TEST REPORT

ELETTRONIKA S.r.l FM TRANSMITTER TECHNICAL REPORT

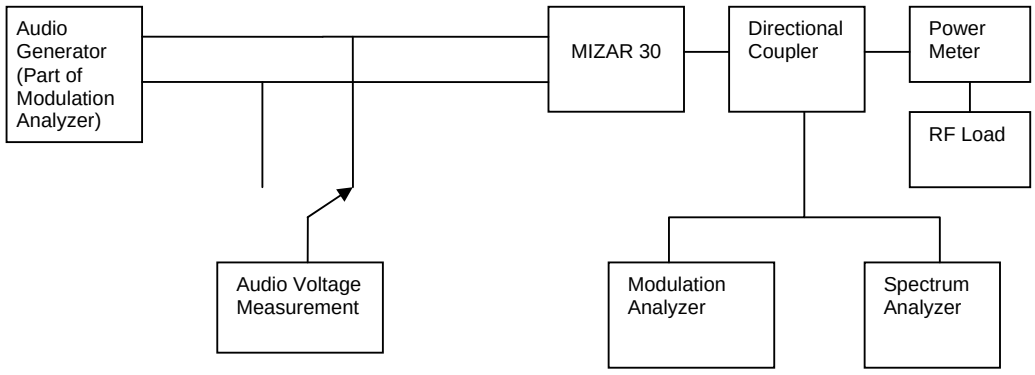
INTRODUCTION

The following information is provided to verify the technical performance of the MIZAR 30 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 73.267.
2. Frequency stability measurements associated with variations in ambient temperature and with variations in line voltage as specified by 73.1545.
3. Occupied BW of the FM signal as specified by FCC Rule Part 73.297, 73.317, 73.322, and 73.1570.
4. Measurement of conducted harmonics and spurs outside its assigned channel as specified by FCC Rule Part 73.317.
5. Demodulated Amplitude versus Frequency response measurements of the transmitter compliant with the Engineering charts identified in 73.333.
6. 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 30 watts and 7.5 watts and constitute the range of power for which type certification is sought.

FIGURE 1--TEST EQUIPMENT CONFIGURATION



The test equipment used for the measurements 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 30 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 7.5 watts. The data is tabulated on the next page.

RF Power	Power Supply		RF Power	Power Supply
30W	$94V_{ac}$		7.5W	$94V_{ac}$
30W	$110V_{ac}$		7.5W	$110V_{ac}$
30W	$126V_{ac}$		7.5W	$126V_{ac}$

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 30 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 7.5 watts and the procedure was repeated.

RF Power	Temperature		RF Power	Temperature
31.5W	0°C		7.8W	0°C
30 W	25°C		7.5W	25°C
27.2 W	50°C		6.8W	50°C

FRQUENCY STABILITY

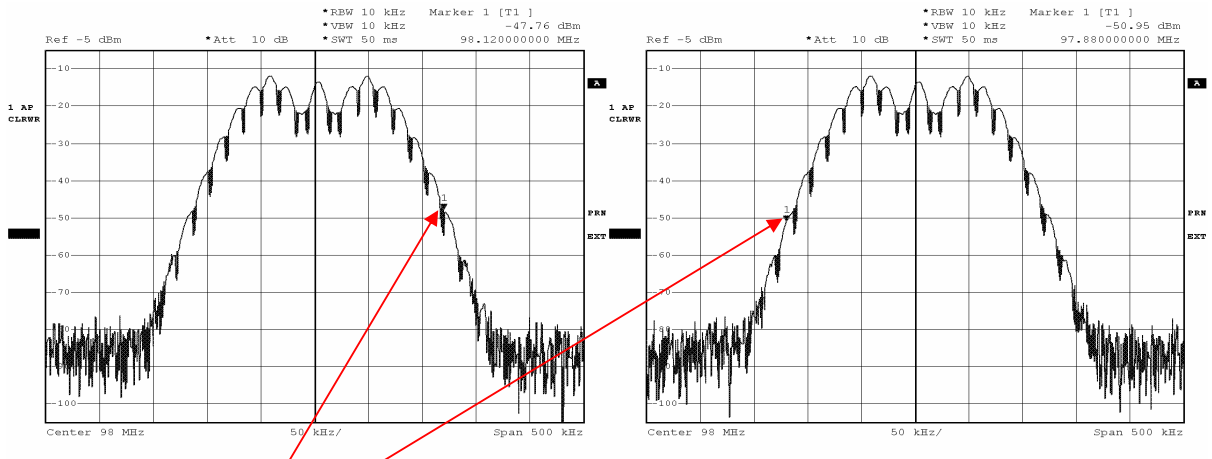
The equipment was configured as shown in Figure 1. The loss through the RF output cable and directional coupler and attenuator was calibrated at the carrier frequency of 98 MHz. The audio generator was not energized. The transmitter was energized at room temperature at a power output of 30 watts. Power 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 with the counter mode engaged. The results are tabulated below.

RF Frequency	Power Supply
97,9999995MHz	$94V_{ac}$
98,0000000MHz	$110V_{ac}$
98,0000006MHz	$126V_{ac}$

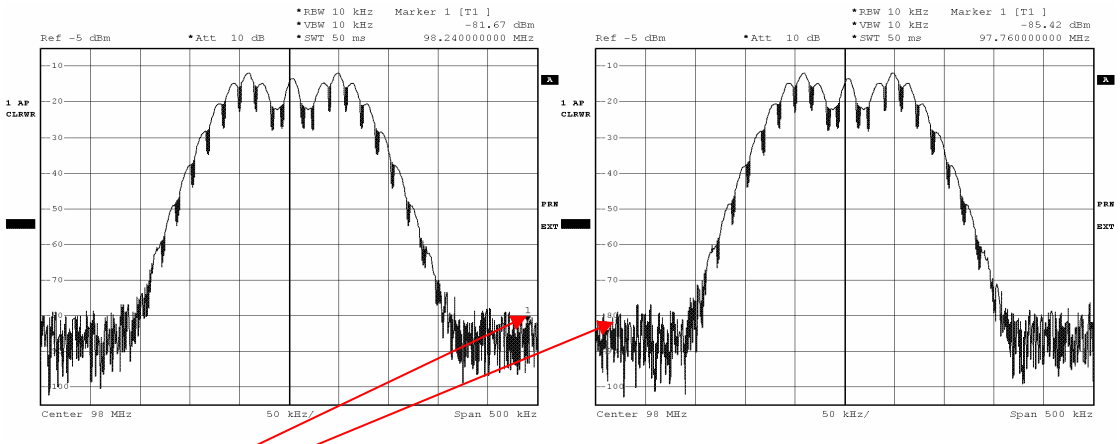
CONDUCTED EMISSION

Two configurations have been considered: Monophonic and Stereophonic.

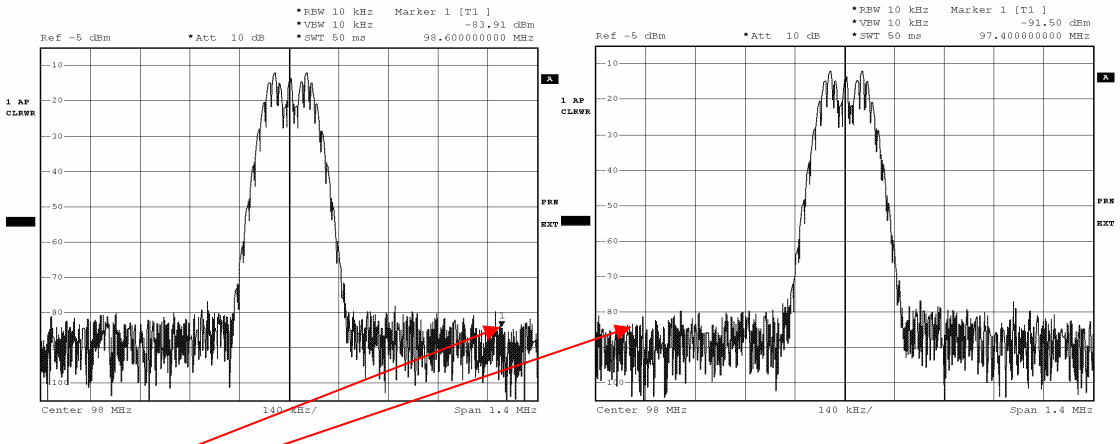
MONO
(15KHZ TONE MODULATING THE CARRIER 85% - DEVIATION 63.75KHZ)



Markers at 120kHz from the carrier. Below 25dBc => Pass



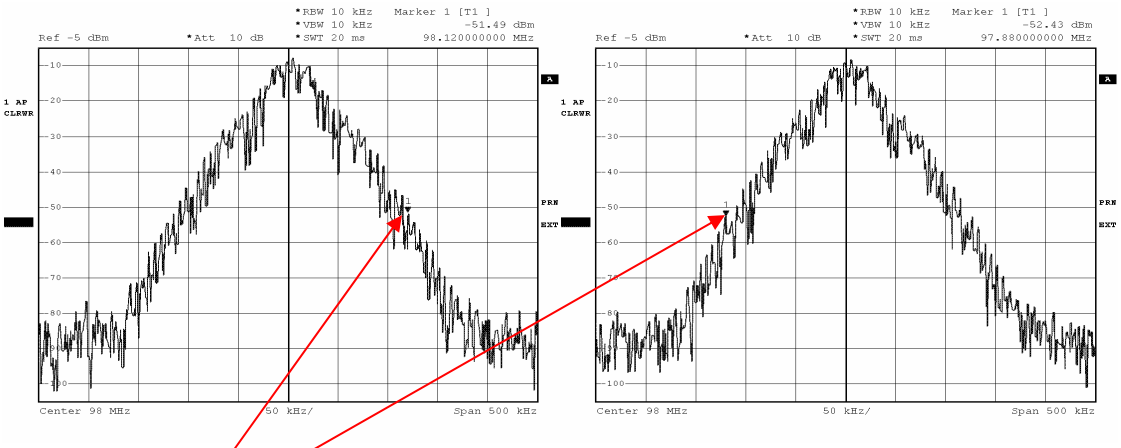
Markers at 240kHz from the carrier. Below 35dBc => Pass



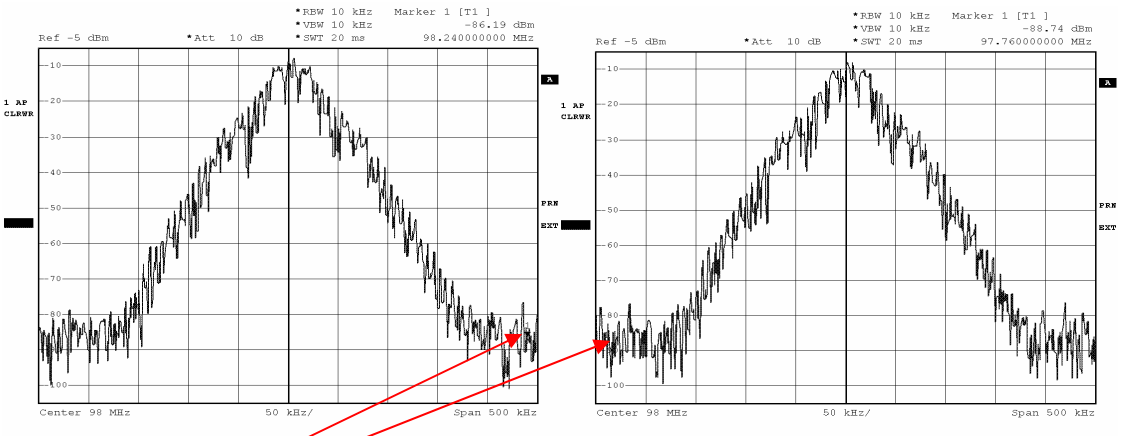
Markers at 600kHz from the carrier. Below (43+10logP)= 58 dBc => Pass

STEREO

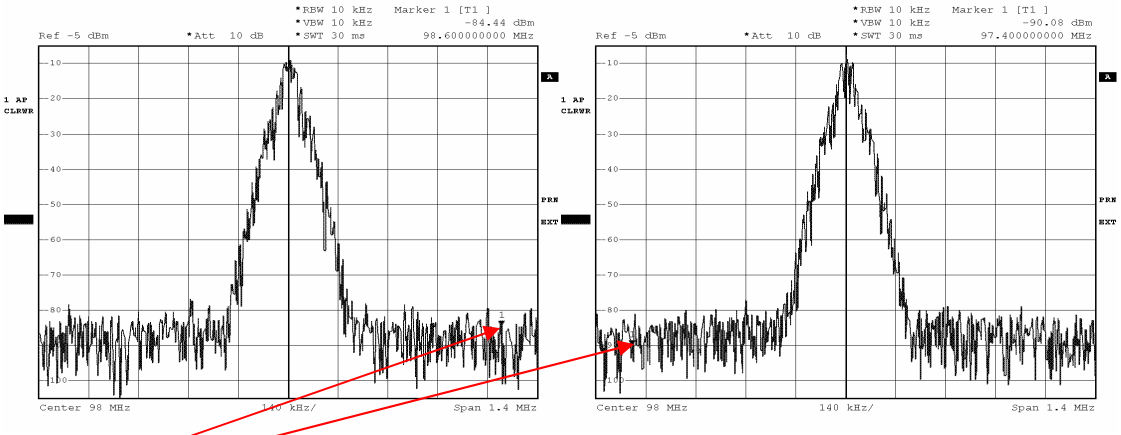
15 KHz MAIN SUBCHANNEL AT 38% MODULATION (28.5 KHz DEVIATION), 15KHz STEREO SUBCHANNEL AT 38% MODULATION (28.5 KHz DEVIATION), PILOT TONE AT 9% MODULATION (6.75 KHz DEVIATION)



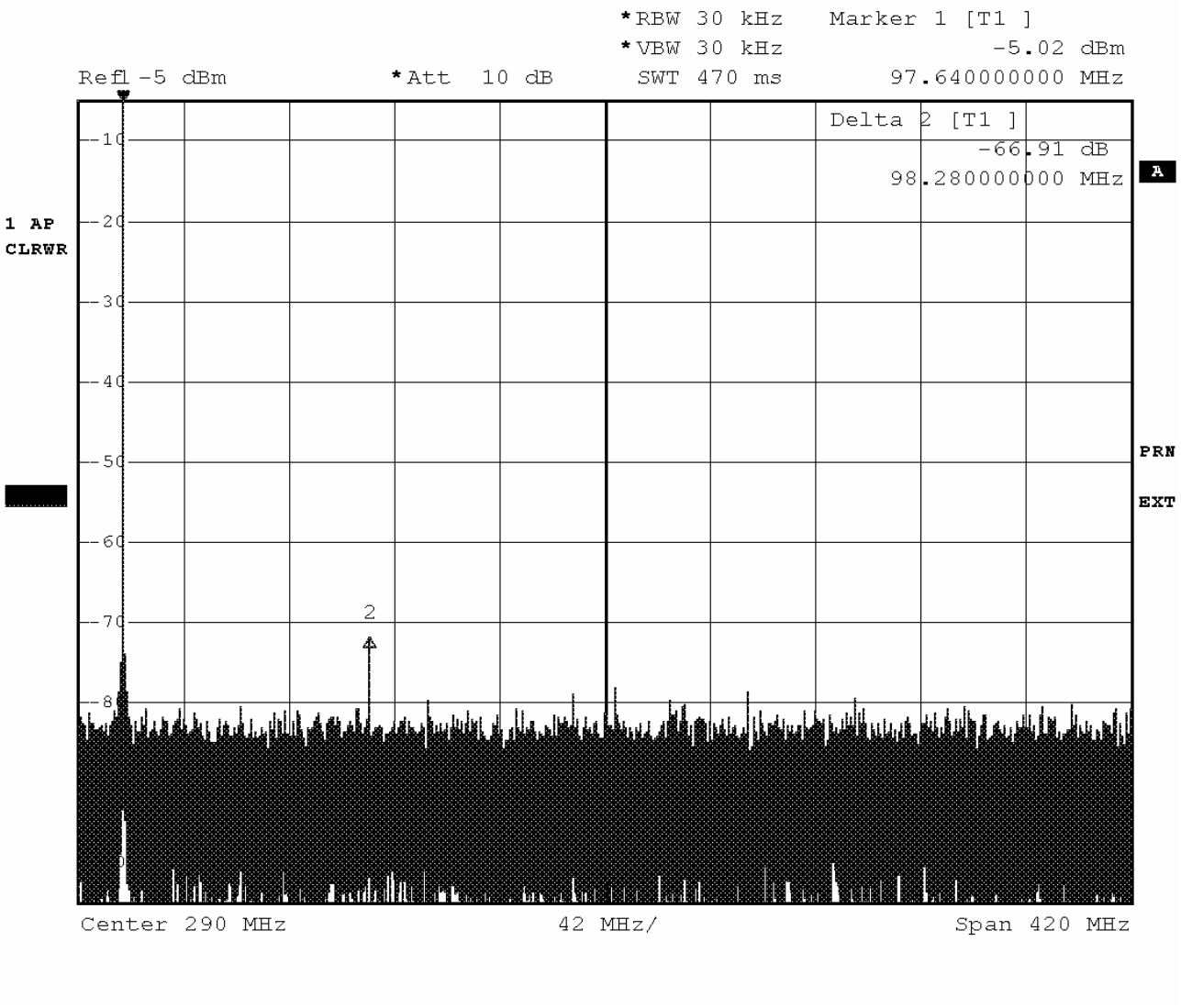
Markers at 120kHz from the carrier. Below 25dBc => Pass



Markers at 240kHz from the carrier. Below 35dBc => Pass



Markers at 600kHz from the carrier. Below (43+10logP)= 58 dBc => Pass

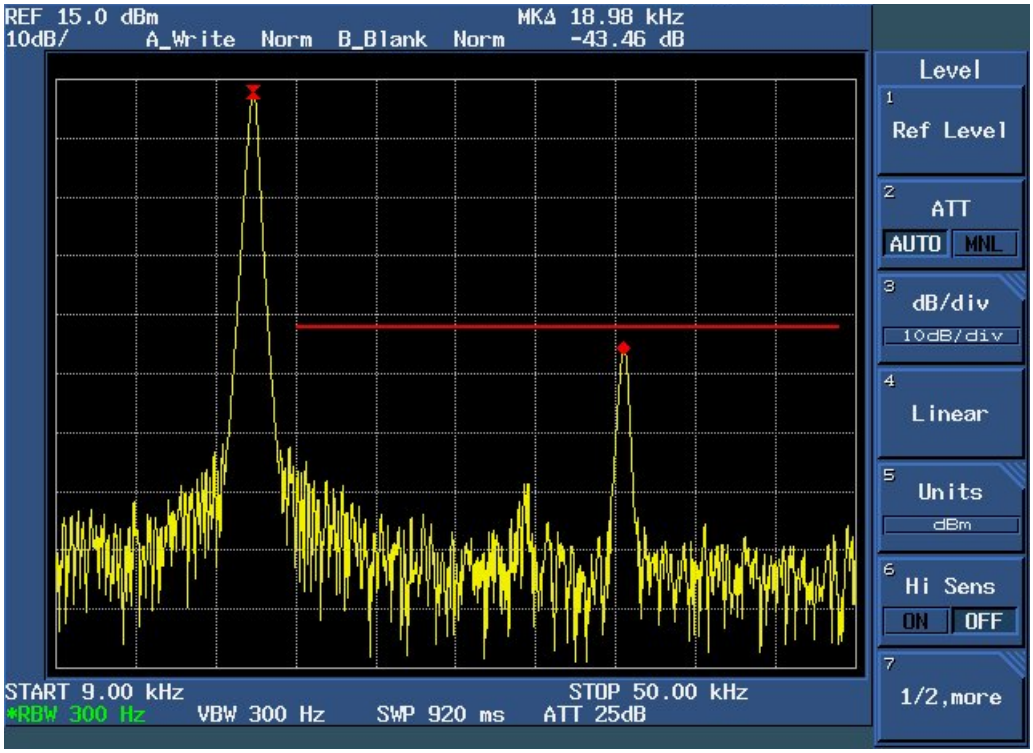


Marker more than 10MHz from the carrier. Below (43+10logP)=58dBc => Pass

As can be seen in the above graphs, in the mono and stereophonic modes, 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 -58 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 correction factor and measured level are used to find the actual level.

HARMONIC	MEASURED LEVEL	CORRECTION FACTOR	CORRECTED VALUE
2th 196 MHz	-67dB	-5.8	-72.8dB
3rd 294 MHz	-78dB	-9.2	-87.2dB
4th 392 MHz	<-85dB (below noise floor)	-10.9	<-95.9dB
5th 490 MHz	<-85dB (below noise floor)	-11.1	<-96.1dB
6th 588 MHz	<-85dB (below noise floor)	-14.1	<-99.1dB
7th 686 MHz	<-85dB (below noise floor)	-16.5	<-101.5dB
8th 784 MHz	<-85dB (below noise floor)	-17.0	<-102.0dB
9th 882 MHz	<-85dB (below noise floor)	-16.5	<-101.5dB
10th 980 MHz	<-85dB (below noise floor)	-18.9	<-103.9dB

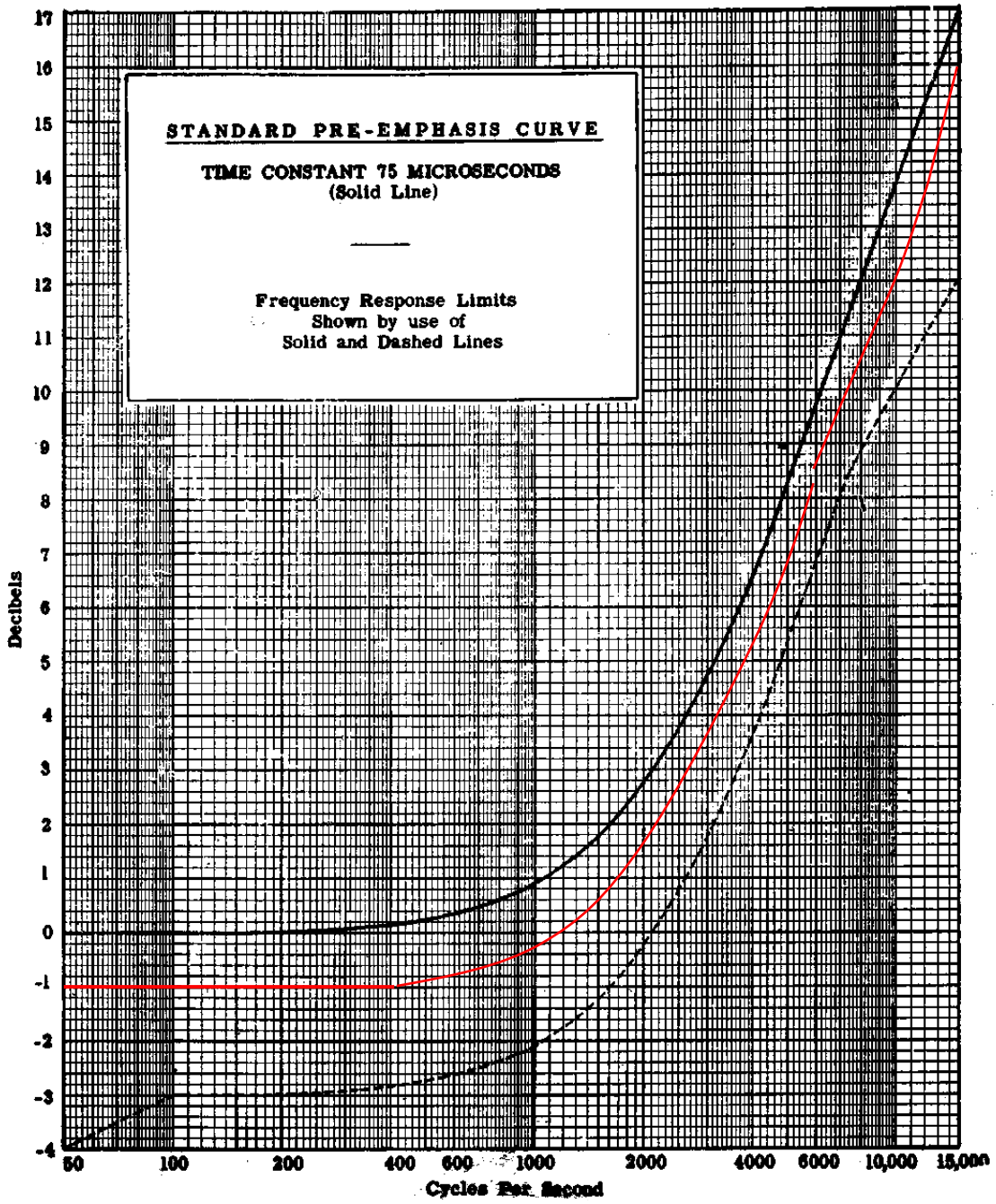
All levels measured are below the level described by –(43+ 10 log Pout); or -58dB.

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 and shown on the graph below.

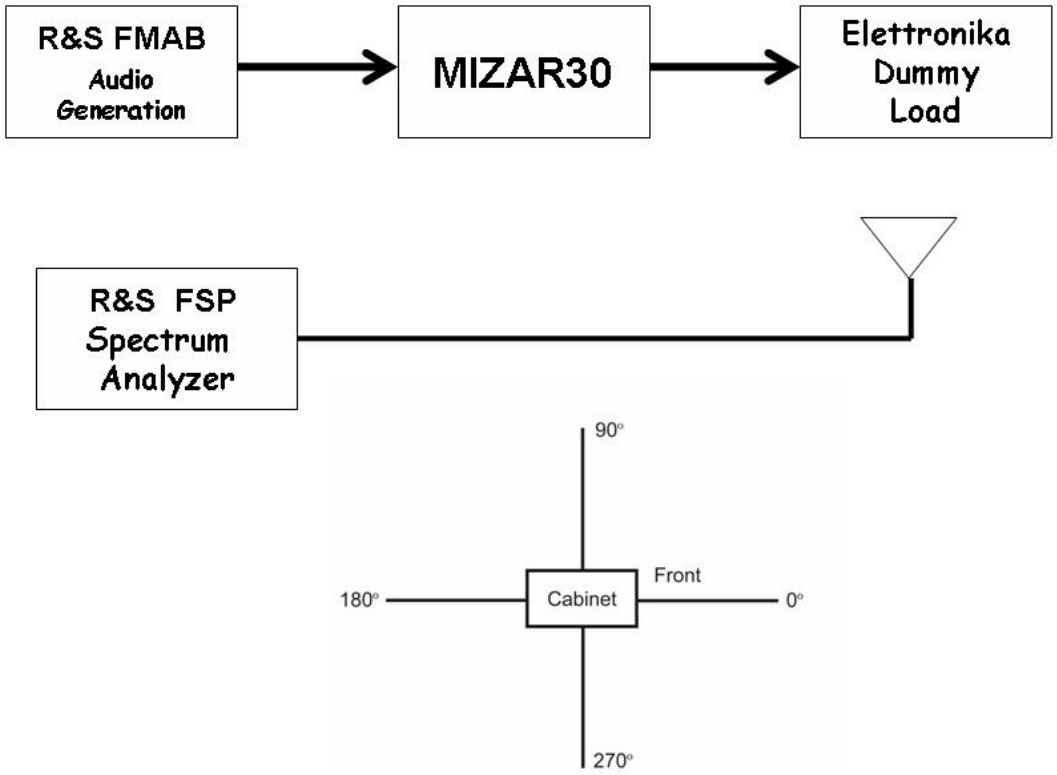
Frequency	Decibels
[Hz]	[dB]
30Hz	-0.05
100Hz	-0.12
400Hz	REF
500Hz	0.08

1kHz	0.72
2kHz	2.62
4kHz	6.42
6kHz	9.26
8kHz	11.41
10kHz	13.18
12kHz	14.94
15kHz	16.90



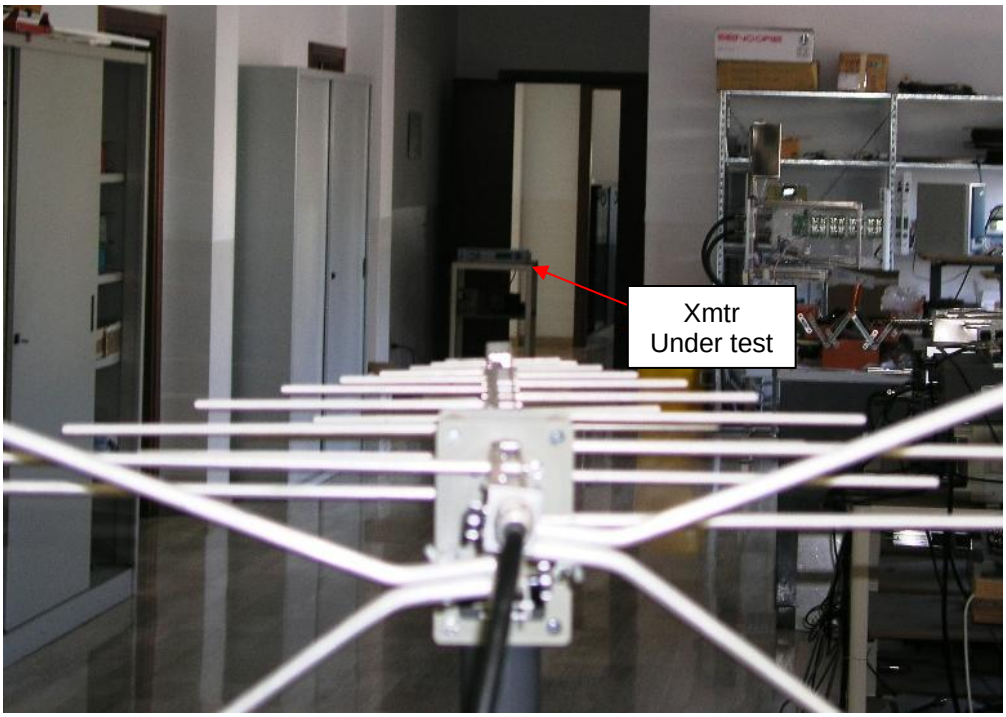
CABINET RADIATION

The transmitter and test equipment were configured as shown below including the angles of measurement with respect to the transmitter cabinet. The photo on the subsequent page also shows the physical set-up of the test equipment and equipment under test. The transmitter was operating at 30 Watts output power (mono 1kHz tone modulating the carrier 100% - deviation 75 kHz). The free space path loss, cable loss and antenna gain characteristics were obtained at the fundamental frequency and at each of the harmonics of the carrier frequency in order to accurately assess the level of the signal radiated from the cabinet. Radiation from the cabinet was measured at a distance of 18m with 4 different physical rotation angles: 0, 90, 180 and 270 degrees (0 degrees being the front of the cabinet). All spurious or harmonic spectral components with levels above the spectrum analyzer noise floor that were radiated from the cabinet were recorded. The frequency range of the main carrier frequency to the 10th harmonic of the carrier frequency was searched. The receiving antenna was oriented to display the highest level of the spurious or harmonic frequency level. The loss of the cable connecting the receiving antenna and the spectrum analyzer is taken into account as part of the spreadsheet. The values are tabulated in the table on the next page following the photo.



PHYSICAL CABINET RADIATION TEST CONFIGURATION

The photograph on the next page shows the actual laboratory environment in which the cabinet radiation tests were conducted with the transmitter under test shown in the background. The transmitter was rotated 90 degrees for each of the measurement orientations.



All measurements at the second harmonic and above were at the noise floor of the spectrum analyzer. As calculated from the spreadsheet data on the following pages, the worst case calculated value was -86dBm at the seventh and eighth harmonic. The measurement tables for the four views of the transmitter are shown on the following pages.

FM XMTR CABINET RADIATION SPREADSHEET

30 W Front View

Antenna	CHASE CBL6111C Bilog Antenna, 30MHz-1GHz, S/N 2630
Spectrum Analyzer	Rohde&Schwarz FSP Spectrum Analyzer, 9kHz - 30GHz, S/N 1093.4495.30
Cable	RG213, 1.92 meters length
Load	ELETTRONIKA 500W S/N 06758
Power meter	BIRD 4391A S/N 11761
Audio Generator	Rohde&Schwarz FMAB, 50kHz - 1360MHz, S/N 0856.4750.52

Harmonic	Frequency	SIGNAL LEVEL	Cable Loss	Antenna Gain	Path Loss	Corrected Level	Maximum Level	Status P=Pass
	MHz	dBm	dB	dB	dB	dBm	dBm	
Fc	98	-60	0,02	-1,2	37,3	-21,5	-15,2	N/A
Fc*2	196	-88	0,03	6,3	43,3	-50,9	-15,2	P
Fc*3	294	-89	0,15	6,2	46,9	-48,2	-15,2	P
Fc*4	392	-88	0,15	5,6	49,4	-44,1	-15,2	P
Fc*5	490	-88	0,3	5,9	51,3	-42,3	-15,2	P
Fc*6	588	-89	0,4	6,0	52,9	-41,7	-15,2	P
Fc*7	686	-89	0,5	6,1	54,2	-40,4	-15,2	P
Fc*8	784	-86	0,5	5,8	55,4	-35,9	-15,2	P
Fc*9	882	-88	0,5	6,2	56,4	-37,3	-15,2	P
Fc*10	980	-87	0,6	5,4	57,3	-34,5	-15,2	P

Left View

Harmonic	Frequency	SIGNAL LEVEL	Cable Loss	Antenna Gain	Path Loss	Corrected Level	Maximum Level	Status P=Pass
	MHz	dBm	dB	dB	dB	dBm	dBm	
Fc	98	-59	0,02	-1,2	37,3	-20,5	-15,2	N/A
Fc*2	196	-87	0,03	6,3	43,3	-49,9	-15,2	P
Fc*3	294	-89	0,15	6,2	46,9	-48,2	-15,2	P
Fc*4	392	-89	0,15	5,6	49,4	-45,1	-15,2	P
Fc*5	490	-91	0,3	5,9	51,3	-45,3	-15,2	P
Fc*6	588	-87	0,4	6,0	52,9	-39,7	-15,2	P
Fc*7	686	-88	0,5	6,1	54,2	-39,4	-15,2	P
Fc*8	784	-89	0,5	5,8	55,4	-38,9	-15,2	P
Fc*9	882	-88	0,5	6,2	56,4	-37,3	-15,2	P
Fc*10	980	-90	0,6	5,4	57,3	-37,5	-15,2	P

Right View

Harmonic	Frequency	SIGNAL LEVEL	Cable Loss	Antenna Gain	Path Loss	Corrected Level	Maximum Level	Status P=Pass
	MHz	dBm	dB	dB	dB	dBm	dBm	
Fc	98	-57	0,02	-1,2	37,3	-18,5	-15,2	N/A
Fc*2	196	-87	0,03	6,3	43,3	-49,9	-15,2	P
Fc*3	294	-89	0,15	6,2	46,9	-48,2	-15,2	P
Fc*4	392	-88	0,15	5,6	49,4	-44,1	-15,2	P
Fc*5	490	-89	0,3	5,9	51,3	-43,3	-15,2	P
Fc*6	588	-88	0,4	6,0	52,9	-40,7	-15,2	P
Fc*7	686	-86	0,5	6,1	54,2	-37,4	-15,2	P
Fc*8	784	-88	0,5	5,8	55,4	-37,9	-15,2	P
Fc*9	882	-89	0,5	6,2	56,4	-38,3	-15,2	P
Fc*10	980	-90	0,6	5,4	57,3	-37,5	-15,2	P

Rear View

Harmonic	Frequency	SIGNAL LEVEL	Cable Loss	Antenna Gain	Path Loss	Corrected Level	Maximum Level	Status P=Pass
	MHz	dBm	dB	dB	dB	dBm	dBm	
Fc	98	-58	0,02	-1,2	37,3	-19,5	-15,2	N/A
Fc*2	196	-91	0,03	6,3	43,3	-53,9	-15,2	P
Fc*3	294	-92	0,15	6,2	46,9	-51,2	-15,2	P
Fc*4	392	-90	0,15	5,6	49,4	-46,1	-15,2	P
Fc*5	490	-89	0,3	5,9	51,3	-43,3	-15,2	P
Fc*6	588	-89	0,4	6,0	52,9	-41,7	-15,2	P
Fc*7	686	-88	0,5	6,1	54,2	-39,4	-15,2	P
Fc*8	784	-90	0,5	5,8	55,4	-39,9	-15,2	P
Fc*9	882	-89	0,5	6,2	56,4	-38,3	-15,2	P
Fc*10	980	-90	0,6	5,4	57,3	-37,5	-15,2	P

VOLTAGE AND CURRENT TO FINAL POWER AMPLIFIER

The transmitter was engaged and the voltage and current to the final amplifier stage were measured at full power and at the indicated reduced power output.

100 % Power = 30 Watts
Voltage = 27 Volts
Current = 2.1 Amps
Power = 56.9 Watts

25% Power = 7.5 Watts
Voltage = 27 Volts
Current = 0.5 Amps
Power = 13.5 Watts

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
Spectrum Analyzer	Rohde & Schwarz	FSP
Receiving Antenna	Chase	CBL6111C Bilog
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