ENGINEERING TEST REPORT

UHF CHANNEL MODULE (RADIO TRANSLATOR)
MODEL NO.: CM UHF HP

FCC ID: LO6CMUHFHP

FCC PART 2 & PART 90, SUBPART I
RADIO SERVICES FOR COMMERCIAL/INDUSTRIAL USES

UltraTech's FILE NO.: FSG-22AFT

Tested for:

FUTURECOM SYSTEMS GROUP INC.
110 Snow Blvd., Unit #3
Concord, Ontario
Canada, L4K 4B8

Tested by:

UltraTech - Group of Labs
4181 Sladeview Crescent, Unit 33
Mississauga, Ontario
Canada L5L 5R2

Report Prepared by: Tri M. Luu, P.Eng.

DATE: Jan. 29, 1999

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1. EXHIBIT 1 - SUMMARY OF TEST RESULTS & GENERAL STATEMENT OF CERTIFICATION

FCC PARAGRAPH.	TEST REQUIREMENTS	COMPLIANCE (YES/NO)
90.205 & 2.985	RF Power Output	Yes
90.213 & 2.995	Frequency Stability	Yes
90.242(b)(8) & 2.987(a)	Audio Frequency Response	Not applicable to new standard. However, tests are attempted to be done due to FCC's recommendation.
90.210 & 2.987(b)	Modulation Limiting	Yes
90.210 & 2.989	Emission Masks	Yes
90.210, 2.997 & 2.991	Emission Limits - Spurious Emissions at Antenna Terminal	Yes
90.210, 2.997 & 2.993	Emission Limits - Field Strength of Spurious Emissions	Yes
90.214	Transient Frequency Behavior	Not applicable for radio translator device

UHF CHANNEL MODULE (RADIO TRANSLATOR), Model No.: CM UHF HP, by **FUTURECOM SYSTEMS GROUP INC.** has also been tested and found to comply with **FCC Part 15, Subpart B - Radio Receivers and Class A Digital Devices**. The engineering test report has been documented and kept in file and it is available anytime upon FCC request.

TESTIMONIAL AND STATEMENT OF CERTIFICATION

THIS IS TO CERTIFY:

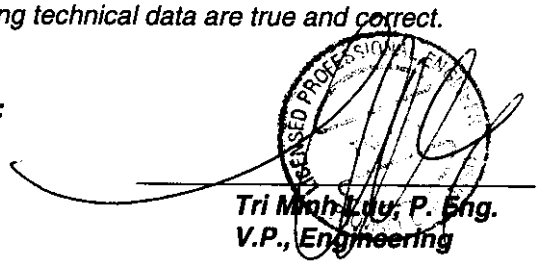
1) *THAT the application was prepared either by, or under the direct supervision of the undersigned.*

2) *THAT the measurement data supplied with the application was taken under my direction and supervision.*

3) *THAT the data was obtained on representative production units, representative.*

4) *THAT, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.*

Certified by:



Tri Minh Luu, P. Eng.
V.P., Engineering

DATE: Jan. 29, 1999

1. EXHIBIT 2 - GENERAL INFORMATION

1.1. APPLICANT

FUTURECOM SYSTEMS GROUP INC.
110 Snow Blvd., Unit #3
Concord, Ontario
Canada, L4K 4B8

Applicant's Representative: Mr. Tony Bombera

1.2. MANUFACTURER

FUTURECOM SYSTEMS GROUP INC.
110 Snow Blvd., Unit #3
Concord, Ontario
Canada, L4K 4B8

1.3. DESCRIPTION OF EQUIPMENT UNDER TESTS

PRODUCT NAME:	UHF CHANNEL MODULE (RADIO TRANSLATOR)
MODEL NUMBER:	CM UHF HP
SERIAL NUMBER:	Pre-production
TYPE OF EQUIPMENT:	Radio Services Transmitters
SERVICES AREAS:	Commercial/Industrial
OSC. FREQUENCY(IES):	14.4MHz, 44.545 MHz, 335.4 MHz Tx Frequency+380.4 MHz (IF), Rx Frequency+380.4 MHz
CPU SPEED:	14.7456 MHz
OPERATING FREQ.:	406.1-430 MHz and 450-470 MHz
CHANNEL SPACINGS	12.5 kHz
POWER RATING:	21.4 Watts max.
OUTPUT IMPEDANCE:	50 Ohms
DUTY CYCLE:	Continuous
99% BANDWIDTH:	Same as the Input Signal
BAUD RATES:	9600 b/s

EMISSION DESIGNATION: 11K0FE3, 14K6F1D

(*) For an average case of commercial telephony, the Necessary Bandwidth is calculated as follows:

(i) For FM Voice Modulation:

- Channel Spacing = 12.5 kHz, D = 2.5 KHz max., K = 1, M = 3 KHz
  $B_n = 2M + 2DK = 2(3) + 2(2.5)(1) =$ **11 KHz**
  emission designation: 11K0F3E

(ii) For FM Digital Modulation:

- M = 9.6/2 kb/s
  $B_n = 2M + 2DK = 2(9.6/2) + 2(2.5)(1) =$ **14.6 KHz**
  emission designation: 14K6F1D

INPUT SUPPLY: 28 Vdc Battery

ASSOCIATED DEVICES: N/A

FCC ID: LO6CMUHFHP

INTERFACE PORTS:
(1) RF IN (SMA)
(2) RF OUT (SMA)
(3) DC IN & Data Port (Pin Header)
(4) RS-232 (DIN) – For factory uses only

1.4. RELATED SUBMITTALS/GRANT

Not applicable

1.5. TEST METHODOLOGY

These tests were conducted on a sample of the equipment for the purpose of certification compliance with Code of Federal Regulations, Parts 2 & 90, Subpart I, Radio Services Operating in the Frequency Bands 403 - 512 MHz.

Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

1.6. TEST FACILITY

AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 16'(L) by 12'(W) by 12'(H).

Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: Sep. 20, 1998.

The above test site is also filed with Interference Technology International Ltd (ITI - An EC Directive on EMC).

1.7. UNITS OF MEASUREMENTS

Measurements of conducted emissions are reported in units of dB referenced to one microvolt [dB(uV)].

Measurements of radiated emissions are reported in units of dB referenced to one microvolt per meter [dB(uV)/m] at the distance specified in the report, wherever it is applicable.

2. EXHIBIT 3 - SYSTEM TEST CONFIGURATION

2.1. TEST SYSTEM DETAILS

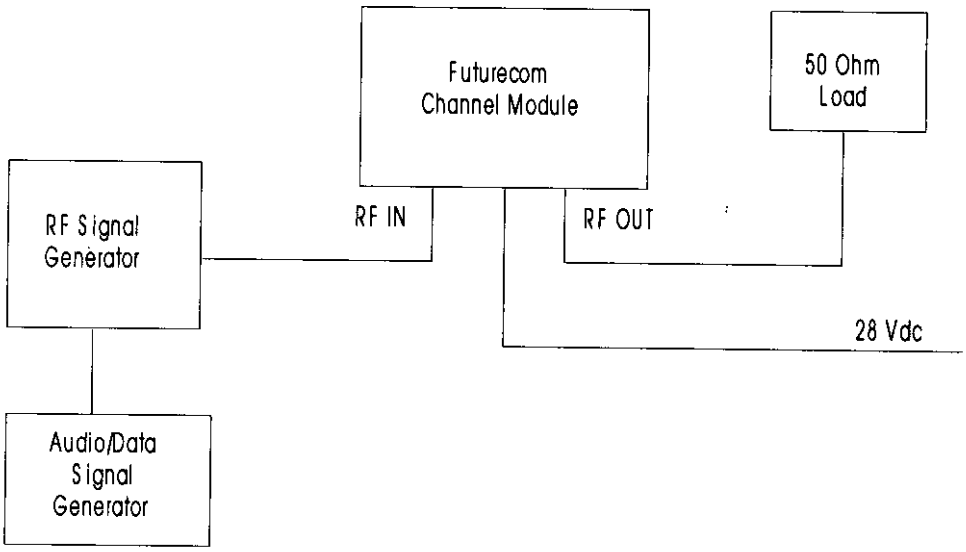
The following peripherals, FCC identifiers and types interconnecting cables were used with the EUT for testing:

(1) EUT: FUTURECOM SYSTEMS GROUP INC., UHF CHANNEL MODULE (RADIO TRANSLATOR), Model : CM UHF HP,, S/N: Pre-production.
I/O Cable: All I/O cables were shielded
Power Supply Cable: Non-shielded

RF INPUT SIMULATING DEVICES:

1. **RF Synthesized RF Signal Generator**, Fluke, Model 6061A, frequency range 10KHz-1050MHz, power output 13dBm max.
2. **Audio Oscillator**, HP, Model 204C, SN: 0989A08798, Output: 0-1.2 MHz, 5 Vrms.
3. **9600 b/s Random Data Generator (Digital Speech Encryption)**, Voice Guard, Model 9600-SW, P/N: 19A148909P, S/N: 9614517.

2.2. BLOCK DIAGRAMS OF TEST SET-UP



2.4. JUSTIFICATION

No deviation, in both configuration and operation manners, different from normal operation were required.

2.5. EUT OPERATING CONDITION

Transmitter/receiver was turned on continuously for testing. The transmitter's carrier was modulated with modulating signal as mentioned in the test data.

2.6. SPECIAL ACCESSORIES

No special accessories were required.

2.7. EQUIPMENT MODIFICATIONS

Not required.

2.8. EXHIBIT 4 - TEST DATA

2.9. POWER AND ANTENNA HEIGHT @ FCC 90.205

PRODUCT NAME: **UHF CHANNEL MODULE (RADIO TRANSLATOR), Model No.: CM UHF HP**

FCC REQUIREMENTS:

FCC Part 90, Para. 90.205:- Please refer to FCC CFR 47, Part 80 to End, Para. 90.205 for specification details.

CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 21 °C
- Relative humidity: 43%

POWER INPUT:

28 Vdc Battery.

TEST EQUIPMENT:

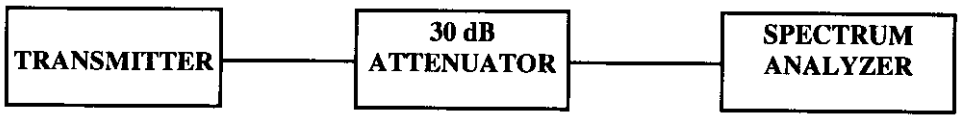
- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Bird Attenuator, 50 Ohm IN/OUT

METHOD OF MEASUREMENTS:

Refer to FCC @ 2.985

(a) For transmitter other than single sideband, independent sideband and controlled carrier radiotelephone, power rf output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of the current and voltage on the circuit elements specified in 2.983(d)(5). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

TEST ARRANGEMENT



TEST RESULTS: Conforms.

TESTED PERSONNEL: Hung Trinh, EMI/RFI Technician

DATE: Jan. 12, 1999

MEASUREMENT DATA

PEAK POWER MEASUREMENT AT THE ANTENNA TERMINAL

TEST CONFIGURATION

- *The transmitter terminal was coupled to the Spectrum Analyzer through a 30 dB attenuator*
- *Power of the transmitter channel near the lowest, middle and highest of each frequency block/band were measured using the power meter, and the reading was corrected by added the calibrated attenuator's attenuation value and cable loss.*
- *The RF Output was turned on with no modulation.*

TRANSMITTER CHANNEL OUTPUT	FUNDAMENTAL FREQUENCY (MHz)	MEASURED PEAK POWER (Watts)	PEAK POWER RATING (Watts)
Near lowest	406.125	20.9	20.0
Middle	450.000	17.0	20.0
Highest	470.000	21.4	20.0

ERP Measurements: -Appropriate antenna type, and adjustment of power output for effective radiated power (ERP) to meet FCC limits will be performed by the manufacturer at location of installation.

2.10. FREQUENCY STABILITY @ FCC 90.213

PRODUCT NAME: **UHF CHANNEL MODULE (RADIO TRANSLATOR), Model No.: CM UHF HP**

FCC REQUIREMENTS:

FCC Part 90, Sub. I, Para. 90.213

The carrier frequency of each transmitter shall be maintained within the following tolerances from the assigned frequencies.

FREQUENCY RANGE (MHz)	FIXED & BASE STATIONS (ppm)			MOBILE STATIONS (ppm)					
				> 2 W			≤ 2 W		
	6.25 kHz	12.5 kHz	25 kHz	6.25 kHz	12.5 kHz	25 kHz	6.25 kHz	12.5 kHz	25 kHz
403 – 512 MHz	0.5	1.5	2.5	1.0	2.5	5.0	1.0	2.5	5.0

CLIMATE CONDITION:

Standard Temperature and Humidity: Please refer to Measurement Data

POWER INPUT:

28 Vdc Battery.

TEST EQUIPMENT:

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Tenney Temp. & Humidity Chamber, Model T5, S/N: 9723B
- Bird Attenuator, 50 Ohm IN/OUT

METHOD OF MEASUREMENTS:

Refer to FCC @ 2.995

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

- From -30 to +50 centigrade except that specified in subparagraph (2) & (3) of this paragraph.

(b) Frequency measurements shall be made at extremes of the specified temperature range and at intervals of not more than 10 centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stability circuitry need be subjected to the temperature variation test.

(d) The frequency stability supply shall be measured with variation of primary supply voltage as follows:

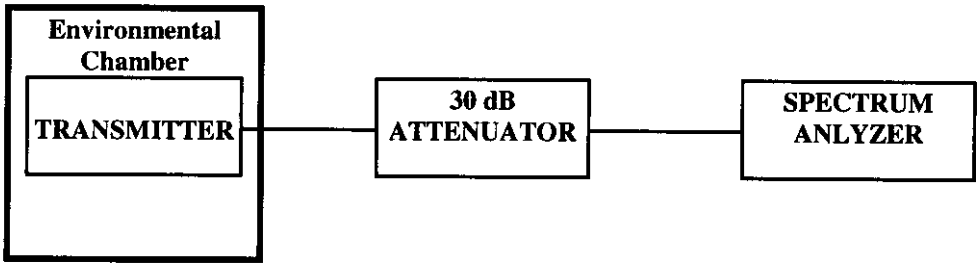
(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provide with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment).

TEST ARRANGEMENT



TEST RESULTS: Conforms.

TEST PERSONNEL: Hung Trinh, EMI/RFI Technician

DATE: Jan. 25, 1999

MEASUREMENT DATA

FREQUENCY STABILITY

TEST CONFIGURATION

- *The transmitter was placed inside the environmental chamber, and its output terminal was coupled to the Spectrum Analyzer through a 30 dB attenuator.*
- *One transmitter channel frequency was tested.*
- *The DUT was supplied by a variable power supply.*
- *The environmental chamber was cycled down to -30° C. When the chamber reaches -30° C, the EUT was powered on with the nominal voltage level, with the transmitter keyed off. The terminal remained in the chamber at –30°C for a period of 1 hour. After 1 hour the transmitter was continuously keyed on, at **full power**. The transmitter frequency of the terminal was measured from the spectrum analyzer every minute for a period of 10 minutes.*
- *After 10 minutes the variable power supply was adjusted to supply the EUT with voltage of 85% nominal voltage level and measurement was repeated.*
- *After 10 minutes the variable power supply was adjusted to supply the EUT with voltage of 110% nominal voltage level and measurement was repeated,*
- *When the measurement complete, the transmitter was keyed off and the chamber was cycled up to the test temperature. The EUT remained powered up (unkeyed) at this temperature for a minimum period of 1 hour, after which the measurements will be made as outlined above.*
- *The above was repeated for 25 & 50 degrees Celsius.*

REMARKS: These tests shall not be applicable for this type of radio translator since the input/output characteristics are identical. However, they are to be performed for our information.

The following frequency deviations observed are just the characteristics of RF input source or measuring instrument.

Product Name **Model No.**	**UHF CHANNEL MODULE (RADIO TRANSLATOR)** **MODEL NO.: CM UHF HP**
Centre Frequency	406 MHz
Full Power Level	43.2 dBm
Frequency Tolerance Limit	±1.5ppm or ±609 Hz
Max. Frequency Tolerance Measured	+0.6ppm or +230 Hz
Base/Mobile/Portable	-30 to +50 degree C, 85% to 115%

		CENTRE FREQUENCY & RF POWER OUTPUT VARIATION					
AMBIENT TEMP. (°C)	KEYED-ON TIME (Minutes)	Supply Voltage (Nominal) 23.8Vdc		Supply Voltage (85% of Nominal) 28Vdc		Supply Voltage (115% of Nominal) 32.2Vdc	
		Hz	dB	Hz	dB	Hz	dB
-30	0	-10	N/A	N/A	N/A	N/A	N/A
	1	-160	N/A	N/A	N/A	N/A	N/A
	2	-10	N/A	N/A	N/A	N/A	N/A
	3	-90	N/A	N/A	N/A	N/A	N/A
	4	-230	N/A	N/A	N/A	N/A	N/A
	5	-20	N/A	N/A	N/A	N/A	N/A
	6	-60	N/A	N/A	N/A	N/A	N/A
	7	-160	N/A	N/A	N/A	N/A	N/A
	8	-90	N/A	N/A	N/A	N/A	N/A
	9	-160	N/A	N/A	N/A	N/A	N/A
	10	-90	N/A	N/A	N/A	N/A	N/A
-20	0	-10	N/A	N/A	N/A	N/A	N/A
	1	-90	N/A	N/A	N/A	N/A	N/A
	2	-10	N/A	N/A	N/A	N/A	N/A
	3	-90	N/A	N/A	N/A	N/A	N/A
	4	-230	N/A	N/A	N/A	N/A	N/A
	5	-90	N/A	N/A	N/A	N/A	N/A
	6	-10	N/A	N/A	N/A	N/A	N/A
	7	-90	N/A	N/A	N/A	N/A	N/A
	8	-10	N/A	N/A	N/A	N/A	N/A
	9	-160	N/A	N/A	N/A	N/A	N/A
	10	-10	N/A	N/A	N/A	N/A	N/A
-10	0	-10	N/A	N/A	N/A	N/A	N/A
	1	-90	N/A	N/A	N/A	N/A	N/A
	2	-160	N/A	N/A	N/A	N/A	N/A
	3	-230	N/A	N/A	N/A	N/A	N/A
	4	-10	N/A	N/A	N/A	N/A	N/A
	5	-160	N/A	N/A	N/A	N/A	N/A
	6	+60	N/A	N/A	N/A	N/A	N/A
	7	-9-	N/A	N/A	N/A	N/A	N/A
	8	+60	N/A	N/A	N/A	N/A	N/A
	9	-90	N/A	N/A	N/A	N/A	N/A
	10	+60	N/A	N/A	N/A	N/A	N/A
0	0	-10	N/A	N/A	N/A	N/A	N/A
	1	-90	N/A	N/A	N/A	N/A	N/A
	2	-90	N/A	N/A	N/A	N/A	N/A
	3	-160	N/A	N/A	N/A	N/A	N/A
	4	-10	N/A	N/A	N/A	N/A	N/A
	5	-160	N/A	N/A	N/A	N/A	N/A
	6	+60	N/A	N/A	N/A	N/A	N/A
	7	-10	N/A	N/A	N/A	N/A	N/A
	8	-230	N/A	N/A	N/A	N/A	N/A
	9	-10	N/A	N/A	N/A	N/A	N/A
	10	-90	N/A	N/A	N/A	N/A	N/A

CENTRE FREQUENCY & RF POWER OUTPUT VARIATION

AMBIENT TEMP. (°C)	KEYED-ON TIME (Minutes)	Supply Voltage (Nominal) 23.8Vdc		Supply Voltage (85% of Nominal) 28Vdc		Supply Voltage (115% of Nominal) 32.2Vdc	
		Hz	dB	Hz	dB	Hz	dB
+10	0	-10	N/A	N/A	N/A	N/A	N/A
	1	-230	N/A	N/A	N/A	N/A	N/A
	2	+60	N/A	N/A	N/A	N/A	N/A
	3	-10	N/A	N/A	N/A	N/A	N/A
	4	+60	N/A	N/A	N/A	N/A	N/A
	5	-90	N/A	N/A	N/A	N/A	N/A
	6	+60	N/A	N/A	N/A	N/A	N/A
	7	-10	N/A	N/A	N/A	N/A	N/A
	8	-160	N/A	N/A	N/A	N/A	N/A
	9	-90	N/A	N/A	N/A	N/A	N/A
	10	+60	N/A	N/A	N/A	N/A	N/A
+25	0	-10	0.0	-10	0.0	-90	0.0
	1	-90	0.0	-230	0.0	-230	0.0
	2	-230	0.0	+60	0.0	-230	0.0
	3	+60	0.0	-90	0.0	-230	0.0
	4	-90	0.0	-160	0.0	+60	0.0
	5	-90	0.0	+60	0.0	-10	0.0
	6	-160	0.0	-230	0.0	-90	0.0
	7	-10	0.0	-10	0.0	-160	0.0
	8	-90	0.0	+230	0.0	-10	0.0
	9	-160	0.0	-90	0.0	-90	0.0
	10	+60	0.0	-10	0.0	+60	0.0
30	0	-10	N/A	N/A	N/A	N/A	N/A
	1	+60	N/A	N/A	N/A	N/A	N/A
	2	-10	N/A	N/A	N/A	N/A	N/A
	3	+60	N/A	N/A	N/A	N/A	N/A
	4	-230	N/A	N/A	N/A	N/A	N/A
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	6	-160	N/A	N/A	N/A	N/A	N/A
	7	-90	N/A	N/A	N/A	N/A	N/A
	8	-230	N/A	N/A	N/A	N/A	N/A
	9	-160	N/A	N/A	N/A	N/A	N/A
	10	+60	N/A	N/A	N/A	N/A	N/A
+40	0	-230	N/A	N/A	N/A	N/A	N/A
	1	-10	N/A	N/A	N/A	N/A	N/A
	2	+60	N/A	N/A	N/A	N/A	N/A
	3	-160	N/A	N/A	N/A	N/A	N/A
	4	-90	N/A	N/A	N/A	N/A	N/A
	5	-10	N/A	N/A	N/A	N/A	N/A
	6	-90	N/A	N/A	N/A	N/A	N/A
	7	-160	N/A	N/A	N/A	N/A	N/A
	8	-230	N/A	N/A	N/A	N/A	N/A
	9	-10	N/A	N/A	N/A	N/A	N/A
	10	-90	N/A	N/A	N/A	N/A	N/A

		CENTRE FREQUENCY & RF POWER OUTPUT VARIATION					
AMBIENT TEMP. (°C)	KEYED-ON TIME (Minutes)	Supply Voltage (Nominal) 23.8Vdc		Supply Voltage (85% of Nominal) 28Vdc		Supply Voltage (115% of Nominal) 32.2Vdc	
		Hz	dB	Hz	dB	Hz	dB
+50	0	-160	N/A	N/A	N/A	N/A	N/A
	1	-10	N/A	N/A	N/A	N/A	N/A
	2	-160	N/A	N/A	N/A	N/A	N/A
	3	-230	N/A	N/A	N/A	N/A	N/A
	4	+60	N/A	N/A	N/A	N/A	N/A
	5	-160	N/A	N/A	N/A	N/A	N/A
	6	-10	N/A	N/A	N/A	N/A	N/A
	7	+60	N/A	N/A	N/A	N/A	N/A
	8	-10	N/A	N/A	N/A	N/A	N/A
	9	-90	N/A	N/A	N/A	N/A	N/A
	10	+160	N/A	N/A	N/A	N/A	N/A
+60	0	-10	N/A	N/A	N/A	N/A	N/A
	1	-90	N/A	N/A	N/A	N/A	N/A
	2	+60	N/A	N/A	N/A	N/A	N/A
	3	-90	N/A	N/A	N/A	N/A	N/A
	4	+60	N/A	N/A	N/A	N/A	N/A
	5	-10	N/A	N/A	N/A	N/A	N/A
	6	-90	N/A	N/A	N/A	N/A	N/A
	7	-160	N/A	N/A	N/A	N/A	N/A
	8	-90	N/A	N/A	N/A	N/A	N/A
	9	-160	N/A	N/A	N/A	N/A	N/A
	10	-90	N/A	N/A	N/A	N/A	N/A

2.11. MODULATION LIMITING @ FCC 90.210

PRODUCT NAME: **UHF CHANNEL MODULE (RADIO TRANSLATOR), Model No.: CM UHF HP**

FCC REQUIREMENTS:

FCC Part 2, Sub. J, Para. 2.987(b) & FCC Part 90, Subpart I, Para. 90.210

The EUT shall be installed with a modulation limiter which limits the deviation of the FM carrier less than manufacturer's setting provided that the rf output spectrum must meet the required MASK (recommedned: 1.25 kHz for 6.25 kHz Channel Spacing System, 2.5 kHz for 12.5 kHz Channel Spacing , and 5 kHz for 25 kHz Channel Spacing System).

CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 21 °C
- Relative humidity: 43%

POWER INPUT:

28 Vdc Battery.

TEST EQUIPMENT:

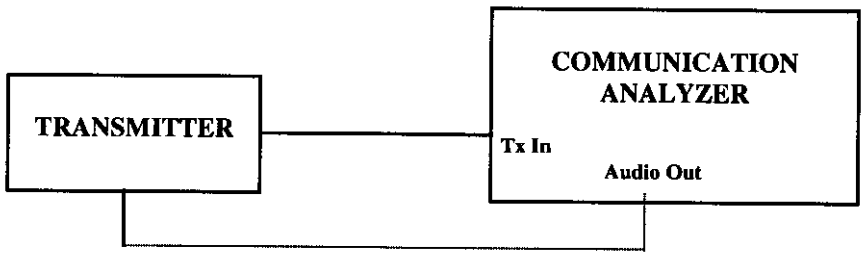
- Communication Analyzer, Rohde & Schawrz, Model SMFO2, S/N: 879988/057, 0.4 - 1000 MHz including AF & RF Signal Generators, SINAD, DISTORTION, DEVIATION meters and etc...

METHOD OF MEASUREMENTS:

For Audio Transmitter:- The carrier frequency deviation was measured with the tone input signal level varied from 0 Vp to audio input rating level plus 16 dB at frequencies 0.1, 0.5, 1.0, 3.0 and 5.0 kHz. The maximum deviation was recorded at each test condition.

For Data Transmitter with Maximum Frequency Deviation set by Factory:- The EUT was set at maximum frequency deviation, and its peak frequency deviation was then measured using EUT's internal random data source.

TEST ARRANGEMENT



TEST RESULTS: Conforms.

TEST PERSONNEL: Hung Trinh, EMI/RFI Technician

DATE: Jan. 26, 1999

MEASUREMENT DATA

Note: *The Futurecom CM UHF HP UHF CHANNEL MODULE is a rf translator, it transforms the rf input signal to the rf output signal with the same spectrum but the frequency and power. Therefore, comparison tests between the input and output signal will be performed.*

MODULATION LIMITING FOR DATA TRANSMITTER

DATA BAUD RATE	Frequency Deviation Of Input Signal (kHz)	Frequency Deviation Of Output Signal (kHz)
Modulating Signal	**Frequency Deviation Of Input Signal (kHz)**	**Frequency Deviation Of Output Signal (kHz)**
9600 b/s random data	0.7	0.7
9600 b/s random data	1.2	1.2
9600 b/s random data	1.7	1.7
9600 b/s random data	2.2	2.2
9600 b/s random data	2.7	2.7
9600 b/s random data	3.2	3.2

MODULATION LIMITING FOR AN AUDIO TRANSMITTER

Modulating Signal	Frequency Deviation Of Input Signal (kHz)	Frequency Deviation Of Output Signal (kHz)
1 KHz, Sine Wave	0.7	0.7
1 KHz, Sine Wave	1.2	1.2
1 KHz, Sine Wave	1.7	1.7
1 KHz, Sine Wave	2.2	2.2
1 KHz, Sine Wave	2.7	2.7
1 KHz, Sine Wave	3.2	3.2

2.12. EMISSION MASKS @ FCC 90.210

PRODUCT NAME: **UHF CHANNEL MODULE (RADIO TRANSLATOR), Model No.: CM UHF HP**

FCC REQUIREMENTS:

FCC Part 90, Sub. I, Para. 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FREQUENCY RANGE (MHz)	Recommended OBW (KHz)	CHANNEL SPACING (KHz)	Recommended FREQ. DEVIATION (KHz)	FCC APPLICABLE MASK
403 – 512	10.0	12.5	2.5	90.210(d): Mask D – Voice & Data

FCC RULES	FREQUENCY RANGE	ATTENUATION LIMIT (dBc)
90.210(d): Mask D – Voice & Data	> Fc – 5.625 kHz - < FC + 5.625 kHz Fc ± 5.625 kHz - Fc ± 12.5 kHz > Fc – 12.5 kHz - < Fc + 12.5 kHz	0 7.27(fd-2.88 kHz) $50 + 10\log_{10}(P)$ or 70 dB whichever is less.

CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 21 °C
- Relative humidity: 43%

POWER INPUT:

28 Vdc Battery.

TEST EQUIPMENT:

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Bird Attenuator, 50 Ohm IN/OUT
- Audio Oscillator, HP, Model 204C, SN: 0989A08798, Output: 0-1.2 MHz, 5 Vrms.

METHOD OF MEASUREMENTS:

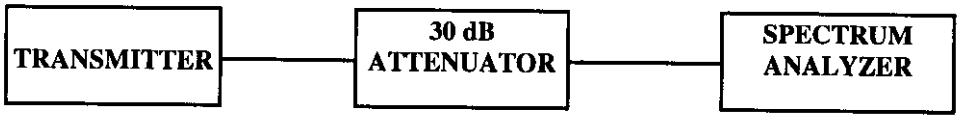
FCC CFR 47, Para. 2.989 - Out-of-Band Emissions:

The Emission Masks was measured with the Spectrum Analyzer controls set as shown on the test results (RBW $\geq$ 300 Hz, VBW $\geq$ 300 Hz and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

Voice or Digital Modulation Through a Voice Input Port @ 2.989(c)(1):- The transmitter was modulated by a 2.5 KHz tone signal at an input level 16 dB greater than that required to produce 50% modulation (e.g.: $\pm$2.5 KHz peak deviation at 1 KHz modulating frequency). The input level was established at the frequency of maximum response of the audio modulating circuit.

Digital Modulation Through a Data Input Port @ 2.989(h):- Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the Emission Masks shall be shown for operation with any devices used for modifying the spectrum when such devices are operational at the descretion of the user.

TEST ARRANGEMENT



TEST RESULTS: Conforms.

TEST PERSONNEL: Hung Trinh, EMI/RFI Technician

DATE: Jan. 19 - 25, 1999

MEASUREMENT DATA

Please see attached plots for detailed measurements.

Note: The Futurecom CM UHF HP UHF CHANNEL MODULE is a rf translator, it transforms the rf input signal to the rf output signal with the same spectrum but the frequency and power. Therefore, comparison tests between the input and output signal will be performed.

2.14. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS @ FCC 90.210

PRODUCT NAME: **UHF CHANNEL MODULE (RADIO TRANSLATOR), Model No.: CM UHF HP**

FCC REQUIREMENTS:

FCC Part 90, Sub. I, Para. 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FREQUENCY RANGE (MHz)	Recommended OBW (KHz)	CHANNEL SPACING (KHz)	Recommended FREQ. DEVIATION (KHz)	FCC SPECIFICATION LIMITS (Para. No.)
403-512	10.0	12.5	2.5	90.210(d): Mask D – Audio & Voice

FCC RULES	FREQUENCY RANGE	ATTENUATION LIMIT (dBc)
90.210(d): Mask D - Voice & Data	Lowest frequency generated from the transmitter circuit to 10^{th} harmonic of the fundamental frequency	$50 + 10\log_{10}(P)$ or 70 dB whichever is less

CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 21 °C
- Relative humidity: 43%

POWER INPUT:

28 Vdc Battery.

TEST EQUIPMENT:

1. EMI Receiver System/Spectrum Analyzer, Hewlett Packard, Model 8546A, Input +25dBm max., 9KHz-5.6GHz, 50 Ohms, built-in Peak, Quasi-Peak & Average Detectors, Pre-Amplifier and Tracking Signal Generator. This System includes: (1) HP 85460A RF Filter Section, S/N: 3448A00236 and (2) HP 85462A Receiver RF Section/Display, S/N: 3520A00248.
2. Spectrum Analyzer, Advantest, Model R3271, S/N: 15050203, 100 Hz to 32 GHz)
3. Microwave Amplifier, HP, Model 83017A, Frequency Range 1 to 22GHz, 30dB gain nominal, low noise floor type.
4. Active Loop Antenna, Emco, Model 6502, SN 9104-2611, Frequency Range 1 KHz - 30 MHz, @ 50 Ohms.
5. BiconiLog Antenna, Emco, Model 3142, SN 10005, 30-2000 MHz @ 50 Ohms.
6. Log Periodic Antenna, AH System, Model SAS-200/518, SN: 343, Frequency Range: 1GHz-18GHz.
7. FCC Listed Open Field Test Site.
8. Audio Oscillator, HP, Model 204C, SN: 0989A08798, Output: 0-1.2 MHz, 5 Vrms.

METHOD OF MEASUREMENTS:

Refer to **ANSI 63.4**, Para. 8 for detailed radiated emissions measurement procedures.

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.989, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the Spectrum Analyzer controls set as RBW = 100 kHz, VBW = 100 kHz and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated

The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10^{th} harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 30 dB below the permissible value need not be reported.

FCC CFR 47, Para. 2.993 - Field Strength Spurious Emissions

(a) Measurements was made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.989(c) as appropriate. For equipment operating on frequencies below 1 GHz , an Open Field Test is normally required, with the measuring instrument antenna located in the far field at all test frequencies. In event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

(b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
(2) All equipment operating on frequencies higher than 25 MHz
(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
(4) Other types of equipment as required, when deemed necessary by the Commission.

METHOD OF CALCULATION FOR TRANSMITTED POWER (P) FROM THE MEASURED FIELD STRENGTH LEVEL (E):

According to IEC 801-3, the power density can be calculated as follows:

$S = P / (4xPIxD^2)$ Where: S: Power density in watts per square feet
P: Transmitted power in watts
PI: 13.1415
D: Distance in meters

The power density S (W/m^2) and electric field E (V/m) is related by:

$$S = E^2/(120xPI)$$

Accordingly, the field intensity of isotropic radiator in free space can be expressed as follows:

$$E = (30xP)^{1/2}/D = 5.5x(P)^{1/2}/D$$

For Halfwave dipole antenna or other antennas correlated to dipole in direction of maximum radiation:

$$S = (1.64xP)/(4xPIxD^2)$$
$$E = (49.2xP)^{1/2}xD = 7.01x(P)^{1/2}/D$$

$$P = (ExD/7.01)^2$$

Calculation of transmitted power P (dBM) given a measured field intensity E (dBuV/m):

$P(W) = [E(V/m)xD/7.01]^2$
$P(mW) = P(W)x1000$
=> $P(dBm) = 10logP(mW)$
$= 20logE(V/m) + 20log(D) - 20log(7.01) + 10log1000$
$= E(dBV/m) + 20logD + 13$
$= E(dBuV/m) - 120 + 20log(D) + 13$
$= E(dBuV/m) + 20log(D) - 107$

The Transmitted Power @ D = 3 Meters

P(dBm) = E(dBuV/m) - 97.5

TEST RESULTS: Conforms.

TEST PERSONNEL: Hung Trinh, EMI/RFI Technician

DATE: Jan. 19 - 25, 1999

MEASUREMENT DATA

TRANSMITTER UNWANTED (SPURIOUS/HARMONIC)
RADIATED EMISSIONS MEASUREMENTS @ 3 METERS

TEST CONFIGURATION

- *For measuring radiated emissions at frequencies below 1 GHz, the Spectrum Analyzer was set as 100 kHz RBW, 100 KHz VBW, SWEEP TIME: AUTO, PEAK DETECTOR.*
- *For measuring radiated emissions at frequencies above 1 GHz, the Spectrum Analyzer was set as 1 MHz RBW, 1 MHz VBW, SWEEP TIME: AUTO, PEAK DETECTOR.*

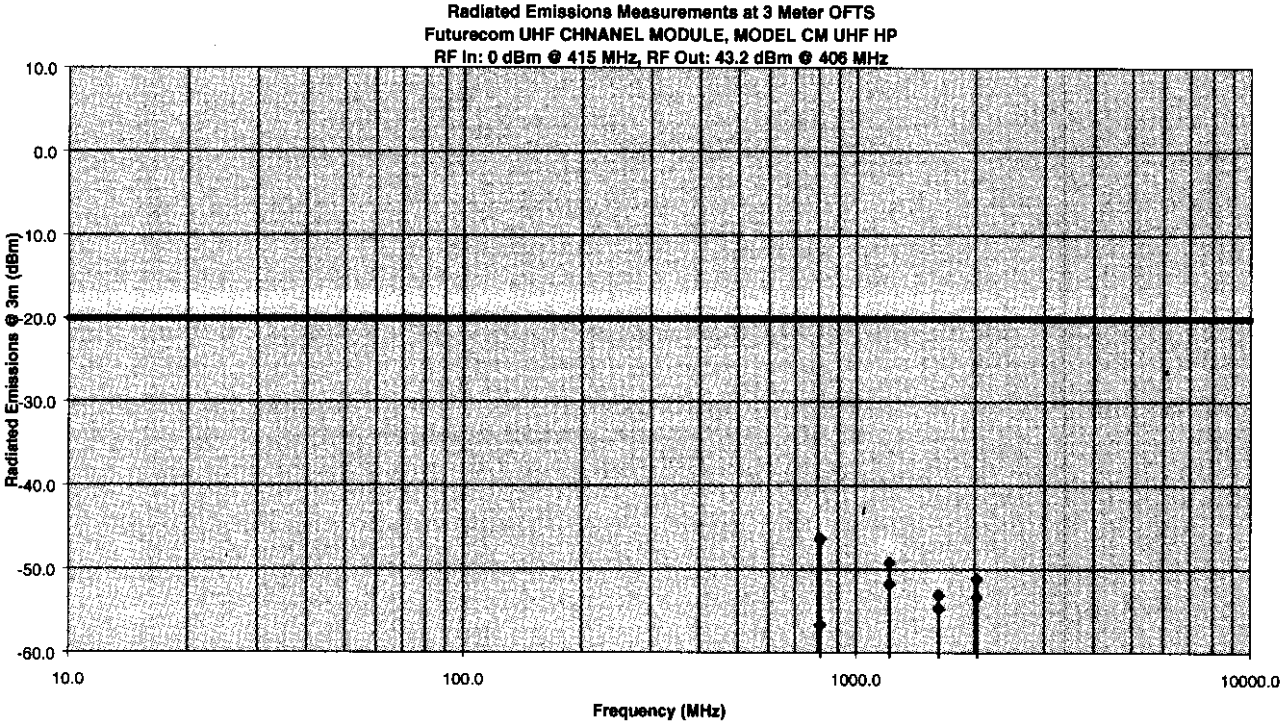
RF In: 0 dBm @ 415 MHz
RF Out: 43.2 dBm @ 406 MHz
Modulation: FM modulation with 2.5 kHz Sine Wave Signal, Freq. Dev. = 2.5 kHz

FREQUENCY (MHz)	RF Field Strength Level (dBuV/m)	RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
812.0	40.8	-56.7	PEAK	V	-20.0	-36.7	PASS
812.0	51.1	-46.4	PEAK	H	-20.0	-26.4	PASS
1218.0	48.3	-49.2	PEAK	V	-20.0	-29.2	PASS
1218.0	45.7	-51.8	PEAK	H	-20.0	-31.8	PASS
1624.0	44.4	-53.1	PEAK	V	-20.0	-33.1	PASS
1624.0	42.8	-54.7	PEAK	H	-20.0	-34.7	PASS
2030.0	46.3	-51.2	PEAK	V	-20.0	-31.2	PASS
2030.0	44.2	-53.3	PEAK	H	-20.0	-33.3	PASS

The emissions were scanned form 10 MHz to 5 GHz and all emissions less than 40 dB below the limits were recorded.

RF In:	0 dBm @ 415 MHz
RF Out:	43.2 dBm @ 406 MHz
Modulation:	FM modulation with 9600 b/s random data, Freq. Dev. = 2.5 kHz

Prescans were applied to this operating condition, and the results were found to be identical with those of the FM Voice Modulation



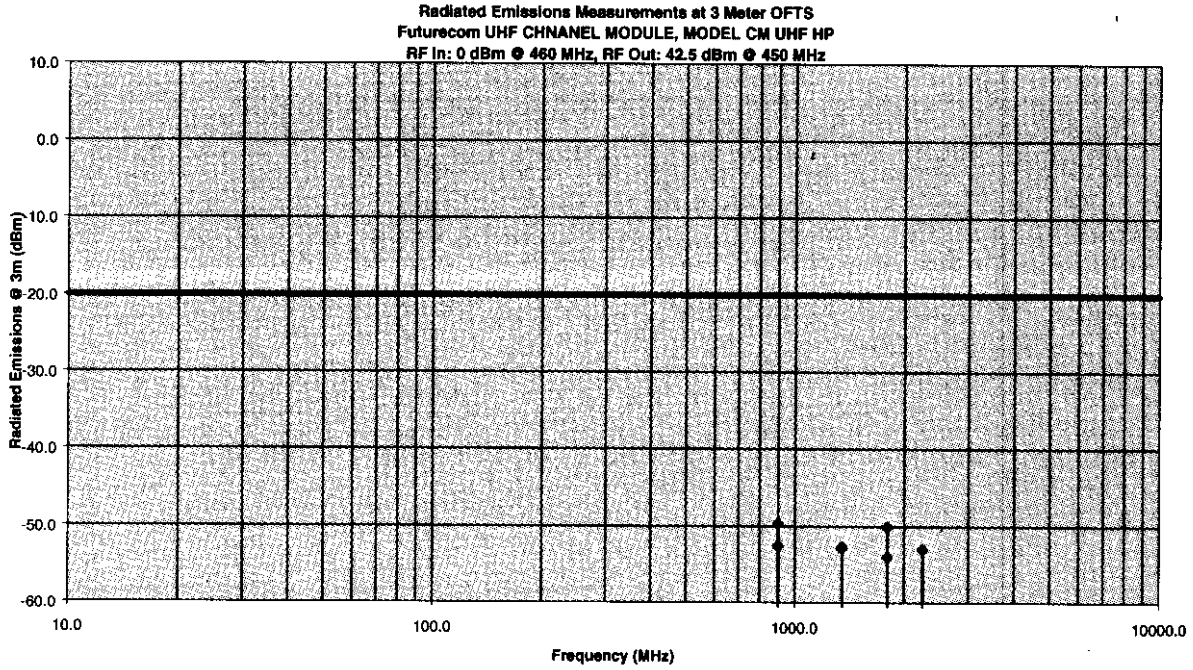
RF In: 0 dBm @ 460 MHz
RF Out: 42.5 dBm @ 450 MHz
Modulation: FM modulation with 2.5 kHz Sine Wave Signal, Freq. Dev. = 2.5 kHz

FREQUENCY (MHz)	RF Field Strength Level (dBuV/m)	RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
900.0	47.8	-49.7	PEAK	V	-20.0	-29.7	PASS
900.0	44.9	-52.6	PEAK	H	-20.0	-32.6	PASS
1350.0	44.6	-52.9	PEAK	V	-20.0	-32.9	PASS
1350.0	44.8	-52.7	PEAK	H	-20.0	-32.7	PASS
1800.0	47.4	-50.1	PEAK	V	-20.0	-30.1	PASS
1800.0	43.5	-54.0	PEAK	H	-20.0	-34.0	PASS
2250.0	44.5	-53.0	PEAK	V	-20.0	-33.0	PASS

The emissions were scanned form 10 MHz to 5 GHz and all emissions less than 40 dB below the limits were recorded.

RF In: 0 dBm @ 460 MHz
RF Out: 42.5 dBm @ 450 MHz
Modulation: FM modulation with 9600 b/s random data, Freq. Dev. = 2.5 kHz

Prescans were applied to this operating condition, and the results were found to be identical with those of the FM Voice Modulation



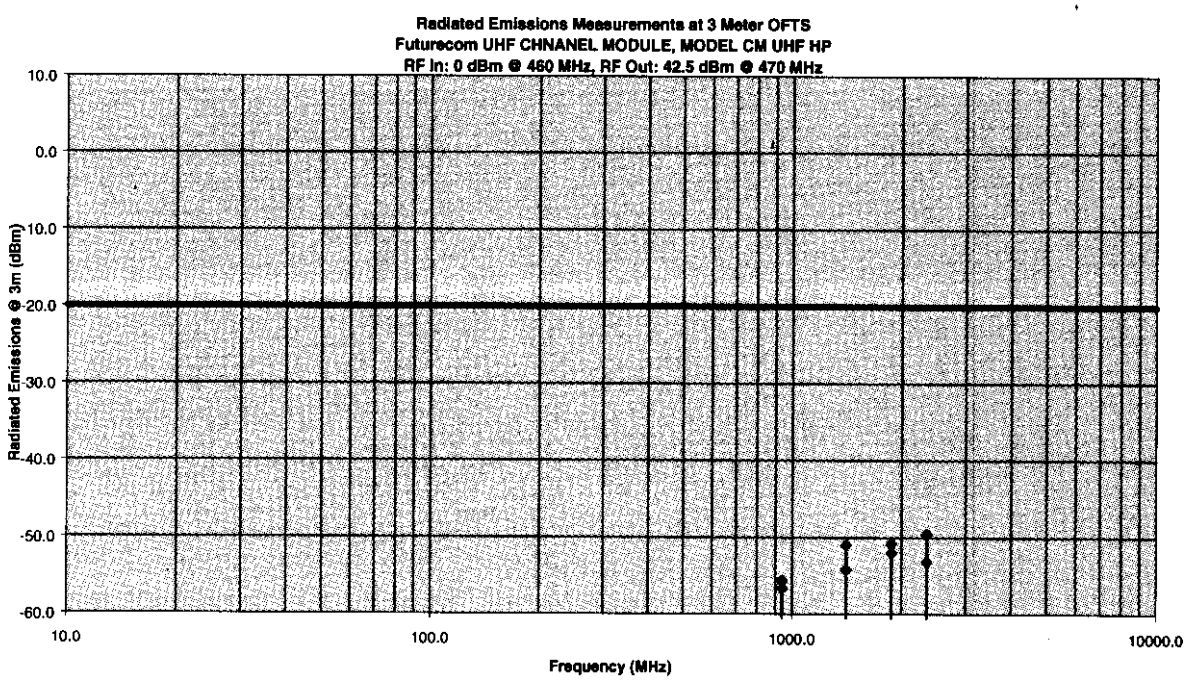
RF In: 0 dBm @ 460 MHz
RF Out: 43.3 dBm @ 470 MHz
Modulation: FM modulation with 2.5 kHz Sine Wave Signal, Freq. Dev. = 2.5 kHz

FREQUENCY (MHz)	RF Field Strength Level (dBuV/m)	RF Power Level (dBm)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
940.0	40.8	-56.7	PEAK	V	-20.0	-36.7	PASS
940.0	41.8	-55.7	PEAK	H	-20.0	-35.7	PASS
1410.0	46.5	-51.0	PEAK	V	-20.0	-31.0	PASS
1410.0	43.3	-54.2	PEAK	H	-20.0	-34.2	PASS
1880.0	46.7	-50.8	PEAK	V	-20.0	-30.8	PASS
1880.0	45.5	-52.0	PEAK	H	-20.0	-32.0	PASS
2350.0	47.9	-49.6	PEAK	V	-20.0	-29.6	PASS
2350.0	44.3	-53.2	PEAK	H	-20.0	-33.2	PASS

The emissions were scanned form 10 MHz to 5 GHz and all emissions less than 40 dB below the limits were recorded.

RF In: 0 dBm @ 460 MHz
RF Out: 43.3 dBm @ 470 MHz
Modulation: FM modulation with 9600 b/s random data, Freq. Dev. = 2.5 kHz

Prescans were applied to this operating condition, and the results were found to be identical with those of the FM Voice Modulation



2.15. TRANSIENT FREQUENCY BEHAVIOR

PRODUCT NAME: **UHF CHANNEL MODULE (RADIO TRANSLATOR), Model No.: CM UHF HP**

FCC REQUIREMENTS:

FCC Part 90, Sub. I, Para. 90.214

Transient frequencies must be within the maximum frequency difference limits during the time intervals indicated:

Transient Frequency Behavior for equipment Designed to Operate on 12.5 KHz Channels

		All Equipment
Time Interval [1,2]	Maximum Frequency Difference [3]	421 to 512 MHz
t1[4]	± 12.5.0 KHz	10.0 ms
t2	± 6.5 KHz	25.0 ms
t3[4]	± 12.5 KHz	10.0 ms

(1) ton: the instant when a 1 KHz test signal is completely suppressed, including any capture time due to phasing.
t1: tme period immediately after ton
t2: time period after t1
t3: time period from the instant when the transmitter is turned off until toff
toff: the instant when the 1 KHz test signal starts to rise.

(2) During the time from the end of t2 to the beginning of t3, the frequency difference must not exceed the limits specified in @ 90.213

(3) Difference between the actual transmitter frequency and assigned transmitter frequency.

(4) If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

RESULTS: Not applicable for this radio translator since the input output signal will be turned on with the same characteristics of frequency transient behavior as that of the rf input signal.

3. EXHIBIT 5 - GENERAL TEST PROCEDURES

3.1. ELECTRICAL FIELD RADIATED EMISSIONS MEASUREMENTS - GENERAL TEST METHOD

- The radiated emission measurements were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario. The Attenuation Characteristics of OFTS have been filed to FCC.

- Radiated emissions measurements were made using the following test instruments:

  1. Calibrated EMCO biconilogl antenna in the frequency range from 30 MHz to 2000 MHz.
  2. Calibrated A.H. Systems log periodic antenna in the frequency range above 1000 MHz (1GHz - 18 GHz).
  3. Calibrated EMI receiver or spectrum analyzer and pre-selector. In general, the spectrum analyzer would be used as follows:

     - The rf electric field levels were measured with the spectrum analyzer set to PEAK detector (100 KHz RBW and 100 KHz VBW).

     - If any rf emission was observed to be a broadBand noise, the spectrum analyzer's CISPR QUASI-PEAK detector (120 KHz RBW and 1MHz VBW) was then set to measure the signal level.

     - If the signal being measured was narrowband and the ambient field was broadBand, the bandwidth of the spectrum analyzer was reduced.

- The EUT was set-up in its typical configuration and operated in its various modes as described in 3.2 of the test report.

- The frequencies of emissions was first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.

- During this process, cables and peripheral devices were manipulated within the range of likely configuration.

- For each mode of operation required to be tested, the frequency spectrum was monitored. Variations in antenna heights (from 1 meter to 4 meters above the ground plane), antenna polarization (horizontal plane and vertical plane), cable placement and peripheral placement (each variable within bounds specified elsewhere) were explored to produce the highest amplitude signal relative to the limit.

  The maximum radiated emission for a given mode of operation was found by using the following step-by-step procedure:

  Step1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.

  Step2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

  Step3: Rotate the EUT 360 degrees to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go back to the azimuth and repeat Step 2. Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.

Step4: Move the antenna over its full allowed range of travel (1 to 4 meters) to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to Step 2 with the highest amplitude observation and proceed.

Step5: Change the polarization of the antenna and repeat Step 2 through 4. Compare the resulting suspected highest amplitude signal with that found for the other polarization. Select and note the higher of the two signals. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.

Step6: The effects of various modes of operation is examined. This is done by varying the equipment modes as steps 2 through 5 are being performed.

Step7: After completing steps 1 through 6, record the final highest emission level, frequency, antenna polarization and detector mode of the measuring instrument.

Calculation of Field Strength:

The field strength is calculated by adding the calibrated antenna factor and cable factor, and subtracting the Amplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where	FS	=	Field Strength
	RA	=	Receiver/Analyzer Reading
	AF	=	Antenna Factor
	CF	=	Cable Attenuation Factor
	AG	=	Amplifier Gain

Example: If a receiver reading of 60.0 dBuV is obtained, the antenna factor of 7.0 dB/m and cable factor of 1.0 dB are added, and the amplifier gain of 30 dB is subtracted. The actual field strength will be:.

Field Level = 60 + 7.0 + 1.0 - 30 = 38.0 dBuV/m.

Field Level = $10^{(38/20)}$ = 79.43 uV/m.

Notes: The frequency and amplitude of at least six highest conducted emissions relative to the limit are recorded unless such emissions are more than 30 dB below the limit. If less than six emissions are within 20dB of the limit, the background or receiver noise level shall be reported at representative frequencies.

4. EXHIBIT 6 - INFORMATION RELATED TO EQUIPMENT UNDER TESTS

4.1. FCC ID LABELLING AND SKETCH OF FCC LABEL LOCATION

Refer to the attached sheets

4.2. PHOTOGRAPHS OF EQUIPMENT UNDER TEST

Refer to the attached photographs

4.3. SYSTEM BLOCK DIAGRAM(S)

Refer to the attached sheets

4.4. SCHEMATIC DIAGRAMS

Refer to the attached sheets

4.5. USER'S MANUAL WITH "FCC INFORMATION TO USER STATEMENTS"

Refer to the attached Users' manual

FUTURECOM
SYSTEMS GROUP INC.

To: Tri M. Luu
Ultratech

From: Tony Bombera
Futurecom

Date: January 22, 1999

Re: CM UHF HP Documentation

Tri,

Here is the required documentation for CM UHF HP reports. Please do not forget to file for confidentiality with FCC.

(ultrat22)

110 Snow Blvd., Unit 3 & 4, Concord, Ontario L4K 4B8 ☎ (905) 660-5548 (905) 660-6858 Toll free 1-800-701-9180

UltraTech
Engineering Labs Inc.

FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 2.5 kHz Sine Wave Signal
TX RF OUT (Translated from the RF In Signal): N/A dBm, N/A MHz

Date: Jan.. 20 /1999
Tested by: Hung Trinh

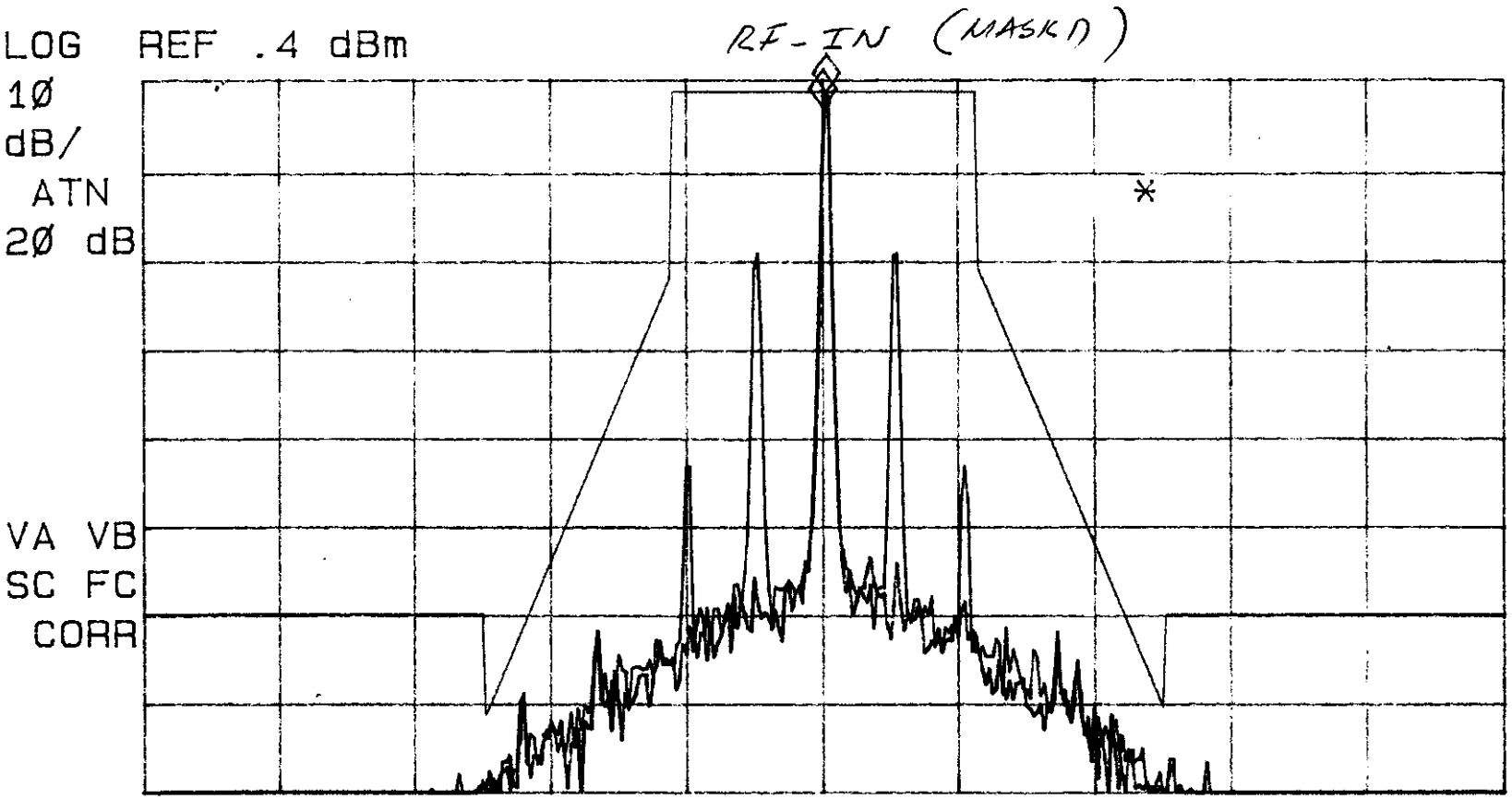
hp

REF LEVEL
.4 dBm

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 459.99988 MHz
-1.Ø1 dBm

NMARKER
→ MKR

MARKER
→ CF



NEXT
PEAK

NEXT PK
RIGHT

NEXT PK
LEFT

More
1 of 3

CENTER 459.99975 MHz
SPAN 5Ø.ØØ kHz
#IF BW 1ØØ Hz
AVG BW 1ØØ Hz
SWP 15.Ø sec

UltraTech Engineering Labs Inc.

FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 2.5 kHz Sine Wave Signal
TX RF OUT (Translated from the RF In Signal): 42.5 dBm, 450 MHz

Date: Jan. 21 /1999
Tested by: Hung Trinh

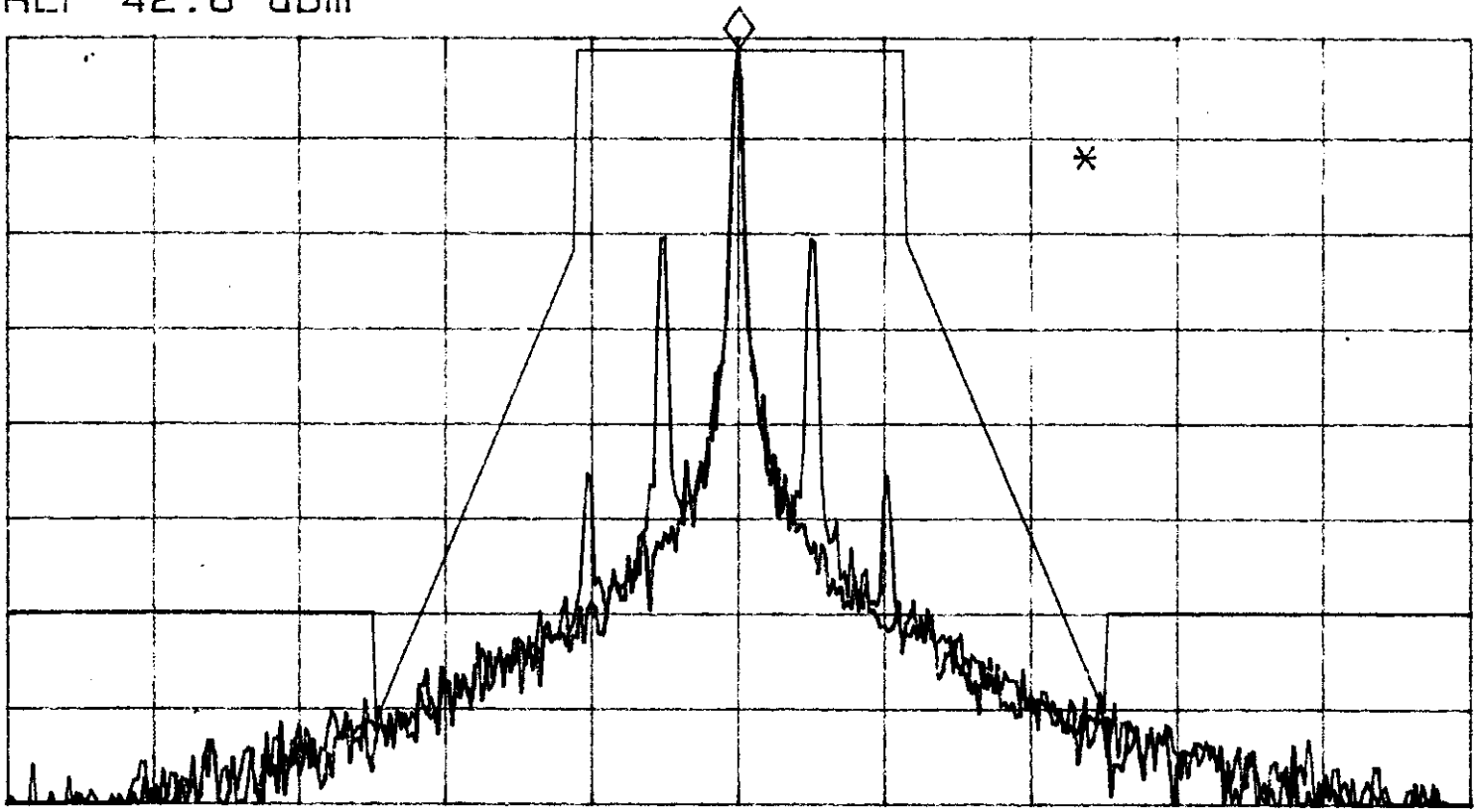
hp

REF LEVEL
42.8 dBm

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 45Ø.ØØØØØ MHz
41.61 dBm

No user Menu

REF OFFST 3Ø.Ø dB
LOG REF 42.8 dBm
1Ø
dB/
ATN
3Ø dB



VA VB
SC FC
CORR

CENTER 45Ø.ØØØØØ MHz
SPAN 5Ø.ØØ kHz
#IF BW 1ØØ Hz
AVG BW 1ØØ Hz
SWP 15.Ø sec

UltraTech
Engineering Labs Inc.

FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 2.5 kHz Sine Wave Signal
TX RF OUT (Translated from the RF In Signal): 43.3 dBm, 470 MHz

Date: Jan. 21 /1999
Tested by: Hung Trinh

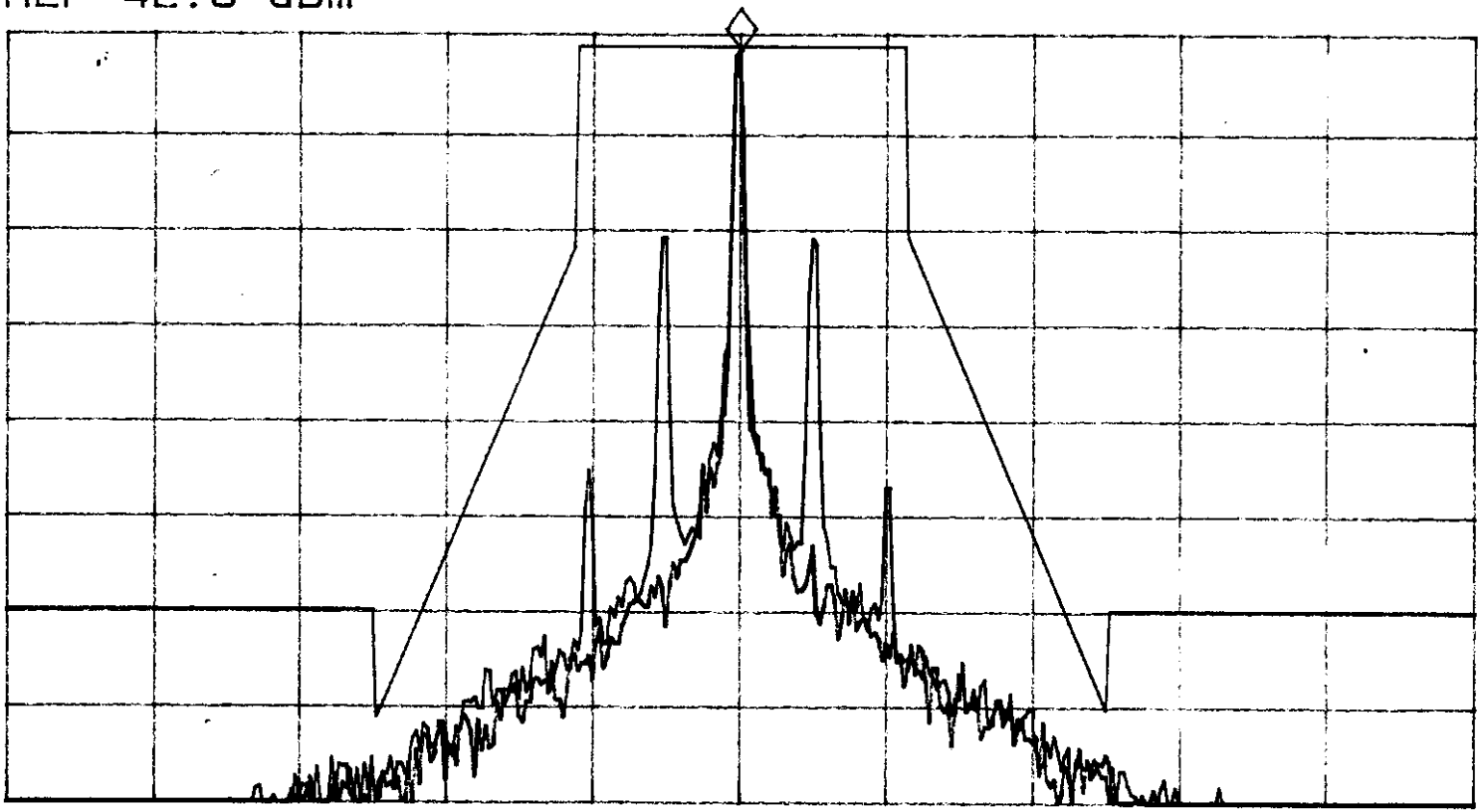
hp

CENTER
470.00000 MHz

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 470.00000 MHz
41.13 dBm

No user Menu

REF OFFST 30.0 dB
LOG REF 42.8 dBm
10
dB/
ATN
30 dB



VA VB
SC FC
CORR

CENTER 470.00000 MHz
#IF BW 100 Hz
AVG BW 100 Hz
SPAN 50.00 kHz
SWP 15.0 sec

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Engineering Labs Inc.

hp

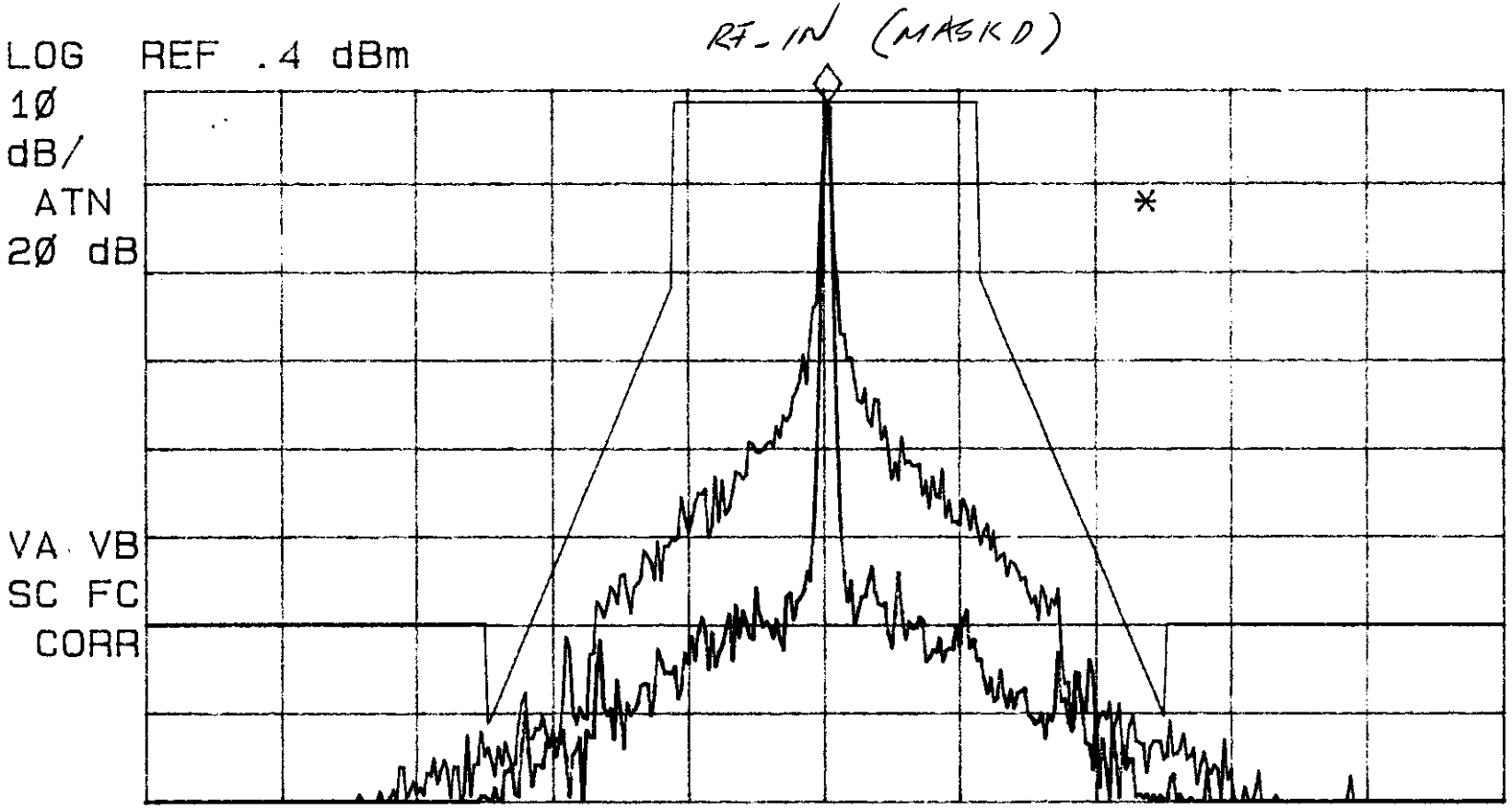
FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 9600 b/s random data
TX RF OUT (Translated from the RF In Signal): N/A dBm, N/A MHz

Date: Jan. 20 /1999
Tested by: Hung Trinh

REF LEVEL
.4 dBm

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 459.99988 MHz
-1.Ø1 dBm

No user Menu



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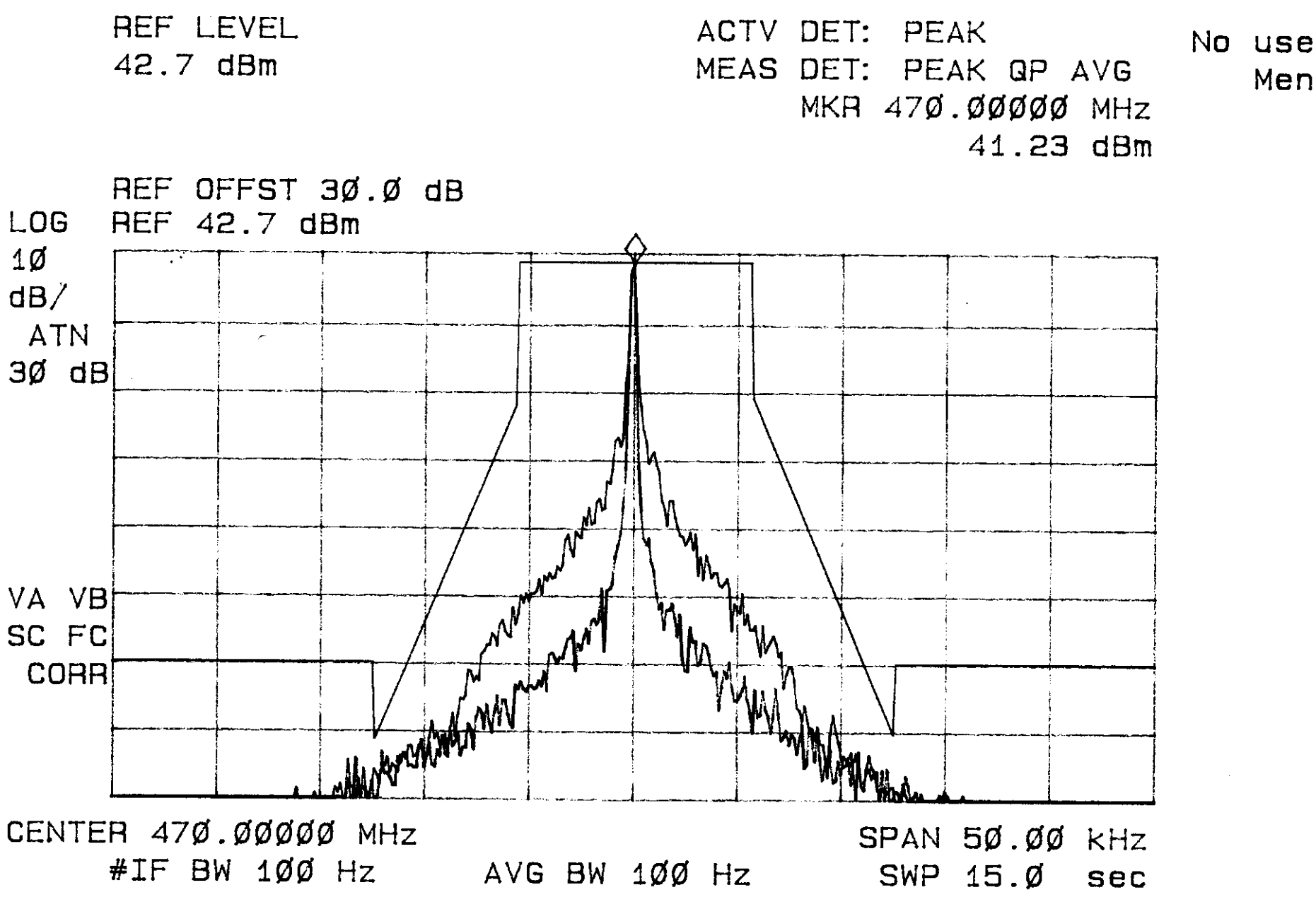
FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 9600 b/s random data
TX RF OUT (Translated from the RF In Signal): 43.3 dBm, 470 MHz

Date: Jan. 21 /1999
Tested by: Hung Trinh

hp



2.13. TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS @ FCC 90.210

PRODUCT NAME: **UHF CHANNEL MODULE (RADIO TRANSLATOR), Model No.: CM UHF HP**

FCC REQUIREMENTS:

FCC Part 90, Sub. I, Para. 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FREQUENCY RANGE (MHz)	Recommended OBW (KHz)	CHANNEL SPACING (KHz)	Recommended FREQ. DEVIATION (KHz)	FCC SPECIFICATION LIMITS (Para. No.)
403-512	10.0	12.5	2.5	90.210(d): Mask D – Audio & Voice

FCC RULES	FREQUENCY RANGE	ATTENUATION LIMIT (dBc)
90.210(d): Mask D - Voice & Data	Lowest frequency generated from the transmitter circuit to 10^{th} harmonic of the fundamental frequency	$50 + 10\log_{10}(P)$ or 70 dB whichever is less

CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 21 °C
- Relative humidity: 43%

POWER INPUT:

28 Vdc Battery.

TEST EQUIPMENT:

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Bird Attenuator, 50 Ohm IN/OUT
- Hihpass Filter, Microphase, P/N: CR220HIB, S/N: IITI11000AB, cut-off freq.: 600 MHz.
- Audio Oscillator, HP, Model 204C, SN: 0989A08798, Output: 0-1.2 MHz, 5 Vrms.

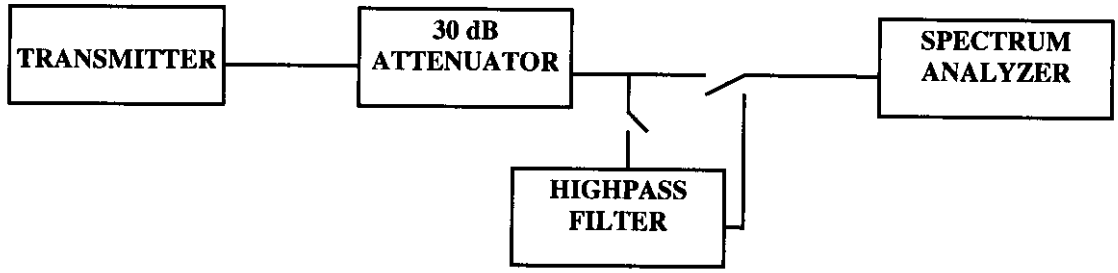
METHOD OF MEASUREMENTS:

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.989, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the Spectrum Analyzer controls set as RBW = 100 kHz, VBW = 100 kHz and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated:- The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10^{th} harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The
amplitude of spurious emissions which are attenuated more than 30 dB below the permissible value need not be reported.

FCC CFR 47, Para. 2.991 - Spurious Emissions at Antenna Terminal:- The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of the harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.989 as appropriate. The magnitude of spurious emissions which are attenuated more than 30 dB below the permissible value need not be specified.

TEST ARRANGEMENT



TEST RESULTS: Conforms.

TEST PERSONNEL: Hung Trinh, EMI/RFI Technician

DATE: January 6, 12 & 22, 1999

MEASUREMENT DATA

UNWANTED (SPURIOUS & HARMONIC) EMISSIONS AT THE TRANSMITTER ANTENNA TERMINAL

TEST CONFIGURATION

- *The transmitter was coupled to the Spectrum Analyzer through a 30 dB attenuator.*
- *The insertion loss between the transmitter output terminal and the spectrum analyzer was measured to be 30 dB*

RF In: 0 dBm @ 415 MHz
RF Out: 43.2 dBm @ 406 MHz
Modulation: FM modulation with 2.5 kHz Sine Wave Signal, Freq. Dev. = 2.5 kHz

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
812.0	-25.7	-20.0	-5.7	PASS
3248.0	-28.3	-20.0	-8.3	PASS

The emissions were scanned form 10 MHz to 5 GHz and all emissions less than 15 dB below the limits were recorded.

RF In: 0 dBm @ 415 MHz
RF Out: 43.2 dBm @ 406 MHz
Modulation: FM modulation with 9600 b/s random data, Freq. Dev. = 2.5 kHz

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
812.0	-25.4	-20.0	-5.4	PASS
2842.0	-28.8	-20.0	-8.8	PASS

The emissions were scanned form 10 MHz to 5 GHz and all emissions less than 15 dB below the limits were recorded.

RF In: 0 dBm @ 460 MHz
RF Out: 42.5 dBm @ 450 MHz
Modulation: FM modulation with 2.5 kHz Sine Wave Signal, Freq. Dev. = 2.5 kHz

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2250.0	-28.8	-20.0	-8.8	PASS
2700.0	-28.2	-20.0	-8.2	PASS

The emissions were scanned form 10 MHz to 5 GHz and all emissions less than 15 dB below the limits were recorded.

RF In: 0 dBm @ 460 MHz
RF Out: 42.5 dBm @ 450 MHz
Modulation: FM modulation with 9600 b/s random data, Freq. Dev. = 2.5 kHz

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2250.0	-28.6	-20.0	-8.6	PASS
2700.0	-28.4	-20.0	-8.4	PASS

The emissions were scanned form 10 MHz to 5 GHz and all emissions less than 15 dB below the limits were recorded.

RF In: 0 dBm @ 460 MHz
RF Out: 43.3 dBm @ 470 MHz
Modulation: FM modulation with 2.5 kHz Sine Wave Signal, Freq. Dev. = 2.5 kHz

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
940.0	-24.5	-20.0	-4.5	PASS
2820.0	-28.6	-20.0	-8.6	PASS

The emissions were scanned form 10 MHz to 5 GHz and all emissions less than 15 dB below the limits were recorded.

RF In: 0 dBm @ 460 MHz
RF Out: 43.3 dBm @ 470 MHz
Modulation: FM modulation with 9600 b/s random data, Freq. Dev. = 2.5 kHz

FREQUENCY (MHz)	RF LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
940.0	-23.5	-20.0	-3.5	PASS
2820.0	-28.2	-20.0	-8.2	PASS

The emissions were scanned form 10 MHz to 5 GHz and all emissions less than 15 dB below the limits were recorded.

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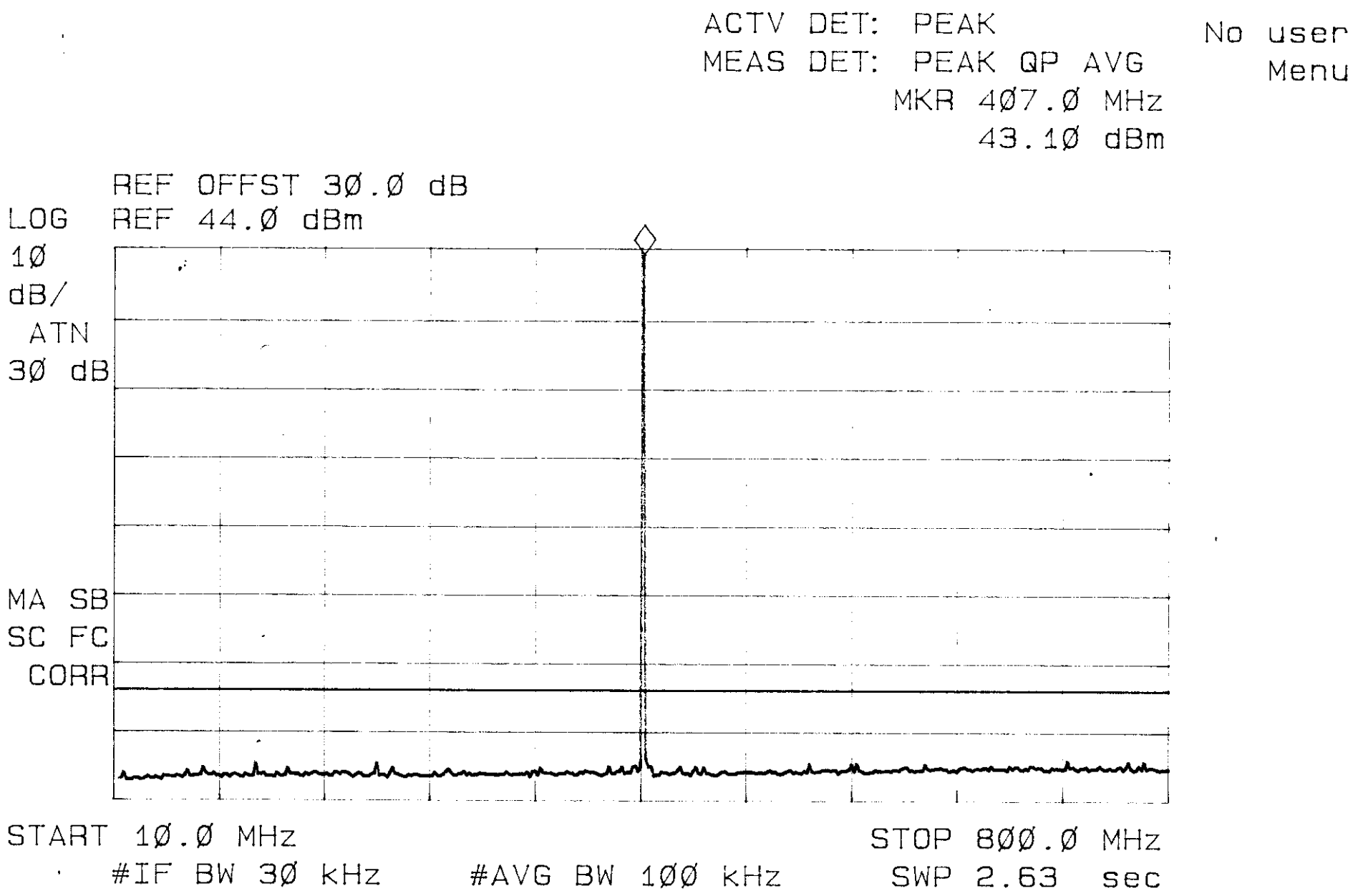
FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 415 MHz, Modulation: FM with 2.5 kHz Sine Wave Signal
TX RF OUT (Translated from the RF In Signal): 43.2 dBm, 406 MHz

Date: Jan.. 22 /1999
Tested by: Hung Trinh

/17



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FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF In: 0 dBm, 405 MHz, Modulation: FM with 2.5 kHz Sine Wave Signal
TX RF Out (Translated from th RF In Signal): 43.2 dBm, 406 MHz

Date: Jan. 22, 1999
Tested by: Hung Trinh

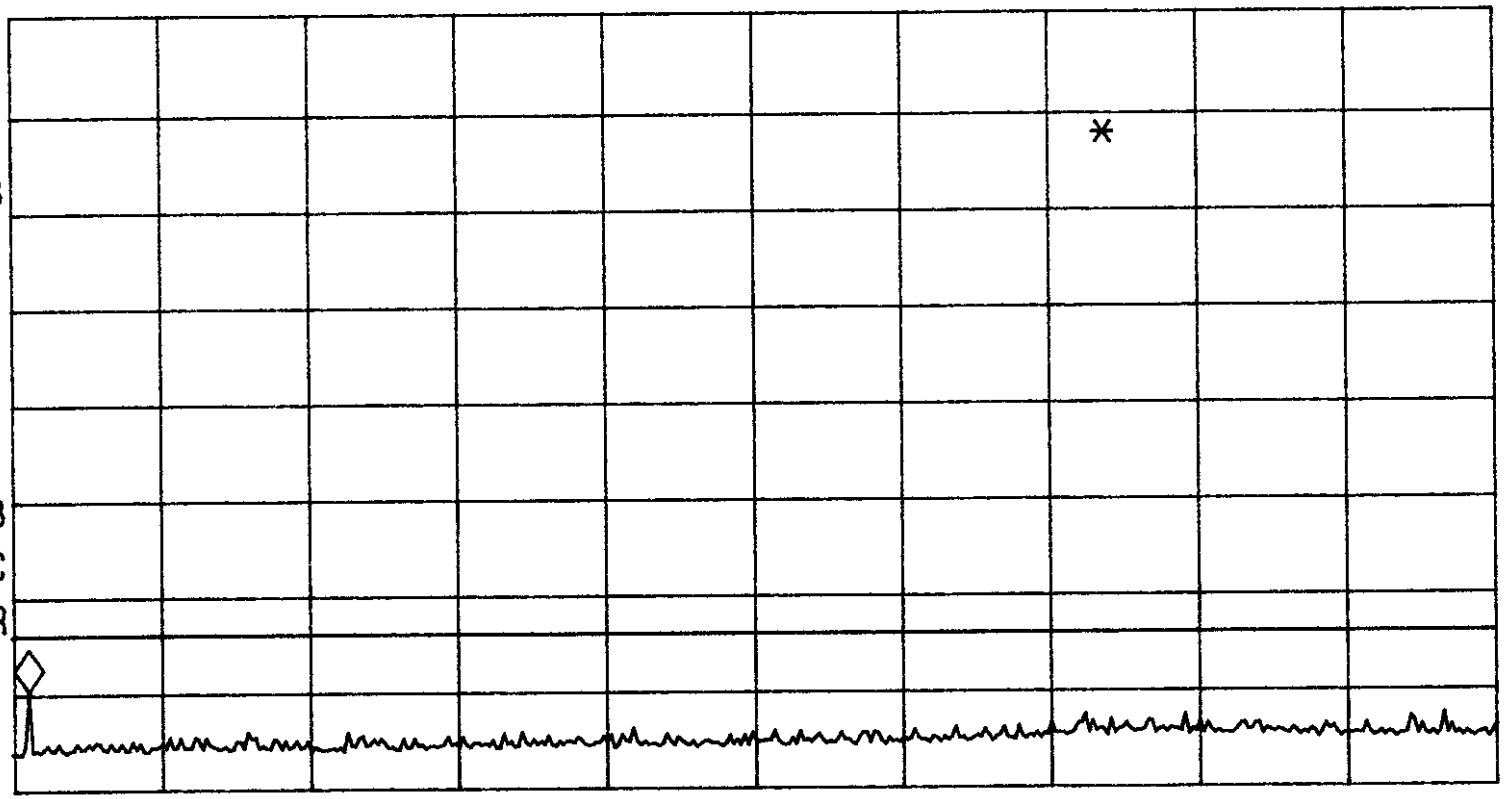
hp

MARKER
817 MHz
-25.69 dBm

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 817 MHz
-25.69 dBm

No user Menu

REF OFFST 3Ø.Ø dB
LOG REF 44.Ø dBm
1Ø dB/
ATN 3Ø dB



VA SB
SC FC
CORR

START 8ØØ MHz
STOP 2.5ØØ GHz
#IF BW 3Ø kHz
#AVG BW 1ØØ kHz
SWP 5.67 sec

UltraTech
Engineering Labs Inc.

FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 415 MHz, Modulation: FM with 2.5 kHz Sine Wave Signal
TX RF OUT (Translated from the RF In Signal): 43.2 dBm, 406 MHz

Date: Jan. 22 /1999
Tested by: Hung Trinh

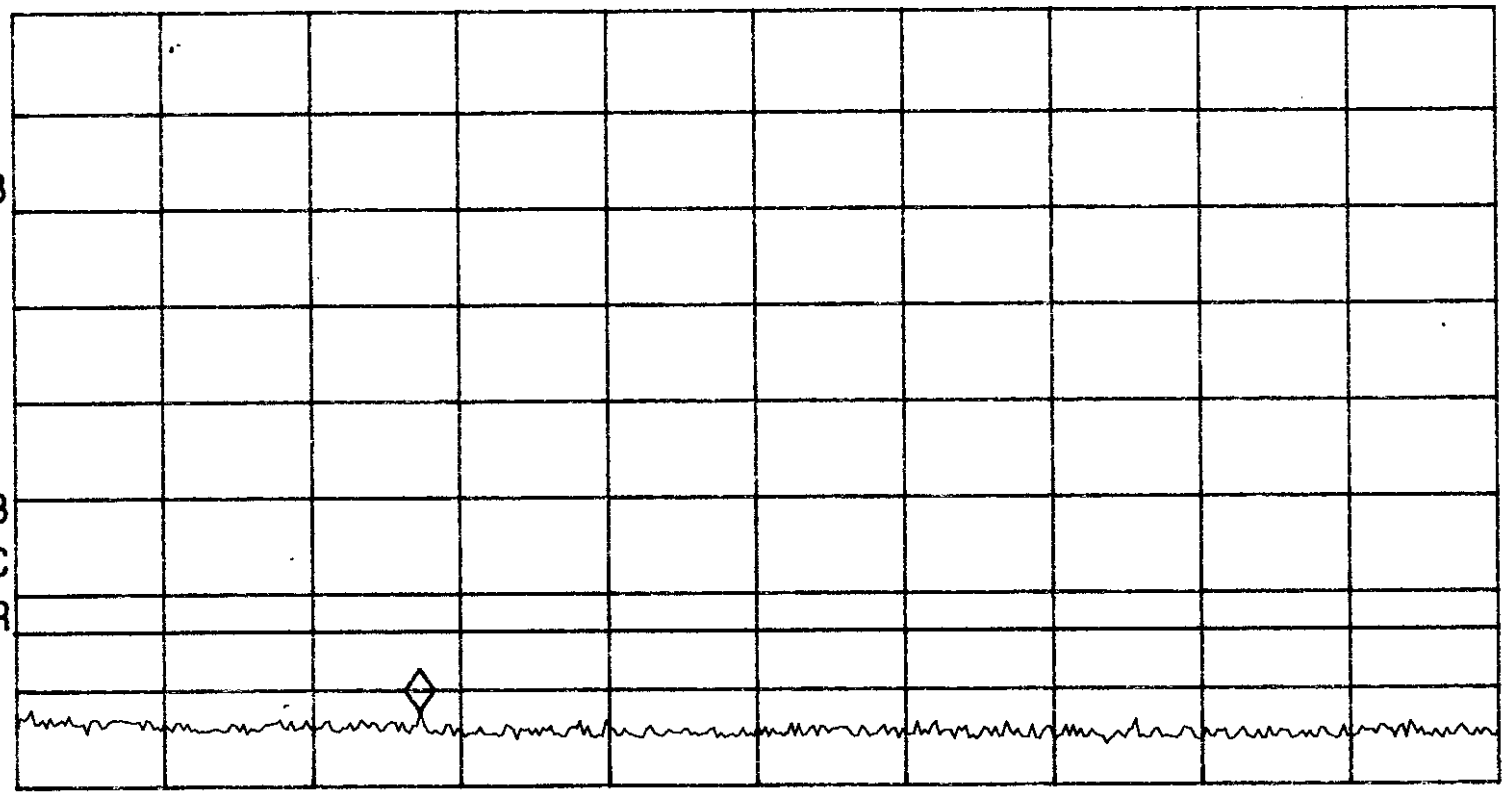
hp

STOP
5.ØØØ GHz

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 3.311 GHz
-28.27 dBm

No user
Menu

REF OFFST 3Ø.Ø dB
LOG REF 44.Ø dBm
1Ø
dB/
ATN
3Ø dB



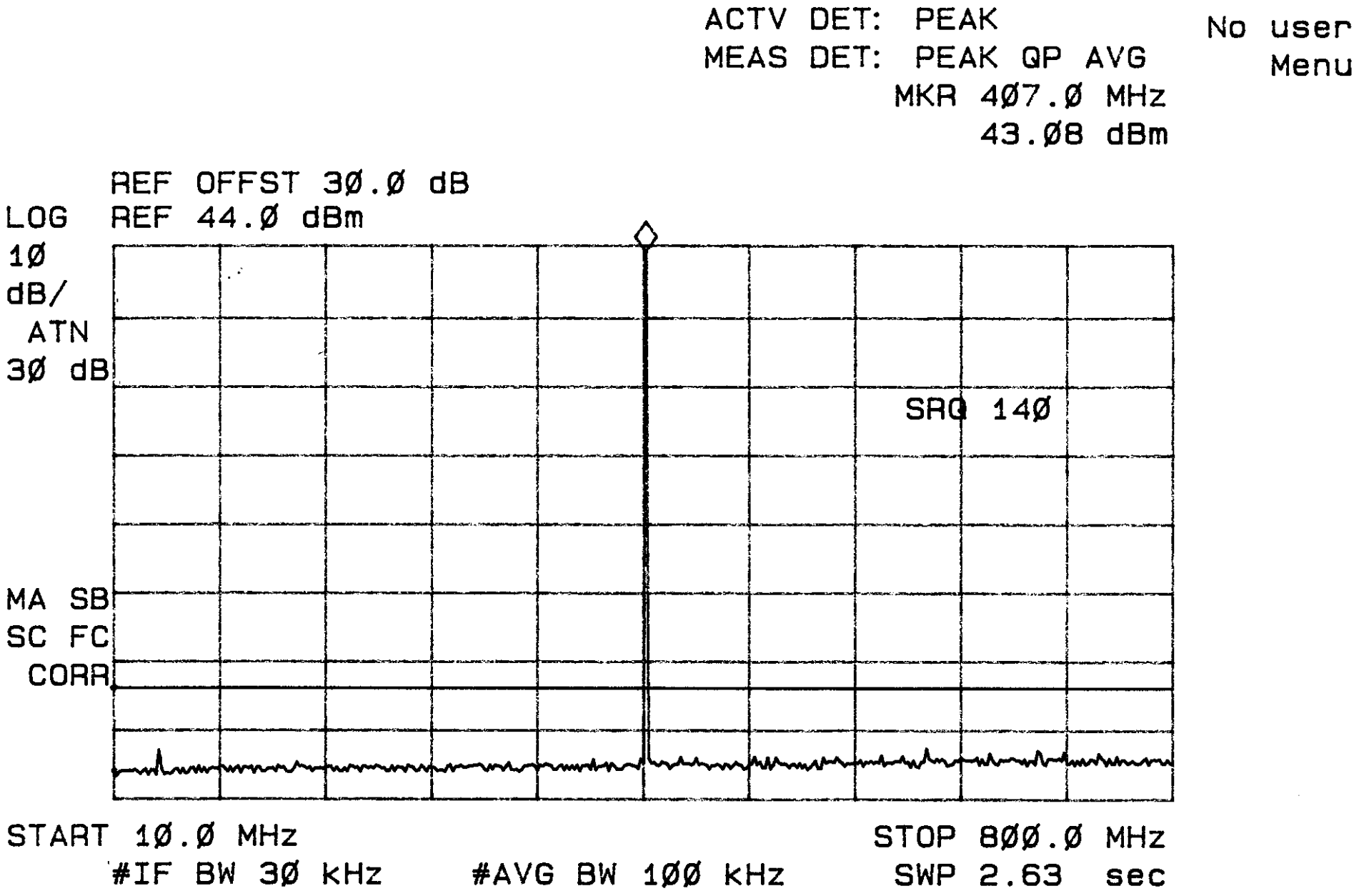
MA SB
SC FC
CORR

START 2.679 GHz
STOP 5.ØØØ GHz
#IF BW 3Ø kHz
#AVG BW 1ØØ kHz
SWP 7.74 sec

UltraTech Engineering Labs Inc.

FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 415 MHz, Modulation: FM with 9600 b/s random data
TX RF OUT (Translated from the RF In Signal): 43.2 dBm, 406 MHz

Date: Jan. 22 /1999
Tested by: Hung Trinh



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Engineering Labs Inc.

FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF In: 0 dBm, 415 MHz, Modulation: FM with 9600 b/s random data
TX RF Out (Translated from th RF In Signal): 432 dBm, 406 MHz

Date: Jan. 28, 1999
Tested by: Hung Trinh

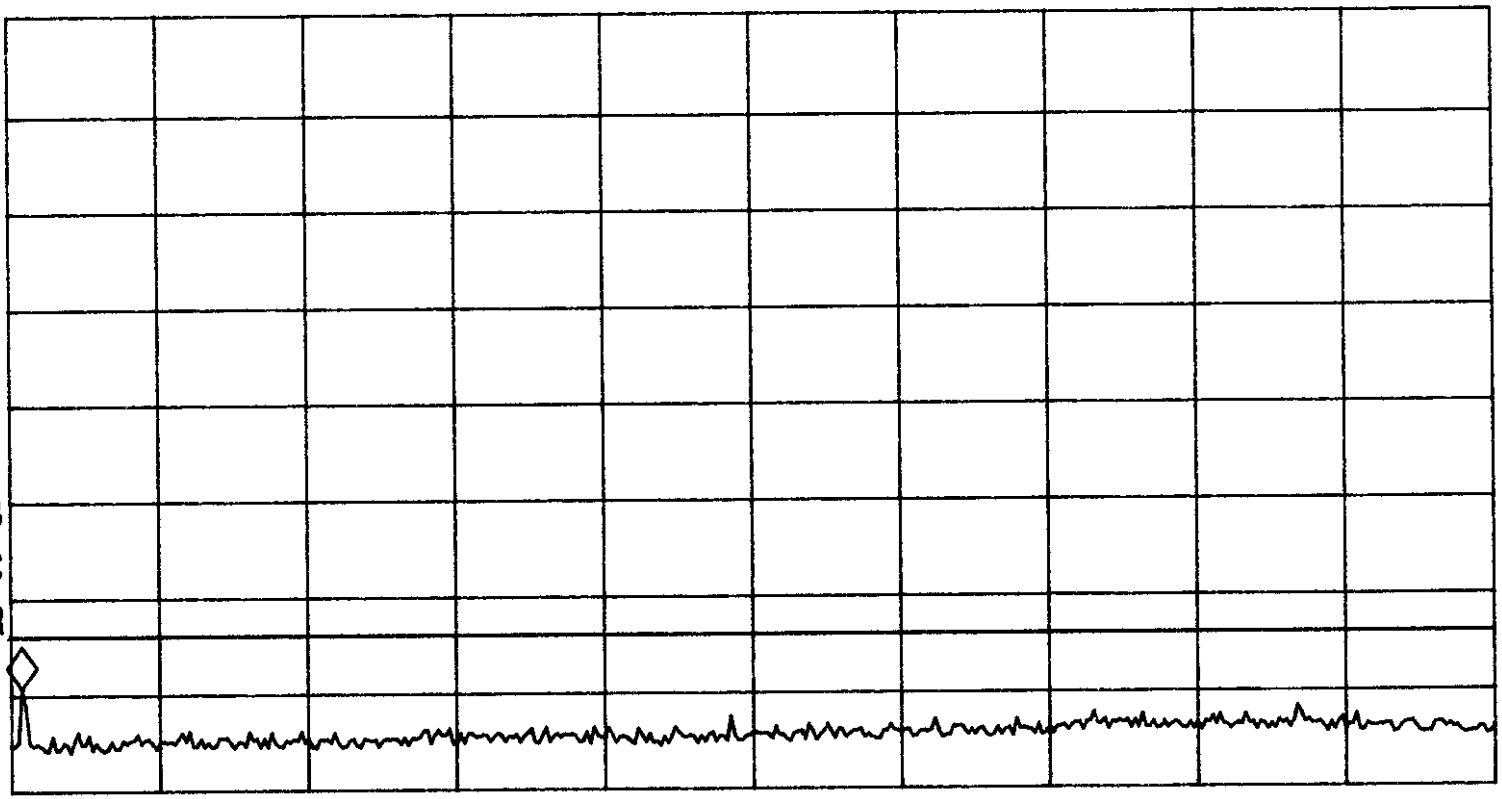
hp

MARKER
813 MHz
-25.36 dBm

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 813 MHz
-25.36 dBm

No user Menu

REF OFFST 3Ø.Ø dB
LOG REF 44.Ø dBm
1Ø dB/
ATN 3Ø dB



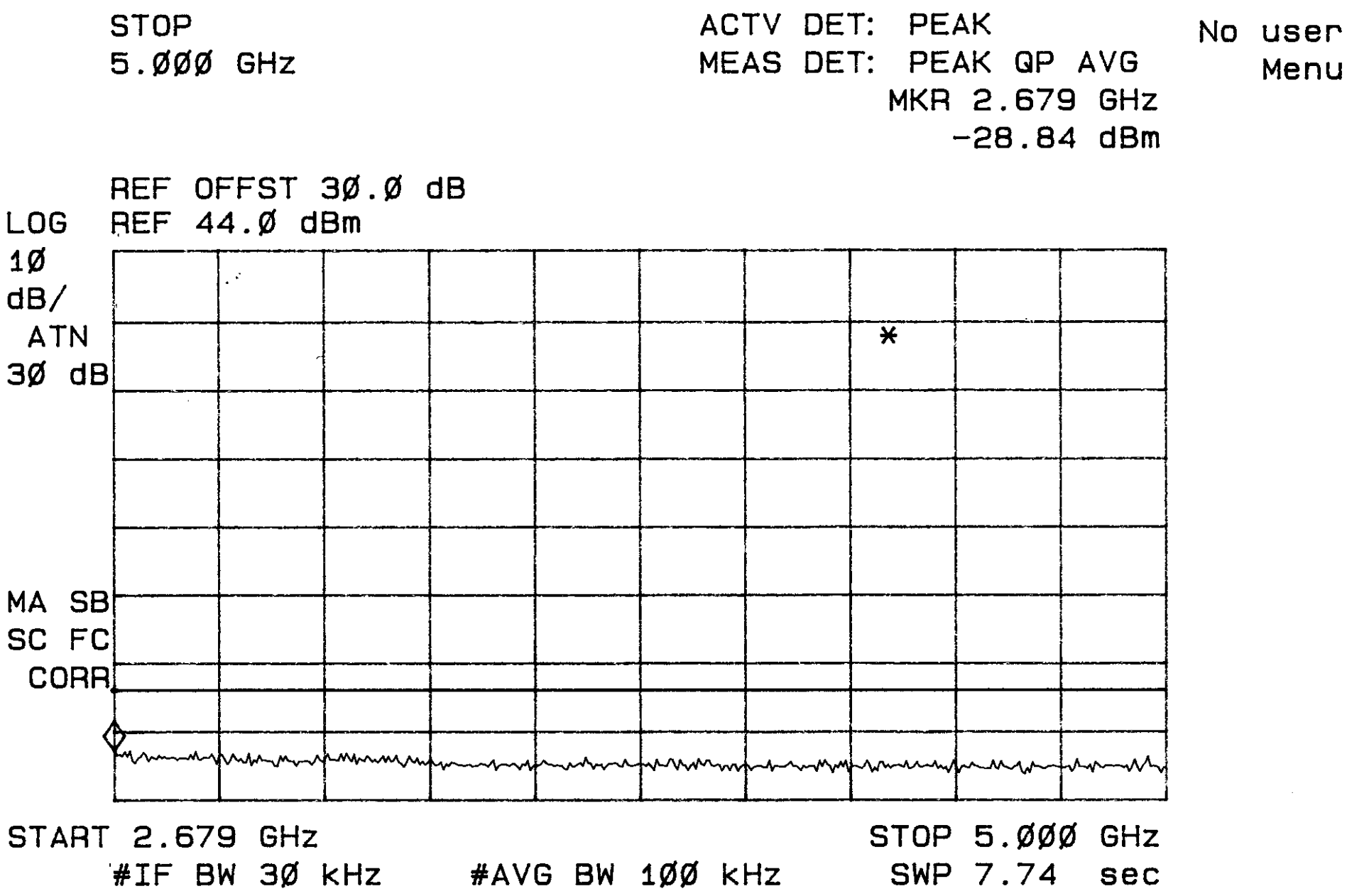
MA SB
SC FC
CORR

START 8ØØ MHz
STOP 2.5ØØ GHz
#IF BW 3Ø kHz
#AVG BW 1ØØ kHz
SWP 5.67 sec

UltraTech Engineering Labs Inc.

FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 415 MHz, Modulation: FM with 9600 b/s random data
TX RF OUT (Translated from the RF In Signal): 43.2 dBm, 406 MHz

Date: Jan. 22 /1999
Tested by: Hung Trinh



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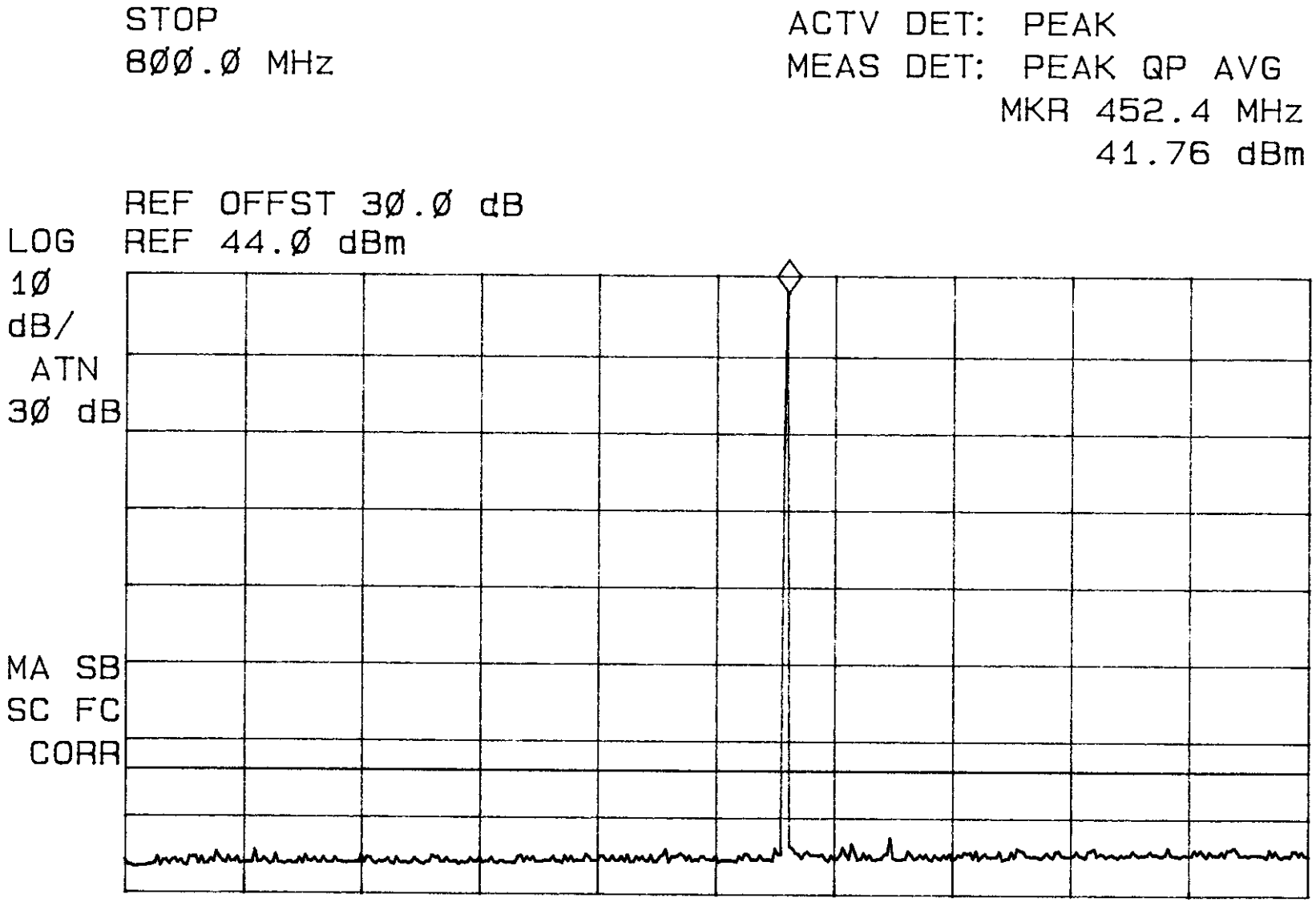
FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 2.5 kHz Sine Wave Signal
TX RF OUT (Translated from the RF In Signal): 42.5 dBm, 450 MHz

Date: Jan.. 6 /1999
Tested by: Hung Trinh



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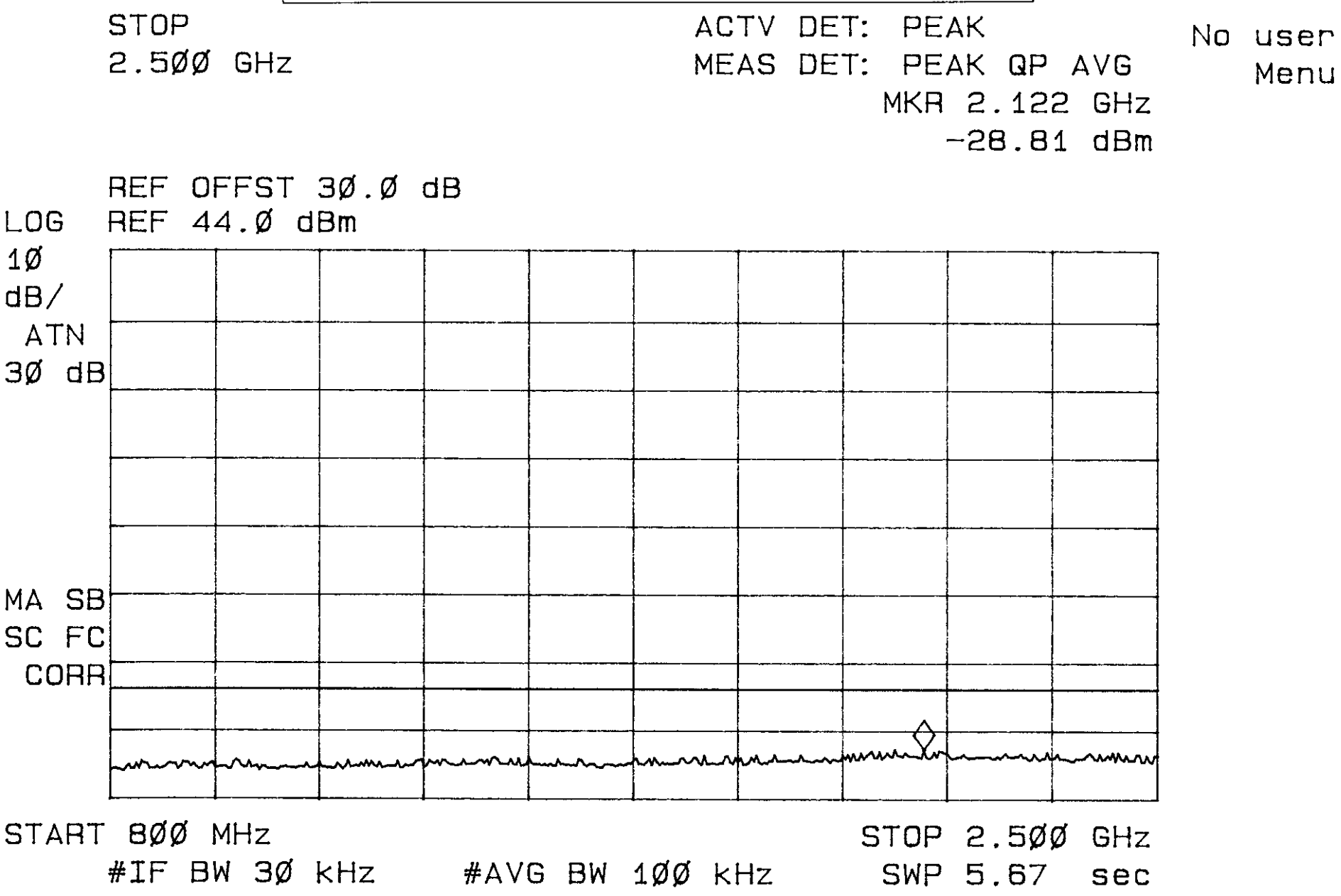
FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 2.5 kHz Sine Wave Signal
TX RF OUT (Translated from the RF In Signal): 462.5 dBm, 450 MHz

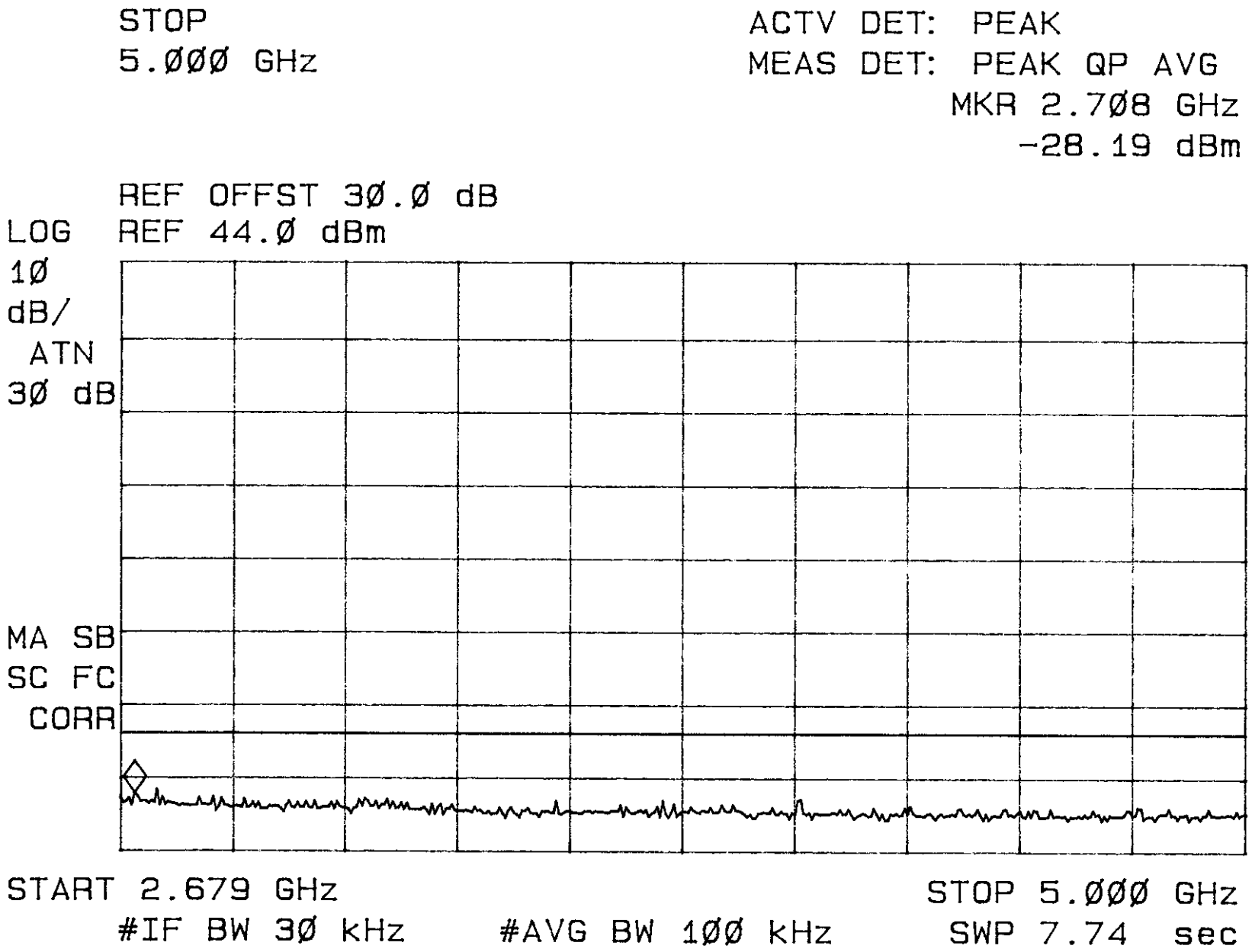
Date: Jan.. 6 /1999
Tested by: Hung Trinh



UltraTech
Engineering Labs Inc.

FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 2.5 kHz Sine Wave Signal
TX RF OUT (Translated from the RF In Signal): 462.5 dBm, 450 MHz

Date: Jan.. 6 /1999
Tested by: Hung Trinh



UltraTech
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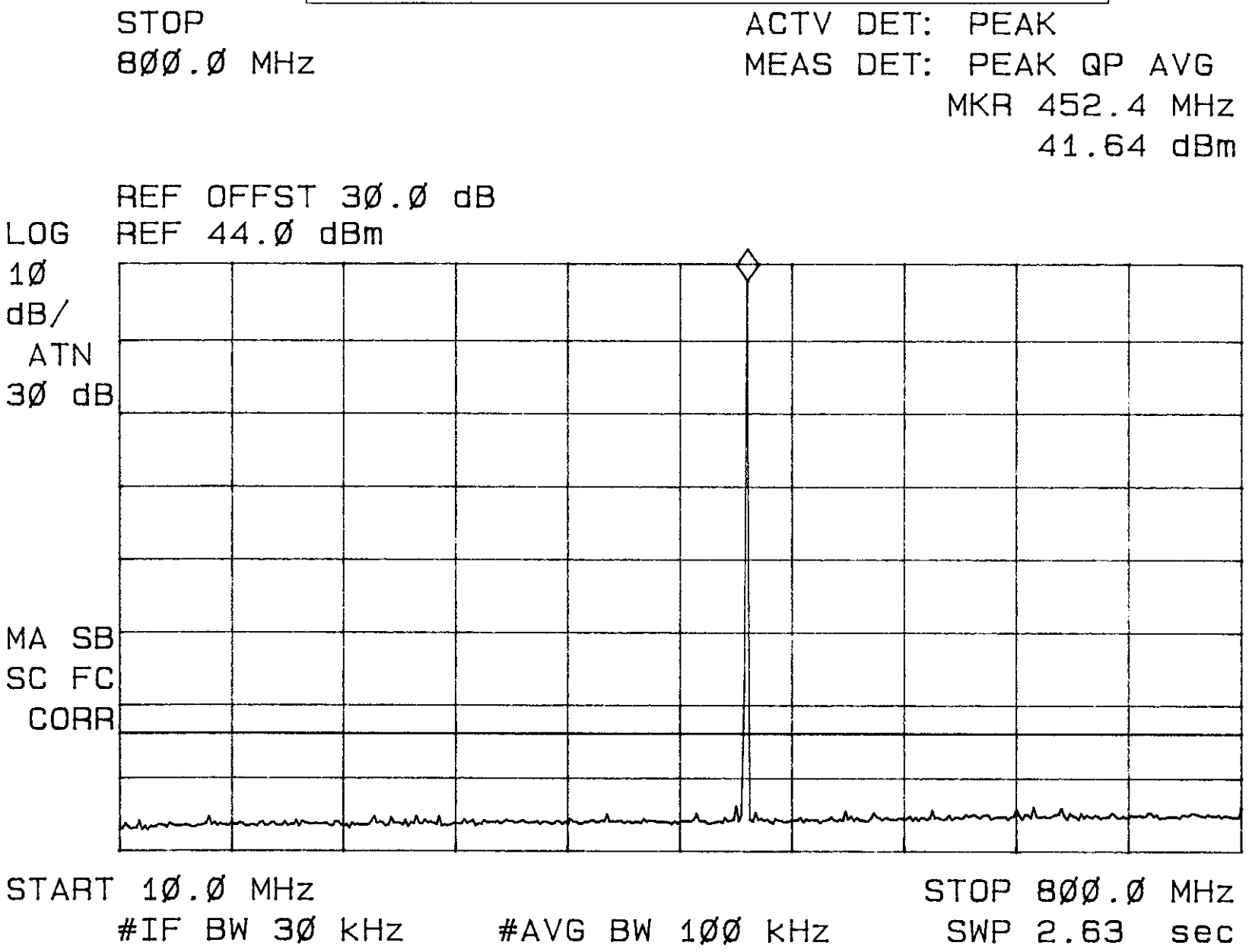
FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 9600 b/s random data
TX RF OUT (Translated from the RF In Signal): 462.5 dBm, 450 MHz

Date: Jan.. 6 /1999
Tested by: Hung Trinh



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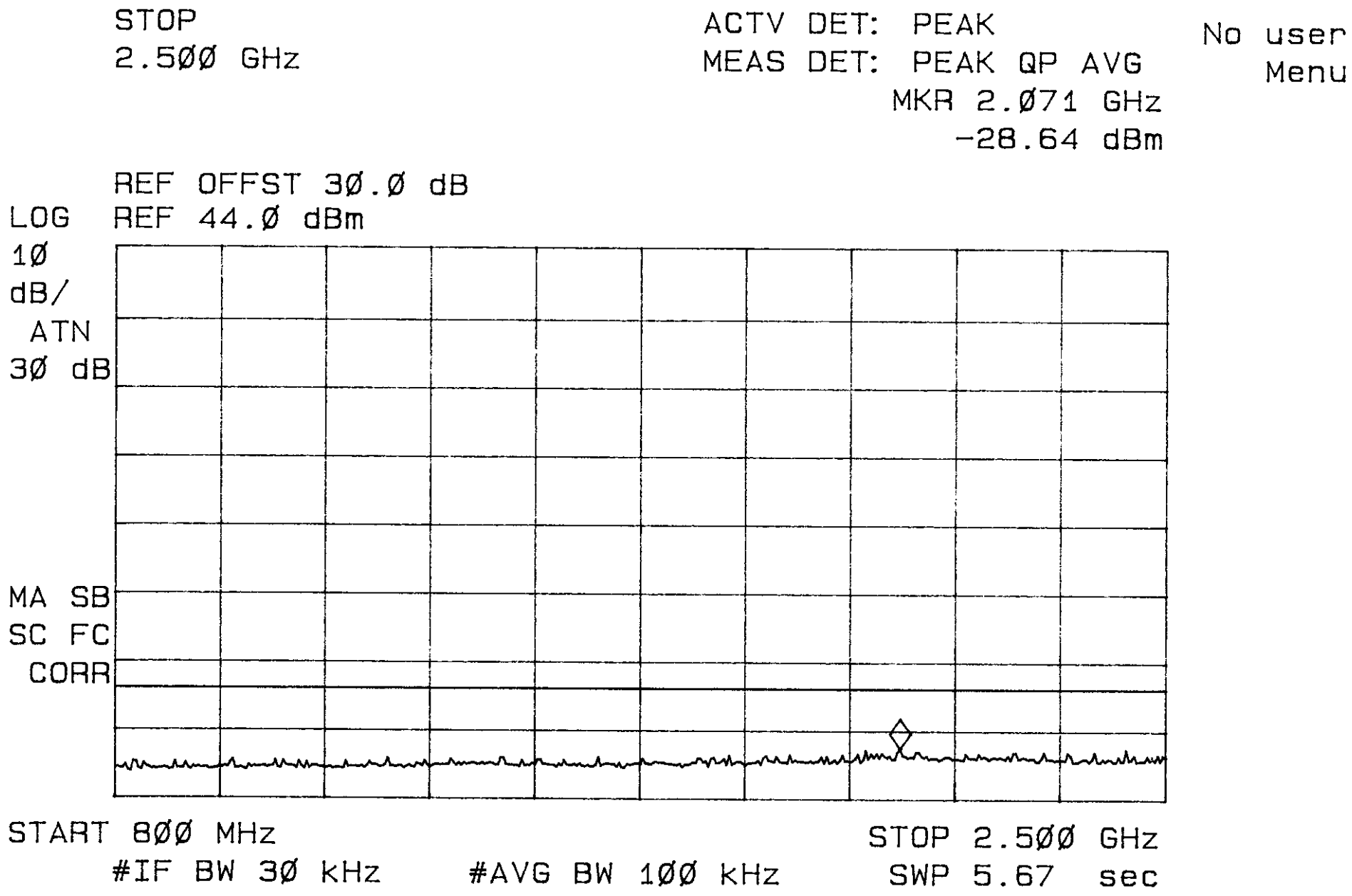
FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 9600 b/s random data
TX RF OUT (Translated from the RF In Signal): 462.5 dBm, 450 MHz

Date: Jan.. 6/1999
Tested by: Hung Trinh



UltraTech
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FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 9600 b/s random data
TX RF OUT (Translated from the RF In Signal): 42.3 dBm, 450 MHz

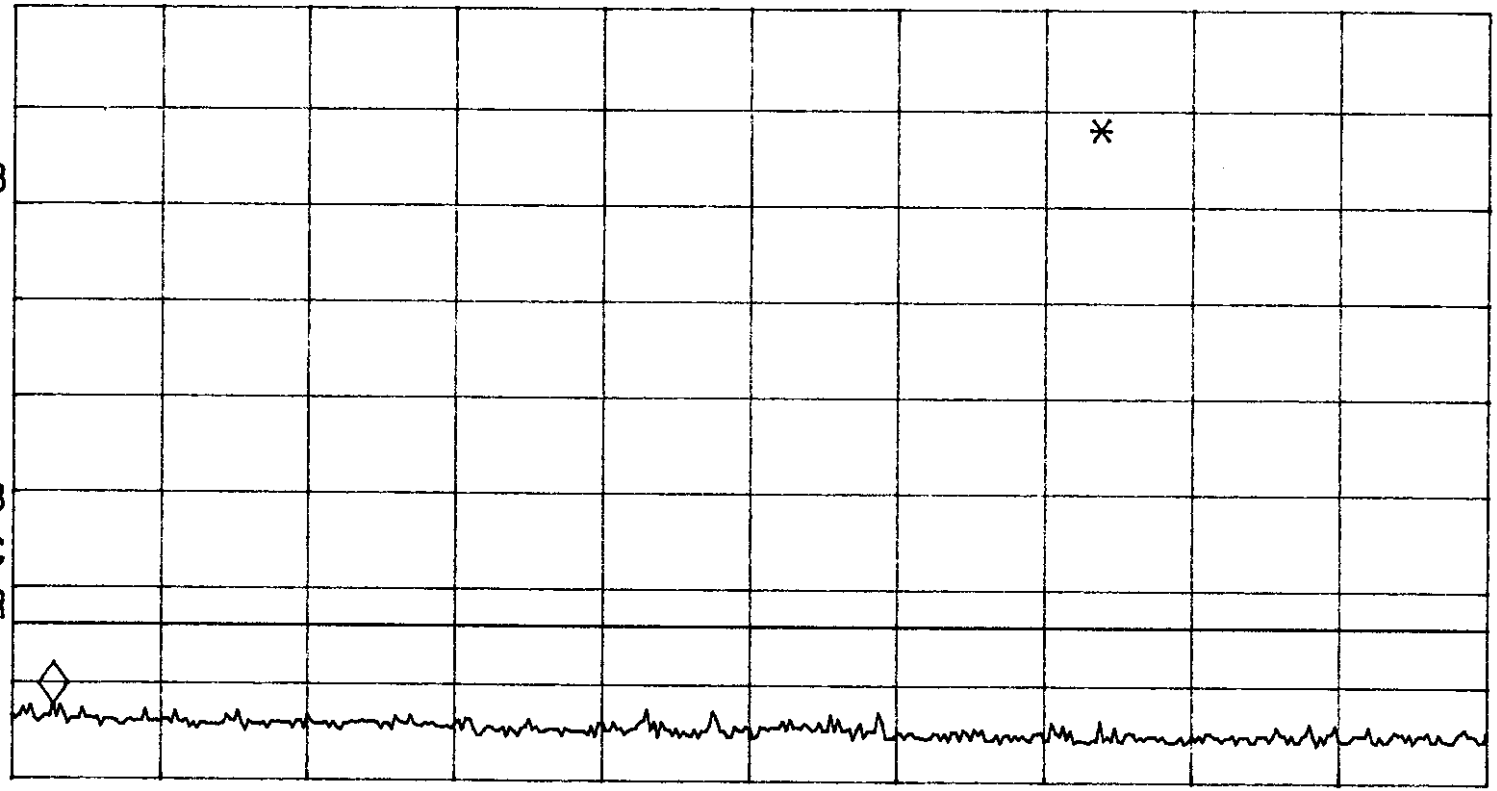
Date: Jan.. 6 /1999
Tested by: Hung Trinh

STOP
5.ØØØ GHz

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.742 GHz
-28.36 dBm

No user Menu

REF OFFST 3Ø.Ø dB
LOG REF 44.Ø dBm
1Ø
dB/
ATN
3Ø dB



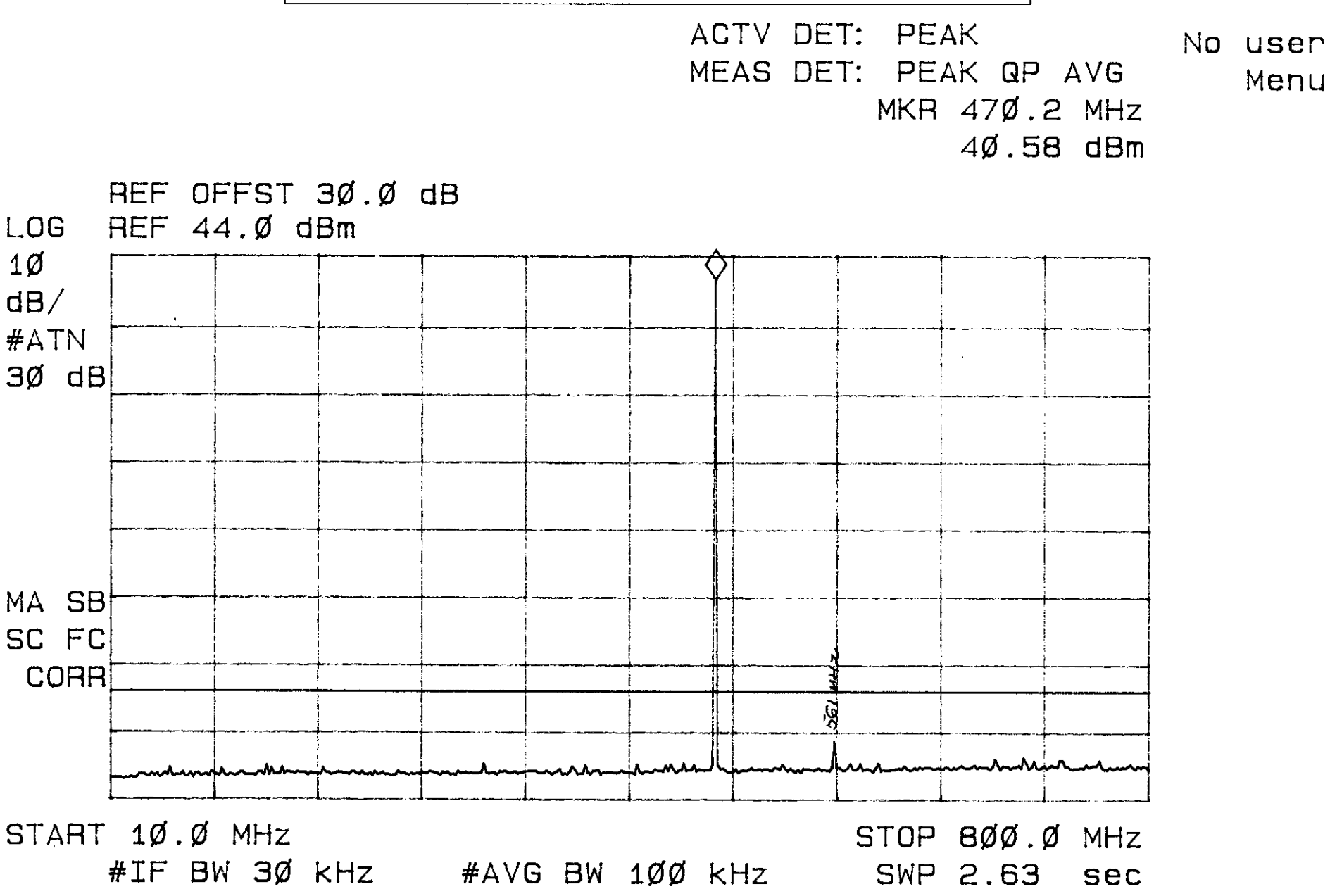
MA SB
SC FC
CORR

START 2.679 GHz
STOP 5.ØØØ GHz
#IF BW 3Ø kHz
#AVG BW 1ØØ kHz
SWP 7.74 sec

UltraTech
Engineering Labs Inc.

FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 2.5 kHz Sine Wave Signal
TX RF OUT (Translated from the RF In Signal): 43.3 dBm, 470 MHz

Date: Jan.. 12 /1999
Tested by: Hung Trinh



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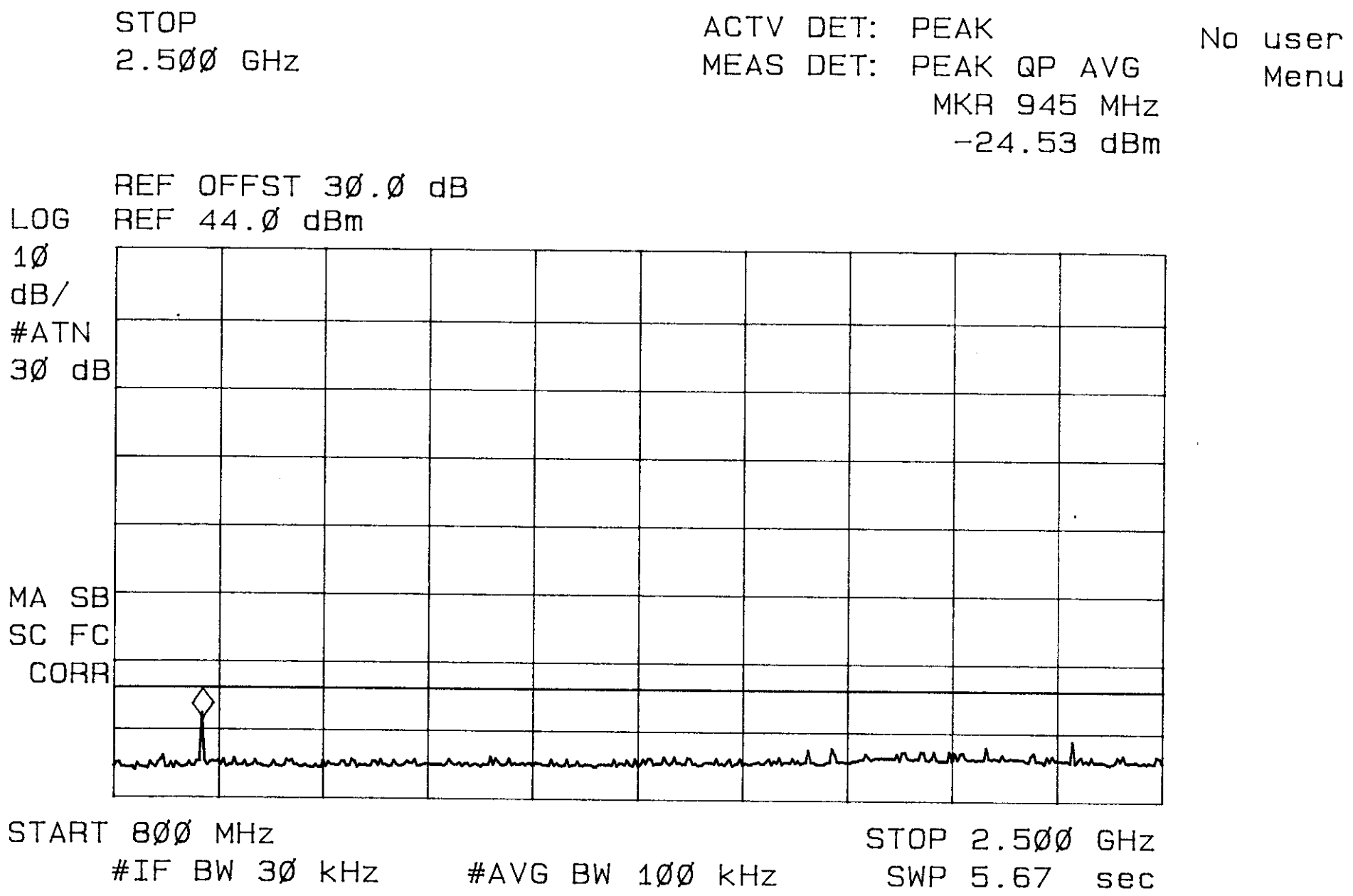
FUTURECOM UHF CHANNEL MODULE TRANSMITTER

Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 2.5 kHz Sine Wave Signal

TX RF OUT (Translated from the RF In Signal): 43.3 dBm, 470 MHz

Date: Jan.. 12 /1999

Tested by: Hung Trinh



UltraTech Engineering Labs Inc.

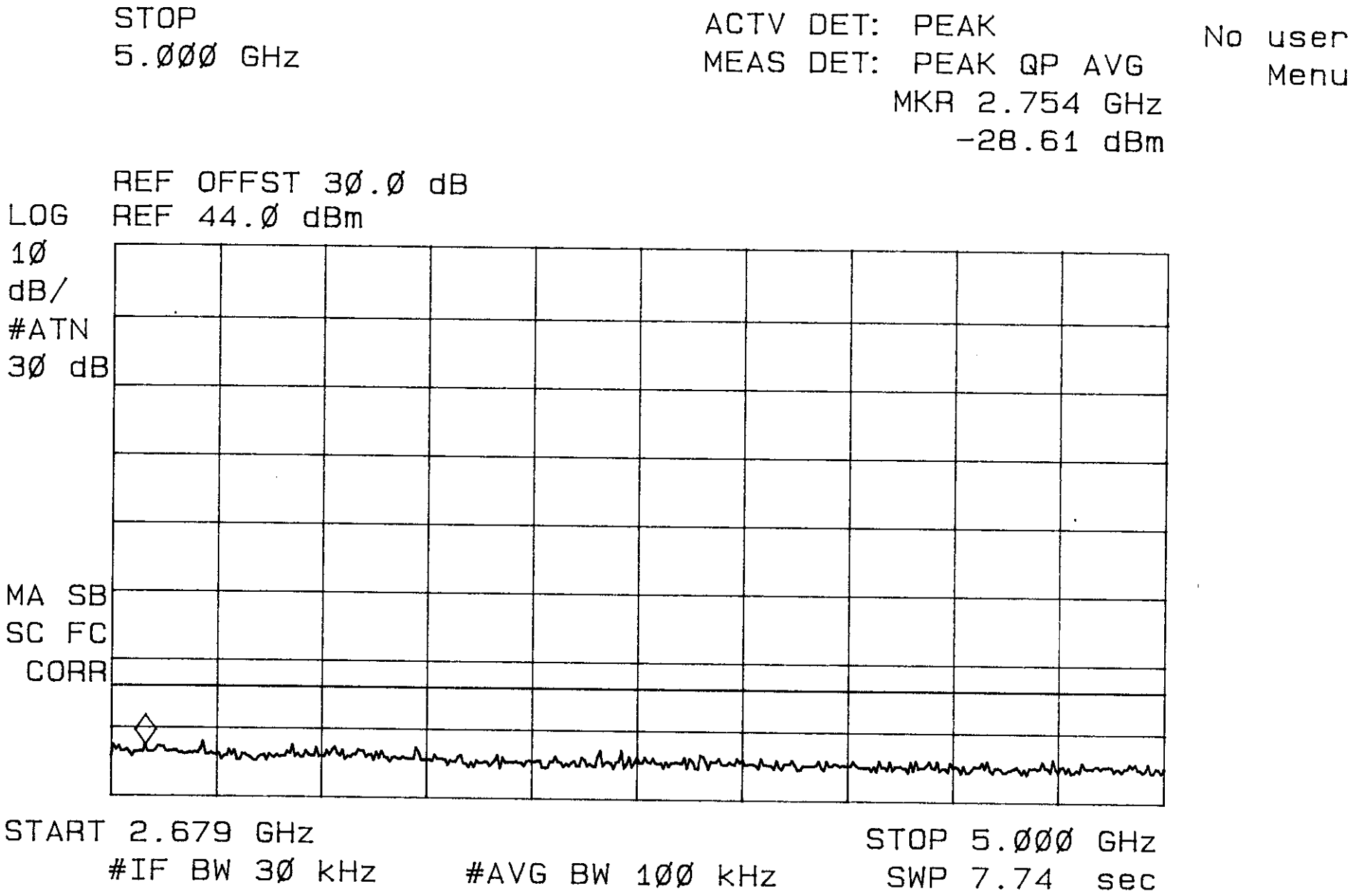
FUTURECOM UHF CHANNEL MODULE TRANSMITTER

Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 2.5 kHz Sine Wave Signal

TX RF OUT (Translated from the RF In Signal): 43.3 dBm, 470 MHz

Date: Jan. 12 /1999

Tested by: Hung Trinh

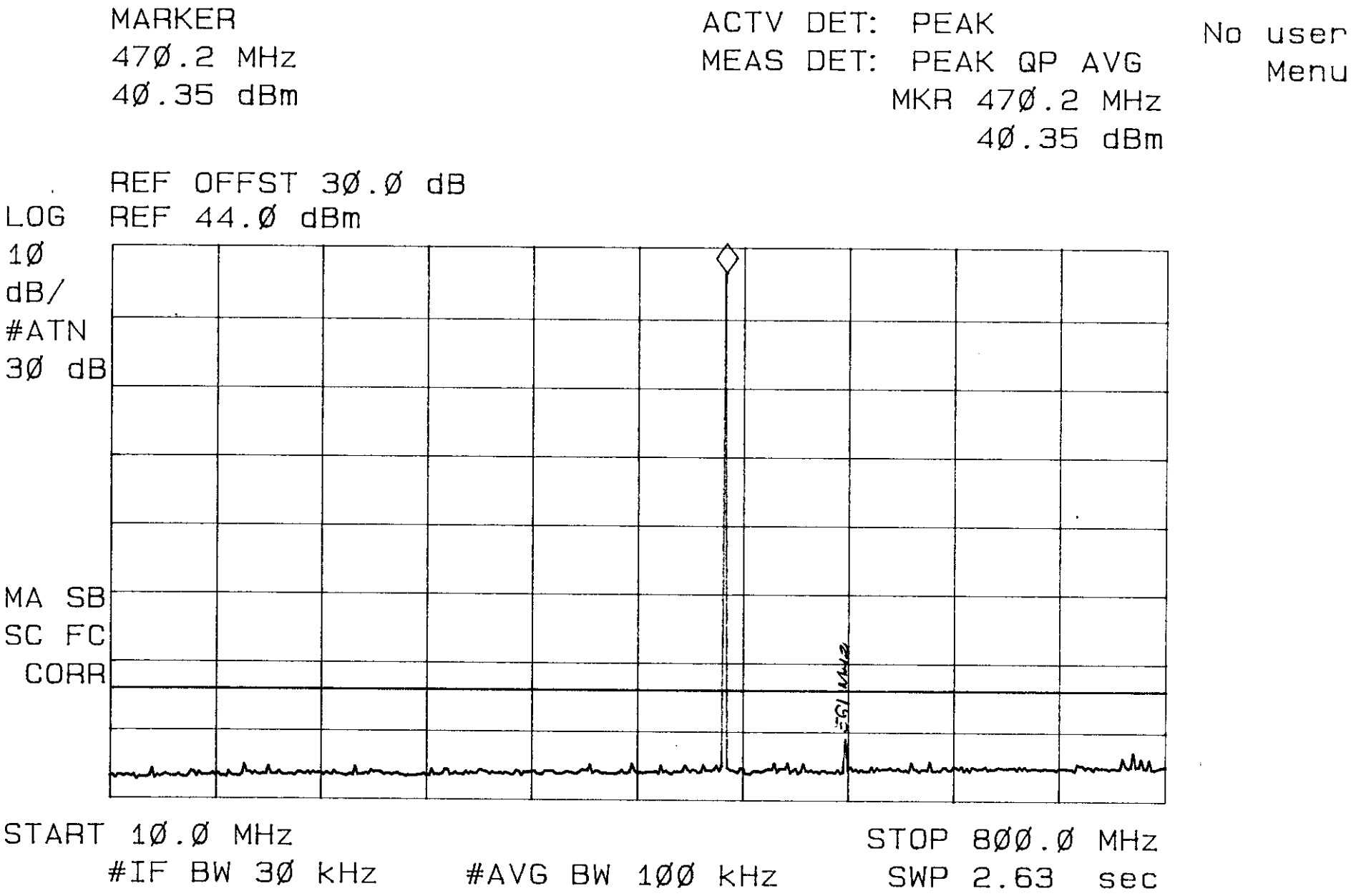


UltraTech
Engineering Labs Inc.

FUTURECOM UHF CHANNEL MODULE TRANSMITTER

Rx RF IN: 0 dBm, 450 MHz, Modulation: FM with 9600 b/s random data
TX RF OUT (Translated from the RF In Signal): 43.3 dBm, 470 MHz

Date: Jan.. 12 /1999
Tested by: Hung Trinh



UltraTech Engineering Labs Inc.

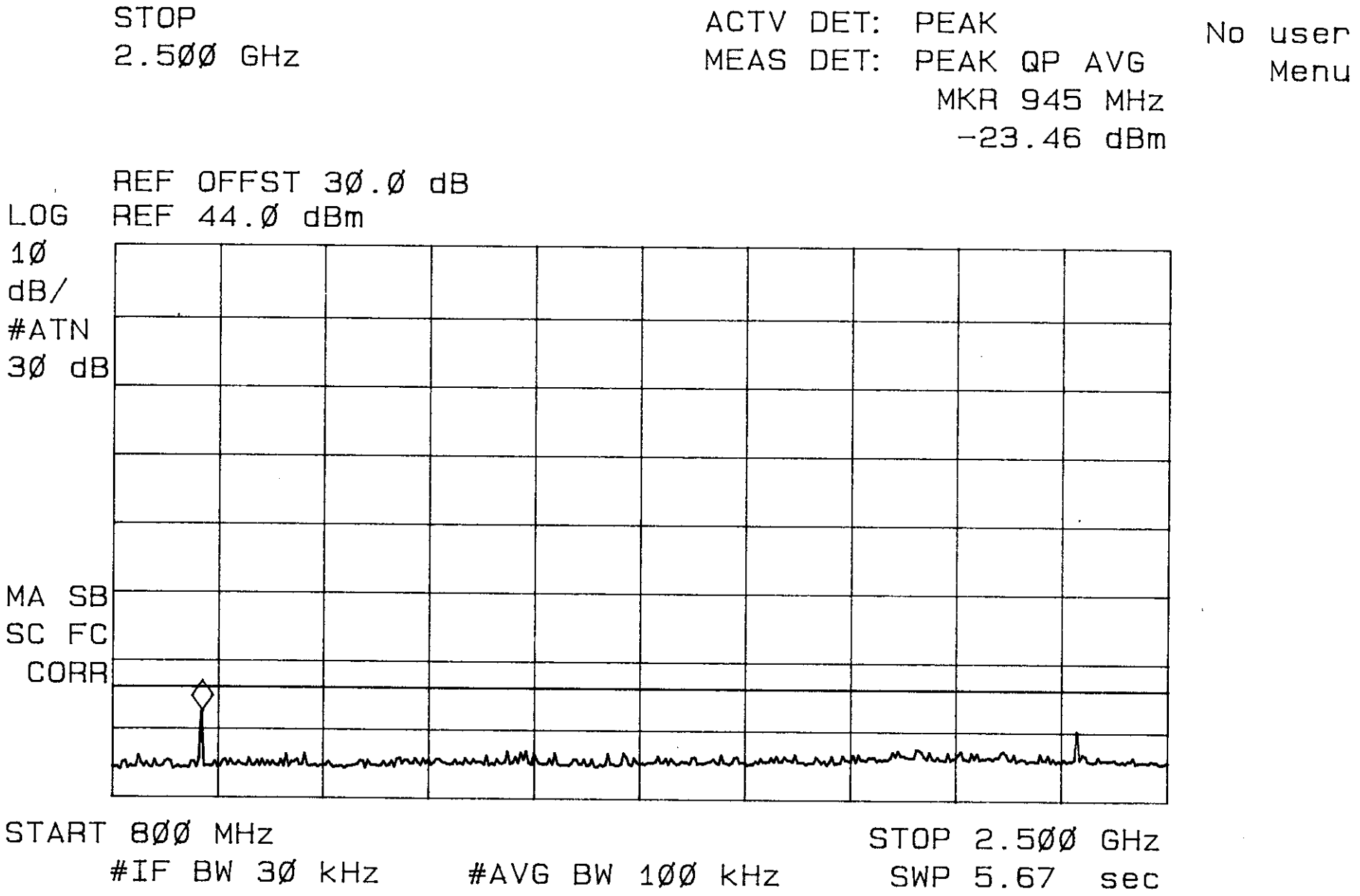
FUTURECOM UHF CHANNEL MODULE TRANSMITTER

Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 9600 b/s random data

TX RF OUT (Translated from the RF In Signal): 43.3 dBm, 470 MHz

Date: Jan.. 12 /1999

Tested by: Hung Trinh



UltraTech
Engineering Labs Inc.

FUTURECOM UHF CHANNEL MODULE TRANSMITTER
Rx RF IN: 0 dBm, 460 MHz, Modulation: FM with 9600 b/s random data
TX RF OUT (Translated from the RF In Signal): 43.3 dBm, 470 MHz

Date: Jan.. 12 /1999
Tested by: Hung Trinh