NVLAP Lab Code 200087-0

Application Submittal Test Report

FOR

FCC CFR47 Part 87, Grant Of Certification

For

Model: TT21

1090 MHz

Multi-Mode S Aviation Transponder

FCC ID: VZI00675

For

Trig Avionics Limited

Heriot Watt Research Park

Riccarton

Currie EH14 4AP United Kingdom

Test Report Number 090507

Authorized Signatory: Scot D Rogers

Scot D. Rogers

NVLAP Lab Code 200087-0

ROGERS LABS, INC.
4405 West 259th Terrace
Louisburg, KS 66053
Phone / Fax (913) 837-3214

Test Report For Application of Certification

For

Trig Avionics Limited

Heriot Watt Research Park
Riccarton
Currie EH14 4AP United Kingdom
Phone: 011 44 131 449 8810

Mr. Andrew Davis
CEO

MULTI-MODE S AVIATION TRANSPONDER
Model: TT21
Part Number: 000675-00
Frequency Range: 1090 MHz

FCC ID: VZI00675

Test Date: May 7, 2009

Certifying Engineer: Scot D Rogers

Scot D. Rogers
Rogers Labs, Inc.
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Table Of Contents

Forward

In accordance with the Federal Communications, Code of Federal Regulations, dated October 1, 2008, Part 2 Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.915, 2.925, 2.926, 2.1031 through 2.1057, and Part 87, Subchapter D, Paragraphs 87.131 through 87.147 the following information is submitted.

Opinion / Interpretation of Results

Tests Performed	Results
Emissions Tests	
Requirements per CFR47 paragraphs 2 2.1031-2.1057	Complies
Requirements per CFR47 paragraphs 87.131	Complies
Requirements per CFR47 paragraphs 87.133 (d)	Complies
Requirements per CFR47 paragraphs 87.135	Complies
Requirements per CFR47 paragraphs 87.139	Complies
Requirements per CFR47 paragraphs 87.141	Complies

Applicable Standards & Test Procedures

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2008, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, and applicable paragraphs of Part 87 the following is submitted for consideration in obtaining a Grant of Certification. Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in ANSI 63.4-2003.

Environmental Conditions

Ambient Temperature	25.3° C
Relative Humidity	37%
Atmospheric Pressure	1007.8 mb

2.1033(c) Application for Certification

(1) Manufacturer: Trig Avionics Limited
Heriot Watt Research Park
Riccarton
Currie EH14 4AP
United Kingdom

(2) Identification: FCC I.D.: VZI00675

(3) Instruction Book: Refer to exhibit for Draft Instruction Manual.

(4) Emission Type: Emissions designator 7M42V1D

(5) Frequency Range: 1090 MHz

(6) Operating Power Level: 141-Watts peak, 1.4 Watts (Average Power) delivered

(7) Maximum P_o: 141 Watts (nominal peak power) and 1.4 watts average delivered from this EUT. Maximum power output as determined by appropriate standards during certification per CFR 47 paragraph 87.131. The specifications of RTCA/DO-181C stipulate 125W peak minimum and 500W maximum RF peak output power.

(8) Power into final amplifying circuitry: Final amplifier 48 volts @ 8.7 amps (415 watts peak power).

(9) Tune Up Procedure for Output Power: Refer to Exhibit for Transceiver Alignment Procedure.

(10) Circuit Diagrams; description of circuits, frequency stability, spurious suppression, and power and modulation limiting: Refer to Exhibit for Circuit Diagrams and theory of Operation.

(11) Photograph or drawing of the Identification Plate: Refer to Exhibit for Photograph or Drawing.

(12) Drawings of Construction and Layout: Refer to Exhibit for Drawings of Components Layout and Chassis Drawings.

(13) Detail Description of Digital Modulation:

The unit employs pulse modulation prescribed by FAA TSOC112. This requires pulses of 0.500 ±0.050 microseconds for Mode S with rise times of 0.100-microsecond maximum and fall-times of 0.200 microseconds maximum for both. The maximum rated condition, Mode S reply, has a 120 microsecond length with four pulses in the first eight microseconds, which is called the preamble, and pulses of 0.5 or 1.0 microsecond length filling in the next 112 microseconds, which is called the data block. Binary data is coded by the pulse position in the one-microsecond frames.

(14) Data required by CFR47 paragraphs 2.1046 through 2.1057 are contained in the report.

(15) External power amplifier requirements do not apply to this device or application.

(16) AM broadcast requirements do not apply to this device or application.

(17) Requirements of CFR47 paragraph 25.129 do not apply to this device or application.

(18) The device is not a software-defined radio and requirements of 2.944 do not apply to this application.

Units of Measurements

AC Line Conducted EMI Data is in dBμV; dB referenced to one microvolt.

Radiated EMI Data is in dBμV/m; dB/m referenced to one microvolt per meter

Antenna Conducted Data is in dBm, dB referenced to one milliwatt

Test Site Locations

Conducted EMI The AC power line conducted emissions testing performed in a shielded screen room located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.

Radiated EMI The radiated emissions tests were performed at the 3 meters, Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.

Site Approval Refer to Annex for FCC Site Registration Letter, # 90910, and Industry Canada Site Registration Letter, IC3041A-1.

List of Test Equipment

A Hewlett Packard 8591EM Spectrum Analyzer was used as the measuring device for the emissions testing of frequencies below 1 GHz. A Hewlett Packard 8562A Spectrum Analyzer was used as the measuring device for testing the emissions at frequencies above 1 GHz. The analyzer settings used are described in the following table. Refer to the appendix for a complete list of test equipment.

HP 8591 EM ANALYZER SETTINGS		
CONDUCTED EMISSIONS		
RBW	AVG. BW	DETECTOR FUNCTION
9 kHz	30 kHz	Peak / Quasi Peak
RADIATED EMISSIONS		
RBW	AVG. BW	DETECTOR FUNCTION
120 kHz	300 kHz	Peak / Quasi Peak
HP 8562A ANALYZER SETTINGS		
RBW	VIDEO BW	DETECTOR FUNCTION
100 kHz	100 kHz	PEAK
1 MHz	1 MHz	Peak / Average

Equipment	Mfg.	Model	Cal. Date	Due.
LISN	Comp. Design	FCC-LISN-2-MOD.CD	10/08	10/09
LISN	Comp. Design	1762	2/09	2/10
Antenna	ARA	BCD-235-B	10/08	10/09
Antenna	EMCO	3147	10/08	10/09
Antenna	EMCO	3143	5/09	5/10
Analyzer	HP	8591EM	5/09	5/10
Analyzer	HP	8562A	5/08	5/10

System Description

System Description

The TT21 transponder is an ED-73B Class 2 compliant Mode S level 2 data link transponder. A remote user interface with an LCD screen and simple mode selector and code entry features controls the transponder. The device interfaces to a serial altitude encoder. Additional serial interfaces are provided to receive GPS position information. The GPS position information provides the data set for ADS-B transmissions. The transponder is based around low power receiver and transmitter subsystems, with the low level transponder state machines implemented in a programmable logic device (PLD). An integrated microcontroller performs the Mode S protocol functions, manages the transponder state, and controls the user interfaces.

2.1046 Radio Frequency Power Output

Measurements Required

Measurements shall be made to establish the radio frequency power delivered by the transmitter into the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted below:

If the power output is adjustable, measurements shall be made for the highest and lowest power levels.

Test Arrangement

The radio frequency power output was measured at the antenna terminal by placing of 50 dB attenuation in the antenna line and observing the emission with the spectrum analyzer. The spectrum analyzer had an impedance of 50Ω to match the impedance of the standard antenna. A HP 8562A Spectrum Analyzer was used to measure the radio frequency power at the antenna port. The data was taken in dBm and converted to watts as shown in the following Table. Refer to Figure 1 showing the maximum output power of the transmitter. Data was taken per CFR47 Paragraph 2.1046(a) and applicable paragraphs of Part 87.

P_{dBm} = power in dB above 1 milliwatt.

$$\text{Milliwatts} = 10^{(PdBm/10)}$$

$$\text{Watts} = (\text{Milliwatts})(0.001)(\text{W/mW})$$

$$\text{milliwatts} = 10^{(51.50/10)}$$

$$= 141{,}254 \text{ mW}$$

$$= 141 \text{ Watts Peak power}$$

Results

Frequency	P_{dBm}	P_{mw}	P_w
1090	51.50	141,254	141.2

The specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 2 and 87.131 are met. There are no deviations to the specifications.

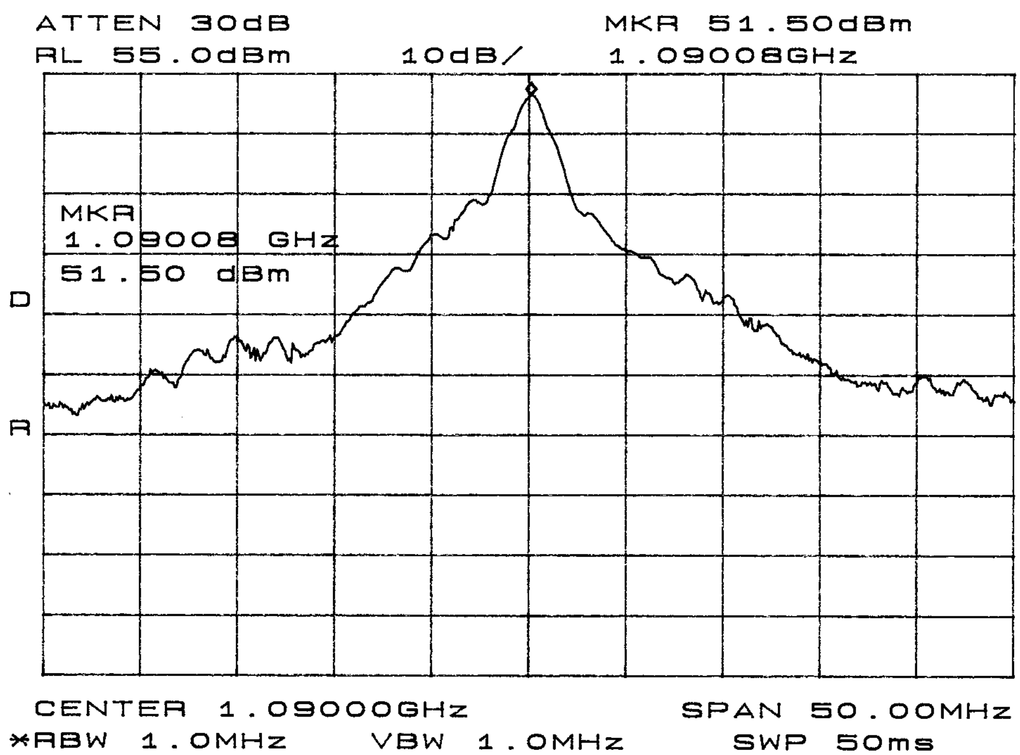


Figure 1 Maximum Power Output

2.1047 Modulation Characteristics

Measurements Required

A curve or equivalent data, which shows that the equipment will meet the modulation requirements of the rules, under which the equipment is to be licensed, shall be submitted.

The modulation specifications are defined by the FAA TSO-C112 standard for use in the Mode A, Mode C, and Mode S interrogations. This requires pulses of 0.500 ±0.050 microseconds for Mode S with rise times of 0.100-microsecond maximum and fall-times of 0.200 microseconds maximum for both. The maximum rated condition, Mode S reply, has a 120 microsecond length with four pulses in the first eight microseconds, which is called the preamble, and pulses of 0.5 or 1.0 microsecond length filling in the next 112 microseconds, which is called the data block. Binary data is coded by the pulse position in the one-microsecond frames.

Results

Figures 2 and 3 depict display of oscilloscope screen display taken while the equipment was operating in normal modes. The requirements of CFR47 2.1049(c)(1) and applicable paragraphs of Part 87.141 are met. There are no deviations to the specifications.

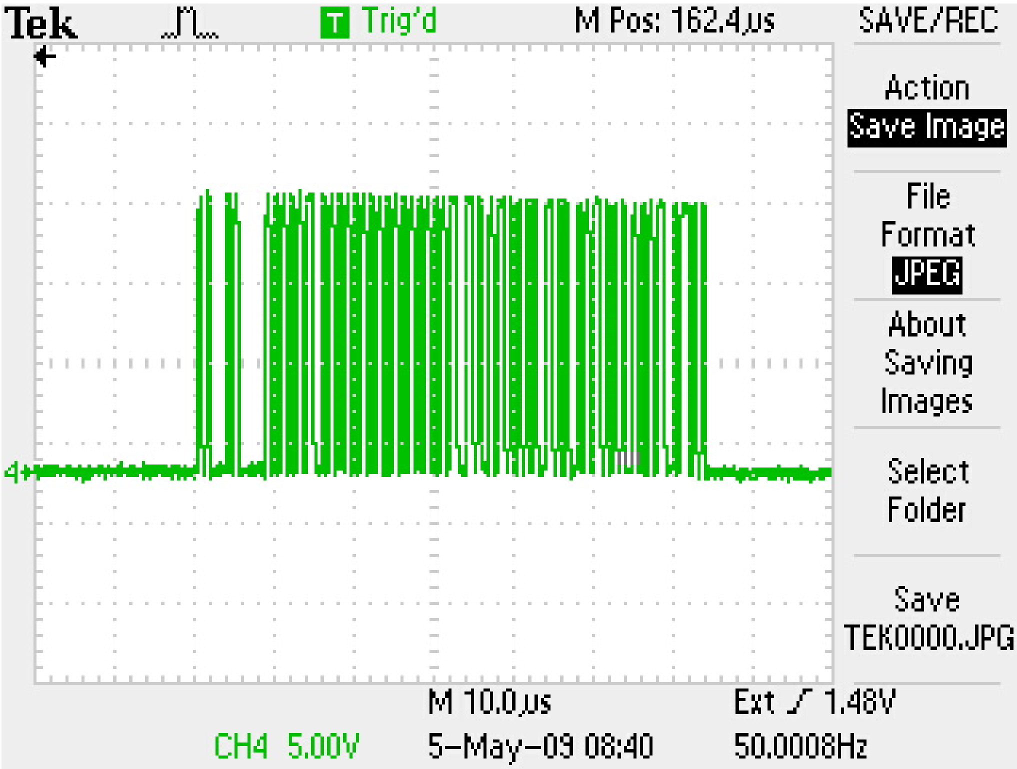


Figure 2 Audio Frequency Response Characteristics

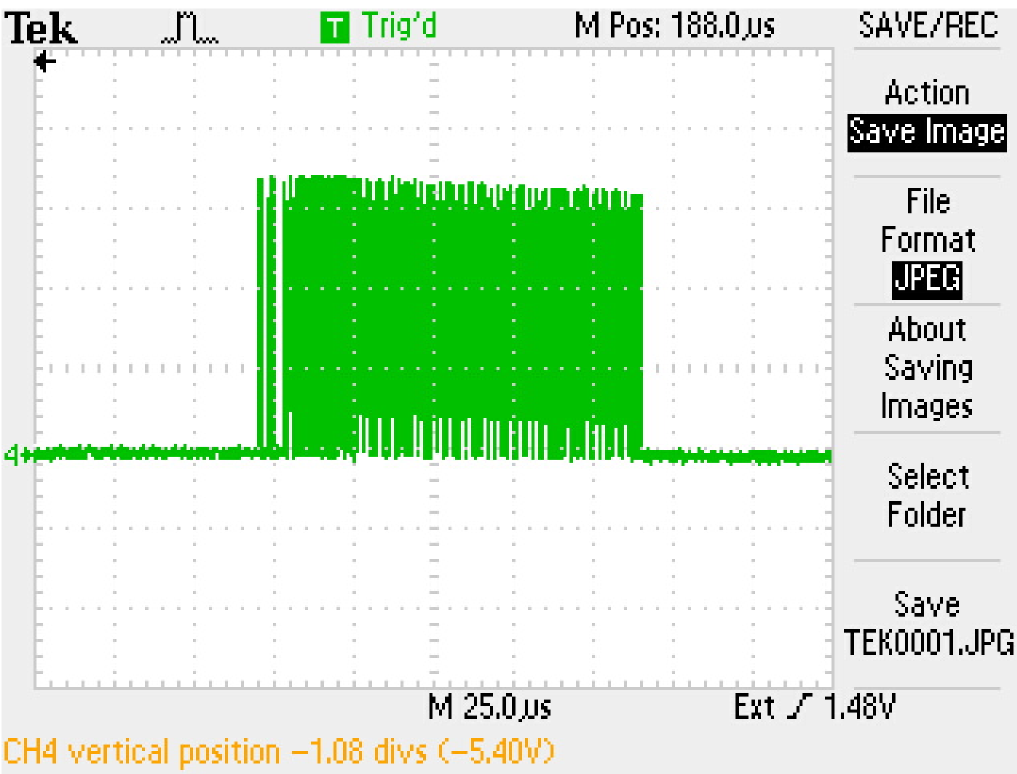


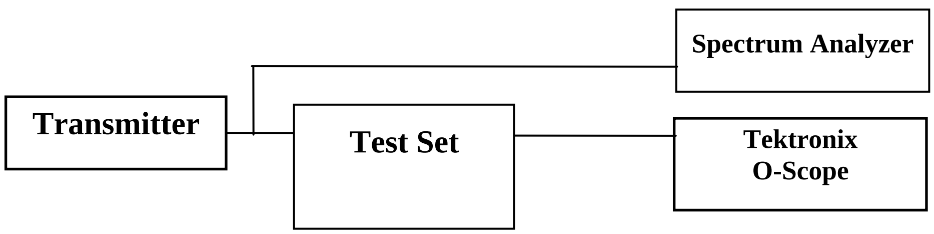
Figure 3 Modulation characteristics

2.1049 Occupied Bandwidth

Measurements Required

The occupied bandwidth, that is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers radiated are equal to 0.5 percent of the total mean power radiated by a given emission.

Test Arrangement



A spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in all normal modes. The Test Set continuously interrogated the transponder while measurements were made.

Results

Frequency (MHz)	Occupied bandwidth(MHz)
1090.00	7.42 MHz (Worst-case Mode A)
1090.00	6.33 MHz (Worst-case Mode C)
1090.00	7.08 MHz (Worst-case Mode S)

The power ratio in dB representing 99.5% of the total mean power was recorded from the spectrum analyzer. Refer to figures 4 through 6 showing plots of the 20 dB occupied bandwidth.

The requirements of CFR47 2.1049(c)(1) and applicable paragraphs of Part 87.135 are met. There are no deviations to the specifications.

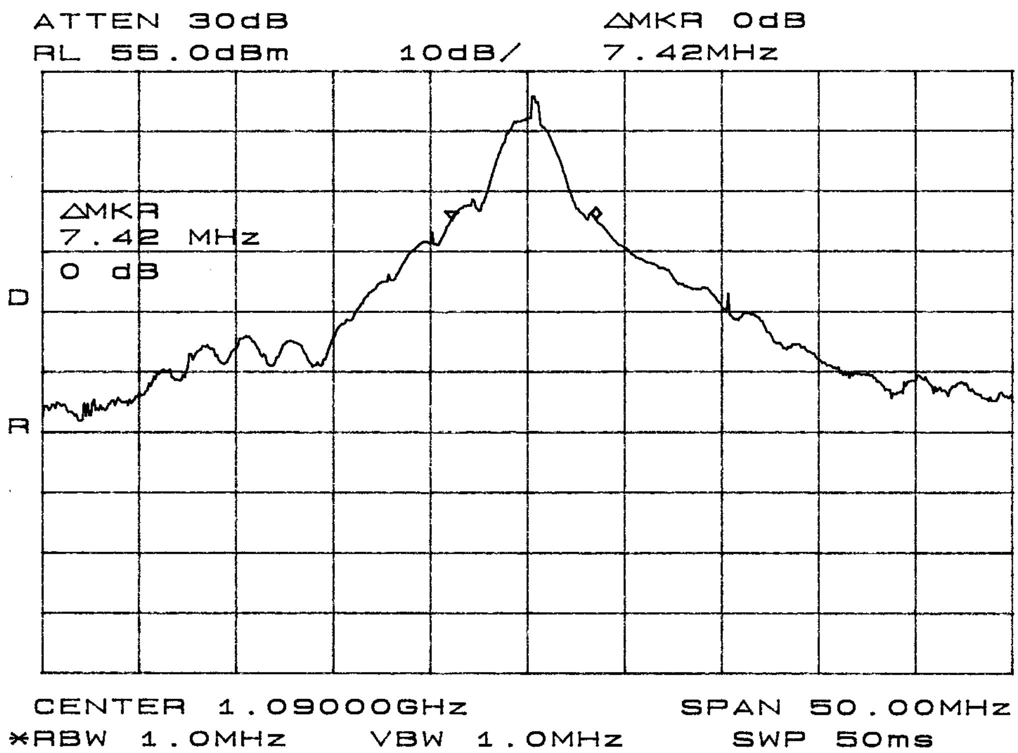


Figure 4 Mode A Occupied Band Width, Carrier frequency 1090.00 MHz

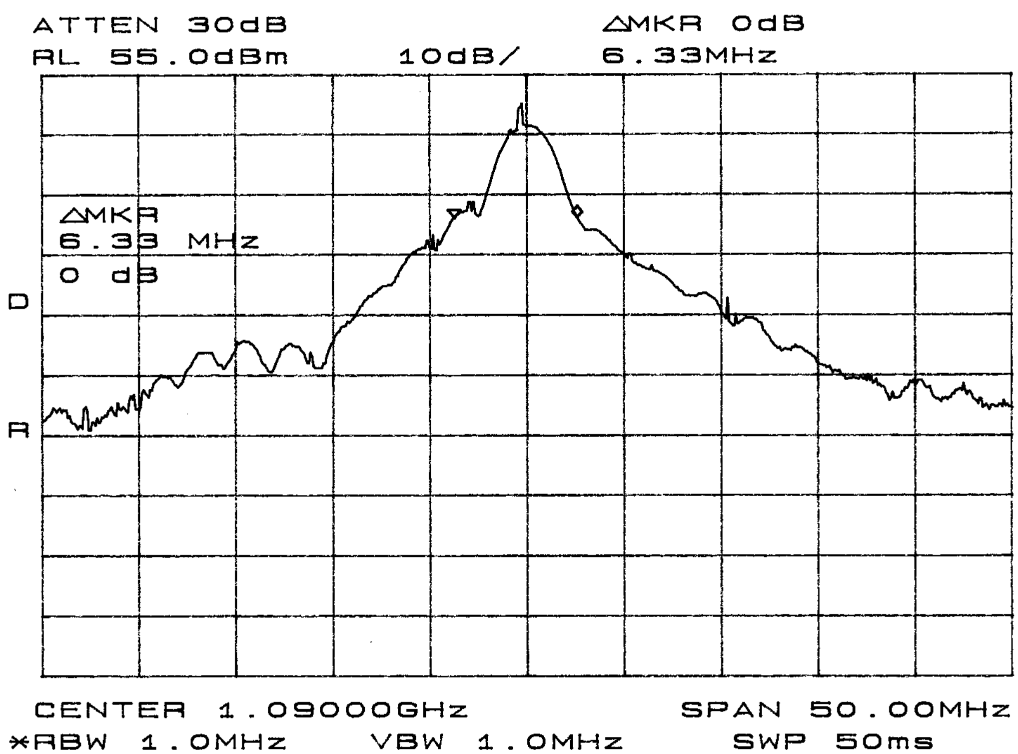


Figure 5 Mode C Occupied Band Width, Carrier frequency 1090.00 MHz

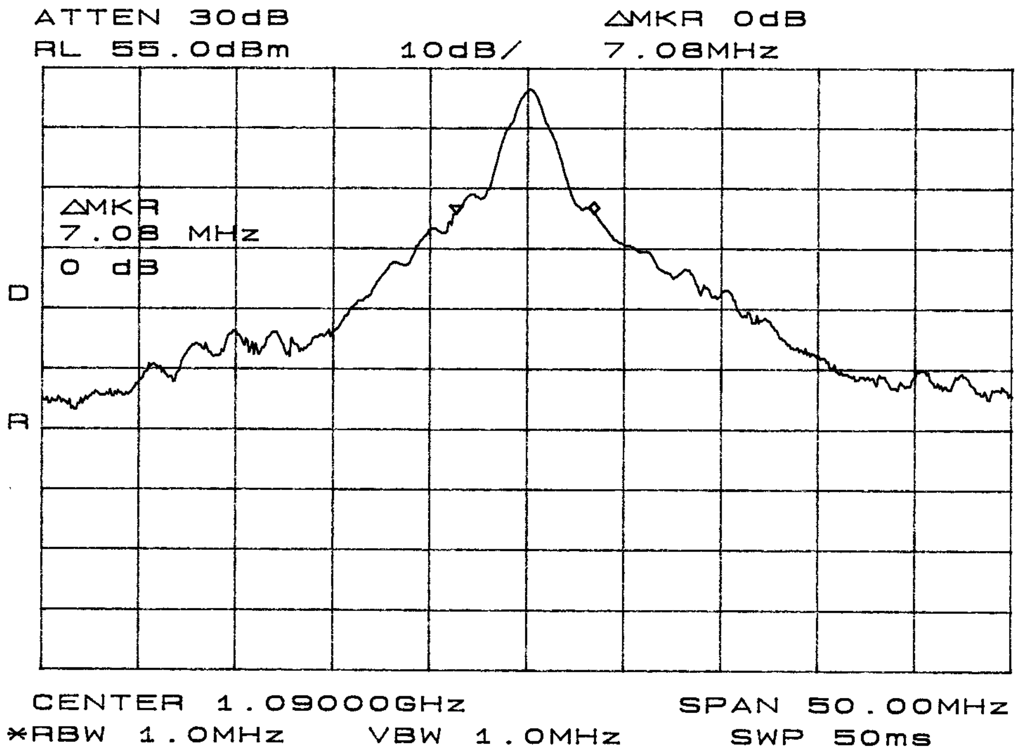


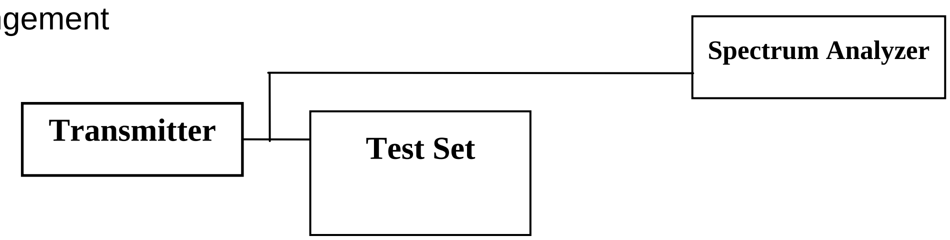
Figure 6 Mode S Occupied Band Width, Carrier frequency 1090.00 MHz

2.1051 Spurious Emissions at Antenna Terminals

Measurements Required

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna.

Test Arrangement



The radio frequency output was coupled to a HP 8562A Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter modulated per section 2.1049 and operated in all normal modes. The frequency spectrum from 30 MHz to 12,000 MHz was observed and plots produced of the frequency spectrum. Figures 7 through 10 represent data for the antenna spurious emissions of the TT21. Data was taken per CFR47 2.1051, 2.1057, and applicable paragraphs of Part 87.139.

Results

The output of the unit was coupled to a HP Spectrum Analyzer and the frequency emissions were measured. Data was taken as per CFR47 2.1051 and applicable paragraphs of Part 87. Specifications of Paragraphs 2.1051, 2.1057 and applicable paragraphs of part 87.139 are met. There are no deviations to the specifications.

All spurious emissions must be attenuated at least 43 +10log(Po) below the fundamental emission power level. The following equations represent the calculated attenuation levels for the equipment.

1.40 W(ave) = 43 + 10 Log(Po)
= 43 + 10 Log(1.41)
= 44.5

Channel MHz	Spurious Freq. (MHz)	Measured Level (dBm)	Level Below Carrier (dB)
1090.00	2180.0	-9.7	61.2
	3270.0	-8.5	60.0
	4360.0	-6.1	57.6
	5450.0	-11.3	62.8
	6540.0	-5.2	56.7
	7630.0	-4.3	55.8
	8720.0	-4.0	55.5
	9810.0	-6.8	58.3
	10900.0	-4.5	56.0

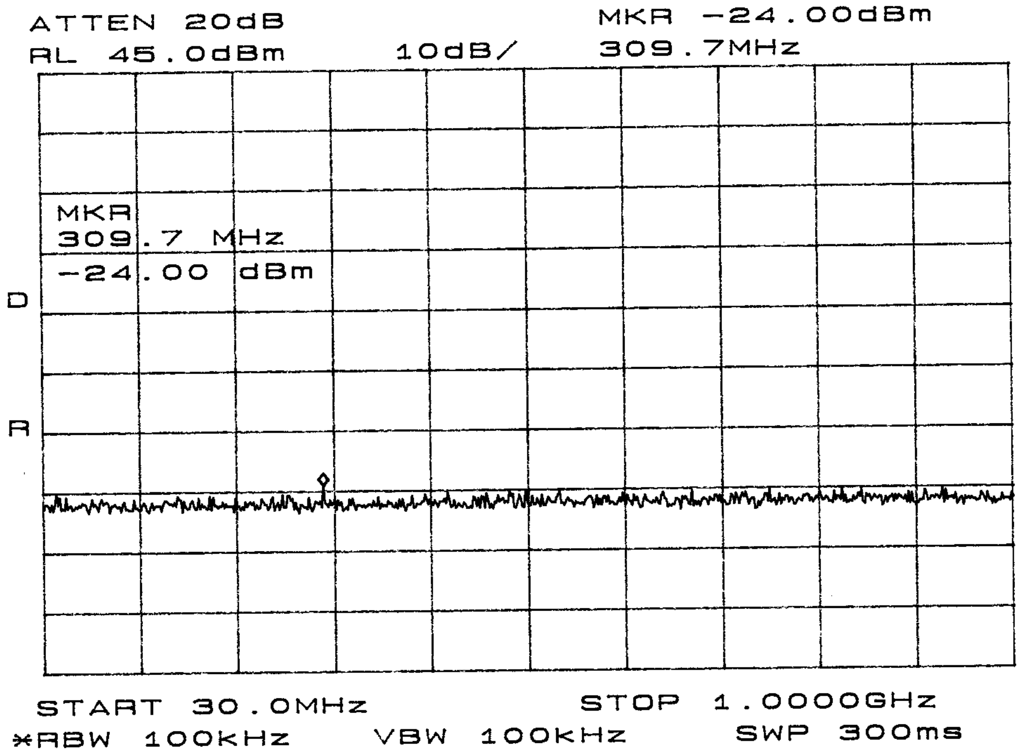


Figure 7 Spurious Emissions at Antenna Terminal

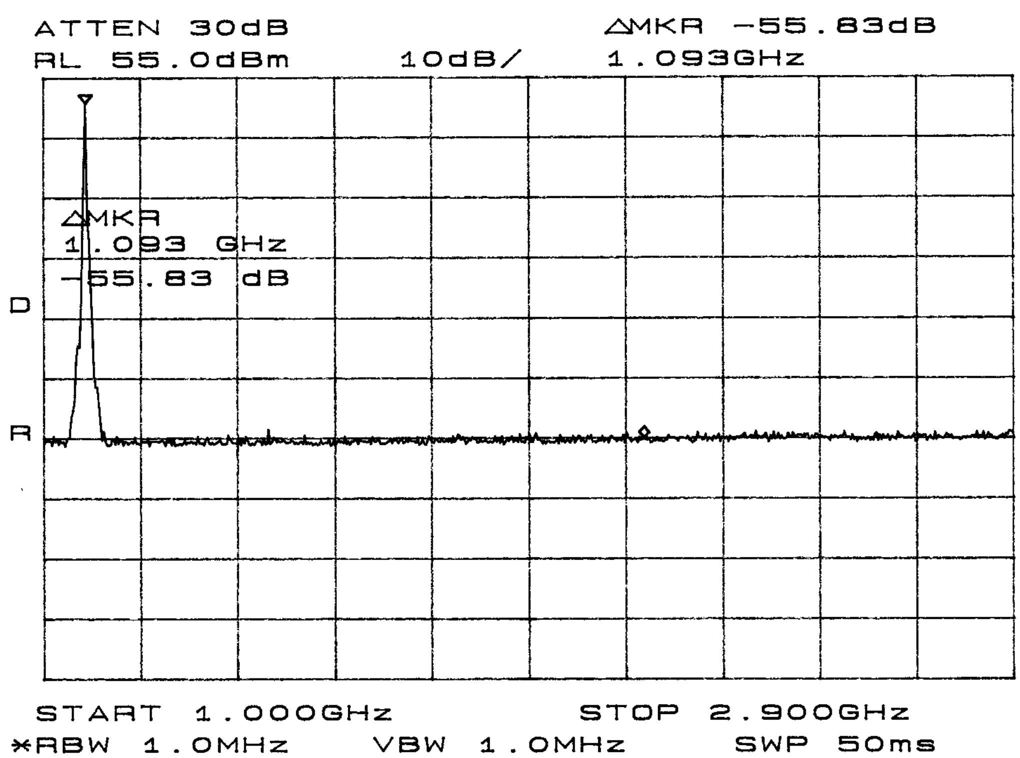


Figure 8 Spurious Emissions at Antenna Terminal

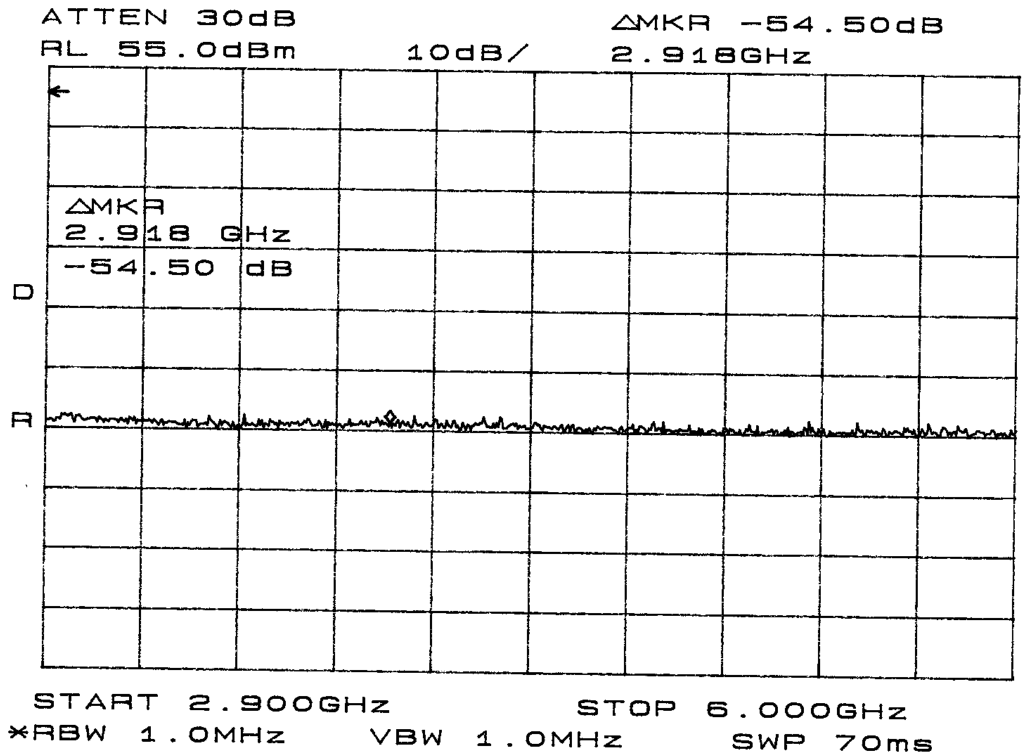


Figure 9 Spurious Emissions at Antenna Terminal

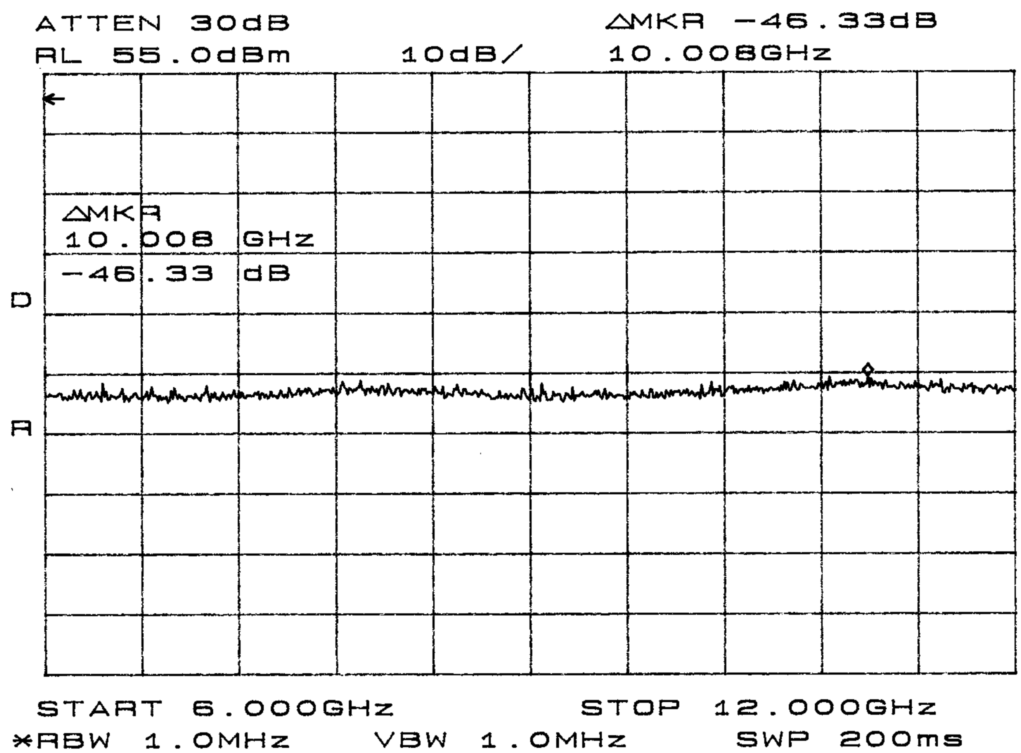


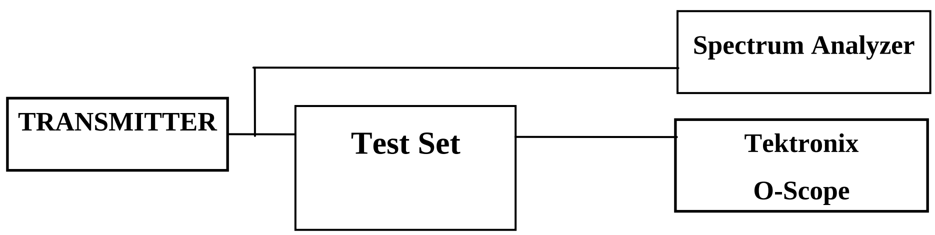
Figure 10 Spurious Emissions at Antenna Terminal

2.1053 Field Strength of Spurious Radiation

Measurements Required

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. This equipment is typically incorporated into a rack of equipment, cabling attached to the cabinet. A test box was used to interface with the equipment for testing purposes. The test box offered transmitter control and continuously interrogated the unit during testing. The test set supplied the 50-ohm load for the antenna connections.

Test Arrangement



The test setup was assembled in a screen room for preliminary screening. The transmitter was placed on a wooden turntable 0.8 meters above the ground plane and at a distance of 1 meter from the receive antenna, plots were made of the radiated emissions. Refer to figures 11 through 15 showing plots of the spectrum analyzer display of the radiated emissions frequency spectrum taken in the screen room.

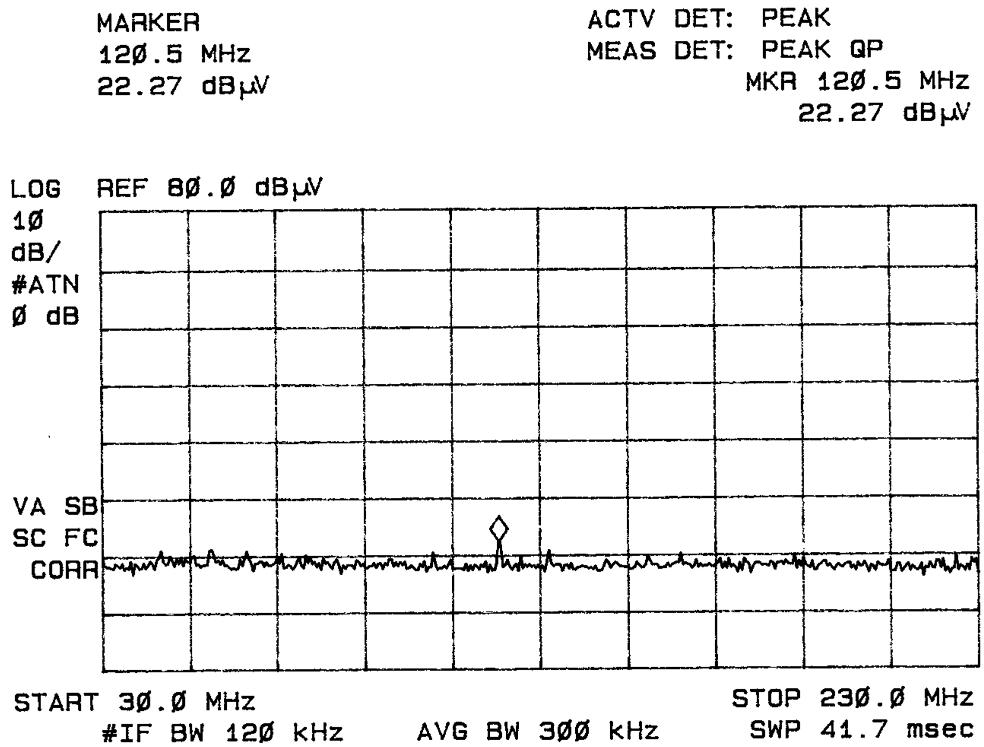


Figure 11 Radiated emissions taken at 1 meter in screen room

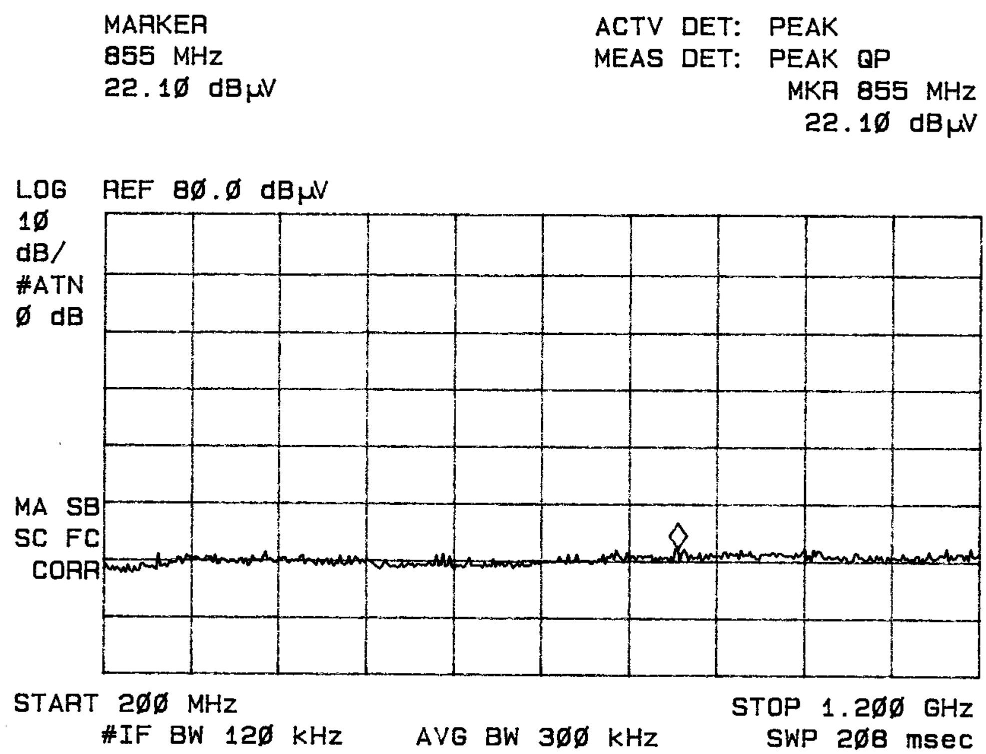


Figure 12 Radiated emissions taken at 1 meter in screen room

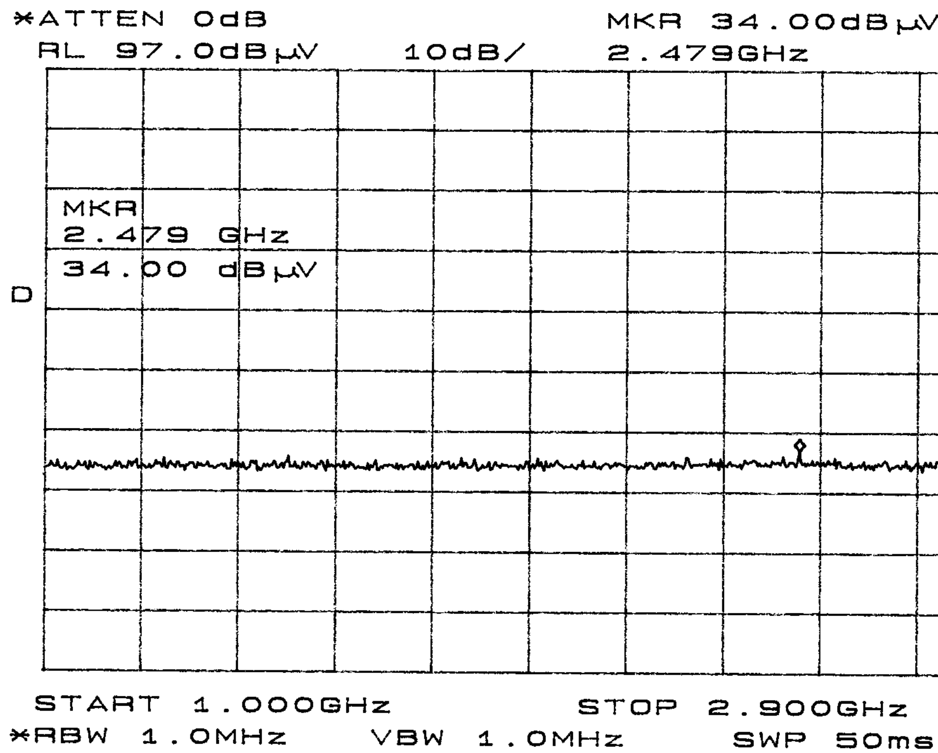


Figure 13 Radiated emissions taken at 1 meter in screen room

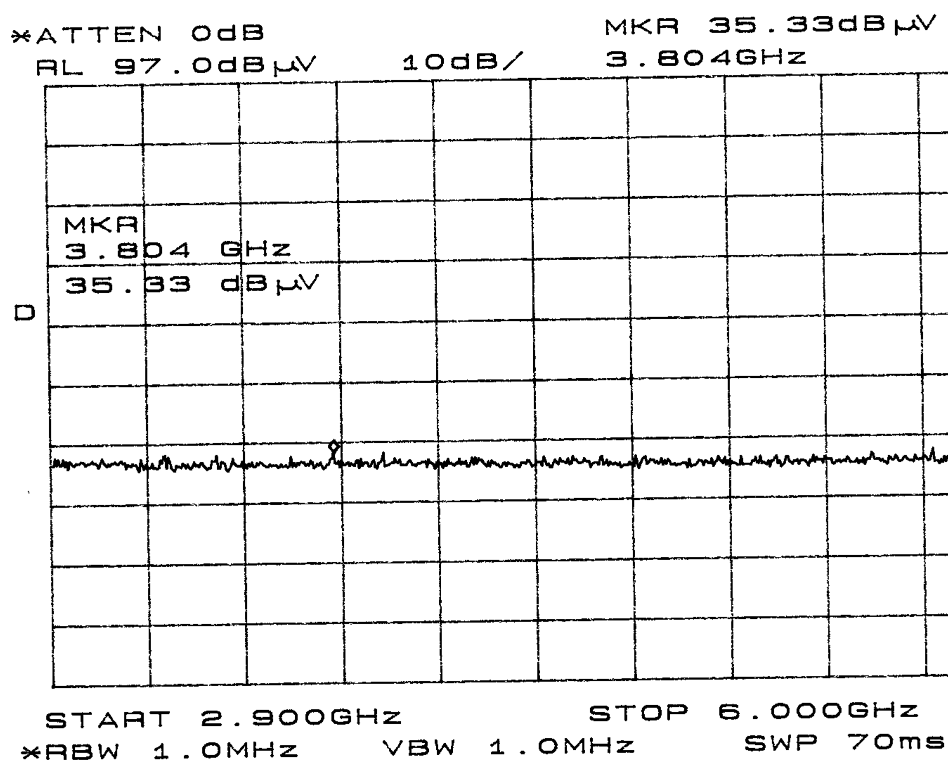


Figure 14 Radiated emissions taken at 1 meter in screen room

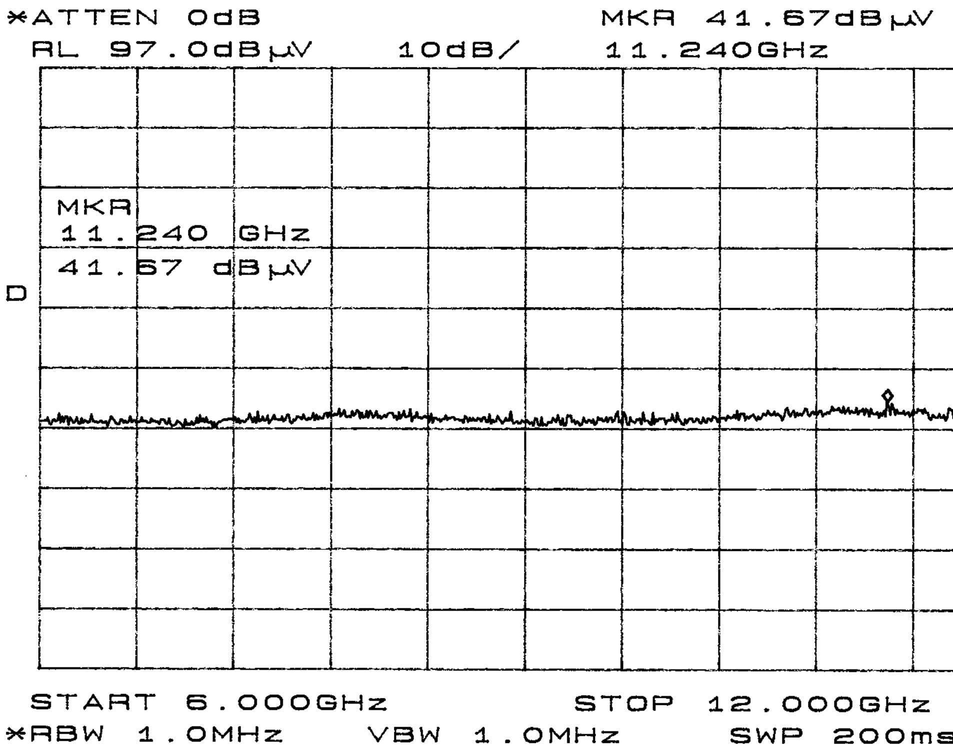


Figure 15 Radiated emissions taken at 1 meter in screen room

The transmitter was placed on a wooden turntable 0.8 meters above the ground plane and at a distance of 3 meters from the Field Strength Measuring (FSM) antenna. With the EUT modulated and radiating into a 50Ω load. The receiving antenna was raised and lowered from 1m to 4m in height to obtain the maximum reading of spurious radiation from the EUT, cabinet, and interface cabling. The turntable was rotated though 360 degrees to locate the position registering the highest amplitude of emission. The frequency spectrum was then searched for spurious emissions generated from the transmitter, interface cabling, and test setup. The amplitude of each spurious emission was maximized by raising and lowering the FSM antenna, and rotating the turntable before final data was recorded. The frequency spectrum from 30 MHz to 12,000 MHz was investigated during radiated emissions testing. A Biconilog antenna was used for frequency measurements of 30 to 1000 MHz. A log periodic antenna was used for frequencies of 1000 MHz to 5000 MHz. A double-ridge horn antenna was used for frequencies of 5000 MHz to 12,000 MHz. Emission levels were measured and recorded from the spectrum analyzer in dBµV. Data was taken at the Rogers Labs, Inc. 3 meters open area test site (OATS).

Results

The EUT was connected to the Test Set and operated in all available normal modes while radiated emissions testing were performed. The amplitude of each spurious emission was maximized and amplitude levels recorded while operating at the open area test site at a distance of 3-meters.

Channel frequency 1090.00 MHz

Frequency In MHz	FSM Hor. (dBµV) Quasi-Peak	FSM Vert. (dBµV) Quasi-Peak	Ant. Fact. (dB/m)	Amp. Gain (dB)	Comp. Hor. (dBµV/m) @ 3m	Comp. Vert. (dBµV/m) @ 3 m	FCC Limit (dBµV)
120.0	44.7	45.8	7.1	30	21.8	22.9	43.5
2180.0	19.5	19.0	29.8	20	29.3	28.8	54.0
3270.0	17.5	18.0	30.0	20	27.5	28.0	54.0
4360.0	20.0	19.6	32.5	20	32.5	32.1	54.0
5450.0	17.0	18.8	33.1	20	30.1	31.9	54.0
6540.0	18.3	19.3	34.2	20	32.5	33.5	54.0
7630.0	19.3	19.3	36.7	20	36.0	36.0	54.0
8720.0	18.5	19.1	36.8	20	35.3	35.9	54.0
9810.0	19.3	18.1	38.1	20	37.4	36.2	54.0
10900.0	19.6	17.8	38.8	20	38.4	36.6	54.0

Other Emissions present with amplitudes at least 20 dB below limit.

Specifications of CFR47 Paragraph 2.1053, 2.1057, applicable paragraphs of part 87.139 are met. There are no deviations or exceptions to the specifications.

2.1055 Frequency Stability

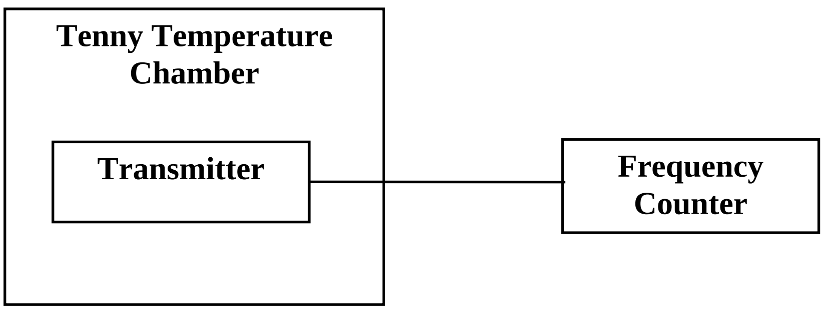
Measurements Required

The frequency stability shall be measured with variations of ambient temperature from -30° to +50° centigrade. Measurements shall be made at the extremes of the temperature range and at intervals of not more than 10° centigrade through the range. A period sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. In addition to temperature stability, the frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value.

(2) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

Test Arrangement



The measurement procedure outlined below shall be followed.

Step 1: The transmitter shall be installed in an environmental test chamber whose temperature is controllable. Provision shall be made to measure the frequency of the transmitter.

Step 2: With the transmitter inoperative (power switched "OFF"), the temperature of the test chamber shall be adjusted to +25°C. After a temperature stabilization period of one hour at +25°C, the transmitter shall be switched "ON" with standard test voltage applied.

Step 3: The carrier shall be keyed "ON", and the transmitter shall be operated unmodulated at full radio frequency power output at the duty cycle, for which it is rated, for duration of at least 5 minutes. The radio frequency carrier frequency shall be monitored and measurements shall be recorded.

Step 4: The test procedures outlined in Steps 2 and 3, shall be repeated after stabilizing the transmitter at the environmental temperatures specified, -30°C to +50°C in 10-degree increments.

The frequency stability was measured with variations in the power supply voltage from 85 to 115 percent of the nominal value. A Sorensen DC Power Supply was used to vary the dc voltage for the power input from 23.80 Vdc to 32.20 Vdc. The frequency was measured and the variation in parts per million was calculated. Data was taken per CFR47 Paragraphs 2.1055 and applicable paragraphs of part 87.133.

CFR47 87.133 (d) requirements

For radar transmitters, except non-pulse signal radio altimeters, the frequency at which maximum emission occurs must be within the authorized frequency band and must not be closer than 1.5/T MHz to the upper and lower limits of the authorized bandwidth, where T is the pulse duration in microseconds.

For pulse width T equal to 0.5 microseconds this equation produces 3 MHz restriction from the OBW edge. Testing of 20 dB Occupied Band Width (OBW) demonstrated 7.42 MHz. This would require stability of something less than 1.42 MHz. The EUT demonstrated 160 kHz deviation (146 ppm well within the 1 MHz DO 181-D standard) and less than 1.42 MHz requirement.

Results

Frequency 1089.9 (MHz)	Frequency Stability Vs Temperature In Parts Per Million (PPM)								
Temperature °C	-30	-20	-10	0	+10	+20	+30	+40	+50
Change (KHz)	159	84	57	-320	-40	-17	-24	-27	-25
PPM	146	78	53	-29	-37	-16	-22	-25	-24
%	-0.002	-0.002	-0.002	0.000	0.000	0.000	0.001	0.002	0.002
Limit (MHz)	1	1	1	1	1	1	1	1	1

Frequency (1089.9 MHz)	Frequency Stability Vs Voltage Variation 28.0 volts nominal; Results In Ppm Input Voltage		
Voltage V_{dc}	23.80	28.00	32.20
Change (Hz)	0.0	0.0	0.0

Specifications of CFR47 Paragraphs 2.1055 and applicable paragraphs of part 87.133 are met. There are no deviations or exceptions to the specifications.

Annex

- Annex A, Measurement Uncertainty Calculations
- Annex B, Test Equipment List.
- Annex C, Rogers Qualifications.
- Annex D, FCC Site Approval Letter.
- Annex E, Industry Canada Approval Letter.

Annex A Measurement Uncertainty Calculations

Radiated Emissions Measurement Uncertainty Calculation

Measurement of vertically polarized radiated field strength over the frequency range 30 MHz to 1 GHz on an open area test site at 3m and 10m includes following uncertainty:

Contribution	Probability Distribution	Uncertainty (dB)
Antenna factor calibration	normal (k = 2)	±0.58
Cable loss calibration	normal (k = 2)	±0.2
Receiver specification	rectangular	±1.0
Antenna directivity	rectangular	±0.1
Antenna factor variation with height	rectangular	±2.0
Antenna factor frequency interpolation	rectangular	±0.1
Measurement distance variation	rectangular	±0.2
Site Imperfections	rectangular	±1.5

Combined standard uncertainty $u_c(y)$ is

$$U_c(y) = \pm \sqrt{\left[\frac{1.0}{2}\right]^2 + \left[\frac{0.2}{2}\right]^2 + \left[\frac{1.0^2 + 0.1^2 + 2.0^2 + 0.1^2 + 0.2^2 + 1.5^2}{3}\right]}$$

$U_c(y) = \pm$ 1.6 dB

It is probable that $u_c(y) / s(q_k) > 3$, where $s(q_k)$ is estimated standard deviation from a sample of n readings unless the repeatability of the EUT is particularly poor, and a coverage factor of k = 2 will ensure that the level of confidence will be approximately 95%, therefore:

$$s(q_k) = \sqrt{\frac{1}{(n-1)} \sum_{k-1}^{n} (q_k - \bar{q})^2}$$

$U = 2\,U_c(y) = 2 \times \pm 1.6$ dB $= \pm$ 3.2 dB

Notes:

1.1 Uncertainties for the antenna and cable were estimated, based on a normal probability distribution with k = 2.

1.2 The receiver uncertainty was obtained from the manufacturer's specification for which a rectangular distribution was assumed.

1.3 The antenna factor uncertainty does not take account of antenna directivity.

1.4 The antenna factor varies with height and since the height was not always the same in use as when the antenna was calibrated an additional uncertainty is added.

1.5 The uncertainty in the measurement distance is relatively small but has some effect on the received signal strength. The increase in measurement distance as the antenna height is increased is an inevitable consequence of the test method and is therefore not considered a contribution to uncertainty.

1.6 Site imperfections are difficult to quantify but may include the following contributions:
-Unwanted reflections from adjacent objects.
-Ground plane imperfections: reflection coefficient, flatness, and edge effects.
-Losses or reflections from "transparent" cabins for the EUT or site coverings.
-Earth currents in antenna cable (mainly effect biconical antennas).

The specified limits for the difference between measured site attenuation and the theoretical value (± 4 dB) were not included in total since the measurement of site attenuation includes uncertainty contributions already allowed for in this budget, such as antenna factor.

Conducted Measurements Uncertainty Calculation

Measurement of conducted emissions over the frequency range 9 kHz to 30 MHz includes following uncertainty:

Contribution	Probability Distribution	Uncertainty (dB)
Receiver specification	rectangular	±1.5
LISN coupling specification	rectangular	±1.5
Cable and input attenuator calibration	normal (k=2)	±0.5

Combined standard uncertainty $u_c(y)$ is

$$U_c(y) = \pm \sqrt{\left[\frac{0.5}{2}\right]^2 + \frac{1.5^2 + 1.5^2}{3}}$$

$U_c(y) = \pm$ 1.2 dB

As with radiated field strength uncertainty, it is probable that $u_c(y) / s(q_k) > 3$ and a coverage factor of k = 2 will suffice, therefore:

$U = 2\ U_c(y) = 2 \times \pm 1.2$ dB $= \pm$ 2.4 dB

Annex B Test Equipment List For Rogers Labs, Inc.

The test equipment used is maintained in calibration and good operating condition. Use of this calibrated equipment ensures measurements are traceable to national standards.

List of Test Equipment	Calibration Date
Oscilloscope Scope: Tektronix 2230	2/09
Wattmeter: Bird 43 with Load Bird 8085	2/09
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/09
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/09
R.F. Generator: HP 606A	2/09
R.F. Generator: HP 8614A	2/09
R.F. Generator: HP 8640B	2/09
Spectrum Analyzer: HP 8562A,	5/09
Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W	
HP Adapters: 11518, 11519, 11520	
Spectrum Analyzer: HP 8591EM	5/09
Frequency Counter: Leader LDC825	2/09
Antenna: EMCO Biconilog Model: 3143	5/09
Antenna: EMCO Log Periodic Model: 3147	10/08
Antenna: Antenna Research Biconical Model: BCD 235	10/08
Antenna: EMCO Dipole Set 3121C	2/09
Antenna: C.D. B-101	2/09
Antenna: Solar 9229-1 & 9230-1	2/09
Antenna: EMCO 6509	2/09
Audio Oscillator: H.P. 201CD	2/09
R.F. Power Amp 65W Model: 470-A-1010	2/09
R.F. Power Amp 50W M185- 10-501	2/09
R.F. PreAmp CPPA-102	2/09
LISN 50 μHy/50 ohm/0.1 μf	10/08
LISN Compliance Eng. 240/20	2/09
LISN Fischer Custom Communications FCC-LISN-50-16-2-08	2/09
Peavey Power Amp Model: IPS 801	2/09
Power Amp A.R. Model: 10W 1010M7	2/09
Power Amp EIN Model: A301	2/09
ELGAR Model: 1751	2/09
ELGAR Model: TG 704A-3D	2/09
ESD Test Set 2010i	2/09
Fast Transient Burst Generator Model: EFT/B-101	2/09
Current Probe: Singer CP-105	2/09
Current Probe: Solar 9108-1N	2/09
Field Intensity Meter: EFM-018	2/09
KEYTEK Ecat Surge Generator	2/09
Shielded Room 5 M x 3 M x 3.0 M	

Annex C Qualifications

Scot D. Rogers, Engineer

Rogers Labs, Inc.

Mr. Rogers has approximately 17 years experience in the field of electronics. Six years working in the automated controls industry and 6 years working with the design, development and testing of radio communications and electronic equipment.

Positions Held:

Systems Engineer:	A/C Controls Mfg. Co., Inc.	6 Years
Electrical Engineer:	Rogers Consulting Labs, Inc.	5 Years
Electrical Engineer:	Rogers Labs, Inc.	Current

Educational Background:

1) Bachelor of Science Degree in Electrical Engineering from Kansas State University

2) Bachelor of Science Degree in Business Administration Kansas State University

3) Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming.

Annex D FCC Test Site Registration Letter

FEDERAL COMMUNICATIONS COMMISSION
Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

June 18, 2008

Registration Number: 90910

Rogers Labs, Inc.
4405 West 259th Terrace,
Louisburg, KS 66053

Attention: Scot Rogers

Re: Measurement facility located at Louisburg
3 & 10 meter site
Date of Renewal: June 18, 2008

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Phyllis Parrish
Industry Analyst

Annex E Industry Canada Test Site Registration Letter

Industry Canada Industrie Canada

July 29th, 2008

OUR FILE: 46405-3041
Submission No: 127059

Rogers Labs Inc.
4405 West 259th Terrace
Louisburg KY 66053
USA

Attention: Scot D. Rogers

Dear Sir/Madame:

The Bureau has received your application for the registration / renewal of a 3/10m OATS. Be advised that the information received was satisfactory to Industry Canada. The following number(s) is now associated to the site(s) for which registration / renewal was sought **(3040A-1).** Please reference the appropriate site number in the body of test reports containing measurements performed on the site. In addition, please be informed that the Bureau is now utilizing a **new site numbering scheme** in order to simplify the electronic filing process. Our goal is to reduce the number of secondary codes associated to one particular company. The following changes have been made to your records.

Your primary code is: **3041**
The company number associated to the site(s) located at the above address is: **3041A**
The table below is a summary of the changes made to the unique site registration number(s):

New Site Number	Obsolete Site Number	Description of Site	Expiry Date (YYYY-MM-DD)
3041A-1	3041-1	3 / 10m OATS	2010-07-29

Furthermore, to obtain or renew a unique site number, the applicant shall demonstrate that the site has been accredited to ANSI C63.4-2003 or later. A scope of accreditation indicating the accreditation by a recognized accreditation body to ANSI C63.4-2003 shall be accepted. Please indicate in a letter the previous assigned site number if applicable and the type of site (example: 3 meter OATS or 3 meter chamber). If the test facility is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating full compliance with the ANSI standard. The Bureau will evaluate the filing to determine if recognition shall be granted.

The frequency for re-validation of the test site and the information that is required to be filed or retained by the testing party shall comply with the requirements established by the accrediting organization. However, in all cases, test site re-validation shall occur on an interval not to exceed two years. There is no fee or form associated with an OATS filing. OATS submissions are encouraged to be submitted electronically to the Bureau using the following URL;

If you have any questions, you may contact the Bureau by e-mail at certification.bureau@ic.gc.ca
Please reference our file and submission number above for all correspondence.

Yours sincerely,

S. Proulx Wireless Laboratory
Manager Certification and
Engineering Bureau Industry Canada
3701 Carling Ave., Building 94
Ottawa, Ontario K2H 8S2
Canada

Canada