TEST REPORT

Report Number: 3139455LAX-002
Project Number: 3139455
November 27, 2007

Testing performed on the
Insteon Thermostat RF Adapter
Model: 2441V

to

FCC Part 15.249
RSS-210 Part A2.9

For
SmartHome, Inc.

ACCREDITED

A2LA Certificate Number: 2085.01

Test Performed by:	Test Authorized by:
Intertek	SmartHome, Inc.
27611 La Paz Rd., Suite C	16542 Millikan Ave.
Laguna Niguel, CA 92677	Irvine, CA 92606

Prepared by: _____ Date: 11/27/07
Sergey Marker

Reviewed by: _____ Date: 11/27/07
Ollie Moyrong

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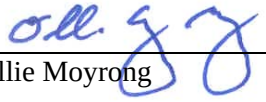
1.0 Summary of Test Results

Test	Reference FCC Subpart C	Reference IC	RESULTS
Field Strength of fundamental	15.249a	RSS-210 A2.9(1)	Complies
Field Strength of harmonics	15.249a	RSS-210 A2.9(1)	Complies
Radiated emissions outside the band, except harmonics.	15.249c	RSS-210 A2.9(2)	Complies
Antenna requirement	15.203	RSS-Gen	Complies
Line Conducted Emissions (transmitter mode)	15.207	RSS-Gen	Complies
Line Conducted Emissions (receiver mode)	15.107	ICES-003	Complies
Radiated Emission from Digital Parts and receiver	15.209	ICES-003	Complies
Occupied Bandwidth	2.1049	RSS-Gen	Complies

We confirm that the product tested and our review of the above numbered report without reasonable doubt will fulfill the requirements concerning electromagnetic compatibility according to the above-mentioned standard.

EMC Department
Date of issue: November 20, 2007

Test Engineer: 
Sergey Marker

Reviewing Engineer: 
Ollie Moyrong

2.0 General Description

2.1 Product Description

EQUIPMENT UNDER TEST

Type of equipment	Insteon Thermostat RF Adapter	
Type/Model	2441V	
EUT description	Range:	150 ft.
	Frequency:	915 MHz
	RF Power:	-2.0 dBm
	Modulation:	FSK
	Supply voltage, wattage:	24 VAC, 500 mA
	Antenna:	Integrated on PCB
Manufacturer	SmartHome, Inc. 16542 Millikan Ave. Irvine, CA 92606	
Tested by request of	Mr. Dan Cregg Phone: (949) 221-9200 Fax: (949) 221-0368	
Standards:	FCC Part 15.249 RSS-210 part A2.9	
Test Report No.	3139455LAX-002	
FCC ID:		
IC ID:		

2.2 Related Submittal(s) Grants

This report is for use with an application for certification of a low power transmitter. One transmitter is included in the application. This specific report details the emission characteristics of transmitter.

2.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4 (2003). Radiated emission measurements were performed in Semi Anechoic 10 m Chamber. All Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

2.4 Test Facility

The 10 m Semi Anechoic Chamber and conducted measurement facility used to collect the radiated data is Site 1. This test facility and site measurement data have been fully placed on file with the FCC, Industry of Canada and A2LA accredited.

Test Facility:	Intertek ETL Semko 27611 La Paz Rd., Suite C Laguna Niguel, CA 92677	
Accreditations:	FCC	Registration Number 90711
	A2LA	Certificate Number 2085.01
	IC	Registration Number 2055D-1

3.0 System Test Configuration

3.1 Justification

For emission testing, the equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

For the measurements, the EUT is attached to a cardboard box (if necessary) and placed on the plastic turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

3.2 EUT Exercising Software

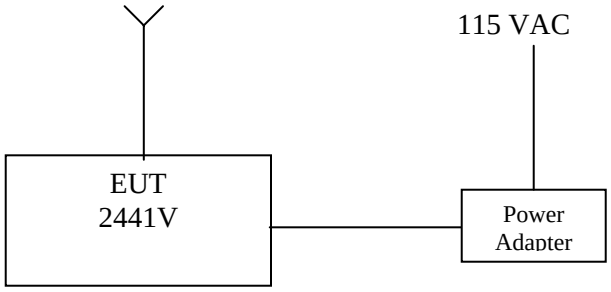
No software was required to exercise the EUT.

3.3 System Test Configuration

3.3.1 Support Equipment

No support equipment was required to operate the EUT.

3.3.2 Block Diagram of Test Setup



S:	Shielded	**U:**	Unshielded	**F:**	With Ferrite Core

EUT					
Equip.#	**Equipment**	**Manufacturer**	**Model #**	**S/N #**	**FCC ID**
	Thermostat RF Adapter	Smarthome	2441V	N/A	SBP2441V
	Power Adapter	Made in China	p/n 224054	N/A	N/A

Support Equipment					
Equip.#	**Equipment**	**Manufacturer**	**Model #**	**S/N #**	**FCC ID**
None					

3.4 Equipment Modification

None

3.5 Mode(s) of operation

The EUT was powered from 115 VAC power line. The EUT utilizes Frequency Shift Keyed (FSK) modulation in normal operation. During the tests EUT was wired to operate at continuous transmitting mode (CW).

4.0 Field Strength of Emission

4.1 Field Strength of Fundamental and Harmonics.

Parameter:	FCC 15.249a
Requirement:	FCC 15.249a
Fundamental: **Harmonics:**	Limit 94 dBµV Limit 54 dBµV

4.1.1 Test Procedure

For the measurements, the EUT is attached to a cardboard box (if necessary) and placed on the plastic table which is 0.8 m above the ground plane on the Open Area Test Site. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power in CW mode.
The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Radiated emission measurements were performed from 30 MHz to the 10th harmonic of transmitter frequency. Analyzer resolution is 120 KHz for 30 to 1000 MHz, 1 MHz for >1000 MHz.
This test was performed per test procedure specified in ANSI C63.4 (2003).

4.1.2 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with antennas, cables, preamplifiers (if any) and average factors (when specified limits is in average and measurements are made with peak detectors) The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG + AV

where FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB/m
AG = Amplifier Gain in dB
AV = Average Factor in (-dB)

Assume a receiver reading of 52.0 dB(µV) is obtained. The antenna factor of 7.4 dB/m ,cable factor of 4.6 dB and average factor of -5.1dB are added. The amplifier gain of 27 dB is subtracted, giving a field strength of 32 dB(µV/m).

RA = 52 dB(µV) CF = 1.6 dB AV = -5.1 dB
AF = 7.4 dB/m AG = 29 dB FS = 52 + 7.4 + 4.7 – 27 – 5.1 = 32 dB(µV/m)

This value in dB(μV/m) was converted to its corresponding level in μV/m.
Level in μV/m = Common Antilogarithm {[32 dB(μV/m)]/20} = 39.8 μV/m
Note: In the following table(s), the level shown on the data table includes the antenna factor, cable factor and preamplifier gain.

4.1.3 Radiated Emission Data

Mode: Trx
Distance: 3 m
EUT Orientation: Vertical

Frequency	Detector	Vertical level	Horizontal level	D.C.F.	Limit	Margin
MHz		(dBuV/m)	(dBuV/m)	dB	(dBuV/m)	(dB)
915	Q.Peak	76.5	76.8	0.0	94	-17.2
1830	Peak	50.4	54.2	0.0	74.0	-19.8
**1830	Ave	47.1	51.9	0.0	54.0	-2.1
*2745	Peak	45.0	44.5	0.0	74.0	-29
*2745	Ave.	32.2	32.2	0.0	54.0	-21.8
*3660	Peak	46.6	46.3	0.0	74.0	-27.4
*2660	Ave.	34.7	34.6	0.0	54.0	-19.3
*4575	Peak	48.0	48.1	0.0	74.0	-25.9
*4575	Ave.	35.1	35.2	0.0	54.0	-18.8
*5490	Peak	48.8	48.9	0.0	74.0	-25.1
*5490	Ave.	36.2	36.3	0.0	54.0	-17.7
*6405	Peak	48.9	49.2	0.0	74.0	-24.8
*6405	Ave.	36.3	36.5	0.0	54.0	-17.5
*7320	Peak	49.2	49.8	0.0	74.0	-24.2
*7320	Ave.	37.0	37.2	0.0	54.0	-16.8
*8235	Peak	49.6	50.1	0.0	74.0	-23.9
*8235	Ave.	37.8	38.0	0.0	54.0	-16.0
*9130	Peak	51.5	52.0	0.0	74.0	-22.0
*9150	Ave.	39.1	39.8	0.0	54.0	-14.2

EUT Orientation: Horizontal

Frequency	Detector	Vertical level	Horizontal level	D.C.F.	Limit	Margin
MHz		(dBuV/m)	(dBuV/m)	dB	(dBuV/m)	(dB)
915	Q.Peak	74.2	83.1	0.0	94	-10.9
1830	Peak	51.2	54.6	0.0	74.0	-19.4
**1830	Ave	47.2	52.0	0.0	54.0	-2.0
*2745	Peak	44.6	44.3	0.0	74.0	-29.4
*2745	Ave.	32.3	32.7	0.0	54.0	-21.3
*3660	Peak	46.6	46.3	0.0	74.0	-27.4
*2660	Ave.	34.7	34.6	0.0	54.0	-19.3
*4575	Peak	48.0	48.1	0.0	74.0	-25.9
*4575	Ave.	35.1	35.2	0.0	54.0	-18.8
*5490	Peak	48.8	48.9	0.0	74.0	-25.1
*5490	Ave.	36.2	36.3	0.0	54.0	-17.7
*6405	Peak	48.9	49.2	0.0	74.0	-24.8

*6405	Ave.	36.3	36.5	0.0	54.0	-17.5
*7320	Peak	49.2	49.8	0.0	74.0	-24.2
*7320	Ave.	37.0	37.2	0.0	54.0	-16.8
*8235	Peak	49.6	50.1	0.0	74.0	-23.9
*8235	Ave.	37.8	38.0	0.0	54.0	-16.0
*9130	Peak	51.5	52.0	0.0	74.0	-22.0
*9150	Ave.	39.1	39.8	0.0	54.0	-14.2

Notes:

a) The field strength shown in the table (Vertical and Horizontal levels) included Antenna factor, Cable loss and Pre-amplifier Gain (if applicable).

b) Negative signs (-) in Margin column signify levels below the limits.

c) For frequencies below 1000 MHz the, above limits are based on quasi-peak limits.
Analyzer setting: RBW =120 KHz, VBW =300 KHz

d) For frequencies above 1000 MHz the, above limits are based on average limits.

e) Peak measurement shown for the compliance with 15.35b (peak measurements of emission shall not exceed the average limits specified above by more than 20 dB).
Analyzer setting: RBW =1 MHz, VBW =1 MHz

f) * All emissions are below the equipment noise floor which is at least 6 dB below the limits.

h) D.C.F: Distance Correction Factor.

Test Result	**Passed with 2 dB margin at 1830 MHz.** ****** The measurement result is below the specification limit by a margin less than the measurement uncertainty; it is not therefore possible to determine compliance at a level of confidence of 95%. However, the measured result indicates a high probability that the product tested complies with the specification limit

4.2 Radiated Emission from Digital Parts and Receiver

Parameter:	FCC 15.109
Requirement:	FCC 15.109, class B
0.009 – 0.490	2400/F (kHz) (µV/m) @ 300 m
0.490 – 1.705	2400/F (kHz) (µV/m) @ 30 m
1.705 – 30.0	29.5 dBµV @ 30 m
30-88 MHz	40 dBµ @ 3 m
88-216 MHz	43.5 dBµV @ 3 m
216-960 MHz	46 dBµV @ 3 m
Above 960 MHz	54 dBµV @ 3 m

4.2.1 Test Procedure

See section 4.1.1.

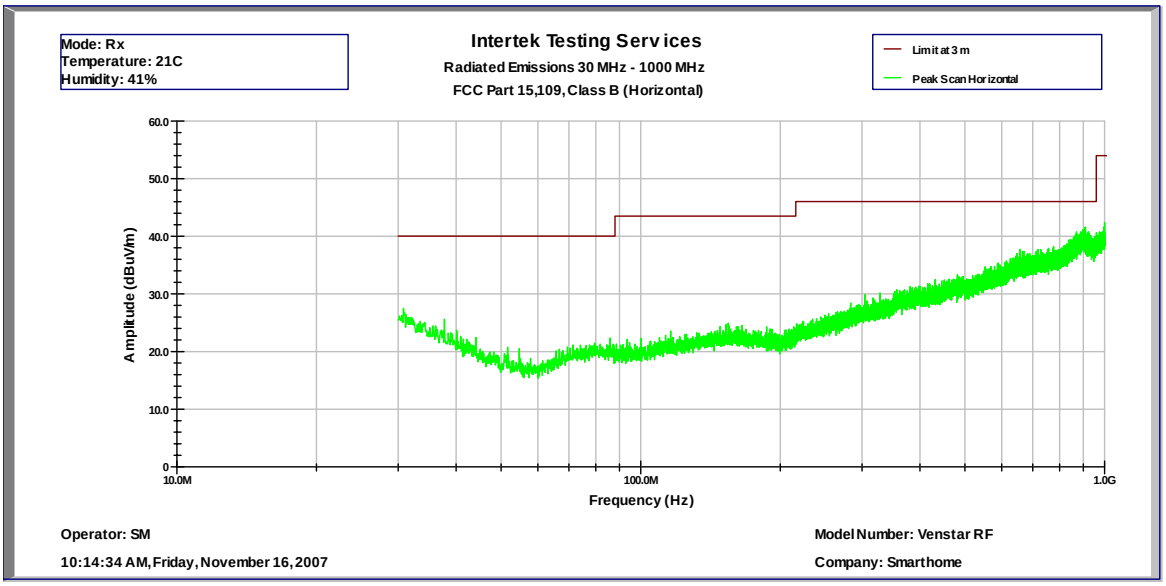
4.2.2 Field Strength Calculation

See section 4.1.2.

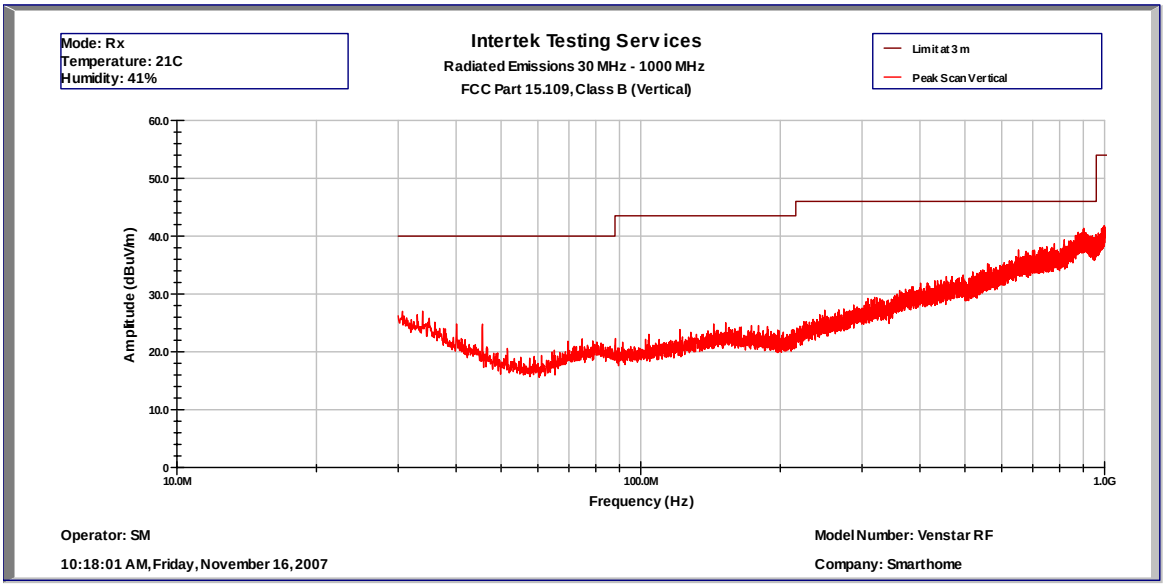
4.2.3 Radiated Emission Data

Mode: Rx
Distance: 3 m

Test Result	Passed. There were no emissions found above the noise floor level of the EMI receiver which was at least 5 dB below the limit.



Radiated Emission Peak scan, Horizontal Antenna Polarization.



Radiated Emission Peak scan, Vertical Antenna Polarization

5.0 Out of Band Emission

5.1 Test Description

Parameter:	FCC 15.249c
Requirement:	FCC 15.249c
Attenuation limits	> 50 dB or FCC 15.209

5.2 Test Procedure

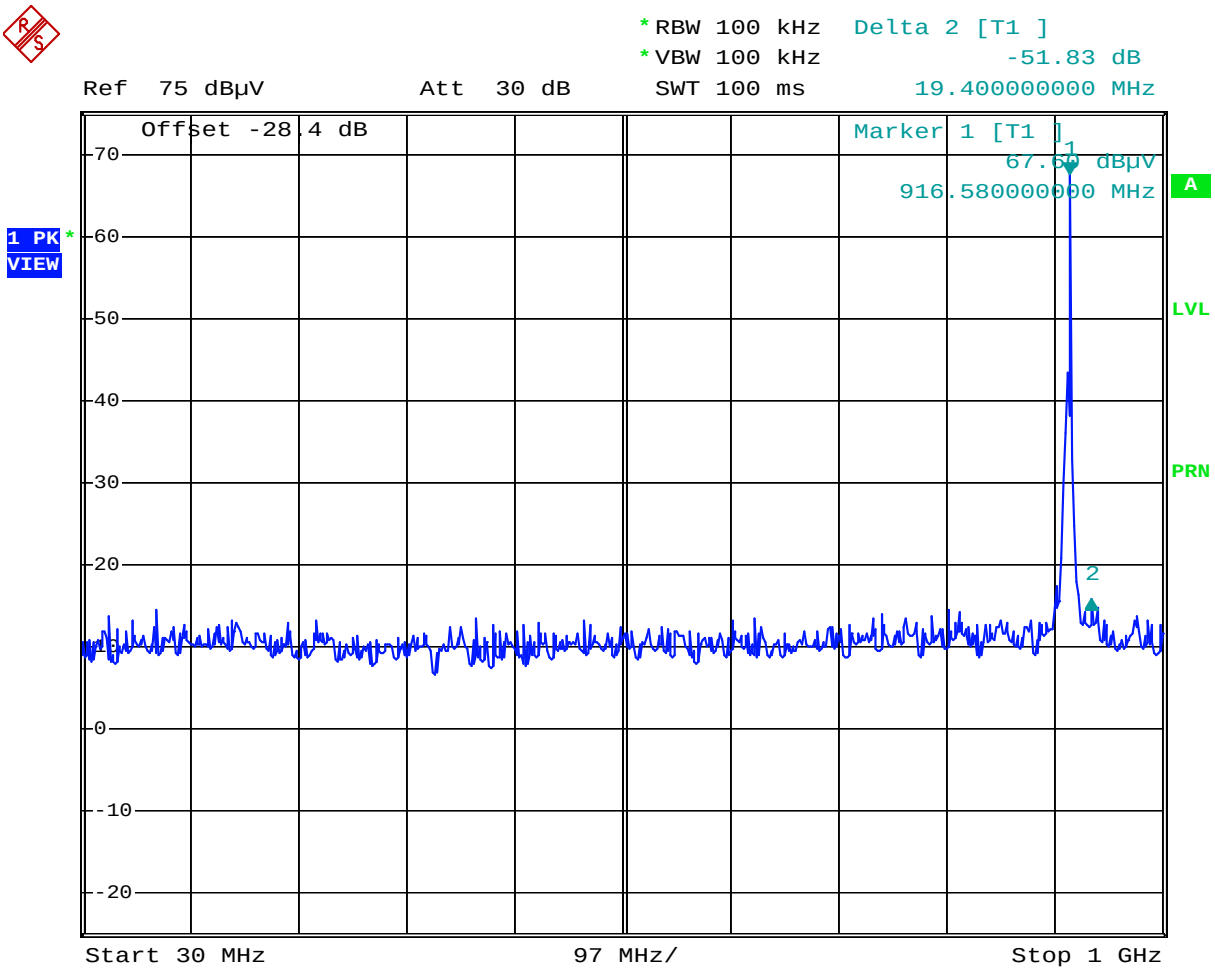
These measurements performed inside the semi anechoic chamber. For measurements below 1 GHz, a biconilog antenna was used. For measurements above 1 GHz, a horn antenna was used. Several plots were made to show emissions from 30 MHz up to 10th harmonic.

5.3 Test Results

See attached plots.
The following plots show the relative spurious emission level of the transmitter.

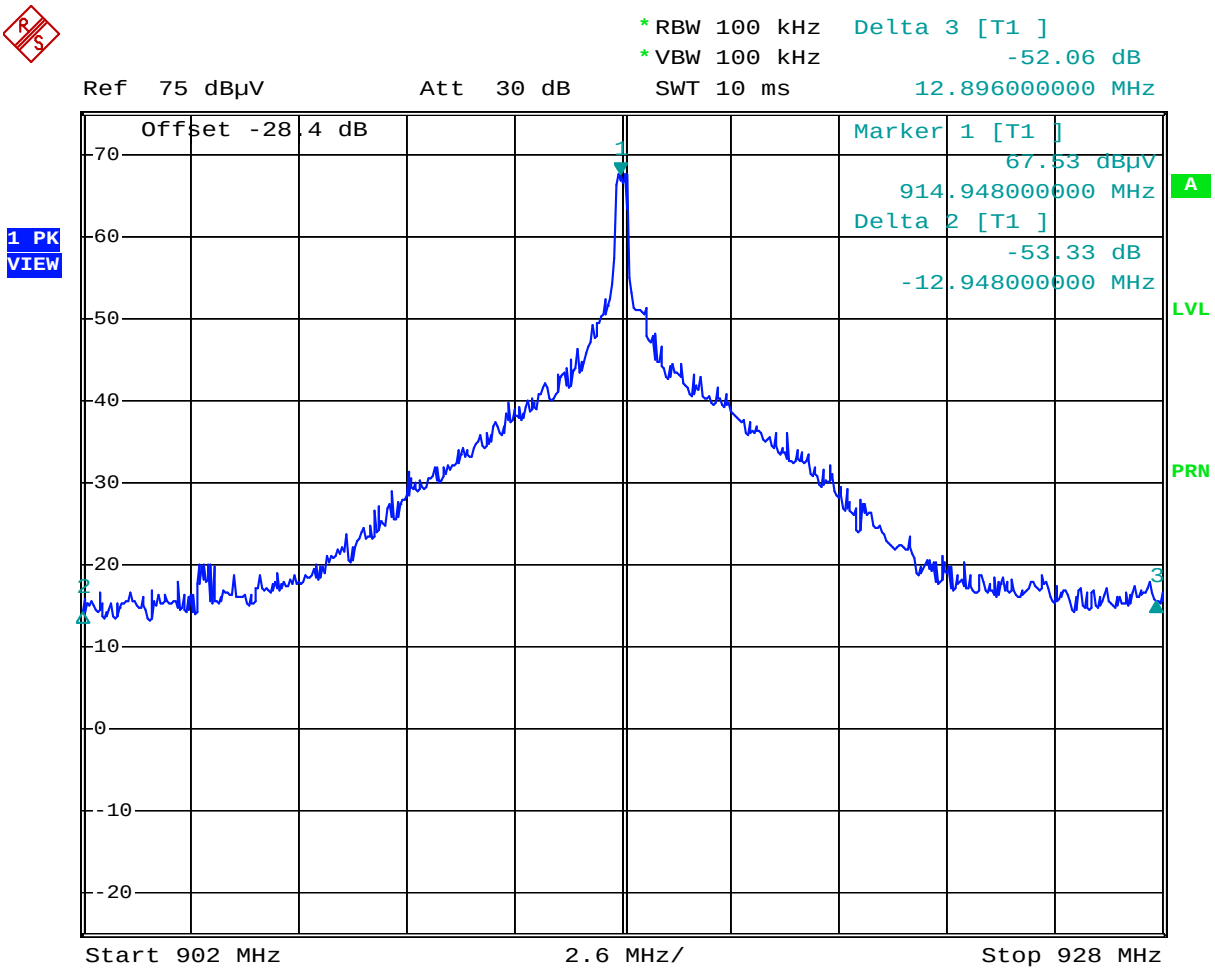
Plot #	Description
5.3.a	Plot shows peak measurements differential between fundamental and frequency range from 30 to 1000 MHz (complies with >50 dB)
5.3.b	Plot shows peak measurements differential between fundamental and edges of the frequency band (complies with >50 dB)
5.3.c	Plot shows peak measurements differential between fundamental and frequency range from 902 to 2000 MHz (complies with >50 dB)
5.3.d	Plot shows no spurious emission from 2000 to 9150 MHz. It also shows compliance with 50 dB below the level of fundamental (complies with >50 dB)

Note 1: There are no emissions observed above 2d harmonic of fundamental frequency. All spurious emissions outside the frequency band 902 – 928 MHz are attenuated by more than 50 dB below the level of fundamental or below the limits specified in 15.209



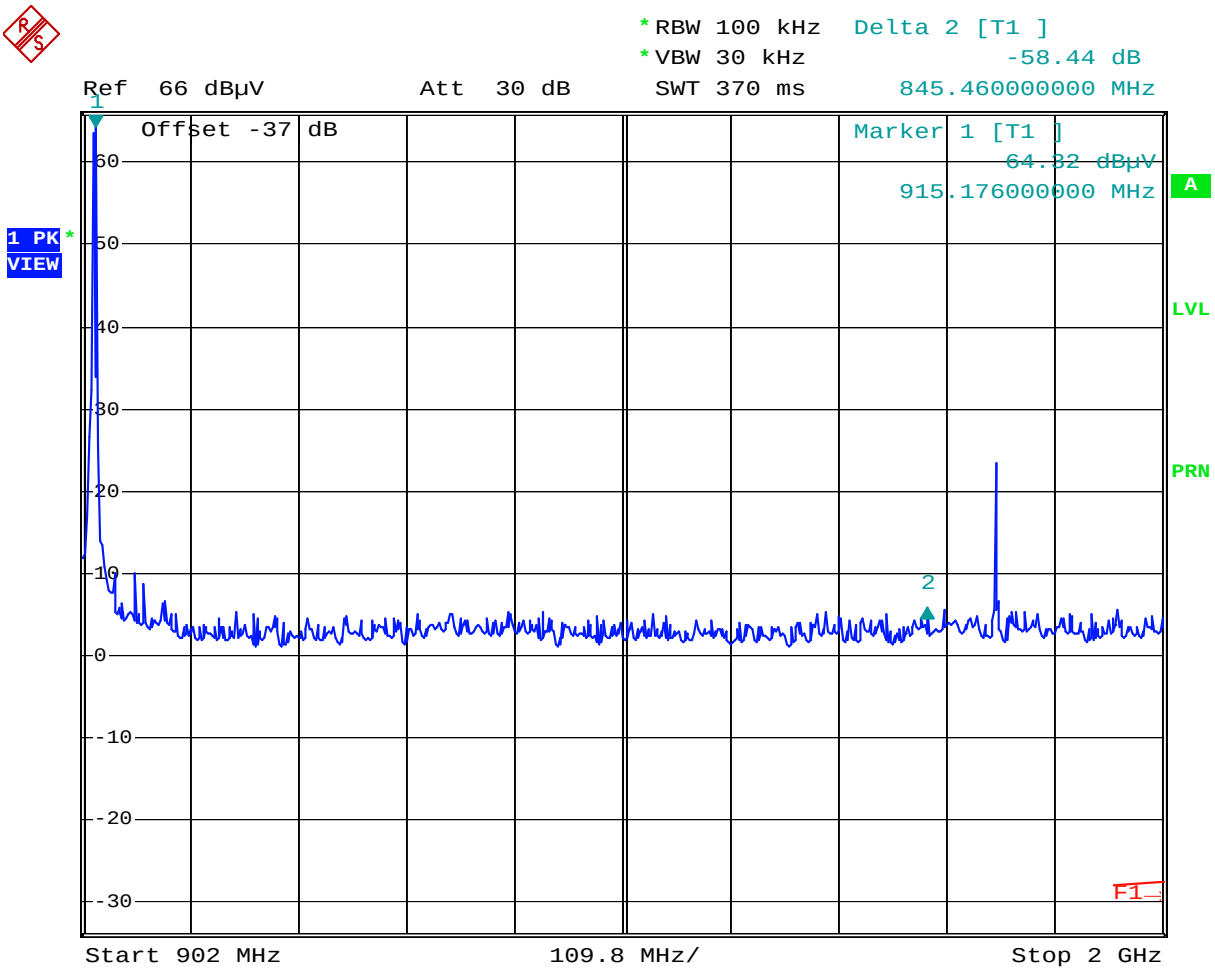
Comment: Out-of-band emission
Date: 20.NOV.2007 08:19:02

Plot 5.3.a



Comment: Band edge compliance
Date: 20.NOV.2007 08:25:21

Plot 5.3.b



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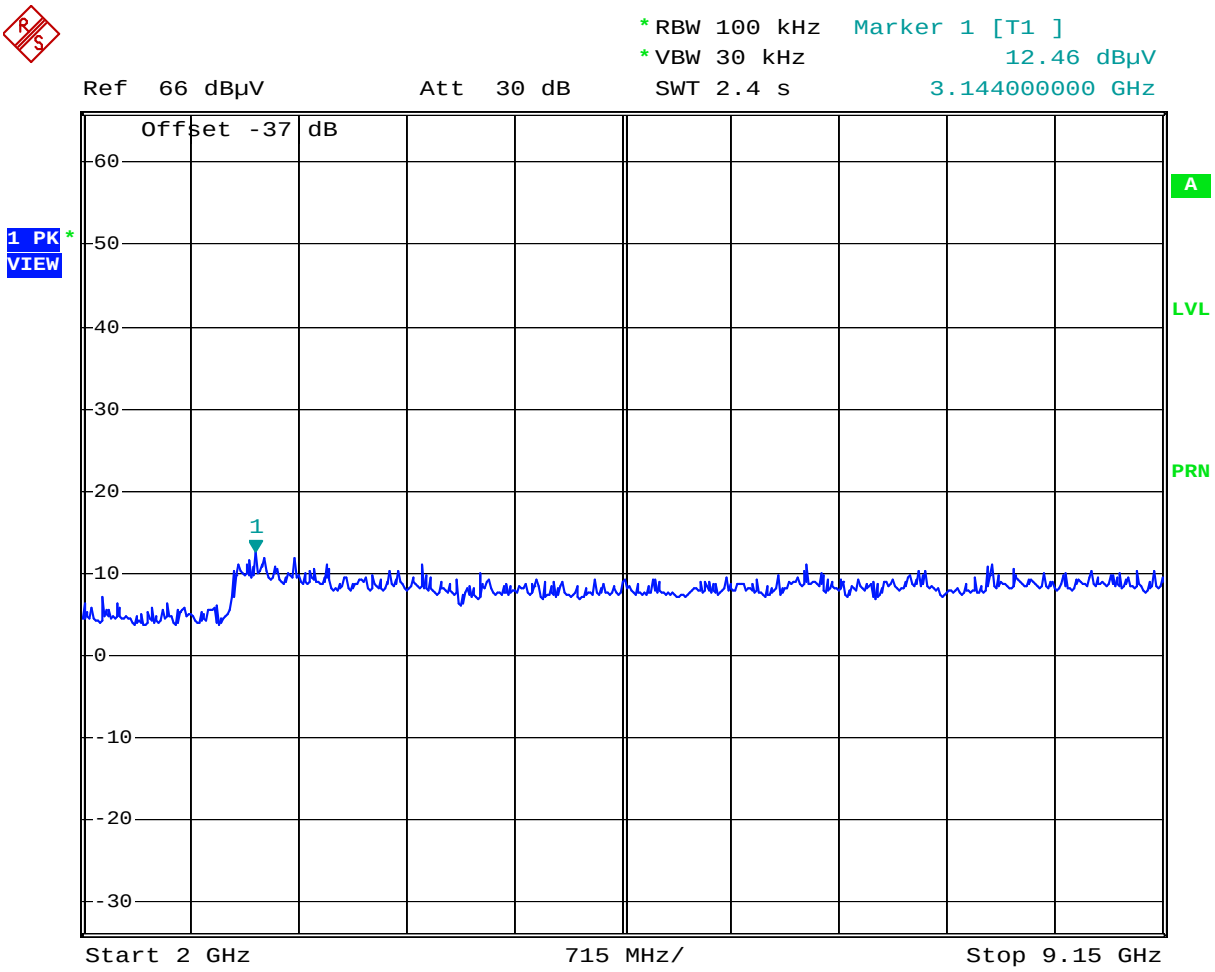
Date: 16.NOV.2007 11:39:12

Plot 5.3.c



Comment: Out-Of-Band emission
Date: 16.NOV.2007 11:40:52

Plot 5.3.d

6.0 Antenna Requirement

6.1 Test description

Parameter:	FCC 15.203
Requirement:	FCC 15.203
Descriptions:	No antenna other than furnished by the responsible party shall be used with the device.

6.2 Test Procedure

None

6.3 Test Result

The device is considered to comply with the requirements by:

	Description
X	The transmitter uses a permanently connected antenna (antenna integrated into PCB of the transceiver)
	The antenna is affixed to the EUT using a unique connector which allows for replacement of a broken antenna, but does NOT use a standard antenna jack or electrical connector.

7.0 Line Conducted Emission

7.1 Test Description

Parameter:	FCC 15.107, 15.207	
Requirement:	FCC 15.107, class B; 15.207	
Frequency (MHz)	**QP Limits (dBµV)**	**AVG Limits (dBµV)**
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

7.2 Test Procedure

All conducted voltage measurements were made on each current-carrying conductor at the plug end of the EUT power cord or calibrated extension by the use of mating plugs and receptacles on the EUT and LISN/AMN if used. Equipment was tested with power cords that were normally used or that have electrical and shielding characteristics that were the same as those cords normally used. For those measurements using a LISN/AMN, the 50 Ω measuring port was terminated by a 50 Ω receiver or a 50 Ω resistive load. Hence all 50 Ω measuring ports of the LISN/AMN were terminated by 50 Ω.

If a screened room or chamber was used, the EUT was placed 40 cm from a conductive wall, with the wall at the lead of the EUT. IF the test was being performed on an OATS or sheltered site, the vertical ground plane was placed 40 cm away from the rear of the EUT.

The excess length of the lead between the EUT and the LISN/AMN receptacle (or mains outlet where a LISN/AMN cannot be used) was folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length. If the EUT does not have a flexible power lead, then it was placed at a distance of 80 cm from the LISN/AMN (or mains outlet where a LISN/AMN cannot be used) and connected to it by a lead or appropriate connection no longer than 1 m. Measurements were made at the LISN/AMN end of this lead or connection

Conducted emission measurements were performed according to the procedures in ANSI C63.4 (2003)

7.3 Line Conducted Emission Data

Standard: FCC part 15.107, class B, 15.207
Company: SmartHome, Inc.
Job No. 3139455LAX-002
Model Name: 2441V
Mode: Trx and Rx

Measurement Uncertainty: 2.6 dB
Temperature: 24°C
Relative Humidity: 49 %

Measurements made on selected frequencies from neutral conductor are given below:

Frequency	Peak	AV Limit	QP Limit	Margin
MHz	(dBµV)	(dBµV)	(dBµV)	(dBµV)
0.154	51.1	55.6	65.6	-4.5
0.175	49.5	55.0	65.0	-5.5
0.184	48.8	54.4	64.4	-5.6
0.199	46.9	53.4	63.4	-6.5
0.207	46.0	53.3	63.3	-7.3
0.231	40.6	52.5	62.5	-11.9

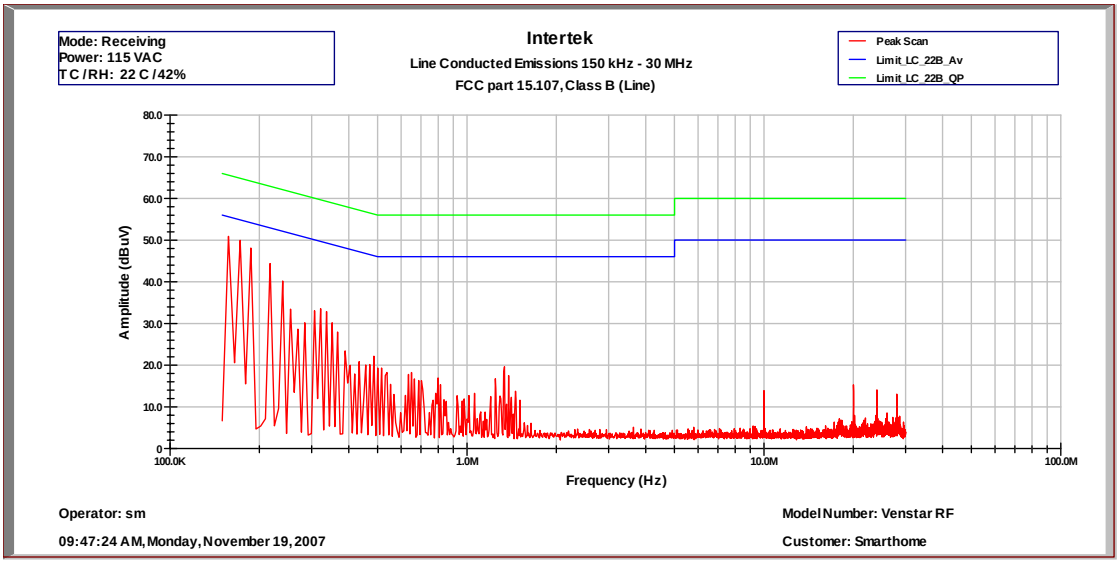
Measurements made on selected frequencies from line conductor are given below:

Frequency	Peak	AV Limit	Q. Peak	Margin
MHz	(dBµV)	(dBµV)	(dBµV)	(dBµV)
0.165	50.5	55.4	65.4	-4.9
0.171	49.9	55.1	65.1	-5.2
0.195	48.2	54.0	64.0	-5.8
0.214	44.8	53.2	63.2	-8.4
0.224	42.7	52.9	62.9	-10.2
0.303	33.6	50.3	60.3	-16.7

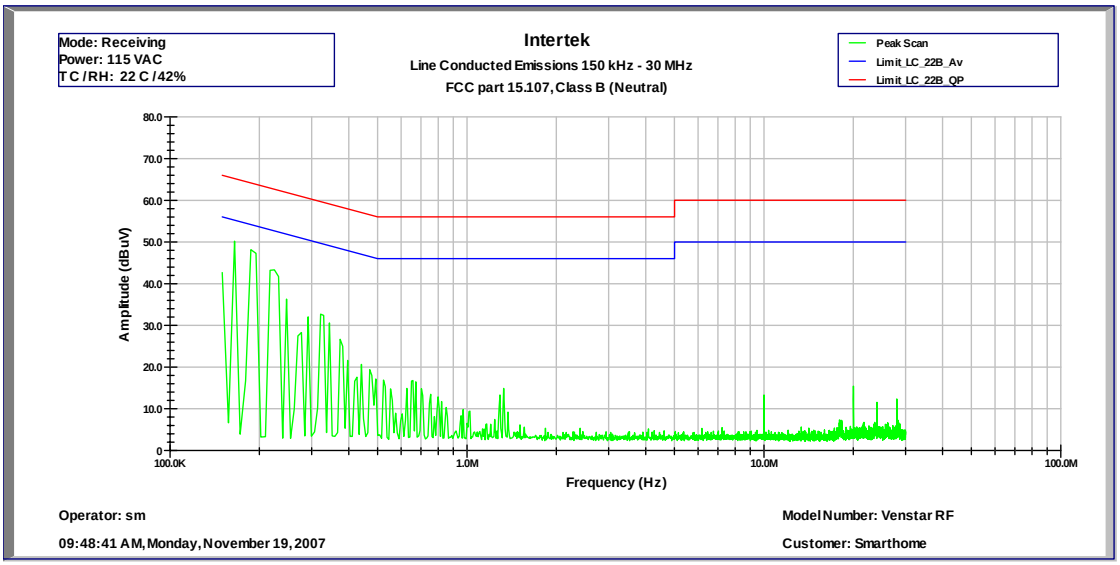
Note 1: a) A complete scan from 0.15 - 30 MHz was made.
b) Analyzer setting: RBW = 9 kHz, VBW = 30 kHz
c) Detector mode: Peak.
d) All other measurements were more than 10 dB below the limit lines.
e) Numbers with a minus sign in margin column are below the limit.

The next two pages are the peak scan made on line and neutral conductors

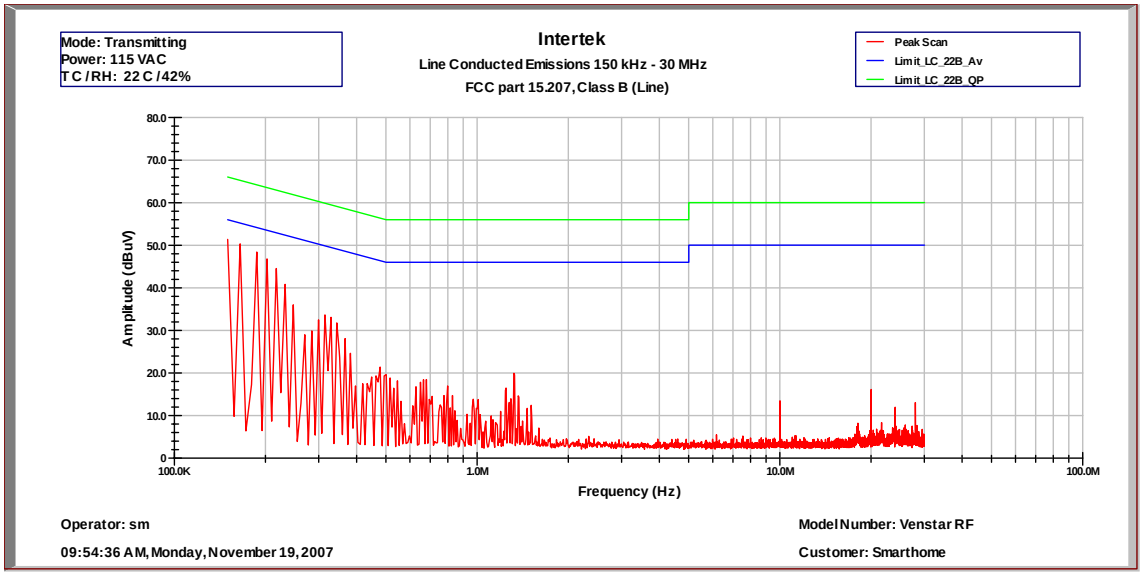
Test Result	**Passed with margin 4.5 dB at 0.154 MHz**



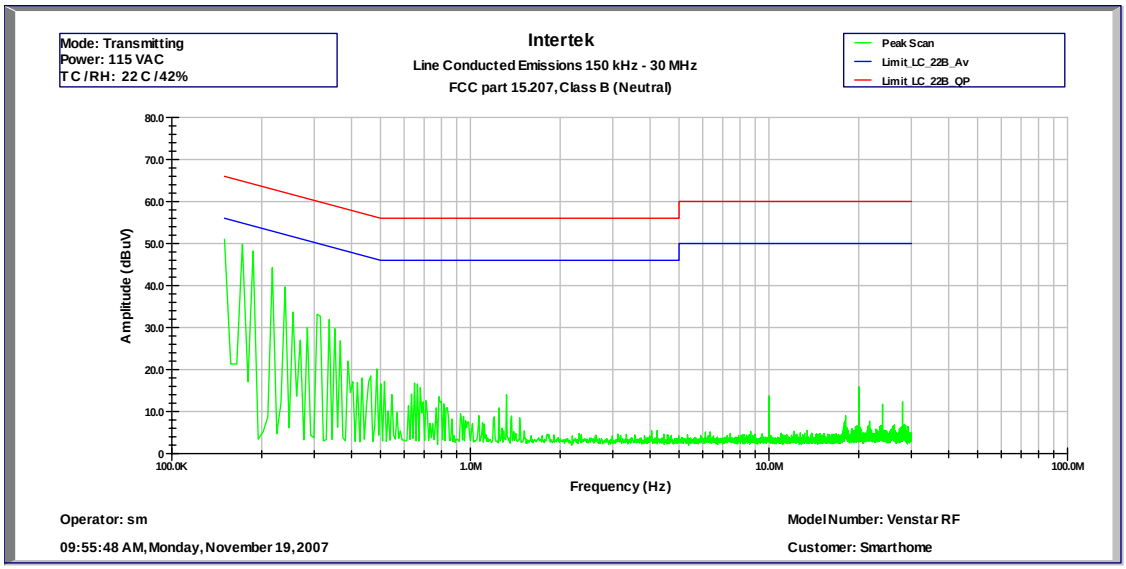
Conducted Emission Peak scan on Line conductor (Receiving mode)



Conducted Emission Peak scan on Neutral conductor (Receiving mode)



Conducted Emission Peak scan on Line conductor (Transmitting mode)



Conducted Emission Peak scan on Neutral conductor (Transmitting mode)

8.0 Occupied Bandwidth

8.1 Test description

Requirement:	FCC §2.1049, RSS-Gen
Emission Bandwidth:	

8.2 Test Procedure

The measurement antenna was positioned at distance 3 m from the transmitter.

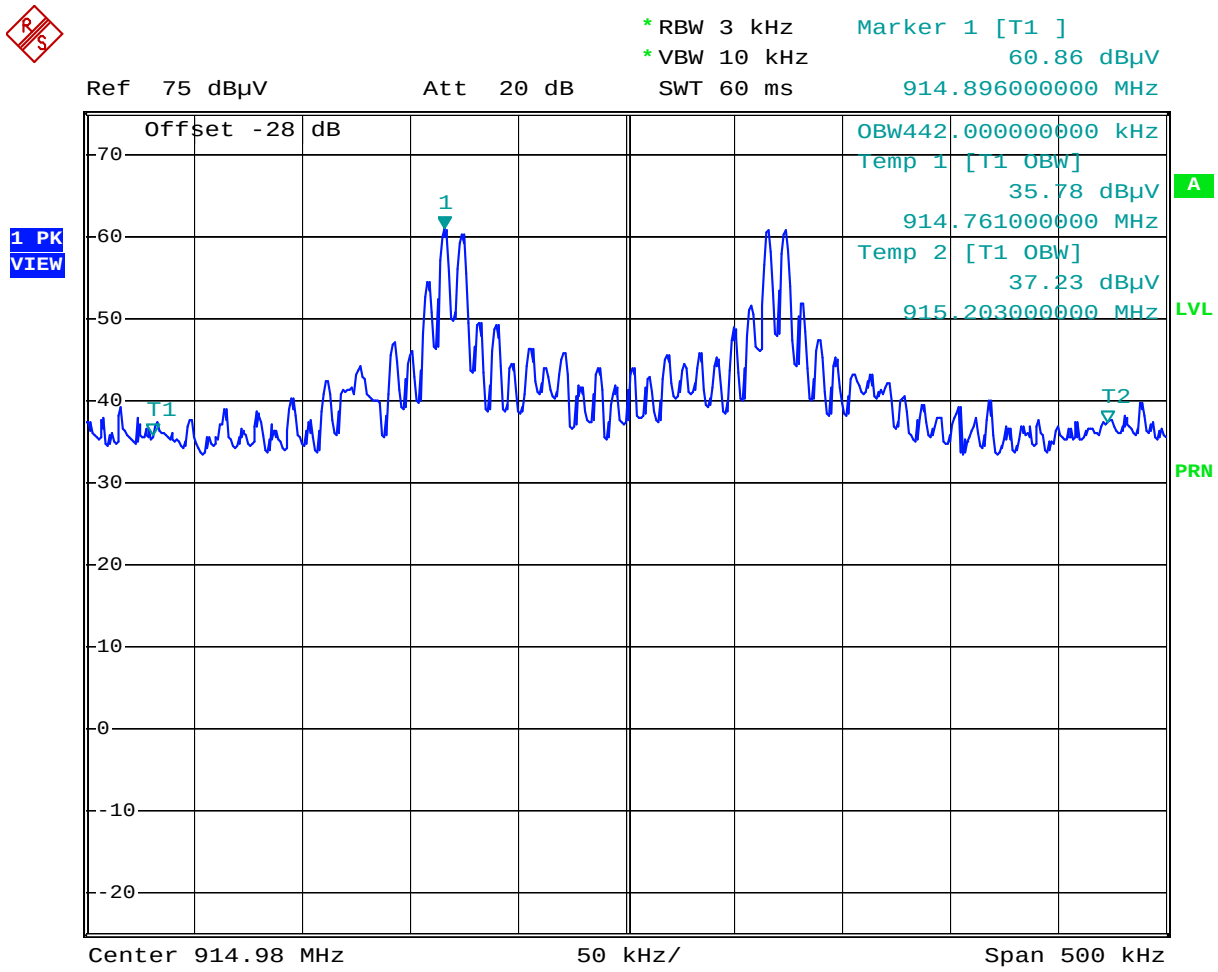
The resolution bandwidth of the spectrum analyzer was set approximately 1 – 10 % of the authorized bandwidth of the transmitter.

The bandwidth is measured at the 99% Power bandwidth.

8.3 Test Results

Please see next page for the occupied bandwidth plot:

Test Result:	The Occupied Bandwidth is 442 kHz



Comment: OBW
Date: 16.NOV.2007 12:10:49

9.0 TEST EQUIPMENT

Receivers / Spectrum Analyzers

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
HP 8546A Receiver RF Section	3549A00261	1/02/07	1/02/08	X
HP 85460A RF Filter Section	3448A00265	1/02/07	1/02/08	X
Tile Software	Rev. 3.0 G	N/A	N/A	X
R & S FSP40 Spectrum Analyzer	100027	3/10/07	3/10/08	X

Antennas / Preamplifiers

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
ETS Lindgren Biconical Antenna 3110B	56996	4/17/07	4/17/08	X
A.H.System SAS-510-4 Logperiodic Antenna	156	1/19/07	1/19/08	X
ETS Lindgren 3115 Horn Antenna	00031626	4/16/07	4/16/08	X
ETS Lindgren 3116 Horn Antenna	00028304	03/22/07	3/22/08	
Agilent RF Preamplifier 8447D	2944A101	12/22/06	12/22/07	X
HP RF Preamplifier 8449B	30080116	1/03/07	1/03/08	X
Miteg				

Artificial Mains Networks/Absorbing Clamps

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
EMCO 3816/2NM 16A LISN	1039	10/04/06	10/04/08	
EMCO 3825/2 25 A LISN	2527	7/26/07	7/27/08	X

10.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3139455	SM	November 27, 2007	Original document
2.0 / 3139455	SM	January 22, 2008	Added FCC, IC ID. Changed model name and product name.