SHURE®

MICROPHONES AND ELECTRONIC COMPONENTS

Shure Brothers
Incorporated

222 Hartrey Avenue
Evanston, IL 60202-3696 • U.S.A.

September 30, 1999

Mr. George Tannahill
FCC Application Processing Branch

Re: FCC ID DD4UC1B
Correspondence Reference Number: 9790
731 Confirmation Number: EA94793
Date of Original E-mail: 09/23/1999

Dear Mr. Tannahill,

With respect to the questions you raised in your E-mail message of the above date:

1. A response to the ERP issue is being addressed by Mr. Arnon C. Rowe of D.L.S. Electronic Systems and is included with these attachments.

2. The occupied bandwidth plots were obtained by following the procedure detailed below, which was previously recommended by your office:

   First, the modulation frequency of maximum response was established by supplying an audio signal to the transmitter input, at a level well below the onset of limiting, and varying its frequency over the entire audio range until the point was found where maximum deviation occurs. Then, the audio signal was adjusted so as to produce 50% modulation (22.5 kHz deviation, in the case of the UC1B) on a Boonton Model 8200 modulation analyzer, and the audio input level was recorded. Next the audio frequency was changed to 2500 Hz, and the input level was increased by 16 dB over that which was recorded at the frequency of maximum response. A plot was then made of the resulting emission. In addition, several other plots were made at other representative modulation frequencies, using the same input level, so as to demonstrate the transmitter's modulation characteristics. A reference plot was also made with no audio modulation applied.

   Note that this transmitter incorporates a 32.768 kHz continuous pilot (control) signal (referred to by Shure as "Tone Key"). Note also, that the Boonton modulation analyzer employs a broadband demodulator. Thus, the deviation of the pilot signal affects the setting of the 50% modulation point. This is probably why the modulation plots appear to be undermodulated. A percentage of the deviation is due to the pilot signal.

   It is possible to perform the procedure in such a way that the modulation due to the pilot signal is ignored in determining the audio input level for 22.5 kHz deviation. To demonstrate this, the above procedure was repeated with the pilot signal temporarily disabled while the audio input level for 22.5 kHz deviation was being determined. A second series of plots showing the resulting emissions have been provided with this attachment. All occupied bandwidth plots were made with the pilot signal re-enabled, with

the exception of one reference plot which was made with the pilot signal disabled and no audio input. You will observe that although larger than in the previous set of plots which were included in the original submission, in no case does the occupied bandwidth of the emission exceed the specified limits. Again, the difference is due to the inclusion or exclusion of the pilot signal in setting up the reference audio input level for 50% modulation (22.5 kHz deviation).

3. There was a typographical error in the specification of the emission designator. According to Section 2.201 of the Commission's Rules, F3E would designate Frequency Modulation, a single channel containing analogue information, and telephony or sound broadcasting. You have indicated that you feel this may be the most appropriate. Another possible designator would be FXW, due to the inclusion of the continuous 32.768 pilot signal which is used by the receiver for telemetry and control. The designator FXW indicates Frequency Modulation, cases not covered, and a combination of modulation types (in this case, telephony or sound broadcasting and telemetry). We will accept whatever designator you would prefer.

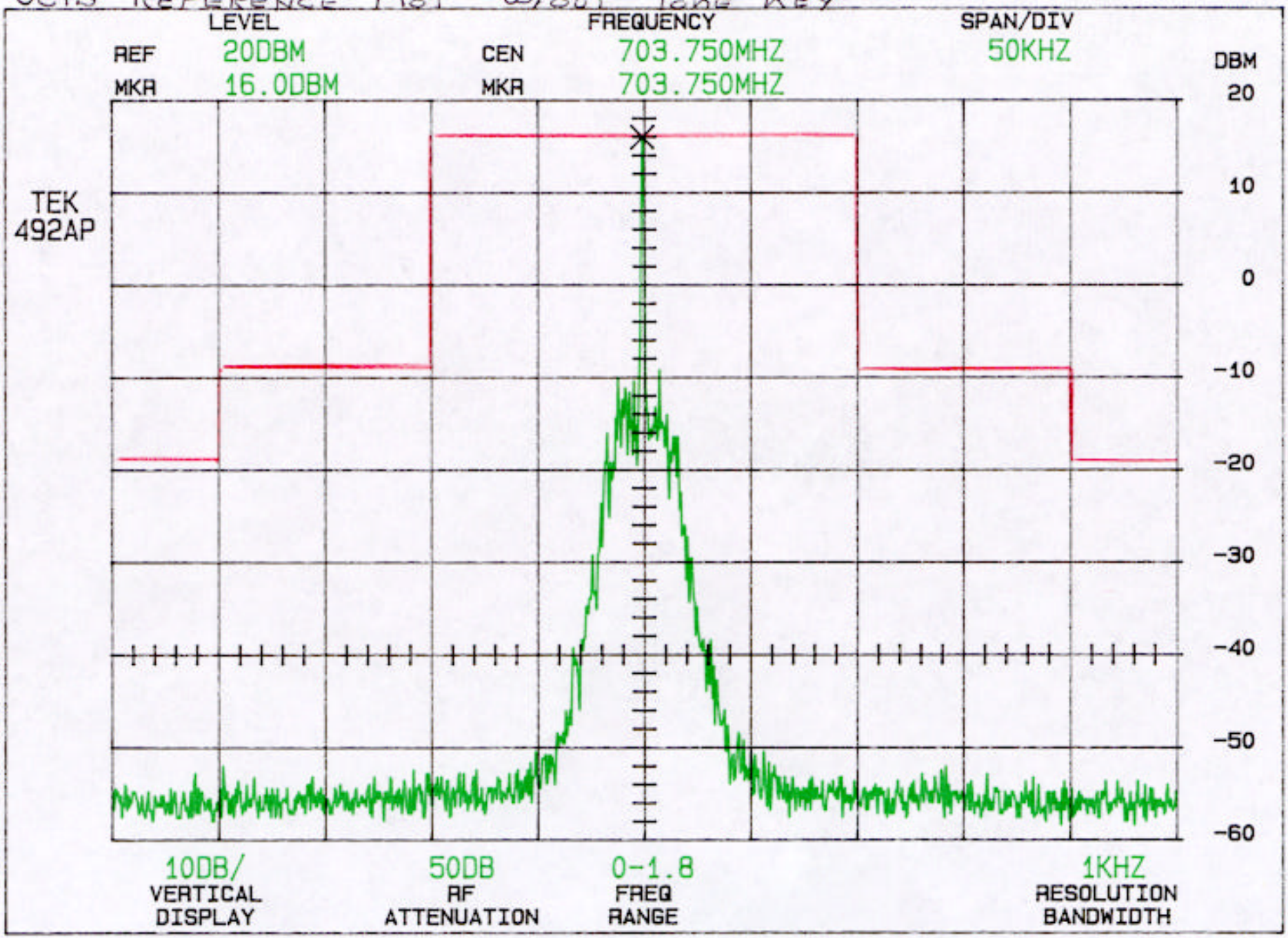
4. The modulation limiting plot was intended to demonstrate the transmitter's modulation characteristics at input levels up to, and beyond input levels for normal operation. From the occupied bandwidth plots, you will note that the audio input level for 16 dB above 50% modulation at the frequency of peak response is –60 dBV, (or –55.5 dBV if deviation due to the pilot signal is disregarded). The peak deviation is dependent upon the modulation frequency due to pre-emphasis; however it would be close to 40 kHz at the frequency of maximum response if the pilot signal is included in determining the input level for the occupied bandwidth. Shure uses 45 kHz as the nominal 100% modulation point.

We trust that the above information will be helpful to you. If you have any further questions, please do not hesitate to contact us.

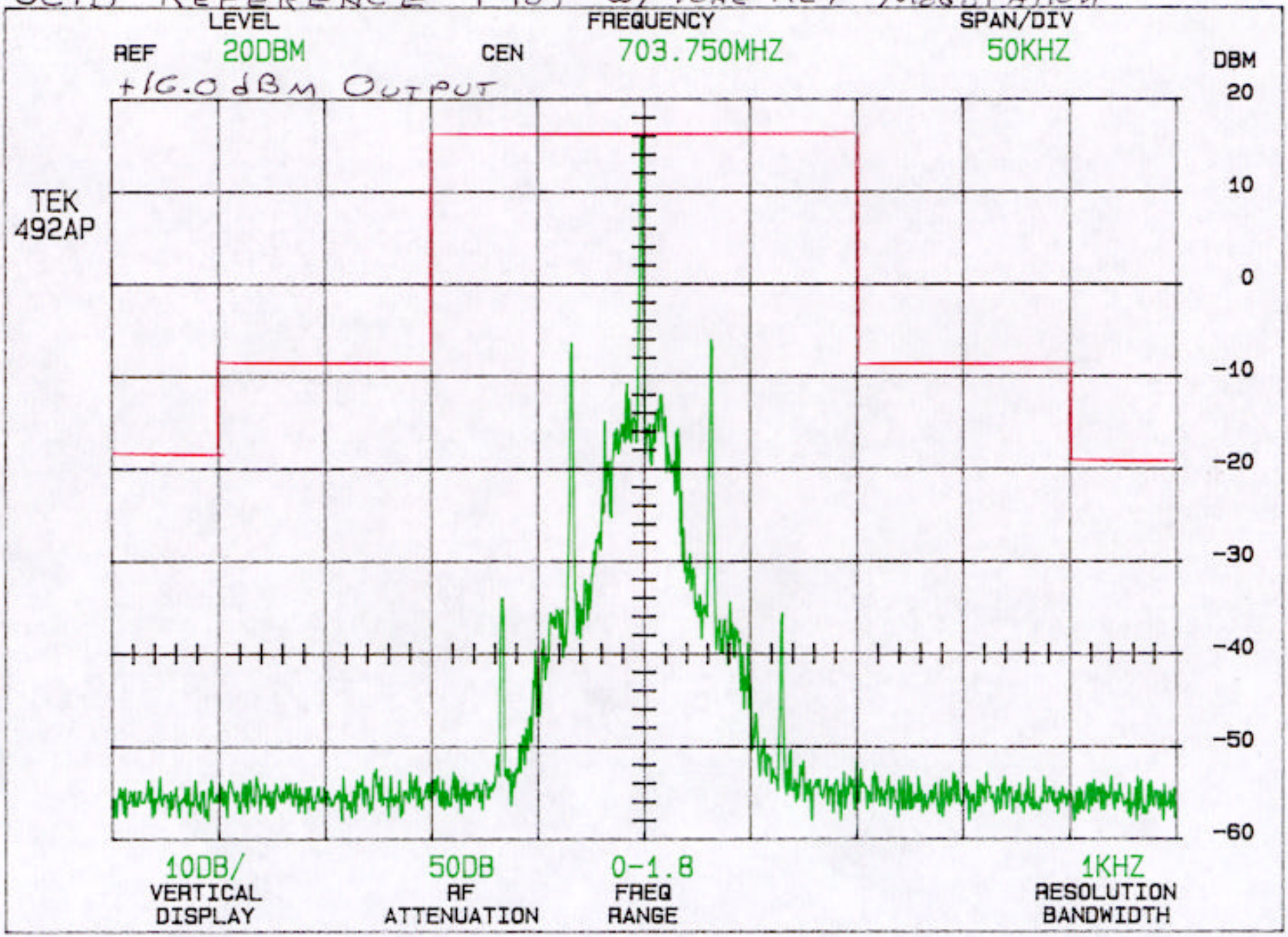
Sincerely,

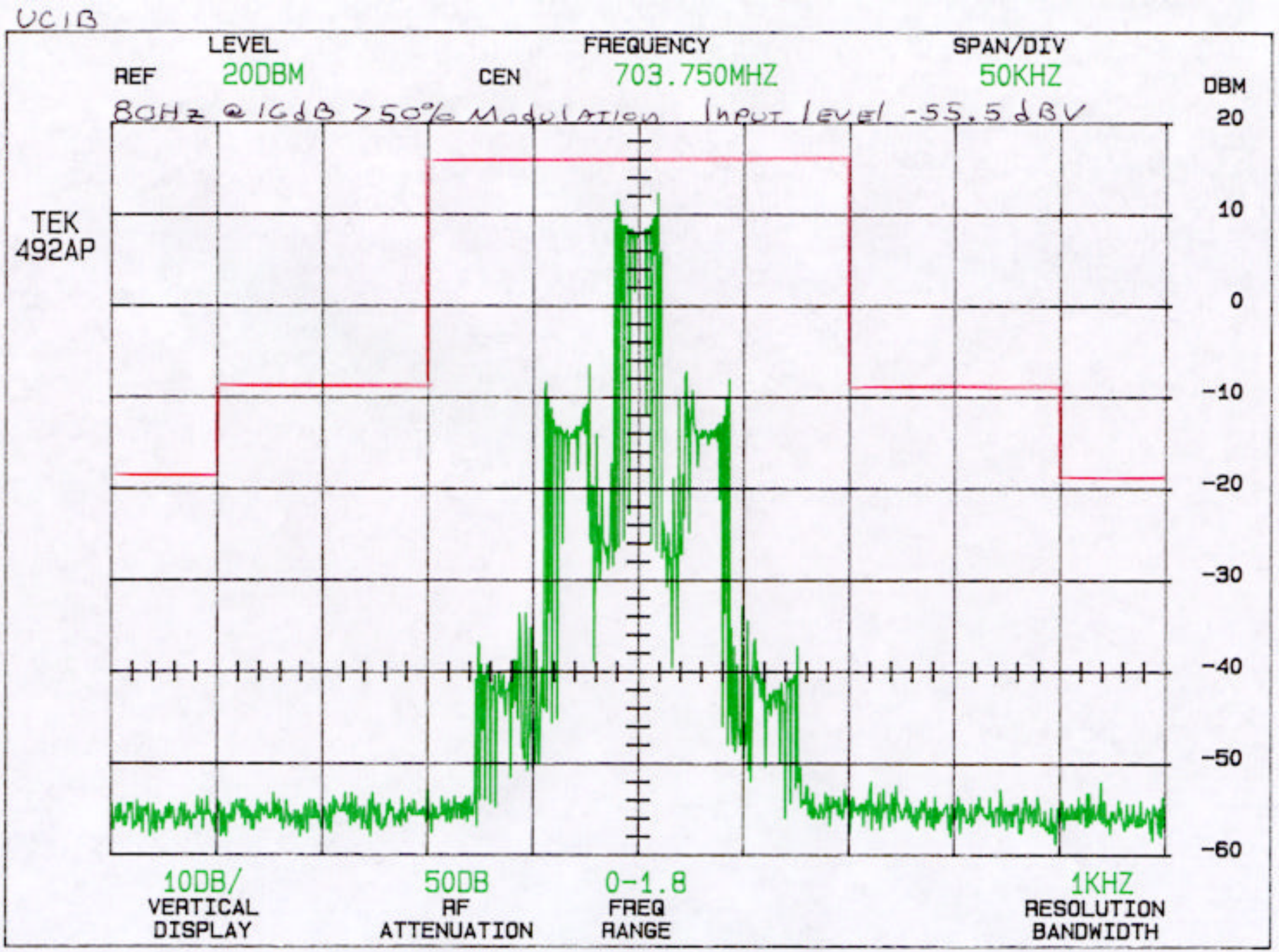
Edgar C. Reihl, P.E.
Principal Engineer
Shure Brothers Incorporated
Telephone: (847) 866-2289
E-mail: ereihl@shure.com

UCIB Reference Plot w/out Tone Key

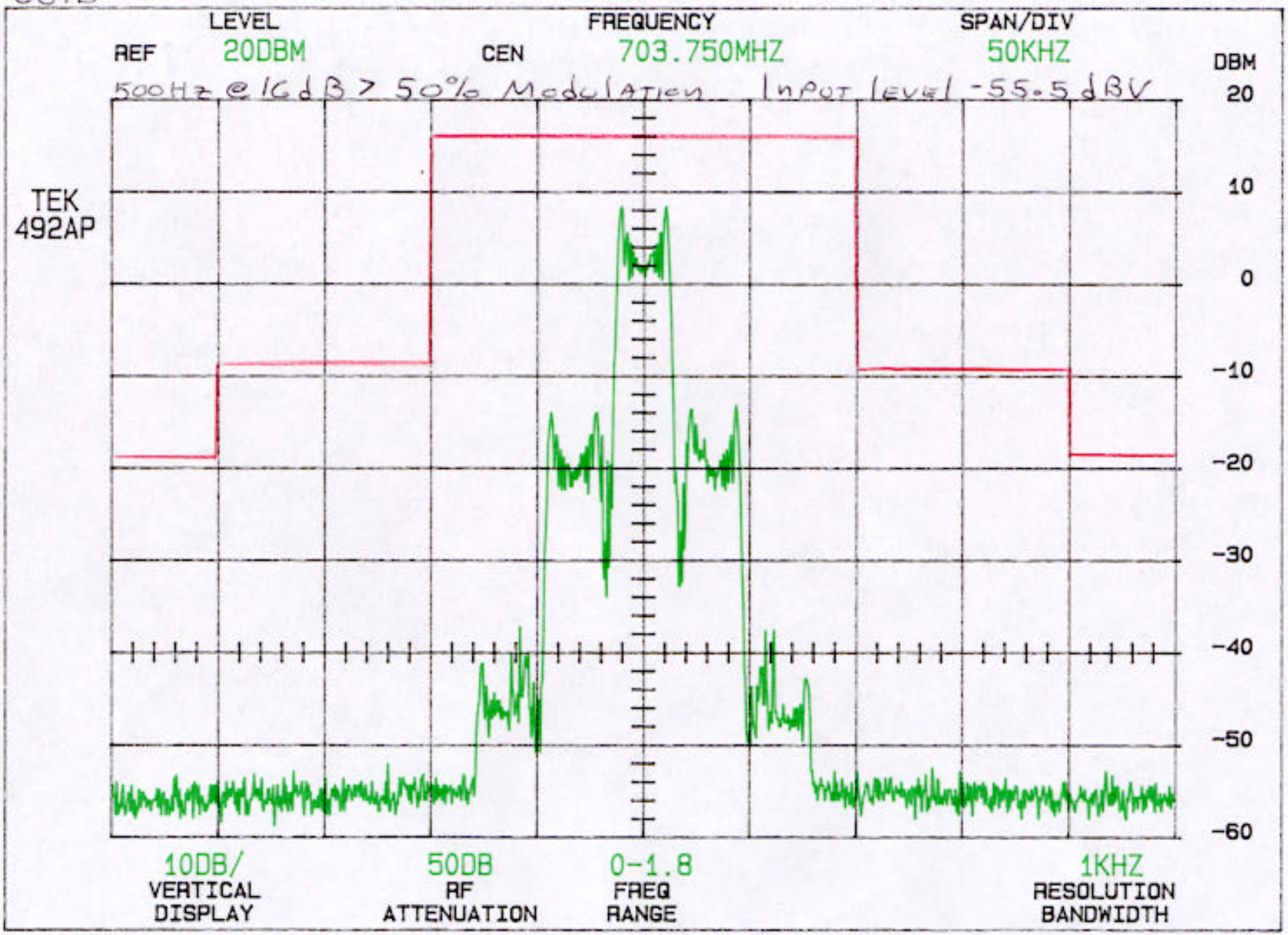


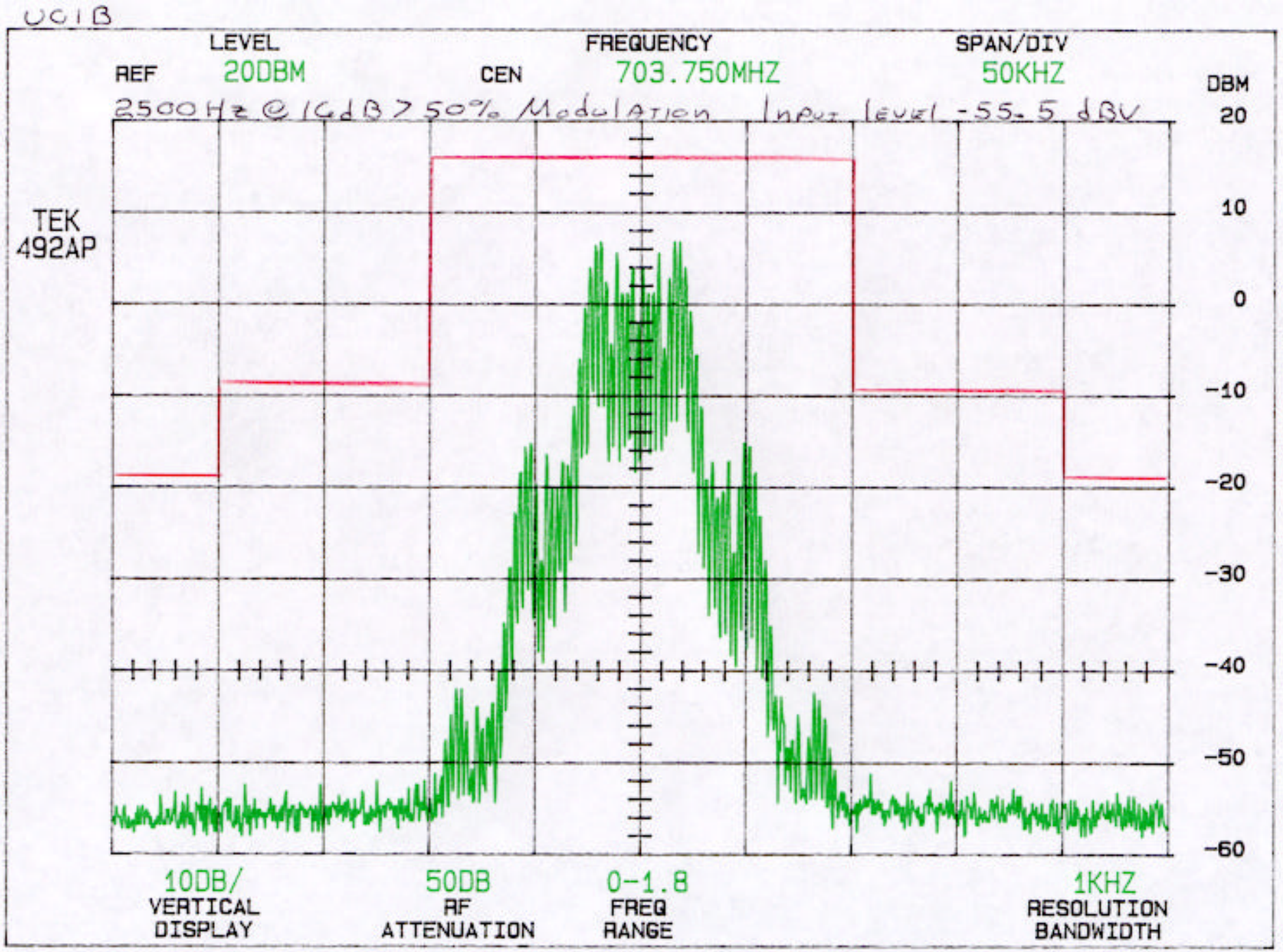
UCIB Reference Plot w/ Tone Key Modulation

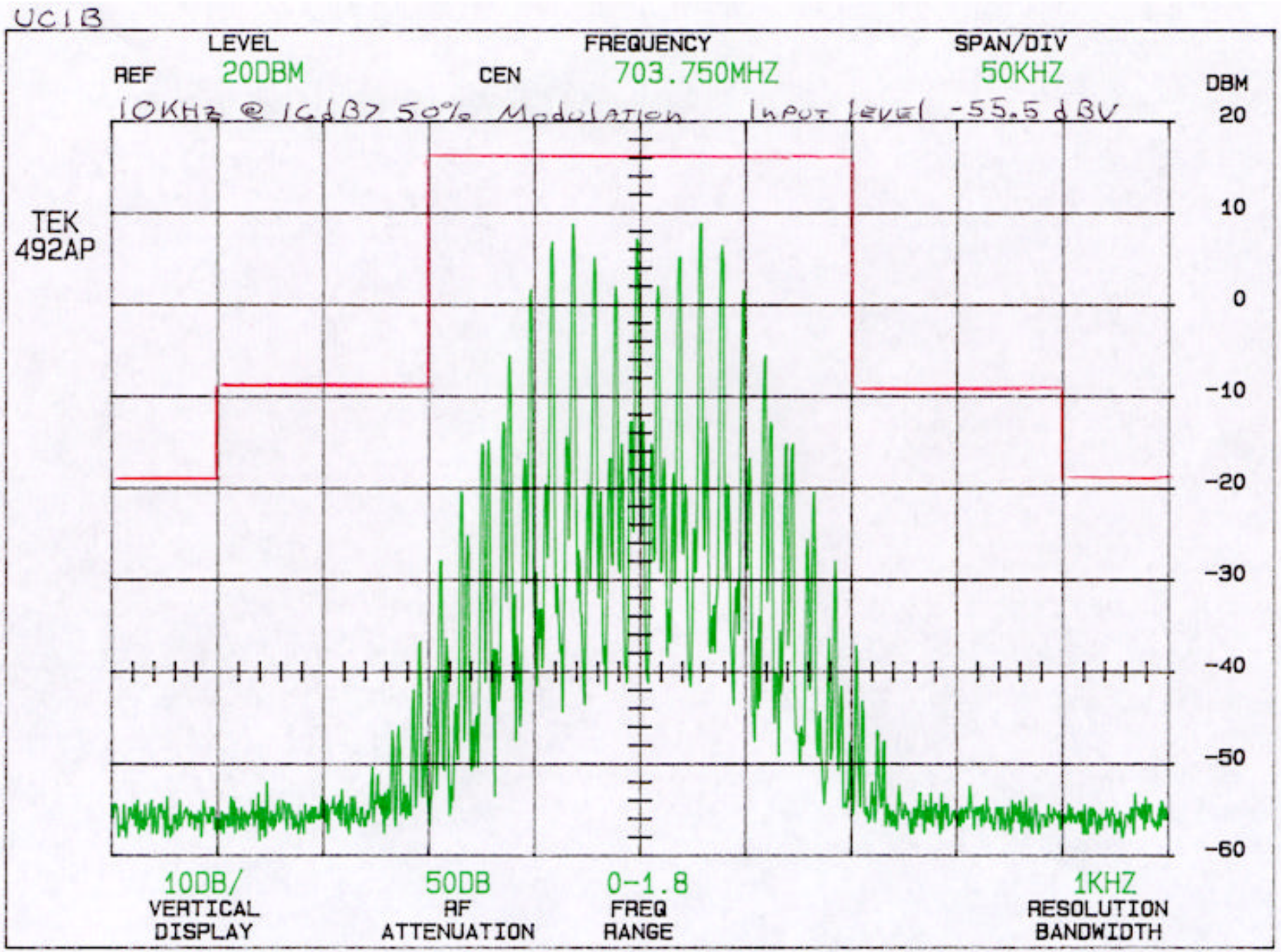


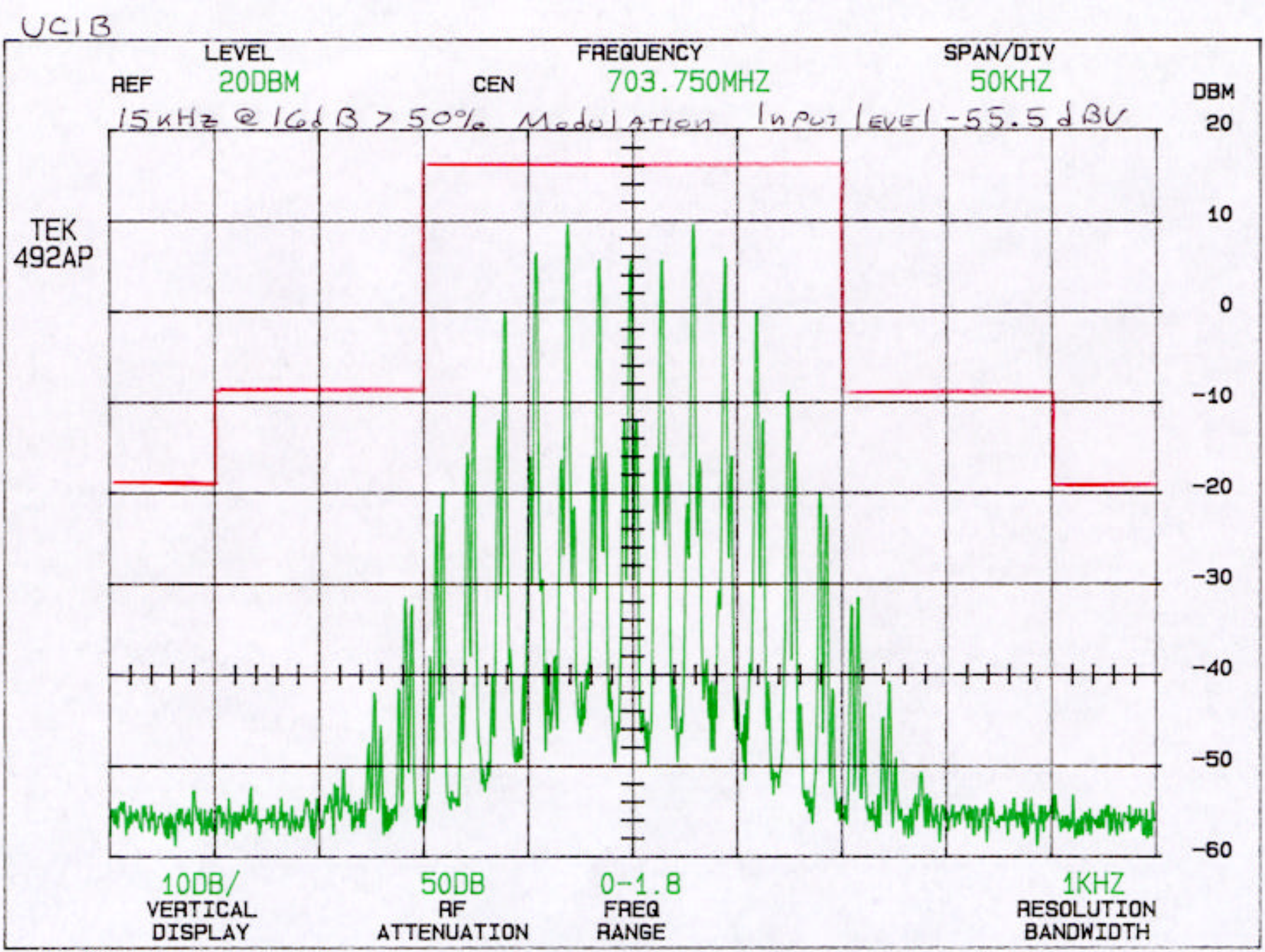

UC1B
LEVEL
FREQUENCY
SPAN/DIV
REF
20DBM
CEN
703.750MHZ
50KHZ
DBM
80Hz @ 16dB 750% Modulation Input level -55.5 dBV
TEK
492AP
20
10
0
-10
-20
-30
-40
-50
-60
10DB/
VERTICAL
DISPLAY
50DB
RF
ATTENUATION
0-1.8
FREQ
RANGE
1KHZ
RESOLUTION
BANDWIDTH

UC1B


LEVEL
REF
20DBM
FREQUENCY
CEN
703.750MHZ
SPAN/DIV
50KHZ
500Hz @ 16dB > 50% Modulation
Input Level -55.5dBV
TEK
492AP
DBM
20
10
0
-10
-20
-30
-40
-50
-60
10DB/
VERTICAL
DISPLAY
50DB
RF
ATTENUATION
0-1.8
FREQ
RANGE
1KHZ
RESOLUTION
BANDWIDTH


UC1B
LEVEL
REF 20DBM
FREQUENCY
CEN 703.750MHZ
SPAN/DIV
50KHZ
2500Hz @ 16dB > 50% Modulation Input level -55.5 dBV
DBM
20
10
0
-10
-20
-30
-40
-50
-60
TEK
492AP
10DB/
VERTICAL
DISPLAY
50DB
RF
ATTENUATION
0-1.8
FREQ
RANGE
1KHZ
RESOLUTION
BANDWIDTH


UC1B
LEVEL
FREQUENCY
SPAN/DIV
REF
20DBM
CEN
703.750MHZ
50KHZ
10KHz @ 16dBV 50% Modulation
Input level -55.5 dBV
DBM
20
10
0
-10
-20
-30
-40
-50
-60
TEK
492AP
10DB/
VERTICAL
DISPLAY
50DB
RF
ATTENUATION
0-1.8
FREQ
RANGE
1KHZ
RESOLUTION
BANDWIDTH


UC1B
LEVEL
REF 20DBM
FREQUENCY
CEN 703.750MHZ
SPAN/DIV
50KHZ
15 kHz @ 16dB > 50% Modulation Input Level -55.5 dBV
TEK 492AP
DBM
20
10
0
-10
-20
-30
-40
-50
-60
10DB/ VERTICAL DISPLAY
50DB RF ATTENUATION
0-1.8 FREQ RANGE
1KHZ RESOLUTION BANDWIDTH

Mr. George Tannahill
FCC Application Processing Branch

FCC ID DD4UC1B
Correspondence Reference Number: 9790
731 Confirmation Number: EA94793
Date of Original E-mail: 9/23/99

Dear Mr. Tannahill,

With respect to the questions you raised in your E-mail message of the above date:

> Please provide an ERP relative to a dipole power output measurement and show all measured values and calculations.
>
> Page 8 (power) and Page 31 (field strength) were updated and included with this letter.
>
> The emission designator requested is F3B. Based on the rest of the report it appears F3E is more appropriate. Please justify the requested designator.
>
> The correct emission designator is F3E. This was an error made when doing the data entry.

Arnom (Arine) Rowe
Test Engineer
EMC-001375-NE

5.0 TEST EQUIPMENT (Bandwidths and Detector Function)

All data was automatically plotted using peak detector function. This information was then used to determine the frequencies of maximum emissions. The FCC performed manual measurements on these frequencies using a peak detector function of the Analyzer with the bandwidths specified. From 200 MHz to 1000 MHz a bandwidth of 100 kHz was used (except for Occupied Bandwidth), and above 1000 MHz, wide enough bandwidths were used, depending upon the test being made, to ensure proper measurement of the narrowband signal. A list of the equipment used can be found in Table 1. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

6.0 RF POWER OUTPUT - PART 2.1046

As stated in PART 74.861 (e-1), the output power should not exceed 250 milliwatts (24 dBm). The UC Wireless Series Transmitter was tuned according to the tune-up procedures specified in Part 2.1033 (c-8), and adjusted for its maximum output power. The radiated signal from the EUT was measured in the open field at one or three meters.

Actual Measurements Taken:

84.00 dBuV Measured output of the transmitter
+30.67 dBuV Total system losses (Antenna, Pads & Cable)
114.67 dBuV which equals 58 mW

Manufacturer's rated output power = 0.05 watts

NOTE:

See the following pages for the graphs of the actual measurements made:

11.0 FIELD STRENGTH OF SPURIOUS EMISSION MEASUREMENTS (CON'T)
PART 2.1053

As stated in Part 74, Section 74.861 (e-1 iii) the limit is 250 mW in the frequency range 614 to 806 MHz.

To determine the **LIMIT** for Spurious Emissions, the following method was used:

Mean output power in watts:

Manufacturer's rated wattage **50 mW (See Paragraph 6.0, page 8)**

Free Space Formula

Convert to 3 meter test distance using the Free Space Formula

$$\frac{\sqrt{49.2 * rated\ wattage}}{\text{Distance}} = \frac{\sqrt{49.2 * .05w}}{3} = .522812904 \text{ volts/meter}$$

.522812904 v/m = 522812.904 uV/m

20*Log(522812.904) = 114.367 dBuV/m

So, the Fundamental at three meters equals 114.37 dBuV,

The emissions must be reduced by:

43 + 10*LOG10(0.05 watts) = 29.99 dB

Therefore, the **LIMIT** at three meters equals:

114.37 dBuV/m extrapolated level for 0.05 watts
-29.99 dB required reduction below the unmodulated fundamental
84.38 dBuV/M maximum spurious emissions allowed