#### **TEST REPORT**

#### ELETTRONIKA S.r.I FM TRANSMITTER TECHNICAL REPORT

#### INTRODUCTION

The following information is provided to verify the technical performance of the MIRA250 FM transmitter. The following information is supplied for FM broadcast service according to applicable portions of Part 2 and Part 73 of the FCC rules and regulations

- 1. Power Output Measurements as indicated by FCC Rule Part 2.1046 and.
- 2. Frequency stability measurements associated with variations in ambient temperature and with variations in line voltage as specified by 73.1545.
- 3. Demodulated Amplitude versus Frequency response measurements of the transmitter compliant with the Engineering charts identified in 73.333.
- 4. Occupied BW of the FM signal as specified by FCC Rule Part 73.297, 73.317, 73.319, 73.322, and 73.1570.
- 5. Measurement of conducted harmonics and spurs outside its assigned channel as specified by FCC Rule Part 73.317.
- Measurement of cabinet radiation of spurs and harmonics as specified in FCC Rule 2.1053 and 2.1057.
- 7. Measurements of voltage and current to final amp stage as outlined in FCC Rule 2.1033.

Measurements were conducted at power output levels of 250 watts and 50 watts and constitute the range of power for which type certification is sought.

#### Audio 6 dB Matrixing Directional Power Generator unit MIRA250 Coupler Meter (Part of (Part of MIRA250) Mod Analyzer) RF Load Modulation Spectrum Voltage Measurement Analyzer Analyzer

#### FIGURE 1--TEST EQUIPMENT CONFIGURATION

The test equipment used for the measurements on the next few pages is listed at the back of this exhibit. All test equipment had been calibrated prior to the use of the equipment by the supplier of the test equipment.

### RF Power Output Stability vs Line Voltage

The equipment was configured as shown in Figure 1. The loss through the RF output cable and directional coupler and attenuator was calibrated at the carrier frequency of 98 MHz. The audio generator was not energized. The transmitter was energized at room temperature at an initial power output of 250 watts. Power was read on the Bird 4391A Power Meter and a reference level was established on the Advantest R131 Spectrum Analyzer. The line voltage was varied from 94 volts to 126 volts using a variac to adjust

the voltage. The test was repeated at an output power of 38 watts. The data is tabulated on the next page.

| RF Power | Power Supply       | RF Power | Power Supply       |
|----------|--------------------|----------|--------------------|
| 248W     | 94V <sub>ac</sub>  | 38W      | 94V <sub>ac</sub>  |
| 248W     | 110V <sub>ac</sub> | 38W      | 110V <sub>ac</sub> |
| 248W     | 126V <sub>ac</sub> | 38W      | 126V <sub>ac</sub> |

### RF Power Output Stability vs Temperature

The equipment was configured as shown in Figure 1. The loss through the RF output cable and directional coupler and attenuator was calibrated at the carrier frequency of 98 MHz. The audio generator was not energized. The transmitter was energized at room temperature at a power output of 290 watts. Power was read on the Bird 4391A Power Meter and a reference level was established on the Advantest R131 Spectrum Analyzer. Next the temperature was varied from 0 C to +50 C. Data at the extreme temperature limits and at room temperature was recorded regarding power output. The transmitter was adjusted to 48 watts and the procedure was repeated.

| RF Power | Temperature | RF Power | Temperature |
|----------|-------------|----------|-------------|
| 292W     | 0°C         | 48W      | 0°C         |
| 291W     | 25°C        | 47W      | 25°C        |
| 293W     | 50°C        | 48W      | 50°C        |

#### FRQUENCY STABILITY

The equipment was configured as shown in Figure 1. The loss through the RF output cable and directional coupler and attenuator was calibrated at the carrier frequencies of 98 MHz. The audio generator was not energized. The transmitter was energized at room temperature at a power output of 250 watts. Power was read on the Bird 4391A Power Meter and a reference level was established on the Advantest R131 Spectrum Analyzer. The line voltage was varied from 94 volts to 126 volts. The output frequency was read on the spectrum analyzer. The results are tabulated below.

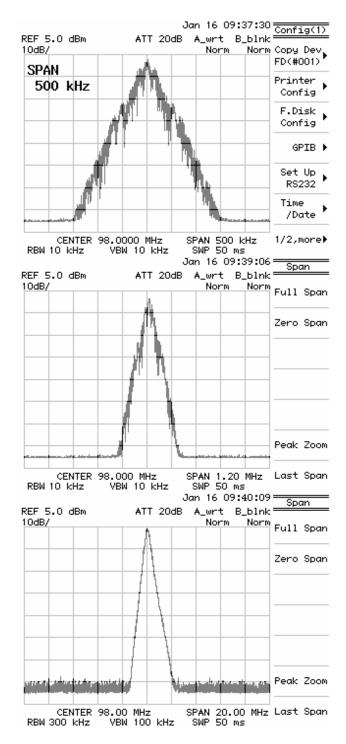
| RF Frequency  | Power Supply       |
|---------------|--------------------|
| 98,0000009MHz | 94V <sub>ac</sub>  |
| 98,0000009MHz | 110V <sub>ac</sub> |
| 98,0000009MHz | 126V <sub>ac</sub> |

#### CONDUCTED EMISSION

Two configurations have been considered: Stereophonic and Monophonic

#### STEREOPHONIC MODE

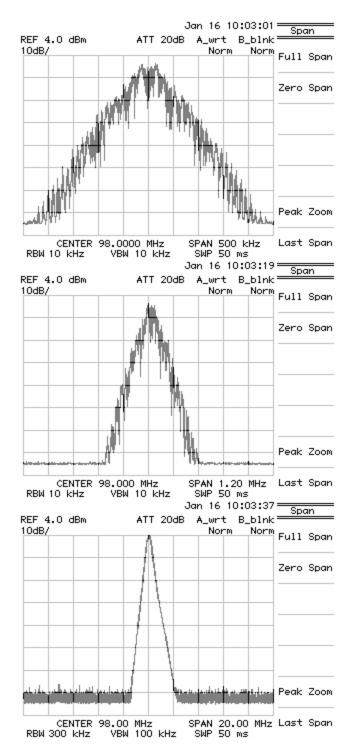
The pilot was set to 9% (6.75 kHz deviation) and 15kHz was injected into the Left (or Right) input with the main channel and the stereo channel at 28.5kHz deviation. The transmitter was energized at 250 watts RF output power and the conducted emission levels were recorded on the Advantest R131 Spectrum Analyzer.



As can be seen in the above graphs, in the stereophonic mode, the emissions meet the requirements as outlined in FCC Rule 73.317. The rule stipulates emissions between 120 kHz and 240 kHz from the carrier frequency are -25 dB or better, emissions between 240 kHz and 600 kHz from the carrier are -35 dB or better, and emissions greater than 600 kHz from the carrier are at least 43 + 10 log  $P_o$ , or -67 dB referenced to the unmodulated carrier (top of the screen for these graphs).

#### STEREOPHONIC MODE PLUS SCA

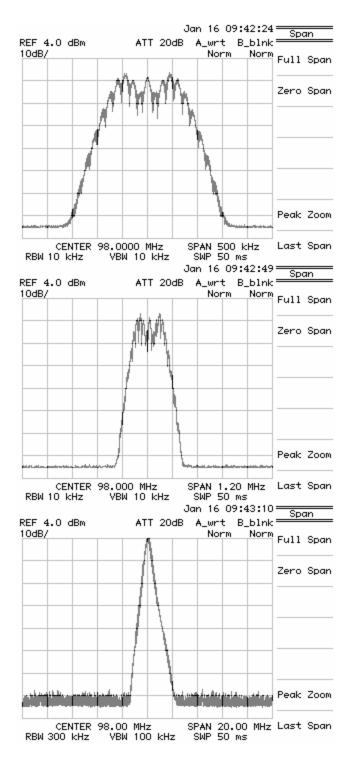
In this case, an SCA channel has been added to the stereo channel. A frequency of 67 kHz is applied to the SCA input and its sub-carrier is modulated at 15% (11.15kHz). The 15 kHz applied to the left (right) channel is adjusted to obtain 70% modulation (52.5kHz).



As can be seen in the above graphs, the combined stereo and SCA channel emissions meet the requirements as outlined in FCC Rule 73.317. The rule stipulates emissions between 120 kHz and 240 kHz from the carrier frequency are -25 dB or better, emissions between 240 kHz and 600 kHz from the carrier are -35 dB or better, and emissions greater than 600 kHz from the carrier are at least 43 + 10 log  $P_o$ , or -67 dB referenced to the unmodulated carrier (top of the screen for these graphs).

#### Monophonic Mode

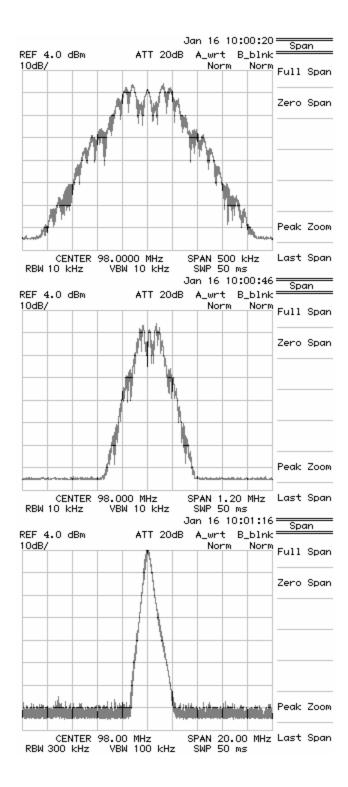
For the Monophonic case, 15kHz has been applied to the Mono input with 85% modulation (63.75kHz deviation).



As can be seen in the above graphs, the monophonic mode emissions meet the requirements as outlined in FCC Rule 73.317. The rule stipulates emissions between 120 kHz and 240 kHz from the carrier frequency are -25 dB or better, emissions between 240 kHz and 600 kHz from the carrier are -35 dB or better, and emissions greater than 600 kHz from the carrier are at least 43 +  $10 \log P_o$ , or -67 dB referenced to the unmodulated carrier (top of the screen for these graphs).

#### MONOPHONIC MODE PLUS SCA

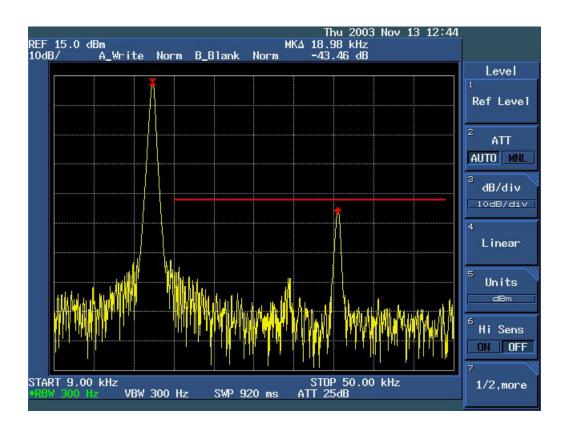
Again for the monophonic case, using the SCA channel, a 67kHz signal is sent to the SCA input and its sub-carrier is modulated at 15% (11.25kHz). The 15kHz is reduced to 52.5kHz.



As can be seen in the above graphs, the monophonic mode emissions meet the requirements as outlined in FCC Rule 73.317. The rule stipulates emissions between 120 kHz and 240 kHz from the carrier frequency are -25 dB or better, emissions between 240 kHz and 600 kHz from the carrier are -35 dB or better, and emissions greater than 600 kHz from the carrier are at least 43 +  $10 \log P_o$ , or -67 dB referenced to the unmodulated carrier (top of the screen for these graphs).

### PILOT FREQUENCY AND 38 kHz LEVEL

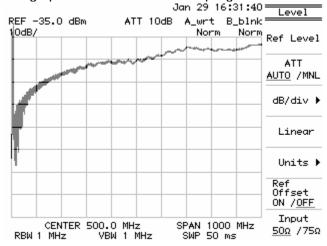
The frequency of the pilot tone was measured to be 19.000 kHz. Its deviation was set at 7.5 kHz, using the FMAB. The deviation of the subcarrier of the pilot tone (38kHz) must be no more than 0.75kHz. This is measured by means of the FMAB, and confirmed by using the spectrum analyzer in order to display the subcarrier level. The photo below demonstrates the frequency to be 37.98 kHz and the amplitude is 43.5 dB relative to the pilot frequency.



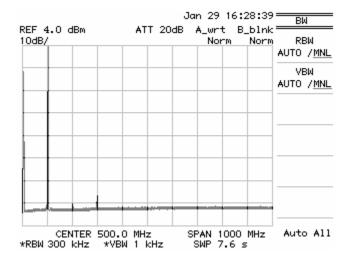
#### CONDUCTED HARMONICS

Conducted harmonics are sampled in the output transmission line and converted to the corrected value (using the directional coupler coupling value and cable loss) and then compared to the power output of the unit under test.

The graph shown below is the coupling factor of the directional coupler versus frequency.



The graph shown below is the measured spectrum showing the fundamental frequency and the harmonic levels before correction.



The correction factor and measured level are used to find the actual level.

| HARMONIC                 | MEASURED LEVEL | CORRECTION FACTOR | CORRECTED VALUE |
|--------------------------|----------------|-------------------|-----------------|
| 2 <sup>th</sup> 196 MHz  | 75dB           | -5.8              | -80.8dB         |
| 3 <sup>rd</sup> 294 MHz  | -68dB          | -9.2              | -77.2dB         |
| 4 <sup>th</sup> 392 MHz  | <-85dB         | -10.9             | <-95.9dB        |
| 5 <sup>th</sup> 490 MHz  | -80dB          | -11.1             | -91.1dB         |
| 6 <sup>th</sup> 588 MHz  | -85dB          | -14.1             | -99.1dB         |
| 7 <sup>th</sup> 686 MHz  | <-85dB         | -16.5             | <101.5dB        |
| 8 <sup>th</sup> 784 MHz  | <-85dB         | -17.0             | <102.0dB        |
| 9 <sup>th</sup> 882 MHz  | <-85dB         | -16.5             | <101.5dB        |
| 10 <sup>th</sup> 980 MHz | <-85dB         | -18.9             | <103.9dB        |

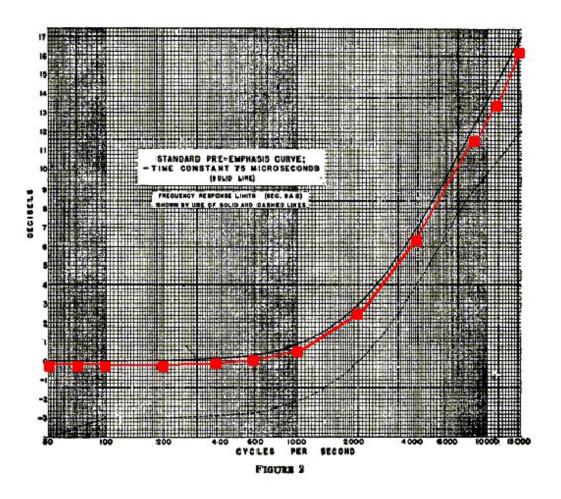
All levels measured are below the level described by 43+ 10 log Pout (or 67 dB).

#### Audio Frequency Response and Pre-emphasis curve Verification

Frequency Response characteristics were measured using the equipment configured in Figure 1. Measurements were recorded from the R&S FMAB without de-emphasis and the results are tabulated on the graph below.

#### Federal Communications Commission

§ 73.333



#### **Cabinet Radiation**

The test equipment was configured as shown below in Figure 2. The transmitter was operated at 250 watts with a carrier frequency of 98 MHz. The laboratory environment limited the measurement range for the field strength measurements to 3 meters. The measured field strength intensity, cable loss, and antenna gain characteristics at the fundamental frequency and at each of the harmonics of the carrier frequency were taken into account in order to accurately assess the level of the signal radiated from the cabinet. Knowing these factors, the radiated power assuming a half-wave dipole would replace the transmitter was calculated and compared to the RF power output of 250 watts. The table showing the measured results and calculated values is provided below.

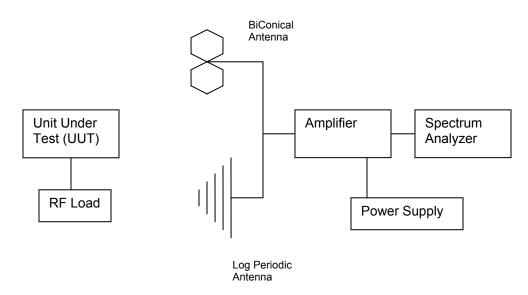


Figure 2 Cabinet Radiation Equipment Configuration

# Cabinet Radiation for MIRA 250

| WIIKA 250 |              |              |                     |       |                  |
|-----------|--------------|--------------|---------------------|-------|------------------|
|           | Managered FC | EC (Voltage) | Equivalent Radiated | Dawar | Relative to Pout |
| Frequency | Measured FS  | FS (Voltage) | Power               | Power | of 250 watts     |
| MHZ       | dBuV/m       | V/m          | watts               | dBm   | dB               |
| 98        | 59           | 0.000891     | 2.38172E-07         | -36.2 | -90.2            |
| 196       | 41           | 0.000112     | 3.77477E-09         | -54.2 | -108.2           |
| 294       | 39           | 0.000089     | 2.38172E-09         | -56.2 | -110.2           |
| 392       | 39           | 0.000089     | 2.38172E-09         | -56.2 | -110.2           |
| 490       | 33           | 0.000045     | 5.98261E-10         | -62.2 | -116.2           |
| 588       | 40           | 0.000100     | 2.99841E-09         | -55.2 | -109.2           |
| 686       | 37           | 0.000071     | 1.50276E-09         | -58.2 | -112.2           |
| 784       | 39           | 0.000089     | 2.38172E-09         | -56.2 | -110.2           |
| 882       | 37           | 0.000071     | 1.50276E-09         | -58.2 | -112.2           |
| 980       | 40           | 0.000100     | 2.99841E-09         | -55.2 | -109.2           |
|           |              |              |                     |       |                  |

The results of this indicate that the radiation meets the FCC rule of cabinet radiation that must be 60 dB or better.

## **EQUIPMENT LIST**

The following test equipment was used in the various test equipment configurations or to create calibration of equipment at various frequencies. All equipment was known to be in good working order and the supplier of the equipment stipulated the equipment was within the calibration period.

| Equipment                      | Manufacturer       | Model           |
|--------------------------------|--------------------|-----------------|
| Spectrum Analyzer              | Advantest          | R3131           |
| Modulation Analyzer            | Rohde&Schwarz      | FMAB            |
| RF Power Meter                 | Bird               | 4391A           |
| Humidifier                     | Cuoghi             | NEB-5000        |
| Thermal detector               | CAREL              | IR32c           |
| Humidity detector              | CAREL              | S90HP           |
| Thermal Chamber (-20°C / 60°C) | Assembled by COTER | No Model Number |
| Test Load                      | Elettronika        | No model number |
| Directional Coupler            | Elettronika        | No model number |