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Test Report

Product Name: Hand-held Transmitter

FCC ID: QBTLTK-1300H

Applicant:

LEE TECHNOLOGY KOREA CO., LTD

3FL #499-2, Sang 3-Dong, Wonmi-Gu
Bucheon-City, Kyungki-Do
KOREA

Date Receipt: 03/25/2005

Date Tested: 04/08/2005

APPLICANT: LEE TECHNOLOGY KOREA CO., LTD

FCC ID: QBTLTK-1300H

REPORT #: THRU-504001

COVER SHEET

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TABLE OF CONTENTS LIST FOR PART 90 UHF DEVICE

APPLICANT: LEE TECHNOLOGY KOREA CO., LTD

FCC ID: QBTLTK-1300H

TEST REPORT CONTAINING:

PAGE 1.....GENERAL INFORMATION & TECHNICAL DESCRIPTION
PAGE 2.....TECHNICAL DESCRIPTION CONTINUED & RF POWER OUTPUT
PAGE 3-5.....FIELD STRENGTH OF SPURIOUS EMISSIONS
PAGE 6.....RADIATION INTERFERENCE(15.209 & 90.2)
PAGE 7-10.....BANDWIDTH LIMITATION
PAGE 11-14.....OCCUPIED BANDWIDTH
PAGE 15.....FREQUENCY STABILITY
PAGE 16-19.....TRANSIENT FREQUENCY BEHAVIOR
PAGE 20.....RADIATION INTERFERENCE(15.109)
PAGE 21.....RF EXPOSURE CALCULATION
PAGE 22.....LIST OF TEST EQUIPMENT

EXHIBITS CONTAINING:

EXHIBIT 1.....FCC ID LABEL SAMPLE AND SKETCH OF LOCATION
EXHIBIT 2.....SCHEMATIC
EXHIBIT 3.....BLOCK DIAGRAM
EXHIBIT 4.....EXTERNAL PHOTOGRAPHS
EXHIBIT 5.....INTERNAL PHOTOGRAPHS
EXHIBIT 6.....USERS MANUAL
EXHIBIT 7.....OPERATIONAL DESCRIPTION
EXHIBIT 8.....PARTS LIST
EXHIBIT 9.....TUNING PROCEDURE
EXHIBIT 10.....TEST SETUP PHOTOGRAPH

APPLICANT: LEE TECHNOLOGY KOREA CO., LTD

FCC ID: QBTLTK-1300H

REPORT #: THRU-504001

TABLE OF CONTENTS

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GENERAL INFORMATION REQUIRED FOR TYPE ACCEPTANCE

2.1033 (c)(1)(2) LEE TECHNOLOGY KOREA CO., LTD. will sell the
FCC ID: QBTLTK-1300H
VHF transceiver in quantity,
for use under FCC RULES PART 15 & 90 & 2.

2.1033 (C) TECHNICAL DESCRIPTION
2.1033 (3) User Manual See Exhibit 6

2.1033 (4) Type of Emission: 10K2F2D
FOR 25kHz

Bn = 2M + 2DK
M = 1,200 Bits per second
D = 4.5 kHz (Peak Deviation)
K = 1
Bn = 2(1,200bps/2) + 2(4500)(1) = 10.2k

ALLOWED AUTHORIZED BANDWIDTH = 10.2 kHz.

90.209(b) (5)

2.1033 (5) Frequency Range: 450-460 MHz

2.1034 (6) Power Range and Controls: There are NO user Power
controls.

(7) Maximum Output Power Rating:
see Next Page.

(8) DC Voltages and Current into Final Amplifier:

POWER INPUT
FIANL AMPLIFIER ONLY
Vce = 12 Volts
IC = 0.16A

(9) Tune-up procedure. The tune-up procedure is given
in EXHIBIT 9.

2.1033 (10) Complete Circuit Diagrams: The circuit diagram is
included as EXHIBIT 2. The block diagram is
included as EXHIBIT 3.

(11) Function of each electron tube or semiconductor
device or other active circuit device:
- SEE EXHIBIT 8.

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FCC ID: QBTLTK-1300H

REPORT #: THRU-504001

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(8) Instruction book. The instruction manual is included as EXHIBIT 6.

(10) Description of all circuitry and devices provided for determining and stabilizing frequency is included in the circuit description in Exhibit #7.

2.1033(c)(11) A photograph or drawing of the equipment identification label is shown in Exhibit 1.

2.1033(c)(12) Photographs of the equipment of sufficient clarity to reveal equipment construction and layout and label location are shown in Exhibit 4-5.

2.1033(c)(13) For equipment employing digital modulation, a detail description of the modulation technique. This UUT uses FSK to modulate the transmitter.

2.1033(c)(14) Data required for 2.1046 to 2.1057 See Below

2.1046(a) RF power output.
& 90.205

MAXIMUM PEAK OUTPUT POWER(RADIATED)

Maximum peak output power(mW)ERP						Limit
449.982MHz		453.007MHz		457.5750		2 watt
H	V	H	V	H	V	
2mw 99.5dBuv /m	23mw 111dBuv/ m	1mw 96.9dBuv /m	41mw 113.5dBuv /m	1mw 97.8dBuv /m	33mw 112.6dBuv/ m	

APPLICANT: LEE TECHNOLOGY KOREA CO., LTD

FCC ID: QBTLLK-1300H

REPORT #: THRU-504001

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RM302, BOKJO, 29-15, CHONGPA3-DONG

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SPURIOUS EMISSIONS

2.1057 SPECTRUM RANGE TO BE INVESTIGATED

Lowest radio frequency signal generated in the equipment, without going below 9kHz, up to at least the frequency shown below:

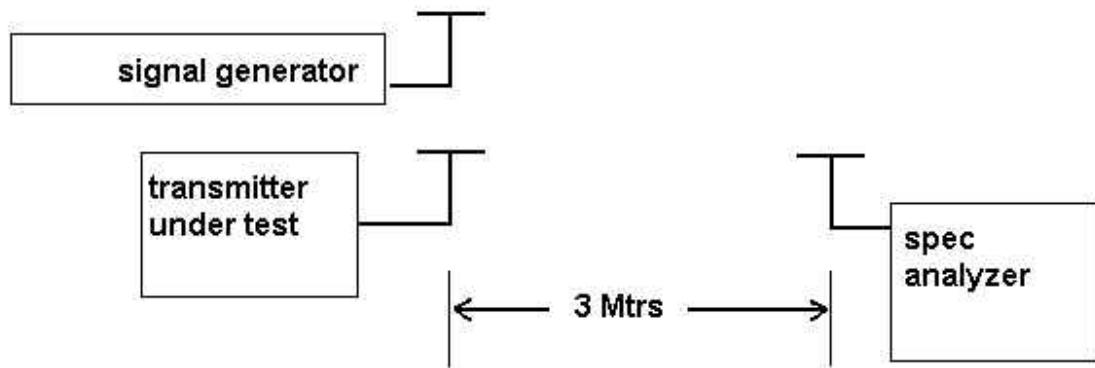
- (1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.
- (2) If the equipment operates at or above 10GHz and below 30GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.
- (3) If the equipment operates at or above 30GHz: to the fifth harmonic of the highest fundamental frequency or to 200GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and sub-harmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

(c) The amplitude of spurious emissions, which are attenuated more than 20dB below the permissible value, need not be reported.

(d) Unless otherwise specified, measurements above 40GHz shall be performed using a minimum resolution bandwidth of 1MHz.

Method of Measuring Radiated Spurious Emissions



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2.1053

UNWANTED RADIATION

95.635 (b) (7)

90.210 (c) (3)

The tabulated Data shows the results of the radiated Field strength emissions test. The spectrum was Scanned from 30 MHz to at least the 10th harmonic of The fundamental. This test was conducted per ANSI C63.4 - 1992

REQUIREMENTS: 43 + 10log(0.041) = 29.127dB

Low Channel

Horizontal			Vertical		
Emission Frequency	ATTN dBc	Margin dB	Emission Frequency	ATTN dBc	Margin dB
453.01	0.00	0.00	453.01	0.00	0.00
906.01	41.20	25.47	906.01	47.30	18.17
1359.02	41.89	26.15	1359.02	48.09	18.95
1812.03	36.39	20.66	1812.03	45.39	16.26
2265.04	33.74	18.01	2265.04	48.64	19.51
2718.04	45.04	29.31	2718.04	58.74	29.61
3171.05	44.50	28.76	3171.05	57.70	28.56
3624.06	43.72	27.98	3624.06	56.52	27.38
4077.06	41.33	25.60	4077.06	56.03	26.90
4530.07	40.70	24.96	4530.07	54.00	24.86

Middle Channel

Horizontal			Vertical		
Emission Frequency	ATTN dBc	Margin dB	Emission Frequency	ATTN dBc	Margin dB
453.01	0.00	0.00	453.01	0.00	0.00
906.01	41.20	25.47	906.01	47.30	18.17
1359.02	41.89	26.15	1359.02	48.09	18.95
1812.03	36.39	20.66	1812.03	45.39	16.26
2265.04	33.74	18.01	2265.04	48.64	19.51
2718.04	45.04	29.31	2718.04	58.74	29.61
3171.05	44.50	28.76	3171.05	57.70	28.56
3624.06	43.72	27.98	3624.06	56.52	27.38
4077.06	41.33	25.60	4077.06	56.03	26.90
4530.07	40.70	24.96	4530.07	54.00	24.86

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High Channel

Horizontal			Vertical		
Emission Frequency	ATTN dBc	Margin dB	Emission Frequency	ATTN dBc	Margin dB
457.58	0.00	0.00	457.58	0.00	0.00
915.15	41.18	24.66	915.15	49.98	20.06
1372.73	44.34	27.83	1372.73	49.54	19.63
1830.30	39.59	23.07	1830.30	45.89	15.97
2287.88	42.80	26.28	2287.88	51.20	21.28
2745.45	46.61	30.09	2745.45	59.41	29.49
3203.03	45.75	29.23	3203.03	58.65	28.73
3660.60	44.90	28.38	3660.60	58.20	28.28
4118.18	43.16	26.64	4118.18	56.86	26.94
4575.75	42.21	25.69	4575.75	54.71	24.79

METHOD OF MEASUREMENT : The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per TIA/EIA STANDARD 603 using the substitution method. Measurements were made at the open field test site of ThruLab & ENGINEERING. located at 389 JeAm-Rhi HyangNam-Myun, HwaSung-Shi, KyoungKi-Do Korea.

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FCC ID: QBTLLK-1300H

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APPLICANT: LEE TECHNOLOGY KOREA CO., LTD

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NAME OF TEST: RADIATION INTERFERENCE

RULES PART NO.: 15.209 & 90.210(c)(3)

REQUIREMENTS: 30 to 88 MHz: 40.0 dBuV/M @ 3 METERS

88 to 216 MHz: 43.5 dBuV/M

216 to 960 MHz: 46.0 dBuV/M

ABOVE 960 MHz: 54.0 dBuV/M

TEST RESULTS: A search was made of the spectrum from 30 to 1000MHz and the measurements indicate that the unit DOES meet the FCC requirements.

Radiated and antenna conducted spurious emissions testing is required. For Antenna Conducted spurious, the limit is 20dBc. For Radiates spurious, the limit is 15.209 limits for emissions falling in the restricted bands(15.205), otherwise the limit is 20dBc.

On any frequency removed from the center of the authorized bandwidth by more than 250percent of the authorized bandwidth: At least $43+10\log(p)$ dB.

TEST DATA:

No	Emission Frequency (MHz)	Meter Reading dBuV/m	Ant. Polaritry	Correction Factor dB	Cable Loss dB	Field Strength (dBuv/m)	Margin (dBuv)	Limit (dBuv/m)
1	30.76	9.9	V	13.1	0.7	23.6	-60.8	84.4
2	39.45	2.1	H	12.8	0.8	15.7	-68.7	84.4
3	55.48	4.3	V	9.0	1.1	14.4	-70.0	84.4
4	67.21	3.5	H	6.0	1.2	10.7	-73.7	84.4
5	85.87	5.6	H	9.5	1.5	16.5	-67.9	84.4
6	160.82	4.6	V	17.0	2.2	23.8	-60.6	84.4
7	192.23	5.6	H	14.1	2.5	22.2	-62.2	84.4
8	204.81	9.0	V	10.8	2.6	22.4	-62.0	84.4
9	226.23	10.1	H	10.8	2.8	23.7	-60.7	84.4
10	300.72	9.4	V	16.1	3.4	29.0	-55.4	84.4
11	344.71	14.9	H	15.3	3.8	34.0	-50.4	84.4
12	442.92	20.4	V	16.2	4.5	41.2	-43.2	84.4
13	449.61	27.6	V	16.4	4.5	48.6	-35.8	84.4
14	465.72	22.0	H	19.3	4.7	46.0	-38.4	84.4
15	472.45	15.7	V	19.9	4.7	40.3	-44.1	84.4
16	521.22	8.8	H	17.8	5.1	31.6	-52.8	84.4
17	570.83	5.3	V	18.5	5.4	29.1	-55.3	84.4
18	649.02	6.5	H	20.2	5.9	32.5	-51.9	84.4

SAMPLE CALCULATION: FSdBuV/m = MR (dBuV) + ACFdB.

TEST PROCEDURE: ANSI STANDARD C63.4-1992 using a Hewlett Packard Model 8566B spectrum analyzer, a Hewlett Packard Model 85685A Preselector, a Hewlett Packard Model 85650A Quasi-Peak adapter, and an appropriate antenna - see the test equipment list. The bandwidth of spectrum analyzer was 100 kHz with an appropriate sweep speed. When an emission was found, the table was rotated to produce the maximum signal strength. The antenna was placed in both the horizontal and vertical planes and the worse case emissions were reported.

PERFORMED BY: K.M.Choi

DATE: 04/08/2005

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BANDWIDTH LIMITATION

90.209 According to 90.203(3) For all other types of emissions, the maximum authorized bandwidth shall not be more than that normally authorized for voice operations.

According to 90.200(5), Unless specified elsewhere, channel spacing and bandwidths that will be authorized in the following frequency bands are given in the following "STANDARD CHANNEL SPACING/BANDWIDTH" table.

Standard Channel Spacing/Bandwidth

Frequency band (MHz)	Channel spacing (KHz)	Authorized Bandwidth(kHz)
<hr/>		
Below 25		
25-50.	20	20
72-76	20	20
150-174	1) 7.5	1, 3) 20/11.25/6
220-222	5	4
421-512	1) 6.25	1, 3) 20/11.25/6
806-821/851-866	25	20
821-824/866-869	12.5	20
896-901/935-940	12.5	13.6
902-928.....		
929-930	25	20
1427-1435.....		
2450-2483.52.....		
Above 2500.....		
<hr/>		

1) For stations authorized on or after August 18, 1995.

3) Operations using equipment designed to operate with a 25kHz channel bandwidth will be authorized a 20kHz bandwidth.

Operations using equipment designed to operate with a 12.5kHz channel bandwidth will be authorized an 11.25kHz bandwidth.

Operations using equipment designed to operate with a 6.25kHz channel bandwidth will be authorized a 6kHz bandwidth.

Specification Limit: 20kHz

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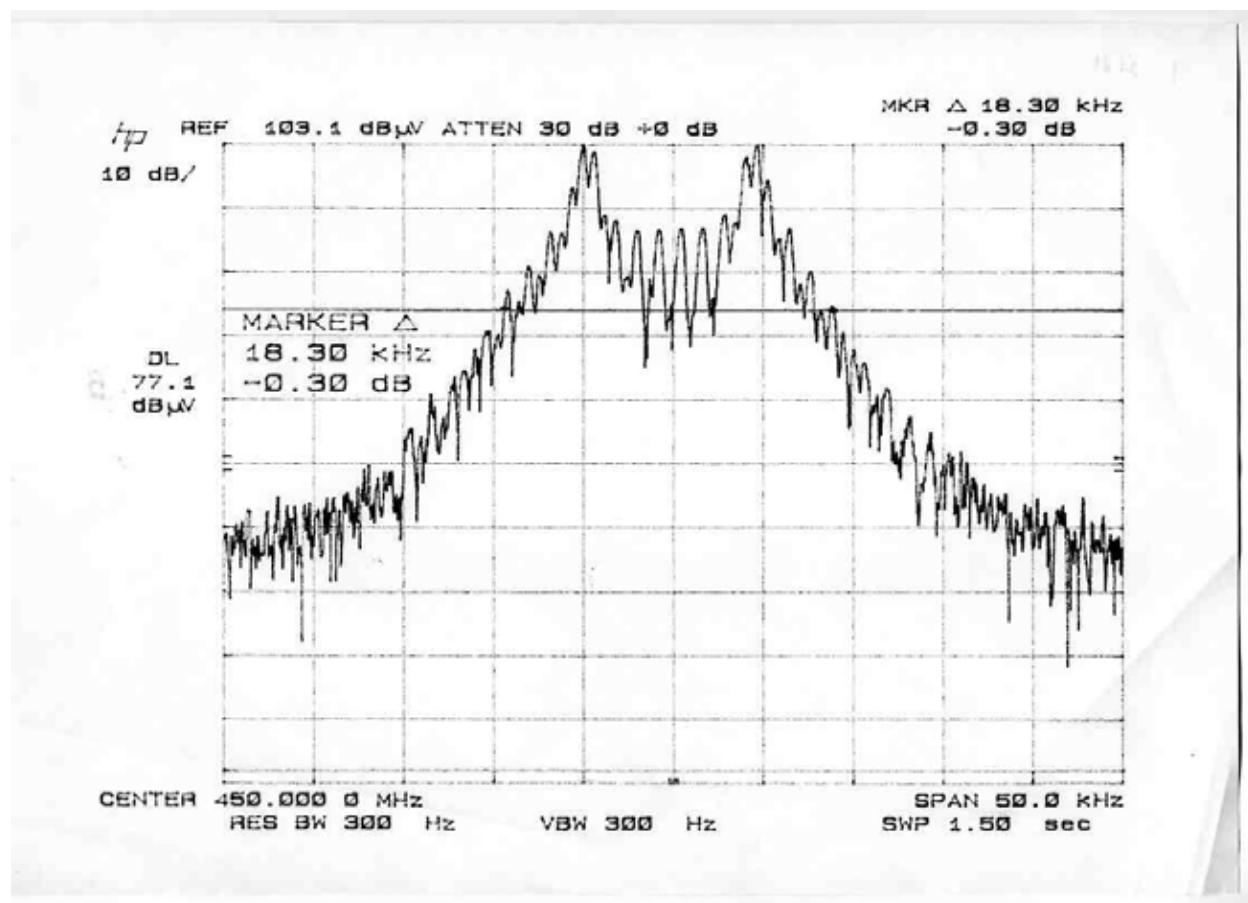
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90.209- 26 dB BANDWIDTH LIMITATION

LOW Channel



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REPORT #: THRU-504001

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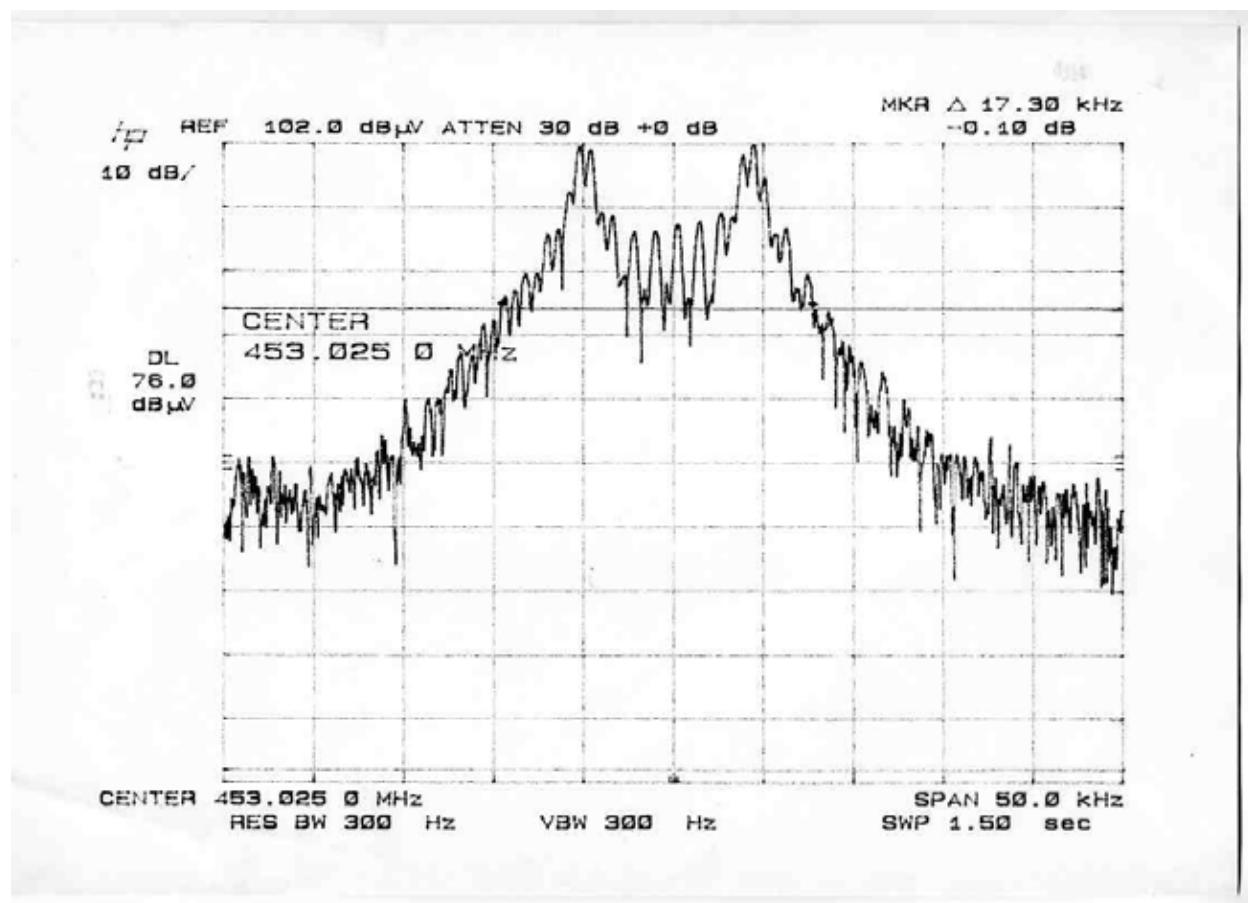
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90.209- 26 dB BANDWIDTH LIMITATION

Middle Channel



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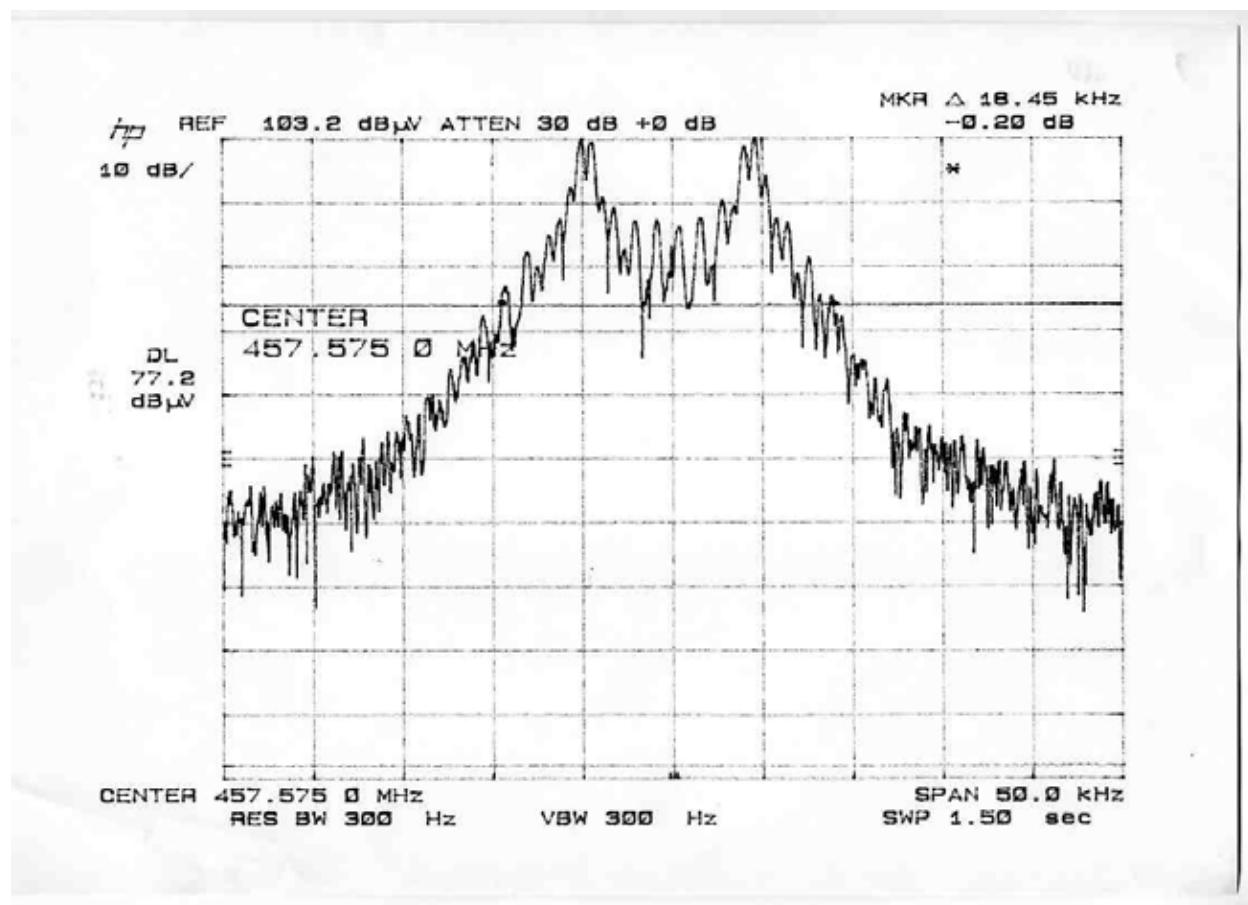
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90.209- 26 dB BANDWIDTH LIMITATION

High Channel



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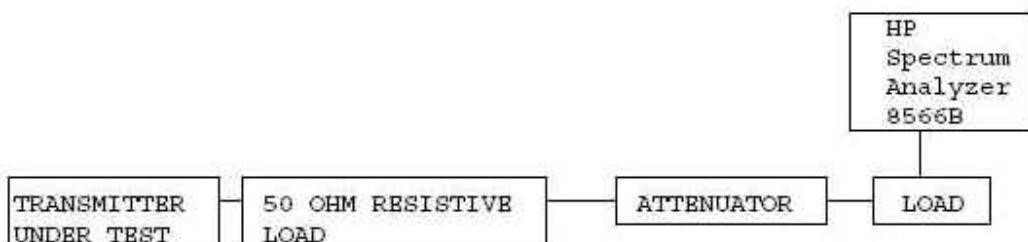
2.1049 Audio Low Pass Filter
This UUT does not have a low pass filter

2.1049 Occupied bandwidth:

90.210(c,)

For transmitters that are not equipped with an audio low pass filter pursuant to S90.211(b), the power of any emission must be attenuated below the unmodulated carrier output power as follows: (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency(fd in kHz) of more than 5 kHz but not more than 10kHz: At least $83\log(fd/5)$ dB; (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency(fd in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: At least $29\log(fd^2/11)$ dB or 50 dB, whichever is the lesser attenuation; (3) On any frequency removed from the center of the authorized bandwidth by more than 250% of the authorized bandwidth: At least $43+10\log(P_o)$ dB.

Method of Measuring Occupied Bandwidth



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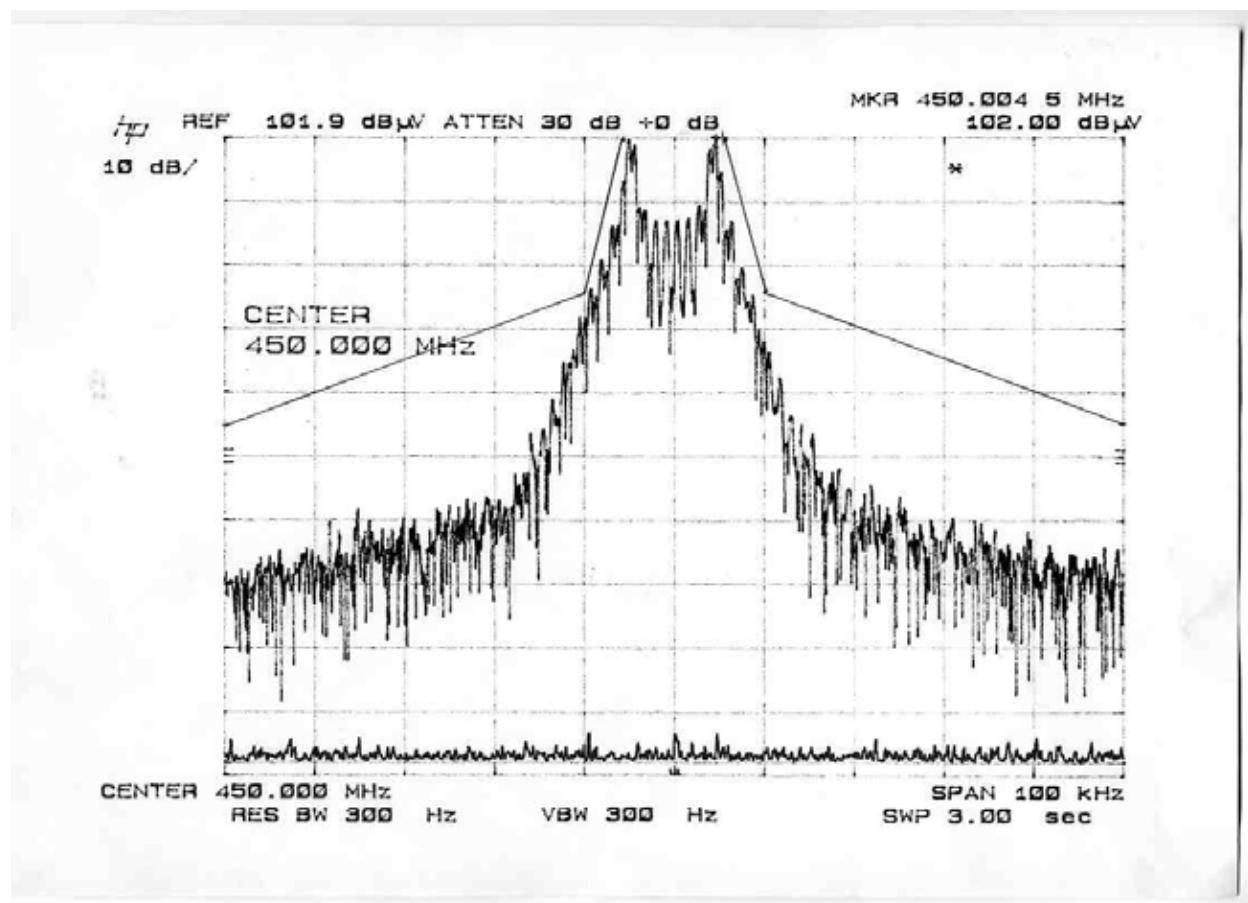
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EMISSIONS MASK PLOT

LOW Channel



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REPORT #: THRU-504001

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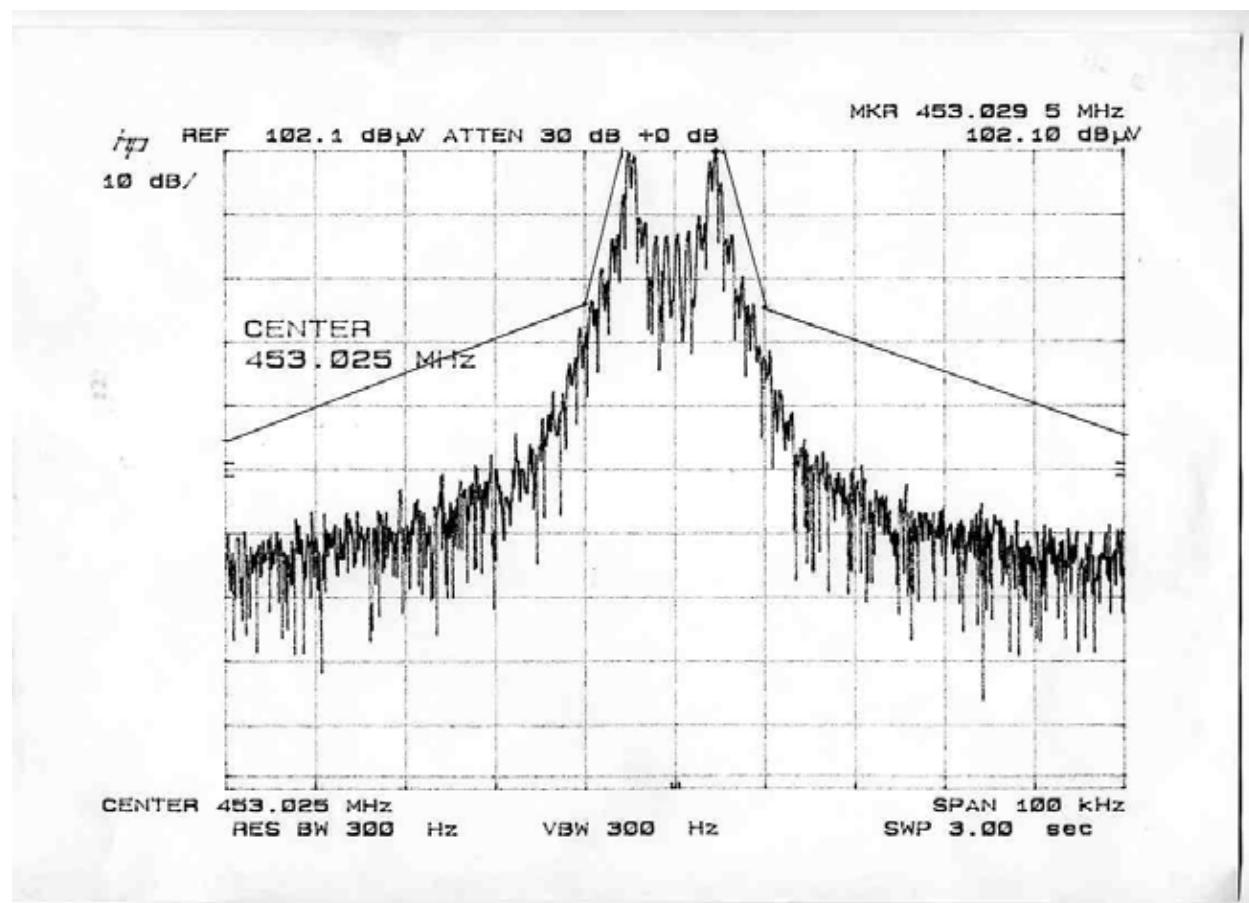
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EMISSIONS MASK PLOT

Middle Channel



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REPORT #: THRU-504001

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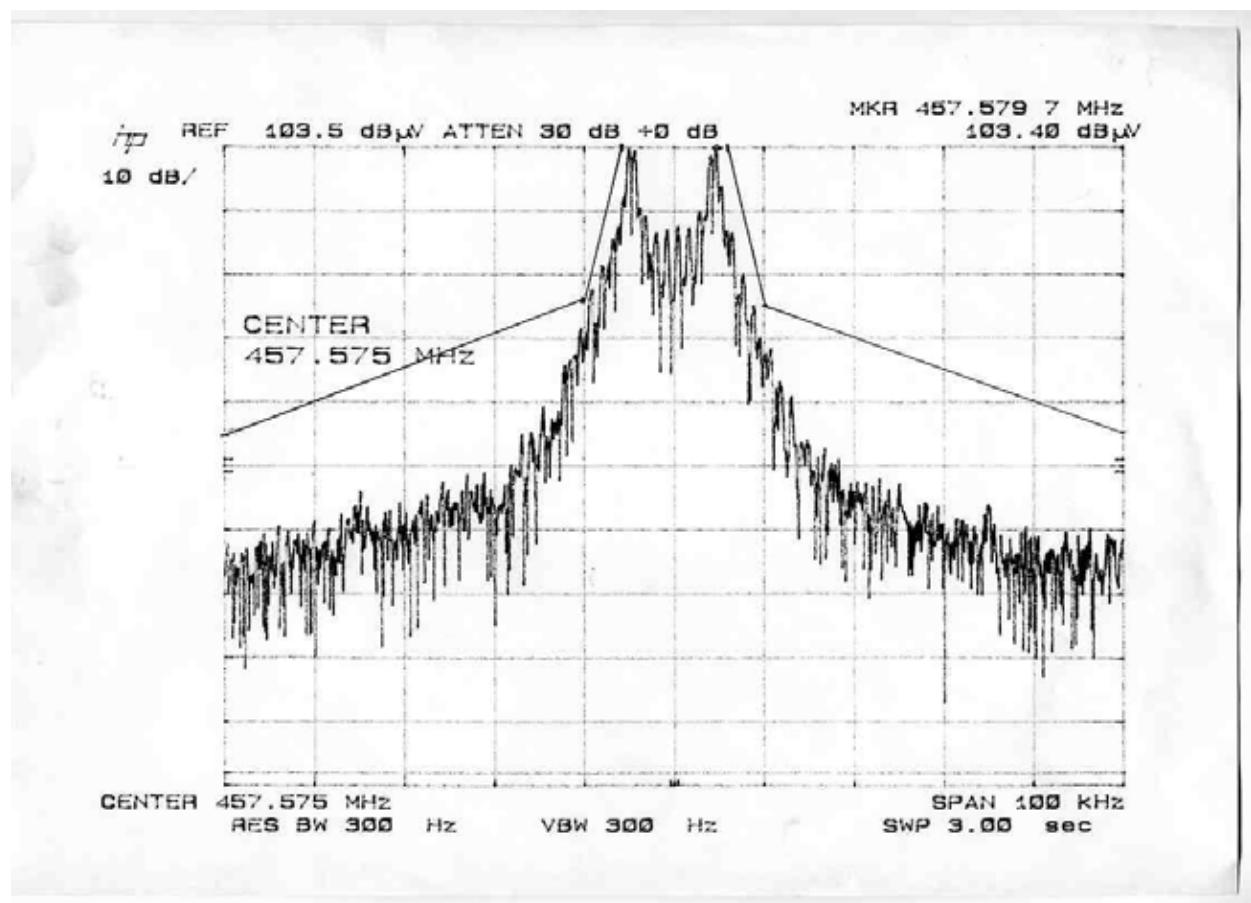
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EMISSIONS MASK PLOT

High Channel



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2.1055 Frequency stability:

90.213(a)(1)

Temperature and voltage tests were performed to verify that the frequency remains within the .00025%, 2.5 ppm specification limit, for 25 kHz spacing. The test was conducted as follows: The transmitter was placed in the temperature chamber at 25 degrees C and allowed to stabilize for one hour. The transmitter was keyed ON for one minute during which four frequency readings were recorded at 15 second intervals. The worse case number was taken for temperature plotting. The assigned channel frequency was considered to be the reference frequency. The temperature was then reduced to -30 degrees C after which the transmitter was again allowed to stabilize for one hour. The transmitter was keyed ON for one minute, and again frequency readings were noted at 15 second intervals. The worst case number was recorded for temperature plotting. This procedure was repeated in 10 degree increments up to +50 degrees C.

MEASUREMENT DATA:

Assigned Frequency (Ref. Frequency) : 457.5750

TEMPERATURE	FREQUENCY(MHz)	ppm	LIMIT(ppm)
REFERENCE	457.57500	0	
-30	457.57449	-1.11	2.5
-20	457.57430	-1.53	2.5
-10	457.57434	-1.44	2.5
0	457.57433	-1.46	2.5
10	457.57445	-1.20	2.5
20	457.57452	-1.05	2.5
30	457.57452	-1.05	2.5
40	457.57458	-0.92	2.5
50	457.57465	-0.76	2.5
END POINT OF BATTERY : 1.6V	457.57451	-1.07	2.5

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2.1055(a)(1) Frequency stability:
90.214 Transient Frequency Behavior

REQUIREMENTS: In the 450-500MHz frequency band, transient frequencies must be within the maximum frequency difference limits during the time interval indicated below for 25kHz Channels:

Time Interval	Maximum Frequency	Portable Radios 450-500 MHz
t 1	+25 kHz	10.0 ms
t 2	+12.5 kHz	25.0 ms
t 3	+25 kHz	10.0 ms

TEST PROCEDURE: TIA/EIA TS603 PARA 2.2.19, the levels were set as follows;

1. Using the variable attenuator the transmitter level was set to 40 dB below the test receivers maximum input level, then the transmitter was turned off.
2. With the transmitter off the signal generator was set 20dB below the level of the transmitter in the above step, this level will be maintained with the signal generator throughout the test.
3. Reduce the attenuation between the transmitter and the RF detector by 30 dB.
4. With the levels set as above the transient frequency behavior was observed & recorded

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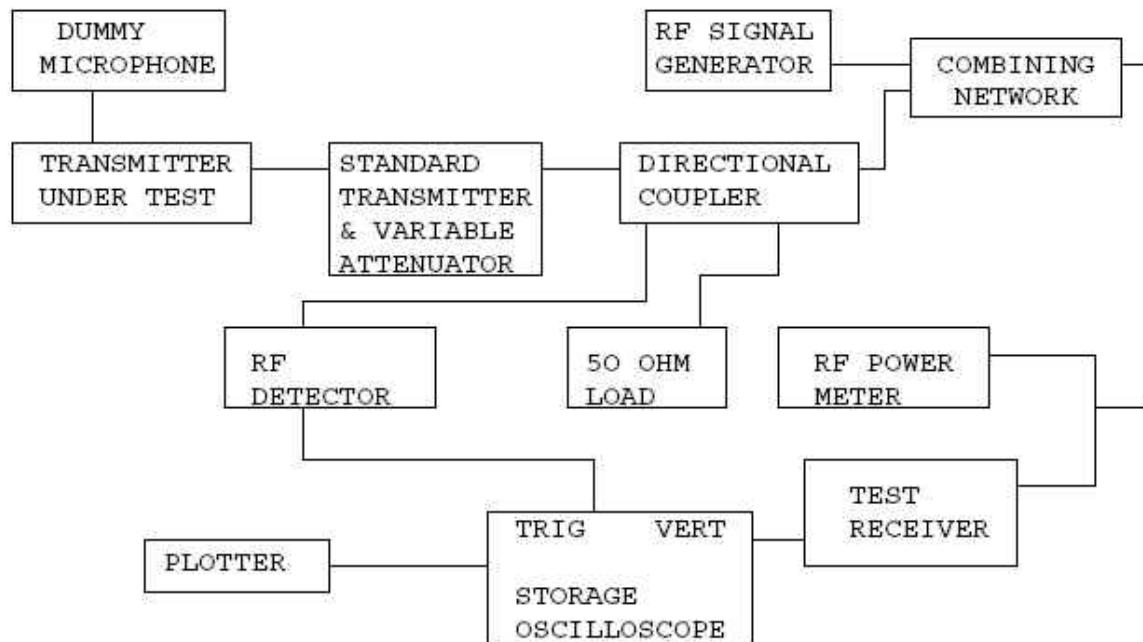
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RM302, BOKJO, 29-15, CHONGPA3-DONG

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2.1055 Frequency stability:
90.214 Transient Frequency Behavior
(Continued)



APPLICANT: LEE TECHNOLOGY KOREA CO., LTD

FCC ID: QBTLLK-1300H

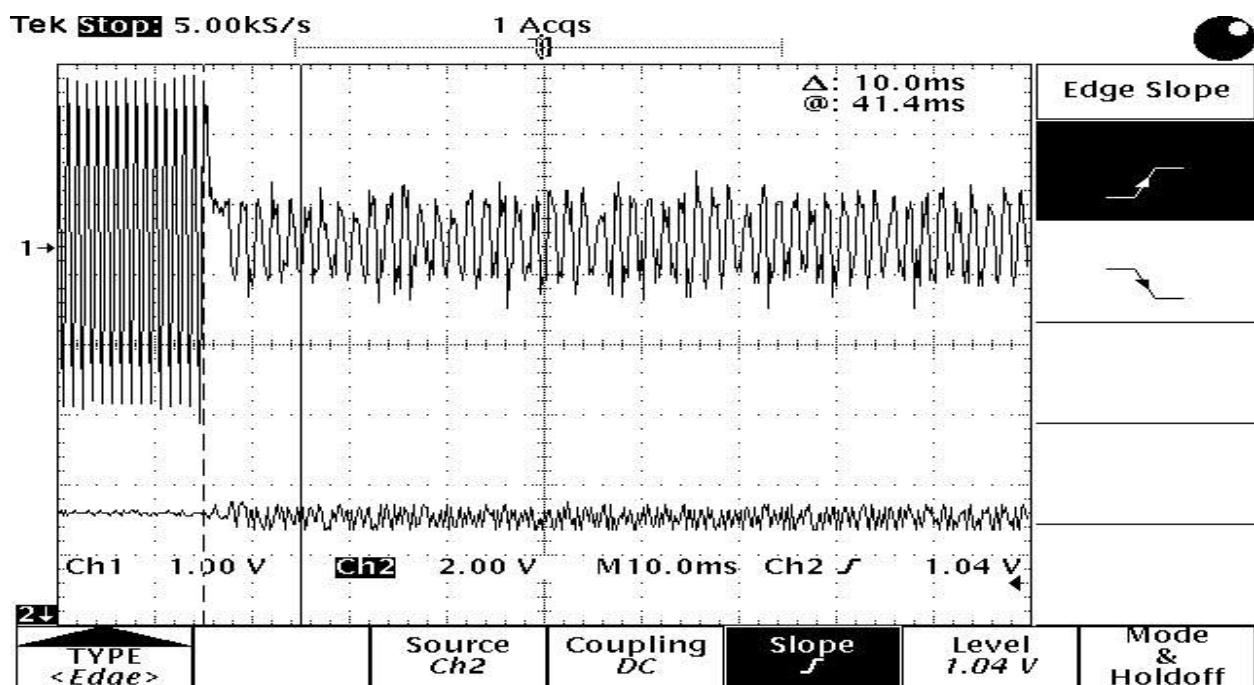
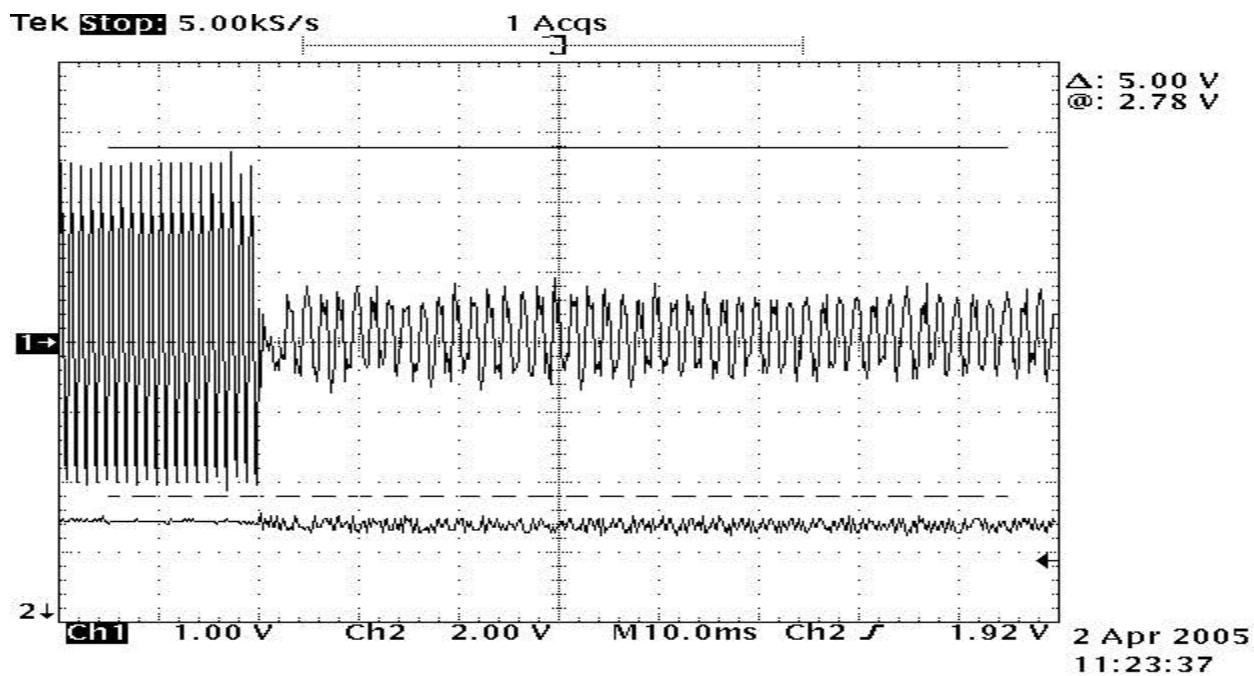
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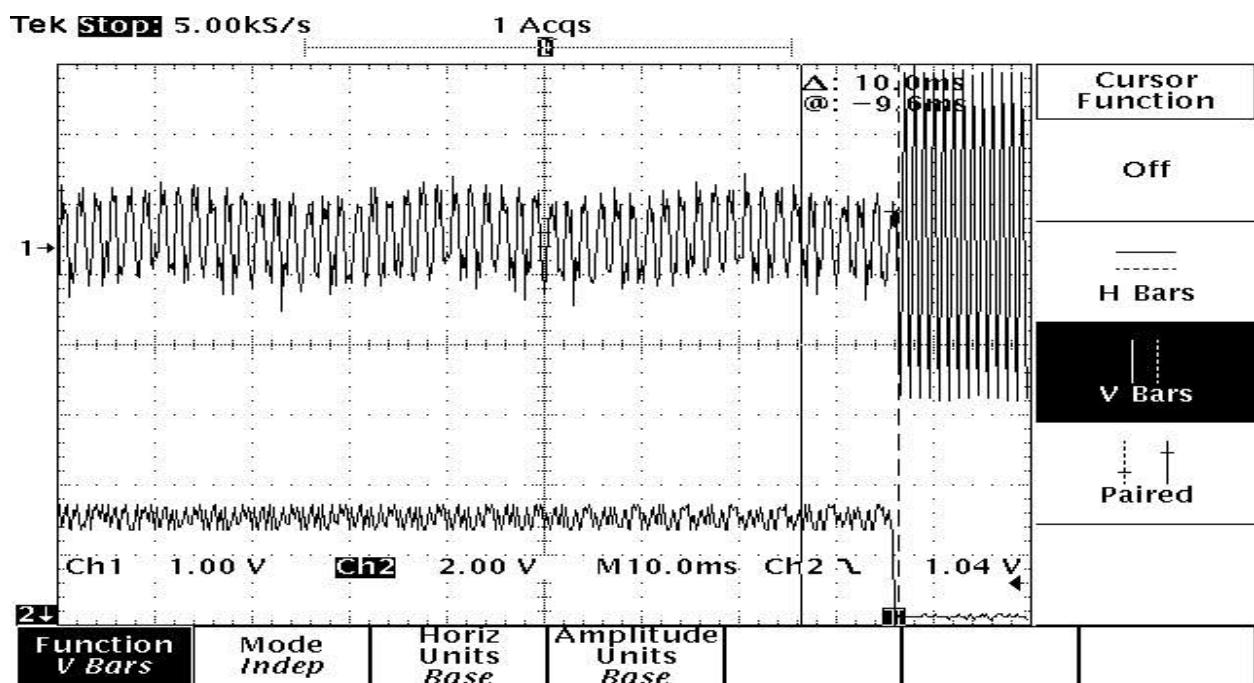
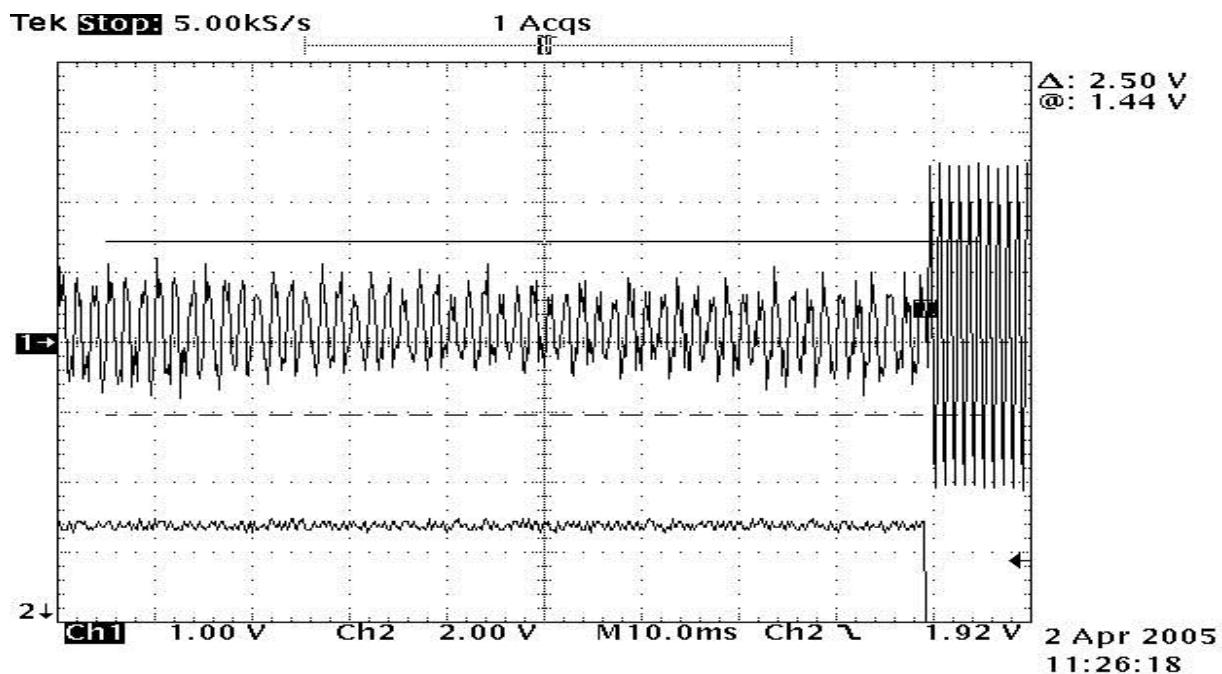
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APPLICANT: LEE TECHNOLOGY KOREA CO., LTD

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NAME OF TEST: RADIATION INTERFERENCE

RULES PART NO.: 15.109

REQUIREMENTS: 30 to 88 MHz: 40.0 dBuV/M @ 3 METERS
88 to 216 MHz: 43.5 dBuV/M
216 to 960 MHz: 46.0 dBuV/M
ABOVE 960 MHz: 54.0 dBuV/M

TEST RESULTS: A search was made of the spectrum from 30 to 1000MHz and the measurements indicate that the unit DOES meet the FCC requirements.

TEST DATA:

No	Emission Frequency (MHz)	Meter Reading dBuV/m	Ant. Polarity	Correction Factor dB	Cable Loss dB	Field Strength (dBuV/m)	Margin (dBuv)	Limit (dBuv/m)
1	43.72	4.3	V	12.1	0.9	17.3	-22.7	40.0
2	67.03	4.7	V	6.1	1.2	11.9	-28.1	40.0
3	81.52	4.3	H	8.4	1.4	14.1	-25.9	40.0
4	96.71	2.3	V	10.9	1.6	14.8	-28.7	43.5
5	162.41	5.1	H	16.9	2.2	24.2	-19.3	43.5
6	190.60	5.7	V	13.7	2.4	21.8	-21.7	43.5
7	205.21	7.6	H	10.8	2.6	21.0	-22.5	43.5
8	257.92	3.1	V	12.8	3.2	19.0	-27.0	46.0
9	337.92	2.8	H	15.9	3.7	22.4	-23.6	46.0
10	377.61	3.1	V	15.0	4.0	22.2	-23.8	46.0
11	426.21	3.2	H	15.8	4.4	23.4	-22.6	46.0
12	461.32	5.6	V	18.4	4.6	28.6	-17.4	46.0
13	554.21	2.1	V	18.3	5.3	25.6	-20.4	46.0
14	639.31	1.9	H	20.4	5.8	28.1	-17.9	46.0
15	750.95	2.7	V	21.0	6.5	30.1	-15.9	46.0
16	835.42	1.6	H	22.6	7.0	31.2	-14.8	46.0
17	929.83	3.0	V	23.1	7.4	33.5	-12.5	46.0

SAMPLE CALCULATION: FSdBuV/m = MR (dBuV) + ACFdB.

TEST PROCEDURE: ANSI STANDARD C63.4-1992 using a Hewlett Packard Model 8566B spectrum analyzer, a Hewlett Packard Model 85685A Preselector, a Hewlett Packard Model 85650A Quasi-Peak adapter, and an appropriate antenna - see the test equipment list. The bandwidth of spectrum analyzer was 100 kHz with an appropriate sweep speed. When an emission was found, the table was rotated to produce the maximum signal strength. The antenna was placed in both the horizontal and vertical planes and the worse case emissions were reported.

PERFORMED BY: K.M.Choi

DATE: 04/08/2005

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Equipment under test :QBTLLTK-1300H

Ambient temperature : 18

Relative humidity : 50%

RF Exposure calculation

SUBCLAUSE 2.1091

The maximal power density at 20cm distance is calculated as: $P_d = (P_{out} * G) / (4 * \pi * r^2)$

41mW/4 400cm² = 0.00816mW/cm²

The Limit for general population/uncontrolled exposures according 1.1307(b) is 1mw/cm².

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Test Equipment List

DEVICE	MODEL	MFGR	SERNO	DUE.CAL
EMI Test Receiver	ESVS 10	Rohde & Schwarz	830489/001	2005.04.07.
Spectrum Analyzer	8566B	Hewlett Packard	2311A02394	2005.04.07.
Spectrum Display	85662A	Hewlett Packard	2542A12429	2005.04.07.
Quasi-Peak Adapter	85650A	Hewlett Packard	2521A00887	2005.04.07.
RF Preselector	85685A	Hewlett Packard	2648A00504	2005.04.07.
Pre-Amplifier	8449B	Hewlett Packard	3008A00375	2005.04.07.
Pre-Amplifier	8447F	Hewlett Packard	3113A05367	2005.04.07.
Spectrum Monitor	EZM	Rohde & Schwarz	862304/007	2005.04.07.
Bico-Antenna	94455-1	Eaton	977	2005.03.17.
Log-Periodic Antenna	3146	EMCO	2051	2005.03.17.
Dipole Antenna	TDA25/1/2	Electro Metrics	176/200/200	2005.03.17.
Horn Antenna	SAS-571	A.H Systems	414	2005.03.17.
Spectrum Analyzer	R3261C	Advantest	71720189	2005.04.07.
LISN	KNW-242	Kyoritsu	8-923-2	2004.07.17.
LISN	8012-50-R-24	Solar	8379121	2004.07.17.
Loop Ant	6507	EMCO	1435	2004.10.06.
Signal Generator	SMS	Rohde & Schwarz	872165/100	2005.04.07.
Modulation Analyzer	8901B	Hewlett Packard	3438A05094	2005.04.07.
Frequency Counter	CMC251	Tektronic	CMC-251TW52489	2005.04.07.
Oscilloscope	TDS460A	tektronic	D02021366	2005.04.07

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