TEST REPORT

Prepared for: **Miltel Communications Ltd.**

Test of: **TxRxD_433_L1 Transceiver**

FCC ID: **MLLSPEEDTRD433L1**

To comply with :**FCC 1998 subpart 15C - Intentional Radiators**

Test Facilities:	Hermon Laboratories Israel	
Tested by:	David Heller – TetraWave Michael Feldman - Hermon Laboratories	
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1. General Information

1.1 Company information

Company Name:	**Miltel Communication System Ltd.**
Address:	**P.O.Box 138 , Moshav Zafria , ISRAEL**
Contact Name:	**Yarum Locker, General Manager**

1.2 Location of Tests

All the measurements in this report were performed with the calibrated test equipment and at certified test facilities of:

Hermon Laboratories Ltd.
Rakevet Ind. Zone, P. O. Box 23
Binyamina 30550, ISRAEL
Phone: +972 6 6288001
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2. Equipment Under Test (E.U.T.)

Brand Name	**Miltel Speed**
Model	**SPEED TxRx_433_L1**
Unique Type Identification	**Transceiver**
Serial Number	**99-00163**
Country of Manufacture	**ISRAEL**
FCC ID Identifier	**MLLSPEEDTRD433L1**
Date of tests	**15 July 99**

Description of E.U.T.

The EUT is a DC operated Transceiver connected to a Concentrator or a Repeater. The EUT includes 2 coaxial cables and 2 dipole antennas and was so tested. When deployed as a minimum with a Transmitter and a Concentrator forms a system. For more details see the Block Diagram attached to form 731.

Modifications to E.U.T.

None

Additional Information

Power Supply Requirement: External – 12 V. DC

Operating Environment: Residential

Weight: 420gr

Dimension: 16 x 12 x 7.5 cm.

Interface: Shielded 5-wire cable.

Support Equipment

None

3. Operation of E.U.T.

Environmental Test Conditions

The E.U.T. was tested at 28^0C and 58% Humidity.

E.U.T. Operating Modes

The EUT has two modes:

1. Transmit
2. Receive

Although the Transmit mode is by far the worst condition for radiated the Receive mode was also tested for verification as per 15.101(b).

E.U.T. Configuration and Peripherals

Two Dipole Antennas were connected to the Transceiver with 3 meters RG213 coaxial cables. The EUT was connected to a Concentrator (support equipment) that controlled the operating modes. In Transmit mode test, the software on the Concentrator forced the EUT to transmit consecutive messages in order to measure the emissions with the automatic EMC receiver (spectrum analyzer).

Support Equipment

Description	Concentrator, (Class B Digital Device)
Brand Name	Miltel Communications Ltd.
Model Name	CML110-1
Serial Number	99-10012
Cable Length and Type	3 meter, 5-wire, shielded
Connected to Port	J1 on PCB

4. Test Specifications

Reference	FCC part 15.231(e) and all the other relevant parts of subpart 15C (e.g. 15.205, 15.209) in Transmit mode. FCC part 15.209,109 in Receive mode and all the other relevant parts of part 15.
Title	CFR (47 part 15) Radio Frequency Devices
Comments	A description of the test facility (Hermon Laboratories) is on file at the FCC as required by Section 2.948
Purpose of Test	Determine E.U.T. compliance with the specifications for the purpose of certification.

5. Methods and Procedures

The Method of measurements used for the measurements are detailed in ANSI C63.4 (1992),

Title: "*American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the range of 9KHz to 40GHz*". Other Relevant ANSI standards as delineated in the above document's chapter 2: References

6. Deviations from Specifications

None

7. Test Results Summary

Measurement	Range of Measurements	Specifications	Comply (Yes / No)
Radiated Emissions Fundamental	433.92MHz	15.231(e)	**Yes**
Radiated Emissions Spurious (Transmit and Receive)	30MHz to 4.5GHz	15.231(e),15.205, 15.209, 15.109	**Yes**
Bandwidth (Fundamental)	433.92MHz	15.231(c)	**Yes**
Transmit Duration and Duty Cycle	433.92MHz	15.231(e)	**Yes**

8. Measurement Uncertainty

HERMON LABORATORIES

Date: July, 1999

3.2.1 Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Conducted emissions with LISN	9 kHz to 30 MHz: ± 2.1 dB
Radiated emissions in the open field test site at 10 m measuring distance	Biconilog antenna: ±3.2 dB Log periodic antenna: ±3 dB Biconical antenna: ±4 dB
Radiated emissions in the anechoic chamber at 3 m measuring distance	Biconilog antenna: ±3.2 dB
ESD uncertainty	EUT without cables ± 13.4% EUT with cables + 22%, -20%
Radiated immunity	10 kHz to 250 MHz: +11% 250 MHz to 1 GHz: +21% required applied field strength 3.33 V/m (10 kHz to 250 MHz) and 3.63 V/m (250 MHz to 1 GHz) instead of 3 V/m required applied field strength 11.1 V/m (10 kHz to 250 MHz) and 12.1 V/m (250 MHz to 1 GHz) instead of 10 V/m
Conducted RF immunity	± 2 dB
EFT	± 6%
Spikes	± 10%

9. Measurement Methods and Test Results

9.1 Radiated Emission Measurement Results

Measurement Method

The tests were performed in Hermon Labs large (9m X 6.5m X 5.5m) full Anechoic Chamber with conductive floor (see attached drawing). The EUT was placed on a wooden turntable with the Dipole antennas and the coaxial cables. The Concentrator, which controlled the EUT via the 5-wire shielded cable, was also placed on the turntable. The Concentrator operated during all the tests. The Hydraulic antenna tower was moved such that the receive antenna was 3 meters from the EUT. The frequency range from 30MHz to 4.5GHz was investigated using an automatic HP8546A EMI receiver 9KHz –6.5GHz and HP85460A RF filter section.

The receive antenna height was changed from 1to 4 meters, polarization was changed from Vertical to Horizontal and the turntable was rotated 360^0.

The following table lists frequencies at which emissions were measured using an average detector (as per 2.231(b)(2)).

Limits

Limit for fundamental was used as per 15.231(e): 4400μμV/m or 72.8dB μV/m. Limits for spurious emissions were used as per 15.209 for restricted bands. For the other bands, 15.231(e) or 15.209 which ever is higher as per 15.231(b)(3).

In the transmit mode, the EUT was operating in the test mode, generating consecutive messages such that the average detector measured the peak power.

Note: Because the Transmission duration is more than 0.1Sec no averaging factor was used (as per 15.35). Signals, which are 20db below the limit, are not tabulated.

Transmit

Signal	**Frequency** (MHz)	**Measured max.** Ave. Amp (dBμμV/m)	**Limit** (dB μV/m)	**Margin** (dB)	**Comply**
1	433.92 (Fundamental)	65.16	72.8	**4.6**	**Yes**
2	1301	47.79	52.8	**5**	**Yes**
3	2169.626	40.45	52.8	**12.4**	**Yes**

Receive Mode

The limits of 15.209 are used. Quasi Peak detector is used.

Signal	Frequency (MHz)	Measured max. Q_Peak Amp (dBμμV/m)	Limit (dB μV/m)	Margin (dB)	Comply
1	33.795	27.21	40	**12.8**	**Yes**
2	131.039	38.52	43.5	**5**	**Yes**
3	138.154	35.20	43.5	**8.3**	**Yes**
4	183.465	36.35	43.5	**7.2**	**Yes**
5	340.718	37.71	46	**8.3**	**Yes**

Bandwidth Measurement Results

Measurements Method

The Spectrum analyzer Resolution bandwidth was set to 10KHz (as per ANSI C63.4-1992 13.1.7.) (See attached drawing). Video BW=10KHz. The scan with was adjusted to clearly display the fundamental spectrum. A peak detector was used. and the BW was measured at 20db points.

Limits

As per 15.231(b): 0.25% from 433.92MHz. Measured at 20dBc from the modulated carrier.

Signal	Frequency (MHz)	Measured Bandwidth (KHz)	Limit (KHz)	Margin (KHz)	Complaiment
1	433.92 (Fundamental)	38.5	1085	1046	**Yes**

Transmission Duration and Duration between Transmissions Results

Measurements Method

The spectrum analyzer was set to Zero Span and was centered around the Fundamental frequency. Resolution Bandwidth was set to 120KHz. (See attached drawing). The EUT mode was changed through the Concentrator to the normal mode and the Concentrator initiated a single transmission. Miltel certifies that by design and by tests, the duration between transmissions is greater than 30Sec under any operating condition.

Limits

As per 15.231(e) the maximum duration is 1sec. Duration between transmissions is more than 10Sec or 30 times the duration of the Transmission which ever is larger.

Signal	**Frequency** (MHz)	**Measured Time** (Sec)	**Limit** (Sec)	**Margin** (Sec)	**Compliant**
1	433.92 (Fundamental)	Duration: 0.76	1	0.24	**Yes**
1	433.92 (Fundamental)	Duration Between Transmissions: > 30Sec (declared value)	22.8	>7.2	**Yes**