MICROTEK ELECTRONICS, INC. THE INTELLIGENT ALTERNATIVE.

FCC PART 90

EVALUATION REPORT

Of

Model: Minilink 2.4TA-90IR

P.O. BOX 3464, SAN CLEMENTE, CA 92674 PHONE: (888) 366-4276 FACSIMILE: (~~714~~ 949) 366-4978

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1.1 Date: 2 Feb. 2000
FCC ID: JRR24TA-90IR

SUMMARY OF TEST

Administrative Data and Test Description

DEVISE TESTED: Video Transmitter
Model: Minilink 2.4TA-90IR

APPLICANT: MICROTEK ELECTRONICS, Inc.
P.O. Box 3464
San Clemente, CA 92672

GRANTEE CODE: JRR

FCC ID# REQUESTED: JRR24TA-90IR
CONTACT: Michael L. Henkoski

FREQUENCY RANGES: CONDUCTED: 0.45 – 30.0 mHz
RADIATED: 10-22,000 mHz

TEST LOCATION: 114 Olinda Drive, Brea, CA 92683

TEST DATE: January 10th, 2000

PURPOSE OF TEST: To demonstrate compliance with limits of FCC Part 90

TESTS PERFORMED: 1) 2.995 Frequency Stability. –30 to +50 C
2) 2.993 Radiated Spurious Emissions.
3) 2.991 Conducted Spurious Emissions.
4) 2.989 Occupied Bandwidth.
5) 2.987 Modulation Characteristics.
6) 2.985 RF Power Output
7) 2.995 Voltage Stability

1.2 Radiated Spurious Emissions

3 Meters

	Antenna Polarity	Preamp Gain	Antenna Factor With Feedline		True Fieldstrength
2474 mHz -32.6	V	0	32.7	=	+0.1
4948 mHz -52.3	V	23.3	38.0	=	-37.6
2474 mHz -34.0	H	0	32.3	=	-1.3
4948 mHz -54.6	H	23.3	38.0	=	-39.9
2458 mHz -38.9	V	0	32.7	=	-6.2
4916 mHz -54.6	V	23.3	38.0	=	-39.9
2458 mHz -28.1	H	0	32.7	=	+4.6
4916 mHz -57.3	H	23.3	38.0	=	-42.6

Field Strength = 1/D $\sqrt{}$ Po X RL
= 1/3 $\sqrt{}$ .250 x 50Ω
= 1.177 V@50Ω
= 14.43 dBm

FCC Limit = 43 + 10 Log (.250)
= -36.98dBc
= 14.43dBm – 36.98
= -22.6 dBm

Spectrum scans were made up to the 10^{th} harmonic as per section 2.997 with all radiated spurious emissions above the 2^{nd} harmonic unmeasureable or greater than 20 dB below the limit.

RADIATED EMISSIONS

COMPANY NAME: MICROTEK DATE: 1-10-00

EUT: VIDEO TRANSMITTER EUT S/N:

EUT MODEL: 2.4TA-90II LOCATION: ■ BREA ☐ SILVERADO ☐ AGOURA

SPECIFICATION: PART 90 CLASS: TEST DISTANCE: 3M LAB: D

ANTENNA: ☐ LOOP ☐ BICONICAL ☐ LOG ■ HORN POLARIZATION: ☐ VERT ■ HORIZ

■ QUALIFICATION ☐ ENGINEERING ☐ MFG. AUDIT ENGINEER: KYLE F.

NOTES:

(dBm)(ØBm)

Frequency (GHz)	Peak Reading (dBuV)	Average Reading (dBuV)	Antenna Height (meters)	Azimuth (degrees)	Antenna Factor (dB)	Cable Loss (dB)	Amplifier Gain (dB)	* Corrected Reading (dBuV)	Delta ** (dB)	Spec Limit (dBuV)
2.474	-34.0	-	1.0	90	28.2	4.5	Ø	-1.3	-	-
4.948	-54.6	-	1.0	90	32.3	5.7	23.3	-39.9	-17.3	-22.6
	NO HARMONICS PAST 2ND HARMONIC WERE WITHIN 20dB OF LIMIT									
2.458	-28.1	-	1.0	0	28.2	4.5	Ø	+4.6	-	-
4.916	-57.3	-	1.0	90	32.3	5.7	23.3	-42.6	-20.0	-22.6
	NO HARMONICS PAST 2ND HARMONIC WERE WITHIN 20dB OF LIMIT									
2.380	-33.1	-	1.5	0	28.2	4.5	Ø	-0.4	-	-
4.760	-60.3	-	1.5	90	32.3	5.7	23.3	-45.6	-23.0	-22.6
7.140	-52.1		3.5	Ø	36.1	13.1	23.1	-26.0	-3.4	-22.6
	NO HARMONICS PAST 3RD HARMONIC WERE WITHIN 20dB OF LIMIT									
2.364	-31.0	—	1.0	0	28.2	4.5	Ø	+1.7	-	-
4.728	-55.0	-	1.0	90	32.3	5.7	23.3	-40.3	-17.7	-22.6
7.092	-54.7	-	1.0	180	36.1	13.1	23.1	-28.6	-6.0	-22.6

NO HARMONICS PAST 3RD HARMONIC WERE WITHIN 20dB OF LIMIT

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN

** DELTA = CORRECTED READING - SPECIFICATION LIMIT

RADIATED EMISSIONS

COMPANY NAME: MICROTEK DATE: 1-10-00

EUT: VIDEO TRANSMITTER EUT S/N:

EUT MODEL: 2.4TA-90II LOCATION: ■ BREA ☐ SILVERADO ☐ AGOURA

SPECIFICATION: PART 90 CLASS: TEST DISTANCE: 3M LAB: D

ANTENNA: ☐ LOOP ☐ BICONICAL ☐ LOG ■ HORN POLARIZATION: ■ VERT ☐ HORIZ

■ QUALIFICATION ☐ ENGINEERING ☐ MFG. AUDIT ENGINEER: KYLE F.

NOTES:

(dBm) (dBm) (dBm) (dBm)

Frequency (GHz)	Peak Reading [redacted]	Average Reading [redacted]	Antenna Height (meters)	Azimuth (degrees)	Antenna Factor (dB)	Cable Loss (dB)	Amplifier Gain (dB)	* Corrected Reading [redacted]	Delta ** (dB)	Spec Limit [redacted]
2.474	-32.6	–	2.0	0	28.2	4.5	Ø	+0.1	–	–
4.947	-52.3	–	1.0	90	32.3	5.7	23.3	-37.6	-15.0	-22.6
	NO HARMONICS PAST 2ND HARMONIC WERE WITHIN 20dB OF LIMIT									
2.458	-38.9	–	1.0	90	28.2	4.5	Ø	-6.2	–	–
4.916	-54.6	–	1.0	270	32.3	5.7	23.3	-39.9	-17.3	-22.6
	NO HARMONICS PAST 2ND HARMONIC WERE WITHIN 20dB OF LIMIT									
2.380	-44.1	–	1.0	0	28.2	4.5	Ø	-11.4	–	–
4.760	-55.8	–	1.0	90	32.3	5.7	23.3	-41.1	-18.5	-22.6
7.139	-53.7	–	1.5	0	36.1	13.1	23.1	-27.6	-5.0	-22.6
	NO HARMONICS PAST 3RD HARMONIC WERE WITHIN 20dB OF LIMIT									
2.363 → [redacted]	-41.9	–	2.0	90	28.2	4.5	Ø	-9.2	–	–
4.728	-55.0	–	1.0	90	32.3	5.7	23.3	-40.3	-17.7	-22.6
7.092	-59.7	–	1.5	0	36.1	13.1	23.1	-33.6	-11.0	-22.6

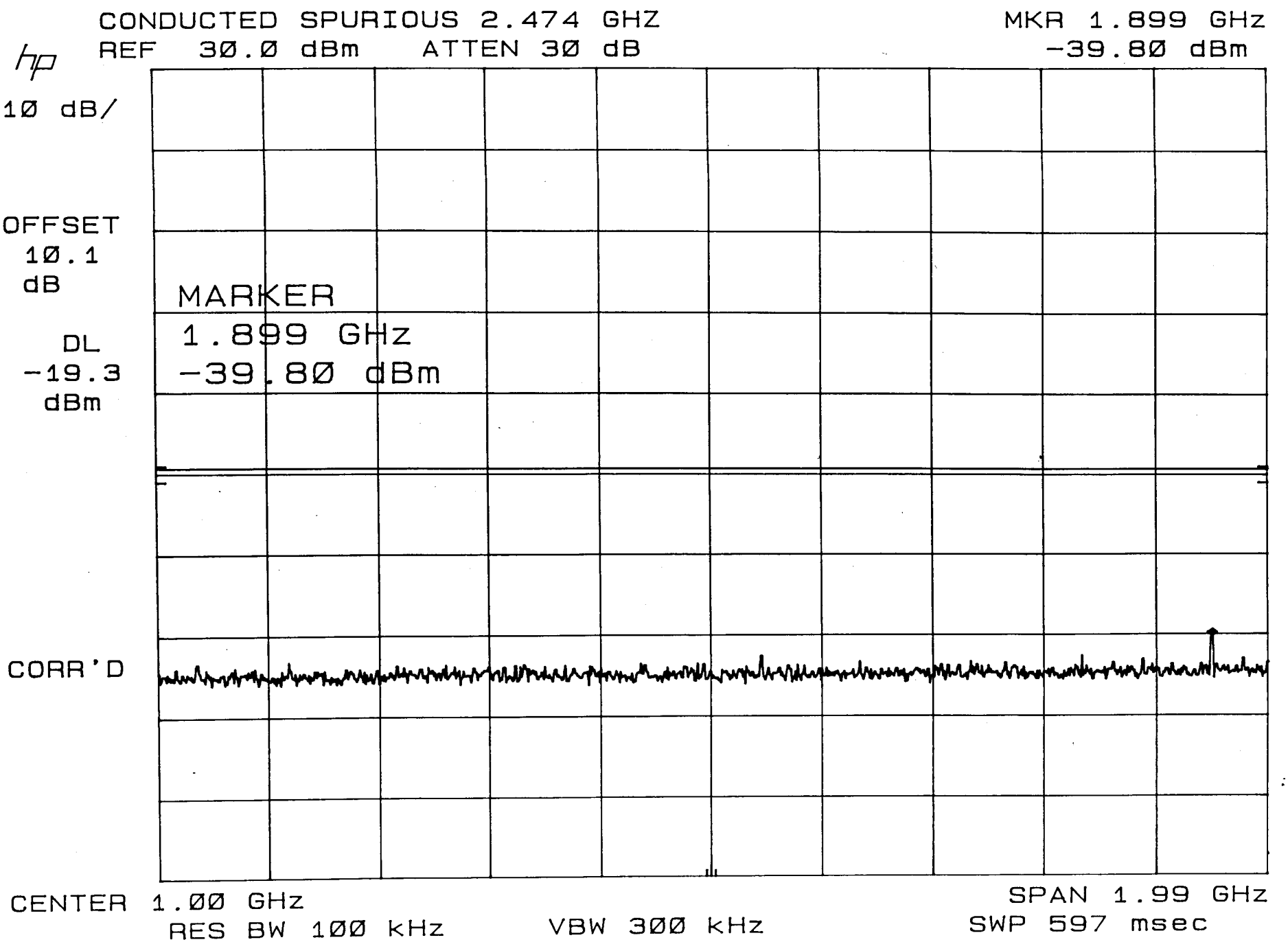
* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN

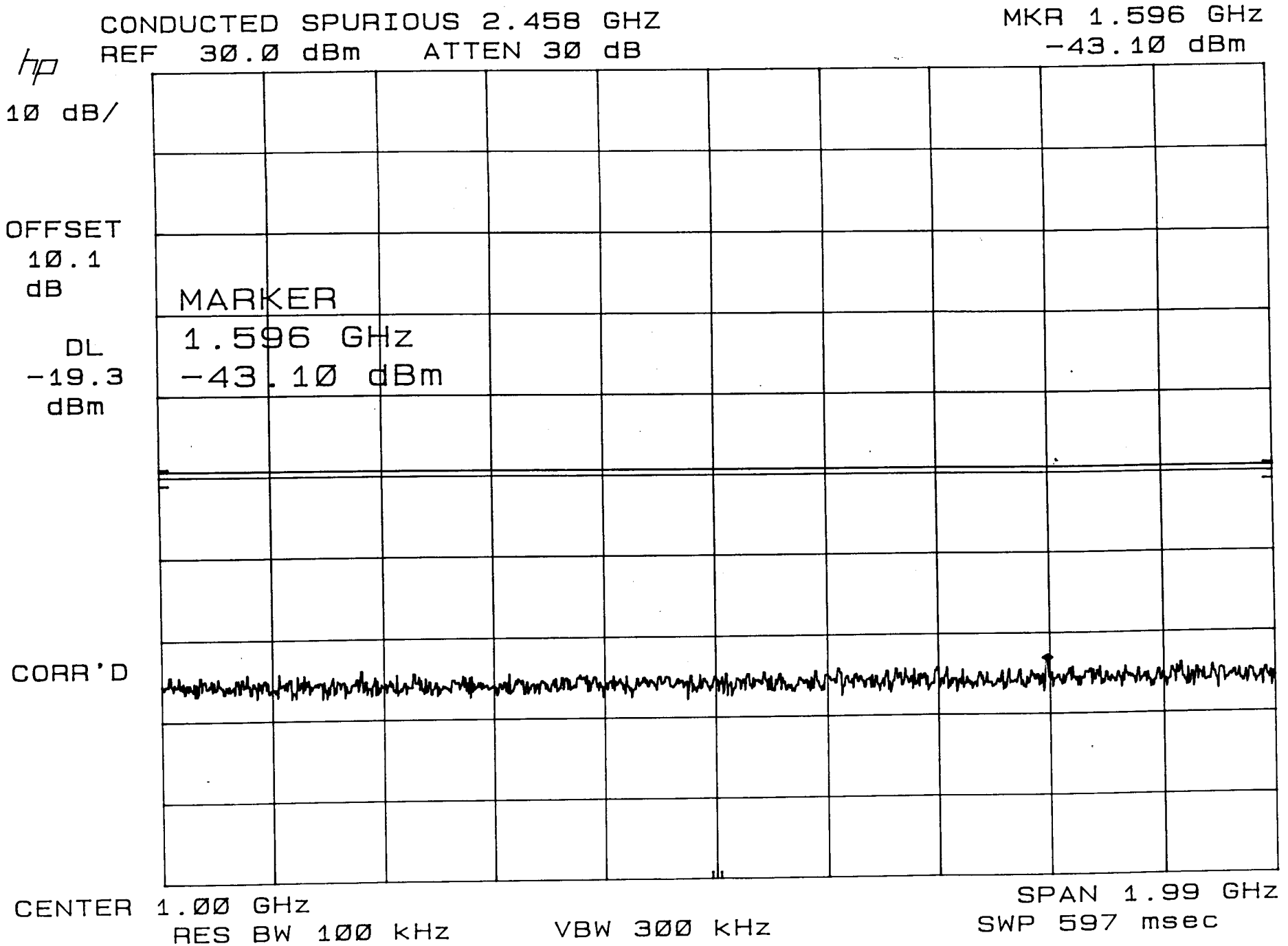
** DELTA = CORRECTED READING - SPECIFICATION LIMIT

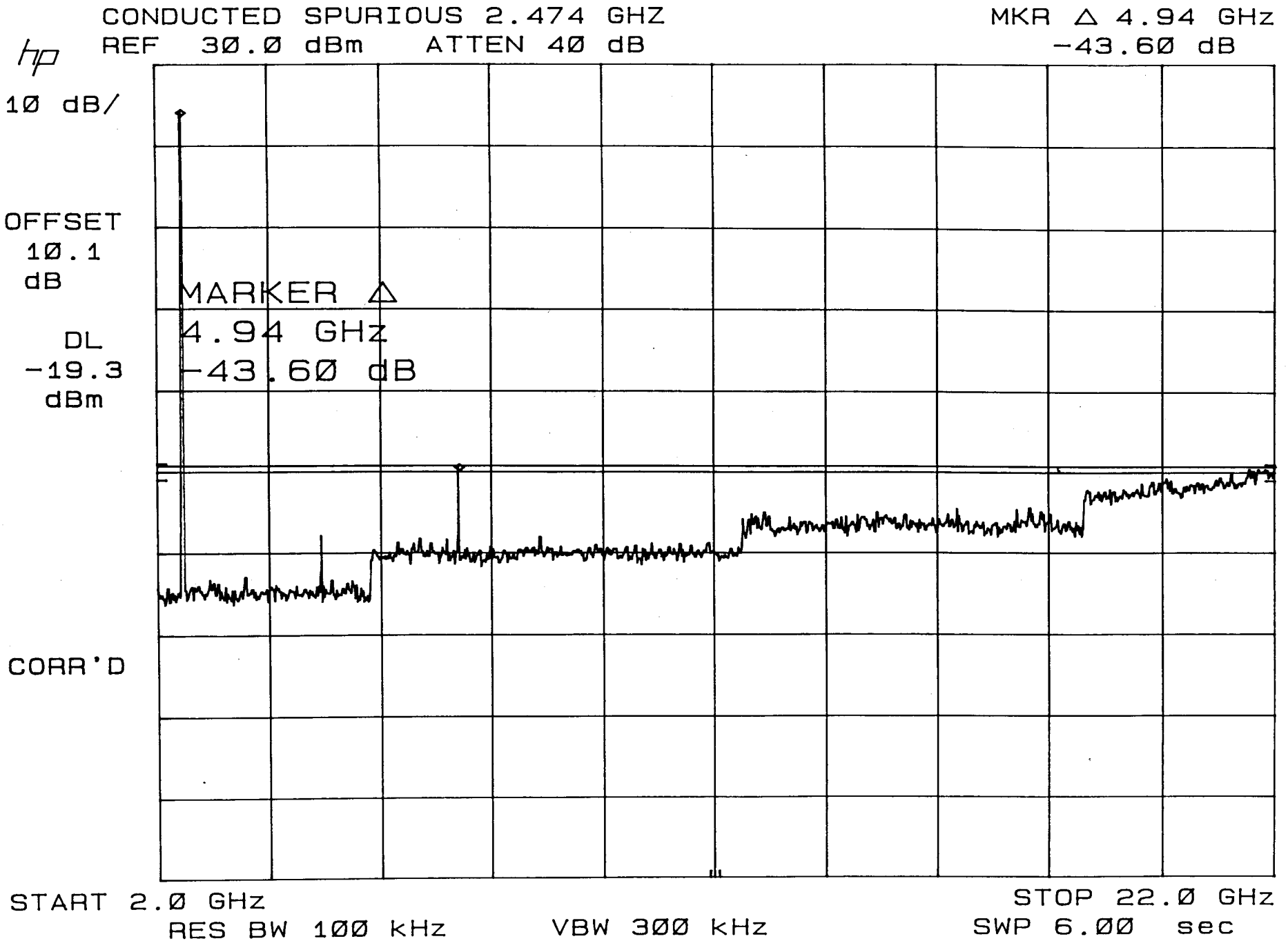
1.3 Conducted Spurious Emissions

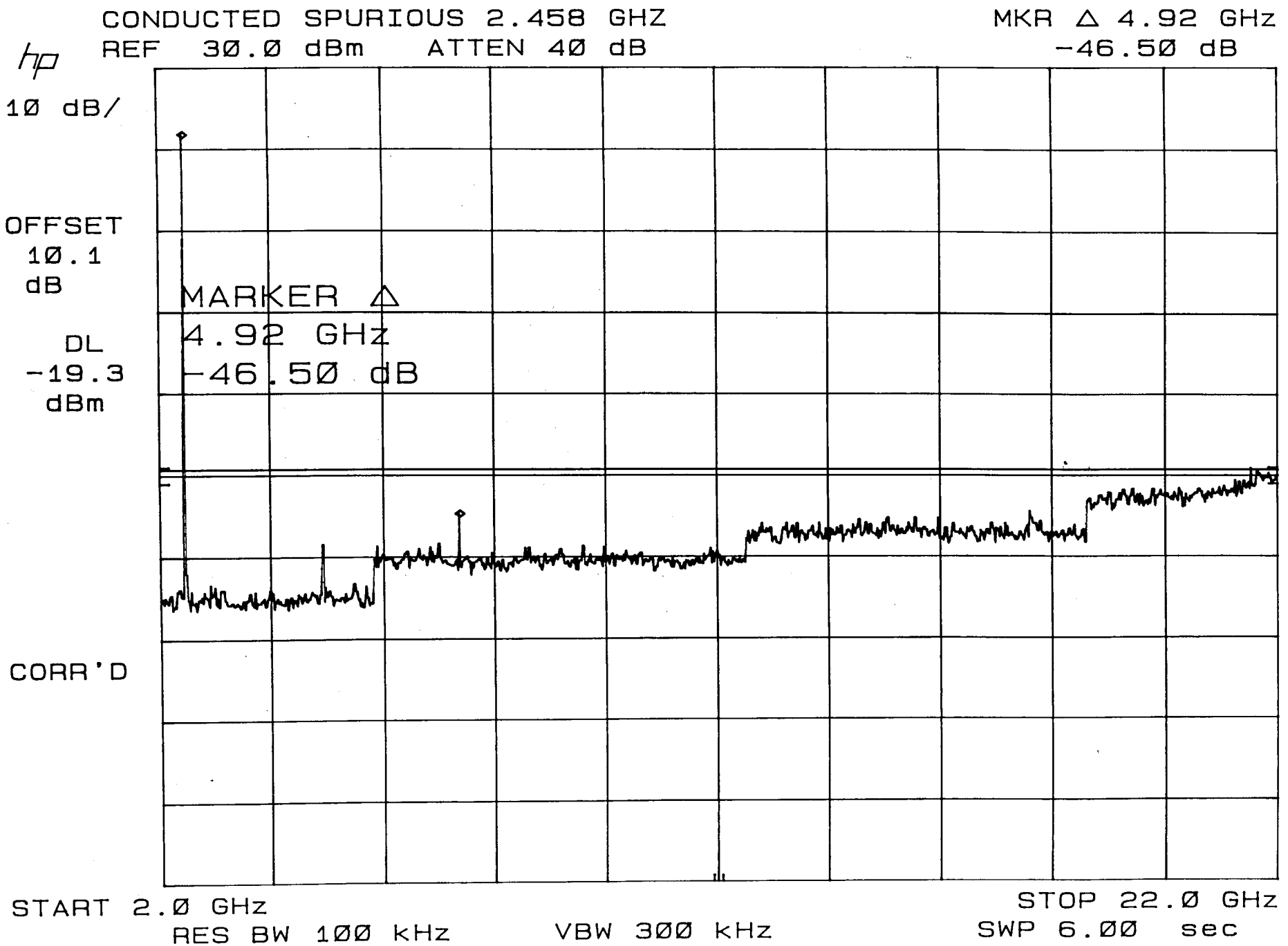
8 plots showing out of band Spurious Emissions at each channel setting 2458 mHz and 2474 mHz.

Spectrum scans were made up to the 10^{th} harmonic as per section 2.997 with all spurious emissions above the 4^{th} harmonic being unmeasureable or greater than 20 dB below the limit.


CONDUCTED SPURIOUS 2.474 GHZ
MKR 1.899 GHz
REF 30.0 dBm
ATTEN 30 dB
-39.80 dBm
10 dB/
OFFSET
10.1
dB
MARKER
1.899 GHz
-39.80 dBm
DL
-19.3
dBm
CORR'D
CENTER 1.00 GHz
SPAN 1.99 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 597 msec


CONDUCTED SPURIOUS 2.458 GHZ
REF 30.0 dBm ATTEN 30 dB
MKR 1.596 GHz
-43.10 dBm
10 dB/
OFFSET
10.1
dB
MARKER
1.596 GHz
-43.10 dBm
DL
-19.3
dBm
CORR'D
CENTER 1.00 GHz
RES BW 100 kHz
VBW 300 kHz
SPAN 1.99 GHz
SWP 597 msec


CONDUCTED SPURIOUS 2.474 GHZ
MKR Δ 4.94 GHz
REF 30.0 dBm
ATTEN 40 dB
−43.60 dB
10 dB/
OFFSET
10.1
dB
MARKER Δ
4.94 GHz
−43.60 dB
DL
−19.3
dBm
CORR'D
START 2.0 GHz
STOP 22.0 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 6.00 sec


CONDUCTED SPURIOUS 2.458 GHZ
MKR Δ 4.92 GHz
REF 30.0 dBm
ATTEN 40 dB
-46.50 dB
10 dB/
OFFSET
10.1
dB
MARKER Δ
4.92 GHz
-46.50 dB
DL
-19.3
dBm
CORR'D
START 2.0 GHz
STOP 22.0 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 6.00 sec

1.4 Occupied Bandwidth and Modulation Characteristics

2 Plots showing Occupied BW and Modulation at each channel setting. 2458 mHz and 2474 mHz.

The emissions designator 16MOF3F was arrived at by the following method:

1. Bandwidth was determined using the following formula:

   2M+2D = Necessary Bandwidth, where M = highest modulation frequency and D = peak deviation.

   Maximum modulation frequency = 4 mHz video modulation. Deviation = 4 mHz.

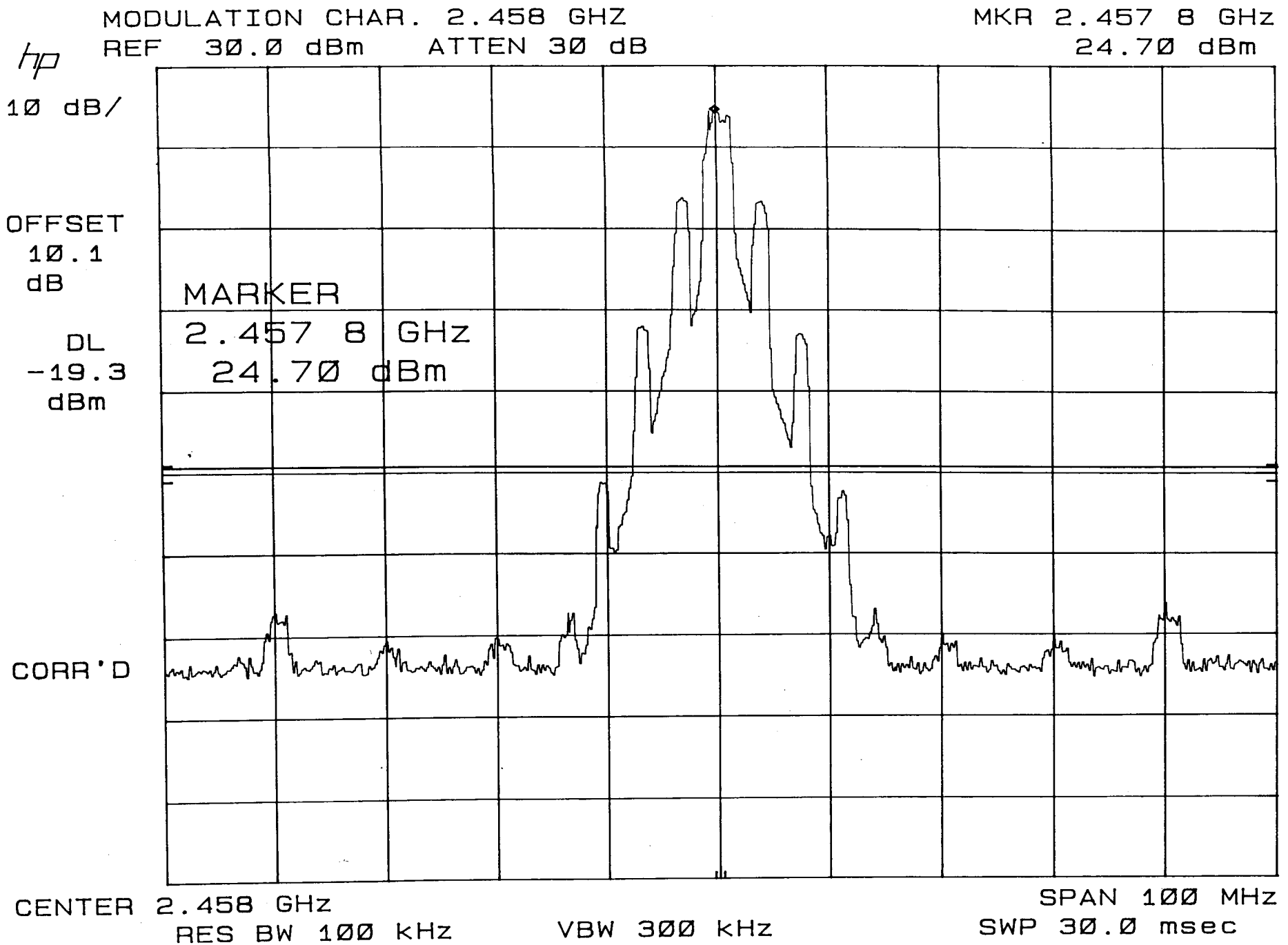
   2X4,000,000 = 8,000,000 + 2X4,000,000 = 16mHz

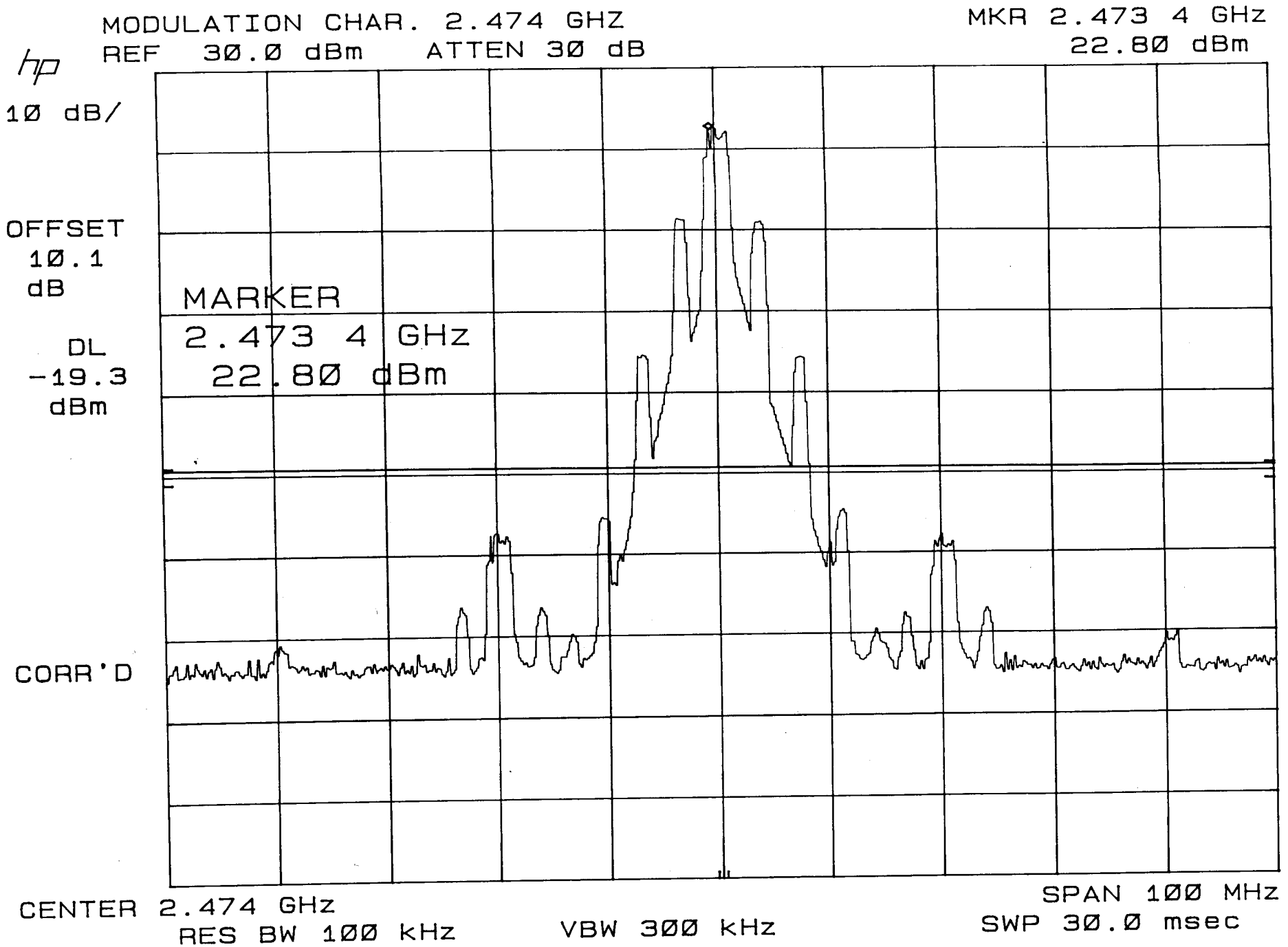
   = 16MO

2. Modulation type is Frequency modulation, one analog channel Television.

   = F3F

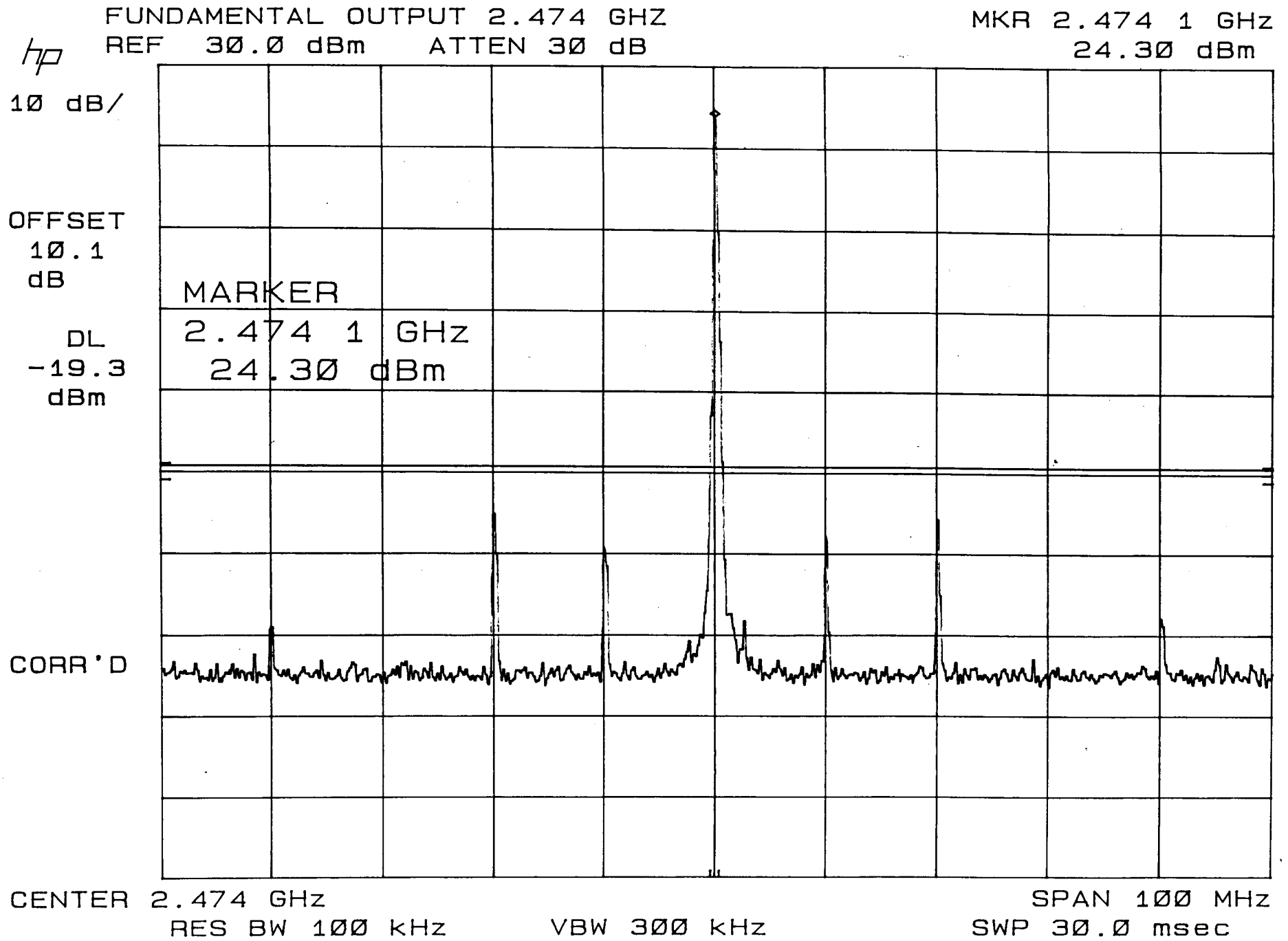
3. Emission designator is: 16MOF3F

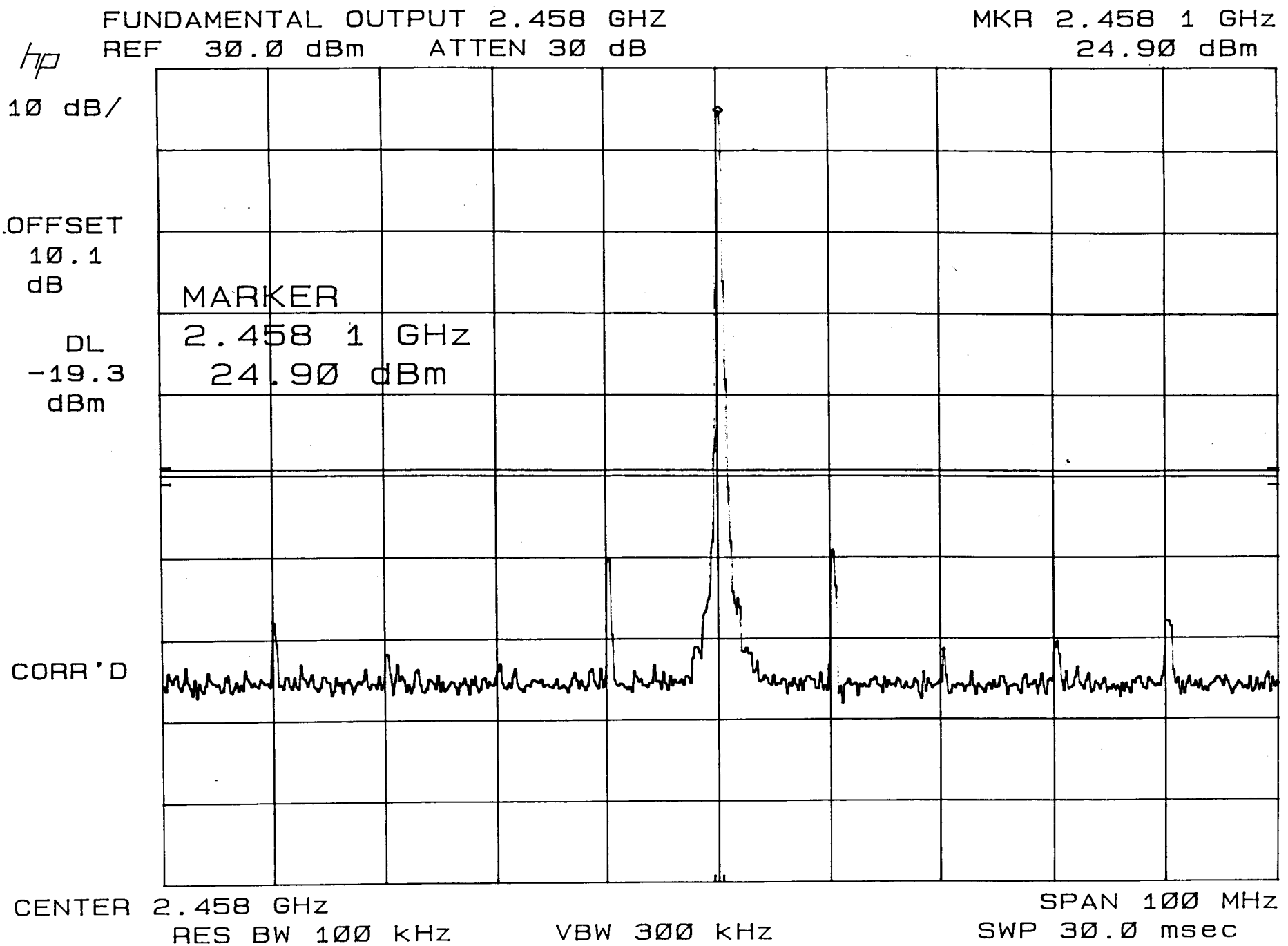

MODULATION CHAR. 2.458 GHZ
MKR 2.457 8 GHz
REF 30.0 dBm
ATTEN 30 dB
24.70 dBm
10 dB/
OFFSET
10.1
dB
MARKER
2.457 8 GHz
24.70 dBm
DL
-19.3
dBm
CORR'D
CENTER 2.458 GHz
SPAN 100 MHz
RES BW 100 kHz
VBW 300 kHz
SWP 30.0 msec


MODULATION CHAR. 2.474 GHZ
REF 30.0 dBm ATTEN 30 dB
MKR 2.473 4 GHz
22.80 dBm
10 dB/
OFFSET
10.1
dB
DL
-19.3
dBm
MARKER
2.473 4 GHz
22.80 dBm
CORR'D
CENTER 2.474 GHz
RES BW 100 kHz
VBW 300 kHz
SPAN 100 MHz
SWP 30.0 msec

1.5 RF Power Output

2 plots showing RF Power Output at each channel setting.
2458 mHz and 2474 mHz.


FUNDAMENTAL OUTPUT 2.474 GHZ
REF 30.0 dBm ATTEN 30 dB
MKR 2.474 1 GHz
24.30 dBm
10 dB/
OFFSET
10.1
dB
DL
-19.3
dBm
MARKER
2.474 1 GHz
24.30 dBm
CORR'D
CENTER 2.474 GHz
SPAN 100 MHz
RES BW 100 kHz
VBW 300 kHz
SWP 30.0 msec


FUNDAMENTAL OUTPUT 2.458 GHZ
MKR 2.458 1 GHz
REF 30.0 dBm
ATTEN 30 dB
24.90 dBm
10 dB/
OFFSET
10.1
dB
MARKER
2.458 1 GHz
24.90 dBm
DL
-19.3
dBm
CORR'D
CENTER 2.458 GHz
SPAN 100 MHz
RES BW 100 kHz
VBW 300 kHz
SWP 30.0 msec

1.6 Conducted Powerline

4 plots showing Conducted Powerline for both White and Black leads at each channel setting.
2458 mHz and 2474 mHz.

COMPATIBLE ELECTRONICS

1/10/2000 14:42:22

MICROTEK ELECTRONICS, INC.
VIDEO TRANSMITTER
MODEL: MINILINK 2.4TA-90 II
FCC B - WHITE LEAD
TEST ENGINEER : Kyle Fujimoto
KYLE FUJIMOTO

26 highest peaks above -50.00 dB of CLASS B limit line
Peak criteria : 0.80 dB, Curve : Peak

Peak#	Freq(MHz)	Amp(dBuV	Limit(dB)	Delta(dB)	
1	0.466	48.09	48.00	0.09	
2	0.507	47.68	48.00	-0.32	
3	0.450	47.49	48.00	-0.51	SEE Q.P. ON NEXT PAGE AND ON PLOT
4	0.577	47.38	48.00	-0.62	
5	0.609	47.08	48.00	-0.92	
6	0.652	46.67	48.00	-1.33	
7	0.688	46.37	48.00	-1.63	
8	14.272	46.30	48.00	-1.70	
9	0.697	46.07	48.00	-1.93	
10	0.761	44.77	48.00	-3.23	
11	0.778	44.37	48.00	-3.63	SEE Q.P.
12	0.797	44.07	48.00	-3.93	
13	0.853	41.87	48.00	-6.13	
14	0.889	41.58	48.00	-6.42	
15	0.908	41.38	48.00	-6.62	
16	0.967	39.78	48.00	-8.22	
17	0.954	39.28	48.00	-8.72	
18	1.017	38.68	48.00	-9.32	
19	1.030	38.38	48.00	-9.62	
20	0.988	38.28	48.00	-9.72	
21	28.550	38.17	48.00	-9.83	
22	1.056	38.08	48.00	-9.92	
23	1.074	37.18	48.00	-10.82	
24	1.168	37.09	48.00	-10.91	
25	17.832	37.06	48.00	-10.94	
26	1.198	36.89	48.00	-11.11	

COMPATIBLE ELECTRONICS

1/10/2000 14:42:22

MICROTEK ELECTRONICS, INC.
VIDEO TRANSMITTER
MODEL: MINILINK 2.4TA-90 II
FCC B - WHITE LEAD
TEST ENGINEER : Kyle Fujimoto
KYLE FUJIMOTO

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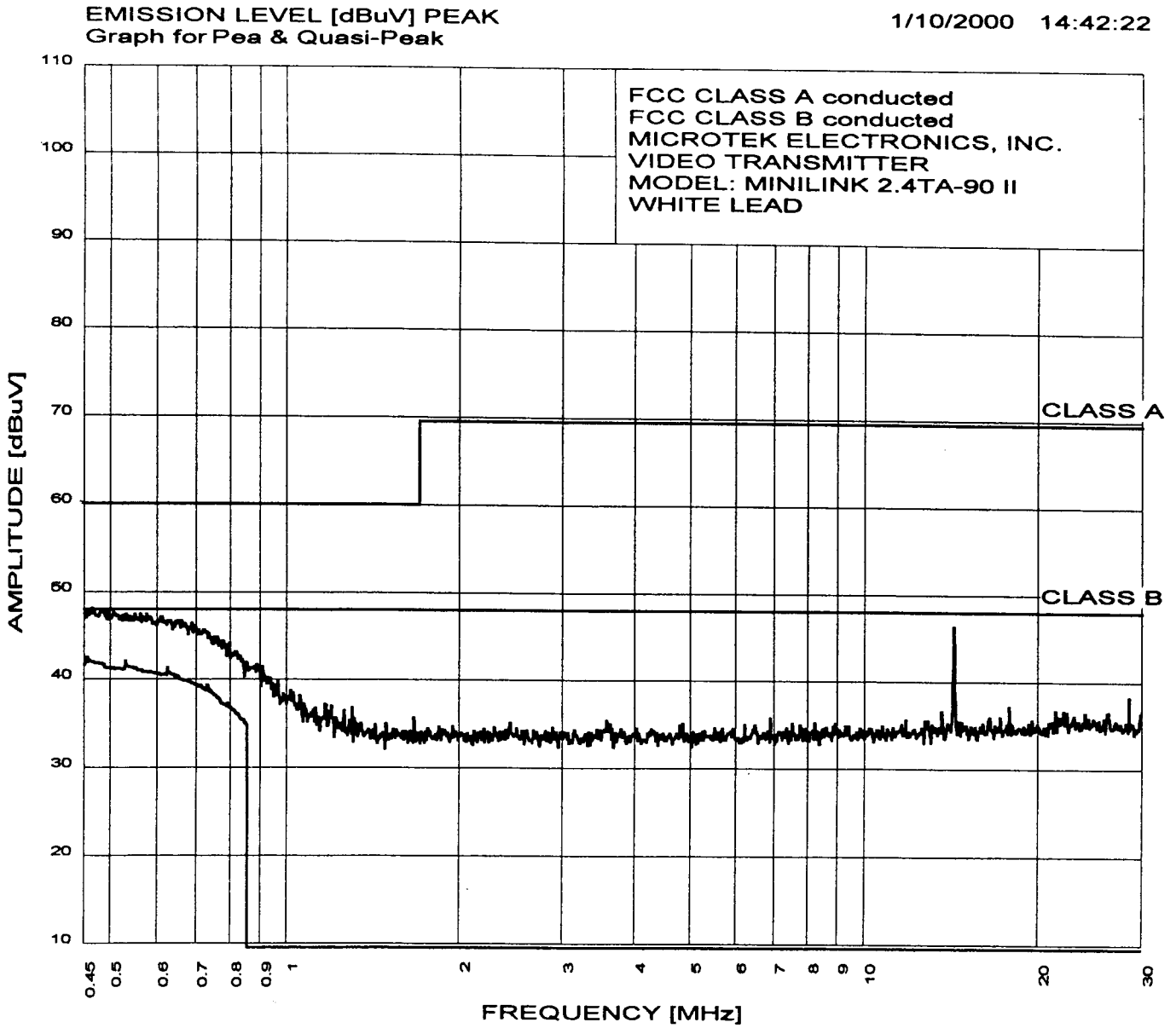
9 highest peaks above -50.00 dB of CLASS B limit line
Peak criteria : 0.10 dB, Curve : Quasi-peak

Peak#	Freq(MHz)	Amp(dBuV	Limit(dB)	Delta(dB)
1	0.454	42.39	48.00	-5.61
2	0.460	42.07	48.00	-5.93
3	0.530	41.97	48.00	-6.03
4	0.450	41.62	48.00	-6.38
5	0.625	41.21	48.00	-6.79
6	0.712	39.29	48.00	-8.71
7	0.730	39.25	48.00	-8.75
8	0.739	38.69	48.00	-9.31
9	0.791	37.19	48.00	-10.81


EMISSION LEVEL [dBuV] PEAK
Graph for Pea & Quasi-Peak
1/10/2000 14:42:22
FCC CLASS A conducted
FCC CLASS B conducted
MICROTEK ELECTRONICS, INC.
VIDEO TRANSMITTER
MODEL: MINILINK 2.4TA-90 II
WHITE LEAD
CLASS A
CLASS B
AMPLITUDE [dBuV]
110
100
90
80
70
60
50
40
30
20
10
0.45
0.5
0.6
0.7
0.8
0.9
1
2
3
4
5
6
7
8
9
10
20
30
FREQUENCY [MHz]

COMPATIBLE ELECTRONICS

1/10/2000 14:35:11

MICROTEK ELECTRONICS, INC.
VIDEO TRANSMITTER
MODEL: MINILINK 2.4TA-90 II
FCC B - BLACK LEAD
TEST ENGINEER : Kyle Fujimoto
KYLE FUJIMOTO

25 highest peaks above -50.00 dB of CLASS B limit line
Peak criteria : 0.80 dB, Curve : Peak

Peak#	Freq(MHz)	Amp(dBuV	Limit(dB)	Delta(dB)	
1	0.466	45.80	48.00	-2.20	SEE Q.P.
2	14.272	45.58	48.00	-2.42	
3	0.478	45.30	48.00	-2.70	
4	0.454	45.10	48.00	-2.90	
5	0.522	44.90	48.00	-3.10	
6	0.489	44.80	48.00	-3.20	
7	0.507	44.70	48.00	-3.30	
8	0.513	44.30	48.00	-3.70	
9	0.544	44.30	48.00	-3.70	
10	0.565	44.30	48.00	-3.70	
11	0.539	44.20	48.00	-3.80	
12	0.558	43.40	48.00	-4.60	
13	0.612	43.30	48.00	-4.70	
14	0.597	43.00	48.00	-5.00	
15	0.604	42.60	48.00	-5.40	
16	0.625	42.00	48.00	-6.00	
17	0.632	42.00	48.00	-6.00	
18	0.660	41.70	48.00	-6.30	
19	0.679	41.30	48.00	-6.70	
20	0.691	40.90	48.00	-7.10	
21	0.697	40.90	48.00	-7.10	
22	0.718	39.70	48.00	-8.30	
23	0.730	39.40	48.00	-8.60	
24	0.739	39.40	48.00	-8.60	
25	0.768	39.00	48.00	-9.00	

SEE QUASI-PEAK ON NEXT PAGE AND ON PLOT

COMPATIBLE ELECTRONICS

1/10/2000 14:35:11

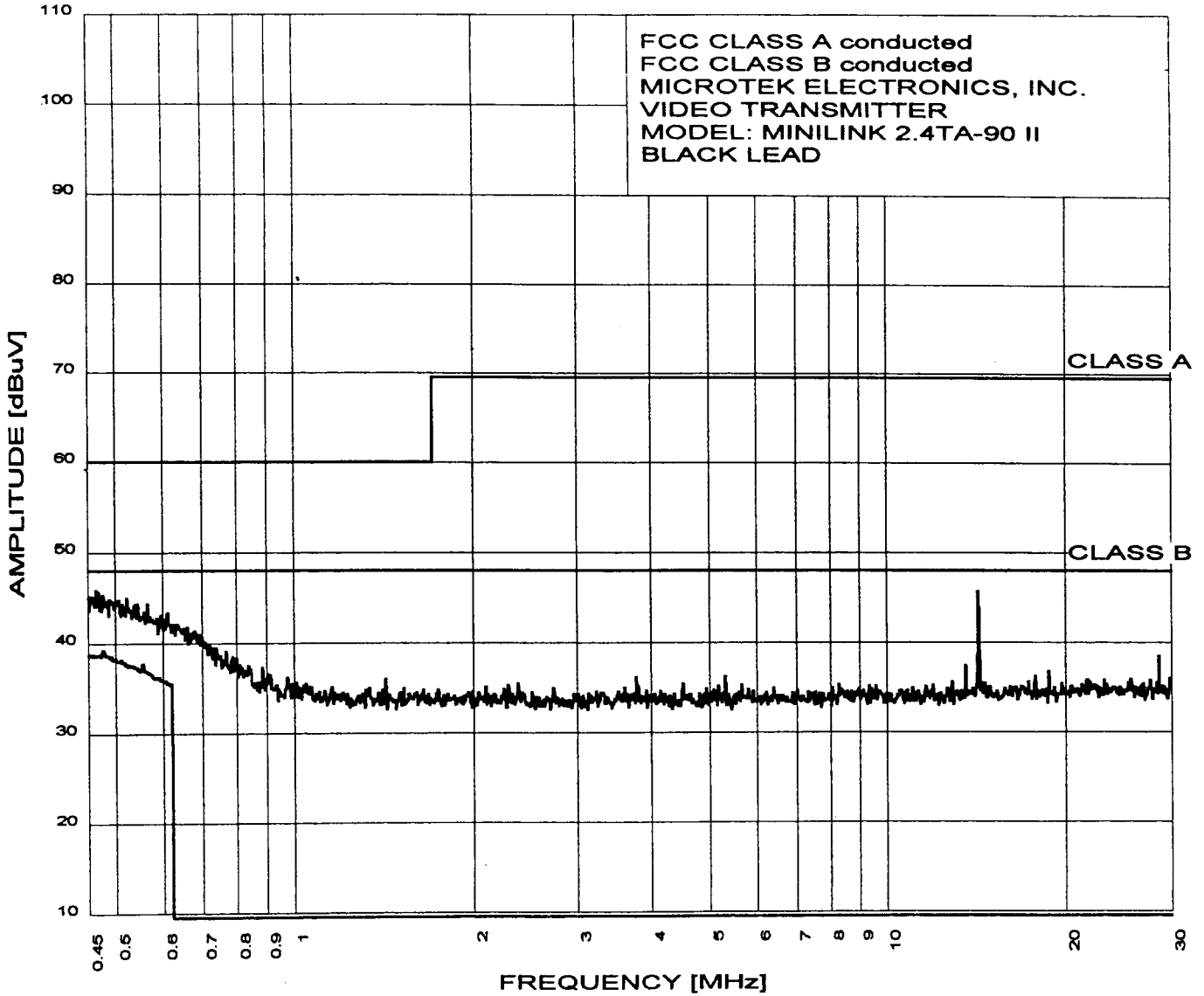
MICROTEK ELECTRONICS, INC.
VIDEO TRANSMITTER
MODEL: MINILINK 2.4TA-90 II
FCC B - BLACK LEAD
TEST ENGINEER : Kyle Fujimoto
KYLE FUJIMOTO

7 highest peaks above -50.00 dB of CLASS B limit line
Peak criteria : 0.10 dB, Curve : Quasi-peak

Peak#	Freq(MHz)	Amp(dBuV	Limit(dB)	Delta(dB)
1	0.478	39.17	48.00	-8.83
2	0.472	38.64	48.00	-9.36
3	0.492	38.48	48.00	-9.52
4	0.498	38.22	48.00	-9.78
5	0.511	38.08	48.00	-9.92
6	0.556	37.64	48.00	-10.36
7	0.526	37.55	48.00	-10.45

EMISSION LEVEL [dBuV] PEAK
Graph for Pea & Quasi-Peak

1/10/2000 14:35:11



1.7 Temperature Stability 2.995 (a) (1)

Minilink 2.4-101 Transmitter

+50 C	2457.9045 mHz
+40 C	2457.9069 mHz
+30 C	2457.9093 mHz
+20 C	2457.9120 mHz
+10 C	2457.9146 mHz
0 C	2457.9179 mHz
-10 C	2457.9209 mHz
-20 C	2457.9237 mHz
-30 C	2457.9265 mHz

Voltage Stability

Minilink 2.4-101 Transmitter

Battery Supply 2.995 (d) (2)

8.5VDC 2457.915 mHz and 2473.925 mHz

Primary AC supply 2.995 (d) (2)

102 VAC	2457.915 mHz and 2473.925 mHz
123 VAC	2457.915 mHz and 2473.925 mHz
141 VAC	2457.915 mHz and 2473.925 mHz

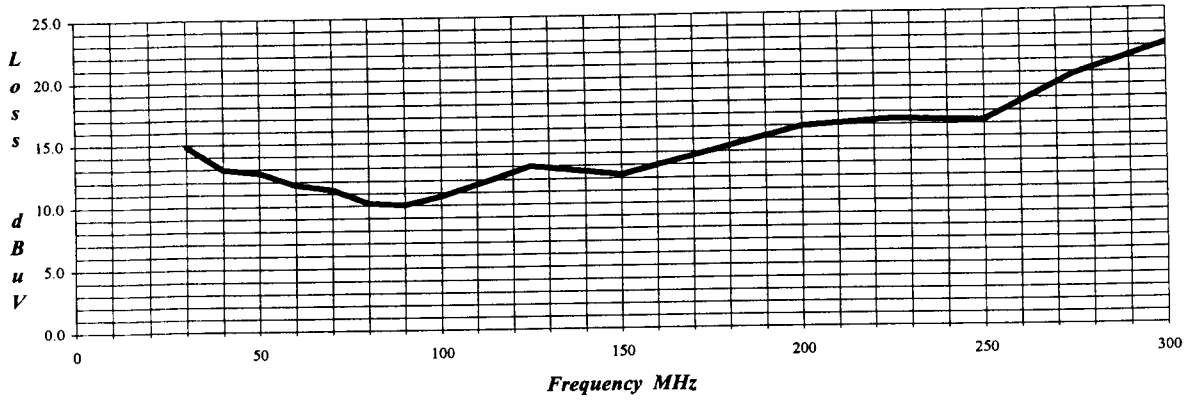
Note:

The stability is due to the double internal regulation design, 8-volt feeding 78L05.

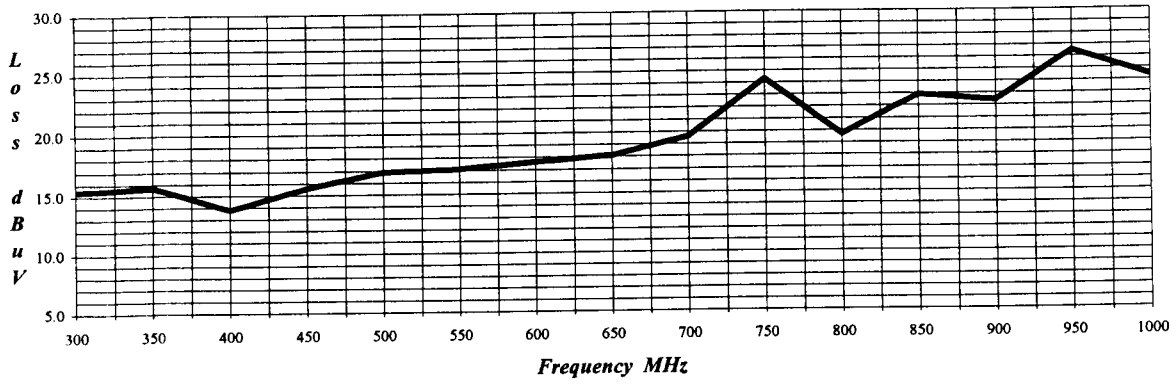
2.1 TEST EQUIPMENT

1. CHART WITH LOG, BICONICAL, AND PREAMPLIFIER FACTORS
2. RADIATED AND CONDUCTED TEST PROCEDURE
3. MICROWAVE PREAMPLIFIER FACTORS
4. LOOP FACTORS
5. HORN ANTENNA FACTORS
6. TESTING EQUIPMENT USED FOR THE TEST

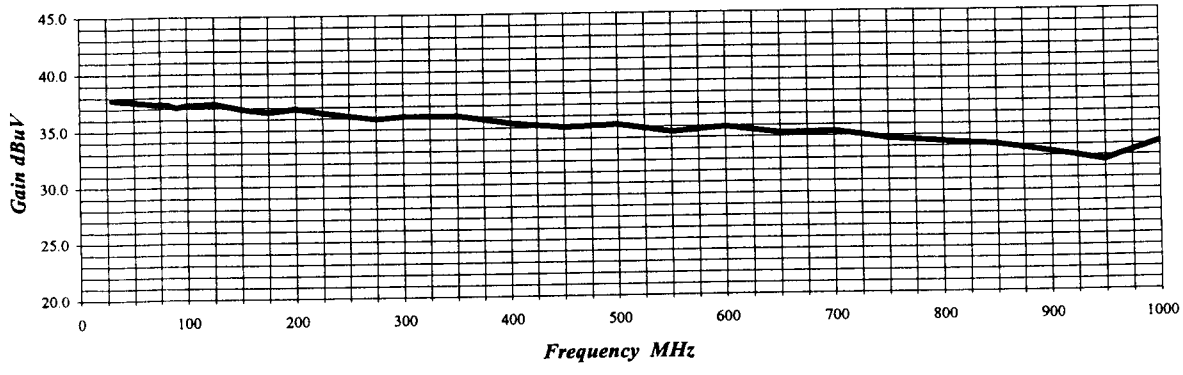
LAB "D" BICONICAL ANTENNA AB-100 S/N 01548 Cal: 10-14-99



LAB "D" LOG PERIODIC ANTENNA AL-100 S/N 16039 Cal: 10-14-99



PREAMPLIFIER EFFECTIVE GAIN AT 3 METERS PA-102 S/N: 1017 Lab "D"
Effective 1-16-99



7. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

7.1 Conducted Emissions Test

The spectrum analyzer was used as a measuring meter. The data was collected with the spectrum analyzer in the peak detect mode with the "Max Hold" feature activated. The quasi-peak was used only where indicated in the data sheets. A 10 dB attenuation pad was used for the protection of the spectrum analyzer input stage, and the offset was adjusted accordingly to read the actual data measured. The LISN output was measured using the spectrum analyzer. The output of the second LISN was terminated by a 50 ohm termination. The effective measurement bandwidth used for this test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI C63.4: 1992. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The conducted emissions from the EUT were maximized for operating mode as well as cable placement. The final data was collected under program control by the HP software in several overlapping sweeps by running the spectrum analyzer at a minimum scan rate of 10 seconds per octave.

7.2 Radiated Emissions (Spurious and Harmonics) Test

The spectrum analyzer was used as a measuring meter along with the quasi-peak adapter. Amplifiers were used to increase the sensitivity of the instrument. The Com Power Preamplifier Model: PA-102 was used for frequencies from 30 MHz to 1 GHz, and the Com-Power Microwave Preamplifier Model: PA-122 was used for frequencies above 1 GHz. The spectrum analyzer was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the spectrum analyzer records the highest measured reading over all the sweeps.

For the peak readings below 1000 MHz that were within 3 dB of the spec limit or higher, the quasi-peak adapter was used.

For the peak readings above 1000 MHz that were within 3dB of the spec limit or higher, the readings were averaged manually by narrowing the video filter down to 1 Hz and slowing the sweep time to keep the amplitude reading calibrated.

The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE	EFFECTIVE MEASUREMENT BANDWIDTH	TRANSDUCER
9 kHz to 150 kHz	200 Hz	Active Loop Antenna
150 kHz to 30 MHz	9 kHz	Active Loop Antenna
30 MHz to 300 MHz	120 kHz	Biconical Antenna
300 MHz to 1 GHz	120 kHz	Log Periodic Antenna
1 GHz to 22 GHz	1 MHz	Horn Antenna

The open field test site of Compatible Electronics, Inc. was used for radiated emission testing. This test site is set up according to ANSI C63.4: 1992. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The gunsight method was used when measuring with the horn antenna in order to ensure accurate results.

The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT. The EUT was tested at a 3 meter test distance to obtain final test data.

HEWLETT PACKARD 8349B

MICROWAVE PREAMPLIFIER

S/N: 2548A00432

CALIBRATION DATE: JANUARY 7, 2000

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	10.7	8	23.5
1.1	18.4	8.5	22.8
1.2	22.3	9.0	23.6
1.3	25.1	9.5	23.2
1.4	27.3	10.0	23.9
1.5	29.5	10.5	27.3
1.6	28.7	11.0	28.0
1.7	28.8	11.5	27.6
1.8	29.0	12.0	23.2
1.9	29.1	12.5	19.3
2.0	28.8	13.0	22.1
2.5	26.8	13.5	20.7
3.0	28.2	14.0	23.2
3.5	24.2	14.5	23.8
4.0	25.8	15.0	23.8
4.5	22.1	15.5	25.0
5.0	23.3	16.0	22.7
5.5	21.7	16.5	22.8
6.0	21.8	17.0	23.6
6.5	22.9	17.5	22.2
7.0	21.8	18.0	20.4
7.5	25.0	18.5	18.4
19.0	17.9	19.5	18.9
20.0	13.1		

ANTENNA RESEARCH ASSOCIATES, INC.
11317 Frederick Avenue, Beltsville, MD 20705

E-FIELD ANTENNA FACTOR CALIBRATION

E(dB V/m) = Vo(dB V) + AFE(dB/m)

Model number : DRG-118/A

Frequency GHz	AFE dB/m	Gain dBi
1	22.3	8.0
2	26.7	9.5
3	29.7	10.1
4	29.5	12.8
5	32.3	12.0
6	32.4	13.4
7	36.1	11.0
8	37.4	10.9
9	36.8	12.5
10	39.5	10.7
11	39.6	11.5
12	39.8	12.0
13	39.7	12.8
14	41.8	11.3
15	41.9	11.9
16	38.1	16.3
17	41.0	13.9
18	46.5	8.9

Serial number : 1053
Job number : 96-092
Remarks : 3 meter calibration
Standards : LPD-118/A, TE-1000

Temperature : 72° F
Humidity : 56 %
Traceability : A01887
Date : December 08, 1995

Calibrated By

Com-Power Corporation

(949) 587-9800

Antenna Calibration

Antenna Type:	Loop Antenna
Model:	AL-130
Serial Number:	25309
Calibration Date:	4/13/99

Frequency MHz	Magnetic (dB/m)	Electric (dB/m)
0.01	-40.6	10.9
0.02	-41.5	10.0
0.03	-39.9	11.6
0.04	-40.2	11.3
0.05	-41.5	10.0
0.06	-41.1	10.4
0.07	-41.3	10.2
0.08	-41.6	9.9
0.09	-41.7	9.8
0.1	-41.7	9.8
0.2	-44.0	7.5
0.3	-41.6	9.9
0.4	-41.6	9.9
0.5	-41.7	9.8
0.6	-41.5	10.0
0.7	-41.4	10.1
0.8	-41.5	10.0
0.9	-41.6	9.9
1	-41.2	10.3
2	-40.5	11.0
3	-40.8	10.7
4	-41.0	10.5
5	-40.5	11.0
6	-40.5	11.0
7	-40.7	10.8
8	-40.8	10.7
9	-40.1	11.4
10	-40.4	11.1
12	-41.0	10.5
14	-42.1	9.4
15	-42.3	9.2
16	-42.7	8.8
18	-41.0	10.5
20	-41.1	10.4
25	-43.4	8.1
30	-45.3	6.2

Trans. Antenna Height	2 meter
Receiving Antenna Height	2 meter

5.2 EMI Test Equipment

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. CYCLE
Spectrum Analyzer	Hewlett Packard	8566B	3638A08789	July 28, 1999	1 Year
Preamplifier	Com Power	PA-102	1017	January 16, 1999	1 Year
Quasi-Peak Adapter	Hewlett Packard	85650A	3303A01688	November 10, 1999	1 Year
RF Attenuator	Sertek	412-10	N/A	November 22, 1999	1 Year
LISN	Com Power	LI-215	12075	November 13, 1999	1 Year
LISN	Com Power	LI-215	12078	November 13, 1999	1 Year
Biconical Antenna	Com Power	AB-100	1548	October 14, 1999	1 Year
Log Periodic Antenna	Com Power	AL-100	16039	October 14, 1999	1 Year
Antenna Mast	Com Power	AM-100	N/A	N/A	N/A
Turntable	Com Power	TT-100	N/A	N/A	N/A
Computer	Hewlett Packard	D5251A 888	US74458128	N/A	N/A
Printer	Hewlett Packard	C5886A	SG7CM1P090	N/A	N/A
Monitor	Hewlett Packard	D5258A	DK74889705	N/A	N/A
Microwave Preamplifier	Hewlett Packard	8349B	2548A00432	January 7, 2000	1 Year
Horn Antenna	Antenna Research	DRG-118/A	1053	December 8, 1995	N.C.R.
Loop Antenna	Com-Power	AL-130	25309	April 13, 1999	1 Year