FCC Part 95(B) Test Report
for
Telson Information and Communication Co., Ltd.
on the
Family Radio
Model: UBZ-AL14
FCC ID: OBAUBZAL14

Test Report: J99027360
Date of Report: November 10, 1999

NVLAP Laboratory Code 200201-0
Accredited for testing to FCC Parts 15

Tested by:	Xi-Ming Yang	Xi-Ming Yang
Reviewer:	David Chernomordik	David Chernomordik

Table of Contents

1 JOB DESCRIPTION

1.1 Client Information

The EUT has been tested at the request of

Company: Telson Information and Communications Co., Ltd.
356_5GA, San-Dong, Kum Cheun-Ku
Seoul, Korea

Name of contact: Don Heo
Telephone: (02) 851-2780
Fax: (02) 857-9583

1.2 Equipment under test (EUT)

Equipment type: Family Radio Face-Held Transceiver

Model number(s): UBZ-AL14

FCC ID: OBAUBZAL14

Manufacturer: SAME as above.

Use of Product : Voice communications

Production is planned: [X] Yes, [ ] No

Technical Specifications:

Type of Emission	11K0F3E
Max. Allowed modulation (M)	3.0 kHz
Max. Allowed deviation (D)	2.5 kHz
Range of RF Output	0.5 W (ERP)
Means for variation of operating power	None
The dc voltage applied to and current into the several elements of the final RF amplifying device	*Collector Voltage:* 6 Vdc *Collector Current:* 150 mA
Frequency Range	462 to 468 MHz
Max. number of Channels	14
Antenna	Monopole
Detachable antenna ?	No
External input	Audio

EUT receive date: 10/25/99

EUT received condition: Good condition prototype

Test start date: 10/28/99
Test end date: 11/09/99

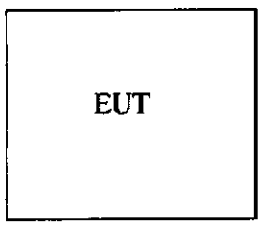
1.3 Test plan reference

FCC Part 2.1033, FCC Part 95 (B)

1.4 System test configuration

1.4.1 System block diagram & Support equipment

For tabletop systems, the EUT shall be centered laterally on the tabletop and its rear shall be flush with the rear of the table. If the EUT is a stand-alone unit, it shall be placed in the center of the tabletop.



S:	Shielded	U:	Unshield	F:	With Ferrite Core

1.4.2 Justification

The system was configured for testing in a typical manner in accordance with ANSI C63.4 standard. During testing, the peripheral locations were varied with respect to the EUT.

1.4.3 Mode(s) of operation

The EUT was powered and fully operational with option speaker/microphone connected. The unit was powered from 4 fully charged AAA batteries.

1.5 Modifications required for compliance

No modifications were implemented by Intertek Testing Services.

2 TEST SUMMARY

FCC Rule	Description of Test	Result	Page
Transmitter Section			
2.1046 95.639(d)	Effective Radiated Power	0.49 W	8
2.1047 95.631(d) 95.637(a)	Modulation Characteristics F3E analogy voice Peak frequency deviation Audio frequency response	 2.45 kHz 3.0 kHz	9
2.1049 95.633(c)	Occupied Bandwidth	11 kHz	13
2.1053 15.109(a)	Field Strength of Spurious Radiation	Worst case Freq.: 4677.1MHz Margin: -4.1dB	18
15.107	Line Conducted Emissions	N/A	N/A
2.1055	Frequency Stability Vs. Temperature Vs. Voltage	 -2.24 ppm -0.16ppm	18
Receiver Section			
15.109(a)	Radiated Emissions	Worst case Freq.: 917.2 MHz Margin: -6.3dB	14

3 EFFECTIVE RADIATED POWER

3.1 Test Description

Parameter:	FCC § 2.1046
Requirement:	FCC § 95.639
Effective Radiated Power (ERP):	< 0.5 watts

3.2 Test Procedure

The EUT was positioned on a non-conductive turntable, 0.8m above the ground plane on an open test site.

The radiated emission at the fundamental frequency was measured at 3m distance with a test antenna and spectrum analyzer. During the measurement, the resolution and video bandwidth of the spectrum analyzer were set to 100 kHz. To maximize emissions, the system was rotated through 360°, the antenna height was varied from 1m to 4m, and the antenna polarization was changed.

The ERP was calculated using equation:

$$E = \frac{\sqrt{30 \cdot P \cdot G}}{D}$$

Where E = Field Strength (V/m), P = ERP (W)
G = Antenna Gain (1.64 for a half-wave dipole), D = Distance (m)

3.3 Test Results

Test Conditions:		*Antenna Gain ,G =*	*1.64*	*Distance, D =*	*3*	
Frequency MHz	**Reading dB(μV)**	**Antenna Factor dB(1/m)**	**Preamp Gain dB**	**Cable Loss DB**	**Field Strength dB(μV/m)**	**ERP W**
462.57	104.8	17.5	0	2.0	124.3	0.492
467.69	104.3	17.7	0	2.0	124.0	0.459

Note: Field Strength = Reading + Antenna Factor – preamp + Cable loss

3.4 Modifications made during testing

None

3.5 Test Instrumentation

[x] Hewlett Packard HP8566B Spectrum Analyzer (S.A.)
[x] EMCO Bi-Log Antenna
[ ] HP Pre-amp

4 MODULATION CHARACTERISTICS

4.1 Test Description

Parameter:	FCC § 2.1047
Requirement:	FCC § 95.637
Peak Frequency Deviation: Audio Frequency Response:	Less than ± 2.5 kHz ≤ 3.125 kHz

4.2 Test Procedure

4.2.1 Audio Frequency Response

The RF output of the transceiver was connected to the input of a FM deviation meter through sufficient attenuation so as not to overload the meter or distort the readings. An audio signal generator was coupled into the external microphone jack of the transceiver, or alternatively, the microphone element was removed and the generator output was connected to the microphone connectors.

The audio signal input level was adjusted to obtain 20% of the maximum rated system deviation at 1 kHz, and recorded as DEV_{REF}. With the audio signal generator level unchanged, set the generator frequency between 300 Hz to 5000 Hz. The transmitter deviations (DEV_{FREQ}) were measured and the audio frequency response was calculated as

$$20\log_{10}\left[\frac{DEV_{FREQ}}{DEV_{REF}}\right]$$

4.2.2 Audio Low-Pass Filter Response

An audio signal generator and an audio spectrum analyzer were connected to the input and output of the post limiter low pass filter respectively. The audio signal generator frequency was set between 1000 Hz and the upper low pass filter limit. The audio frequency response at test frequency was calculated as

$LEV_{FREQ} - LEV_{REF}$

4.2.3 Modulation Limiting

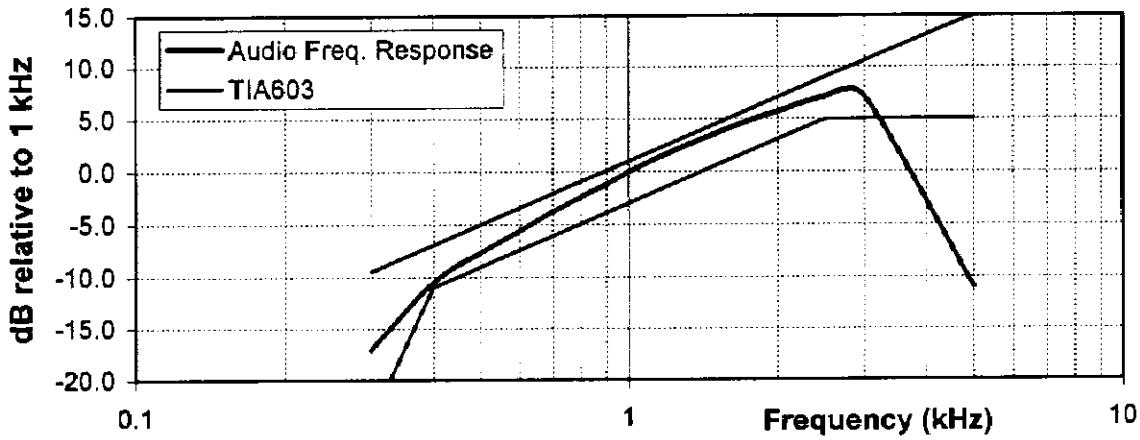
With the same setup as section 4.2.1 above, at three different modulating frequencies, the output level of the audio generator was varied and the FM deviation level was recorded.

4.3 Test Results

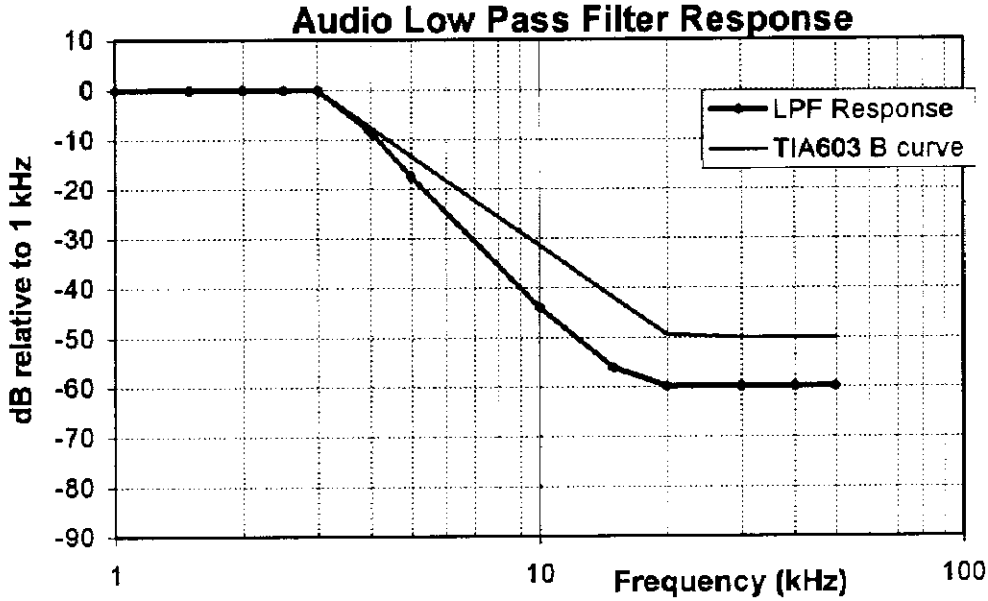
X	See below.
	There were no changes in the schematics and PCB layout of the already granted unit.

Test Condition	
Frequency (MHz)	mid channel

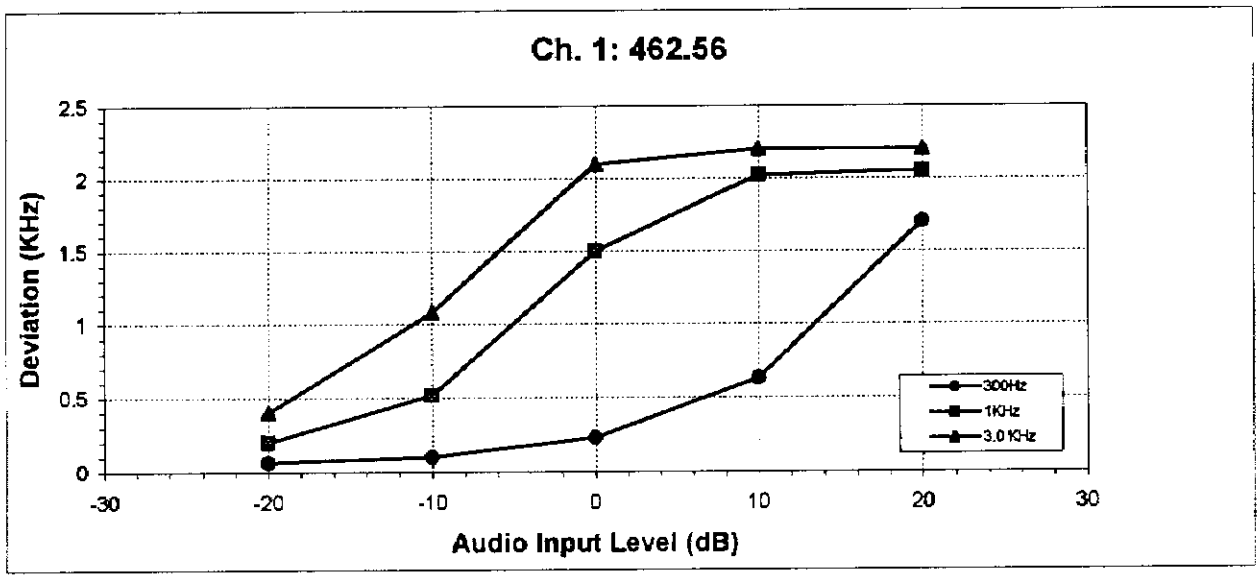
Transmitter Audio Frequency Response

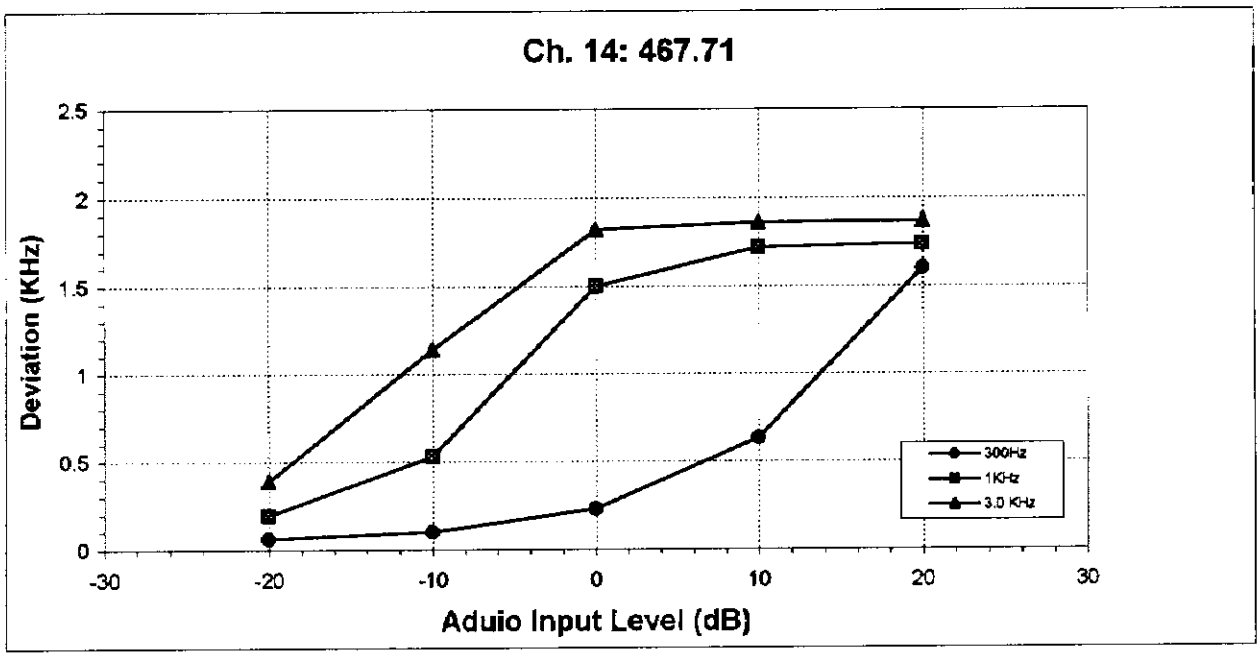


Audio Low Pass Filter Response



Modulation Limiting Test Condition	
Frequency (MHz)	462.56 and 467.7125
V_{pp} (mV)	15 mV
Reference Deviation	1.5 kHz at 1 kHz modulating frequency





4.4 Modifications made during testing

None.

4.5 Test instrumentation

[X] Marconi 2955A Radio Communication Test Set
[X] Leader LFG-1300S Function Generator
[X] LMV-182 AC Millivoltmeter

5 OCCUPIED BANDWIDTH

5.1 Test description

Parameter:	FCC §2.1049
Requirement:	FCC § 95.633(c)
Emission Bandwidth:	12.5 kHz

5.2 Test Procedure

The antenna was disconnected from the transmitter and the short cable was connected to the transmitter RF output.

The RF output was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set up at least 10 times higher then the authorized bandwidth of the transmitter. With the transmitter keyed, the level of the unmodulated carrier was set to the full scale reference line of the spectrum analyzer. This is used as a 0dB reference for emission mask measurements.

The transmitter was then modulated with a 2500 Hz tone at an input level 16 dB greater than the necessary to produce 50% of rated system deviation. The resolution bandwidth of the spectrum analyzer was set up to 100 Hz and the spectrum of the transmitting signal was recorded. This spectrum was compared to the required emission mask.

5.3 Test Results

Please see Exhibit 10 for the occupied bandwidth plots:

Plot Number	Description
10-1	Full Power, reference level
10-2	Occupied bandwidth, scan 62.5 kHz

5.4 Modifications made during testing

None.

5.5 Test instrumentation

[X] Leader LFG-1300S Function Generator
[X] HP 8566B Spectrum Analyzer
[X] HP 7470A Plotter

6 RADIATED SPURIOUS EMISSIONS

6.1 Test description

Parameter:	FCC §2.1053
Requirement:	FCC § 15.109
--	--

6.2 Test Procedure

The transmitter was placed on a wooden turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3 orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

The spurious harmonic attenuation was calculated as the difference between E in dB(uV/m) at the fundamental frequency and at the spurious emission frequency.

Spurious attenuation in dB = $43 + 10\text{Log}_{10}$(power out in Watts)

The antenna conducted test was also performed from 0 to 5 GHz.

6.3 Test Results

The unit passed the following tests for:

[X] Spurious harmonic attenuation – See attached page.
[X] FCC Part 15.109 Radiated Emission – See attached page.
[X] Plot 10-3 Low Channel, 0–5 GHz
[X] Plot 10-4, High Channel, 0–5 GHz

ITS Intertek Testing Services

Radiated Emissions Test Data

Company:	Telson	**Model #:**	OBAUBZAL 14		**Req.**	FCC 2.993	
EUT:	FRS	**S/N or FCC #:**			**Test Dist.**	3	meters
Project #:	J99027360	**Test Date:**	October 28, 1999		**I/P:**	0.50	Watt
Test Mode:	Low CH. Tx	**Engineer:**	Xi Ming Y.		**Min. Attn.**	30.0	dBc

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	2	2	14	0	8	13	0	0	1	0
Model:	EMCO 3143	EMCO 3143	EMCO 3115	None	CDI_P1000	ACO/400	None	None	Ska 1	None

Frequency	Reading	Detector	Ant	Amp	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	Net	ERP	Attn.	Margin
MHz	dB(uV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB(uV/m)	mW	dBc	dB
462.57	104.8	Peak	2	0	H	17.5	0.0	2.0	124.3	4.92E+02	N/A	N/A
925.12	53.7	Peak	2	0	V	22.3	0.0	3.3	79.3	1.56E-02	45.0	-5.0
1387.69	35.0	Ave.	14	0	V	26.2	0.0	3.3	64.5	5.16E-04	59.8	-19.8
1850.26	32.0	Ave.	14	0	V	26.6	0.0	3.9	62.5	3.25E-04	61.8	-21.8
2318.81	44.0	Ave.	14	0	V	30.1	0.0	4.5	78.6	1.33E-02	45.7	-5.7
2775.38	39.5	Ave.	14	0	H	32.7	0.0	5.0	77.2	9.60E-03	47.1	-7.1
3237.93	39.4	Ave.	14	0	H	31.1	0.0	5.5	76.0	7.28E-03	48.3	-8.3
3700.50	40.6	Ave.	14	0	H	32.1	0.0	5.7	78.4	1.27E-02	45.9	-5.9
4163.07	35.5	Ave.	14	0	H	34.5	0.0	5.9	75.9	7.12E-03	48.4	-8.4
4625.63	38.3	Ave.	14	0	H	35.4	0.0	6.4	80.1	1.88E-02	44.2	-4.2

Notes:

a) O.C.F.:Other Correction Factor

b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.

c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.

d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).

e) Negative signs (-) in Margin column signify levels below the limits.

ITS Intertek Testing Services

Radiated Emissions Test Data

Company:	Telson	Model #:	OBAUBZAL 14		Ref.	FCC 2.993	
EUT:	FRS	S/N or FCC #:			Test Dist.	3	meters
Project #:	J99027360	Test Date:	October 28, 1999		TP	0.50	Watt
Test Mode:	High CH. Tx	Engineer:	Xi Ming Y.		Min. Attn.	39.00	dBc

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	2	2	14	0	8	13	0	0	1	0
Model:	EMCO 3143	EMCO 3143	EMCO 3115	None	CDI_P1000	ACO/400	None	None	Site 1	None

Frequency	Reading	Detector	Ant.	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	Net	ERP	Attn.	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB(μV/m)	mW	dBc	dB
467.69	104.3	Peak	2	0	H	17.7	0.0	2.0	124.0	4.59E+02	N/A	N/A
935.38	53.8	Peak	2	0	V	22.1	0.0	3.3	79.2	1.52E-02	44.2	-4.2
1403.10	36.8	Ave.	14	0	V	26.2	0.0	3.4	66.4	7.97E-04	57.0	-17.0
1870.86	33.1	Ave.	14	0	V	26.6	0.0	3.9	63.6	4.20E-04	59.8	-19.8
2338.55	41.0	Ave.	14	0	V	30.1	0.0	4.5	75.6	6.64E-03	47.8	-7.8
2806.27	38.8	Ave.	14	0	H	32.7	0.0	5.0	76.5	8.21E-03	46.8	-6.9
3273.99	40.9	Ave.	14	0	H	31.1	0.0	5.5	77.5	1.04E-02	45.8	-5.8
3741.70	40.5	Ave.	14	0	H	32.1	0.0	5.7	78.3	1.23E-02	45.1	-5.1
4209.42	36.8	Ave.	14	0	H	34.5	0.0	5.9	77.2	9.64E-03	46.1	-6.2
4677.11	37.5	Ave.	14	0	H	35.4	0.0	6.4	79.3	1.55E-02	44.1	-4.1

Notes:

a) O.C.F.:Other Correction Factor

b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.

c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.

d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).

e) Negative signs (-) in Margin column signify levels below the limits.

ITS Intertek Testing Services

Radiated Emissions Test Data

Company:	Telson	**Model #:**	OBAUBZAL 14	**Standard**	FCC § 15.209
EUT:	FRS	**S/N #:**		**Limits**	3
Project #:		**Test Date:**	November 9, 1999	**Test Distance**	3 meters
Test Mode:	Rx	**Engineer:**	Xi-Ming Y.	**Duty Relaxation**	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	2	8	10	8	1	0	1	0	0	0
Model:	EMCO 3143	EMCO 3115	EMCO 3104	CDI_P100 0	HP 8447D	None	Site 1	None	None	None

Frequency	Reading	Detector	Ant.	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dBuV	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dBuV/m	dBuV/m	dB
32.0	13.0	Peak	2	0	H	14.6	0.0	0.3	0.0	27.9	40.0	-12.1
140.0	12.0	Ave.	2	0	H	9.2	0.0	1.0	0.0	22.2	43.5	-21.3
440.8	20.0	Peak	2	0	V	16.5	0.0	2.1	0.0	38.6	46.0	-7.4
446.0	18.3	Peak	2	0	V	16.5	0.0	2.1	0.0	36.9	46.0	-9.1
892.0**	11.7	Peak	2	0	V	22.4	0.0	3.0	0.0	37.1	46.0	-8.9
881.7**	12.0	Ave.	2	0	V	22.0	0.0	3.0	0.0	37.0	46.0	-9.0
917.2	14.0	Peak	2	0	V	22.4	0.0	3.3	0.0	39.7	46.0	-6.3

Notes:

a) D.C.F.:Distance Correction Factor

b) Insert. Loss (dB) = Cable A + Cable B + Cable C .

c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).

d) Negative signs (-) in Margin column signify levels below the limits.

e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

f) * Local oscillator (L.O.) frequency

g) ** Second harmonic of L.O.

6.4 Modifications made during testing

None

6.5 Test instrumentation

[X] CDI B100/200/300 Biconical Antennas
[X] EMCO Bi-logcon Antenna
[X] EMCO 3115 Horn Antenna
[X] HP 8566B Spectrum Analyzer
[X] Preamplifiers

7 AC LINE CONDUCTED EMISSIONS

7.1 Test description

Parameter:	ANSI C63.4
Requirement:	FCC § 15.107

7.2 Test Procedure

The EUT was connected to the DC power supply, that was connected to the AC line through the LISNs.

Both HOT and NEUTRAL leads were tested.

7.3 Test Results

[X] Not applicable, the EUT is battery powered only.

7.4 Modifications made during testing

None

7.5 Test instrumentation

[ ] HP 8566B Spectrum Analyzer
[ ] LISN

8 FREQUENCY STABILITY

8.1 Test description

Parameter:	FCC §2.1055
Requirement:	FCC § 95.627
Frequency Tolerance:	Within 0.00025% (25ppm)

8.2 Test Procedure

The ppm frequency error of the transmitter was calculated by:

$$ppm\ error = \left(\frac{MCF}{ACF} - 1\right) \cdot 10^6$$

Where MCF is the Measured Carrier Frequency in MHz
ACF is the Assigned Carrier Frequency in MHz

8.2.1 Frequency Stability vs. Temperature

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feedthrough attenuators. The EUT was placed inside the temperature chamber.

After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

9.2.2 Frequency Stability vs. Voltage

At room temperature (25 ±5 °C), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for 115%, 100% and 85% of the nominal operating input voltage.

9.3 Test Results

ACF (MHz): 462.5625		LIMIT: 2.5 ppm PPM Error
Temperature, C	Δ (Hz)	
50	-643	-1.39
40	-611	-1.32
30	-208	-0.45
20	268	0.58
10	680	1.47
0	708	1.53
-10	-65	-0.4
-20	-1036	-2.24

ACF (MHz): 462.5625			LIMIT: 2.5 ppm PPM Error
%	Voltage	Δ (Hz)	
115	6.90	-59	-0.128
100	6.00	-39	-0.085
85	5.10	-74	-0.16
Battery Endpoint	4.00	-74	-0.16

9.4 Modifications made during testing

None

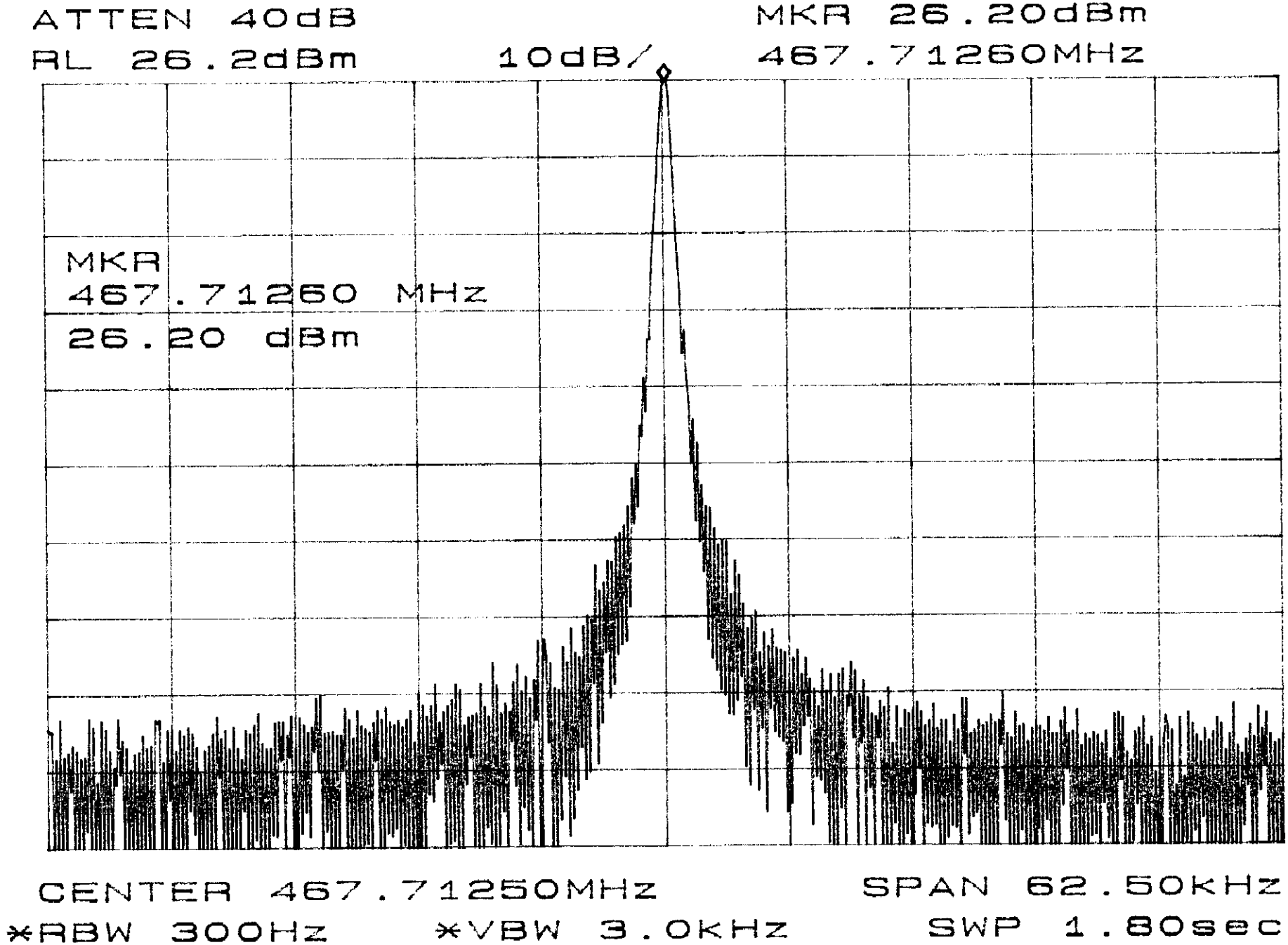
9.5 Test instrumentation

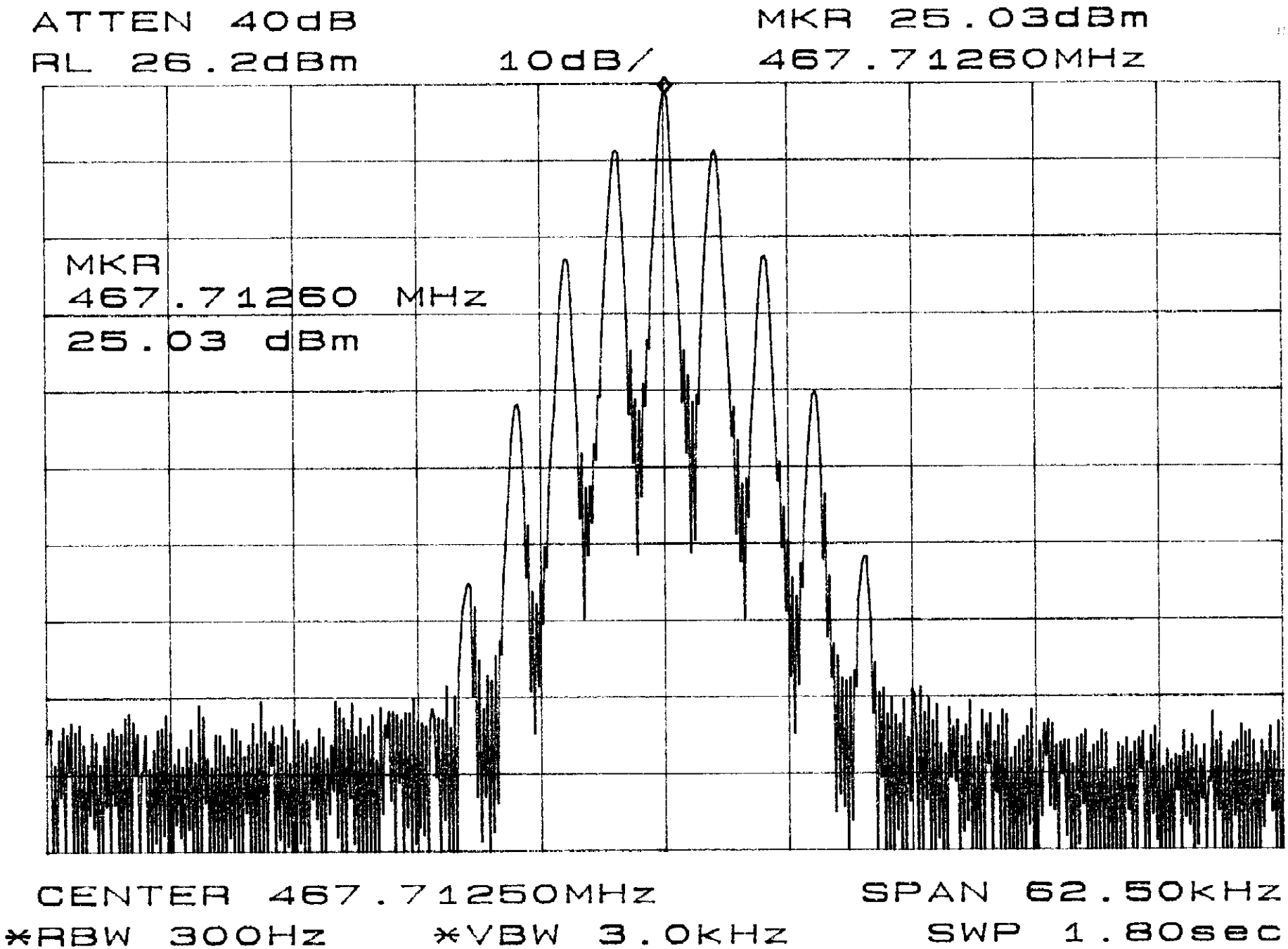
[X] Temperature Chamber, -50C to +100C
[X] Hewlett Packard 5383A Frequency Counter
[X] Tektronix 2784 Spectrum Analyzer
[X] Goldstar DC Power Supply, GR303

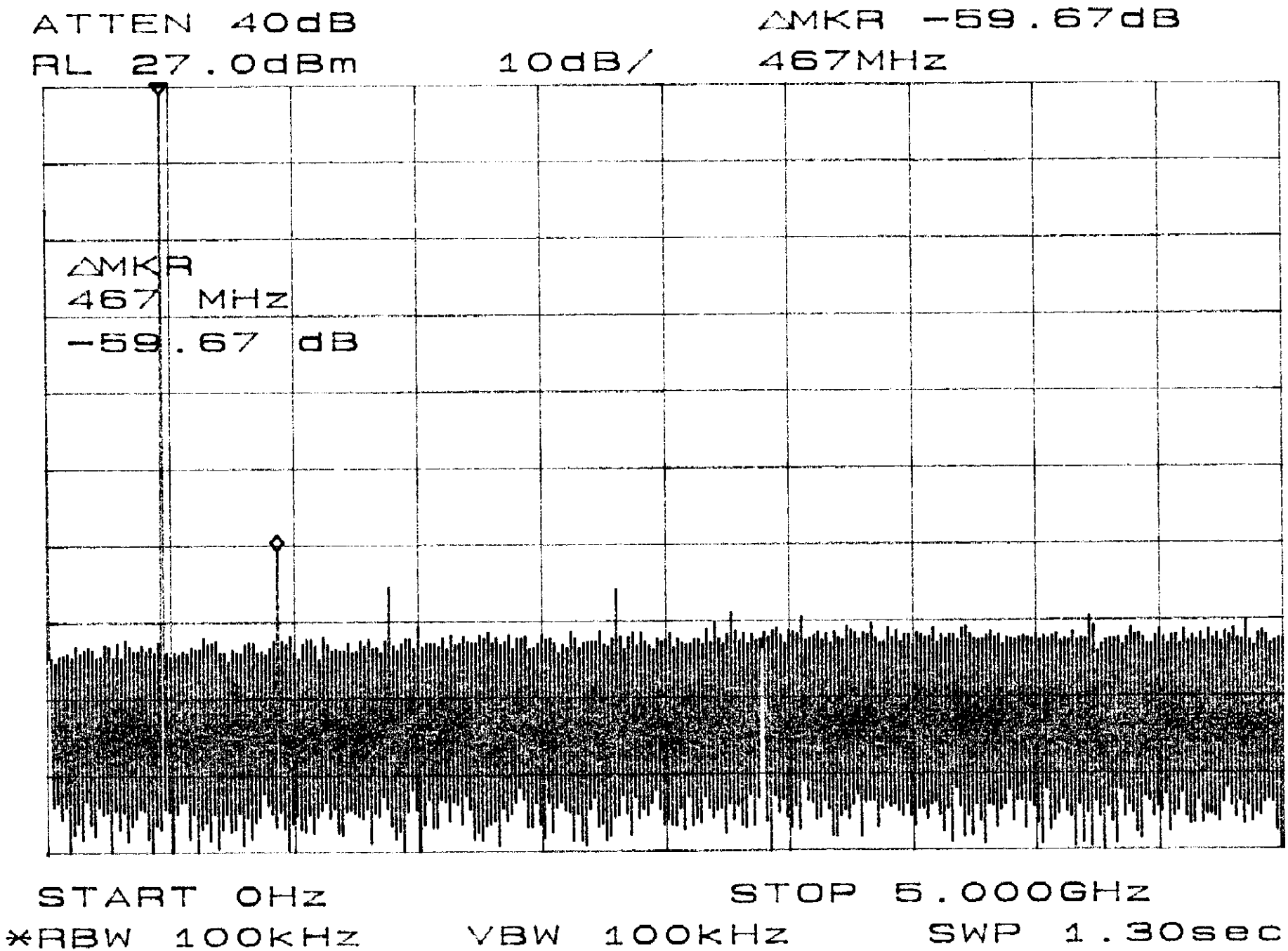
10 PLOTS

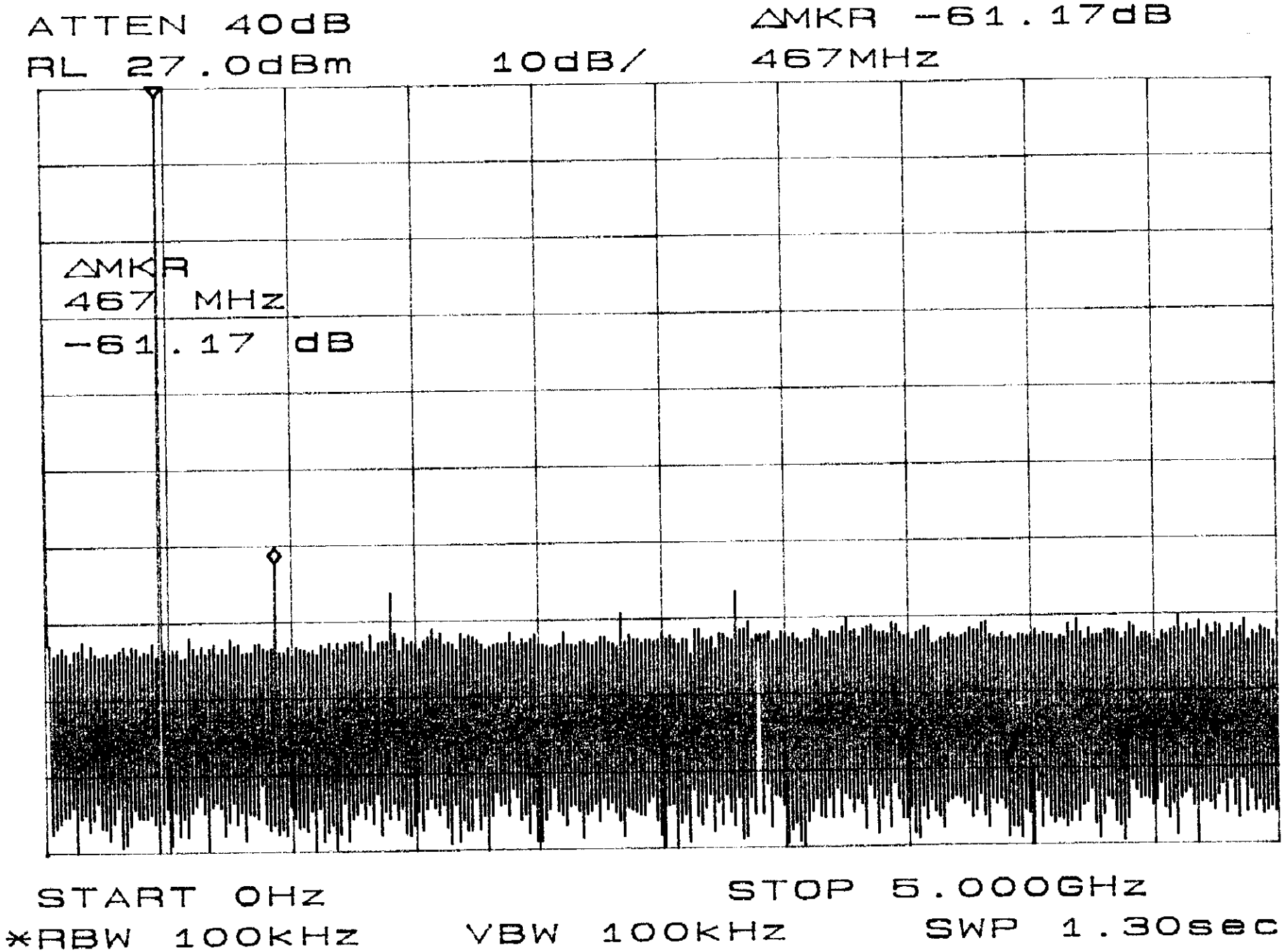
Full Power, reference level – See attached.

Occupied bandwidth, scan 62.50kHz – See attached.


ATTEN 40dB
RL 26.2dBm
10dB/
MKR 26.20dBm
467.71260MHz
MKR
467.71260 MHz
26.20 dBm
CENTER 467.71250MHz
SPAN 62.50KHz
*RBW 300Hz
*VBW 3.0KHz
SWP 1.80sec


ATTEN 40dB
RL 26.2dBm
10dB/
MKR 25.03dBm
467.71260MHz
MKR
467.71260 MHz
25.03 dBm
CENTER 467.71250MHz
SPAN 62.50kHz
*RBW 300Hz
*VBW 3.0kHz
SWP 1.80sec


ATTEN 40dB
ΔMKR -59.67dB
RL 27.0dBm
10dB/
467MHz
ΔMKR
467 MHz
-59.67 dB
START 0Hz
STOP 5.000GHz
*RBW 100kHz
VBW 100kHz
SWP 1.30sec


ATTEN 40dB
RL 27.0dBm
10dB/
ΔMKR -61.17dB
467MHz
ΔMKR
467 MHz
-61.17 dB
START 0Hz
STOP 5.000GHz
*RBW 100KHz
VBW 100KHz
SWP 1.30sec