



FCC CFR47 PART 95 SUBPART D CERTIFICATION

TEST REPORT

FOR

72 MHZ – 5 CHANNEL BROADCAST TRANSMITTER

MODEL: SYSTEM-X FLASH-5

FCC ID: IFHFLA54SX

REPORT NUMBER: 99U0207

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NVLAQ[®]
LAB CODE:200065-0

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(9) Tune-up/Optimization Procedure

1. Attached 9.6Vdc power supply
2. Using a spectrum analyzer and a short pick-up antenna, look for 72 MHz signal with sufficient scan width to see 28-144MHz spurious.
3. Adjust T, T2, T3, T4 and T5 for maximum output at operating frequency and minimum output at $F_o \times 4$ MHz.
4. Repeat step 3.
5. Check for minimum emission from 144 to 730 MHz.

(10) Means for Frequency Stabilization

SEE ATTACHMENT: SPECIFICATIONS OF TRANSMITTER

(11) Means for Limiting Modulation

SEE ATTACHMENT: SPECIFICATIONS OF TRANSMITTER

(11) Means for Limiting Power

SEE ATTACHMENT: SPECIFICATIONS OF TRANSMITTER

(11) Means for Attenuating Higher Audio Frequencies

Not Applicable

(12) Description of Digital Modulation Techniques

Not Applicable

2.983(e) Standard Test Conditions

The transmitter was tested under the following conditions:

Room Temperature: 20 - 23 °C

Relative Humidity: 35 - 50%

DC Supply Voltage: 9.6Vdc.

The transmitter was aligned and tuned up according to manufacturer's alignment procedure, prior to testing. All data presented represents the worst case parameter being measured.

Section 2.983(f) Equipment Identification

FCC ID:IFHFLA54SX

Section 2.983(g) Photographs

SEE ATTACHMENT: PHOTOS

.Section 2.983 Description of Various Base Station Configurations

Not applicable

Section 2.983 Use of Various Power Supplies

Not applicable

TYPE OF EQUIPMENT:	RC TRANSMITTER
MEASUREMENT DISTANCE:	3 METER
TECHNICAL LIMIT:	95.635
FCC RULES:	95.635
EQUIPMENT AUTHORIZATION PROCEDURE	CERTIFICATION
MODIFICATIONS MADE ON EUT	NO

The above equipment was tested by Compliance Certification Services for compliance with the requirements set forth in the FCC CFR 47, PART 15 AND 95. The results of testing in this report apply to the product/system, which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved By

MIKE C.I. KUO / VICE - PRESIDENT
COMPLIANCE CERTIFICATION SERVICES

2. TEST FACILITY

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

3. ACCREDITATION AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code:200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT(1300F2))

4. MEASUREMENT INSTRUMENTATION

Radiated emissions were measured with one or more of the following types of linearly polarized antennas: tuned dipole, Biconical, log periodic, BI-log, ridged waveguide, and liner horn. EMI receivers were used for line conducted readings, spectrum analyzers with pre-selectors and quasi-peak detectors were used to perform radiated measurements. Receiving equipment (i.e., receiver, analyzer, quasi-peak adapter, pre-selector) and LISNs conform to CISPR specification for "Radio Interference Measuring Apparatus and Measurement Methods," Publication 16.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

5. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

6. UNITS OF MEASUREMENT

Measurements of radiated interference are reported in terms of dB(uV/m) at a specified distance. The indicated readings on the spectrum analyzer were converted to dB(uV/m) by

use of appropriate conversion factors. Measurements of conducted interference are reported in terms of dB(uV).

The field strength is calculated by adding the Antenna Factor and Cable Factors, then by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

Assume a receiver reading of 52.5 dBuV is obtained. The Antenna Factor of 7.4dB/m and a Cable Factor of 1.1dB is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dBuV/m. The 32 dBuV/m value was mathematically converted to its corresponding level in uV/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dBuV/m}$$

$$\text{Level in uV/m} = \text{Common Antilogarithm} [(32 \text{ dBuV/m})/20] = 39.8 \text{ uV/m}$$

7. CLASSIFICATION OF DIGITAL DEVICE

Class A includes digital devices that are marketed for use in commercial, industrial or business environments, excluding devices which are marketed for use by the general public or are intended to be used in the home.

Class B includes digital devices that are marketed for use in residential environments, notwithstanding use in commercial, business and industrial environments.

Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as Class B device, and in fact is encouraged to do so provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

8. RADIATED EMISSION LIMITS

FCC PART 15 CLASS A

MEASURING DISTANCE OF 10 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	90	39.1
88-216	150	43.5
216-960	210	46.4
Above 960	300	49.5

FCC PART 15 CLASS B

MEASURING DISTANCE OF 3 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

9. RADIATED EMISSION TEST PROCEDURE

The EUT and all other support equipment are placed on a wooden table 80-cm above the ground screen. Antenna to EUT distance is 3 meters . During the test, the table is rotated 360 degrees to maximize emissions and the antenna is positioned from 1 to 4 meters above the ground screen to further maximize emissions. The antenna is polarized in both vertical and horizontal positions.

EUT test configuration is according to Section 8 of ANSI C63.4/1992.

Monitor the frequency range of interest at a fixed antenna height and EUT azimuth. Frequency span should be small enough to easily differentiate between broadcast stations and intermittent ambients. Rotate EUT 360 degrees to maximize emissions received from EUT. If emission increases by more than 1 dB, or if another emission appears that is greater by 1 dB, return to azimuth where maximum occurred and perform additional cable manipulation to further maximize received emission.

Move antenna up and down to further maximize suspected highest amplitude signal. If emission increased by 1 dB or more, or if another emission appears that is greater by 1dB or more, return to antenna height where maximum signal was observed and manipulate cables to produce highest emissions, noting frequency and amplitude.

10. AMBIENT CONDITIONS

The ambient conditions at the time of final tests were as follows:

	Radiated Emission	Conducted Emission
Temperature	20	N/A °C
Humidity	60	N/A %

11. EQUIPMENT MODIFICATIONS

Not Applicable

12. TEST EQUIPMENT LIST

Equipment	Manufacturer	Model No.	Serial No.	Site	Cal Date	Due Date
Spectrum Analyzer	H.P.	8568B	2732A03661	C	04/99	04/00
Spectrum Display	H.P.	85662A	2811A015728	C	04/99	04/00
Quasi-peak Detector	H.P.	85650A	2811A01335	C	11/99	11/00
Pre-Amp	H.P.(P5)	8447D	2944A06550	C	09/98	09/99
Antenna	Eaton	94455-1	1214	C	10/98	10/99
Antenna	EMCO	3146	9107-3163	C	10/98	10/99

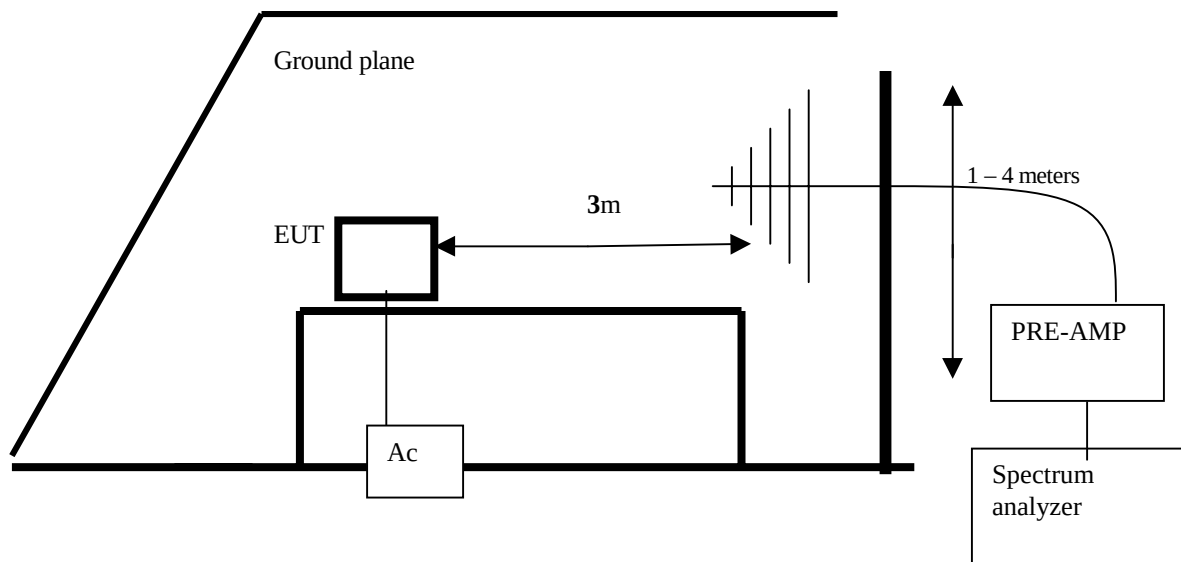
13. FCC PART 2 CERTIFICATION TEST RESULTS:

SECTION 2.1046 (was section 2.985): RF POWER OUTPUT

Equipment used.

HP Spectrum Analyzer/8566B
HP Spectrum Display/85662A
HP Quasi-Peak Detector/85650A
HP Pre-Amp(P5)/8447D
Emco Log-Periodic Antenna/3146

Test setup



Test procedure:

The EUT was placed on a wooden table on the outdoor ground plane. The search antenna was placed 3 Meters from the EUT. With the transmitter operating at full power the turntable was slowly rotated to locate the direction of maximum emission once maximum direction was determined; the search antenna was raised and lowered in both vertical and horizontal polarization.

Test Result:

Radiated power was measured with Spectrum analyzer. Output power was calculated from radiated readings.

$$117.95\text{dBuV/m} = 0.79\text{V/m}$$

$$\text{ERP} = \frac{(E \cdot D)^2}{30 \cdot G} \quad \text{ERP} = \frac{(0.79 \cdot 3)^2}{30 \cdot 0.64} = 292\text{mWatts}$$

E=V/m, D=distance in meters, G=antenna gain

SECTION 2.1049 (Was Section 2.989): OCCUPIED BANDWIDTH

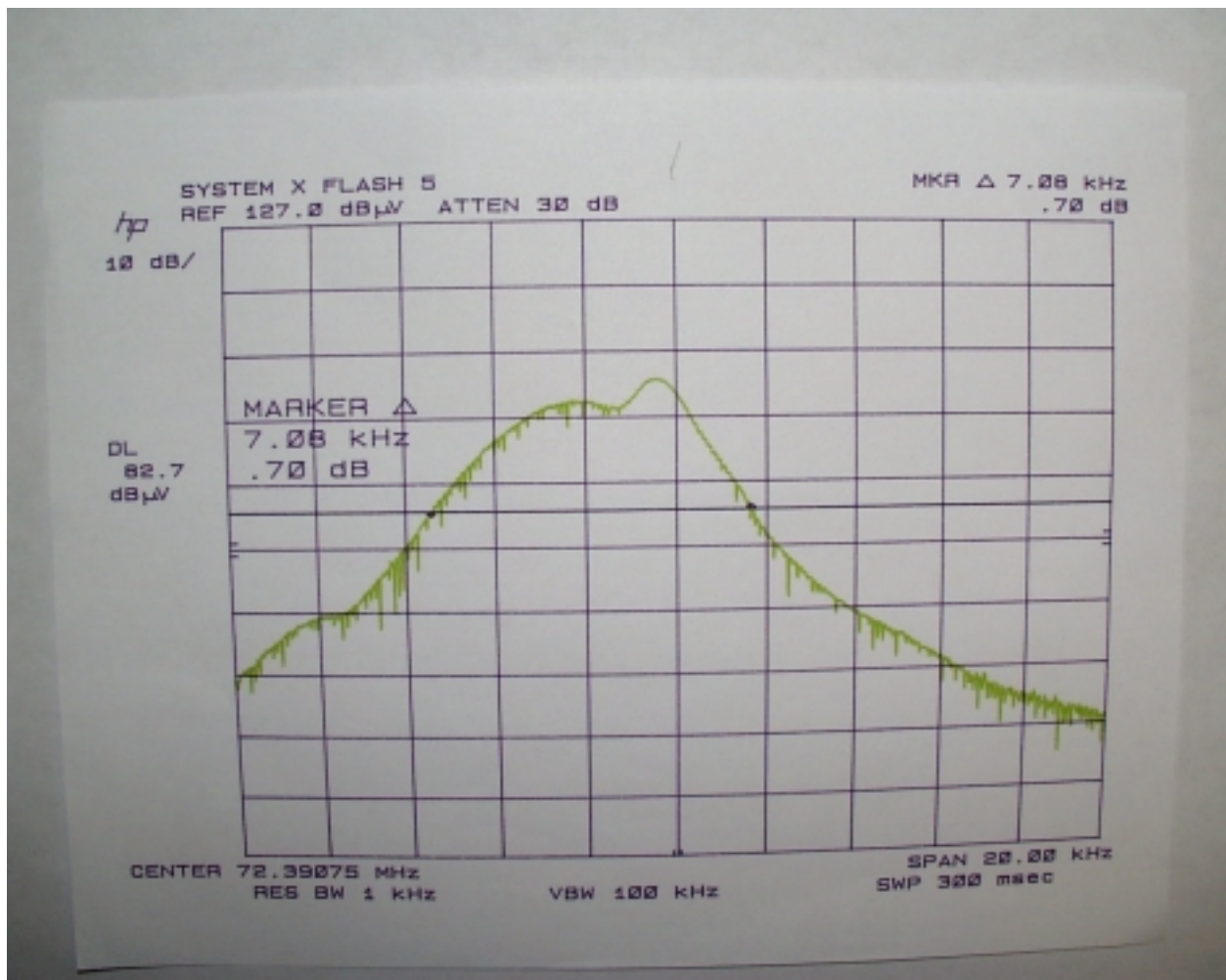
SPECTRUM ANALYZER PLOTS

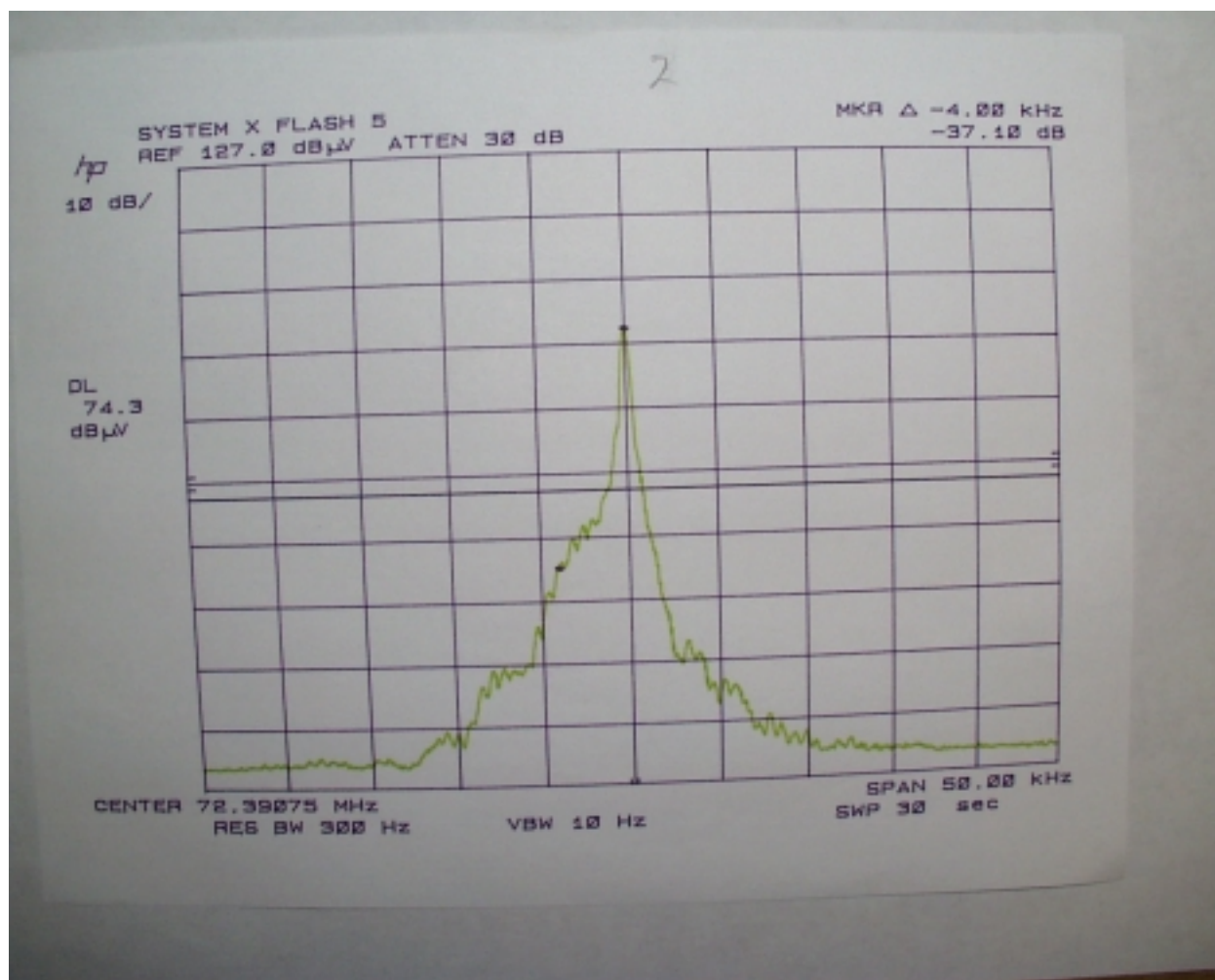
PLOT

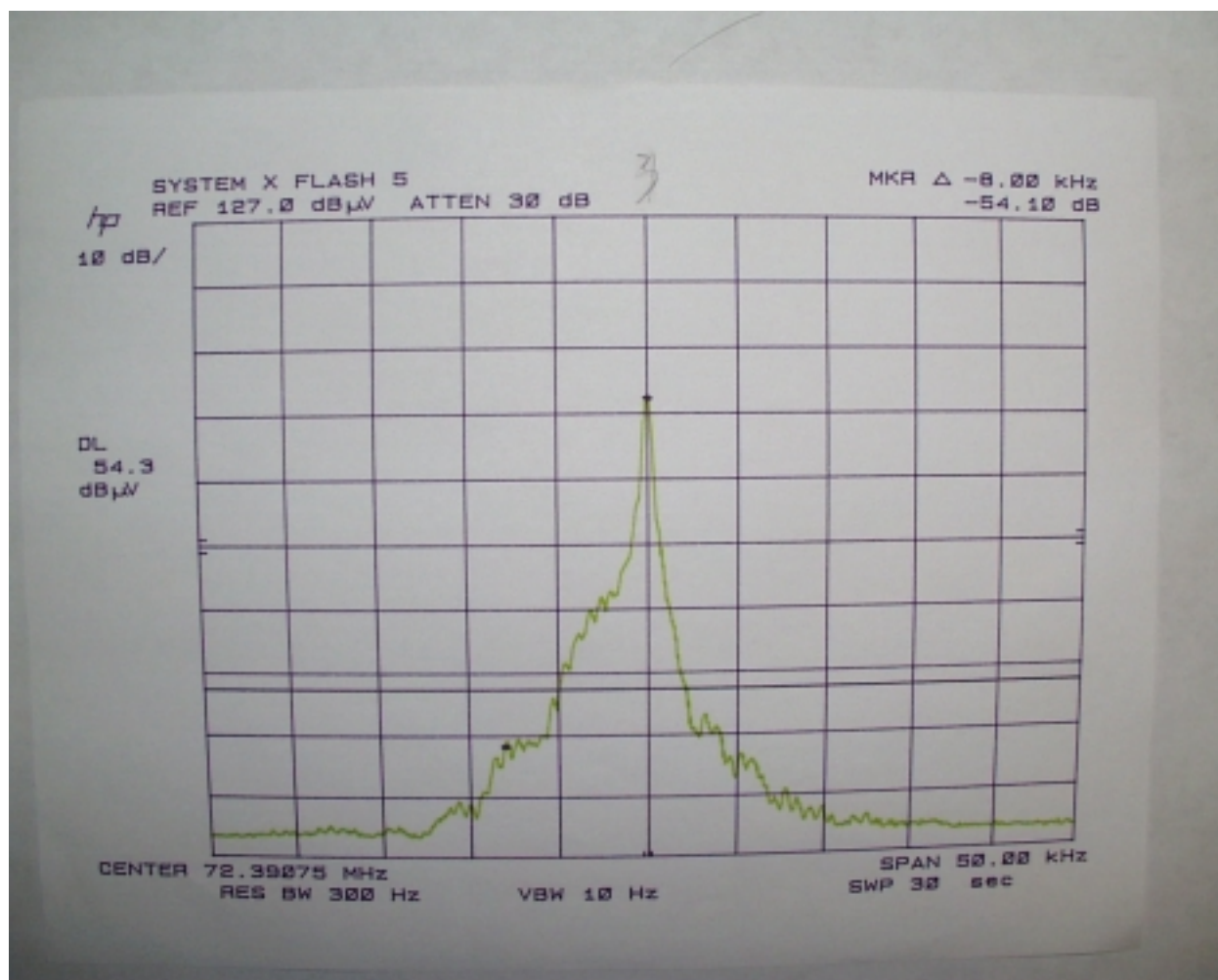
Authorized Bandwidth
50%-100% of Auth. B/W -25dB
100%-125% of Auth. B/W -45dB
125%-250% of Auth. B/W -55dB

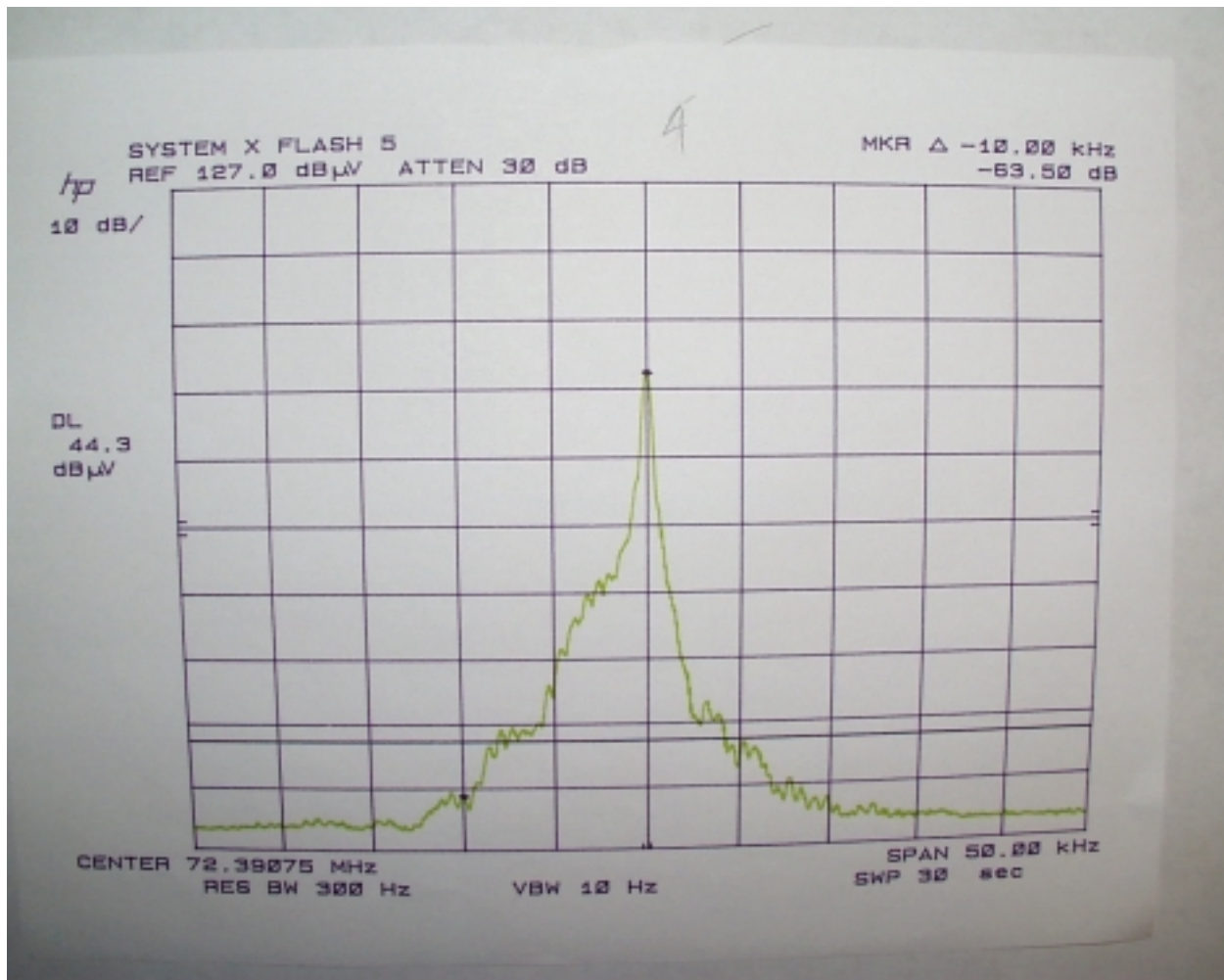
PLOT

1
2
3
4









SECTION 2.1051 (2.991): SPURIOUS EMISSION AT ANTENNA TERMINAL.

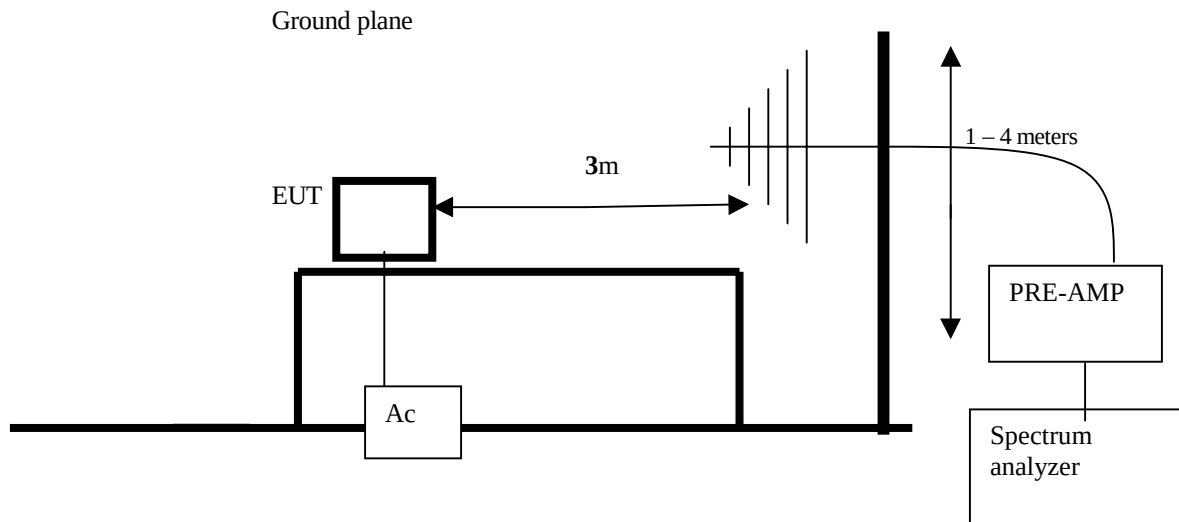
Not Applicable

SECTION 2.1053 (2.993): FIELD STRENGTH OF SPURIOUS RADIATION.

Equipment used.

HP Spectrum Analyzer/8566B
HP Spectrum Display/85662A
HP Quasi-Peak Detector/85650A
HP Pre-Amp(P5)/8447D
Emco Log-Periodic Antenna/3146

Test setup



Test procedure:

The EUT was placed on a wooden table on the outdoor ground plane. The search antenna was placed 3 Meters from the EUT. With the transmitter operating at full power the turntable was slowly rotated to locate the direction of maximum emission once maximum direction was determined; the search antenna was raised and lowered in both vertical and horizontal polarization.

Test Result:

Radiated data attached.

Compliance Engineering Services Inc.

Project No. : 99U0207
Report No. : 990427B2
Date : 04/28/1999
Time : 13:45
Test Engr : PETE K

>> 3 M RADIATED EMISSION DATA <<

Company : HITEC RCD
Equipment Under Test : SYSTEM-X FLASH 5
Test Configuration : EUT ONLY
Type of Test : FCC CLASS B
Mode of Operation : NORMAL

Freq.	dBuV	PreAmp	Ant	Cable	dBuV/m	Limit	Margin	Pol	Hgt(m)	Az
X-AXIS										
Biconical 1197 ; No Pre-pamp :										
72.39	109.90	0.00	6.18	1.65	117.72			H	3.0	90
144.78	48.30	0.00	15.78	2.43	66.51	69.20	-2.69	H	3.0	90
Z-AXIS										
72.39	109.90	0.00	6.18	1.65	117.72			H	3.0	0
144.78	48.50	0.00	15.78	2.43	66.71	69.20	-2.48	H	3.0	0
Y-AXIS										
72.39	109.70	0.00	6.60	1.65	117.95			V	1.5	0
144.78	46.80	0.00	16.38	2.43	65.61	69.20	-3.59	V	1.5	0
LP 2120 ; No Pre-pamp :										
217.17	40.80	0.00	10.98	3.08	54.85	69.20	-14.35	V	1.5	0
LP 2120 ; Pre-pamp = 8447D-P8 2944A06589:										
289.56	47.50	-26.80	13.48	3.58	37.77	69.20	-31.43	V	1.0	0
361.93	47.80	-27.10	14.89	4.06	39.65	69.20	-29.55	V	1.0	0
434.34	51.00	-27.49	16.13	4.50	44.14	69.20	-25.06	V	1.0	0
506.73	42.70	-27.88	17.49	4.90	37.21	69.20	-31.99	V	1.0	0
579.10	51.00	-28.05	18.20	5.28	46.43	69.20	-22.77	V	1.0	0
651.51	43.10	-28.08	19.46	5.72	40.19	69.20	-29.01	V	1.0	0
723.90	43.30	-28.00	20.55	6.15	41.99	69.20	-27.21	V	1.0	0
X-AXIS:										
LP 2120 ; No Pre-pamp :										
217.15	48.10	0.00	11.49	3.08	62.67	69.20	-6.53	H	2.0	90
LP 2120 ; Pre-pamp = 8447D-P8 2944A06589:										
289.56	54.80	-26.80	13.98	3.58	45.56	69.20	-23.64	H	2.0	90
361.95	51.00	-27.10	15.41	4.06	43.37	69.20	-25.83	H	2.0	90
434.34	53.60	-27.49	16.51	4.50	47.12	69.20	-22.08	H	2.0	90
506.73	44.70	-27.88	17.65	4.90	39.38	69.20	-29.82	H	2.0	90
579.10	56.60	-28.05	18.91	5.28	52.74	69.20	-16.46	H	3.0	90
651.51	46.70	-28.08	20.12	5.72	44.46	69.20	-24.74	H	2.0	90
723.90	53.30	-28.00	21.11	6.15	52.56	69.20	-16.64	H	2.0	90
Z-AXIS:										
LP 2120 ; No Pre-pamp :										
217.17	47.50	0.00	11.49	3.08	62.07	69.20	-7.13	H	2.0	90
LP 2120 ; Pre-pamp = 8447D-P8 2944A06589:										
289.56	54.30	-26.80	13.98	3.58	45.06	69.20	-24.14	H	2.0	90

361.93	46.70	-27.10	15.41	4.06	39.07	69.20	-30.13	H	2.0	90
434.34	50.60	-27.49	16.51	4.50	44.12	69.20	-25.08	H	2.0	90
506.73	44.50	-27.88	17.65	4.90	39.18	69.20	-30.02	H	2.0	90
579.12	51.10	-28.05	18.91	5.28	47.24	69.20	-21.96	H	2.0	90
651.51	48.80	-28.08	20.12	5.72	46.56	69.20	-22.64	H	2.0	90
723.90	46.60	-28.00	21.11	6.15	45.86	69.20	-23.34	H	2.0	90

Total # of data 38

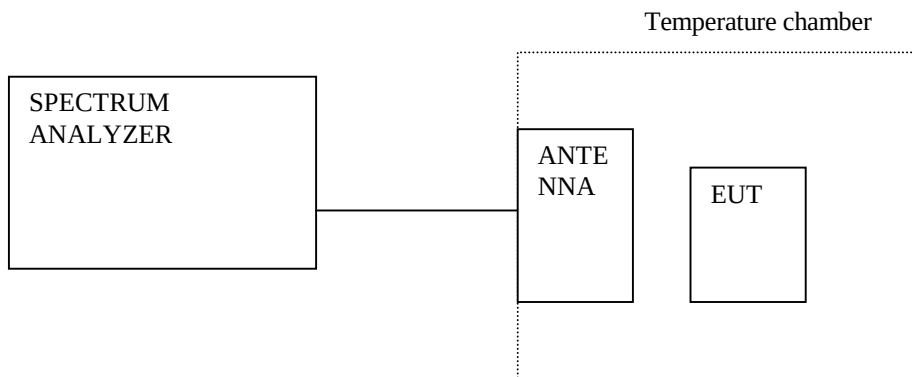
V. b2.2

SECTION 2.1055 (Was Section 2.995): FREQUENCY STABILITY

Test Equipment:

HP Spectrum Analyzer/8593EM
FLEXCO cable; 1ft. coaxial cable (loss: .9dB/ft @ 26GHz)
Thermotron Corp./SAF-16C Mini max (Temperature chamber)

Test Setup:



Minimum Requirement:

Test Method

Temperature: Vary the ambient temperature from -30 to +50°C, in 10 degree increments, allowing the EUT to stabilize at each temperature.

Primary Supply Voltage: Vary the supply voltage from 85% to 115% of the nominal operating voltage

Test Results

Refer to spreadsheet.

[illegible]

SECTION 95.635 EMISSION MASKS

SPECTRUM ANALYZER PLOTS

PLOT

Authorized Bandwidth
50%-100% of Auth. B/W -25dB
100%-125% of Auth. B/W -45dB
125%-250% of Auth. B/W -55dB

PLOT

1
2
3
4

