Israel Testing Laboratories

ACCREDITED
Cert. No. 1152.01
Electrical (EMC)

DATE: 13 August 2009

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

FCC Radio Test Report

for

Fourier Systems Ltd.

Equipment under test:

DataNet RH/Temp Logger

DNL920

Written by: _____
D. Shidlowsky, Documentation

Approved by: _____
A. Sharabi, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

Cert. No. 1152.01
Electrical (EMC)

Measurement/Technical Report for

Fourier Systems Ltd.

DataNet RH/Temp Logger

DNL920

FCC ID: XGO-DNL9XX

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:
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Kfar Bin Nun
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Israel
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Applicant for this device:
(different from "prepared by")
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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):	DataNet RH/Temp Logger
Equipment Model No.:	DNL920
Equipment Serial No.:	814935
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 DataNet is a 16-bit data logging system with data transmission from units to the central computer utilizing the ZigBee wireless telemetry protocol. ZigBee wireless protocol transmits on a 2.4 GHz license free frequency RF band. Each DataNet unit also serves as a transmission repeater to neighboring units, forming a reliable mesh network of up to 65,000 nodes.

The DNL 920 logger has 4 inputs for direct measurement and recording of PT-100, thermocouple (J, K, T), voltage, current, frequency, pulse and dry contact. The logger can run from battery or from AC power.

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

Exploratory radiated emission screening inside a shielded room was performed on the DNL920 and DNL910 models in the band of 9 kHz up to 10th harmonic to determine worst case situation.
The only emission that was found in the units were in 2nd harmonic at the same level.
The DNL920 model was chosen to represent both models since it contains 2 internal sensors, while the DNL910 model contains only a logger.

The layout, enclosure, RF output power, antenna gain and all other RF parameters and circuitry are identical both units.

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.

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

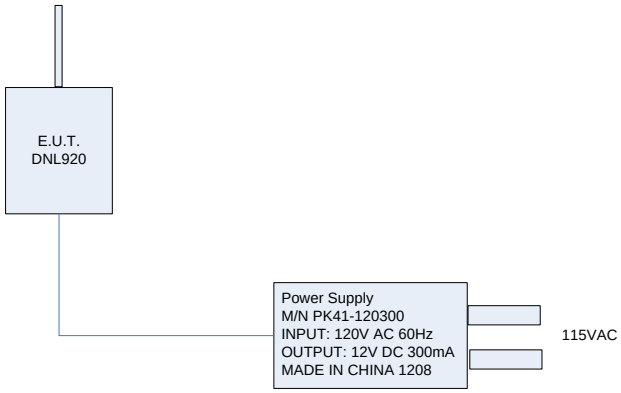


Figure 1. Configuration of Tested System

3. Test Set-up Photos

Figure 2. Conducted Emission Test

Figure 3. Radiated Emission Test

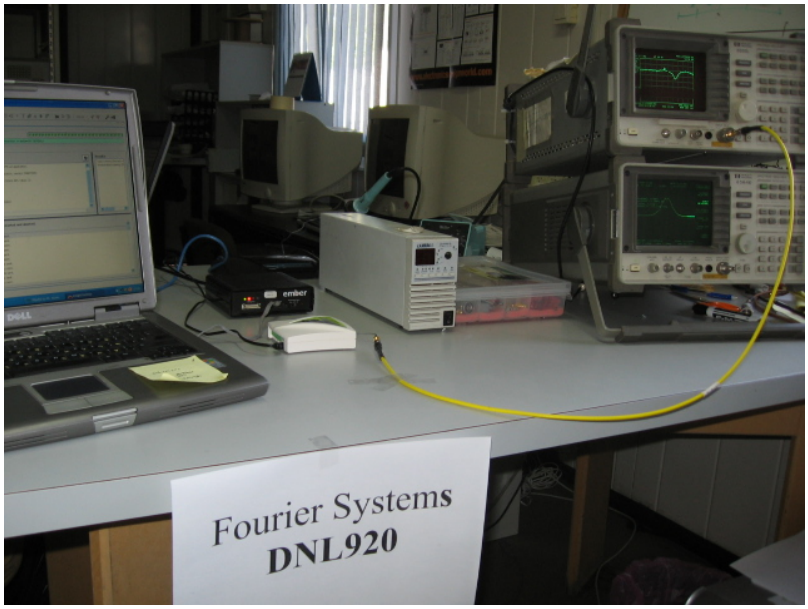


Figure 4. Conducted Emission From Antenna Port Tests

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 µHn 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 31.0 dB

The margin between the emission levels and the specification limit is, in the worst case, 32.6 dB for the phase line at 0.53 MHz and 31.0 dB at 0.56 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	DataNet RH/Temp Logger
Type	DNL920
Serial Number:	814935

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	0.154038	35.6	28.4	-37.4	-3.8	-59.6	0.0
2	0.182208	34.7	28.2	-36.2	-4.5	-58.9	0.0
3	0.229862	32.1	24.8	-37.7	-6.9	-59.4	0.0
4	0.395009	27.1	19.3	-38.7	-10.0	-58.0	0.0
5	0.533721	30.7	23.4	-32.6	-6.6	-52.6	0.0
6	0.566336	28.7	21.8	-34.2	-8.5	-54.5	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	DataNet RH/Temp Logger
Type	DNL920
Serial Number:	814935

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

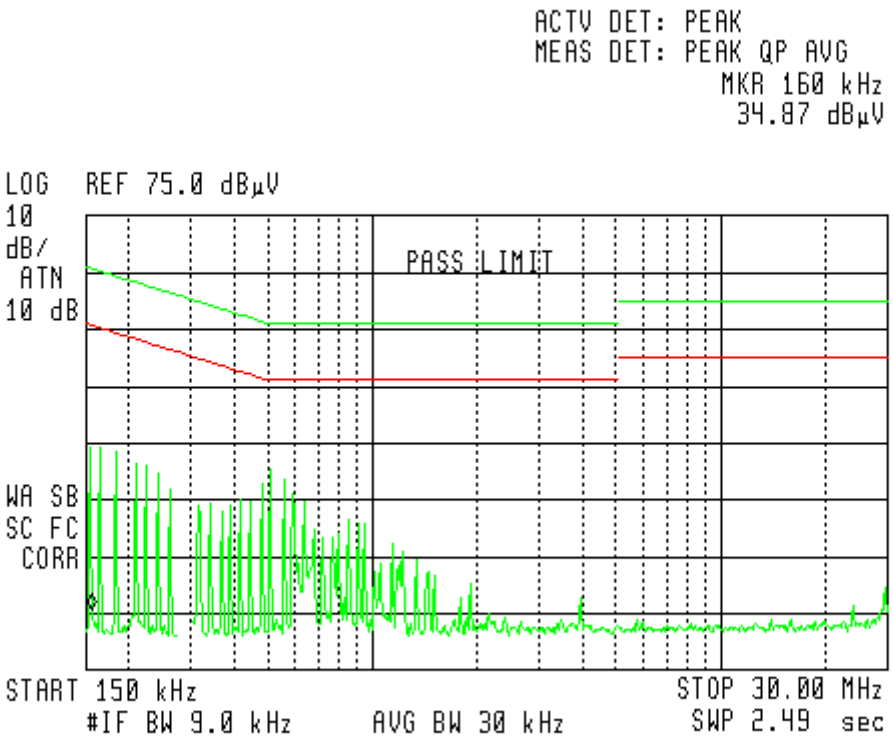


Figure 6. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description	DataNet RH/Temp Logger
Type	DNL920
Serial Number:	814935

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	0.157674	36.5	29.4	-36.2	-2.6	-58.2	0.0
2	0.179825	35.8	28.9	-35.6	-3.8	-58.3	0.0
3	0.218393	35.2	28.3	-34.6	-2.2	-55.2	0.0
4	0.275519	34.2	27.1	-33.9	-5.2	-56.2	0.0
5	0.363659	31.9	24.1	-34.6	-7.7	-56.4	0.0
6	0.559810	31.9	25.0	-31.0	-7.0	-53.0	0.0

Figure 7. 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	DataNet RH/Temp Logger
Type	DNL920
Serial Number:	814935

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

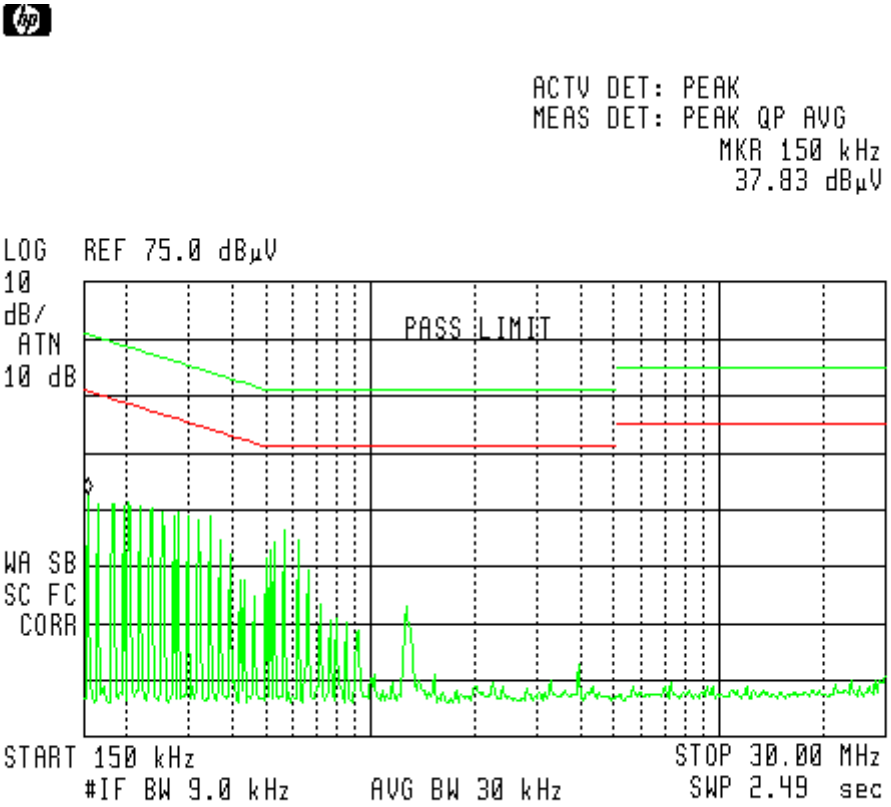


Figure 8 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average

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	1Year
RF Filter Section	HP	85420E	3705A00248	November 16, 2008	1Year
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 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

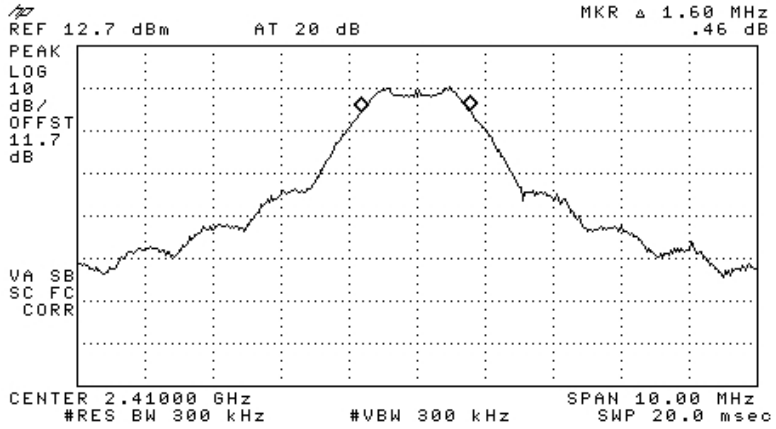


Figure 9 —2410 MHz

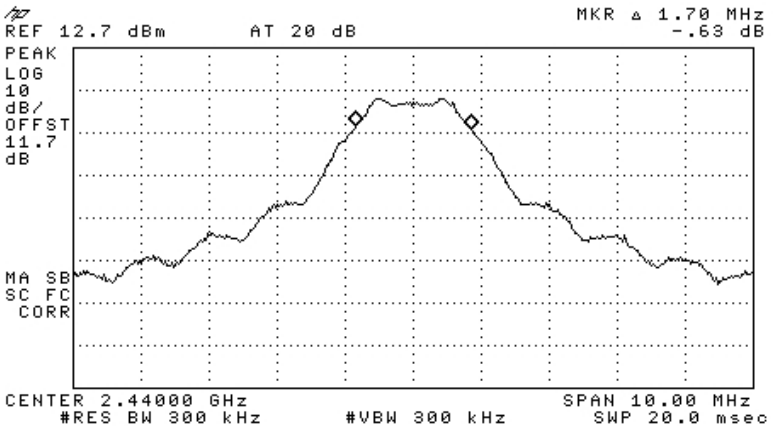


Figure 10 —2440MHz

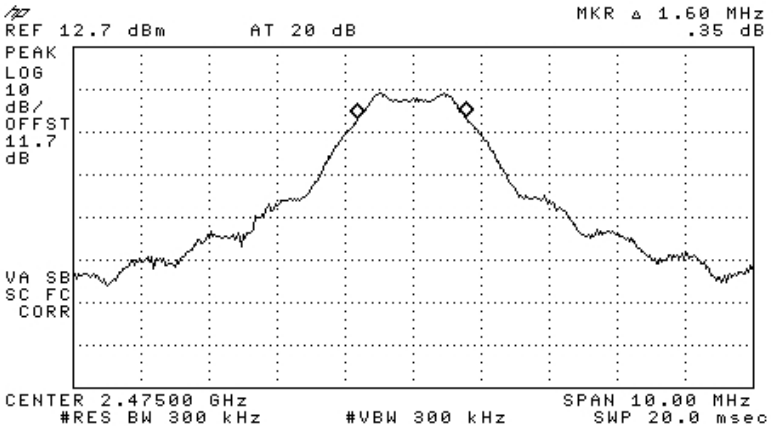


Figure 11 —2475 MHz

5.2 6.2. Results table

E.U.T Description: DataNet RH/Temp Logger
Model No.: DNL920
Serial Number: 814935
Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)
2410	1.60	0.5
2440	1.70	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

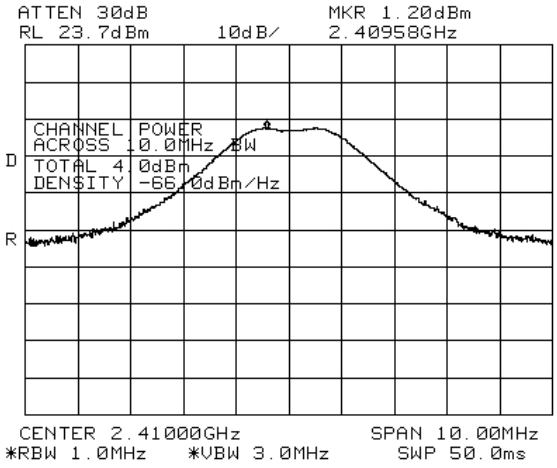


Figure 14 2410

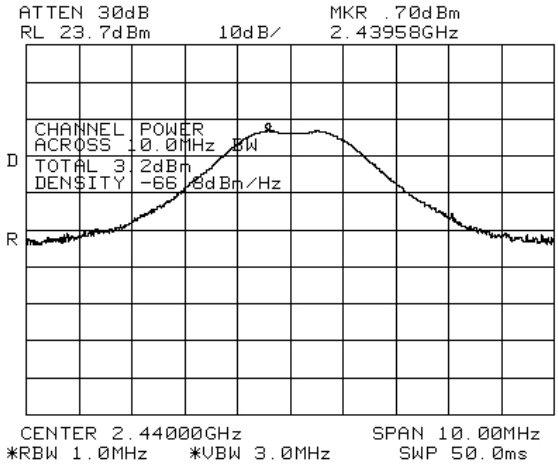


Figure 15 2440 MHz

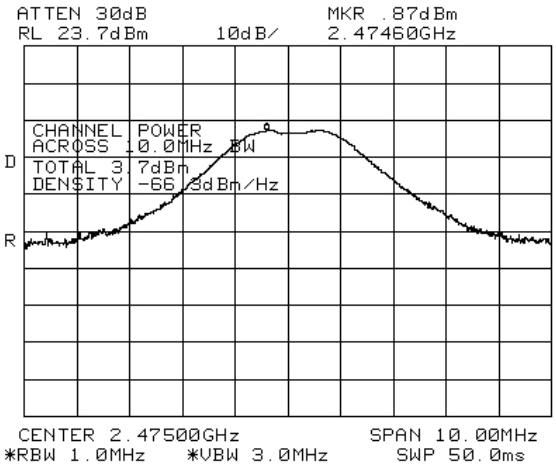


Figure 16 2475 MHz

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	4.0	30.0	-26.0
2440	3.2	30.0	-26.8
2475	3.7	30.0	-26.3

Figure 17 Maximum Peak Power Output

JUDGEMENT: Passed by 26.0 dB

TEST PERSONNEL:
Tester Signature: _____ Date: 20.08.09
Typed/Printed Name: A. Sharabi

6.3 Test Equipment Used.

Peak Power Output

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	December 15, 2008	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 with the following

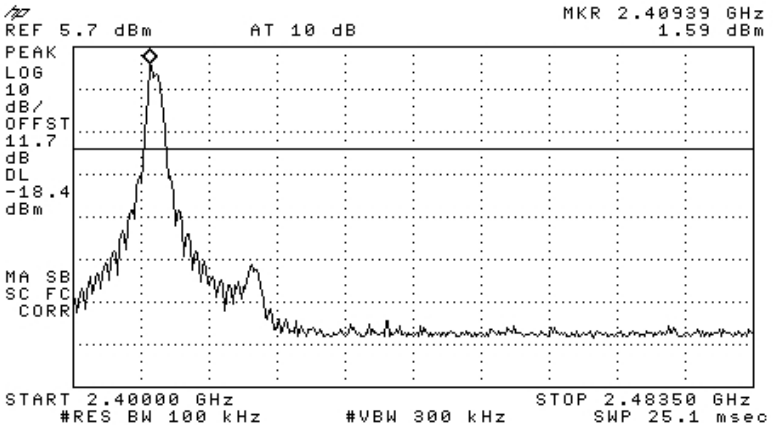


Figure 19 —2410 MHz

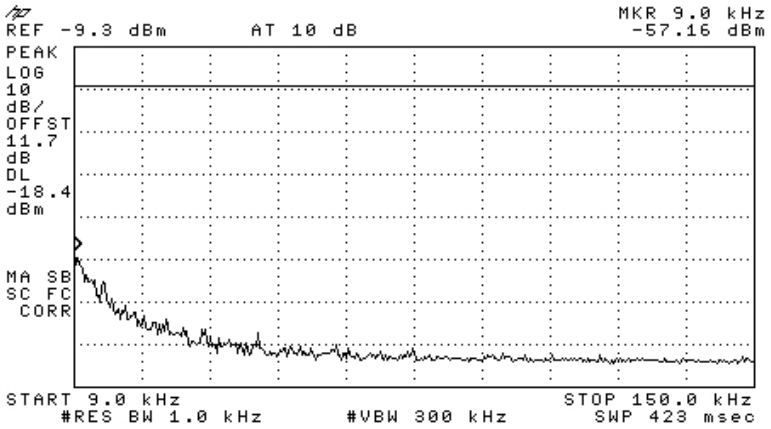


Figure 20 —2410 MHz

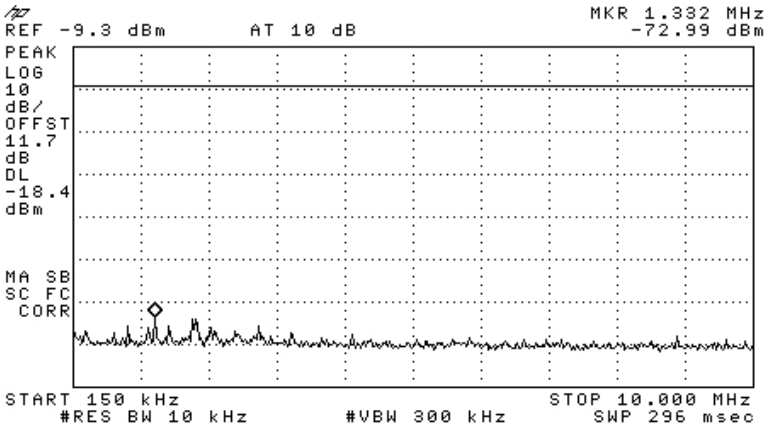


Figure 21 —2410 MHz

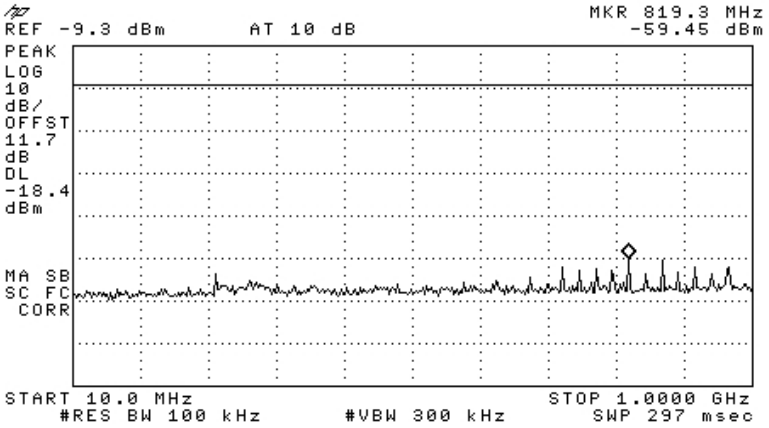


Figure 22 —2410 MHz

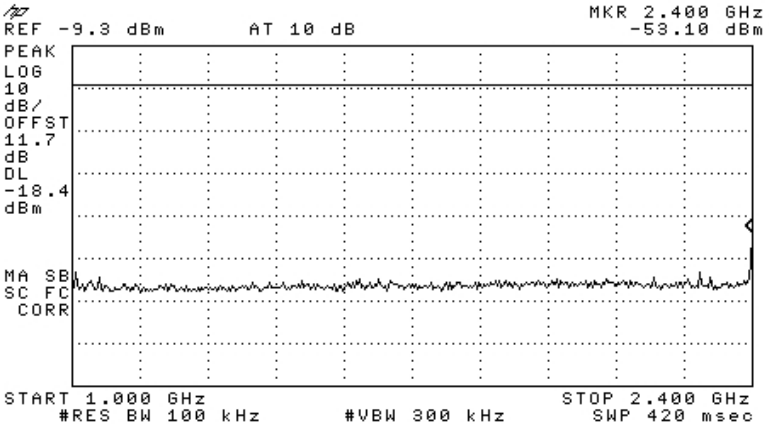


Figure 23 —2410 MHz

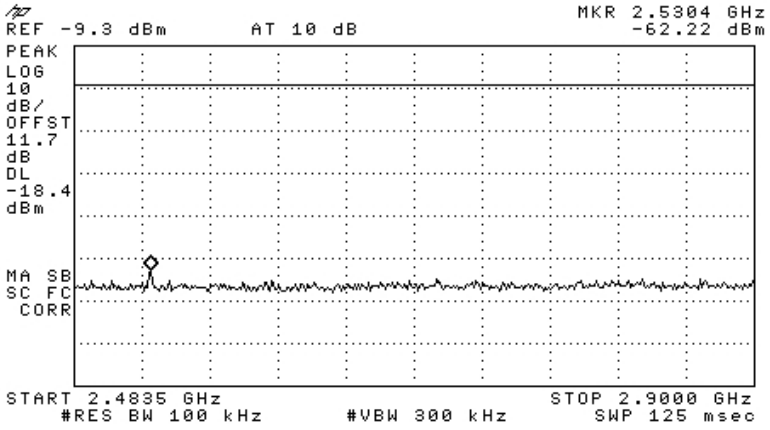


Figure 24 —2410 MHz

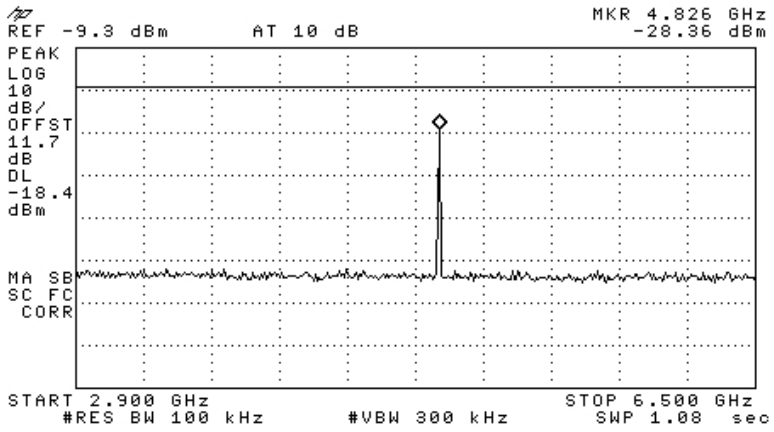
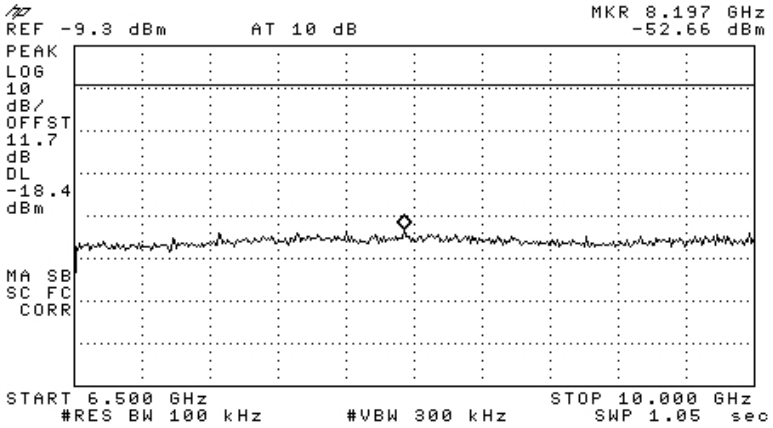


Figure 25 —2410 MHz



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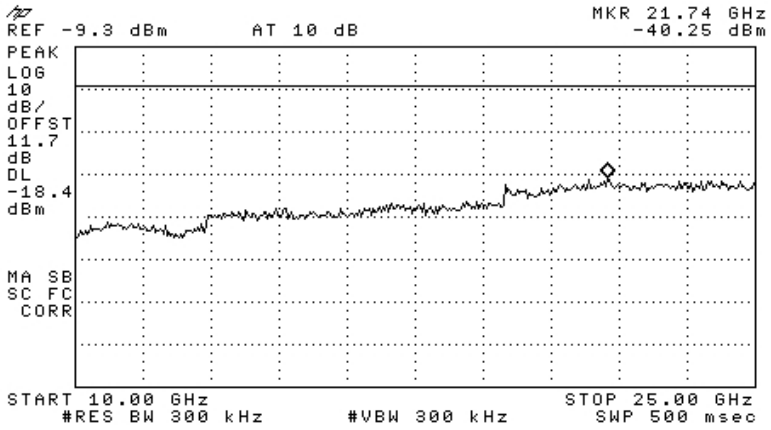


Figure 27 —2410 MHz

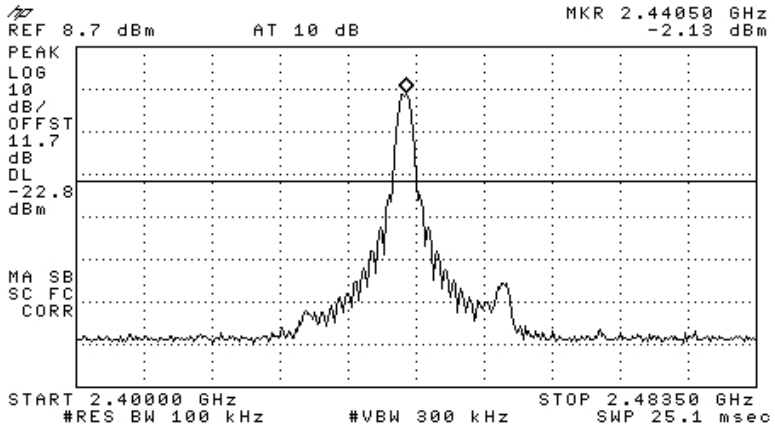


Figure 28 —2440 MHz

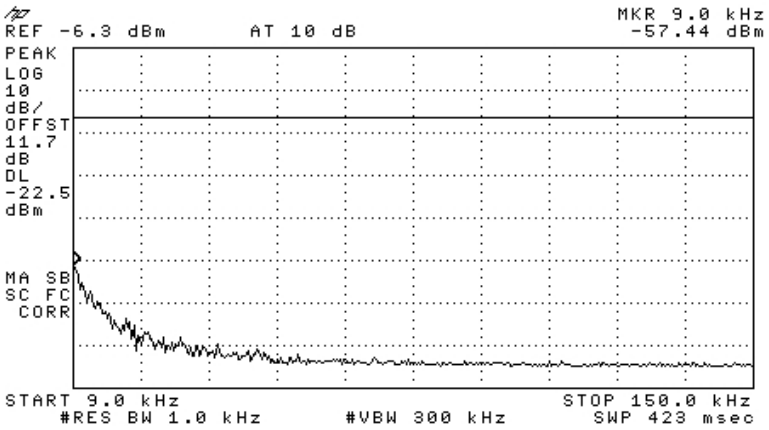


Figure 29 —2440 MHz

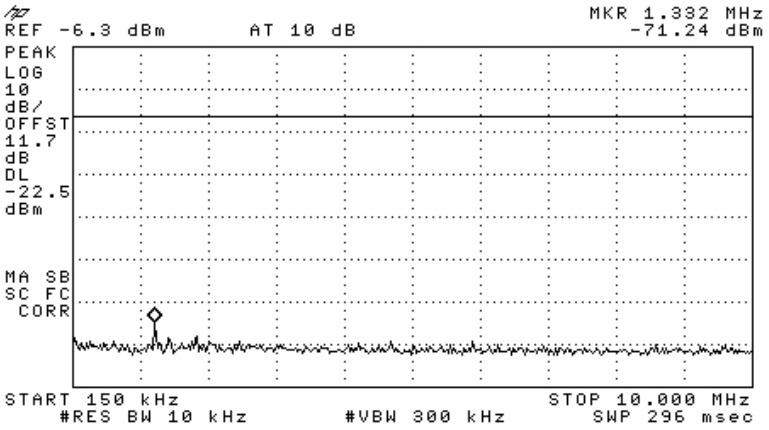


Figure 30 —2440 MHz

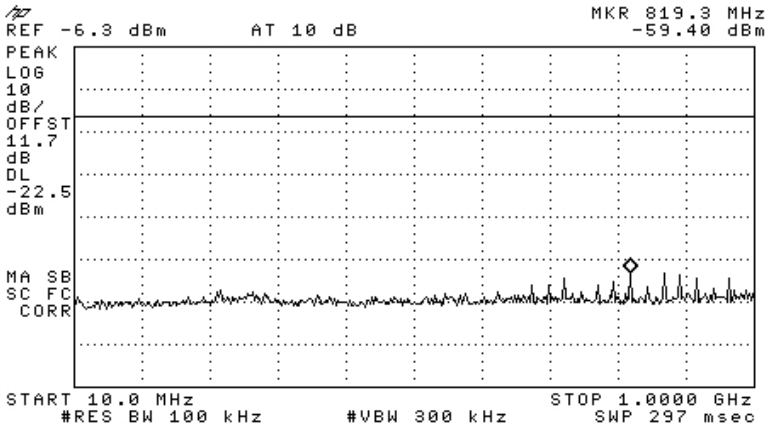
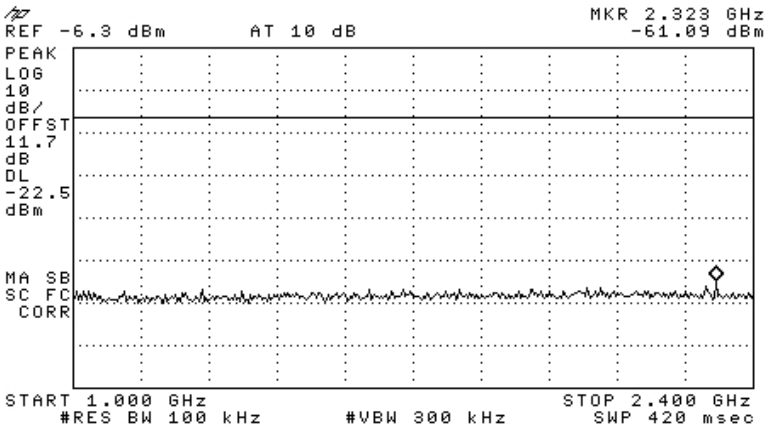


Figure 31 —2440 MHz



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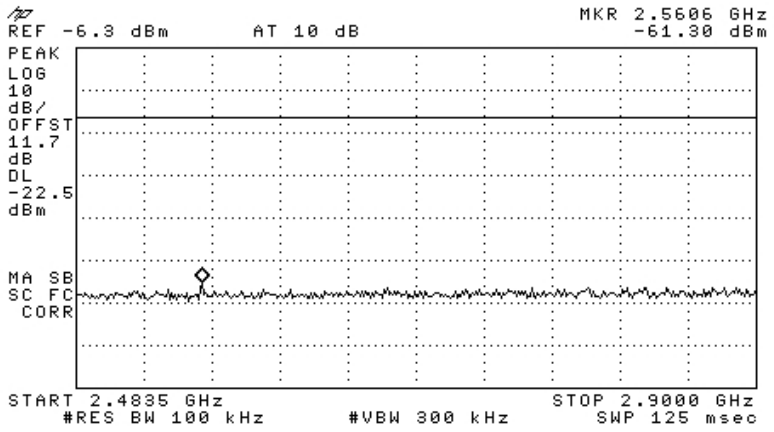

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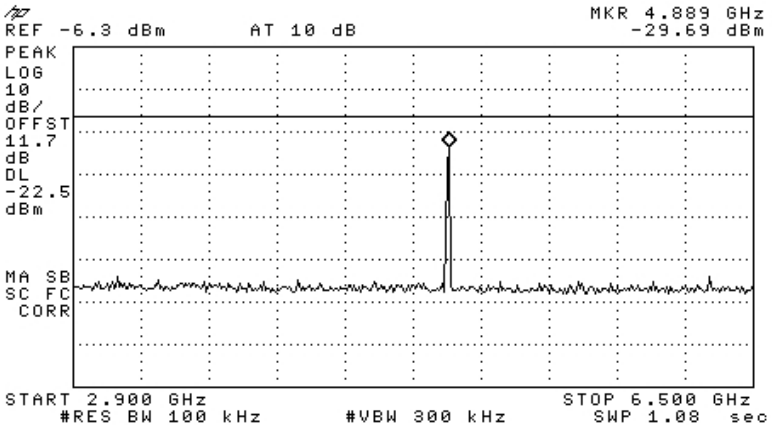


Figure 34 —2440 MHz

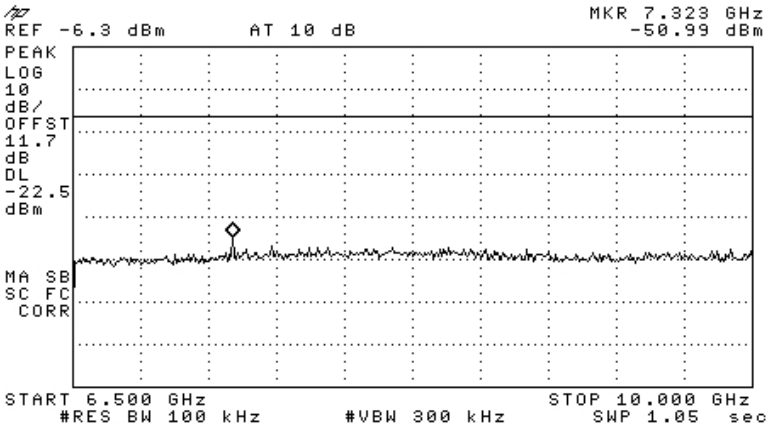


Figure 35 —2440 MHz

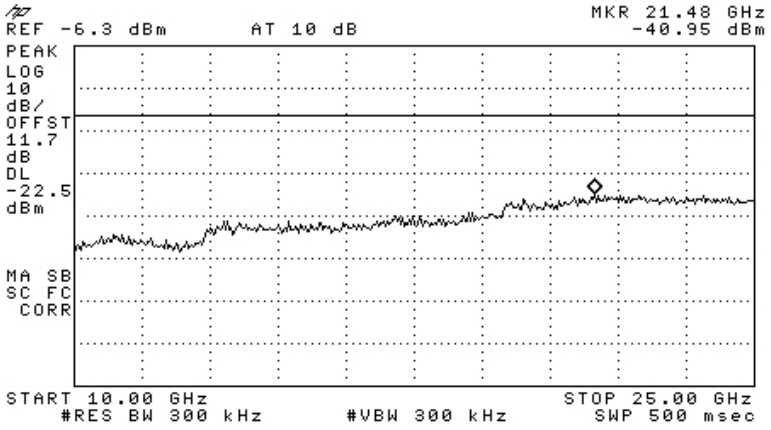


Figure 36 —2440 MHz

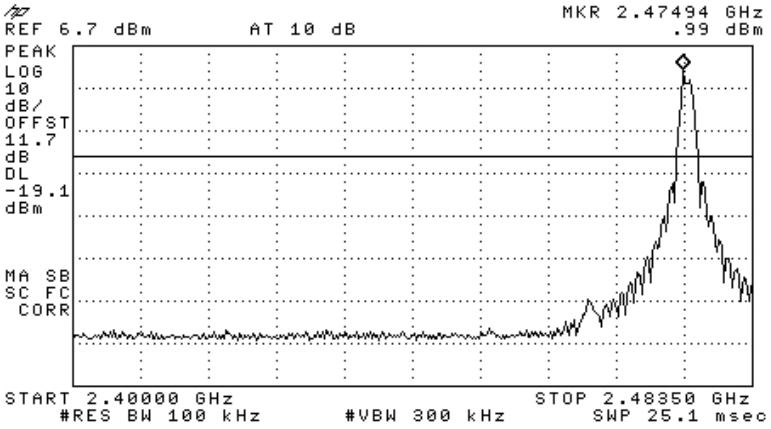


Figure 37 —2475 MHz

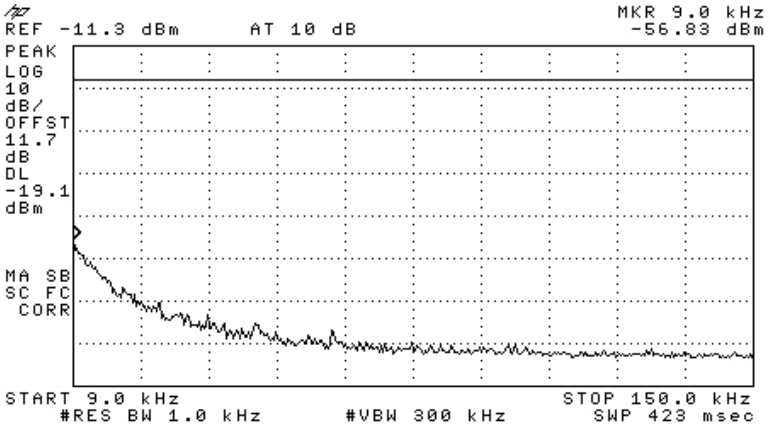


Figure 38 —2475 MHz

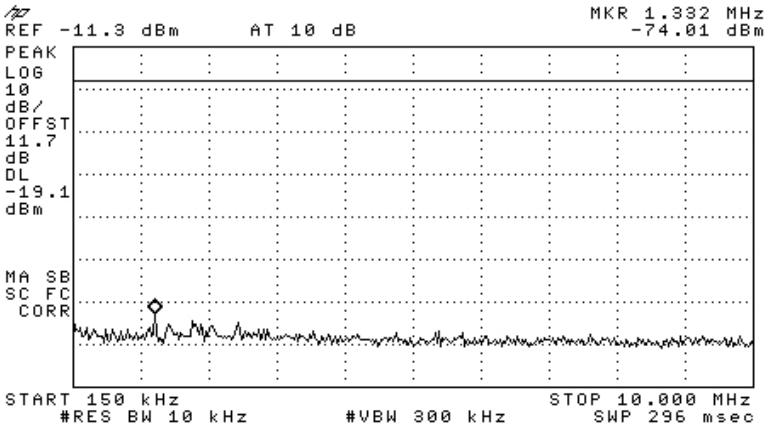


Figure 39 —2475 MHz

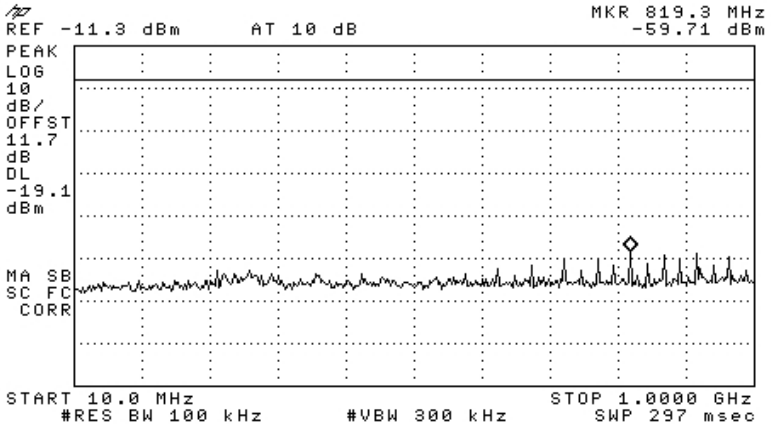


Figure 40 —2475 MHz

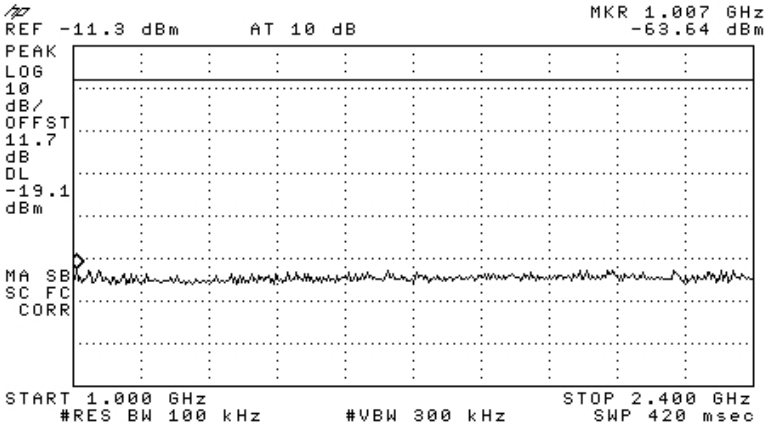


Figure 41 —2475 MHz

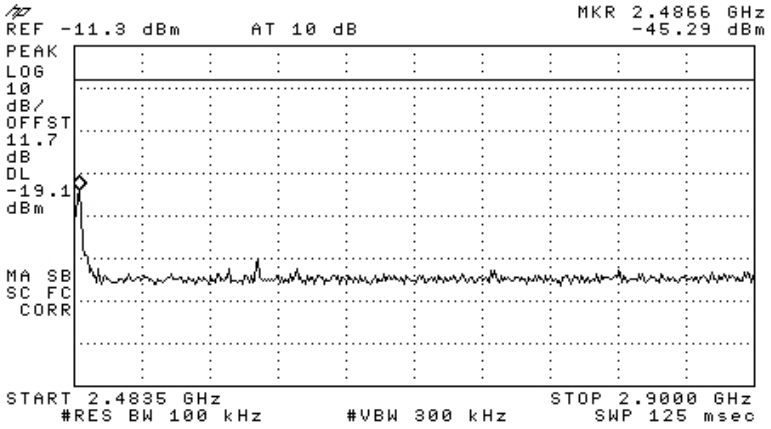


Figure 42 —2475 MHz

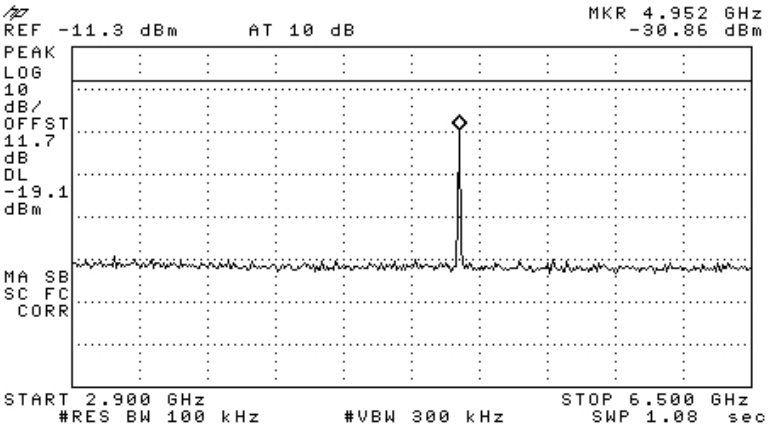


Figure 43 —2475 MHz

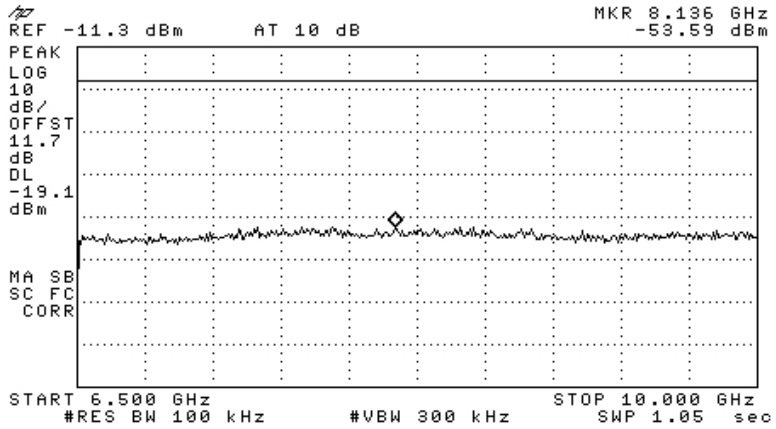


Figure 44 —2475 MHz

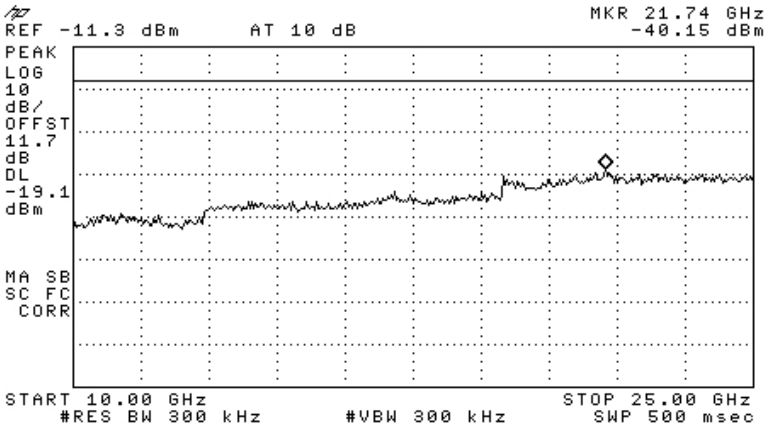


Figure 45 —2475 MHz

7.2 Results table

E.U.T Description: DataNet RH/Temp Logger
Model No.: DNL920
Serial Number: 814935
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading (dBc)	Specification (dBc)	Margin (dB)
2410	30.0	20.0	-10.0
2440	27.2	20.0	-7.2
2475	31.8	20.0	-11.8

Figure 46 Peak Power Output of 2400-2483.5 MHz Band

JUDGEMENT: Passed by 7.2 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.

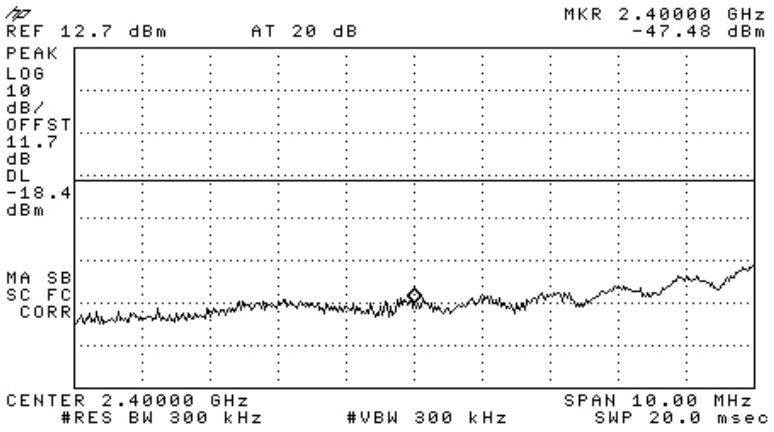


Figure 48 —2405 MHz

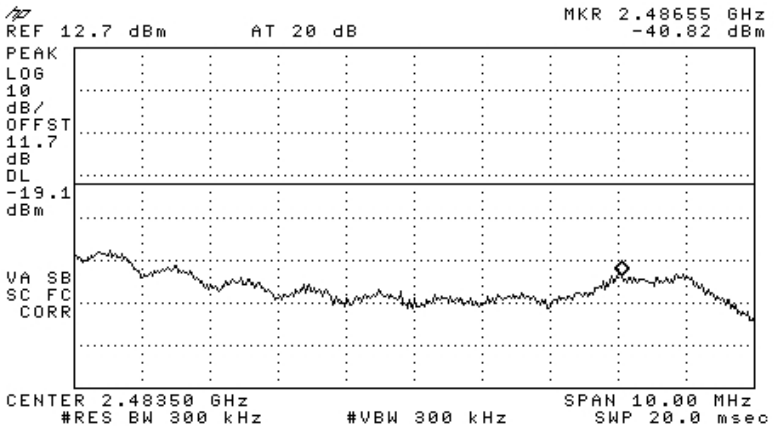


Figure 49 —2475 MHz

8.2 Results table

E.U.T. Description:
Model No.:
Serial Number: 814935
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBc)	Specification (dBc)	Margin (dB)
2410	2400.00	49.1	20.0	-29.1
2475	2486.55	41.7	20.0	-21.7

Figure 50 Band Edge Spectrum

JUDGEMENT: Passed by 21.7 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 in the Restricted Band Below 1 GHz

9.1 Test Specification

9kHz-1000 MHz, F.C.C., Part 15, Subpart C

9.2 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 3.1.

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

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.

9.3 Test Data

JUDGEMENT: Passed

The results for all three operating frequencies and modulations were the same.

The signals in the band 9 kHz – 1000 MHz were below the spectrum analyzer noise level, at least 20 dB below the specification limit.

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

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
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
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:

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

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

No external pre-amplifiers are used.

10. Radiated Emission in the Restricted Band, Above 1 GHz

10.1 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.

10.2 Test Data

JUDGEMENT: Passed by 7.8 dB

For the operation frequency of 2410 MHz, the margin between the emission level and the specification limit is 7.8 dB in the worst case at the frequency of 2390.00 MHz, vertical polarization.

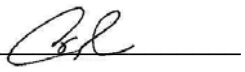
For the operation frequency of 2440 MHz, the margin between the emission level and the specification limit is 16.6 dB in the worst case at the frequency of 4880.00 MHz, horizontal polarization.

For the operation frequency of 2475 MHz, the margin between the emission level and the specification limit is 8.5 dB in the worst case at the frequency of 2483.00 MHz, vertical polarization.

The results for all modulations were the same.

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	DataNet RH/Temp Logger
Type	DNL920
Serial Number:	814935

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: 2412 MHz

Freq. (MHz)	Polarity (H/V)	Peak Amp (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2390.00	H	64.8*	74.0	-9.2
2390.00	V	60.5*	74.0	-13.5
4820.00	H	54.8**	74.0	-19.2
4820.00	V	50.6**	74.0	-23.4

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	DataNet RH/Temp Logger
Type	DNL920
Serial Number:	814935

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: 2412 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
2390.00	H	44.3*	54.0	-9.7
2390.00	V	46.2*	54.0	-7.8
4820.00	H	39.5**	54.0	-14.5
4820.00	V	38.8**	54.0	-15.2

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	DataNet RH/Temp Logger
Type	DNL920
Serial Number:	814935

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: 2437 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
4880.00	H	55.4*	74.0	-18.6
4880.00	V	52.9*	74.0	-21.1

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 DataNet RH/Temp Logger
Type DNL920
Serial Number: 814935

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: 2437 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
4880.00	H	37.4*	54.0	-16.6
4880.00	V	35.9*	54.0	-18.1

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	DataNet RH/Temp Logger
Type	DNL920
Serial Number:	814935

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 (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2483.50	H	60.4*	74.0	-13.6
2483.50	V	65.2*	74.0	-8.8
4950.00	H	55.8**	74.0	-18.2
4950.00	V	50.7**	74.0	-23.3

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 DataNet RH/Temp Logger
Type DNL920
Serial Number: 814935

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: 2462 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
2483.50	H	44.8*	54.0	-9.2
2483.50	V	45.5*	54.0	-8.5
4950.00	H	39.8**	54.0	-14.2
4950.00	V	28.7**	54.0	-25.3

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

10.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	November 17, 2008	1 year
RF Section	HP	85420E	3705A00248	November 16, 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
Antenna-Log Periodic	A.H.System	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 year
Horn Antenna	Narda	V637	0410	December 23, 2008	2 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 3, 2008	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 8, 2009	1 year
Low Noise Amplifier	MK Milliwave	MKT6-3000 400-30-13P	A0399	January 15, 2009	1 year
Spectrum Analyzer	HP	8546E	3442A00275	December 15, 2008	1 year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

11. Transmitted Power Density

[In accordance with section 15.247(d)]

11.1 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.

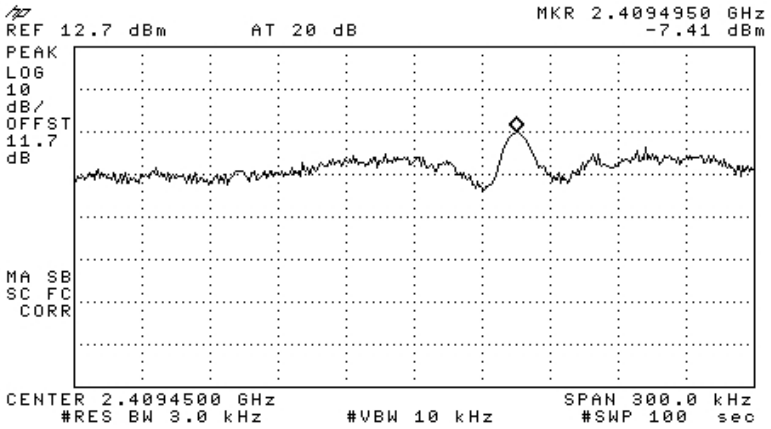


Figure 58 —2410 MHz

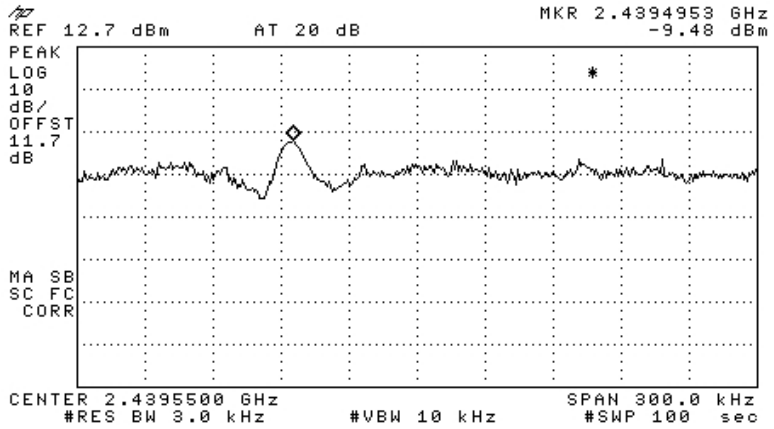


Figure 59 —2440 MHz

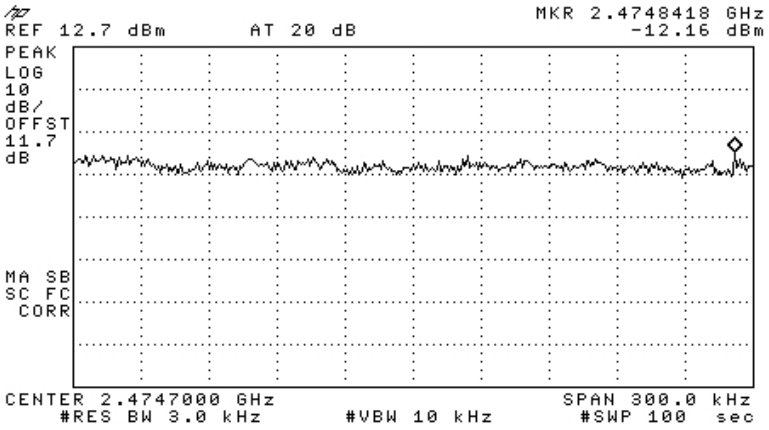


Figure 60 —2475 MHz

11.2 Results table

E.U.T. Description: DataNet RH/Temp Logger
Model No.: DNL920
Serial Number: 814935
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading Spectrum Analyzer (dBm)	Specification (dBm)	Margin (dB)
2410	-7.41	8.0	-15.41
2440	-9.48	8.0	-17.48
2475	-12.16	8.0	-20.16

Figure 61 Test Results

JUDGEMENT: Passed by 15.4 dB

TEST PERSONNEL:
Tester Signature: _____ Date: 20.08.09
Typed/Printed Name: A. Sharabi

11.3 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

12. Antenna Gain

The antenna gain is -2 dBi.

13. R.F Exposure/Safety Calculation

The E.U.T. is a wall mounted logger used for direct measurement and recording of PT-100, thermocouple (J, K, T), voltage, current, frequency, pulse and dry contact. 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 2.5mw (Peak)

G_T- Antenna Gain, -2 dBi = 0.63

R- Distance from Transmitter using 20cm worst case

(c) The peak power density is :

$$S_p = \frac{2.5 \times 0.63}{4\pi (20)^2} = 0.3 \times 10^{-3} \frac{mW}{cm^2}$$

(d) This is below the FCC limit.

14. APPENDIX A - CORRECTION FACTORS

14.1 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.6
30.0	0.8
40.0	0.9
50.0	1.1
60.0	1.2
70.0	1.3
80.0	1.4
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

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.3
1400.0	7.8
1600.0	8.4
1800.0	9.1
2000.0	9.9
2300.0	11.2
2600.0	12.2
2900.0	13.0

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".*

14.2 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.

14.3 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 38M3O.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".*

14.4 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".*

14.5 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".

14.6 Correction factors for Double-Ridged Waveguide Horn

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

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA 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			

14.7 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

14.8 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

14.9 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