



Electromagnetic Compatibility Test Report

Test Report No: MLM 090707

Issued on: July 09, 2007

Product Name

RF-Modem II

Model: CR011-2007

FCC ID: P29EDT88RFM20707

Tested According to

FCC 47 CFR, Part 15.231(e)

Tests Performed for

E-Drive Technology Ltd.

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1633.01

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QualiTech EMC Laboratory



1633.01

Accreditation/ Registration reference & Test Facility:

Accreditation/ Registration reference:

- A2LA Certificate Number: 1633.01

Test Facility description

The tests were performed at the EMC Laboratory, QualiTech Division, ECI Telecom Group

Address: 30, Hasivim St., Petah Tikva, Israel.
Tel: 972-3-926-8443

Test Report details:

Issued on: 09.07.2007

Assessment information:

This report contains an assessment of the EUT against Electromagnetic Compatibility based upon tests carried out on the samples submitted. The results contained in this report relate only to the items tested. Manufactured products will not necessarily give identical results due to production and measurement tolerances. QualiTech, EMC Lab does not assume responsibility for any conclusion and generalization drawn from the test results with regards to other specimens or samples of type of the equipment represented by test item.

The EUT was set up and exercised using the configuration, modes of operation and arrangements defined in this report only.

Modifications:

Modifications made to the EUT

None.

Modifications made to the Test Standard

None.

Summary of Compliance Status

Periodic operation in the band 40.66-40.70MHz and above 70MHz: FCC 47 CFR, Part 15.231(e)

Test Spec. Clause	Test Case	Remarks
§15.231(e)	Field strength of fundamental, Radiated	Pass
§15.231(e)	Field strength of the Spurious Emissions, Radiated	Pass
§15.205	Radiated Emissions, Restricted Bands	Pass
§15.231(c)	Emission Bandwidth	Pass
§15.231(e)	Duration of Transmission	Pass
§15.109	Radiated Emission (receive mode)	Pass
§15.107	Power Line Emission measurements	Pass
§15.203	Antenna Connector requirement	Pass



1633.01

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1. General Description

1.1. Description of the EUT /test Item:

Product name: RF-MODEM II

FCC ID: P29EDT88RFM20707

EUT Description

The RF-Modem-II is used as 433MHz transceiver for wireless communication data logger and control system.

The duration of each transmission is limited by the operating software to be less than 1 second, as well, the silent periods between transmissions is controlled by software to be at least 30 seconds.

The transmitter was provided with special operating software to continuously transmit during testing at almost 100% duty cycle.

2. Method of Measurements

2.1. Radiated Emissions Measurements in the restricted bands:

For radiated emissions, which fall in the restricted bands the spectrum from 30MHz to 12.7 GHz was investigated following the guidelines in ANSI C63.4-2003

Measurements were performed with peak detector and repeated averaged with VBW=10Hz for frequencies above 1GHz, and quasi-peak detector below 1GHz.

2.2. Radiated Field Strength and Emission BW Measurements:

During the testing process, the EUT was controlled via dedicated software. The EUT was operated at maximum power, continuous transmission and FSK data modulation.

The EUT was placed in a semi-anechoic chamber, on a non-metallic table/support, 0.8m above the turntable, at 3 meter from the receive antenna, and its position where the maximum antenna gain occurs was identified. The peak readings and duty cycle correction to convert to average readings of the emissions were measured and recorded. (Duty Cycle Correction = $20 \log(\text{effective on time} / 100\text{ms period})$, per §15.35).

2.3. Duration of Transmission, Emission BW, Conducted Measurement:

During the testing process, the EUT was controlled via dedicated software. The EUT was operated at maximum power, continuous transmission and FSK data modulation.

The transmitter output was connected to the Spectrum Analyzer via an RF attenuator, and peak output power was measured.

The duration of transmission was measured at the fundamental frequency at zero span. The Emission Bandwidth is determined at the 20dB down from the modulated carrier.

2.4. Radiated Emission measurements:

During the testing process, the EUT was controlled via dedicated software. The EUT was operated at in receive mode.

Measurements were performed at a 3-meter measurement distance in the semi-anechoic chamber in order to evaluate the radiated electromagnetic interference characteristics of the EUT. The EUT was placed on a non-metallic table/support, 0.8m above the turntable, was configured, arranged and operated in a manner consistent with typical application and load conditions.

An appropriate antenna depending upon the frequency range, per ANSI C63.4-2003 clause 4.1.5 was used. While the turntable was being rotated, the height of the antenna was varied from 1 to 4m for the frequency range of 30 MHz to 12.7 GHz. The highest radiated emission was detected by manipulating the system cables to the worst-case position. This process was repeated for both antenna polarizations. The amplitudes of worst-case emission were measured with the detector modes and resolution bandwidths over various frequency ranges according to the requirements of ANSI C63.4-2003 clause 4.2.

Since Quasi-Peak Detector requires long integration times, it is not practical to automatically sweep through the Quasi-Peak levels. Therefore, radiated emissions from the test item were first scanned using a Peak Detector and automatically plotted. The frequencies where significant emission levels were noted were then re-measured using the Quasi-Peak and Average Detectors.

2.5. Power line Emission measurements:

The EUT was placed on a non-conductive table/support 80 cm above the reference ground plane. The EUT was configured in accordance with ANSI C63.4-2003 using a 50 μ H/50 ohm LISN.

Compliance with the provisions was based on the measurements of the radio frequency voltage between each line and the ground at the power terminal.

3. Report of Measurements and examinations

3.1. Field Strength of Fundamental

Reference document:	47 CFR §15.231(e)																							
Test Requirements:	Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:																							
	<table><tr><th>Funda-mental fre-quency (MHz)</th><th>Field strength of fun-damental (microvolts/ meter)</th><th>Field strength of spu-rious emission (microvolts/meter)</th></tr><tr><td>40.66–40.70.</td><td>1,000</td><td>100</td></tr><tr><td>70–130</td><td>500</td><td>50</td></tr><tr><td>130–174</td><td>500 to 1,500¹</td><td>50 to 150¹</td></tr><tr><td>174–260</td><td>1,500</td><td>150</td></tr><tr><td>260–470</td><td>1,500 to 5,000¹</td><td>150 to 500¹</td></tr><tr><td>Above 470</td><td>5,000</td><td>500</td></tr></table>			Funda-mental fre-quency (MHz)	Field strength of fun-damental (microvolts/ meter)	Field strength of spu-rious emission (microvolts/meter)	40.66–40.70.	1,000	100	70–130	500	50	130–174	500 to 1,500 ¹	50 to 150 ¹	174–260	1,500	150	260–470	1,500 to 5,000 ¹	150 to 500 ¹	Above 470	5,000	500
	Funda-mental fre-quency (MHz)	Field strength of fun-damental (microvolts/ meter)	Field strength of spu-rious emission (microvolts/meter)																					
	40.66–40.70.	1,000	100																					
	70–130	500	50																					
130–174	500 to 1,500 ¹	50 to 150 ¹																						
174–260	1,500	150																						
260–470	1,500 to 5,000 ¹	150 to 500 ¹																						
Above 470	5,000	500																						
¹ Linear interpolations.																								
Test setup:	See Sec. 2.2	Pass																						
Operating conditions:	Under normal test conditions																							
Method of testing:	Radiated																							
S.A. Settings:	RBW: 120kHz, VBW: 300kHz																							
Environment conditions:	Ambient Temperature: 22°C	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa																					
Test Result:	See below	Plot 3.1																						

Test results:

Frequency [MHz]	Measured field Strength, Peak Value at 3m [dBμV/m]	Calculated field Strength limit at 3m [μV/m]	Calculated field Strength limit at 3m [dBμV/m]	Margin [dB]	Result
433.9300	65.64	4399*	72.87	-7.23	Pass

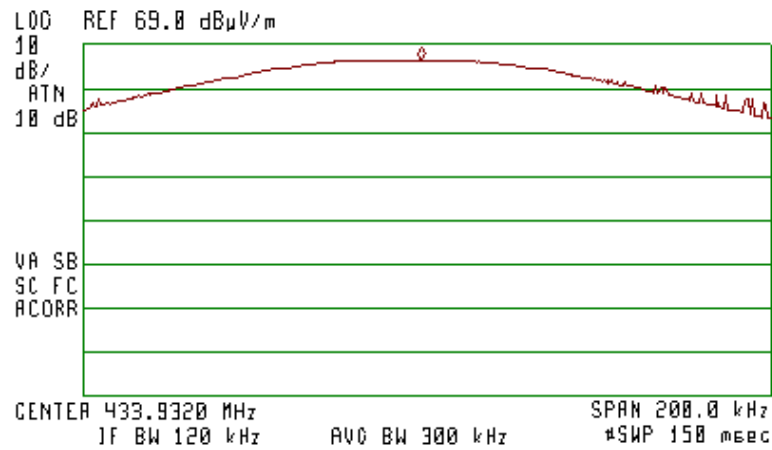
* Since peak reading of the field strength of the emission demonstrates compliance with the limit, duty-cycle correction was not necessary.

Note: Radiated Emission [dBμV/m] = measured [dBμV] + Correction-factor [dB(1/m)]
Correction Factor = Antenna factor + Cable Loss

Plot 3.1



ACTV DET: PEAK
MEAS DET: PEAK OP AVG
NKR 433.9300 MHz
65.64 dB μ V/m



3.2. Field Strength of Spurious Emission

Reference document:	47 CFR §15.231(e)																							
Test Requirements:	Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:																							
	<table><tr><th>Funda-mental fre-quency (MHz)</th><th>Field strength of fun-damental (microvolts/ meter)</th><th>Field strength of spu-rious emission (microvolts/meter)</th></tr><tr><td>40.66–40.70</td><td>1,000</td><td>100</td></tr><tr><td>70–130</td><td>500</td><td>50</td></tr><tr><td>130–174</td><td>500 to 1,500 ¹</td><td>50 to 150 ¹</td></tr><tr><td>174–260</td><td>1,500</td><td>150</td></tr><tr><td>260–470</td><td>1,500 to 5,000 ¹</td><td>150 to 500 ¹</td></tr><tr><td>Above 470</td><td>5,000</td><td>500</td></tr></table>			Funda-mental fre-quency (MHz)	Field strength of fun-damental (microvolts/ meter)	Field strength of spu-rious emission (microvolts/meter)	40.66–40.70	1,000	100	70–130	500	50	130–174	500 to 1,500 ¹	50 to 150 ¹	174–260	1,500	150	260–470	1,500 to 5,000 ¹	150 to 500 ¹	Above 470	5,000	500
	Funda-mental fre-quency (MHz)	Field strength of fun-damental (microvolts/ meter)	Field strength of spu-rious emission (microvolts/meter)																					
	40.66–40.70	1,000	100																					
	70–130	500	50																					
130–174	500 to 1,500 ¹	50 to 150 ¹																						
174–260	1,500	150																						
260–470	1,500 to 5,000 ¹	150 to 500 ¹																						
Above 470	5,000	500																						
	¹ Linear interpolations.																							
Test setup:	See Sec. 2.1	Pass																						
Operating conditions:	Under normal test conditions																							
Method of testing:	Radiated																							
S.A. Settings:	f <1GHz: RBW: 120kHz,VBW: 1MHz f >1GHz: RBW: 1MHz, VBW: 3MH																							
Environment conditions:	Ambient Temperature: 22°C	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa																					
Test Result:	See below	Plot 3.2.1 & 3.2.2																						

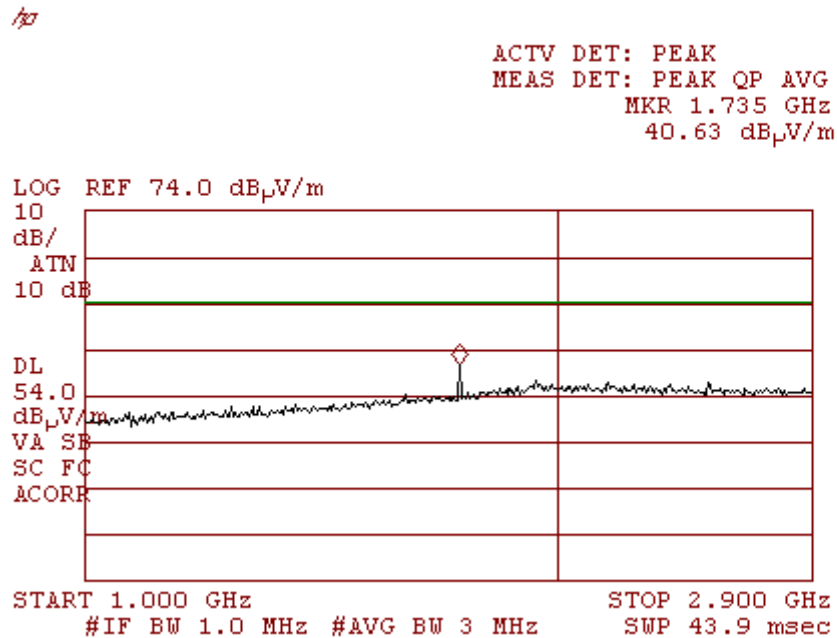
Test results:

Frequency [MHz]	Detector type	Max. Emission at 3m [dBμV/m]	Limit [dBμV/m]	Reference	Result
1735	Peak	43.16	54	Plot 3.2.1 & 3.2.2	Pass

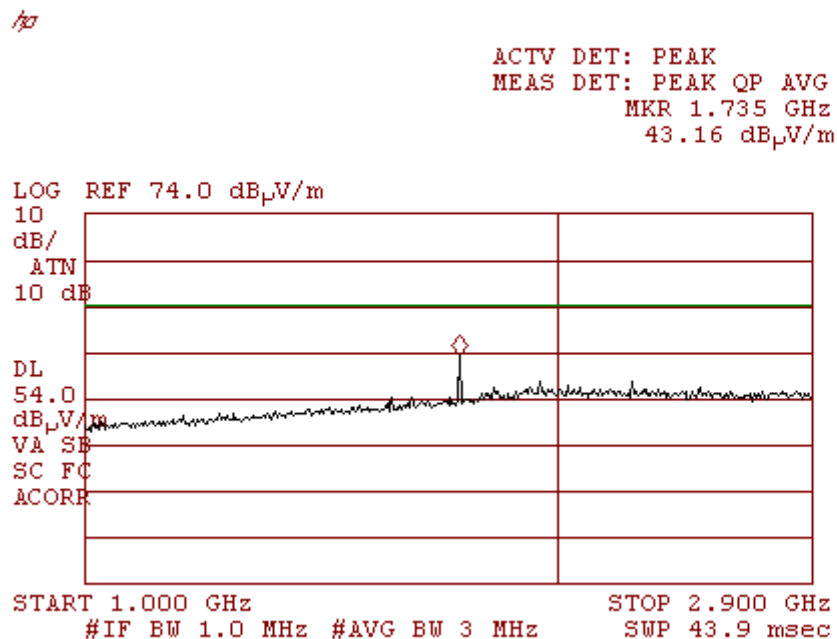
* Since peak reading of the field strength of the emission demonstrates compliance with the limit, duty-cycle correction was not necessary.

Note: Radiated Emission [dBμV/m] = measured [dBμV] + Correction-factor [dB(1/m)]
Correction Factor = Antenna factor + Cable Loss

Horizontal Polarization Plot 3.2.1



Vertical Polarization Plot 3.2.2



3.3. Radiated Emissions, Restricted Bands

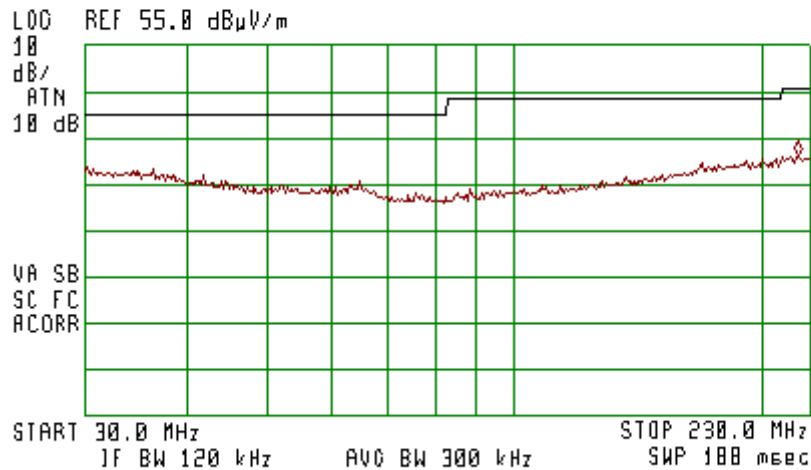
Reference document:	47 CFR §15.205		
Test Requirements:	Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a) (See section 15.205(c).		
Test setup:	See Sec. 2.1	Pass	
Operating conditions:	Under normal test conditions		
Method of testing:	Radiated		
S.A. Settings:	f <1GHz: RBW: 120kHz, VBW: 1MHz f >1GHz: RBW: 1MHz, VBW: 3MH		
Environment conditions:	Ambient Temperature: 22°C	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	In restricted bands: no peaks found. .	See Plot 3.3.1 to Plot 3.3.10	

Note: Radiated Emission [dBμV/m] = measured [dBμV] + Correction-factor [dB(1/m)]
Correction Factor = Antenna factor + Cable Loss

Vertical Polarization
Plot 3.3.1



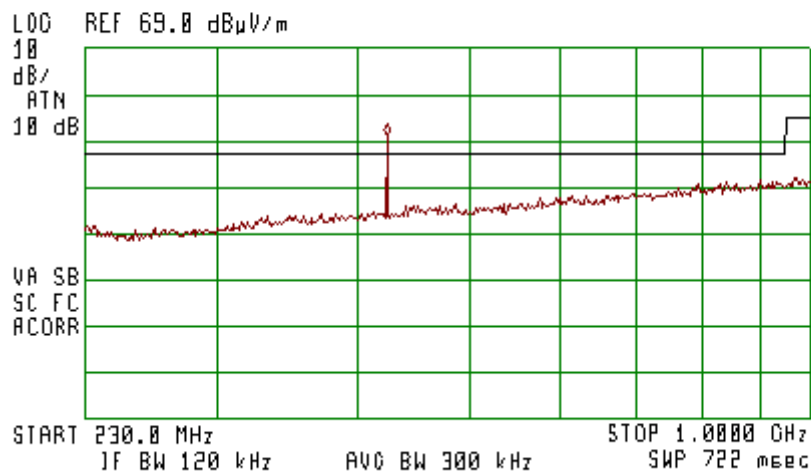
ACTV DET: PEAK
MEAS DET: PEAK OP AVG
Mkr 224.0 MHz
31.44 dB μ V/m



Vertical Polarization
Plot 3.3.2



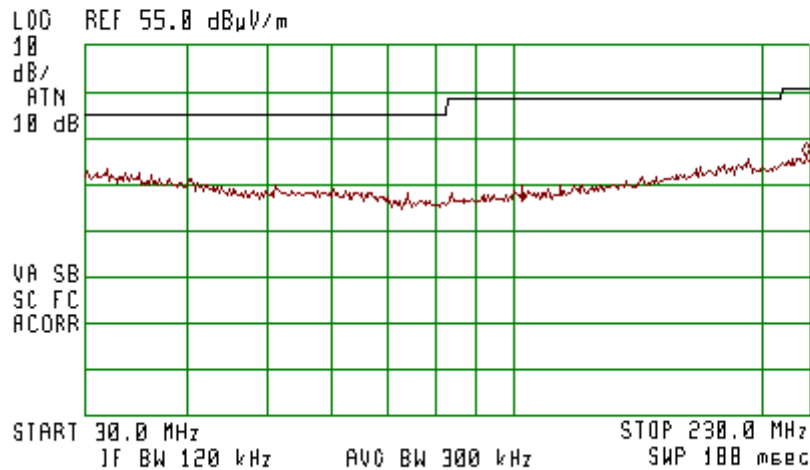
ACTV DET: PEAK
MEAS DET: PEAK OP AVG
Mkr 432.9 MHz
50.13 dB μ V/m



Horizontal Polarization
Plot 3.3.3



ACTV DET: PEAK
MEAS DET: PEAK OP AVG
Mkr 227.4 MHz
31.06 dB μ V/m

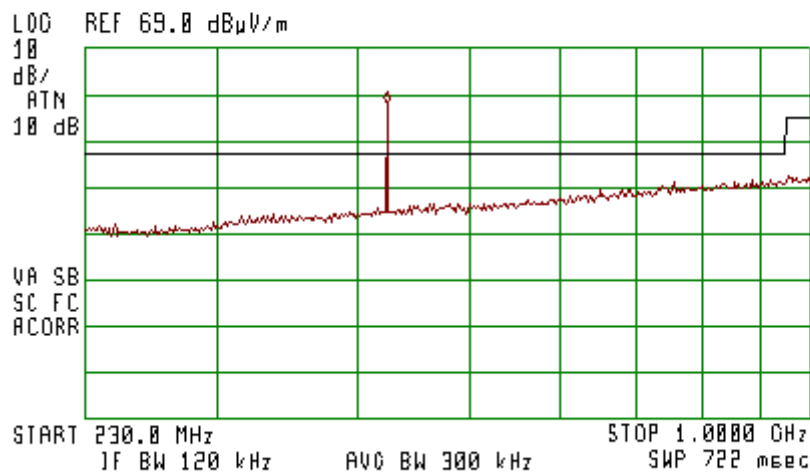


Horizontal Polarization
Plot 3.3.4

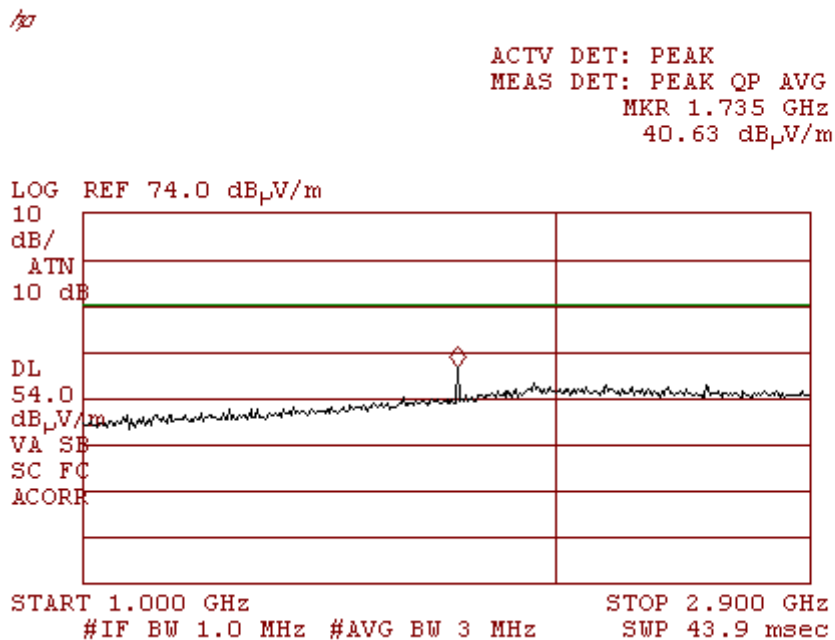


RE CLASS B 16:00:35 JAN 16, 2002

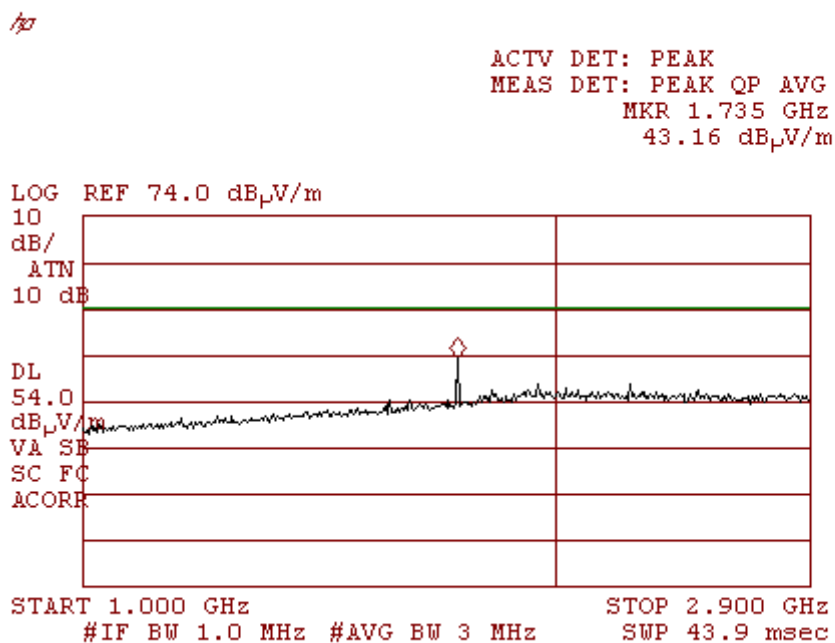
ACTV DET: PEAK
MEAS DET: PEAK OP AVG
Mkr 432.9 MHz
56.88 dB μ V/m



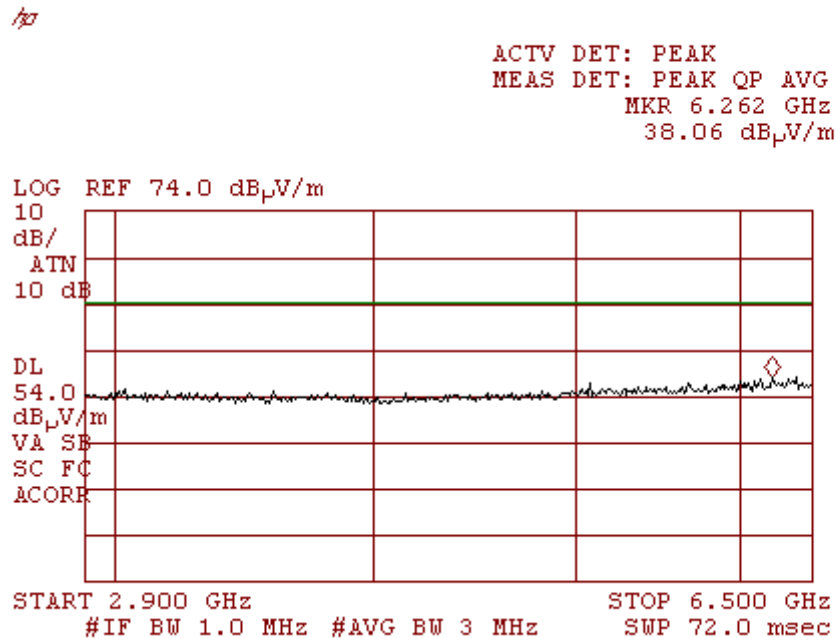
Horizontal Polarization
Plot 3.3.5



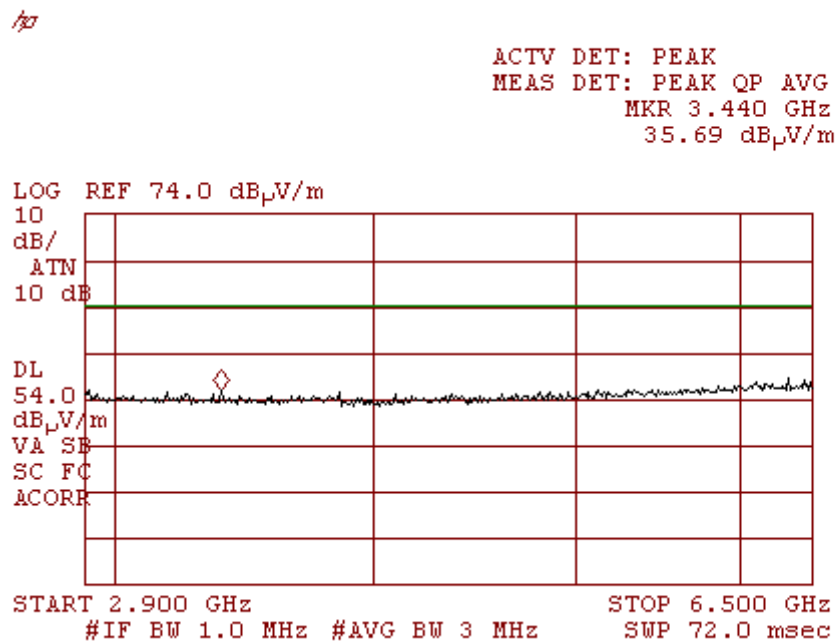
Vertical Polarization
Plot 3.3.6



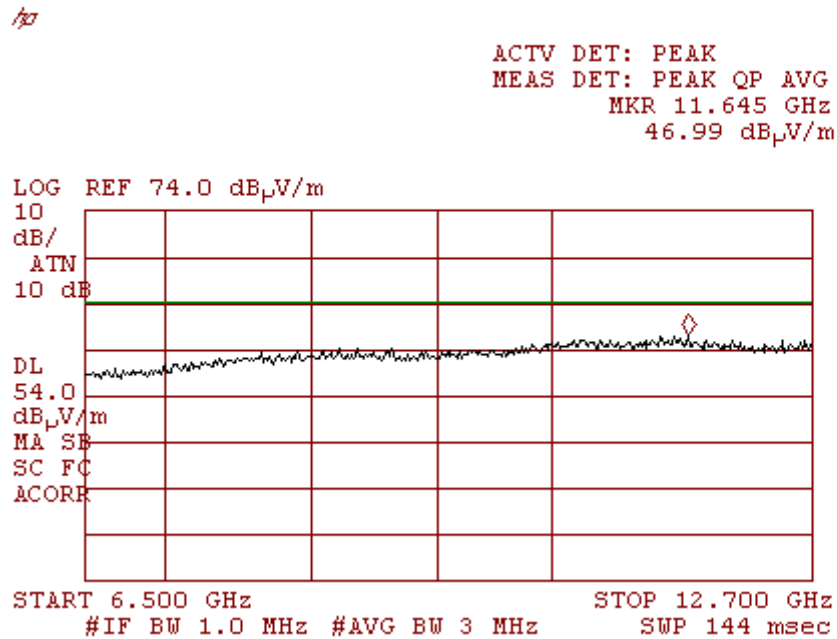
Horizontal Polarization
Plot 3.3.7



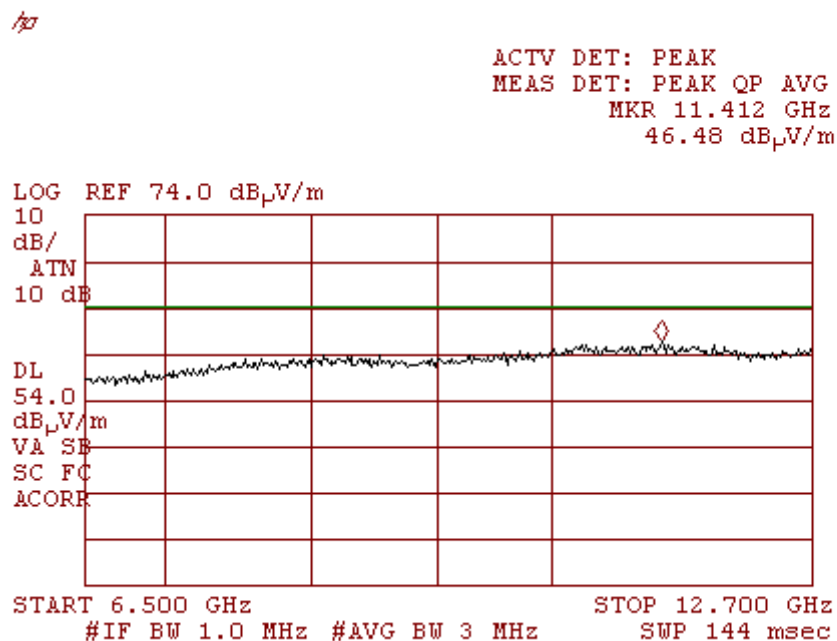
Vertical Polarization
Plot 3.3.8



Horizontal Polarization
Plot 3.3.9



Vertical Polarization
Plot 3.3.10



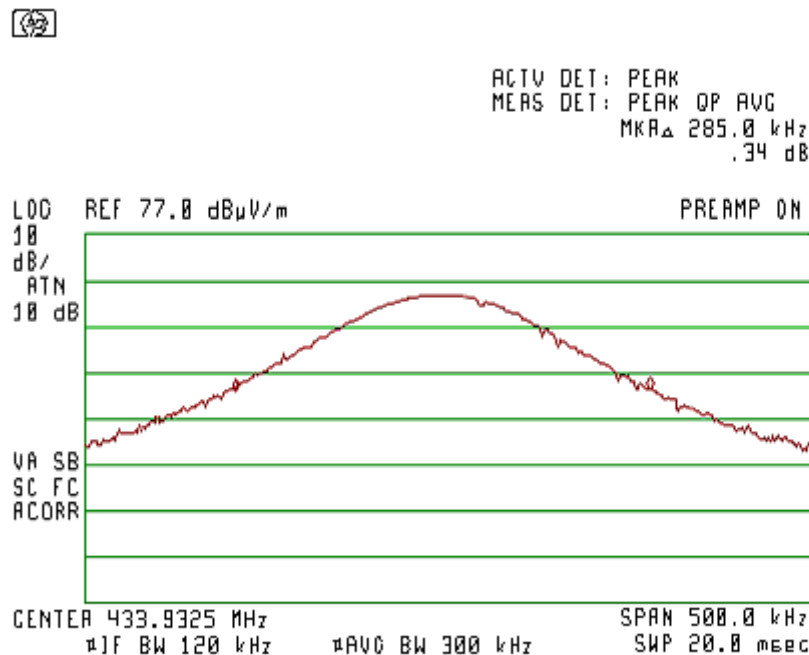
3.4. Emission bandwidth

Reference document:	47 CFR §15.231(c)		
Test Requirements:	The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900MHz. Bandwidth is determined at the 20dB down from the modulated carrier.		
Test setup:	See Sec. 2.2	Pass	
Operating conditions:	Under normal test conditions		
Method of testing:	Radiated		
S.A. Settings:	RBW: 120kHz, VBW: 300kHz		
Environment conditions:	Ambient Temperature: 22°C	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	Plot 3.4	

Test results:

20dB BW [kHz]	Center frequency [MHz]	0.25% of Center frequency [kHz]	Result
285	433.92	1085	Pass

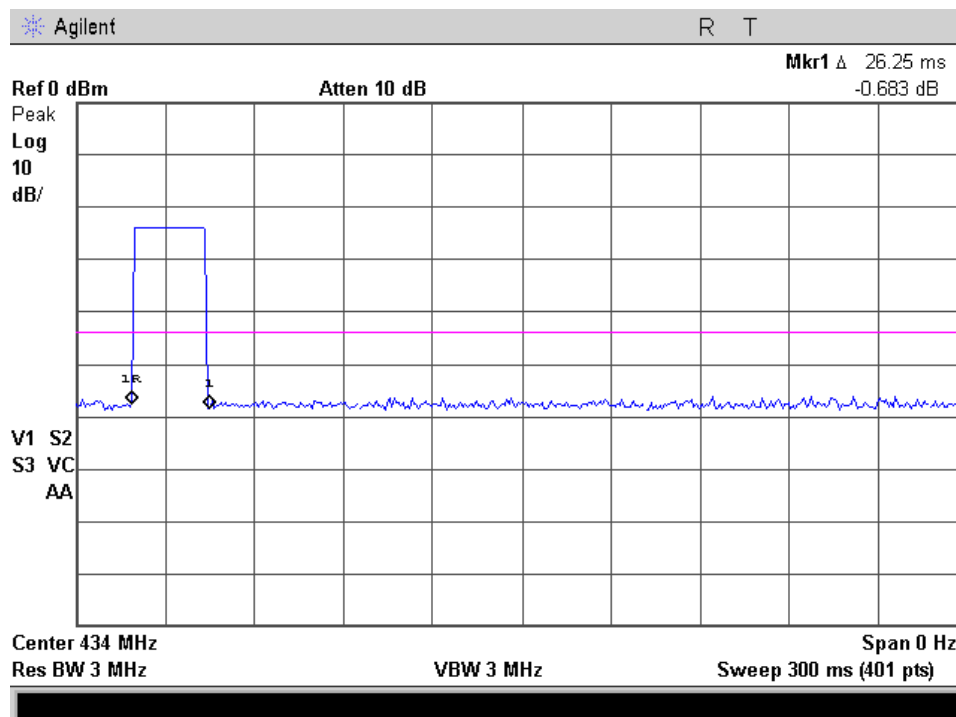
Plot 3.4



3.5. Duration of Transmission

Reference document:	47 CFR §15.231(e)		
Test Requirements:	Devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.		
Test setup:	See Sec. 2.3	Pass	
Operating conditions:	Under normal test conditions		
Method of testing:	Conducted		
S.A. Settings:	RBW: 3MHz, VBW: 3MHz, Span: 0		
Environment conditions:	Ambient Temperature: 22°C	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	26.25ms < limit of 1second	See Plot 3.5	

Plot 3.5

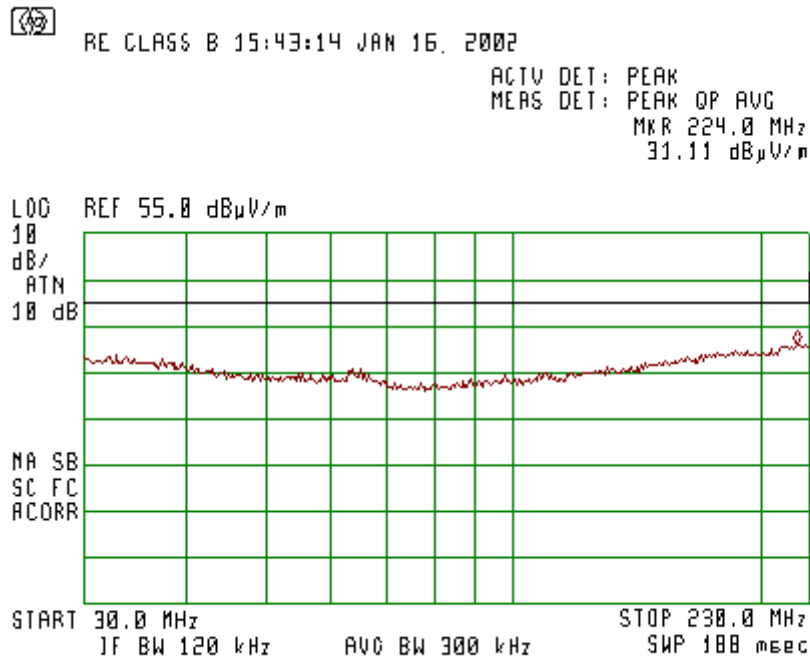


3.6. Radiated Emission- (Receive mode)

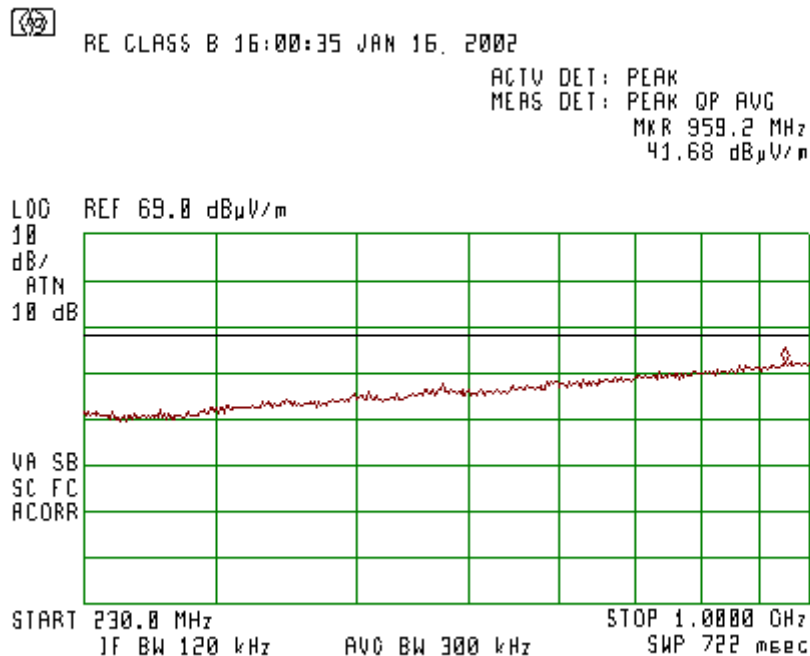
Reference document:	47 CFR §15.109		
Test Requirements:	Emission Level shall not exceed §15.109 limits		
Test setup:	See Sec. 2.4	Pass	
Operating conditions:	Under normal test conditions		
Method of testing:	Radiated		
S.A. Settings:	F <1GHz: RBW: 120kHz,VBW: 1MHz		
Mode of operation:	Receive		
Environment conditions:	Ambient Temperature: 22°C	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	All readings were at least 10 db below the limit	Plot 3.6.1 to Plot 3.6.4	

Note: Radiated Emission [dBμV/m] = measured [dBμV] + Correction-factor [dB(1/m)]
Correction Factor = Antenna factor + Cable Loss

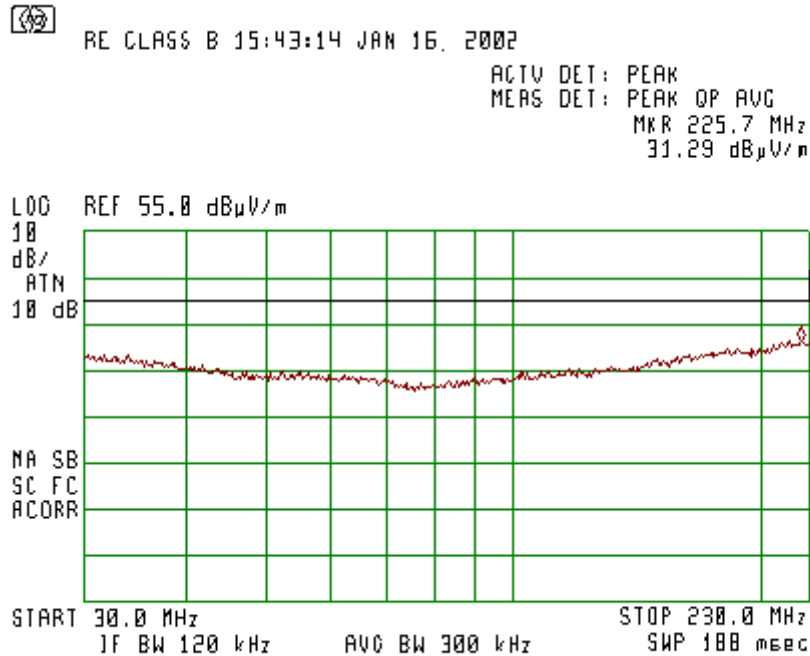
Vertical Polarization
Plot 3.6.1



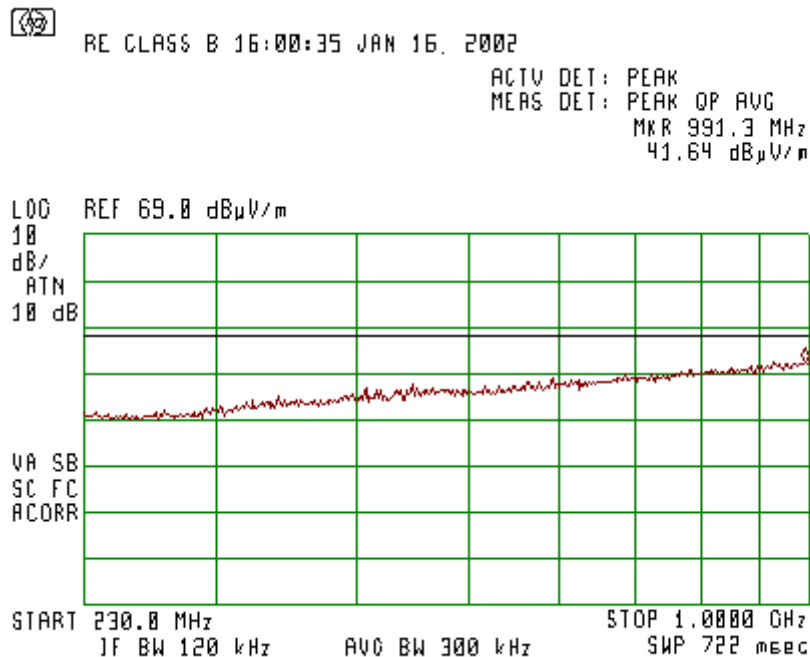
Vertical Polarization
Plot 3.6.2



Horizontal Polarization
Plot 3.6.3



Horizontal Polarization
Plot 3.6.4



3.7. Power line Emission measurements

Reference document:	47 CFR §15.107		
Test Requirements:	The radio frequency voltage that is conducted back onto the AC power line shall not exceed the limits specified in §15.107 & §15.207		
Test setup:	See Sec. 2.5	Pass	
Operating conditions:	Under normal test conditions		
Method of testing:	Conducted		
S.A. Settings:	f <30MHz: RBW: 9kHz, VBW:30kHz		
Environment conditions:	Ambient Temperature: 22°C	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	See Plots 3.7.1 – 3.7.2	

Test Results:

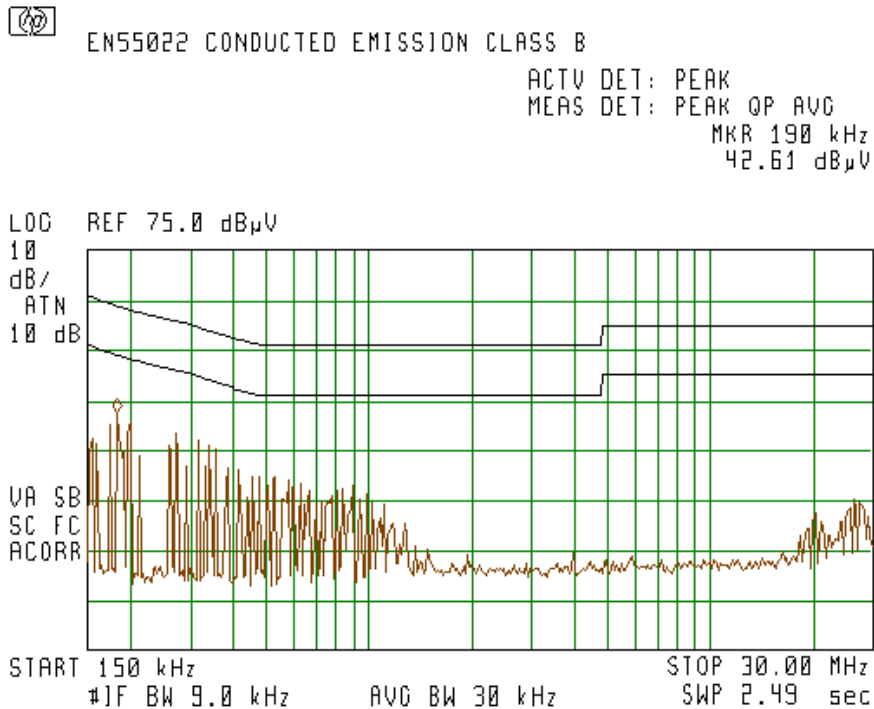
“Phase” Lead, 110VAC

Frequency [MHz]	Measured Result [dBμV]		Class B Limits [dBμV]		Margin [dB]		Pass/Fail
	QP	AVR	QP	AVR	QP	AVR	
0.153527	31.2	2.6	65.81	55.81	-34.61	-53.21	Pass
0.476065	25.3	-2.3	56.41	46.41	-31.11	-48.71	Pass
0.540891	24.9	-3.7	56.00	46.00	-31.10	-49.70	Pass
1.021075	7	0.4	56.00	46.00	-49.00	-45.60	Pass
26.971665	23.8	22.8	60.00	50.00	-36.20	-27.20	Pass
28.18	24.6	23.8	60.00	50.00	-35.40	-26.20	Pass

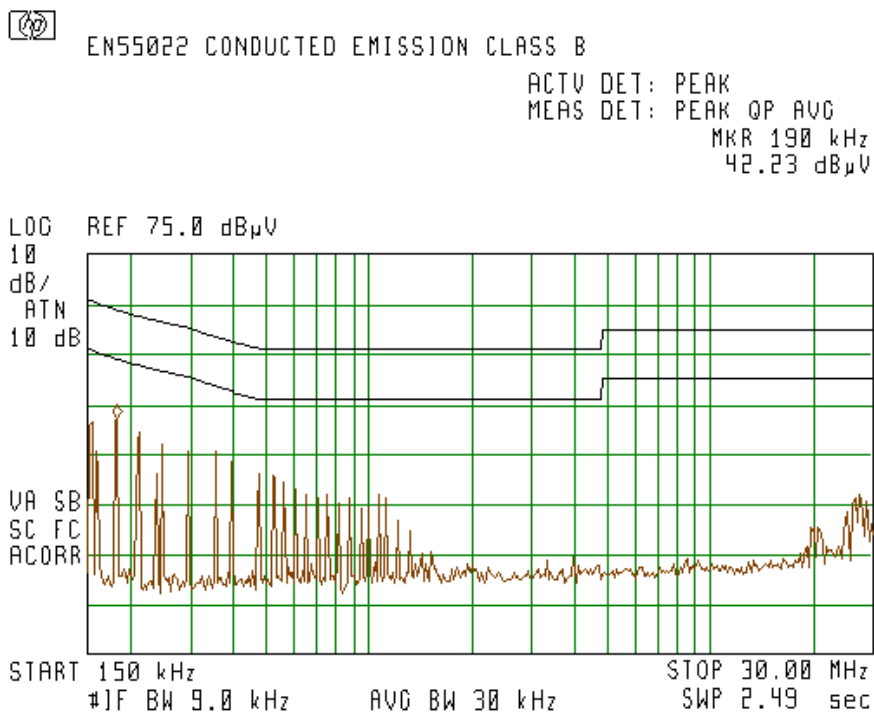
“Neutral” Lead, 110VAC

Frequency [MHz]	Measured Result [dBμV]		Class B Limits [dBμV]		Margin [dB]		Pass/Fail
	QP	AVR	QP	AVR	QP	AVR	
0.153527	35.8	-4.9	65.81	55.81	-30.01	-60.71	Pass
0.476065	20	-5.4	56.41	46.41	-36.41	-51.81	Pass
0.540891	18.9	0.1	56.00	46.00	-37.10	-45.90	Pass
1.021075	21.4	-0.8	56.00	46.00	-34.60	-46.80	Pass
26.971665	8.2	1.9	60.00	50.00	-51.80	-48.10	Pass
27.73	26.4	25.9	60.00	50.00	-33.60	-24.10	Pass

Plot 3.7.1
"Phase" Lead



Plot 3.7.2
"Neutral" Lead



3.8. Antenna Connector Requirements

Reference document:	47 CFR §15.203	
Test Requirements:	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with provisions of this section.	
Test Result:	The RF MODEM II employs a soldered connector.	Comply

4. Appendix

Appendix A: List of Measuring Equipment used:

Equipment	Manufacturer/ Model	Serial Number	Due date
CISPR16 EMI Receiver	HP8546A	3710A00392	30.06.2008
Spectrum Analyzer 9kHz ÷ 22 GHz	HP 8593EM	3536A00131	30.06.2008
Spectrum Analyzer 100 Hz ÷ 26.5 GHz	Agilent E7405A	US41160436	30.06.2008
LNA Amplifier 1 GHz ÷ 18 GHz	AMP – 5D-010180-30-10P-GW	618653	01.01.2008
Dual Ridged Guide Ant.1-18 GHz	EMCO 3115	9602-4677	01.01.2008
Antenna 18 GHz ÷ 26.5 GHz	Alpha Industry 861A/599	505	01.01.2008
Turn table	HD100	100/693	-
Antenna Mast	HD 100	100/693	-
Biconical 20 –200 MHz	Schwarzbeck VHBB9124	9124/0255	30.06.2008
Log-Periodic 200 – 1000 MHz	Schwarzbeck VUSLP9111	VUSLP9111184	30.06.2008
Pre-Amplifier	MiTeq, AMF-5F-18002650-30-10P	945372	01.01.2008
LISN	Fischer 50/250-25-2	-	30.06.2008
Transient Limiter	HP11947A	-	30.06.2008
Notch Filter	Micro-Tronics BRM50702-05	0001	01.01.2008
Antenna 15G-40 GHz	Schwarzbeck BBHA 9170	BBHA9170214	01.01.2008
High pass Filter	Wainwright WHK 1.2/15G-10EF	3	30.06.2008
High pass Filter	Wainwright WHK2.4/18G-10EF	1	30.06.2008
Oven	Tenneg Ten	10.158-5	30.06.2008
LISN	Fischer 50/250-25-2	-	30.06.2008
Transient Limiter	HP11947A	-	30.06.2008

Appendix B: Accreditation Certificate



End of the Test Report