

## TABLE OF CONTENTS LIST FOR PART 90 UHF DEVICE

**APPLICANT:** LEE TECHNOLOGY KOREA CO., LTD.

**FCC ID:** QBTLTK-25

### TEST REPORT:

PAGE	1.....	GENERAL INFORMATION & TECHNICAL DESCRIPTION
PAGE	2.....	TECHNICAL DESCRIPTION CONTINUED & RF POWER OUTPUT
PAGE	3.....	MODULATION CHARACTERISTICS
PAGE	4-5.....	OCCUPIED BANDWIDTH
PAGE	6.....	OCCUPIED BANDWIDTH PLOT
PAGE	7.....	SPURIOUS EMISSIONS AT ANTENNA TERMINALS
PAGE	8.....	METHOD OF MEASURING SPURIOUS EMISSIONS AT ANTENNA TERM.
PAGE	9.....	FIELD STRENGTH OF SPURIOUS EMISSIONS
PAGE	10.....	METHOD OF MEASURING RADIATED SPURIOUS EMISSIONS
PAGE	11.....	FREQUENCY STABILITY
PAGE	12-13.....	TRANSIENT FREQUENCY STABILITY
PAGE	12.....	TRANSIENT FREQUENCY STABILITY PLOTS
PAGE	15-18.....	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-25

REPORT #: L\LTK\495KT3\495KT3TestReport.doc

TABLE OF CONTENTS

GENERAL INFORMATION REQUIRED  
FOR TYPE ACCEPTANCE

2.1033            LEE TECHNOLOGY KOREA CO., LTD. will sell the  
(c)(1)(2)        FCC ID: QBTLTK-25  
                 VHF transceiver in quantity,  
                 for use under FCC RULES PART 22 & 90.

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

2.1033 (4)        Type of Emission:            20K0F2D

For 25 kHz

Bn = 2M + 2DK

M = 19,200 Bits per second

D = 0.4 kHz (Peak Deviation)

K = 1

Bn = 2(19,200/2) + 2(0.4k)(1) = 19.2k + 0.8k = 20.0k

ALLOWED AUTHORIZED BANDWIDTH = 20.00 kHz.

90.209(b)(5)

2.1033        (5)    Frequency Range:            455-460 MHz

(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

FINAL AMPLIFIER ONLY

Vce =    12 Volts

IC    =    2A

(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.

APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

FCC ID: QBTLTK-25

REPORT #: L\LTK\495KT3\495KT3TestReport.doc

Page 1 of 18

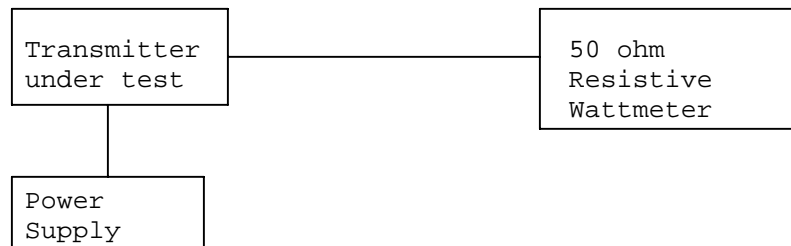
- (8) Instruction book. The instruction manual is included as EXHIBIT 6.
- (10) Description of all circuitry and devices provided for determining and stabilizing frequency is included in the circuit description in Exhibit #7.
- 2.1033(c)(11) A photograph or drawing of the equipment identification label 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.  
RF power is measured by connecting a 50 ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage of 12 VDC, and the transmitter properly adjusted the RF output measures:

POWER OUTPUT

INPUT POWER - (12V)(2A) = 24 Watts

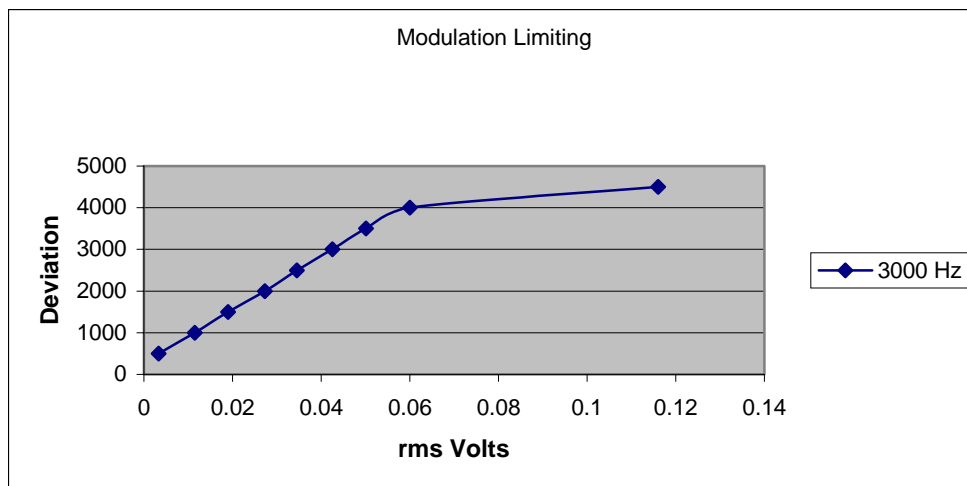
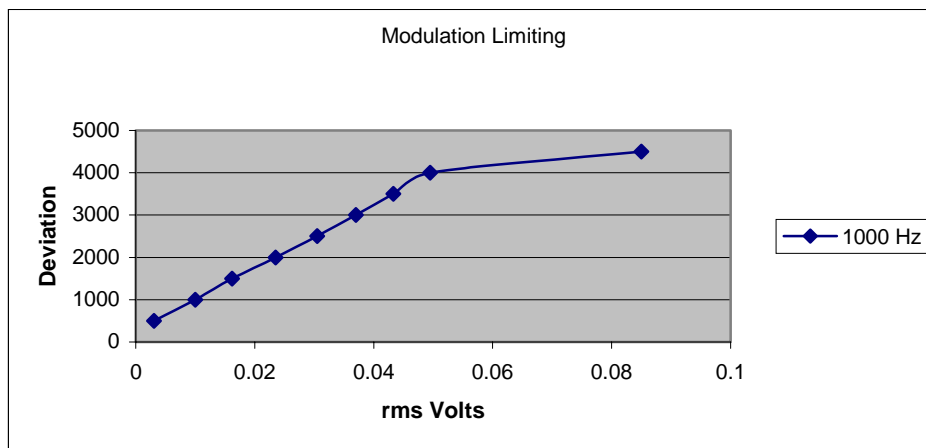
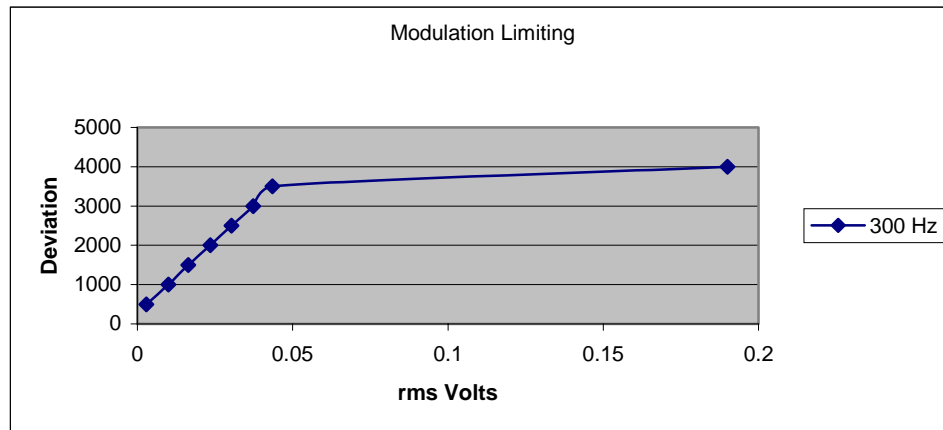
OUTPUT POWER: 1.0 Watt

METHOD OF MEASURING RF POWER OUTPUT



2.1047(a)

Voice Modulation characteristics:  
F2 type of emission - See plots below.



APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

FCC ID: QBTLTK-25

REPORT #: L\LTK\495KT3\495KT3TestReport.doc

Page 3 of 18

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( $f_d$  in kHz) of more than 5 kHz but not more than 10 kHz: At least  $83 \log(f_d/5)$  dB; (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency( $f_d$  in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: At least  $29 \log(f_d/11)$  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.

APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

FCC ID: QBTLTK-25

REPORT #: L\LTK\495KT3\495KT3TestReport.doc

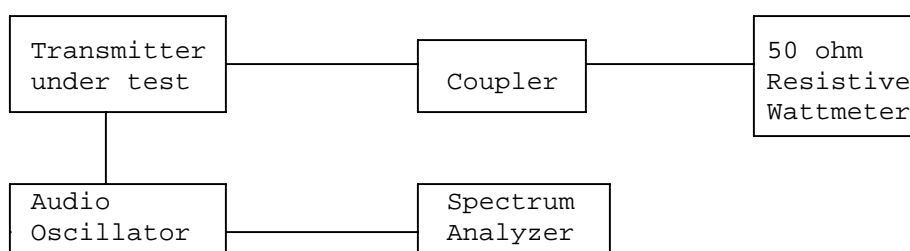
Page 4 of 18

Radiotelephone transmitter with modulation limiter.

Test procedure: TIA/EIA-603 para 2.2.11 , with the exception that various tones were used.

Test procedure diagram

OCCUPIED BANDWIDTH MEASUREMENT



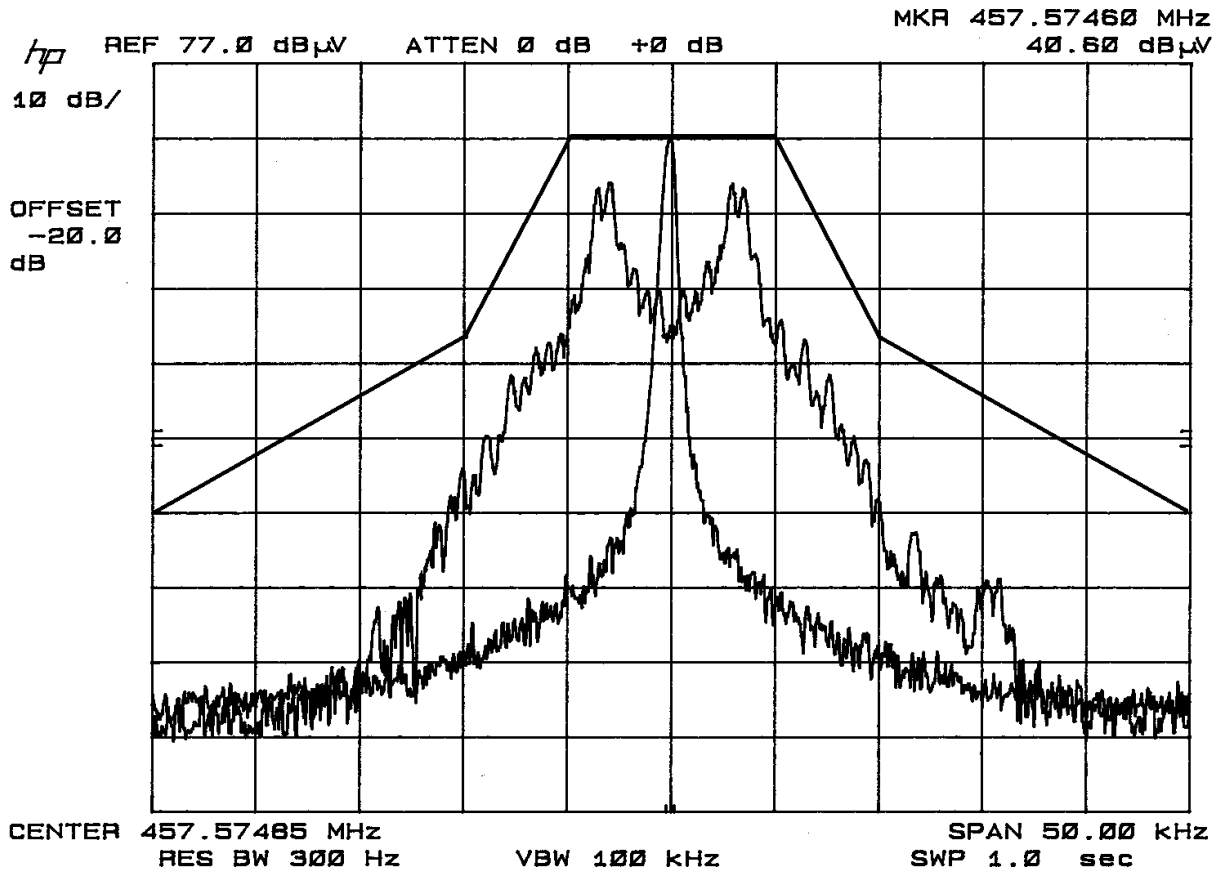
APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

FCC ID: QBTLTK-25

REPORT #: L\LTK\495KT3\495KT3TestReport.doc

Page 5 of 18

# OCCUPIED BANDWIDTH PLOT



2.1051 Spurious emissions at antenna terminals(conducted):  
 2.1052 Data on the following page shows the level of conducted spurious responses. The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard TIA/EIA-603.

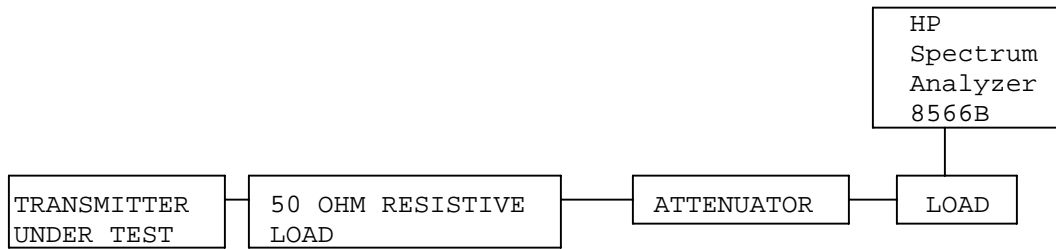
REQUIREMENTS: Emissions must be  $43 + 10\log(P_o)$  dB below the mean power output of the transmitter.

For 25 kHz  $43 + 10\log(1) = 43$  dB

EMISSION FREQUENCY MHz	dB BELOW CARRIER
457.5	00.0
915.1	-53
1372.1	-68
1830.3	-73
2287.9	-85
2745.5	-95
3203.1	-87
3660.7	-83
4118.3	-87
4575.9	-103



### Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was TIA/EIA-603 STANDARD without any exceptions. An audio generator was connected to the UUT through a dummy microphone circuit and the output of the transmitter connected to a standard load and from the standard load through a pre-selector filter of the spectrum analyzer. The spectrum was scanned from 400 kHz to at least the tenth harmonic of the fundamental using a HP model 8566B spectrum analyzer. The measurements were made using the shielded room located at TIMCO ENGINEERING INC. 849 N.W. State Road 45, Newberry, Florida 32669.

2.1053 Field strength of spurious emissions:

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

REQUIREMENTS: Emissions must be  $50 + 10\log(P_o)$  dB below the mean power output of the transmitter.

$$43 + 10\log(1.0) = 43 \text{ dB}$$

TEST DATA:

Emission Frequency MHz	ANT. POLARITY	Signal Generator Level (dBm)	Coax Loss (dB)	Substitution Antenna (dBd)	ERP (dBc)
457.5	V	29.70	0	0	0.00
915.1	H	-23.60	0	0	53.30
1,372.70	V	-28.80	1.1	-4.99	64.59
1,830.30	V	-42.40	1.2	-5.24	78.54
2,287.90	H	-28.10	1.25	-6.7	65.75
2,745.50	V	-45.50	1.3	-7.2	83.70
3,203.10	H	-47.30	1.4	-7.4	85.80
3,660.70	H	-53.00	1.4	-7.5	91.60
4,118.30	H	-51.60	1.45	-7.6	90.35

Sample Calculation: Sig Gen.-coax loss+sub antenna=Corrected ERP

APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

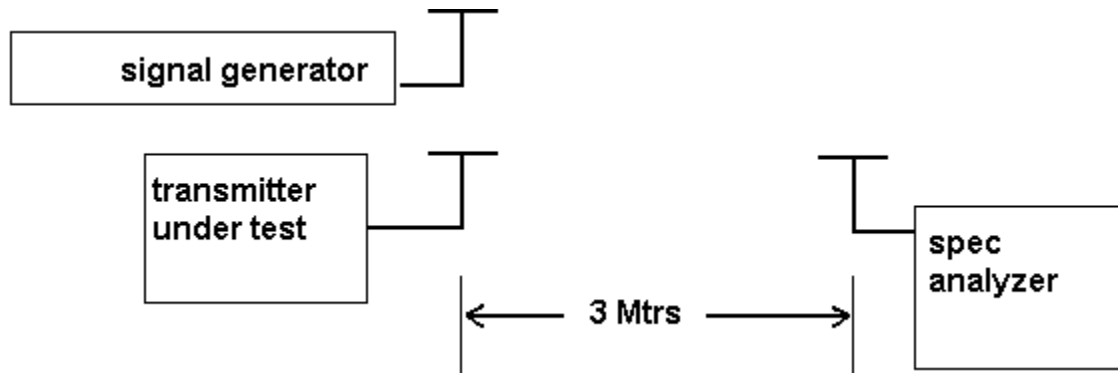
FCC ID: QBTLTK-25

REPORT #: L\LTK\495KT3\495KT3TestReport.doc

Page 9 of 18

METHOD OF MEASUREMENTS: 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 TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.

#### Method of Measuring Radiated Spurious Emissions



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.

Readings were also taken at plus and minus 15% of the power supply voltage of 12VDC.

MEASUREMENT DATA:

Assigned Frequency (Ref. Frequency): 457.574 880 MHz

TEMPERATURE_°C	FREQUENCY_MHz	PPM
REFERENCE_____	457.574 880	00.0
-30_____	457.574 432	- 0.98
-20_____	457.574 511	- 0.81
-10_____	457.574 681	- 0.44
0_____	457.574 762	- 0.26
+10_____	457.574 879	0.00
+20_____	457.574 979	+ 0.22
+30_____	457.574 843	- 0.08
+40_____	457.574 346	- 1.17
+50_____	457.573 745	- 2.48

-15% supply voltage: VDC	457.574 978	+ 0.21
+15% supply voltage: VDC	457.574 977	+ 0.21

APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

FCC ID: QBTLTK-25

REPORT #: L\LTK\495KT3\495KT3TestReport.doc

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

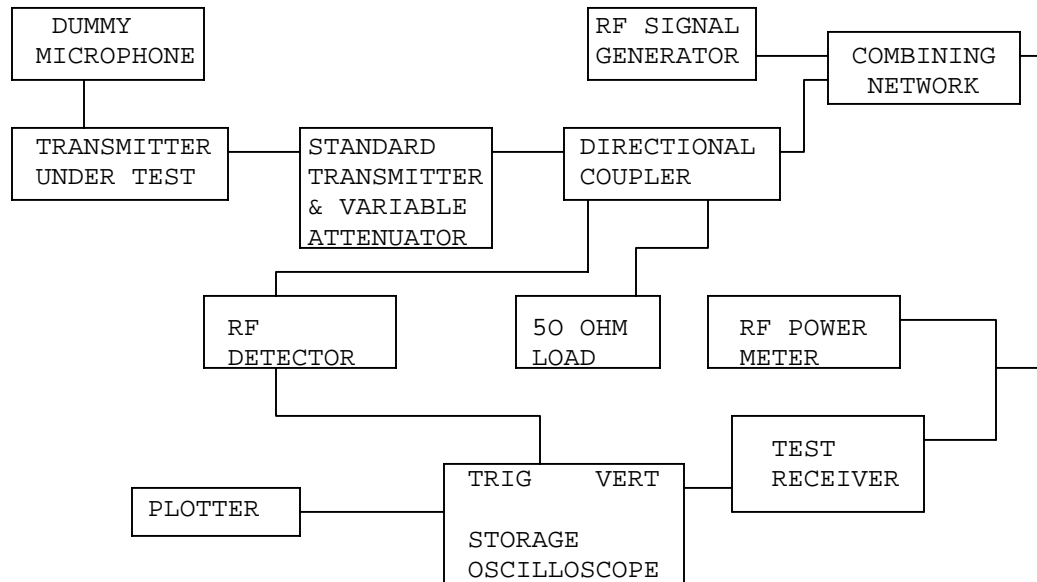
REQUIREMENTS: In the 450-500MHz frequency band, transient frequencies must be within the maximum frequency difference limits during the time interval indicated below for 12.5kHz Channels:

Time Interval	Maximum Frequency	Portable Radios 450-500 MHz
t1	+12.5 kHz	10.0 ms
t2	+6.25 kHz	25.0 ms
t3,t4	+12.5 kHz	10.0 ms

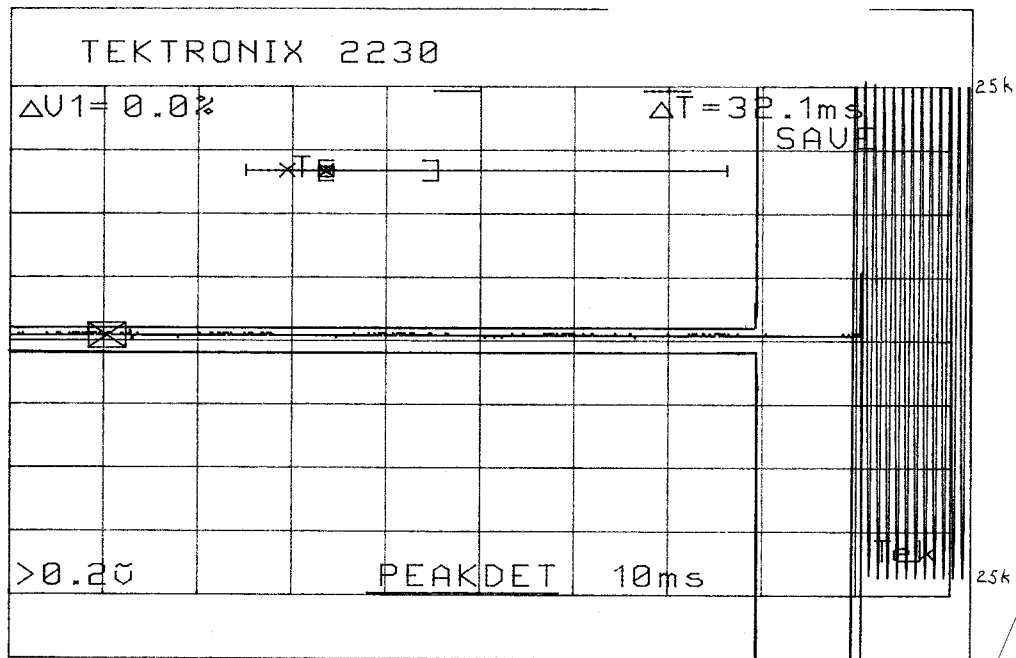
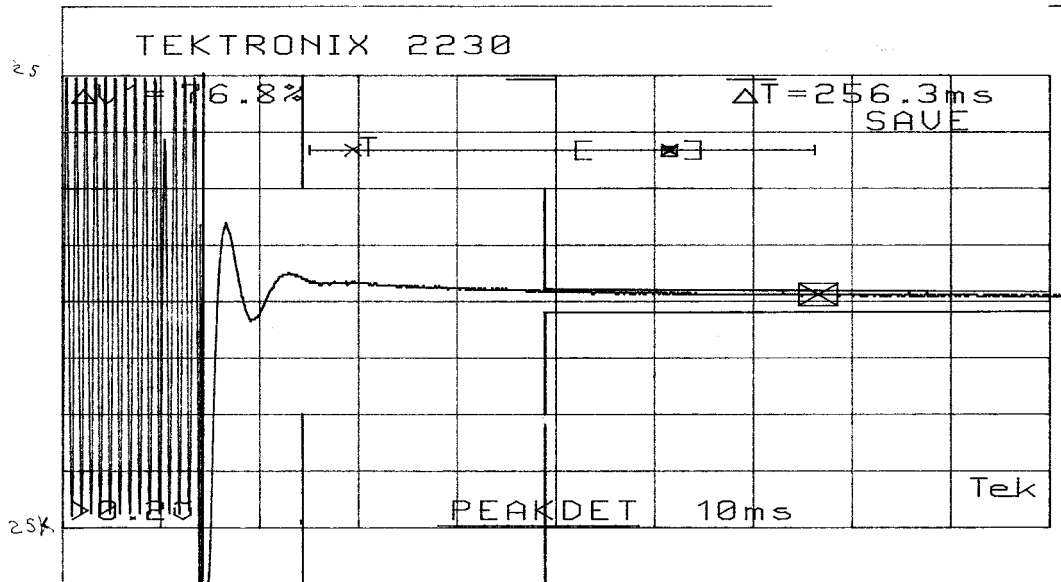
TEST PROCEEDURE: TIA/EIA TS603 PARA 2.2.19, the levels were set as follows;

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 through-out 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.

2.1055                      Frequency stability:  
90.214                      Transient Frequency Behavior  
(Continued)



TRANSIENT FREQUENCY RESPONSE - 25 kHz DEVIATION



APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

FCC ID: QBTLTK-25

REPORT #: L\LTk\495KT3\495KT3TestReport.doc

Page 14 of 18

## EMC Equipment List

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
X	3-Meter OATS	TEI	N/A	N/A	Listed 1/13/03	1/13/06
	3/10-Meter OATS	TEI	N/A	N/A	Listed 3/26/01	3/26/04
	Receiver, Beige Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 8/31/01	8/31/03
	RF Preselector	HP	85685A	3221A01400	CAL 8/31/01	8/31/03
	Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 8/31/01	8/31/03
X	Receiver, Blue Tower Spectrum Analyzer	HP	8568B	2928A04729	CAL	4/15/05
X				2848A18049	4/15/03	
X	RF Preselector	HP	85685A	2926A00983	CAL 4/15/03	4/15/05
X	Quasi-Peak Adapter	HP	85650A	2811A01279	CAL 4/15/03	4/15/05
	Receiver, Silver/Grey Tower Spectrum Analyzer	HP	8566B Opt 462	3552A22064 3638A08608	CAL 10/14/02	10/14/04
	RF Preselector	HP	85685A	2620A00294	CAL 10/14/02	10/14/04
	Quasi-Peak Adapter	HP	85650A	3303A01844	CAL 10/14/02	10/14/04
	Preamplifier	HP	8449B	3008A01075	CHAR 1/28/02	1/28/04
X	Biconnical Antenna	Electro-Metrics	BIA-25	1171	CAL 4/26/01	4/26/03
	Biconnical Antenna	Eaton	94455-1	1096	CAL 10/1/01	10/1/03
	Biconnical Antenna	Eaton	94455-1	1057	CAL 3/18/03	3/18/05
	BiconiLog Antenna	EMCO	3143	9409-1043		
X	Log-Periodic Antenna	Electro-Metrics	LPA-25	1122	CAL 10/2/01	10/2/03
	Log-Periodic Antenna	Electro-Metrics	EM-6950	632	CHAR 10/15/01	10/15/03
	Log-Periodic Antenna	Electro-Metrics	LPA-30	409	CAL 3/4/03	3/4/05
	Dipole Antenna Kit	Electro-Metrics	TDA-30/1-4	152	CAL 3/21/01	3/21/04

APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

FCC ID: QBTLTK-25

REPORT #: L\LTK\495KT3\495KT3TestReport.doc

Page 15 of 18



	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
	Dipole Antenna Kit	Electro-Metrics	TDA-30/1-4	153	CAL 9/26/02	9/26/05
	Double-Ridged Horn Antenna	Electro-Metrics	RGA-180	2319	CAL 2/17/03	2/17/05
	Horn Antenna	Electro-Metrics	EM-6961	6246	CAL 3/31/03	3/31/05
	Horn Antenna	ATM	19-443-6R	None	No Cal Required	
	Passive Loop Antenna	EMC Test Systems	EMCO 6512	9706-1211	CHAR 7/10/01	7/10/03
	Line Impedance Stabilization . . .	Electro-Metrics	ANS-25/2	2604	CAL 10/9/01	10/9/03
	Line Impedance Stabilization . . .	Electro-Metrics	EM-7820	2682	CAL 3/12/03	3/12/05
	Termaline Wattmeter	Bird Electronic Corporation	611	16405	CAL 5/25/99	5/25/01
	Termaline Wattmeter	Bird Electronic Corporation	6104	1926	CHAR 12/12/01	12/12/03
	Oscilloscope	Tektronix	2230	300572	CHAR 2/1/01	2/1/03
	System One	Audio Precision	System One	SYS1-45868	CHAR 4/25/02	4/25/04
	Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 1/22/02	1/22/04
	AC Voltmeter	HP	400FL	2213A14499	CAL 10/9/01	10/9/03
	AC Voltmeter	HP	400FL	2213A14261	CHAR 10/15/01	10/15/03
	AC Voltmeter	HP	400FL	2213A14728	CHAR 10/15/01	10/15/03
X	Digital Multimeter	Fluke	77	35053830	CHAR 1/8/02	1/8/04
	Digital Multimeter	Fluke	77	43850817	CHAR 1/8/02	1/8/04
	Digital Multimeter	HP	E2377A	2927J05849	CHAR 1/8/02	1/8/04
	Multimeter	Fluke	FLUKE-77-3	79510405	CHAR 9/26/01	9/26/03
	Peak Power Meter	HP	8900C	2131A00545	CHAR 1/26/01	1/26/03
	Power Meter	HP	432A	1141A07655	CAL 4/15/03	4/15/05
	Power Meter And Sensor	Bird	4421-107 4022	0166 0218	CAL 4/16/03	4/16/05

APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

FCC ID: QBTLTK-25

REPORT #: L\LTk\495KT3\495KT3TestReport.doc

Page 16 of 18

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
	Power Sensor	HP	478A	72129	CAL 4/15/03	4/15/05
	Digital Thermometer	Fluke	2166A	42032	CAL 1/16/02	1/16/04
	Thermometer	Traulsen	SK-128		CHAR 1/22/02	1/22/04
	Thermometer	Extech	4028	14871-2	CAL 3/7/03	3/7/05
X	Hygro-Thermometer	Extech	445703	0602	CAL 10/4/02	10/4/04
	Frequency Counter	HP	5352B	2632A00165	CAL 11/28/01	11/28/03
	Frequency Counter	HP	5385A	2730A03025	CAL 3/7/03	3/7/05
	Power Sensor	Agilent Technologies	84811A	2551A02705	CHAR 1/26/01	1/26/03
	Service Monitor	IFR	FM/AM 500A	5182	CAL 11/22/00	11/22/02
	Comm. Serv. Monitor	IFR	FM/AM 1200S	6593	CAL 5/12/02	5/12/04
	Signal Generator	HP	8640B	2308A21464	CAL 2/15/02	2/15/04
	Sweep Generator	Wiltron	6648	101009	CAL 4/15/03	4/15/05
	Sweep Generator	Wiltron	6669M	007005	CAL 3/3/03	3/3/05
	Modulation Analyzer	HP	8901A	3435A06868	CAL 9/5/01	9/5/03
	Modulation Meter	Boonton	8220	10901AB	CAL 4/15/03	4/15/05
	Near Field Probe	HP	HP11940A	2650A02748	CHAR 2/1/01	2/1/03
	BandReject Filter	Lorch Microwave	5BR4-2400/ 60-N	Z1	CHAR 3/2/01	3/2/03
	BandReject Filter	Lorch Microwave	6BR6-2442/ 300-N	Z1	CHAR 3/2/01	3/2/03
	BandReject Filter	Lorch Microwave	5BR4-10525/ 900-S	Z1	CHAR 3/2/01	3/2/03
	High Pass Filter	Microlab	HA-10N		CHAR 10/4/01	10/4/03
	High Pass Filter	Microlab	HA-20N		CHAR 2/7/03	2/7/05
	Audio Oscillator	HP	653A	832-00260	CHAR 3/1/01	3/1/03

APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

FCC ID: QBTLTK-25

REPORT #: L\LTk\495KT3\495KT3TestReport.doc

Page 17 of 18

	<b>DEVICE</b>	<b>MFGR</b>	<b>MODEL</b>	<b>SERNO</b>	<b>CAL/CHAR DATE</b>	<b>DUE DATE or STATUS</b>
	Frequency Counter	HP	5382A	1620A03535	CHAR 3/2/01	3/2/03
	Frequency Counter	HP	5385A	3242A07460	CAL 3/7/03	3/7/05
	Preamplifier	HP	8449B-H02	3008A00372	CHAR 3/4/01	3/4/03
	Amplifier	HP	11975A	2738A01969	CHAR 3/1/01	3/1/03
	Egg Timer	Unk			CHAR 8/31/01	8/31/03
	Measuring Tape, 20M	Kraftixx	0631-20		CHAR 2/1/02	2/1/04
	Measuring Tape, 7.5M	Kraftixx	7.5M PROFI		2/1/02	2/1/04
	Coaxial Cable #51	Insulated Wire Inc.	NPS 2251-2880	Timco #51	CHAR 1/23/02	1/23/04
	Coaxial Cable #64	Semflex Inc.	60637	Timco #64	CHAR 1/24/02	1/24/04
	Coaxial Cable #65	General Cable Co.	E9917 RG233/U	Timco #65	CHAR 1/23/02	1/23/04
	Coaxial Cable #106	Unknown	Unknown	Timco #106	CHAR 1/23/02	1/23/04

APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

FCC ID: QBTLTK-25

REPORT #: L\LTk\495KT3\495KT3TestReport.doc

Page 18 of 18