TEST REPORT

of

Part 15 Subpart C § 15.231

Equipment Under Test	:	FSK Transmitter
Model Name	:	Vellux Bell
Serial No.	:	N/A
Applicant	:	Dunan Co., Ltd.
Manufacturer	:	Dunan Co., Ltd.
Date of Test(s)	:	2008-07-22 ~ 2008-08-07
Date of Issue	:	2008-08-08

In the configuration tested, the EUT complied with the standards specified above.

Tested By: **Date** **2008-08-08**

Geoffrey Do

Approved By **Date** **2008-08-08**

Jim Kim

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1. General information

1.1. Testing laboratory

SGS Testing Korea Co., Ltd.
Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040
www.electrolab.kr.sgs.com
Telephone : +82 +31 428 5700
FAX : +82 +31 427 2371

1.2.Details of applicant

Applicant : Dunan Co., Ltd.
Address : #304 Hansol B/D, 145-1, Gumi-dong, Bundang-gu, Seongnam-si, Gyunggi-do, Korea
Contact Person : Kwan-Hong Hong
Phone No. : 82-31-715-4513
Fax No. : 82-31-715-4531

1.3. Description of EUT

Kind of Product	FSK Transmitter
Model Name	Vellux Bell
Serial Number	N/A
Power Supply	DC 12 V
Frequency Range	433.050 MHz ~ 434.790 MHz(TX)
Modulation Technique	FSK
Number of Channels	70
Operating Conditions	-20℃ ~ 50℃
Antenna Type	Fixed type (Wire ANT)

1.4. Details of modification

-N/A

1.5. Test equipment list

Equipment	Manufacturer	Model	Cal due.
Signal Generator	Agilent	E4438C	May 09, 2009
Spectrum Analyzer	Agilent	E4440A	May 09, 2009
Spectrum Analyzer	H.P.	8565E	Dec. 31, 2008
Attenuator	Agilent	8494B	May 09, 2009
DC Power Supply	Agilent	E3631A	May 09, 2009
Test Receiver	R & S	ESVS10	Mar. 21, 2009
Preamplifier	H.P.	8447F	Sep. 17, 2008
Preamplifier	Agilent	8449B	May 09, 2009
Ultra Broadband Antenna	R & S	HL562	Oct. 02, 2009
Horn Antenna	R & S	HF 906	Nov. 13, 2009
Anechoic Chamber	SY Corporation	L x W x H (9.6 m x 3.5 m x 3.5 m)	Feb. 15, 2009

1.6. Summary of test results

The EUT has been tested according to the following specifications:

Applied standard : FCC Part15 Subpart C		
Standard section	**Test item**	**Result**
15.231(b)	Field strength of the fundamental, spurious emission	Complied
15.231(a)	Transmission time	Complied
15.231(c)	Bandwidth of operation frequency	Complied

1.7. Test report revision

Revision	Report number	Description
0	F690501/RF-RTL002259	Initial

2. Field strength of the fundamental & spurious emission

2.1. Test setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 40 GHz Emissions.

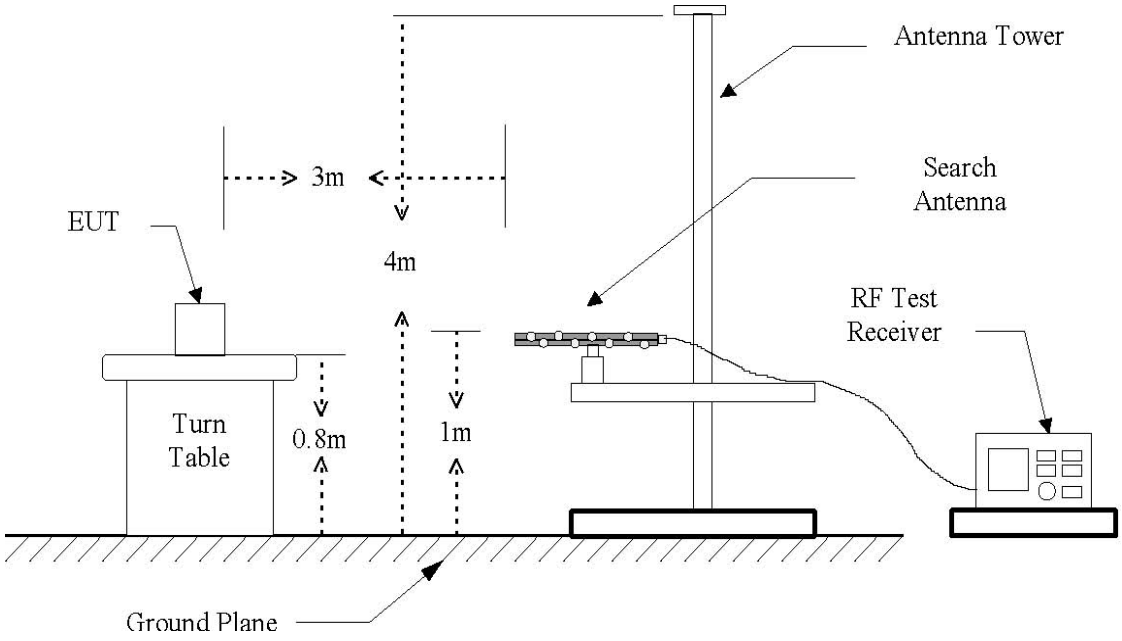


Figure 1 : Frequencies measured below 1 GHz configuration

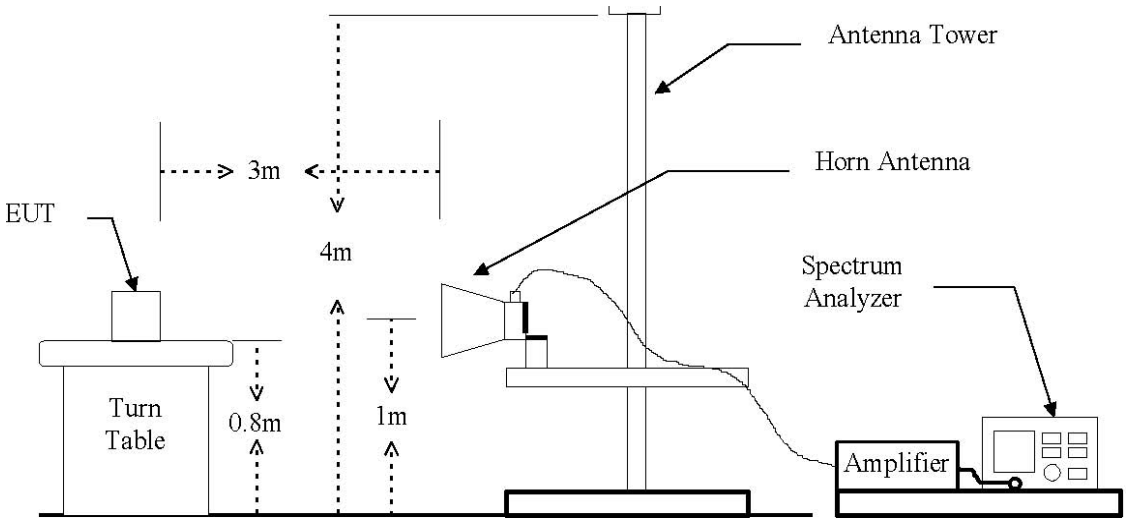


Figure 2 : Frequencies measured above 1 GHz configuration

2.2. Limit

In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66 – 47.70	2,250	225
70 - 130	1,250	125
130 – 174	1,250 to 3,750 **	125 to 375 **
174 – 260	3,750	375
260 – 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** linear interpolations

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows : for the band 130-174 MHz,, uV/m at 3 meters = 56.81818(F)-6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F)-7083.333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

2.3. Test procedures for emission from 30 MHz to 1000 MHz

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 1 meter away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Note：

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz for Peak detection and frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1 GHz.

2.4. Test result

Ambient temperature : 22 ℃
Relative humidity : 45 % R.H.

2.4.1. Below 1 GHz

a. Low channel

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
433.05	60.60	P	H	14.64	2.80	78.04	100.80	22.76

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
291.9	58.20	P	H	10.66	-24.78	44.08	80.80	36.72
578.05	56.30	P	H	16.66	-25.23	47.73	80.80	33.07
721.13	56.30	P	H	18.79	-24.77	50.32	80.80	30.48
864.20	55.70	P	H	20.53	-24.01	52.22	80.80	28.58

b. Middle channel

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
433.92	60.70	P	H	14.68	2.80	78.18	100.83	22.65

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
291.90	59.80	P	H	10.66	-24.78	45.68	80.83	35.15
483.48	53.10	P	H	15.71	-25.29	43.52	80.83	37.31
580.48	57.50	P	H	16.70	-25.22	48.98	80.83	31.85
723.55	54.10	P	H	18.84	-24.76	48.18	80.83	32.65
869.05	55.90	P	H	20.59	-23.98	52.51	80.83	28.32

c. High channel

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
434.79	61.60	P	H	14.71	2.81	79.12	100.86	21.74

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
481.05	47.80	P	H	15.63	-25.29	38.14	80.86	42.72
578.05	52.60	P	H	16.66	-25.23	44.03	80.86	36.83
721.13	49.10	P	H	18.79	-24.77	43.12	80.86	37.74
864.20	49.30	P	H	20.53	-24.01	45.82	80.86	35.04

Remark:

1. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

2.4.2. Above 1 GHz

a. Low channel

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1011.00	58.75	P	H	24.02	-31.61	51.16	74.00	22.84
1154.00	57.89	P	H	24.34	-31.16	51.07	74.00	22.93
1300.00	56.58	P	H	24.66	-30.74	50.50	74.00	23.50
1731.00	50.75	P	H	26.21	-28.98	47.98	80.80	32.82
1874.00	50.27	P	H	26.90	-28.67	48.49	80.80	32.31
2020.00	52.07	P	H	27.53	-28.56	51.04	80.80	29.76
2163.00	51.81	P	H	27.73	-28.57	50.97	80.80	29.83
2309.00	54.68	P	H	27.93	-28.14	54.47	80.80	26.33
2455.00	51.54	P	H	28.14	-28.16	51.52	80.80	29.28
Above 2500	Not Detected							

b. Middle channel

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1012.14	58.93	P	H	24.03	-31.61	51.34	74.00	22.66
1155.20	58.07	P	H	24.34	-31.15	51.26	74.00	22.74
1301.76	56.76	P	H	24.66	-30.73	50.69	74.00	23.31
1735.68	50.93	P	H	26.23	-28.95	48.21	74.00	25.79
1875.25	50.45	P	H	26.90	-28.68	48.68	80.83	32.15
2021.25	52.25	P	H	27.53	-28.56	51.22	80.83	29.61
2169.65	51.99	P	H	27.74	-28.57	51.16	80.83	29.67
2310.25	54.86	P	H	27.93	-28.15	52.93	74.00	21.07
2456.25	51.72	P	H	28.14	-28.16	51.70	80.83	29.13
Above 2500	Not Detected							

c. High channel

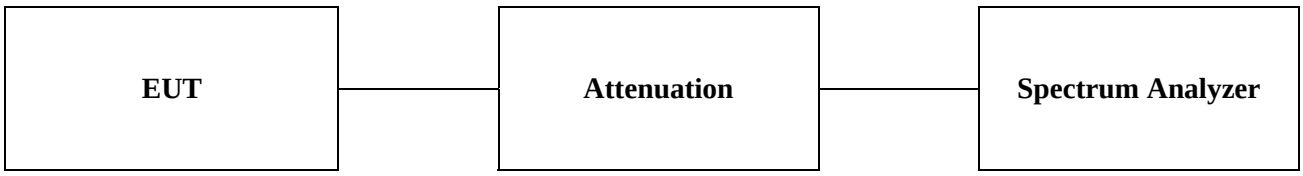
Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1012.14	58.93	P	H	24.03	-31.61	51.35	74.00	22.65
1155.20	58.07	P	H	24.34	-31.15	51.26	74.00	22.74
1305.47	56.76	P	H	24.67	-30.71	50.72	74.00	23.28
1740.57	50.93	P	H	26.25	-28.92	48.26	74.00	25.74
1875.25	50.45	P	H	26.90	-28.68	48.67	80.86	32.19
2021.25	52.25	P	H	27.53	-28.56	51.22	80.86	29.64
2173.45	51.99	P	H	27.74	-28.57	51.16	80.86	29.70
2310.47	51.44	P	H	27.93	-28.14	51.23	80.86	29.63
2467.24	51.72	P	H	28.15	-28.15	51.72	80.86	29.14
Above 2500	Not Detected							

Remark:

1. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

3. Transmission time

3.1. Test setup



3.2. Limit

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

3.3. Test procedure

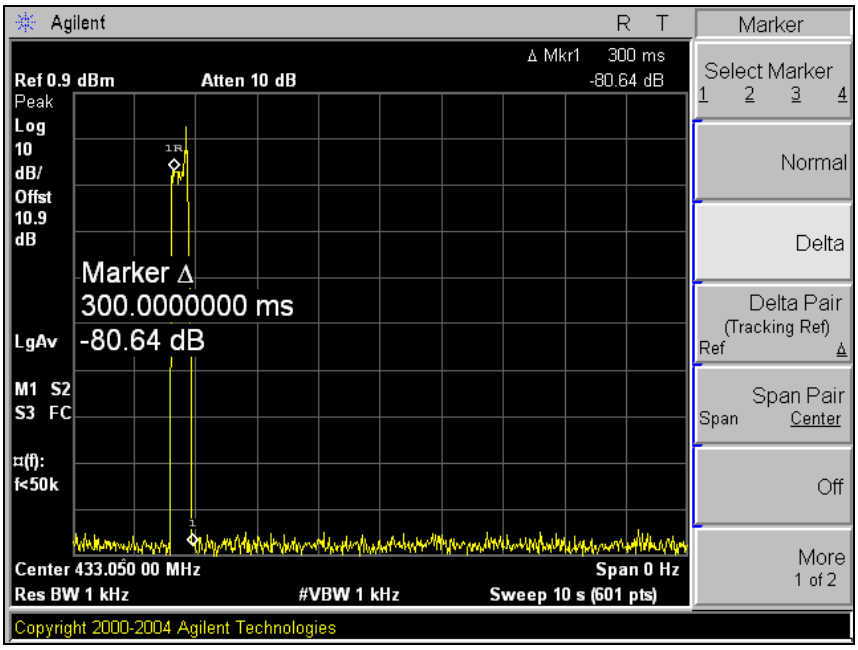
1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. The transmission time was measured with the spectrum analyzer using RBW=1 kHz, VBW=1 kHz and span=0 Hz.

3.4. Test result

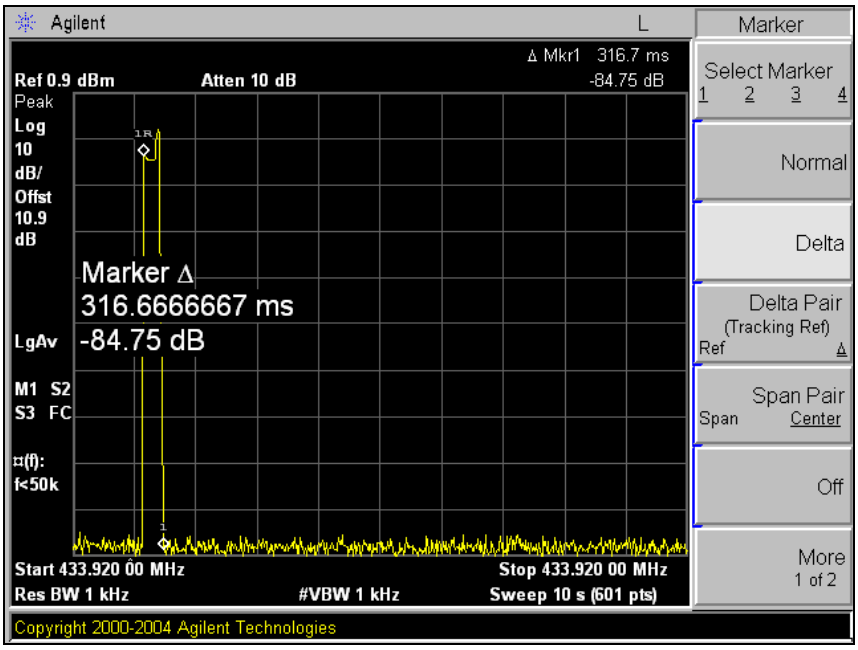
Ambient temperature : 24 ℃
Relative humidity : 42 % R.H.

Channel	Transmission time(ms)	Limit (sec)
Low	300.00	5
Middle	316.67	5
High	316.67	5

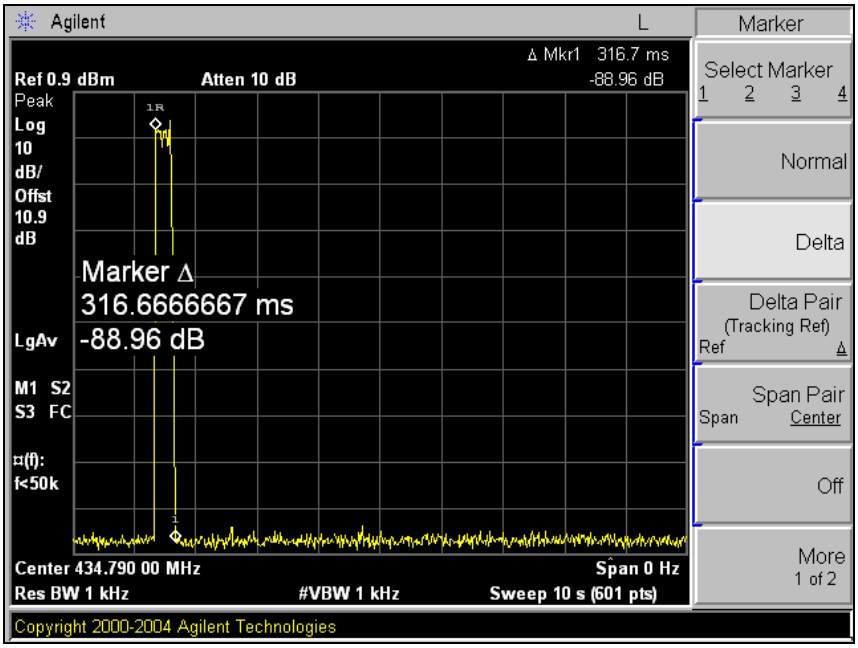
Low channel : Transmission time



Middle channel : Transmission time

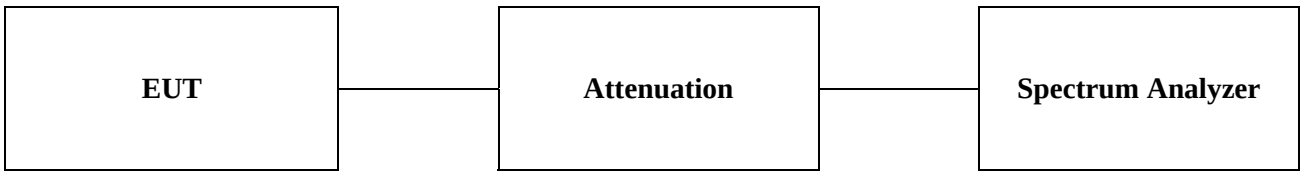


High channel : Transmission time



4. Bandwidth of operation frequency

4.1. Test setup



4.2. Limit

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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Limit of 20 dB bandwidth

Low channel	:	433.05	MHz	× 0.0025 =	1082.63	kHz
Middle channel	:	433.92	MHz	× 0.0025 =	1084.80	kHz
High channel	:	434.79	MHz	× 0.0025 =	1086.98	kHz

4.3. Test procedure

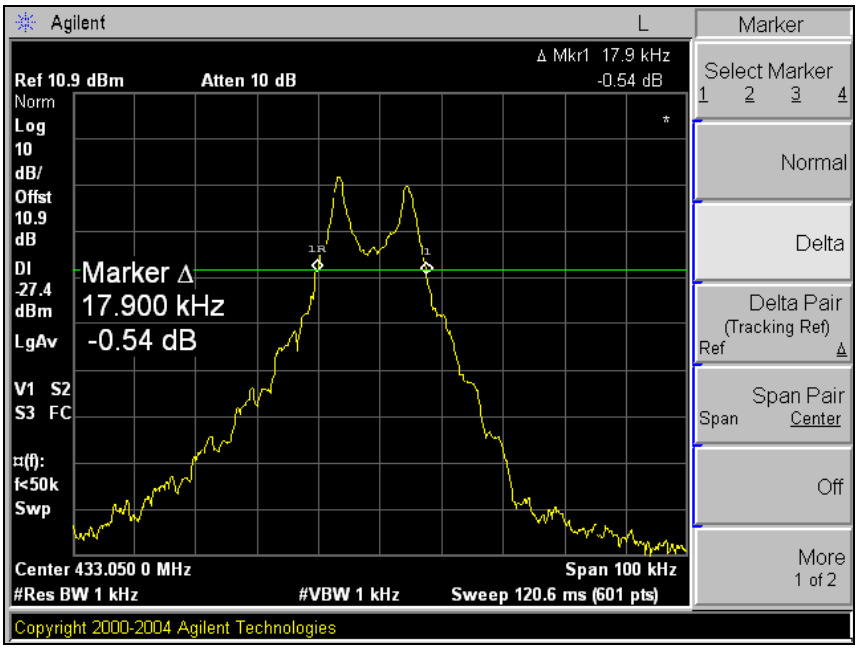
1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=1 kHz, VBW=1 kHz and Span=100 kHz.

4.4. Test result

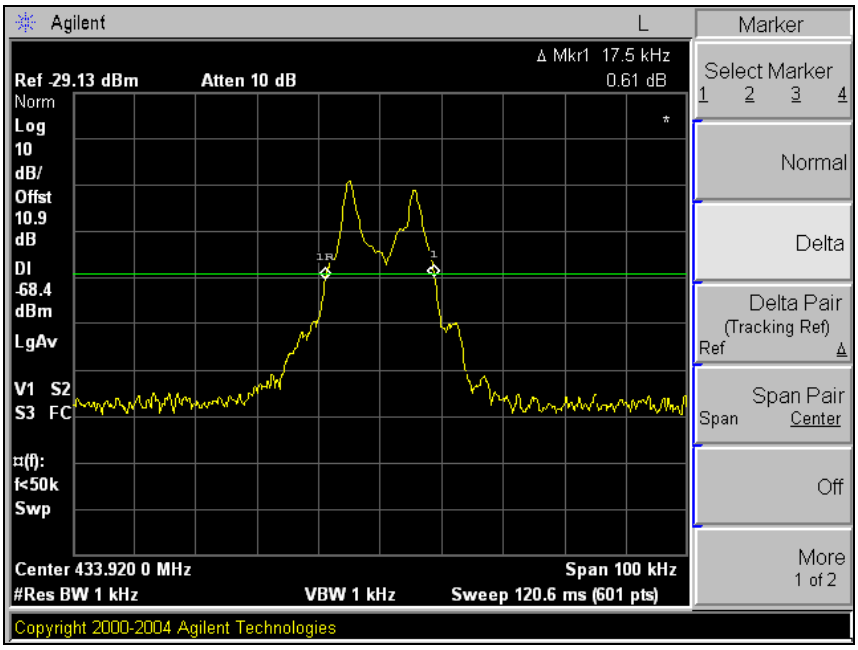
Ambient temperature : 24 ℃
Relative humidity : 42 % R.H.

Channel	20 dB Bandwidth (kHz)	Limit (kHz)
Low	17.90	1082.63
Middle	17.50	1084.80
High	17.40	1086.98

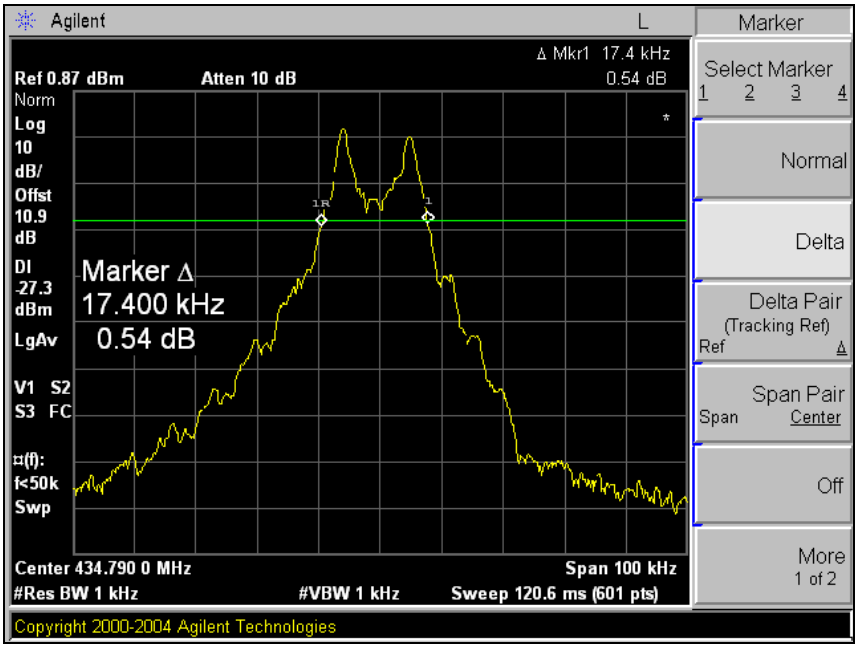
Low channel



Middle channel



High channel



Test setup photo of EUT

A. Photo of field strength & spurious emission