

DATE: 04 August 2009

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

FCC Radio Test Report

for

Fourier Systems Ltd.

Equipment under test:

MINI DataNet Repeater

DNR800

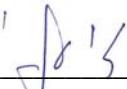
Written by:


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Approved by:


A. Sharabi, Test Engineer

Approved by:


I. Raz, EMC Laboratory Manager

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This report relates only to items tested.

Measurement/Technical Report for for Fourier Systems Ltd.

Equipment under test: MINI DataNet Repeater

DNR800

FCC ID: XGO-DNR800

This report concerns: Original Grant: X

Class I Change:

Class II Change:

Equipment type: Digital Transmission System

Limits used:

47CFR15 Section 15.247

Measurement procedure used is ANSI C63.4-2003.

Application for Certification
prepared by:

Ishaishou Raz

ITL (Product Testing) Ltd.

Kfar Bin Nun

D.N. Shimshon 99780

Israel

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Applicant for this device:
(different from "prepared by")

Haim Bila

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1. General Information

1.1 Administrative Information

Manufacturer: Fourier Systems Ltd.

Manufacturer's Address: 9611 West 165th St., Suite 11b
Orland Park
IL 60467
USA
Tel: +708-364-9500
Fax: +708-364-9555

Manufacturer's Representative: Haim Bila

Equipment Under Test (E.U.T): MINI DataNet Repeater

Equipment Model No.: DNR800

Equipment Serial No.: Not designated

Date of Receipt of E.U.T: 19.05.09

Start of Test: 19.05.09

End of Test: 03.06.09

Test Laboratory Location: I.T.L (Product Testing) Ltd.
Kfar Bin Nun,
ISRAEL 99780

Test Specifications: See Section 2

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.), Registration No. 90715.
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), File No. IC 4025.
6. TUV Product Services, England, ASLLAS No. 97201.
7. Nemko (Norway), Authorization No. ELA 207.

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 DNR800 Repeater is externally powered but also includes a rechargeable battery for back up (in case the external power fails). These units are considered the backbone of the network, as they enhance the network range by receiving and transmitting the data from Repeater to Repeater until the data reaches the designated end unit or the PC.

1.4 *Test Methodology*

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 *Test Facility*

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing August 22, 2006).

I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 *Measurement Uncertainty*

Radiated Emission

The Open Site complies with the ± 4 dB Normalized Site Attenuation requirements of ANSI C63.4-2003. In accordance with Paragraph 5.4.6.1 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

2. System Test Configuration

2.1 ***Justification***

For the purposes of the system test the DataNet system was configured in a typical manner, as a customer normally would use it.

The E.U.T. is a wall mounted device.

2.2 ***EUT Exercise Software***

The DataNet hardware was run via the DataNet PC Software.

The software was configured to run the E.U.T. with the following parameters:

Output Power: -17 dBm

Internal Booster: ON

Amplifier: ON

Frequency range: 2410-2475 MHz

Continuous transmission at 2410, 2440 and 2475 MHz at ZigBee modulation and data rate,

2.3 ***Special Accessories***

No special accessories were needed to achieve compliance.

2.4 ***Equipment Modifications***

No modifications were necessary in order to achieve compliance.

2.5 ***Configuration of Tested System***

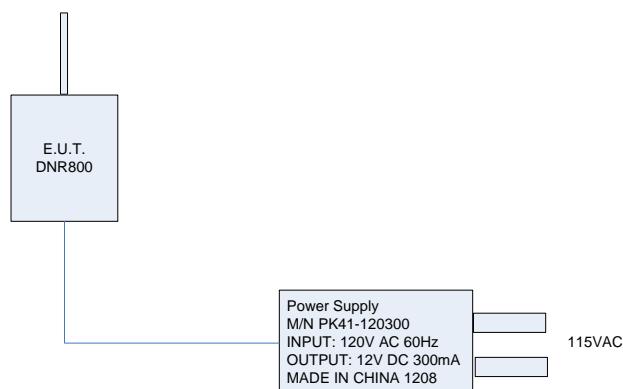


Figure 1. Configuration of Tested System

3. Test Set-up Photos



Figure 2. Conducted Emission Test



Figure 3. Radiated Emission Test



Figure 4. Conducted Emission From Antenna Port Tests

4. Conducted Emission Data

4.1 Test Specification

F.C.C., Part 15, Subpart C

4.2 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 3.1. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T placed on an 0.8 meter high wooden table, 0.4 meter from the room's vertical wall.

The E.U.T was powered from 115 V AC / 60 Hz via a 50 Ohm / 50 μ Hn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, and using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

4.3 Measured Data

JUDGEMENT: Passed by 28.8 dB

The margin between the emission levels and the specification limit is, in the worst case, 30.0 dB for the phase line at 0.54 MHz and 28.8 dB at 0.33 MHz for the neutral line.

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

The details of the highest emissions are given in *Figure 5* to *Figure 8*.

TEST PERSONNEL:

Tester Signature:  Date: 20.08.09

Typed/Printed Name: A. Sharabi

Conducted Emission

E.U.T Description MINI DataNet Repeater
 Type DNR800
 Serial Number: Not designated

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

Lead: Phase

Detectors: Peak, Quasi-peak, Average

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.171961	39.5	31.9	-33.0	-2.3	-57.2	0.0
2	0.246095	34.9	28.9	-33.1	-5.5	-57.4	0.0
3	0.540039	33.1	26.0	-30.0	-6.8	-52.8	0.0
4	0.954547	23.0	16.9	-39.1	-9.0	-55.0	0.0
5	1.338736	18.0	11.4	-44.6	-11.0	-57.0	0.0
6	3.999827	11.3	8.6	-47.4	6.5	-39.5	0.0

Figure 5. Detectors: Peak, Quasi-peak, AVERAGE .

Note: QP Delta/Av Delta refer 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.

Conducted Emission

E.U.T Description MINI DataNet Repeater
 Type DNR800
 Serial Number: Not designated

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

Lead: Phase

Detectors: Peak, Quasi-peak, Average



ACTV DET: PEAK
 MEAS DET: PEAK QP AVG
 MKR 170 kHz
 39.22 dB μ V

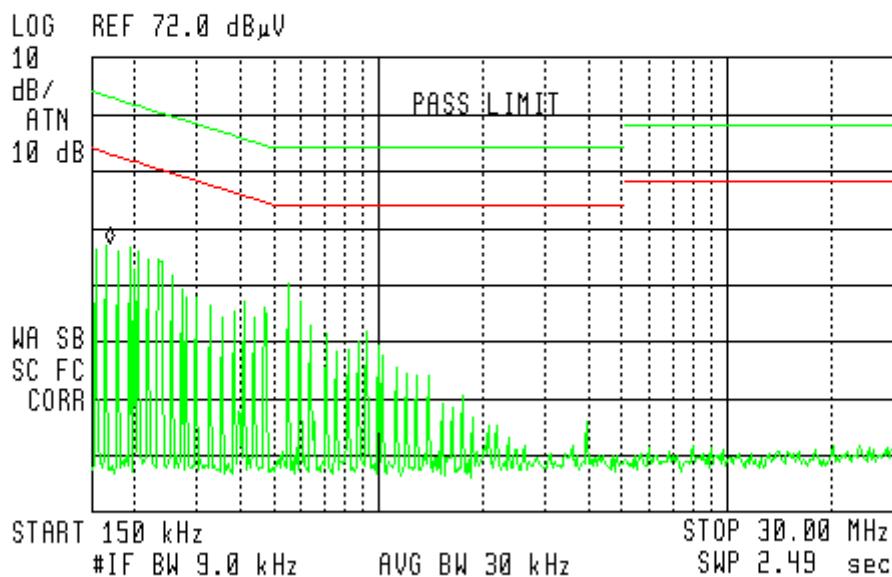


Figure 6. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description: MINI DataNet Repeater
 Type: DNR800
 Serial Number: Not designated

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

Lead: Neutral

Detectors: Peak, Quasi-peak, Average

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.179337	40.7	33.2	-31.4	-1.5	-56.1	0.0
2	0.330922	36.7	30.7	-28.8	-3.8	-53.3	0.0
3	0.362682	36.6	29.5	-29.2	-4.9	-53.7	0.0
4	0.526841	31.3	25.5	-30.5	-8.1	-54.1	0.0
5	0.683502	28.5	21.5	-34.5	-9.9	-55.9	0.0
6	4.001836	11.1	8.3	-47.7	6.2	-39.8	0.0

Figure 7. Detectors: Peak, Quasi-peak, AVERAGE

Note: QP Delta/Avg Delta refer 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.

Conducted Emission

E.U.T Description: MINI DataNet Repeater
 Type: DNR800
 Serial Number: Not designated

Specification: F.C.C., Part 15, Subpart C
 Lead: Neutral
 Detectors: Peak, Quasi-peak, Average



ACTV DET: PEAK
 MEAS DET: PEAK QP AVG
 MKR 170 kHz
 40.68 dB μ V

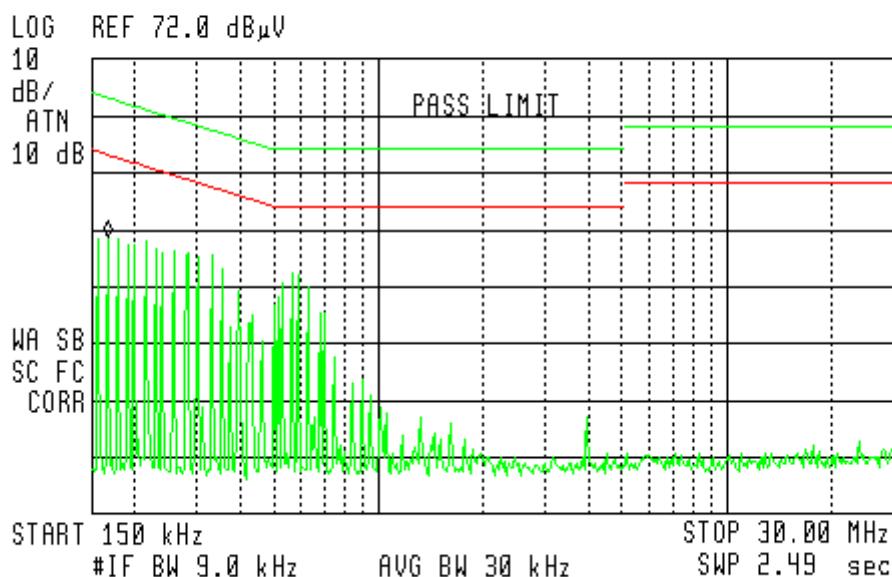


Figure 8 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average

4.4 **Test Instrumentation Used, Conducted Measurement**

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
LISN	Fischer	FCC-LISN-2A	127	March 3, 2009	1 Year
LISN	Fischer	FCC-LISN-2A	128	March 3, 2009	1 Year
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1 Year
RF Filter Section	HP	85420E	3705A00248	November 16, 2008	1 Year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

5. 6 dB Minimum Bandwidth

5.1 *Test procedure*

The E.U.T. was set to the applicable test frequency. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (10 dB) and an appropriate coaxial cable (cable loss = 1.7 dB). The spectrum analyzer was set to 100 kHz resolution BW. The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded.

The E.U.T. was tested at 2410, 2440, and 2475MHz

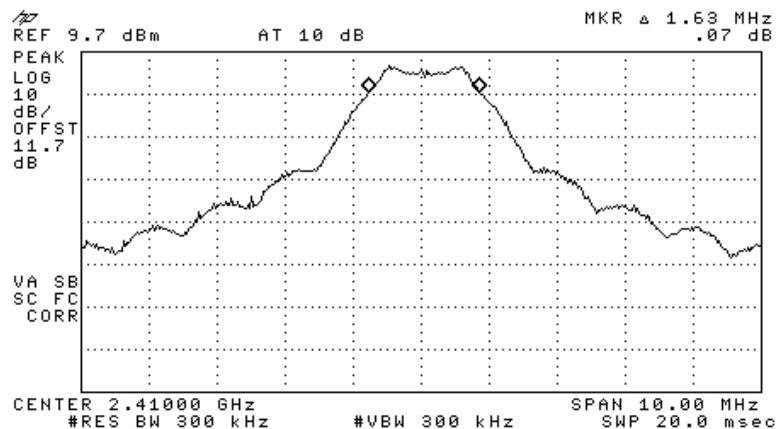


Figure 9 —2410 MHz

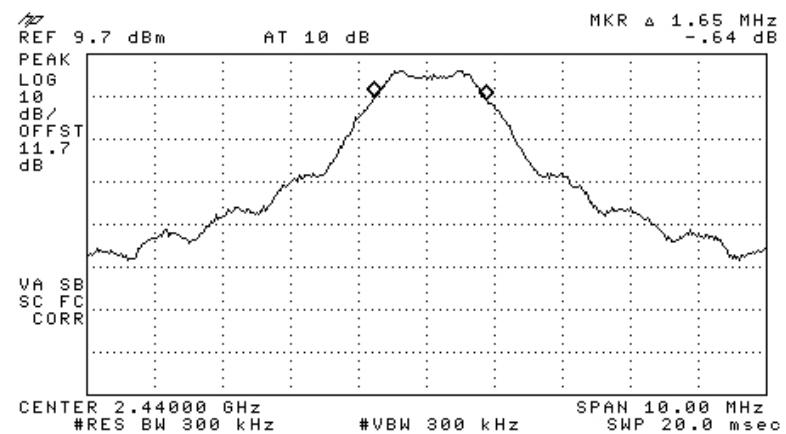


Figure 10 —2440MHz

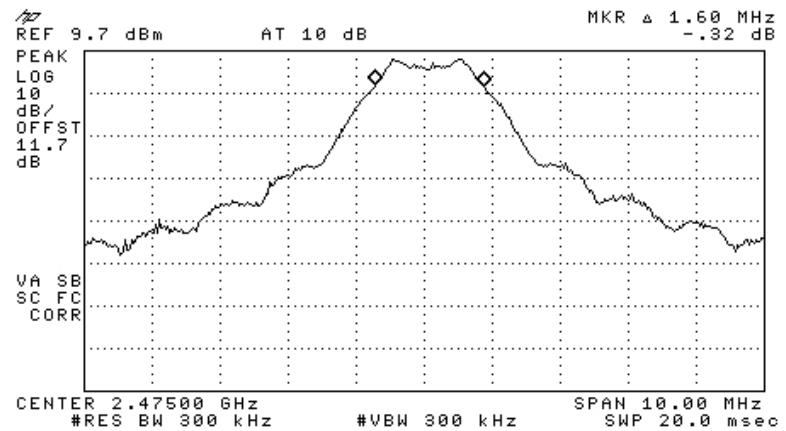


Figure 11 —2475 MHz

5.2 Results table

E.U.T Description: MINI DataNet Repeater
 Model No.: DNR800
 Serial Number: Not designated
 Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)
2410	1.63	0.5
2440	1.65	0.5
2475	1.60	0.5

Figure 12 6 dB Minimum Bandwidth

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature:  Date: 20.08.09

Typed/Printed Name: A. Sharabi

5.3 **Test Equipment Used.**

6 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 19, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 19, 2009	1 year

Figure 13 Test Equipment Used

6. Maximum Transmitted Peak Power Output

6.1 Test procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (10dB) and an appropriate coaxial cable (cable loss = 1.7 dB). The Spectrum Analyzer was set to 1.0 MHz resolution BW. Peak power level was measured at selected operation frequencies.

The E.U.T. was tested at 2410, 2440, and 2475 MHz

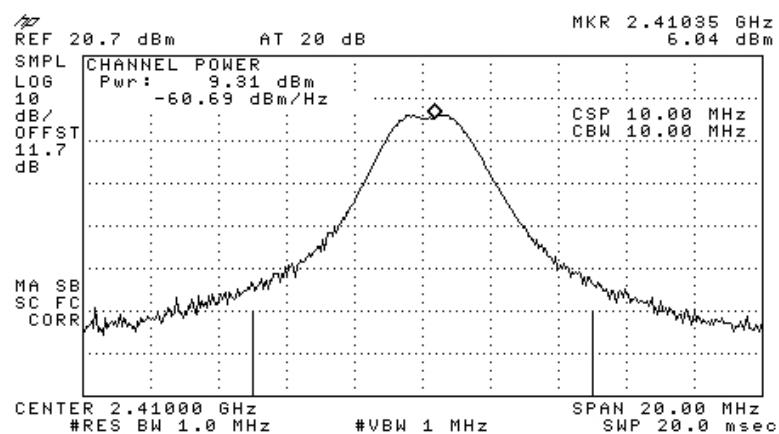


Figure 14 2410

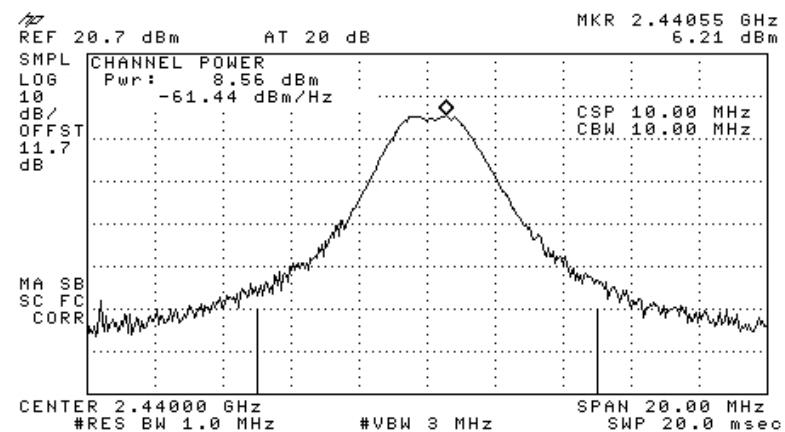


Figure 15 2440 MHz

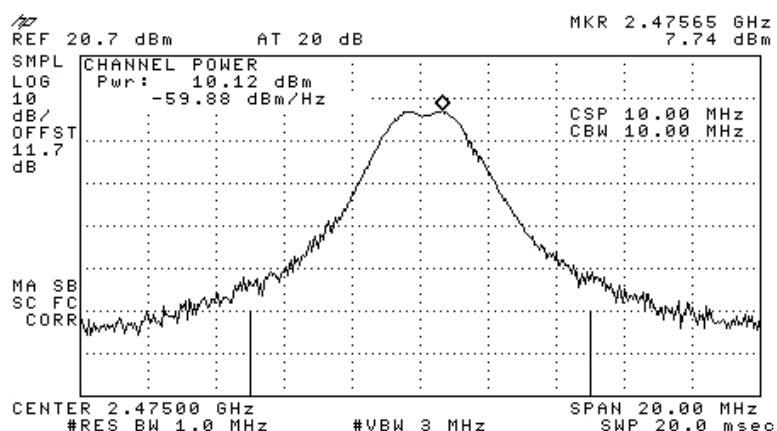


Figure 16 2475 MHz

6.2 Results table

E.U.T. Description:

Model No.:

Serial Number: 1. 860M:

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

Freq.	Power (dBm)	Specification (dBm)	Margin (dB)
2410	9.31	30.0	-20.7
2440	8.56	30.0	-21.4
2475	10.12	30.0	-19.9

Figure 17 Maximum Transmitted Peak Power Output

JUDGEMENT: Passed by 19.9 dB

TEST PERSONNEL:

Tester Signature:  Date: 20.08.09

Typed/Printed Name: A. Sharabi

6.3 Test Equipment Used.

Maximum Transmitted Peak Power Output

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 19, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 19, 2009	1 year

Figure 18 Test Equipment Used

7. Peak Power Output Out of 2400-2483.5 MHz Band

7.1 *Test procedure*

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (10 dB) and an appropriate coaxial cable (cable loss = 1.7 dB). The spectrum analyzer was set to 100 kHz resolution BW except for the frequency range 9 kHz-150 kHz where the RBW was set to 1kHz and the frequency range 150 kHz-10 MHz where the RBW was set to 10kHz. The frequency range from 9 kHz to 25 GHz was scanned. Level of spectrum components out of the 2400-2483.5 MHz was measured at the selected operation frequencies.

The E.U.T. was tested at 2410, 2440, and 2475MHz.

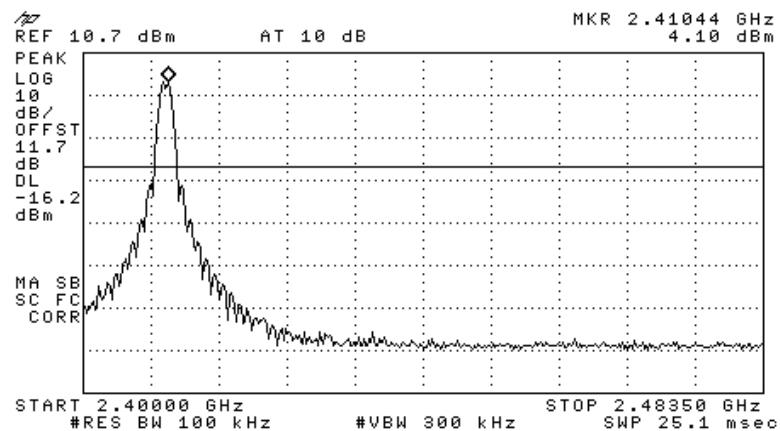


Figure 19 —2410 MHz

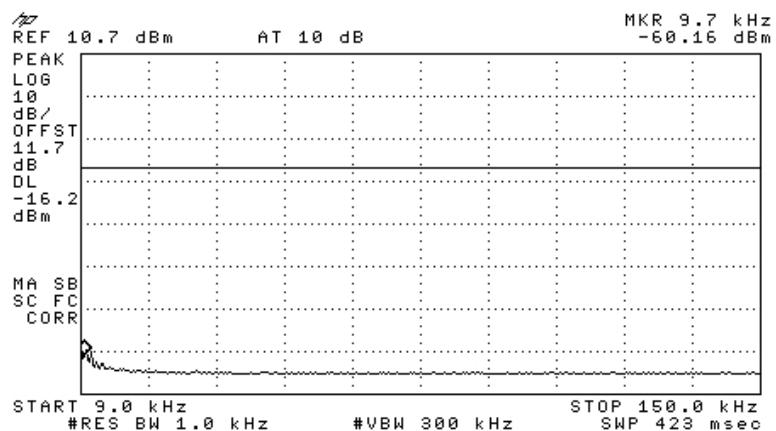


Figure 20 —2410 MHz

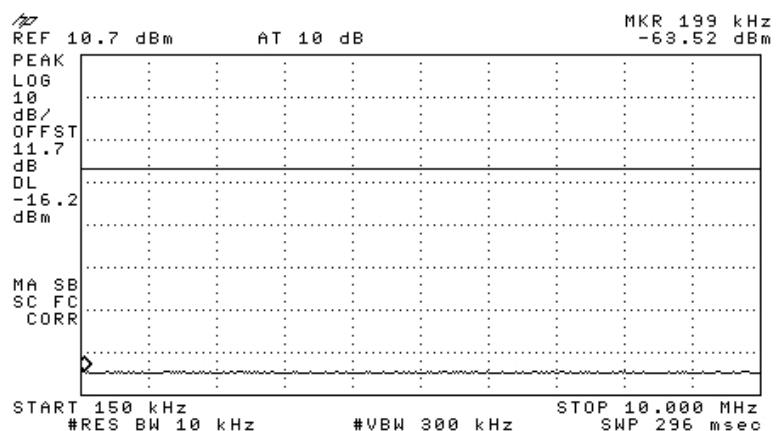


Figure 21 —2410 MHz

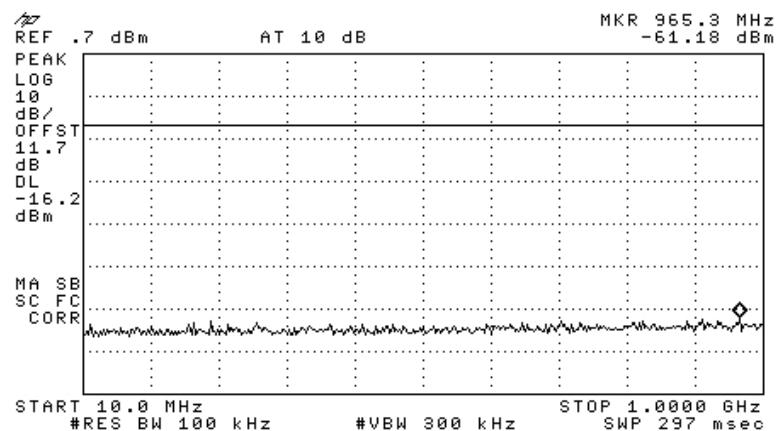


Figure 22 —2410 MHz

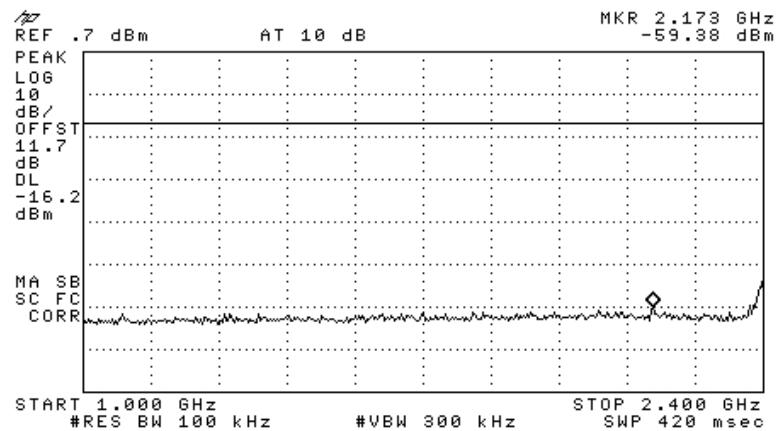


Figure 23 —2410 MHz

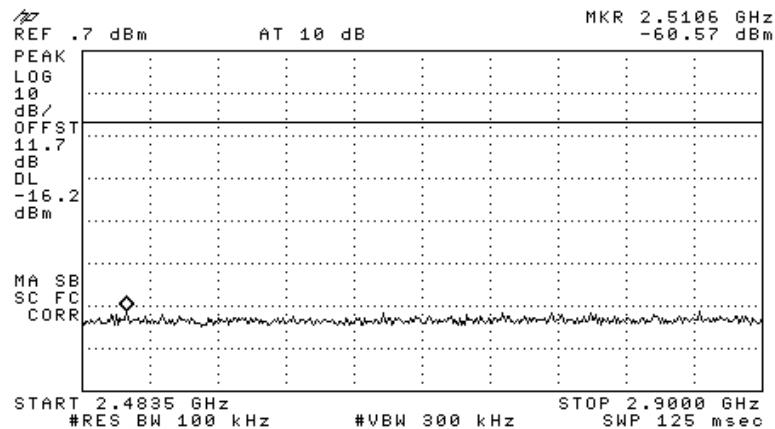


Figure 24 —2410 MHz

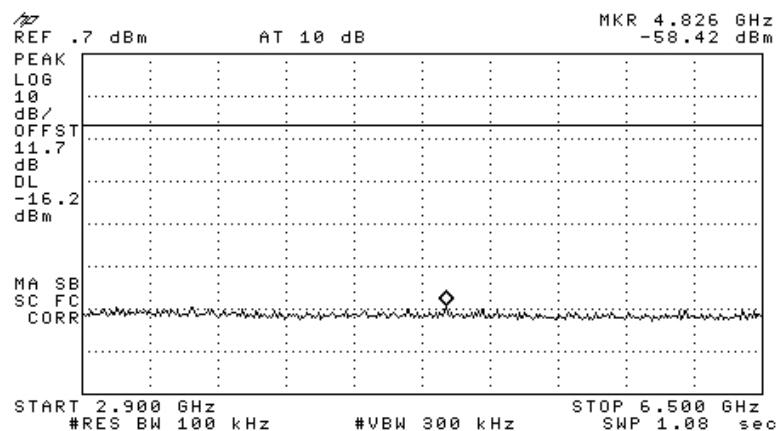


Figure 25 —2410 MHz

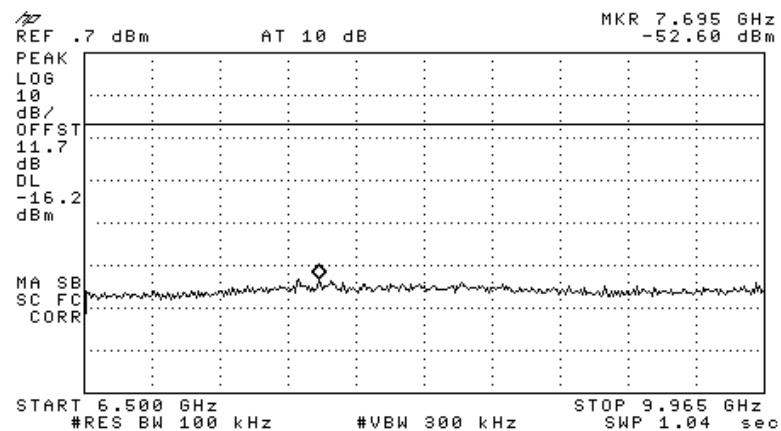


Figure 26 —2410 MHz

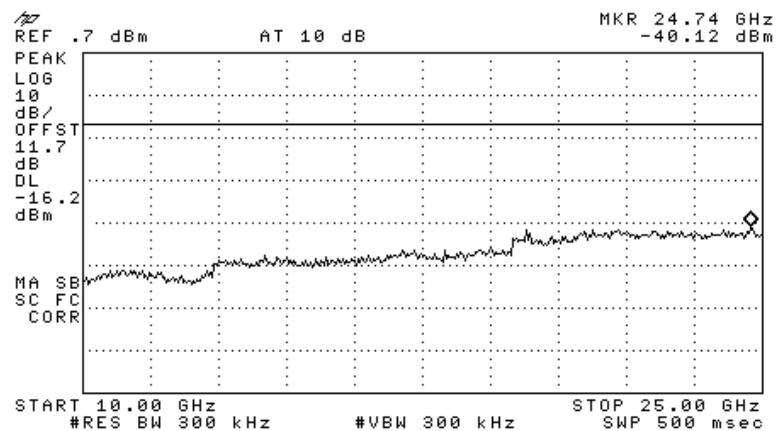


Figure 27 —2410 MHz

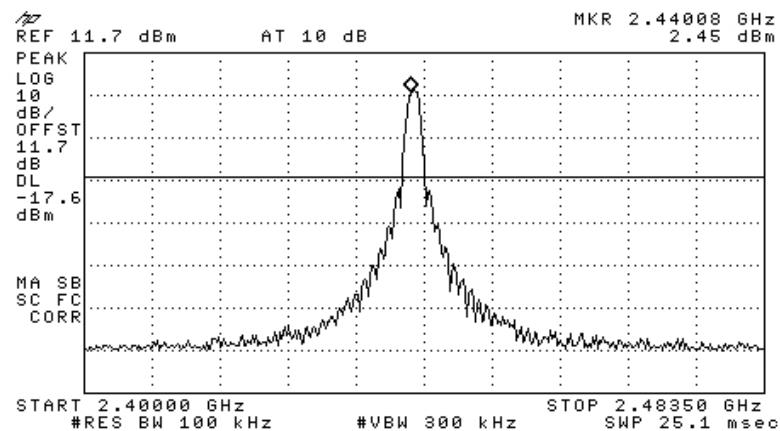


Figure 28 —2440 MHz

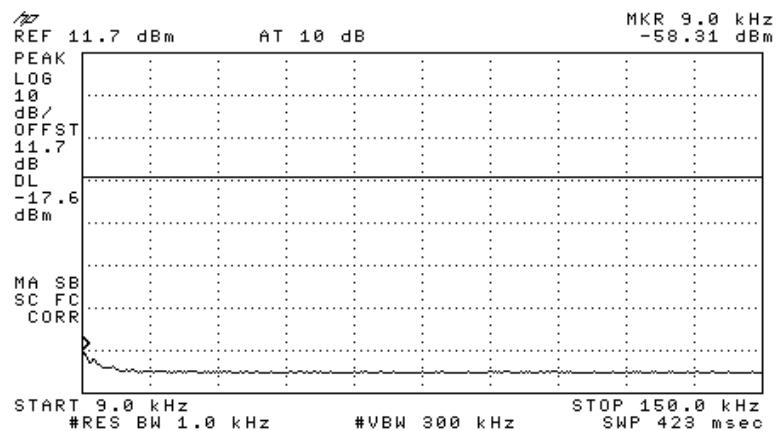


Figure 29 —2440 MHz

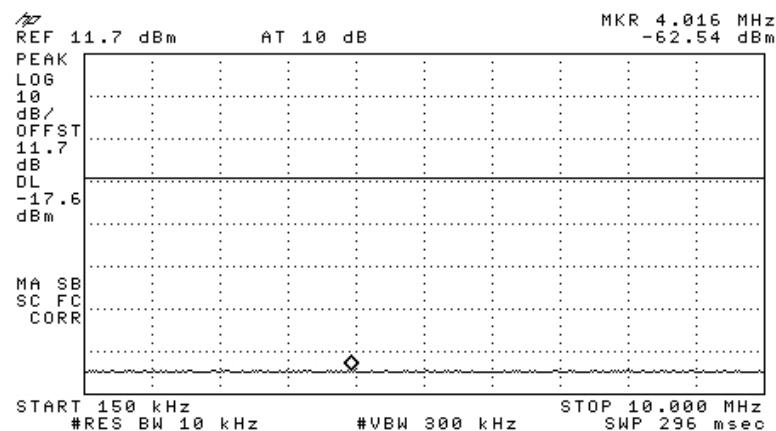


Figure 30 —2440 MHz

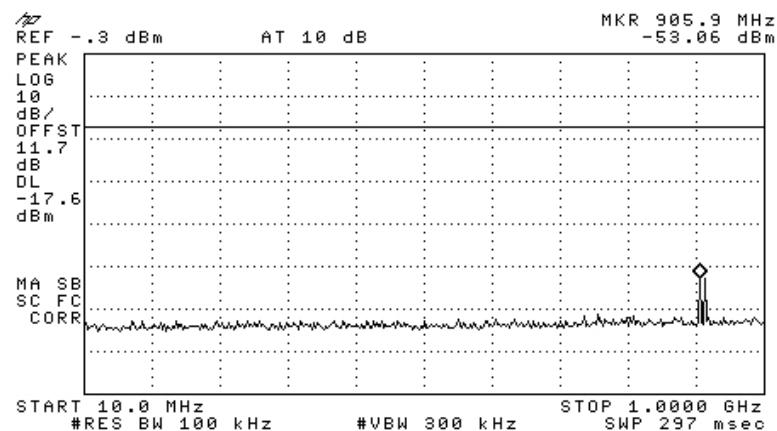


Figure 31 —2440 MHz

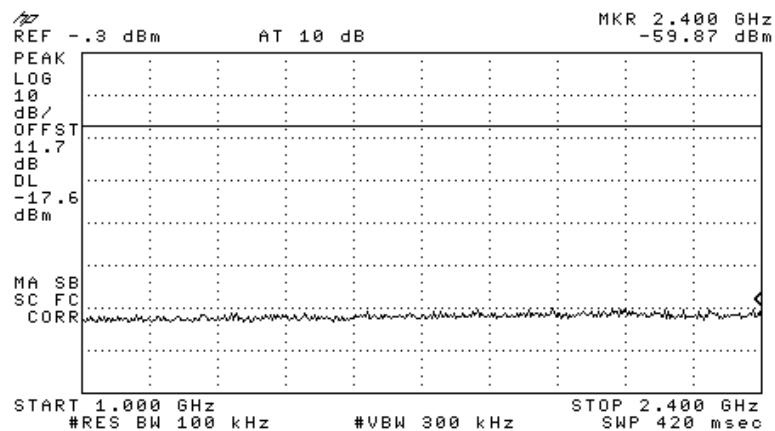


Figure 32 —2440 MHz

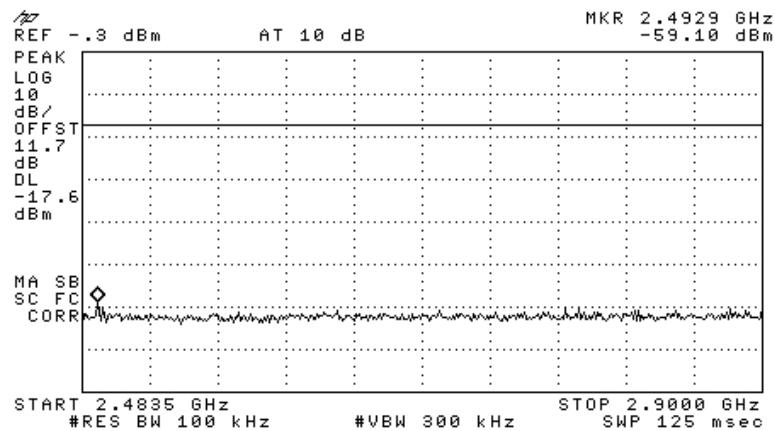


Figure 33 —2440 MHz

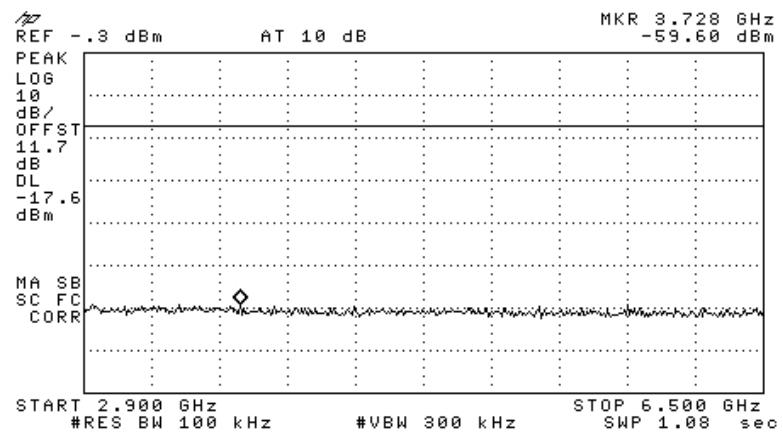


Figure 34 —2440 MHz

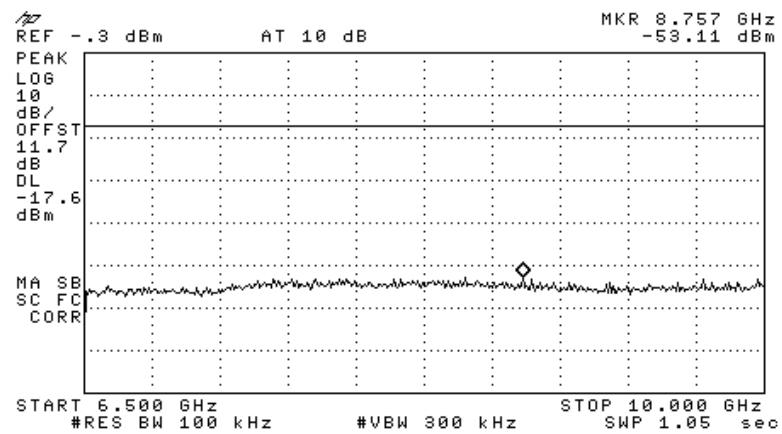


Figure 35 —2440 MHz

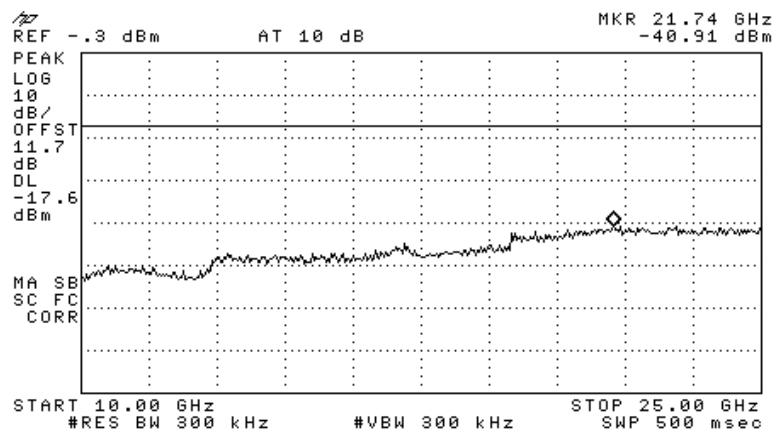


Figure 36 —2440 MHz

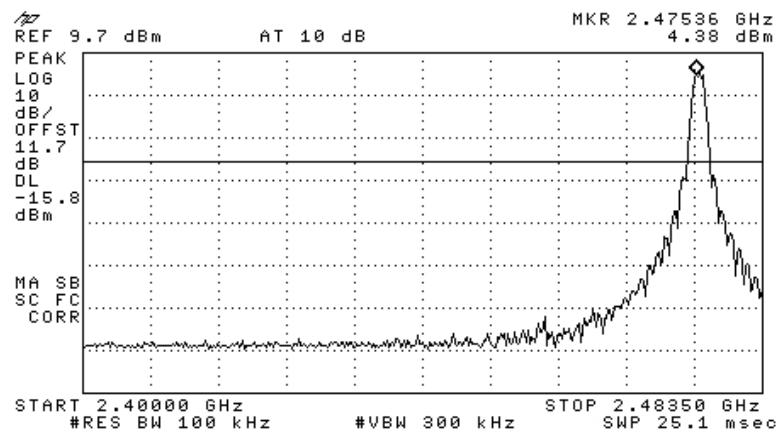


Figure 37 —2475 MHz

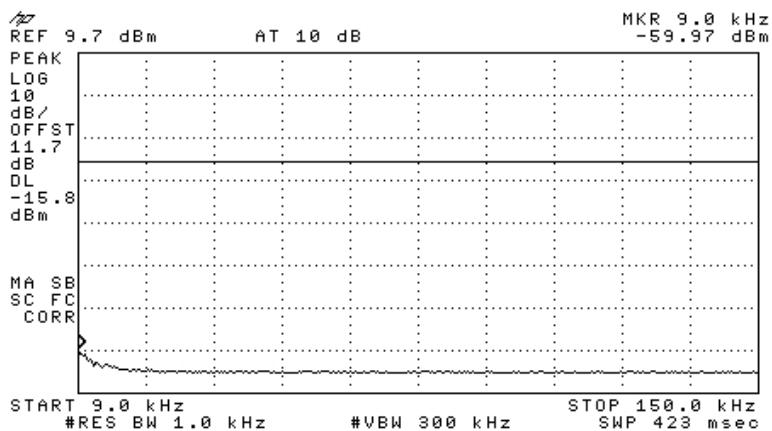


Figure 38 —2475 MHz

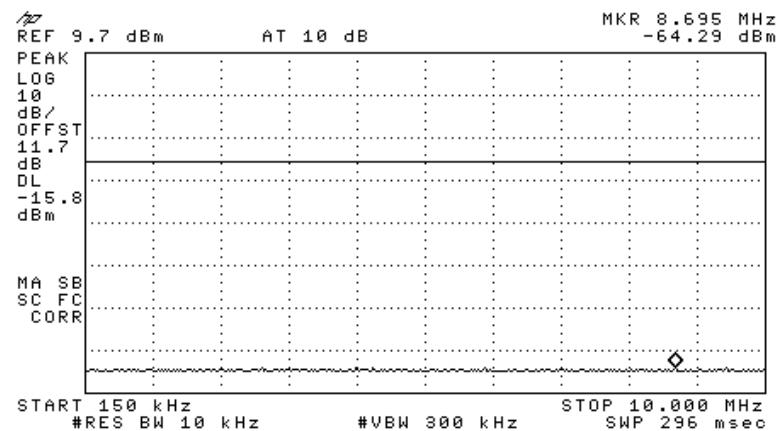


Figure 39 —2475 MHz

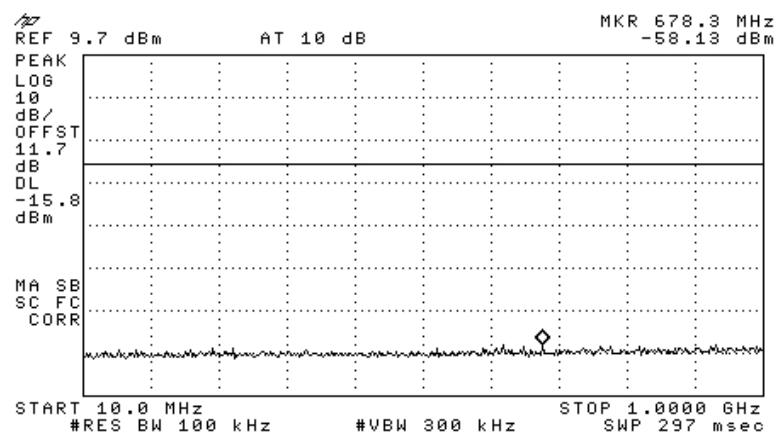


Figure 40 —2475 MHz

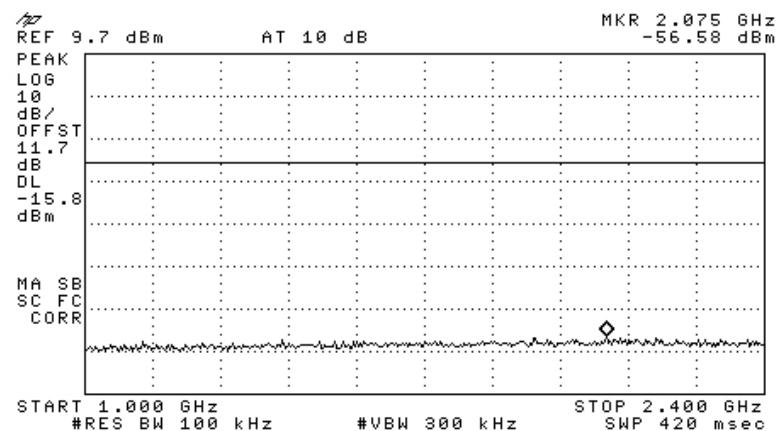


Figure 41 —2475 MHz

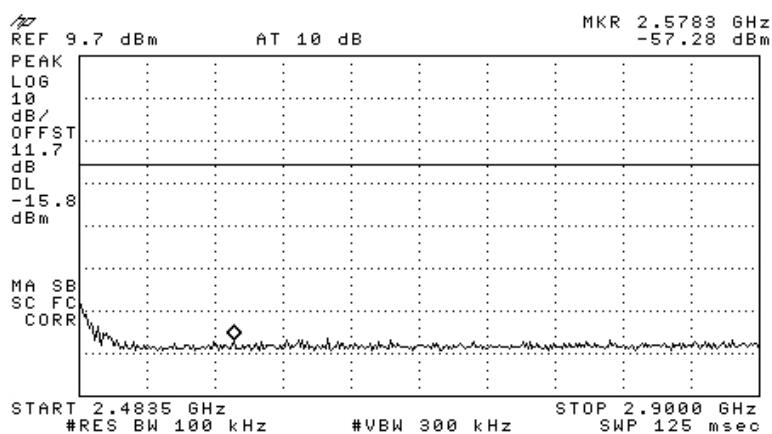


Figure 42 —2475 MHz

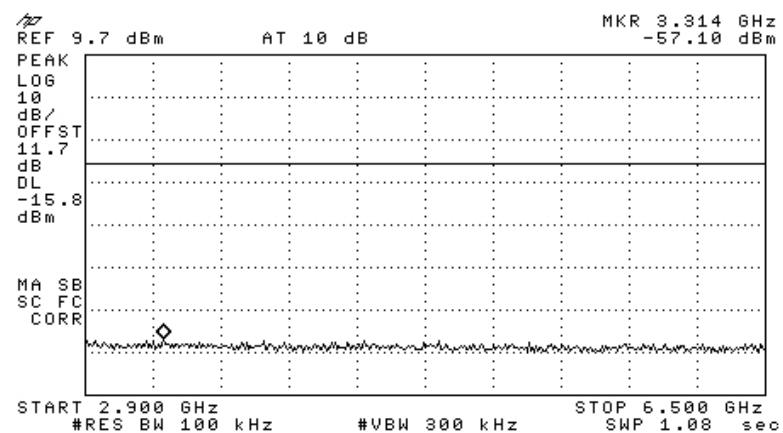


Figure 43 —2475 MHz

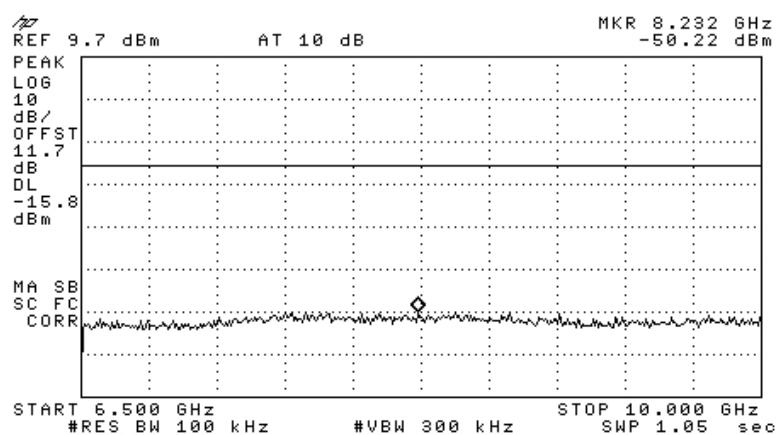


Figure 44 —2475 MHz

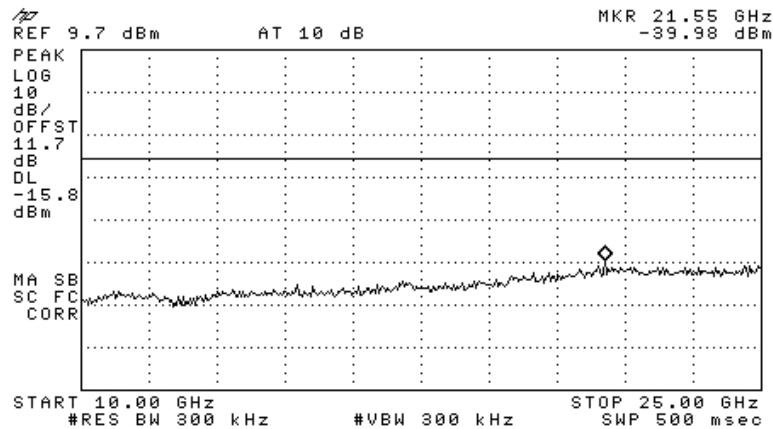


Figure 45 —2475 MHz

7.2 Results table

E.U.T Description: MINI DataNet Repeater

Model No.: DNR800

Serial Number: Not designated

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

Operation Frequency (MHz)	Reading (dBc)	Specification (dBc)	Margin (dB)
2410	43.9	20.0	-23.9
2440	43.3	20.0	-23.3
2475	44.2	20.0	-24.2

Figure 46 Peak Power Output of 2400-2483.5 MHz Band

JUDGEMENT: Passed by 23.3 dB

TEST PERSONNEL:

Tester Signature: 

Date: 20.08.09

Typed/Printed Name: A. Sharabi

7.3 **Test Equipment Used.**

Peak Power Output of 2400-2438.5 MHz Band

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 19, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 19, 2009	1 year

Figure 47 Test Equipment Used

8. Band Edge Spectrum

[In Accordance with section 15.247(c)]

8.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (10 dB) and an appropriate coaxial cable (cable loss = 1.7 dB). The spectrum analyzer was set to 100 kHz resolution BW. Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at 2410 MHz, and 2475 MHz correspondingly.

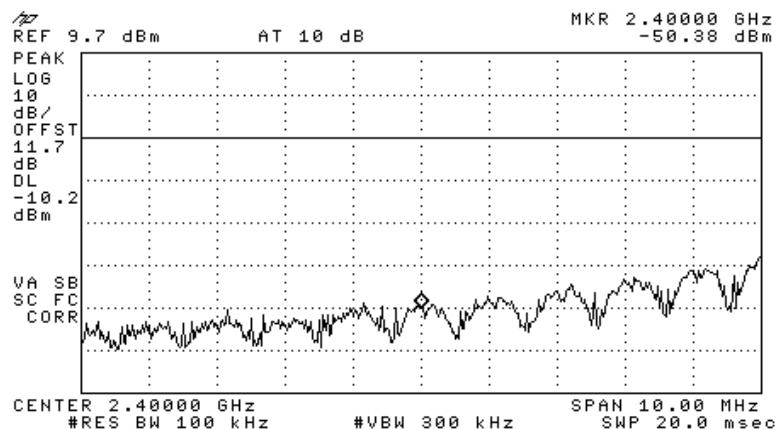


Figure 48 —2410 MHz

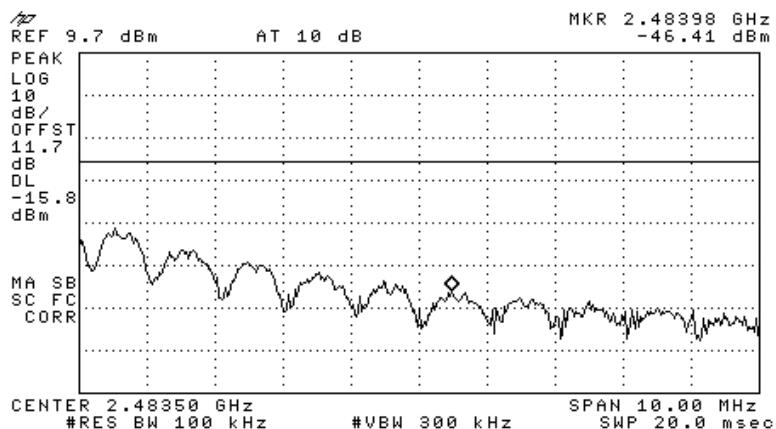


Figure 49 —2475 MHz

8.2 Results table

E.U.T. Description:

Model No.:

Serial Number: Not designated

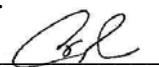
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency	Band Edge Frequency	Spectrum Level	Specification	Margin
(MHz)	(MHz)	(dBc)	(dBc)	(dB)
2410	2400.00	60.2	20.0	-40.2
2475	2483.41	50.6	20.0	-30.6

Figure 50 Band Edge Spectrum

JUDGEMENT: Passed by 30.6 dB

TEST PERSONNEL:

Tester Signature:  Date: 20.08.09

Typed/Printed Name: A. Sharabi

8.3 Test Equipment Used.

Band edge Spectrum

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 19, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 19, 2009	1 year

Figure 51 Test Equipment Used

9. Radiated Emission, 9 kHz – 30 MHz

9.1 **Test Specification**

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

9.2 **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 to 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.

The E.U.T. was operated at the frequencies of 2410, 2440, and 2475 MHz.

9.3 **Measured Data**

JUDGEMENT: Passed dB

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

The results for all three operating frequencies were the same.

The signals in the band 9 kHz – 30 GHz were below the spectrum analyzer noise level, at least 20 dB below the specification limit.

TEST PERSONNEL:

Tester Signature: 

Date: 20.08.09

Typed/Printed Name: A. Sharabi

9.4 **Test Instrumentation Used, Radiated Measurements**

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1 year
RF Section	HP	85420E	3705A00248	November 16, 2008	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 15, 2008	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

9.5 **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.

10. Spurious Radiated Emission 30 – 1000 MHz

10.1 ***Test Specification***

30 MHz-1000 MHz, F.C.C., Part 15, Subpart C

10.2 ***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 configuration tested is shown in Figure 1.

The frequency range 30 MHz-1000 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 to 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 30-1000 MHz, 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.

The E.U.T. was tested at the operating frequencies of 2410, 2440, and 2475 MHz.

10.3 Test Data

JUDGEMENT: Passed

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

The results for all three operating frequencies were the same.

The signals in the band 30 – 1000 MHz were below the spectrum analyzer noise level, at least 20 dB below the specification limit.

TEST PERSONNEL:

Tester Signature:  Date: 20.08.09

Typed/Printed Name: A. Sharabi

10.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1 year
RF Section	HP	85420E	3705A00248	November 16, 2008	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	March 25, 2009	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 06, 2008	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

10.5 **Field Strength Calculation**

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

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

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.

11. Spurious Radiated Emission Above 1 GHz

11.1 Radiated Emission Above 1 GHz

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, 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 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.

In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.

In the frequency range 2.9-25.0 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.)

The E.U.T. was tested at the operating frequencies of 2410, 2440, and 2475 MHz.

11.2 **Test Data**

JUDGEMENT: Passed by 8.4 dB

For the operation frequency of 2410 MHz, the margin between the emission level and the specification limit is 9.2 dB in the worst case at the frequency of 2390.00 MHz, vertical polarization.

For the operation frequency of 2440 MHz, the margin between the emission level and the specification limit is 14.6 dB in the worst case at the frequency of 4880.00 MHz, vertical polarization.

For the operation frequency of 2475 MHz, the margin between the emission level and the specification limit is 8.4 dB in the worst case at the frequency of 2483.50 MHz, vertical polarization.

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

TEST PERSONNEL:

Tester Signature:  Date: 20.08.09

Typed/Printed Name: A. Sharabi

Radiated Emission Above 1 GHz

E.U.T Description MINI DataNet Repeater
 Type DNR800
 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: 2410 MHz

Freq. (MHz)	Polarity (H/V)	Peak Amp (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
2390.00	H	57.7*	74.0	-16.3
2390.00	V	57.7*	74.0	-16.3
4820.00	H	53.2**	74.0	-20.8
4820.00	V	53.0**	74.0	-21.0

**Figure 52. 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

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

Radiated Emission Above 1 GHz

E.U.T Description MINI DataNet Repeater
 Type DNR800
 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: Average
 Operation Frequency: 2410 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dB μ V/m)	Average Specification (dB μ V/m)	Peak. Margin (dB)
2390.00	H	44.6*	54.0	-9.4
2390.00	V	44.8*	54.0	-9.2
4820.00	H	39.7**	54.0	-14.3
4820.00	V	39.2**	54.0	-14.8

**Figure 53. 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

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

Radiated Emission Above 1 GHz

E.U.T Description: MINI DataNet Repeater
 Type: DNR800
 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: 2440 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dB μ V/m)	(dB μ V/m)	(dB)
4880.00	H	53.6*	74.0	-20.4
4880.00	V	54.0*	74.0	-20.0

Figure 54. 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 + Band Pass Filter

Radiated Emission Above 1 GHz

E.U.T Description MINI DataNet Repeater
 Type DNR800
 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: Average
 Operation Frequency: 2440 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dB μ V/m)	Average Specification (dB μ V/m)	Peak. Margin (dB)
4880.00	H	38.6*	54.0	-15.4
4880.00	V	39.4*	54.0	-14.6

**Figure 55. 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 + Band Pass Filter

Radiated Emission Above 1 GHz

E.U.T Description MINI DataNet Repeater
 Type DNR800
 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: 2462 MHz

Freq. (MHz)	Polarity (H/V)	Peak Amp (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
2483.50	H	58.2*	74.0	-15.8
2483.50	V	61.4*	74.0	-12.6
4950.00	H	53.0**	74.0	-21.0
4950.00	V	53.5**	74.0	-20.5

**Figure 56. 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

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

Radiated Emission Above 1 GHz

E.U.T Description MINI DataNet Repeater
 Type DNR800
 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: Average
 Operation Frequency: 2475 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dB μ V/m)	Average Specification (dB μ V/m)	Peak. Margin (dB)
2483.50	H	45.3*	54.0	-8.7
2483.50	V	45.6*	54.0	-8.4
4950.00	H	39.4**	54.0	-14.6
4950.00	V	39.5**	54.0	-14.5

**Figure 57. 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

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

11.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1 Year
RF Filter Section	HP	85420E	3705A00248	November 16, 2008	1 Year
Antenna Biconical	ARA	BCD 235/B	1041	March 25, 2009	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 06, 2008	1 Year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 29, 2009	2 Years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 16, 2008	2 Years
Horn Antenna	ARA	SWH-28	1008	December 23, 2008	2 Years
Horn Antenna	Narda	V637	0410	December 23, 2008	2 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 3, 2008	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 9, 2009	1 Year
Low Noise Amplifier	MK Milliwave	MKT6-3000 4000-30-13P	A0399	January 15, 2009	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	December 15, 2008	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

12. Transmitted Power Density

[In accordance with section 15.247(d)]

12.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (10dB) and an appropriate coaxial cable (cable loss = 1.7 dB). The spectrum analyzer was set to 3 kHz resolution BW. and sweep time of 1 second for each 3 kHz “window”. The spectrum peaks were located at each of the 3 operating frequencies.

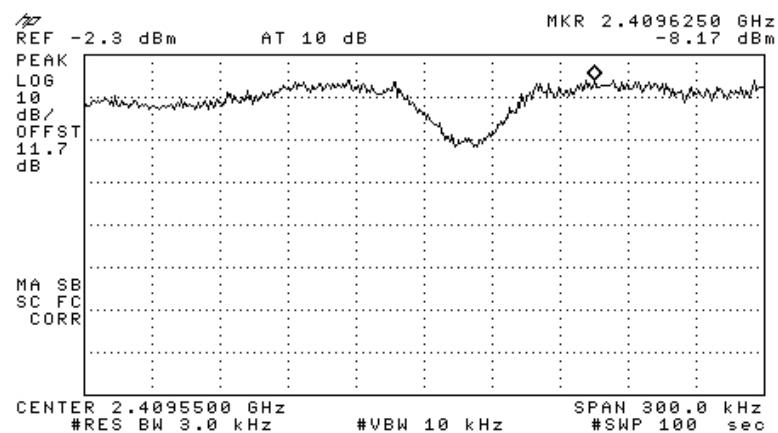


Figure 58 —2410 MHz

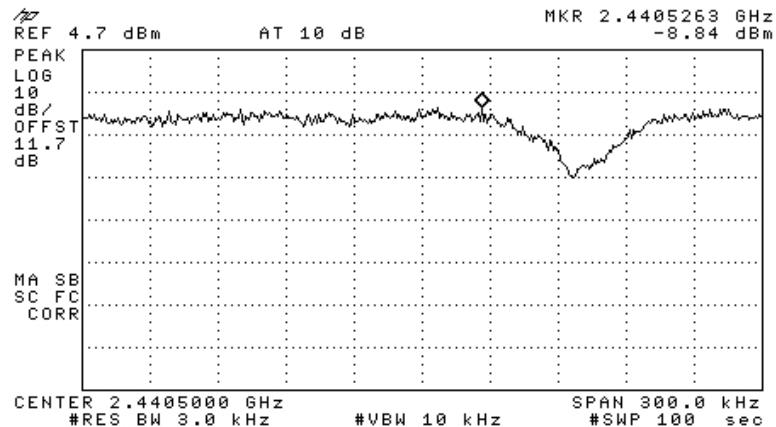


Figure 59 —2440 MHz

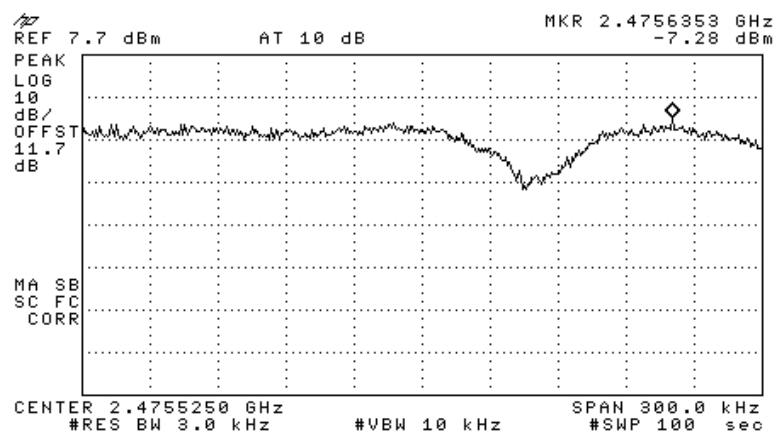


Figure 60 —2475 MHz

12.2 Results table

E.U.T. Description: MINI DataNet Repeater
 Model No.: DNR800
 Serial Number: Not designated
 Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading Spectrum Analyzer (dBm)	Specification (dBm)	Margin (dB)
2410	-8.17	8.0	-16.17
2440	-8.84	8.0	-16.84
2475	-7.28	8.0	-15.28

Figure 61 Test Results

JUDGEMENT: Passed by 15.3 dB

TEST PERSONNEL:

Tester Signature: A. Sharabi Date: 20.08.09

Typed/Printed Name: A. Sharabi

12.3 Test Equipment Used.

Transmitted Power Density

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 19, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 19, 2009	1 year

Figure 62 Test Equipment Used

13. Antenna Gain

The antenna gain is 5 dBi.

14. R.F Exposure/Safety Calculation

The E.U.T. is a wall mounted repeater used for enhancing network range. The typical distance between the E.U.T. and the user is > 20 cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 2437 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 10.5 mw (Peak)

G_T- Antenna Gain, 5 dBi = 3.2

R- Distance from Transmitter using 1cm worst case

(c) The peak power density is :

$$S_p = \frac{10.5 \times 3.2}{4\pi(20)^2} = 6.6 \times 10^{-3} \frac{mW}{cm^2}$$

(d) This is below the FCC limit.

15. APPENDIX A - CORRECTION FACTORS

**15.1 Correction factors for CABLE
from EMI receiver
to test antenna
at 3 meter range.**

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	7.3
20.0	0.6	1400.0	7.8
30.0	0.8	1600.0	8.4
40.0	0.9	1800.0	9.1
50.0	1.1	2000.0	9.9
60.0	1.2	2300.0	11.2
70.0	1.3	2600.0	12.2
80.0	1.4	2900.0	13.0
90.0	1.6		
100.0	1.7		
150.0	2.0		
200.0	2.3		
250.0	2.7		
300.0	3.1		
350.0	3.4		
400.0	3.7		
450.0	4.0		
500.0	4.3		
600.0	4.7		
700.0	5.3		
800.0	5.9		
900.0	6.3		
1000.0	6.7		

NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 27 meters.
3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

15.2 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.

15.3 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.

12.6 Correction factors for LOG PERIODIC ANTENNA

Type LPD 2010/A
at 3 and 10 meter ranges.

Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

NOTES:

1. Antenna serial number is 1038.
2. The above lists are located in file number 38M30.ANT for a 3 meter range, and file number 38M100.ANT for a 10 meter range.
3. The files mentioned above are located on the disk marked "Radiated Emission Test EMI Receiver".

15.4 Correction factors for

LOG PERIODIC ANTENNA

Type SAS-200/511
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

NOTES:

1. Antenna serial number is 253.
2. The above lists are located in file number SAS3M0.ANT for a 3 meter range.
3. The files mentioned above are located on the disk marked "Antenna Factors".

15.5 Correction factors for

BICONICAL ANTENNA
Type BCD-235/B,
at 3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

NOTES:

1. Antenna serial number is 1041.
2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

15.6 Correction factors for Double-Ridged Waveguide Horn

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

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENN A Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
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			

15.7 Correction factors for

Horn Antenna
Model: SWH-28
at 1 meter range.

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4

15.8 Correction factors for

**Horn Antenna
Model: V637**

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
26.0	43.6	14.9
27.0	43.7	15.1
28.0	43.8	15.3
29.0	43.9	15.5
30.0	43.9	15.8
31.0	44.0	16.0
32.0	44.1	16.2
33.0	44.1	16.4
34.0	44.1	16.7
35.0	44.2	16.9
36.0	44.2	17.1
37.0	44.2	17.4
38.0	44.2	17.6
39.0	44.2	17.8
40.0	44.2	18.0

15.9 Correction factors for ACTIVE LOOP ANTENNA

Model 6502

S/N 9506-2950

FREQUENCY (MHz)	Magnetic Antenna Factor (dB)	Electric Antenna Factor (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