

**NATIONAL CERTIFICATION LABORATORY**

**8370 Court Avenue, Suite B-1  
Ellicott City MD 21043  
(410) 461-5548**

**FCC REPORT OF RADIO INTERFERENCE**

**for**

**Control Chief Corporation  
P.O. Box 141  
Bradford, PA 16701**

**FCC ID: CBFCRANET1**

**May 7, 1998**

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***NCL PROJ.# CONTROL-449TX***

## 1.0 Introduction

This report has been prepared on behalf of Control Chief Corporation, to support the attached Application for Certification of a Part 15 Intentional Radiator. The Equipment Under Test was the Control Chief Corporation *CRANE1 Radio Remote Transmitter*.

Radio-Noise Emissions tests were performed according to ANSI C63.4-1992 *"Methods of Measurement of RFI from Low-Voltage Electronic Equipment in the Range of 9 KHz - 40 GHz"*. The measuring equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

Testing was performed at National Certification Laboratory in Ellicott City, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch. FCC acceptance was granted on May 26, 1993.

## 1.1 Summary

The *CRANE1 Radio Remote Transmitter* complies with the Part 15.231 Radio Limits for periodic operation above 70 MHz of an Intentional Radiator.

## 2.0 Description of Equipment Under Test (EUT)

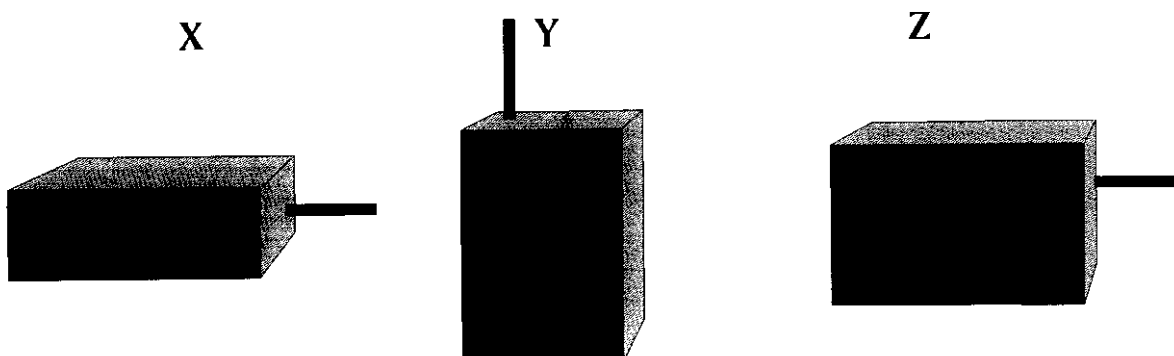
The EUT Features:

| <u>FEATURES</u>               | <u>FREQUENCY</u>  |
|-------------------------------|-------------------|
| Flexible Antenna              | 433.87-434.65 MHz |
| Crystal Stable                |                   |
| Digital FM Modulated          |                   |
| Manual Keying - Immediate off |                   |
| Battery Operation Only        |                   |

### 3.0 Test Configuration

The EUT was setup on the test table in a manner which follows the general guidelines of ANSI C63.4, Section 6 "**General Operating Conditions and Configurations**". One of the keying buttons was bound to the "on" position during testing.

The EUT was configured in 3 orthogonal positions to determine the maximum RF level at each emission frequency. The data tables give the EUT position designation that produces worst-case field strength, in an X, Y, Z system. This is described below:



#### 4.0 Conducted Emissions Scheme

The EUT is powered by battery only.

#### 5.0 Radiated Emissions Scheme

The EUT was initially scanned in the frequency range 30 to 4340 MHz indoors, at a distance of 1 meter to determine its emissions profile. The EUT was then placed on an 80 cm high 1 X 1.5 meter non-conductive motorized turntable for radiated testing on the 3-meter open area test site. The emissions from the EUT are measured continuously at every azimuth by rotating the turntable. Waveguide horn and log periodic broadband antennas are mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna is varied between 1 and 4 meters. Both the horizontal and vertical field components are measured.

The output from the antenna is connected to the input of the spectrum analyzer. The detector function is set to Peak. The resolution bandwidth of the spectrum analyzer system is set at 120 kHz, for measurements in the range 30 MHz - 1 GHz, and 1 MHz for measurements in the range of 1 - 4 GHz, with all post-detector filtering no less than 10 times the resolution bandwidth. All emissions within 20 dB of the limit are recorded in the data tables.

To convert the spectrum analyzer reading into a quantified E-field level to allow comparison with the FCC limits, it is necessary to account for various calibration factors. These factors include cable loss (CL) and antenna factors (AF). The AF/CL in dB/m is algebraically added to the Spectrum Analyzer Voltage in dB $\mu$ V to obtain the Radiated Electric Field in dB $\mu$ V/m. This level is then compared with the FCC limit.

#### Example:

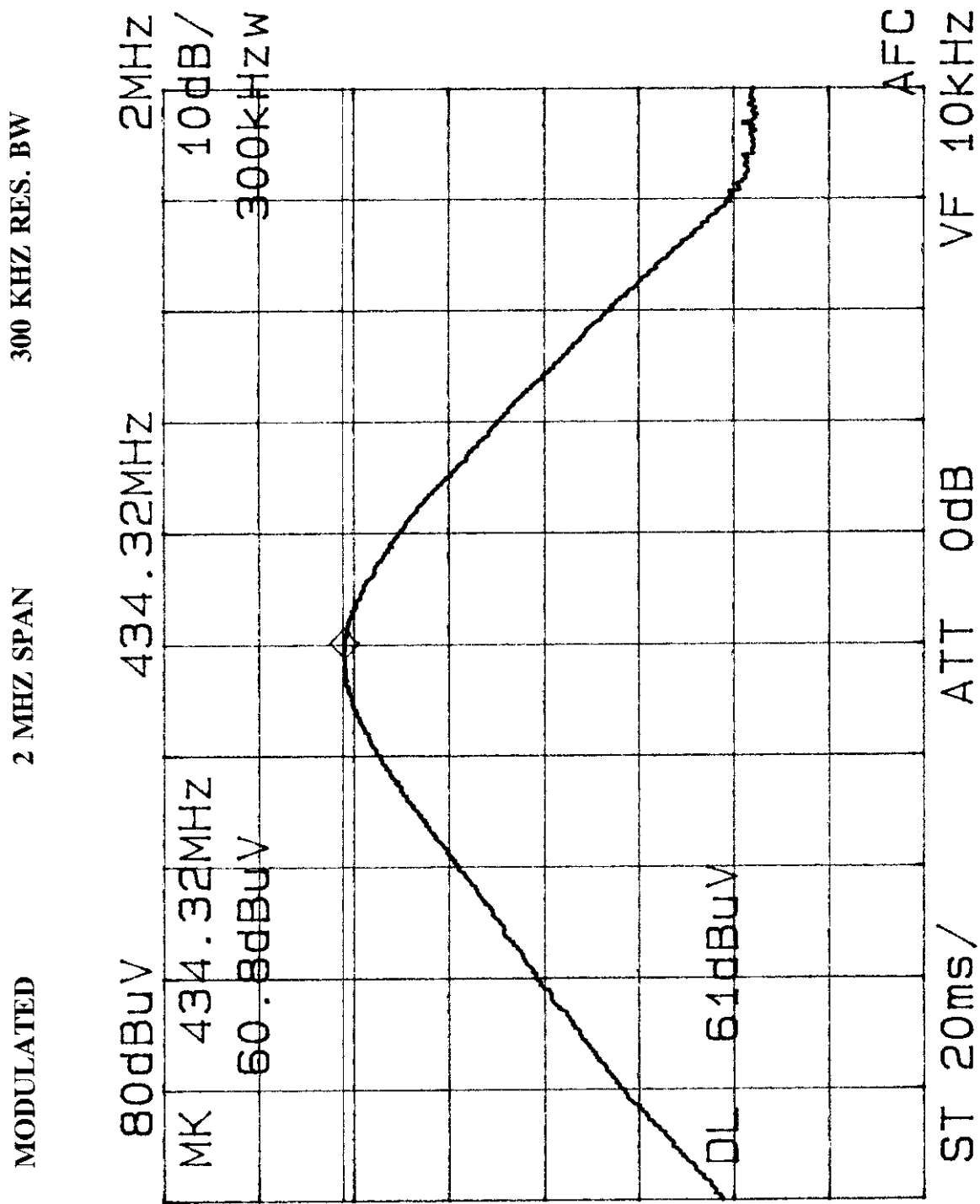
Spectrum Analyzer Volt: VdB $\mu$ V

Composite Factor: AF/CLdB/m

Electric Field: EdB $\mu$ V/m = VdB $\mu$ V + AF/CLdB/m

Linear Conversion: EuV/m = Antilog (EdB $\mu$ V/m/20)

PEAK RADIATED FIELD LEVEL - PREAMP OFF



# FCC RADIATED EMISSIONS DATA

FCC ID: CBRCRANET1

CLIENT: CONTROL CHIEF  
EUT: CRANE1 TX

FREQ.: 434.325

| 3-METER TEST |            |     | PEAK           |              | AVERAGE     |                |                   |                 |           |
|--------------|------------|-----|----------------|--------------|-------------|----------------|-------------------|-----------------|-----------|
| FREQ<br>MHz  | POL<br>ANT | EUT | SPEC A<br>dBuV | AF/C<br>dB/m | AMP<br>GAIN | AVG.<br>FACTOR | E-FIELD<br>dBuV/m | LIMIT<br>dBuV/m | MRG<br>dB |
| 434.33       | V          | Y   | 91.0           | 17.0         | -30         | -1.0           | 77.0              | 81.0            | -4.0      |
| 868.66       | H          | Z   | 64.0           | 24.0         | -30         | -1.0           | 57.0              | 61.0            | -4.0      |
| 1302.99      | V          | Y   | 54.0           | 26.0         | -30         | -1.0           | 49.0              | 54.0            | -5.0      |
| 1737.32      | V          | Y   | 51.0           | 29.0         | -30         | -1.0           | 49.0              | 61.0            | -12.0     |
| 2171.65      | H          | X   | 50.0           | 32.0         | -30         | -1.0           | 51.0              | 61.0            | -10.0     |
| 2605.98      | H          | Z   | 47.0           | 33.0         | -30         | -1.0           | 49.0              | 61.0            | -12.0     |
| 3040.31      | H          | X   | 43.0           | 36.0         | -30         | -1.0           | 48.0              | 61.0            | -13.0     |
| 3474.64      | V          | Y   | 45.0           | 36.0         | -30         | -1.0           | 50.0              | 61.0            | -11.0     |
| 3908.97      | H          | X   | 40.0           | 37.0         | -30         | -1.0           | 46.0              | 54.0            | -8.0      |
| 4343.30      | V          | Z   | 37.0           | 38.0         | -30         | -1.0           | 44.0              | 54.0            | -10.0     |

TEST ENGINEER

422 DATE 5/4/78  
STEVE DAYHOFF

#### **Average Field Strength Calculation:**

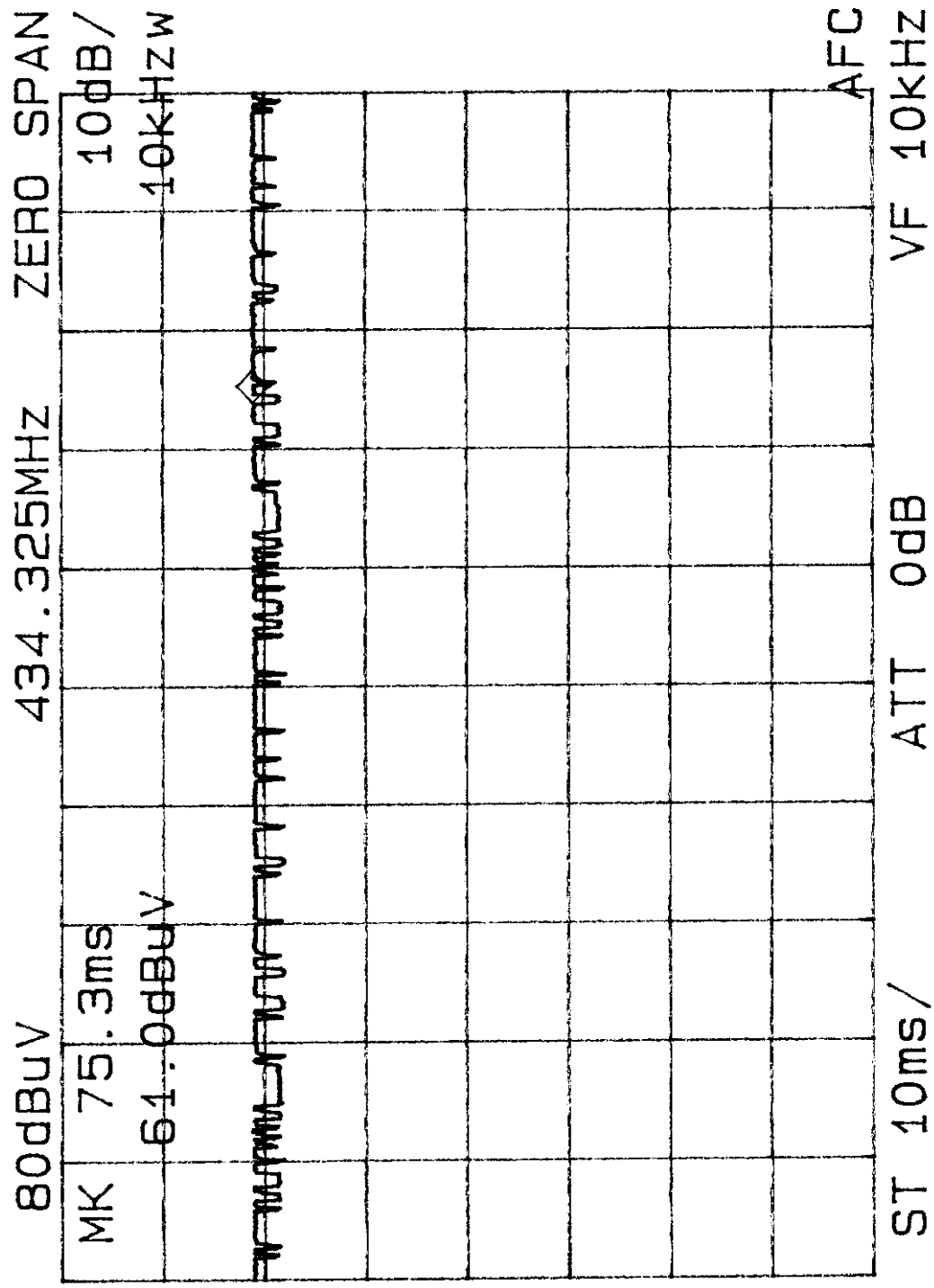
The following spectrum analyzer plot reveals the maximum pulsed on/off duty cycle of the modulated carrier. This plot demonstrates clearly that the duty cycle is near 100 %. The average electric field level was determined by averaging the Peak level with a 10 Hz video filter on the analyzer. The difference between Peak and Average readings was 1 dB.

**DUTY CYCLE MEASUREMENT PER 100 ms FRAME - PREAMP OFF**

# MODULATED

## ZERO SPAN

10 KHZ RES. BW

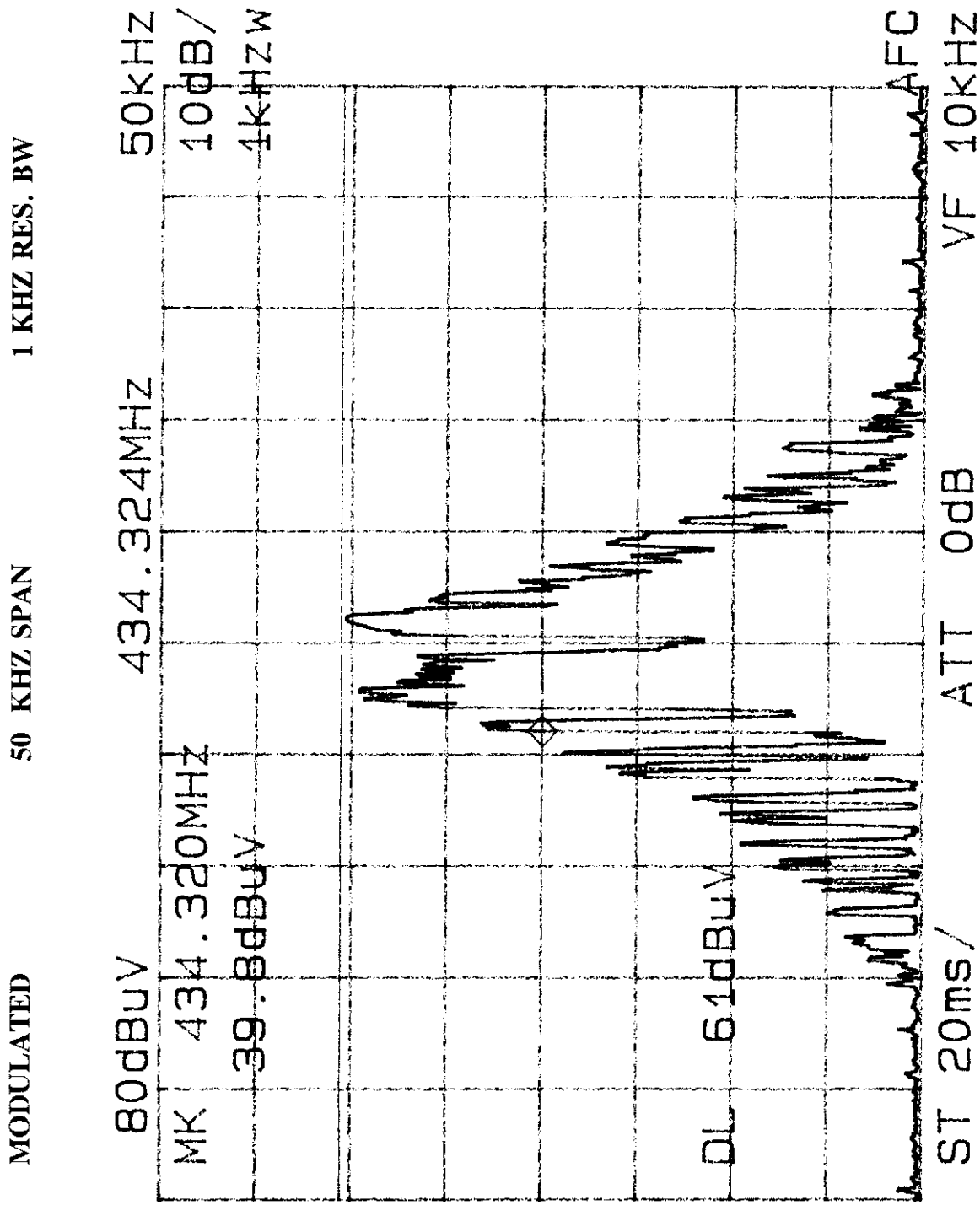


### **Bandwidth Measurement:**

The following plots include a graph of the modulated carrier which demonstrates the Bandwidth at a 20 dB point down from peak. Section 15.231(c) limits the Bandwidth to 0.25% of the center frequency:

$$\text{BW Limit} = .0025 * 434 \text{ MHz} = 1085 \text{ KHz}$$

20 dB OCCUPIED BANDWIDTH MEASUREMENT - PREAMP OFF



**Table 1**

**Support Equipment**

---

| MANUFACTURER | FCC ID # | SERIAL # |
|--------------|----------|----------|
| N/A          | N/A      | None     |
|              |          |          |
|              |          |          |
|              |          |          |
|              |          |          |
|              |          |          |

**Table 2****Measurement Equipment Used**

The following equipment is used to perform measurements:

| <b>EQUIPMENT</b>                         | <b>SERIAL NUMBER</b> |
|------------------------------------------|----------------------|
| Wavetek 2410A 1100 MHz Signal Generator  | 1362016              |
| HP Model 8449B Preamplifier              | 12A533-A             |
| EMCO Model 3146 Log Periodic Antenna     | 1222                 |
| Solar 8012-50-R-24-BNC LISN              | 924867               |
| Advantest Model R4131D Spectrum Analyzer | 54378A               |
| EMCO Model 3115 Ridge Horn Antenna       | 1238                 |
| 4 Meter Antenna Mast                     | None                 |
| Motorized Turntable                      | None                 |
| RG-233U 50 ohm coax Cable                | None                 |