

A. INTRODUCTION

The TRANSPONDITV2 is a low powered, battery operated transmitter designed for reading water, gas and electric meters. It operates at a nominal 919 MHz frequency. The transmitter, constructed on an etched circuit card, is powered from two 3 volt lithium batteries. An integral, loop antenna is used.

The TRANSPONDITV2 enables meter readings to be taken from a distance via a hand-held system, using the Ramar hand-held Radio Reader, or by Ramar's vehicle-mounted system, or by Ramar's fixed network product, the Micronode.

The TRANSPONDITV2 is comprised of one printed circuit board, housed in an ultrasonically-welded, waterproof box, with dimensions 75mm x 75mm x 20mm. The TRANSPONDITV2 can be connected to pulse output or electronic meters.

FM modulation consists of binary data at a rate of 100 kbps with a maximum deviation of +/- 100 kHz.

A data frame is 128 bits.

The data is scrambled using a 7 bit pseudo random code to avoid long periods of ones or zeros which would make clock recovery difficult in the receiver. This results in the spectrum having a "noise like" envelope.

Transmission duration is 2.5 milliseconds occurring every 47.6×10^{-3} seconds which corresponds to a PRF of 21 Hz. (See Figures 1a and 1b.)

The tested sample was modified at the request of the Commission to enable testing at the above period. It actually operates at a period of 5-10 or 20 seconds.

B. DESCRIPTION OF MEASUREMENT PROCEDURE: RADIATED MEASUREMENTS

Measurements of transmitter radiated emissions were made using ANSI 63.4 (1992) as the test procedure. Measurements were made with 3 meter spacing between the transmitter under test and the test equipment antenna.

The transmitter and attached 1-meter long sensor cable was placed on a rotatable table approximately 80 cm in height.

Fresh batteries were installed.

B. DESCRIPTION OF MEASUREMENT PROCEDURE: RADIATED MEASUREMENTS
(Continued)

Measurement of field strength was made through use of HP 8568B and Tektronix 494P spectrum analyzers in conjunction with HP 8447D and Avantek wide band, low noise preamplifiers; and, below 1 GHz, an HP 85650A quasi-peak adapter.

Above 1 GHz the 494P spectrum analyzer, a peak responding device, was used with Avantek amplifiers.

Eaton 3120 or "Roberts" calibrated dipoles were used as the test antennas in the 25-1000 MHz range. A Polarad CA-S, CA-L or Emco 3115 calibrated horn antennas were used between 1 and 10 GHz.

An analysis of time domain measurements (see plots in Figures 1 and 2) was made to determine average field intensity of any harmonics above 1 GHz. Sample calculations are included in Figure 3.

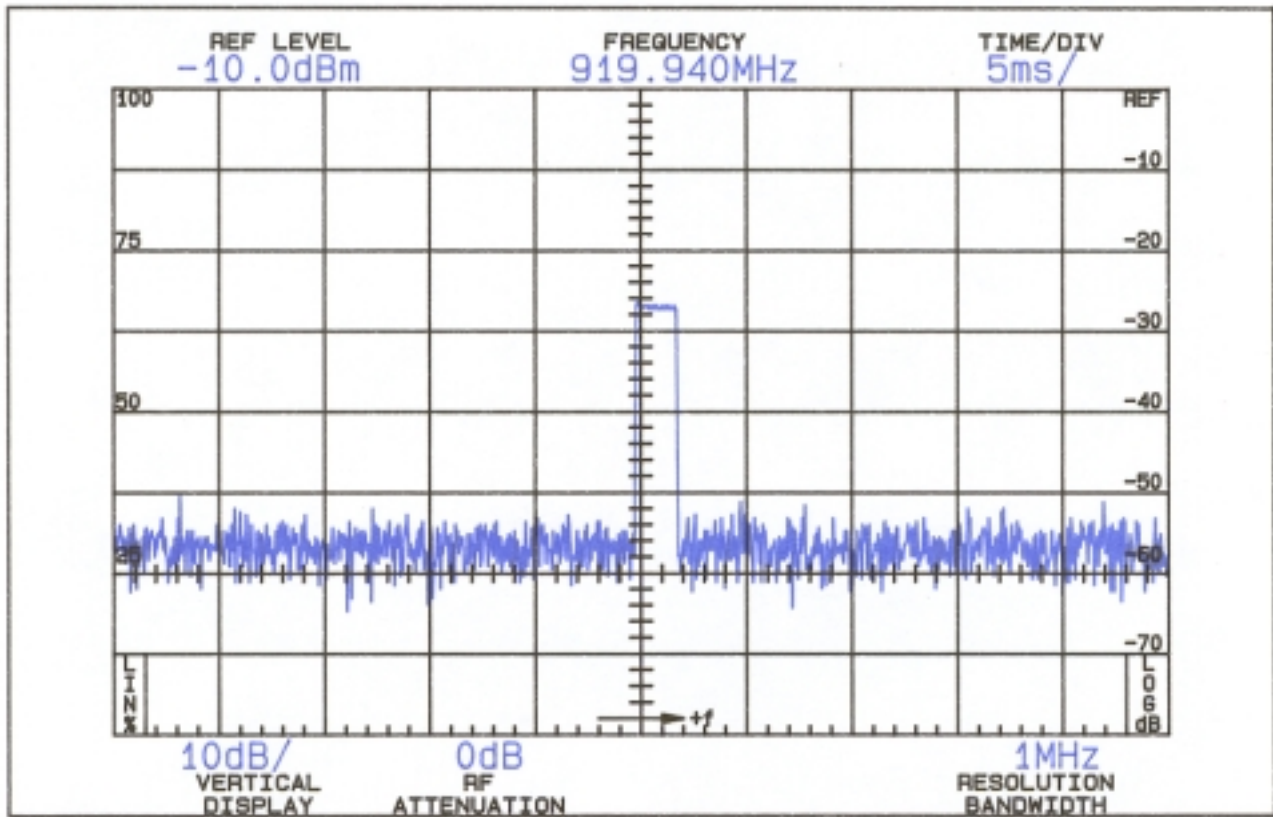
Based on time domain observations a correction factor for a nominal 50 mS averaging interval was computed and is included in Table 1 data.

For each spurious emission identified between 30 to the tenth harmonic the test assembly was rotated for maximum pickup, the test antenna varied in elevation and the test antenna polarization shifted between horizontal to vertical in order to maximize observed signals.

The measurement procedure included recording the worst-case field strength for receiving antenna polarization, test antenna height variation from 3 feet to 10 feet, test sample rotation, and placing the test sample on each of its major planes.

The spectrum was checked from 30 to 9200 MHz. All emissions not reported were more than 20 dB below the permitted level or below FCC limits but in the ambient/system noise floor. Tabulation of the measurements are shown in Table 1.

Specific forbidden band scans were made per Paragraph 15.205 and 15.209.



BIT DETAIL

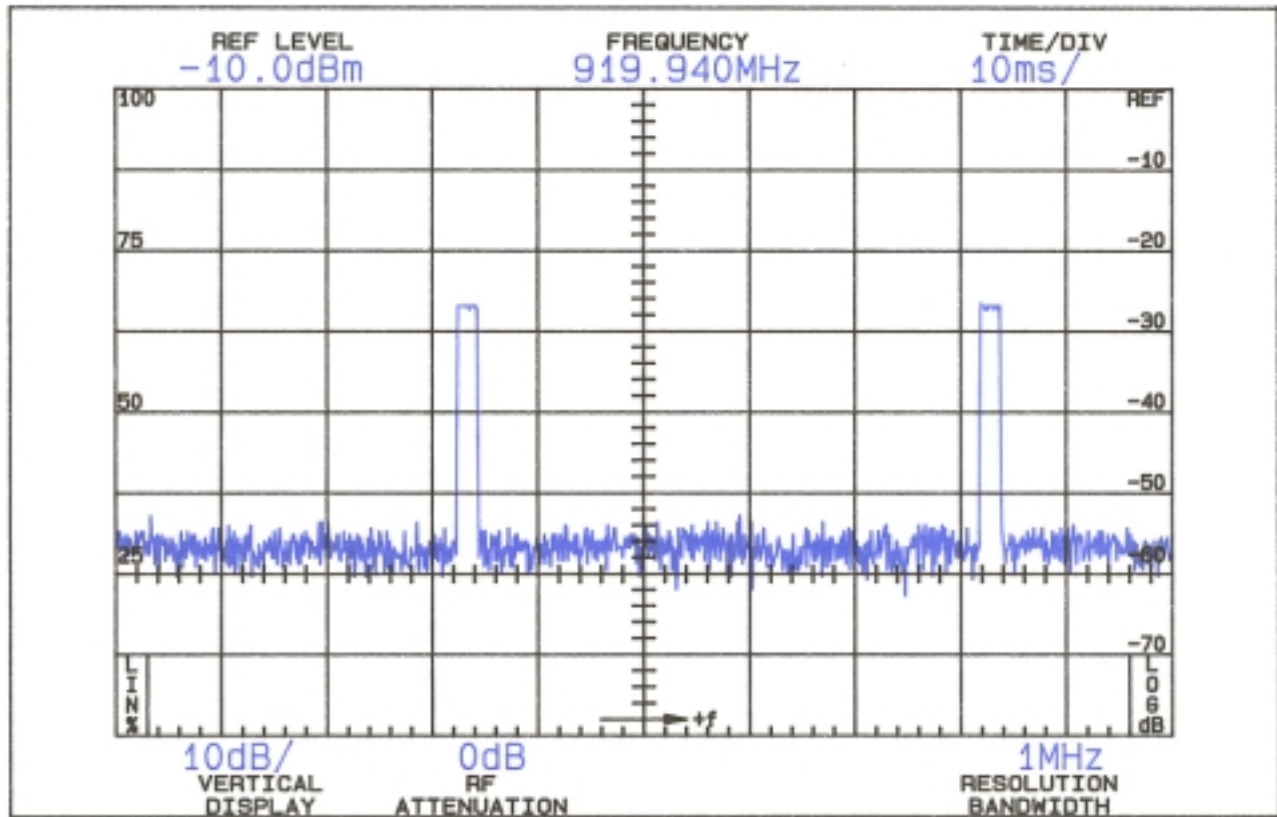
Horizontal: 5 mS/Div.

(Time domain)

PULSE CHARACTERISTICS
FCC ID: MS8-TRANSPONDITV2

FIGURE 1

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PULSE REPETITION RATE

Horizontal: 10 milliseconds/Division

(Time Domain)

TRANSMISSION CHARACTERISTICS
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FIGURE 2

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SAMPLE COMPUTATIONS

Using the time domain plots of Figures 1 and 2, maximum "on" time over any 50 mS interval is:

"On" Pulses:

2.5 milliseconds

Duty Cycle: $2.5/50 = 0.05$

$20 \text{ Log } 0.05 = -26 \text{ dB}$

*Maximum of -20 dB was used in Table 1 peak/average computations, per Para. 15.249(d).

SAMPLE COMPUTATIONS
FCC ID: MS8-TRANSPONDITV2

FIGURE 3

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TABLE 1

RADIATED FIELD INTENSITY
Measured at 3 meters
15.249

<u>Freq. (MHz)</u>	<u>Meter Reading (dBm)</u>	<u>Antenna Factor (dB)</u>	*	<u>Field¹ Intensity uV/m @ 3m</u>	<u>Avg.Field² Intensity uV/m @ 3m</u>	<u>FCC Limit uV/m @ 3m</u>	<u>dB to Limit</u>
919.80	-44.31	30.9	Q	47,808	N/A	50000	- 0.4
919.80	-40.96	30.9	P	70,307	N/A	50000	+ 2.9
1839.60	-73.84	32.8	P	1,986	199	500	- 8.0
2759.40	-97.62	36.9	P	206	21	500	-28.0

Note 1:
$$\text{uV/m} = \text{Log}^{-1} \frac{\text{dBu/m}}{20}$$

dBu = dBm + antenna factor + 107

Note 2: Field Intensity calculated from peak value and -20 dB peak/average factor.

*Detector Type: Q = Quasi-peak; P = Peak Detector; **antenna factor includes cable loss.**

All other emissions to the tenth harmonic were in system noise @ 1 m or greater than 20 dB below FCC limits.

(Unit was measured on 3 major planes)

RADIATED FIELD INTENSITY
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TABLE 1

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C. FORBIDDEN BAND MEASUREMENTS

Any spurious signals from the transmitter that fell in a forbidden band are identified in Table 1. All forbidden bands, per Paragraph 15.205, from 73 MHz to 10 GHz were searched and any applicable emissions above noise or interference levels are shown in Table 1.

D. POWER LINE CONDUCTED MEASUREMENTS

AC line conducted spurious measurements were not made since the device does not use the public power supply system.

E. COMPLIANCE WITH SECTION 15.249 OF PART 15

- 15.249(a,b) The field strength of the radiation emission was measured and found to comply with the limits established by 15.249(a) and 15.209. (See data of Table 1.)
- 15.249(c) Emissions radiated outside of the specified frequency bands, except for harmonics, were attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in 15.209, (whichever is the lesser attenuation).

