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Technical Report No. 98-058

"EMI Evaluation of the KBS, Inc. TSC 002 Transmitter to FCC "B" Radiated Emission Requirements"

Performed: 26 August 1998

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1. INTRODUCTION

The KBS, Inc.TSC 002 Transmitter operating at 314 MHz was evaluated and the duty cycle was given as 21% (0.021/0.1). The Average value was calculated by using the formulae indicated on Pages 4 and 5 of this report.

The results reported in this 7 page document apply only to the specific items of equipment, configurations, and procedures supplied to the Florida Atlantic University EMI Research Laboratory by The Audio Group, Inc. under the test conditions listed herein.

2. OBJECTIVE

This evaluation was performed to verify conformance of the TSC 002 Transmitter with reference to the U.S. Federal Communications Commission (FCC) Code of Federal Regulations (CFR), Title 47 - Telecommunication, Part 15 - Radio Frequency Devices, Subpart C - Intentional Radiators, Section 15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

3. CONCLUSION

The KBS, Inc. TSC 002 Transmitter met the FCC Class "B" radiated requirements as described in the following pages.

4. TEST PROCEDURES AND RESULTS

4.1 TEST PROCEDURES

The measurement techniques identified in measurement procedure ANSI C63.4-1992 *"American National Standard of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"* were followed as close as practical during this evaluation. Complete details and specific procedures used in this evaluation are discussed in the Tests Results section.

It should be noted that The KBS, Inc. had discussed this device with FCC personnel (Mr. Tom Phillips) as indicated in page 7 of this report. The calculated average value was lower than the peak value due to the duty cycle as indicated in Pages 4 and 5 of this report.

4.2 TEST RESULTS

4.2.1 RADIATED EMISSIONS

The KBS TSC 002 Transmitter unit was placed on the wooden table 80 centimeters above the ground plane floor of the FCC listed Semi-Anechoic test site. Photographs 1 and 2 show the physical configuration that produced the worst case emissions from the unit.

For the fundamental (314 MHz) frequency, an EMCO 1385 Log Periodic Antenna was position 3 meters from the unit. the received signal was fed directly to the HP 8566B Spectrum Analyzer. The analyzer was operated with a resolution video bandwidth of 1 MHz through the HP 8650A Quasi Peak Adapter that was in normal mode.

For second and third harmonic (628 MHz and 942 MHz) frequencies, an EMCO 3185 Log Periodic Antenna was positioned 3 meters from the unit. The received signal was fed through an HP 8447D Amplifier and displayed on the HP 8566B Spectrum Analyzer. The analyzer was operated with a resolution and video bandwidth of 1 MHz through the HP 85650A Quasi Peak Adapter that was in normal mode. The Spectrum Analyzer was operated in the "peak" detector mode at all times with 'Trace A' in 'Max Hold' and 'Trace B' in 'Clear Write'.

The turntable was then rotated 360 degrees and the antenna scanned in height from 1 to 4 meters until the maximum emission level was observed. This procedure was repeated with the antenna in both the horizontal and vertical polarizations and with the "TSC 002 Transmitter" unit in the two orthogonal axis orientations.

For spurious (harmonic) emission frequencies above 1 GHz, an EMCO 3115 Double Ridged Guide Antenna was positioned 3 meters from the unit. The received signal was fed through an HP 83017A Amplifier and a low loss heliax cable to the HP 8566B Spectrum Analyzer. The spectrum analyzer was operated with a resolution bandwidth of 1 MHz and video bandwidth on Auto in the "peak" detector mode with 'Trace A' in 'Max Hold' and 'Trace B' in 'Clear Write'.

The turntable was again rotated and the antenna scanned in height for the maximum emission level in both horizontal and vertical polarizations with the "TSC 002 Transmitter" unit oriented in the two orthogonal axis positions.

Tables 1 and 2 show the antenna induced voltage (dBuV) at the spectrum analyzer with the respective cable loss (dB), amplifier gain (dB), and antenna factors (dB) used to determine the field intensity (dBuV/m and uV/m) level at each frequency for both antenna polarizations and unit positions.

TABLE 1. FIELD STRENGTH - SIDE ORIENTATION

FREQ MHz	ANT. POL.	PEAK Reading . dBuV	C.L. dB	G.A. dB	A.F. dB	Calculated Peak value dBuV/m	Average Value uV/m	Allowable Limit uV/m
314	VERT	47.6	2.3	N/A	13.9	63.8	325.3	2,399
314	HOR	50.6	2.3	N/A	13.9	66.8	459.4	2,399
628	VERT	60.6	3.5	26.6	18.9	56.4	138.7	240
628	HOR	60.6	3.5	26.6	18.9	56.4	138.7	240
942	VERT	44.5	4.6	26.6	21.9	44.3	34.5	240
942	HOR	43.6	4.6	26.6	21.9	43.4	31.1	240
1,256	VERT	53.7	6.5	32.0	30.5	58.7	180.8	240
1,256	HOR	51.3	6.5	32.0	30.5	56.3	137.2	240
1,570	VERT	45.4	7.1	31.2	31.1	52.4	87.5	240
1,570	HOR	45.7	7.1	31.2	31.1	52.7	90.6	240
1,884	VERT	46.5	7.7	31.0	33.9	57.1	150.4	240
1,884	HOR	44.3	7.7	31.0	33.9	54.9	116.7	240
2,198	VERT	42.5	8.1	29.7	34.5	55.4	123.7	240
2,198	HOR	40.5	8.1	29.7	34.5	53.4	98.2	240
2,512	VERT	40.0	8.6	29.5	34.4	53.5	99.4	240
2,512	HOR	39.4	8.6	29.5	34.4	52.9	92.7	240
2,826	VERT	39.8	9.0	29.5	35.9	55.2	120.8	240
2,826	HOR	39.7	9.0	29.5	35.9	55.1	119.5	240
3,140	VERT	38.4	9.4	27.7	36.6	56.7	143.6	240
3,140	HOR	39.0	9.4	27.7	36.6	57.3	153.9	240

IND. dBuV + C.L.dB - G.A.dB + A.F.dB = TOTAL dBuV/m
IND. dBuV = Induced Voltage at Spectrum Analyzer
C.L. dB = Cable Loss, G.A. dB = Amplifier Gain
A.F. dB = Antenna Factors, Duty cycle = (0.021/0.1)

Average Value = Calculated Peak value in uV/m *Duty cycle

TABLE 2: FIELD STRENGTH LEVELS - BASE ORIENTATION.

FREQ MHz	ANT. POL.	PEAK Reading . dBuV	C.L. dB	G.A. dB	A.F. dB	Calculated Peak Value dBuV/m	Average Value uV/m	Allowable Limit uV/m
314	VERT	47.6	2.3	N/A	13.9	63.8	325.3	2,399
314	HOR	47.6	2.3	N/A	13.9	63.8	325.3	2,399
628	VERT	55.9	3.5	26.6	18.9	51.7	80.8	240
628	HOR	61.0	3.5	26.6	18.9	56.8	145.3	240
942	VERT	46.5	4.6	26.6	21.9	46.4	43.9	240
942	HOR	41.6	4.6	26.6	21.9	41.5	25.0	240
1,256	VERT	52.1	6.5	32.0	30.5	57.1	150.4	240
1,256	HOR	46.6	6.5	32.0	30.5	51.6	79.8	240
1,570	VERT	44.0	7.1	31.2	31.1	51.0	74.5	240
1,570	HOR	44.0	7.1	31.2	31.1	51.0	74.5	240
1,884	VERT	43.4	7.7	31.0	33.9	54.0	105.2	240
1,884	HOR	44.5	7.7	31.0	33.9	55.1	119.5	240
2,198	VERT	40.7	8.1	29.7	34.5	53.6	100.5	240
2,198	HOR	40.9	8.1	29.7	34.5	53.8	102.9	240
2,512	VERT	40.5	8.6	29.5	34.4	54.0	105.2	240
2,512	HOR	39.9	8.6	29.5	34.4	53.4	98.2	240
2,826	VERT	38.7	9.0	29.5	35.9	54.1	106.5	240
2,826	HOR	38.8	9.0	29.5	35.9	54.2	107.7	240
3,140	VERT	38.8	9.4	27.7	36.6	57.1	150.4	240
3,140	HOR	37.8	9.4	27.7	36.6	56.1	134.0	240

IND. dBuV + C.L.dB - G.A.dB + A.F.dB = TOTAL dBuV/m
IND. dBuV = Induced Voltage at Spectrum Analyzer
C.L. dB = Cable Loss**,** G.A. dB = Amplifier Gain
A.F. dB = Antenna Factors**,** Duty Cycle = (0.021/0.1)
Average Value = Calculated Peak Value in uV/m * Duty Cycle

PHOTOGRAPHS 1 & 2: RADIATED EMISSION SETUP