



FCC PART 73

TEST AND MEASUREMENT REPORT

For

FM Broadcast Inc.

2780 S Jones Blvd. #3627,
Las Vegas, NV 89146, USA

FCC ID: AUNFM300ES

Report Type: Original Report	Product type: FM Broadcast Transmitter
Test Engineer: <u>Quinn Jiang</u> 	
Report Number: <u>R1109228-73</u>	
Report Date: <u>2012-03-13</u>	
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* This report may contain data that are not covered by the NVLAP accreditation and are marked with an asterisk “*” (Rev. 2)

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1109228-73	Original Report	2012-03-13

1. General Information

1.1 Product Description for Equipment under Test (EUT)

The report has been prepared on behalf of *FM Broadcast Inc.* and their product FCC ID: AUNFM300ES, Model: FM300ES or the EUT as referred to in the rest of this report. The EUT is a FM broadcast transceiver.

The EUTs are Radio Transceivers that operates under FCC Part 73.

Specifications	
Frequency Bands	88.1-107.9 MHz
Modulation Type	FM
Emission Designator	F3E
RF Output Power	330 Watts
Power Source	110 VAC
Operating Temperature	0°C to 50°C

1.2 Mechanical Description

The EUTs measures approximately 48cm (L) x 38 cm (W) x 12.5 cm (H) and weighs approximately 7.9kg.

The test data gathered are from production sample, serial number: H5QZA4, assisgned by BACL.

1.3 Objective

This Type approval report is prepared on behalf of *FM Broadcast Inc.* in accordance with Part 73 of the Federal Communication Commissions rules.

1.4 Related Submittal(s)/Grant(s)

None.

1.5 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 73 – Radio Broadcast Services

Applicable Standards: TIA603-C and ANSI 63.4-2003, American National Standard for Method of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All emissions measurement was performed by Bay Area Compliance Laboratories Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR16-4-2:2003, The Treatment of Uncertainty in EMC Measurements, the values ranging from ± 2.0 dB for Conducted Emissions tests and ± 4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

1.7 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2003, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: R-3729, C-4176, G-469, and T-1206. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is a National Institute of Standards and Technology (NIST) accredited laboratory under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at <http://ts.nist.gov/Standards/scopes/2001670.htm>

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to TIA/EIA-603-C.

The EUT was tested in the normal (native) operating mode to represent *worst-case* results during the final qualification test.

2.2 EUT Exercise Software

N/A

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Internal Configuration

Manufacturer	Description	Model No.	Serial No.
PTek	RF PCB Board 1	110726 Rev E	-
PTek	RF PCB Board 2	111141 Rev C-29	P91304

2.5 Local Support Equipment

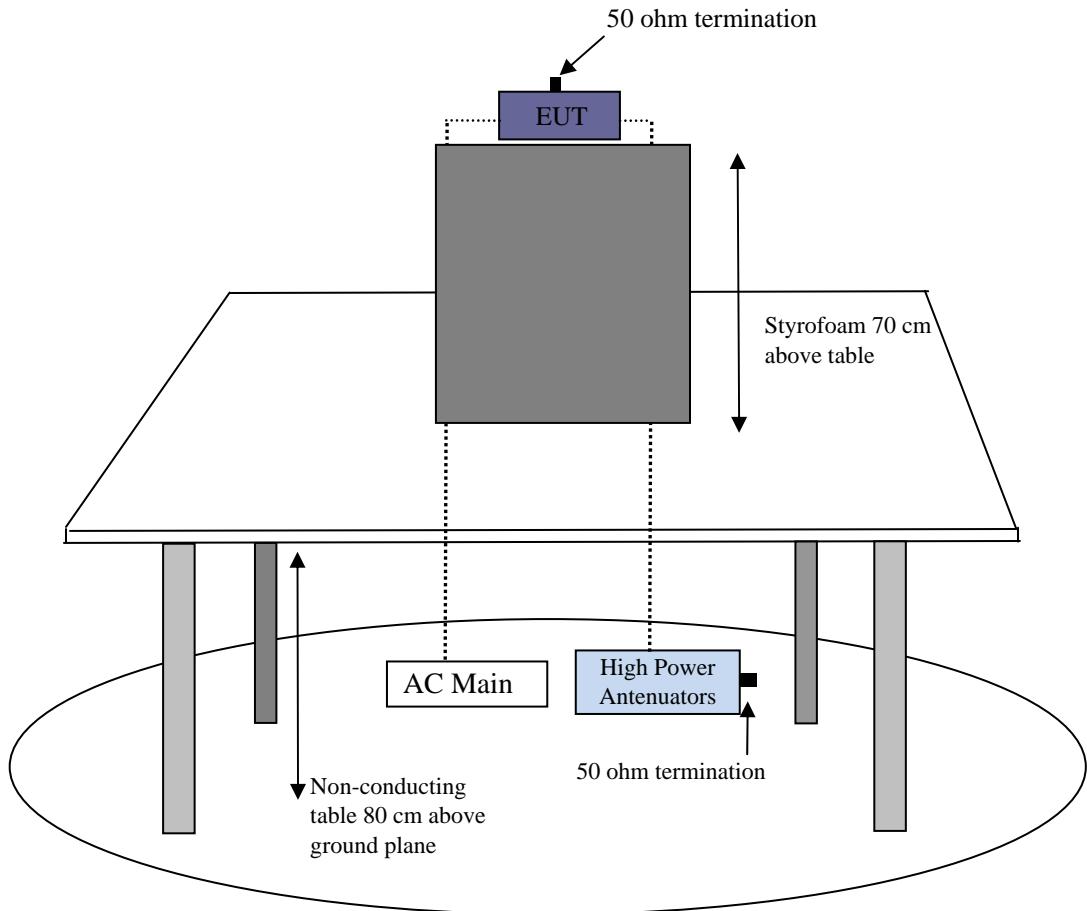
N/A

2.6 Interface Ports and Cabling

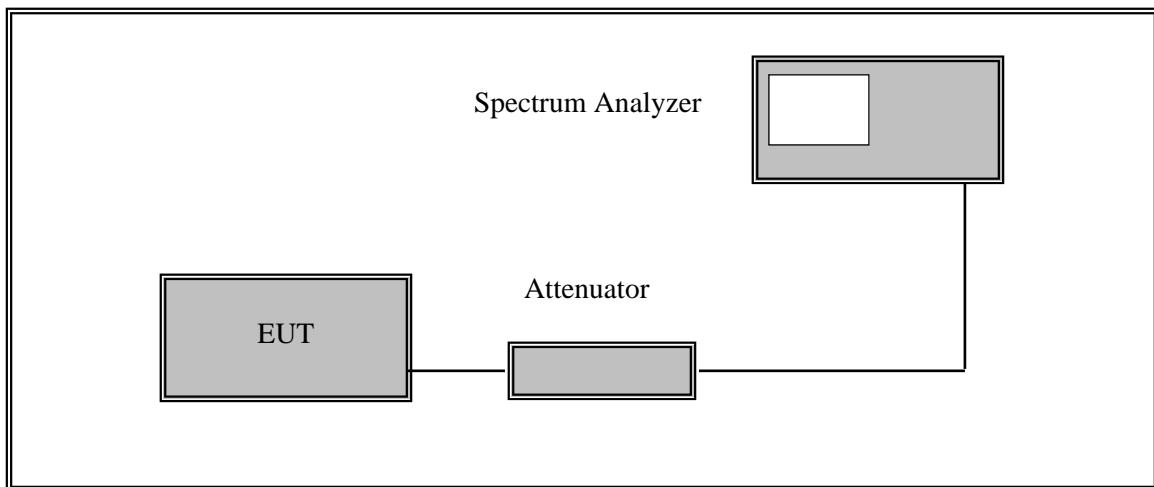
Cable Description	Length (m)	From	To
N Type Cable	< 2.0	High Power Attenuator	EUT
N Type Cable	< 2.0	High Power Attenuator	PSA

2.7 Test Setup Block Diagram

Radiated Test



Conducted Test



3 Summary of Test Results

FCC Rules	Description of Tests	Results
§1.1310, §2.1091	RF Exposure	N/A
§2.1046, §73.267	RF Output Power	Compliant
§2.1047	Audio Frequency Response	Compliant
§2.1049, §73.317	Occupied Bandwidth and Emission Mask	Compliant
§2.1051, §73.317	Spurious Emissions at Antenna Terminals	Compliant
§2.1055, § 73.1545	Frequency Stability	Compliant
§2.1053, §73.317	Field Strength of Spurious Radiation	Compliant
§15.109	Radiated Emissions	Compliant

4 FCC §2.1091 - RF Exposure

4.1 Applicable Standards

FCC §2.1091, (a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular §1.1307(b).

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,00	/	/	1	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	842/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/150	30
1500-100,000	/	/	1	30

f = frequency in MHz

* = Plane-wave equivalent power density

Note 1 to Table 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2 to Table 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

4.2 Result

Conclusion

No MPE calculation needed:

The antenna(s) used for this transmitter must be fixed-mounted on outdoor permanent structures. RF exposure compliance is addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of Part. 1.1307(b)(3).

5 FCC §2.1046 & §73.1560 – Conducted Output Power

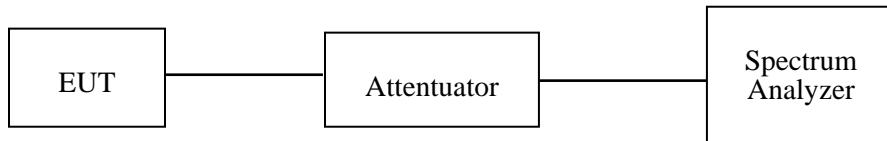
5.1 Applicable Standard

According to FCC §2.1046 and §73.267, the Output power is measured using Direct Method.

According to FCC §73.1560 (b) FM stations, the transmitter output power of an FM station, with power output as determined by the procedures specified in §73.267, which is authorized for output power more than 10 watts must be maintained as near as practicable to the authorized transmitter output power and may not be less than 90% nor more than 105% of the authorized power. FM stations operating with authorized transmitter output power of 10 watts or less, may operate at less than the authorized power, but not more than 105% of the authorized power.

5.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.



5.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
Agilent	Function Arbitrary Waveform Generator	33220A	MY43004878	2011-07-22

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

5.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	44 %
ATM Pressure:	101.2 kPa

The testing was performed by Quinn Jiang on 2011-10-15 in the RF Site.

5.5 Test Result

Test Mode: Transmitting

Power vs. Temperature

Test Condition		High Power		Low Power		Declared Output Power	
Voltage (VAC)	Temperature (°C)	Power (dBm)	Power (Watt)	Power (dBm)	Power (Watt)	Power (dBm)	Power (Watt)
110	50	54.93	311.17	44.82	30.33	55.19	330
110	25	55.07	321.37	44.74	29.79	55.19	330
110	0	55.02	317.69	44.80	30.2	55.19	330

Power vs. Voltage

Test Condition		High Power		Low Power		Declared Output Power	
Voltage (VAC)	Temperature (°C)	Power (dBm)	Power (Watt)	Power (dBm)	Power (Watt)	Power (dBm)	Power (Watt)
126.5	25	55.01	316.96	44.75	29.85	55.19	330
93.5	25	54.99	315.50	44.73	29.72	55.19	330

6 FCC §2.1047 – Modulation Characteristic

6.1 Applicable Standard

FCC §2.1047:

- (a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. for equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.
- (b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

6.2 Test Procedure

Test Method: TIA/EIA-603-C 2.2.3

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
HP	RF Communication test set	8920A	3438A05338	2010-05-18 ¹

Note¹: 2 year calibration cycle

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

6.4 Test Environmental Conditions

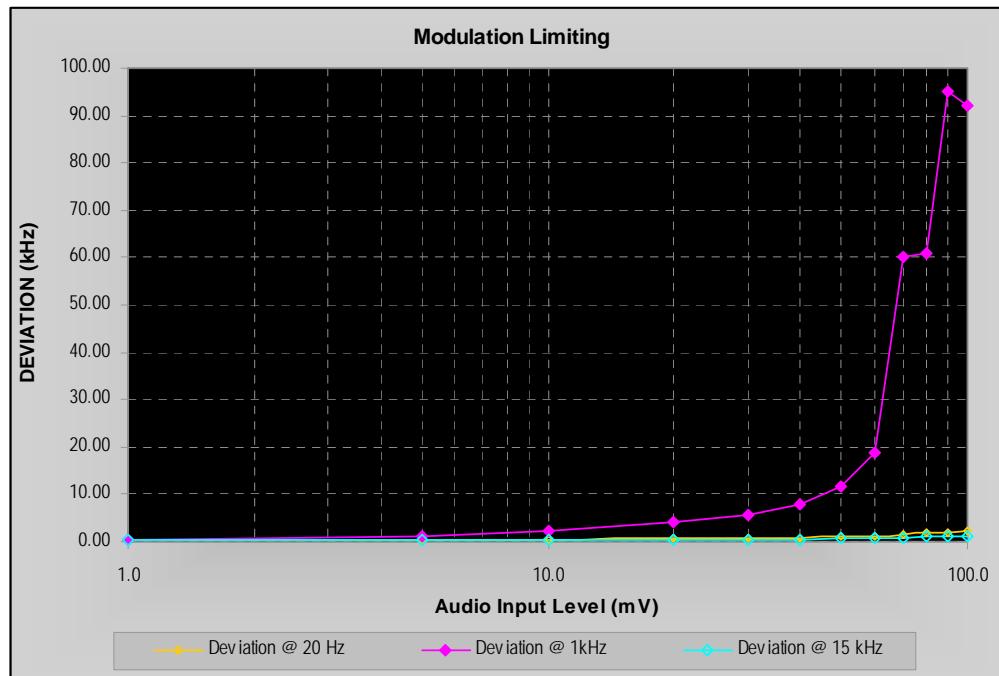
Temperature:	20-25 °C
Relative Humidity:	45 %
ATM Pressure:	101.3 kPa

The testing was performed by Quinn Jiang on 2011-10-21 in the RF Site.

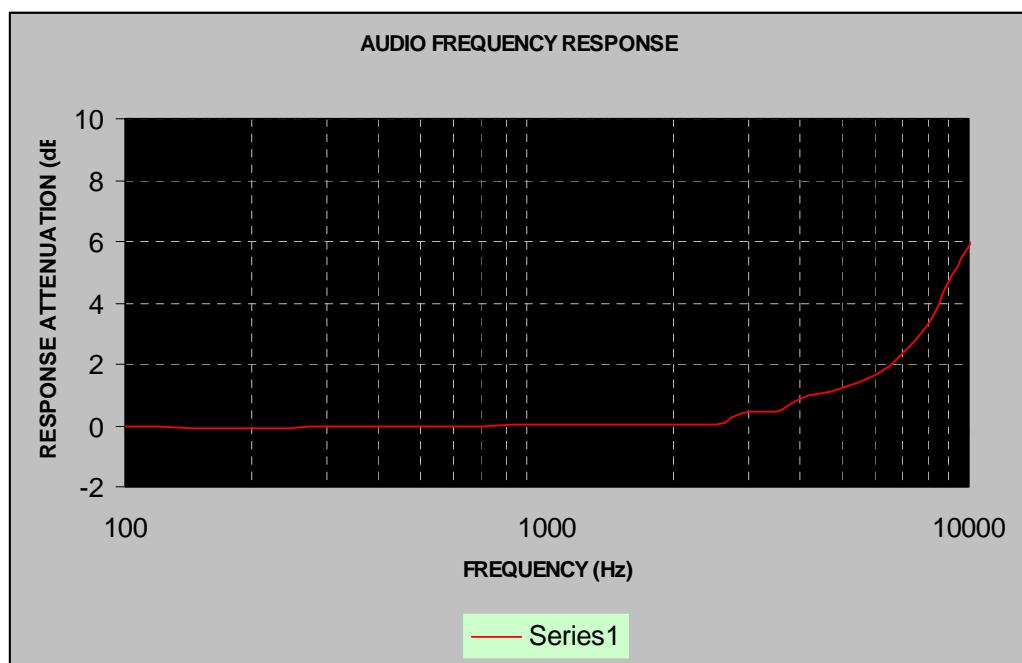
6.5 Test Result

Please refer to the hereinafter plots.

Modulation Limiting



Audio Frequency Response



7 FCC §2.1049 & §73.317 – Occupied Bandwidth & Emission Mask

7.1 Applicable Standard

FCC §73.317:

(b) Any emission appearing on a frequency removed from the carrier by between 120 kHz and 240 kHz inclusive must be attenuated at least 25 dB below the level of the unmodulated carrier. Compliance with this requirement will be deemed to show the occupied bandwidth to be 240 kHz or less.

(c) Any emission appearing on a frequency removed from the carrier by more than 240 kHz and up to and including 600 kHz must be attenuated at least 35 dB below the level of the unmodulated carrier.

(d) Any emission appearing on a frequency removed from the carrier by more than 600 kHz must be attenuated at least $43 + 10 \log_{10}(\text{Power, in watts})$ dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

7.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the frequency band ± 750 KHz from the carrier frequency.

7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
Agilent	Function Arbitrary Waveform Generator	33220A	MY43004878	2011-07-22

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

7.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	44 %
ATM Pressure:	101.2 kPa

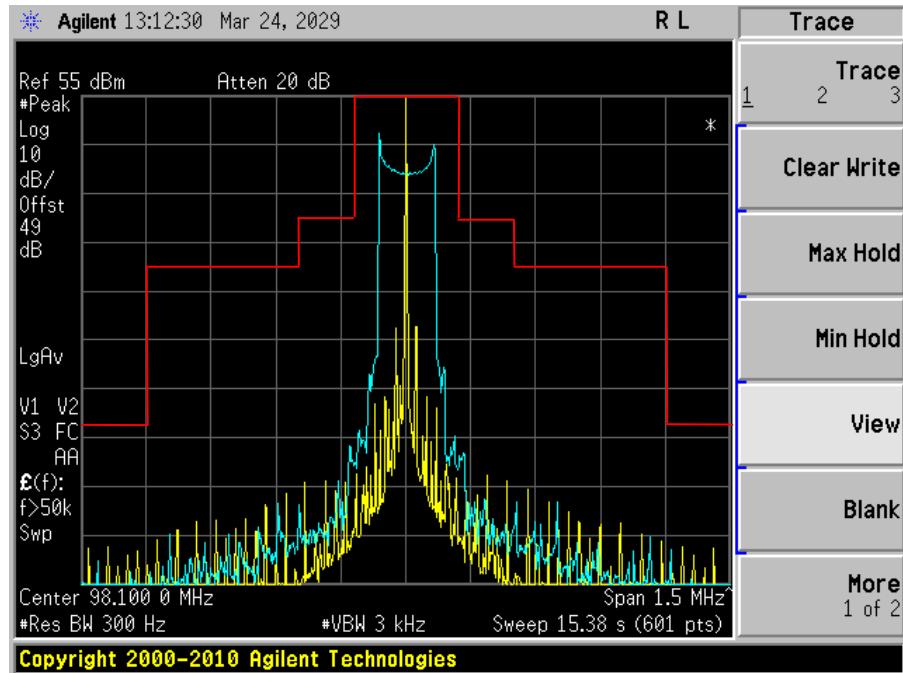
The testing was performed by Quinn Jiang on 2011-10-15 in the RF Site.

7.5 Test Result

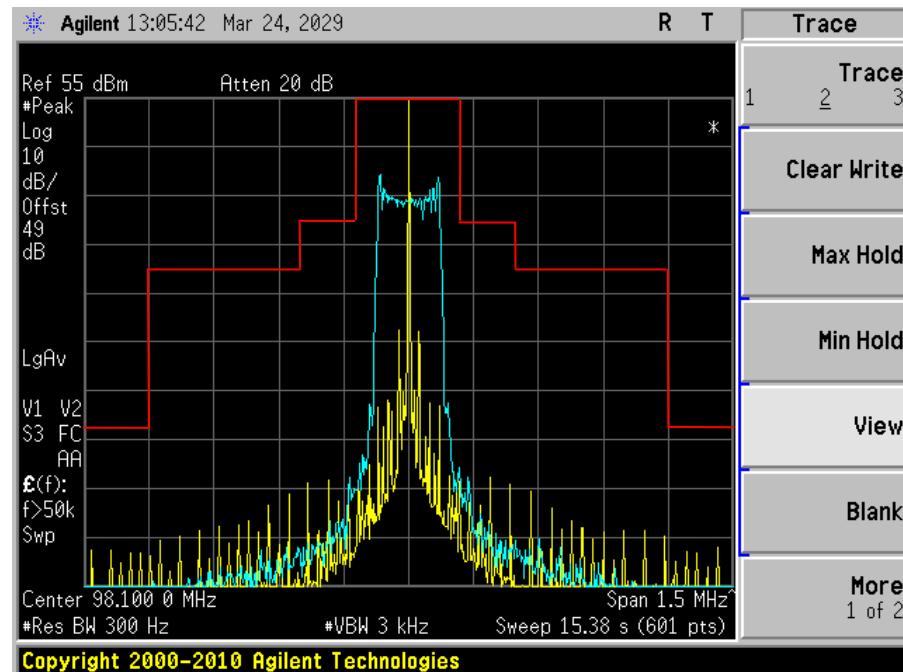
Please refer to the hereinafter plots.

Emission Mask

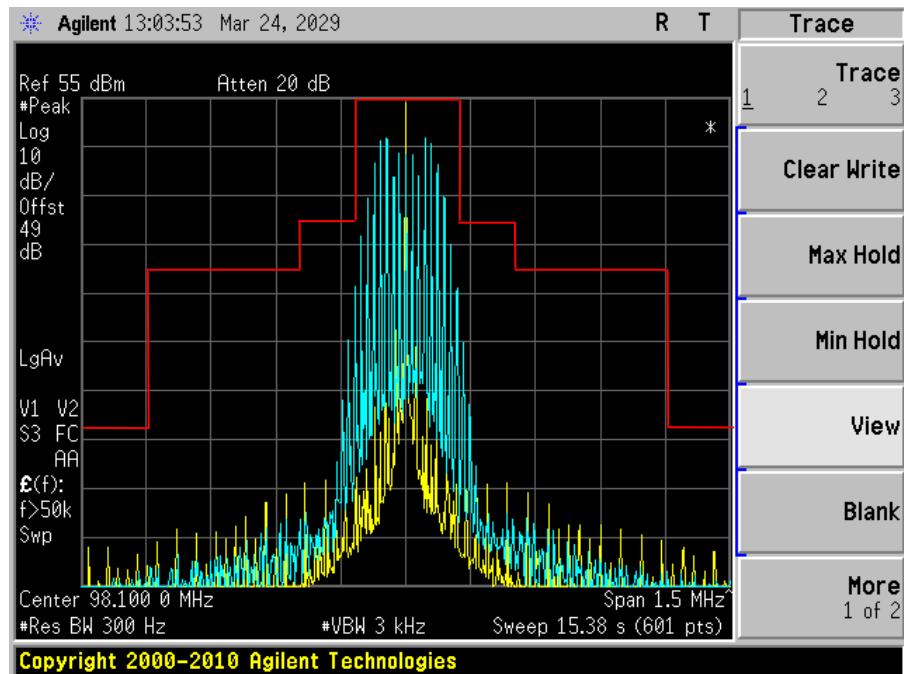
Audio in: 20 Hz, Middle Channel – 98.1 MHz



Audio in: 1 kHz, Middle Channel – 98.1 MHz



Audio in: 15 kHz, Middle Channel – 98.1 MHz



8 FCC §2.1051 & §73.317 - Spurious Emissions at Antenna Terminals

8.1 Applicable Standard

FCC §73.317 (d)

Any emission appearing on a frequency removed from the carrier by more than 600 kHz must be attenuated at least $43 + 10 \log_{10}(\text{Power, in watts})$ dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

8.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 10 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
Agilent	Function Arbitrary Waveform Generator	33220A	MY43004878	2011-07-22

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

8.4 Test Environmental Conditions

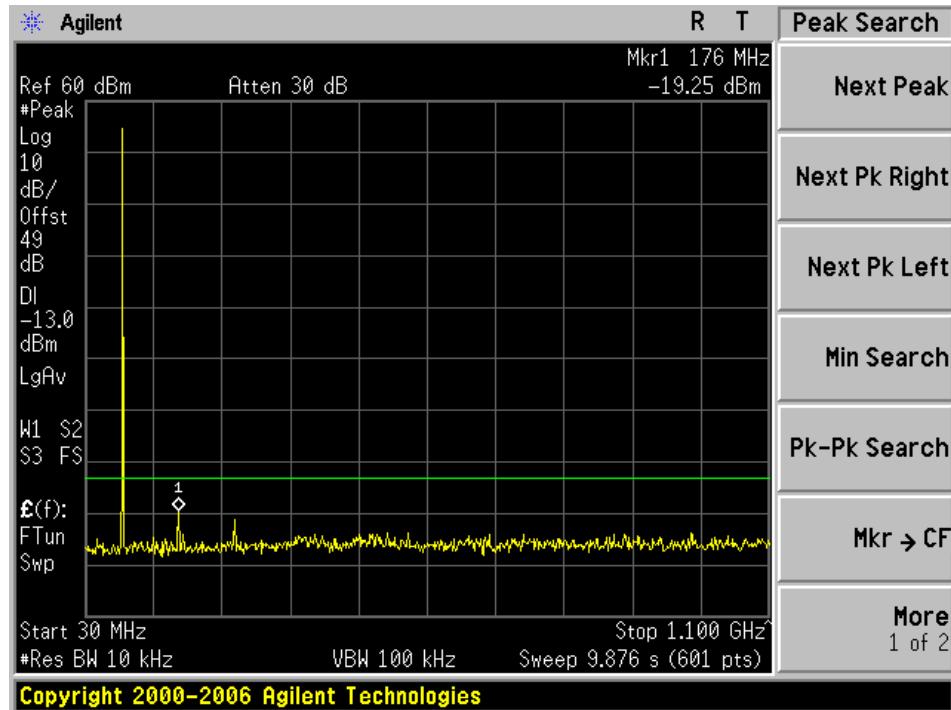
Temperature:	20-25 °C
Relative Humidity:	44 %
ATM Pressure:	101.2 kPa

The testing was performed by Quinn Jiang on 2011-10-15 in the RF site.

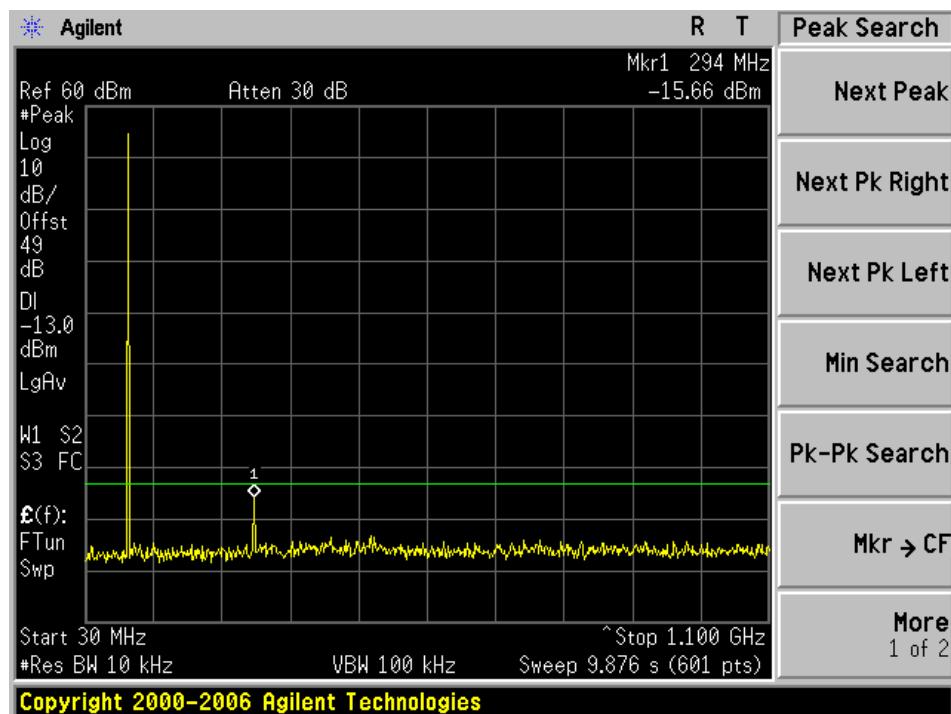
8.5 Test Results

Please refer to the hereinafter plots.

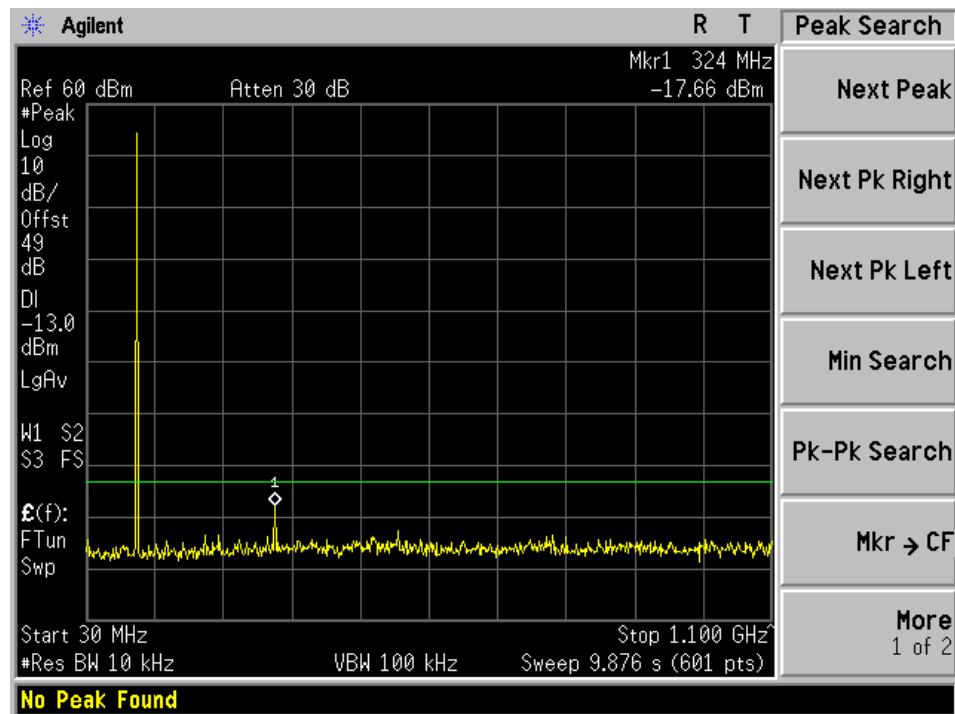
Low Channel – 88.1 MHz



Middle Channel – 98.1 MHz



High Channel – 107.9 MHz



9 FCC §2.1055 & §73.1545 - Frequency Stability

9.1 Applicable Standard

FCC §2.1055, §73.1545

The departure of the carrier or center frequency of an FM station with an authorized transmitter output power more than 10 watts may not exceed ± 2000 Hz from the assigned frequency.

9.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an AC power supply and the RF output was connected to the Spectrum Analyzer via feed-through attenuators. The EUT was placed inside the temperature chamber. The AC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Spectrum Analyzer.

Frequency Stability vs. Voltage: An external variable AC power supply Source. The voltage was set to 115% and 85% of the nominal value. The output frequency was recorded for each voltage.

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
Agilent	Function Arbitrary Waveform Generator	33220A	MY43004878	2011-07-22
ESPEC	Oven, Temperature	ESL-4CA	18010	N/A

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

9.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	44 %
ATM Pressure:	101.2 kPa

The testing was performed by Quinn Jiang on 2011-10-15 in the RF Site.

9.5 Test Results

Frequency vs. Temperature

Test Condition		Reference Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (Hz)	Limit (Hz)
Voltage (VAC)	Temperature (°C)				
110	50	98.1	98.1008	800	± 2000
110	25	98.1	98.0998	-200	± 2000
110	0	98.1	98.1003	300	± 2000

Frequency vs. Voltage

Test Condition		Reference Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (Hz)	Limit (Hz)
Voltage (VAC)	Temperature (°C)				
126.5	25	98.1	98.0996	-400	± 2000
93.5	25	98.1	98.0994	-600	± 2000

10 FCC §2.1053 & §73.317 – Field Strength of Spurious Radiation

10.1 Applicable Standard

FCC §2.1053 (a)

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. FCC §73.317 (d) Any emission appearing on a frequency removed from the carrier by more than 600 kHz must be attenuated at least $43 + 10 \log_{10}(\text{Power, in watts})$ dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

10.2 Test Procedure

The transmitter was placed on a Styrofoam with wooden turntable, and it was normal transmitting with 50ohm termination which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \lg (\text{TXpwr in Watts}/0.001)$ – the absolute level
Spurious attenuation limit in dB = $43 + 10 \log_{10}(\text{power out in Watts})$

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB1	A020106-1	2011-05-17
A.R.A Inc	Horn antenna	DRG-1181A	1132	2010-11-29
Hewlett Packard	Pre amplifier	8447D	2944A06639	2011-06-09
Mini-Circuits	Pre Amplifier	ZVA-183-S	570400946	2011-05-09
Rhode & Schwarz	Signal Generator	SMIQ 03	DE23746	2010-03-31 ¹

Note¹: Based on a two-year calibration cycle

Statement of Traceability: BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

10.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	46 %
ATM Pressure:	101.2 kPa

The testing was performed by Quinn Jiang on 2011-10-14 in 5 meter chamber -3.

10.5 Test Results

Worst Margin: -5.34 dB at 588.6 MHz in the Horizontal polarization.

Middle Channel – 98.1 MHz

Indicated		Turntable Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (m)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
294.3	52.18	348	1.0	V	294.3	-32.34	0	0.2	-32.54	-13	-19.54
294.3	57.81	199	1.84	H	294.3	-26.71	0	0.2	-26.91	-13	-13.91
588.6	58.6	341	1.0	V	588.6	-21.78	0	0.4	-22.18	-13	-9.18
588.6	62.44	218	1.35	H	588.6	-17.94	0	0.4	-18.34	-13	-5.34
686.7	58.1	174	1.27	V	686.7	-19.07	0	0.5	-19.57	-13	-6.57
686.7	58.64	12	1.2	H	686.7	-18.53	0	0.5	-19.03	-13	-6.03

11 FCC §15.109 - Radiated Emissions

11.1 Applicable Standard

As per FCC §15.109: Radiated Emission Limits

(b) The field strength of radiated emissions from a Class A digital device, as determinated at a distance of 10 meters, shall not exceed the following:

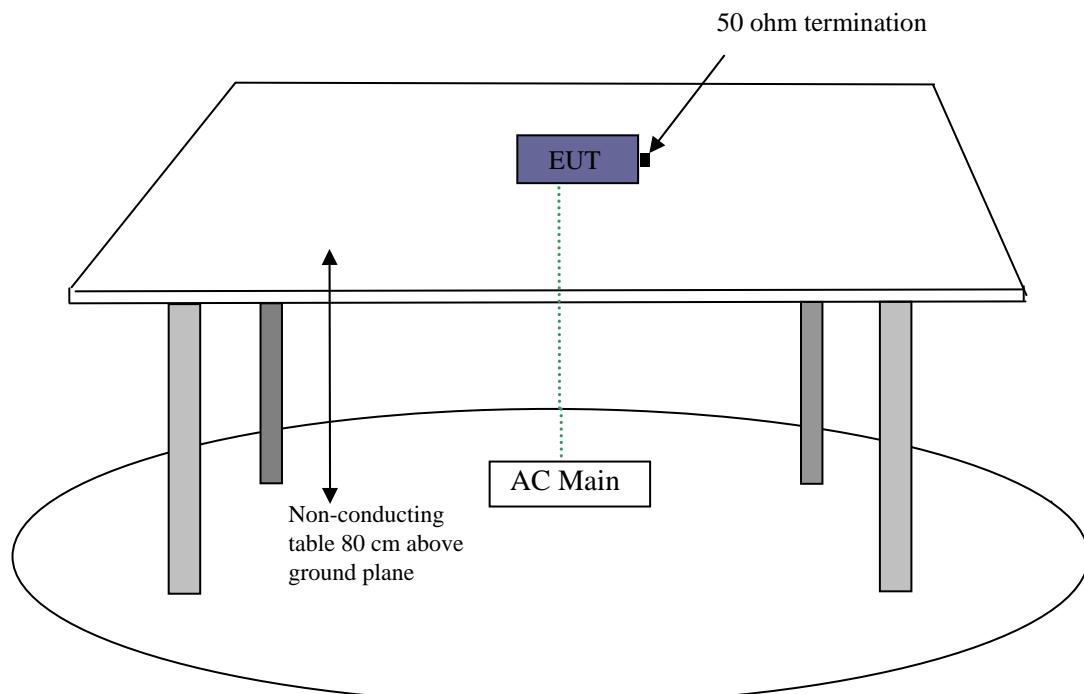
Frequency (MHz)	Field Strength (μ V/m)
30-88	90
88-216	150
216-960	210
Above 960	300

11.2 Test Procedure

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

11.3 Test Block Diagram



11.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to the indicated Amplitude (Ai) reading. The basic equation is as follows:

$$CA = Ai + AF + CL + Atten - Ga$$

For example, the Corrected Amplitude (CA) of 40.3 dBuV/m = indicated Amplitude reading (Ai) 32.5 dBuV + Antenna Factor (AF) 23.5dB + Cable Loss (CL) 3.7 dB + Attenuator (Atten) 10 dB - Amplifier Gain (Ga) 29.4 dB

The “Margin” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

11.5 Test Equipment Lists and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates
Hewlett Packard	Pre-amplifier	8447D	2944A07030	2011-04-11
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K 03	100044	2011-04-14
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2011-06-29
HP	Pre Amplifier	8449B	3147A00400	2011-02-03
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
A.R.A Inc.	Horn antenna	DRG-1181A	1132	2010-11-29

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

11.6 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	46 %
ATM Pressure:	101.2 kPa

The testing was performed by Quinn Jiang on 2011-10-14 in 5 meter chamber -3.

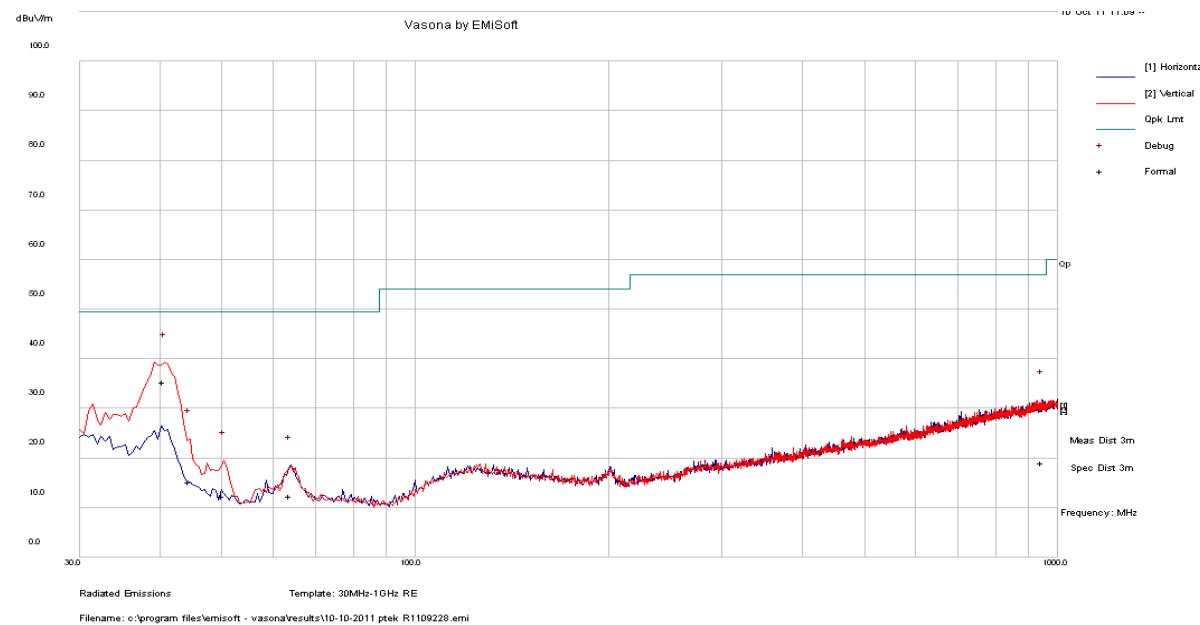
11.7 Summary of Test Results

According to the test data, the EUT complied FCC 15.109 Class A limit, with the worst margins from the limit listed below:

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Test Range
-14.24	40.5915	Vertical	30 MHz-1 GHz

11.8 Radiated Spurious Emissions Plot and Data

30 MHz – 1 GHz, Measured at 3 Meter distance



Quasi-Peak Measurements:

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)
40.5915	35.3	98	V	25	49.54	-14.24
44.556	15.32	98	V	121	49.54	-34.22
50.251	12.34	163	V	20	49.54	-37.20
63.9015	12.34	400	H	221	49.54	-37.20
945.5993	19.13	260	V	236	56.9	-37.77