

THRU Lab & Engineering.

477-6, Hager-Ri, Yoju-Up, Yoju-Gun

Kyunggi-Do, 469-803, Korea

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THRU

Test Report

Product Name: UHF Alpha Transmitter

FCC ID: QBTCLK-1100L

Applicant:

LEE TECHNOLOGY KOREA CO., LTD.

**3rd FL #499-2, Sang 3-dong, Wonmi-gu,
Bucheon-city, Kyungki-do,
KOREA**

Date Receipt: 02/27/2007

Date Tested: 02/28/2007

APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

FCC ID: QBTCLK-1100L

REPORT #: THRU-702008

COVER SHEET

THRU Lab & Engineering.

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APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

FCC ID: QBTLTK-1100L

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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-1100L
UHF transceiver in quantity,
for use under FCC RULES PART 90 .

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

2.1033 (4) Type of Emission: 10K2F1D
FOR 25kHz

$B_n = 2M + 2DK$
 $M = 1,200$ Bits per second
 $D = 4.5$ kHz (Peak Deviation)
 $K = 1$
 $B_n = 2(1,200\text{bps}/2) + 2(4500)(1) = 10.2\text{k}$

ALLOWED AUTHORIZED BANDWIDTH = 10.2 kHz.

90.209(b) (5)

2.1033 (5) Frequency Range: 450,0000 ~ 467,8750 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 = 5 Volts
IC = 180 mA

(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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(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(CONDUCTED)

Maximum peak output power(W)		
LOW	Mid	HIGH
0.5W	0.5W	0.5W
27.0 dBm	27.0 dBm	27.0 dBm

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PLOT

LOW



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Mid



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High



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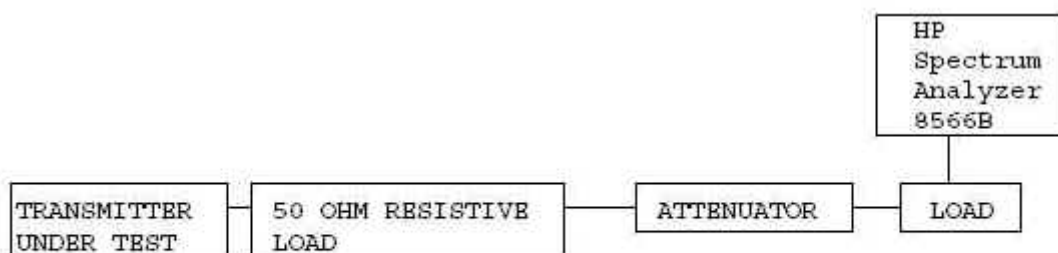
SPURIOUS EMISSIONS (Conducted)

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 100GHz, 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 Conducted Spurious Emissions



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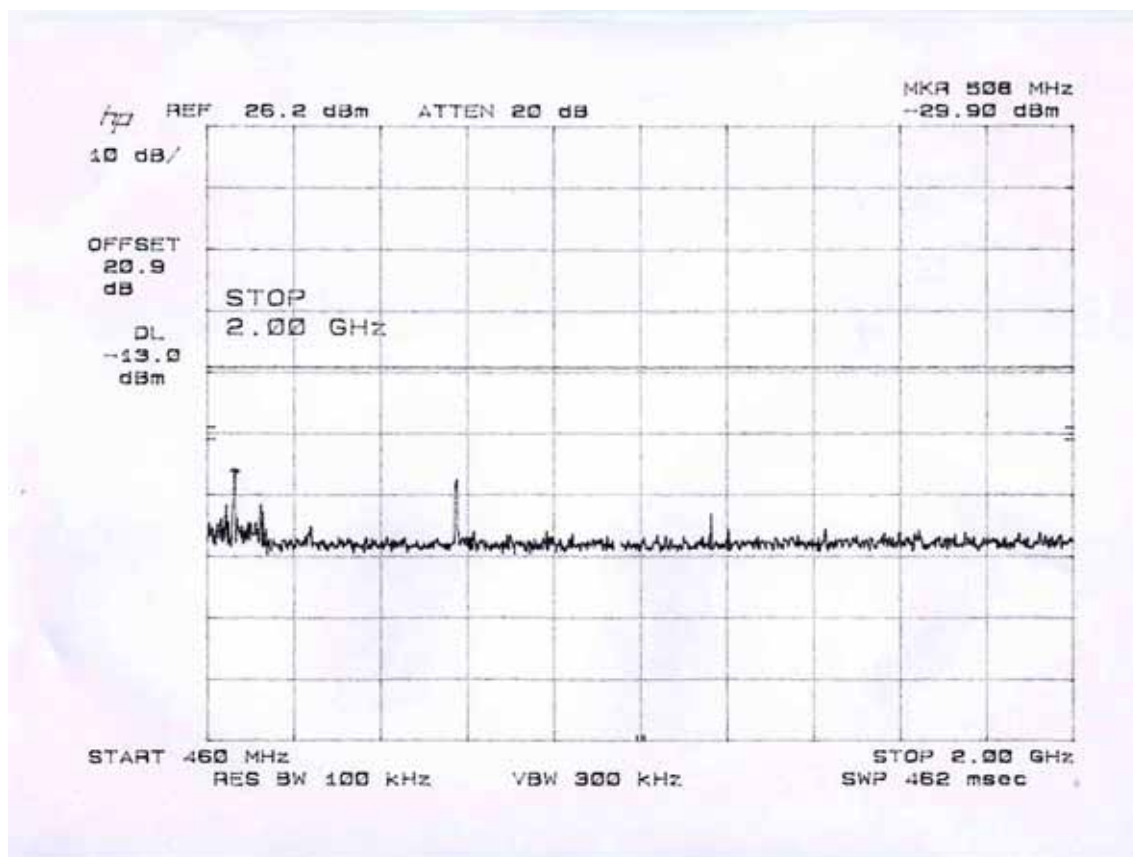
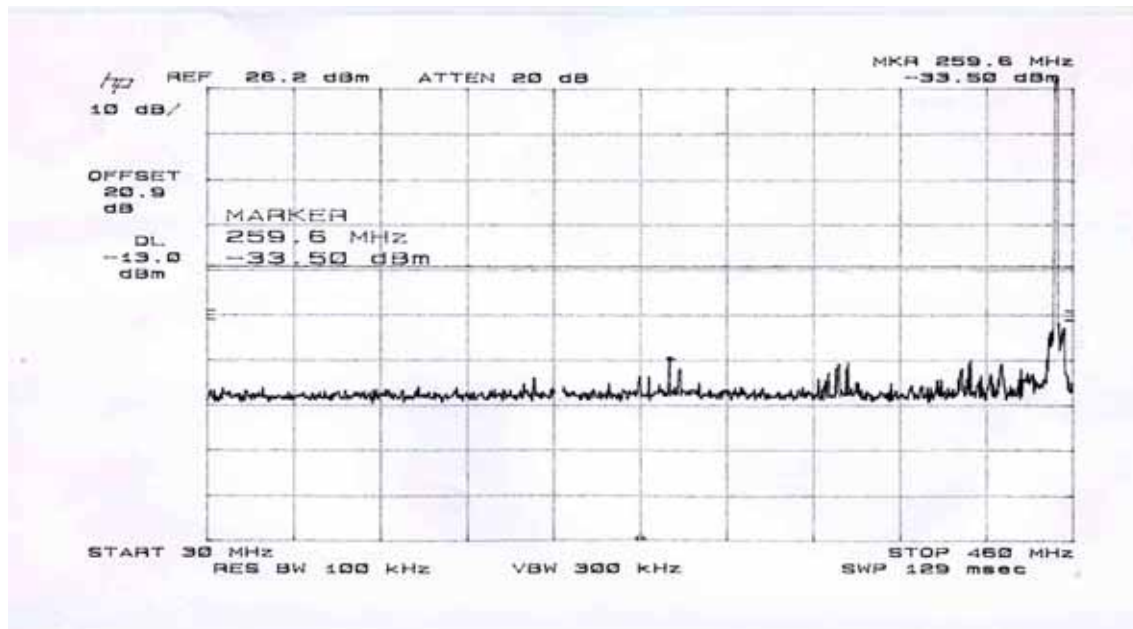
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PLOT

REQUIREMENTS : $43 + 10\log(0.5) = 40.0 \text{ dB}$

LOW



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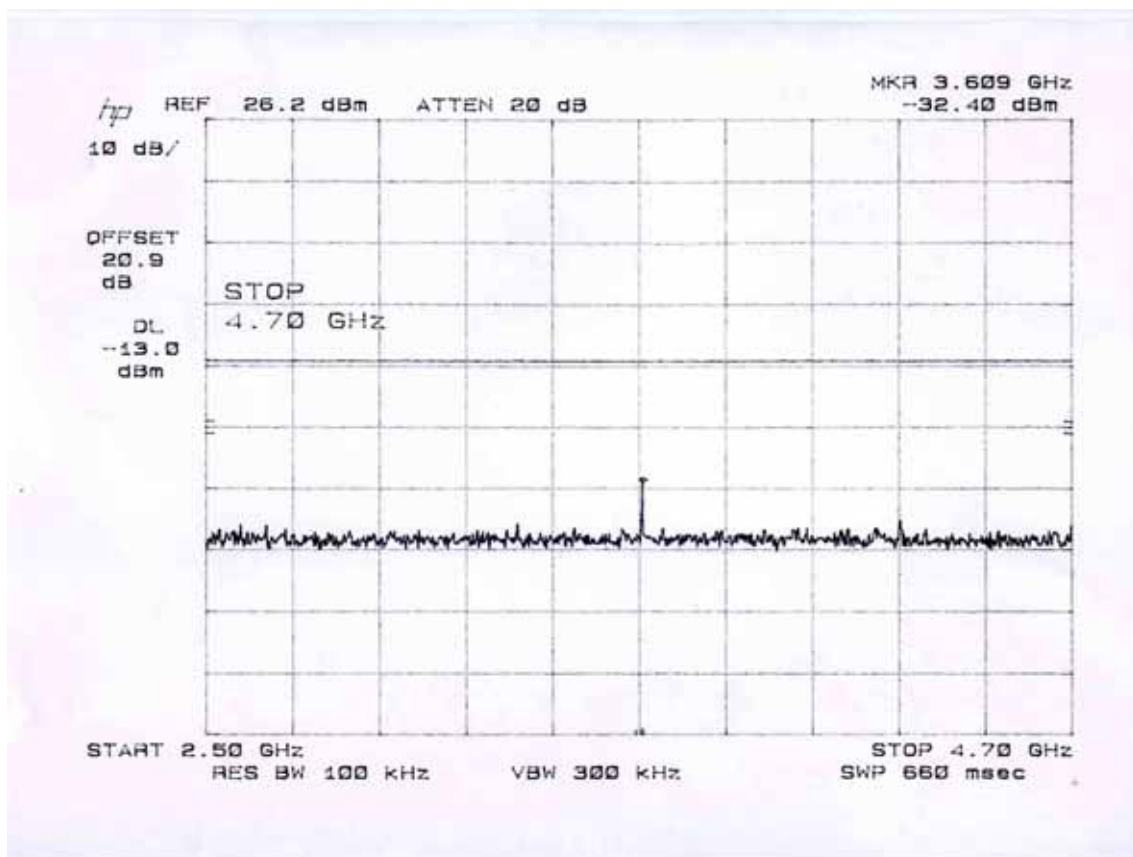
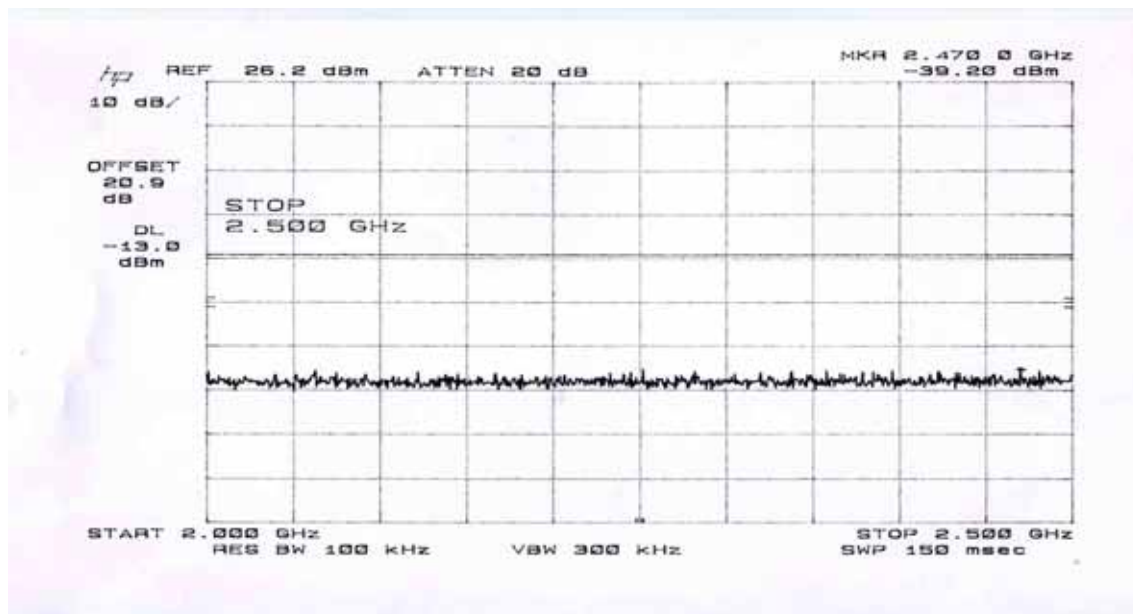
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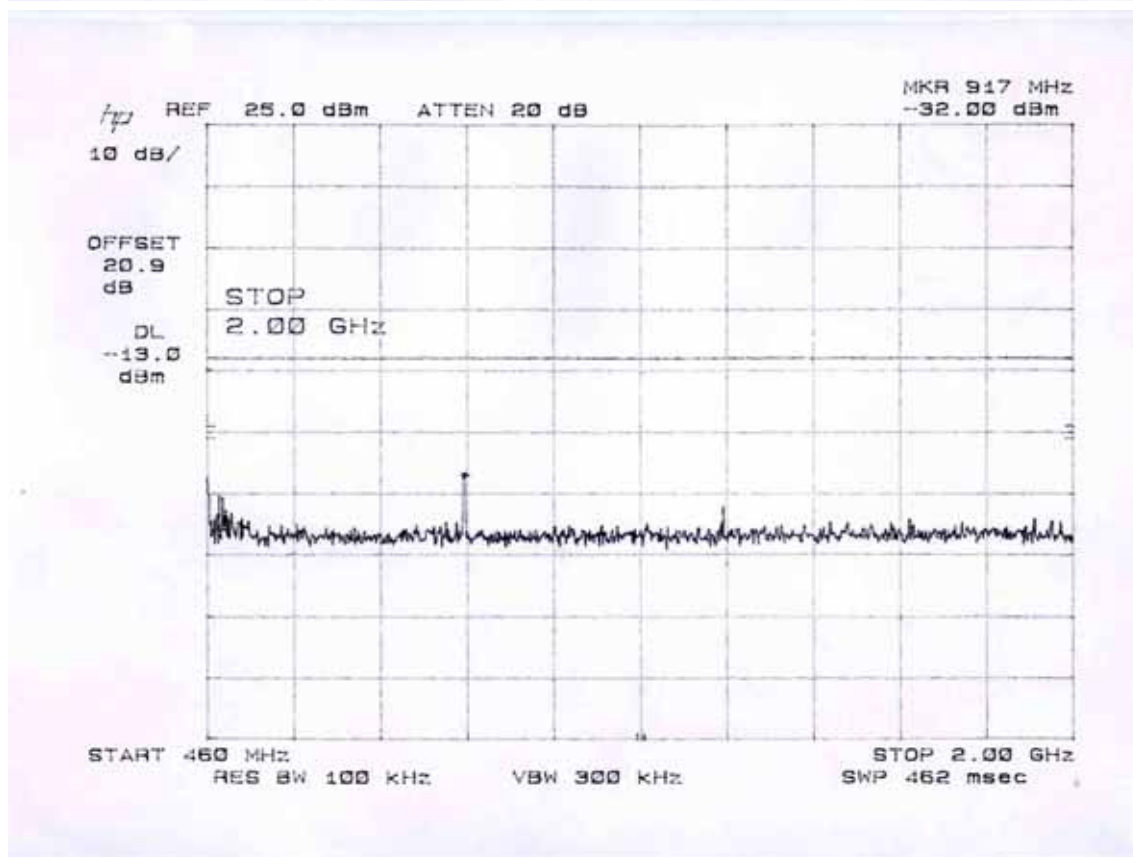
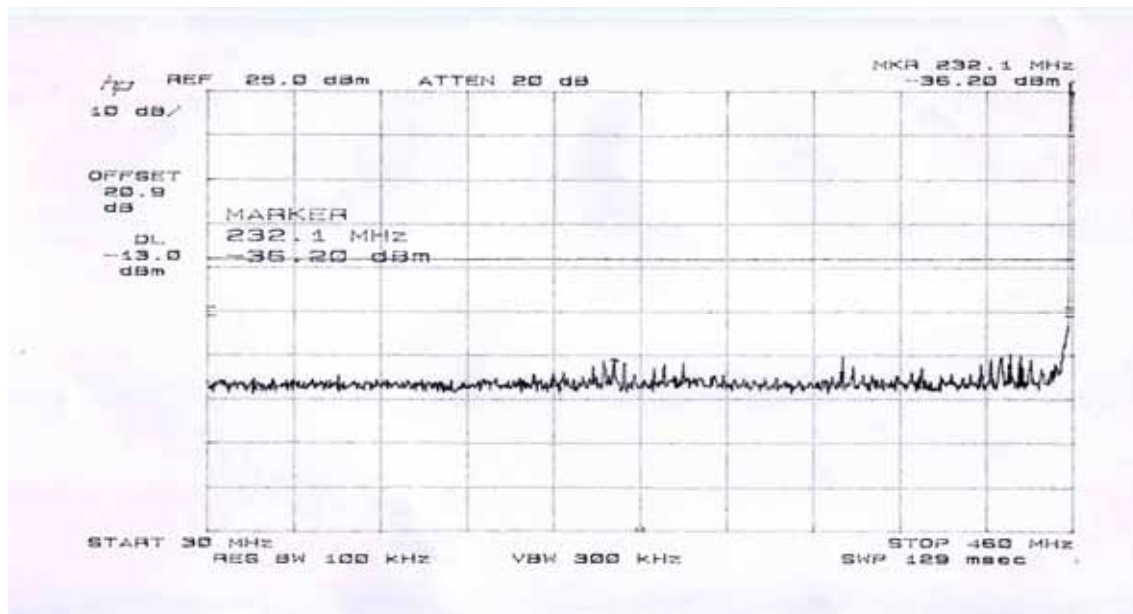
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Mid

REQUIREMENTS : $43 + 10\log(0.5) = 40.0 \text{ dB}$



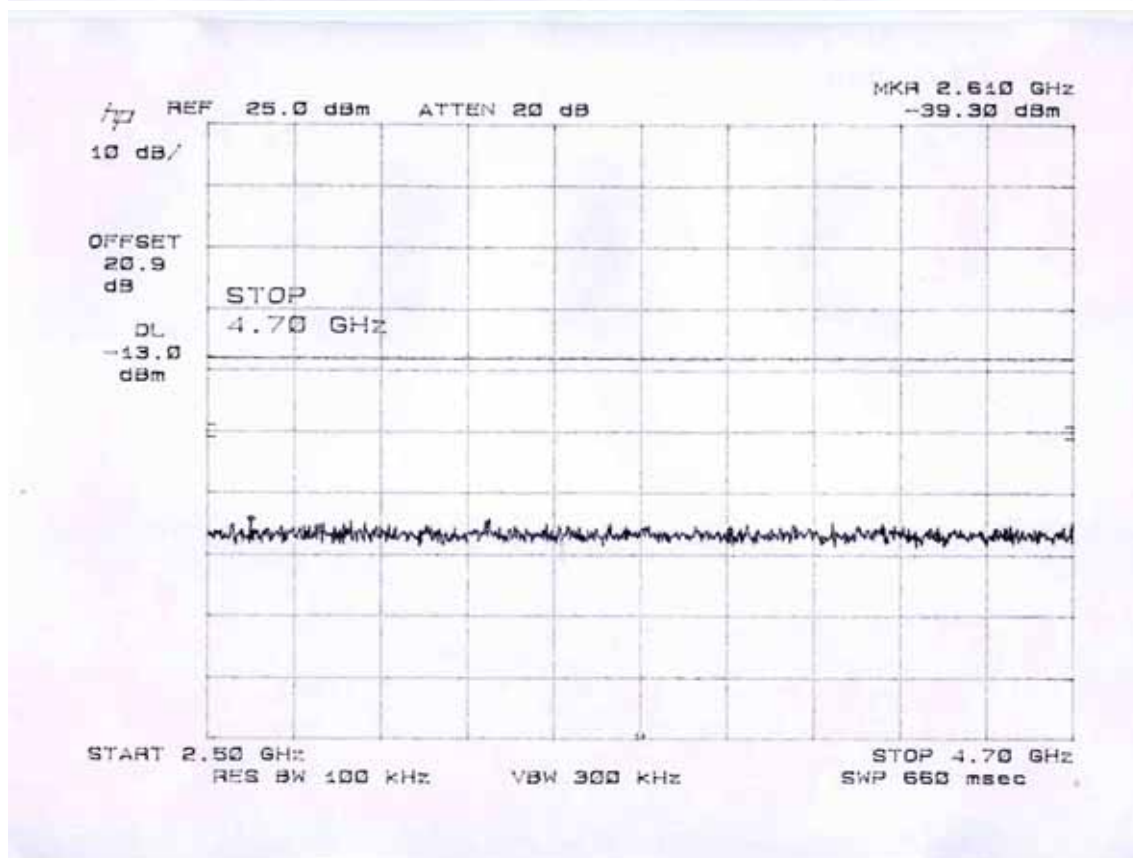
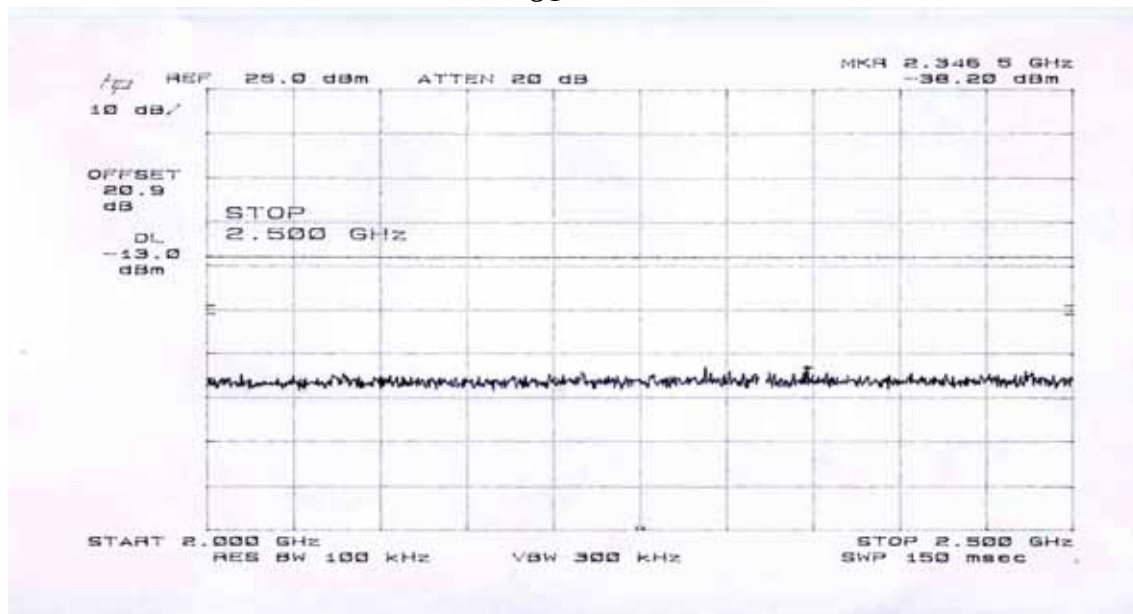
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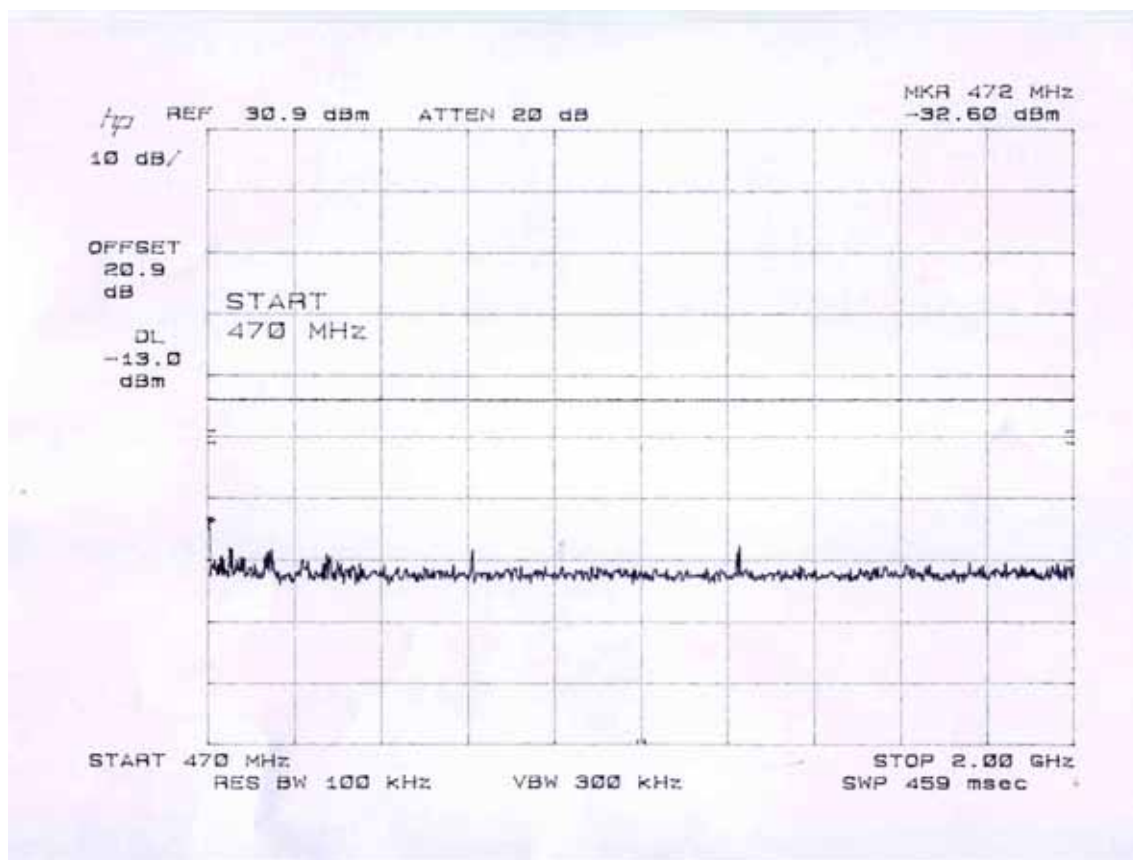
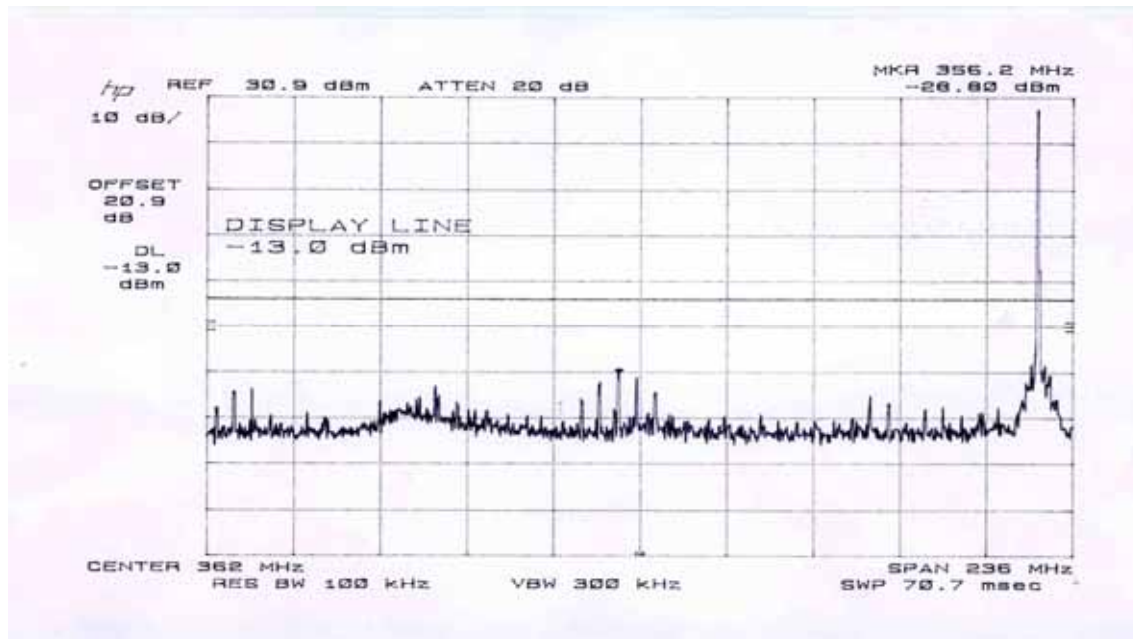
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HIGH

REQUIREMENTS : $43 + 10\log(0.5) = 40.0 \text{ dB}$



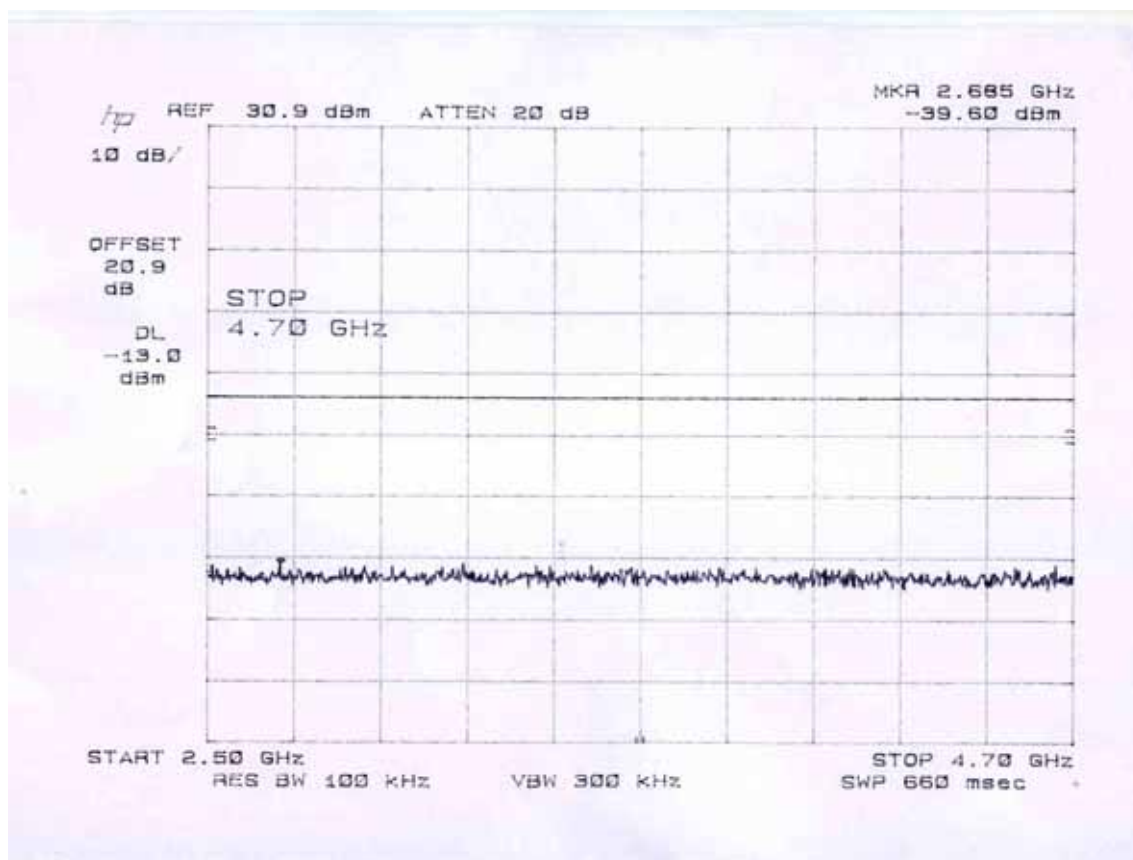
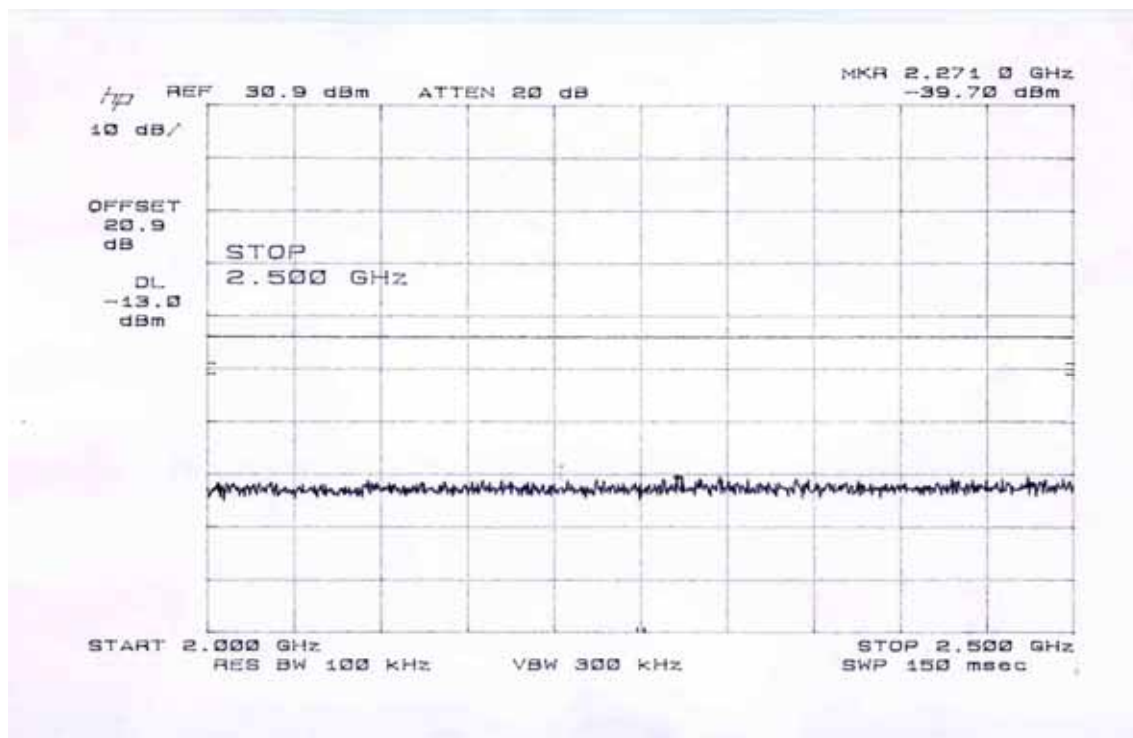
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2.1053

UNWANTED RADIATION

90.210 (g) (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.

REQUIREMENTS : $43 + 10\log(0.5) = 40.0$ dB

Test result : Low

Horizontal				Vertical			
frequency	dBc	Margin	dBm	frequency	dBc	Margin	dBm
450.3250	0	0	0	450.3250	0	0	0
900.6500	67.28	27.28	-40.28	900.6500	62.08	22.08	-35.08
1350.9750	59.39	19.39	-32.39	1350.9750	55.09	15.09	-28.09
1801.3000	65.40	25.40	-38.40	1801.3000	60.20	20.20	-33.20
2251.6250	54.64	14.64	-27.64	2251.6250	52.34	12.34	-25.34
2701.9500	49.37	9.37	-22.37	2701.9500	46.37	6.37	-19.37
3152.2750	55.96	15.96	-28.96	3152.2750	57.86	17.86	-30.86
3602.6000	52.84	12.84	-25.84	3602.6000	51.74	11.74	-24.74
4052.9250	50.84	10.84	-23.84	4052.9250	47.74	7.74	-20.74
4503.2500	51.68	11.68	-24.68	4503.2500	51.98	11.98	-24.98

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 477-6, Hager-Ri, Yoju-Up, Yoju-Gun, Kyunggi-Do, 469-803, Korea

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2.1053

UNWANTED RADIATION

90.210 (g) (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.

REQUIREMENTS : $43 + 10\log(0.5) = 40.0$ dB

Test result : Mid

Horizontal				Vertical			
frequency	dBc	Margin	dBm	frequency	dBc	Margin	dBm
457.5750	0	0	0	457.5750			0
915.1500	53.77	13.77	-26.77	915.1500	57.37	17.37	-30.37
1372.7250	55.08	15.08	-28.08	1372.7250	46.68	6.68	-19.68
1830.3000	66.53	26.53	-39.53	1830.3000	61.53	21.53	-34.53
2287.8750	59.13	19.13	-32.13	2287.8750	56.63	16.63	-29.63
2745.4500	49.85	9.85	-22.85	2745.4500	49.65	9.65	-22.65
3203.0250	49.85	9.85	-22.85	3203.0250	51.95	11.95	-24.95
3660.6000	45.14	5.14	-18.14	3660.6000	43.24	3.24	-16.24
4118.1750	52.36	12.36	-25.36	4118.1750	47.06	7.06	-20.06
4575.7500	56.97	16.97	-29.97	4575.7500	55.37	15.37	-28.37

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 477-6, Hager-Ri, Yoju-Up, Yoju-Gun, Kyunggi-Do, 469-803, Korea

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UNWANTED RADIATION

90.210 (g) (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.

$$\text{REQUIREMENTS} : 43 + 10\log(0.5) = 40.0 \text{ dB}$$

Test result : High

Horizontal

Vertical

frequency	dBc	Margin	dBm	frequency	dBc	Margin	dBm
467.8500	0	0	0	467.8500	0	0	0
935.7000	61.06	21.06	-34.06	935.7000	61.76	21.76	-34.76
1403.5500	64.34	24.34	-37.34	1403.5500	56.24	16.24	-29.24
1871.4000	64.81	24.81	-37.81	1871.4000	60.91	20.91	-33.91
2339.2500	56.71	16.71	-29.71	2339.2500	53.51	13.51	-26.51
2807.1000	61.64	21.64	-34.64	2807.1000	59.34	19.34	-32.34
3274.9500	49.80	9.80	-22.80	3274.9500	48.40	8.40	-21.40
3742.8000	54.80	14.80	-27.80	3742.8000	47.30	7.30	-20.30
4210.6500	48.66	8.66	-21.66	4210.6500	51.46	11.46	-24.46
4678.5000	52.71	12.71	-25.71	4678.5000	55.11	15.11	-28.11

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 477-6, Hager-Ri, Yoju-Up, Yoju-Gun, Kyunggi-Do, 469-803, Korea

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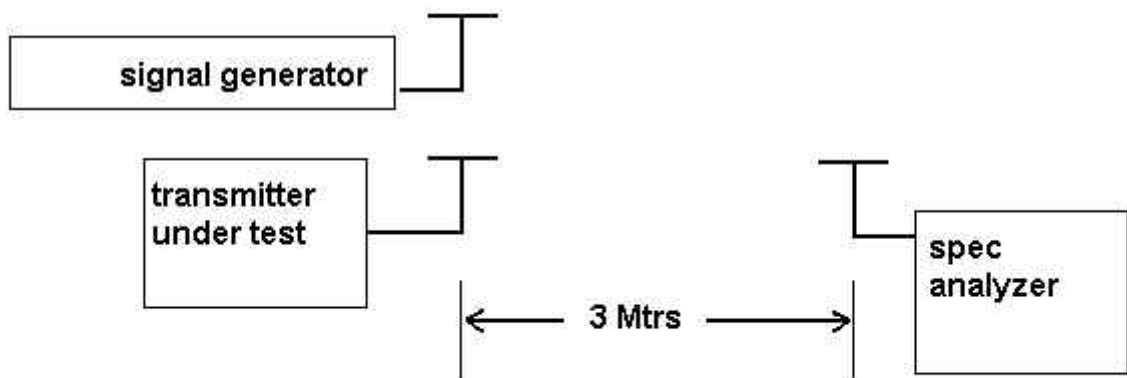
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Method of Measuring Radiated Spurious Emissions



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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) (KHz)	Channel	
	spacing	Authorized
	Bandwidth(kHz)	
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.....		

- 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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2.1049

Audio Low Pass Filter

This UUT does not have a low pass filter

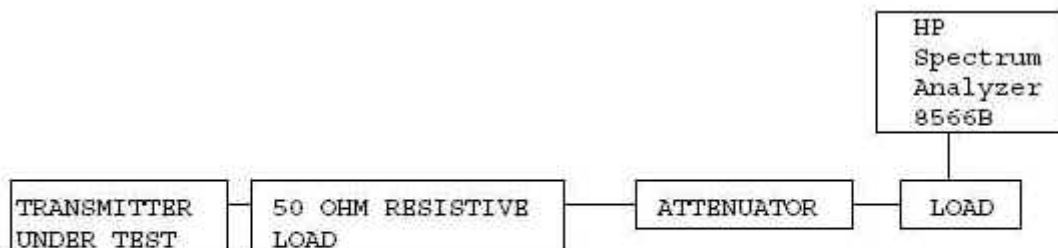
2.1049 Occupied bandwidth:

90.210(g) Emission Mask G.

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 power(P) 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 no more than 10kHz: 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 no more than 250% of the authorized bandwidth: At least $116\log(f_d/6.1)$ dB or $50+10\log(P)$, or 70dB, 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 $43+10\log(P)$ dB.

Method of Measuring Occupied Bandwidth



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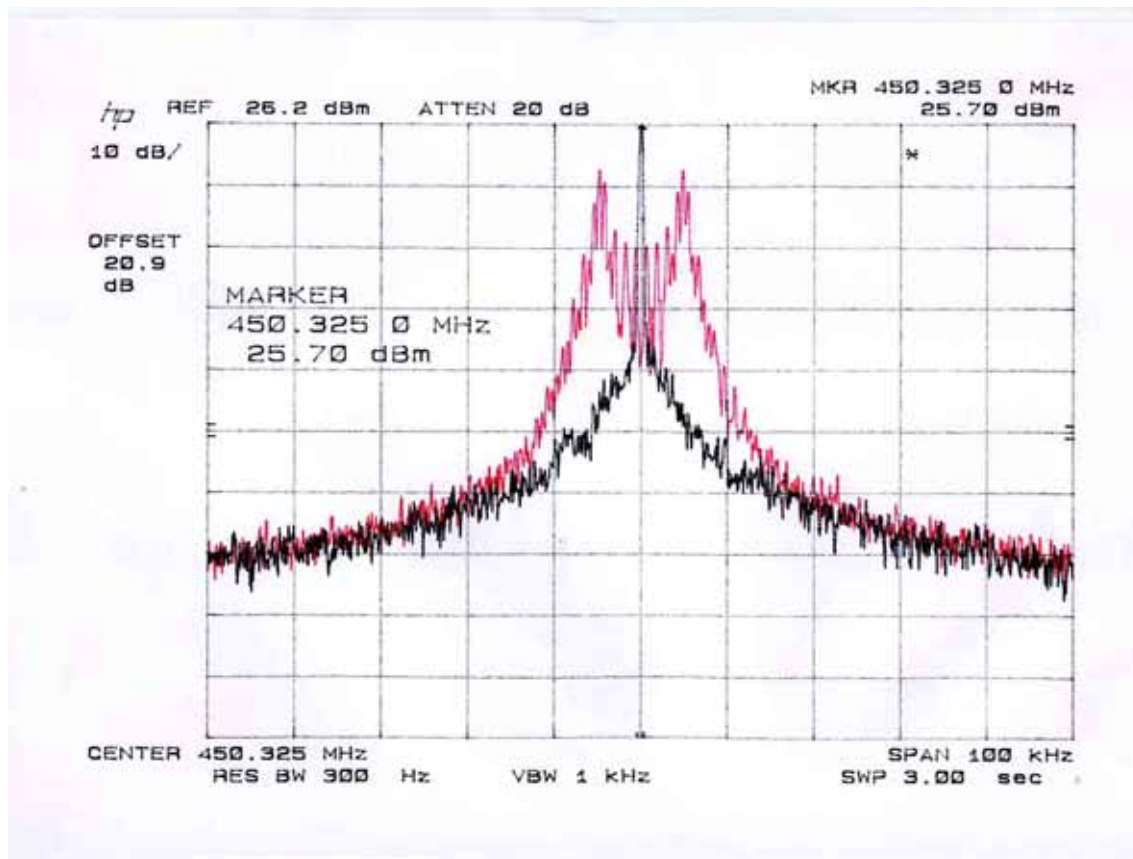
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EMISSIONS MASK(G) PLOT

Low



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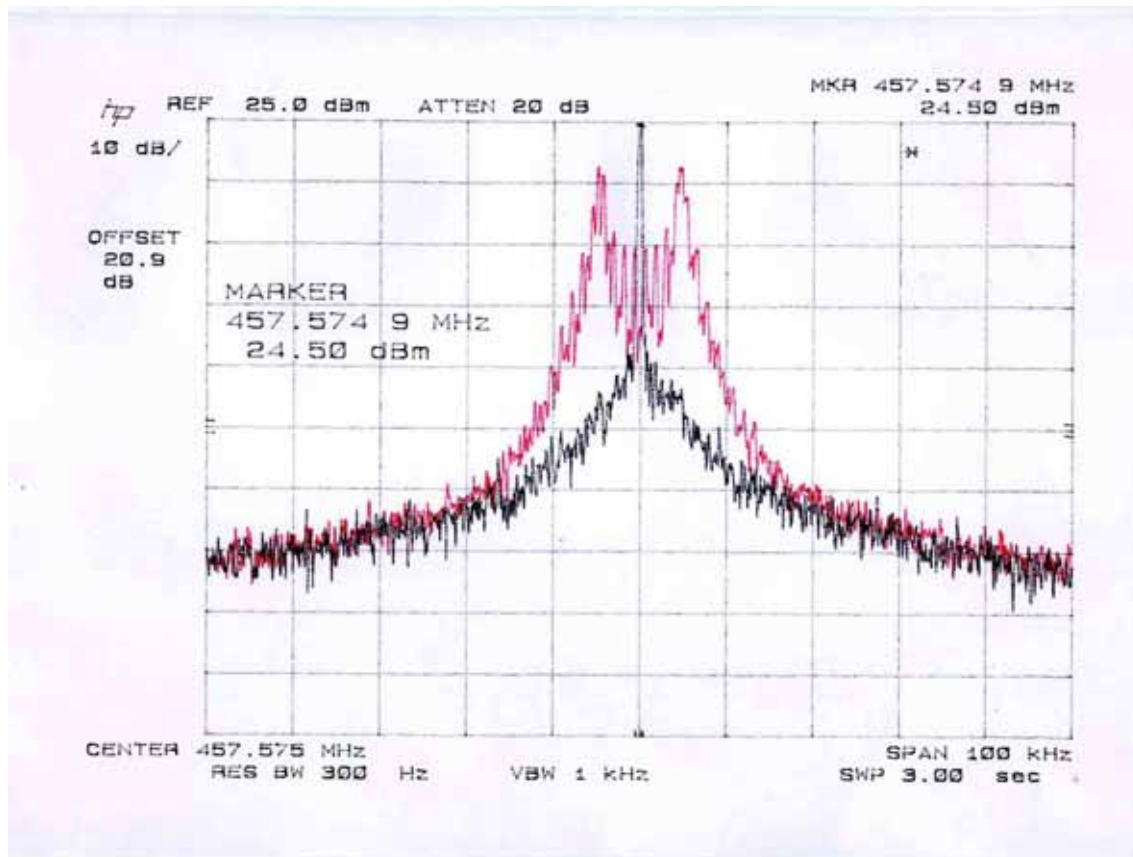
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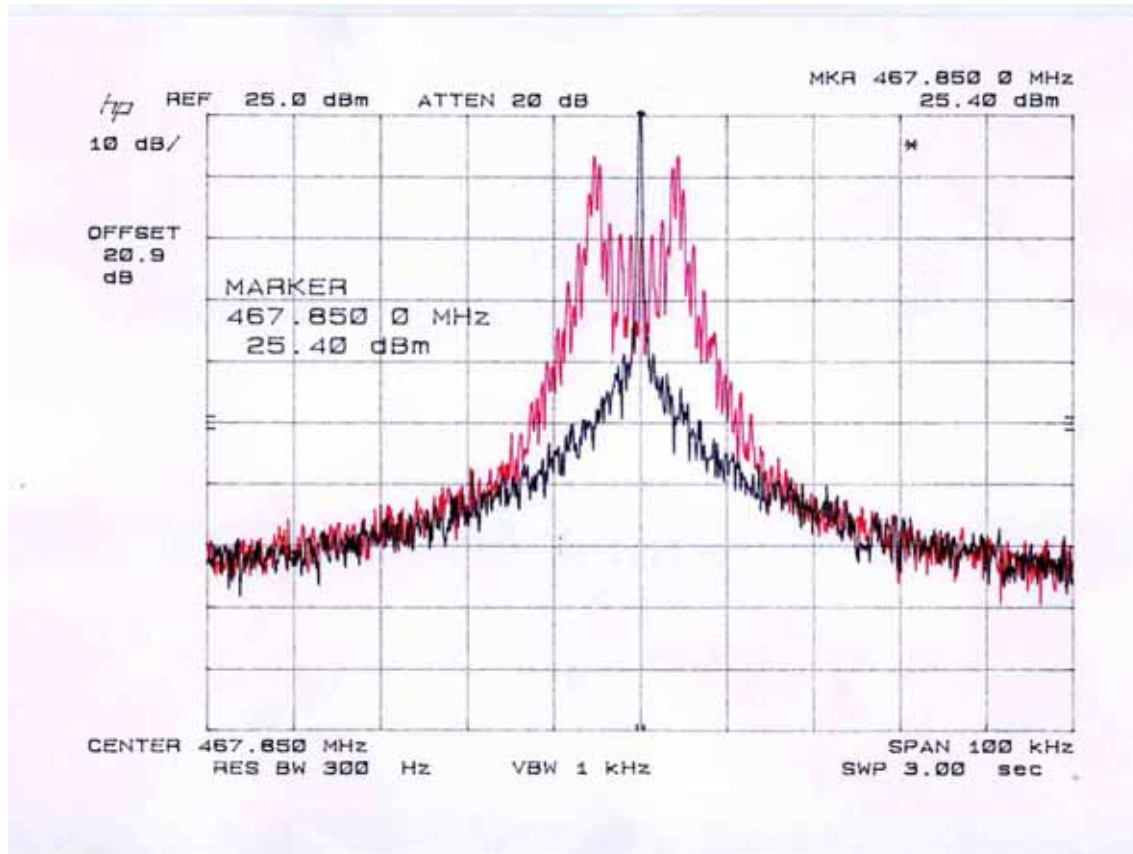
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High



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Frequency stability:

90.213 (a)(11)

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) : 450.3250

TEMPERATURE	FREQUENCY(MHz)	PPM	LIMIT(ppm)
-30	450.32439	-1.36	2.5
-20	450.32454	-1.02	2.5
-10	450.32464	-0.79	2.5
0	450.32462	-0.84	2.5
10	450.32411	-1.97	2.5
20	450.32452	-1.07	2.5
30	450.32475	-0.55	2.5
40	450.32463	-0.82	2.5
50	450.32466	-0.76	2.5
+15% Battery : 13.8V	450.32475	-0.57	2.5
-15% Battery : 10.2V	450.324772	-0.51	2.5

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APPLICANT: LEE TECHNOLOGY KOREA CO., LTD.

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NAME OF TEST: POWER LINE CONDUCTED INTERFERENCE

RULES PART NO.: 15.207

REQUIREMENTS:

	QUASI-PEAK	AVERAGE
.15 - 0.5 MHz	66-56 dBuV	56-46 dBuV
0.5 - 5.0	56	46
5.0 - 30.	60	50

TEST PROCEDURE: ANSI STANDARD C63.4-2003. The spectrum was scanned from .15 to 30 MHz.

The highest emission read for Line 1 was 0.169MHz @ 47.5 dBuV/m

The highest emission read for Line 2 was 0.185MHz @ 45.8 dbuv/m

THE GRAPHS ON THE FOLLOWING PAGES REPRESENT THE EMISSIONS READ FOR POWER LINE CONDUCTED FOR THIS DEVICE.

TEST RESULTS: Both lines were observed. The measurements indicate that the unit DOES appear to meet the FCC requirements for this class of equipment.

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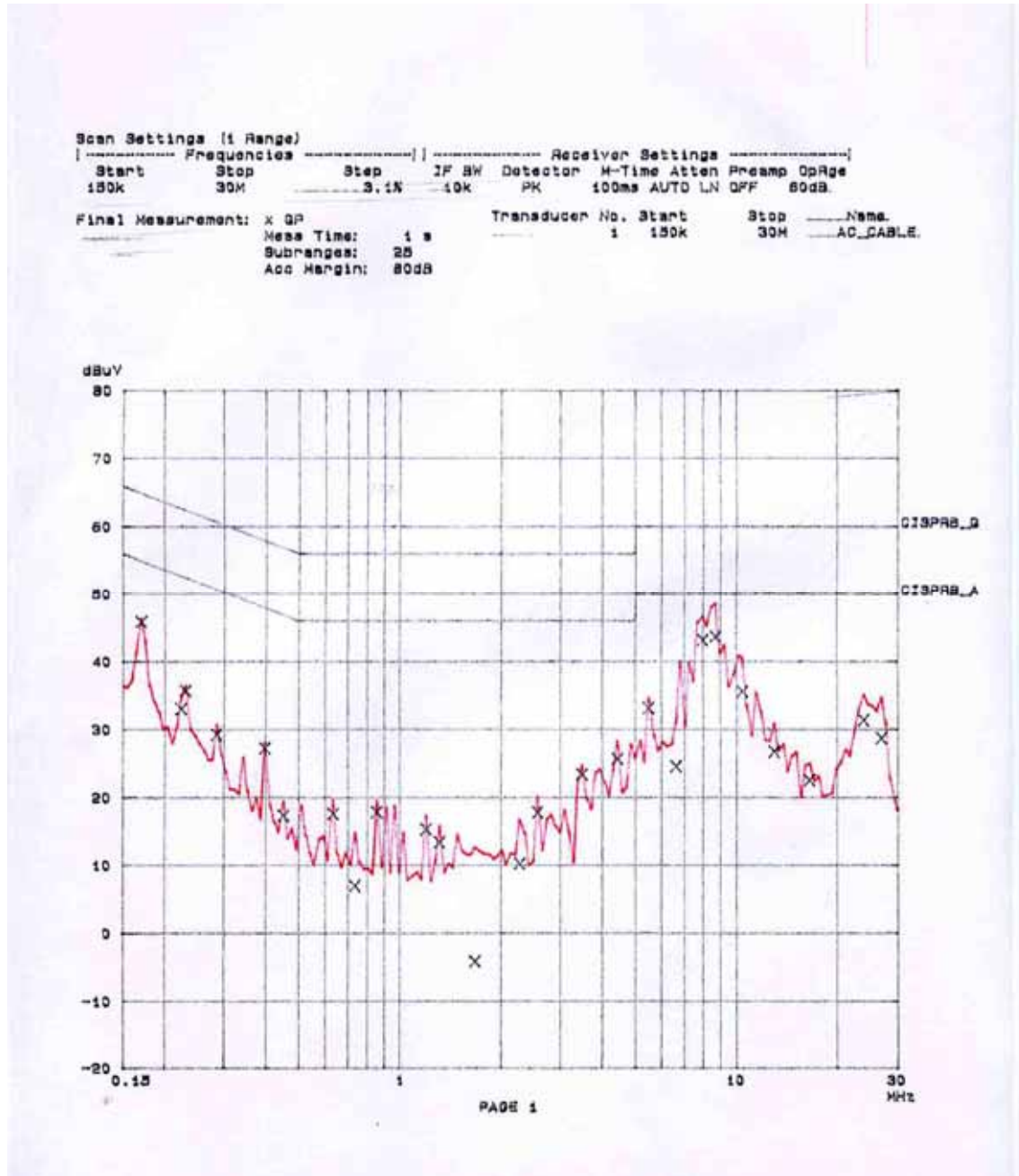
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Line1(H)



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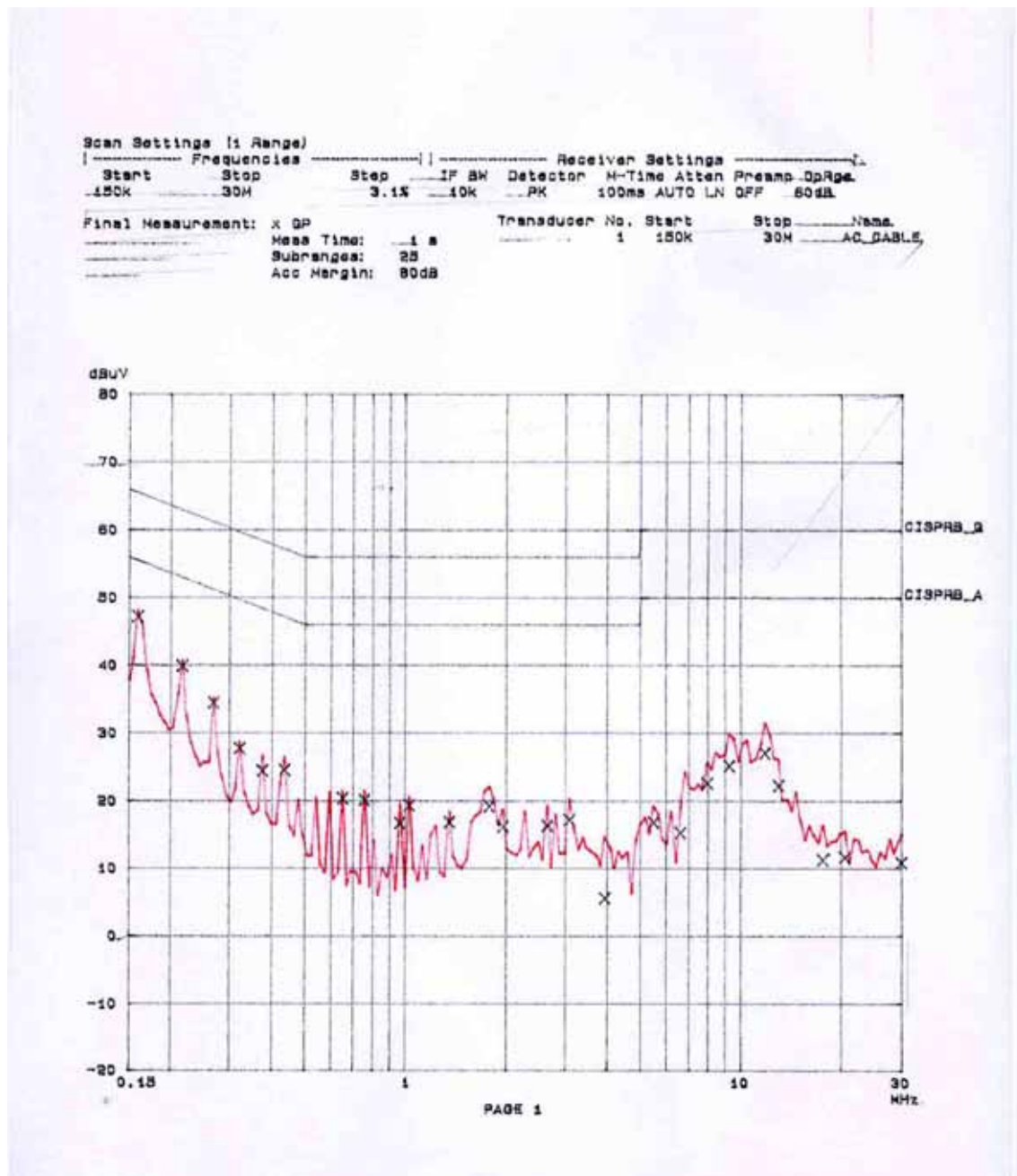
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Line2(N)



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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 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

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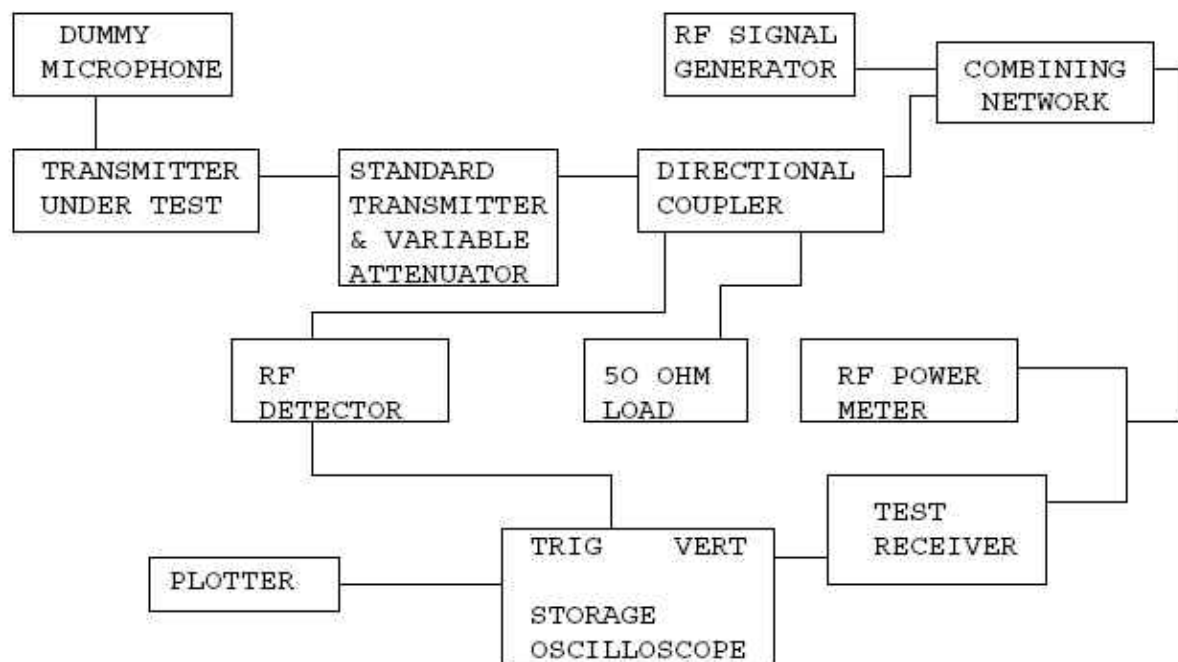
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2.1055

Frequency stability:

90.214

Transient Frequency Behavior
(Continued)

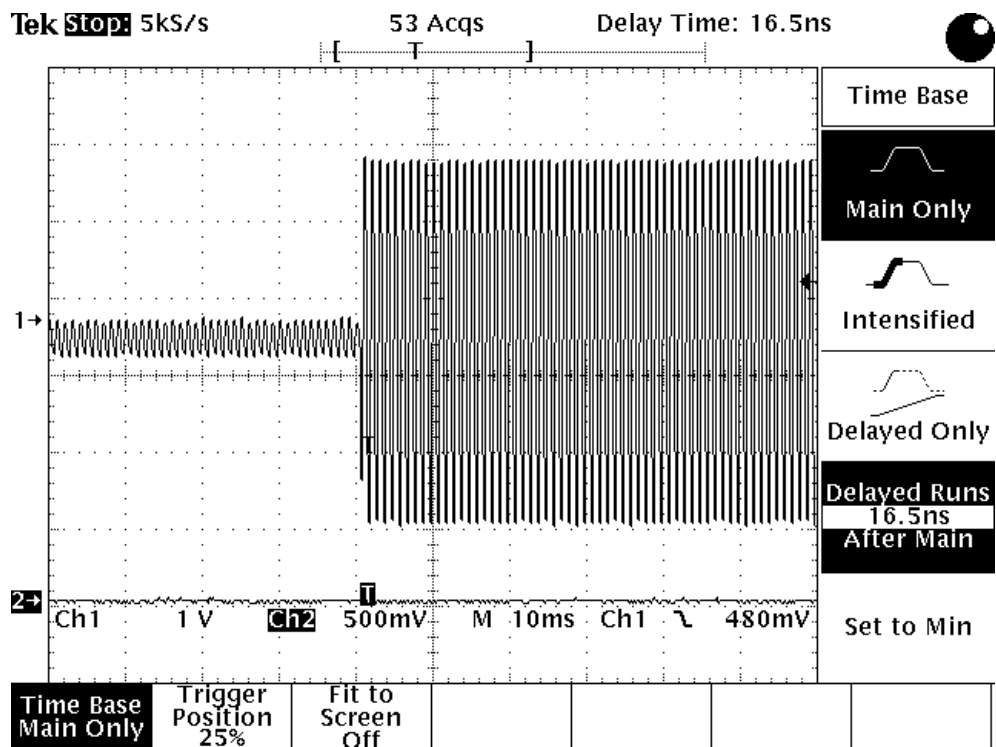
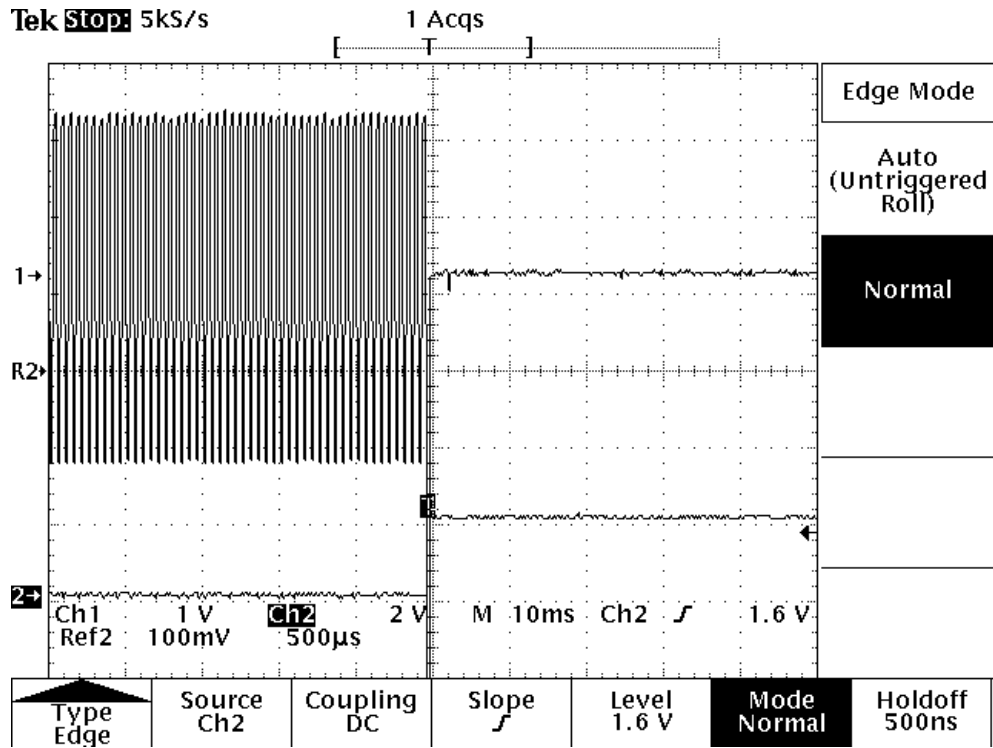


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TEST Equipment List

No	Description	Manufacturer	Model No.	Serial No.	Due Cal.
1	Test Receiver	Rohde & Schwarz	ESVS10	830489/001	2007.04.23
2	Test Receiver	Rohde & Schwarz	ESHS 10	825832/014	2007.08.25
3	Test Receiver	Rohde & Schwarz	ESVS 10	826008/014	2006.05.24
4	Spectrum Analyzer	Hewlett Packard	8566B	2311A02394	2007.06.17
5	Spectrum Display	Hewlett Packard	85662A	2542A12429	2007.06.17
6	Quasi-peak Adapter	Hewlett Packard	85650A	2521A00887	2007.06.17
7	RF Preselector	Hewlett Packard	85685A	2648A00504	2007.06.17
8	Preamplifier	Hewlett Packard	8449B	3008A00375	2007.04.23
9	Preamplifier	Hewlett Packard	8447F	3113A05367	2007.05.09
10	Preamplifier	Hewlett Packard	8447F	2805A02570	2005.12.12
11	Preamplifier	A.H. Systems	PAM-0118	164	2007.04.01
12	Biconical Antenna	Eaton Corp.	94455-1	0977	2007.04.01
13	Biconical Antenna	EMCO	3104C	9111-2468	2006.06.07
14	Log Periodic Antenna	EMCO	3146	2051	2007.05.11
15	Log Periodic Antenna	EMCO	3146	8901-2320	2006.03.28
16	Horn Antenna	A.H. Systems	SAS-571	414	2007.03.17
17	Horn Antenna	A.H. Systems	SAS-571	781	2006.01.07
18	Loop Antenna	Rohde & Schwarz	HFH2-Z2.335.4711.52	826532/006	2009.01.31
19	Dipole Antenna	Rohde & Schwarz	VHAP	574	2007.12.12
20	Dipole Antenna	Rohde & Schwarz	VHAP	575	2007.12.12
21	Dipole Antenna	Rohde & Schwarz	UHAP	546	2007.12.12
22	Dipole Antenna	Rohde & Schwarz	UHAP	547	2007.12.12
23	Signal Generator	Rohde & Schwarz	SMS	872165/100	2006.04.23
24	Signal Generator	Rohde & Schwarz	SMX	825459/030	2007.06.15
25	Spectrum Monitor	Rohde & Schwarz	EZM	862304/007	None
26	Panorama Monitor	Rohde & Schwarz	EPN	883707/207	None
27	Spectrum Analyzer	Advantest Corp.	R3261C	61720208	2007.06.05
28	Spcectrum Analyzer	Hewlett Packard	8591A	3205A02641	2007.12.12
29	LISN	EMCO	3825/2	9111-1912	2007.12.12
30	LISN	Solar	8012-50-R-24	8379121	2007.04.25
31	LISN	Kyoritsu	KNW-242	8-923-2	2007.05.28
32	Plotter	Hewlett Packard	7475A	2210A02802	None
33	Modulation Analyzer	Hewlett Packard	8901B	3438A05094	2007.05.19
34	Waveform Generator	Hewlett Packard	33120A	US3400119 0	2007.05.23
35	Audio analyzer	Hewlett Packard	8903B	3011A12915	2007.05.23
36	Universal counter	Hewlett Packard	5343A	3020A02978	2007.05.23
37	Frequency Counter	Tektronic	CMC251	TW52489	2007.04.23
38	Temperature & Humidity Chamber	TABAI EZPEC CORP.	MC711P	112000492	2006.08.27
39	Antenna Mast	EMCO	1070-3	9109-1617	None
40	Turn Table	EMCO	1080-1,2	9203-1762	None
41	Positioning Controller	EMCO	1090	9111-1054	

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42	Antenna Power Supply	Rohde & Schwarz	HZ-9	920127	None
43	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	881052	None
44	Coaxial Take-up Reel	EMCO	100817	9109-1684	None