



ISRAEL TESTING LABORATORIES
Global Certifications You Can Trust



DATE: 09 February 2015

I.T.L. (PRODUCT TESTING) LTD.

FCC Radio Test Report

for

Micronet Ltd.

Equipment under test:

Mobile Data Terminal (MDT)

M317

2.4 GHz Bluetooth

Approved by: _____

M. Zohar

Approved by: _____

D. Shidlowsky

This report must not be reproduced, except in full, without the written permission of I.T.L. (Product Testing) Ltd.

This report relates only to items tested.



ISRAEL TESTING LABORATORIES
Global Certifications You Can Trust



Measurement/Technical Report for Micronet Ltd.

Mobile Data Terminal (MDT)

M317

FCC ID: U8ONB860

This report concerns:

Original Grant:

Class I Change:

Class II Change: X

Equipment type:

Spread Spectrum Transmitter

Limits used:

47 CFR15 Section 15.247

Measurement procedure used is Public Notice: DA 00-705 Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems and ANSI C63.4-2003.

Application for Certification
prepared by:

R. Pinchuck
ITL (Product Testing) Ltd.
1 Bat Sheva St.
Lod 7116002
Israel
e-mail rpinchuck@itl.co.il

Applicant for this device:

(different from "prepared by")

Erez Cohen-Zedek
Micronet Ltd.
P.O.B. 11524, 27 Hametsuda St.
Azor 5800171
Israel
Tel: +972-3-558-4884
Fax: +972-3-558-4885
e-mail: erez.cohen-zedek@micronet-inc.com

TABLE OF CONTENTS

1.	GENERAL INFORMATION -----	4
1.1	Administrative Information	4
1.2	List of Accreditations	5
1.3	Product Description	6
1.4	Test Methodology	6
1.5	Test Facility	6
1.6	Measurement Uncertainty	6
2.	SYSTEM TEST CONFIGURATION -----	7
2.1	Justification	7
2.2	EUT Exercise Software	7
2.3	Special Accessories	7
2.4	Equipment Modifications	7
2.5	Configuration of Tested System	8
3.	RADIATED MEASUREMENT TEST SET-UP PHOTOS -----	9
4.	RADIATED POWER OUTPUT -----	11
4.1	Test Specification	11
4.2	Test procedure	11
4.3	Results Calculation	14
4.4	Test Equipment Used, Radiated Maximum Power Output	15
6.	BAND EDGE -----	16
6.1	Test procedure	16
6.2	Results Table	19
6.3	Test Equipment Used, Band Edge Spectrum	20
7.	RADIATED EMISSION, 9 KHZ – 30 MHZ -----	21
7.1	Test Specification	21
7.2	Test Procedure	21
7.3	Measured Data	21
7.4	Test Instrumentation Used, Radiated Measurements	22
7.5	Field Strength Calculation	23
8.	SPURIOUS RADIATED EMISSION 30 – 25000 MHZ -----	24
8.1	Test Specification	24
8.2	Test Procedure	24
8.3	Test Data	25
8.4	Test Instrumentation Used, Radiated Measurements	30
8.4	Field Strength Calculation 30 – 25000 MHz	31
9.	ANTENNA GAIN/INFORMATION -----	32
10.	R.F EXPOSURE/SAFETY -----	33
11.	. APPENDIX B - CORRECTION FACTORS -----	34
11.1	Correction factors for CABLE	34
11.2	Correction factors for CABLE	35
11.3	Correction factors for CABLE	36
11.4	Correction factors for Bilog ANTENNA	37
11.5	Correction factors for Double-Ridged Waveguide Horn	38
11.7	Correction factors for ACTIVE LOOP ANTENNA	39

1. General Information

1.1 Administrative Information

Manufacturer:	Micronet Ltd.
Manufacturer's Address:	P.O.B. 11524, 27 Hametsuda St., Azor, 58001 Israel Tel : +972-3-558 4884 Fax: +972-3-558 4885
Manufacturer's Representative:	Erez Cohen-Zedek
Equipment Under Test (E.U.T):	Mobile Data Terminal (MDT)
Equipment Model No.:	M317
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	27.11.2014
Start of Test:	27.11.2014
End of Test:	09.12.2014
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Sub-Part C



1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation Number US1004.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025A-1.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

The M-317 provides Original Equipment Manufacturers (OEMs) and Telematics Service Providers (TSP's) with a rugged and versatile vehicle-centric mobile-computing platform for a variety of Mobile Resource Management (MRM) applications. The E.U.T. includes new BT\WiFi 3G - approved transmitters.

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in Public Notice: DA 00705 Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems and ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

Both conducted and radiated emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is US1004.

1.6 Measurement Uncertainty

Radiated Emission

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.98 dB

Note: See ITL Procedure No. PM 198.

2. System Test Configuration

2.1 **Justification**

The product was originally authorized for FCC certification under FCC ID: U8ONB860.

The device contains both a 2402.0-2480.0 MHz Bluetooth radio and a WiFi radio.

No changes have been made to either radio.

The Class II Permissive changes to the original product are as follows:

1. The two separate radio boards were merged into one board.
2. DVI connector was added for camera option.

For Wifi/BT evaluation, 11Mbps was chosen as representative data rate.

RF output and spurious emissions were retested.

2.2 **EUT Exercise Software**

No special exercise software was used.

2.3 **Special Accessories**

No special accessories were needed to achieve compliance.

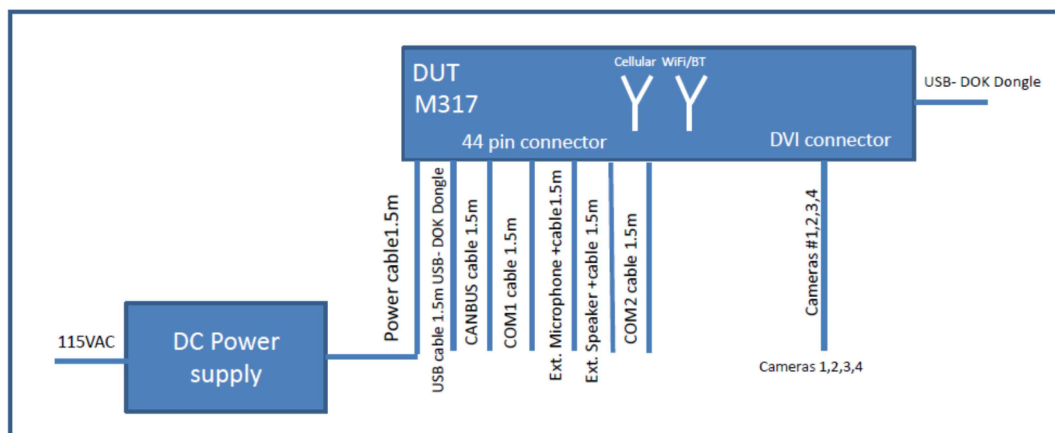
2.4 **Equipment Modifications**

No modifications were needed to achieve compliance.

2.5 Configuration of Tested System

The EUT was transmitting BT/WiFi modulation with SW application (MTS_WiLink6&7).

The SW application forces the module to transmit in each frequency/data rate/modulation.



- USB are loaded with DOK dongle
- Serial ports (COM1, COM2) - Tx shorted to Rx (through parallel resistor) with data loop-back.
- Can Bus with resistor shorted between the two signals.
- The all cameras were connected to the cables.
- DUT= Device Under Test.
- DOK= Disk On Key.
- The all cables are shielded.

Figure 1. Configuration of Tested System

3. Radiated Measurement Test Set-up Photos



Figure 2. Radiated Emission Test

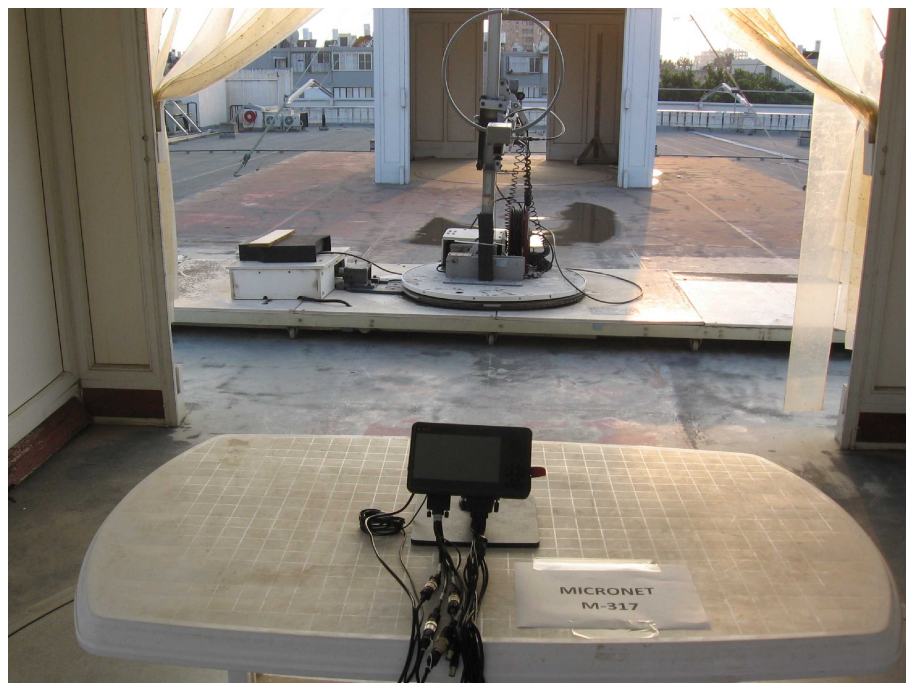


Figure 3. Radiated Emission Test

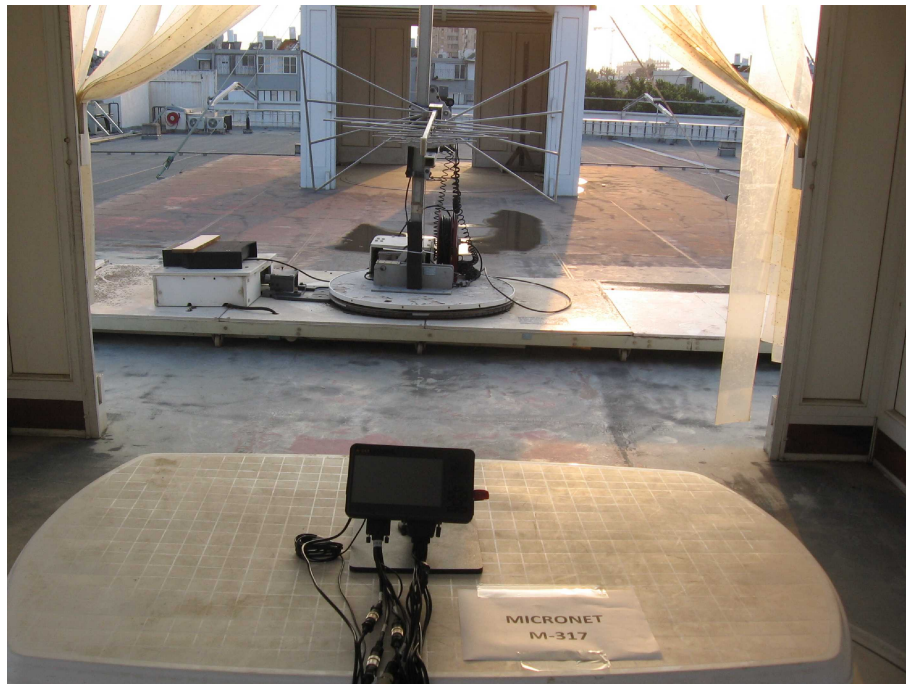


Figure 4. Radiated Emission Test

4. Radiated Power Output

4.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(b)

4.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

The worst results was detected in horizontal polarization ant

The E.U.T. was tested in three operating channels and frequencies
2.402 GHz, 2.440 GHz, 2.480 GHz.

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} [W]$$

E- Field Strength (v/m)

d- Distance from transmitter (m)

G- Antenna gain

P- Peak power (W)

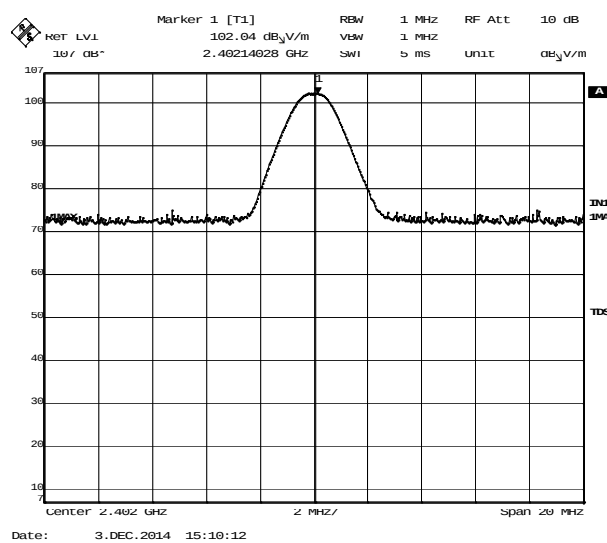


Figure 5 2402.00 MHz – Horizontal, Standard Modulation

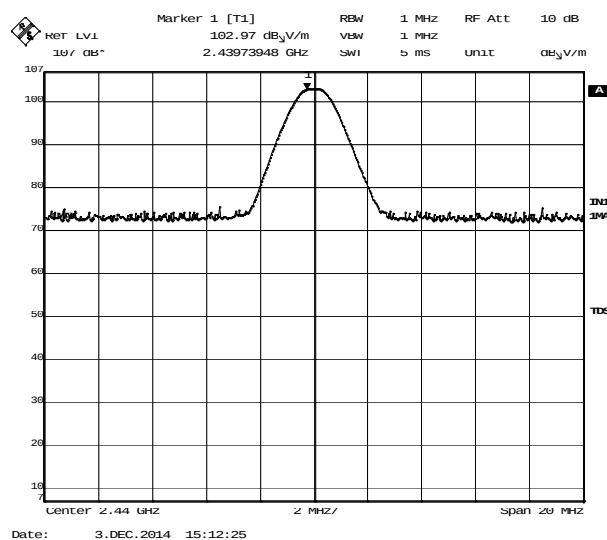


Figure 6 2440.00 MHz – Horizontal, Standard Modulation

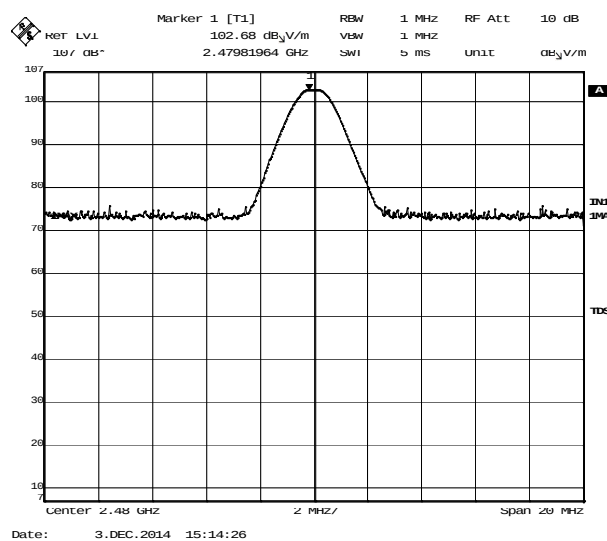


Figure 7 2480.00 MHz – Horizontal, Standard Modulation

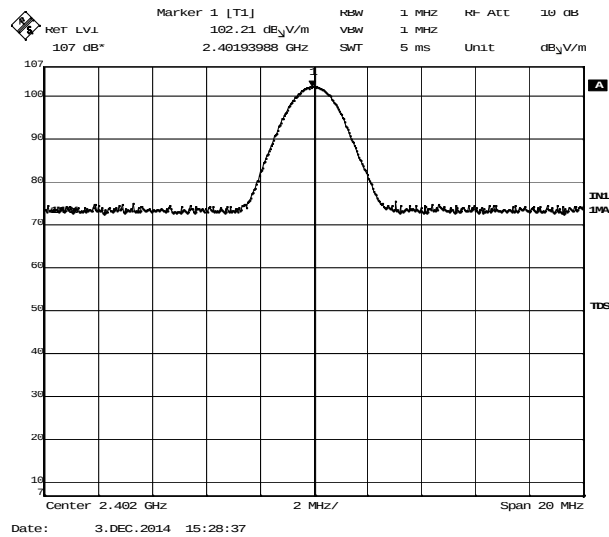


Figure 8 2402.00 MHz – Horizontal, EDR Modulation

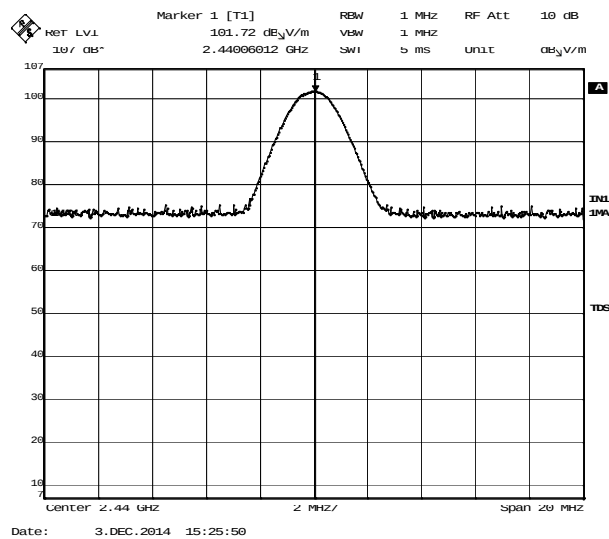


Figure 9 2440.00 MHz – Horizontal, EDR Modulation

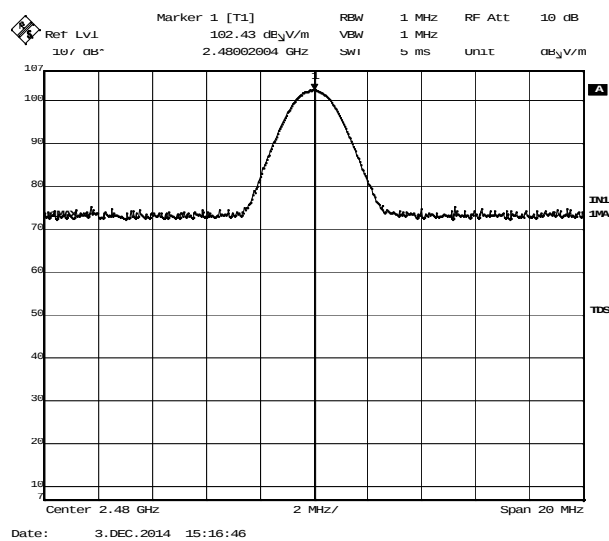


Figure 10 2480.00 MHz – Horizontal, EDR Modulation

4.3 Results Calculation

E.U.T. Description: Mobile Data Terminal (MDT)

Model No.: M317

Serial Number: Not Designated

Specification: F.C.C. Part 15, Subpart C

The following calculations were used to determine maximum radiated power output.

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} [\text{W}]$$

Operation Frequency (MHz)	Modulation	Polarization	Field Level (dBuV/m)	Power (dBm)	Power (mW)	Specification (mW)	Margin (mW)
Low	Standard	H	102.0	6.8	4.9	1000	-995.1
Mid	Standard	H	103.0	7.8	6.3	1000	-993.7
High	Standard	H	102.7	7.5	5.5	1000	-994.5
Low	EDR	H	102.2	7.0	5.0	1000	-995.0
Mid	EDR	H	101.7	6.5	4.5	1000	-995.5
High	EDR	H	102.4	7.2	5.4	1000	-994.6

Figure 11 Radiated Power Output

JUDGEMENT: Passed by 993.7 mW

TEST PERSONNEL:

Tester Signature: 

Date: 15.12.14

Typed/Printed Name: M. Zohar

4.4 Test Equipment Used, Radiated Maximum Power Output

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	December 19, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2014	1 year
Biconolog Antenna	EMCO	3142B	1250	May 22, 2014	2 years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 years
Horn Antenna	ETS	3115	29845	March 14, 2012	3 years
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Spectrum Analyzer	HP	8564E	3442A00275	March 2, 2014	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 12 Test Equipment Used

6. Band Edge

[In Accordance with section 15.247(d)]

6.1 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 100 KHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The EMI receiver was adjusted to the transmission channel at the maximum radiated level. The display line was set to 20 dBc and the EMI receiver was set to the band edge frequencies.

Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at the Low and the High channels correspondingly.

The E.U.T was evaluated in the horizontal polarization for the worst case.

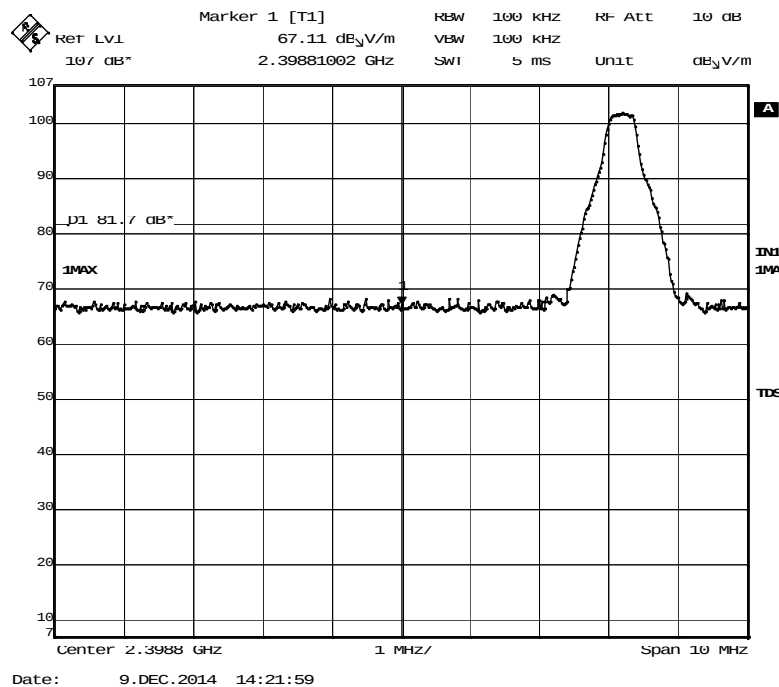


Figure 13 — Lower Band Edge, Standard Modulation

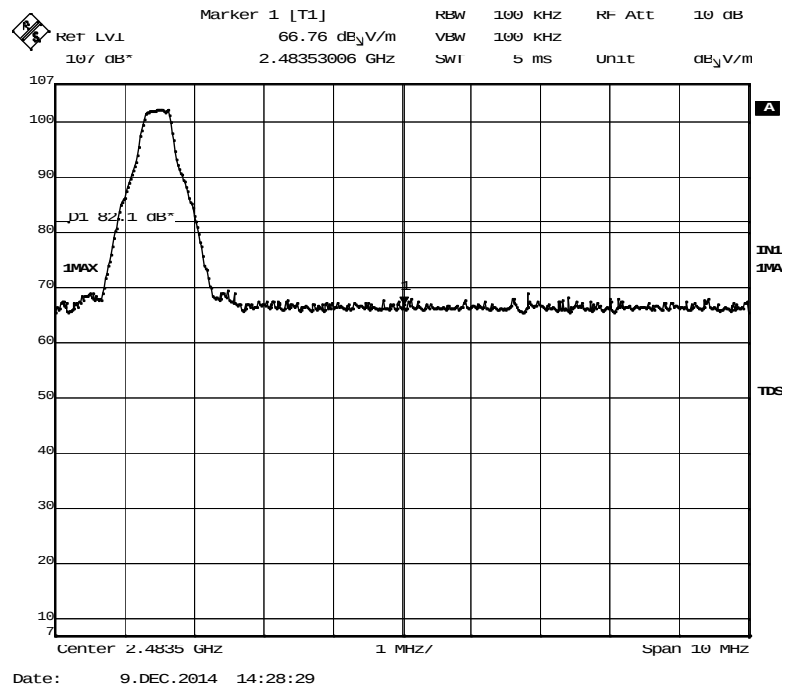


Figure 14 — Upper Band Edge, Standard Modulation

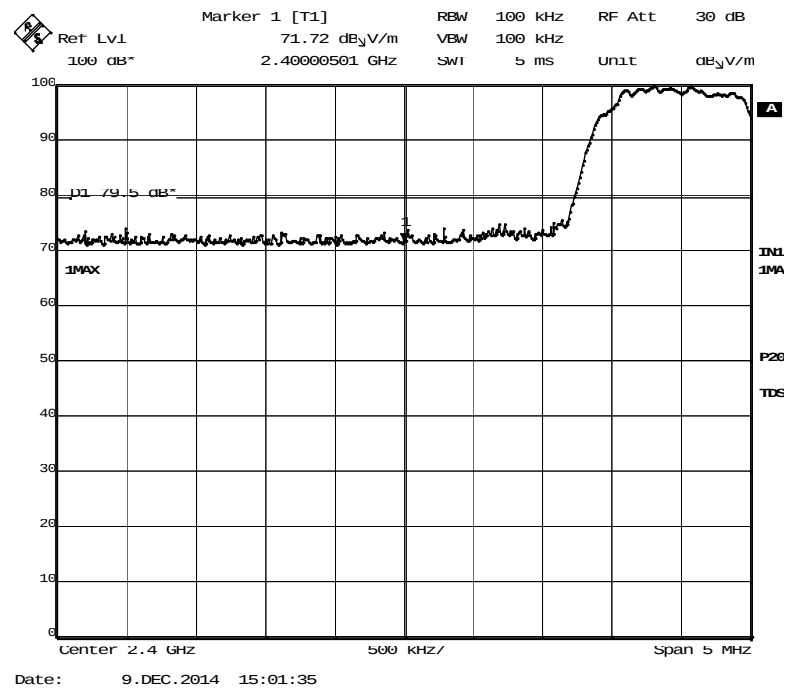


Figure 15 — Lower Band Edge, EDR Modulation

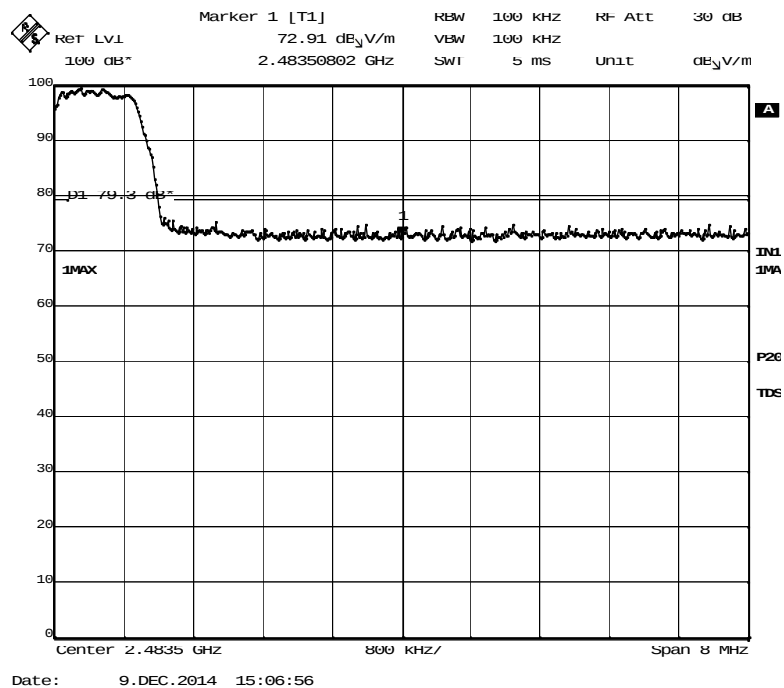


Figure 16 — Upper Band Edge, EDR Modulation

6.2 Results Table

E.U.T. Description: Mobile Data Terminal (MDT)

Model No.: M317

Serial Number: Not Designated

Specification: F.C.C. Part 15, Subpart C (15.247 (d))

Operation Frequency (MHz)	Modulation	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBuV/m)	Margin (dB)
2402	Standard	2400.0	67.1	81.7	-14.6
2480	Standard	2483.5	66.8	82.1	-15.3
2402	EDR	2400.0	71.7	79.5	-7.8
2480	EDR	2483.5	72.9	79.3	-6.4

Figure 17 Band Edge

JUDGEMENT: Passed by 6.4 dB

TEST PERSONNEL:

Tester Signature: 

Date: 15.12.14

Typed/Printed Name: M. Zohar

6.3 Test Equipment Used, Band Edge Spectrum

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	December 19, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2014	1 year
Biconolog Antenna	EMCO	3142B	1250	May 22, 2014	2 years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 years
Horn Antenna	ETS	3115	29845	March 14, 2012	3 years
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Spectrum Analyzer	HP	8564E	3442A00275	March 2, 2014	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 18 Test Equipment Used

7. Radiated Emission, 9 kHz – 30 MHz

7.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

7.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 3 meters.

7.3 Measured Data

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

The results for all three channels were the same.

No signals were detected in the frequency range of 9 kHz – 30 MHz.

TEST PERSONNEL:

Tester Signature: 

Date: 15.12.14

Typed/Printed Name: M. Zohar

7.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	December 19, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2014	1 year
Biconolog Antenna	EMCO	3142B	1250	May 22, 2014	2 years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 years
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Spectrum Analyzer	HP	8564E	3442A00275	March 2, 2014	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 19 Test Equipment Used

7.5 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

FS:	Field Strength [dB μ V/m]
RA:	Receiver Amplitude [dB μ V]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

Example: $FS = 30.7 \text{ dB}\mu\text{V (RA)} + 14.0 \text{ dB (AF)} + 0.9 \text{ dB (CF)} = 45.6 \text{ dB}\mu\text{V}$

No external pre-amplifiers are used.

8. Spurious Radiated Emission 30 – 25000 MHz

8.1 Test Specification

30 MHz- 25000 MHz, F.C.C., Part 15, Subpart C

8.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground.

The frequency range 30 MHz-25000 MHz was scanned and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 30-25000 MHz, the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

In the frequency range 1.0-6.0 GHz, a computerized EMI receiver complying with CISPR 16 requirements was used.

In the frequency 6.0-25.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

The test distance was 3 meters.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)



8.3 **Test Data**

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C specification.

TEST PERSONNEL:

Tester Signature:  _____

Date: 15.12.14

Typed/Printed Name: M. Zohar

Radiated Emission

E.U.T Description Mobile Data Terminal (MDT)
Type M317
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters Detector: Peak

Operation Frequency (MHz)	Modulation	Freq. (MHz)	Polarity (H/V)	Peak Reading (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
2402.0	Standard	2390.0	H	54.2	74.0	-19.8
2402.0	Standard	2390.0	V	55.2	74.0	-18.8
2402.0	Standard	4804.0	H	56.3	74.0	-17.7
2402.0	Standard	4804.0	V	56.1	74.0	-17.9
2440.0	Standard	4880.0	H	54.3	74.0	-19.7
2440.0	Standard	4880.0	V	51.0	74.0	-23.0
2480.0	Standard	4960.0	H	52.0	74.0	-22.0
2480.0	Standard	4960.0	V	50.0	74.0	-24.0
2480.0	Standard	2483.5	H	51.1	74.0	-22.9
2480.0	Standard	2483.5	V	50.0	74.0	-24.0

**Figure 20. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission

E.U.T Description Mobile Data Terminal (MDT)
Type M317
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Test Distance: 3 meters

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Operation Frequency (MHz)	Modulation	Freq. (MHz)	Polarity (H/V)	Average Reading (dBμ V/m)	Average Specification (dB μ V/m)	Average Margin (dB)
2402.0	Standard	2390.0	H	51.4	54.0	-2.6
2402.0	Standard	2390.0	V	51.5	54.0	-2.5
2402.0	Standard	4804.0	H	50.0	54.0	-4.0
2402.0	Standard	4804.0	V	49.0	54.0	-5.0
2440.0	Standard	4880.0	H	46.5	54.0	-7.5
2440.0	Standard	4880.0	V	47.7	54.0	-6.3
2480.0	Standard	4960.0	H	47.0	54.0	-7.0
2480.0	Standard	4960.0	V	46.5	54.0	-7.5
2480.0	Standard	2483.5	H	42.1	54.0	-11.9
2480.0	Standard	2483.5	V	42.3	54.0	-11.7

**Figure 21. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Average**

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission

E.U.T Description Mobile Data Terminal (MDT)
Type M317
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters Detector: Peak

Operation Frequency (MHz)	Modulation	Freq. (MHz)	Polarity (H/V)	Peak Reading (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
2402.0	EDR	2390.0	H	60.9	74.0	-13.1
2402.0	EDR	2390.0	V	52.1	74.0	-21.9
2402.0	EDR	4804.0	H	55.3	74.0	-18.7
2402.0	EDR	4804.0	V	53.1	74.0	-20.9
2440.0	EDR	4880.0	H	52.0	74.0	-22.0
2440.0	EDR	4880.0	V	50.0	74.0	-24.0
2480.0	EDR	4960.0	H	51.1	74.0	-22.9
2480.0	EDR	4960.0	V	50.0	74.0	-24.0
2480.0	EDR	2483.5	H	53.1	74.0	-20.9
2480.0	EDR	2483.5	V	49.0	74.0	-25.0

**Figure 22. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission

E.U.T Description Mobile Data Terminal (MDT)
Type M317
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Test Distance: 3 meters

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Operation Frequency (MHz)	Modulation	Freq. (MHz)	Polarity (H/V)	Average Reading (dB μ V/m)	Average Specification (dB μ V/m)	Average Margin (dB)
2402.0	EDR	2390.0	H	50.7	54.0	-3.3
2402.0	EDR	2390.0	V	47.1	54.0	-6.9
2402.0	EDR	4804.0	H	49.7	54.0	-4.3
2402.0	EDR	4804.0	V	48.7	54.0	-5.3
2440.0	EDR	4880.0	H	45.1	54.0	-8.9
2440.0	EDR	4880.0	V	46.4	54.0	-7.6
2480.0	EDR	4960.0	H	44.1	54.0	-9.9
2480.0	EDR	4960.0	V	45.9	54.0	-8.1
2480.0	EDR	2483.5	H	44.0	54.0	-10.0
2480.0	EDR	2483.5	V	42.3	54.0	-11.7

**Figure 23. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Average**

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

13.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	December 19, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2014	1 year
Biconolog Antenna	EMCO	3142B	1250	May 22, 2014	2 years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 years
Horn Antenna	ETS	3115	29845	March 14, 2012	3 years
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Spectrum Analyzer	HP	8564E	3442A00275	March 2, 2014	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 24 Test Equipment Used

8.4 **Field Strength Calculation 30 – 25000 MHz**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[\text{dB}\mu\text{V/m}] \text{ FS} = \text{RA} + \text{AF} + \text{CF}$$

FS: Field Strength [dB μ V/m]
RA: Receiver Amplitude [dB μ V]
AF: Receiving Antenna Correction Factor [dB/m]
CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dB μ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB μ V

No external pre-amplifiers are used.



9. Antenna Gain/Information

The antenna gain is 3.4 dBi, integral.

10. R.F Exposure/Safety

Typical use of the E.U.T. is as a versatile vehicle-centric mobile –computing platform. The typical placement of the E.U.T. is on a vehicle dashboard or cabin. The distance between the E.U.T. and the user in the worst case application, is 20 cm.

Calculation of Maximum Permissible Exposure (MPE)
Based on Section 1.1310 Requirements

(a) FCC limits at 2480 MHz is: $1 \frac{mW}{cm^2}$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

$$S = \frac{P_t G_t}{4\pi R^2}$$

P_t- Transmitted Power 103.00 dBuV/m = 6.025 mW *

*Note- Since testing was radiated transmitted power includes antenna gain.

G_T- Antenna Gain, 3.4 dBi = 2.2 numeric

R- Distance from Transmitter using 20 cm worst case

(c) The peak power density is :

$$S = \frac{6.025}{4\pi (20)^2} = 0.0012 \frac{mW}{cm^2}$$

(d) This is below the FCC limit.

11. . APPENDIX B - CORRECTION FACTORS

11.1 Correction factors for CABLE

from EMI receiver
to test antenna
at 3 meter range.

Frequency (MHz)	Cable Loss (dB)	Frequency (MHz)	Cable Loss (dB)
0.010	0.4	50.00	1.2
0.015	0.2	100.00	0.7
0.020	0.2	150.00	20.1
0.030	0.3	200.00	2.3
0.050	0.3	300.00	2.9
0.075	0.3	500.00	3.8
0.100	0.2	750.00	4.8
0.150	0.2	1000.00	5.4
0.200	0.3	1500.00	6.7
0.500	0.4	2000.00	9.0
1.00	0.4	2500.00	9.4
1.50	0.5	3000.00	9.9
2.00	0.5	3500.00	10.2
5.00	0.6	4000.00	11.2
10.00	0.8	4500.00	12.1
15.00	0.9	5000.00	13.1
20.00	0.8	5500.00	13.5
		6000.00	14.5

NOTES:

1. The cable type is SPUMA400 RF-11N(X2) and 39m long
2. The cable is manufactured by Huber + Suhner

11.2 Correction factors for CABLE

from EMI receiver
to test antenna
at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.
2. The overall length of the cable is 10 meters.

11.3 Correction factors for CABLE

from spectrum analyzer
to test antenna above 2.9 GHz

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.
2. The cable is used for measurements above 2.9 GHz.
3. The overall length of the cable is 10 meters.

11.4 Correction factors for Bilog ANTENNA

Model: 3142

Antenna serial number: 1250

3 meter range

FREQUENCY	AFE	FREQUENCY	AFE
(MHz)	(dB/m)	(MHz)	(dB/m)
30	18.4	1100	25
40	13.7	1200	24.9
50	9.9	1300	26
60	8.1	1400	26.1
70	7.4	1500	27.1
80	7.2	1600	27.2
90	7.5	1700	28.3
100	8.5	1800	28.1
120	7.8	1900	28.5
140	8.5	2000	28.9
160	10.8		
180	10.4		
200	10.5		
250	12.7		
300	14.3		
400	17		
500	18.6		
600	19.6		
700	21.1		
800	21.4		
900	23.5		
1000	24.3		



11.5 Correction factors for Double-Ridged Waveguide Horn

Model: 3115, S/N 29845
at 3 meter range.

FREQUENCY	ANTENNA	ANTENNA	FREQUENCY	ANTENNA	ANTENNA
(GHz)	FACTOR	Gain	(GHz)	FACTOR	Gain
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			

11.7 Correction factors for ACTIVE LOOP ANTENNA

Model 6502

S/N 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2