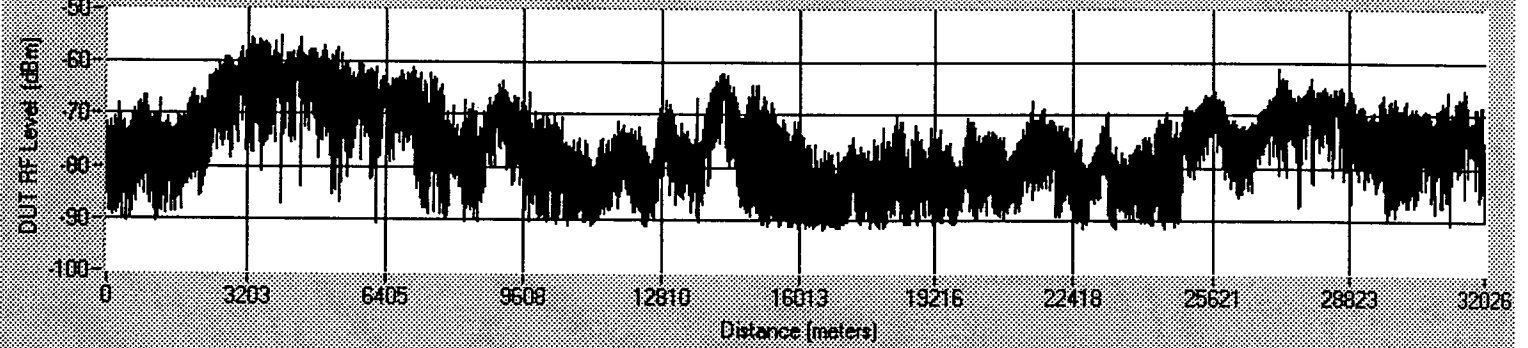
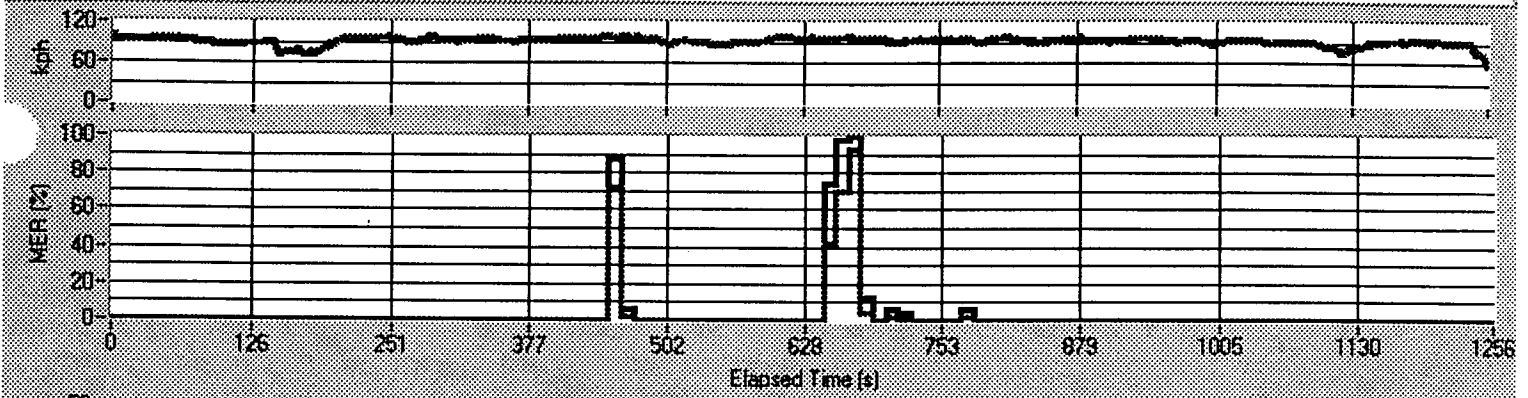
NRSC © 1997 HSSC Field Test @ WGAR

00:27:16:17

20: Frames 120: MER=0% 60 (50.0%): 0<MER<=10% 31 (25.8%): 10<MER<=50% 16 (13.3%): MER>50% 13 (10.8%)

220: Frames 120: MER=0% 60 (50.0%): 0<MER<=10% 12 (10.0%): 10<MER<=50% 21 (17.5%): MER>50% 27 (22.5%)

MITRE -- Route 5 I-71 South -- Landmarks 1-19

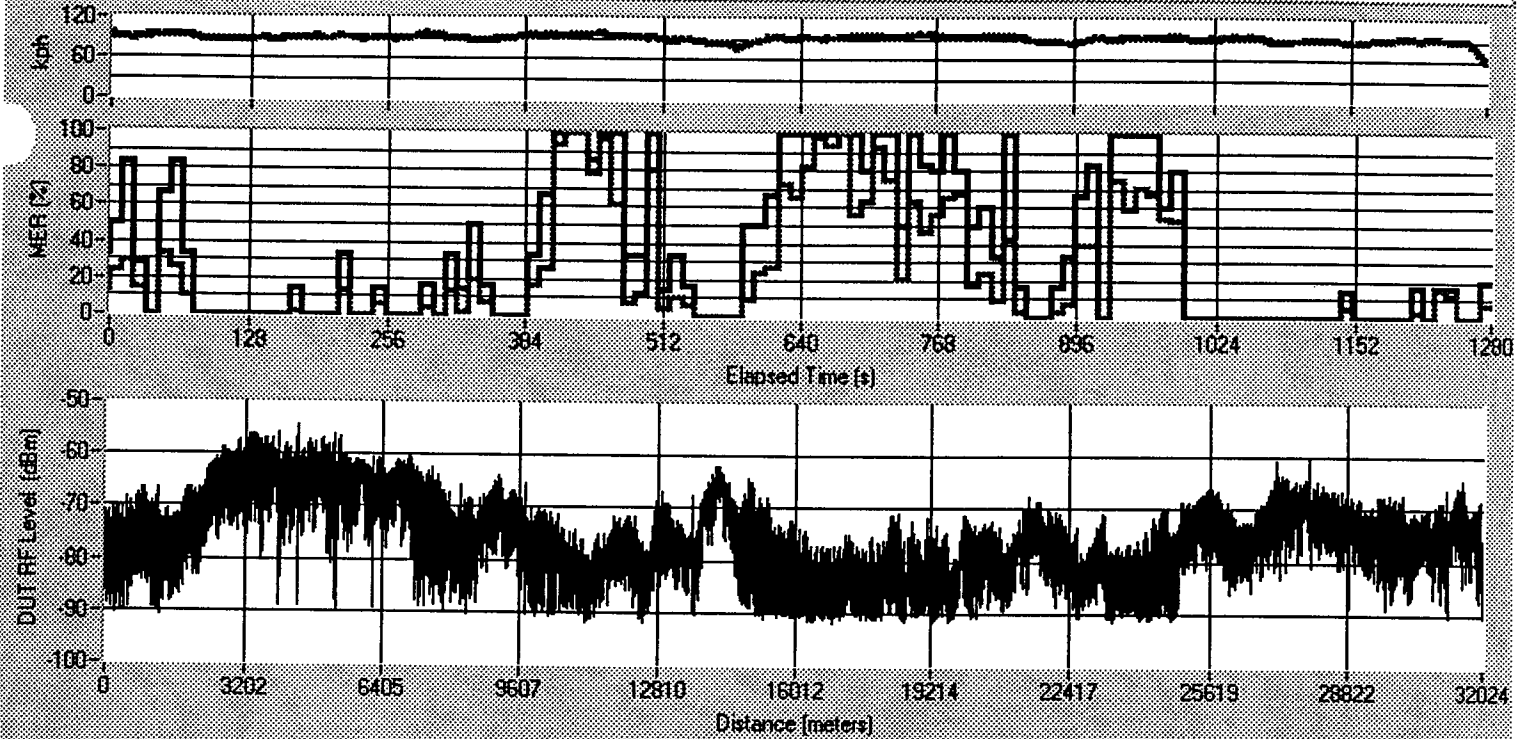


00:33:12:22 NRSC © 1997 HSSC Field Test @ WGAR 00:54:11:18

20: Frames 110: MER=0% 101 (91.8%): 0<MER<=10% 5 (4.5%): 10<MER<=50% 1 (0.9%): MER>50% 3 (2.7%)

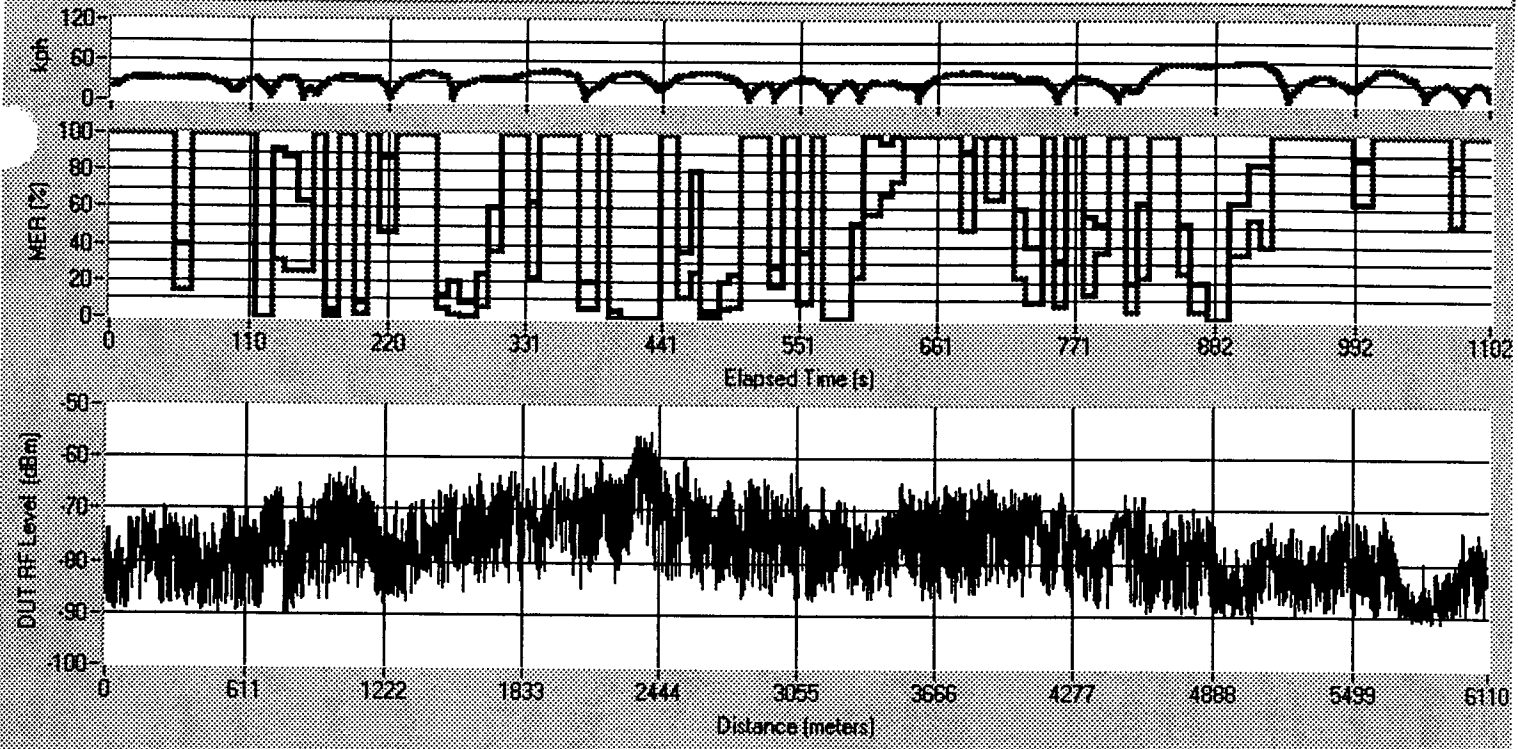
220: Frames 110: MER=0% 101 (91.8%): 0<MER<=10% 4 (3.6%): 10<MER<=50% 1 (0.9%): MER>50% 4 (3.6%)

Seiko -- Route 5 I-71 South -- Landmarks 1-19



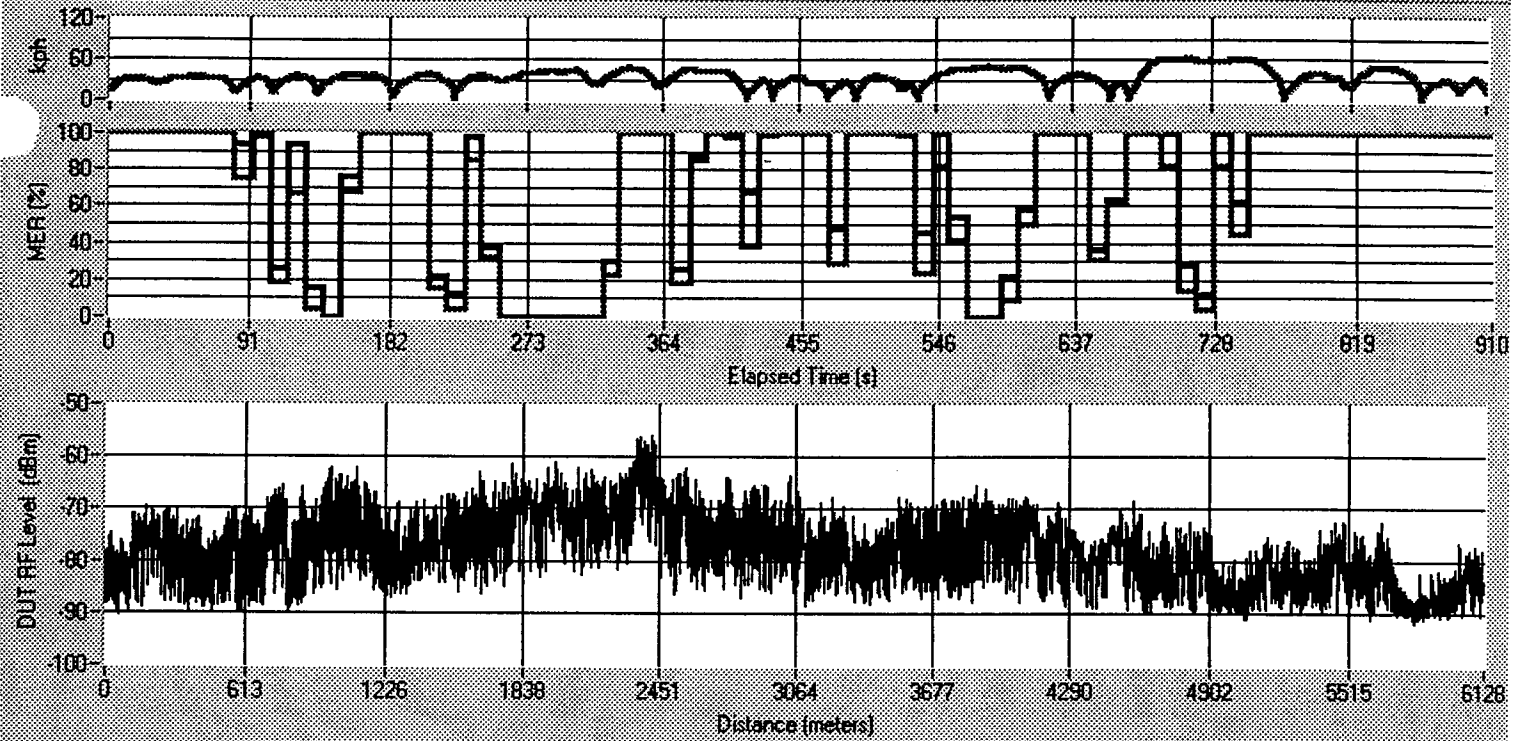
01:01:30:27	NRSC © 1997 HSSC Field Test @ WGAR	01:22:42:15
20: Frames 117: MER=0% 49 (41.9%): 0<MER<=10% 16 (13.7%): 10<MER<=50% 25 (21.4%): MER>50% 27 (23.1%)		
220: Frames 117: MER=0% 49 (41.9%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 31 (26.5%): MER>50% 37 (31.6%)		

Digital DJ -- Route 1 Flats -- Landmarks 1-12



00:03:19:05	NRSC © 1997 HSSC Field Test @ WKSU	00:21:33:14
20: Frames 103: MER=0% 8 (7.8%): 0<MER<=10% 16 (15.5%): 10<MER<=50% 19 (18.4%): MER>50% 60 (58.3%)		
220: Frames 103: MER=0% 8 (7.8%): 0<MER<=10% 5 (4.9%): 10<MER<=50% 14 (13.6%): MER>50% 76 (73.8%)		

MITRE -- Route 1 Flats -- Landmarks 1-12

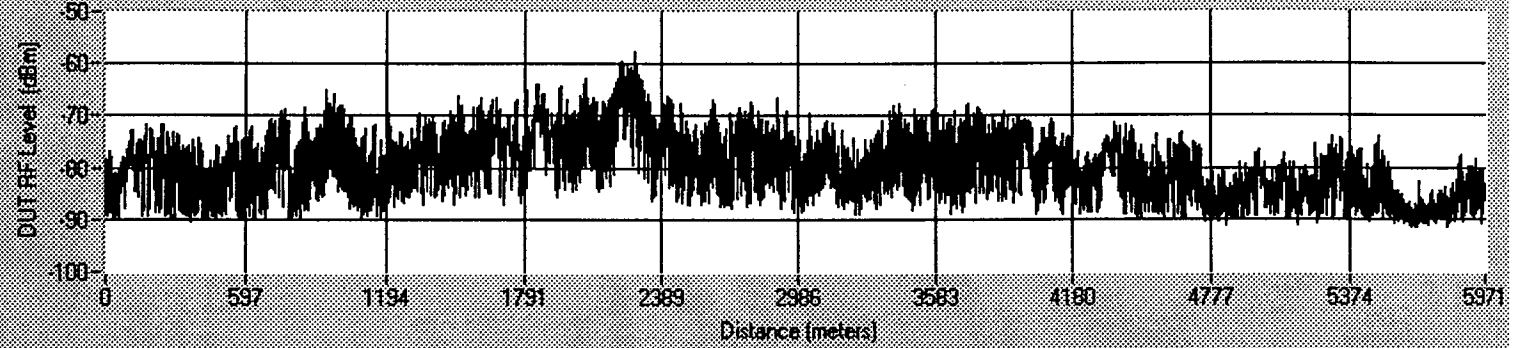
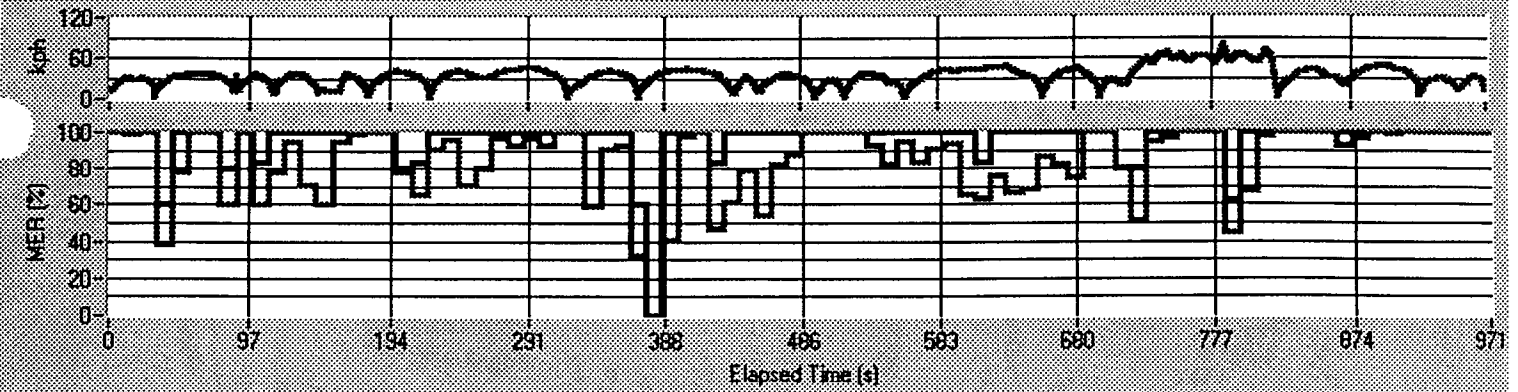


00:24:18:06 NRSC © 1997 HSSC Field Test @ WKSU 00:39:29:15

20: Frames 80: MER=0% 9 (11.2%): 0<MER<=10% 4 (5.0%): 10<MER<=50% 13 (16.2%): MER>50% 54 (67.5%)

220: Frames 80: MER=0% 9 (11.2%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 13 (16.2%): MER>50% 58 (72.5%)

Seiko -- Route 1 Flats -- Landmarks 1-12

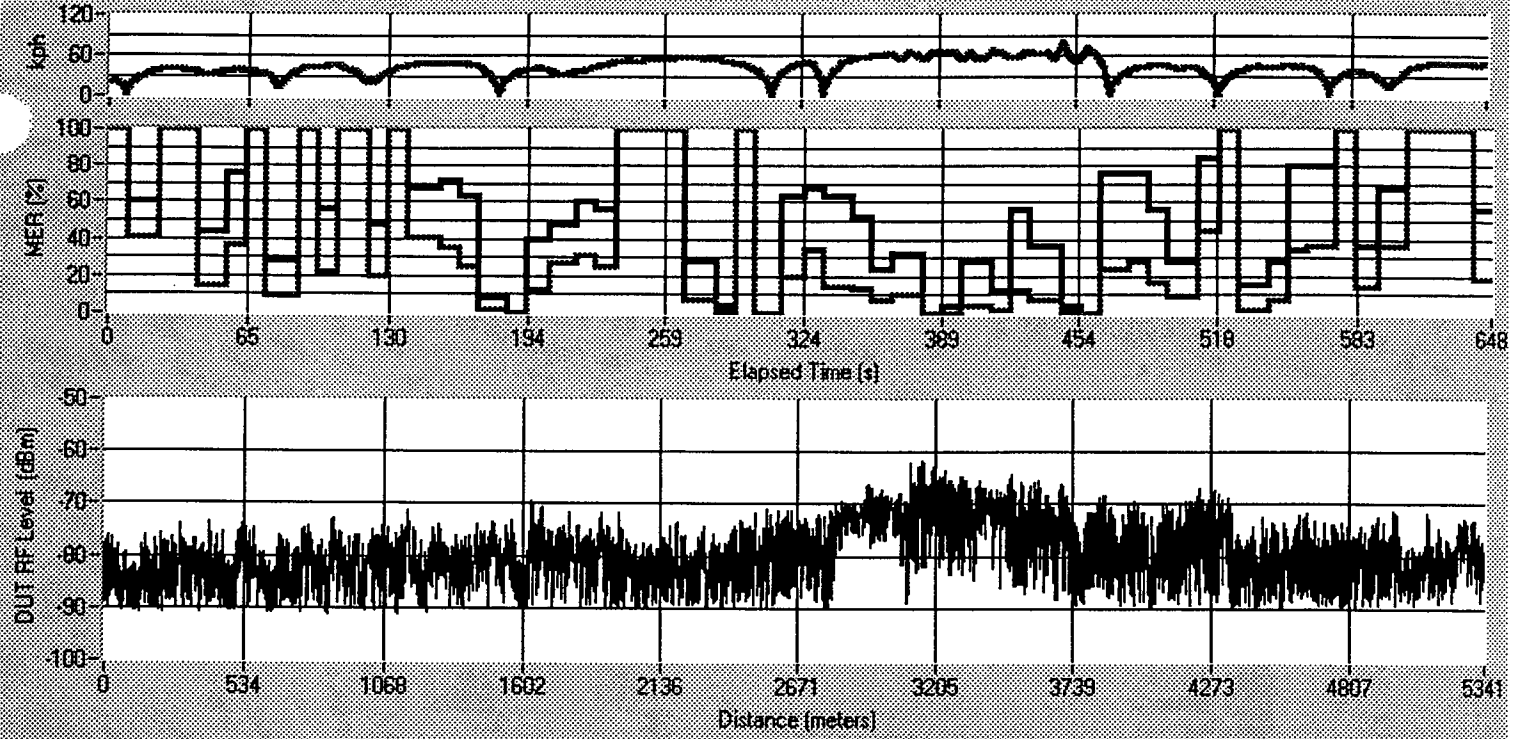


00:42:59:13 NRSC © 1997 HSSC Field Test @ WKSU 00:59:08:24

20: Frames 89: MER=0% 1 (1.1%); 0<MER<=10% 0 (0.0%); 10<MER<=50% 5 (5.6%); MER>50% 83 (93.3%)

220: Frames 89: MER=0% 1 (1.1%); 0<MER<=10% 0 (0.0%); 10<MER<=50% 0 (0.0%); MER>50% 88 (98.9%)

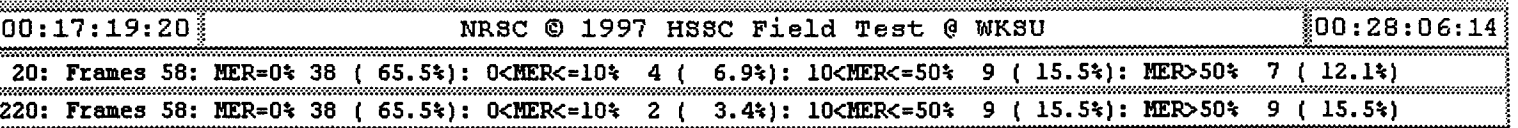
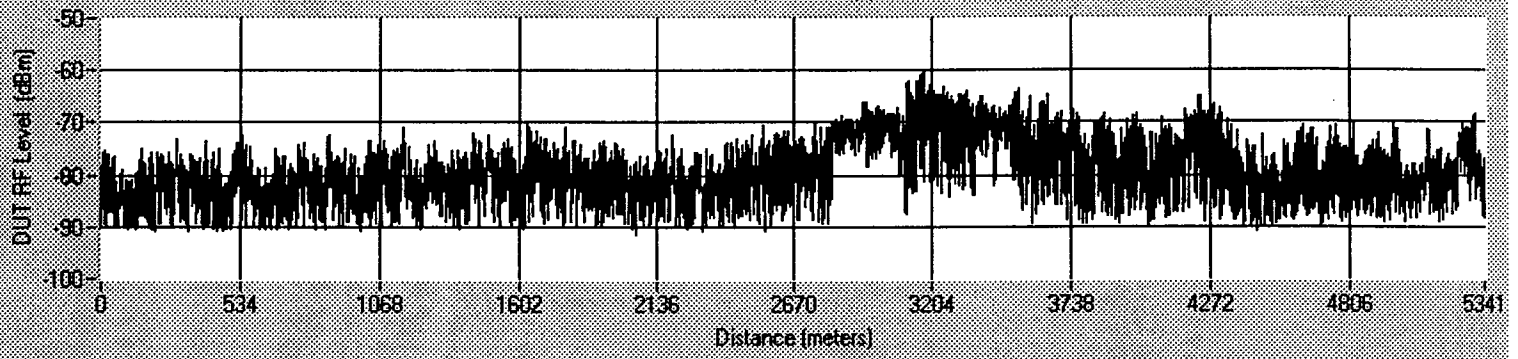
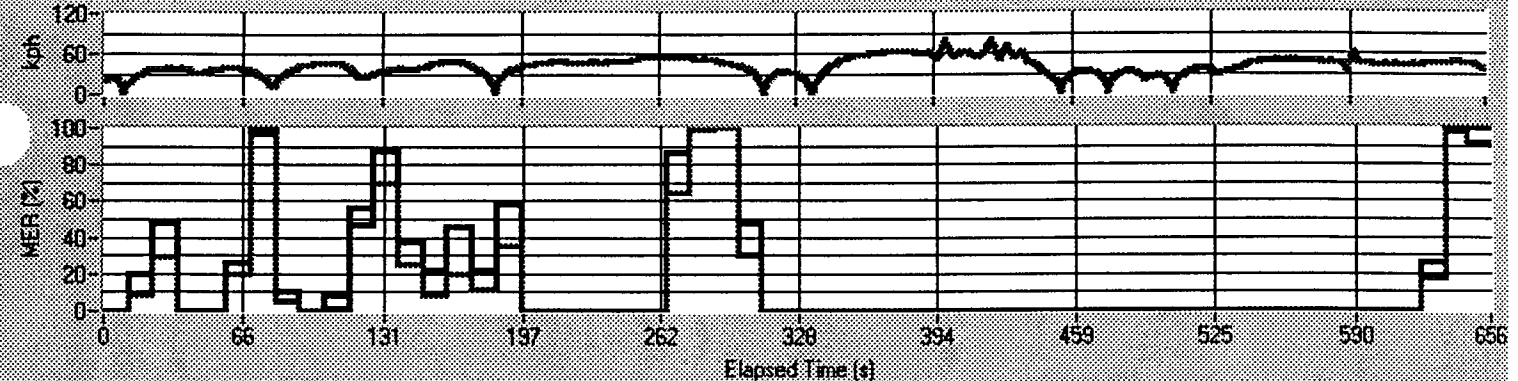
Digital DJ -- Route 2 Urban Slow -- Landmarks 1-8



00:44:43:07 NRSC © 1997 HSSC Field Test @ WKSU 00:55:31:25

20: Frames 61: MER=0% 4 (6.6%): 0<MER<=10% 13 (21.3%): 10<MER<=50% 27 (44.3%): MER>50% 17 (27.9%)
220: Frames 61: MER=0% 4 (6.6%): 0<MER<=10% 4 (6.6%): 10<MER<=50% 15 (24.6%): MER>50% 38 (62.3%)

MITRE -- Route 2 Urban Slow -- Landmarks 1-8



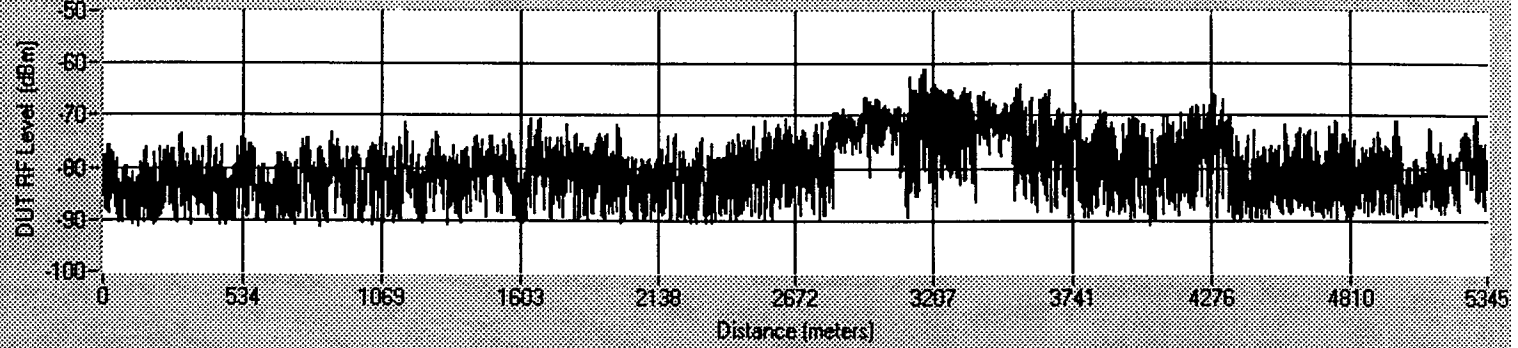
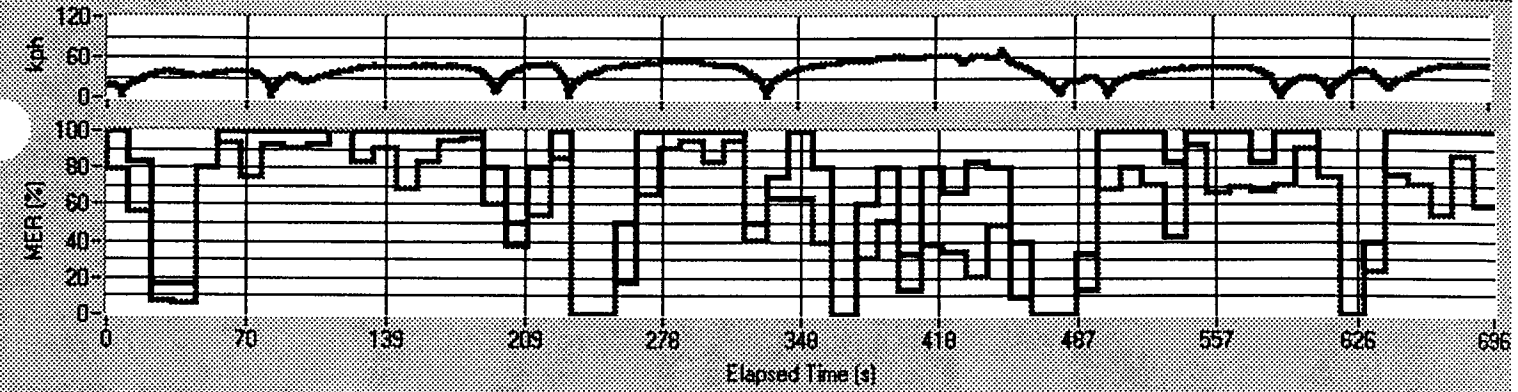
00:17:19:20

NRSC © 1997 HSSC Field Test @ WKSU

00:28:06:14

20: Frames 58: MER=0% 38 (65.5%): 0<MER<=10% 4 (6.9%): 10<MER<=50% 9 (15.5%): MER>50% 7 (12.1%)
220: Frames 58: MER=0% 38 (65.5%): 0<MER<=10% 2 (3.4%): 10<MER<=50% 9 (15.5%): MER>50% 9 (15.5%)

Seiko -- Route 2 Urban Slow -- Landmarks 1-8

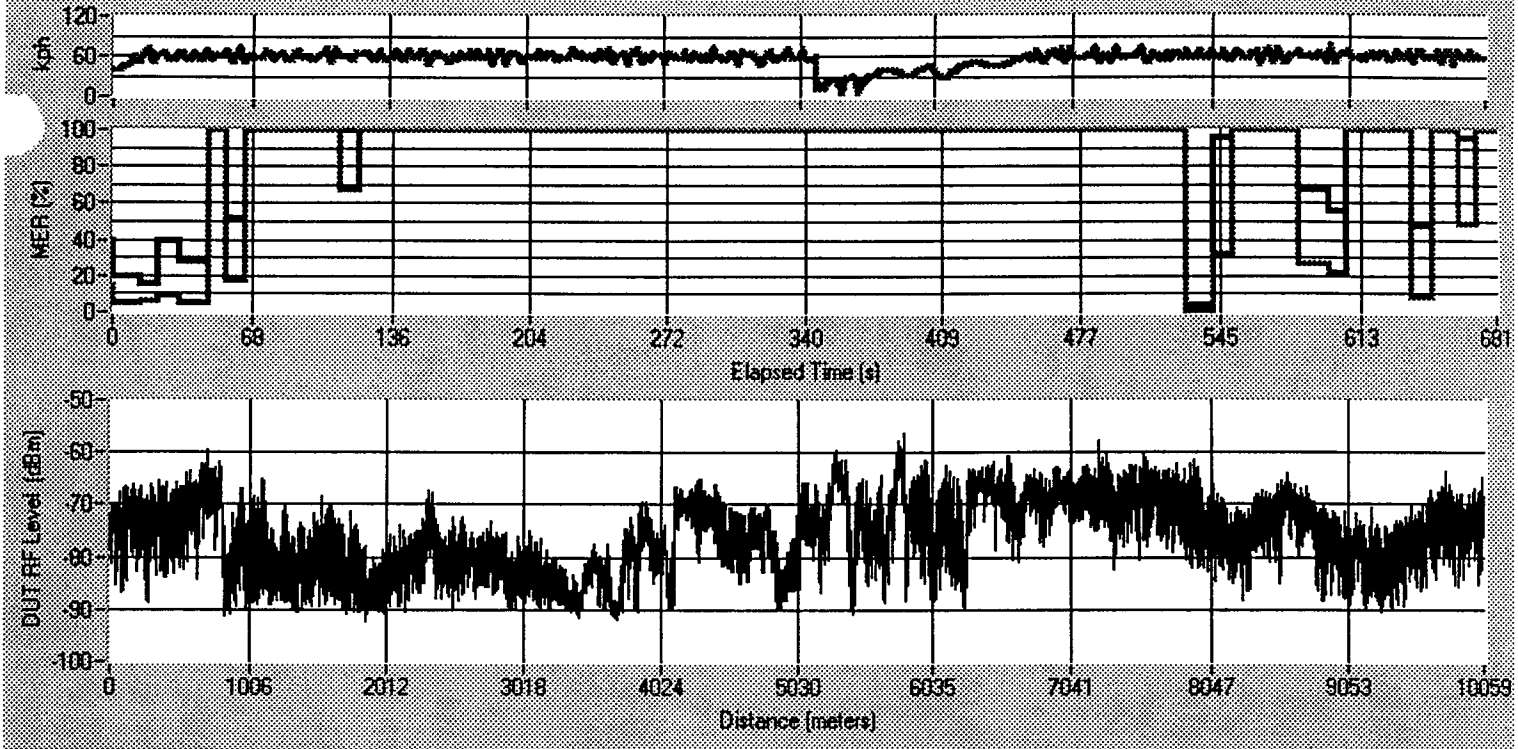


00:30:23:10 NRSC © 1997 HSSC Field Test @ WKSU 00:41:58:21

20: Frames 64: MER=0% 6 (9.4%): 0<MER<=10% 3 (4.7%): 10<MER<=50% 13 (20.3%): MER>50% 42 (65.6%)

220: Frames 64: MER=0% 6 (9.4%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 9 (14.1%): MER>50% 49 (76.6%)

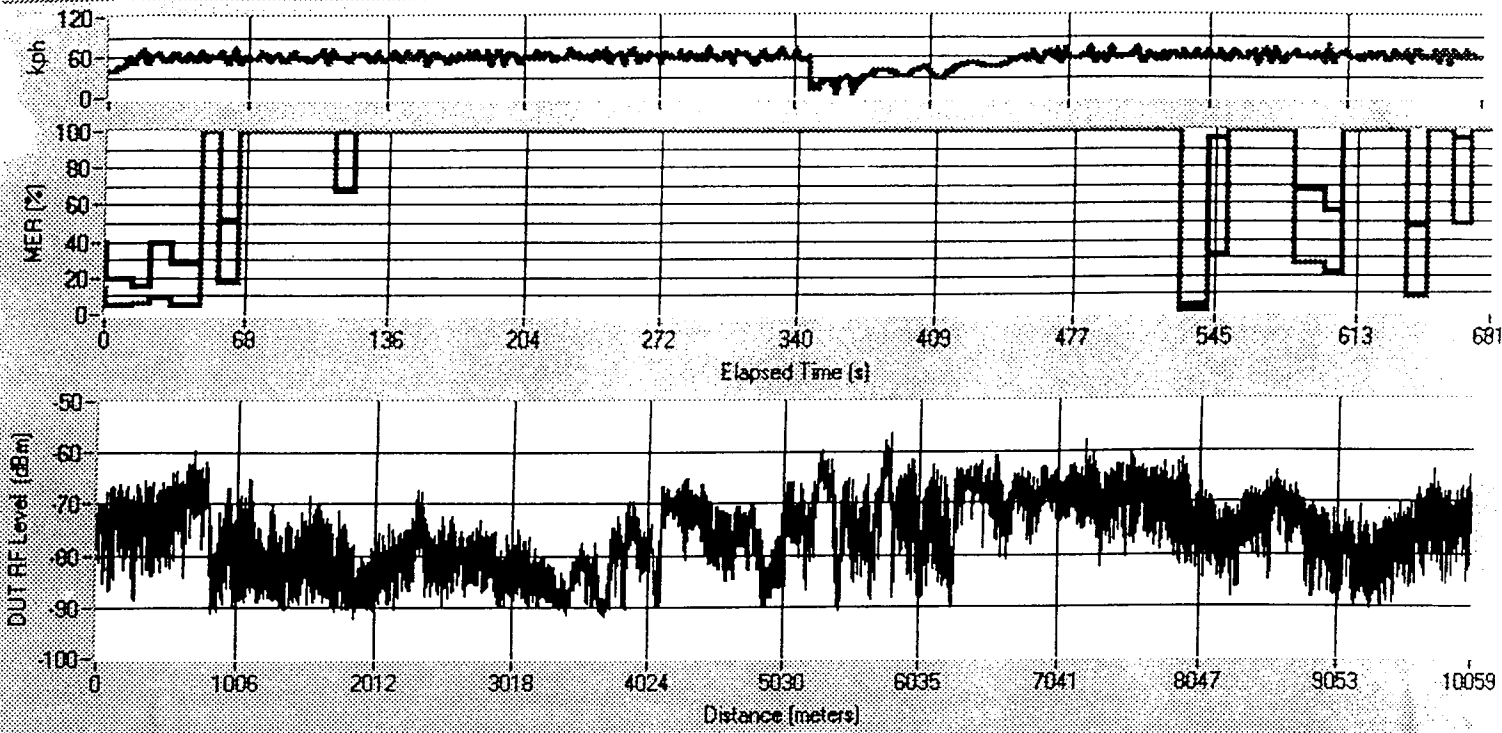
Digital DJ -- Route 3 Urban Fast -- Landmarks 1-7



00:19:23:15	NRSC © 1997 HSSC Field Test @ WKSU	00:30:45:24
20: Frames 64: MER=0% 0 (0.0%); 0<MER<=10% 6 (9.4%); 10<MER<=50% 6 (9.4%); MER>50% 52 (81.2%)		
220: Frames 64: MER=0% 0 (0.0%); 0<MER<=10% 1 (1.6%); 10<MER<=50% 6 (9.4%); MER>50% 57 (89.1%)		

(disclaimer added -
see revised sheet)

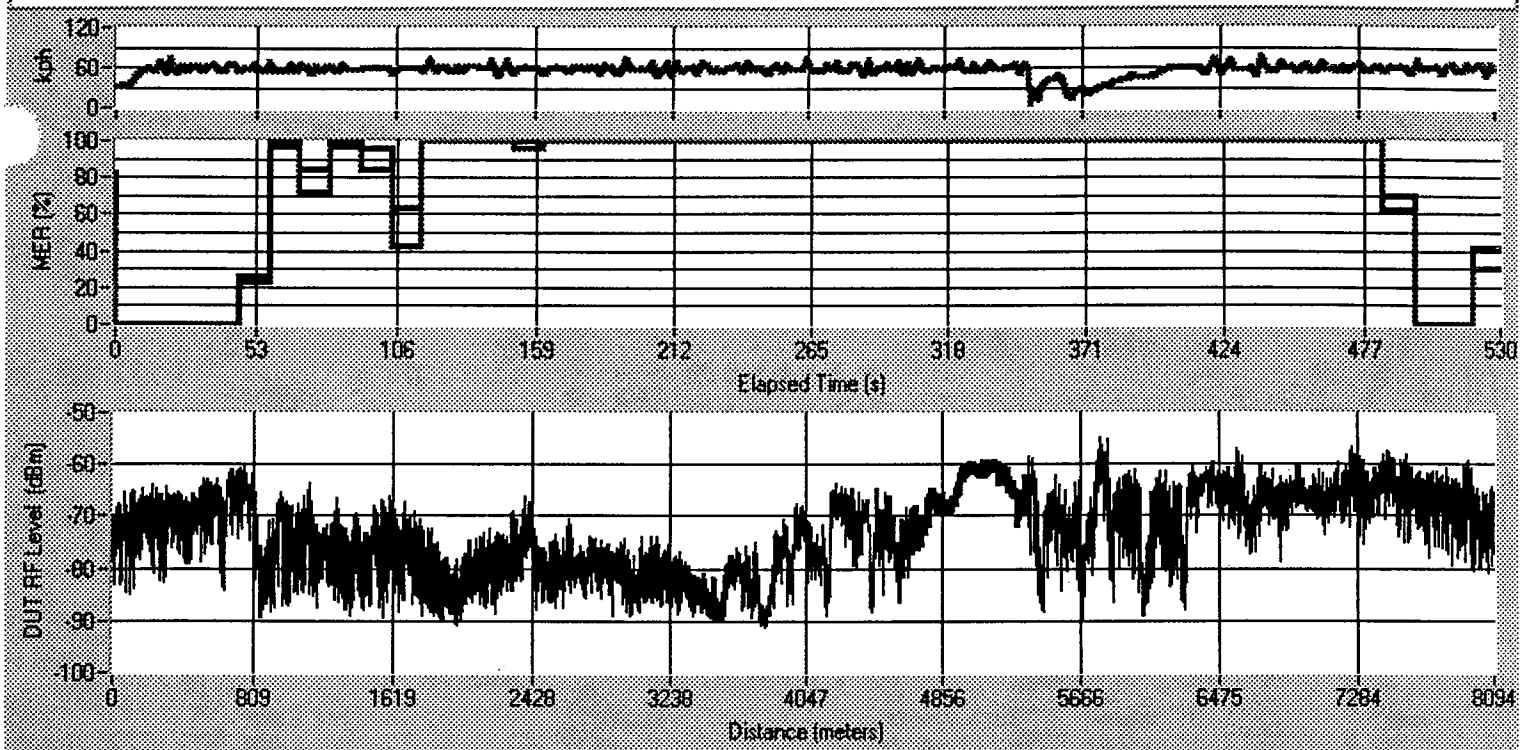
Digital DJ -- Route 3 Urban Fast -- Landmarks 1-7



00:19:23:15	NRSC © 1997 H88C Field Test @ WKSU	00:30:45:24
20: Frames 64: MER=0% 0 (0.0%); 0<MER<=10% 6 (9.4%); 10<MER<=50% 6 (9.4%); MER>50% 52 (81.2%)		
220: Frames 64: MER=0% 0 (0.0%); 0<MER<=10% 1 (1.6%); 10<MER<=50% 6 (9.4%); MER>50% 57 (89.1%)		

Note: It was established by the High-speed FM Subcarrier Subcommittee that this data is unreliable because of some specific problems in the test equipment and peculiarities of the signal environment which existed for this test only. Additional information may be found in the Minutes of Subcommittee, from the August 13, 1997 meeting. Consequently, this data should be considered invalid and not used for system evaluation purposes.

MITRE -- Route 3 Urban Fast -- Landmarks 1-6



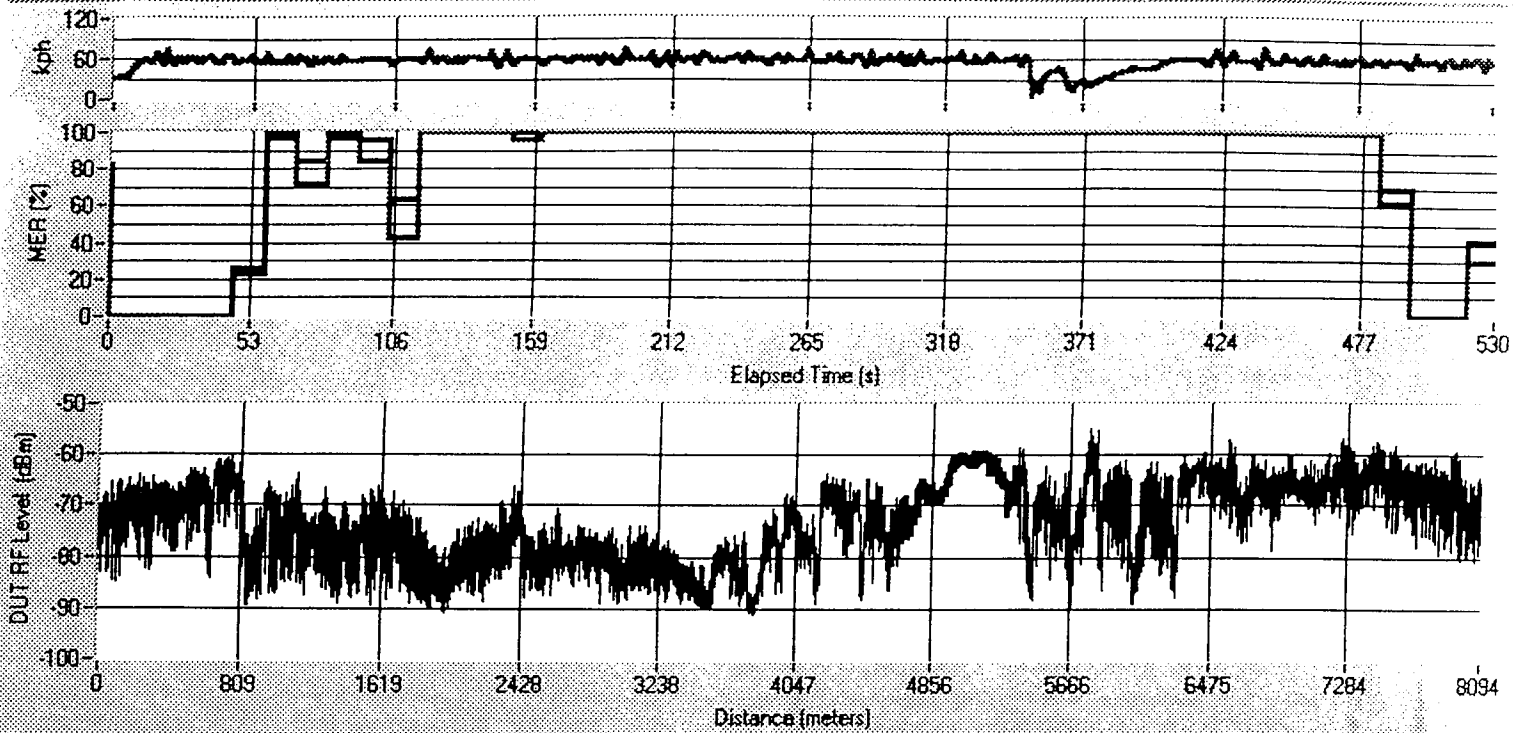
00:02:27:23 NRSC © 1997 HSSC Field Test @ WKSU 00:11:22:23

20: Frames 47: MER=0% 6 (12.8%); 0<MER<=10% 0 (0.0%); 10<MER<=50% 3 (6.4%); MER>50% 38 (80.9%)

220: Frames 47: MER=0% 6 (12.8%); 0<MER<=10% 0 (0.0%); 10<MER<=50% 2 (4.3%); MER>50% 39 (83.0%)

(disclaimer added - see revised sheet)

MITRE -- Route 3 Urban Fast -- Landmarks 1-6



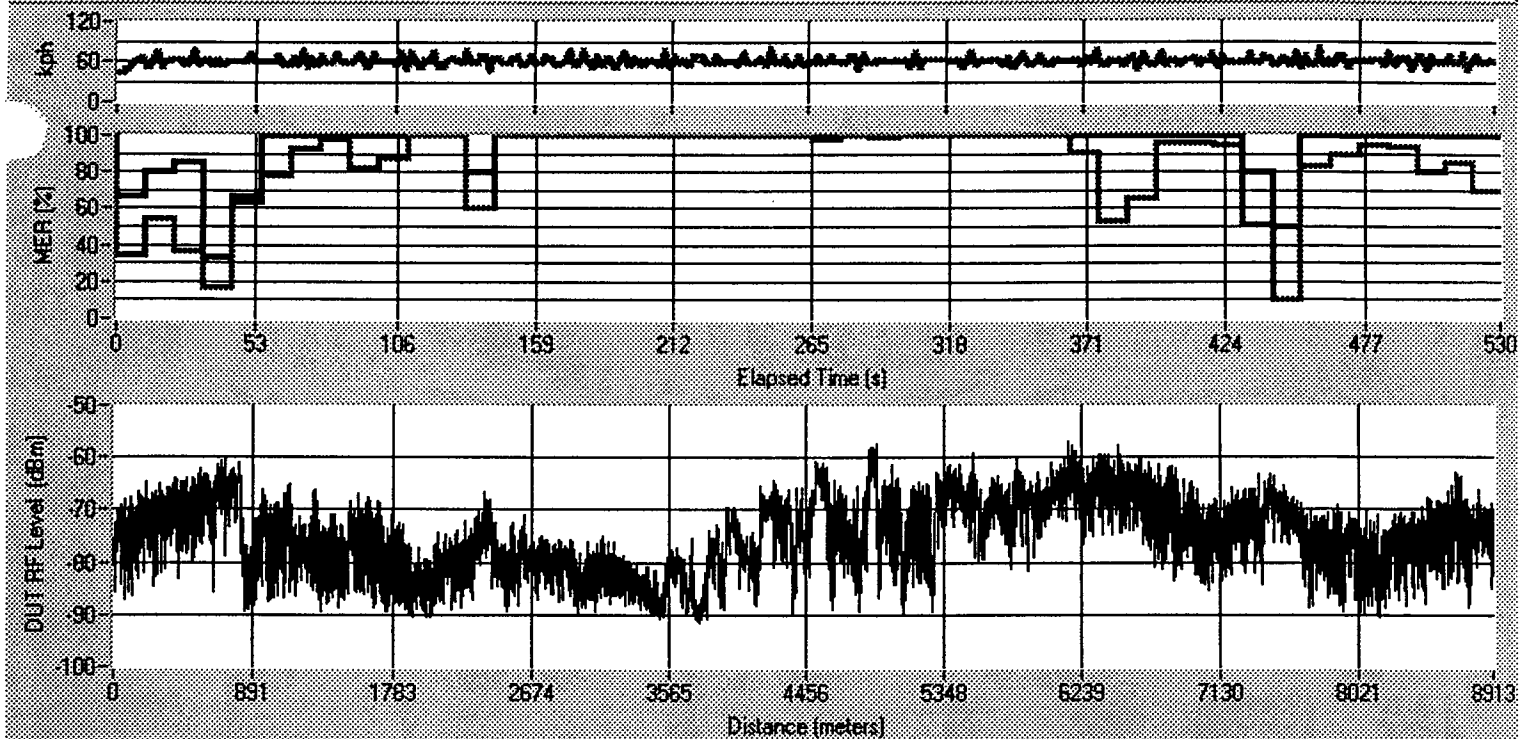
00:02:27:23 NRSC © 1997 HSSC Field Test @ WKSU 00:11:22:23

20: Frames 47: MER=0% 6 (12.8%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 3 (6.4%): MER>50% 38 (80.9%)

220: Frames 47: MER=0% 6 (12.8%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 2 (4.3%): MER>50% 39 (83.0%)

Note: It was established by the High-speed FM Subcarrier Subcommittee that this data is unreliable because of some specific problems in the test equipment and peculiarities of the signal environment which existed for this test only. Additional information may be found in the Minutes of Subcommittee, from the August 13, 1997 meeting. Consequently, this data should be considered invalid and not used for system evaluation purposes.

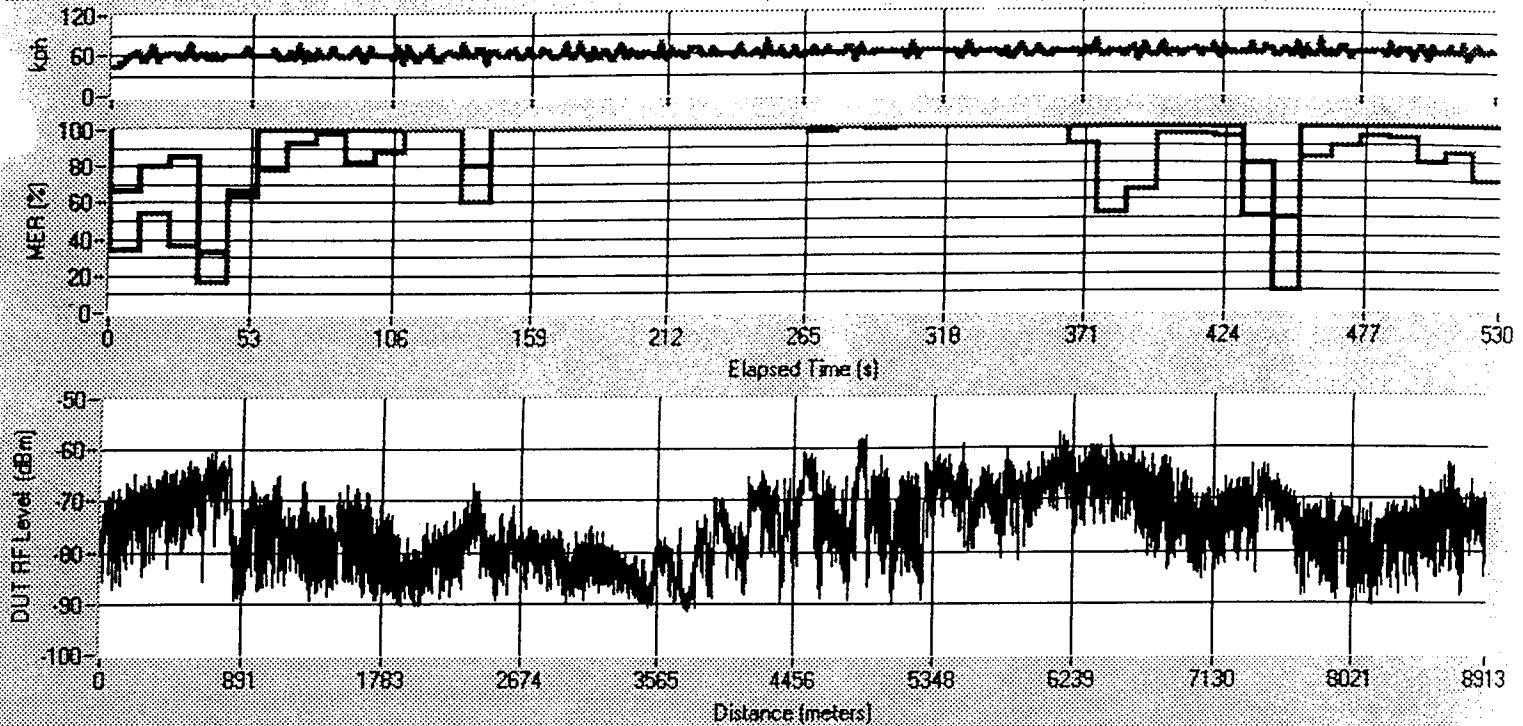
Seiko -- Route 3 Urban Fast -- Landmarks 1-7



00:35:51:23	NRSC © 1997 HSSC Field Test @ WKSU	00:44:40:21
20: Frames 49: MER=0% 0 (0.0%); 0<MER<=10% 0 (0.0%); 10<MER<=50% 4 (8.2%); MER>50% 45 (91.8%)		
220: Frames 49: MER=0% 0 (0.0%); 0<MER<=10% 0 (0.0%); 10<MER<=50% 2 (4.1%); MER>50% 47 (95.9%)		

(disclaimer added- see revised sheet)

Seiko -- Route 3 Urban Fast -- Landmarks 1-7



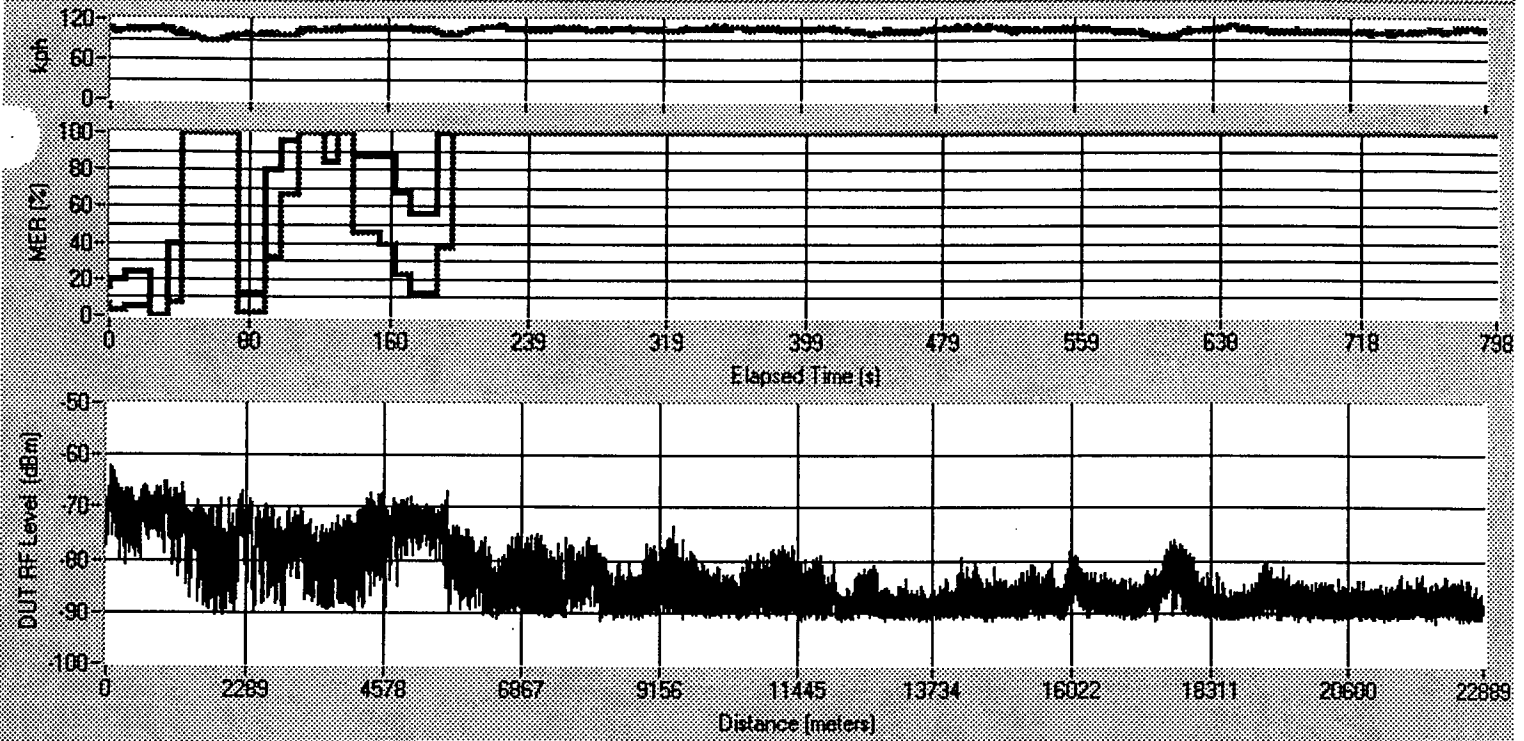
00:35:51:23 NRSC © 1997 HSSC Field Test @ WKSU 00:44:40:21

20: Frames 49: MER=0% 0 (0.0%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 4 (8.2%): MER>50% 45 (91.8%)

220: Frames 49: MER=0% 0 (0.0%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 2 (4.1%): MER>50% 47 (95.9%)

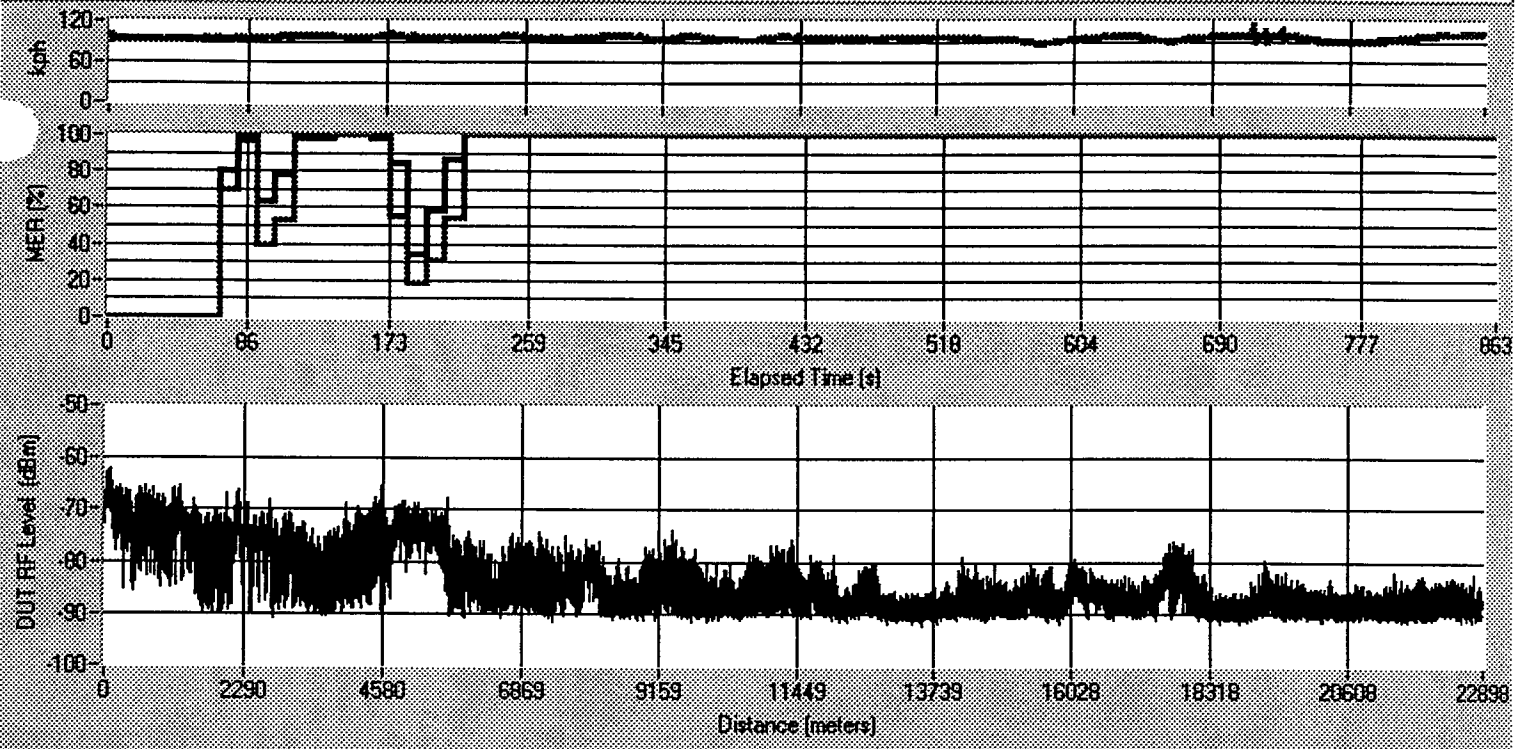
Note: It was established by the High-speed FM Subcarrier Subcommittee that this data is unreliable because of some specific problems in the test equipment and peculiarities of the signal environment which existed for this test only. Additional information may be found in the Minutes of Subcommittee, from the August 13, 1997 meeting. Consequently, this data should be considered invalid and not used for system evaluation purposes.

Digital DJ -- Route 4 I-90 East -- Landmarks 1-13



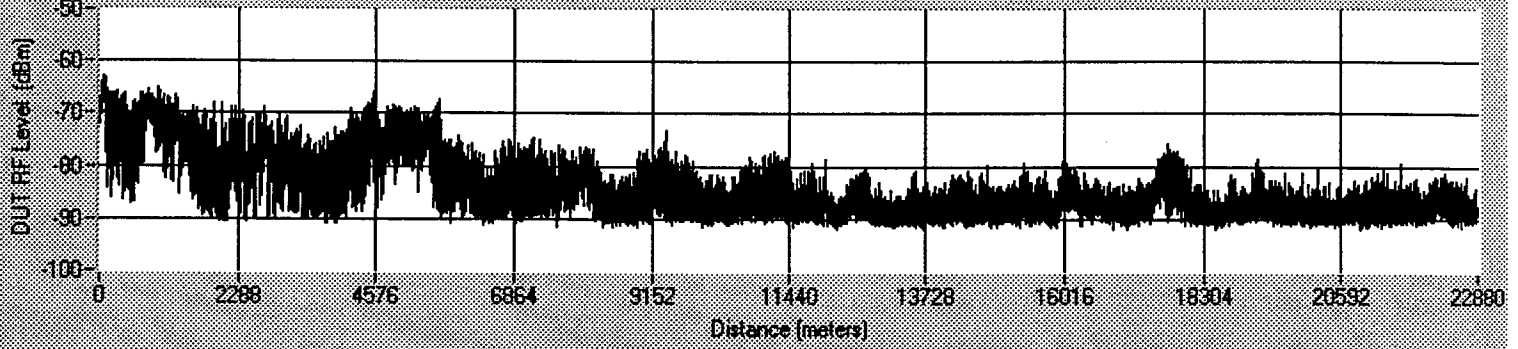
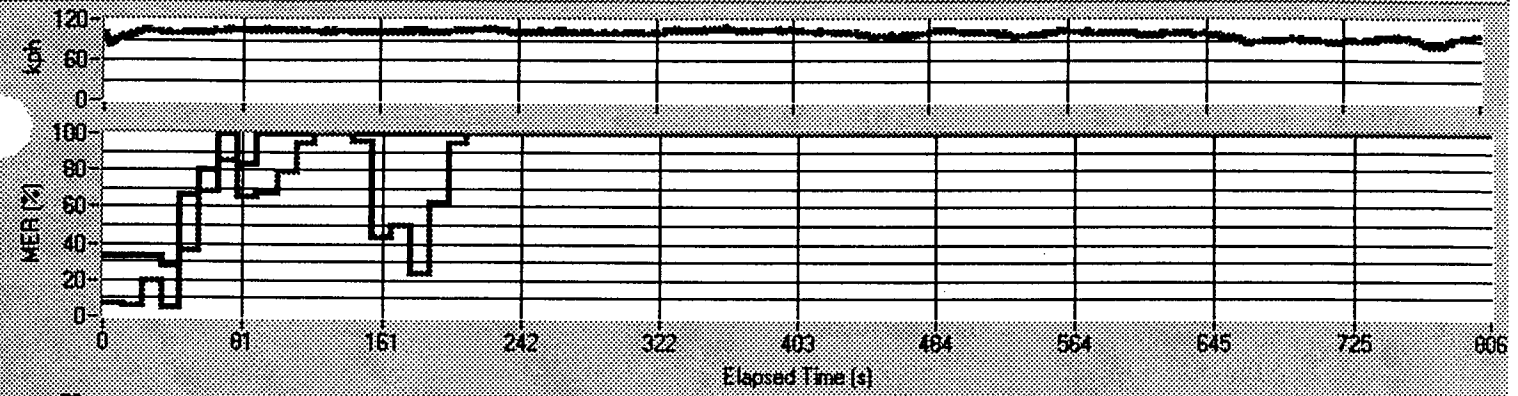
00:44:47:00	NRSC © 1997 HSSC Field Test @ WKSU	00:58:04:14
20: Frames 74: MER=0% 1 (1.4%): 0<MER<=10% 5 (6.8%): 10<MER<=50% 6 (8.1%): MER>50% 62 (83.8%)		
220: Frames 74: MER=0% 1 (1.4%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 5 (6.8%): MER>50% 68 (91.9%)		

MITRE -- Route 4 I-90 East -- Landmarks 1-13



00:04:43:27	NRSC © 1997 HSSC Field Test @ WKSU	00:19:06:18
20: Frames 76: MER=0% 7 (9.2%); 0<MER<=10% 0 (0.0%); 10<MER<=50% 3 (3.9%); MER>50% 66 (86.8%)		
220: Frames 76: MER=0% 7 (9.2%); 0<MER<=10% 0 (0.0%); 10<MER<=50% 1 (1.3%); MER>50% 68 (89.5%)		

Seiko -- Route 4 I-90 East -- Landmarks 1-13



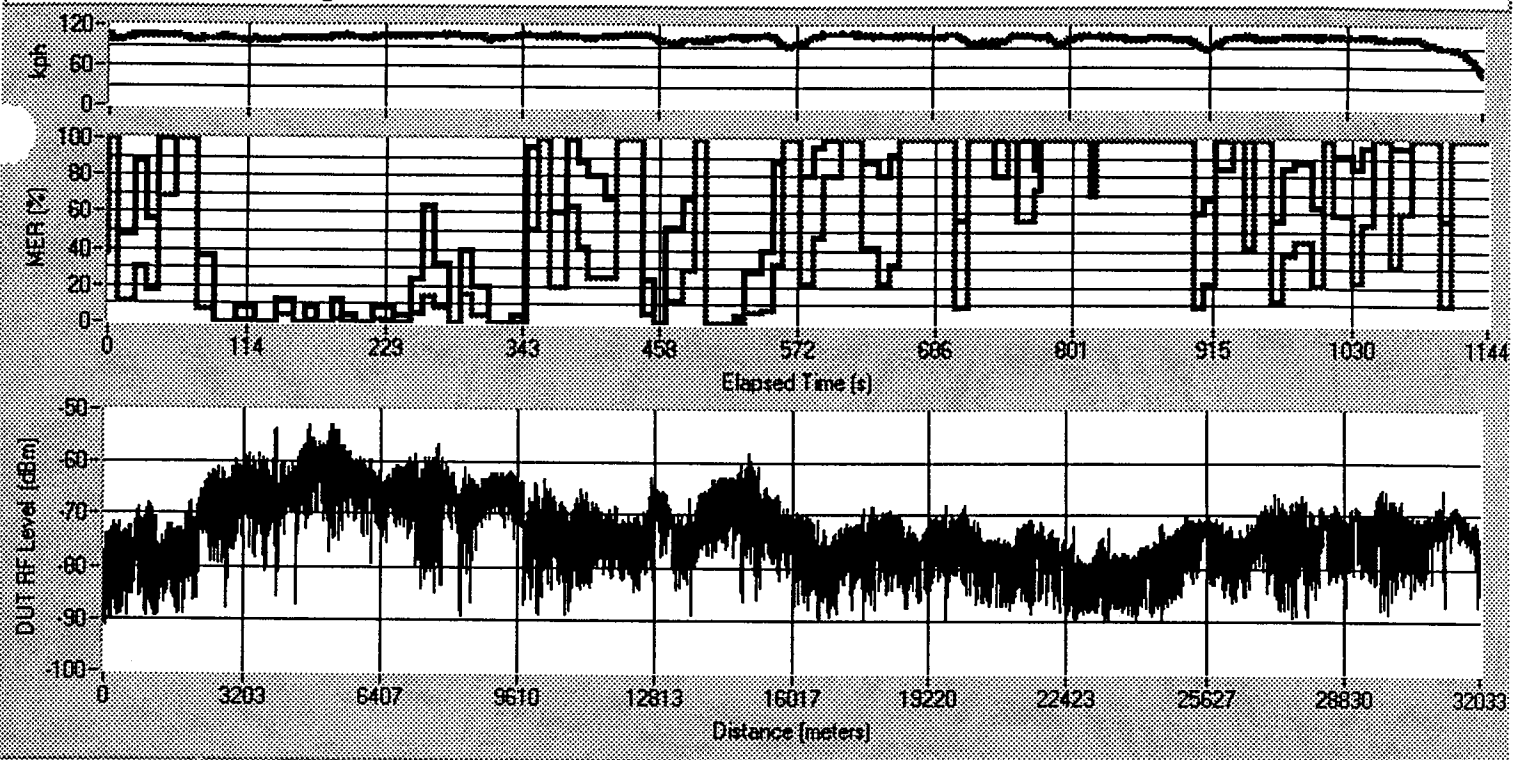
00:25:53:22

NRSC © 1997 HSSC Field Test @ WKSU

00:39:41:25

20: Frames 74: MER=0% 0 (0.0%): 0<MER<=10% 4 (5.4%): 10<MER<=50% 5 (6.8%): MER>50% 65 (87.8%)
220: Frames 74: MER=0% 0 (0.0%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 5 (6.8%): MER>50% 69 (93.2%)

Digital DJ -- Route 5 I-71 South -- Landmarks 1-19

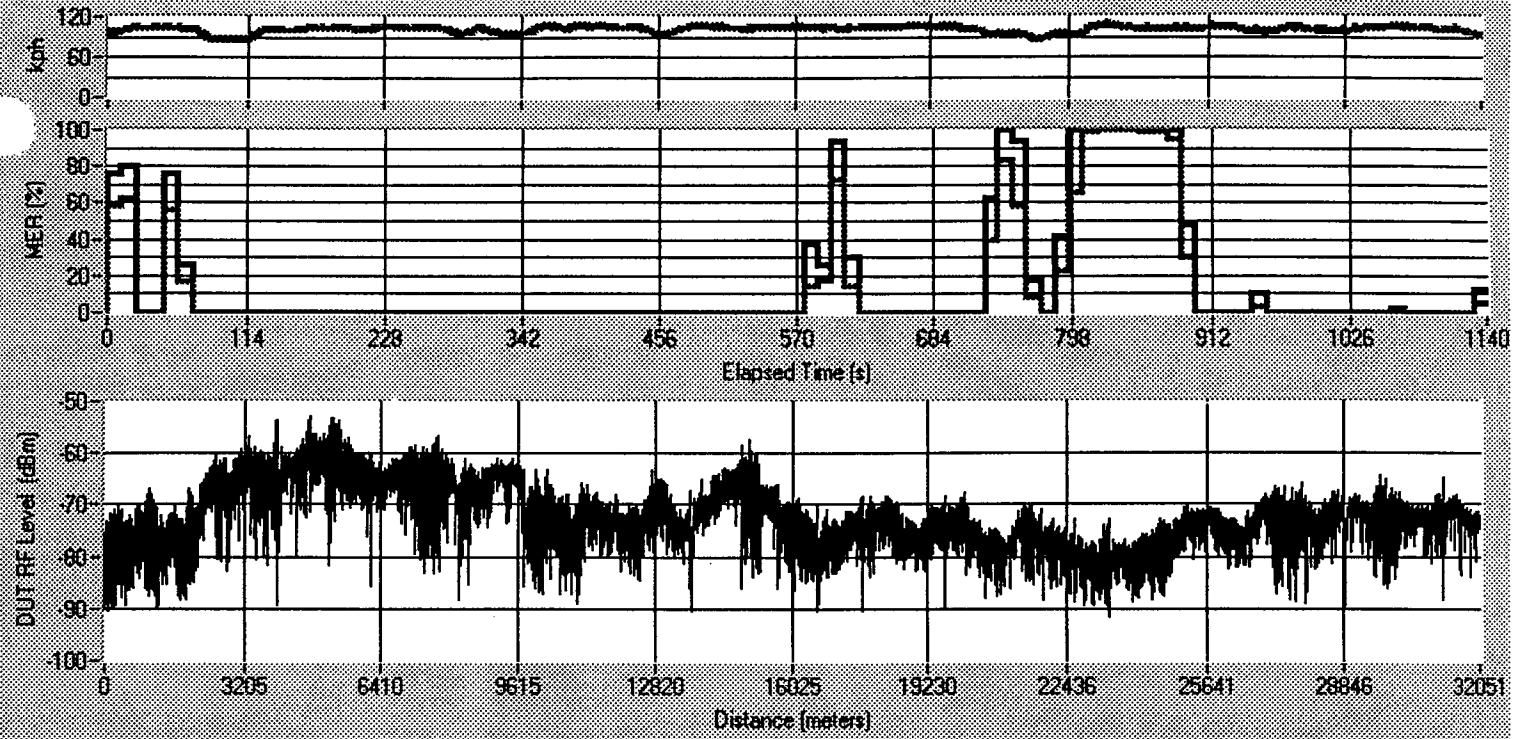


00:59:19:08 NRSC © 1997 HSSC Field Test @ WKSU 01:18:16:10

20: Frames 108: MER=0% 13 (12.0%): 0<MER<=10% 19 (17.6%): 10<MER<=50% 27 (25.0%): MER>50% 49 (45.4%)

220: Frames 108: MER=0% 13 (12.0%): 0<MER<=10% 8 (7.4%): 10<MER<=50% 11 (10.2%): MER>50% 76 (70.4%)

MITRE -- Route 5 I-71 South -- Landmarks 1-19

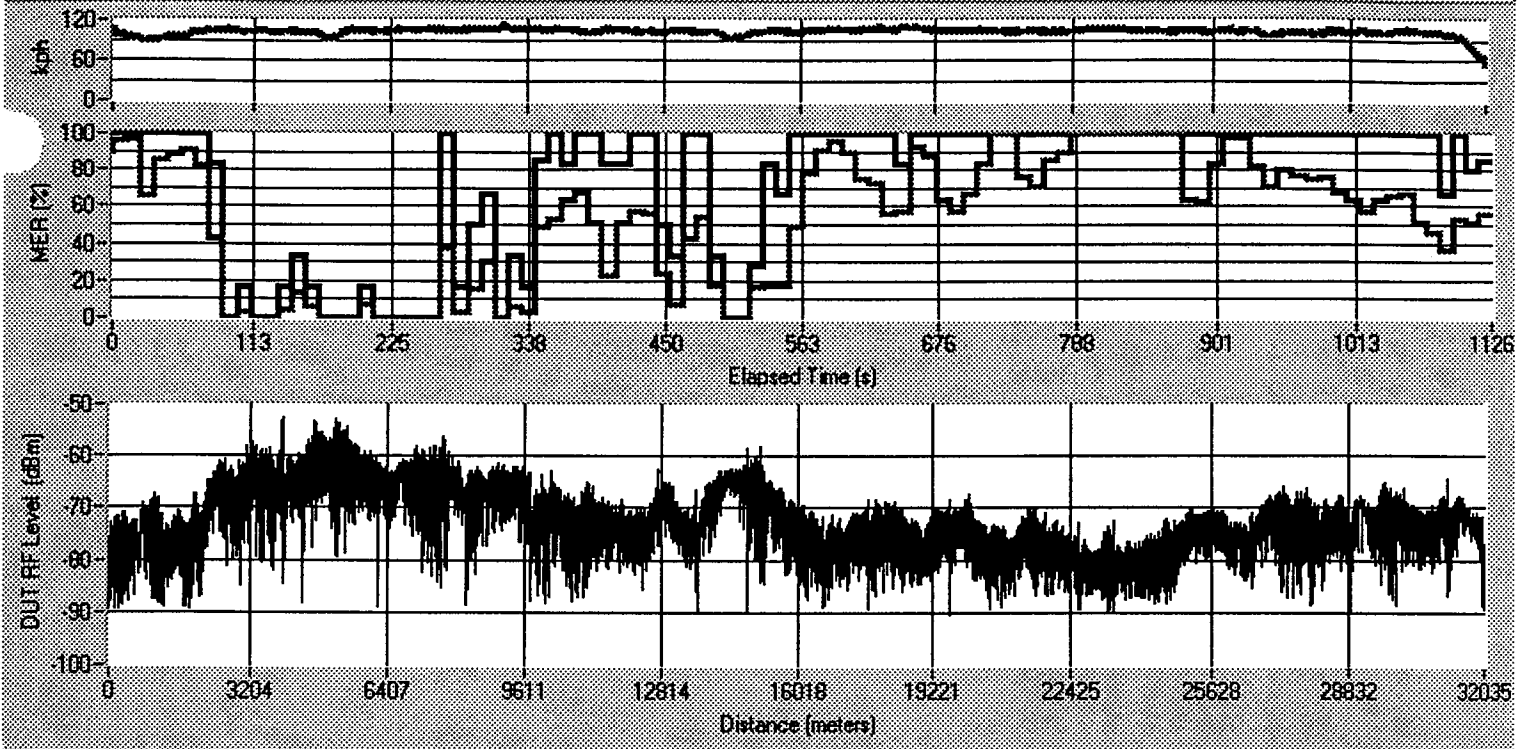


00:05:19:20 NRSC © 1997 HSSC Field Test @ WKSU 00:24:19:10

20: Frames 100: MER=0% 75 (75.0%): 0<MER<=10% 4 (4.0%): 10<MER<=50% 7 (7.0%): MER>50% 14 (14.0%)

220: Frames 100: MER=0% 75 (75.0%): 0<MER<=10% 2 (2.0%): 10<MER<=50% 8 (8.0%): MER>50% 15 (15.0%)

Seiko -- Route 5 I-71 South -- Landmarks 1-19



00:34:50:00 NRSC © 1997 HSSC Field Test @ WKSU 00:53:38:25

20: Frames 103: MER=0% 14 (13.6%): 0<MER<=10% 8 (7.8%): 10<MER<=50% 16 (15.5%): MER>50% 65 (63.1%)
220: Frames 103: MER=0% 14 (13.6%): 0<MER<=10% 0 (0.0%): 10<MER<=50% 13 (12.6%): MER>50% 76 (73.8%)

	DDJ		MITRE		SEIKO		
	SMPTE	Elapsed	SMPTE	Elapsed	SMPTE	Elapsed	
Fagens sign @ Front & Old River Rd Turn Left	1	0:02:42	0:00:00	0:22:22	0:00:00	0:43:59	0:00:00
Rail Road Xing Do Not Stop On Tracks Turn Right	2	0:03:50	0:01:08	0:23:33	0:01:11	0:45:12	0:01:13
Left to James Gate Before Blue Bridge turn Left onto Carter	3	0:05:23	0:02:41	0:24:52	0:02:30	0:47:26	0:03:27
Right onto Eagle Gate before bridge	4	0:06:40	0:03:58	0:26:18	0:03:56	0:48:42	0:04:43
Left onto Ontario Orange and Blue Gund Arena Sign on right	5	0:08:29	0:05:47	0:28:43	0:06:21	0:50:25	0:06:26
Right onto Huron Gund Arena Sign at E 6th right then left	6	0:09:18	0:06:36	0:29:39	0:07:17	0:51:13	0:07:14
Parking Sign on Right after Law Office Left on Chester	7	0:12:01	0:09:19	0:32:28	0:10:06	0:54:15	0:10:16
Right onto E 9th National City Bank Sign on right	8	0:15:04	0:12:22	0:35:26	0:13:04	0:57:15	0:13:16
Turn Left onto Route 2 West Yield Sign	9	0:17:01	0:14:19	0:37:13	0:14:51	1:00:23	0:16:24
Turn Left onto W 3rd West Route 2 Sign	10	0:17:55	0:15:13	0:38:21	0:15:59	1:01:25	0:17:26
Right onto Lakeside Stop Sign	11	0:19:24	0:16:42	0:39:54	0:17:32	1:02:43	0:18:44
END Right Onto West 10th Stop Sign	12	0:20:16	0:17:34	0:40:46	0:18:24	1:03:49	0:19:50

	DDJ		MITRE		SEIKO	
	SMPTE	Elapsed	SMPTE	Elapsed	SMPTE	Elapsed
West 78 & Lake Ave Emergcy Snow Street Sign take right on Detroit	1 0:35:43	0:00:00	0:21:46	0:00:00	0:05:50	0:00:00
Mc Donald's Arch on right	2 0:36:26	0:00:43	0:23:13	0:01:27	0:06:55	0:01:05
Lucielle's Strudel Sign on right	3 0:38:00	0:02:17	0:24:48	0:03:02	0:08:27	0:02:37
Water Tower on Left across from Thomas Beverage	4 0:39:06	0:03:23	0:25:50	0:04:04	0:09:39	0:03:49
Hospital Sign after West 28th Street	5 0:40:47	0:05:04	0:26:50	0:05:04	0:11:09	0:05:19
Veterans Memorial Bridge Sign	6 0:42:11	0:06:28	0:27:29	0:05:43	0:11:48	0:05:58
Frank and Pauly's Sign on Right by BP Building	7 0:45:42	0:09:59	0:31:04	0:09:18	0:13:54	0:08:04
END North Point Inn Sign before 17th	8 0:48:29	0:12:46	0:32:41	0:10:55	0:16:50	0:11:00

	DDJ		MITRE		SEIKO		
	SMPTE	Elapsed	SMPTE	Elapsed	SMPTE	Elapsed	
Rt 2 Entrance off of W 28th Street Red Yeild Sign	1	0:02:56	0:00:00	0:16:46	0:00:00	0:29:42	0:00:00
Miller Beer Bill Board	2	0:04:15	0:01:19	0:18:04	0:01:18	0:30:55	0:01:13
Double Right Arrows W I-90 Exit	3	0:06:10	0:03:14	0:20:03	0:03:17	0:32:51	0:03:09
Exit 173B @ Chester	4	0:07:28	0:04:32	0:21:14	0:04:28	0:34:02	0:04:20
Exit 172A Over Head Sign @ Ramp	5	0:08:30	0:05:34	0:22:13	0:05:27	0:35:02	0:05:20
Exit 171 W I-90 Sign @ Ramp	6	0:10:06	0:07:10	0:23:46	0:07:00	0:36:30	0:06:48
END Exit 169 @ Ramp	7	0:12:07	0:09:11	0:25:50	0:09:04	0:38:27	0:08:45

	DDJ		MITRE		SEIKO	
	SMPTE	Elapsed	SMPTE	Elapsed	SMPTE	Elapsed
I-271 N Mile Marker 36	1 0:55:44	0:00:00	0:31:45	0:00:00	0:08:30	0:00:00
Mile Marker 37	2 0:56:47	0:01:03	0:32:52	0:01:07	0:09:37	0:01:07
Mile Marker 38	3 0:57:48	0:02:04	0:33:54	0:02:09	0:10:42	0:02:12
Mile Marker 39	4 0:58:47	0:03:03	0:34:54	0:03:09	0:11:46	0:03:16
Mile Marker 189	5 1:00:08	0:04:24	0:36:14	0:04:29	0:13:12	0:04:42
Mile Marker 190	6 1:01:08	0:05:24	0:37:19	0:05:34	0:14:17	0:05:47
Mile Marker 191	7 1:02:11	0:06:27	0:38:25	0:06:40	0:15:24	0:06:54
Mile Marker 193	8 1:04:14	0:08:30	0:40:33	0:08:48	0:17:36	0:09:06
Mile Marker 195	9 1:06:15	0:10:31	0:42:40	0:10:55	0:19:46	0:11:16
Mile Marker 196	10 1:07:14	0:11:30	0:43:44	0:11:59	0:20:53	0:12:23
Mile Marker 197	11 1:08:14	0:12:30	0:44:48	0:13:03	0:21:56	0:13:26
Mile Marker 198	12 1:09:18	0:13:34	0:45:52	0:14:07	0:23:02	0:14:32
Mile Marker 199	13 1:10:17	0:14:33	0:46:53	0:15:08	0:24:04	0:15:34
END Exit 200 @ Rt 44	14 1:12:13	0:16:29	0:48:46	0:17:01	0:26:06	0:17:36

	DDJ		MITRE		SEIKO		
	SMPTE	Elapsed	SMPTE	Elapsed	SMPTE	Elapsed	
I-71 S Mile Marker 218	1	0:05:24	0:00:00	0:33:12	0:00:00	1:01:30	0:00:00
Mile Marker 217	2	0:06:34	0:01:10	0:34:13	0:01:01	1:02:33	0:01:03
Mile Marker 215	3	0:08:55	0:03:31	0:36:31	0:03:19	1:04:43	0:03:13
Mile Marker 214	4	0:10:02	0:04:38	0:37:32	0:04:20	1:05:46	0:04:16
Mile Marker 213	5	0:11:06	0:05:42	0:38:34	0:05:22	1:07:54	0:06:24
Mile Marker 211	6	0:13:12	0:07:48	0:40:36	0:07:24	1:08:55	0:07:25
Mile Marker 210	7	0:14:16	0:08:52	0:41:36	0:08:24	1:09:56	0:08:26
Mile Marker 209	8	0:15:24	0:10:00	0:42:41	0:09:29	1:11:03	0:09:33
Mile Marker 208	9	0:16:28	0:11:04	0:43:42	0:10:30	1:12:09	0:10:39
Mile Marker 207	10	0:17:31	0:12:07	0:44:41	0:11:29	1:13:11	0:11:41
Mile Marker 206	11	0:18:34	0:13:10	0:45:43	0:12:31	1:14:11	0:12:41
Mile Marker 205	12	0:19:37	0:14:13	0:46:44	0:13:32	1:15:12	0:13:42
Mile Marker 204	13	0:20:42	0:15:18	0:47:45	0:14:33	1:16:16	0:14:46
Mile Marker 203	14	0:21:45	0:16:21	0:48:45	0:15:33	1:17:19	0:15:49
Mile Marker 202	15	0:22:51	0:17:27	0:49:48	0:16:36	1:18:22	0:16:52
Mile Marker 201	16	0:23:56	0:18:32	0:50:51	0:17:39	1:19:25	0:17:55
Mile Marker 200	17	0:25:02	0:19:38	0:51:57	0:18:45	1:20:29	0:18:59
Mile Marker 199	18	0:26:08	0:20:44	0:53:03	0:19:51	1:21:34	0:20:04
END Mile Marker 198	19	0:27:16	0:21:52	0:54:11	0:20:59	1:22:42	0:21:12

	DDJ		MITRE		SEIKO		
	SMPTE	Elapsed	SMPTE	Elapsed	SMPTE	Elapsed	
Fagens sign @ Front & Old River Rd Turn Left	1	0:03:19	0:00:00	0:24:18	0:00:00	0:42:59	0:00:00
Rail Road Xing Do Not Stop On Tracks Turn Right	2	0:04:21	0:01:02	0:25:26	0:01:08	0:44:13	0:01:14
Left to James Gate Before Blue Bridge turn Left onto Carter	3	0:06:37	0:03:18	0:26:35	0:02:17	0:45:21	0:02:22
Right onto Eagle Gate before bridge	4	0:08:26	0:05:07	0:27:55	0:03:37	0:46:38	0:03:39
Left onto Ontario Orange and Blue Gund Arena Sign on right	5	0:11:02	0:07:43	0:29:00	0:04:42	0:48:45	0:05:46
Right onto Huron Gund Arena Sign at E 6th right then left	6	0:11:45	0:08:26	0:29:40	0:05:22	0:49:35	0:06:36
Left onto Euclid Hotel and Theater Park Sign on Right	7	0:14:25	0:11:06	0:32:11	0:07:53	0:52:12	0:09:13
Right onto E 9th National City Bank Sign on right	8	0:16:08	0:12:49	0:33:58	0:09:40	0:53:57	0:10:58
Turn Left onto Route 2 West Yield Sign	9	0:18:35	0:15:16	0:36:39	0:12:21	0:56:26	0:13:27
Turn Left onto W 3rd West Route 2 Sign	10	0:19:45	0:16:26	0:37:49	0:13:31	0:57:32	0:14:33
Right onto Lakeside Stop Sign	11	0:20:36	0:17:17	0:38:38	0:14:20	0:58:20	0:15:21
END Right Onto West 10th Stop Sign	12	0:21:33	0:18:14	0:39:29	0:15:11	0:59:08	0:16:09

	DDJ		MITRE		SEIKO	
	SMPTE	Elapsed	SMPTE	Elapsed	SMPTE	Elapsed
West 78 & Lake Ave Emergcy Snow Street Sign take right on Detroit	1 0:44:43	0:00:00	0:17:19	0:00:00	0:30:23	0:00:00
Mc Donald's Arch on right	2 0:45:47	0:01:04	0:18:45	0:01:26	0:31:43	0:01:20
Lucielle's Strudel Sign on right	3 0:47:20	0:02:37	0:20:20	0:03:01	0:33:20	0:02:57
Water Tower on Left across from Thomas Beverage	4 0:48:29	0:03:46	0:21:22	0:04:03	0:34:45	0:04:22
Hospital Sign after West 28th Street	5 0:49:46	0:05:03	0:22:42	0:05:23	0:36:03	0:05:40
Veterans Memorial Bridge Sign	6 0:51:17	0:06:34	0:24:12	0:06:53	0:36:40	0:06:17
Frank and Pauly's Sign on Right by BP Building	7 0:53:48	0:09:05	0:26:48	0:09:29	0:39:18	0:08:55
END North Point Inn Sign before 17th	8 0:55:31	0:10:48	0:28:06	0:10:47	0:41:58	0:11:35

Rt 2 Entrance off of W 28th Street Red Yield Sign
 Miller Beer Bill Board
 Double Right Arrows W I-90 Exit
 Exit 173B @ Chester
 Exit 172A Over Head Sign @ Ramp
 Exit 171 W I-90 Sign @ Ramp
 END Exit 169 @ Ramp

	DDJ		MITRE		SEIKO	
	SMPTE	Elapsed	SMPTE	Elapsed	SMPTE	Elapsed
1	0:19:23	0:00:00	0:02:27	0:00:00	0:35:51	0:00:00
2	0:20:38	0:01:15	0:03:47	0:01:20	0:37:05	0:01:14
3	0:22:35	0:03:12	0:05:50	0:03:23	0:39:05	0:03:14
4	0:25:02	0:05:39	0:07:37	0:05:10	0:40:20	0:04:29
5	0:27:20	0:07:57	0:09:51	0:07:24	0:41:19	0:05:28
6	0:28:49	0:09:26	0:11:22	0:08:55	0:42:43	0:06:52
7	0:30:45	0:11:22			0:44:40	0:08:49

}
 |
 missed a
 landmark

	DDJ		MITRE		SEIKO		
	SMPTE	Elapsed	SMPTE	Elapsed	SMPTE	Elapsed	
I-271 N Mile Marker 36	1	0:44:47	0:00:00	0:04:43	0:00:00	0:25:53	0:00:00
Mile Marker 37	2	0:45:47	0:01:00	0:05:48	0:01:05	0:26:54	0:01:01
Mile Marker 38	3	0:46:46	0:01:59	0:06:48	0:02:05	0:27:49	0:01:56
Mile Marker 39	4	0:47:41	0:02:54	0:07:47	0:03:04	0:28:46	0:02:53
Mile Marker 189	5	0:48:53	0:04:06	0:09:05	0:04:22	0:29:58	0:04:05
Mile Marker 190	6	0:49:46	0:04:59	0:10:03	0:05:20	0:30:53	0:05:00
Mile Marker 191	7	0:50:41	0:05:54	0:11:04	0:06:21	0:31:50	0:05:57
Mile Marker 193	8	0:52:31	0:07:44	0:13:04	0:08:21	0:33:41	0:07:48
Mile Marker 195	9	0:53:25	0:08:38	0:14:04	0:09:21	0:34:38	0:08:45
Mile Marker 196	10	0:55:16	0:10:29	0:16:06	0:11:23	0:36:31	0:10:38
Mile Marker 197	11	0:56:11	0:11:24	0:17:05	0:12:22	0:37:33	0:11:40
Mile Marker 198	12	0:57:08	0:12:21	0:18:08	0:13:25	0:38:37	0:12:44
Mile Marker 199	13	0:58:04	0:13:17	0:19:06	0:14:23	0:39:41	0:13:48
END Exit 200 @ Rt 44							

	DDJ		MITRE		SEIKO	
	SMPTE	Elapsed	SMPTE	Elapsed	SMPTE	Elapsed
I-71 S Mile Marker 218	1	0:59:19 0:00:00	0:05:19 0:00:00	0:34:50 0:00:00		
Mile Marker 217	2	1:00:14 0:00:55	0:06:15 0:00:56	0:35:50 0:01:00		
Mile Marker 215	3	1:02:09 0:02:50	0:08:16 0:02:57	0:37:44 0:02:54		
Mile Marker 214	4	1:03:05 0:03:46	0:09:11 0:03:52	0:38:40 0:03:50		
Mile Marker 213	5	1:04:00 0:04:41	0:10:07 0:04:48	0:39:35 0:04:45		
Mile Marker 211	6	1:04:56 0:05:37	0:12:01 0:06:42	0:41:24 0:06:34		
Mile Marker 210	7	1:06:45 0:07:26	0:12:56 0:07:37	0:42:19 0:07:29		
Mile Marker 209	8	1:07:44 0:08:25	0:13:52 0:08:33	0:43:16 0:08:26		
Mile Marker 208	9	1:08:40 0:09:21	0:14:48 0:09:29	0:44:13 0:09:23		
Mile Marker 207	10	1:09:35 0:10:16	0:15:43 0:10:24	0:45:07 0:10:17		
Mile Marker 206	11	1:10:29 0:11:10	0:16:38 0:11:19	0:46:01 0:11:11		
Mile Marker 205	12	1:11:26 0:12:07	0:17:35 0:12:16	0:46:56 0:12:06		
Mile Marker 204	13	1:12:22 0:13:03	0:18:37 0:13:18	0:47:52 0:13:02		
Mile Marker 203	14	1:13:17 0:13:58	0:19:33 0:14:14	0:48:46 0:13:56		
Mile Marker 202	15	1:14:15 0:14:56	0:20:31 0:15:12	0:49:42 0:14:52		
Mile Marker 201	16	1:15:13 0:15:54	0:21:28 0:16:09	0:50:39 0:15:49		
Mile Marker 200	17	1:16:07 0:16:48	0:22:24 0:17:05	0:51:35 0:16:45		
Mile Marker 199	18	1:17:05 0:17:46	0:23:21 0:18:02	0:52:32 0:17:42		
END Mile Marker 198	19	1:18:16 0:18:57	0:24:19 0:19:00	0:53:38 0:18:48		

8. Data Collection Fixed Sites

Fixed Test Sites

Distance Transmitter to Fixed Test Site WGAR		
Site Number	Miles	Location
1.	8.3	NASA Lewis parking lot east of building #54, Cleveland
2.	8.6	1760 Scranton Rd., Cleveland
3.	16.5	On state 18 about 1 mile east of I 71
4.	34.6	About 1 mile north of I 71 exit 198,
5.	8.0	Lake Ave. east of West 78 th St., Cleveland
6.	17.7	In parking lot on SW corner of US 322 and State 91, Mayfield Heights

Distance Transmitter to Fixed Test Site WKSU		
Site Number	Miles	Location
1.	31.0	Lake Ave. east of West 78 th St., Cleveland
2.	30.6	Detroit Ave. between LM-2 and LM-3 across from Lucielle's Strudel Sign, Cleveland
3.	30.5	Detroit Ave., Cleveland
4.	30.5	1400 West 2 nd St., Cleveland
5.	30.0	1970 Scranton, Rd., Cleveland
6.	26.0	In parking lot on SW corner of US 322 and State 91, Mayfield Heights
7.	32.0	SW corner of state route 91 and 84, Willoughby Hills
8.	31.0	USNR parking lot east of East 9 th St. north of state Rt-2, Cleveland
9.	36.0	BP parking lot at I 71 exit on state Rt-83, 2.5 miles south of Lodi
10.	24.2	Rest stop on I 71 at 221 mile marker. West side of highway.

(revised)

HSSC FIELD TEST FIXED SITE MEASUREMENTS WGAR #1							
Route : NA							
Site: NASA Lewis parking lot east of Building #54.				Station: WGAR			
Date: June 23, 1997			Weather:				
Engineer/Operator		DL		TK			
Signal stability: Good							
Signal Level without Attenuation: -43 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten: 48 dB	Level: -91 dBm	Atten: 50 dB	Level: -93 dBm	Atten: 42 dB	Level: -85 dBm
	OME + 3 dB	Error: 18.7%		Error: 40.3%		Error: 14.1%	
20 byte message error	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see .BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 69.7%		Error: 99.4%		Error: 40.3%	
220 byte message error	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 96%		Error: 100%		Error: 85.7%	

The distance from the transmitter to the receiver fixed site is 8.3 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WGAR #1							
Route : NA							
Site: NASA Lewis parking lot east of Building #54.				Station: WGAR			
Date: June 23, 1997			Weather:				
Engineer/Operator		DL		TK			
Signal stability: Good							
Signal Level without Attenuation: -43 dBm (at proponent RF input)							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: 48 dB	Level: -91 dBm	Atten: 50 dB	Level: -93 dBm	Atten: 42 dB	Level: -85 dBm
	OME + 3 dB	Error: 18.7%		Error: 40.3%		Error: 14.1%	
20 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see .BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 69.7%		Error: 99.4%		Error: 40.3%	
220 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 96%		Error: 100%		Error: 85.7%	

The distance from the transmitter to the receiver fixed site is 8.3 miles.

(revised)

HSSC FIELD TEST FIXED SITE MEASUREMENTS WGAR #2							
Route: About ¼ mile south of route #1 in Cuyahoga River Valley (Flats).							
Site: 1970 Scranton Road (just north of Lorain Ave. bridge)				Station: WGAR			
Date: June 23, 1997 Measurements taken between 420PM and 520PM.			Weather: Partly cloudy and hot.				
Engineer/Operator		DL		TK		3	
Signal stability: Good after moving unit a few inches.							
Signal Level without Attenuation: -46 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: Error free		Error: Error free		Error: .057%	
	OME	Atten: 35 dB	Level: -81 dBm	Atten: 43 dB	Level: -89 dBm	Atten: NA ^o	Level: NA ⁻⁴⁶
	OME + 3 dB	Error: .004%		Error: 33%		Error: .043%	
20 byte message error	No RF Attenuation	Error: Error free		Error: Error free		Error: .72%	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: NA ^o	Level: NA ⁻⁴⁶
	OME + 3 dB	Error: .061%		Error: 100%		Error: .727%	
220 byte message error	No RF Attenuation	Error: Error free		Error: Error Free		Error: 4%	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: NA ^o	Level: NA ⁻⁴⁶
	OME + 3 dB	Error: .3%		Error: 100%		Error: 6.67%	

The distance from transmitter to the receiver site is 8.6 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WGAR #2							
Route: About ¼ mile south of route #1 in Cuyahoga River Valley (Flats).							
Site: 1970 Scranton Road (just north of Lorain Ave. bridge)				Station: WGAR			
Date: June 23, 1997 Measurements taken between 420PM and 520PM.			Weather: Partly cloudy and hot.				
Engineer/Operator		DL		TK		3	
Signal stability: Good after moving unit a few inches.							
Signal Level without Attenuation: -46 dBm (at proponent RF input)							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: Error free		Error: Error free		Error: .057%	
	OME	Atten: 35 dB	Level: -81 dBm	Atten: 43 dB	Level: -89 dBm	Atten: 0 dB	Level: see Note
	OME + 3 dB	Error: .004%		Error: 33%		Error: .043%	
20 byte message error	No RF Attenuation	Error: Error free		Error: Error free		Error: .72%	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: 0 dB	Level: see Note
	OME + 3 dB	Error: .061%		Error: 100%		Error: .727%	
220 byte message error	No RF Attenuation	Error: Error free		Error: Error Free		Error: 4%	
	OME	Atten: see BER	Level: see BER	Atten : see BER	Level: see BER	Atten: 0 dB	Level: see Note
	OME + 3 dB	Error: .3%		Error: 100%		Error: 6.67%	

The distance from transmitter to the receiver site is 8.6 miles.

Note: With a received signal level of -46 dBm, errors were detected.

(revised)

HSSC FIELD TEST FIXED SITE MEASUREMENTS WGAR #3							
Route : At the beginning of the SW route #4.							
Site: On the south side of Ohio route 18 about 1 mile east of the I71 interchange. Site in a parking lot west of the FM Security Systems building.				Station: WGAR			
Date: June 24, 1997 1040A to 1220P			Weather: Hot and hazy				
Engineer/Operator		DL		TK			
Signal stability: Relatively stable							
Signal Level without Attenuation: -70 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten:	Level:	Atten:	Level:	Atten:	Level:
		23 dB	-93 dBm	23 dB	-93 dBm	12 dB	-82 dBm
	OME + 3 dB	Error:		Error:		Error:	
		6.9% (+)		11.7%		.542%	
20 byte message error	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten:	Level:	Atten:	Level:	Atten:	Level:
		see BER	see BER	see BER	Same	see BER	see BER
	OME + 3 dB	Error:		Error:		Error:	
		31.0% (+)		96.4%		2.79%	
220 byte message error	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten:	Level:	Atten:	Level:	Atten:	Level:
		see BER	see BER	see BER	see BER	see BER	see BER
	OME + 3 dB	Error:		Error:		Error:	
		88% (+)		97.6%		18.7%	

The distance form transmitter to receiver sit is 16.5 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WGAR #3							
Route : At the beginning of the SW route #4.							
Site: Cleveland On the south side of Ohio route 18 about 1 mile east of the I71 interchange. Site in a parking lot west of the FM Security Systems building.					Station: WGAR		
Date: June 24, 1997 1040A to 1220P				Weather: Hot and hazy			
Engineer/Operator		DL		TK			
Signal stability: Relatively stable							
Signal Level without Attenuation: -70 dBm (at proponent RF input)							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: 23 dB	Level: -93 dBm	Atten: 23 dB	Level: -93 dBm	Atten: 12 dB	Level: -82 dBm
	OME + 3 dB	Error: 6.9% (+)		Error: 11.7%		Error: .542%	
20 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: Same	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 31.0% (+)		Error: 96.4%		Error: 2.79%	
220 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 88% (+)		Error: 97.6%		Error: 18.7%	

Note: Because the DDJ utility indicated a loss of system synchronism at this test site, the errors marked with a (+) are likely higher than reported in the table.

The distance form transmitter to receiver site is 16.5 miles.

(revised)

HSSC FIELD TEST FIXED SITE MEASUREMENTS WGAR #4							
Route : Near the end of Route #5.							
Site: North of I71 exit 198 North on State 539 and 1/8 mile east on C103				Station: WGAR			
Date: June 24, 1997 330P			Weather: Hot & hazy with broken clouds.				
Engineer/Operator		DL		TK			
Signal stability:							
Signal Level without Attenuation: -70 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: 18dB	Level: -88 dBm	Atten: 23 dB	Level: -93 dBm	Atten: 9 dB	Level: -79 dBm
	OME + 3 dB	Error: 2.97%		Error: 21.8%		Error: .036%	
20 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten see BER	Level: see BER	Atten: Same	Level Same	Atten: see BER	Level Same
	OME + 3 dB	Error: 16.5%		Error: 96.5%		Error: .49%	
220 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: Error Free	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 61.7%		Error: 97.7%		Error: 4.1%	

The distance from the transmitter to the receiver site is 34.6 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WGAR #4							
Route : Near the end of Route #5.							
Site: North of I71 exit 198 North on State 539 and 1/8 mile east on C103				Station: WGAR			
Date: June 24, 1997 330P			Weather: Hot & hazy with broken clouds.				
Engineer/Operator		DL		TK			
Signal stability:							
Signal Level without Attenuation: -70 dBm (at proponent RF input)							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten: 18dB	Level: -88 dBm	Atten: 23 dB	Level: -93 dBm	Atten: 9 dB	Level: -79 dBm
	OME + 3 dB	Error: 2.97%		Error: 21.8%		Error: .036%	
20 byte message error	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 16.5%		Error: 96.5%		Error: .49%	
220 byte message error	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		Error Free	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 61.7%		Error: 97.7%		Error: 4.1%	

The distance from the transmitter to the receiver site is 34.6 miles.

(revised)

HSSC FIELD TEST FIXED SITE MEASUREMENTS WGAR #5							
Route : Tests were conducted at the start of R-2.							
Site: On Lake Ave. just east of West 78 th Street. Between Cleveland Hermetic & Supply and Marathon Gas Station.					Station: WGAR		
Date: June 25, 1997				Weather: Hot and hazy			
Engineer/Operator		DL		TK			
Signal stability: Good							
Signal Level without Attenuation: -50 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: 41 dB	Level: -91 dBm	Atten: 43 dB	Level: -93 dBm	Atten: 34 dB	Level: -84 dBm
	OME + 3 dB	Error: 18.2% (+)		Error: 19.1%		Error: 7%	
20 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 69.9% (+)		Error: 99.7%		Error: 39.2%	
220 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 90% (+)		Error: 100%		Error: 92.9%	

The distance from the transmitter to receiver site is 8.0 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WGAR #5							
Route: Tests were conducted at the start of R-2.							
Site: On Lake Ave. just east of West 78 th Street. Between Cleveland Hermetic & Supply and Marathon Gas Station.					Station: WGAR		
Date: June 25, 1997				Weather: Hot and hazy			
Engineer/Operator		DL		TK			
Signal stability: Good							
Signal Level without Attenuation: -50 dBm (at proponent RF input)							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: 41 dB	Level: -91 dBm	Atten: 43 dB	Level: -93 dBm	Atten: 34 dB	Level: -84 dBm
	OME + 3 dB	Error: 18.2% (+)		Error: 19.1%		Error: 7%	
20 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 69.9% (+)		Error: 99.7%		Error: 39.2%	
220 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 90% (+)		Error: 100%		Error: 92.9%	

The distance from the transmitter to receiver site is 8.0 miles.

(revised)

HSSC FIELD TEST FIXED SITE MEASUREMENTS WGAR #6							
Route : At the staging area for the NE route #4							
Site: In a parking lot on the SW corner of US 322 and State 91.				Station: WGAR			
Date: June 26, 1997 About 930A			Weather: Light rain Temperature 74 degrees				
Engineer/Operator		DL		TK			
Signal stability:							
Signal Level without Attenuation: -68 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		0.15%	
	OME	Atten:	Level:	Atten:	Level:	Atten:	Level:
		21 dB	-89 dBm	21 dB	-89 dBm	NA	NA
	OME + 3 dB	Error:		Error:		Error:	
		19.2% (+)		5.47%		1.76%	
20 byte message error	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		2.3%	
	OME	Atten:	Level:	Atten:	Level:	Atten:	Level:
		see BER	see BER	see BER	see BER	NA	NA
	OME + 3 dB	Error:		Error:		Error:	
		66.2% (+)		89.5%		4.79%	
220 byte message error	No RF Attenuation	Error:		Error		Error	
		No Errors		Error free		13%	
	OME	Atten:	Level:	Atten:	Level:	Atten:	Level:
		see BER	see BER	see BER	see BER	NA	NA
	OME + 3 dB	Error:		Error:		Error:	
		78% (+)		99%		18.9%	

RBDS = No errors

The distance from the transmitter to the receiver site is 17.7 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WGAR #6							
Route : At the staging area for the NE route #4							
Site: In a parking lot on the SW corner of US 322 and State 91.				Station: WGAR			
Date: June 26, 1997 About 930A			Weather: Light rain Temperature 74 degrees				
Engineer/Operator		DL		TK			
Signal stability:							
Signal Level without Attenuation: -68 dBm (at proponent RF input)							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: No Errors		Error: No Errors		Error: 0.15%	
	OME	Atten: 21 dB	Level: -89 dBm	Atten: 21 dB	Level: -89 dBm	Atten: 0 dB	Level: see Note
	OME + 3 dB	Error: 19.2% (+)		Error: 5.47%		Error: 1.76%	
20 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: 2.3%	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: 0 dB	Level: see Note
	OME + 3 dB	Error: 66.2% (+)		Error: 89.5%		Error: 4.79%	
220 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: 13%	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: 0 dB	Level: see Note
	OME + 3 dB	Error: 78% (+)		Error: 99%		Error: 18.9%	

The distance from the transmitter to the receiver site is 17.7 miles.

Note: With a received signal level of -68 dBm, errors were detected.

(revised)

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #1							
Route: At the start of R-2.							
Site: Cleveland South side of Lake Ave. east of W78th St. between Cleveland Hermetic & Supply and the Marathon Gas Station					Station: WKSU		
Date: May 31, 1997 140PM to 225PM				Weather: Rain			
Engineer/Operator		DL		RM		TK	
Signal stability: Stable							
Signal Level without Attenuation: -77 dBm (at proponent RF input) Signal variations over 40' run from noise to -70 dBm							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors			
	OME	Atten:	Level:	Atten:	Level:	Atten:	Level:
		11 dB	-89dBm	16 dB	-93dBm		
	OME + 3 dB	Error:		Error:		Error:	
		0.21%		22.6%		NA	
20 byte message error	No RF Attenuation	Error:		Error:		Error:	
		0		0		22.0%	
	OME	Atten:	Level:	Atten:	Level:	Atten:	Level:
		see BER	see BER	see BER	see BER	NA	NA
	OME + 3 dB	Error,		Error:		Error:	
		1.13%		96.7%		32.0%	
220 byte message error	No RF Attenuation	Error:		Error:		Error:	
		0		0		14.67%	
	OME	Atten:	Level:	Atten:	Level:	Atten:	Level:
		see BER	see BER	see BER	see BER	NA	NA
	OME + 3dB	Error:		Error:		Error:	
		6.91%		97%		69.33%	
CCIR rating		4		4		4	
Denon, RBDS max block error		7%		6%		7%	

The distance from the WKSU transmitter to the fixed site is 31.0 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #1							
Route: At the start of R-2.							
Site: Cleveland South side of Lake Ave. east of W78th St. between Cleveland Hermetic & Supply and the Marathon Gas Station					Station: WKSU		
Date: May 31, 1997 140PM to 225PM				Weather: Rain			
Engineer/Operator		DL		RM		TK	
Signal stability: Stable							
Signal Level without Attenuation: -77 dBm (at proponent RF input) Signal variations over 40' run from noise to -70 dBm							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Data	
	OME	Atten: 11 dB	Level: -89dBm	Atten: 16 dB	Level: -93dBm	Atten: No Data	Level: No Data
	OME + 3 dB	Error: 0.21%		Error: 22.6%		Error: No Data	
20 byte message error	No RF Attenuation	Error: 0		Error: 0		Error: 14.76%	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: 0 dB	Level: -77 dBm
	OME + 3 dB	Error: 1.13%		Error: 96.7%		Error: 32.0%	
220 byte message error	No RF Attenuation	Error: 0		Error: 0		Error: 22.0%	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: 0 dB	Level: -77 dBm
	OME + 3dB	Error: 6.91%		Error: 97%		Error: 69.33%	

The distance from the WKSU transmitter to the fixed site is 31.0 miles.

(revised)

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #2							
Route : Adjacent to R2.							
Site: Cleveland In parking lot on the north side of Detroit Ave. across from the Lucielle's Strudel Sign. Between R2 LM 2 and LM 3.				Station: WKSU			
Date: May 31, 1997 243PM to 400PM			Weather: Rain				
Engineer/Operator		DML		RM		TK	
Signal stability: Stable							
Signal Level without Attenuation: -71 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: 21 dB	Level: -92 dBm	Atten: 22 dB	Level: -93 dBm	Atten: 11 dB	Level: -82 dBm
	OME + 3 dB	Error: 100%		Error: 26%		Error: 2.3%	
20 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: 22.0% 0	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 100%		Error: 98.5%		Error: 18.8%	
220 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error; No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3dB	Error: 100%		Error: 99.2%		Error: 72.72%	
CCIR rating		3		3		3	
Denon, RBDS max block error <i>no atten</i>		6%		2%		1%	

The distance from the WKSU transmitter to the fixed site is 30.6 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #2							
Route : Adjacent to R2.							
Site: Cleveland In parking lot on the north side of Detroit Ave. across from the Lucielle's Strudel Sign. Between R2 LM 2 and LM 3.					Station: WKSU		
Date: May 31, 1997 243PM to 400PM				Weather: Rain			
Engineer/Operator		DML		RM		TK	
Signal stability: Stable							
Signal Level without Attenuation: -71 dBm (at proponent RF input)							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten: 21 dB	Level: -92 dBm	Atten: 22 dB	Level: -93 dBm	Atten: 11 dB	Level: -82 dBm
	OME + 3 dB	Error:		Error:		Error:	
		100%		26%		2.3%	
20 byte message error	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error:		Error:		Error:	
		100%		98.5%		18.8%	
220 byte message error	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3dB	Error:		Error:		Error:	
		100%		99.2%		72.72%	

The distance from the WKSU transmitter to the fixed site is 30.6 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #3							
Route : Adjacent to R-2							
Site: Cleveland In a parking lot on the South side of Detroit Ave. just east of R-2, LM-4.					Station: WKSU		
Date: May 31, 1997 408PM				Weather: Rain			
Engineer/Operator		DML		RM		TK	
Signal stability: Looks like multipath Test spot selected after a 40' run Measurements were unstable							
Signal Level without Attenuation: -70 dBm (at proponent RF input) Signal variations over 40' from -65 dBm to noise.							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: 1.39%		Error: 5%		Error: 0.79%	
	OME	Atten: NA	Level: NA	Atten: NA	Level: NA	Atten: NA	Level: NA
	OME + 3 dB	Error: 1.98%		Error: 0.22%		Error: 14.4%	
20 byte message error	No RF Attenuation	Error: 7.47%		Error: 53.8%		Error: 7.29%	
	OME	Atten: NA	Level: NA	Atten: NA	Level: NA	Attn: NA	Level: NA
	OME + 3 dB	Error: 9.56%		Error: 7.22%		Error: 56.8%	
220 byte message error	No RF Attenuation	Error: 32.73%		Error: 51.7%		Error: 36.04%	
	OME	Atten: NA	Level: NA	Attn: NA	Level: NA	Attn: NA	Level: NA
	OME + 3dB	Error: 34.2%		Error: 13.7%		Error: 96.1%	
CCIR rating		2.5		2.5		2.5	
RBDS max block error (Denon)		16%		6%		13%	

The distance from the WKSU transmitter to the fixed receiver site is 30.5 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #3							
Route : Adjacent to R-2							
Site: Cleveland In a parking lot on the South side of Detroit Ave. just east of R-2, LM-4.				Station: WKSU			
Date: May 31, 1997 408PM			Weather: Rain				
Engineer/Operator		DML		RM		TK	
Signal stability: Looks like multipath Test spot selected after a 40' run Measurements were unstable							
Signal Level without Attenuation: -70 dBm (at proponent RF input) Signal variations over 40' from -65 dBm to noise.							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: 1.39%		Error: 5.0%		Error: 0.79%	
	OME	Atten: 0 dB	Level: see Note	Atten: 0 dB	Level: see Note	Atten: 0 dB	Level: see Note
	OME + 3 dB	Error: 1.98%		Error: 0.22%		Error: 14.4%	
20 byte message error	No RF Attenuation	Error: 7.47%		Error: 53.8%		Error: 7.29%	
	OME	Atten: 0 dB	Level: see Note	Atten: 0 dB	Level: see Note	Attn: 0 dB	Level: see Note
	OME + 3 dB	Error: 9.56%		Error: 7.22%		Error: 56.8%	
220 byte message error	No RF Attenuation	Error: 32.73%		Error: 51.7%		Error: 36.04%	
	OME	Atten: 0 dB	Level: see Note	Attn: 0 dB	Level: see Note	Attn: 0 dB	Level: see Note
	OME + 3dB	Error: 34.2%		Error: 13.7%		Error: 96.1%	

The distance from the WKSU transmitter to the fixed receiver site is 30.5 miles.

Note: With a received signal level of -70 dBm, errors were detected.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #4							
Route : North of R-2 in downtown Cleveland.							
Site: Near 1400 West 2 nd St.				Station: WKSU			
Date: May 31, 1997 408PM to 515PM			Weather: Rain 63.3 Degrees				
Engineer/Operator		DML		RM		TK	
Signal stability: Looks like multipath Test spot selected a 30' run Measurements were unstable							
Signal Level without Attenuation: -71 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: 0.56%		Error: 0.13%		Error: 36.6%	
	OME	Atten: NA	Level: NA	Atten: NA	Level: NA	Atten: NA	Level: NA
	OME + 3 dB	Error: 1.94%		Error: 0.47%		Error: NA	
20 byte message error	No RF Attenuation	Error: 2.89%		Error: 4.8%		Error: 93.0%	
	OME	Atten: NA	Level: NA	Atten: NA	Level: NA	Atten: NA	Level: NA
	OME + 3 dB	Error: 8.36%		Error: 15.5%		Error: NA	
220 byte message error	No RF Attenuation	Error: 17.1%		Error: 12%		Error: 100%	
	OME	Atten: NA	Level: NA	Atten: NA	Level: NA	Atten: NA	Level: NA
	OME + 3dB	Error: 34.5%		Error: 33%		Error: NA	
CCIR rating		2.5		2.5		2.5	
RBDS max block error (Denon)		22%		19%		13%	

The distance from the WKSU transmitter to the receiver fixed site is 30.5 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #4							
Route : North of R-2 in downtown Cleveland.							
Site: Near 1400 West 2 nd St.				Station: WKSU			
Date: May 31, 1997 408PM to 515PM			Weather: Rain 63.3 Degrees				
Engineer/Operator		DML		RM		TK	
Signal stability: Looks like multipath Test spot selected a 30' run Measurements were unstable							
Signal Level without Attenuation: -71 dBm (at proponent RF input)							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: 0.56%		Error: 0.13%		Error: 36.6%	
	OME	Atten: 0 dB	Level: see Note	Atten: 0 dB	Level: see Note	Atten: 0 dB	Level: see Note
	OME + 3 dB	Error: 1.94%		Error: 0.47%		Error: Failure	
20 byte message error	No RF Attenuation	Error: 2.89%		Error: 4.8%		Error: 93.0%	
	OME	Atten: 0 dB	Level: see Note	Atten: 0 dB	Level: see Note	Atten: 0 dB	Level: see Note
	OME + 3 dB	Error: 8.36%		Error: 15.5%		Error: Failure	
220 byte message error	No RF Attenuation	Error: 17.1%		Error: 12%		Error: 100%	
	OME	Atten: 0 dB	Level: see Note	Atten: 0 dB	Level: see Note	Atten: 0 dB	Level: see Note
	OME + 3dB	Error: 34.5%		Error: 33%		Error: Failure	

The distance from the WKSU transmitter to the receiver fixed site is 30.5 miles.

Note: With a received signal level of -71 dBm, errors were detected.

(revised)

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #5							
Route: About ¼ mile south of route #1. Site in Cuyahoga River Valley (Flats).							
Site: Cleveland 1970 Scranton Ave., just north of Lorain Ave bridge.				Station: WKSU			
Date: June 5, 1997			Weather: 70 degrees, partly cloudy				
Engineer/Operator		DL		TK			
Signal stability: Moderate (some fluctuations)							
Signal Level without Attenuation: -67 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: 11.6%		Error: 0.0		Error 13.3%	
	OME	Atten: NA	Level: NA	Atten: 14dB	Level: -82dBm	Atten: NA	Level: NA
	OME + 3 dB	Error: NA		Error: 9.77%		Error: NA	
20 byte message error	No RF Attenuation	Error: 49.4%		Error: No Errors		Error: 54.5%	
	OME	Atten: NA	Level: NA	Atten: 14dB	Level: -82dBm	Atten: NA	Level: NA
	OME + 3 dB	Error: NA		Error: 97.2%		Error: NA	
220 byte message error	No RF Attenuation	Error: 86%		Error: No Errors		Error: 95.4%	
	OME	Atten: NA	Level: NA	Atten: see BER	Level: see BER	Atten: NA	Level: NA
	OME + 3 dB	Error: NA		100%: NA		Error: NA	
RBDS		5%		2%		1%	
CCIR		4		4		4	

The distance from the WKSU transmitter to the receiver fixed site is 30.0 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #5							
Route: About ¼ mile south of route #1. Site in Cuyahoga River Valley (Flats).							
Site: Cleveland 1970 Scranton Ave., just north of Lorain Ave bridge.				Station: WKSU			
Date: June 5, 1997			Weather: 70 degrees, partly cloudy				
Engineer/Operator		DL		TK			
Signal stability: Moderate (some fluctuations)							
Signal Level without Attenuation: -67 dBm (at proponent RF input)							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: 11.6%		Error: No errors		Error 13.3%	
	OME	Atten: 0 dB	Level: see Note	Atten: 14dB	Level, -82dBm	Atten: 0 dB	Level: see Note
	OME + 3 dB	Error: Failure		Error: 9.77%		Error: Failure	
20 byte message error	No RF Attenuation	Error: 49.4%		Error: No Errors		Error: 54.5%	
	OME	Atten; 0 dB	Level: see Note	Atten: 14dB	Level: -82dBm	Atten: 0 dB	Level: see Note
	OME + 3 dB	Error: Failure		Error: 97.2%		Error: Failure	
220 byte message error	No RF Attenuation	Error: 86%		Error: No Errors		Error: 95.4%	
	OME	Atten: 0 dB	Level: see Note	Atten: see BER	Level: see BER	Atten: 0 dB	Level: see Note
	OME + 3 dB	Error: Failure		100%: Failure		Error: Failure	

The distance from the WKSU transmitter to the receiver fixed site is 30.0 miles.

Note: With a received signal level of -67 dBm, errors were detected.

(revised)

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HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #6							
Route: Tests were conducted at the staging area for NE route #4.							
Site: In the parking lot on the SW corner of US 322 and State 91.				Station: WKSU			
Date: June 6, 1997 1115AM			Weather: Clear 70 Degrees				
Engineer/Operator		DML		RM		TK	
Signal stability: Very stable							
Signal Level without Attenuation: -63 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: 26dB	Level: -89 dBm	Atten: 29 dB	Level: -92 dBm	Atten: 20dB	Level: -83 dBm
	OME + 3 dB	Error: 15.0%		Error: 34.0%		Error: 6.94%	
20 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: 93.0% <i>0 errors</i>	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 61.4%		Error: 99.9%		Error: 48.2%	
220 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3dB	Error: 93.2%		Error: 100.0%		Error: 97.3%	
RBDS max block error		0.0%		0.0%		0.0%	

The distance from the WKSU transmitter to the fixed receiver site is 26 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #6							
Route: Tests were conducted at the staging area for NE route #4.							
Site: In the parking lot on the SW corner of US 322 and State 91.				Station: WKSU			
Date: June 6, 1997 1115AM			Weather: Clear 70 Degrees				
Engineer/Operator		DML		RM		TK	
Signal stability: Very stable							
Signal Level without Attenuation: -63 dBm (at proponent RF input)							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: 26dB	Level: -89 dBm	Atten: 29 dB	Level: -92 dBm	Atten: 20dB	Level: -83 dBm
	OME + 3 dB	Error: 15.0%		Error: 34.0%		Error: 6.94%	
20 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 61.4%		Error: 99.9%		Error: 48.2%	
220 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3dB	Error 93.2%		Error 100.0%		Error 97.3%	

The distance from the WKSU transmitter to the fixed receiver site is 26 miles.

(revised)

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HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #7							
Route: This site is adjacent to the NE route #4.							
Site: S2 Harley Motel parking lot on the SW corner of state route 91 and 84. This is north of I90 exit 189.				Station: WKSU			
Date: June 6, 1997 405PM			Weather: Clear 75 Degrees				
Engineer/Operator		DML		RM		TK	
Signal stability: Good							
Signal Level without Attenuation: -76 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error, No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: 14 dB	Level: -90 dBm	Atten: 17 dB	Level: -93 dBm	Atten: 3 dB	Level: -79 dBm
	OME + 3 dB	Error 12.5%		Error 21.1%		Error 0.65%	
20 byte message error	No RF Attenuation	Error, No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: -90 dBm	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 55.7%		Error: 93.7%		Error: 3.7%	
220 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3dB	Error: 93.7%		Error: 95.2%		Error: 19.7%	
CCIR rating		0		0		0	
RBDS max block error (Denon)		1%		3.0%		1.0%	

The distance from the WKSU transmitter to the fixed receiver site is 32 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #7							
Route: This site is adjacent to the NE route #4.							
Site: S2 Harley Motel parking lot on the SW corner of state route 91 and 84. This is north of I90 exit 189.				Station: WKSU			
Date: June 6, 1997 405PM			Weather: Clear 75 Degrees				
Engineer/Operator		DML		RM		TK	
Signal stability: Good							
Signal Level without Attenuation: -76 dBm (at proponent RF input)							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error; No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: 14 dB	Level: -90 dBm	Atten: 17 dB	Level: -93 dBm	Atten: 3 dB	Level: -79 dBm
	OME + 3 dB	Error 12.5%		Error 21.1%		Error 0.65%	
20 byte message error	No RF Attenuation	Error; No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: -90 dBm	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 55.7%		Error: 93.7%		Error: 3.7%	
220 byte message error	No RF Attenuation	Error; No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3dB	Error: 93.7%		Error: 95.2%		Error: 19.7%	

The distance from the WKSU transmitter to the fixed receiver site is 32 miles.

(revised)

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HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #8							
Route: Test site just north of route #1. USNR parking lot east of E9th St. and north of freeway							
Site: Cleveland USNR parking lot east of E9th Street and north of RT-2.				Station: WKSU			
Date: June 6, 1997 405PM			Weather: Clear 78 Degrees				
Engineer/Operator		IDML		RM		TK	
Signal stability: Stable							
Signal Level without Attenuation: -66 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: 23dB	Level: -89 dBm	Atten: 27 dB	Level: -93 dBm	Atten: 17 dB	Level: -83 dBm
	OME + 3 dB	Error: 100% about		Error: 31%		Error: No Errors	
20 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER:	Level: see BER
	OME + 3 dB	Error: 100%		Error: 100%		Error: 3.7%	
220 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3dB	Error: 100%		Error: 100%		Error: 19.7%	
CCIR rating		0		0		0	
RBDS max block error (Denon)		0.0%		0.0%		1.0%	

The distance from the WKSU transmitter to the fixed site is 31 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #8							
Route: Test site just north of route #1. USNR parking lot east of E9th St. and north of freeway							
Site: Cleveland USNR parking lot east of E9th Street and north of RT-2.				Station: WKSU			
Date: June 6, 1997 405PM				Weather: Clear 78 Degrees			
Engineer/Operator		IDML		RM		TK	
Signal stability: Stable							
Signal Level without Attenuation: -66 dBm (at proponent RF input)							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: 23dB	Level: -89 dBm	Atten: 27 dB	Level: -93 dBm	Atten: 17 dB	Level: -83 dBm
	OME + 3 dB	Error: 100% about		Error: 31%		Error: No Errors	
20 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER:	Level: see BER
	OME + 3 dB	Error: 100%		Error: 100%		Error: 3.7%	
220 byte message error	No RF Attenuation	Error: No Errors		Error: No Errors		Error: No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3dB	Error: 100%		Error: 100%		Error: 19.7%	

The distance from the WKSU transmitter to the fixed site is 31 miles.

(revised)

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HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #9							
Route : Adjacent to the SW route #5.							
Site: I71 exit #204 In BP parking lot on Ohio RT 83				Station: WKSU			
Date: June 9, 1997			Weather: Sunny 77 Degrees				
Engineer/Operator		IDML		RM			
Signal stability: Relatively stable							
Signal Level without Attenuation: -80 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: 0.333%		Error: No Errors		Error: 24.8%	
	OME	Atten: NA	Level: NA	Atten: 8 dB	Level: -89 dBm	Attn: NA	Level: NA
	OME + 3 dB	Error: 6.5%		Error: 3.73%		Error: --	
20 byte message error	No RF Attenuation	Error: 1.89%		Error: No Errors		Error: 80.9%	
	OME	Atten: NA	Leve: NA	Atten: see BER	Level: see BER	Atten: NA	Level: NA
	OME + 3 dB	Error: 34.1%		Error: 77.9%		Error: --	
220 byte message error	No RF Attenuation	Error: 9.3%		Error: No Errors		Error: 100%	
	OME	Atten: NA	Level: NA	Atten: see BER	Level: see BER	Atten: NA	Level: NA
	OME + 3dB	Error: 76%		Error: 96.2%		Error: 100%	
CCIR rating							
RBDS max block error (Denon)		14%		7%		--	

oversight.

The distance from the WKSU transmitter to the fixed receiver site is 36 miles.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #9							
Route : Adjacent to the SW route #5.							
Site: I71 exit #204 In BP parking lot on Ohio RT 83				Station: WKSU			
Date: June 9, 1997			Weather: Sunny 77 Degrees				
Engineer/Operator		IDML		RM			
Signal stability: Relatively stable							
Signal Level without Attenuation: -80 dBm (at proponent RF input)							
	Test (Observation time 150 seconds)	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error: 0.333%		Error: No Errors		Error: 24.8%	
	OME	Atten: 0 dB	Level: see Note	Atten: 8 dB	Level: -89 dBm	Attn: 0 dB	Level: see Note
	OME + 3 dB	Error: 6.5%		Error: 3.73%		Error: No Data	
20 byte message error	No RF Attenuation	Error: 1.89%		Error: No Errors		Error: 80.9%	
	OME	Atten: 0 dB	Leve: see Note	Atten: see BER	Level: see BER	Atten: 0 dB	Level: see Note
	OME + 3 dB	Error: 34.1%		Error: 77.9%		Error: No Data	
220 byte message error	No RF Attenuation	Error: 9.3%		Error: No Errors		Error: 100%	
	OME	Atten: 0 dB	Level: see Note	Atten: see BER	Level: see BER	Atten: 0 dB	Level: see Note
	OME + 3dB	Error: 76%		Error: 96.2%		Error: 100%	

The distance from the WKSU transmitter to the fixed receiver site is 36 miles.

Note: With a received signal level of -80 dBm, errors were detected.

HSSC FIELD TEST FIXED SITE MEASUREMENTS WKSU #10							
Route: Rest stop on I71 north of RT-5 start.							
Site: Rest stop on I 71 at 221mile marker. West side of highway.					Station: WKSU		
Date: June 9, 1997				Weather: Sunny 68.4 Degrees			
Engineer/Operator		IDML		RM			
Signal stability: Signal Level without Attenuation: -64 dBm (at proponent RF input)							
	Test	DDJ		MITRE		Seiko	
BER	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten: 25 dB	Level: -89 dBm	Atten: 29 dB	Level: -93 dBm	Attn: 19 dB	Level: -83 dBm
	OME + 3 dB	Error: 100%		Error: 16.5%		Error: 2.17%	
20 byte message error	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten: see BER	Leve: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3 dB	Error: 100%		Error: 96%		Error: 19.3%	
220 byte message error	No RF Attenuation	Error:		Error:		Error:	
		No Errors		No Errors		No Errors	
	OME	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER	Atten: see BER	Level: see BER
	OME + 3dB	Error: 100%		Error: 97%		Error: 73%	
CCIR rating							
RBDS max block error (Denon)		0.0%		0.0%		0.0%	

The distance from the WKSU transmitter to the fixed receiver site is 24.2 miles.

FIELD AND LABORATORY TEST COMPARISONS							
(Weak Signal Failure Compared at OME)							
Test	Signal Level dBm	Miles from Transmitter	General Description of Site or Signal Path.	Signal Stability	OME dBm		
					DDJ	MITRE	Seiko
Reference: LAB Results	-65	NA	NA	NA	-91.5	-92.5	-82.5
WGAR #1	-43	8.3	Desired path from TX. Flat land with some buildings. Elevation 740 Ft.	Stable	-91	-93	-85
WGAR #2	-46	8.6	Indirect path from TX. Site in valley adjacent to bridges) Elevation 590 Ft.	Stable after moving unit a few inches	-81	-89	Errors BER 0.057%
WGAR #3	-70	16.5	Signal blockage caused by hill in the transmitter direction. Elevation 1150 Ft.	No comment	-93	-93	-82
WGAR #4	-70	34.6	Flat open area. Elevation 1148 Ft.	No comment	-88	-93	-79
WGAR #5	-50	8.0	Residential and industrial city area, no hills. Elevation 640 Ft.	Stable	-91	-93	-84
WGAR #6	-68	17.7	Site in strip mall parking lot at intersection. Elevation 1010 Ft.	No comment	-89	-89	Errors BER 0.15%
WKSU #1	-77	31.0	Residential and industrial city area, no hills. Elevation 640 Ft.	Signal varied from -79 dBm to noise over 40' run.	-89	-93	Errors Not Recorded
WKSU #2	-71	30.6	Parking lot on north side of street. Adjacent to store fronts. Elevation 640 Ft.	Stable	-92	-93	-82
WKSU#3	-70	30.5	Site in parking lot on north side of street. Site adjacent to multi-story buildings. Elevation 640 Ft.	Varied with van position from -65 dBm to noise.	Error BER 1.39%	Error BER 5.0%	Error BER 0.79%

CONTINUED

Test	Signal Level dBm	Miles from Transmitter	General Description of Site or Signal Path	Signal Stability	OME		
					DDJ	MITRE	Seiko
Reference: LAB Results	-65	NA	NA	NA	-91.5	-92.5	-82.5
WKSU#4	-71	30.5	Street site on the NW side of downtown Cleveland. Site adjacent to 30 or more story buildings. Elevation 630 Ft.	Unstable, appearance of high M.P.	Errors BER 0.56%	Errors BER 0.13%	Errors BER 36.6%
WKSU#5	-67	30.0	Indirect path from TX. Site in valley adjacent to many bridges. Elevation 590 Ft.	Some fluctuations	Errors BER 11.6%	-82	Errors BER 13.3%
WKSU#6	-63	26.0	Site in strip mall parking lot at intersection. Elevation 1010 Ft.	Very stable	-89	-92	-83
WKSU#7	-76	32.0	In motel parking lot. Hilly suburban area. Elevation 770 Ft.	Stable	-90	-93	-79
WKSU#8	-66	31.0	Site on the north side of the downtown area adjacent to the lake. Signal had to go through the tall buildings. Elevation 580 Ft.	Stable	-89	-93	-83
WKSU#9	-80	36.0	Gas station parking area. Elevation 970 Ft.	Relatively stable	Errors BER 0.33%	-89	Errors BER 24.85
WKSU#10	-64	24.2	Interstate rest stop parking area. Elevation 1115 Ft.	No Comment	-89	-93	-83

Notes:

The weak signal OME was found with a 1 dB switched attenuator in the RF path for both laboratory and field tests. In the laboratory the weak signal test was conducted prior to all other tests. The results of the laboratory tests ranged 1.0 dB for all three systems. The laboratory comparative reference, used in this table, was established by dividing the 1.0 dB laboratory test range by two.

NRSC-R34

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
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