TEST REPORT

Date: 2011-09-08
Report No.: 60.870.11.017.01F

Applicant:	Acoustics Arc international Ltd. Unit 311B, 3/F, IC Development Centre, No.6, Science Park West Avenue, Hong Kong Science Park, Shatin, N.T., Hong Kong	
Description of Samples:	Model name:	900MHz Wireless Outdoor Speakers (Transmitter)
	Brand name:	aai
	Model no.:	AS113UST / AS113USAT
	FCCID:	VHC-AAI-AS1130US0
Date Samples Received:	2011-08-25	
Date Tested:	2011-09-06 to 2011-09-07	
Investigation Requested:	FCC Part 15 Subpart C, Section 15.249	
Conclusions:	The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.	
Remarks:	----	

Checked by:

Nicolas Cheng
Project Manager
Wireless & Telecom department

Approved by:-

Jeff Pong
Operation Manager
Wireless & Telecom department

CONTENT:

1.0 General Details

1.1 Test Laboratory

Neutron Engineering Inc.
B1, No.37, Lane 365, Yang-quang St, Nei-hu District,
Taipei, 114, Taiwan.
Registration Number: 538587

Tested by:

Ares Liu

1.2 Applicant Details

Applicant

Acoustic Arc international Ltd.
Unit 311B, 3/F, IC Development Centre, No. 6
Science Park West Avenue, Hong Kong Science
Park, Shatin, N.T., Hong Kong

Manufacturer

Acoustic Arc international Ltd.
Unit 311B, 3/F, IC Development Centre, No. 6
Science Park West Avenue, Hong Kong Science
Park, Shatin, N.T., Hong Kong

1.3 Equipment Under Test [EUT]

Description of EUT

Model Name:	900MHz Wireless Outdoor Speakers (Transmitter)
Brand Name:	aai
Model Number:	AS113UST / AS113USAT
FCCID:	VHC-AAI-AS1130US0
Rating:	DC 6.0V 300mA powered by AC/DC adaptor
Antenna Type:	Integral
Operated Frequency:	912.5 - 913.5MHz
No. of Channel:	3
Accessories and Auxiliary Equipment:	iPod
EUT Exercising Software:	None

General Operation of EUT

The Equipment Under Test (EUT) is a transmitter of wireless Outdoor Speakers operated at 912 to 914 MHz

As per Client Declaration, the circuit design, PCB Layout, shielding and interface of AS113UST and AS113USAT are identical, only the cosmetic are different. So we use AS113UST as a representative model to perform all testing.

1.4 Equipment Modification

No modification was made to the tested unit by TÜV SÜD Hong Kong Ltd.

1.5 Related Submittal(s) Grants

This is a single application of certification for this transmitter.

2.0 Technical Details

2.1 Investigations Requested

Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2009 and ANSI C63.4: 2003.

2.2 Test Standards and Results Summary Tables

EMISSION Results Summary				
Test Condition	FCC Test Requirement	Test Result		
		Pass	Failed	N/A
Field Strength of Fundamental and Harmonics	Part 15.249 (a),(e)	☒	☐	☐
Spurious Radiated Emission	Part 15.249 (d) Part 15.209 Part 15.205	☒	☐	☐
Out of Band Emissions	Part 15.249 (d)	☒	☐	☐
Bandwidth Measurement	Part 15.215 (c)	☒	☐	☐
Conducted Emission	Part 15.207	☒	☐	☐

Note: N/A - Not Applicable

3.0 Test Methodology

3.1 Radiated Emission

The sample was placed 0.8m above the ground plane on a standard emission test site *. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

*On a standard emission test site with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 538587.

3.2 Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

FS = R + System Factor
System Factor = AF + CF + FA – PA

Where FS = Net Field Strength in dBuV/m at 3 meters.
R = Reading of Spectrum Analyzer / Test Receiver in dBuV.
AF = Antenna Factor in dB.
CF = Cable Attenuation Factor in dB.
FA = Filter Attenuation Factor in dB.
PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

3.3 Conducted Emissions

The EUT was placed on a non-metallic table 0.8m above the horizontal metal reference place and 0.4m from a vertical ground plane which is connected to the horizontal metal ground plane. Meanwhile, the AC main of EUT was connected to the distance of 0.8m line impedance stabilization network (LISN) during measurement.

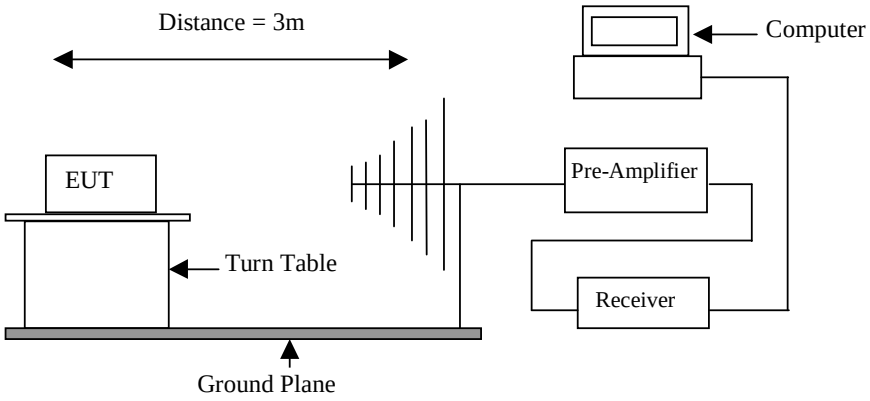
Initial measurements were performed in quasi-peak and average detection modes by the test receiver, any emissions recorded within 30dB of the relevant limit lines were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

4.0 Test Results

4.1 Field Strength of Fundamental and Harmonics

Test Requirement:	FCC part 15 section 15.249(a)(e)
Test Method:	ANSI C63.4:2003
Test Date:	2011-09-07
Mode of Operation:	Transmitting mode.
Detector Function:	Quasi-peak (Below 1000 MHz) Average and Peak (Above 1000 MHz)
Measurement BW:	120 kHz (Below 1000 MHz) 1 MHz (Above 1000 MHz)

Test Setup:



Results: PASS

Field Strength of Fundamental and Harmonics									
Channel	Value	Emissions Frequency **MHz**	E-Field Polarity	Reading **dBµV/m**	System Factor **dB**	Field Strength at 3m **dBµV/m**	Limit **dBµV/m**	Delta to Limit **dBµV/m**	Remarks
1	QP	912.50	V	94.48	-3.38	91.10	94.00	-2.90	Fund.
1	QP	912.50	H	91.02	-3.38	87.64	94.00	-6.36	Fund.
3	QP	913.50	V	94.61	-3.36	91.25	94.00	-2.75	Fund.
3	QP	913.50	H	90.69	-3.36	87.33	94.00	-6.67	Fund.
1	AV	1825.13	V	53.25	-1.81	51.44	54.00	-2.56	Harmonic
	PK	1825.13		54.72	-1.81	52.91	74.00	-21.09	Harmonic
1	AV	1825.00	H	42.92	-1.82	41.10	54.00	-12.90	Harmonic
	PK	1825.00		47.72	-1.82	45.90	74.00	-28.10	Harmonic
3	AV	1827.13	V	52.14	-1.80	50.34	54.00	-3.66	Harmonic
	PK	1827.13		53.98	-1.80	52.18	74.00	-21.82	Harmonic
3	AV	1827.00	H	43.96	-1.80	42.16	54.00	-11.84	Harmonic
	PK	1827.00		49.91	-1.80	48.11	74.00	-25.89	Harmonic

Remark : - (*) Radiated emissions which fall in the restricted bands as defined in Section 15.205(a).

- Calculated measurement uncertainty: ±5.0dB

Limits of Field Strength for Fundamental and Harmonics Frequency [Section 15.249 (a)]:

Fundamental Frequency	Field Strength of Fundamental		Field Strength of Harmonics	
[MHz]	[mV/m]	[dBμV/m]	[μV/m]	[dBμV/m]
902 - 928	50	94	500	54

Compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector.

Limit Requirement under Section 15.249 (e) :
According to section 15.249 (e), for frequencies above 1000MHz, the above field strength limits is based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20dB under any condition of modulation.

Limit for Radiated Emission [Section 15.209]:

Frequency (MHz)	Field Strength [μV/m]	Field Strength [dBμV/m]
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
Above 960	500	54.0

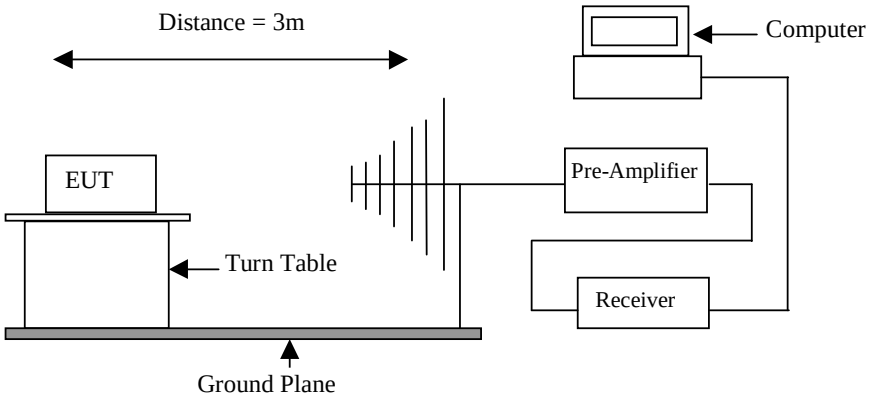
Radiated emissions, which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209.

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

4.2 Spurious Radiated Emission

Test Requirement:	FCC part 15 section 15.249(d),15.209
Test Method:	ANSI C63.4:2003
Test Date:	2011-09-06
Mode of Operation:	Transmitting Mode
Detector Function:	Quasi-peak (Below 1000 MHz) Average and Peak (Above 1000 MHz)
Measurement BW:	120 kHz (Below 1000 MHz) 1 MHz (Above 1000 MHz)

Test Setup:



Results: PASS

Spurious Radiated Emissions								
Channel	Value	Emissions Frequency	E-Field Polarity	Reading	System Factor	Field Strength at 3m	Limit	Delta to Limit
		MHz		**dBµV/m**	**dB**	**dBµV/m**	**dBµV/m**	**dBµV/m**
1	QP	44.55	V	48.19	-17.06	31.13	40.00	-8.87
1	QP	105.18	V	37.34	-16.64	20.70	43.50	-22.80
1	QP	226.43	V	36.86	-13.69	23.17	46.00	-22.83
1	QP	*323.43	V	32.91	-10.78	22.13	46.00	-23.87
1	QP	451.95	V	35.98	-8.76	27.22	46.00	-18.78
1	QP	643.53	V	32.46	-5.36	27.10	46.00	-18.90
1	QP	44.55	H	39.24	-17.06	22.18	40.00	-17.82
1	QP	214.30	H	38.29	-13.94	24.35	43.50	-19.15
1	QP	362.23	H	32.78	-10.19	22.59	46.00	-23.41
1	QP	602.30	H	32.95	-5.47	27.48	46.00	-18.52
1	QP	745.38	H	33.15	-4.88	28.27	46.00	-17.73
1	QP	903.00	H	35.87	-3.68	32.19	46.00	-13.81
3	QP	44.55	V	46.19	-17.06	29.13	40.00	-10.87
3	QP	105.18	V	37.34	-16.64	20.70	43.50	-22.80
3	QP	226.43	V	35.86	-13.69	22.17	46.00	-23.83
3	QP	442.25	V	33.33	-8.96	24.37	46.00	-21.63
3	QP	565.93	V	32.64	-5.96	26.68	46.00	-19.32
3	QP	643.53	V	32.46	-5.36	27.10	46.00	-18.90
3	QP	44.55	H	37.24	-17.06	20.18	40.00	-19.82
3	QP	209.45	H	38.01	-14.01	24.00	43.50	-19.50
3	QP	371.93	H	32.77	-10.06	22.71	46.00	-23.29
3	QP	633.83	H	32.41	-5.37	27.04	46.00	-18.96
3	QP	675.05	H	32.40	-5.15	27.25	46.00	-18.75
3	QP	752.65	H	31.92	-4.84	27.08	46.00	-18.92

Note: - No further spurious emissions found between 30MHz and lowest internal used / generated frequency.
- Result data graph is shown at the next pages for reference.

Remark : - (*) Radiated emissions which fall in the restricted bands as defined in Section 15.205(a).
- Calculated measurement uncertainty: ±5.0dB.

Limit of Outside of the Specified Bands [Section 15.249 (d)]

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in section 15.209, whichever is the lesser attenuation

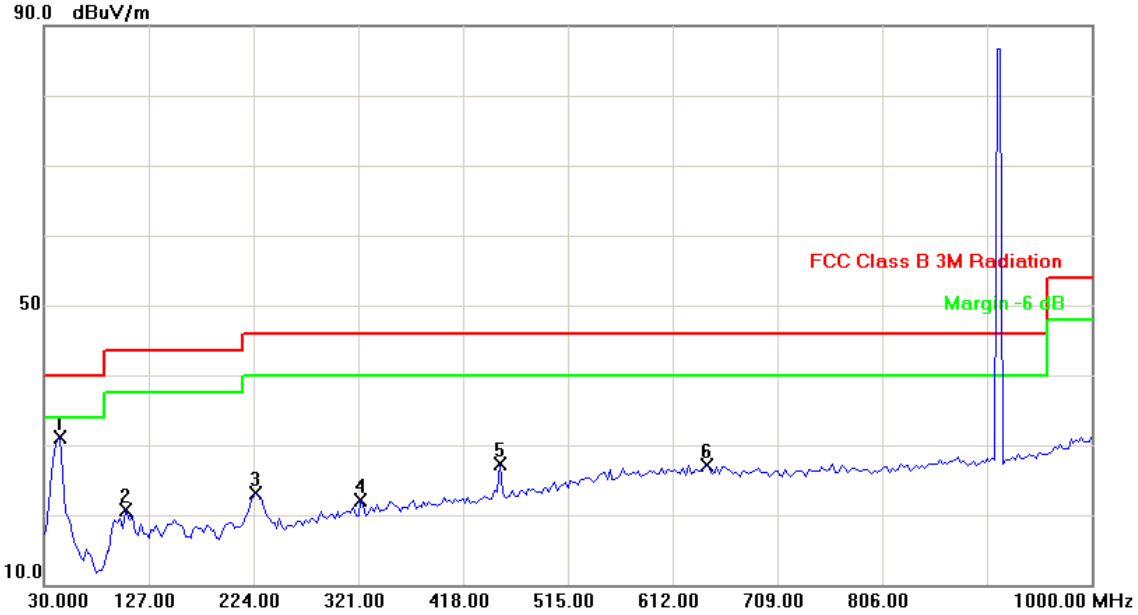
Limit for Radiated Emission [Section 15.209]:

Frequency (MHz)	Field Strength [μV/m]	Field Strength [dBμV/m]
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
Above 960	500	54.0

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.

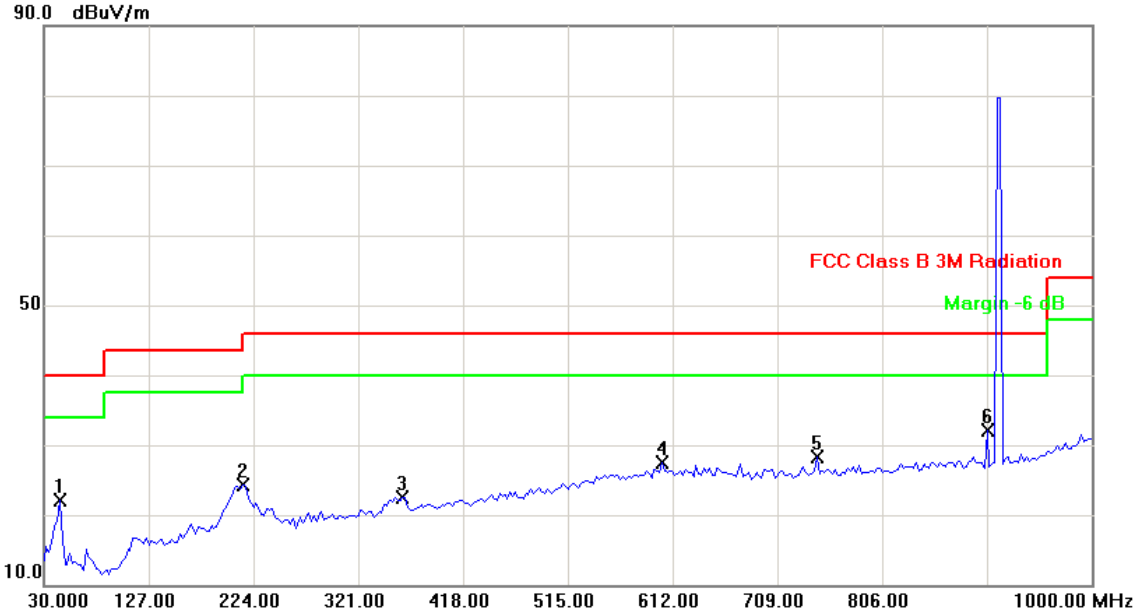
The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

Channel 1 (Vertical)



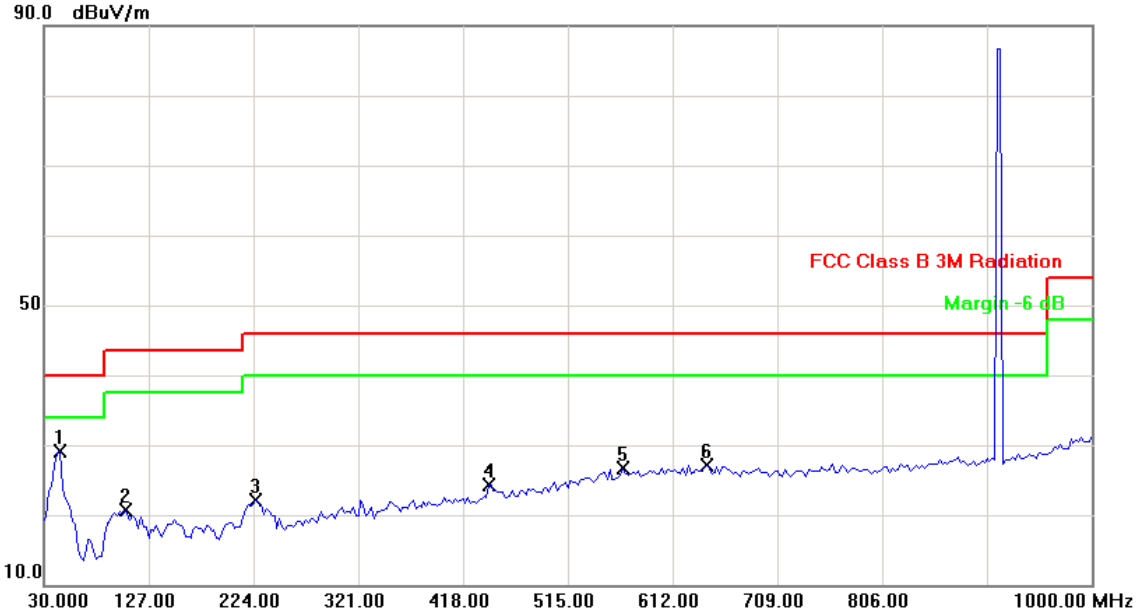
Remark: Only background noise was measured from 1GHz-10GHz except about operating frequency.

Channel 1 (Horizontal)



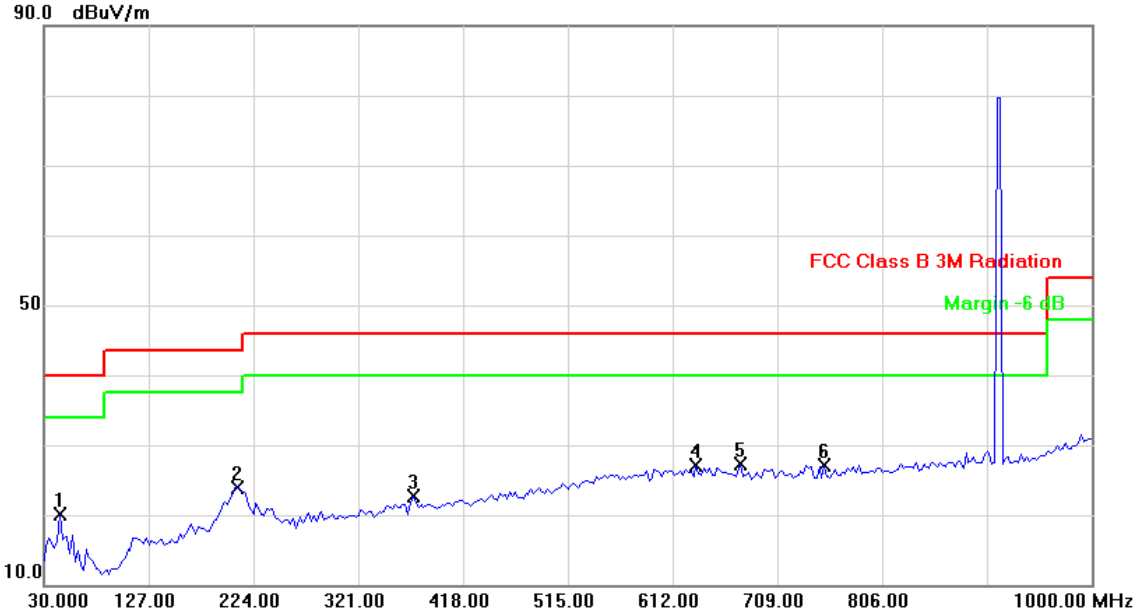
Remark: Only background noise was measured from 1GHz-10GHz except about operating frequency.

Channel 3 (Vertical)



Remark: Only background noise was measured from 1GHz-10GHz except about operating frequency.

Channel 3 (Horizontal)



Remark: Only background noise was measured from 1GHz-10GHz except about operating frequency.

4.3 Out of Band Emissions

Test Requirement:	FCC part 15 section 15.249 (d)
Test Method:	ANSI C63.4:2003
Test Date:	2011-09-07
Mode of Operation:	Transmitting mode.
Detector Function:	Peak

Results: PASS

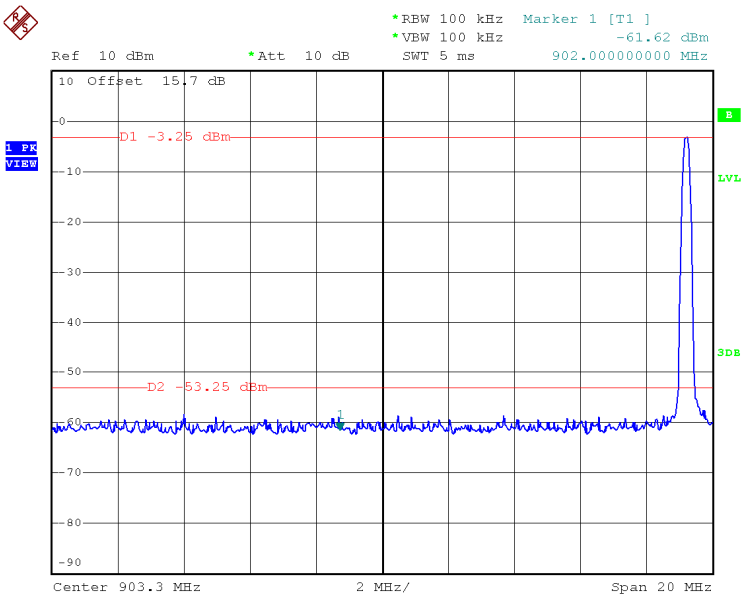
Refer to the data graph, the lower and higher edge of the specified frequency bands fulfill the general radiated emission limits in section 15.209. Therefore, the EUT meets the requirement of section 15.249 (d).

Limit for Out of Band Emissions [Section 15.249 (d)]

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in section 15.209, whichever is the lesser attenuation.

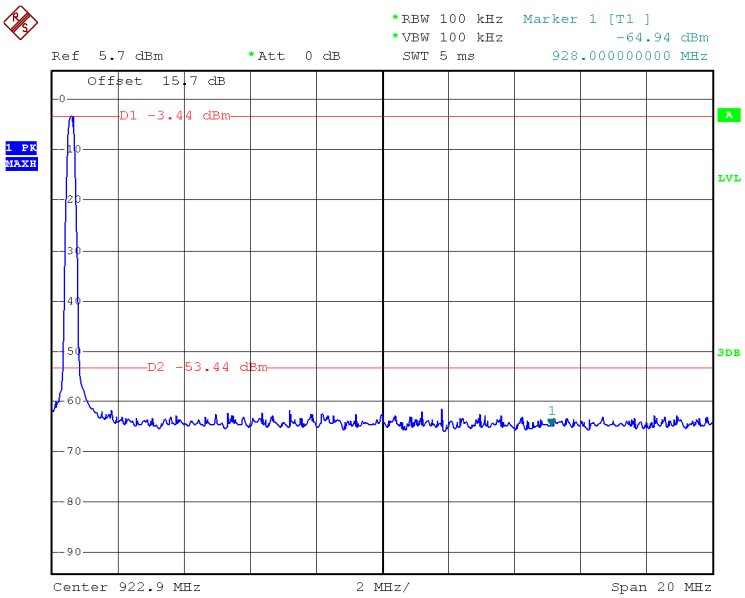
Test Result: Result data graph is shown at the next pages for reference.

Lowest Channel



Date: 7.SEP.2011 06:08:00

Highest Channel



Date: 7.SEP.2011 06:16:11

4.4 Bandwidth Measurement

Test Requirement:	FCC part 15 section 15.215 (c)
Test Method:	ANSI C63.4:2003
Test Date:	2011-09-07
Mode of Operation:	Transmitting mode.
Detector Function:	Peak

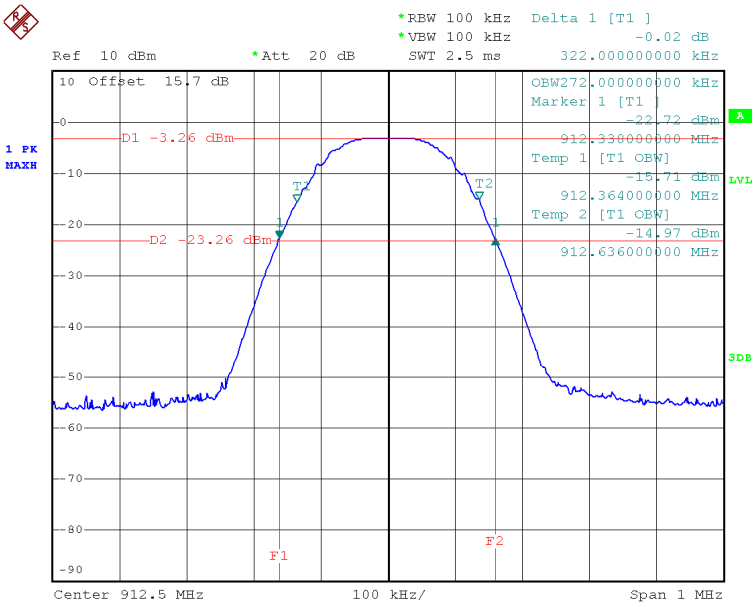
Results: PASS

Refer to the data graph, the 20dB points of Channel 1, Channel 2 and Channel 3 are 322kHz, 324kHz and 320kHz. All channels within the operation bandwidth when equipment is operated. Therefore, the EUT meets the requirement of section 15.215(c).

Limit for Bandwidth [Section 15.215 (c)]

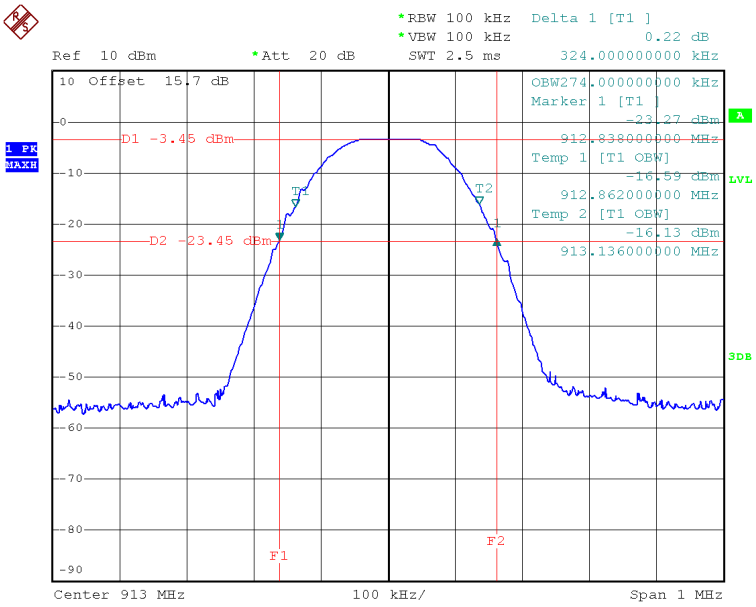
The 20dB bandwidth of the emission shall be within the frequency band designated in the rule section under which the equipment is operated.

Test Result: Result data graph is shown at the next pages for reference.



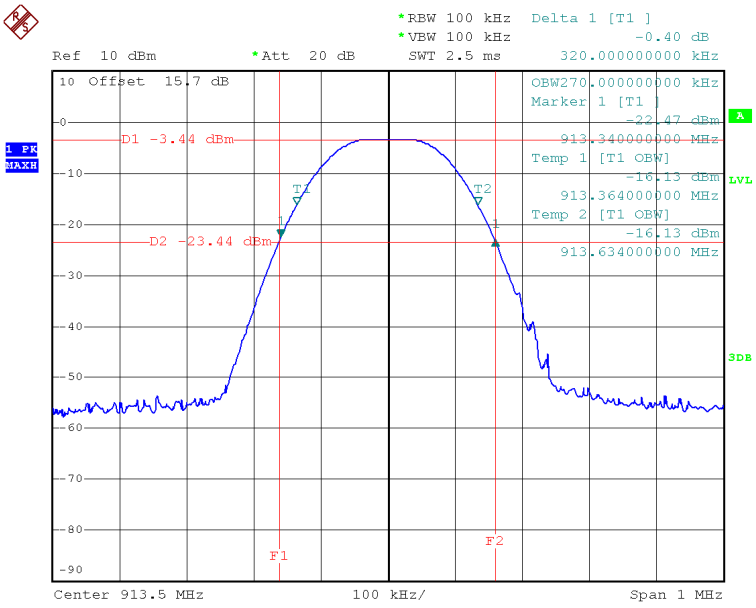
Date: 7.SEP.2011 06:04:46

Channel 1 – 20 dB point, Bandwidth 322 kHz



Date: 7.SEP.2011 06:13:37

Channel 2 – 20 dB point, Bandwidth 324 kHz

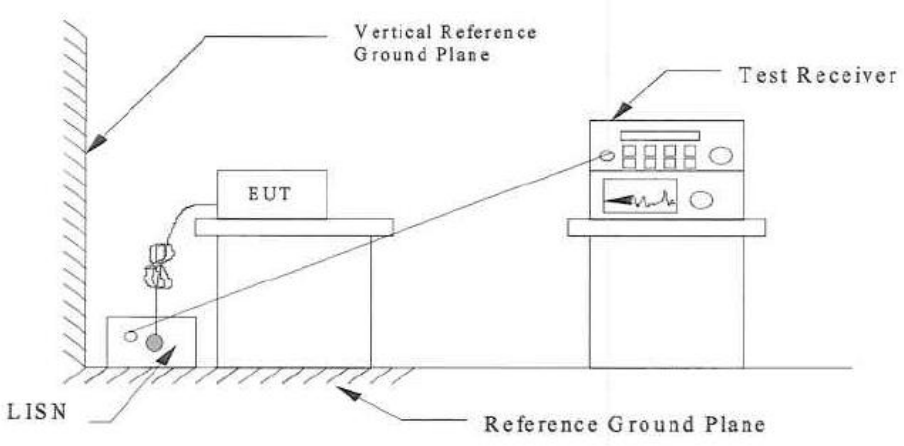


Channel 3 – 20 dB point, Bandwidth 320 kHz

4.5 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC part 15 Section 15.207 Class B
Test Method:	ANSI C63.4:2003
Test Date:	2011-09-06
Mode of Operation:	Transmitting and Charging for normal operate
Detector Function:	Quasi-peak, average
Measurement BW:	9 kHz

Test Setup:



Results: PASS

Conducted Emission					
Frequency (MHz)	Detector (QP/AV)	Phase	Result (dBµV)	Limit (dBµV)	Margin
0.150	QP	L	43.18	66.00	-22.82
0.396	QP	L	37.89	57.94	-20.05
0.607	QP	L	32.54	56.00	-23.46
0.693	QP	L	32.47	56.00	-23.53
4.027	QP	L	31.86	56.00	-24.14
8.688	QP	L	35.80	60.00	-24.20
0.150	QP	N	42.26	66.00	-23.74
0.167	QP	N	41.54	65.12	-23.58
0.361	QP	N	36.25	58.71	-22.46
0.685	QP	N	30.70	56.00	-25.30
8.351	QP	N	34.49	60.00	-25.51
25.715	QP	N	28.87	60.00	-31.13

Note : - The worst case result data graph is attached at the next pages for reference.

Remark: - The EUT is connected to AC/DC Adaptor during testing.

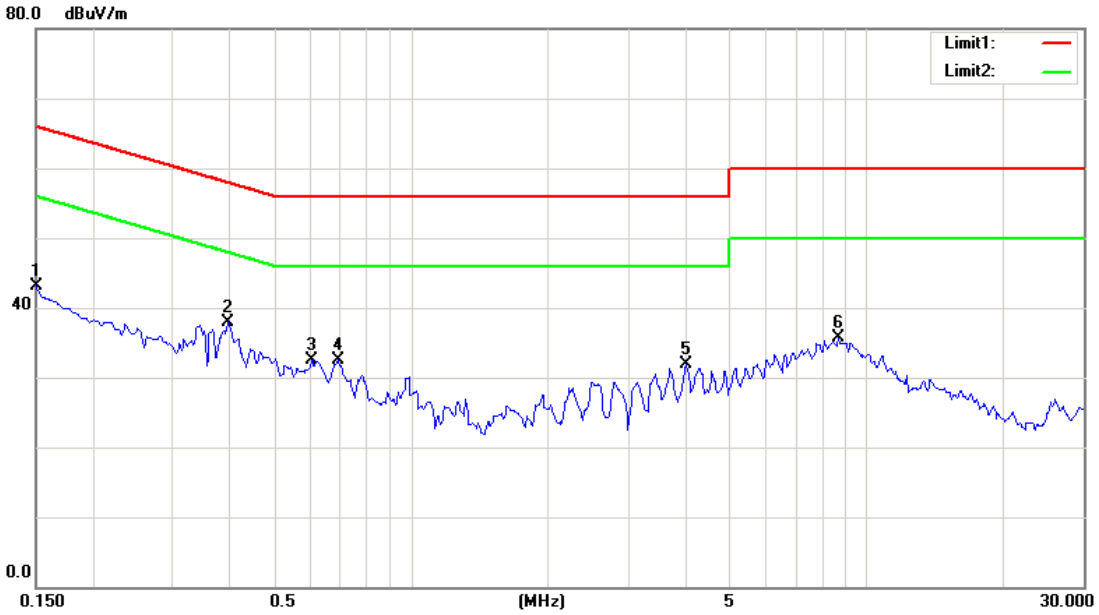
- Calculated measurement uncertainty: ±2.8dB

Limits for Conducted Emission [Section 15.207]:

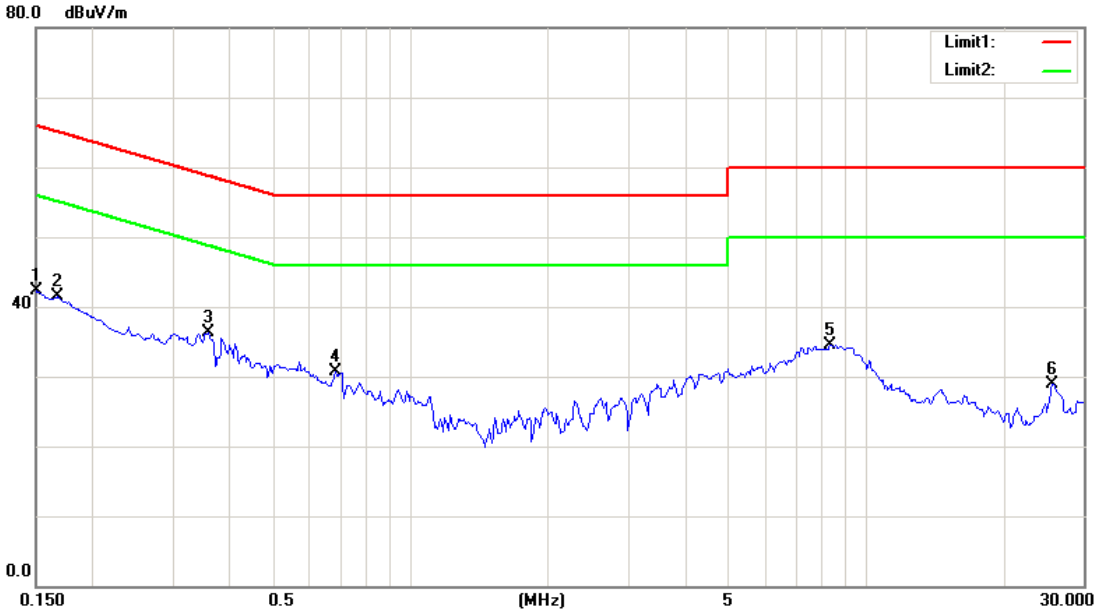
Frequency Range [MHz]	Quasi-Peak Limit [dBµV]	Average Limit [dBµV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Conducted Emissions Result



Phase – L



Phase – N

5.0 List of Measurement Equipment

Radiated Emission and Out of Band Emissions

Description	Manufacturer	Model no.	Serial no.	CAL due
Antenna	Schwarbeck	VULB9160	9160-3232	04 Jun 2012
Amplifier	HP	8447D	2944A09673	26 May 2012
Test Receiver	R & S	ESCI	100382	26 May 2012
Test Cable	N/A	C-01_CB03	N/A	01 Jul 2012
Antenna	ETS	3115	00075789	26 May 2012
Amplifier	Agilent	8449B	3008A02274	26 May 2012
Spectrum	Agilent	E4408B	US39240143	26 Nov 2011
Test Cable	HUBER + SUHNER	C-45	N/A	04 May 2012

Conducted Emission

Description	Manufacturer	Model no.	Serial no.	CAL due
LISN	EMCO	3816/2	00052765	26 May 2012
LISN	R & S	ENV216	100087	26 May 2012
Test Cable	N/A	C-17	N/A	30 Mar 2012
EMI TEST RECEIVER	R & S	ESCS30	826547/022	26 May 2012
50Ω Terminator	SHX	TF2-3G-A	08122902	26 May 2012

Remarks:
CM Corrective Maintenance
N/A Not Applicable or Not Available