CLASS II PERMISSIVE CHANGE

ENGINEERING TEST REPORT

ON:
VT1901 / VT1920C CORDLESS TELEPHONE

FCC ID: EW780-4042-00

IN ACCORDANCE WITH:
FCC PART 15, SUBPART C
PARAGRAPH 15.249 - 900 MHz CORDLESS TELEPHONES

PROJECT NO.: 7VT025-14CS1

TESTED FOR:

VTECH ENGINEERING CANADA LTD.
200-7671 ALDERBRIDGE WAY
RICHMOND, BC V6X 1Z9

TESTED BY:

CERTELECOM LABORATORIES INC.
3325 RIVER ROAD, R.R. 5
OTTAWA, ONTARIO K1V 1H2

JANUARY 1998

This document contains 30 pages including this one.

EQUIPMENT DESCRIPTION: 900 MHz Cordless Telephone

MODEL NO.: VT1901 / VT1920C

SERIAL NO.: Base 261097002000002 Handset 2621097002000002

GENERAL:

The models VT1901 and VT1920c are identical other than VT1920c has LCD display and caller identification decoder.

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15 Subpart C, Paragraph 15.249.

ABSTRACT:

NAME OF TEST	PARA. NO.	RESULTS
HANDSET		
Radiated Emissions	15.249	Complies
BASE		
Radiated Emissions	15.249	Complies
Powerline Conducted Emissions		Complies

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE. None

TESTED BY: Wayne Clarke DATE: FEB 17, 98
Wayne Clarke, Technologist

APPROVED BY: W Waterhouse DATE: 17th Feb 1998.
W. Waterhouse, RF Engineering Lab Manager

General Equipment Information (HANDSET)

TRANSMITTER

Frequency Range:	925 - 928 MHz
Frequency of Sample Tested:	925.37 MHz, 927.17 MHz
Tunable Bands:	One
Number of Channels:	10
Channel Spacing:	200 kHz
Emission Designator:	102k5F1D
Crystal Frequencies:	18.25 MHz
User Frequency Adjustment:	None

RECEIVER

Type of Receiver:	Super Heterodyne
Intermediate Frequencies:	10.7 MHz
Primary Power Requirement:	NICAD Battery Pack
Frequency Range:	902.3 - 905 MHz
Tunable Bands:	One
Designated Reception Mode:	102k5F1D
Operating Frequency of Sample Tested:	902.35, 904.45 MHz
User Frequency Adjustment:	None

EQUIPMENT MODIFICATIONS

Introduction

The following is a summary, of the changes between the original PDL and the PDL MKII cordless telephone platforms. The purpose of the MKII is to perform a cost reduction as well as performance improvements over the MKI platform. This document will discuss the changes to handset and to the base unit separately in the following sections.

Handset Changes

Changes to the handset do not involve any exterior cosmetic or chassis changes. The PCB dimensions remain unchanged as well as most of the major component locations and general topology. There is no change to the antenna or antenna structure.

Handset Unit RF Circuit Changes

The RF changes do not significantly change the RF circuit layout - most changes are limited to component values only. The structure of the RF circuit, the RF shielding configuration (including the location of internal partition walls), and the IF and LO frequencies are not changed in any way. Frequency control of the on-board oscillators is via an unchanged reference frequency circuit, and an unchanged PLL.

Change	Reason For Change
– SAW Filter F3 is changed from a leaded to a surface mount package.	Cost reduction, no performance change.
– Change Q2 from NE68139 to NE85630	Change package style for receiver LNA transistor for cost reduction. Transistor die remains the same.
– Change Q4 from NE85633 to NE85630	Change package style for 2nd receiver amp for cost reduction. Transistor die remains the same.
– Change Q1 from BFR92A to 2SC4083	Change transistor in transmit amp for cost reduction. Transistor die does not remain the same; however, its performance for this application is similar to that provided by the original transistor.

Handset Unit RF Circuit Changes, continued

Change	Reason For Change
- Delete Q10, Q11 (BFR92A) - Delete R56, R544 - Change R55, R43, C80, C73 to Or - Delete C25, C90 - Change R32, R41 from 470r to 300r	More detailed testing along with an improvement in the minimum input level spec for synthesizer U2 has revealed that the transmit and receive PLL buffers Q10 and Q11 are not required. Identical performance can be obtained eliminating Q10 & Q11 and slightly increasing the input level by reducing R32 and R41.
- Change Q8 from BFR92A to 2SC4083 - Change R31 from 150r 1% to 100r 1% - Change R29 from 47 r to 24r	Change transistor in transmit VCO for cost reduction. Transistor die does not remain the same; however, its performance for this application is similar to that provided by the original transistor. 2 bias resistor changes were made to maintain system performance.
- Change Q9 from BFR92A to 2SC4083 - Change R39 from 15k0 1% to 10k0 1% - Change R38 from 10k0 1% to 11k0 1%	Change transistor in receive VCO for cost reduction. Transistor die does not remain the same; however, its performance for this application is similar to that provided by the original transistor. 2 bias resistor changes were made to maintain system performance
- Remove C49 tuning cap - Remove C53 - Change C54 from 1p5 to N/U - Change C52 from 7p5 to 4p7 - Change R58 from 3k9 to 1k8 - Change C83 from 470n to 1u - Change C84 from 100n to 220n	Remove tuning capacitor from transmit VCO for cost reduction and to improve manufacturability and long-term reliability. Our manufacturing process control has demonstrated that we can remove the tuning capacitor from the VCO while maintaining the required level of performance. Removing the tuning cap eliminates any potential problems caused by drift and mechanical vibration. Surrounding capacitor and resistor changes are to compensate for the removal of the tuning cap.
- Remove C88 tuning cap - Remove C68 - Change C69 from 4p7 to 10p - Change C67 from 2p7 to 1p8 - Change R47 from 51k to 18k - Change C76 from 15n to 39n - Change C89 from 4n7 to 12n	Remove tuning capacitor from transmit VCO for cost reduction and to improve manufacturability and long-term reliability. Our manufacturing process control has demonstrated that we can remove the tuning capacitor from the VCO while maintaining the required level of performance. Removing the tuning cap eliminates any potential problems caused by drift and mechanical vibration. Surrounding capacitor and resistor changes are to compensate for the removal of the tuning cap

Handset Unit Audio Circuit Changes

The handset audio changes consist of changes to different packages and component substitutions to facilitate cost reductions.

Change	Reason For Change
– C103 & C87 have been changed from an SMD to a leaded package (now C91 & C123)	Cost reduction; no performance change.
– U11 will be directly die-bonded to a small daughter PCB and soldered directly to the main PCB.	Cost reduction; the exact same semiconductor die will be used, only the package is changed.
– Voltage regulator U5 (NS LP2981) will be substituted with a Torex XC62AP30 (U6)	Cost reduction; drop in replacement part.
– C98, C94 changed from SMD to leaded capacitor (now C93, C99) – C119 deleted	Cost reduction.

Base Unit Changes

Changes to the base do not involve any exterior cosmetic or chassis changes. There is no change to the antenna or antenna structure.

Changes to the base components are made to the RF circuit (the same changes as those made to the handset RF circuit), to the audio circuits and to the PCB construction. The original base unit consists of a single PCB that contains the RF, audio, and telephone line interface circuits. The revised base unit will contain 2 PCBs, splitting the telephone line interface from the RF and audio circuits.

Base Unit RF Circuit Changes

The RF changes made to the base unit do not significantly change the RF circuit layout - most changes are limited to component values only. The structure of the RF circuit, the RF shielding configuration (including the location of internal partition walls), and the IF and LO frequencies are not changed in any way. Frequency control of the onboard oscillators is via an unchanged reference frequency circuit, and an unchanged PLL.

Base Unit RF Circuit Changes, continued

Change	Reason For Change
– SAW Filter F3 is changed from a leaded to a surface mount package.	Cost reduction, no performance change.
– Change Q2 from NE68139 to NE68130 (now Q24)	Change package style for receiver LNA transistor for cost reduction. Transistor die remains the same.
– Change Q4 from NE85633 to NE85630	Change package style for 2nd receiver amp for cost reduction. Transistor die remains the same.
– Change Q1 from BFR92A to 2SC4083	Change transistor in transmit amp for cost reduction. Transistor die does not remain the same; however, its performance for this application is similar to that provided by the original transistor.
– Delete Q10, Q11 (BRF92A) – Delete R56, R44, R55, R43,C80, C73, C25 and C90	More detailed testing along with an improvement in the minimum input level spec for synthesizer U2 has revealed that the transmit and receive PLL buffers Q10 and Q11 are not required.
– Change Q8 from BFR92A to 2SC4083	Change transistor in transmit VCO for cost reduction. Transistor die does not remain the same; however, its performance for this application is similar to that provided by the original transistor.
– Change Q9 from BFR92A to 2SC4083	Change transistor in transmit VCO for cost reduction. Transistor die does not remain the same; however, its performance for this application is similar to that provided by the original transistor.
– Remove C49 tuning cap – Remove C53 – Change C52 from 4p7 to 9p1 – Change R58 from 3k9 to 1k8 – Change C83 from 470n to 1u – Change C84 from 100n to 220n	Remove tuning capacitor from transmit VCO for cost reduction and to improve manufacturability and long-term reliability. Our manufacturing process control has demonstrated that we can remove the tuning capacitor from the VCO while maintaining the required level of performance. Removing the tuning cap eliminates any potential problems caused by drift and mechanical vibration. Surrounding capacitor and resistor changes are to compensate for the removal of the tuning cap.

Base Unit RF Circuit Changes, continued

Change	Reason For Change
– Remove C88 tuning cap – Remove C68 – Change C69 from 4p7 to 10p – Change C67 from 2p7 to 1p8 – Change R48 from 51k to 18k – Change C76 from 15n to 39n – Change C89 from 4n7 to 12n	Remove tuning capacitor from transmit VCO for cost reduction and to improve manufacturability and long-term reliability. Our manufacturing process control has demonstrated that we can remove the tuning capacitor from the VCO while maintaining the required level of performance. Removing the tuning cap eliminates any potential problems caused by drift and mechanical vibration. Surrounding capacitor and resistor changes are to compensate for the removal of the tuning cap.

Base Unit Baseband Changes

Change	Reason For Change
– All components on the Line Interface PC8 are not leaded components (as opposed to SDM). All values are the same except as described below.	Cost reduction.
– U8 will be directly die-bonded to a small daughter PCB and soldered directly to the main PCB.	Cost reduction; the exact same semiconductor die will be used, only the packaging is changed.
– Voltage regulator U6 (NS LP2981) will be substituted with a Torex XC6AP30 U9	Cost reduction; drop in replacement part.
– C120, C87 changed from SMD to leaded capacitor (now C91, C99)	Cost reduction
– Optocoupler U4 deleted – Delete R46, R84, R85, R88, R86 and Q12 – Change U10C to U10A	Circuit simplification which will allow the ring detection to take place using the high input impedance OP-Amp circuit already in place for extracting type II CID information from tip and ring.
– Change U10D to U1C on line interface PCB – Delete Q14, R116 and R120 – Delete U10 to U1 on the line interface PCB	Designator and change to leaded on line interface PCB.
– Delete LM324 U9 and replace with an LM393 comparator U10	Replace LM324 where used as a comparator with an actual comparator for cost reduction.

NAME OF TEST: Radiated Emissions (HANDSET)	PARA. NO.: 15.249(a) & (c)
TESTED BY: Wayne Clarke	DATE: January 29, 1998

TEST CONDITIONS: Standard Temperature and Humidity
Standard Test Voltage

MINIMUM STANDARD:

Fundamental Frequency (MHz)	Field Strength of Fundamental (mV/m @ 3m)	Field Strength of Fundamental (dBμV/m @ 3m)	Field Strength of Spurious (μV/m @ 3m)	Field Strength of Spurious (dBμV/m @ 3m)
902 - 928	50	94	500	54

The fundamental was searched up to the 10th harmonic with all relevant emissions being noted.

Any emissions radiated outside the specified frequency band, except for harmonics shall be attenuated by at least 50 dB below the level of the fundamental emission or meet the following limits, whichever is the lesser attenuation.

Frequency (MHz)	Field Strength (μV/m @ 3m)	Field Strength (db @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

TEST RESULTS: Complies. The worst-case emission level is 85.9 dBμV/m @ 3m at 925.37MHz. This is 8.1 dB below the specification limit.

MEASUREMENT DATA: See attached table.

TESTED BY: Wayne Clarke | DATE: January 29, 1998 | RECEIVER: ESVP 014
E.U.T. M/N.: VT1920C | TEST DISTANCE(metres): 3 | RBW: 120 kHz, 1 MHz
E.U.T. S/N.: Handset (2621097002000002) | RANGE: A | DETECTOR: CISPR

FREQ. (MHz)	ANT. *	POL. (V/H)	ANT. HGT (m)	TABLE (Deg.)	RCVD SIGNAL (dBuV)	ANT. FACTOR (dB)**	AMP GAIN (dB) ***	DUTY CYCLE (dB)	FIELD STRENGTH (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)
925.37	H	V			51.0	34.9			85.9	94	8.1
925.37	H	H			44.0	34.9			78.9	94	15.1
927.17	H	V			49.4	34.9			84.3	94	9.7
927.17	H	H			48.2	34.9			83.1	94	10.9
*		V									
		H									
		V									
		H									
		V									
		H									
		V									
		H									
		V									
		H									
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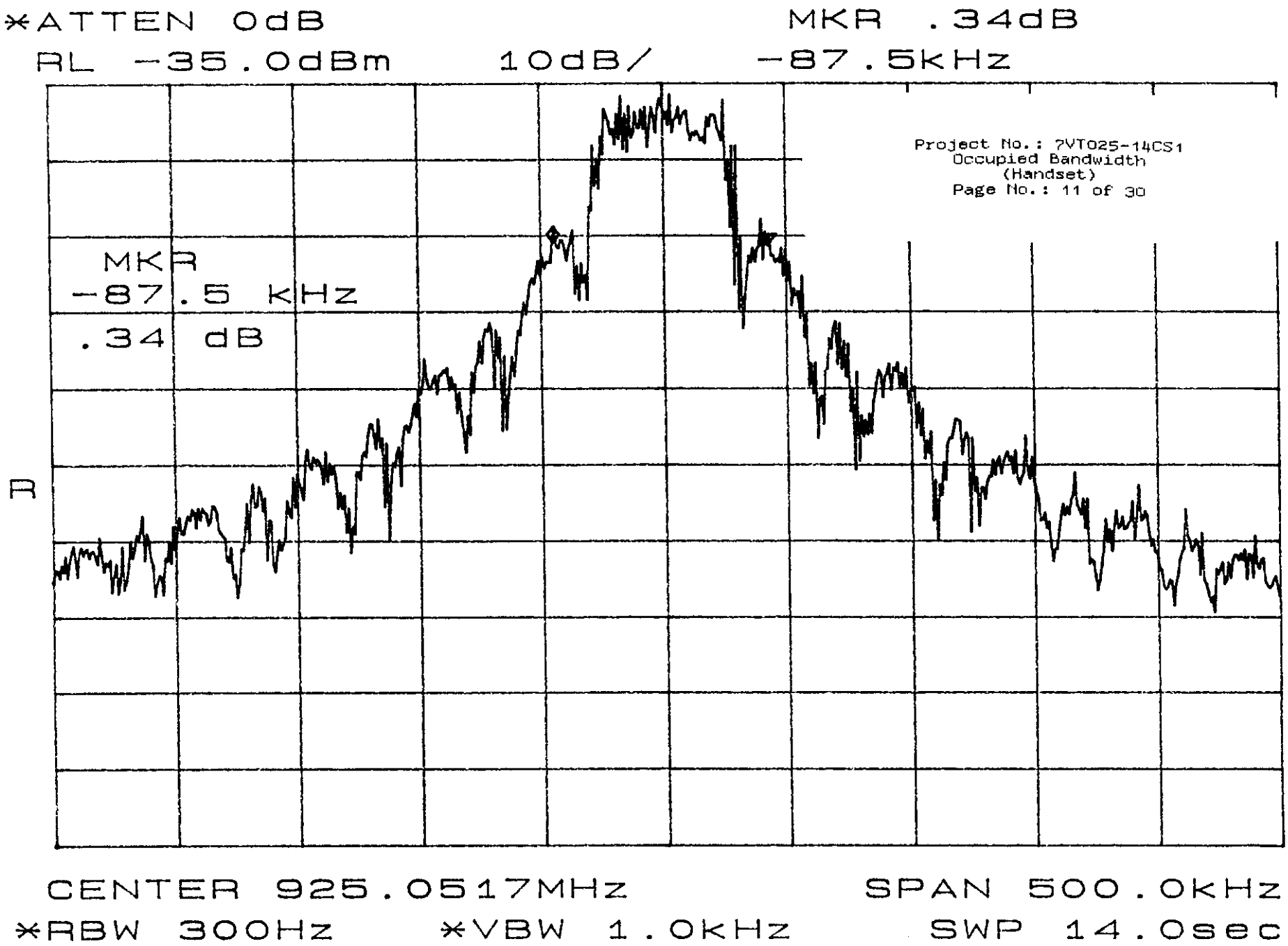
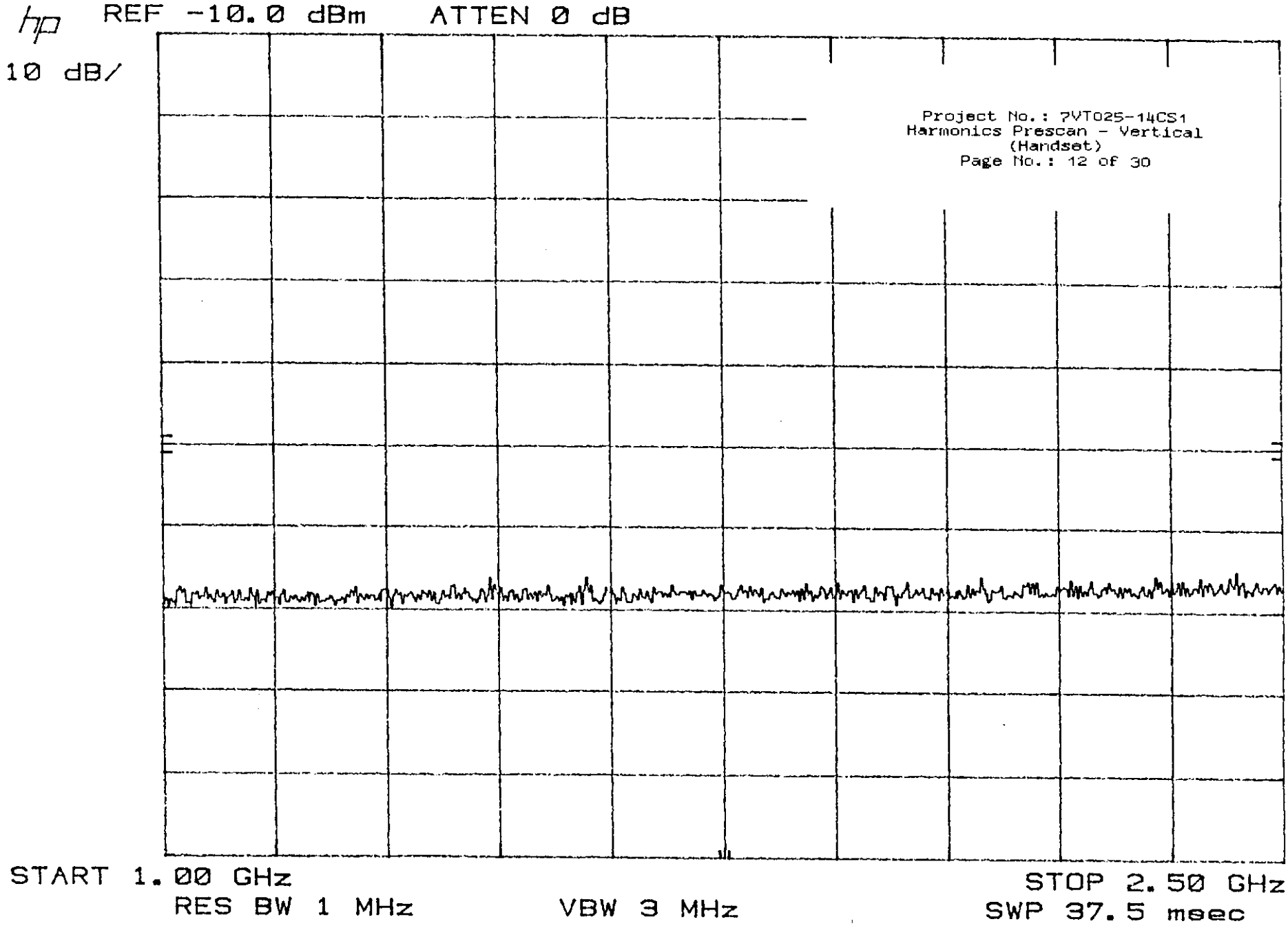
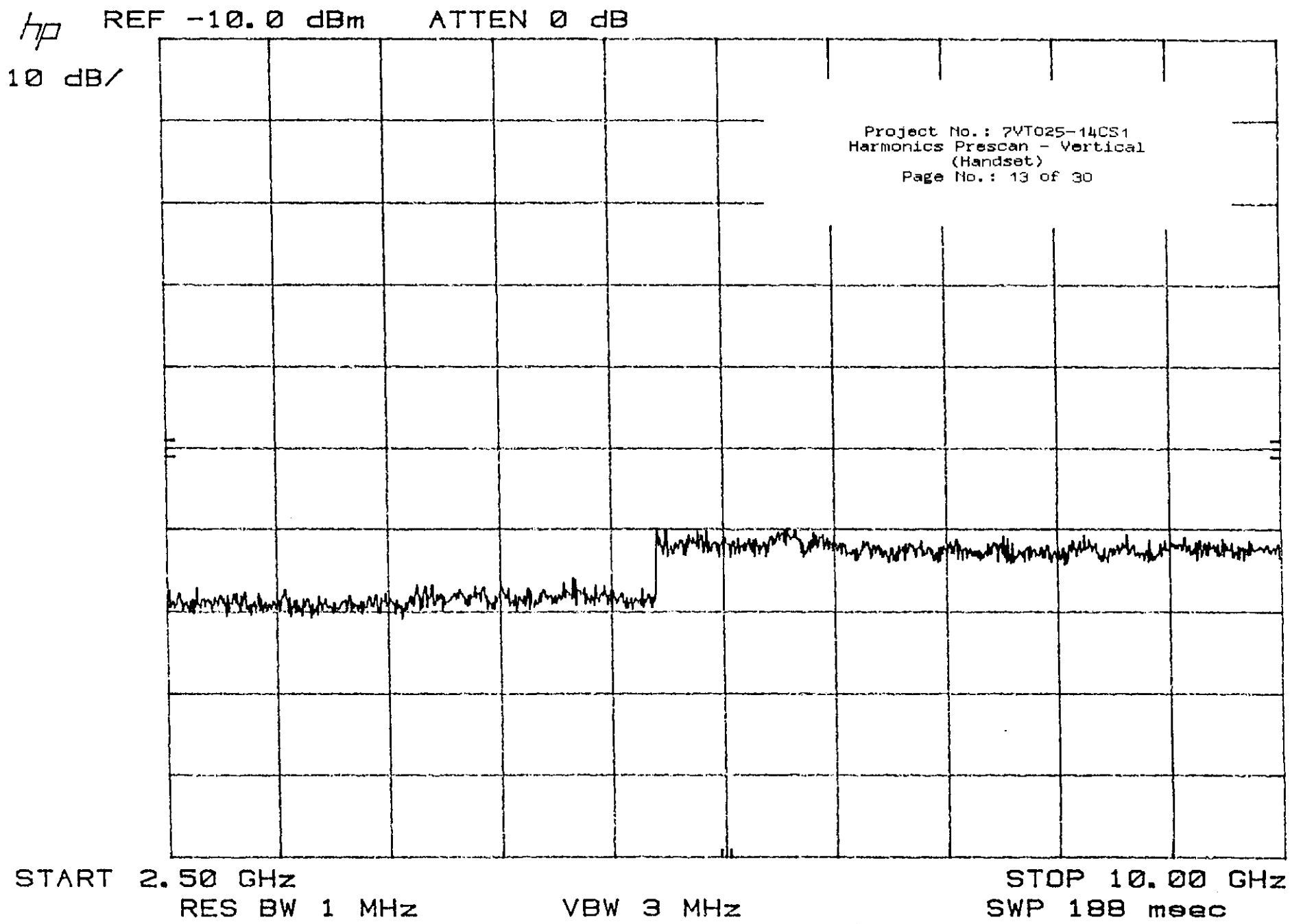
		H									
		V									
		H									
		V									
		H									
		V									
		H									
		V									
		H									

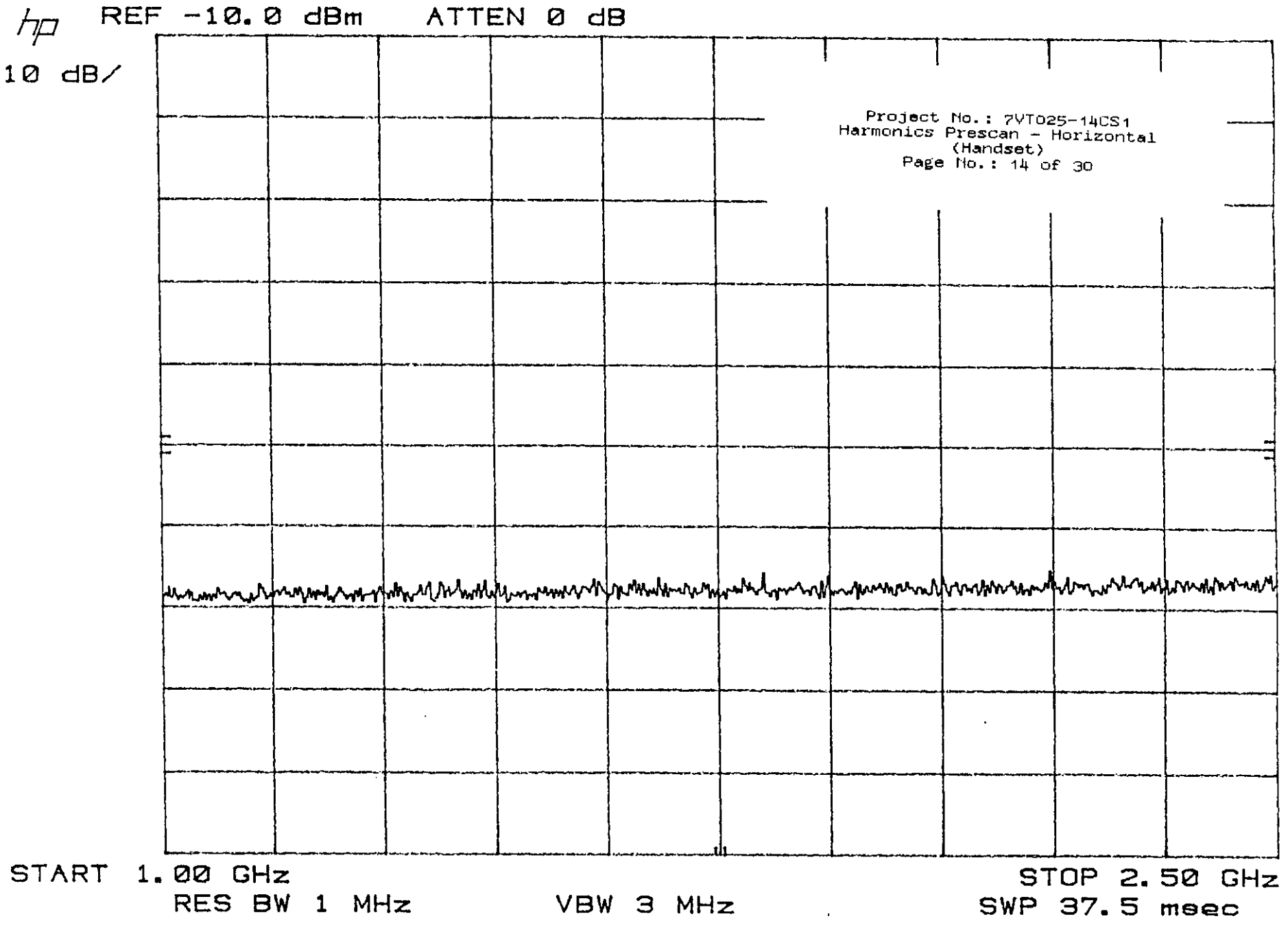
NOTES:
* The E.U.T. was searched to the 10th harmonic with no harmonics detected. The noise floor was sufficient to measure 20 dB down from limit.

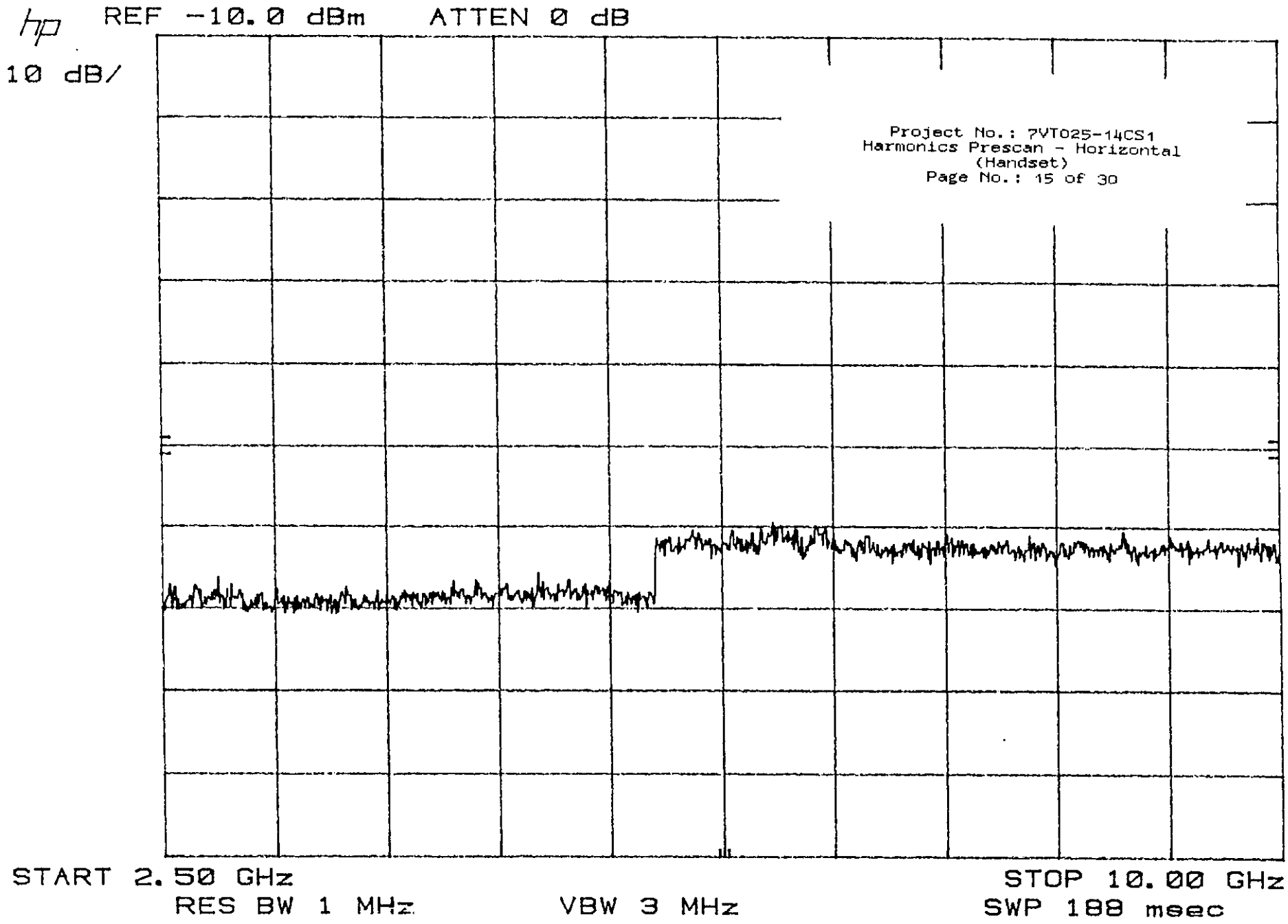
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole
* Re-measured using dipole antenna.
** Includes cable loss when amplifier is not used.
*** Includes cable loss.
( ) Denotes failing emission level.


*ATTEN 0dB
MKR .34dB
RL -35.0dBm
10dB/
-87.5kHz
Project No.: 7VT025-14CS1
Occupied Bandwidth
(Handset)
Page No.: 11 of 30
MKR
-87.5 kHz
.34 dB
R
CENTER 925.0517MHz
SPAN 500.0kHz
*RBW 300Hz
*VBW 1.0kHz
SWP 14.0sec


REF -10.0 dBm
ATTEN 0 dB
10 dB/
Project No.: 7VT025-14CS1
Harmonics Prescan - Vertical
(Handset)
Page No.: 12 of 30
START 1.00 GHz
RES BW 1 MHz
VBW 3 MHz
STOP 2.50 GHz
SWP 37.5 msec


REF -10.0 dBm
ATTEN 0 dB
10 dB/
Project No.: 7VT025-14CS1
Harmonics Prescan - Vertical
(Handset)
Page No.: 13 of 30
START 2.50 GHz
STOP 10.00 GHz
RES BW 1 MHz
VBW 3 MHz
SWP 188 msec


REF -10.0 dBm
ATTEN 0 dB
10 dB/
Project No.: 7VT025-14CS1
Harmonics Prescan - Horizontal
(Handset)
Page No.: 14 of 30
START 1.00 GHz
RES BW 1 MHz
VBW 3 MHz
STOP 2.50 GHz
SWP 37.5 msec


REF -10.0 dBm
ATTEN 0 dB
10 dB/
Project No.: 7VT025-14CS1
Harmonics Prescan - Horizontal
(Handset)
Page No.: 15 of 30
START 2.50 GHz
RES BW 1 MHz
VBW 3 MHz
STOP 10.00 GHz
SWP 188 msec

General Equipment Information (BASE)

TRANSMITTER

Frequency Range:	902.3 - 905 MHz
Frequency of Sample Tested:	902.35, 904.45 MHz
Tunable Bands:	One
Number of Channels:	10
Channel Spacing:	200 kHz
Emission Designator:	102k5F1D
Crystal Frequencies:	18.25, 3.58 MHz
User Frequency Adjustment:	None

RECEIVER

Type of Receiver:	Super Heterodyne
Intermediate Frequencies:	10.7 MHz
Primary Power Requirement:	120 VAC
Frequency Range:	925 - 927.75
Tunable Bands:	One
Designated Reception Mode:	102k5F1D
Operating Frequency of Sample Tested:	925.37, 927.17
User Frequency Adjustment:	None

NAME OF TEST: Radiated Emissions (BASE)	PARA. NO.: 15.249(a) & (c)
TESTED BY: Wayne Clarke	DATE: January 29, 1997

TEST CONDITIONS: Standard Temperature and Humidity
Standard Test Voltage

MINIMUM STANDARD:

Fundamental Frequency (MHz)	Field Strength of Fundamental (mV/m @ 3m)	Field Strength of Fundamental (dBμV/m @ 3m)	Field Strength of Spurious (μV/m @ 3m)	Field Strength of Spurious (dBμV/m @ 3m)
902 - 928	50	94	500	54

The fundamental was searched up to the 10th harmonic with all relevant emissions being noted.

Any emissions radiated outside the specified frequency band, except for harmonics shall be attenuated by at least 50 dB below the level of the fundamental emission or meet the following limits, whichever is the lesser attenuation.

Frequency (MHz)	Field Strength (μV/m @ 3m)	Field Strength (db @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

TEST RESULTS: Complies. The worst-case emission level is 86.3 dBμV/m @ 3m at 904.45 MHz. This is 7.7 dB below the specification limit.

MEASUREMENT DATA: See attached table.

TESTED BY: Wayne Clarke | DATE: January 29, 1998 | RECEIVER: ESVP 014
E.U.T. M/N.: VT1920C | TEST DISTANCE(metres): 3 | RBW: 120 kHz, 1 MHz
E.U.T. S/N.: Base (261097002000002) | RANGE: A | DETECTOR: CISPR

FREQ. (MHz)	ANT. *	POL. (V/H)	ANT. HGT (m)	TABLE (Deg.)	RCVD SIGNAL (dBuV)	ANT. FACTOR (dB)**	AMP GAIN (dB) ***	DUTY CYCLE (dB)	FIELD STRENGTH (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)
902.35	H	V			51.5	34.5			86.0	94.0	8.0
902.35	H	H			44.5	34.5			79.0	94.0	15.0
904.45	H	V			51.8	34.5			86.3	94.0	7.7
904.45	H	H			44.7	34.5			79.2	94.0	14.8
*		V									
		H									
		V									
		H									
		V									
		H									
		V									
		H									
		V									
		H									
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		V									
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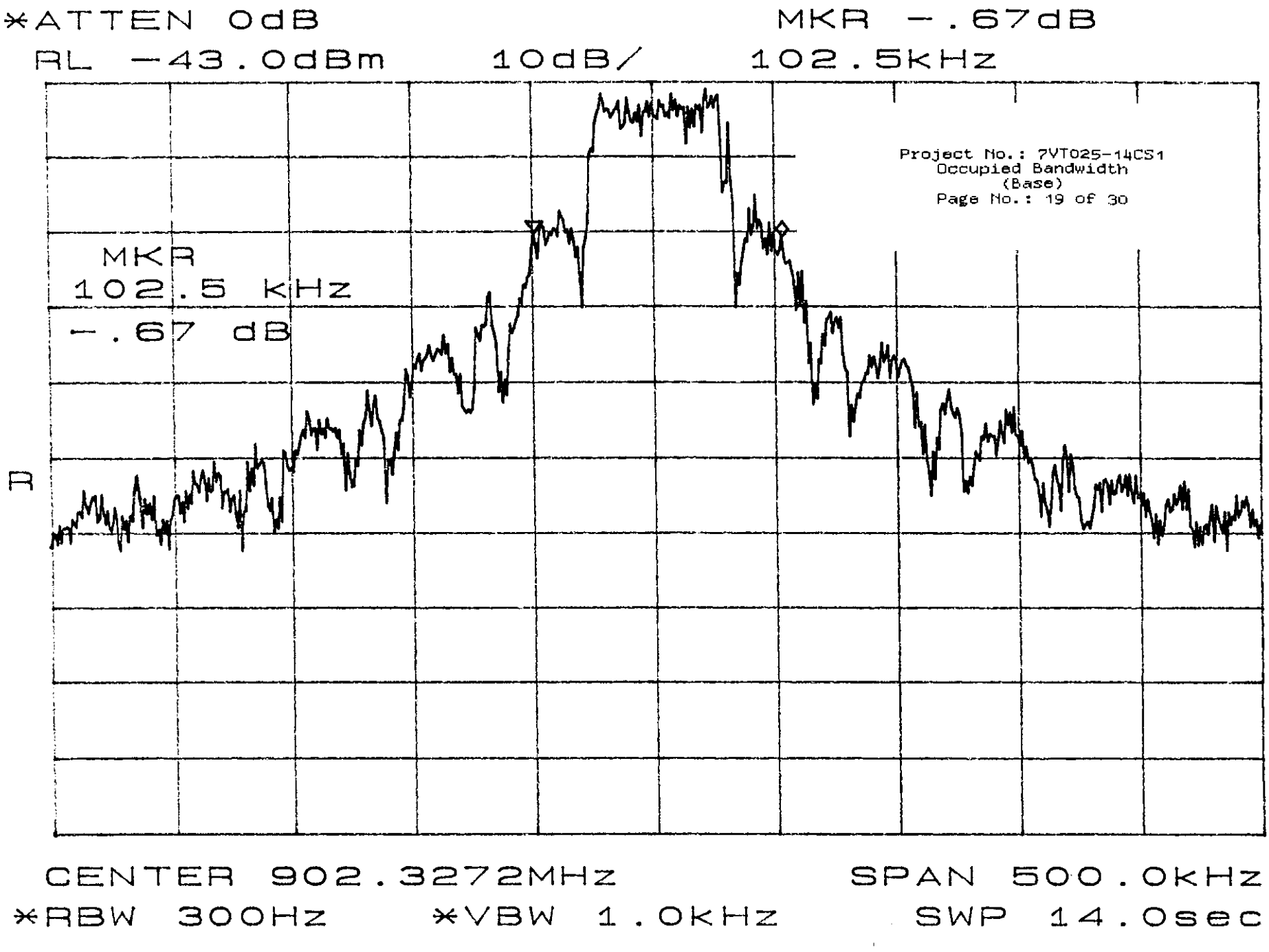
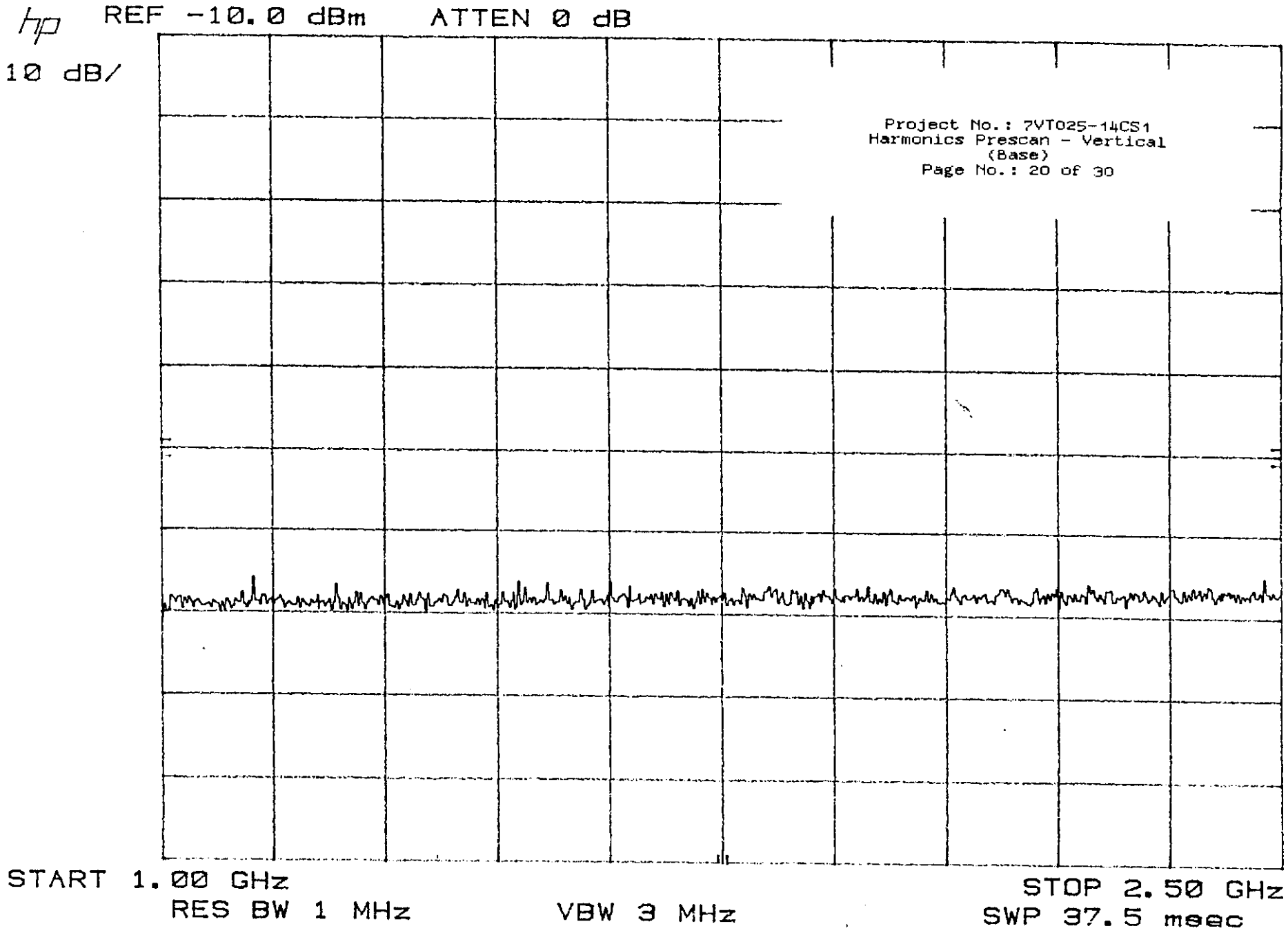
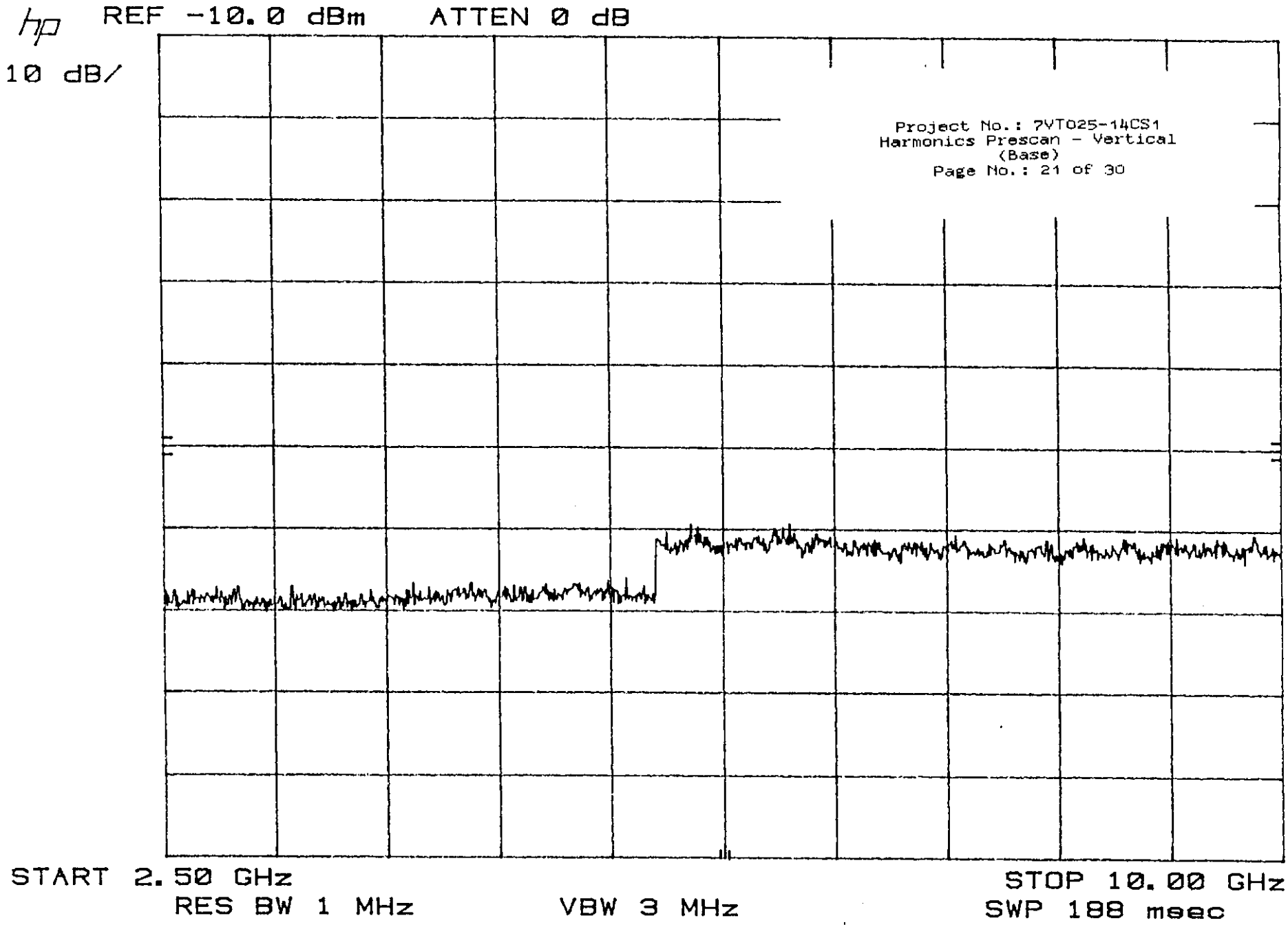
		V									
		H									
		V									
		H									
		V									
		H									

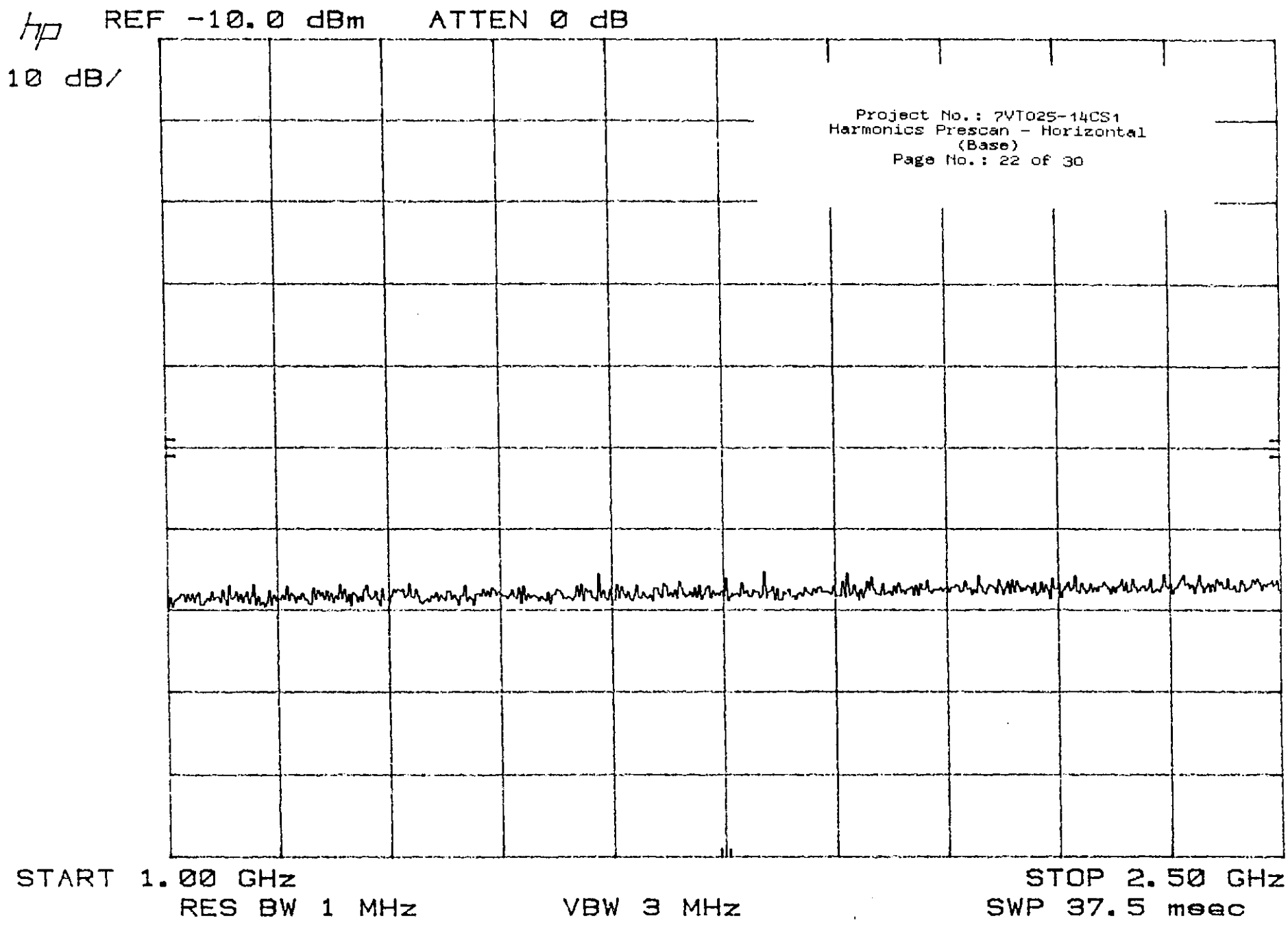
NOTES:
* The E.U.T. was searched to the 10th harmonic with no harmonics detected. The noise floor was sufficient to measure 20 dB down from limit.

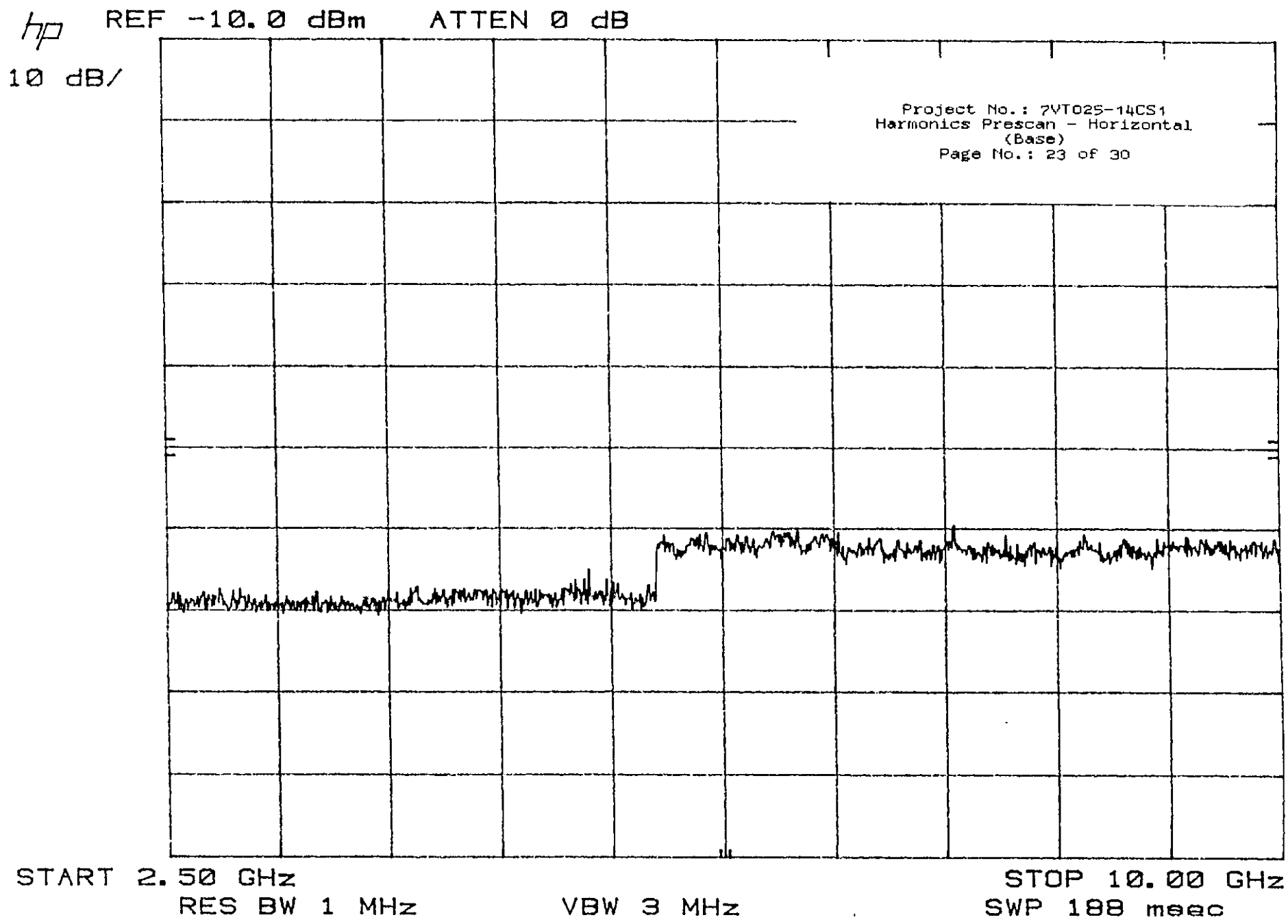
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole
* Re-measured using dipole antenna.
** Includes cable loss when amplifier is not used.
*** Includes cable loss.
( ) Denotes failing emission level.

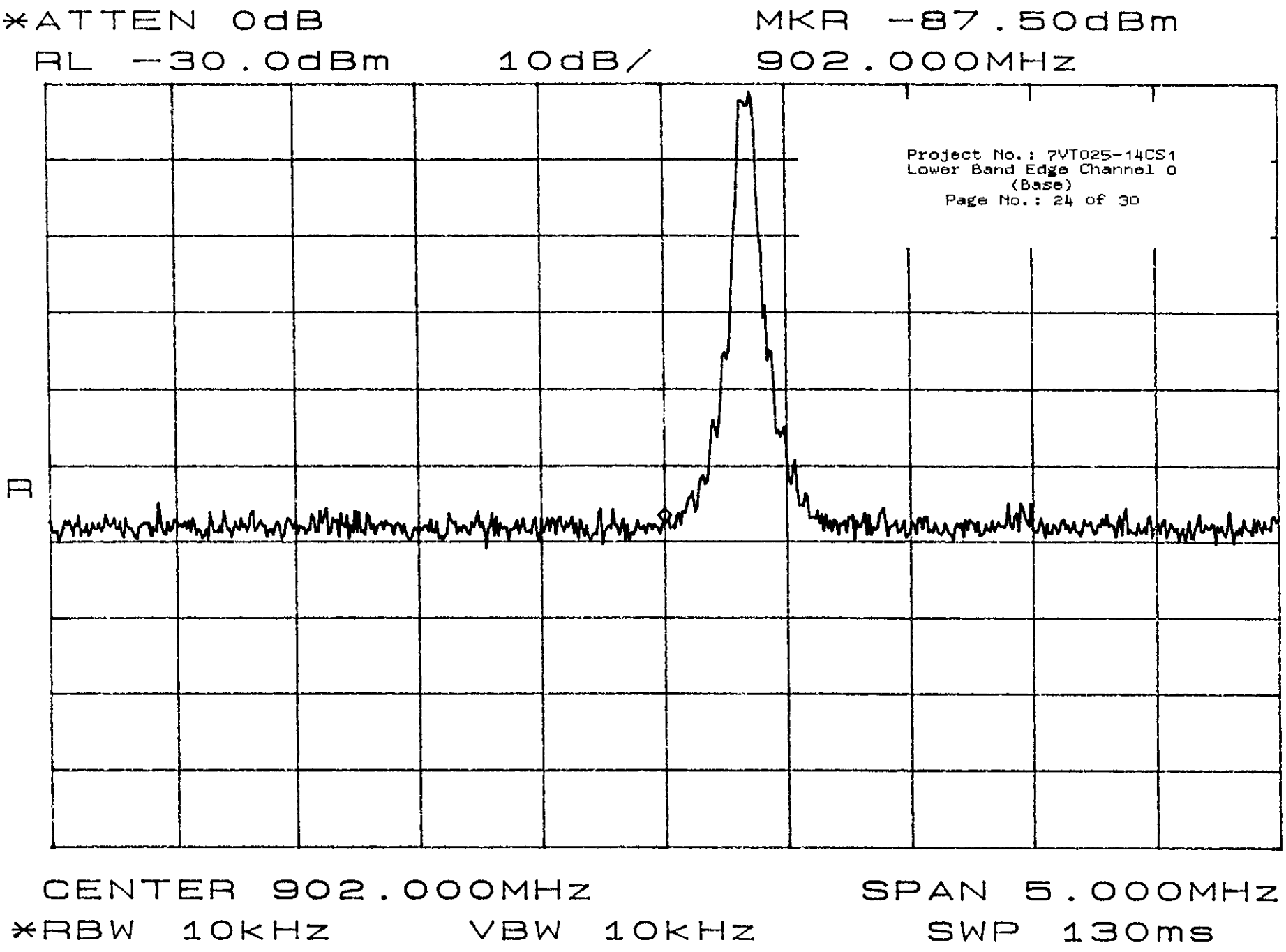

*ATTEN 0dB
MKR -.67dB
RL -43.0dBm
10dB/
102.5kHz
Project No.: 7VT025-14CS1
Occupied Bandwidth
(Base)
Page No.: 19 of 30
MKR
102.5 kHz
-.67 dB
R
CENTER 902.3272MHz
SPAN 500.0kHz
*RBW 300Hz
*VBW 1.0kHz
SWP 14.0sec

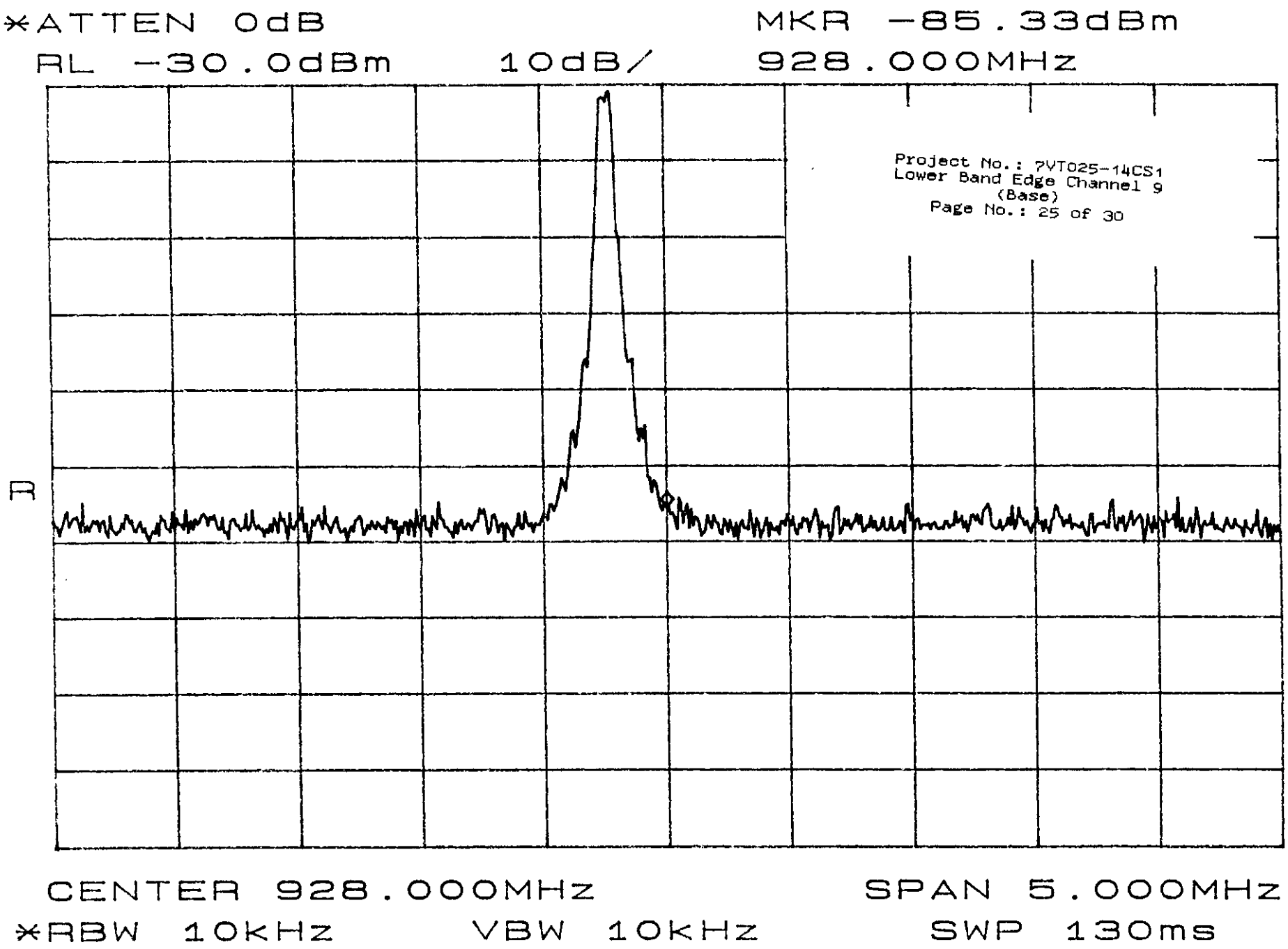

REF -10.0 dBm
ATTEN 0 dB
10 dB/
Project No.: 7VT025-14CS1
Harmonics Prescan - Vertical
(Base)
Page No.: 20 of 30
START 1.00 GHz
RES BW 1 MHz
VBW 3 MHz
STOP 2.50 GHz
SWP 37.5 msec


hp
REF -10.0 dBm
ATTEN 0 dB
10 dB/
Project No.: 7VT025-14CS1
Harmonics Prescan - Vertical
(Base)
Page No.: 21 of 30
START 2.50 GHz
RES BW 1 MHz
VBW 3 MHz
STOP 10.00 GHz
SWP 188 msec


hp REF -10.0 dBm ATTEN 0 dB
10 dB/
Project No.: 7VT025-14CS1
Harmonics Prescan - Horizontal
(Base)
Page No.: 22 of 30
START 1.00 GHz
STOP 2.50 GHz
RES BW 1 MHz
VBW 3 MHz
SWP 37.5 msec


REF -10.0 dBm
ATTEN 0 dB
10 dB/
Project No.: 7VT025-14CS1
Harmonics Prescan - Horizontal
(Base)
Page No.: 23 of 30
START 2.50 GHz
STOP 10.00 GHz
RES BW 1 MHz
VBW 3 MHz
SWP 188 msec


*ATTEN 0dB
MKR -87.50dBm
RL -30.0dBm
10dB/
902.000MHz
Project No.: 7VT025-14CS1
Lower Band Edge Channel 0
(Base)
Page No.: 24 of 30
R
CENTER 902.000MHz
SPAN 5.000MHz
*RBW 10KHz
VBW 10KHz
SWP 130ms


*ATTEN 0dB
MKR -85.33dBm
RL -30.0dBm
10dB/
928.000MHz
Project No.: 7VT025-14CS1
Lower Band Edge Channel 9
(Base)
Page No.: 25 of 30
R
CENTER 928.000MHz
SPAN 5.000MHz
*RBW 10kHz
VBW 10kHz
SWP 130ms

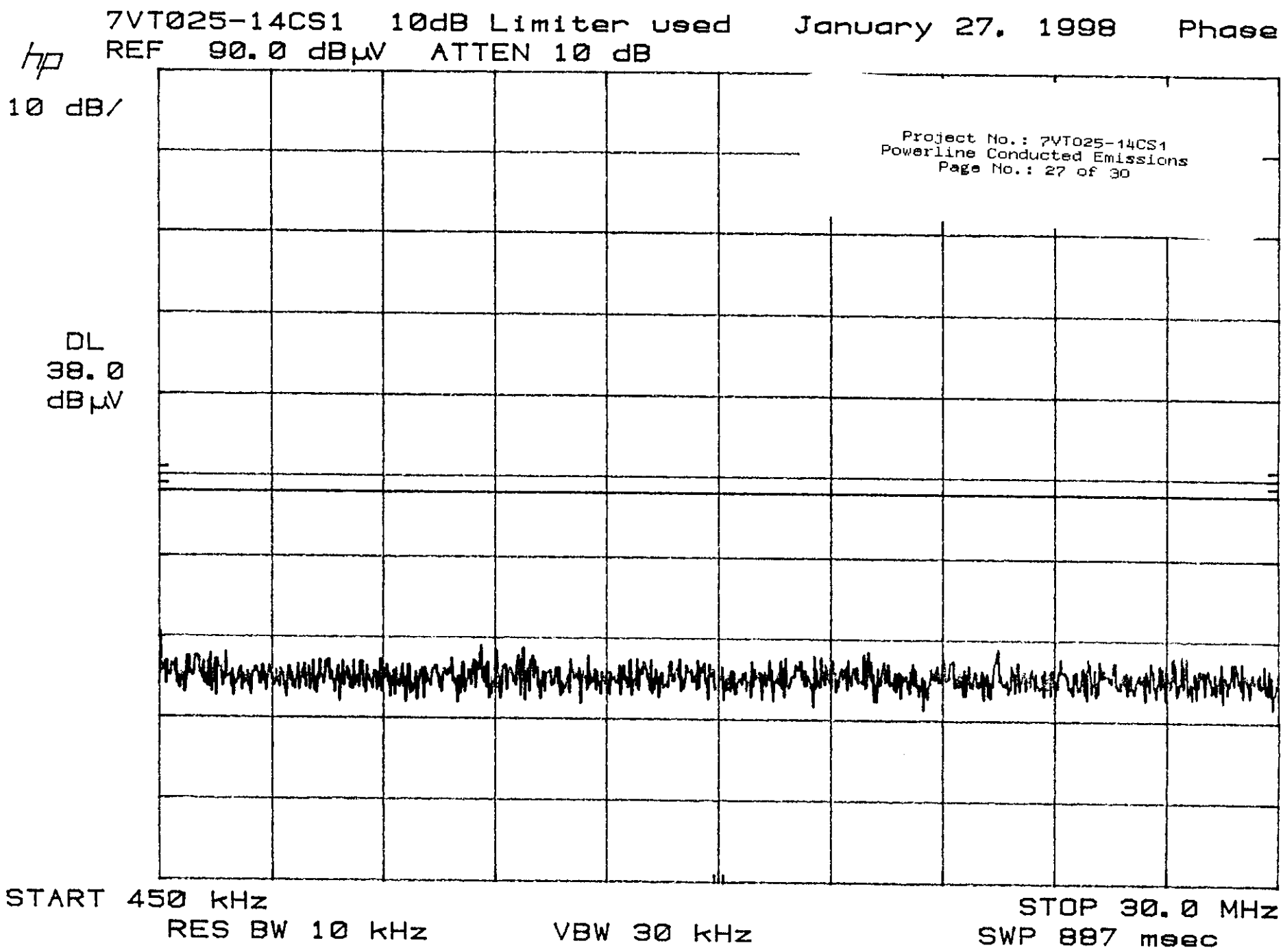
NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: Wayne Clarke	DATE: January 27, 1998

TEST CONDITIONS: Standard Temperature and Humidity
Standard Test Voltage

MINIMUM STANDARD: The R.F. that is conducted back onto the AC power line on any frequency within the band 0.45 to 30 MHz shall not exceed 250μV (48 dBμV) across 50 ohms.

TEST RESULTS: Complies. See attached graphs.

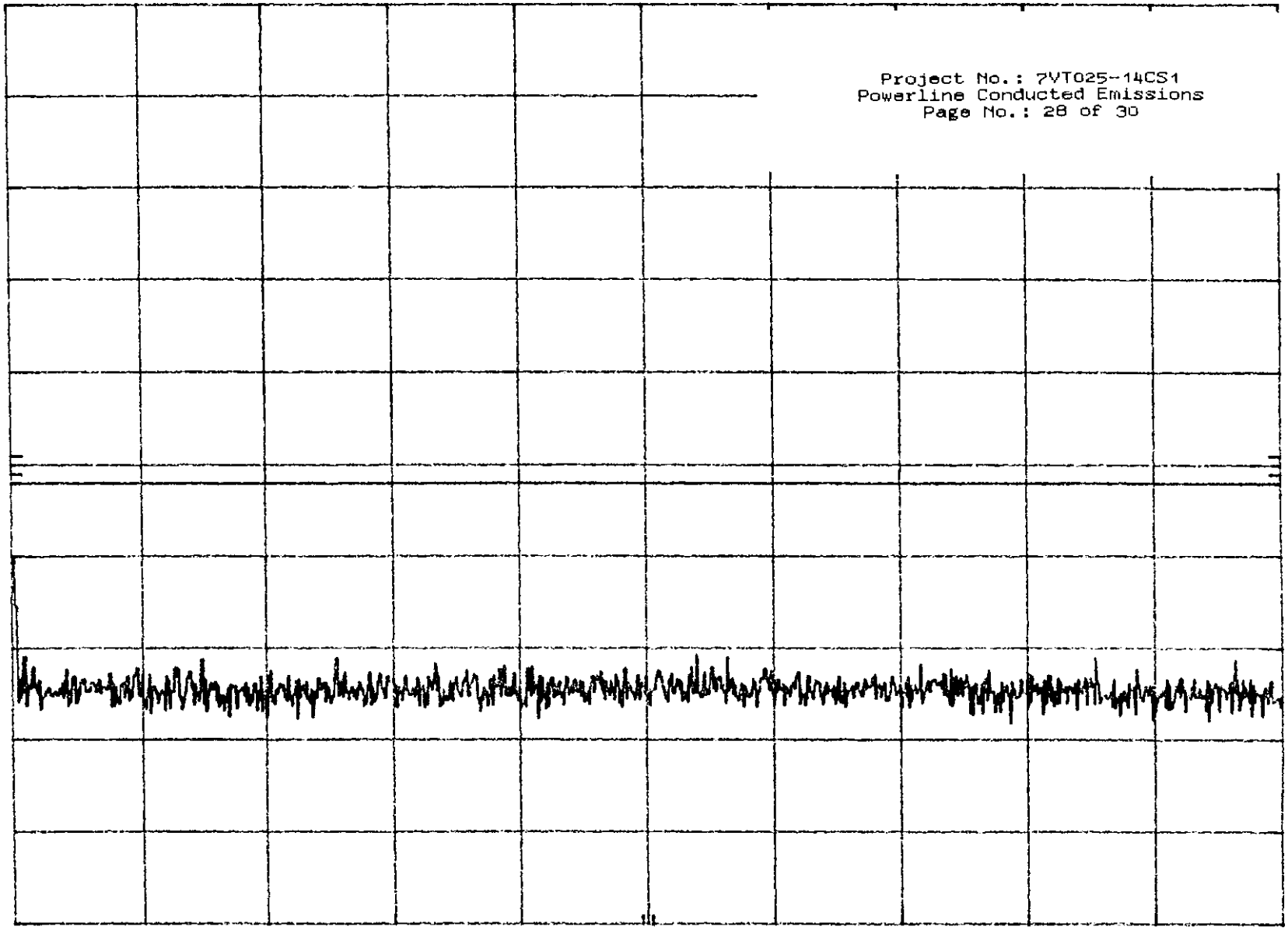
MEASUREMENT DATA: See attached graphs.


7VT025-14CS1 10dB Limiter used January 27, 1998 Phase
REF 90.0 dBµV ATTEN 10 dB
10 dB/
DL
38.0
dBµV
Project No.: 7VT025-14CS1
Powerline Conducted Emissions
Page No.: 27 of 30
START 450 kHz
STOP 30.0 MHz
RES BW 10 kHz
VBW 30 kHz
SWP 887 msec

7VT025-14CS1 10dB Limiter used January 27. 1998 Neutral

REF 90.0 dBµV ATTEN 10 dB

10 dB/



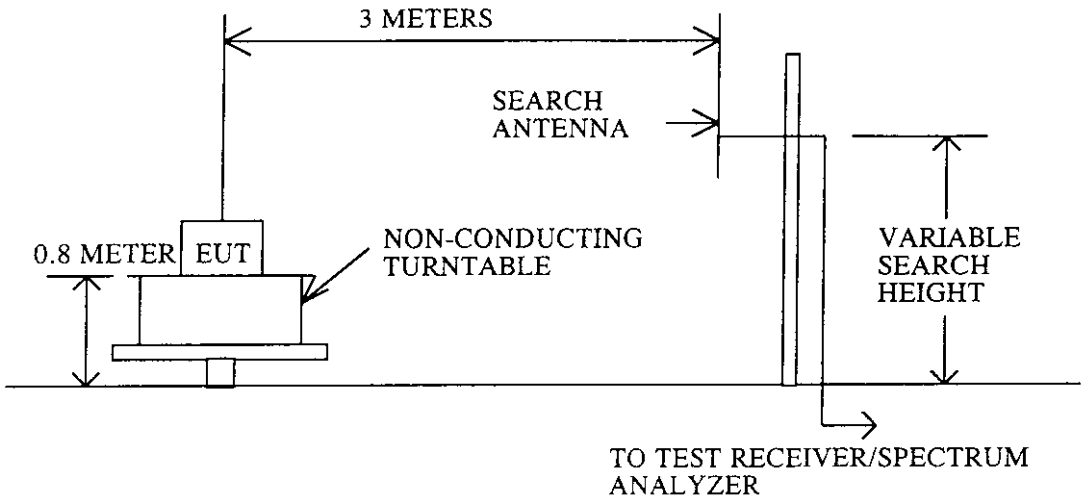
DL
38.0
dBµV

START 450 kHz STOP 30.0 MHz

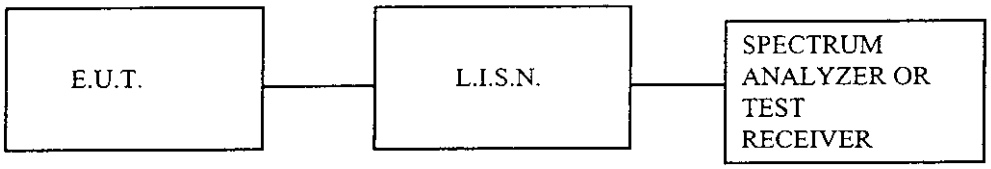
RES BW 10 kHz VBW 30 kHz SWP 887 msec

Block Diagrams

TEST SITE FOR RADIATED EMISSIONS



CONDUCTED EMISSIONS



SHIELDED ROOM

RADIO TEST EQUIPMENT LIST

CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.	
	Plotter	Hewlett Packard	7470A	2308A30807	NCR	NCR	
1 Year	Spectrum Analyzer	Hewlett Packard	8566B	2311A02238	Sept. 30/97	Sept. 30/98	
1 Year	Spectrum Analyzer Display	Hewlett Packard	8566B	2314A04759	Sept. 30/97	Sept. 30/98	
1 Year	Spectrum Analyzer	Hewlett Packard	8566B	1950A00400	Oct. 3/97	April 3/98	
1 Year	Spectrum Analyzer Display	Hewlett Packard	8566B	1950A01177	Oct. 3/97	April 3/98	
1 Year	Quasi Peak Adaptor	Hewlett Packard	8565B	2251A00620	Aug. 19/97	Feb. 19/98	
1 Year	LISN	Rohde & Schwarz	ESH2-Z5	890485/017	July 25/97	July 25/98	
1 Year	Receiver	Rohde & Schwarz	ESVP	892661/014	Mar. 25/97	Mar. 25/98	
	Biconilog Antenna	EMCO	3143	1038	NCR	NCR	
2 Year	Horn Antenna	EMCO #1	3115	3132	Feb. 5/96	Feb. 5/98	
1 Year	Dipole Antenna Set	EMCO	3121C	1029	Oct. 28/97	Oct. 28/98	
1 Year	Low Noise Amplifier	Avantek	AWT-8035	1005	Oct. 24/97	Oct. 24/98	

NA: Not Applicable
NCR: No Cal Required