



Engineering and Testing for EMC and Safety Compliance

## APPLICATION FOR FCC CERTIFICATION

**MODEL: FM-10 Tx**  
**FCC ID: MQ5FM-10-TX**

Telean Technology Ltd.  
1603, 16/F Fo Tan Industrial Centre  
26-28 Au Pui Wan Street  
Fo Tan, Hong Kong

**March 13, 2003**

STANDARDS REFERENCED FOR THIS REPORT	
PART 2: 1999	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 15: 1999	RADIO FREQUENCY DEVICES
ANSI C63.4-1992	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS

FCC Rules Parts	Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
15.239	88.1 – 88.7 MHz	N/A	N/A	171KF3E

### REPORT PREPARED BY:

Test Engineer: Daniel Baltzell  
Administrative Writer: Daniel Baltzell

Rhein Tech Laboratories, Inc.

Document Number: 2003030

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<http://www.rheintech.com>

Client: Telean Technology Ltd  
Model: FM-10 Tx  
Standards: FCC 15.239  
Report #: 2003030  
Date: March 11, 2003

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## 1 GENERAL INFORMATION

The following application for FCC Type Certification of a Transceiver is prepared on behalf of Telean Technology Ltd. in accordance with Part 2, and Part 15, Subparts A and B, of the Federal Communications Commission rules and regulations. The Equipment Under Test (EUT) was Model: FM-10 Tx, FCC ID: MQ5FM-10-TX. The test results reported in this document relate only to the item that was tested.

All measurements contained in this Application were conducted in accordance with ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 1992. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. Calibration checks are performed regularly on the instruments, and all accessories, including the high pass filter, preamplifier and cables.

All radiated emissions measurements were performed manually at Rhein Tech Laboratories. The radiated emissions measurements required by the rules were performed on the three-meter, open field; test range maintained by Rhein Tech Laboratories, 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. A complete description and site attenuation measurement data have been placed on file with the Federal Communications Commission. The power line conducted emissions measurements were performed in a shielded enclosure also located at the Herndon, Virginia facility. The FCC accepts Rhein Tech Laboratories, Inc. as a facility available to do measurement work for others on a contractual basis.

### 1.1 MODIFICATIONS

The antenna was shortened to a length of 3.8 cm to decrease the gain, due to initial high levels of the fundamental field strength measurements.

### 1.2 RELATED SUBMITTAL(S)/GRANT(S)

This is an original certification submission.

### 1.3 TEST METHODOLOGY

Radiated testing was performed according to the procedures in ANSI C63.4 1992. Radiated testing was performed at an antenna-to-EUT distance of 3 meters. An input signal was used to establish maximum response of the audio modulating circuit, modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.

### 1.4 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report, submitted to and approved by the Federal Communications Commission, to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

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Standards: FCC 15.239  
Report #: 2003030  
Date: March 11, 2003

## 2 CONFORMANCE STATEMENT

STANDARDS REFERENCED FOR THIS REPORT	
<b>PART 2: 1999</b>	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
<b>PART 15: 1999</b>	RADIO FREQUENCY DEVICES
<b>ANSI C63.4-1992</b>	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS

FCC Rules Parts	Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
15.239	88.1 – 88.7 MHz	N/A	N/A	N/A

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described above. Modifications to the equipment were made during testing in order to achieve compliance with these standards. The client was notified, and will conform to these modifications.

Furthermore, there was no deviation from, additions to or exclusions from the ANSI C63.4 test methodology.

Signature: 

Date: March 13, 2003

Typed/Printed Name: Desmond A. Fraser

Position: President  
(NVLAP Signatory)

**NVLAP** Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 20061-0.

**Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.**

### 3 SYSTEM TEST CONFIGURATION

#### 3.1 JUSTIFICATION

To complete the test configuration required by the FCC, stereo input was determined to be the worst case configuration between the mono and stereo options on the device. The EUT's fundamental frequency and crystal oscillator of 7.6 MHz, and the harmonics of each, were investigated. IF and LO frequencies were not investigated because this transmitting-only device cannot receive radio frequencies. The device has four channels (88.1 MHz, 88.3 MHz, 88.5 MHz, and 88.7 MHz). 88.3 MHz was measured as the highest output power using a conducted method at the antenna port. Data from this channel was determined to be worst case.

Per 15.31(m), because the EUT's frequency range is less than 1MHz, one channel was tested. Because the EUT has 4 channels, the two "middle" channels were checked, and the channel with the highest output power was used for testing.

Conducted emission is not required since the device is operated from a 12 VDC power supply.

#### 3.2 EXERCISING THE EUT

The Model: FM-10 Tx is a transmitter designed to function at 88.1, 88.3, 88.5, and 88.7 MHz. When a 12 VDC supply voltage is connected, and the on/off button on the controller is pressed, the transmitter is activated. Both Mono and Stereo can be selected by an external switch.

#### 3.3 TEST SYSTEM DETAILS

The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system are:

TABLE 3-1: EQUIPMENT UNDER TEST (EUT)

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
TRANSMITTER	TELEAN TECHNOLOGY LTD.	FM-10 Tx	TTL-ES303065	MQ5FM-10-TX	UNSHIELDED I/O; UNSHIELDED POWER	015060

#### 3.4 CONFIGURATION OF TESTED SYSTEM

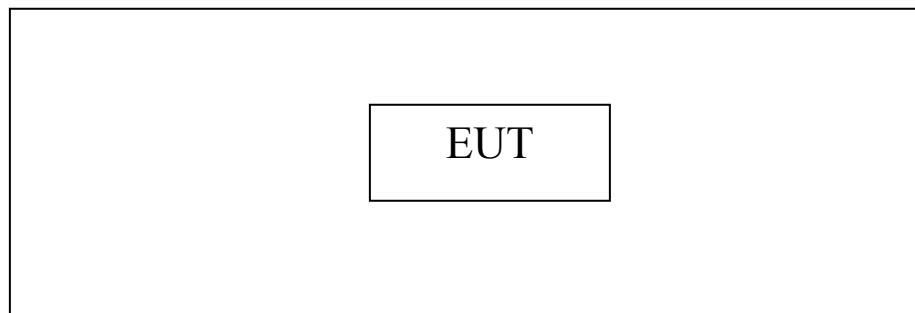


FIGURE 1: TEST SYSTEM CONFIGURATION

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#### **4 CONDUCTED EMISSIONS**

AC conducted emissions is not required since the device under test is not powered from AC mains, but has a 12 VDC input requirement.

## 5 RADIATED EMISSIONS

### 5.1 TEST METHODOLOGY FOR RADIATED EMISSIONS MEASUREMENTS

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one meter and three meter distances, in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction, and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three-meter, open-field test site. The EUT was placed on a nonconductive turntable approximately 0.8 meters above the ground plane. The spectrum was examined from 30 MHz to 1000 MHz using a spectrum analyzer, a quasi-peak adapter, and EMCO log periodic and biconical antenna. In order to gain sensitivity, a preamplifier was connected in series between the antenna and the input of the spectrum analyzer.

At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations. The spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. No video filter less than 10 times the resolution bandwidth was used. The second harmonic of the highest LO was tested. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Per FCC 15.239, the field strength should not exceed 250 microvolts/meter at 3 meters. Table 5-2 demonstrates this compliance.

*Note: Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech Quality Manual, section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: daily and annual calibration methods, technician training, and emphasis to employees on avoiding error.*

### 5.2 RADIATED TEST EQUIPMENT

TABLE 5-1: EQUIPMENT USED FOR TESTING

RTL ASSET #	MANUFACTURER	MODEL	PART TYPE	SERIAL NUMBER	CALIBRATION DUE DATE
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	N/A
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	N/A
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	5/10/03
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	5/10/03
901053	Schaffner &Chase	CBL6112B	Bilog Antenna (20 MHz - 2 GHz)	2648	05/24/03
900905	Rhein Tech Labs	PR-1040	Pre Amplifier 40dB (10 MHz - 2 GHz)	1006	N/A
900969	Hewlett Packard	85650A	Quasi-Peak Adapter	2412A00414	5/10/03

### 5.3 RADIATED EMISSION DATA

TABLE 5-2: FUNDAMENTAL RADIATED EMISSIONS; CHANNEL 2, FCC PART 15.239(B) AND 15.35

Temperature: 35°F      Humidity: 75%									
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
88.3	Av	H	30	2.0	68.6	-21.0	47.6	48.0	-0.4
88.3	Pk	H	30	2.0	69.0	-21.0	48.0	68.0	-20.0

TABLE 5-3: HARMONIC RADIATED EMISSIONS; CHANNEL 2, FCC PART 15.239(C)

Temperature: 44°F      Humidity: 55%									
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
176.616	Qp	H	185	2.0	55.7	-19.3	36.4	43.5	-7.1
209.671	Qp	H	90	1.5	45.0	-18.6	26.4	43.5	-17.1
264.924	Qp	H	190	1.0	49.7	-14.7	35.0	46.0	-11.0
353.232	Qp	H	270	1.0	38.3	-12.9	25.4	46.0	-20.6
441.540	Qp	H	180	2.0	36.7	-10.6	26.1	46.0	-19.9
529.836	Qp	V	260	1.0	36.0	-9.3	26.7	46.0	-19.3
618.136	Qp	V	30	1.0	35.2	-7.4	27.8	46.0	-18.2
706.436	Qp	V	0	1.0	32.3	-6.9	25.4	46.0	-20.6
794.736	Qp	V	0	1.0	32.5	-5.7	26.8	46.0	-19.2
883.000	Qp	V	0	1.0	39.8	-5.0	34.8	46.0	-11.2

TABLE 5-4: DIGITAL RADIATED EMISSIONS; CHANNEL 2, FCC PART 15.209

Temperature: 35°F      Humidity: 75%									
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
70.000	Qp	H	260	2.8	52.0	-23.2	28.8	40.0	-11.2
75.539	Qp	H	250	2.0	51.4	-22.7	28.7	40.0	-11.3
79.404	Qp	H	270	2.0	46.8	-22.4	24.4	40.0	-15.6
115.814	Qp	H	160	2.4	49.7	-17.0	32.7	43.5	-10.8
154.337	Qp	H	170	2.0	46.5	-18.3	28.2	43.5	-15.3
209.671	Qp	H	90	1.5	45.0	-18.6	26.4	43.5	-17.1

\*All readings are quasi-peak, unless stated otherwise.

\* Note: The preamplifier's gain is included in the site correction factor.

### TEST PERSONNEL:

Daniel W. Baltzell  
 Test Engineer

Signature

March 11, 2003

Date Of Test

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## 6 COMPLIANCE WITH THE BAND EDGE - §15.239 (A)

### 6.1 TEST PROCEDURE

Compliance with the band edge was performed using the lowest channel frequency of 88.1 MHz. The determination of the band at 88 MHz was made using 1% of the span for the resolution bandwidth setting. The final data derived below were from radiated measurements only. The data taken in this report represents the worst case using stereo mode input.

### 6.2 BAND EDGE TEST EQUIPMENT

TABLE 6-1 BAND EDGE TEST EQUIPMENT

RTL ASSET #	MANUFACTURER	MODEL	PART TYPE	SERIAL NUMBER	CALIBRATION DUE DATE
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	N/A
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	N/A
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	5/10/03
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	5/10/03
901053	Schaffner &Chase	CBL6112B	Bilog Antenna (20 MHz - 2 GHz)	2648	05/24/03
900905	Rhein Tech Labs	PR-1040	Pre Amplifier 40dB (10 MHz – 2 GHz)	1006	N/A
900969	Hewlett Packard	85650A	Quasi-Peak Adapter	2412A00414	5/10/03

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### 6.3 COMPLIANCE WITH THE BAND EDGE TEST DATA

**Operating Frequency:** 88.1 MHz  
**Channel:** 1  
**Distance:** 3 meter  
**Limit:** 40 dB $\mu$ V/m

The band 88 MHz to 108 MHz is the band authorized by FCC Part 15.239. FCC Part 15.239(c) states that the field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed the general radiated emission limits in §15.209. The following emission is taken at the edge of the authorized band using the more stringent FCC §15.209 limit of 100 microvolts/meter at a 3 meter distance, equivalent to a 40 dB $\mu$ V/m limit.

TABLE 6-2 COMPLIANCE WITH THE BAND EDGE TEST DATA

Frequency (MHz)	Detector (Normalized to 120 kHz BW)	Field Strength (dB $\mu$ V/m)	Site Correction Factor (dB/m)	Corrected Field Strength (dB $\mu$ V/m)	Corrected Field Strength Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
88.0	Quasi-Peak	38.4	-21.1	17.3	17.3	40.0	-22.7

#### TEST PERSONNEL:

Daniel W. Baltzell

Test Engineer



March 13, 2003

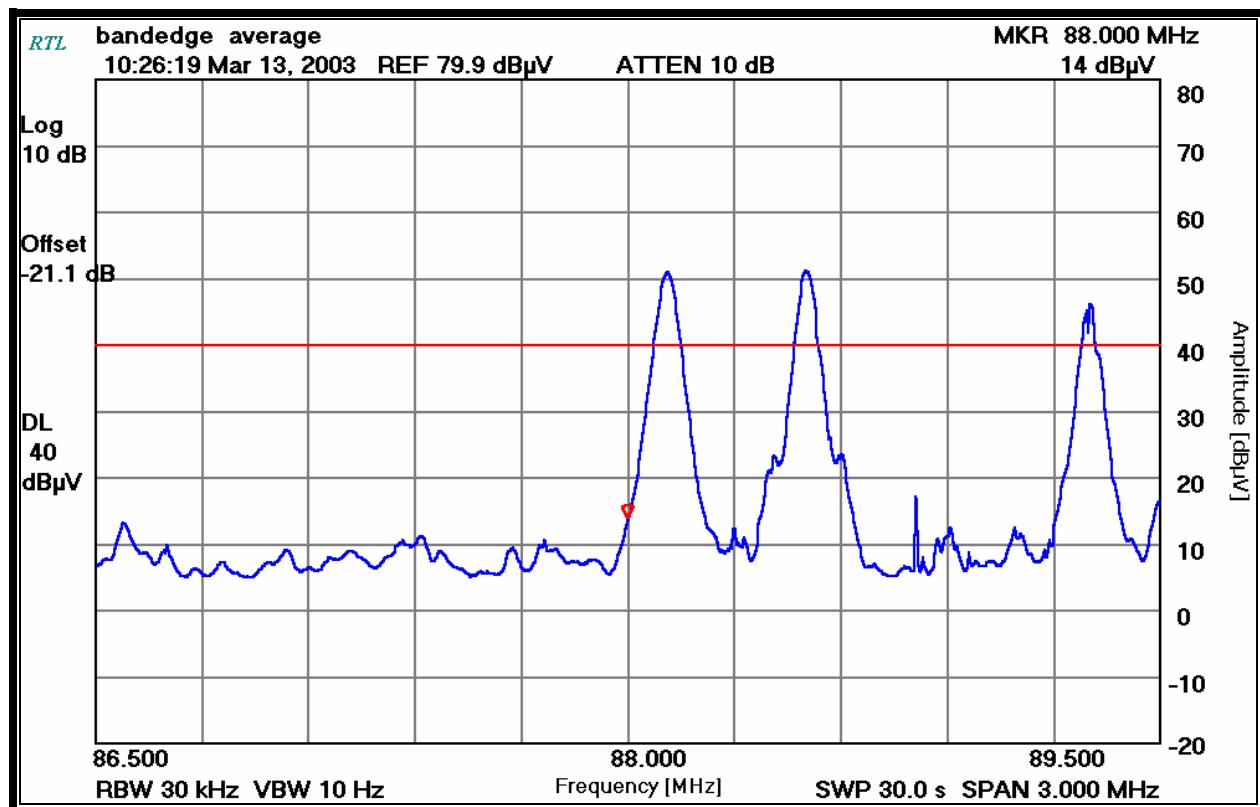
Signature

Date Of Test

#### 6.4 BAND EDGE PLOTS

Channel Number: 1  
Frequency: 88.1 MHz  
Resolution Bandwidth: 30 kHz  
Video Bandwidth: 10 Hz  
Sweep Time: 30.0 s

PLOT 6-1: LOWER BAND EDGE (AVERAGE)



#### TEST PERSONNEL:

Daniel W. Baltzell  
Test Engineer

Signature

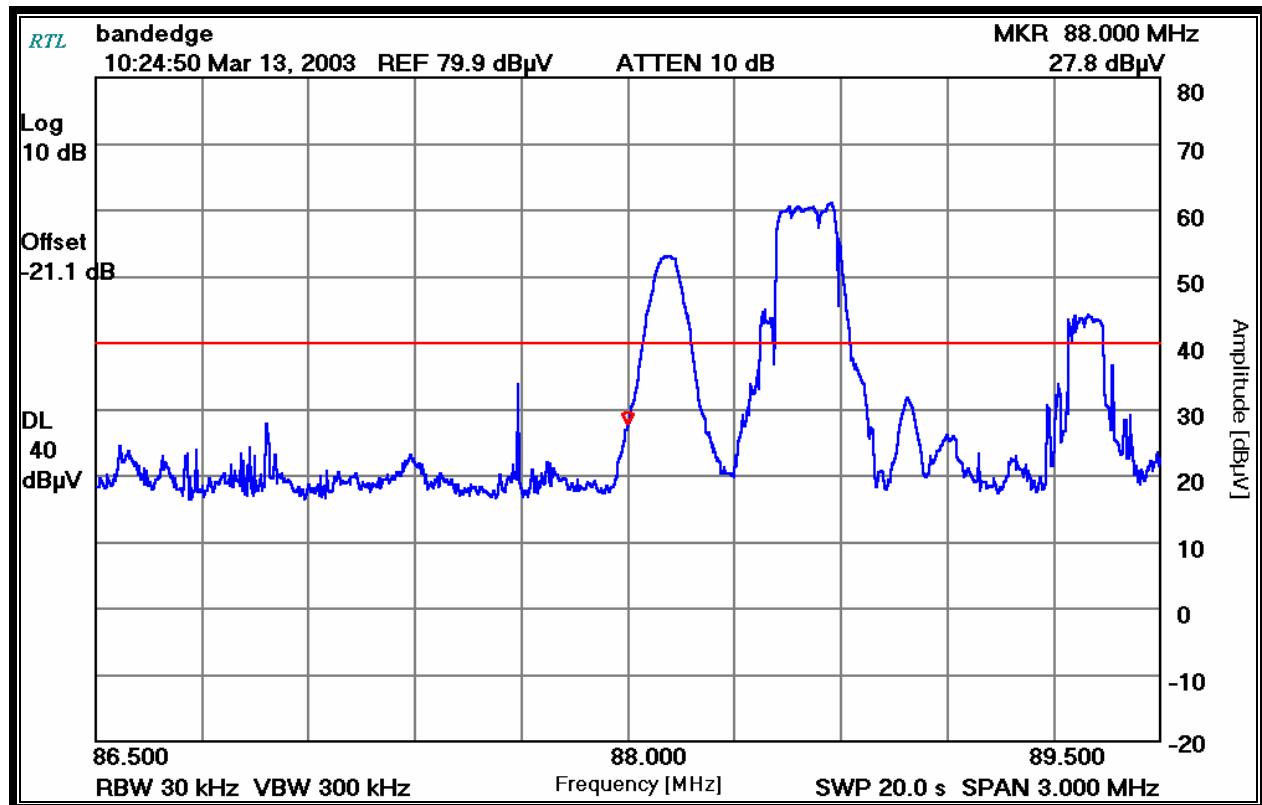
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**Channel Number:** 1  
**Frequency:** 88.1 MHz  
**Resolution Bandwidth:** 30 kHz  
**Video Bandwidth:** 300 kHz  
**Sweep Time:** 20.0 s

PLOT 6-2: LOWER BAND EDGE (PEAK)



TEST PERSONNEL:

Daniel W. Baltzell  
Test Engineer

*Daniel W. Baltzell*

Signature

March 13, 2003  
Date Of Test

## 7 MODULATED BANDWIDTH - §15.239(A)

### 7.1 MODULATED BANDWIDTH TEST PROCEDURE

The minimum 20 dB bandwidth was measured using a 50 ohm spectrum analyzer with the resolution bandwidth set to 1% of the span, and the video bandwidth greater than the resolution bandwidth. The minimum 20 dB modulated bandwidth is shown in Table 7-2.

### 7.2 TEST EQUIPMENT USED FOR TESTING

TABLE 7-1: TEST EQUIPMENT USED FOR TESTING (MODULATED BANDWIDTH)

RTL ASSET #	MANUFACTURER	MODEL	PART TYPE	SERIAL NUMBER	CALIBRATION DUE DATE
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	N/A
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	N/A
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	5/10/03
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	5/10/03
901053	Schaffner &Chase	CBL6112B	Bilog Antenna (20 MHz - 2 GHz)	2648	05/24/03
900905	Rhein Tech Labs	PR-1040	Pre Amplifier 40dB (10 MHz – 2 GHz)	1006	N/A
900969	Hewlett Packard	85650A	Quasi-Peak Adapter	2412A00414	5/10/03

### 7.3 MODULATED BANDWIDTH TEST DATA

TABLE 7-2: 20 DB MODULATED BANDWIDTH

CHANNEL	20 dB BANDWIDTH (kHz)
1	171
2	171

#### TEST PERSONNEL:

Daniel W. Baltzell		March 13, 2003
Test Engineer	Signature	Date Of Test

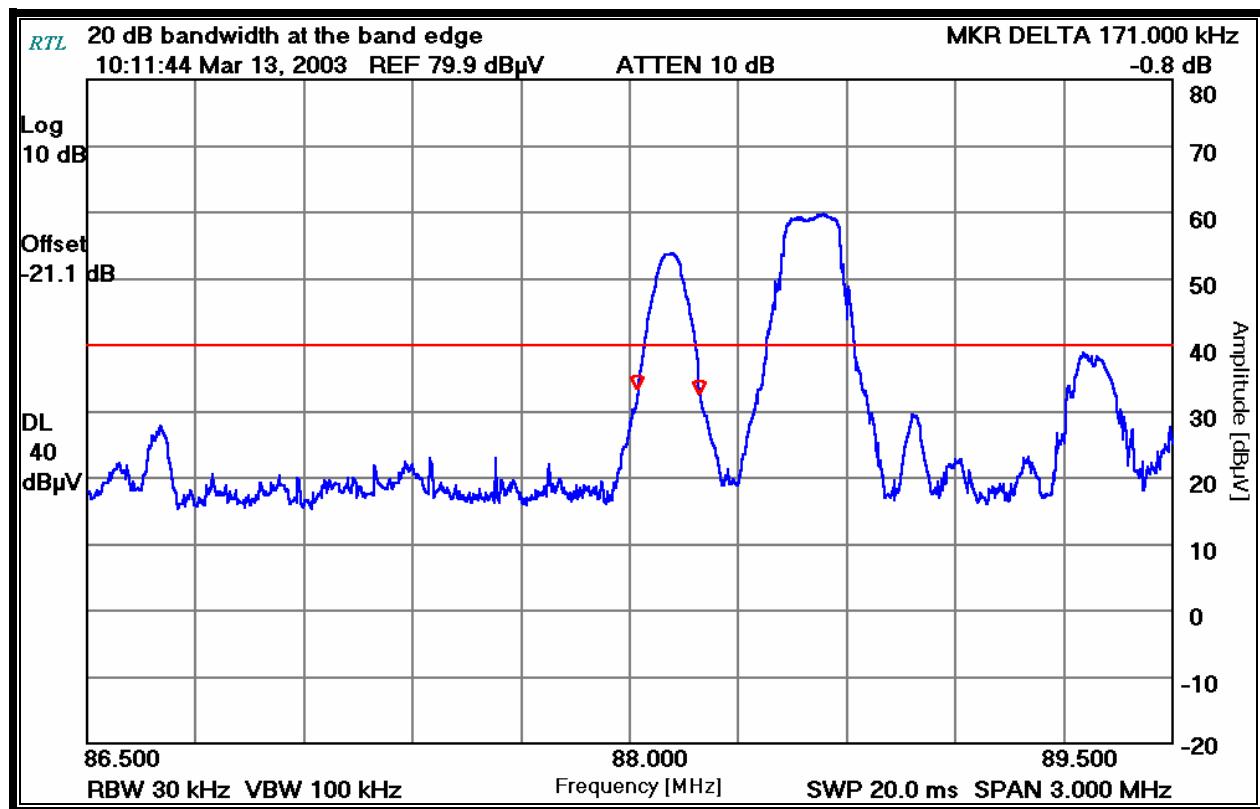
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#### 7.4 MODULATED BANDWIDTH PLOTS

Channel Number: 1  
Frequency: 88.1 MHz  
Resolution Bandwidth: 30 kHz  
Video Bandwidth: 100 kHz  
Sweep Time: 20.0 ms

PLOT 7-1: MODULATED BANDWIDTH CHANNEL 1



#### TEST PERSONNEL:

Daniel W. Baltzell  
Test Engineer

Signature

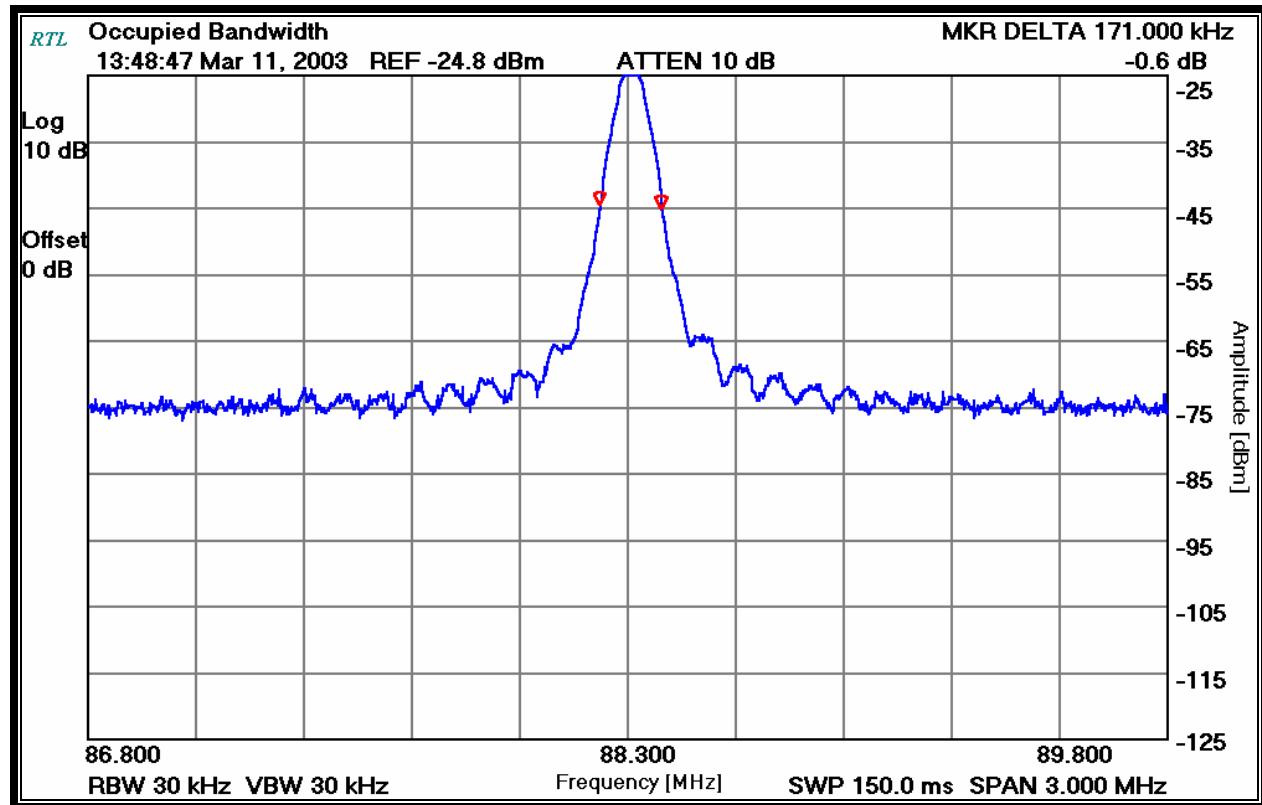
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**Channel Number:** 2  
**Frequency:** 88.3 MHz  
**Resolution Bandwidth:** 30 kHz  
**Video Bandwidth:** 30 kHz  
**Sweep Time:** 150.0 ms

PLOT 7-2: MODULATED BANDWIDTH CHANNEL 2



TEST PERSONNEL:

Daniel W. Baltzell  
Test Engineer

Signature

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## 8 CONCLUSION

The data in this measurement report shows that the Telean Technology Ltd., Model: FM-10 Tx, FCC ID: MQ5FM-10-TX, complies with all the requirements of Parts 2 and 15.239 of the FCC Rules.