



October 12, 1999

Federal Communications Commission
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD 21046

Attention: Applications Examiner

Applicant: AUTEC s.r.l.
36030 Caldogno (VI)
via Pomaroli 9
Italy

Equipment:
FCC ID:

Specification: 47 CFR 90 Licensed Certification

Dear Examiner:

The following application for Grant of Equipment Authorization is presented on behalf of AUTEC s.r.l. for the Licensed Certification of their Model: MTXUS04A, Transmitter Radio Module.

Enclosed, please find a complete data and documentation package demonstrating that this device complies with the technical requirements of 47 CFR 90, for a Transmitter Radio Module.

If you have any questions, please contact the undersigned, who is authorized to act as Agent.

Sincerely,

Chris Harvey
Director, EMC Laboratory



MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*

914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230-3432 • PHONE (410) 354-3300 • FAX (410) 354-3313

ENGINEERING TEST REPORT

in support of the Application for Grant of Equipment Authorization

EQUIPMENT: Transmitter Radio Module MODEL: MTXUS04A
FCC ID:

Specification: 47 CFR 90

On Behalf of the Applicant: AUTECH s.r.l.
36030 Caldogno (VI)
via Pomaroli 9
Italy

Manufacturer: AUTECH s.r.l.
36030 Caldogno (VI)
via Pomaroli 9
Italy

Manufacturer's Representative Antonio Silvestri

Test Date(s): June 29, 1999 through July 12, 1999

ENGINEERING STATEMENT

I ATTEST: the measurements shown in this report were made in accordance with the procedures indicated, and that the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements. On the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 90 of the FCC Rules under normal use and maintenance.

Andrew Leimer
EMI Engineer, MET Laboratories



1.0 INTRODUCTION

The following data is presented on behalf of the Applicant, AUTECH s.r.l., as verification of the compliance of the AUTECH Transmitter Radio Module, Model MTXUS04A to the requirements of 47 CFR 90.

2.0 TEST SITE

All testing was conducted at MET Laboratories, Inc., 914 West Patapsco Avenue, Baltimore, Maryland 21230-3493. Radiated emissions measurements were performed on a three-meter open area test site (OATS). A complete site description is on file with the FCC Laboratory Division as 31040/SIT/MET.

3.0 TEST EQUIPMENT USED

Manufacturer	Equipment	Calibration Due	Cal. Interval
Hewlett Packard	8563A Spectrum Analyzer	5/22/00	annual
EMCO	Biconical Antenna 3104	3/9/00	annual
EMCO	EMCO Log Periodic Antenna	2/16/00	annual
EMCO	Double Ridge Guided Horn	2/8/00	annual
Hewlett Packard	8594EM Analyzer	11/18/99	annual

4.0 EQUIPMENT UNDER TEST CONFIGURATION

The Equipment Under Test (EUT) was a Transmitter Radio Module MODEL: MTXUS04A. It is a radio signal transmitter with no external ports and was configured with the transmitter which modulates the carrier continually transmitting secure codes to establish communications with the receiver.

5.0 TEST TYPE(S)

- 5.1 Field Strength of Spurious Radiation: 47 CFR 2.1053, 15.209, 15.205, 90.217, 90.210 (d)
- 5.2 Occupied Bandwidth: 47 CFR 2.1049, 2.1047, 90.211, 90.217, 90.210 (d)
- 5.3 RF Power Output: 47 CFR 2.1046, 90.217
- 5.4 Spurious Emission at Antenna Terminals: 47 CFR 2.1051, 90.217, 90.210(d)
- 5.5 Frequency Stability Over Temperature Variations: 47 CFR 2.1055, 90.213 (a) Footnote 8
- 5.6 Frequency Stability Over Voltage Variations: 47 CFR 2.1055 (d) (2), 90.213 (a) Footnote 8
- 5.7 Requirements for Exempt Transmitters: 47 CFR 90.217 (b)



6.0 TEST RESULTS

6.1 TEST TYPE: Field Strength of Spurious Radiation

6.1.1 TECHNICAL SPECIFICATION: 2.1053, 15.209, 15.205, 90.217, 90.210 (d)

6.1.2 TEST DATE(S): July 7, 1999

6.1.3 MEASUREMENT PROCEDURES:

As required by 47 CFR 2.993, Field Strength of Spurious Radiation measurements were made in accordance with the general procedures of ANSI C63.4-1992 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz". Preliminary radiated emission measurements were performed inside a shielded chamber with all digital signal generators on and terminated. The frequency list from the preliminary measurements was used as a guide for making final measurements on a 3 meter open area test site. The unit was scanned over the frequency range of 9 kHz to 5 GHz.

The Field Strength of Spurious Radiation *Limit* is obtained by the following:

Based on an output power (assuming the minimum power for non-exempt transmitters) of 120 mW:

$$P_o = 120 \text{ mW}$$

As per 2.1051 (a), it is assumed this power is to be fed to a half-wave tuned dipole. Using a conversion formula for distance, the field strength at one meter can be derived:

$$E(V/m)_{1m} = \frac{\sqrt{49.2 \times 0.120}}{1}$$
$$E(V/m)_{1m} = 2.4298 \text{ V/m or } 127.71 \text{ dB}\mu\text{V}$$

As per 90.210 (d), the spurious emissions must be attenuated by $50 + \log(P)$ which is:

$$50 + 10\log(0.120) = 40.792 \text{ dB}$$

Therefore, the limit for spurious emissions is:

$$127.71 \text{ dB}\mu\text{V} - 40.79 \text{ dB} = 86.92 \text{ dB}\mu\text{V} @ 1m$$

At 3 meters measurement distance, the limit is;

$$E(V/m)_{3m} = \frac{\sqrt{49.2 \times 0.120}}{3}$$
$$E(V/m)_{3m} = 0.80994 \text{ V/m or } 118.17 \text{ dB}\mu\text{V}$$

According to 24.238(a), all signals must be attenuated by 40.792 dB. Therefore, the limit for spurious emissions for a test distance of 3 meters is:

$$118.169 - 40.79 = 77.38 \text{ dB}\mu\text{V} @ 3m$$

**6.1.4 RESULTS:**

Frequency (MHz)	Azimuth (°CCW-O°=EUT facing ant.)	Polarity	Height (m)	Raw Amplitude (dBuV)	Ant.Cor. Factor (db)	Cable Loss (db)	Other 1m to 3m	Corrected Amplitude (dBuV/m)	Limit (dBuV/m) at 10 meters
453.287	90	H	1.8	92.0	17.6	4.4	3	114.0	118.2
453.287	160	V	2.0	80.5	17.1	4.4	3	102.0	118.2
906.575	180	H	2.0	14.8	25.8	6.6	3	47.2	77.4
906.575	180	V	2.0	15.8	24.5	6.6	3	46.9	77.4
1359.860	0	H	1.0	19.5	23.5	1.0	1	44.0	87.0
1359.860	0	V	1.0	27.8	23.5	1.0	1	52.3	87.0
1813.150	0	H	1.0	15.3	27.4	1.0	1	43.7	87.0
1813.150	0	V	1.0	31.8	27.0	1.0	1	59.8	87.0
2266.440	0	H	1.0	34.8	27.4	1.0	1	63.2	87.0
2266.440	0	V	1.0	13.8	27.0	1.0	1	41.8	87.0



- fundamental Transmit frequency

Equipment meets the specifications of 2.1053, 90.217, 90.210 (d)

Photograph of Radiated Emissions Test Configuration





6.2 TEST TYPE: Occupied Bandwidth

6.2.1 TECHNICAL SPECIFICATION: 47 CFR 2.1049, 90.217, 90.210 (d)

6.2.2 TEST DATE(S): June 29, 1999

6.2.3 MEASUREMENT PROCEDURES:

As required by 47 CFR 2.1049, occupied bandwidth measurements were made on the Transmitter Radio Module.

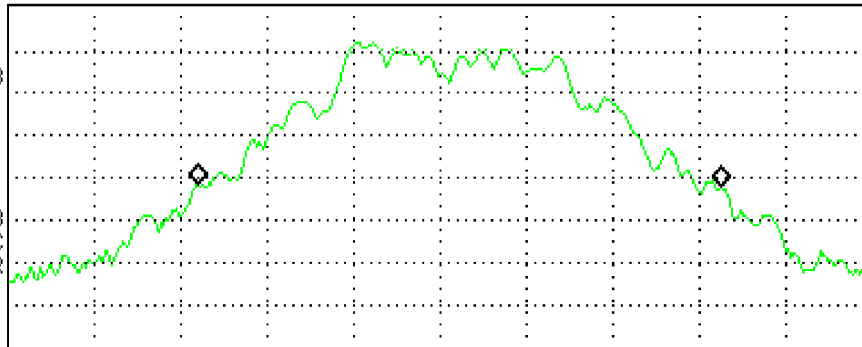
Using an IF bandwidth of 300Hz, the occupied bandwidth of the emission at the lowest, middle and highest selectable channel range was determined.

6.2.4 RESULTS:

Equipment complies with Section 2.1049. Plots of the occupied bandwidth, as measured at the antenna RF output connection (post amplification), follow:

**Occupied BW. MTXUS04A EMI1229A) - Low Band**22:27:19 JUN 29, 1999
*hp*ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRA 12.10 kHz
-1.48 dB

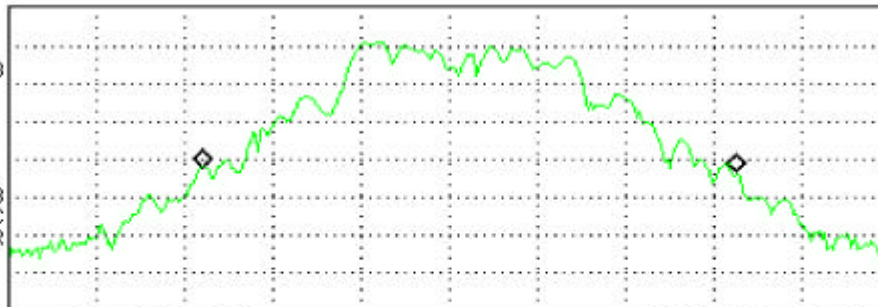
LOG REF 10.0 dBm

10
dB/
#ATTN
30 dBVA SB
SC FC
CORRCENTER 450.10000 MHz
RL #IF BW 300 Hz

AVG BW 300 Hz

SPAN 20.00 kHz
SWP 1.00 sec**Occupied BW - MTXUS04A (EMI1229A) - Mid Band
25 kHz Ckannel Spacing Mode**22:01:14 JUN 29, 1999
*hp*ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRA 12.10 kHz
-1.36 dB

LOG REF 10.0 dBm

10
dB/
#ATTN
30 dBVA SB
SC FC
CORRCENTER 453.27500 MHz
RL #IF BW 300 Hz

AVG BW 300 Hz

SPAN 20.00 kHz
SWP 1.00 sec

**Occupied BW - MTXUS04A (EMI1229A) - High Band**

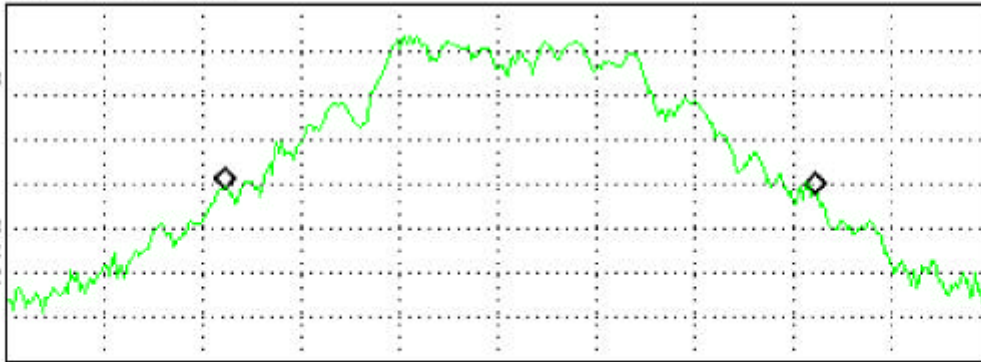
22:44:07 JUN 29, 1999

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 12.00 kHz
-1.10 dB

LOG REF 10.0 dBm

10
dB/
#ATN
30 dB

VA SB
SC FC
CORR



CENTER 469.28750 MHz
R #IF BW 300 Hz

AVG BW 300 Hz

SPAN 20.00 kHz
SWP 1.00 sec



6.3 TEST TYPE: RF Power Output

6.3.1 TECHNICAL SPECIFICATION: 47 CFR 2.1046 and 90.217

6.3.2 TEST DATE(S): July 6, 1999

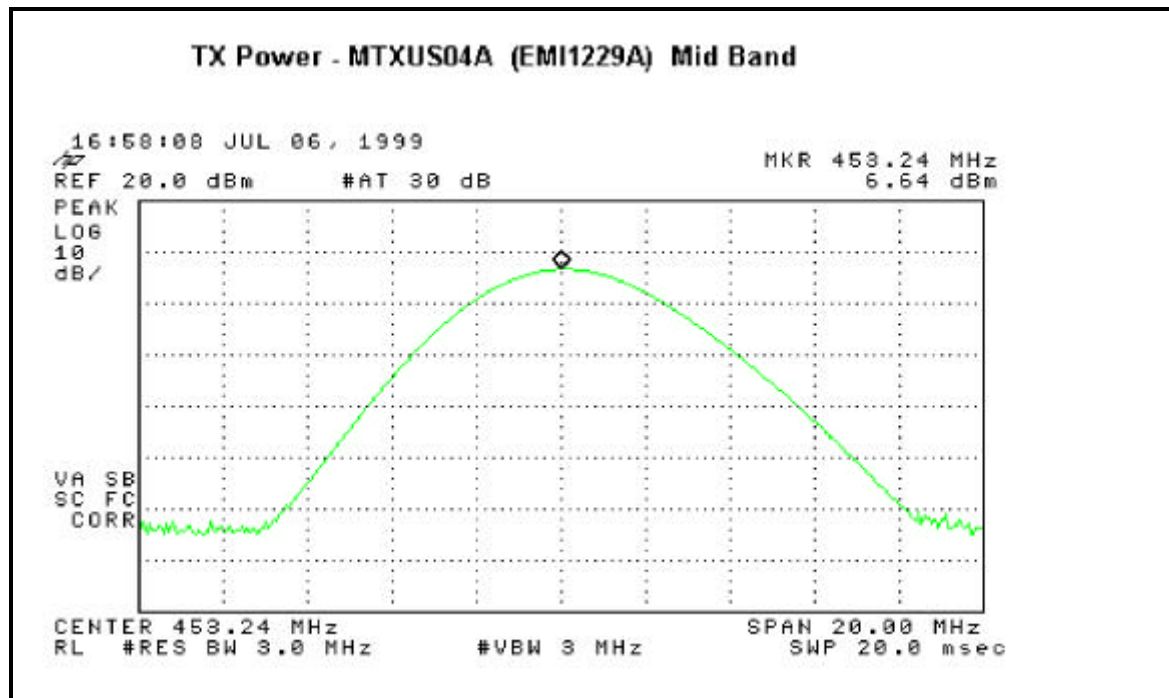
6.3.3 MEASUREMENT PROCEDURES:

As required by 47 CFR 2.1046, RF Power Output measurements were made at the RF output terminal using an attenuator and spectrum analyzer. This test was performed with carrier modulated by a GFSK modulation signal.

Plots of the RF output Power level of the Digitally modulated carrier, as measured at the RF output of the signal generator and at the RF output terminals of the EUT appear on the following pages.

6.3.4 RESULTS:

Equipment complies with 47 CFR 2.1046 and 90.205. Power Output measured at the RF output terminal is 6.64 dBm. With the addition of 1.25 dB for cable loss, EUT output power is less than 8 dBm or 6 mW. Therefore, the Transmitter Radio Module power is less than 120 mW and thus is Exempt from technical standards per 90.217.



**6.4 TEST TYPE:** Spurious Emissions at Antenna Terminals**6.4.1 TECHNICAL SPECIFICATION:** 2.1051, 90.217, 90.210(d)**6.4.2 TEST DATE(S):** July 2, 1999**6.4.3 MEASUREMENT PROCEDURES:**

As required by 47 CFR 2.1051, Spurious Emissions at Antenna Terminals measurements were made at the RF output terminals using a 50 Ω attenuator and spectrum analyzer set for a 100 kHz bandwidth. This test was performed with the digitally modulated carrier signal. The frequency spectrum was investigated from 9 kHz to 5 GHz. For measuring emissions above 2 GHz, a high-pass filter was used to eliminate the fundamental transmit frequency to prevent possible saturation effects on the front end of the spectrum analyzer.

6.4.4 RESULTS:

Equipment complies with Section 2.1051, 90.217, and 90.210(d)

SUMMARY OF SPURIOUS EMISSIONS AT ANTENNA TERMINALS

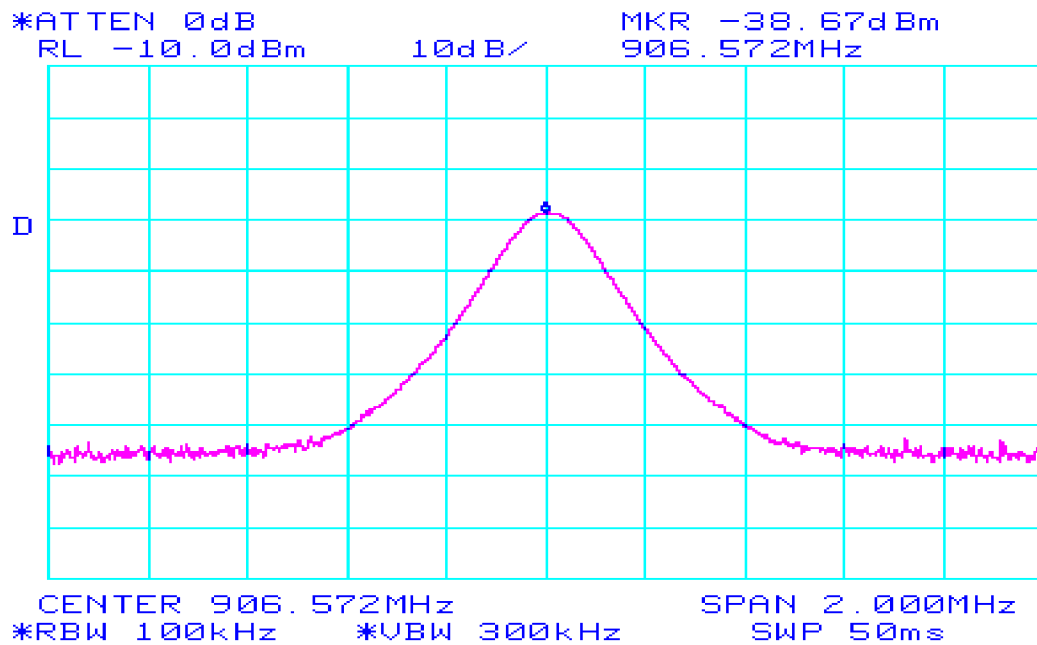
Emission Frequency (MHz)	Emission Level (dBm)	Limit* (dBm)
906.572	-38.67	-20
1359.863	-30.83	-20
1813.140	-46.33	-20
2266.438	-38.00	-20

The following plots are included to illustrate compliance with the requirements of 47 CFR 2.1051, 90.217, 90.210(d):

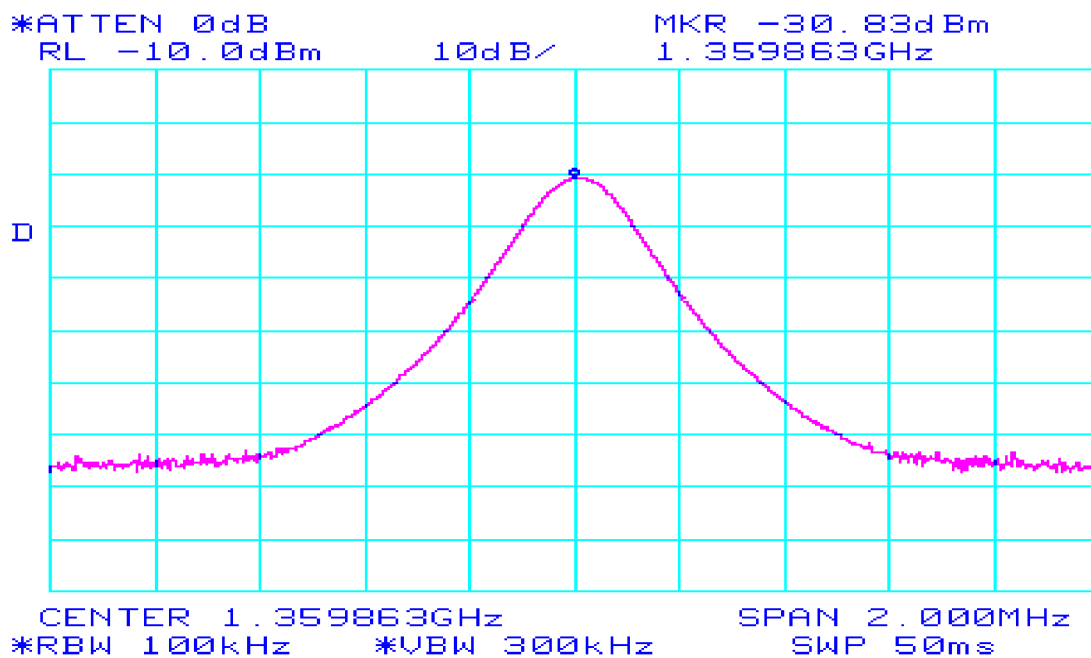
*- 20 dBm=86.92 dBuV from report section 6.1.3



Autec -MTXUS 04 A (EMI1229A)
Conducted Spurious Emission - 2nd harmonic

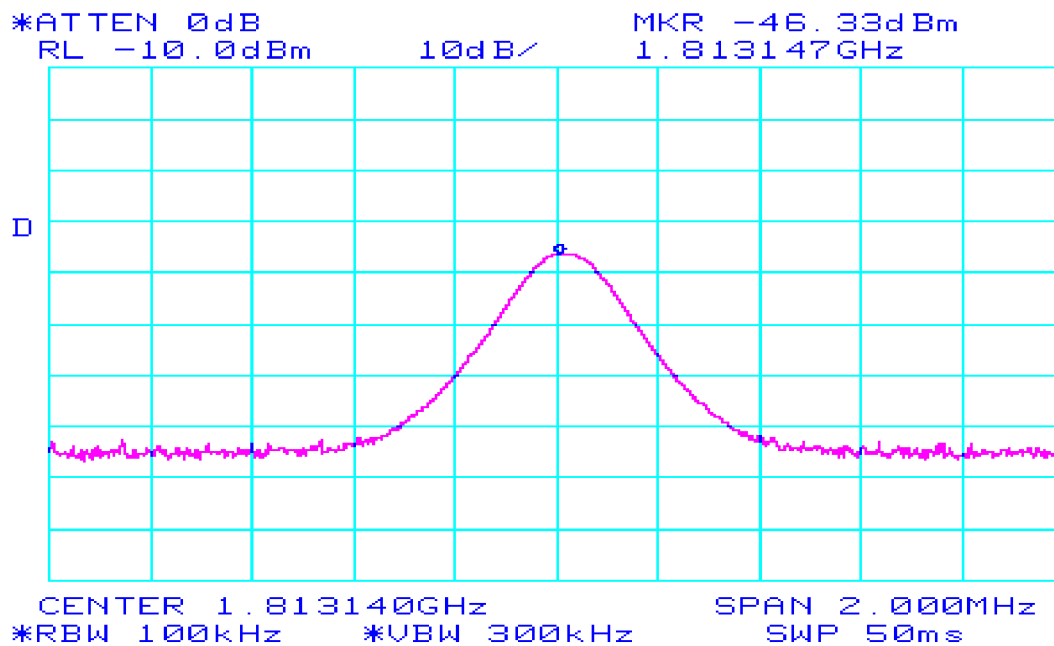


Autec -MTXUS 04 A (EMI1229A)
Conducted Spurious Emissions - 3rd harmonic

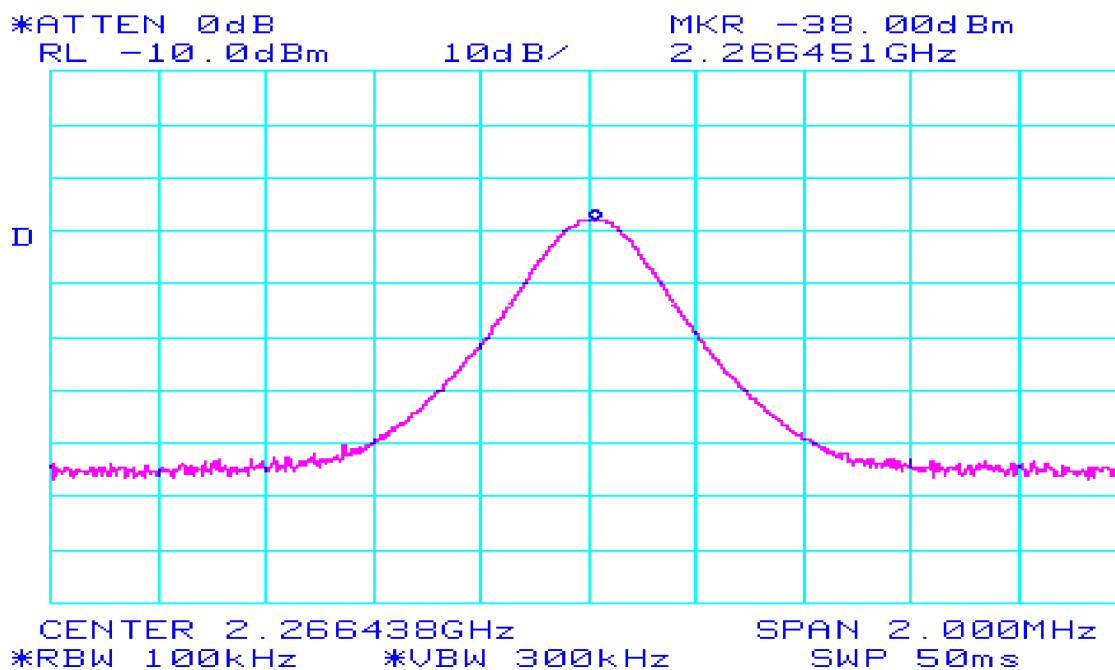




Autec MTXUS04A (EMI1229A)
Conducted Spurious Emissions - 4th harmonic



Autec MTXUS04A(EMI1229A)
Conducted Spurious Emissions - 5th harmonic



**6.5 TEST TYPE:** Frequency Stability Over Temperature Variations**6.5.1 TECHNICAL SPECIFICATION:** 2.1055(a), 90.213 (a) Footnote 8**6.5.2 TEST DATE(S):** July 8, 1999**6.5.3 MEASUREMENT PROCEDURES:**

As required by 47 CFR 2.1055(a), measurements of Frequency Stability over Temperature Stability were made at the RF output terminals using a 50 Ω attenuator and spectrum analyzer. This test was performed with the digitally modulated carrier signal. Temperature was varied in 10° C steps from -30° C to 50° C. The 20° C frequency (room temperature) was used as a reference to determine the change in frequency as temperature varied. The EUT was allowed to stabilize before measurements were made. The BW was set to 300 Hz so that small changes in frequency could be detected.

6.5.4 RESULTS:

Equipment complies with Section 2.1055(a), 90.213 (a) Footnote 8

Summary of Frequency Stability Over Temperature Variations

Temperature (° C)	Carrier Frequency (MHz)	Carrier Frequency Deviation (Hz)	Deviation Limit* (Hz)
-30	453.2875	300	1125
-20	453.2875	230	1125
-10	453.2875	80	1125
0	453.2875	150	1125
10	453.2875	80	1125
20	453.2875	0	1125
30	453.2875	80	1125
40	453.2875	80	1125
50	453.2875	80	1125

* As per 47 CFR 2.1055, the frequency deviation limit is 2.5 ppm of the Carrier Frequency.

**6.6 TEST TYPE:** Frequency Stability Over Voltage Variations**6.6.1 TECHNICAL SPECIFICATION:** 2.1055(a) (2), 90.213 (a) Footnote 8**6.6.2 TEST DATE(S):** July 12, 1999**6.6.3 MEASUREMENT PROCEDURES:**

As required by 47 CFR 2.1055, measurements of Frequency Stability Over Voltage Variations were made at the RF output terminal using a 50 Ω attenuator and spectrum analyzer. This test was performed with Digitally modulated carrier signals. The battery supply voltage was reduced from the nominal voltage of 7.2 VDC to the lower of the Manufacturers Battery Range (6.2 VDC). The carrier frequency at the batteries nominal voltage of 7.2 VDC was used as a reference for measuring frequency shift as voltage varied. The EUT was allowed to stabilize before measurements were made. The BW was set to 300 Hz so that small changes in frequency could be detected.

Summary of Frequency Stability Over Voltage Variations

Battery Voltage (VDC)	Carrier Frequency (MHz)	Carrier Frequency Deviation (Hz)	Deviation Limit* (Hz)
6.2	453.2875	0	1125
7.2	453.2875	0	1125

Plots on the following pages illustrate compliance to the required rule parts.

* As per 47 CFR 2.1055, the frequency deviation limit is 2.5 ppm of the Carrier Frequency.



6.7 TEST TYPE: Requirements for Exempt Transmitters

6.7.1 TECHNICAL SPECIFICATION: 90.217 (b)

6.7.2 TEST DATE(S): July 1, 1999

6.7.3 MEASUREMENT PROCEDURES:

For equipment designed to operate with a 25 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 40 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.

6.7.4 RESULTS:

Plots on the following pages illustrate compliance to the required rule parts.



Autec - MTXUS04A (EMI1229A)
Compliance of Part 90.217 (b) for Exempt TX

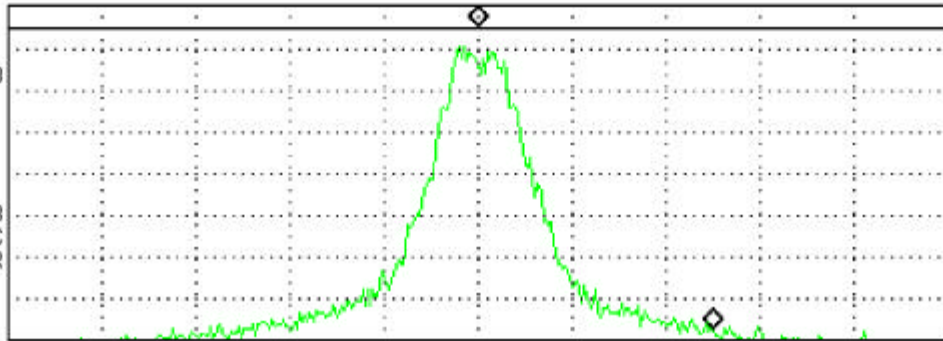
19:03:54 JUL 01, 1999

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 25.0 kHz
-72.25 dB

LOG REF 10.0 dBm

10
dB/
ATN
20 dB

DL
4.7
dBm
VA SB
SC FC
CORR



CENTER 453.2875 MHz SPAN 100.0 kHz
RL #IF BW 300 Hz AVG BW 300 Hz SWP 3.33 sec