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LILCO, March 25, 1988

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
LONG ISLAND LIGHTING COMPANY	)	Docket No. 50-322-OL-3
	)	(Emergency Planning)
(Shoreham Nuclear Power Station, Unit 1)	)	(EBS)
	)	

LILCO'S RESPONSES AND OBJECTIONS TO SUFFOLK COUNTY'S THIRD SET OF INTERROGATORIES AND REQUESTS FOR PRODUCTION OF DOCUMENTS REGARDING EMERGENCY BROADCAST SYSTEM

LILCO hereby responds to Suffolk County's Third Set of Interrogatories and Requests for Production of Documents on the EBS issues, dated March 11, 1988.[1/]

I. General Answers and Objections

LILCO gives the same general answers and makes the same general objections to the County's third set of interrogatories and requests for production that it made in its March 7, 1988 Responses to the County's first set of interrogatories.

II. Answers and Objections to Interrogatories

Suffolk County Interrogatory No. 1

The Cohen and Dippell Engineering Report concerning the field strength measurement survey of radio stations WEZN (FM) and WPLR (FM), dated June 1987 (hereafter "June 1987 Engineering Report") indicates (at page 2) that a rectangular grid of approximately 3 kilometers was used in connection with the field strength measurement tests conducted by Cohen and Dippell. (a) Why was a grid of approximately 3 kilometers used? (b) Was any consideration given to using a different size grid? (c) If so, specify precisely what consideration(s). (d) If no consideration was given to using a different size grid, explain why this was the case.

Response: The June 1987 engineering report explains why an approximate 3 kilometer rectangular grid was used. As that report states,

1/ The County served its Third Set of Interrogatories by telecopier at about 7:00 p.m. on Friday, March 11. LILCO considers the interrogatories served on Saturday, March 12.

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> A rectangular grid of approximately 3 kilometers was selected to encompass the boundaries of the EPZ and to meet the minimum number of measurement locations according to the formula 0.1 (P) $\frac{1}{2}$ provided in the FCC Rules. This procedure is outlined in Section 73.314 (c)(1)(ii) of the FCC Rules and is based on the population within the area or community being surveyed.

Further, as stated in the May 12, 1987 letter from Robert W. Guill to Douglas M. Crocker, which was produced to the County on March 1, 1988, the EPZ was assumed to be one whole community for purposes of the FM measurement survey. In short, the field measurement surveys were conducted according to 47 C.F.R. § 73.314 of the FCC rules. No consideration was given to not following these rules.

Suffolk County Interrogatory No. 2

The June 1987 Engineering Report (at page 2) notes that 1980 U.S. census data were used to determine the minimum number of measurement locations. (a) Why were 1980 U.S. census data used? (b) Why was a 1988 census projection not used? (c) Was consideration given to using any other census data, including projected population data? (d) If so, what data? If not, why not?

Response: Cohen and Dippell used 1980 census data in accordance with § 73.314 (c)(1) of the FCC regulations. The 1980 census is an "appropriate source" of population information because it constitutes the most recent established population figures. Projected population data was not used because, by definition, it is more speculative than the established 1980 data. The answer to (c) is no.

Suffolk County Interrogatory No. 3

The June 1987 Engineering Report (at page 3) states that, based upon a listening test conducted by Cohen and Dippell, WPLR (FM) provides "a very good signal level throughout the measured area." What qualitative and quantitative criteria were used in determining that WPLR (FM) provides "a very good signal level?"

Response: The criteria used were that there be a consistent, clear, listenable signal without interruption.

Suffolk County Interrogatory No. 4

The June 1987 Engineering Report (at page 3) notes that during the listening test, "nothing was heard that suggested any reception problems." What level or amount of interference would have constituted a "reception problem" for purposes of the Cohen and Dippell report?

Response: Interruption, loss, or switching of the broadcast signal to other stations would have constituted a reception problem.

Suffolk County Interrogatory No. 5

The June 1987 Engineering Report (at page 3) notes that field strength measurements were made with a receive antenna elevated 30 feet above ground level. (a) Why was the receive antenna elevated to a 30 foot elevation? (b) Was any consideration given to taking any measurements with the receive antenna elevated to a different height? (c) If so, specify precisely what consideration(s). (d) Would there have been any variation in the measurements if the receive antenna had been elevated 6 feet above ground level? (e) If so, what would that variation have been?

Response: The receive antenna was elevated to 30 feet to comply with FCC regulations, which require an antenna elevation of nine meters (29.5 feet). See § 73.314 (b)(2). The answer to (b) is no. There might have been variation in the measurements if the receive antenna were elevated to a height of six feet, but that is irrelevant because the regulations call for the antenna to be elevated to nine meters, not six feet.

Suffolk County Interrogatory No. 6

The June 1987 Engineering Report (at page 3) notes that field strength measurements were taken with a "horizontally polarized dipole receive antenna." (a) Why was such an antenna used? (b) Was any consideration given to using a vertically polarized antenna? (c) If so, specify precisely what consideration(s)?

Response: A horizontally polarized dipole receive antenna was used because that is the type specified in FCC regulations. The answer to (b) is yes. In fact, measurements using a vertically polarized receive antenna were made simultaneously with the horizontal measurements. Both sets of measurements are contained in the field notes that were produced to the County on March 11, 1988. The June 1987 Engineering Report reflects only the horizontal measurements because they are the ones recognized by the FCC.

Suffolk County Interrogatory No. 7

What is the ratio of horizontal to vertical polarization from: (a) WPLR (FM); (b) WRCN (FM); and (c) WLNG (FM)?

Response: The ratio for each is 1.

Suffolk County Interrogatory No. 8

Assuming that the instrumentation used to take the field strength measurements that were reported in the June 1987 Engineering Report was properly calibrated, what is the margin of error -- both in percentage and mV/m -- of the field strength measurements made on radio station WPLR? Please provide a copy of the calibration report and any other documents relating to the June 4, 1986 calibration of the field strength meter referenced at page 3-4 of the June 1987 Engineering Report.

Response: The manufacturer's calibration report is provided with these responses. The desired answers can be derived from that report.

Suffolk County Interrogatory No. 9

For every reading provided in the June 1987 Engineering Report, what is the uncertainty due to instrument, antenna and/or other inaccuracies?

Response: See LILCO's Response to Interrogatory no. 8.

Suffolk County Interrogatory No. 10

Were there any deviations from the FCC regulations contained in Title 47 of the Code of Federal Regulations with respect to the procedures used in the June 1987 Engineering Report? If so, please specify each and every such deviation.

Response: No.

Suffolk County Interrogatory No. 11

(a) With respect to Table VI of the June 1987 Engineering Report, why is the range of readings in the column entitled "Min/Max" 29.4 dBu for Point 1? (b) Identify every factor, reason or basis for such a range. (c) Is this range possible elsewhere within the area measured by Cohen and Dippell?

Response: The range of 29.4 for Point 1 is arrived at by subtracting the minimum measured horizontal field strength from the maximum. Ranges of measured field strength are possible at all measuring points. The ranges measured in the field strength measurement survey reported in the June 1987 engineering report are identified in Table VI of that report.

Suffolk County Interrogatory No. 12

With respect to Table VII of the June 1987 Engineering Report, how was the elevation of each point determined?

Response: The elevation of all measuring points was taken from United States Geological Survey (U.S.G.S.) topographic quadrangle maps (7.5 minute series).

Suffolk County Interrogatory No. 13

(a) Can field strength measurements of an FM signal vary depending upon when such measurements are made? (b) Can such measurements vary during the day and night? (c) Can such measurements vary during the different seasons of the year?

Response: The answer to (a) is yes, although such variation is not significant. The answer to (b) is no. The answer to (c) is that it is possible for measurements to vary during different seasons, for example, because of tree foliage.

Suffolk County Interrogatory No. 14

(a) Can field strength measurements of an AM signal vary depending upon when such measurements are made? (b) Can such measurements vary during the day and night? (c) Can such measurements vary during the different seasons of the year?

Response: The answer to (a), (b), and (c) is yes.

Suffolk County Interrogatory No. 15

The Cohen and Dippell Engineering Report concerning the computed signal contours for radio stations WICC, WELI, WGLI, WRHD, WLIM, WLNG AM and FM, WPLR and WRCN, dated September, 1987 (hereafter "September 1987 Engineering Report") references "interference-free contours." (a) Identify how the interference-free contour for daytime reception of each FM station in LILCO's EBS network would vary from the interference-free contour for nighttime reception. (b) Identify how the interference-free contour for daytime reception of each AM station in LILCO's EBS network would vary from the interference-free contour for nighttime reception. Please provide a copy of any and all documents referencing such variances.

Response: The answer to (a) is that the interference-free contours for daytime operation of each FM station do not vary from the nighttime interference-free contours for such stations. The differences between the daytime and nighttime interference-free contours for the AM stations are as shown in the September 1987 engineering report. All relevant documents have been provided.

Suffolk County Interrogatory No. 16

Identify any changes or modifications made to the FCC data used to compute the interference-free contours included in the September 1987 Engineering Report. Please provide a copy of any and all documents referencing in any way such changes or modifications.

Response: No changes or modifications to FCC data were made.

Suffolk County Interrogatory No. 17

Identify all FM stations that cover any part of the EPZ at nighttime, and designate the specific parts of the EPZ that are covered. Identify all AM stations that cover any part of the EPZ at nighttime, and designate the specific parts of the EPZ that are covered. Please provide a copy of any documents relating to such FM and/or AM coverage.

Response: LILCO objects to Interrogatory no. 17 to the extent that it is redundant of Interrogatory no. 17 in the County's first set of interrogatories, which asked LILCO to describe portions of the EPZ that are not covered by AM or FM signals. LILCO also objects to Interrogatory no. 17 because it is not limited to stations in the Shoreham EBS; it instead asks for the identity of all AM and FM stations that cover parts of the EPZ at night. Information about stations not in the Shoreham EBS is not relevant. In any case, the information sought is contained in public FCC files, and thus is as accessible to the County as it is to LILCO.

To the extent Interrogatory no. 17 seeks information about the nig .time coverage of AM and FM stations in the Shoreham EBS, that information is contained in the Cohen and Dippell studies that have already been provided.

Suffolk County Interrogatory No. 18

Please provide a copy of any maps of the EPZ that show only the interference-free contours of AM stations in LILCO's EBS network.

Response: The only responsive map is the one contained in the June 1987 engineering report on WINS and WELI, which was provided to the County on March 1, 1988. The contours of the other AM stations in the Shoreham EBS are shown in the September 1987 report.

Suffolk County Interrogatory No. 19

(a) Did any person, including but not limited to Cohen and Dippell, recalculate the signal contours depicted in the September 1987 Engineering Report that, according to the Affidavit of Ralph E. Dippell, Jr., (Attachment 9 to LILCO's Nov. 6 Summary Disposition Motion), were generated from FCC-recognized signal strengths in the radio stations' license files? (b) If so, please specifically identify what recalculations were made. (c) Please provide a copy of any documents referencing such recalculations.

Response: All contours depicted in the September 1987 Engineering Report were taken from FCC files with the exception of the contours for WPLR-FM and the nighttime interference-free contour for WELI (AM). Those contours were generated from measured field data that was previously collected and submitted. Thus, with the stated exceptions FCC data was relied upon.

Suffolk County Interrogatory No. 20

(a) How far beyond the signal contours depicted in the September 1987 Engineering Report does LILCO expect the AM radio stations in the EBS network to be heard? (b) How far beyond the signal contours depicted in the September 1987 Engineering Report does LILCO expect the FM stations in the EBS network to be heard? (c) Please specify the basis for LILCO's opinion regarding this interrogatory.

Response: Experience shows that broadcast signals do not stop at the contour lines. An exact determination of the extent or reach of the signals cannot be made, however, without conducting tests.

Suffolk County Interrogatory No. 21

Identify any studies, analyses and/or tests that have been performed or conducted with respect to whether the tone alert receivers provided the radio stations in LILCO's EBS network can, in fact, be activated by WPLR's signal. Please provide a copy of any and all documents concerning such studies, analyses and/or tests.

Response: No such "studies" or "analyses" have been performed. The tone alert receivers were checked to make sure they were functional at the time they were delivered to LILCO. The only other "tests" that have been conducted are those mentioned in LILCO's Responses to Interrogatory no. 19 in the County's first set of interrogatories. All documents regarding those tests were provided with LILCO's Responses to the County's first set of interrogatories.

Suffolk County Interrogatory No. 22

Identify any studies, analyses and/or tests that have been performed or conducted with respect to whether the tone alert radios provided by LILCO to schools, hospitals, special facilities, large employers, and others can, in fact, be activated by WPLR's signal. Please provide a copy of any and all documents concerning such studies, analyses and/or tests.

Response: As discussed by Mr. Crocker in his March 8 deposition (at 57-59), WPLR conducts weekly EBS tests. Upon delivery and installation of the tone alert radios at special facilities, schools, etc., LILCO asks those facilities to contact LILCO if they notice that their tone alert radios are not activated once a week by WPLR's signal. LILCO has received no phone calls from these organizations saying that the radios have not been activated by WPLR's signal. No other tests, studies, or analyses have been performed. There is no documentation concerning tests of the tone alert radios at these facilities.

Suffolk County Interrogatory No. 23

What is the minimum signal strength necessary to trigger and/or activate the tone alert receivers provided the radio stations in LILCO's EBS network?

Response: This Interrogatory is redundant of Interrogatory no. 7 in the County's second set of interrogatories. See LILCO's Response to Interrogatory no. 7.

Suffolk County Interrogatory No. 24

(a) Identify any studies, tests and/or analyses of LILCO's EBS network that were contemplated. (b) Identify any studies, tests and/or analyses of LILCO's EBS network that were started or initiated, but not completed or finalized.

Response: LILCO objects to Interrogatory no. 24 on the ground that it seeks information that is not relevant to the issues in this proceeding and is not reasonably calculated to lead to the discovery of admissible evidence. LILCO already has identified and provided copies of all documents concerning all studies, tests, and analyses conducted to date that LILCO will rely on to show the coverage of the radio stations in the Shoreham EBS. Any tests, analyses, etc. that may have been contemplated by LILCO at some point in time but were not in fact undertaken are not relevant.

Without waiving this objection, LILCO states that, as mentioned by Mr. Crocker in his March 8 deposition, LILCO personnel and counsel have discussed the possibility of conducting field tests on the AM stations in the EBS. As Mr. Crocker testified, however, no formal decision to perform such tests has been made. Answering further, LILCO states that no studies, tests, etc. were started but not completed or finalized.

Suffolk County Interrogatory No. 25

(a) With respect to Figures 1 and 2 of the September 1987 Engineering Report, what, if any, assumptions were made concerning the ground conductivity of Long Island? (b) What, if any, assumptions were made concerning the conductivity of Long Island Sound?

Response: The only conductivity assumptions that were made are those based on FCC estimated conductivities provided in FCC regulations.

Suffolk County Interrogatory No. 26

Identify the back-up or alternative power source for each of the radio stations included in LILCO's EBS network. Please provide a copy of all documents referencing or mentioning in any way such back-up or alternative power sources.

Response: LILCO objects to Interrogatory no. 26 on the ground that it seeks information that is irrelevant to the admitted contentions in this proceeding and is not reasonably calculated to lead to the discovery of admissible evidence on the admitted contentions. The admitted contentions do not raise the issue of the adequacy of backup equipment at the EBS radio stations. The contentions admitted for hearing raise only the issues of the strength of WPLR's broadcast signal within the EPZ, the alleged attenuation of that signal due to geography and directional orientation of receiving antennae in the EPZ, the lack of AM broadcasting by WPLR, and alleged gaps in the EBS' nighttime AM coverage. The admitted contentions do not fairly raise -- or even mention -- the issue of backup power sources.

Moreover, LILCO objects to Interrogatory no. 25 to the extent that it questions the backup power sources for the seven EBS members stations that were previously in the WALK-triggered EBS that was litigated and approved by the Board. The County could have raised that issue in the WALK hearings on Contention 20 but did not. Thus, the adequacy of backup power supplies for the secondary stations on Long Island is not among the "earlier-admitted issues" reopened by the Commission, and the County cannot raise that issue for the first time now. The matter is res judicata.

Without waiving these objections, LILCO notes that the backup power source for WPLR is listed on Attachment 4 to LILCO's November 6 Summary Disposition Motion and is described in the Motion itself (at pp. 8-9).

Suffolk County Interrogatory No. 27

Do all radio stations in LILCO's EBS network have a person capable of operating the station on the premises of the station at all times? Identify any stations that do not, and for each such station identify the times when there is not a person on the premises capable of operating the station.

Response: LILCO objects to Interrogatory no. 27 on the ground that it seeks information that is not relevant to the admitted contentions and is not reasonably calculated to lead to the discovery of admissible evidence on the admitted contentions. The contentions specifically raise only the issue of coverage within the 10-mile EPZ; they say nothing about the existence or

qualifications of radio station personnel. Moreover, LILCO objects to Interrogatory no. 27 to the extent that it seeks information concerning the seven EBS stations that were previously in the WALK-triggered EBS that was litigated and approved by the Board. The County could have raised the issue of the existence of qualified station operators at these stations earlier in this proceeding but did not. The County cannot raise that issue for the first time now.

Without waiving these objections, LILCO answers that WPLR, WICC, and WELI each have a person capable of operating the station on the premises at all times.

Objections Stated by Counsel

All objections and references to objections were stated by counsel.

Respectfully submitted,

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DATED: March 25, 1988

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
INSTITUTE FOR BASIC STANDARDS
BOULDER, COLORADO 80302

REPORT OF CALIBRATION

DIPOLE ANTENNA
POTOMAC INSTRUMENTS, INC.
Model ANT-71, Serial No. 100

Submitted by

Potomac Instruments, Inc.
Silver Spring, Maryland 20910

The data in this report are for use in making RMS cw measurements only and are not valid for broadband interference measurements.

The dipole antenna was connected to a detector having a VSWR of less than 1.05 through a 12.19 meter (40 foot) length of RG 223 U cable supplied with the antenna. The voltage was measured at the output of the cable. The output voltage of the antenna may be expressed in terms of the voltage measured at the cable output by including the loss factor of the cable. Since the cable was not calibrated at NBS, the accuracy of this part of the calculation cannot be certified.

The antenna was calibrated at a height of 9.14 meters (30 feet) in a horizontally polarized field at all frequencies. In addition, a calibration was made for two different dipole element lengths for some frequencies. The antenna was also tested in a horizontally polarized field at 2.13 meters (7 feet) at selected frequencies.

Prior to calibration, the orientation of the antenna (with respect to the transmitter direction) which produced maximum output from the test antenna was determined. This orientation was such that the direction of propagation of the incoming wave is defined by a line drawn from the center of the 1/4-20 mounting hole to the BNC rf output connector.

Tests were also performed to determine the sensitivity of the test antenna to vertically polarized fields.

Field strength may be determined with this dipole antenna by measuring the output voltage of the antenna when terminated in a 50 ohm load and applying the following equation:

$$E = KV$$

where:

E = unknown field strength in volts/meter.
K = antenna factor in (volts/meter)/volt.
V = output voltage of antenna (terminated in 50 ohms) in volts.

Dipole Antenna
Potomac Instruments, Inc.
Model ANT-71, Serial No. 100
Submitted by:
Potomac Instruments, Inc.
Silver Spring, Maryland 20910

Calibration at a Height of 9.14 Meters (30 feet).

The uncertainty of the calibrating field is believed to be within 12 percent.

Frequency MHz	Element Length La inches	Antenna Factor (Volts/meter)/Volt	Element Length Lb inches	Antenna Factor (Volts/meter)/Volt
45.00	63.0	1.29	66.5	1.22
48.25	58.6	1.38	61.4	1.31
55.25	51.3	1.49	52.7	1.46
61.25	46.0	1.72	47.2	1.69
67.25	41.8	1.78	42.6	1.77
77.25			36.7	2.01
83.25			34.0	2.24
93.60			30.0	2.49
102.60			27.25	2.76
118.25			23.5	3.18
153.25			18.1	4.23
175.25			15.8	4.87
181.25			15.25	5.11
187.25			14.75	5.08
193.25			14.25	5.18
199.25			13.65	5.43
205.25	13.5	5.53	13.25	5.53
211.25	13.15	5.88	12.8	5.87
217.25	12.7	5.87	12.5	5.81
224.25	12.2	6.04	11.9	6.04

Dipole Antenna
Potomac Instruments, Inc.
Model ANT-71, Serial No. 100
Submitted by:
Potomac Instruments, Inc.
Silver Spring, Maryland 20910

Calibration at 2.13 Meters (7 feet).

The uncertainty of the calibrating field is believed to be within 18 percent.

Frequency MHz	Element Length, Lb inches	Antenna Factor (Volts/meter)/Volt
45.00	66.5	1.23
77.25	36.7	1.85
118.25	23.5	2.93
153.25	18.1	3.55
187.25	14.75	4.65
224.25	11.9	5.28

Additional Tests

In addition to the above calibrations, tests were performed at three frequencies to determine the front-to-back ratio of the antenna, and the sensitivity of the antenna to vertically polarized fields relative to the sensitivity to horizontally polarized fields. Front-to-back ratio tests were made by rotating the test antenna 180° from the preferred orientation as discussed earlier. The vertical polarization tests were made by rotating the transmitting antenna to a vertical position and measuring the residual horizontal field with the NBS standard dipole. The test antenna output was then measured. Because of the dynamic range limitations of the standard dipole and of the detector used for the test antenna, the values of cross polarization response are maximum responses and the true response may, in fact, be less.

Frequency MHz	Element Length inches	Front-to-Back Ratio dB	Cross Polarization Ratio dB
55.25	52.7	.03	< -25
102.60	27.25	.03	< -24
211.25	12.8	.04	< -29

Note: Included here for reference are the cable loss factors used in calculating the antenna factor, measured at the antenna terminals. These values were supplied by the customer and are not part of the calibration performed by NBS.

Dipole Antenna
Potomac Instruments, Inc.
Model ANT-71, Serial No. 100
Submitted by:
Potomac Instruments, Inc.
Silver Spring, Maryland 20910

Frequency MHz	Loss dB
45.00	1.1
48.25	1.1
55.25	1.2
61.25	1.2
67.25	1.3
77.25	1.4
83.25	1.4
93.60	1.5
102.60	1.6
118.25	1.7
153.25	2.0
175.25	2.25
181.25	2.25
187.25	2.25
193.25	2.3
199.25	2.35
205.25	2.4
211.25	2.45
217.25	2.47
224.25	2.5

For the Director
Institute for Basic Standards

Ramon C. Baird

Ramon C. Baird, Chief
Fields and Antennas Section
Electromagnetics Division

Date: January 6, 1976
Calibration NBR: 809722
Reference: P.O. No. 8601-A

(Also see the RO-71 described under Optional Accessories.)

The FIM-71 operates from a battery of ten (10) "D" size cells. Standard carbon-zinc cells are suitable for many applications; alkaline cells provide greater life with heavy duty and/ or extreme temperatures. The POWER switch has a momentary TEST position which allows the power source to be checked on a special panel meter scale.

A rechargeable battery kit is also available: the battery and charger fit into the instrument battery compartment. An AC operated power source is also available for continuous "bench" operation. (See Optional Accessories.)

1.1.2 Antenna

The ANT-71 antenna consists of a pair of telescoping elements attached to a rugged light weight housing which encloses a wide band balun. The balun is designed to efficiently couple the antenna to a 50 ohm unbalanced system over the specified frequency range. The balun output is provided at a BNC connector on the bottom of the balun housing.

The antenna elements are adjusted for an effective half wavelength (overall) in accordance with a curve, supplied, which relates element length to measured frequency.

The balun housing includes a standard ¼ –20 "camera-type" bushing which facilitates mounting. For near-ground measurements, the antenna is normally attached to the selective voltmeter on a short telescoping mast. With the aid of a leather neck strap, supplied, the instrument can be conveniently hand held, or a unipod can be used. (See Optional Accessories.) When not in use, the antenna and mast are easily collapsed into a storage position on the side of the instrument.

For precise elevated measurements, the antenna can be mounted to any mast with a ¼ –20 threaded stud such as provided on camera tripods. An elevation of 30 feet has been standardized for the FCC approved "TASO" tests. Antenna cables are supplied – see Accessories.

The FIM-71 antenna was calibrated by the National Bureau of Standards in an extensive series of tests performed at Boulder, Colorado. (See Section 5.) A curve is supplied which relates the ratio of antenna output voltage to field strength, at the measured frequency. Because of the method of calibration, these "antenna factors" are independent of cable length and the voltmeter used: as long as the antenna is terminated in a 50 ohm system. Antenna Factor curves are supplied for elevations of both 7 feet and 30 feet over the specified frequency range.

The fact that the antenna and the receiver interface at 50 ohms allows the use of many commercially available RF devices such as attenuators, power dividers, filters, etc.

The FIM-71 is furnished with a removable cover which protects the front panel, and also provides storage for the antenna cables, antenna scale, and neck strap. With the cover in place, and the antenna and mast in the storage position, the user obtains a rugged and truly portable package.

Table 1-1. Specifications, FIM-71

FREQUENCY RANGE	45 MHz to 225 MHz, continuous tuning.
FREQUENCY DIAL	Six turn spiral provides scale length of 56 inches, FM band is 7¼ inches, adjustable hairline cursor.
Dial Accuracy	± 0.5% of indicated frequency with cursor set to MHz index, ± 200 KHz typical for 87.5 MHz to 108 MHz band after setting cursor on known signal.
RF INPUT IMPEDANCE VSWR	50 ohms, VSWR 1.2:1 for 100uV FULL SCALE and greater, VSWR 1.5:1 for 10uV FULL SCALE.
VOLTAGE MEASUREMENT RANGE	1uV to 10V RMS in seven ranges, selected with the FULL SCALE switch.

Table 1-1. Specifications, FIM-71 (Contd.)

METERING	4½ inch taut band panel meter, two-color mirrored scale.
Metering Detectors	AVG (average responding), and PEAK (peak-responding) for measuring TV sync and other pulses, selected with DET switch.
Indication Modes	LIN (linear), and LOG (compressed range obtained with receiver DC feedback), selected with MTR switch.
Scales (Graduation)	LIN mode: 1 to 10 VOLTS (logarithmic) and −20 to 0 dB (linear). LOG mode: −20 to +40 dB (linear) POWER TEST: BATTERY/EXTernal (bracket).
RF VOLTAGE ACCURACY	AVG detector, LIN mode FM/AM: ± 1.5 dB, 1.5uV to 10 V. TV: ± 1.5 dB, 3.0uV to 10 V. AVG detector, LOG mode FM/AM: ± 2.0 dB, 1.5uV to 10 V. TV: ± 2.0 dB, 3.0uV to 10 V. PEAK detector: Add ± 0.5 dB to AVG accuracy limits, 10uV to 10 V, or use peak detector correction factors.
FIELD STRENGTH ACCURACY, 30 FEET (Using ANT-71 Antenna and Antenna Factors for 30 feet from Curve A, Figure 3-2)	AVG detector, LIN mode, 45 MHz FM/AM: ± 4.2 dB, 1.8uV/M to 12.2u V/M, ± 3.0 dB> 12uV/M. TV: ± 4.2 dB, 3.7uV/M to 12.2u V/M, ± 3.0 dB > 12.2uV/M. AVG detector, LIN mode, 225 MHz FM/AM: ± 4.2 dB, 9.1uV/M to 60.5uV/M, ± 3.0 dB > 60.5uV/M. TV: ± 4.2 dB, 18.1uV/M to 60.5uV/M, ± 3.0 dB > 60.5uV/M. AVG detector, LOG mode, 45 MHz FM/AM: ± 4.7 dB, 1.8uV/M to 12.2uV/M, ± 3.5 dB > 12.2uV/M. TV: ± 4.7 dB, 3.7uV/M to 12.2uV/M, ± 3.5 dB > 12.2uV/M. AVG detector, LOG mode, 225 MHz FM/AM: ± 4.7 dB, 9.1uV/M to 60.5uV/M, ± 3.5 dB > 60.5uV/M TV: ± 4.7 dB, 18.1uV/M to 60.5uV/M, ± 3.5 dB > 60.5uV/M. PEAK detector: Add ± 0.5 dB to AVG accuracy limits, 10uV to 10V, or use peak detector correction factors.

Table 1-1. Specifications, FIM-71 (Contd.)

FIELD STRENGTH ACCURACY, 7 FEET (Using ANT-71 Antenna)	Add ± 2.0 dB to 30 foot accuracy limits for same control settings, use Antenna Factors for 7 feet from Curve B, Figure 3-2 (See note 3.)
RELATIVE ACCURACY	± 1 dB at any one frequency for voltage or field strength, in LIN mode, using correction factors for PEAK detector, 10uV to 10V.
RECEIVER BANDWIDTHS	FM/AM: 200 KHz at −3 dB; TV: 450 KHz at −3 dB, selected with IF BW switch.
RECEIVER SPURIOUS RESPONSES	Image Rejection, 55 dB; IF Rejection, 100 dB.
LOCAL OSCILLATOR RADIATION	45 MHz: 2uV; 225 MHz: 35uV, typical values across 50 ohm load at RF input connector.
HARMONIC MEASUREMENT RANGE	Measures second harmonic field strength of 87.5 MHz to 108 MHz signals to −80 dB for fundamental voltage less than 100mV. Using fundamental trap (described in text) measures harmonics to −80 dB for fundamental voltage to 10V, at any frequency within tuning range.
CALIBRATING OSCILLATOR	Modes, selected with OSC switch CAL: Oscillator internally switched to receiver input for calibration. OUT: Oscillator switched to BNC output connector, receiver normal. OFF: Oscillator off, receiver normal.
Output (source) Impedance	50 ohms
Output Level & Accuracy	100mV ± 0.3 dB with 50 ohm load.
Oscillator Frequency	Coupled to receiver tuning, AFC'd to receiver frequency when applied to receiver input with any on-scale reading above 8uV, sweeps approximately ± 1 MHz at 0.6 Hz when not locked.
DEMODULATORS	AM and FM, selected with DEMOD switch.
Output	Level varied with AUDIO control to at least 4.5 V P-P into load impedance of 75 ohms, output (source) resistance 75 ohms, ¼ inch PHONES jack.
Frequency Response	50 Hz to 100 KHz, 3 dB maximum variation
AUDIO MONITORING	Front panel loudspeaker, headphones plug into PHONES jack which disconnects speaker, AM or FM selected with DEMOD switch, AUDIO control includes amplifier disabling switch to save battery in 0 (max. CCW) position.
RECORD OUTPUT	Two-circuit ¼ inch phone jack.

Table 1-1. Specifications, FDM-71 (Contd.)

Tip Contact	DC voltage proportional to panel meter indication, −0.8 V to −8.0 V open circuit, 2000 ohms source resistance.
Ring Contact	Calibration oscillator AFC (or sweep) voltage, −5 V ± 3 V open circuit, 10,000 ohms source resistance. (Note that single-circuit phone plug provides tip contact only.)
POWER SUPPLY	
Standard Internal Battery	1.5 volt size "D" cells, ten required.
Rechargeable Battery Pack	See Optional Accessories
External Supply	−11.5 V to −19 V DC (positive ground) at 150mA, Switchcraft No. 760 connector.
TEMPERATURE	
Operating	+15°F (−10°C) to +105°F (40°C)
Storage (see note 4)	With battery: −40°F (−40°C) to +120°F (49°C) Less battery : −40°F (−40°C) to +150°F (65°C)
DIMENSIONS	Without antenna: 9½ inches (24 CM) high, 12¼ inches (31 CM) wide, 7¼ inches (18.4 CM) deep. With antenna attached and retracted: 9-7/8 inches (25 CM) high, 13½ inches (34.3 CM) wide, 7¼ inches (18.4 CM) deep.
WEIGHT	16 pounds (7.3 KG) with batteries and antenna.

Notes:
1. Values without limits are typical only.
2. Accuracy limits may increase slightly at temperature extremes.
3. Near-ground accuracy limit is estimate only, not fully supported by measurements; also, near-ground field strength values may differ significantly from readings with the antenna elevated.
4. Operation at storage temperature extremes may result in electrical and/or mechanical damage.

Table 1-2. Specifications, ANT-71

ANTENNA TYPE	Half-wave dipole, tuned with adjustable telescoping elements.
FREQUENCY RANGE	45 MHz to 225 MHz
OVER-ALL LENGTH	20-3/8 inches (51.75 CM) to 138-7/8 inches (3.53 M) A curve showing element length vs. frequency is supplied for the specified frequency range.
LOAD IMPEDANCE	50 ohms, unbalanced
CALIBRATION	Curves showing Antenna Factors vs. frequency are supplied for antenna elevations of 30 feet and 7 feet. The Antenna Factor data is based on National Bureau of Standards calibration of the ANT-71. (National Bureau of Standards, Report of Calibration No. 809722, 6 January 1976.) The uncertainty of the NBS calibrating field is believed to be within 12% (.98 dB) for the 30 foot tests and 18% (1.44 dB) for the 7 foot tests. Field strength accuracy measurements depend on the characteristics of the voltmeter used (see Table 4-1.)
MOUNTING	Balun housing includes ¼ –20 threaded bushing (standard camera attachment) for mounting to any mast with a ¼ –20 screw, 3/16 to 7/16 inches long. For near ground measurements and storage, antenna mounts on a short telescoping mast attached to FIM-71 case.
WEIGHT INCLUDING ELEMENTS	0.7 pounds (0.3 KG)

1.2 ACCESSORIES SUPPLIED

In addition to the ANT-71 antenna, the FIM-71 is supplied with the following accessories which are normally stored in the removable front panel cover:

1. Short Coaxial Cable: 50 ohms, double shielded, approximately 45 inches (114 CM) long, RG-223/U with BNC connectors. This cable is used to connect the antenna to the receiver when the antenna is attached to the receiver telescoping mast.
2. Long Coaxial Cable: 50 ohms, double shielded, approximately 34 feet (10.4 m) long, RG-223/U with BNC connectors. This cable is used to connect the antenna to the receiver when the antenna is detached from the receiver for elevated measurements, such as the 30 foot TASO tests.
3. Measuring Tape: Graduated english and metric, 6 feet (2 M) x ½ inch (1.3 CM) wide, all metal, spring return with lock and belt clip. This scale is used to set antenna element lengths.
4. Neck Strap: Natural leather, approximately 50 inches (127 CM) long x 1 inch (2.5 CM) wide, with 6 slotted cleat holes for length adjustment. This strap is used to support the field strength meter during hand-held measurements.

1.3 OPTIONAL ACCESSORIES

1.3.1 AC Power Supply, AC-71

The FIM-71 has many uses as a laboratory or "bench" instrument. When AC line voltage is available,

FIM-71 CHECKOUT SHEET

S/N 258

4. Final Test

4.01 - Range switch adjusted at 62 MHz	✓ Check
4.02 - Front pot A adjusted for max. output in FM/AM BW, and Cal position	✓ Check
4.03 - Front pots B and C checked for proper operation	✓ Check
4.04 - In Lin. mode 0 db and -20 db adj. for exact reading	✓ Check
4.05 - In Lin mode -5, -10, -15 db meter readings are within ±.3 db	.2 .10 db
4.06 - In Log. mode +40, +20, 0 -20 adj. for exact readings	✓ Check
4.07 - In Log. mode +30, +10, -10 meter readings are within ±.3 db	.3 @ +20 db
4.08 - Glyptol all IF board pots	✓ Check
4.09 - Audio output with 100% modulation 5 Vp-p	✓ Check
4.10 - Audio distortions checked above full scale	✓ Check
4.11 - Record meter increase from Avg. Det. to Peak Det.	4 db
4.12 - Record Record output at full scale 4 ± .12 VDC	4.05 VDC
4.13 - Record Record output at low scale .40 ± .03 VDC	.395 VDC
4.14 - Check meter calibration with HP 606 at 100 mV output (100 ± 2 mV)	100 mV
4.15 - AFC voltage stays between -2.6 VDC and 6.5 VDC	3.0 - 5.3 Check
4.16 - Max. overall gain change versus freq. (max. 6 db)	4 db
4.17 - Cal output loss not more than .2 db	.1 db
4.18 - Output frequency tracks dial within ± .5%	✓ Check
4.19 - Osc. Output	✓ Check

MHz	µV
45	200
50	202
100	202
150	200
200	198
225	202

Tested by: [signature]

Date: 5-30-85

LILCO, March 25, 1988

CERTIFICATE OF SERVICE

In the Matter of
LONG ISLAND LIGHTING COMPANY
(Shoreham Nuclear Power Station, Unit 1)
Docket No. 50-322-OL-3

I hereby certify that copies of LILCO's Responses and Objections to Suffolk County's Third Set of Interrogatories and Requests for Production of Documents Regarding Emergency Broadcast System were served this date upon the following by Federal Express as indicated by one asterisk, or by first-class mail, postage prepaid.

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DATED: March 25, 1988