TEST REPORT #250303

STANDARD: FCC PART 15

SUBPART C--INTENTIONAL RADIATORS

SECTION 15.249 OPERATION WITHIN THE BANDS 902-928 Mhz, 2400-2483.5 Mhz, 5725-5875 Mhz, and 24.0-24.25 Ghz

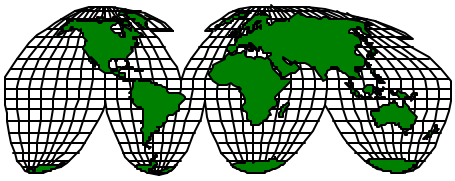
EQUIPMENT TESTED:

JAMES MASON AUSTRALIA P/L

MODEL: J.M.A.COMPUTER & WIRELESS AUTO MEASURING SYSTEM

TEST DATE: 25 MARCH 2003

INTERNATIONAL



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INTERNATIONAL

CERTIFICATION SERVICES, INC.

1.0 TEST SUMMARY

TEST REPORT: #250303	
COMPANY:	James Mason Australia P/L
AGENT:	International Certification Services, Inc.
PHONE:	320-864-4444
TEST DATE:	25 March, 2003
EQUIPMENT UNDER TEST:	J.M.A. Computer & Wireless Auto Measuring System
GENERAL TEST SUMMARY:	The testing was performed at International Certification Services, Inc. at 1100 Falcon Ave, Glencoe, MN 55336
VERIFICATION / CERTIFICATION STATUS:	The J.M.A. Computer & Wireless Auto Measuring System was found to be in compliance with the FCC Part 15 Subpart C, Section 15.249 requirements.
MODIFICATIONS NECESSARY:	None

TESTED BY

Steve Wendlandt

WRITTEN BY

Duane R. Bagdons

Applicable Standards

47 CFR Ch.1 (10-1-98 Edition)

FCC Part 15 Radio Frequency Devices

Subpart C Intentional Radiators

Section 15.249 Operation within the bands 902-928 Mhz, 2400-2483.5 Mhz, 5725-5875 Mhz and 24.0-24.25 Ghz

2.1 Referenced Standards

ANSI C63.4-1992 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 Khz to 40 Ghz.

2.2 Equipment Units Tested

The equipment tested is a measuring device to compare vehicle manufacturers data against damaged or repaired vehicles and product a hard copy report of variations at the data reference points of the vehicle. There are three radio transmitters (all identical) in the system. One is for Rod 1 (for reporting the Underbody Measurements), the second is on Rod 2 (for reporting the comparative and Upperbody Measurements), and the third is the transmitter box that connects to the computer for communicating with the above 2 devices. All transmitters operate on the same frequency 916.596 Mhz and are controlled by the device attached to the computer. All receivers are SAW based type devices and do not have a local oscillator. These devices have been verified here at the lab also for radiated emissions and found to be compliant with the 15.109 regulation for Radiated Emission Limits.

2.3 Equipment and Cable Configuration

See photos of the EUT PC board and schematic and test configuration setup in Attachment A

2.4 List of Test Equipment

Test Equipment	Model	S/N	Last Calibration Date
Spectrum Analyzer	Hewlett-Packard 8566B	2421A00458	08/01/02
Preamp	Nextec NB00391	378	03/03/03
Log Periodic Antenna (200-1000 MHz)	EMCO 3146	9101-2991	12/16/02
Horn Antenna (1-18 Ghz)	EMCO 3115	5697	12/16/02

Measurement cable losses, and antenna correction factors are included in the Corrected Data column of the data sheet. Quasi Peak Detection was used for measuring the Fundamental frequency signal and Average detection method was used to measure the Harmonics since they were all above 1000 Mhz. The Resolution BW

was set at 100 Khz and the Video BW was set at 1 Hz with a Span of 0 Hz to perform the correct average detected measurements.

2.5 Units of Measurement.

All measurements were taken in dBuV/m with the antenna located at 3 meters distance from the EUT. Frequency measurements are recorded in Mhz. Input power to the intentional radiator was not recorded---only the radiated emissions with the internal transmitting antenna were recorded.

2.6 Location of Test Site

The open area test site (OATS) and conducted measurement facility used to collect the data was International Certification Services, Inc. at 1100 Falcon Ave. in Glencoe, MN 55336. This site has been certified to be in compliance with the normalized site attenuation section of CISPR 16-1. (See FCC Registration number: 91103 and Industry Canada File number: IC 3701.)

2.7 Measurement Procedures

The antenna was placed at a distance of 3 meters from the EUT. The EUT was set on an insulating table in the OATS site and rotated through 360 degrees to determine the worst case EUT orientation. The antenna was then positioned vertical and horizontal to determine which antenna polarity orientation was worst case. Then certification data was recorded at all the transmitter frequencies from the fundamental to the 10^{th} harmonic at an antenna height variation of from 1-4 meters.

2.8 Reporting Measurement Data

See data sheets and plots in Attachment B for the Transmitter section and in Attachment C for the Receiver section of the product.

2.9 Radiated Emissions Data

The frequency and amplitude of the tuned frequency of the EUT along with the frequencies and amplitudes of the harmonics up to the 4 th harmonic are reported in the data sheets in Attachment B. No harmonic signals were observed above 4582.98 Mhz. This information is plotted against the limit of section 15.249 of FCC Part 15 subpart C. Both Horizontal and Vertical antenna polarities as well as antenna heights of 1 to 4 meters were observed.

The Final Level, expressed in dBuV/m, is arrived at by taking the reading from the spectrum analyzer (Level dBuV) and adding the antenna correction factor and cable loss factor (Factor dB) and subtracting the preamp gain. This result then has the FCC limit subtracted from it to provide the margin which gives the tabular data as shown in the data sheets in Attachment B.

Example:

Frequency (MHz)	Level (dBuV)	+	Factor (dB)	=	Corr Data (dBuV/m)	-	FCC Limit (dBuV/m)	=	Margin (dB)
100.0	20.6	+	11.0	=	31.6	-	43.5	=	-11.9

2.10 Operating Frequency Data for Intentional Radiators

All operating frequencies and harmonic frequencies and ambient temperature at which all data was taken at is recorded in the data sheets in Attachment B.

2.11 Occupied Bandwidth Data for Intentional Radiators

The occupied BW data for the EUT is listed in the data sheets in Attachment B.

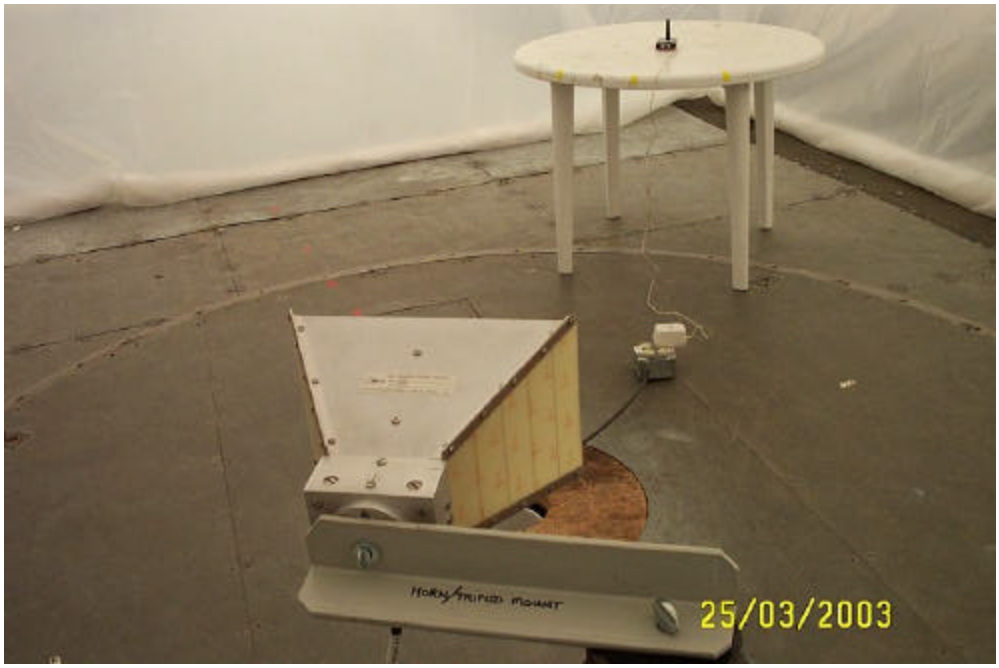
2.12 Summary of Results

The EUT passed the requirements of FCC Part 15 Subpart C, Section 15.249 with a minimum passing margin of –2.5276 dB (Quasi Peak Detected signal) at the Fundamental frequency of 916.596 Mhz. No modifications were necessary to accomplish this compliance.

ATTACHMENT A

RADIATED MEASUREMENT PHOTOS

Model: J.M.A. Computer & Wireless Auto Measuring System
Transmitter Radiated Emissions
Test Configuration



ATTACHMENT B
TRANSMITTER SECTION
DETAILED TEST DATA SHEETS

Each radiated emissions plot indicates the receiving antenna measurement distance in meters and the emission amplitudes with respect to their applicable limits. The associated tabulation for each radiated plot lists the emission frequency, the final emission level, and the margin from the limit.

James Mason Australia P/L
Model: J.M.A. Computer & Wireless Auto Measuring System
Temperature: 73 Deg F.
Humidity: 38 % R.H.

Test Technician: Steve Wendlandt

Center Frequency: 916.596 Mhz

There are two modes of operation for the system:

- Idle mode - No radio transmissions, so we can ignore this mode of operation.

- Recording mode - In the recording mode, system is transmitting "data messages" (all data messages are always 190ms) and "control messages" (all control messages POLL and ACK are always 20ms). The length of these messages is controlled by micro FW on both sides (PC and black box side).

  There are three possible situations in the recording mode:

  - PC side needs to send data to the black box (operator is starting or stopping the recording mode of operation). In this situation, instead of sending a regular POLL control message, PC side sends a data message (190ms) to the black box. If this message is received by the black box, it will reply with ACK control message. When PC side receives this ACK control message, this instance of data transfer from PC to the black box is completed and regular POLL control messages will resume, but only after another 800ms delay.

  - Black box needs to send data to the PC (operator has pressed transmit button on the black box). Black box will wait for the POLL control message from the PC side. When this POLL control message is received, black box will send back the data message (190ms). Upon receiving this data message, PC side will send back ACK control message to the black box. This completes the data transfer from black box to the PC side. The next POLL control message from the PC side will be sent after the 800ms delay.

  - Neither PC nor black box side needs to transfer data - PC side is sending POLL control messages every 800ms. Black box will not reply to these messages.

The situation where the system will transmit the most messages is case 2 where black box needs to transfer data to the PC side. Our system will transmit POLL control message (20ms - sent by PC side), immediately followed by data message (190ms – send by black box), immediately followed by ACK control message (20ms – sent by PC side). This means the system will transmit for 240ms, followed by 800ms delay.

Preliminary testing was done to determine what antenna polarity and antenna height generated the highest signal levels. Tests were performed at this test configuration and then each frequency was maximized to 0-360 degrees orientation and antenna height of 1-4 meters.

Transmit signal total BW (See plot)

Certification testing was performed at the OATS site with an antenna distance of 3 meters and the EUT at 90 Degrees to the antenna.

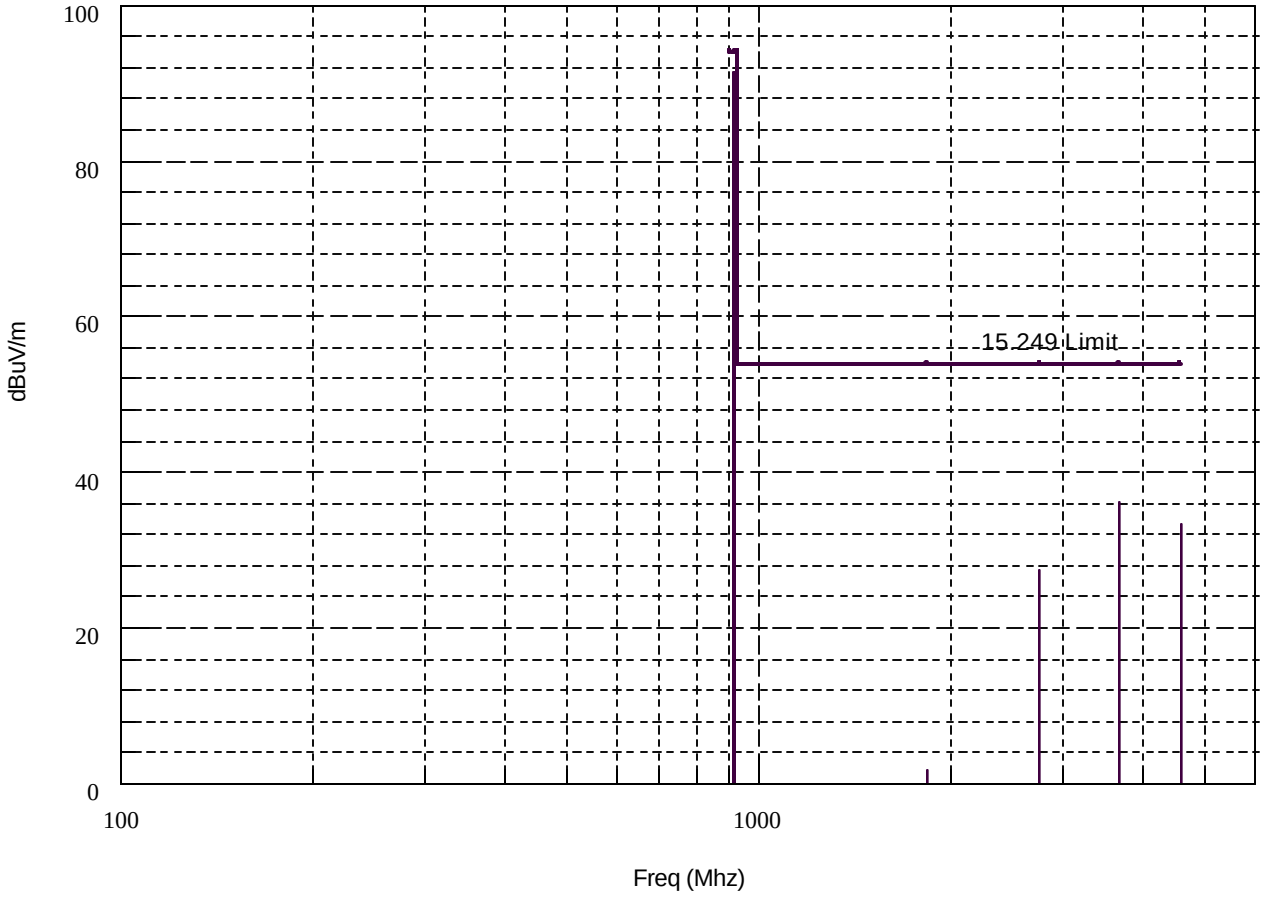
The limit for section 15.249 is 50 mV/m with a Quasi Peak Detector for the fundamental signal and 500 uV/m with an Average Detector for the Harmonics. This converted to dBuV is 93.979 dBuV/m for the Fundamental signal and 53.979 dBuV for the Harmonics which is the limit shown in the next table.

Freq (Mhz)	Corr Data (dBuV)	Limits	Margin	Quasi-Peak	EUT Orientation	Ant Pol
916.5960	91.4514	93.979	-2.5276	QP	90	H
1833.1920	1.7014	53.979	-52.2776	AVG	270	H
2749.7880	27.34853	53.979	-26.63047	AVG	270	H
3666.3840	36.0967096	53.979	-17.88229	AVG	0	V
4582.9800	33.3770328	53.979	-20.601967	AVG	180	H

Worst Case Margiin

There were no Signal frequencies above 4582.98 Mhz.

Chassis Aligner (James Mason)
Transmitter Output Fundamental and Harmonic frequencies
FCC 15.249



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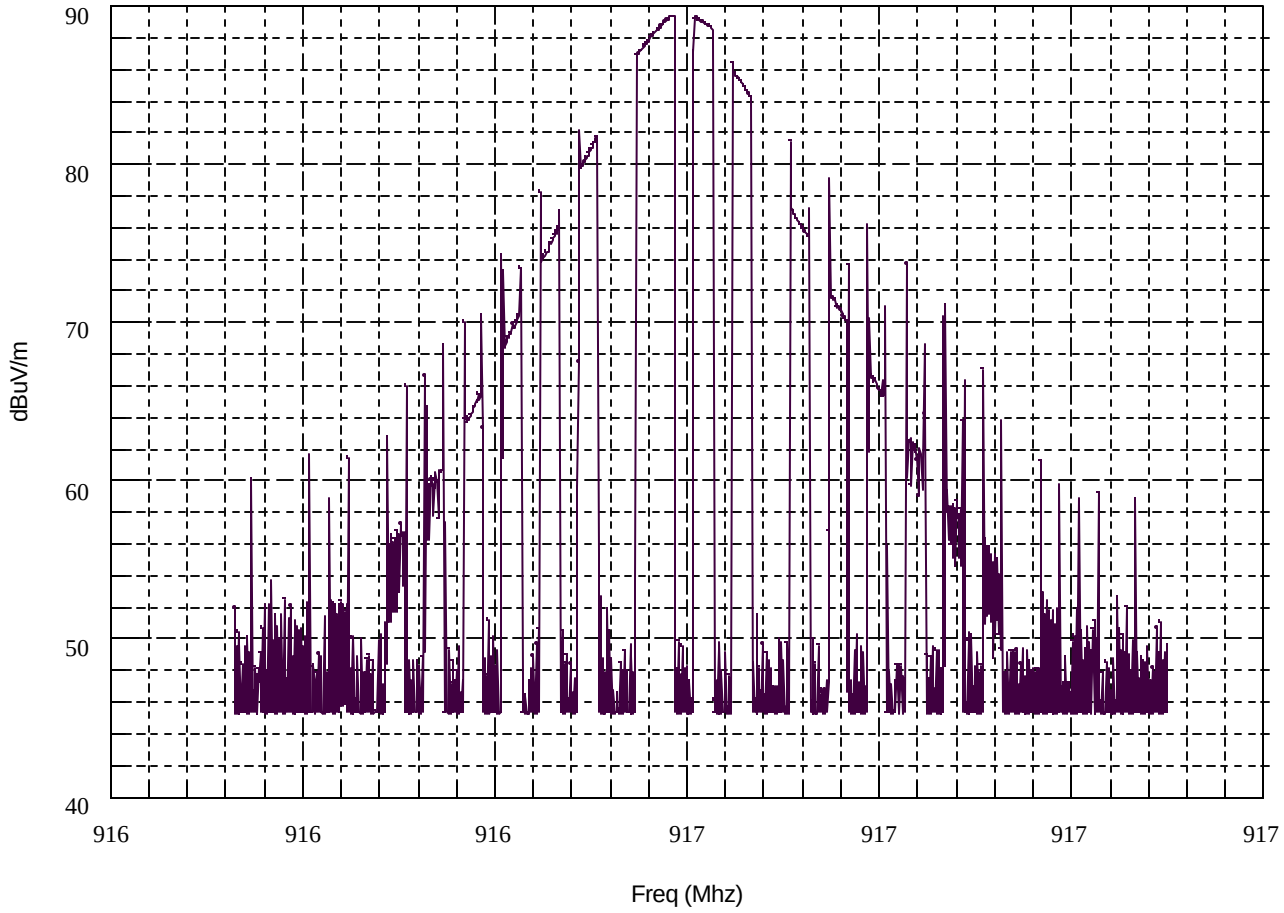
Chassis Aligner (James Mason)
Model:
Transmitter Output



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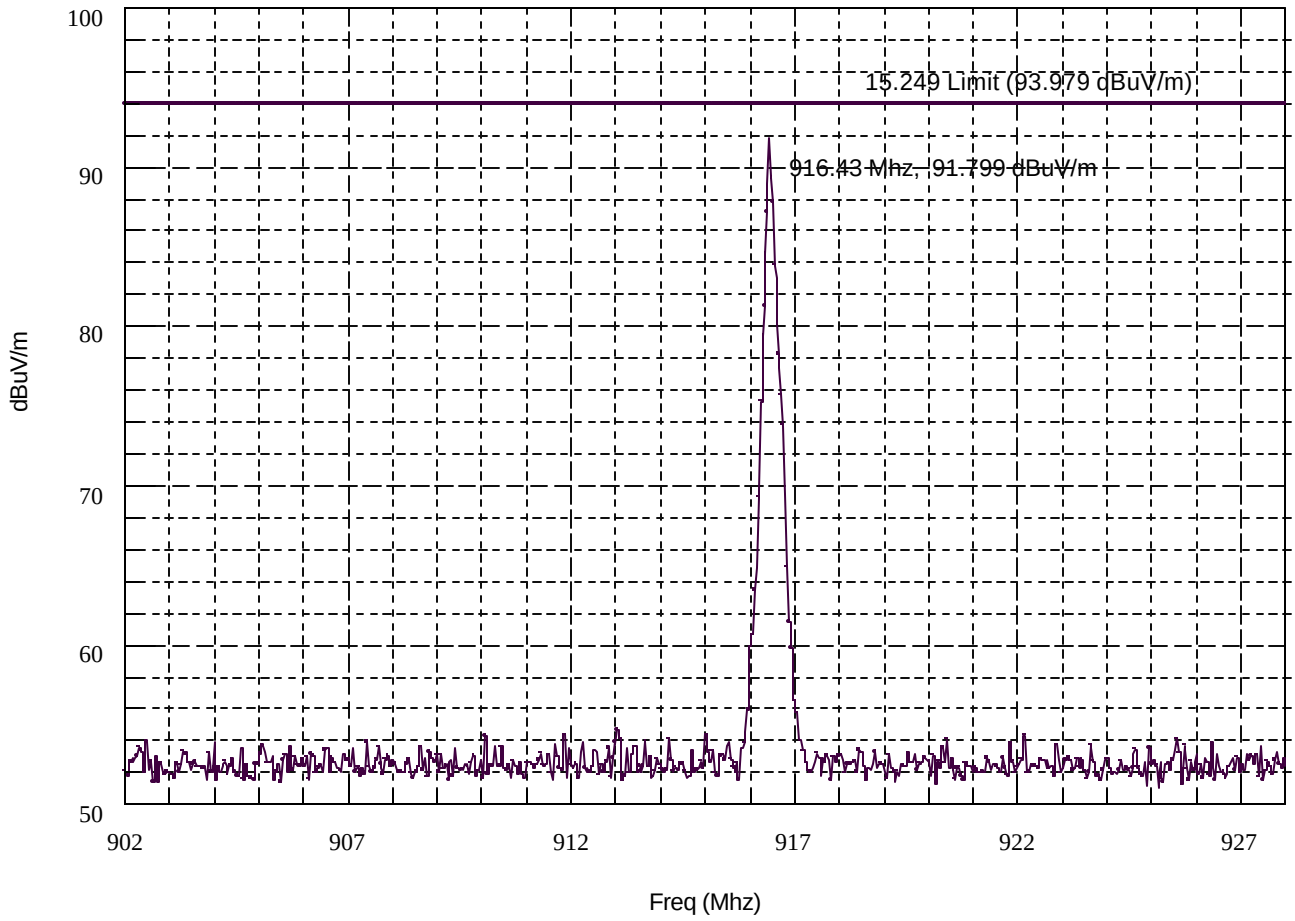
Chassis Aligner (James Mason)
FCC 15.249 Radiated Emissions



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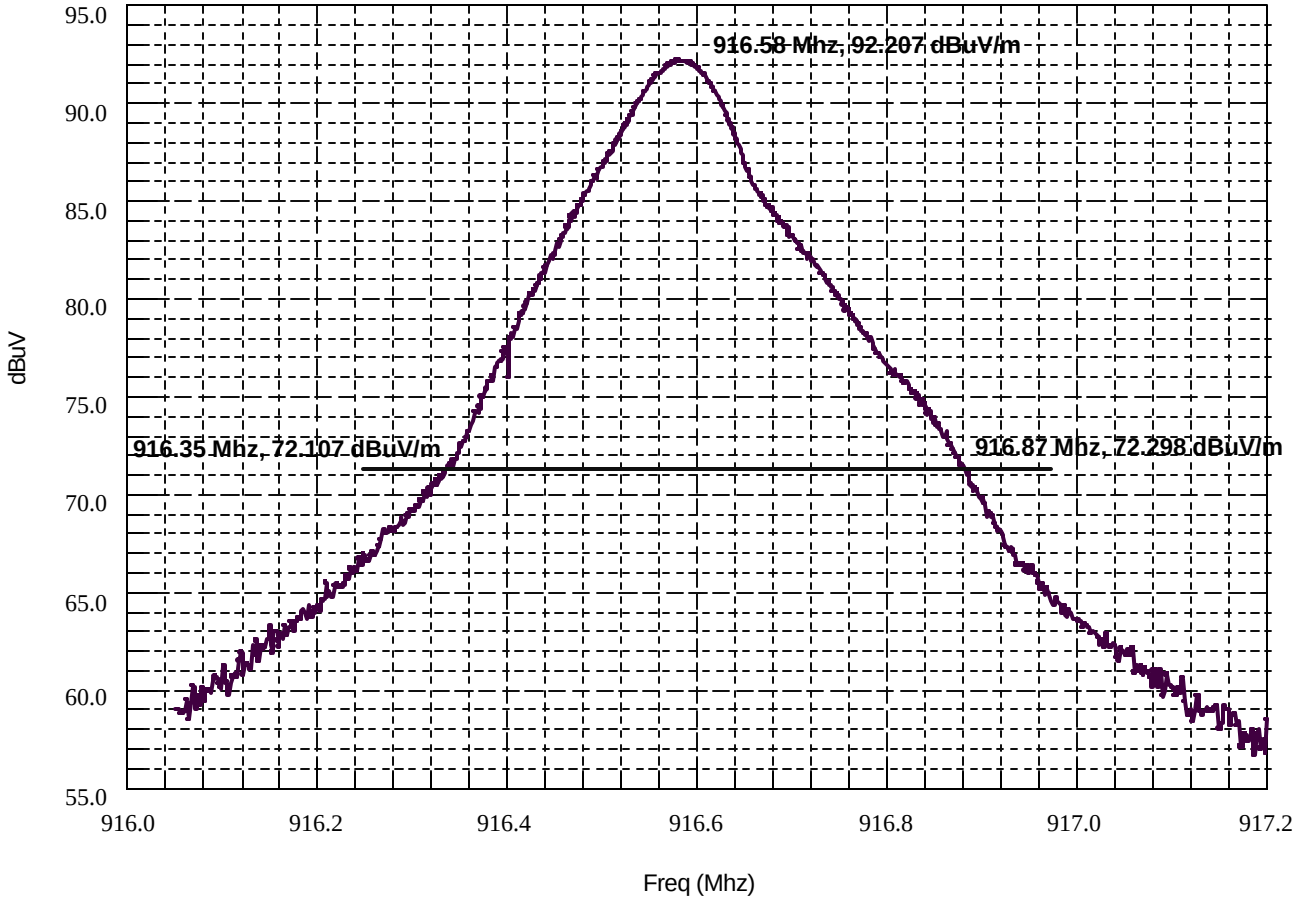
Chassis Aligner (James Mason)
Transmitter Output Bandwidth (20 dB points)



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ATTACHMENT C
RECEIVER SECTION
DETAILED TEST DATA SHEETS

James Mason Australia P/L
Model: J.M.A. Computer & Wireless Auto Measuring System
Temperature: 68 Deg F.
Humidity: 53 % R.H.

Test Technician: Steve Wendlandt

Center Frequency: 916.596 Mhz

Since this product is a Transceiver, the receiver section must be observed per the ANSI C63-4 requirement. An external signal was induced to the receiver from a signal generator by wrapping a wire around the antenna to inductively couple this signal into the receiver. The signal generator was set to 916.596 Mhz. The Signal Generator was unmodulated and set to an output level of –50 dBm to excite the receiver local oscillator. No emitted signals were observed on the OATS site so the EUT was taken into the shield room and observed with an antenna at 3 meters distance. Still no signals were observed.

ATTACHMENT D

PRODUCT DATA SHEET OR PRODUCT INFORMATION FORM AS SUPPLIED BY THE CUSTOMER

INTERNATIONAL

CERTIFICATION SERVICES, INC.

COMPANY NAME: James Mason Australia P/L

CUSTOMER REPRESENTATIVE: International Certification Services, Inc.

EQUIPMENT DESCRIPTION: J.M.A. Computer & Wireless Auto Measuring System

MODEL NUMBER: J.M.A. Computer & Wireless Auto Measuring System

SERIAL NUMBER: Engineering Unit

TYPE OF TEST:

_____Development
_____Initial Design Verification
_____Design Change (Please describe exact changes below)
__X__Production Sample (Audit Test)

Changes made: NONE

OSCILLATOR FREQUENCIES:

11.0592 Mhz

PRODUCT SHIELDING PROVISION:

Plastic enclosure

SOFTWARE AND / OR OPERATING MODES:

The unit tested was set up to constantly transmit a burst of pulses so the signal could be observed and recorded..

I/O CABLES:

Serial port cable between the PC transceiver device and the computer.