FCC PART 15.231

TEST AND MEASUREMENT REPORT

For

South Pacific Electronics Ltd.

PO Box 9417, Nadi Airport, Fiji Islands

FCC ID: OHKPCK433
Model: PCK43304

Report Type:	**Product Type:**
Original Report	Keying Transmitter

Prepared By:	Lionel Lara
Report Number:	R1209133-231
Report Date:	2012-10-22
Reviewed By:	Victor Zhang EMC/RF Lead

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1209133-231	Original Report	2012-10-22

1 General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *South Pacific Electronics Ltd*, and their product FCC ID: OHKPCK433, model: *PCK43304* or the "EUT" as referred on this report is a keying transmitter operating from 433.1 to 434.7 MHz.

1.2 Mechanical Description of EUT

The "EUT" measures approximately *6.8cm (L) x 3.8cm (W) x 1.4cm (H)*, and weighs approximately *22*g.

The test data gathered are from typical production sample, serial number: 9I7E5O provided by the manufacturer.

1.3 Objective

This type approval report is prepared on behalf of *South Pacific Electronics Ltd*, in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for section 15.205, 15.209 and 15.231.

1.4 Related Submittal(s)/Grant(s)

No Related Submittals

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

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 $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

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 C63.4-2009, 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.: A-0027. 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 an American Association for laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

2 System Test Configuration

2.1 Justification

The host system was configured for testing according to ANSI C63.4-2009.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

2.2 EUT Exercise Software

The EUT is in normal operation mode during the testing.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Local Support Equipment

N/A

2.5 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
Elsema	PCB	PCK43304 V3	-

2.6 Interface Ports and Cabling

N/A

2.7 External I/O Cabling List and AC Cord

N/A

2.8 Power Supply List and Details

Manufacturer	Description	Model	Serial Number
BK Precision	DC Power Supply	1621A	D185052265

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Result
§15.207(a)	AC Line Conduction Emissions	N/A
§15.231 (a)	Periodic Transmission	Compliant
§15.205, §15.209, §15.231 (b)	Radiated Emissions	Compliant
§15.231 (c)	Emission Bandwidth	Compliant

N/A: EUT is battery powered.

4 FCC §15.231 (a) – Periodic Transmission

4.1 Applicable Standard

According to FCC §15.231 (a) (1), a manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

4.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument via radiated horn antenna. Then set it to any one convenient frequency within its operating range.
3. Set span to zero and record.
4. Repeat above procedures until all frequencies measured were complete.

4.3 Test Equipment List and Details

Manufacturers	Description	Model No.	Serial No.	Calibration Dates	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 Year
Sunol Sciences	Horn Antenna	DRH-118	A052704	2012-02-24	1 Year

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

4.4 Test Environmental Conditions

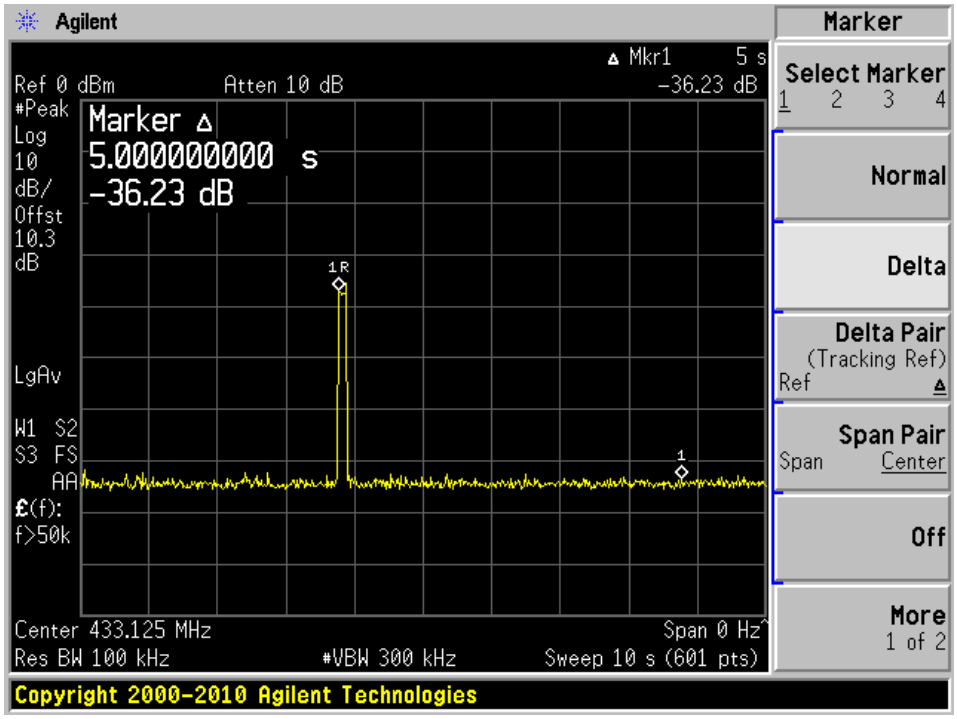
Temperature:	23.3 °C
Relative Humidity:	59 %
ATM Pressure:	101.1 kPa

The testing was performed by Lionel Lara on 2012-09-27 at RF Bench Site.

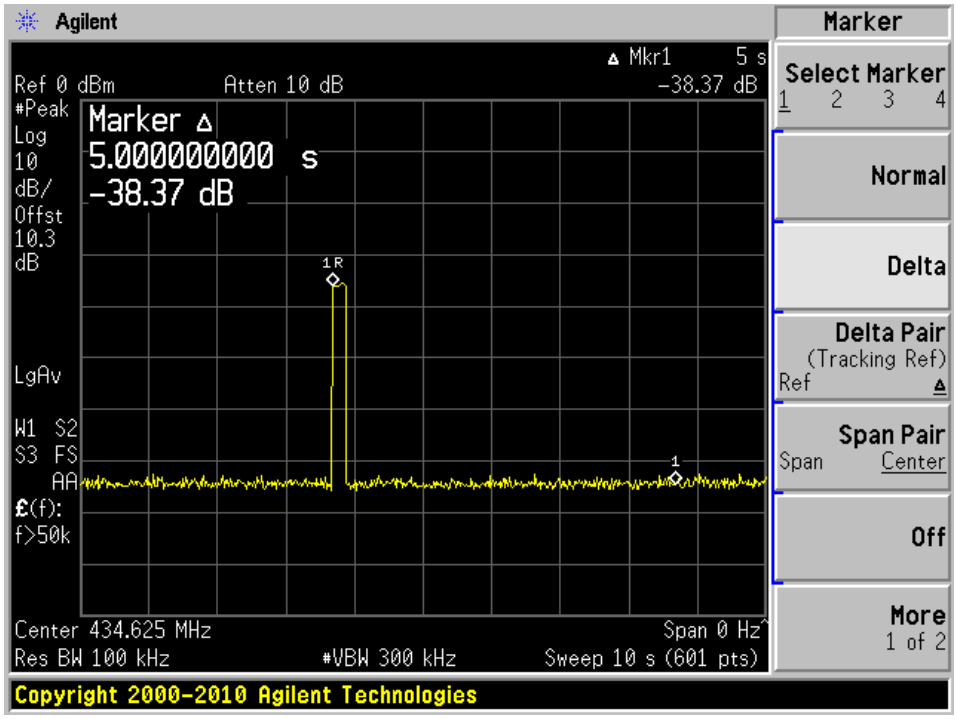
4.5 Test Results

Please refer to the following plots for detailed test results

Low Channel



High Channel



5 FCC §15.205, §15.209 & §15.231 (b) – Radiated Emissions

5.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4.5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5.35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3332 – 3339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3345.8 – 3358	23.6 – 24.0
12.29 – 12.293	240 – 285	3600 – 4400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

As Per FCC §15.231(b), In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental Frequency	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70 MHz	2250	225
70-130 MHz	1250	125
130-174 MHz	1250 to 3750[1]	125-375[1]
174-260 MHz	3750	375
260-470 MHz	3750 to 12500[1]	375 to 1250[1]
Above 470 MHz	12500	1250

Note 1: Linear Interpolations.

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

5.2 Test Setup

The radiated emissions tests were performed using the setup accordance with the ANSI C63.4-2009. The specification used was the FCC 15C.

The spacing between the peripherals was 10 centimeters.

5.3 Test Procedure

For the radiated emissions test, the EUT was performed using a DC power supply.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

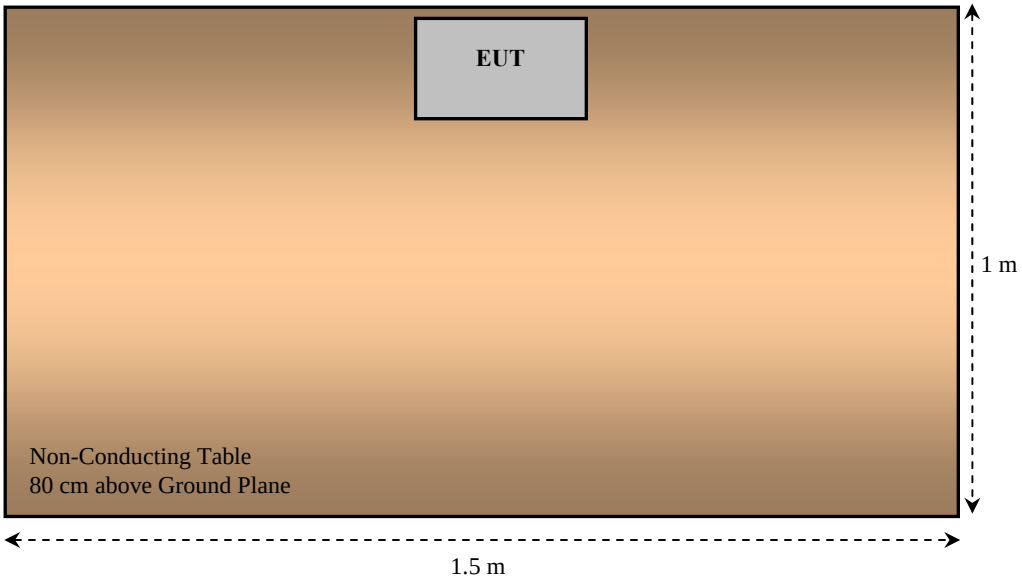
The EUT is set 3 meters away from the testing antenna, which is varied from 1-4 meters, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both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

The spectrum analyzer or receiver is set as:

Below 1000 MHz:
RBW = 100 kHz, VBW = 300 kHz, Sweep = Auto

Above 1000 MHz:
(1) Peak: RBW = 1MHz, VBW = 1MHz, Sweep = Auto
(2) Average: RBW = 1MHz, VBW = 10Hz, Sweep = Auto

5.4 Test Setup Block Diagram



5.5 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:

Margin (dB) = Corrected Amplitude (dBuV/m) - Limit (dBuV/m)

5.6 Test Equipment List and Details

Manufacturers	Descriptions	Model No.	Serial No.	Calibration Dates	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 Year
Sunol Sciences	Horn Antenna	DRH-118	A052704	2012-02-24	1 Year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09	1 Year
Sunol Sciences	Biconi-Log Antenna	JB3	A020106-3	2012-06-18	1 Year
HP	Pre-amplifier	8447D	2944A06639	2012-06-09	1 Year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

5.7 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	48 %
ATM Pressure:	101.2 kPa

The testing was performed by Lionel Lara on 2012-10-02 & 2012-10-04 at 5m chamber 3.

5.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the limits presented in FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.249, and had the worst margin of:

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Comments
-0.28	433.125	Horizontal	Average Measurement

5.9 Radiated Emissions Test Plot & Data

Low Channel

Freq. (MHz)	S.A. Reading (dBuV)	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Duty Cycle CF (dB)	Cord. Amp. (dBµV/m)	FCC Part 15.231		
			Height (cm)	Polar. (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)	Comment
433.125	70.15	69	233	H	17.2	2.07	0	0	89.42	100.8	-11.38	Peak/Fund.
433.125	70.09	210	100	V	17.2	2.07	0	0	89.36	100.8	-11.44	Peak/Fund.
433.125	70.15	69	233	H	17.2	2.07	0	-8.9	80.52	80.8	-0.28	Ave/Fund.
433.125	70.09	210	100	V	17.2	2.07	0	-8.9	80.46	80.8	-0.34	Ave/Fund.
866.25	57.1	252	100	H	22.6	3.27	25.15	0	57.82	80.8	-22.98	Peak
866.25	54.99	137	100	V	22.6	3.27	25.15	0	55.71	80.8	-25.09	Peak
866.25	57.1	252	100	H	22.6	3.27	25.15	-8.9	48.92	60.8	-11.88	Ave
866.25	54.99	137	100	V	22.6	3.27	25.15	-8.9	46.81	60.8	-13.99	Ave
1299.375	58.61	207	100	H	24.66	2.08	27.39	0	57.96	80.8	-22.84	Peak
1299.375	58.93	292	147	V	24.66	2.08	27.39	0	58.28	80.8	-22.52	Peak
1299.375	58.61	207	100	H	24.66	2.08	27.39	-8.9	49.06	60.8	-11.74	Ave
1299.375	58.93	292	147	V	24.66	2.08	27.39	-8.9	49.38	60.8	-11.42	Ave
2165.625	47.69	78	100	H	27.52	2.8	27.7	0	50.31	80.8	-30.49	Peak
2165.625	56.26	107	104	V	27.52	2.8	27.7	0	58.88	80.8	-21.92	Peak
2165.625	47.69	78	100	H	27.52	2.8	27.7	-8.9	41.41	60.8	-19.39	Ave
2165.625	56.26	107	104	V	27.52	2.8	27.7	-8.9	49.98	60.8	-10.82	Ave
409.11	25.04	69	233	H	16.6	2.07	0	0	43.71	54	-10.29	QP
409.14	25.38	210	100	V	16.6	2.07	0	0	44.05	54	-9.95	QP
325	27.12	0	100	H	14.6	1.79	25.26	0	18.25	46	-27.75	QP
325	27.12	0	100	V	14.6	1.79	25.26	0	18.25	46	-27.75	QP
965	25.98	0	100	H	23.6	3.62	25.31	0	27.89	74	-46.11	Peak/NF
965	25.98	0	100	V	23.6	3.62	25.31	0	27.89	74	-46.11	Peak/NF
965	13.05	0	100	H	23.6	3.62	25.31	0	14.96	54	-39.04	Ave/NF
965	13.05	0	100	V	23.6	3.62	25.31	0	14.96	54	-39.04	Ave/NF

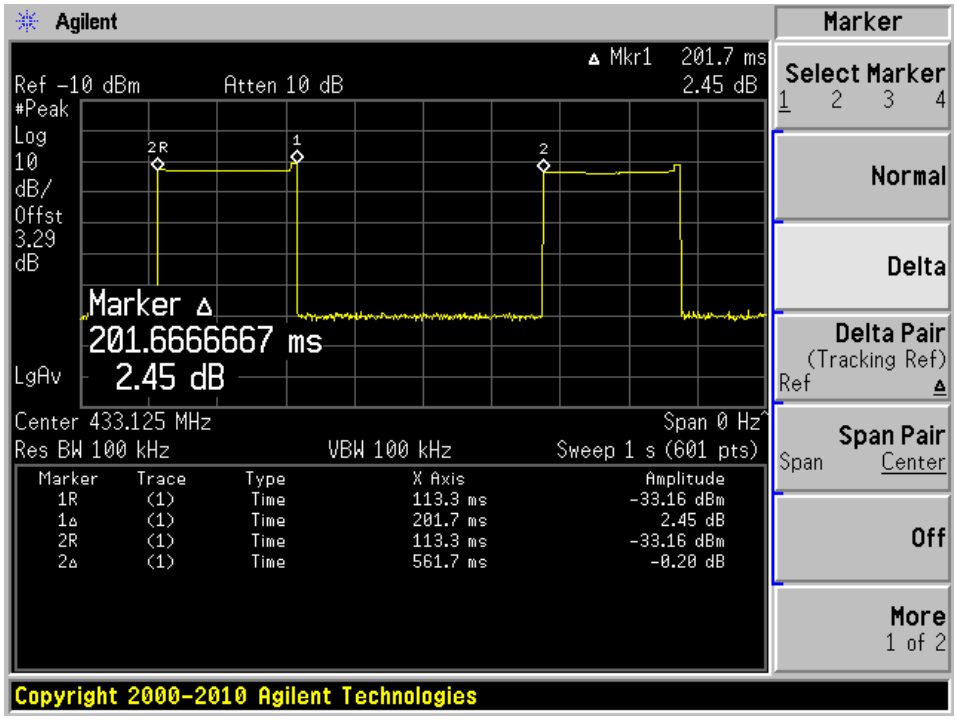
Note: Fundamental = 433.125 MHz, NF = Noise Floor

High Channel

Freq. (MHz)	S.A. Reading (dBuV)	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Duty Cycle CF (dB)	Cord. Amp. (dBµV/m)	FCC Part 15.231		
			Height (cm)	Polar. (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)	Comment
434.6251	70.1	77	188	H	17.2	2.07	0	0	89.37	100.8	-11.43	Peak/Fund.
434.6251	70.06	208	100	V	17.2	2.07	0	0	89.33	100.8	-11.47	Peak/Fund.
434.6251	70.1	77	188	H	17.2	2.07	0	-8.9	80.47	80.8	-0.33	Ave/Fund.
434.6251	70.06	208	100	V	17.2	2.07	0	-8.9	80.43	80.8	-0.37	Ave/Fund.
869.2502	58.79	241	100	H	22.7	3.27	25.15	0	59.61	80.8	-21.19	Peak
869.2502	55.59	135	181	V	22.7	3.27	25.15	0	56.41	80.8	-24.39	Peak
869.2502	58.79	241	100	H	22.7	3.27	25.15	-8.9	50.71	60.8	-10.09	Ave
869.2502	55.59	135	181	V	22.7	3.27	25.15	-8.9	47.51	60.8	-13.29	Ave
1303.8753	59.1	210	100	H	24.66	2.08	27.39	0	58.45	74	-15.55	Peak
1303.8753	58.84	294	148	V	24.66	2.08	27.39	0	58.19	74	-15.81	Peak
1303.8753	59.1	210	100	H	24.66	2.08	27.39	-8.9	49.55	54	-4.45	Ave
1303.8753	58.84	294	148	V	24.66	2.08	27.39	-8.9	49.29	54	-4.71	Ave
2173.1255	46.2	110	108	H	27.52	2.8	27.7	0	48.82	80.8	-31.98	Peak
2173.1255	54.33	256	109	V	27.52	2.8	27.7	0	56.95	80.8	-23.85	Peak
2173.1255	46.2	110	108	H	27.52	2.8	27.7	-8.9	39.92	60.8	-20.88	Ave
2173.1255	54.33	256	109	V	27.52	2.8	27.7	-8.9	48.05	60.8	-12.75	Ave
325	27.24	0	100	H	14.6	1.79	25.26	0	18.37	46	-27.63	QP
325	27.24	0	100	V	14.6	1.79	25.26	0	18.37	46	-27.63	QP
965	26.15	0	100	H	23.6	3.62	25.31	0	28.06	74	-45.94	Peak/NF
965	26.15	0	100	V	23.6	3.62	25.31	0	28.06	74	-45.94	Peak/NF
965	13.01	0	100	H	23.6	3.62	25.31	0	14.92	54	-39.08	Ave/NF
965	13.01	0	100	V	23.6	3.62	25.31	0	14.92	54	-39.08	Ave/NF

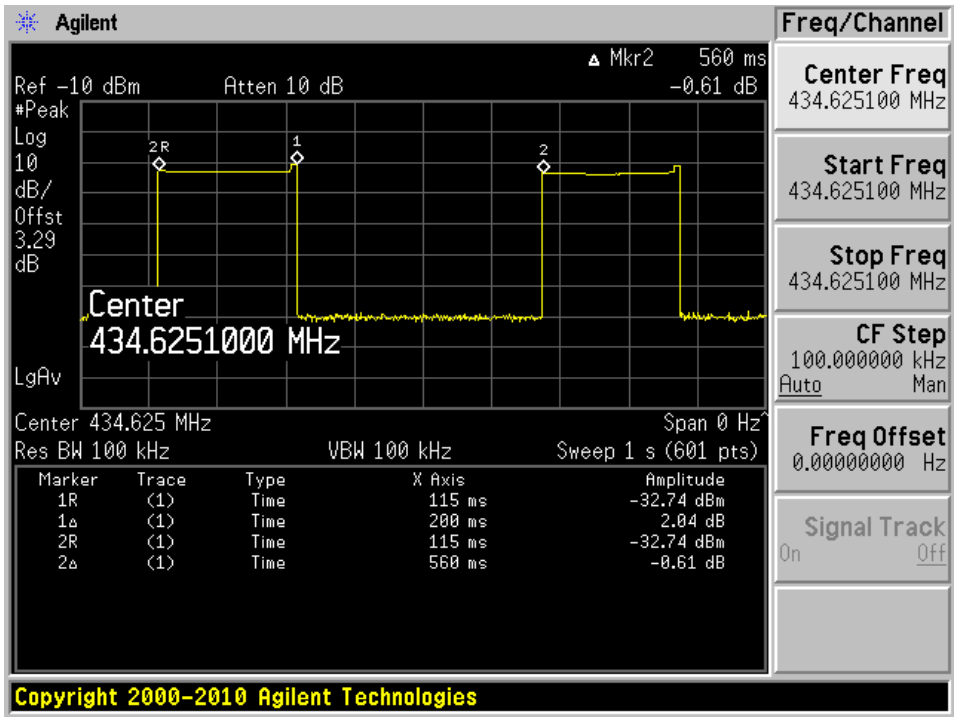
Note: Fundamental = 434.6251 MHz, NF = Noise Floor

Duty Cycle, Low Channel



Duty Cycle Correction Factor = 20*log(Ton/Tp) = 20*log(201.7/561.7) = -8.9

Duty Cycle, High Channel



Duty Cycle Correction Factor = 20*log(Ton/Tp) = 20*log(200/560) = -8.9

6 FCC §15.231 (c) – Emission Bandwidth

6.1 Applicable Standard

FCC §15.231(c)

(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

6.2 Measurement Procedure

5. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
6. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument via radiated horn antenna. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
7. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emissions bandwidth. (20 dB bandwidth for DTS)
8. Repeat above procedures until all frequencies measured were complete.

6.3 Test Equipment List and Details

Manufacturers	Description	Model No.	Serial No.	Calibration Dates	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 Year
Sunol Sciences	Horn Antenna	DRH-118	A052704	2012-02-24	1 Year

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

6.4 Test Environmental Conditions

Temperature:	23.3 °C
Relative Humidity:	59 %
ATM Pressure:	101.1 kPa

The testing was performed by Lionel Lara on 2012-09-27 at RF Bench Site.

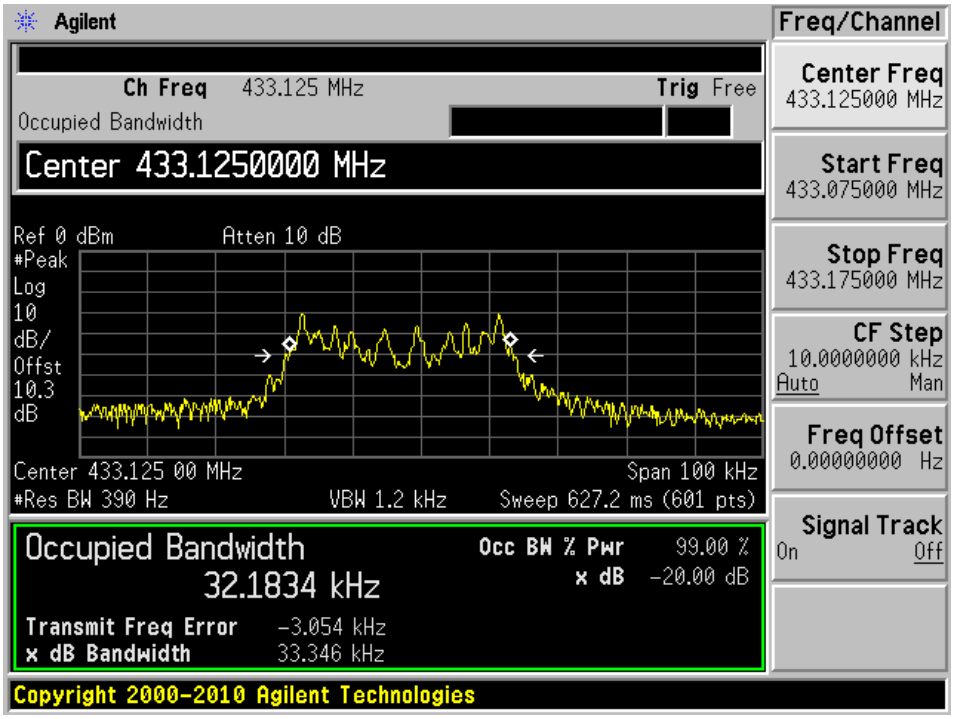
6.5 Test Results

433.125 MHz FCC/IC Limit = Fundamental Frequency X 0.25% = 433.125 MHz ×0.25%= 1082.8125 kHz
434.6251 MHz FCC/IC Limit = Fundamental Frequency X 0.25% = 434.6251 MHz×0.25%= 1086.56275 kHz

Frequency	FCC Result		
	20 dB Bandwidth (kHz)	Limit (kHz)	Result
433.125	33.346	1082.8125	Compliant
434.6251	32.684	1086.56275	Compliant

Please refer to the following plots for detailed test results

Low Channel, 433.125 MHz



High Channel, 434.6251 MHz