SK TECH CO., LTD.

Certificate of Compliance

Test Report No.:	**SKTOS-02057**		
NVLAP CODE :	**200220-0**		
Applicant:	**BONTEC CO., LTD.**		
Applicant Address:	#27-31, Hanchun-Ri, Ducksan-Myun, Jinchun-Gun, Chungbuk, Korea		
Product:	**Transmitter keyless**		
FCC ID:	**PLNBONTEC-T009**	**Model No.:**	**BONTEC-T009**
Receipt No.:	SKE20020528-346	**Date of receipt:**	May 28, 2002
Date of Issue:	June 10, 2002		
Testing location:	**SK TECH CO., LTD.** 820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea		
Test Standards:	**ANSI C63.4 / 2000**		
Rule Parts:	**FCC part 15 Subpart C**		
Equipment Class :	**Part 15 Security/Remote Control Transmitter**		
Test Result:	The above mentioned product has been tested and passed.		

Prepared by: *Y.H. Kang*	**Tested by**:*J.S.Hyun/Engineer*	**Approved by**: *K.S.Kim/Manager & Chief Engineer*
Signature *Date*	*Signature* *Date*	*Signature* *Date*
Other Aspects :		
Abbreviations :	**· OK, Pass = passed · Fail = failed · N/A = not applicable**	

- **This test report is not permitted to copy partly without our permission.**
- **This test result is dependent on only equipment to be used.**
- **This test result is based on a single evaluation of one sample of the above mentioned.**
- **This test report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S Government.**
- **We certify that this test report has been based on the measurement standards that is traceable to the national or International standards.**

NVLAP®

NVLAP Lab. Code: 200220-0

》》 Contents 《《

》List of Tables

》Appendix: Measured data

1. General

This equipment has been shown to be capable of compliance with the applicable technical standards and was tested in accordance with the measurement procedures as indicated in this report.

We attest to the accuracy of data. All measurements reported herein were performed by SK Tech Co., Ltd. and were made under Chief Engineer's supervision.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

2. Test Site

SK TECH Co., Ltd.

2.1 Location

820-2, Wolmoon Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea

The test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.
This laboratory is accredited by NVLAP for NVLAP Lab. Code : 200220-0
and DATech for DAR-Registration No.:TTI-P-G155/97-10

2.2 List of Test and Measurement Instruments

Table 1 : List of Test and Measurement Equipment

- **Radiated Disturbance**

Kind of Equipment	Type	S/N	Calibrated until
EMI Receiver	ESVS 10	825120/013	02.2003
EMI Receiver	ESVS 10	834468/008	11.2002
Spectrum Analyzer	R3361A	11730187	06.2002
Amplifier	8447F	3113A05153	06.2003
Log Periodic Antenna	UHALP9107	1819	02.2003
Horn Antenna	SAS-200/571	304	04.2003
Biconical Antenna	BBA9106	91031626	02.2003
Antenna Mast	5907	N/A	N/A
Antenna & Turntable controller	5906	N/A	N/A
Amp & Receiver connection cables	N/A	N/A	N/A
50Ω Switcher	MP59B	6100214538	N/A

2.3 Test Date

Date of Application : May 28, 2002

Date of Test : June 05, 2002

2.4 Test Environment

See each test item's description.

3. Description of the tested samples

The EUT is Transmitter Keyless.

3.1 Rating and Physical Characteristics

	TRANSMITTER	RECEIVER
Operating Voltage	3 VDC	10 ~ 16 VDC
Consumption Current	Max 20mA	Max 5mA
Operating frequency	315MHz	
Power	10mW under	-
Sensitivity	-	-95dBm(typical)
Operating temperature	-20 ~ +60℃	-30 ~ +80℃
Etc	AM modulation	Super-heterodyne

3.2 Submitted Documents

N/A

4. Measurement Conditions

Testing Input Voltage : DC 3V

4.1 Modes of Operation

The EUT was in the following operation mode during all testing;

The EUT is in the mode of pushing the Lock / Unlock key button.

4.2 List of Peripherals

Description	Manufacturer	Model Name	Serial No.	FCC ID
Receiver	Bontec	BONTEC-E900	N/A	N/A

4.3 Type of Used Cables

Description	Length	Type of shield	Manufacturer	Remark

N/A

4.4 Test Setup

The test setup photographs showed the external supply connections and interfaces.

4.5 Uncertainty

1) Radiated disturbance

Uc (Combined standard Uncertainty) = ±1.9dB

Expanded uncertainty U = KUc

K = 2

∴ U = ±3.8dB

2) Conducted disturbance

Uc = ±0.88dB

U = KUc = 2xUc = ±1.8dB

5. Test and Measurements

5.1 Transmission Requirement according to § 15.231(a)(1)

Results: **PASS**

The results of the transmission duration and duty cycle are shown in *Appendix 1*. The duty cycle correction factor was computed to be –6.97 dB.

The intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, such as voice or video, and data transmissions are not permitted.
According to §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.

The test of the transmission duration was performed in the normal operation at the operating frequency. And the duty cycle correction factor was used to convert peak-detected readings to average readings. This factor was calculated from the time domain trace. With the transmitter setup to transmit for maximum pulse density, the time domain trace was displayed on the spectrum analyzer. This trace was obtained by tuning center frequency to the transmitter frequency and then setting zero-span. The sweep time was then adjusted in order to display one full pulse train. If the period was longer than 100 milliseconds then 100 milliseconds is used for the period. The duty cycle correction factor was determined using the worst-case duty cycle. The markers were set at beginning and end of a word period. The On time and Off time were then measured. The duty cycle was then calculated as following:

Calculation of Duty cycle correction factor (Average factor)

1 Large Pulse = 34 x 0.8ms
2. Small Pulse = 44 x 0.4ms
Transmitter Duty Cycle = 44.8 %
Correction Factor = 20 log(0.448) = – 6.97 dB

5.2 Field strength of emissions according to § 15.231(b)

Results: **PASS**

The results of the field strength of the fundamental and spurious/harmonic emissions are shown in *Appendix 2*. The worst-case emission level is 70.1 dBuV/m @ 3m at 315 MHz, This is 5.5 dB below the specification limit.

According to §15.231(b), the field strength of emissions from intentional radiators operated under these frequency bands shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (uV/m @ 3m)	Field strength of spurious emissions (uV/m @ 3m)
260–470	3,750 to 12,500	375 to 1,250

<Use quasi-peak or average detector function>

Any emissions that fall within the restricted bands of FCC Section 15.205 shall not exceed the following limits:

Frequency (MHz)	Field strength (uV/m @ 3m)	Field strength (dBuV/m @ 3m)
30–88 88–216 216–960 Above 960	100 150 200 500	40.0 43.5 46.0 54.0

Measurement Procedures

Preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters. The EUT was programmed to operate in continuous transmit by using modified firmware which was programmed into the sample's processor, and then was placed on the top of the 0.8 meter high, 1 x 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 300 MHz using the biconical antenna and from 300 to 1000 MHz using the log-periodic antenna. Above 1GHz, linearly polarized double ridge horn antenna was used.

To obtain the final test data, the EUT was arranged on a turntable situated on a 4x4 meter at the Open Area Test Site. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set to peak detector function and specified bandwidth with "max hold" mode. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT. The EUT was tested at a 3-meter test distance.

5.3 Occupied bandwidth according to § 15.231(c)

Results: **PASS**

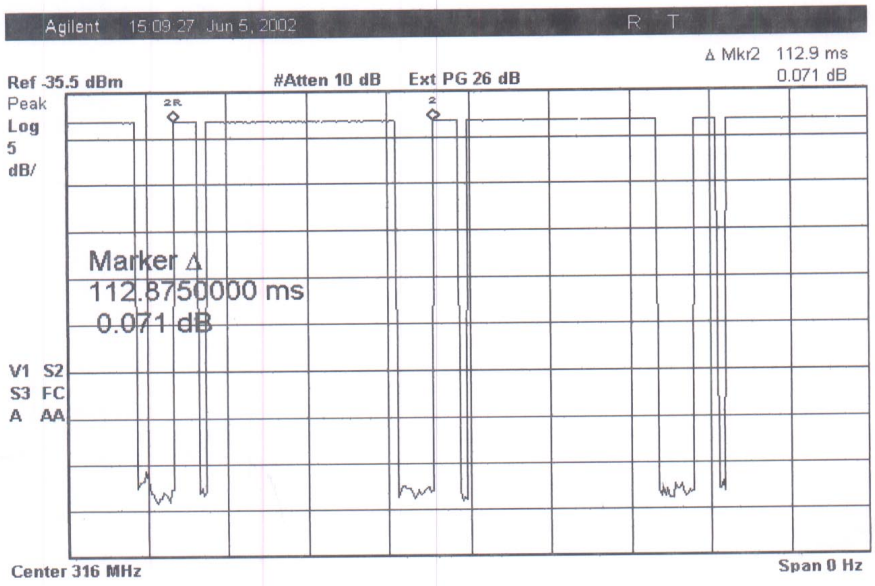
The measured spectrum of the signal is shown in *Appendix 3*. From the plot, we can see that in the worst case, the occupied bandwidth is 50 KHz.

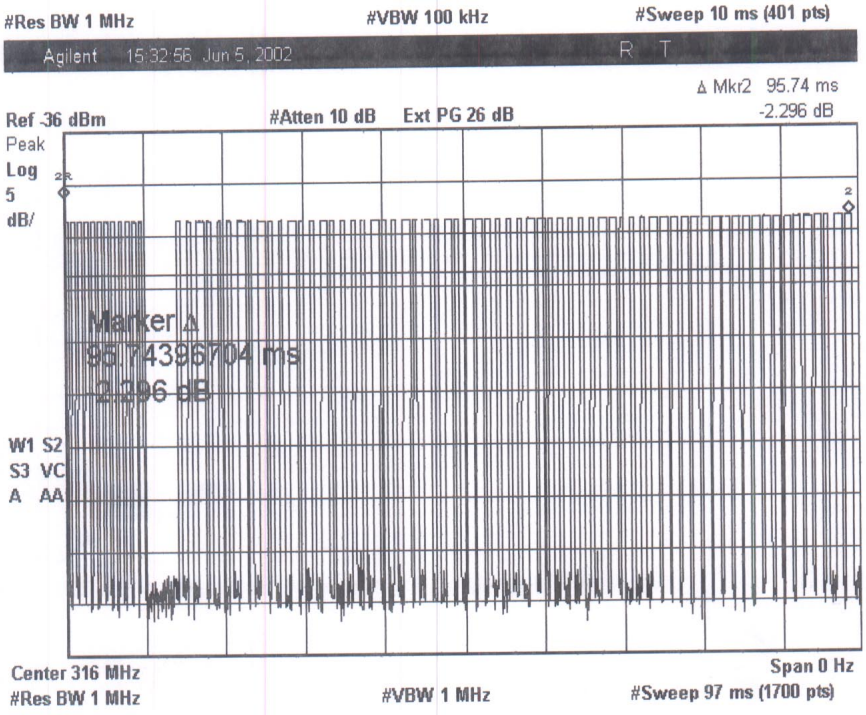
This test was performed to demonstrate that the bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900MHz. The measurement was performed at the operating frequency, 315MHz. The spectrum trace data around fundamental frequency of the EUT was obtained with the spectrum analyzer in “Max Hold” mode. The bandwidth value was determined between the two points of 20dB down from the modulated carrier.

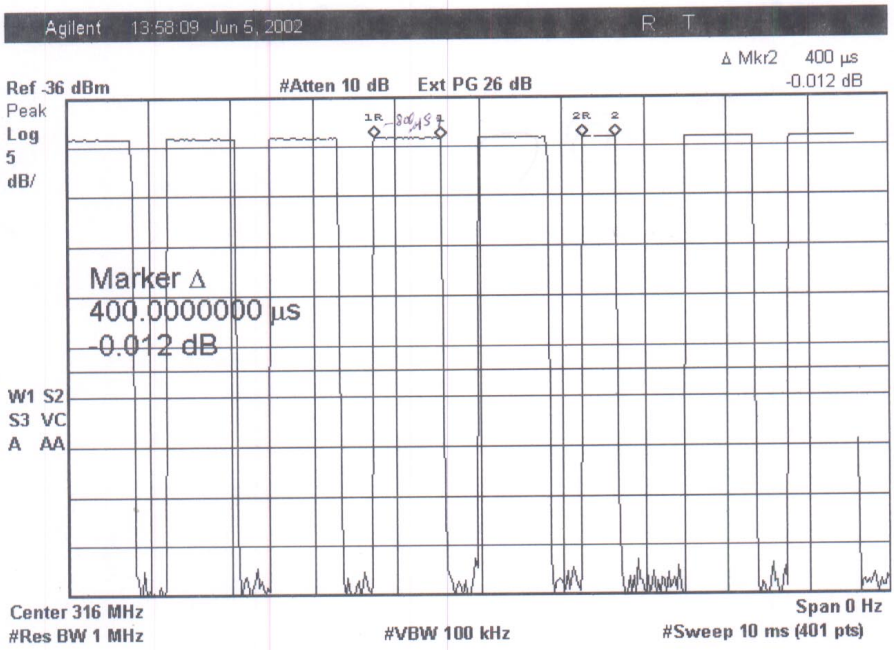
Calculation of the bandwidth limit

Limit = F X 0.0025 = 315 MHz X 0.0025 = 787.5 KHz

Appendix 1: Figure of the measured Transmission Duration






Agilent 13:58:09 Jun 5, 2002
R T
Δ Mkr2 400 µs
-0.012 dB
Ref -36 dBm
#Atten 10 dB
Ext PG 26 dB
Peak
Log
5
dB/
1R
2R 2
Marker Δ
400.0000000 µs
-0.012 dB
W1 S2
S3 VC
A AA
Center 316 MHz
#Res BW 1 MHz
#VBW 100 kHz
Span 0 Hz
#Sweep 10 ms (401 pts)

Appendix 2: Table of the measured Field strength

Frequency (MHz) *Fundamental*	Pol.	Height [m]	Angle [˚]	(1) Reading (dBμV)	(2) AFCL (dB/m)	(3) Actual (dBμV/m)	(4) Limit (dBμV/m)	(5) Margin (dB)
315.00	H	1.2	76	50.6	19.5	70.1	75.6	5.5
Frequency (MHz) *Spurious Emission*	**Pol.**	**Height [m]**	**Angle [˚]**	**(1) Reading (dBμV)**	**(2) AFCL (dB/m)**	**(3) Actual (dBμV/m)**	**(4) Limit (dBμV/m)**	**(5) Margin (dB)**
630.00	H	2.1	46	23.4	26.6	50.0	55.6	5.6
945.00	H	1.6	57	15.8	32.4	48.2	55.6	7.4

Table. Radiated Measurements at 3-meters

※ Comment

1. This manually operated transmitter shall have a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

2. Formulas for calculating the maximum permitted fundamental field strengths.
Limit. = 41.6667(F) – 7083.3333 (3meters)
= 41.6667(315)-7083.3333
= 6041.6772㎶/m
= 75.6dB㎶

3. Maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level.

NOTES:

1. All modes of operation were investigated and the worst-case emission are reported.
2. All other emission are non-significant.
3. All readings are calibrated by self-mode in receiver.
4. Measurements using CISPR quasi-peak mode.
5. AFCL = Antenna factor and cable loss
6. H = Horizontal, V = Vertical Polarization

♠Margin Calculation
(5)Margin = (4)Limit - (3)Actual
[(3)Actual = (1)Reading + (2)AFCL + *duty cycle factor(-6.97)]

∗duty cycle factor(-6.97) : See page 7

Appendix 3: Figure of the measured Occupied bandwidth