

TEST REPORT

Prepared for: **Mitel Communications Ltd.**

FCC ID: **MLLSPEEDTx433L1**

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

Test Facilities:	Hermon Laboratories Israel	
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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

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2. Equipment Under Test (E.U.T.)

Brand Name	Miltel Speed
Model	SPEED Tx_433_L1
Unique Type Identification	Transmitter
Serial Number	99-10003
Country of Manufacture	ISRAEL
FCC ID Identifier	MLLSPEEDTx433L1
Date of tests	15 July 99

Description of E.U.T.

The E.U.T. is a battery operated low-power Transmitter connected to meters (e.g. water). The device senses meter pulses and accumulates this data for transmission at a pre-defined time. When deployed, the Transmitter sends data directly to a Concentrator or via a Transceiver. For more details see the Block Diagram attached to form 731.

Modifications to E.U.T.

None

Additional Information

Power Supply Requirement:	Internal Battery
Operating Environment:	Residential
Weight:	200gr
Dimension:	11x6x3
Interface:	Meters cables - twisted pair with a magnetic switch Integral Antenna

Support Equipment

None

3. Operation of E.U.T.

Environmental Test Conditions

The E.U.T. was tested at 28⁰C and 58% Humidity. A new battery was installed in the unit at the beginning of the tests (as per 15.31(e)).

E.U.T. Operating Modes

The E.U.T. has two modes:

1. Transmit
2. Standby between Transmissions.

Although the Transmit mode is by far the worst condition for radiated emissions the Standby mode was also tested.

E.U.T. Configuration and Peripherals

Meter cables with magnetic switches were connected as this represents the worst case EMC conditions. The E.U.T. was initialized when the Test Port was short (see description) to allow the transmission of consecutive messages in order to measure the emissions with an automatic EMC receiver (spectrum analyzer).

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 in standby mode
Title	CFR (47 part 15) Radio Frequency Devices: Intentional Radiators
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 Standby)	30MHz to 4.5GHz	15.231(e),15.205, 15.209	Yes
Bandwidth (Fundamental)	433.92MHz	15.231(c)	Yes
Transmit Duration and Duration between Transmissions	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 $\pm 13.4\%$ 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	$\pm 6\%$
Spikes	$\pm 10\%$

9. Measurement Methods and Test Results

9.1 Radiated Emission Measurement Results

Measurement Method

The tests were performed in Hermon Labs large full Anechoic Chamber (9m X 6.5m X 5.5m) with conductive floor (see drawing). The E.U.T. was placed on a wooden turntable. 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 1 to 4meters, polarization was changed from Vertical to Horizontal and the turntable was rotated 360°. 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): 4400µV/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). The E.U.T. was operating in the test mode, generating consecutive messages such that the average detector measured the peak power for the fundamental and harmonics.

Note: Because the Transmission duration is more than 0.1Sec no averaging factor was used (as per 15.35).

Signal	Frequency (MHz)	Measured max. Avg. Amp (dB µV/m)	Limit (dB µV/m)	Margin (dB)	Comply
1	433.92 (Fundamental)	68.19	72.8	4.6	Yes
2	393.24	28.46	52.8	24.3	Yes
3	867.84	43.42	52.8	9.4	Yes

9.2 Bandwidth Measurement Results

Measurements Method

The Spectrum analyzer Resolution bandwidth was set to 10KHz (as per ANSI C63.4-1992 13.1.7.) (see figure9.2). Video BW=10KHz. The scan width 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% of 433.92MHz. Measured at 20dBc from the modulated carrier.

Signal	Frequency (MHz)	Measured Bandwidth (KHz)	Limit (KHz)	Margin (KHz)	Comply
1	433.92 (Fundamental)	32.5	1085	1053	Yes

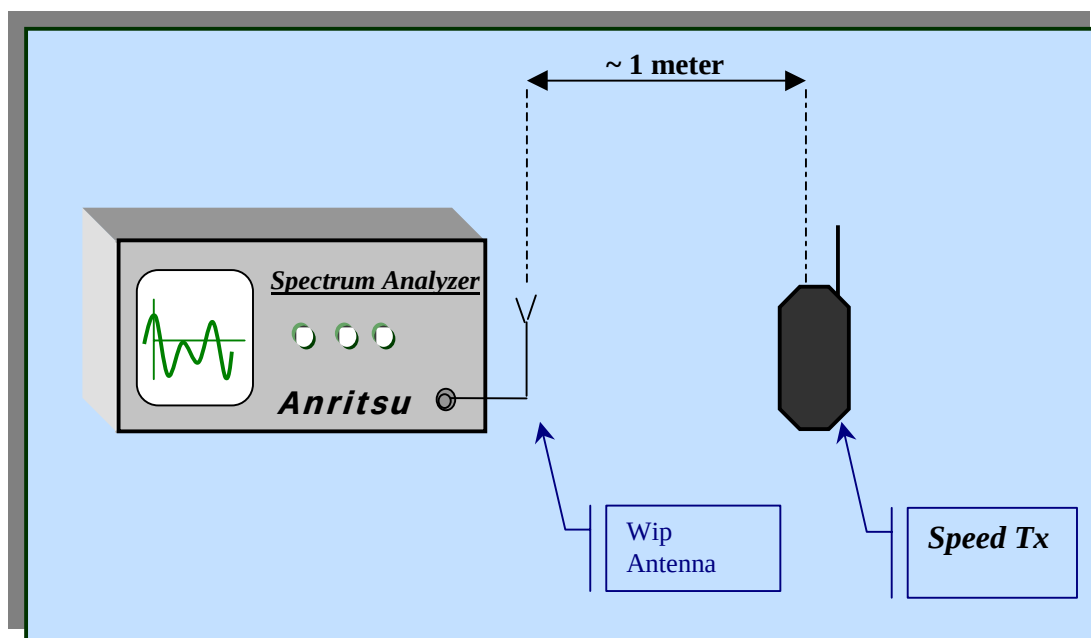


Figure 1 - Test Configuration for Bandwidth Measurement

Note: E.U.T. antenna is integral, thus B.W. measurement was done through the air.

9.3 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 figure 9.2 above). The E.U.T. was initiated in the normal mode and a transmission was initiated by manually releasing the tampering switch. The spectrum was also monitored for 5 minutes to verify that no additional transmissions occurred..

Limits

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

Signal	Frequency (MHz)	Measured Time (Sec)	Limit (Sec)	Margin (Sec)	Comply
1	433.92 (Fundamental)	Duration: 0.76	1	0.24	Yes
1	433.92 (Fundamental)	Duration Between Transmissions: > 5minutes	22.8	>4.5min.	Yes

Appendix 1 - List of Test Equipment

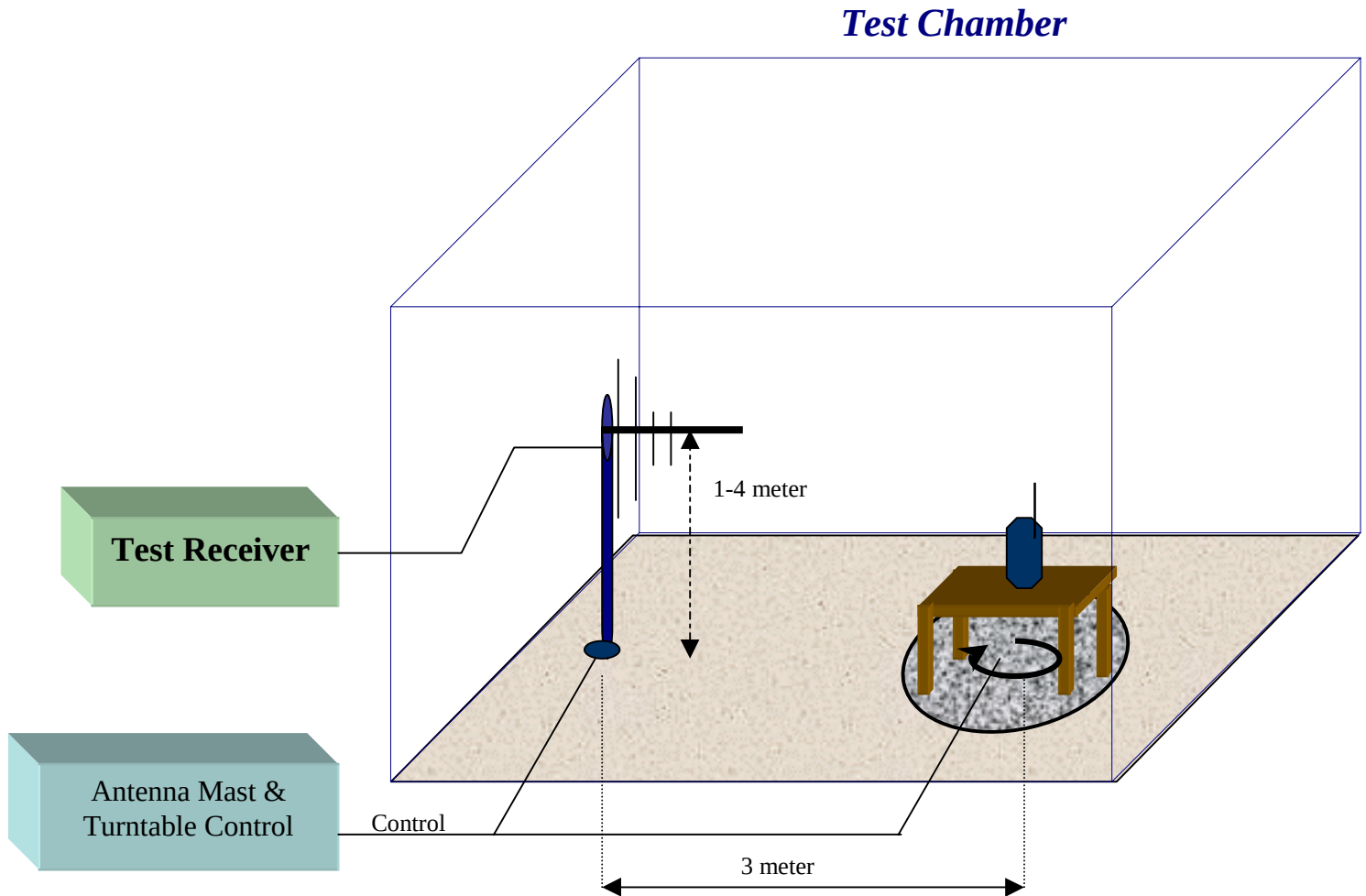
Equipment	Manufacturer	Model
EMC Receiver	HP	HP8546A+HP85460A
Controller	ANR	L2-SR3000
Biconilog Antenna	EMMCO	3141
Ridged Horn Antenna 1-18GHz	Electro-Metrics	RGA50/60
Spectrum Analyzer	Anritsu	MS2601A

Equipment Calibration

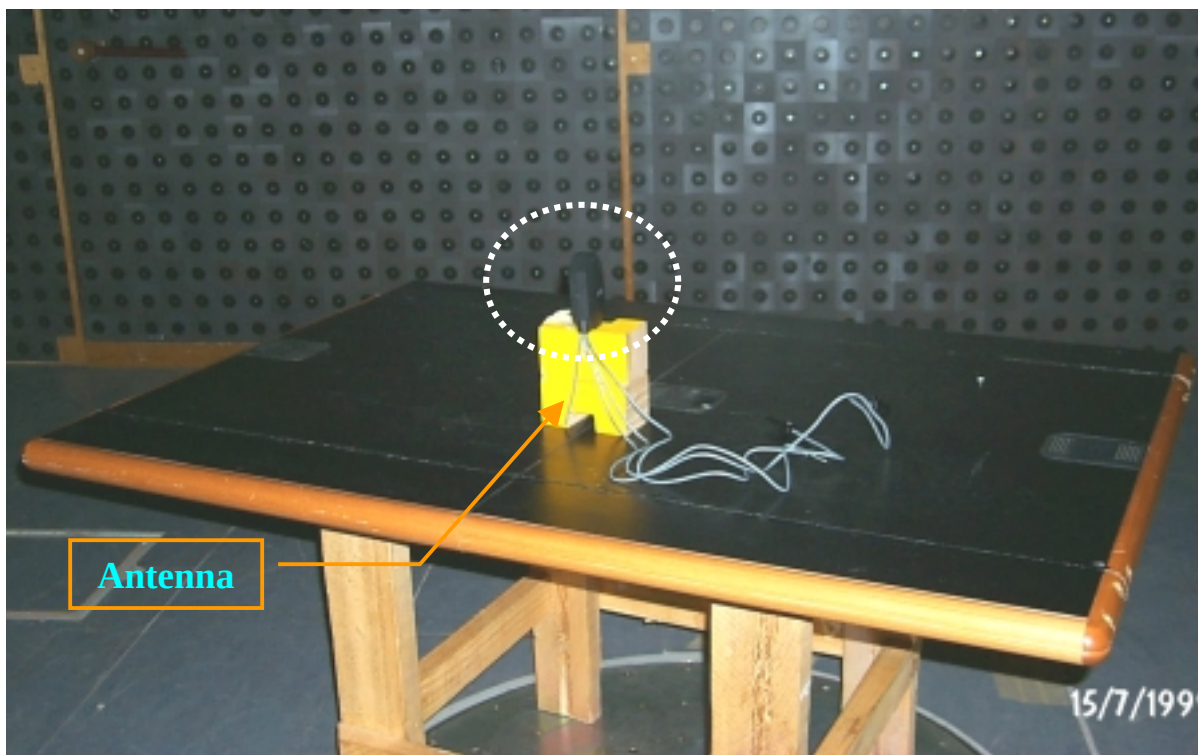
All the above Hermon Lab's test equipment including additional accessories (Cables, Attenuators and Adapters) has been calibrated according to its recommended procedure and is within the manufacturer's published limit of errors. The Laboratory standards are calibrated by a third party (Traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements.

Appendix 2 - Test set-up Drawings and Pictures

The following diagram depicts the test configuration for radiated emission measurement and bandwidth testing.



Test chamber is constructed of ferrite loaded anechoic chamber (except for conductive ground). E.U.T. is mounted on a 80 cm. turntable.



Transmitter Close-Up

Full set of test setup photos in separate file (file name – *Test_Setup_Photos*)

Appendix 3. Graphical Test Results

Radiated Emissions

19:59:13 JUL 15, 1999 FCC 15.231(e) D=3m
MILTEL EUT-TxYY-433-L1 Pr.13525

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 1.0000 GHz
32.63 dB μ V/m

MEASURE
AT MKR

ADD TO
LIST

CLEAR
WRITE A

MAX
HOLD A

VIEW A

BLANK A

Trace
A B C

More
1 of 3

LOG REF 75.0 dB μ V/m

10
dB/
#ATN
0 dB

VA SB
SC FC
ACORR

START 30.0 MHz
RL #1F BW 120 kHz

AVG BW 300 kHz

STOP 1.0000 GHz
SWP 909 msec

19:47:30 JUL 15, 1999 FCC 15.231(e) D=3m
MILTEL EUT-TxYY-433-L1 Pr.13525

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.070 GHz
37.70 dB μ V/m

MEASURE
AT MKR

ADD TO
LIST

CLEAR
WRITE A

MAX
HOLD A

VIEW A

BLANK A

Trace
A B C

More
1 of 3

LOG REF 60.0 dB μ V/m

10
dB/
#ATN
0 dB

VA SB
SC FC
ACORR

START 1.000 GHz
RL #1F BW 1.0 MHz

AVG BW 300 kHz

STOP 4.500 GHz
SWP 70.0 msec

PREAMP ON

20:31:37 JUL 15 1999 FCC p.15.231 Stand-by mode
 MJTEL EUT-TYY-433-L1 Pr.13525

ACTV DET: PEAK
 MEAS DET: PEAK QP AVG
 MKR 516.8 MHz
 29.41 dB μ V/m

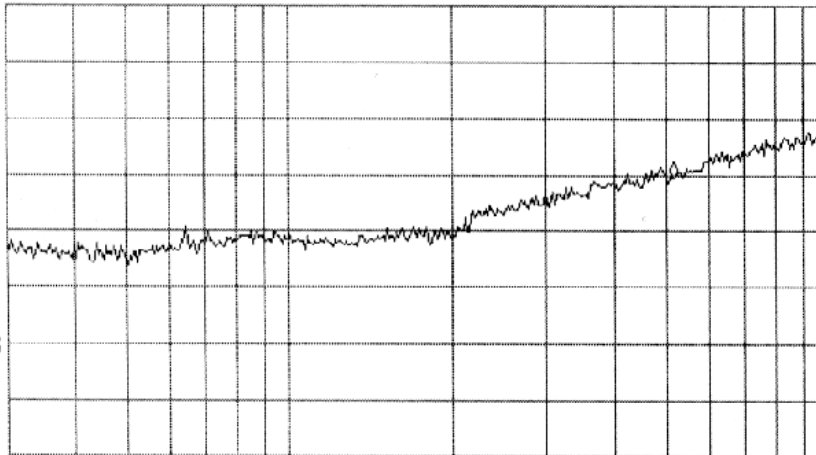
MEASURE
 AT MKR

ADD TO
 LIST

LOG REF 60.0 dB μ V/m

PREAMP ON

10
 dB/
 ATN
 10 dB



VA SB
 SC FC
 ACORR

CLEAR
 WRITE A

MAX
 HOLD A

VIEW A

BLANK A

Trace
 A B C

START 30.0 MHz

STOP 1.0000 GHz

RL #1F BW 120 kHz

AVG BW 300 kHz

SWP 909 msec

More
 1 of 3

Signal	Freq (MHz)	Avg Amp (dB μ V/m)	Avg - Lim1 (dB)	Corrections (dB)
1	433.919482	68.19	22.19	19.00
2	393.241197	28.46	-17.54	18.51
3	867.842344	43.42	-2.58	26.75

20:21:55 JUL 15, 1999 FCC p.15.231(e) D=3m
 MILTEL EUT-TXYY-433-L1 Pr.13525

MARKER Δ
 32.5 kHz
 .76 dB

ACTV DET: PEAK
 MEAS DET: PEAK QP AVG
 MKR Δ 32.5 kHz
 .76 dB

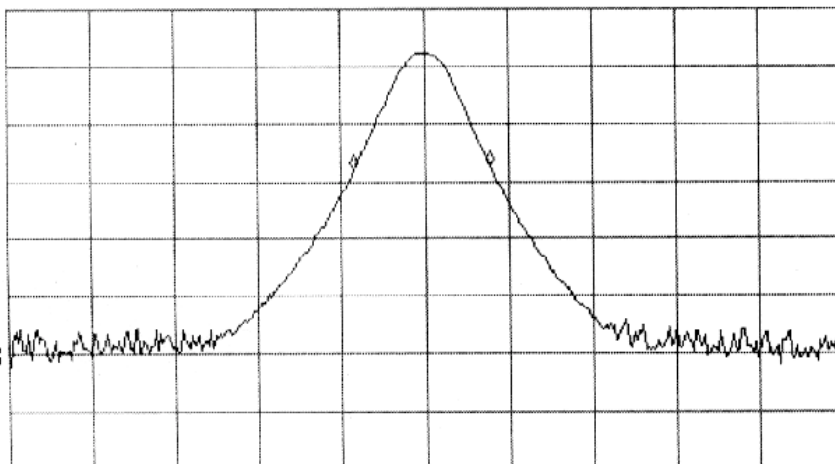
MEASURE
 AT MKR
 ADD TO
 LIST

LOG REF 75.0 dB μ V/m

PREAMP ON

10
 dB/
 ATN
 10 dB

VA SB
 SC FC
 ACORR



CENTER 433.9199 MHz
 RL #1F BW 10 kHz

AVG BW 10 kHz

SPAN 200.0 kHz
 SWP 30.0 msec

MARKER
 NORMAL

MARKER
 Δ

MARKER
 AMPTD

SELECT
 1 2 3 4

MARKER 1
 ON OFF

More
 1 of 2

Appendix 4. Photographs of E.U.T.

Full set of E.U.T. photos is in attached files: External View – *External_Photos Tx*

Internal Photos - *Internal_Photos Tx*