DAR FM TEST RECEIVER DATA

Receiver Lab #3

Type Portable

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FM -> FM Laboratory Measurements for the Panasonic Model RX-FS430

Laboratory Receiver #3

Type: Portable (Blaster)

Measurements were made at a moderate signal level of -62 dBm.

The signal to noise ratio was set at 45 dB and this measurement was made using a 15kHz low pass and a CCIR filter with quasi-peak detection.

Test Results:

Co-Channel	D/U	40.94 dB
Lower First Adjacent	D/U	27.33 dB
Upper First Adjacent	D/U	27.19 dB
Lower Second Adjacent	D/U	-22.41 dB
Upper Second Adjacent	D/U	2.16 dB

ELECTRONIC INDUSTRIES ASSOCIATION
Digital Audio Radio Laboratory
Engineers: RMc/DL
DATE: 2/21/95

PROJ.: RADIO CHARACTERIZATION/CONFIRMATION

* Key point measurements for comparison to Grossjean data
* Additional data with regard to audio performance VS RF level

TEST SET-UP

* Receiver: Panasonic Portable stereo
* Ant. Net: 50/75 ohm resistive pad (-7.8dB insertion loss)
* Audio Ref: 1.0Vrms
* Test Bed, W/Orban Stereo Gen & Harris Exciter as Signal Source
* Audio measurements made with Audio Precision as rms unweighted except stereo noise.

FM TESTS (TEST FQ. 94.1MHZ)

S/N RATIO - 1KHZ, 100% MOD

MAX	-61dB	-62dBm	(mono)

THD - 1KHZ, 100% MOD (-50dBm)

MONO	0.54 %	
STEREO	1.10 %	(Increase due to pilot content)

LIMITING THRESHOLD (Audio -1dB)

-96dBm

HIGH CUT THRESHOLD

Audio: 10KHZ, L+R, 100% Mod, Pilot off
NA

SEPARATION @ -62dBm

Freq.	L->R	R->L	
1KHZ	30.8dB	29dB	(W/O Pre-Emph)
10KHZ	25dB	24dB	(W/O Pre-Emph)

SIGNAL, NOISE & SEPARATION VS RF LEVEL

* Left channel used as the measurement channel for Signal and Noise data
* Left channel driven (L only) for separation data
* Audio test frequency = 1KHZ
* RF levels represent power into the receiver after 50/75 ohm conversion

CURVE DATA

SIGNAL, NOISE & SEPARATION VS RF LEVEL

	mono (L)		Stereo (L)				Separation L->R	
RF Level	Signal	Noise	Signal	Filt. Noise	Noise	RF Level	Left	Right
dBm	dB	dB	dB	dB	dB	dBm	dB	dB
-130	-27.8	-27.8	-28	-27	-28	-130	-27.5	-27.5
-125	-27.7	-27.8	-28	-27	-28	-125	-27.5	-27.5
-120	-27.3	-27.9	-28	-27	-28	-120	-27.5	-27.5
-115	-24.6	-28.2	-25.4	-25	-29	-115	-26.2	-26.7
-110	-18	-29	-18.4	-24	-29.7	-110	-21.5	-22
-105	-9.8	-31.5	-10.2	-21.5	-32	-105	-14.1	-14.8
-100	-3.46	-37	-3.8	-22	-28	-100	-3.2	-22
-95	-0.6	-46.5	-0.6	-29.6	-32.3	-95	-0.5	-26.3
-90	0	-55.4	0	-34.4	-36	-90	0	-28.3
-85	0	-61	0	-39.5	-38.6	-85	0	-29.4
-80	0	-64.5	0	-46	-40	-80	0	-30
-75	0	-66	0	-51	-40.5	-75	0	-30.6
-70	0	-66	0	-55.7	-40.7	-70	0	-30.7
-62	0	-66	0	-61	-40.7	-62	0	-30.8
-57						-57		

EIA DAR LAB

SIGNAL & FILTERED NOISE VS RF LEVEL

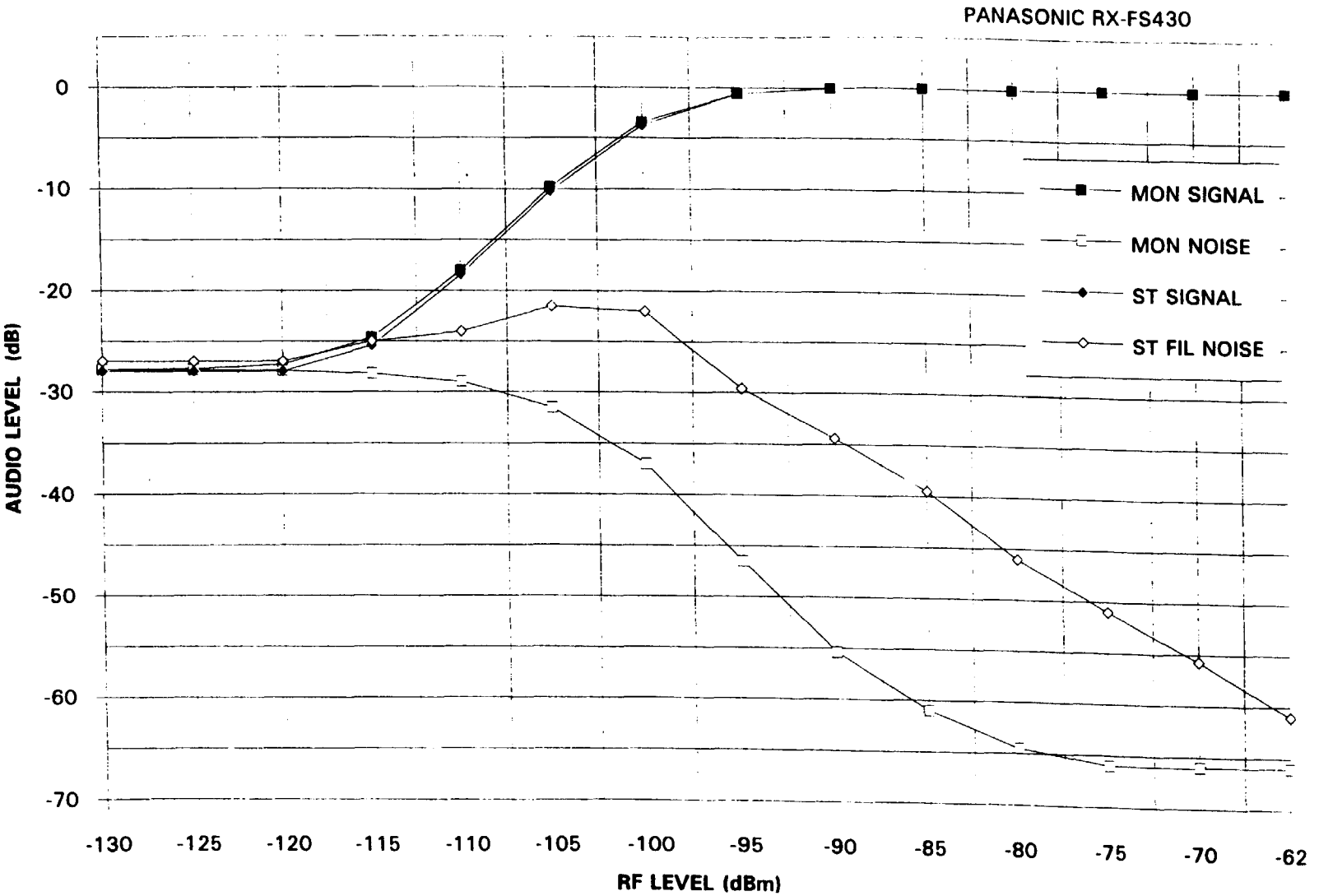

Chart 1 of 3

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SEPARATION VS RF LEVEL

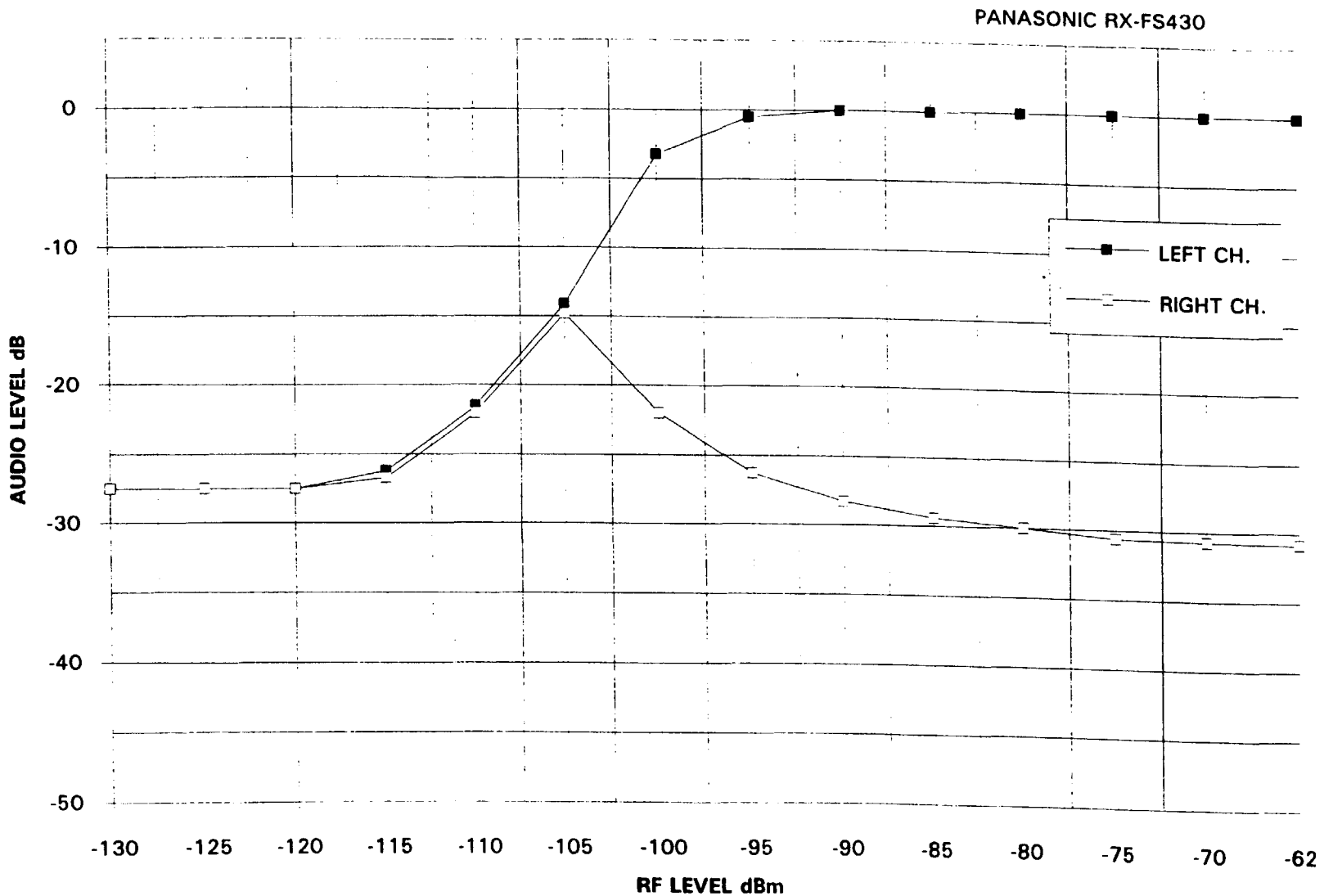


Chart 2 of 3

EIA DAR LAB

SIG., NOISE, FILT. NOISE & SEPARATION VS RF LEVEL

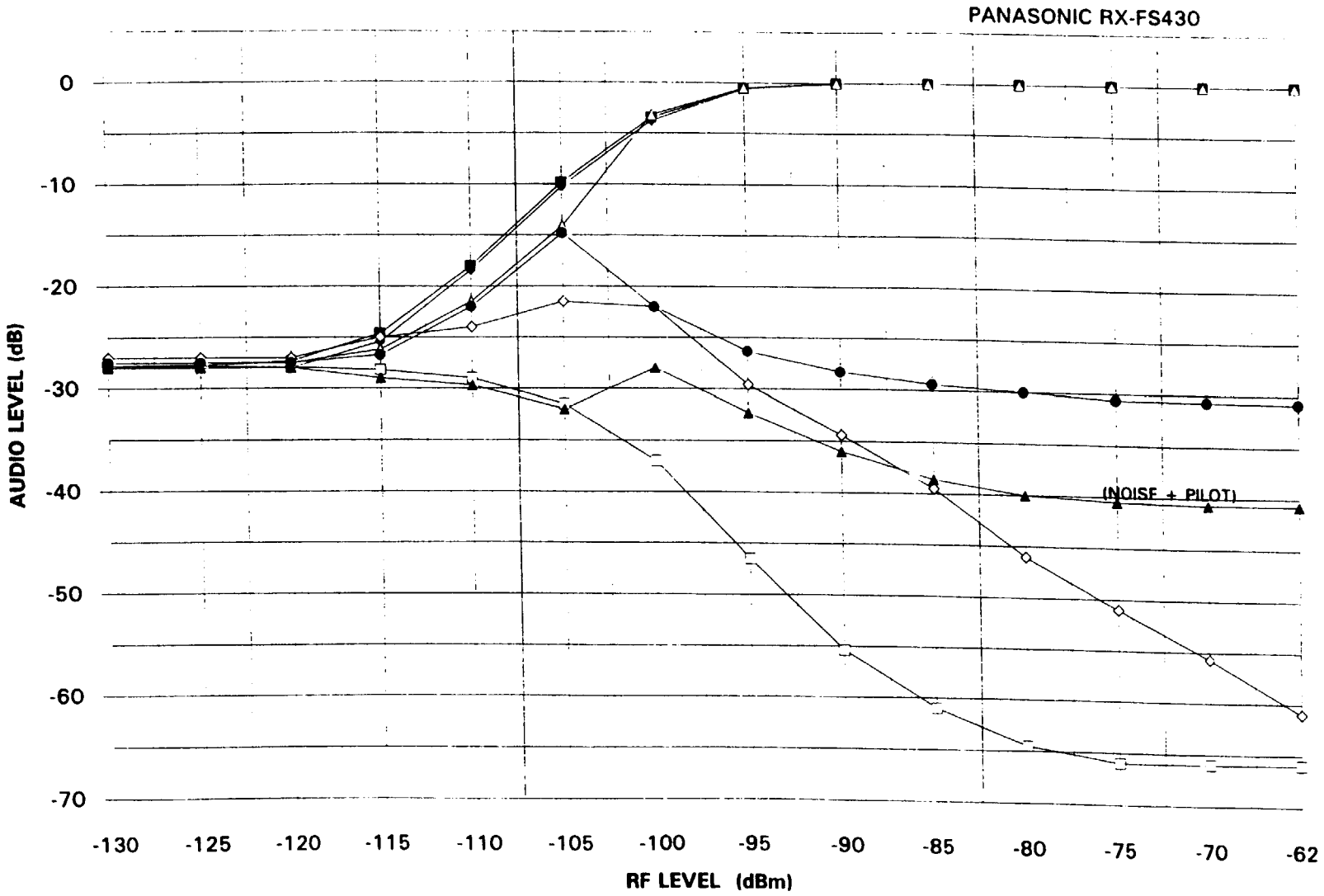


Chart 3 of 3

	GEN	RCVR		RCVR
FM TUNER TEST DATA				
Manufacturer:	Panasonic			
Model Number:	RX-FS430			
Serial Number:	GR3JA01184			
Type:	Personal Portable			
	using IEEE/IHF 10Ω,10Ω,45Ω resistive pad			
	external antenna disconnected			
FM 30% modulation(98.1MHz)				
20 dB S/N	4.3	2.15 μV	17.9 dBf	-100.3 dBm
30 dB S/N	6.8	3.4 μV	21.9 dBf	-96.4 dBm
50 dB S/N	80	40 μV	43.3 dBf	-74.9 dBm
Interstation Noise	-15	dB		
Mute start Level		μV	dBf	dBm
High cut at 10KHz		dB at	μV	
Fo+½IF rejection	8	4 mV	65.4 dB	
Image rejection	36	18 μV	18.5 dB	
FM 100% MODULATION MONO				
Usable Senditivity	6	3 μV	20.8 dBf	-97.4 dBm
50dB S/N	14	7 μV	28.1 dBf	-90.1 dBm
Maximum S/N	61	dB		
THD %	0.34			
AM Rejection at 1mV	48	dB		
FM 100% MODULATION STEREO				
Usable Sensitivity	9	4.5 μV	24.3 dBf	-93.9 dBm
50dB S/N	100	50 μV	45.2 dBf	-73.0 dBm
Maximum S/N	60	dB		
THD %	0.35			
1KHz separation	35	dB		
10KHz separation	38.5	dB		
Stero Blend action: none				
Separation at 50μV		dB	39.0 dBf	-81.0 dBm
67KHz SCA Rejection	54	dB		
δF=5KHz				
19 and 38KHzproducts	-40	dB		
FM TWO SIGNAL TESTS(98.1 MHz)				
708μV (-50dBm)				
Capture Ratio	1.4	dB		
Selectivity@ 200KHz				
for 30dB S/N	5.5	dB		
for 50dB S/N	2	dB		
Selectivity@ 400KHz				
for 30dB S/N	29	dB		
for 50dB S/N	23.5	dB		
IM Rejection	4	2 mV	77.3 dBf	-41.0 dBm
(98.9 and 99.7)				
2MHz IM rejection	4	2 mV	77.3 dBf	-41.0 dBm
(99.1 and 100.1)				
IF mix rejection	4	2 mV	77.3 dBf	-41.0 dBm
(96.4 and 107.2)				
AM 30% MODULATION MONO				
DUMMY ANTENNA:	50Ω gem to 5.6μH in series with ferrite antenna			
20dB S/N	16	16 μV	-82.9 dBm	
Max S/N	51	dB		
THD at max S/N	0.7	%		
THD at 80% mod	1.1	%		
-3dB Audio Response		%		
600KHz	1570			
1400KHz	1680	Hz		
±10KHz Selectivity	14	dB		
±20KHz Selectivity	28.5	dB		
Local AGC action:		μV	dBm	
level for -3dB 600KHz desired signal reduction				
1400KHz		mV	dBm	
10MHz	141	141 mV	-4.0 dBm	
27MHz		mV	dBm	
IF mix rejection				
(1400 & 945 or 950)	NM	mV	dBm	
	local AGC prevents measurement			

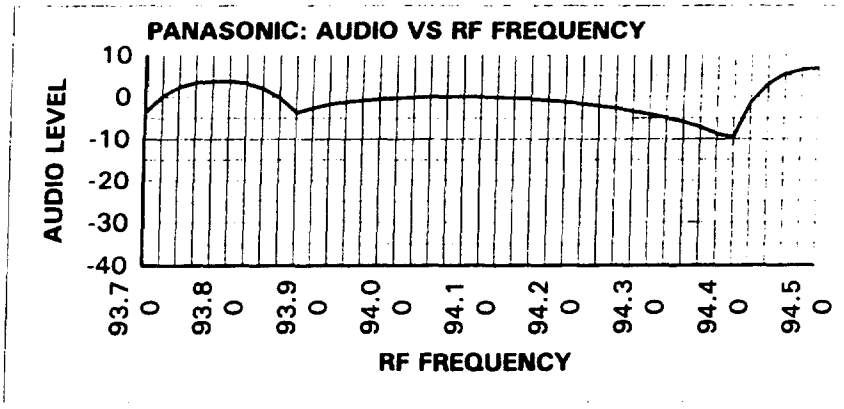
DAR Lab
Mar 15/95 PANAVRF.XLS
Panasonic Channel Characteristics **94.1MHZ**

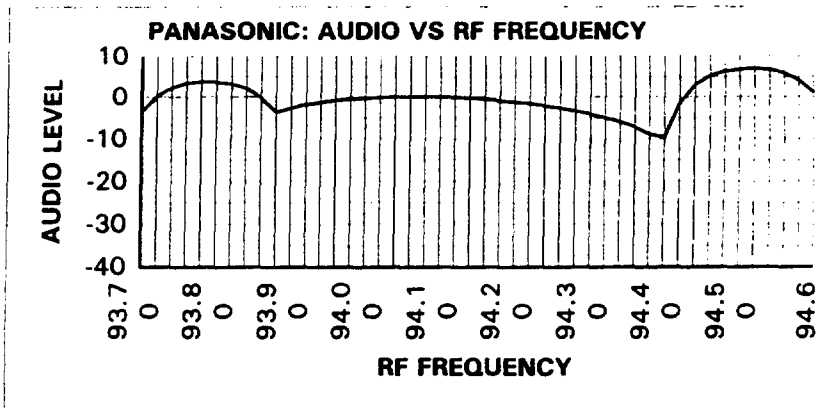
Audio VS RF Frequency

Note:

* The results here represent a chacteristic receiver input signature based on sweeping the RF signal through the desired channel
* The test signal is modulated with 1khz @ 100%
* The measurements are made using 15khz low pass and CCIR filters with quasi-peak detection
* RF level is -62dBm
* Manual tuned radio - tuned for lowest distortion for center tuning

RF FREQ.	AUDIO LEVEL	
93.70	-3.6	
93.72	0.12	
93.74	2.31	
93.76	3.36	
93.78	3.72	
93.80	3.65	
93.82	3.15	
93.84	2.03	
93.86	-0.14	
93.88	-3.67	
93.90	-2.66	
93.92	-1.77	
93.94	-1.22	
93.96	-0.83	
93.98	-0.56	
94.00	-0.34	
94.02	-0.17	
94.04	-0.03	
94.06	0.05	
94.08	0.07	
94.10	**0**	**Tuning**
94.12	-0.09	
94.14	-0.29	
94.16	-0.54	
94.18	-0.85	
94.20	-1.21	
94.22	-1.63	
94.24	-2.12	
94.26	-2.69	
94.28	-3.34	
94.30	-4.09	
94.32	-4.95	
94.34	-5.94	
94.36	-7.18	
94.38	-8.82	
94.40	-9.56	
94.42	-1.51	
94.44	3.06	
94.46	5.32	
94.48	6.36	
94.50	6.89	





DAR Lab
Mar 8/95 PANUP1.XLS
RMc

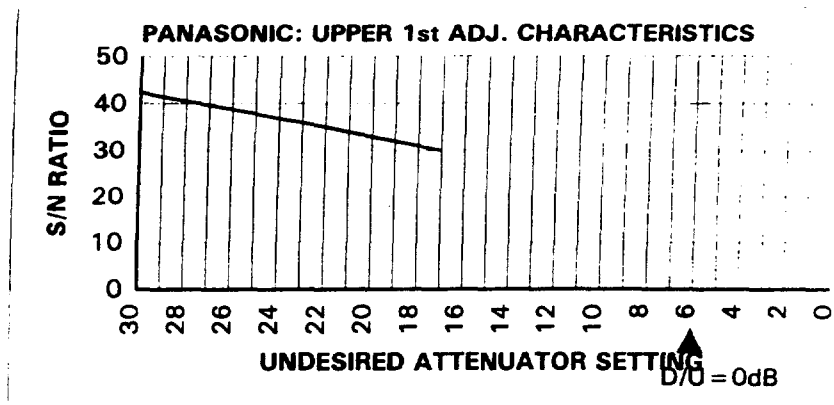
Panasonic Adjacent Channel Characteristics

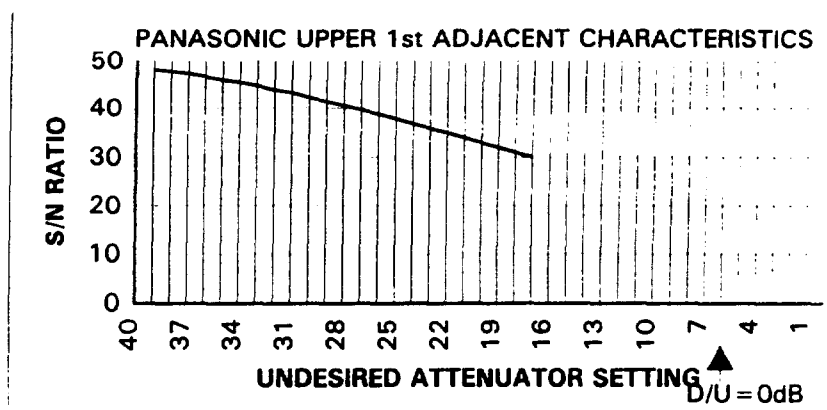
Upper first adj. channel 94.3mhz

Note:

* The results here represent a chacteristic receiver input signature based on ramping the undesired signal up in 1dB increments and recording the signal to noise ratio.
* The measurements are made using a 15khz low pass and CCIR filters with quasi-peak detection
* The interfering signal is modulated with clipped pink noise
* SCA's (group B) are employed on both the desired and the undesired signals.

UNDES. ATTEN.	RADIO S/N (dB)	
40		
39	48.2	
38	47.8	
37	47.3	
36	46.7	
35	46	
34	45.5	
33	44.8	
32	43.9	
31	43.3	
30	42.3	
29	41.4	
28	40.5	
27	39.6	
26	38.7	
25	37.8	
24	36.7	
23	35.8	
22	34.9	
21	33.9	
20	32.9	
19	32	
18	31	
17	30	
16		
15		
14		
13		
12		
11		
10		
9		
8		
7		
6		D/U=0dB
5		
4		
3		
2		
1		
0		





DAR Lab
Mar 8/95 PANLOW2.XLS

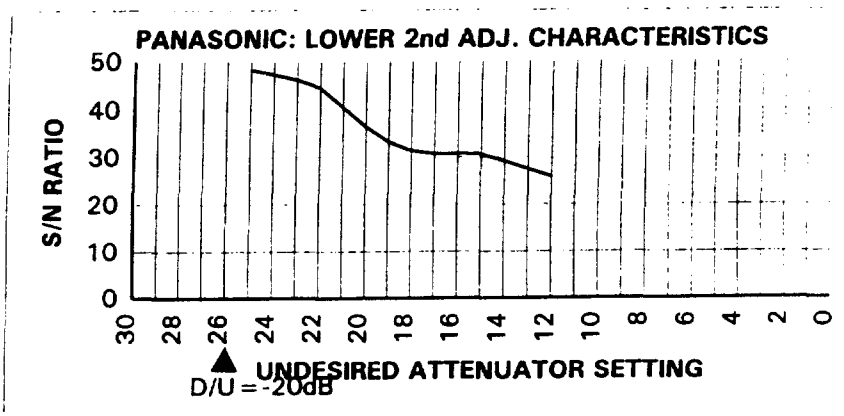
Panasonic Adjacent Channel Characteristics

Lower second adj. channel 93.7mhz

Note:

* The results here represent a chacteristic receiver input signature based on ramping the undesired signal up in 1dB increments and recording the signal to noise ratio.
* The measurements are made using a 15khz low pass and CCIR filters with quasi-peak detection
* The interfering signal is modulated with clipped pink noise
* SCA's (group B) are employed on both the desired and the undesired signals.

UNDES. ATTEN.	RADIO S/N (dB)	
40		
39		
38		
37		
36		
35		
34		
33		
32		
31		
30		
29		
28		
27		
26		**D/U = -20dB**
25	48.3	
24	47.3	
23	46.2	
22	44.6	
21	40.6	
20	36.5	
19	33.2	
18	31.4	
17	30.8	
16	30.8	
15	30.6	
14	29.2	
13	27.5	
12	25.8	
11		
10		
9		
8		
7		
6		
5		
4		
3		
2		
1		
0		



DAR Lab
Mar 13/95 PANUP2.XLS

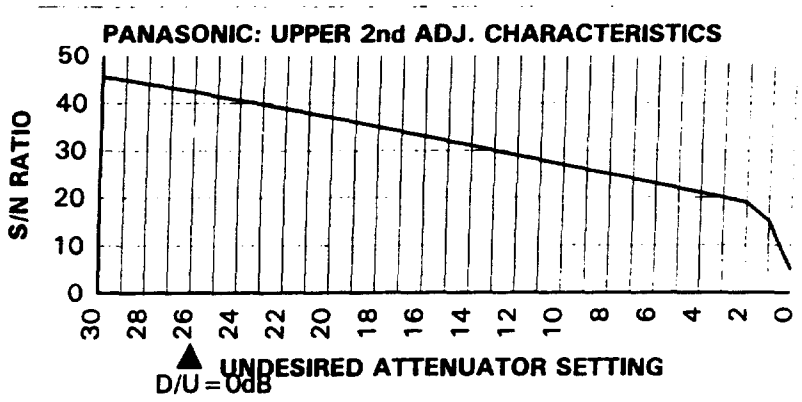
Panasonic Portable Radio Adjacent Channel Characteristics

Upper second adj. channel 94.5mhz

Note:

* The results here represent a chacteristic receiver input signature based on ramping the undesired signal up in 1dB increments and recording the signal to noise ratio.
* The measurements are made using a 15khz low pass and CCIR filters with quasi-peak detection
* The interfering signal is modulated with clipped pink noise
* SCA's (group B) are employed on both the desired and the undesired signals.

UNDES. ATTEN.	RADIO S/N (dB)	
40	47.9	
39	49.7	
38	49.5	
37	48.7	
36	48.8	
35	47.5	
34	48	
33	47.5	
32	46.8	
31	46.1	
30	45.6	
29	45	
28	44.1	
27	43.3	
26	**42.5**	**D/U = 0dB**
25	41.4	
24	40.6	
23	39.8	
22	38.8	
21	38	
20	37	
19	36.1	
18	35	
17	34	
16	33	
15	32	
14	31	
13	30	
12	29	
11	28	
10	27	
9	26	
8	25	
7	24	
6	23	
5	22	
4	21	
3	20	
2	19	
1	15	
0	5	



DAR FM TEST RECEIVER DATA

Receiver Lab #4

Type Home Hi-Fi

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11	Receiver Upper 2nd Adjacent Interference/Noise

FM -> FM Laboratory Measurements for the Pioneer Model SX-201

Laboratory Receiver #4

Type: Home Hi-Fi

Measurements were made at a moderate signal level of -62 dBm.

The signal to noise ratio was set at 45 dB and this measurement was made using a 15kHz low pass and a CCIR filter with quasi-peak detection.

Test Results:

Co-Channel	D/U	44.18 dB
Lower First Adjacent	D/U	31.87 dB
Upper First Adjacent	D/U	21.22 dB
Lower Second Adjacent	D/U	-15.16 dB
Upper Second Adjacent	D/U	-14.92 dB

ELECTRONIC INDUSTRIES ASSOCIATION
Digital Audio Radio Laboratory
Engineers: RMc/DL
DATE: 2/21/95

PROJ.: RADIO CHARACTERIZATION/CONFIRMATION

* Key point measurements for comparison to Grossjean data
* Additional data with regard to audio performance VS RF level

TEST SET-UP

* Receiver: Pioneer SX-201
* Ant. Net: 50/75 ohm resistive pad (-7.8dB insertion loss)
* Audio Ref: 580mV
* Receiver in "Manual Tuning" Mode for all measurements
* Test Bed, W/Orban Stereo Gen & Harris Exciter as Signal Source
* Audio measurements made with Audio Precision as rms unweighted

FM TESTS (TEST FQ. 94.1MHZ)

S/N RATIO - 1KHZ, 100% MOD

MAX	-65dB	-62dBm	(mono)

THD - 1KHZ, 100% MOD (-50dBm)

MONO	0.64 %	
STEREO	1.37 %	(Increase due to pilot content)

LIMITING THRESHOLD (Audio -1dB)

-108dBm

HIGH CUT THRESHOLD

Audio: 10KHZ, L+R, 100% Mod, Pilot off
NA

SEPARATION @ -62dBm

Freq.	L->R	R->L	
1KHZ	-33.4dB	-34.5dB	(W/O Pre-Emph)
10KHZ	-23dB	-24.4dB	(W/O Pre-Emph)

SIGNAL, NOISE & SEPARATION VS RF LEVEL

* Left channel used as the measurement channel for Signal and Noise data
* Left channel driven (L only) for separation data
* Audio test frequency = 1KHZ
* Receiver in "Manual Tuning" Mode for all measurements
* RF levels represent power into the receiver after 50/75 ohm conversion
* Filt. Noise figures represent noise measurements made with a 15khz low pass filter to reject the pilot

CURVE DATA

SIGNAL, NOISE & SEPARATION VS RF LEVEL

RF Level	mono (L)		Stereo (L)			RF Level	Separation L->R	
	Signal	Noise	Signal	Filt. Noise	Noise		Left	Right
dBm	dB	dB	dB	dB	dB	dBm	dB	dB
-130	-14.3	-14.3	-14.8	-14.5	-14.8	-130	-15	-15
-125	-14.3	-14.3	-14.8	-14.5	-14.8	-125	-15	-15
-120	-12.8	-15.3	-13	-14.7	-15	-120	-15	-14
-115	-7.8	-17.5	-8.3	-16.5	-17	-115	-13.5	-8.7
-110	-2.2	-25	-2.5	-22.5	-24	-110	-8.6	-6
-105	-0.2	-46	-0.23	-43.5	-40	-105	-6	-6
-100	0	-53	0	-52.6	-41.5	-100	-6	-6
-95	0	-58	0	-57.9	-42	-95	-6	-6
-90	0	-62.3	0	-62.3	-42	-90	-6	-6
-85	0	-65	0	-45	-39	-85	0	-33.1
-80	0	-67	0	-50	-39.8	-80	0	-33.4
-75	0	-67	0	-54.8	-40	-75	0	-33.4
-70	0	-68	0	-59.3	-40	-70	0	-33.4
-62	0	-68	0	-64.5	-40	-62	0	-33.4
-57						-57		

EIA DAR LAB

SIGNAL & FILTERED NOISE VS RF LEVEL

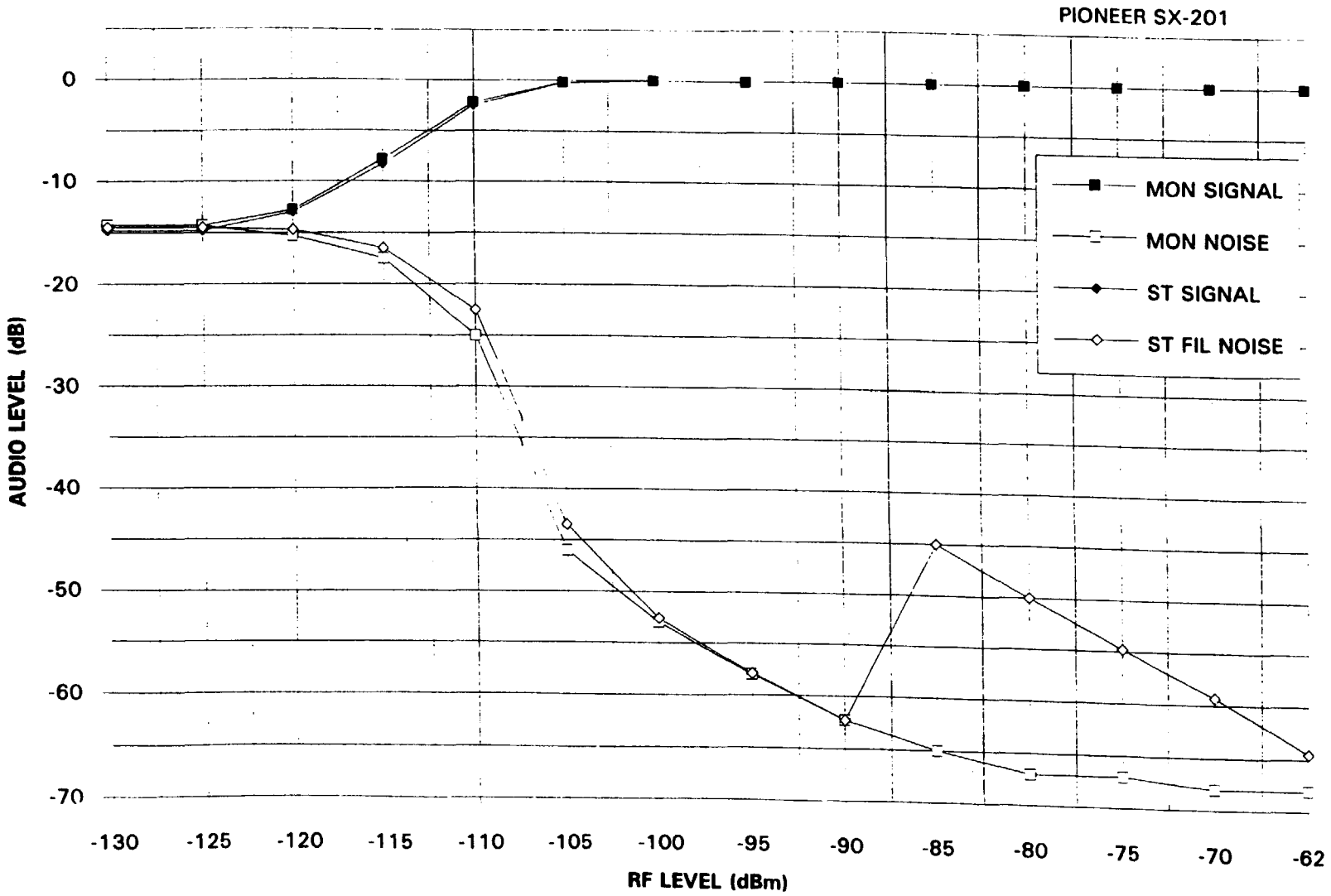
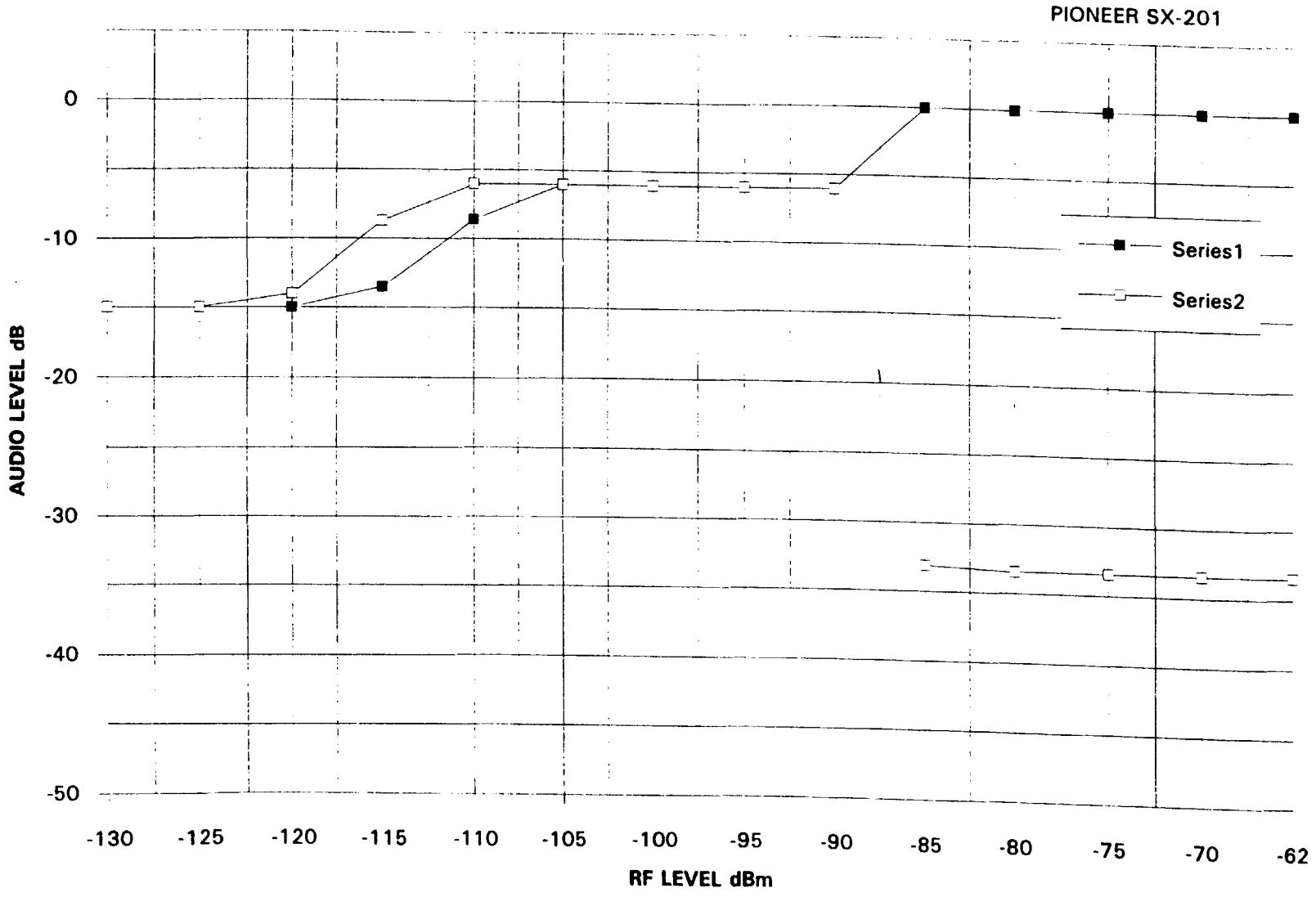


Chart 1 of 3

EIA DAR LAB

SEPARATION VS RF LEVEL



EIA DAR LAB

SIG., NOISE, FILT. NOISE & SEPARATION VS RF LEVEL

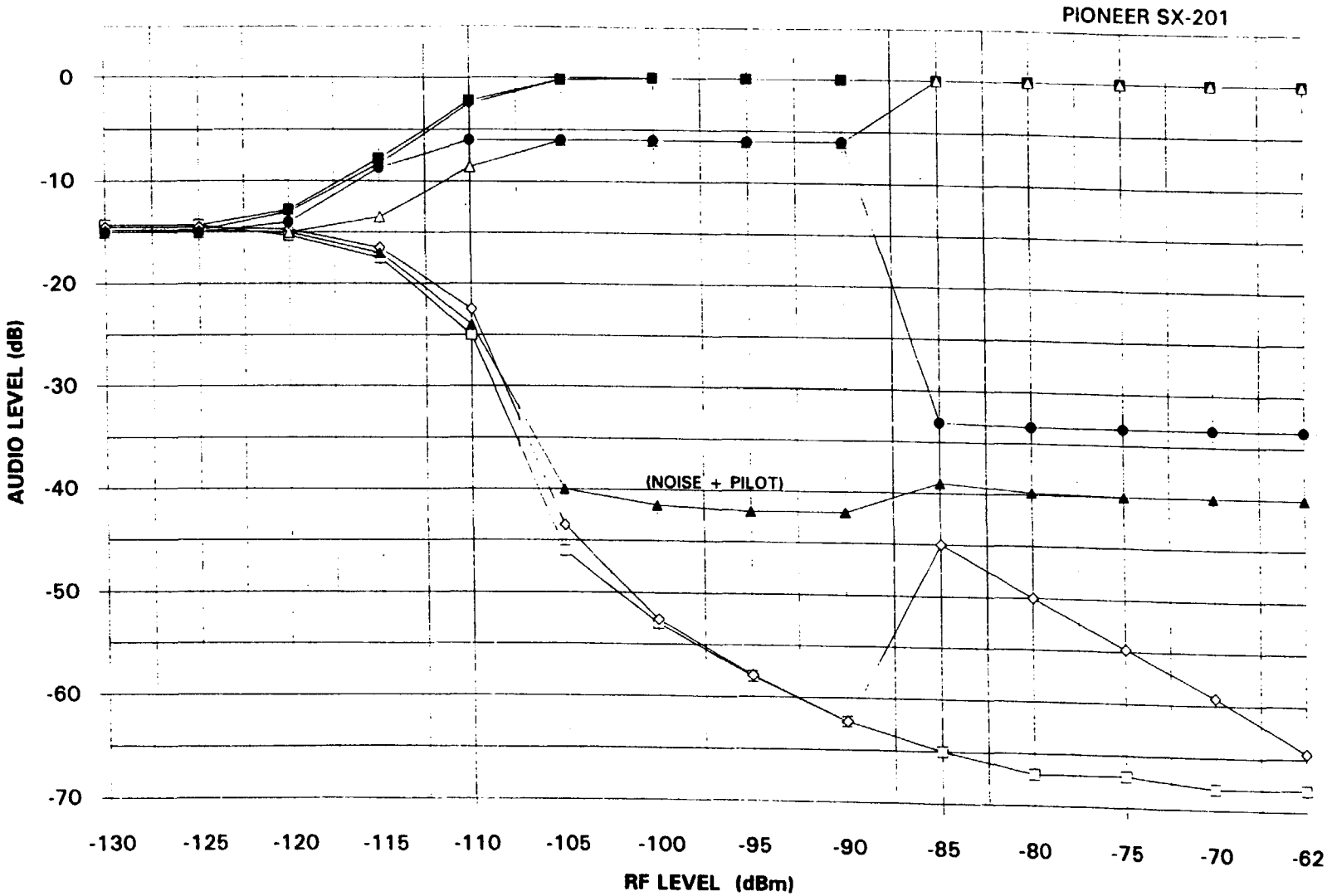


Chart 3 of 3

	GEN	RCVR 300Ω		RCVR
FM TUNER TEST DATA				
Manufacturer:	Pioneer			
Model Number:	SX-201			
Serial Number:	OA3965843C			
Type:	Home Hi-Fi			
	using IEEE/IHF 10Ω,10Ω,45Ω resistive pad			
	and balun transformer			
FM 30% modulation(98.dBm levels are 300Ω balanced output level				
20 dB S/N	3	3 μV	14.8 dBf	-97.4 dBm
30 dB S/N	4.4	4.4 μV	18.1 dBf	-94.1 dBm
50 dB S/N	7	7 μV	22.1 dBf	-90.1 dBm
Interstation Noise	-2	dB		
Mute start Level		μV	dBf	dBm
High cut at 10KHz	0	dB at	μV	
Fo+½IF rejection	5	5 mV	64.4 dB	
Image rejection	224	224 μV	37.5 dB	
FM 100% MODULATION MONO				
Usable Senditivity	4.4	2.2 μV	18.1 dBf	-100.1 dBm
50dB S/N	14	7 μV	28.1 dBf	-90.1 dBm
Maximum S/N	75	dB		
THD %	0.33			
AM Rejection at 1mV	56	dB		
FM 100% MODULATION STEREO				
Usable Sensitivity	switches to mono		dBf	dBm
50dB S/N	70	35 μV	42.1 dBf	-76.1 dBm
Maximum S/N	66	dB		
THD %	0.8			
1KHz separation	39	dB		
10KHz separation		dB		
Stero Blend action:				
separation at 50μVrec	37	dB	39.2 dBf	-73.0 dBm
67KHz SCA Rejection	65	dB		
δF=5KHz				
19 and 38KHzproducts	-21	dB		
FM TWO SIGNAL TESTS(98.1 MHz)				
Capture Ratio	1.5	dB		
Selectivity@ 200KHz				
for 30dB S/N	6	dB		
for 50dB S/N	2.5	dB		
Selectivity@ 400KHz				
for 30dB S/N	51	dB		
for 50dB S/N	46.5	dB		
IM Rejection	3	3 mV	74.8 dBf	-37.4 dBm
(98.9 and 99.7)				
2MHz IM rejection	8	8 mV	83.3 dBf	-28.9 dBm
(96.4 and 100.1)				
IF mix rejection	1.4	1.4 mV	68.1 dBf	-44.1 dBm
(96.4 and 107.1)				
AM 30% MODULATION MONO				
DUMMY ANTENNA:	50Ω generator replacing loop			
20dB S/N	15	15 μV	-83.5 dBm	
Max S/N	51	dB		
THD at max S/N	0.1	%		
THD at 80% mod	0.5	%		
-3dB Audio Response		%		
600KHz	1484			
1400KHz	1484	Hz		
±10KHz Selectivity	26	dB		
±20KHz Selectivity	38	dB		
Local AGC action:		μV	dBm	
level for -3dB 600KHz desired signal reduction				
1400KHz				
10MHz		mV	dBm	
27MHz		mV	dBm	
IF mix rejection				
(1400 & 945 or 950)	10	10 mV	-26.98 dBm	

DAR Lab
Mar ~~8~~/95 MAR 15/95 PIONAVRF.XLS

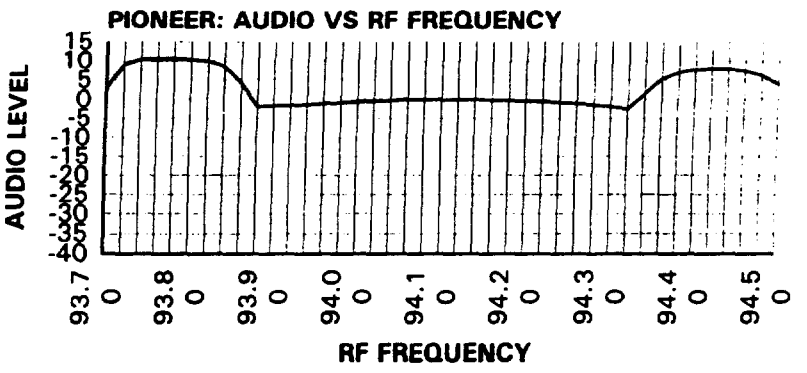
Pioneer Channel Characteristics **94.1MHZ**

Audio VS RF Frequency

Note:

* The results here represent a chacteristic receiver input signature based on sweeping the RF signal through the desired channel
* The test signal is modulated with 1khz @ 100%
* The measurements are made using 15khz low pass and CCIR filters with quasi-peak detection
* RF level is -62dBm

RF FREQ.	AUDIO LEVEL	
93.70	2.75	
93.72	9	
93.74	10.4	
93.76	10.66	
93.78	10.63	
93.80	10.4	
93.82	9.88	
93.84	8.52	
93.86	4.12	
93.88	-1.76	
93.90	-1.62	
93.92	-1.52	
93.94	-1.3	
93.96	-1.05	
93.98	-0.81	
94.00	-0.6	
94.02	-0.41	
94.04	-0.26	
94.06	0	
94.08	0	
94.10	**0**	**Tuning Frequency**
94.12	0	
94.14	0	
94.16	-0.13	
94.18	-0.24	
94.20	-0.39	
94.22	-0.57	
94.24	-0.78	
94.26	-1.07	
94.28	-1.43	
94.30	-1.88	
94.32	-2.5	
94.34	1.54	
94.36	5.32	
94.38	7	
94.40	7.7	
94.42	8	
94.44	7.9	
94.46	7.5	
94.48	6.2	
94.50	4	



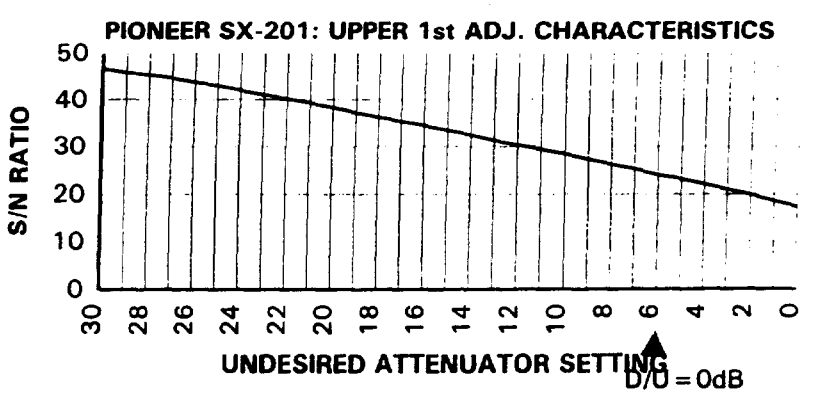
DAR Lab
Mar 8/95 PIONUP1.XLS
RMc
Pioneer Adjacent Channel Characteristics

Upper first adj. channel 94.3mhz

Note:

* The results here represent a chacteristic receiver input signature based on ramping the undesired signal up in 1dB increments and recording the signal to noise ratio.
* The measurements are made using a 15khz low pass and CCIR filters with quasi-peak detection
* The interfering signal is modulated with clipped pink noise
* SCA's (group B) are employed on both the desired and the undesired signals.

UNDES. ATTEN.	RADIO S/N (dB)	
40		
39		
38		
37		
36		
35		
34		
33		
32		
31		
30	46.6	
29	45.8	
28	45.3	
27	44.6	
26	43.7	
25	43	
24	42	
23	41	
22	40.2	
21	39.3	
20	38.3	
19	37.3	
18	36.3	
17	35.4	
16	34.5	
15	33.5	
14	32.5	
13	31.3	
12	30.4	
11	29.4	
10	28.4	
9	27.3	
8	26.3	
7	25.3	
6	**24**	**D/U=0dB**
5	23.2	
4	22.1	
3	21	
2	19.9	
1	18.6	
0	17.4	



DAR Lab
Mar 8/95 PIONLOW2.XLS

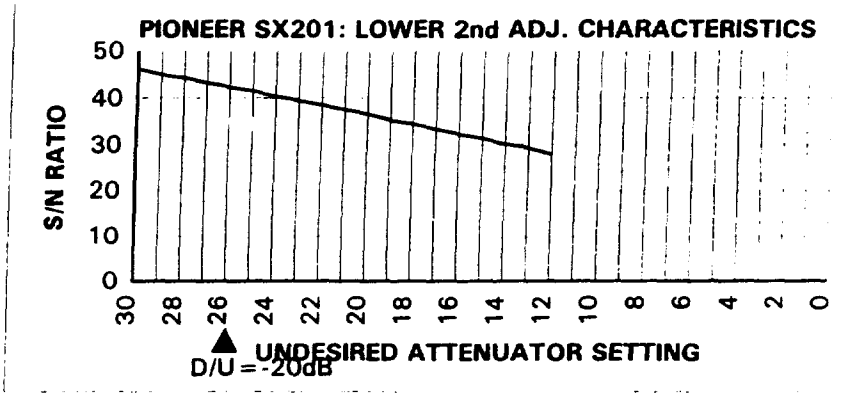
Pioneer SX201 Adjacent Channel Characteristics

Lower second adj. channel 93.7mhz

Note:

* The results here represent a chacteristic receiver input signature based on ramping the undesired signal up in 1dB increments and recording the signal to noise ratio.
* The measurements are made using a 15khz low pass and CCIR filters with quasi-peak detection
* The interfering signal is modulated with clipped pink noise
* SCA's (group B) are employed on both the desired and the undesired signals.

UNDES. ATTEN.	RADIO S/N (dB)	
40		
39		
38		
37		
36		
35	49.9	
34	49.2	
33	48.5	
32	47.8	
31	47	
30	46.2	
29	45	
28	44.3	
27	43.3	
26	**42.3**	**D/U = -20dB**
25	41.5	
24	40.4	
23	39.4	
22	38.5	
21	37.5	
20	36.6	
19	35.3	
18	34.5	
17	33.4	
16	32.3	
15	31.4	
14	30.2	
13	29.3	
12	27.9	
11		
10		
9		
8		
7		
6		
5		
4		
3		
2		
1		
0		



DAR Lab
Mar 13/95 PIONUP2.XLS

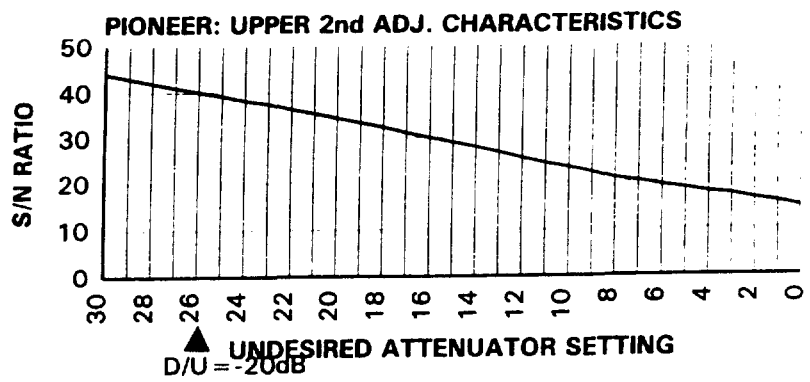
PIONEER SX-201 Adjacent Channel Characteristics

Upper second adj. channel 94.5mhz

Note:

- The results here represent a chacteristic receiver input signature based on ramping the undesired signal up in 1dB increments and recording the signal to noise ratio.
- The measurements are made using a 15khz low pass and CCIR filters with quasi-peak detection
- The interfering signal is modulated with clipped pink noise
- SCA's (group B) are employed on both the desired and the undesired signals.

UNDES. ATTEN.	RADIO S/N (dB)	
40		
39		
38		
37		
36		
35	47.5	
34	46.9	
33	46.1	
32	45.3	
31	44.6	
30	44	
29	43	
28	42	
27	41	
26	**40.1**	**D/U = -20dB**
25	39.3	
24	38.2	
23	37.5	
22	36.3	
21	35.4	
20	34.3	
19	33.3	
18	32.3	
17	31.1	
16	30	
15	29	
14	28	
13	26.8	
12	25.5	
11	24.3	
10	23.3	
9	22.2	
8	20.9	
7	20.2	
6	19.3	
5	18.6	
4	17.8	
3	17.3	
2	16.3	
1	15.6	
0	14.6	



DAR FM TEST RECEIVER DATA

Receiver Lab #5

Type Auto

Index

Page	Description
1	Laboratory FM -> FM D/U Ratios
2	Radio Characterization/Confirmation
3	Signal, Noise, & Separation VS RF Level
4	Graph of Signal & Filtered Noise VS RF Level
5	Graph of Separation VS RF Level
6	Graph of Signal, Noise, Filtered Noise, & Separation VS RF Level
7	Woodstock Engineering Receiver Test Report
8	Audio VS RF Frequency Test
9	Receiver Upper 1st Adjacent Interference/Noise
10	Receiver Lower 2nd Adjacent Interference/Noise (no measurements made)
11	Receiver Upper 2nd Adjacent Interference/Noise (no measurements made)

FM -> FM Laboratory Measurements for the Ford Model F4XF-19B132-CB

Laboratory Receiver #5

Type: Auto

Measurements were made at a moderate signal level of -62 dBm.

The signal to noise ratio was set at 45 dB and this measurement was made using a 15kHz low pass and a CCIR filter with quasi-peak detection. For the second adjacent tests 45 dB S/N was not attainable on the test bed and 48 dB was used.

Test Results:

Co-Channel	D/U	35.22 dB
Lower First Adjacent	D/U	-6.18 dB
Upper First Adjacent	D/U	-6.12 dB
Lower Second Adjacent	D/U	-44.43 dB
Upper Second Adjacent	D/U	-46.18 dB

ELECTRONIC INDUSTRIES ASSOCIATION
Digital Audio Radio Laboratory
Engineers: RMc/DL
DATE: 2/21/95

PROJ.: RADIO CHARACTERIZATION/CONFIRMATION

* Key point measurements for comparison to Grossjean data
* Additional data with regard to audio performance VS RF level
* Unweighted rms noise measurements

TEST SET-UP

* Receiver: Ford Auto Radio
* Ant. Net: 50/75 (auto radio version)
* Audio Ref: 2.0Vrms into 4 ohms
* Test Bed, W/Orban Stereo Gen & Harris Exciter as Signal Source
* Audio measurements made as rms unweighted for singal tone tests
* Two tone tests (adjacent channel) made according to NAB Technical Report of 8/30/83

FM TESTS (TEST FQ. 94.1MHZ)

S/N RATIO - 1KHZ, 30% MOD

20dB S/N	dBm
30dB S/N	dBm
50dB S/N	dBm

S/N RATIO - 1KHZ, 100% MOD

USABLE	50dB S/N	-97dBm
MAX	66dB	-62dBm

THD - 1KHZ, 100% MOD (-50dBm)

MONO	0.90 %
STEREO	0.90 %

LIMITING THRESHOLD (Audio - 1dB)

-97dBm

HIGH CUT THRESHOLD

Audio: 10KHZ, L+R, 100% Mod, Pilot off
-3dB = -85dBm
Note: Same result with Pilot On

SEPARATION @ -62dBm

Freq.	L->R	R->L	
1KHZ			(W/O Pre-Emph)
10KHZ			(W/O Pre-Emph)

SIGNAL, NOISE & SEPARATION VS RF LEVEL

* Left channel used as the measurement channel for Signal and Noise data
* Left channel driven (L only) for separation data

* Audio test frequency = 1KHZ
* RF levels represent power into the dummy antenna

SIGNAL, NOISE & SEPARATION VS RF LEVEL

	mono (L)		Stereo (L)				Separation L->R	
RF Level	Signal	Noise	Signal	Filt. Noise	Noise	RF Level	Left	Right
dBm	dB	dB	dB	dB	dB	dBm	dB	dB
-130	-33	-33	-33	-33	-33	-130	-32	-32
-125	-33	-33	-33	-33	-33	-125	-32	-32
-120	-32.6	-33	-33	-33	-33	-120	-32	-32
-115	-31	-33.5	-31	-33.5	-33	-115	-32	-32
-110	-26	-34.5	-24.5	-34.5	-35	-110	-28	-28
-105	-18	-38	-16.3	-38	-38	-105	-22	-22
-100	-8.3	-44	-5.8	-43	-42.5	-100	-10.7	-10
-95	-2	-54	-0.51	-53.5	-50.3	-95	-7.27	-7.4
-90	-1.34	-58	-0.24	-57	-53.8	-90	-6.73	-6.8
-85	-0.94	-61	-0.52	-61.1	-56.5	-85	-6.3	-6.6
-80	-0.62	-64	0	-63.5	-58.2	-80	-6	-6.4
-75	-0.36	-65.5	0	-64.3	-58.7	-75	-5.5	-6.5
-70	-0.17	-66.5	0	-64.6	-58.8	-70	-4.9	-6.8
-62	0	-67	0	-64.2	-56	-62	-3.28	-8
-55						-55	-1.35	-10
-50						-50	-0.44	-14
-45						-45	0	-25

EIA DAR LAB

SIGNAL & FILTERED NOISE VS RF LEVEL

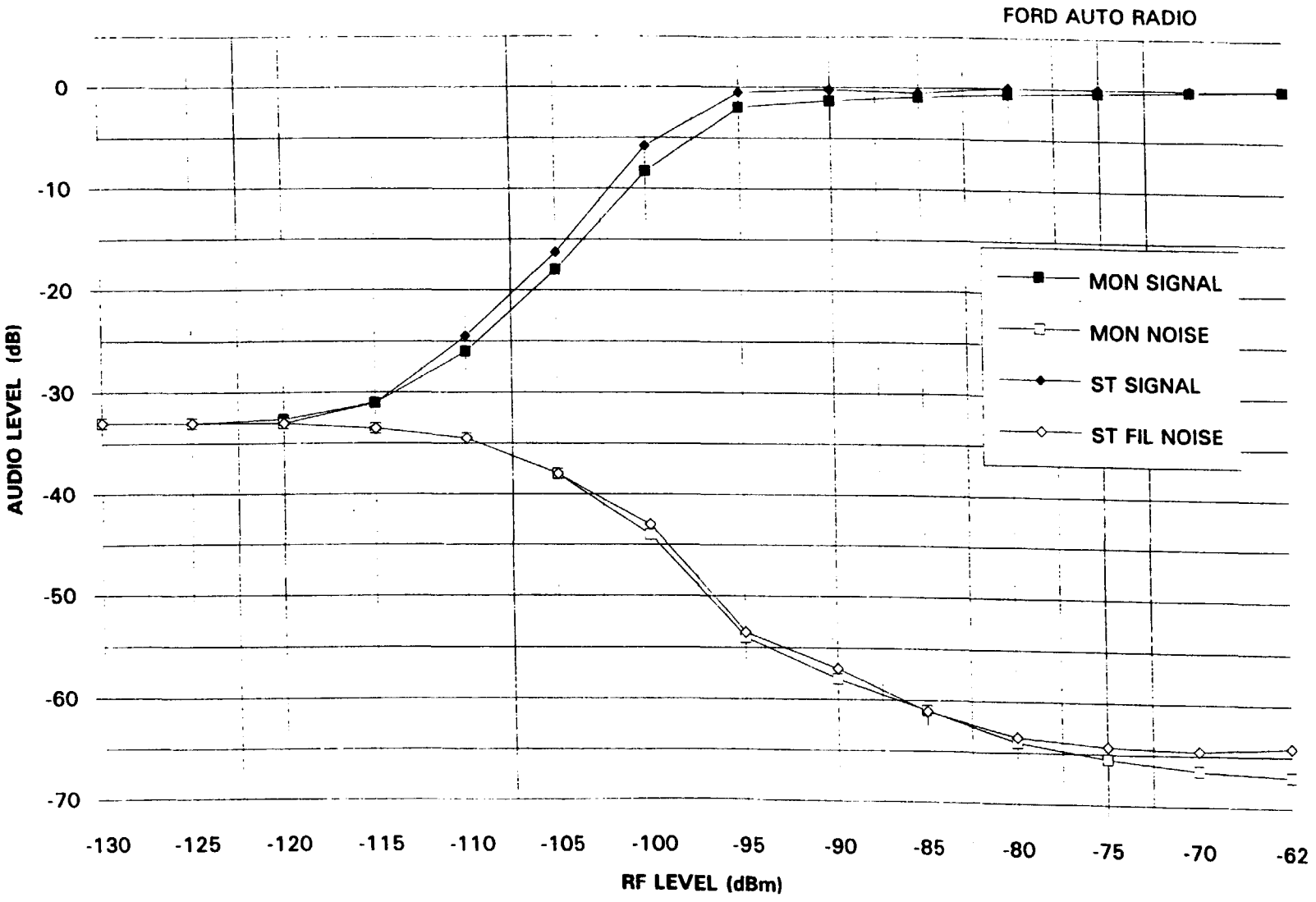


Chart 1 of 3

EIA DAR LAB

SEPARATION VS RF LEVEL

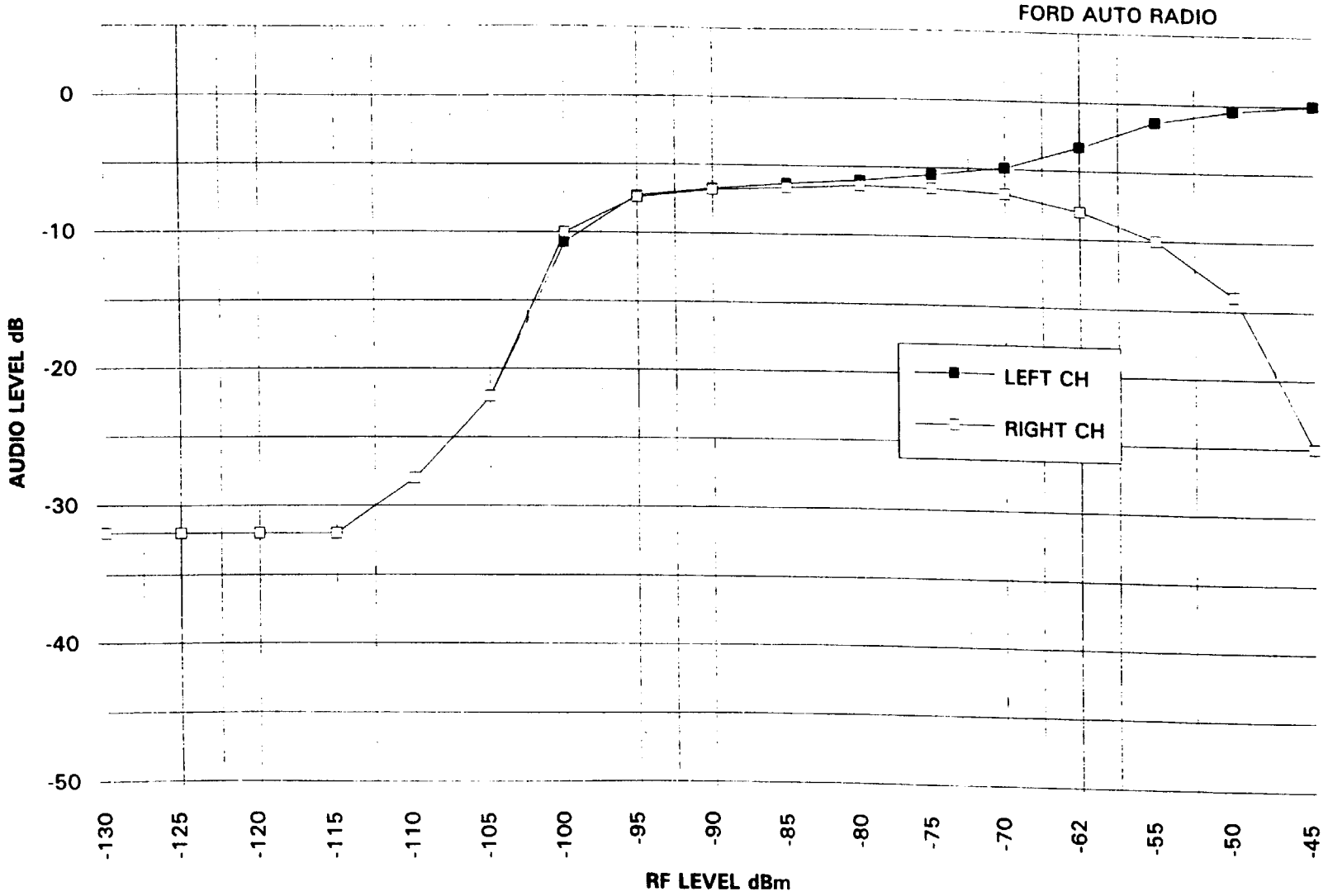


Chart 2 of 3

EIA DAR LAB

SIG., NOISE, FILT. NOISE & SEPARATION VS RF LEVEL

FORD AUTO RADIO

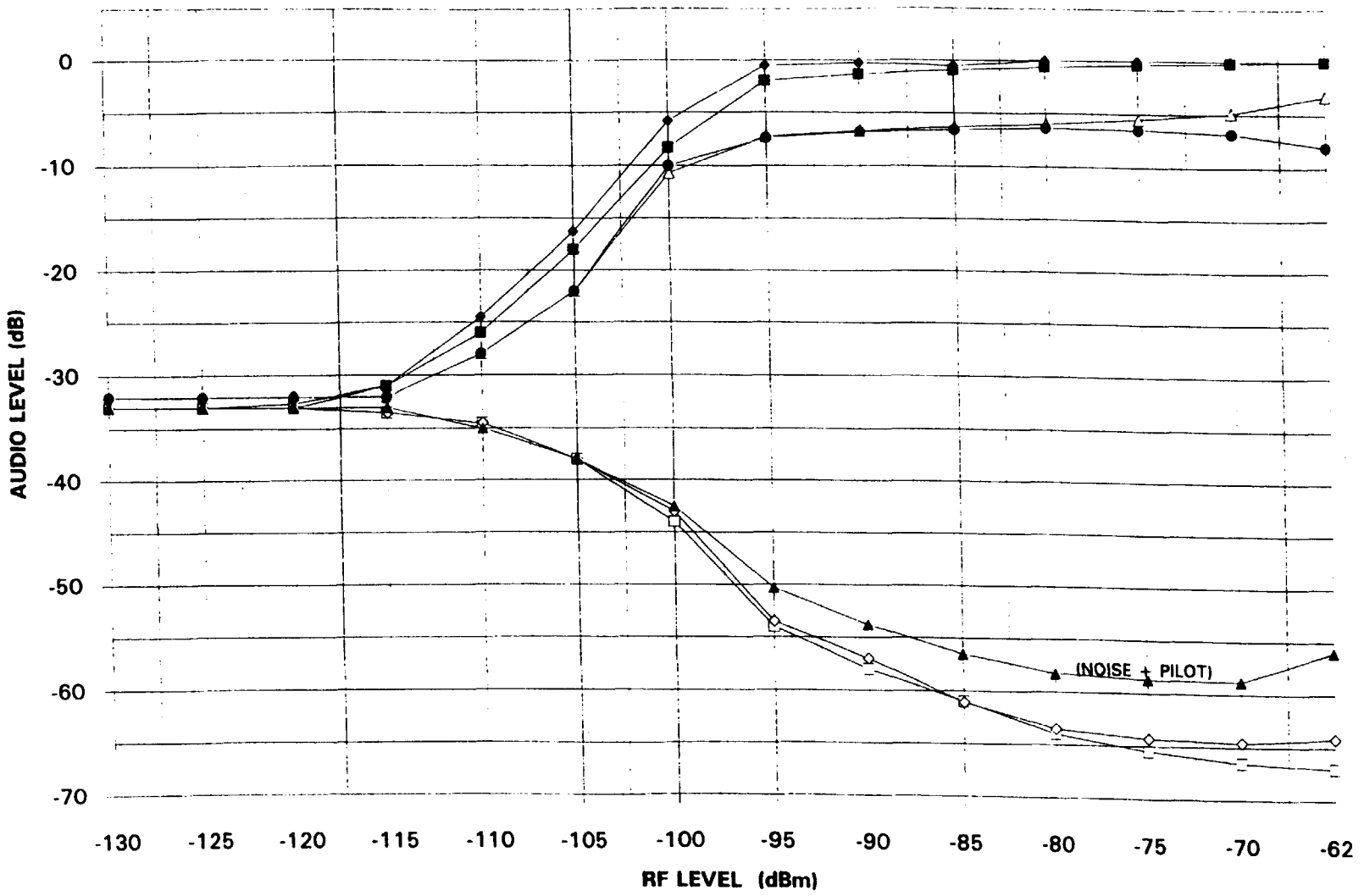


Chart 3 of 3

	GEN	RCVR		RCVR
FM TUNER TEST DATA				
Manufacturer:	Ford			
Model Number:	F4XF-19B132-CB			
Serial Number:	9411			
Type:	Car Radio			
	Using IEEE/EIA 10Ω,10Ω,45Ω resistive pad			
FM 30% modulation(98.1MHz)				
20 dB S/N	1.5	0.75 μV	8.7 dBf	-109.5 dBm
30 dB S/N	2.2	1.1 μV	12.1 dBf	-106.2 dBm
50 dB S/N	13	6.5 μV	27.5 dBf	-90.7 dBm
Interstation Noise	-23	dB		
Mute start Level	2.2	1.1 μV	12.1 dBf	-106.2 dBm
High cut at 10KHz	3	dB at	6.3 μV receiver input	
Fo+½IF rejection	56.2	28.1 mV	91.5 dB	-18.0
Image rejection	447	223.5 μV	49.5 dB	-60.0
FM 100% MODULATION MONO				
Usable Sensitivity	3.98	1.99 μV	17.2 dBf	-101.0 dBm
50dB S/N	2.8	1.4 μV	14.2 dBf	-104.1 dBm
Maximum S/N	68	dB		
THD %	0.7			
AM Rejection at 1mV	57	dB		
FM 100% MODULATION STEREO				
Usable Sensitivity	BLEND	μV		
50dB S/N	BLEND	μV		
Maximum S/N	61	dB		
THD %	0.6			
1KHz separation	35.5	dB		
10KHz separation	30	dB		
Stero Blend action: Blend starts at 1mV receiver input level				
Separation at 50μVrec	2.5	dB	45.2 dBf	-73.0 dBm
67KHz SCA Rejection δF=5KHz	61	dB		
19 and 38KHzproducts	-54	dB		
FM TWO SIGNAL TESTS(98.1 MHz)				
708μV (-50dBm)				
Capture Ratio	2.5	dB		
Selectivity@ 200KHz				
for 30dB S/N	20.9	dB		
for 50dB S/N	18.8	dB		
Selectivity@ 400KHz				
for 30dB S/N	70	dB		
for 50dB S/N	37.2	dB		
IM Rejection (98.9 and 99.7)	10	5 mV	85.2 dBf	-33.0 dBm
2MHz IM rejection (99.1 and 100.1)	12	6 mV	86.8 dBf	-31.4 dBm
IF mix rejection (96.4 and 107.2)	12	6 mV	86.8 dBf	-31.4 dBm
AM 30% MODULATION MONO				
DUMMY ANTENNA:	15/60pF			
20dB S/N	20	20 μV	-81.0 dBm	
Max S/N	50	dB		
THD at max S/N	0.4	%		
THD at 80% mod	0.5	%		
-3dB Audio Response				
600KHz	2333			
1400KHz	2333	Hz		
±10KHz Selectivity	64	dB		
±20KHz Selectivity	NM	local AGC prevents measurement		
Local AGC action:				
level for -3dB 600KHz signal S/N reduction				
1400KHz	20	14.14 mV	-21.0 dBm	
10MHz	20	14.14 mV	-21.0 dBm	
27MHz	20	14.14 mV	-21.0 dBm	
IF mix rejection (1400 & 945 or 950)	NM	local AGC prevents measurement		

DAR Lab
Mar ~~8/95~~ 15/95 FRDAVRF.XLS

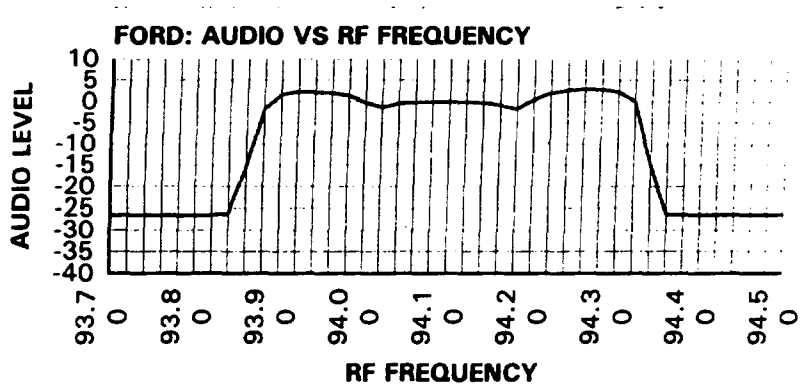
Ford Channel Characteristics **94.1MHZ**

Audio VS RF Frequency

Note:

- The results here represent a chacteristic receiver input signature based on sweeping the RF signal through the desired channel·
- The test signal is modulated with 1khz @ 100%
- The measurements are made using 15khz low pass and CCIR filters with quasi-peak detection
- RF level is -62dBm

RF FREQ.	AUDIO LEVEL	
93.70	-26.5	
93.72	-26.5	
93.74	-26.5	
93.76	-26.5	
93.78	-26.5	
93.80	-26.5	
93.82	-26.5	
93.84	-26.2	
93.86	-15.4	
93.88	-1.75	
93.90	1.7	
93.92	2.31	
93.94	2.26	
93.96	2.07	
93.98	1.42	
94.00	-0.15	
94.02	-1.31	
94.04	-0.44	
94.06	-0.12	
94.08	0	
94.10	0	Tuning Frequency
94.12	0	
94.14	-0.33	
94.16	-0.8	
94.18	-1.64	
94.20	0.51	
94.22	2.08	
94.24	2.63	
94.26	2.85	
94.28	2.91	
94.30	2.35	
94.32	0.2	
94.34	-14.84	
94.36	-26.4	
94.38	-26.5	
94.40	-26.5	
94.42	-26.5	
94.44	-26.5	
94.46	-26.5	
94.48	-26.5	
94.50	-26.5	



Additional Compatibility Receiver Data

DAR Lab
17-May-95 ANTDUM1.XLS
RMc

Antenna Dummy Characteristics

Delco/JFW Antenna Dummy Network

FM

Input impedance:	50 ohms
Ouptut Impedance:	50 ohms
Insersion loss:	6dB

Delco Radio

FM

Input Impedance:	50 ohms nominal

AM

Input Impedance:	Capacitive - impedance varies with frequency

Ford Antenna Dummy Network

FM

Input impedance:	50 ohms
Output Impedance:	75 ohms
Insersion loss:	4.88dB

Ford Radio

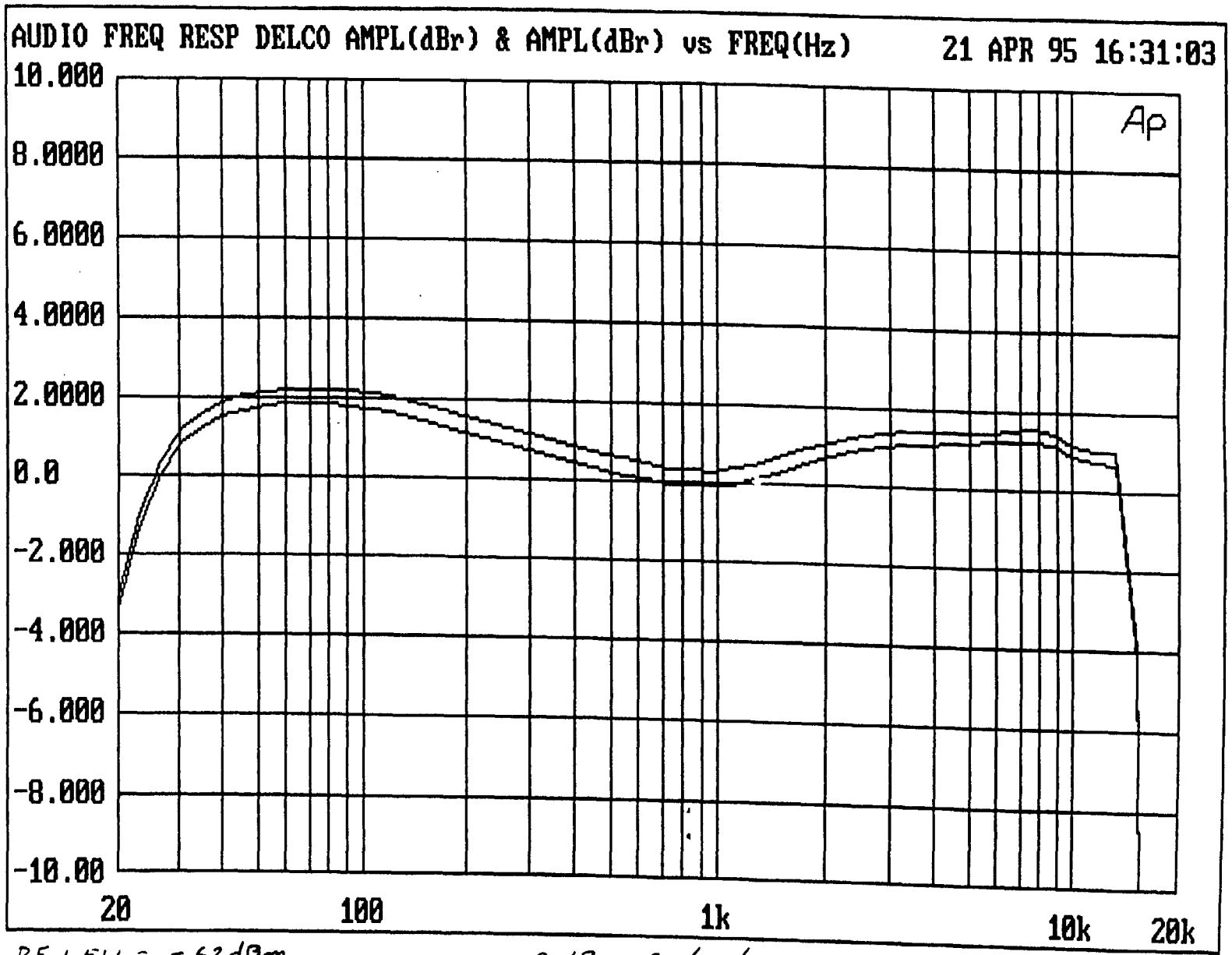
FM

Input Impedance:	100 ohms nominal

AM

Input Impedance:	Capacitive - impedance varies with frequency

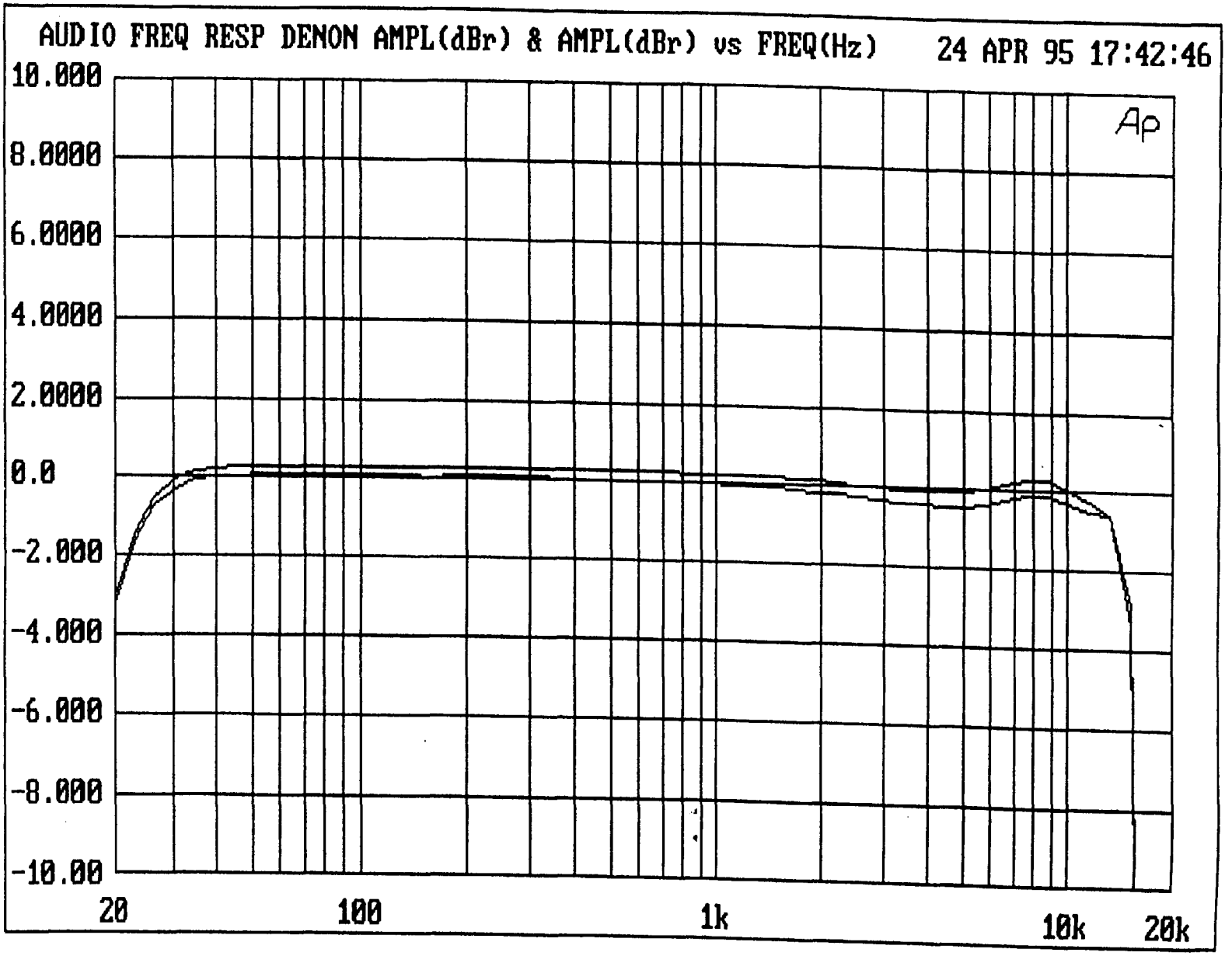
#1



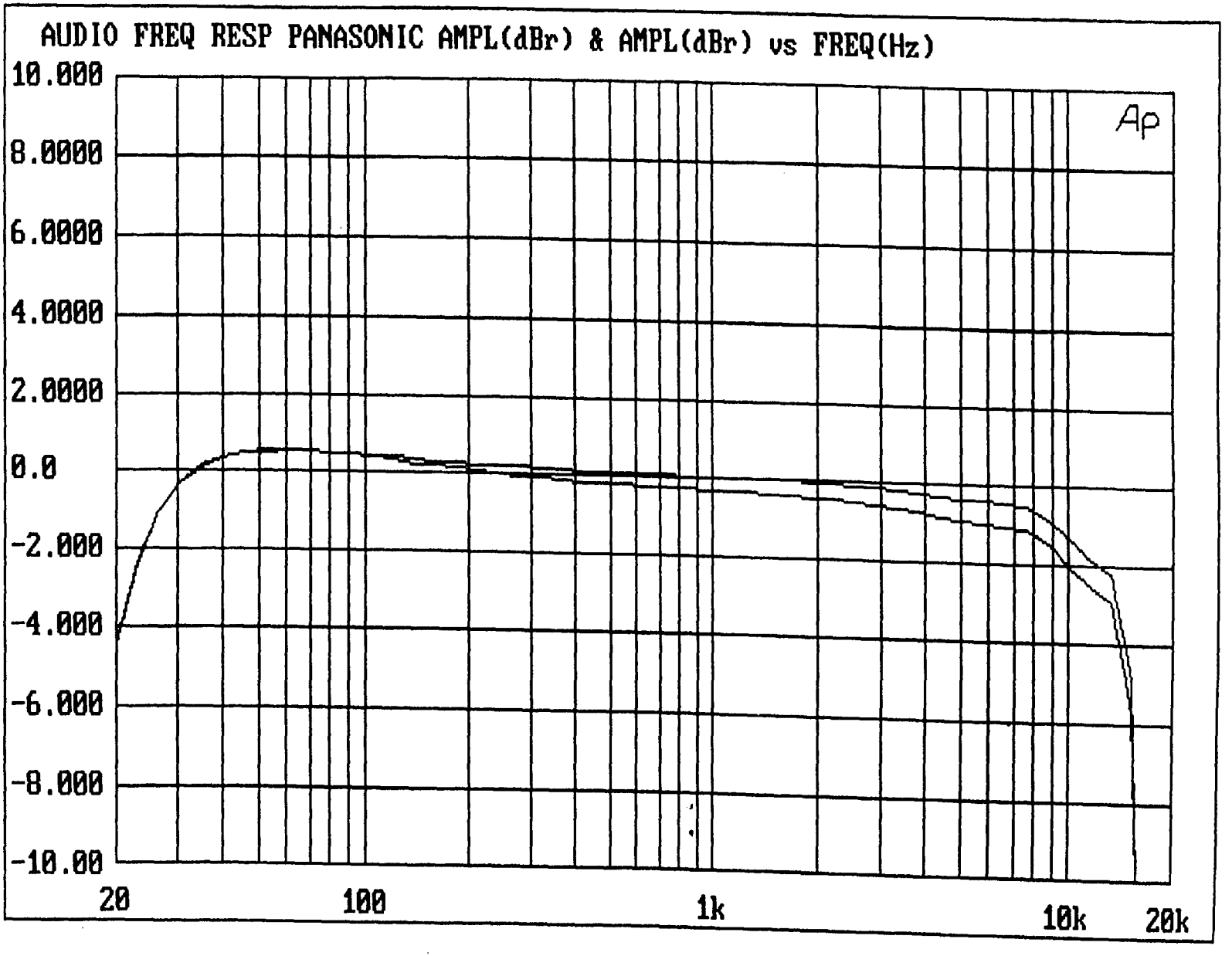
RF LEV = -62dBm
MOD = 100% @ 15kHz

0 dB = 2V/4Ω/1WATT
GRAPHIC EQ = FLAT

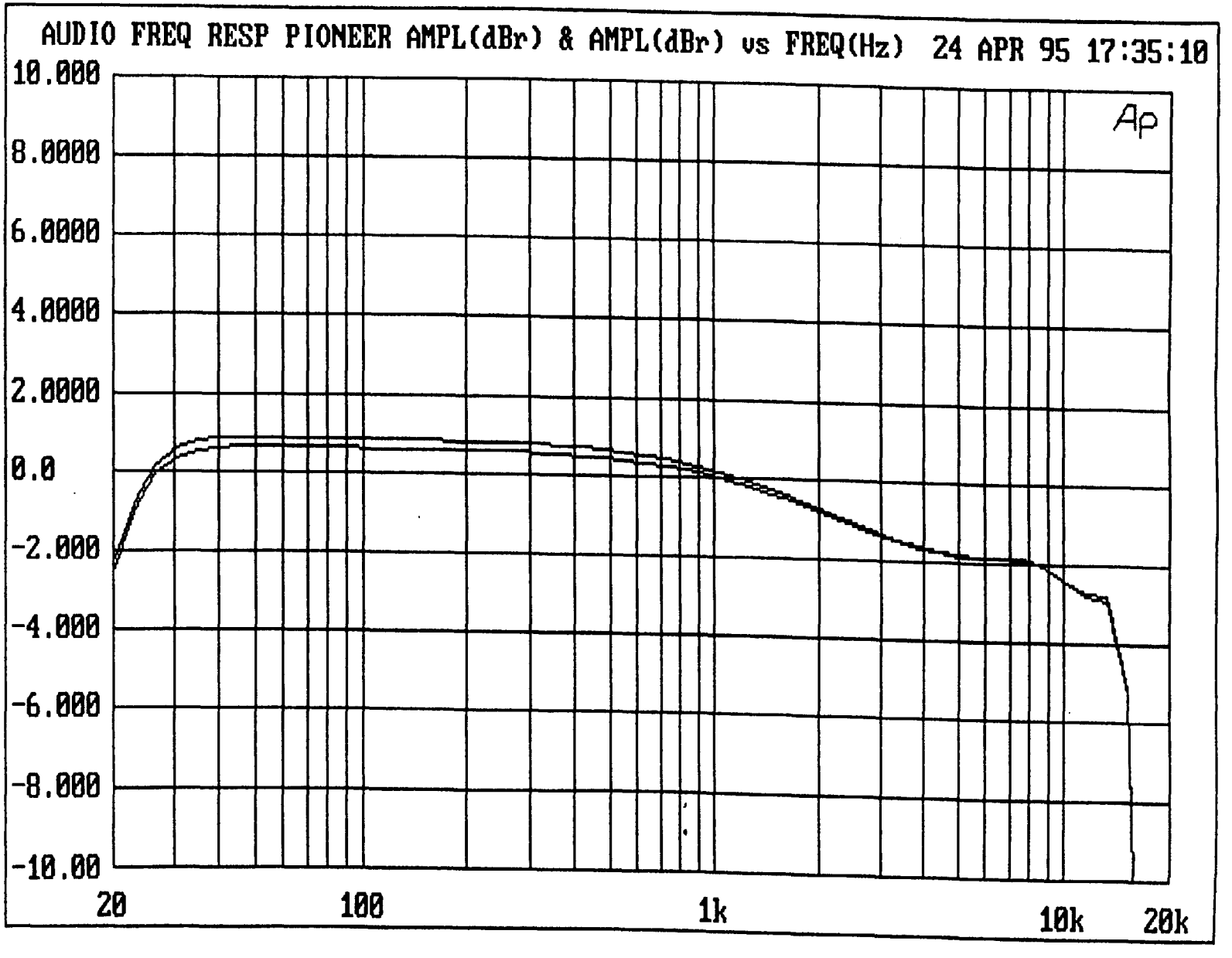
#2

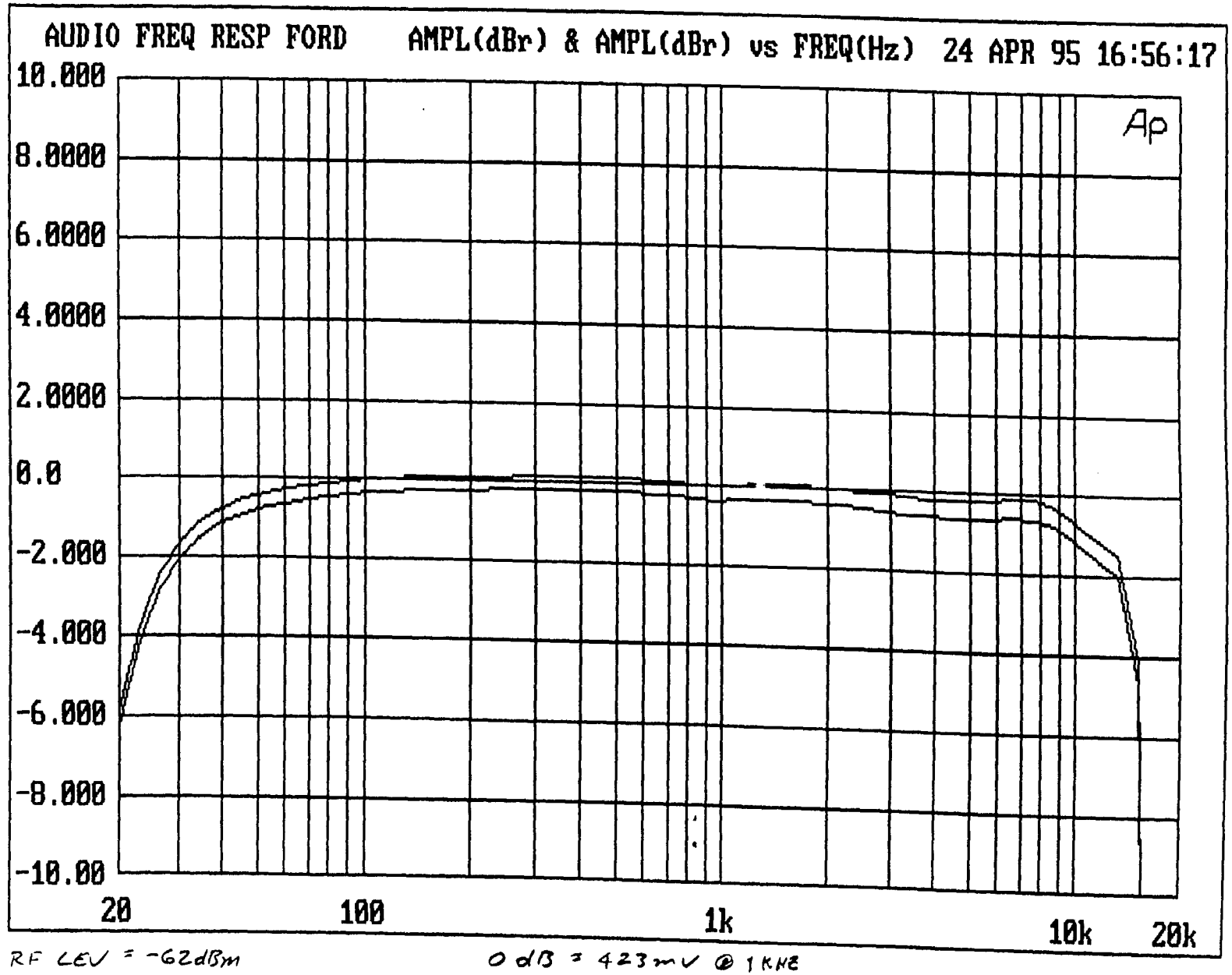

AUDIO FREQ RESP DENON AMPL(dBr) & AMPL(dBr) vs FREQ(Hz)
24 APR 95 17:42:46
Ap
10.000
8.0000
6.0000
4.0000
2.0000
0.0
-2.000
-4.000
-6.000
-8.000
-10.00
20
100
1k
10k
20k

#3


AUDIO FREQ RESP PANASONIC AMPL(dBr) & AMPL(dBr) vs FREQ(Hz)
10.000
8.0000
6.0000
4.0000
2.0000
0.0
-2.000
-4.000
-6.000
-8.000
-10.00
20
100
1k
10k
20k
Ap

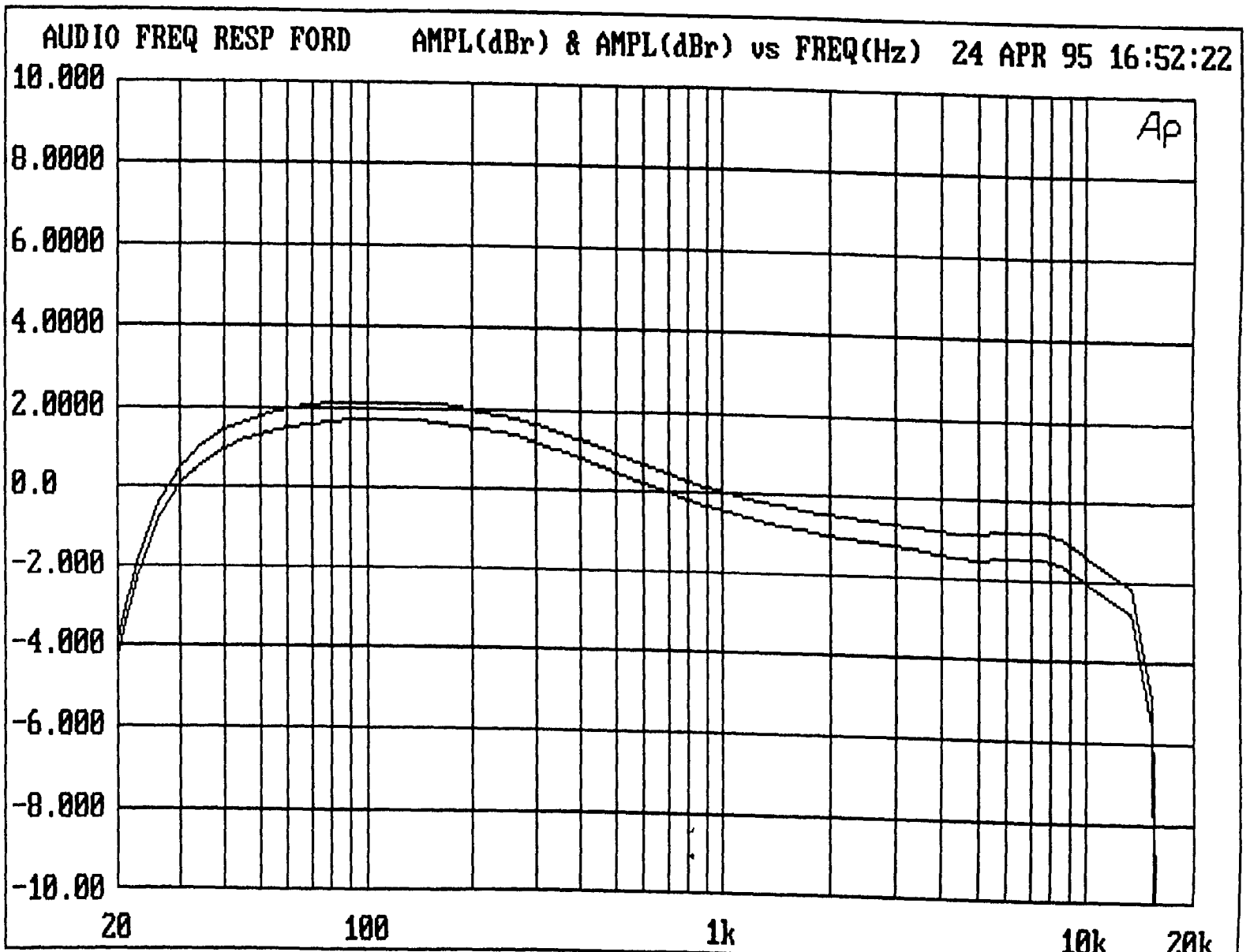
#4


AUDIO FREQ RESP PIONEER AMPL(dBr) & AMPL(dBr) vs FREQ(Hz) 24 APR 95 17:35:10
Ap
10.000
8.0000
6.0000
4.0000
2.0000
0.0
-2.000
-4.000
-6.000
-8.000
-10.00
20
100
1k
10k
20k



RF LEV = -62dBm
MOD = 100% @ 15KHZ
0 dB = 423mV @ 1KHZ
BASS = DETENT
TREB = DETENT

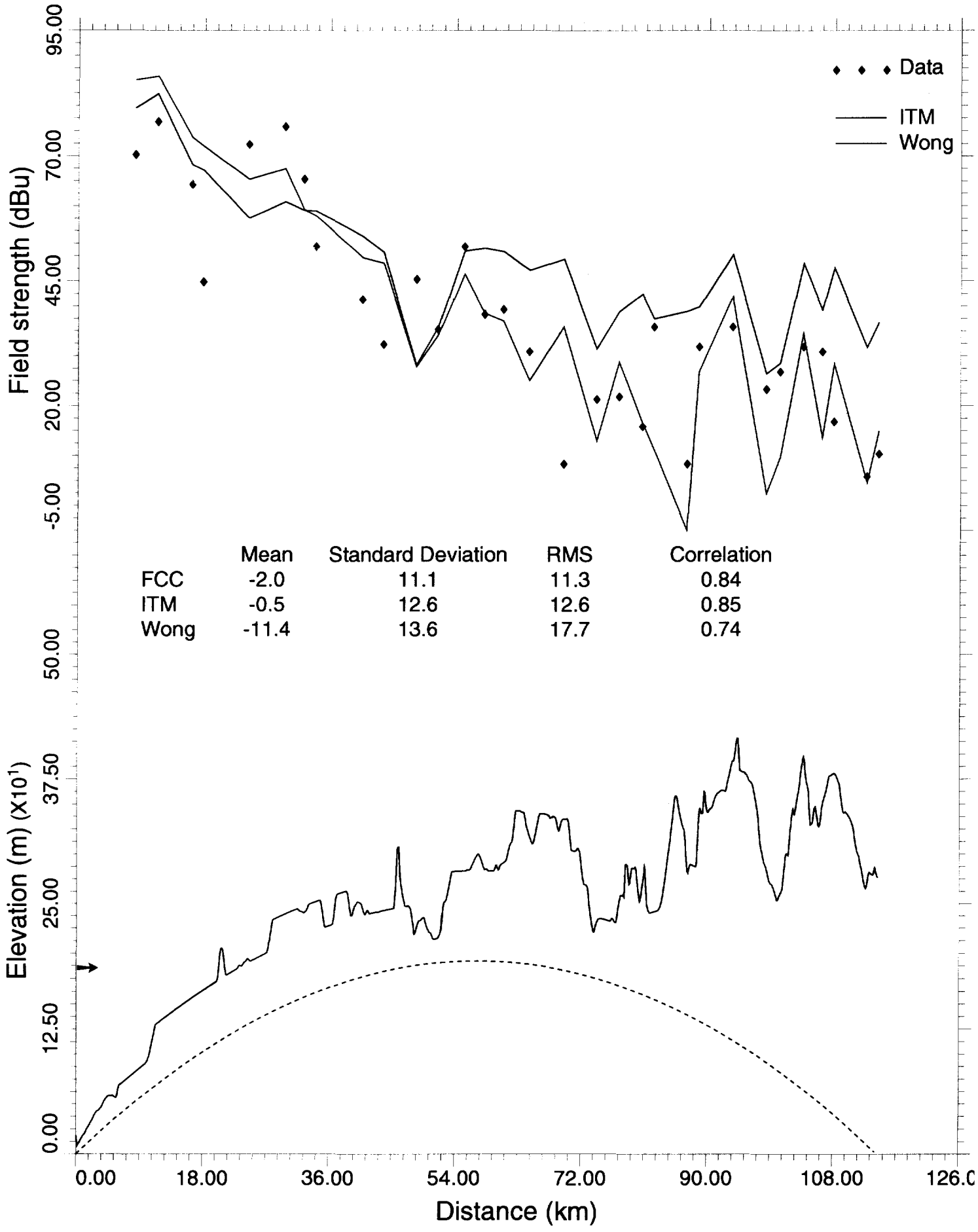
#5 B



RF LEV = -62dBm
MOD = 100% @ 15KHZ
0dB = 111mV
BASS = DETENT
TREB = DETENT

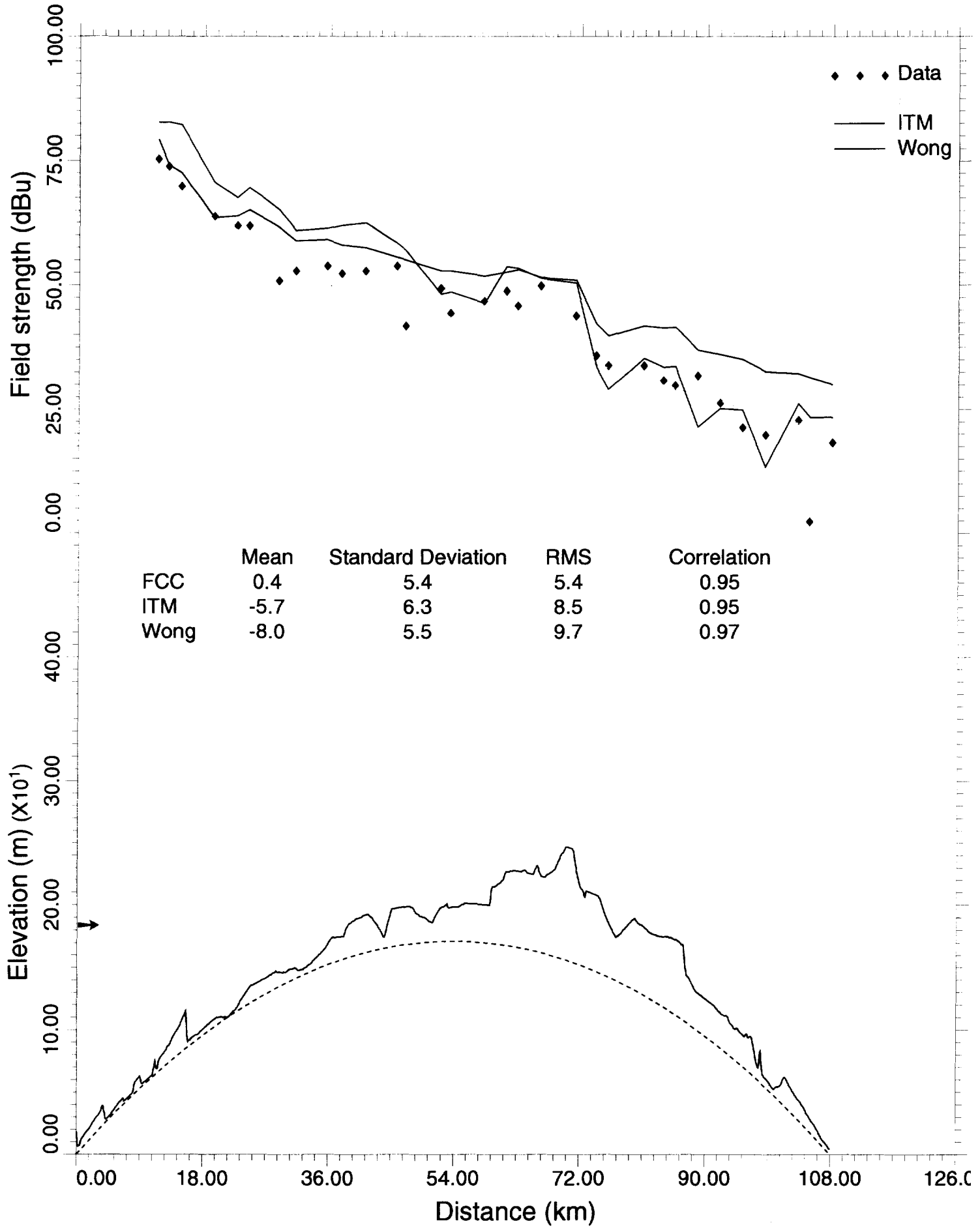
APPENDIX E

PHILADELPHIA_90.9_MHz_20.0_Deg



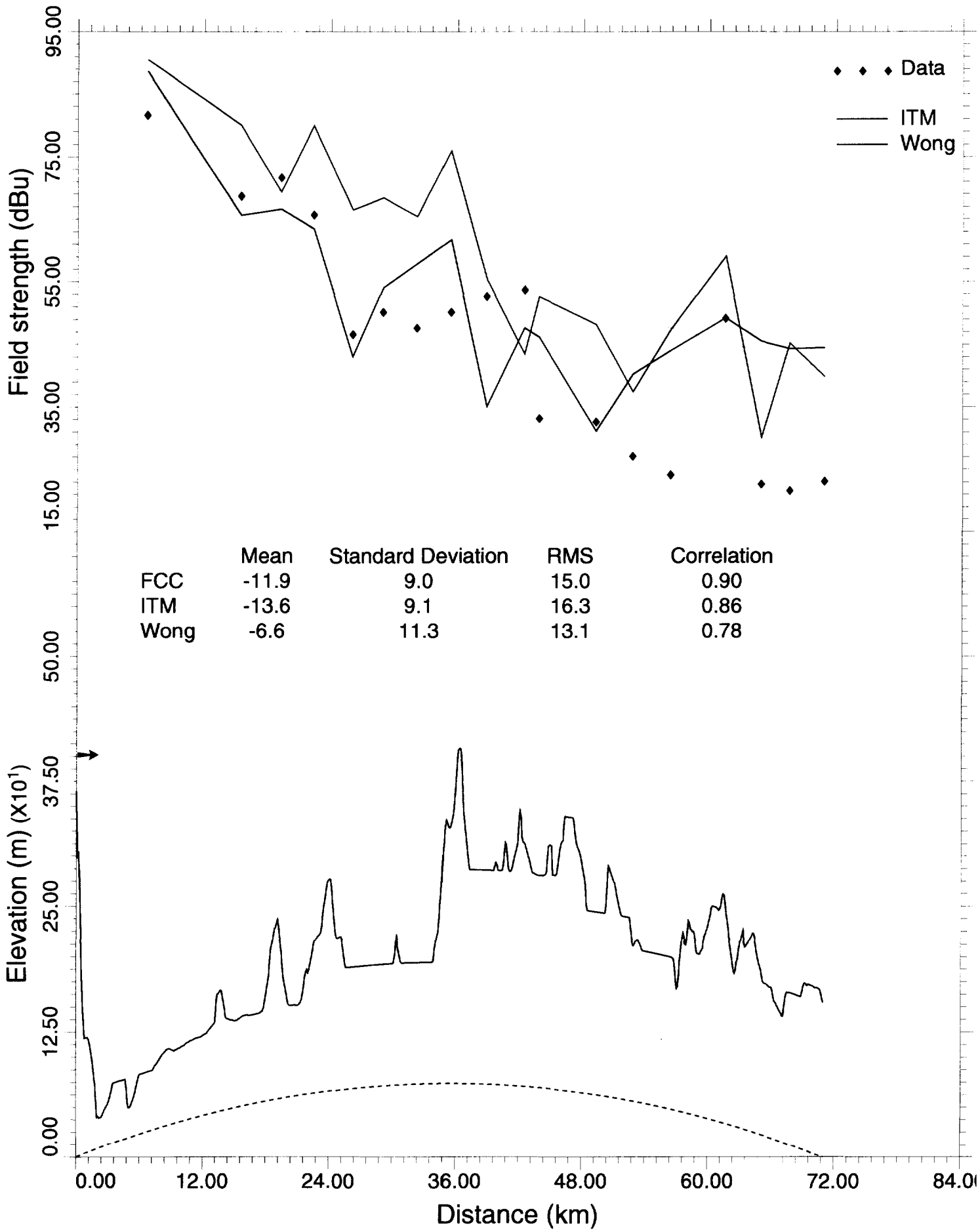
	Mean	Standard Deviation	RMS	Correlation
FCC	-2.0	11.1	11.3	0.84
ITM	-0.5	12.6	12.6	0.85
Wong	-11.4	13.6	17.7	0.74

PHILADELPHIA_90.9_MHz_65.0_Deg



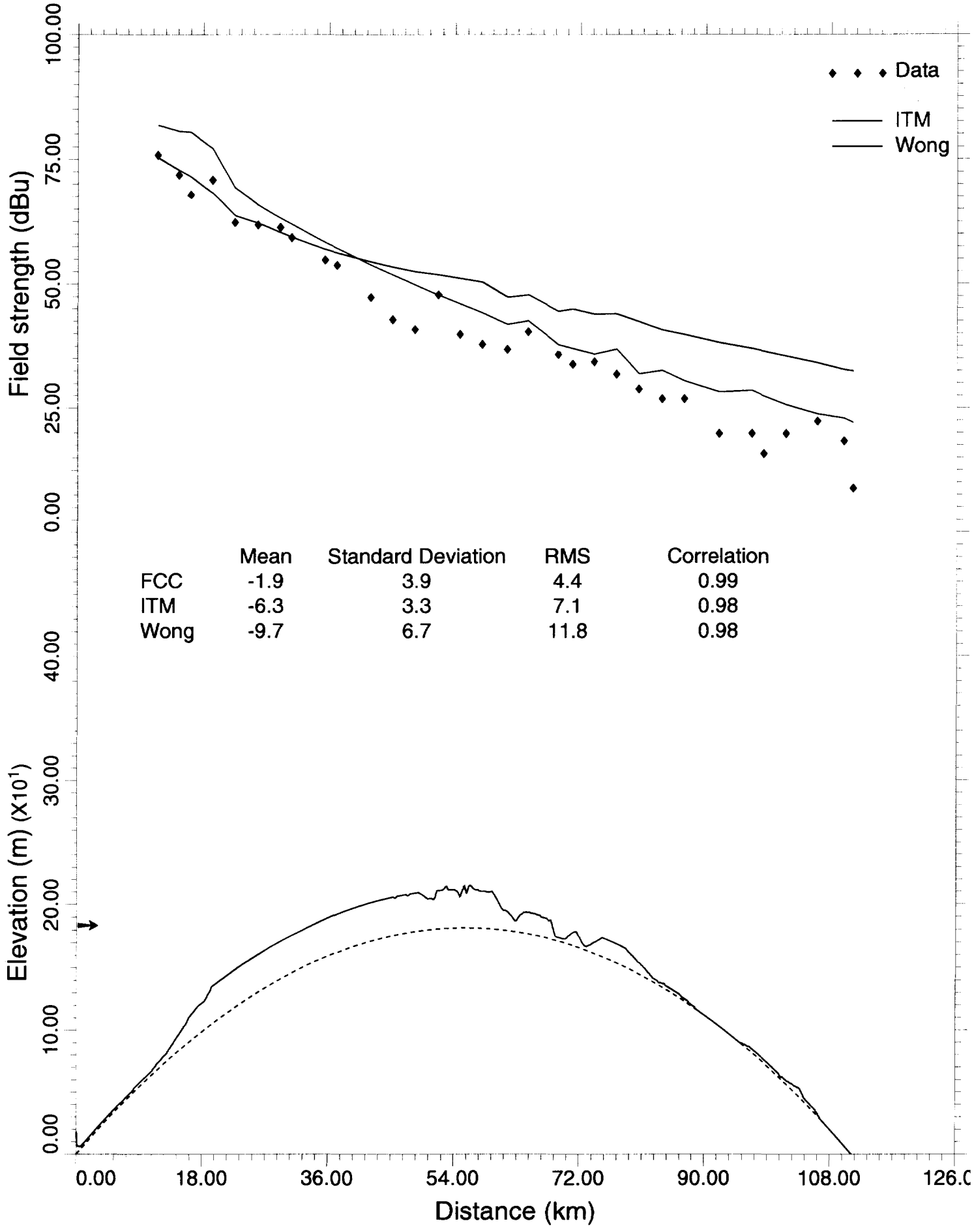
	Mean	Standard Deviation	RMS	Correlation
FCC	0.4	5.4	5.4	0.95
ITM	-5.7	6.3	8.5	0.95
Wong	-8.0	5.5	9.7	0.97

SPRINGFIELD_93.1_MHz_110.0_Deg



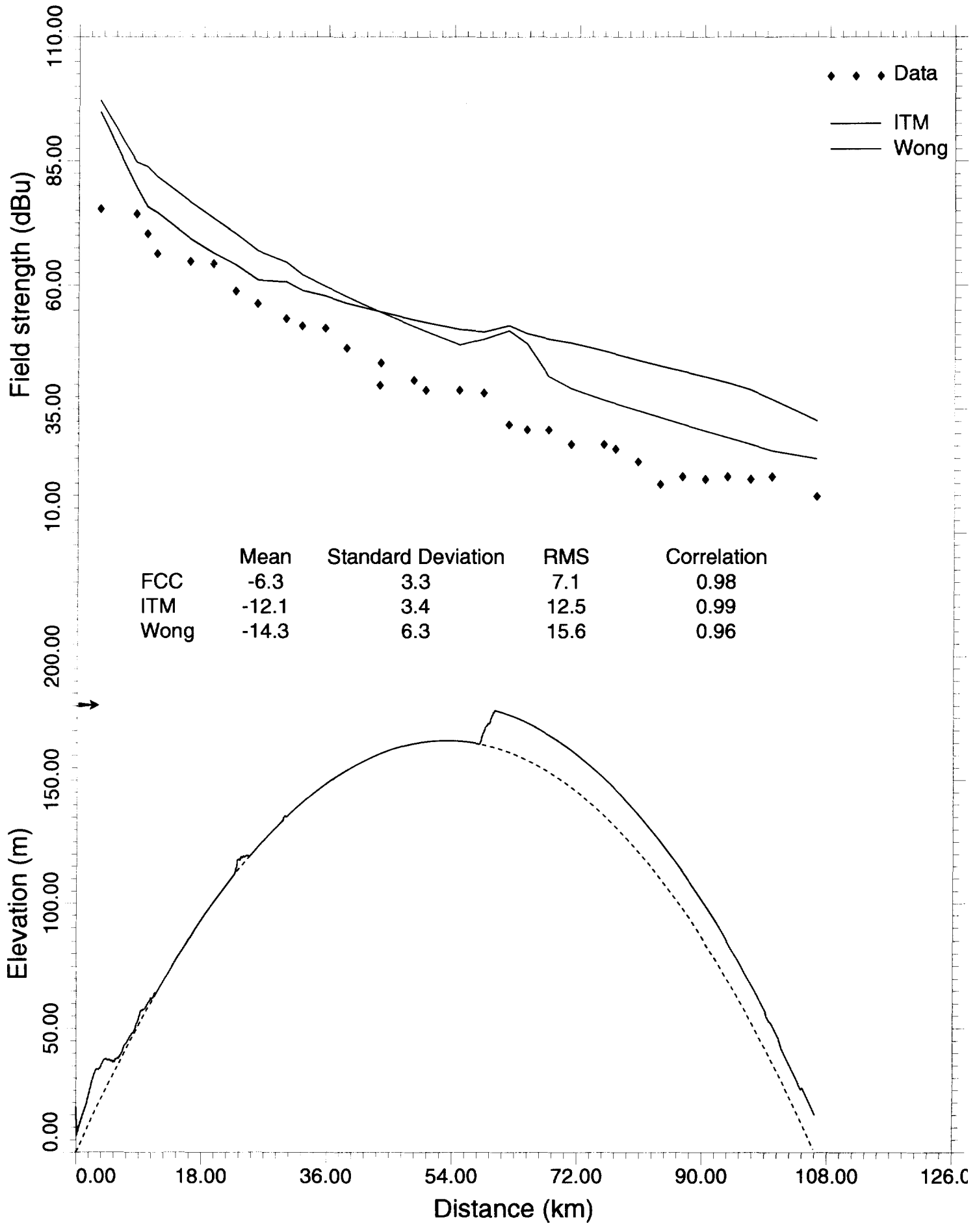
	Mean	Standard Deviation	RMS	Correlation
FCC	-11.9	9.0	15.0	0.90
ITM	-13.6	9.1	16.3	0.86
Wong	-6.6	11.3	13.1	0.78

PHILADELPHIA_90.9_MHz_165.0_Deg



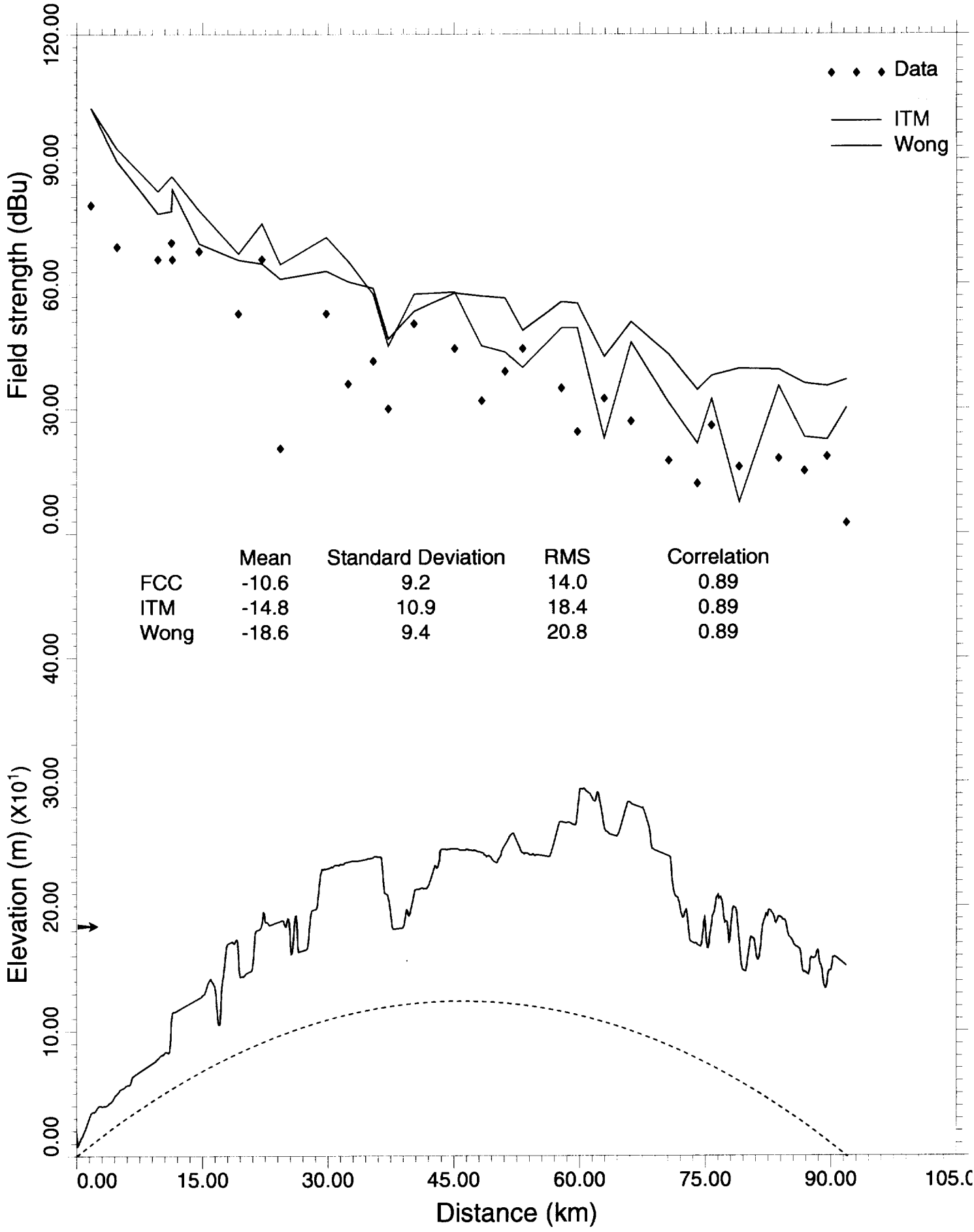
	Mean	Standard Deviation	RMS	Correlation
FCC	-1.9	3.9	4.4	0.99
ITM	-6.3	3.3	7.1	0.98
Wong	-9.7	6.7	11.8	0.98

PHILADELPHIA_90.9_MHz_220.0_Deg



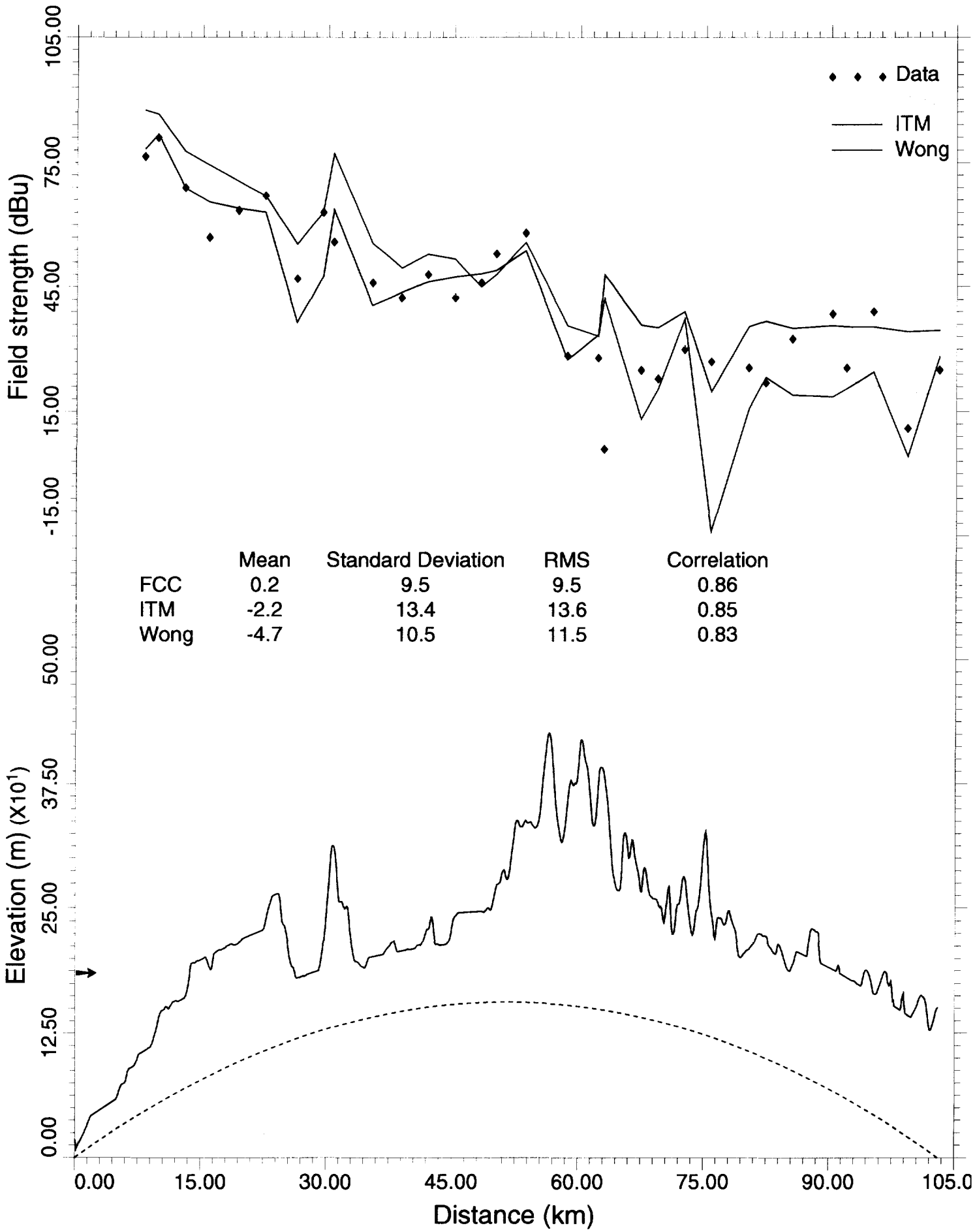
	Mean	Standard Deviation	RMS	Correlation
FCC	-6.3	3.3	7.1	0.98
ITM	-12.1	3.4	12.5	0.99
Wong	-14.3	6.3	15.6	0.96

PHILADELPHIA_90.9_MHz_260.0_Deg



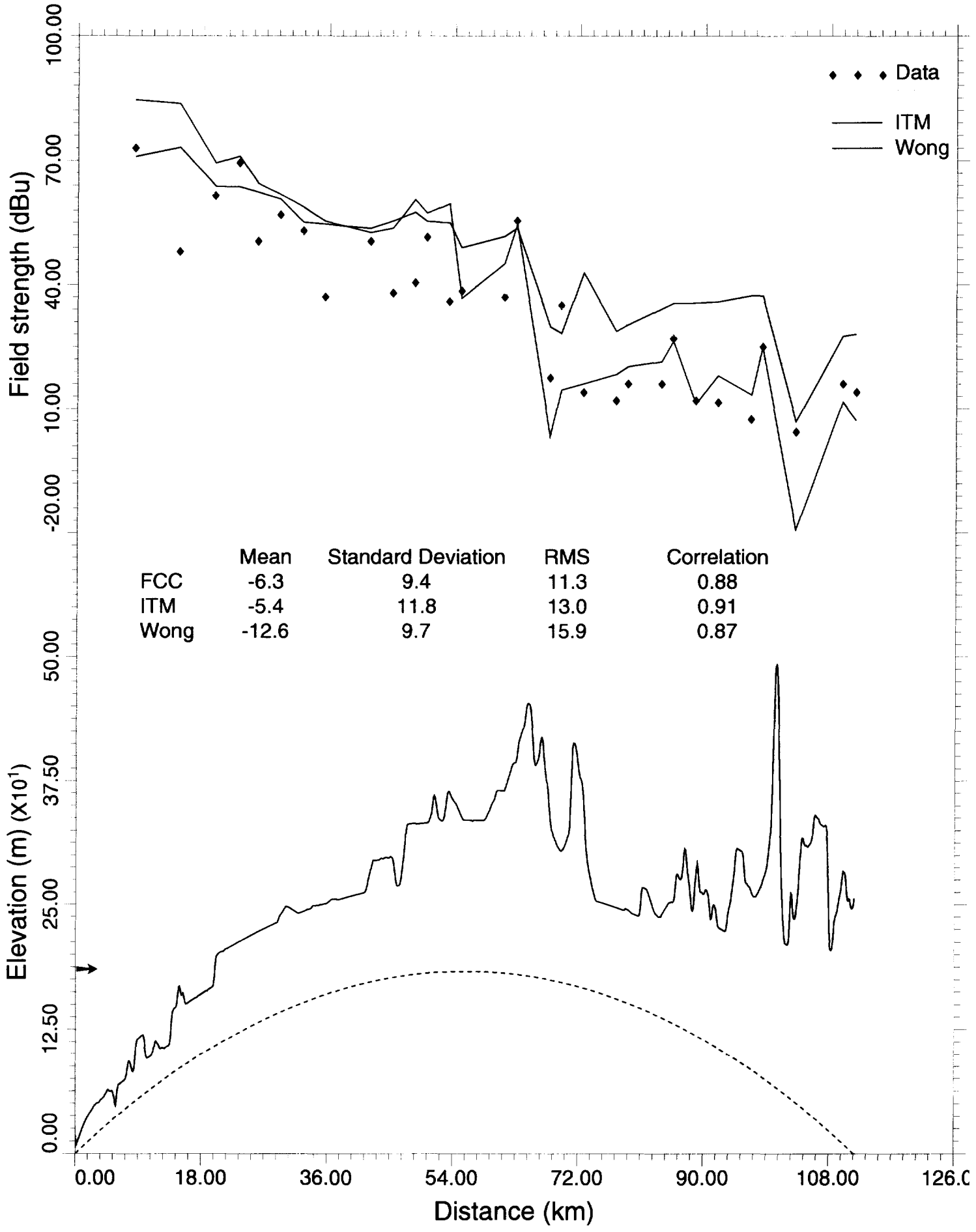
	Mean	Standard Deviation	RMS	Correlation
FCC	-10.6	9.2	14.0	0.89
ITM	-14.8	10.9	18.4	0.89
Wong	-18.6	9.4	20.8	0.89

PHILADELPHIA_90.9_MHz_300.0_Deg



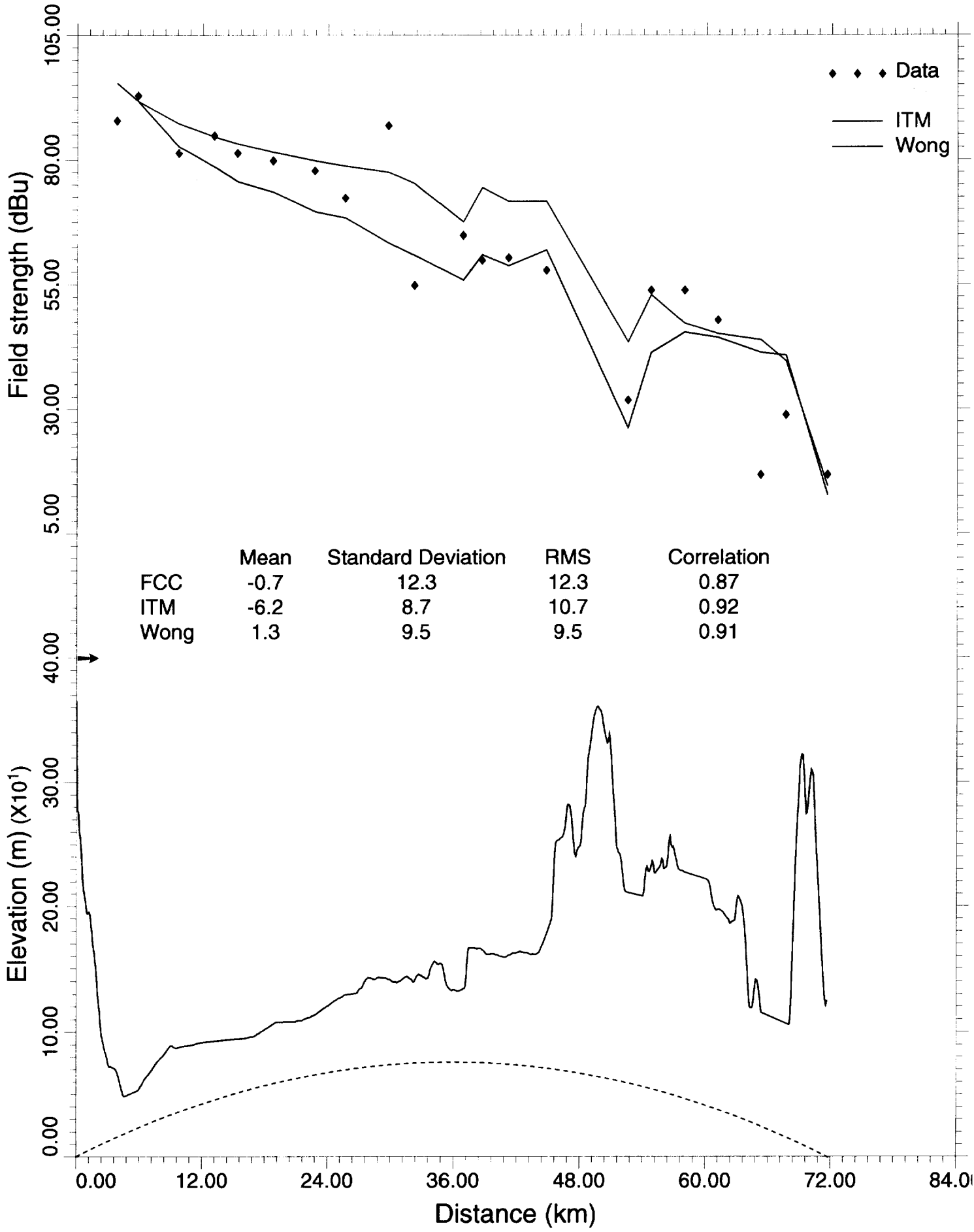
	Mean	Standard Deviation	RMS	Correlation
FCC	0.2	9.5	9.5	0.86
ITM	-2.2	13.4	13.6	0.85
Wong	-4.7	10.5	11.5	0.83

PHILADELPHIA_90.9_MHz_340.0_Deg



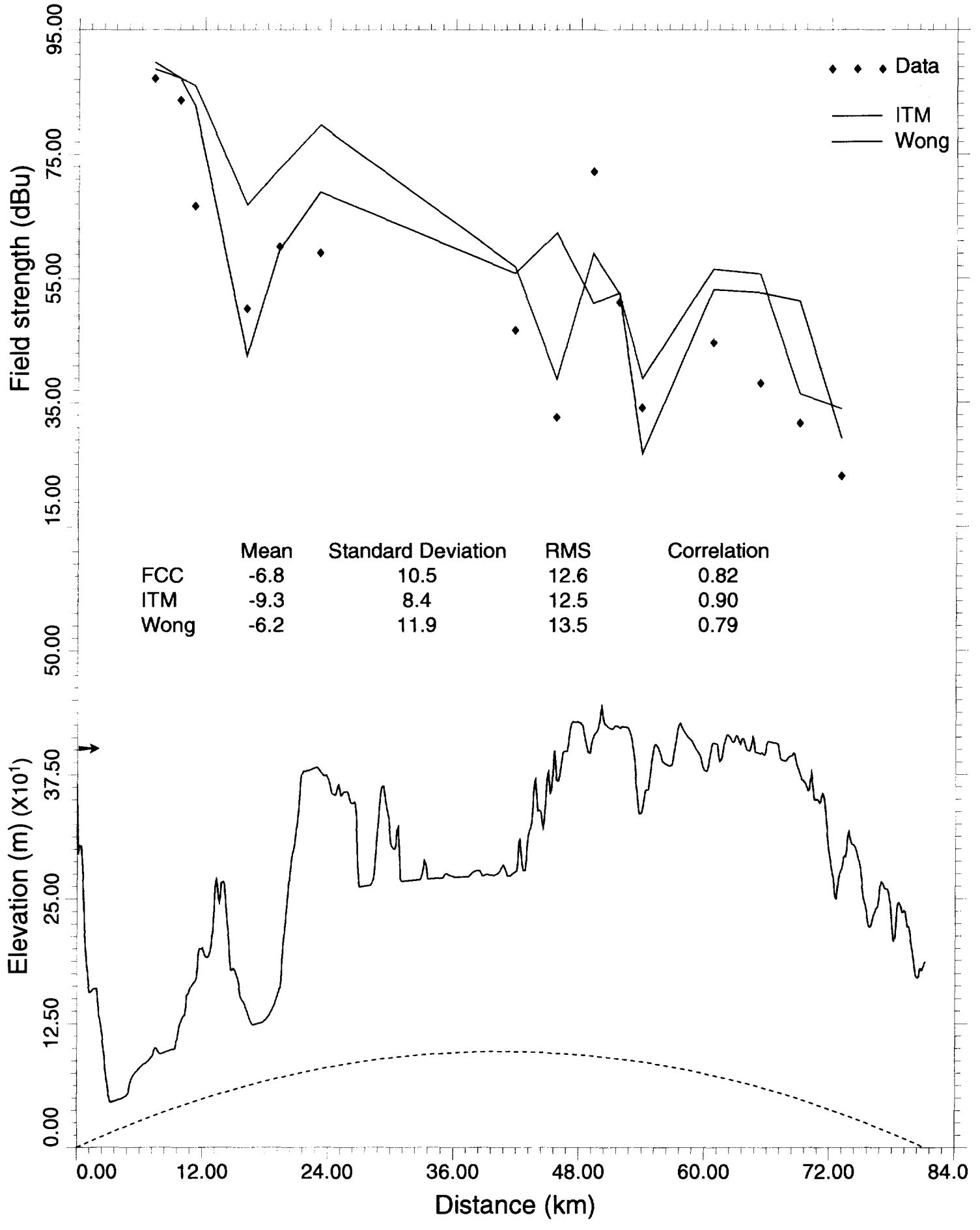
	Mean	Standard Deviation	RMS	Correlation
FCC	-6.3	9.4	11.3	0.88
ITM	-5.4	11.8	13.0	0.91
Wong	-12.6	9.7	15.9	0.87

SPRINGFIELD_93.1_MHz_7.0_Deg



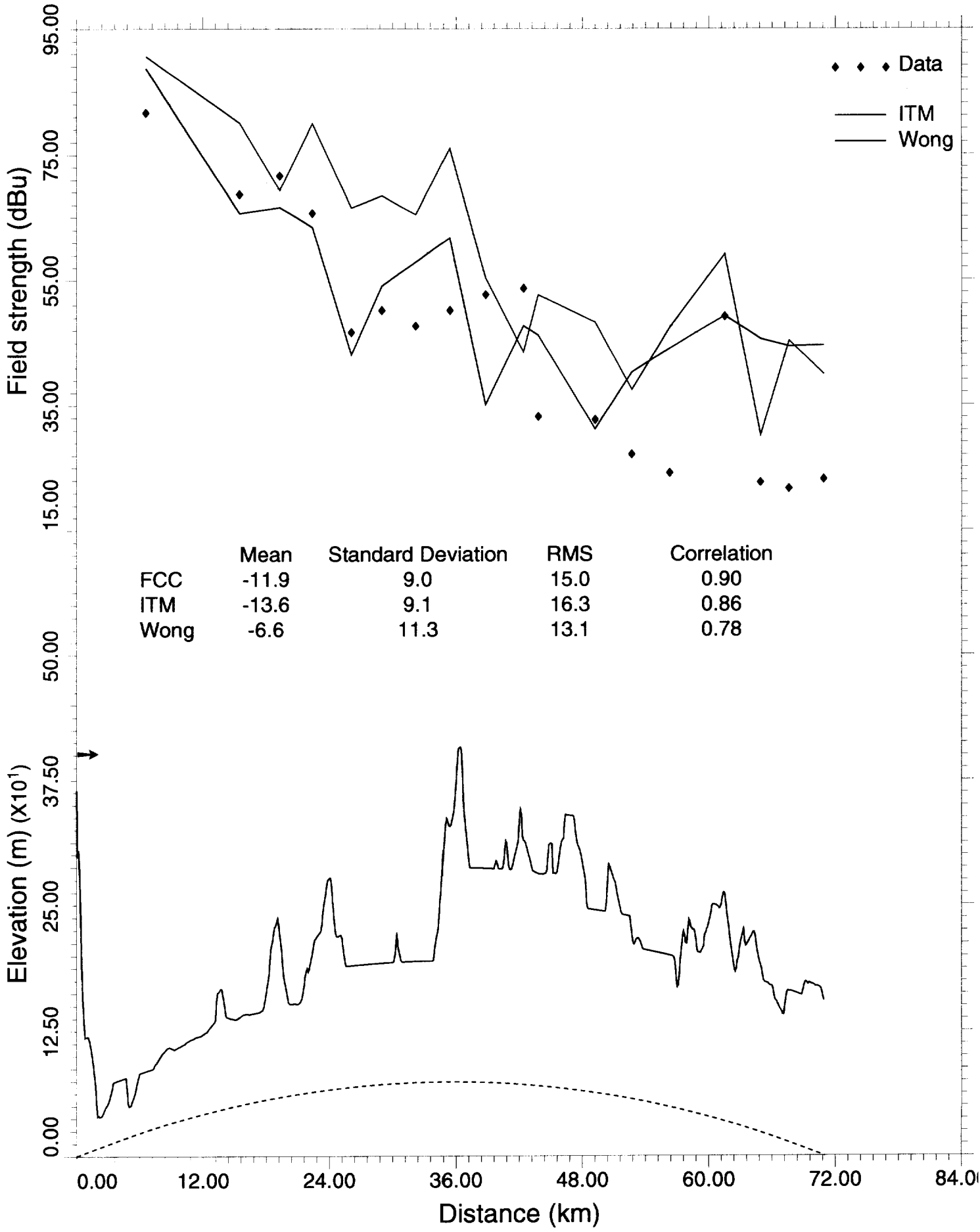
	Mean	Standard Deviation	RMS	Correlation
FCC	-0.7	12.3	12.3	0.87
ITM	-6.2	8.7	10.7	0.92
Wong	1.3	9.5	9.5	0.91

SPRINGFIELD_93.1_MHz_60.0_Deg



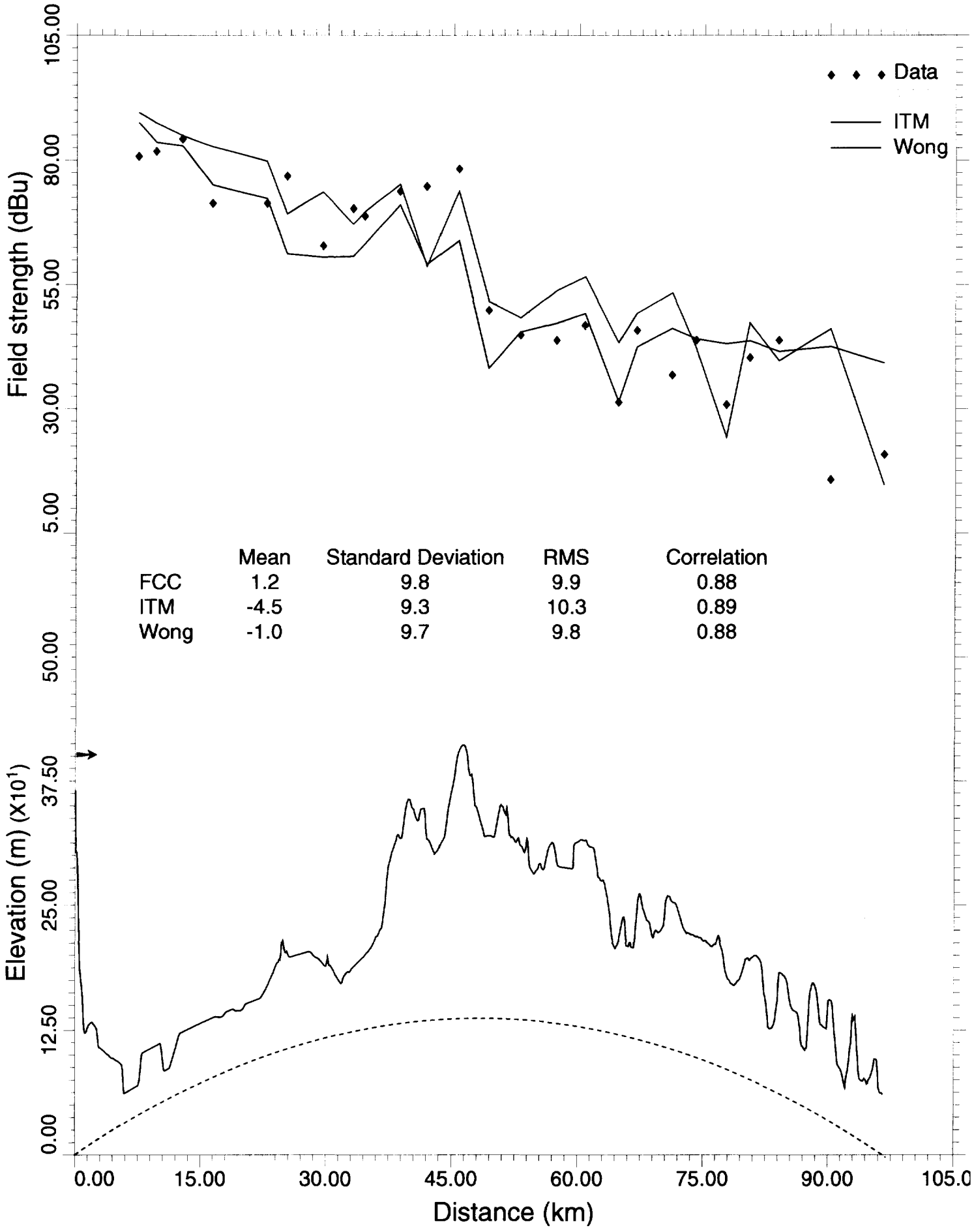
	Mean	Standard Deviation	RMS	Correlation
FCC	-6.8	10.5	12.6	0.82
ITM	-9.3	8.4	12.5	0.90
Wong	-6.2	11.9	13.5	0.79

SPRINGFIELD_93.1_MHz_110.0_Deg



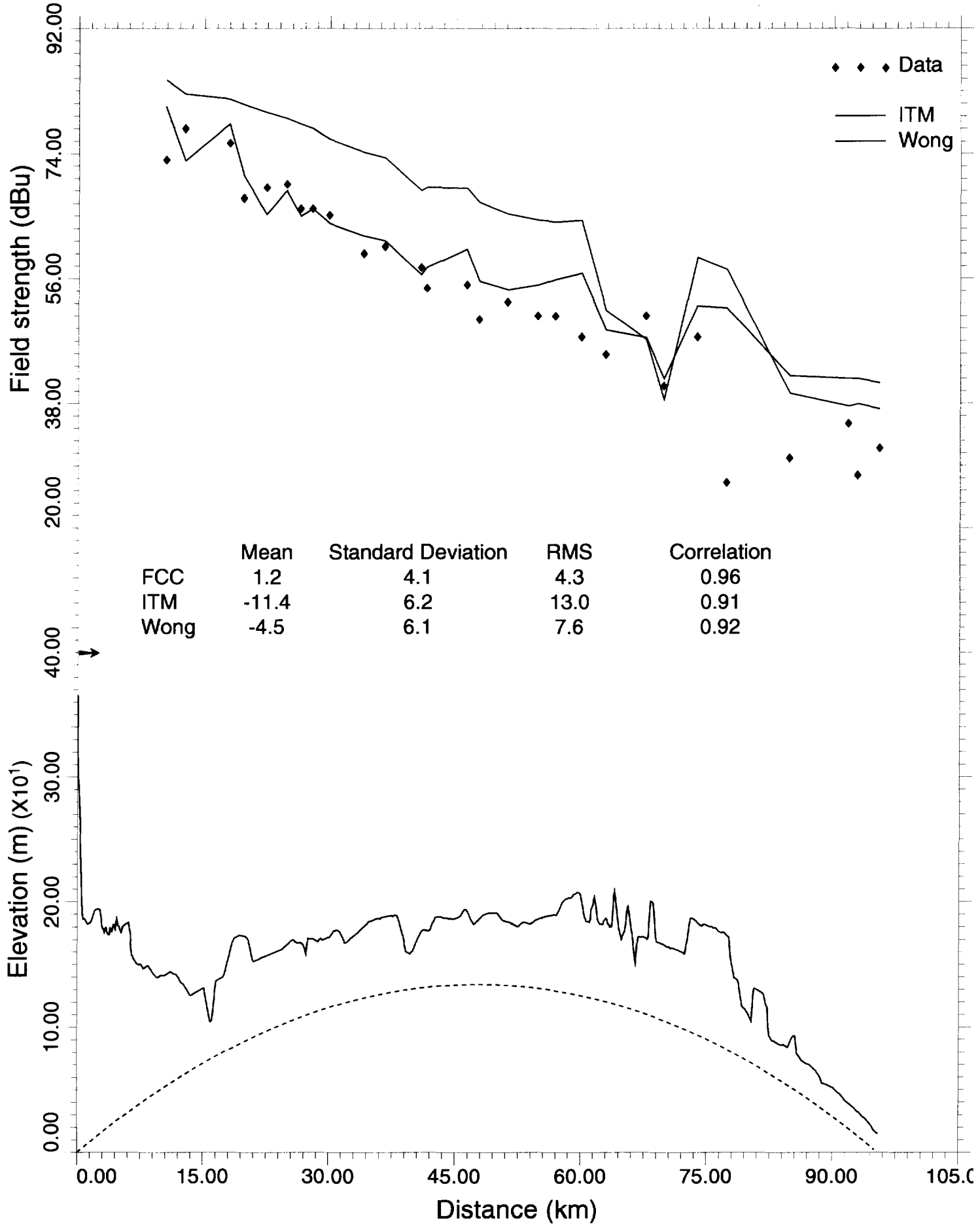
	Mean	Standard Deviation	RMS	Correlation
FCC	-11.9	9.0	15.0	0.90
ITM	-13.6	9.1	16.3	0.86
Wong	-6.6	11.3	13.1	0.78

SPRINGFIELD_93.1_MHz_153.0_Deg



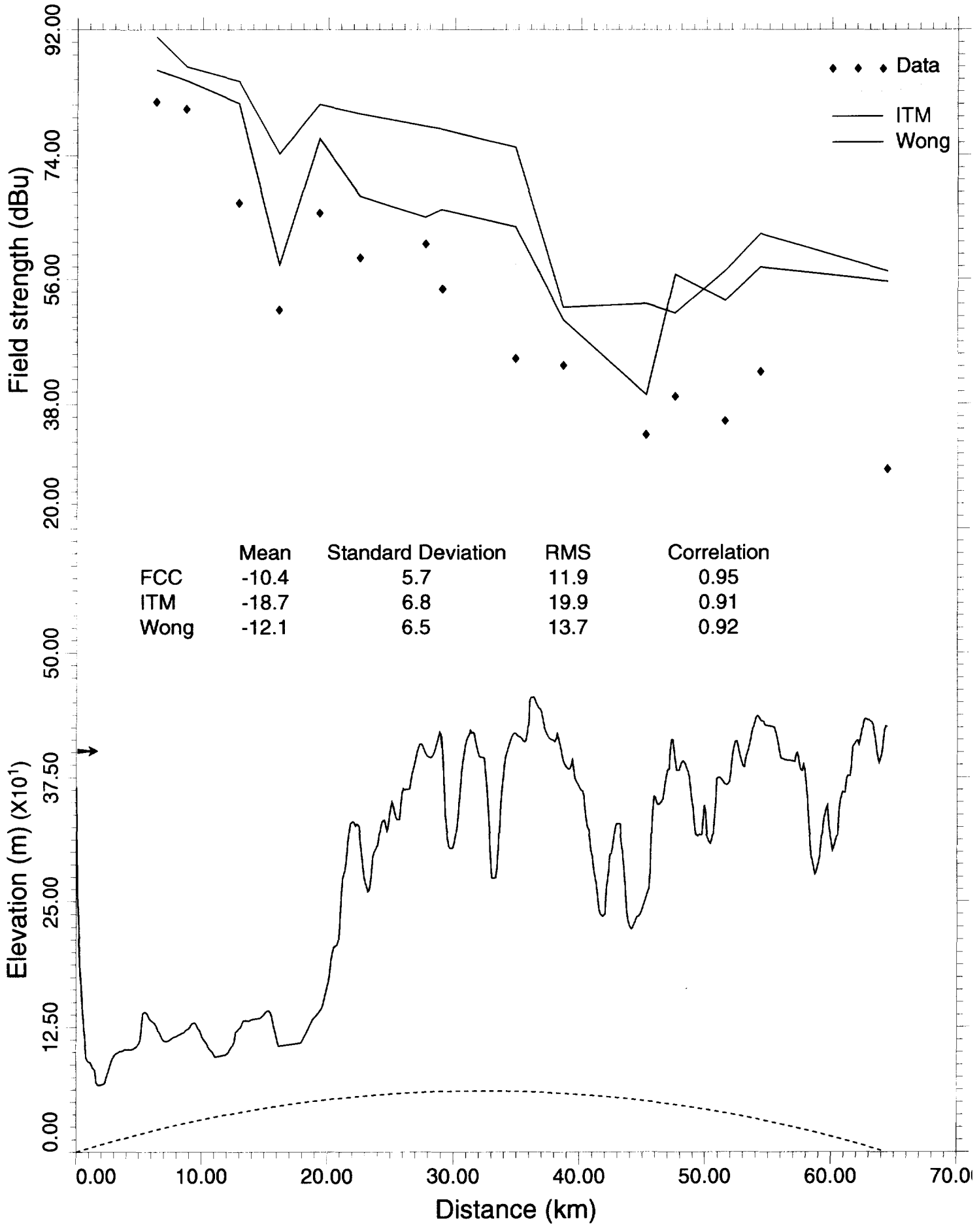
	Mean	Standard Deviation	RMS	Correlation
FCC	1.2	9.8	9.9	0.88
ITM	-4.5	9.3	10.3	0.89
Wong	-1.0	9.7	9.8	0.88

SPRINGFIELD_93.1_MHz_190.0_Deg



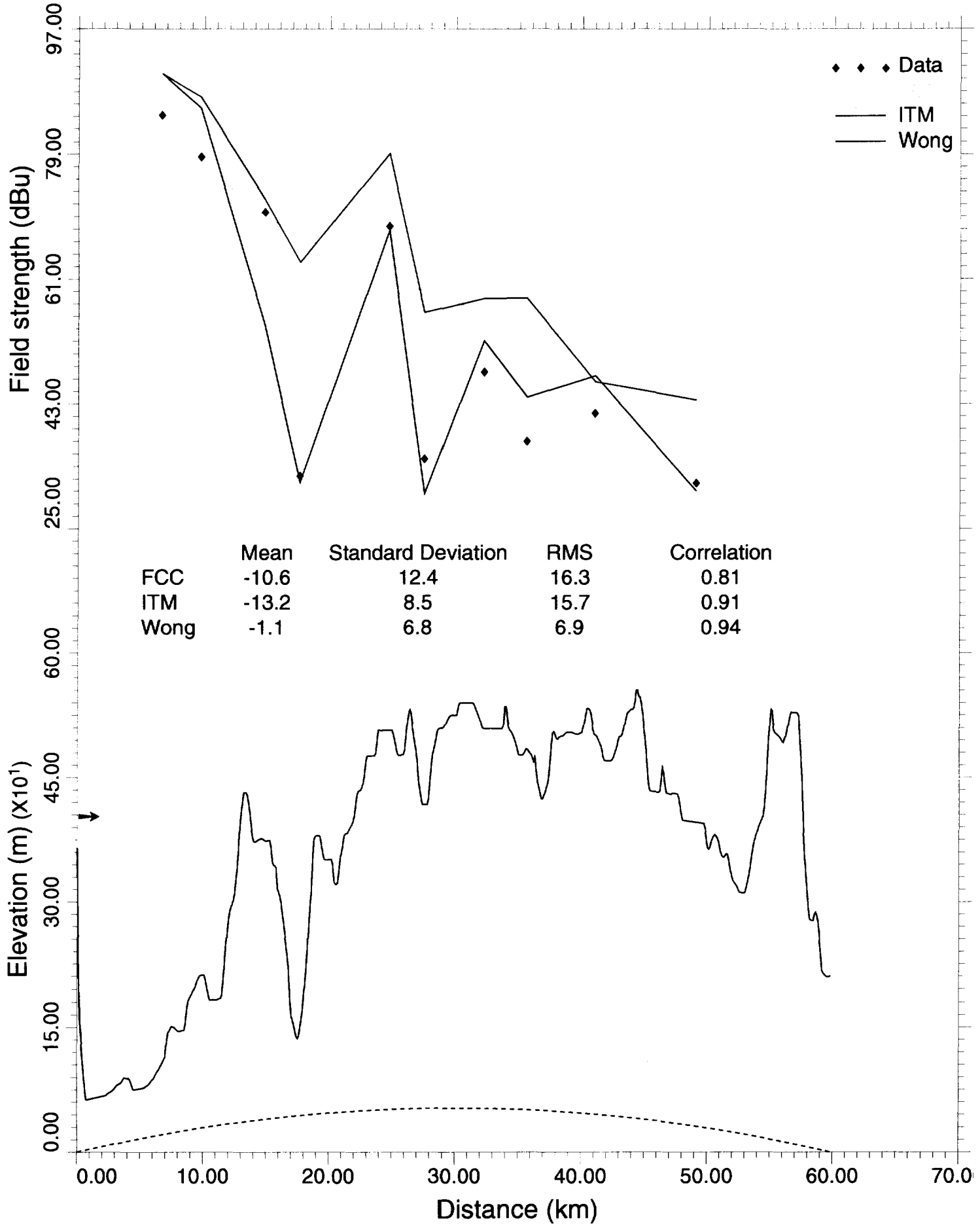
	Mean	Standard Deviation	RMS	Correlation
FCC	1.2	4.1	4.3	0.96
ITM	-11.4	6.2	13.0	0.91
Wong	-4.5	6.1	7.6	0.92

SPRINGFIELD_93.1_MHz_227.0_Deg



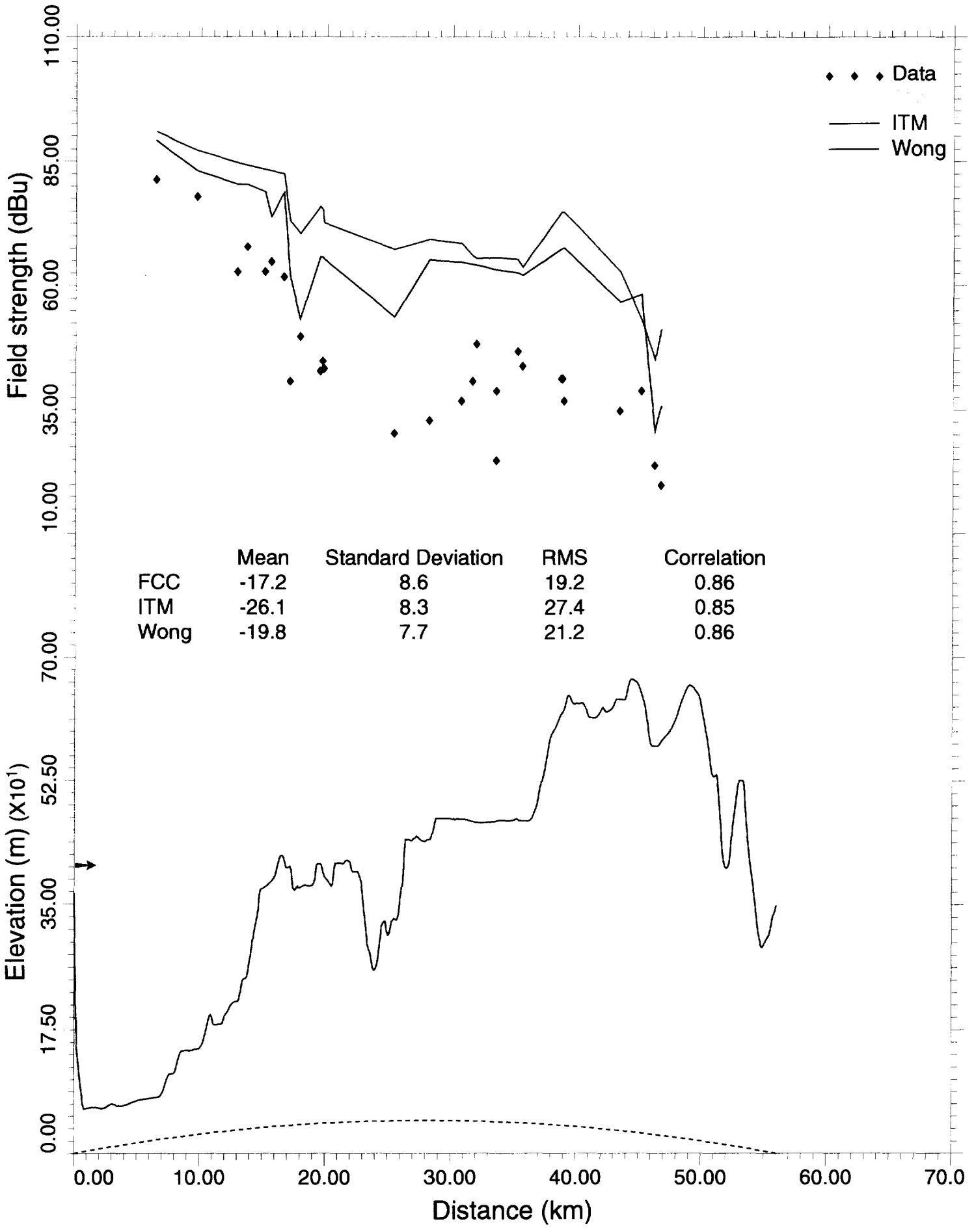
	Mean	Standard Deviation	RMS	Correlation
FCC	-10.4	5.7	11.9	0.95
ITM	-18.7	6.8	19.9	0.91
Wong	-12.1	6.5	13.7	0.92

SPRINGFIELD_93.1_MHz_262.0_Deg



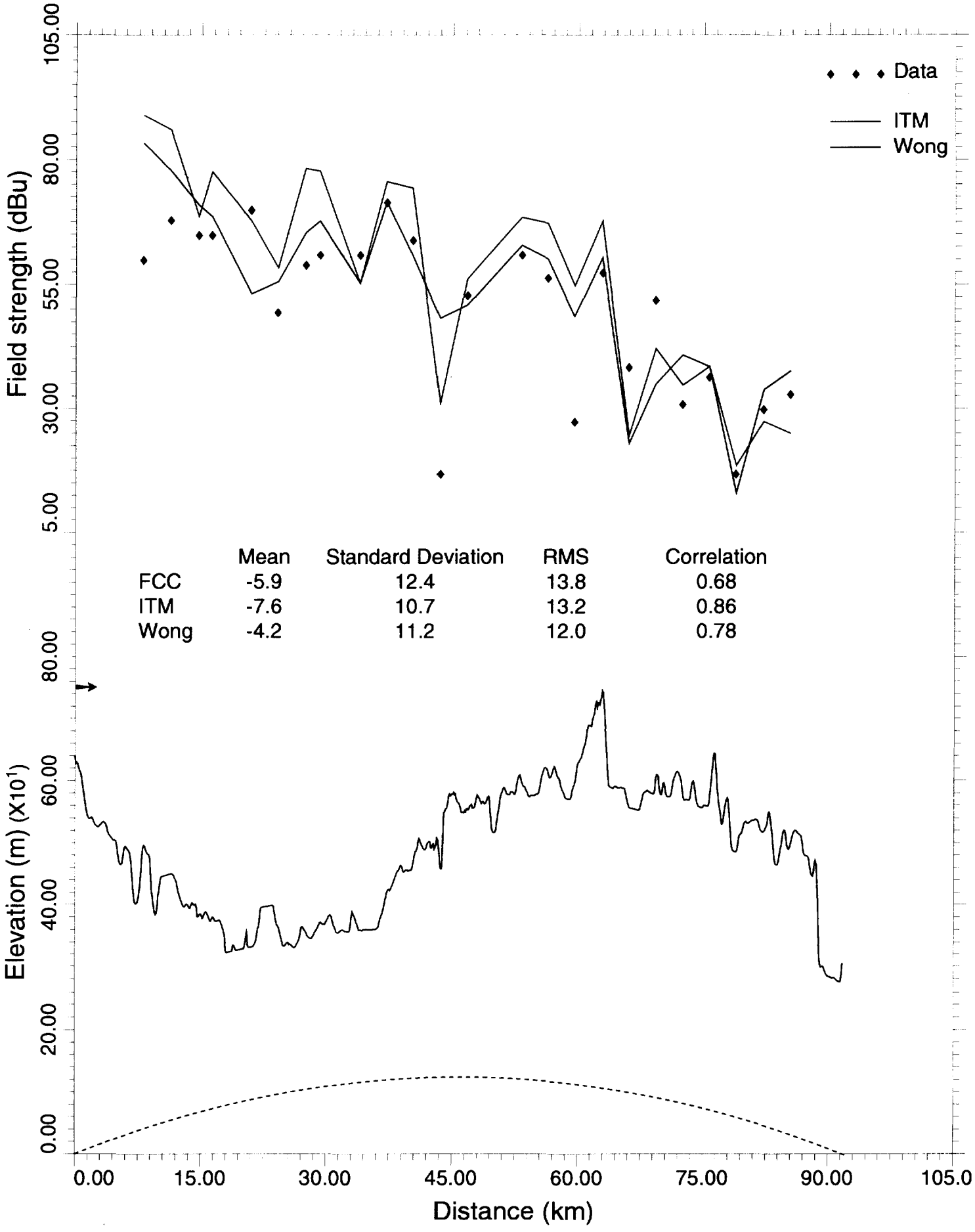
	Mean	Standard Deviation	RMS	Correlation
FCC	-10.6	12.4	16.3	0.81
ITM	-13.2	8.5	15.7	0.91
Wong	-1.1	6.8	6.9	0.94

SPRINGFIELD_93.1_MHz_310.0_Deg



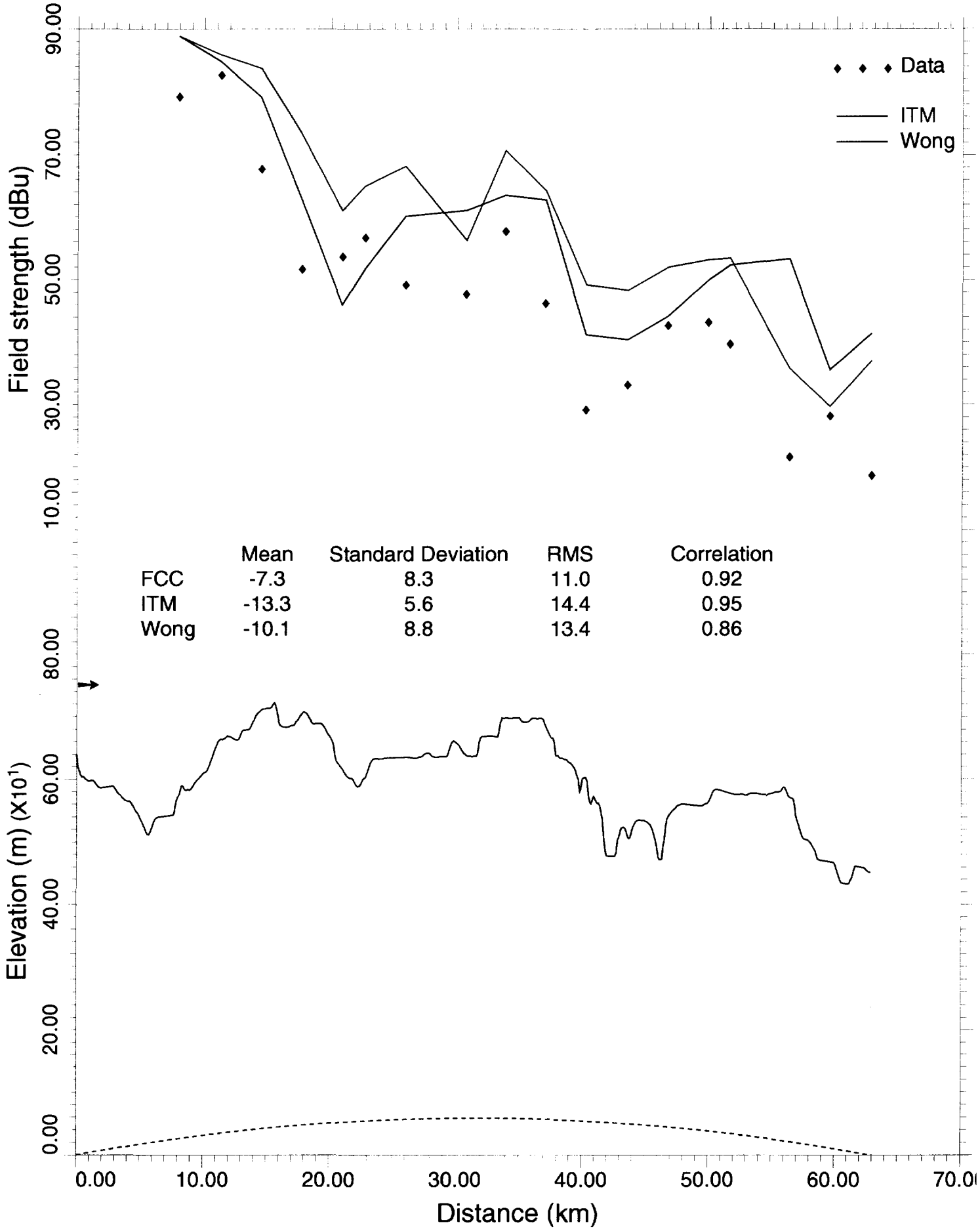
	Mean	Standard Deviation	RMS	Correlation
FCC	-17.2	8.6	19.2	0.86
ITM	-26.1	8.3	27.4	0.85
Wong	-19.8	7.7	21.2	0.86

WILKES-BARRE_98.5_MHz_30.0_Deg



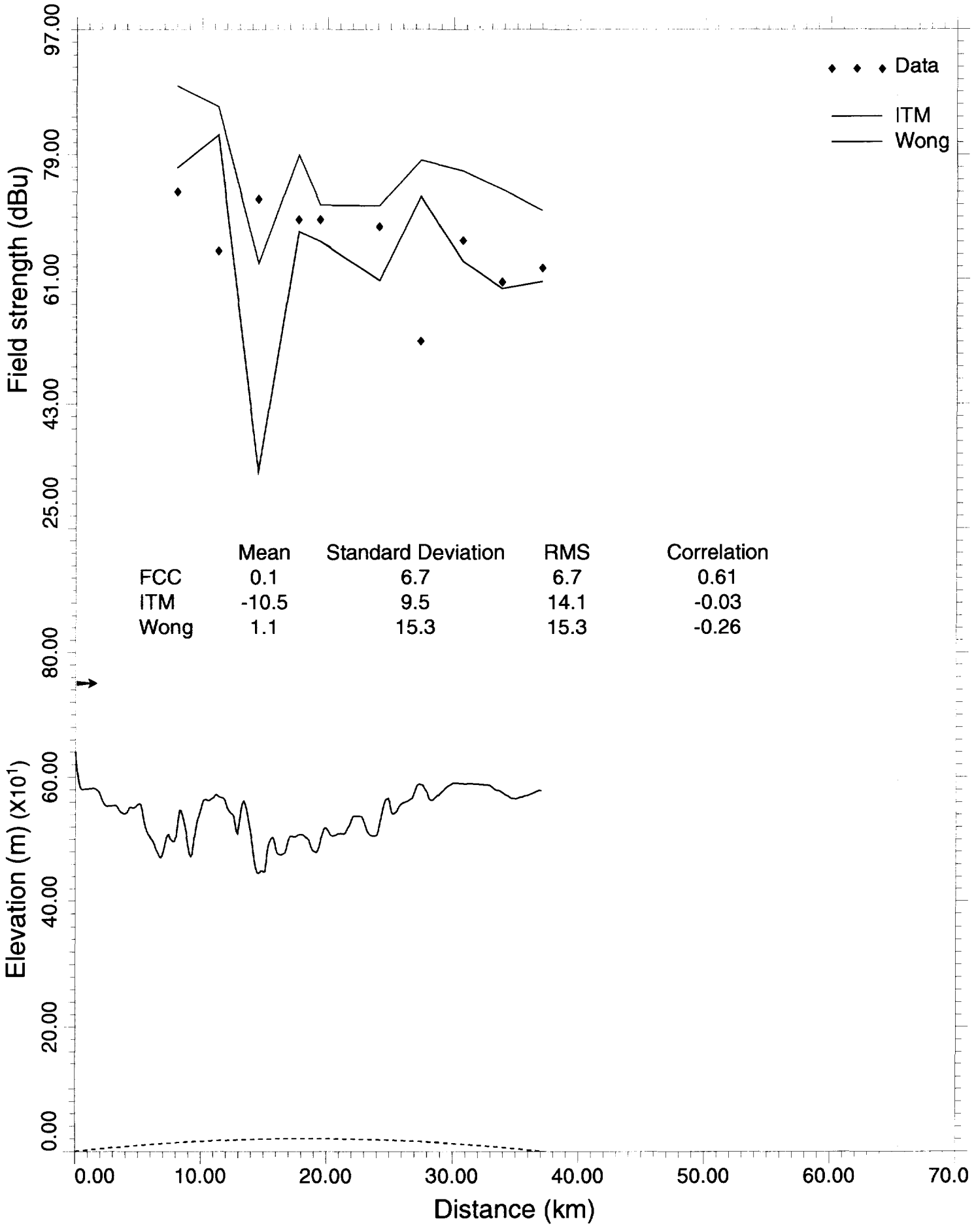
	Mean	Standard Deviation	RMS	Correlation
FCC	-5.9	12.4	13.8	0.68
ITM	-7.6	10.7	13.2	0.86
Wong	-4.2	11.2	12.0	0.78

WILKES-BARRE_98.5_MHz_75.0_Deg



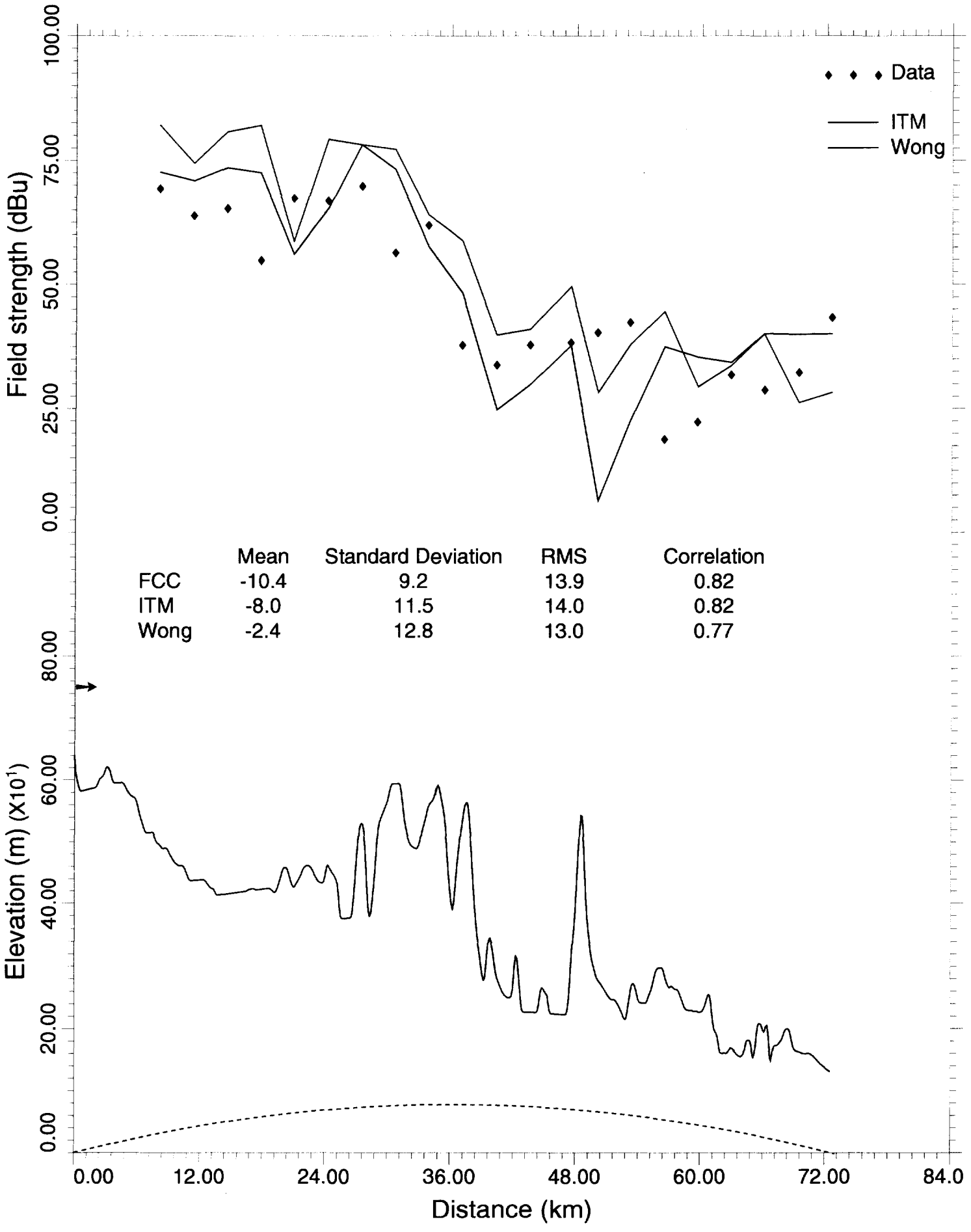
	Mean	Standard Deviation	RMS	Correlation
FCC	-7.3	8.3	11.0	0.92
ITM	-13.3	5.6	14.4	0.95
Wong	-10.1	8.8	13.4	0.86

WILKES-BARRE_98.5_MHz_120.0_Deg



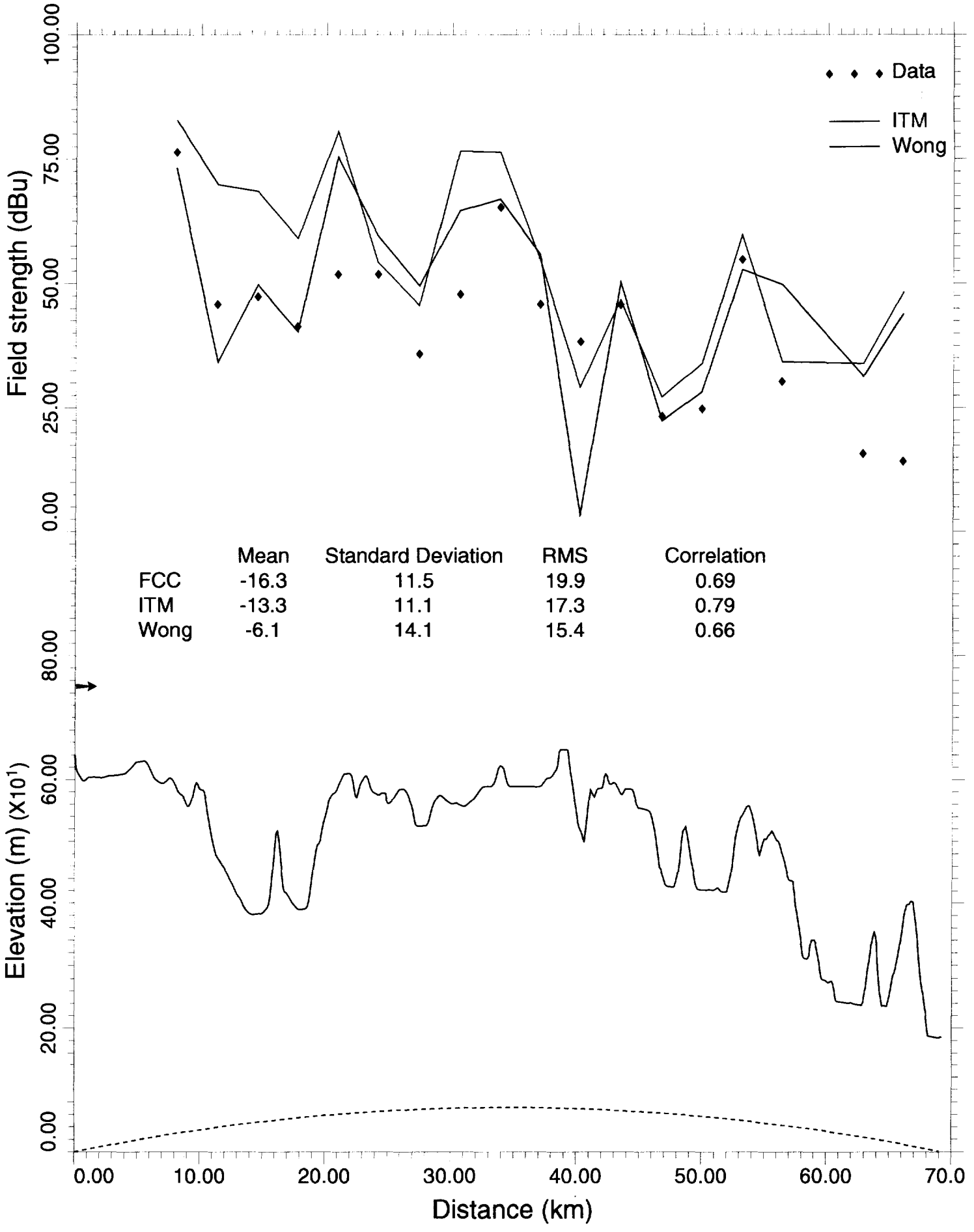
	Mean	Standard Deviation	RMS	Correlation
FCC	0.1	6.7	6.7	0.61
ITM	-10.5	9.5	14.1	-0.03
Wong	1.1	15.3	15.3	-0.26

WILKES-BARRE_98.5_MHz_165.0_Deg



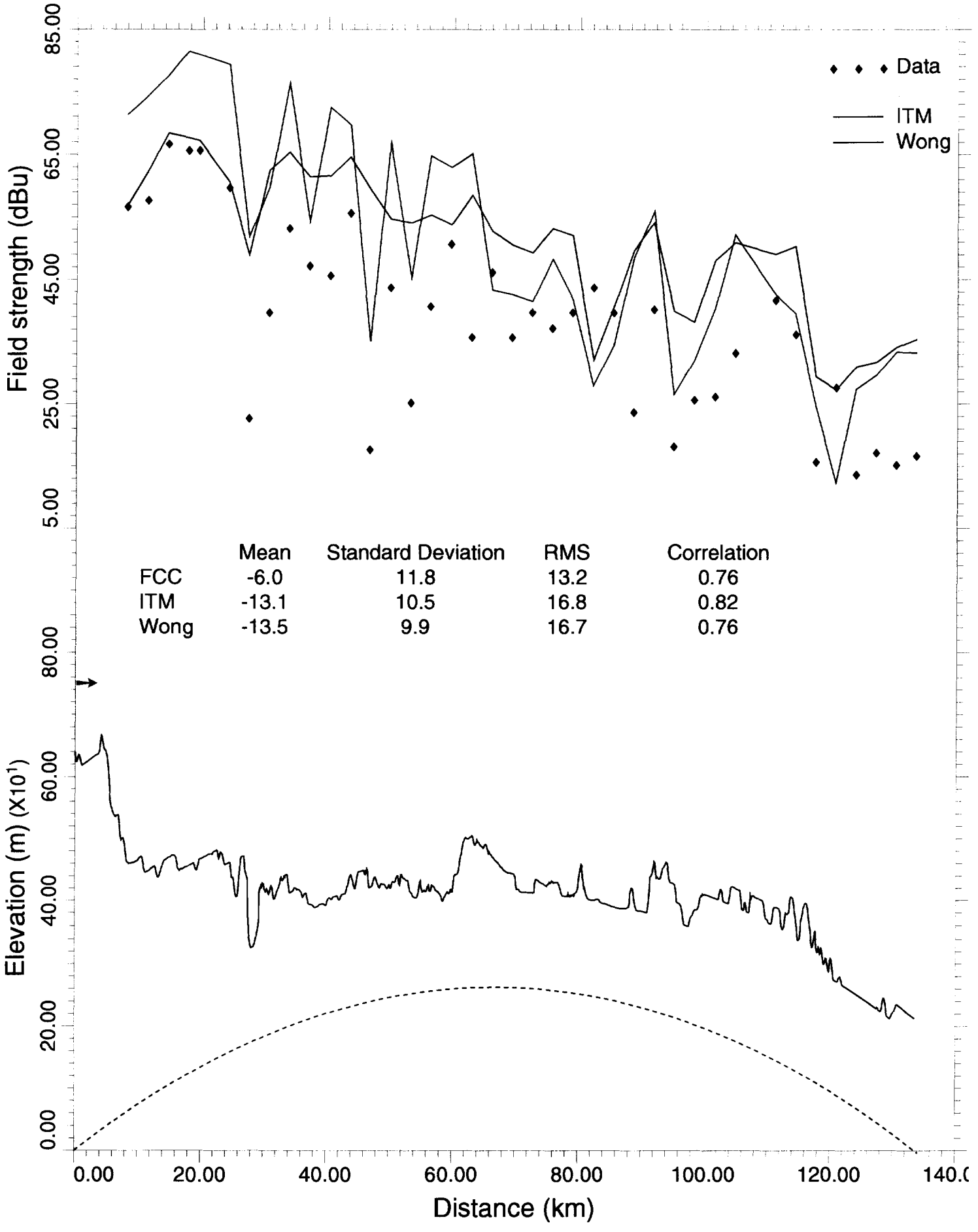
	Mean	Standard Deviation	RMS	Correlation
FCC	-10.4	9.2	13.9	0.82
ITM	-8.0	11.5	14.0	0.82
Wong	-2.4	12.8	13.0	0.77

WILKES-BARRE_98.5_MHz_207.0_Deg



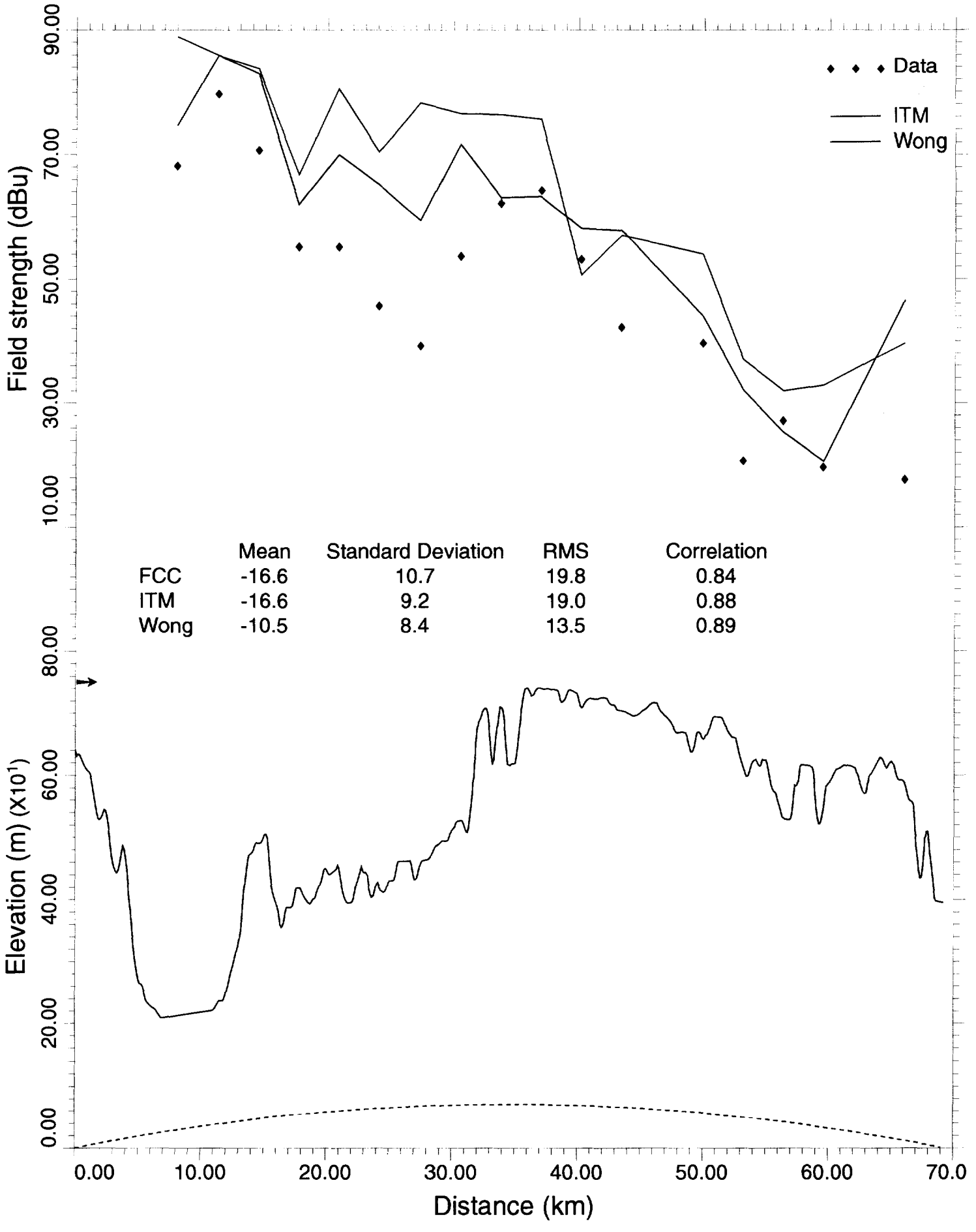
	Mean	Standard Deviation	RMS	Correlation
FCC	-16.3	11.5	19.9	0.69
ITM	-13.3	11.1	17.3	0.79
Wong	-6.1	14.1	15.4	0.66

WILKES-BARRE_98.5_MHz_248.0_Deg



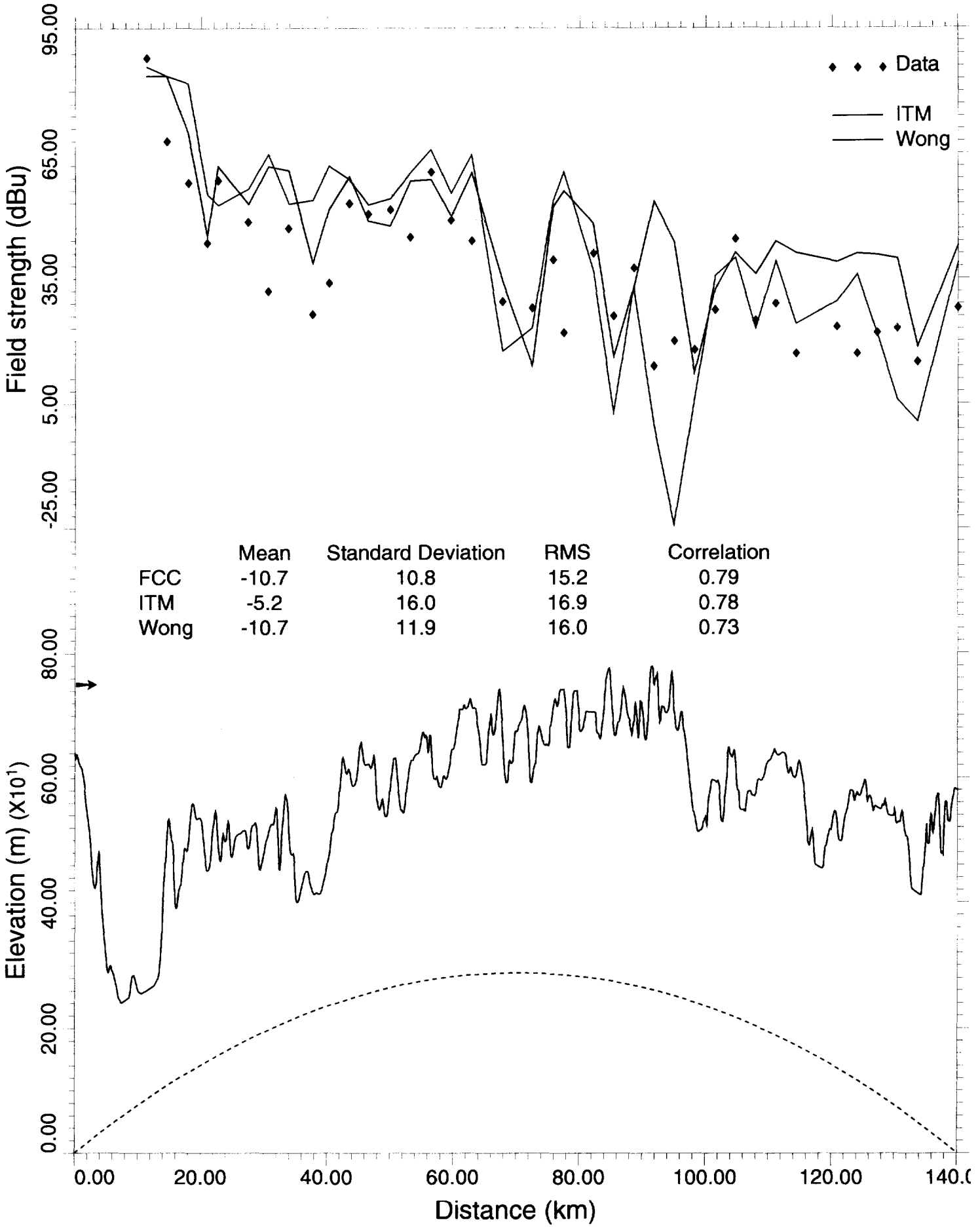
	Mean	Standard Deviation	RMS	Correlation
FCC	-6.0	11.8	13.2	0.76
ITM	-13.1	10.5	16.8	0.82
Wong	-13.5	9.9	16.7	0.76

WILKES-BARRE_98.5_MHz_300.0_Deg



	Mean	Standard Deviation	RMS	Correlation
FCC	-16.6	10.7	19.8	0.84
ITM	-16.6	9.2	19.0	0.88
Wong	-10.5	8.4	13.5	0.89

WILKES-BARRE_98.5_MHz_345.0_Deg



	Mean	Standard Deviation	RMS	Correlation
FCC	-10.7	10.8	15.2	0.79
ITM	-5.2	16.0	16.9	0.78
Wong	-10.7	11.9	16.0	0.73