USA Type Approval Test Report

For

MainStreet Broadband Wireless

Customer Premise Equipment (CPE) 28GHz

(LMDS)

With Telaxis Communications Corp. (Millitech) Radios

Test Dated: Sept. 15,1999

Test Performed:

FCC Part 101 and 2

NOTICE

ABSTRACT

This document provides the test procedure and test report used to fulfill the requirements of the Approvals Group personnel and the Wireless product designers to evaluate the MainStreet Broadband Wireless System during radio type approval testing.

The test data contained in this report is evidence of compliance to specified radio standards for the units described herein.

GLOSSARY

ARIC	*ATM Radio Interface Card*
ATM	*Asynchronous Transfer Mode*
BER	*Bit Error Rate.* The ratio of incorrect bits to total number of bits transmitted.
BTS	*Base Transceiver System*
CISPR	*International Special Committee on Radio Interference*
CPE	*Customer Premises Equipment*
CW	*Continuous Wave*
EMC	*Electro Magnetic Compatibility*
EUT	*Equipment Under Test*
FCC	*Federal Communications Commission*
ITE	*Information Technology Equipment*
MIB	*Management Information Base.* A collection of objects that can be accessed via a network management protocol.
NIU	*Network Interface Unit*
ORU	*Outdoor Receiver Unit*
OTRU	*Outdoor Transmitter Receiver Unit*
OTU	*Outdoor Transmitter Unit*
RF	*Radio Frequency*
TBD	*To Be Determined*

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1 INTRODUCTION

1.1 Purpose

This document provides a test plan and report for Radio Type Approval testing of the "MainStreet Broadband Wireless System" according to applicable FCC standards. This test report is to show compliance according to the FCC Part 101 requirements and FCC Part 2 methods for the MainStreet Broadband Wireless System – **Customer Premises Equipment from 27.5GHz to 28.35GHz** using ***Telaxis Communications Corp. (Millitech) Radios*** with different NIU interface modules to achieve certification in the United States.

1.2 Scope

This document shall be used to evaluate "MainStreet Broadband Wireless – Customer Premises Equipment (CPE) 28GHz" conformance to the test requirements contained in applicable FCC standards. The test results are documented according to the test methods as mentioned in the FCC standards, and are to be submitted with the FCC Form 731 "Application for Equipment Authorization. This report is to show compliance for the 27.5GHz to 28.35GHz band only.

2 EQUIPMENT UNDER TEST (EUT)

2.1 Equipment Description

The Broadband Wireless System is a network of Network Interface Units connected to Base Stations via wireless links and the Base Stations are, in turn, connected to the ATM Backbone Network via wired or point to point wireless links. A Network Manager augments the network. The system consists of a TDM QPSK downstream and two TDMA upstream Differential Coded QPSK burst mode per ARIC card.

The BTS is the hub that delivers and collects all the wireless traffic from and to the subscribers in the BTS coverage area. The BTS is also the linking point between the subscribers and the Backbone Network.

The external transmitters and receivers is typically mast mounted or mounted on a flat surface of the building.

Customer Premises Equipment

The wireless customer premises equipment consists of two major components; an outdoor radio transceiver/antenna unit (OTRU) and an indoor Network Interface Unit (NIU).

A maximum of 2 NIUs can be supported from a single OTRU using a combiner splitter arrangement similar to that used at the base station. In this configuration, both NIUs must share the same uplink operating frequency, however uplink time slots can be assigned to the two NIUs as required by the service being supported.

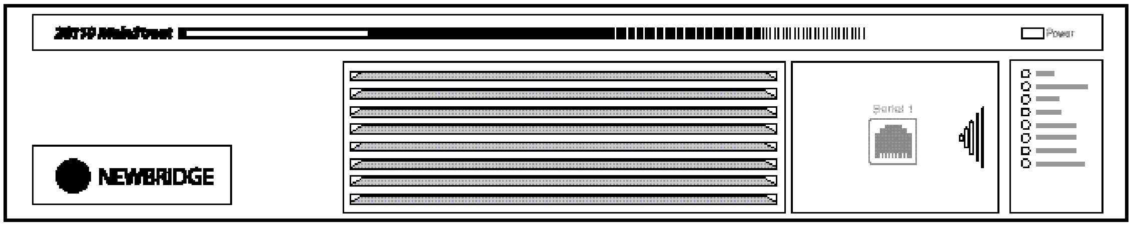
No support for multicarrier operation from a single OTRU is provided.

Indoor Equipment

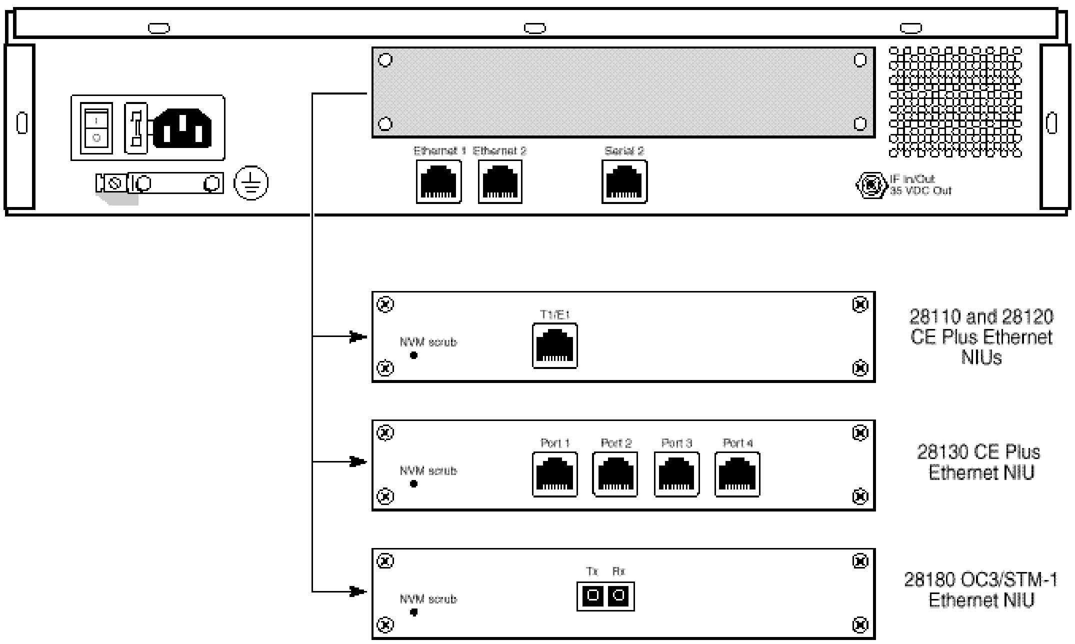
The NIU resides on the customer premises and, on the network side, is connected to an external transceiver (OTRU). The customer side connects to various types of customer premises equipment depending on the type of NIU. All NIUs operate with the same UP (9MHz) and down stream (36MHz) bandwidth.

- T1 CE NIU 28110 which has a single T1 interface supporting either full or fractional T1 services and a single 10Base-T Ethernet port**. Note: The 28120 is the E1 NIU which is not used for North America.**
- Quad T1 CE NIU 28130 which has four T1 interface supporting either full or fractional T1 services and a single 10Base-T Ethernet Port
- OC3 NIU 28180 that supports a single SONET OC-3 port interface.

Front



Back

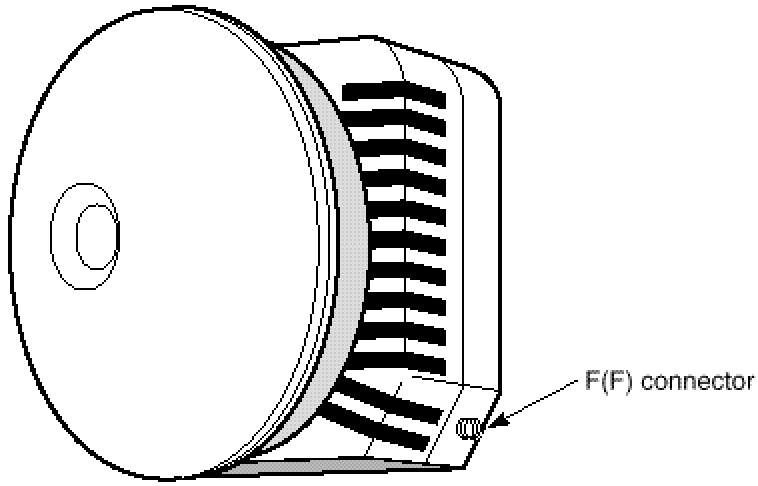


External Equipment

In addition to the NIU, an external transceiver is required. The external transceiver is typically mounted near the roof of a building and is mounted in a fixed position. Figure 1 shows a typical application for the T1 CE /Ethernet NIU.

Only the external equipment is developed/provided by an OEM supplier. The OEM supplier for the OTRU has been tested and mentioned within this report is:

Telaxis Communications Corporation (name changed from Millitech)
20 Industrial Drive east
P.O Box 109
South Deerfield Massachusetts 01373-0109, USA



OTRU (Telaxis Communications)

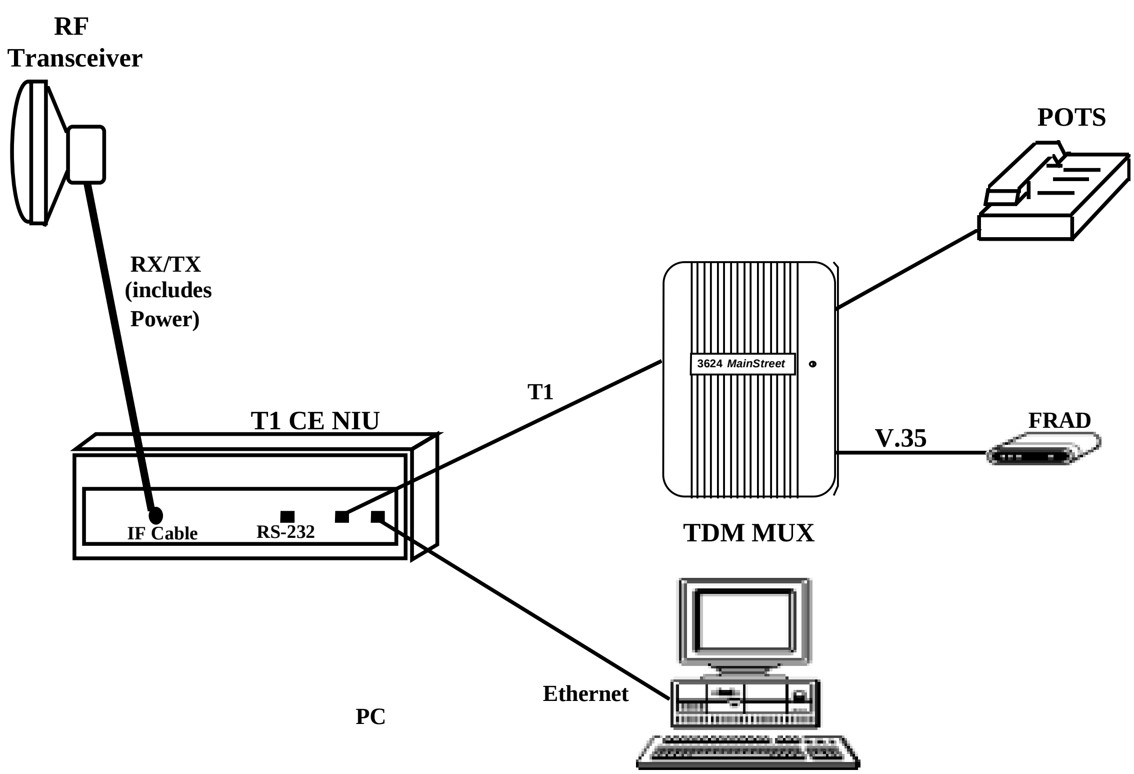


Figure1: T1 Circuit Emulation / Ethernet NIU

2.2 EUT Configuration

Model Number	Name and Description	S/N
90-6210-01	28110 T1 CE NIU 120V	23990108967
90-6626-01	Telaxis (Millitech) OTRU 28GHz with integrated one foot antenna	991633649

2.3 EUT Cables

Part Number	Cable Type	Length (m)	Shield	Connector Hoods
N/A	RJ45 shielded cable	5.0	Foil	metalized
N/A	coaxial cable	2.0	braid	SMA

2.4 System Test Configuration

2.4.1 Justification

The system was configured with one NIU (T1 +Ethernet port) having a bandwidth (BW) of 9MHz, which is then provided to the OTRU. The TX IF modulated carrier is adjusted by providing attenuation to the BTS receiver, which in return will provide a command to increase or decrease the CPE transmit power level. This function is called ATPC (Automatic Transmit Power Control) and it is used to achieve a maximum RF level of approximately +19dBm. Only one CPE was used to operate with the ORU and OTU (BTS) to achieve traffic. Operating with the maximum output level will provide the worst condition based on intermodulation, spurious and spectral re-growth.

Only one NIU was used in the setup, due to there is no additional intermodulation when operating with 2 NIUs with one OTRU. The CPE OTRU operates with a TDMA access scheme on the upstream, therefore only one carrier will transit at one time. The OTRU will not support multicarriers.

Also, the T1 CE NIU 28110 was only tested with the OTRU, due to the Quad T1 28130 and OC-3 NIU 28180 have no influence on the performance of the transmitter. The overall line rate is limited by the air interface, which provides a fixed ATM rate of 10Mb/s and a RF bit rate of 12.87MB/s. The upstream and downstream bandwidth will not change due to the different interfaces, therefore the transmit carrier bandwidth is always 9MHz.

For the frequency stability measurements, an external source was used to provide an IF CW to the radio unit. Only the OTRU was placed in the temperature chamber during this specific test due to the NIU unit will usually be in a temperature-controlled environment, but meets all internal performance requirements between the temperatures of –5^{o}C to +55^{o}C.

For all tests, the EUT was configured to simulate a typical application. The testing was conducted using only cables recommended for use with the EUT by Newbridge. Attention was made to follow any recommended chassis grounding, cable routing, etc. in the Newbridge Technical Practices.

The EUT was placed according to the required set ups detailed in the test specifications and methods within this document for each type of radio type approval test (FCC Part 101 and 2).

The test result for conducted and radiated spurious were performed by an external lab (KTL Ottawa) and complied together in this test report. The measurements were taken according to the instructions mentioned in the FCC Part 2 and Part 101.

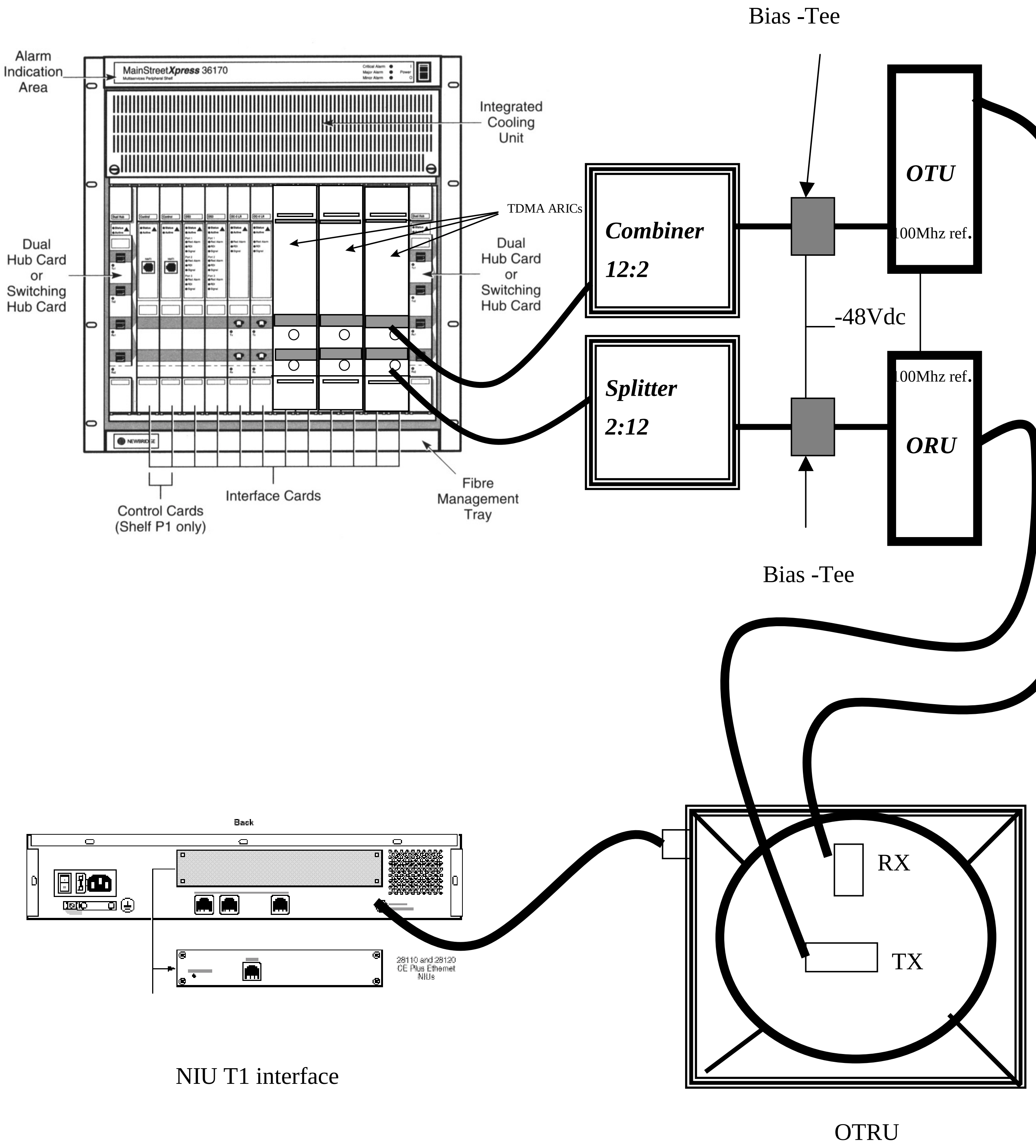
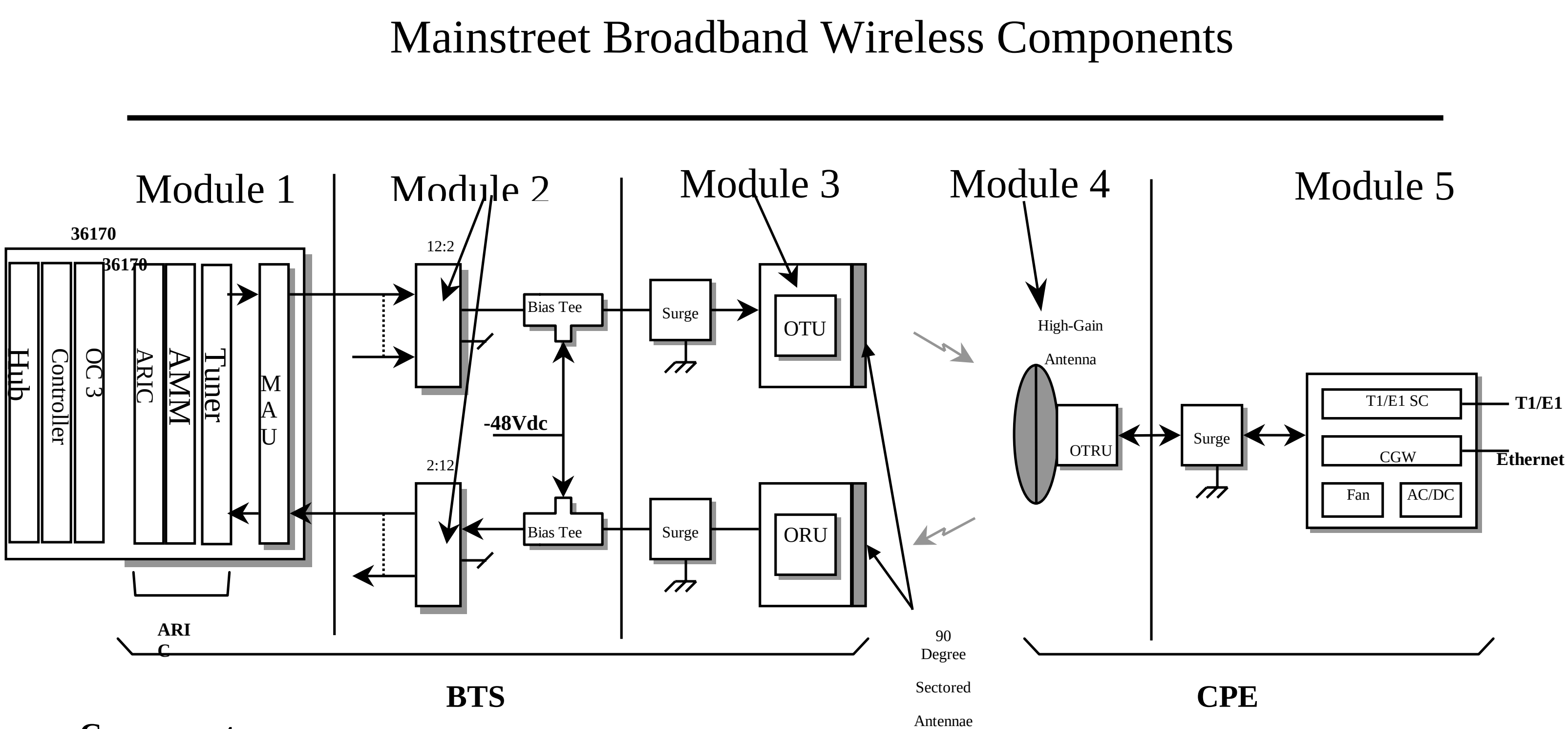


Figure 2 Diagram of System Configuration

2.4.2 Functional Interconnect

Figure 3 Block Diagram of Functional Interconnect



Component

BTS	**CPE**
ARIC, Tuner, AMM, MAU Combiner, Splitter, Bias-Tee	T1/E1 Services Card Commercial GateWay (CGW)
Surge Arrestor	Surge Arrestor
OTU, ORU	OTRU
90 Degree Sectored Antennae	12” Antenna

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3 Regulatory COMPLIANCE Summary

This report has been read and approved by the appropriate departments responsible for its implementation. All changes found necessary for compliance will be incorporated into production.
The EUT as configured in this report meets the requirements indicated below. The results of these tests apply only to items tested and provide an indication of hardware quality during operation and maintenance in their intended environment.

Declaration of Compliance

" This equipment has been tested in accordance with the requirements contained in the appropriate Commission regulations. To the best of my knowledge, these tests were performed using measurement procedures consistent with industry or Commission standards and demonstrate that the equipment complies with the appropriate standards. . Each unit manufactured, imported or marketed, as defined in the Commission's regulations, will conform to the sample(s) tested within the variations that can be expected due to quantity production and testing on a statistical basis. I further certify that the necessary measurements were made by Newbridge Networks Corporation, 600 March Road, Kanata, Ontario, K2K2E6. and KTL, 3325 River Road RR#5, Ottawa, Ontario, K1V 1H2 "

Standard	**Measurement Type**	**Method/ Limit**	**Pass/Fail Criteria**
FCC Part 101 & FCC Part 2 (10-1-98 edition)	Output Power	Section 2.1046 / Section 101.113	Pass
	Spectrum Mask (Occupied Bandwidth)	Section 2.1049 / Section 101.111(a)(2)(ii)	Pass
	Radiated Spurious	Section 2.1053 & 2.1057 / Section 101.111(a)(2)(ii)	Pass
	Conducted Spurious	Section 2.1051 & 2.1057 / Section 101.111(a)(2)(ii)	Pass
	Frequency Stability	Section 2.1055 / Section 101.107	Pass

Regulatory Compliance Requirements

__________Vito Scaringi ________
Wireless Approvals Specialist

Date Nov.03/ 1999

4 TEST RESULTS

4.1 RF Output Power

4.1.1 Test Specification

Standard	FCC Part 101 section 101.113 (edition 10-1-98)
Method	FCC Part2 section 2.1046 (edition 10-1-98)
Limits	Maximum EIRP of +55dBW

4.1.2 Test Location

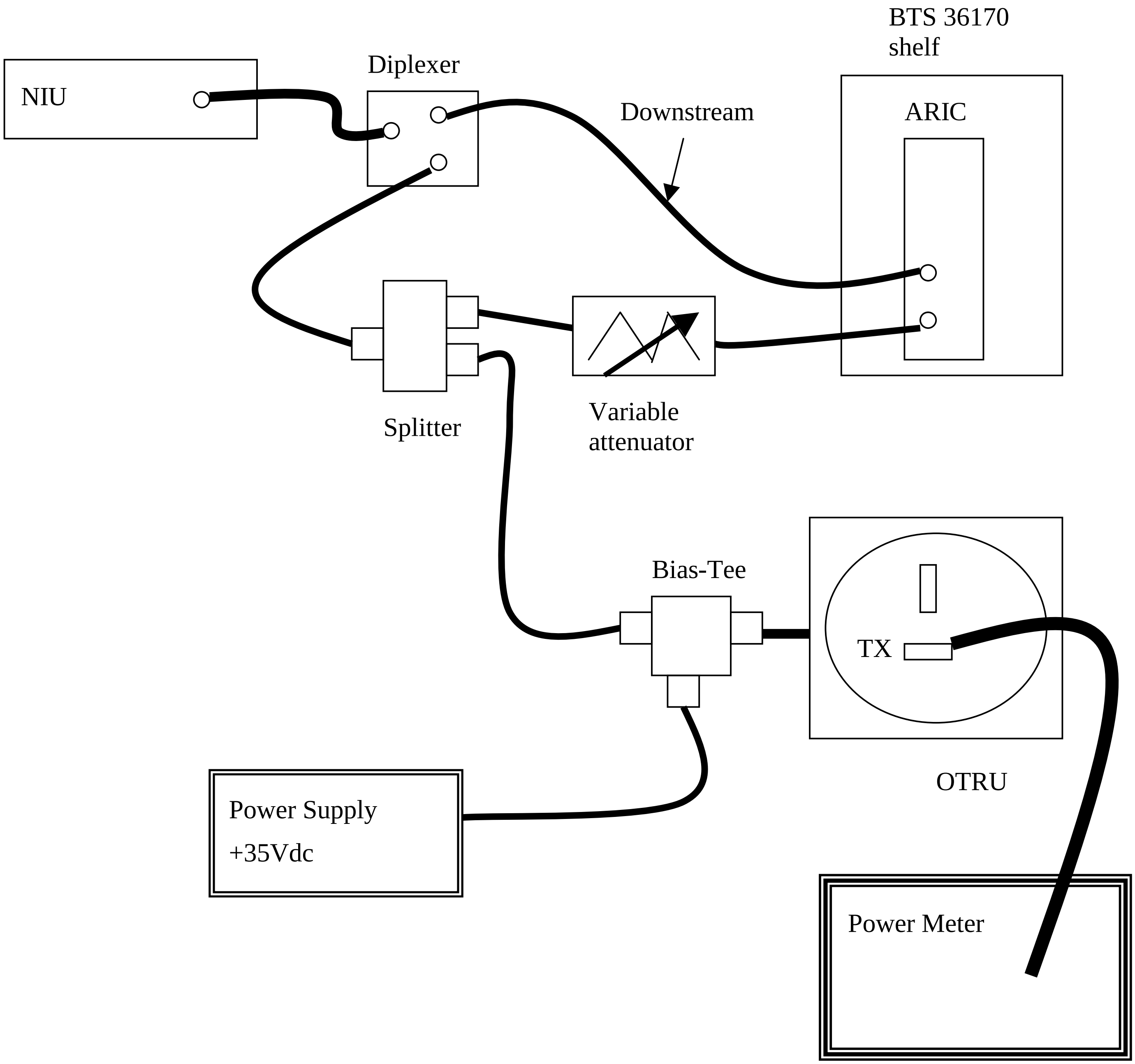
Test Laboratory	Newbridge Networks Corporation, Design Integrity Laboratory
Address	600 March Road Kanata, Ontario K2K 2E6
Prime Contact	Vito Scaringi, Wireless Approvals Specialist

4.1.3 Tested by

Test Engineer	Vito Scaringi, Wireless Approvals Specialist
Company	Newbridge Networks Corporation

4.1.4 Test Procedure

The output power was adjusted to have the carrier set at approximately ≥+19dBm at the antenna port. All power measurements were taken in normal operation (modulated).



RF Power Output Test Setup

Note: The diplexer is used to separate the Upstream and Downstream IF signals from the +35Vdc. The splitter is used to separate the Upstream path to maintain a closed loop system with the BTS at the IF level. Without a closed loop, the Upstream is not able to transmit. The Bias-Tee is used to combine the external +35Vdc and the modulated IF upstream signal to the radio (OTRU). By increasing the variable attenuator, the BTS will detect a weaker signal, which will return a message to the NIU via the downstream to increase the power level of the upstream.

(1) Calibrate power meter to the proper frequency of transmission.

(2) Turn on the OTRU and adjust the variable attenuator on the upstream IF path to achieve a ≥ +19dBm at the antenna port. Add the appropriate fixed attenuators to avoid damage to the power meter.

(3) Measure output power at the low and high end of the band of operation of the OTRU. Measure the attenuator and compensate with an offset.

4.1.5 Test Equipment and Support Equipment

Instrument	Mfr./Model / S/N	Range	Calibration
Power Meter	Hewlett Packard/ Model EPM-441A Tool # 8067	N/A	Last: 98/11/13 Due: 99/11/13
Power Sensor	Hewlett Packard/ Model 8487A Tool # 10419	-30dBm to +20dBm	Last: 99/08/23 Due: 00/08/23

4.1.6 Results - Test Data

Equipment under Test	Frequency Band (MHz)	Maximum EIRP Level
OTRU Telaxis (Millitech) Basestation Transmitter	27,500 to 27,650	+25dBW maximum (1 foot antenna) 31dBW maximum (2 foot antenna)

Antenna Gain of a 1-foot antenna: 36dBi

Antenna Gain of a 2-foot antenna: 42dBi

Each carrier set at +19dBm (-11dBW), at the antenna port

Conversion from dBm to dBW: +19dBm - 30dB= -11dBW

4.2 Spectrum Mask

4.2.1 Test Specification

Standard	FCC Part 101 section 101.111(a)(2)(ii) (edition 10-1-98)
Method	FCC Part 2 section 2.1049 (edition 10-1-98)
Limits	A= 11+0.4(P-50) =10logB (B= 850MHz)

4.2.2 Test Location

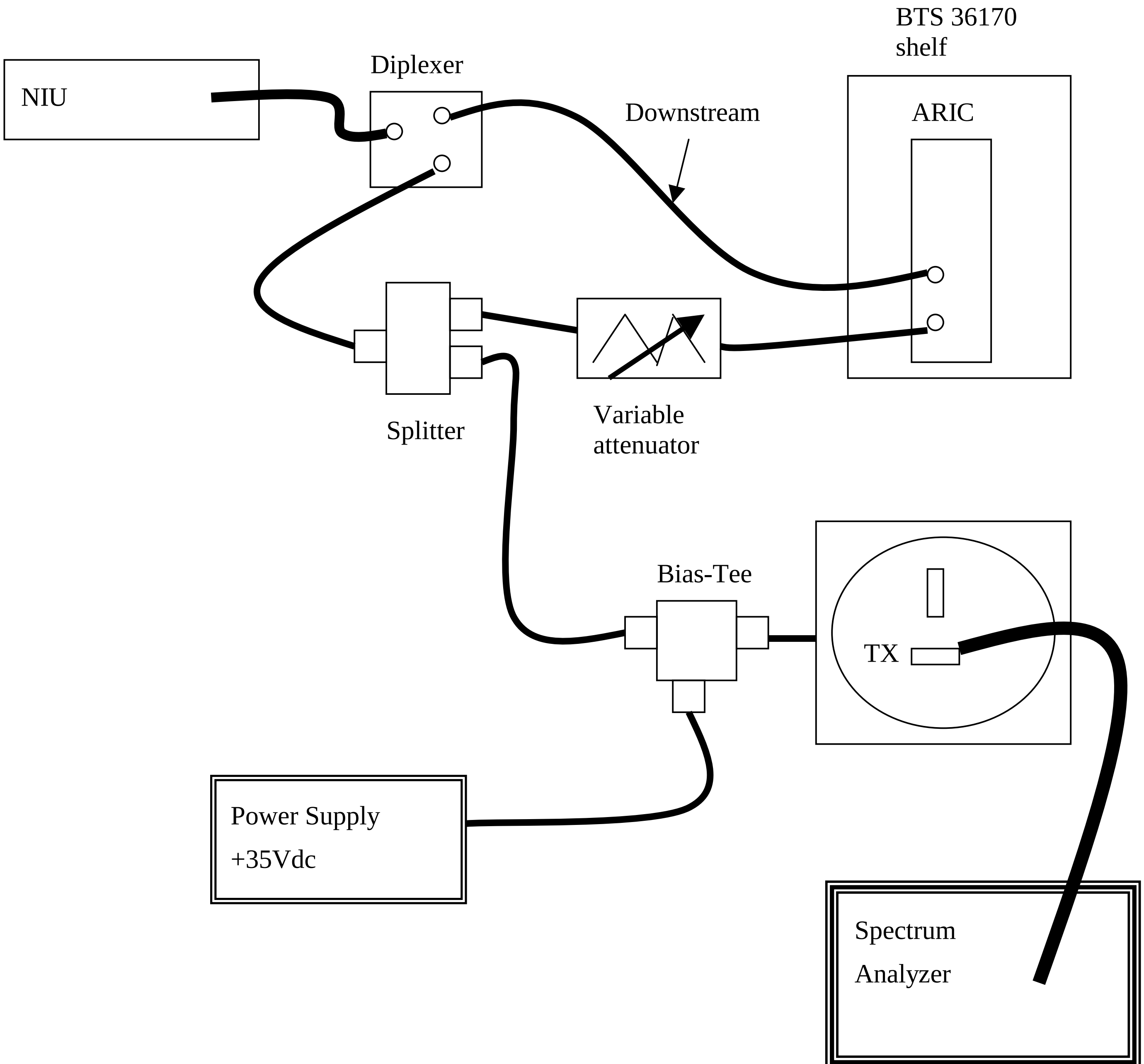
Test Laboratory	Newbridge Networks Corporation, Design Integrity Laboratory
Address	600 March Road Kanata, Ontario K2K 2E6
Prime Contact	Vito Scaringi, Wireless Approvals Specialist

4.2.3 Tested by

Test Engineer	Vito Scaringi, Wireless Approvals Specialist
Company	Newbridge Networks Corporation

4.2.4 Test Procedure

The measurements were done with one NIU and one OTRU communicating with the Basestation to control the output power level. The upstream was attenuated at the IF level, where the Basestation then provided a command to the NIU via the downstream to increase or decrease the output power level for the upstream. The carrier was adjusted at the RF output to approximately +19dBm.



Spectrum Mask measurement setup

(1) Set the settings of a spectrum analyzer as follows:

Center frequency	Carrier set at 27,505MHz (carrier is 9MHz)
Sweeping time	Automatic
Resolution bandwidth	1 MHz
Video bandwidth	$\geq$ 300 kHz (video averaging of display is allowed)
Y scale	10 dB/Div

(2) Connect spectrum analyzer at the antenna port of the transmitter and record the spectrum shape. Perform measurements at the edge of the frequency block near the lower end of the assigned band. Repeat measurements at the higher end of the assigned band or to the highest frequency the transmitter can operate at.

(3) Overlay the FCC mask and verify that it does not exceed the limits.

4.2.5 Test Equipment and Support Equipment

Instrument	Mfr./Model / S/N	Range	Calibration
Spectrum Analyzer	Hewlett Packard/ Model 8564/ Tool # 738	9kHz to 40GHz	Last: 98/11/13 Due: 99/11/13

4.2.6 Results - Test Data

Upstream frequency range: 27,500 to 27, 650MHz

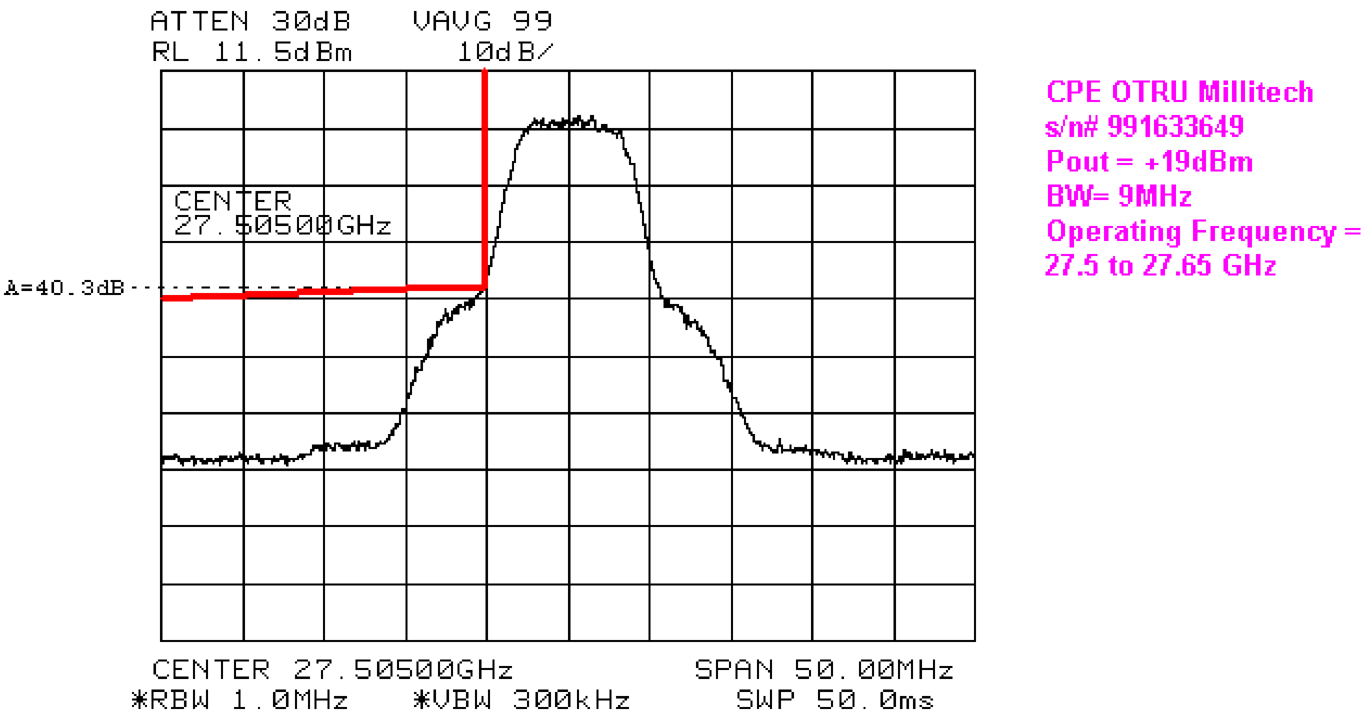
The highest frequency the last carrier will operate is at 27,645MHz with 9MHz carrier.

The lowest frequency the first carrier will operate at is 27,505MHz with 9MHz carrier

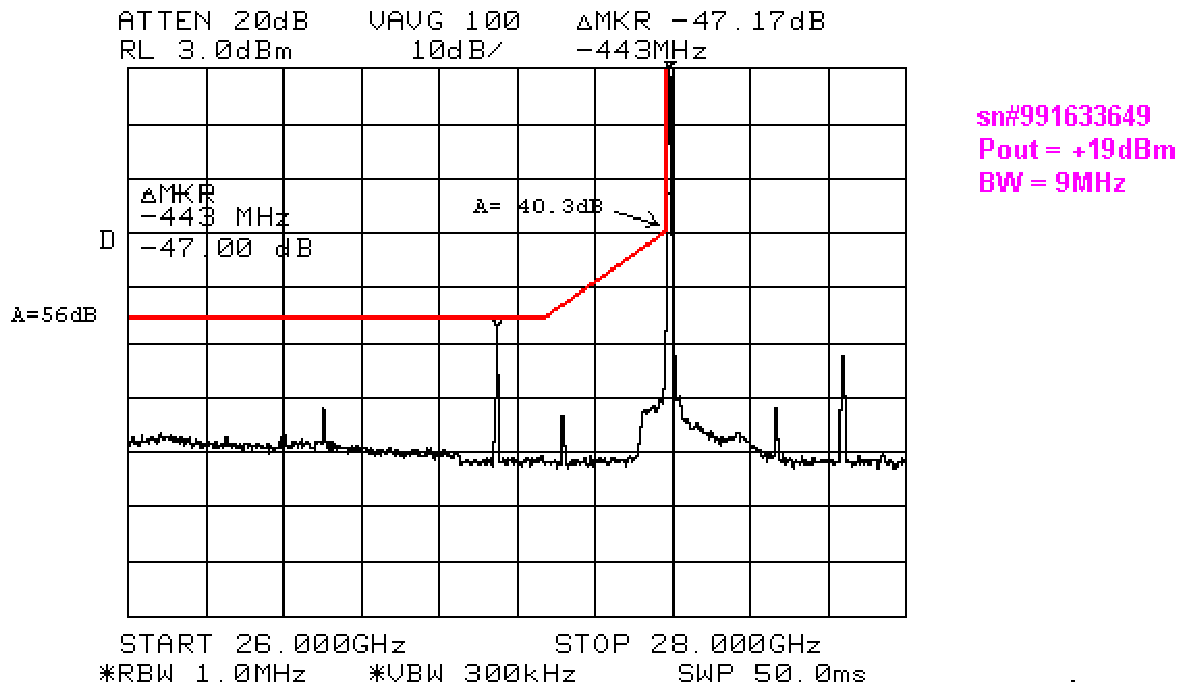
Note: The OTRU (TX) will not operate above 27,650MHz, therefore the spectrum mask is offset by 700MHz from the edge of the highest frequency carrier.

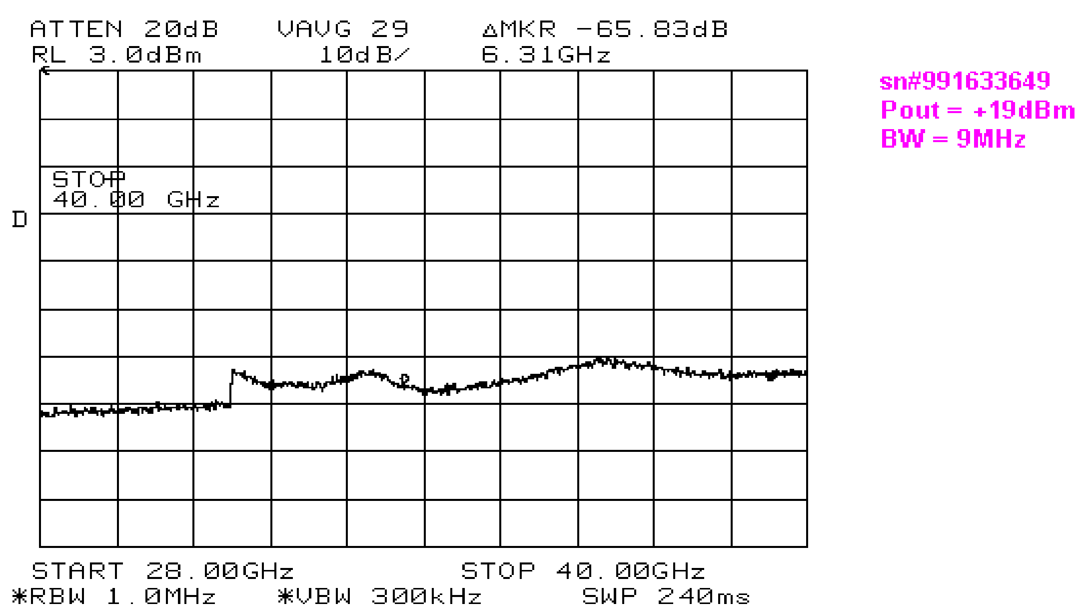
Each carrier BW= 9MHz

No spurious were measurable above 28GHz. See Spectrum Plots



Spectrum Plot was taken with a span of 50MHz to show a better resolution.





Spectrum Plots with wider span

4.3 Radiated Spurious

4.3.1 Test Specification

Standard	FCC Part 101 section 101.111(a)(2)(iii) (edition 10-1-98)
Limit	43 +10log Pmean

4.3.2 Test Location

Test Laboratory KTL Ottawa Inc.

Address 3325 River Road R.R.5
Ottawa, Ontario K1V 1H2

Prime Contact Ted Grant, Manager Electromagnetic Services

4.3.3 Tested by

Test Engineer Wayne Clarke

Company KTL Ottawa Inc.

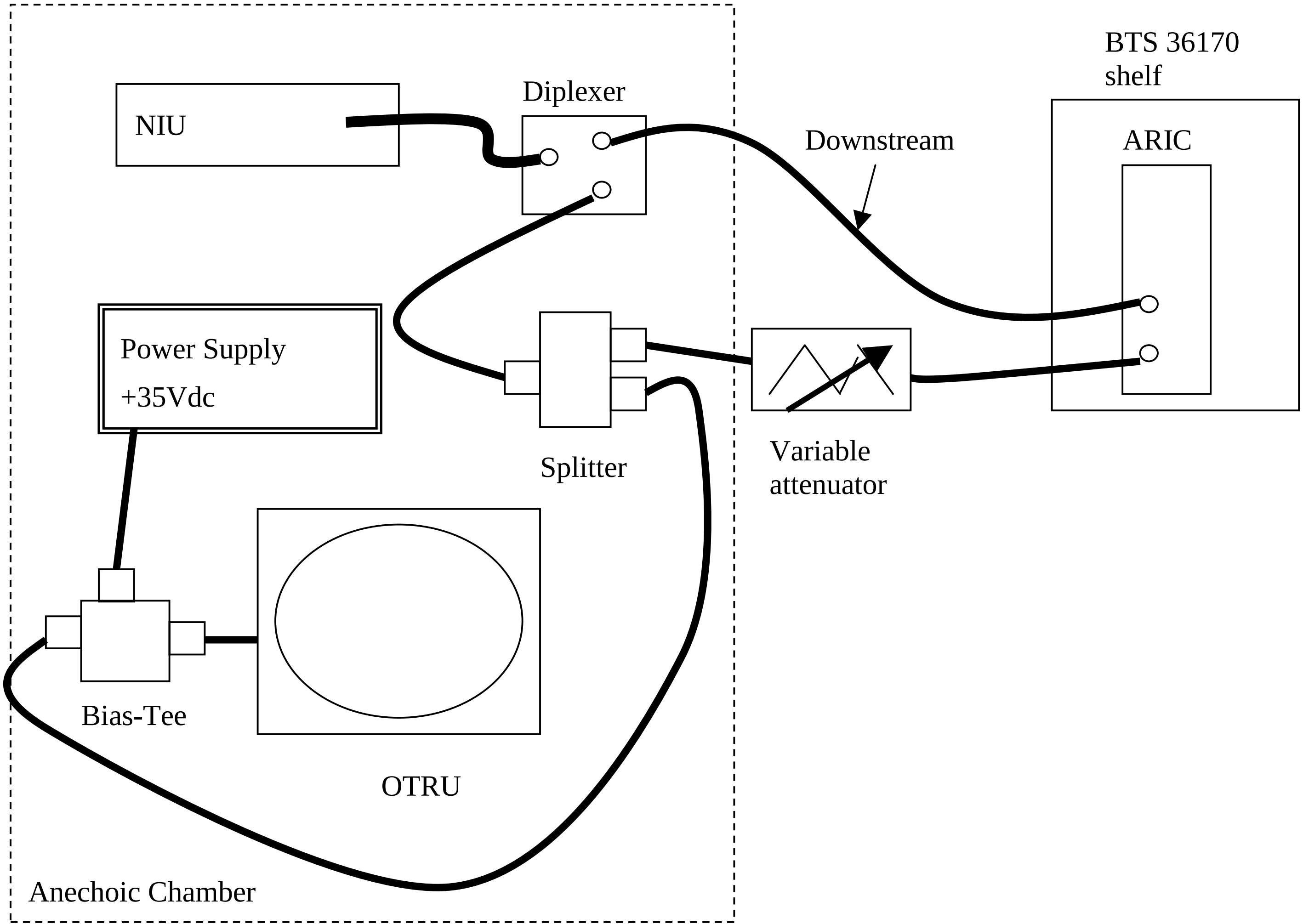
4.3.4 Test Procedure

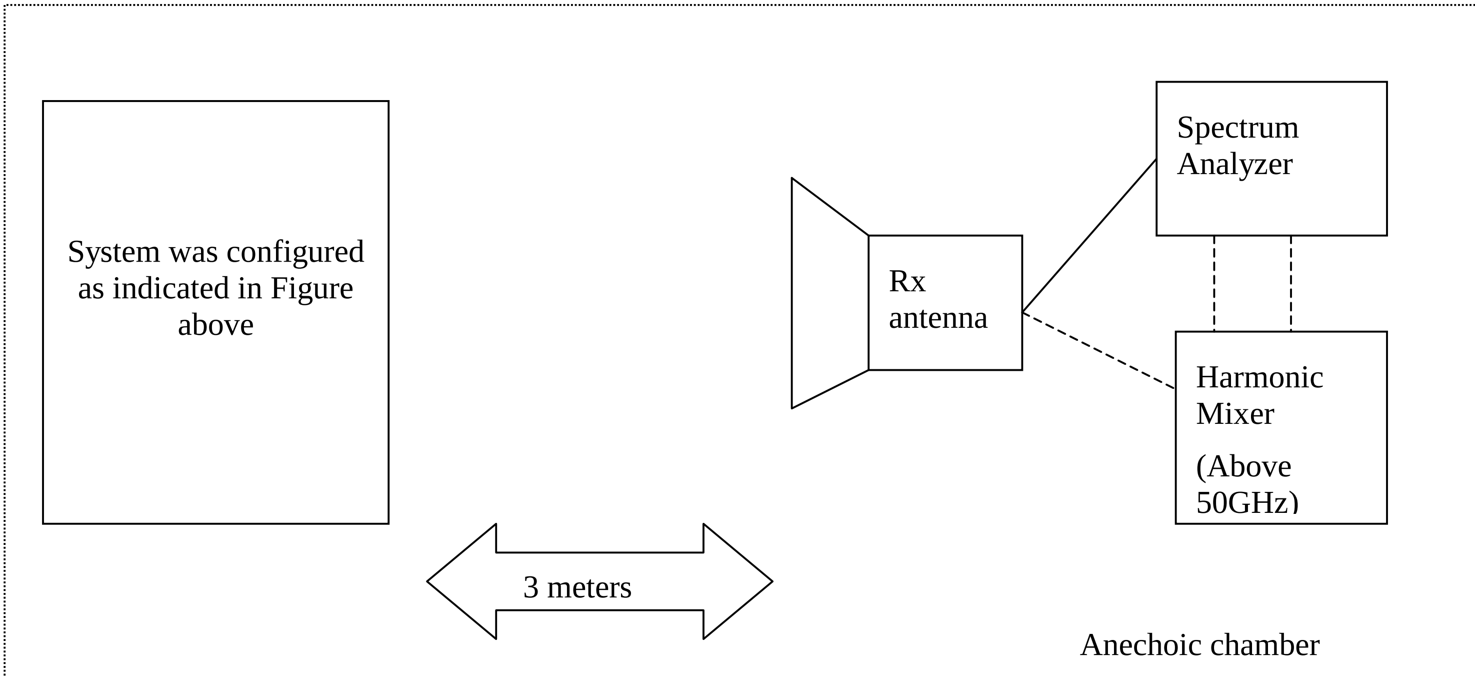
The measurements were done with one NIU and the OTRU was adjusted at the RF output to approximately $\geq$+19dBm at the antenna port.

The reference level was measured with the vertical polarized antenna that had a gain of 36dBi. Once the reference level was defined, the final measurements were taken with the OTRU port terminated with a 50Ω load.

All radiated spurious measurements were taken in semi-anechoic room at a distance of 3 meters in the vertical and horizontal polarization.

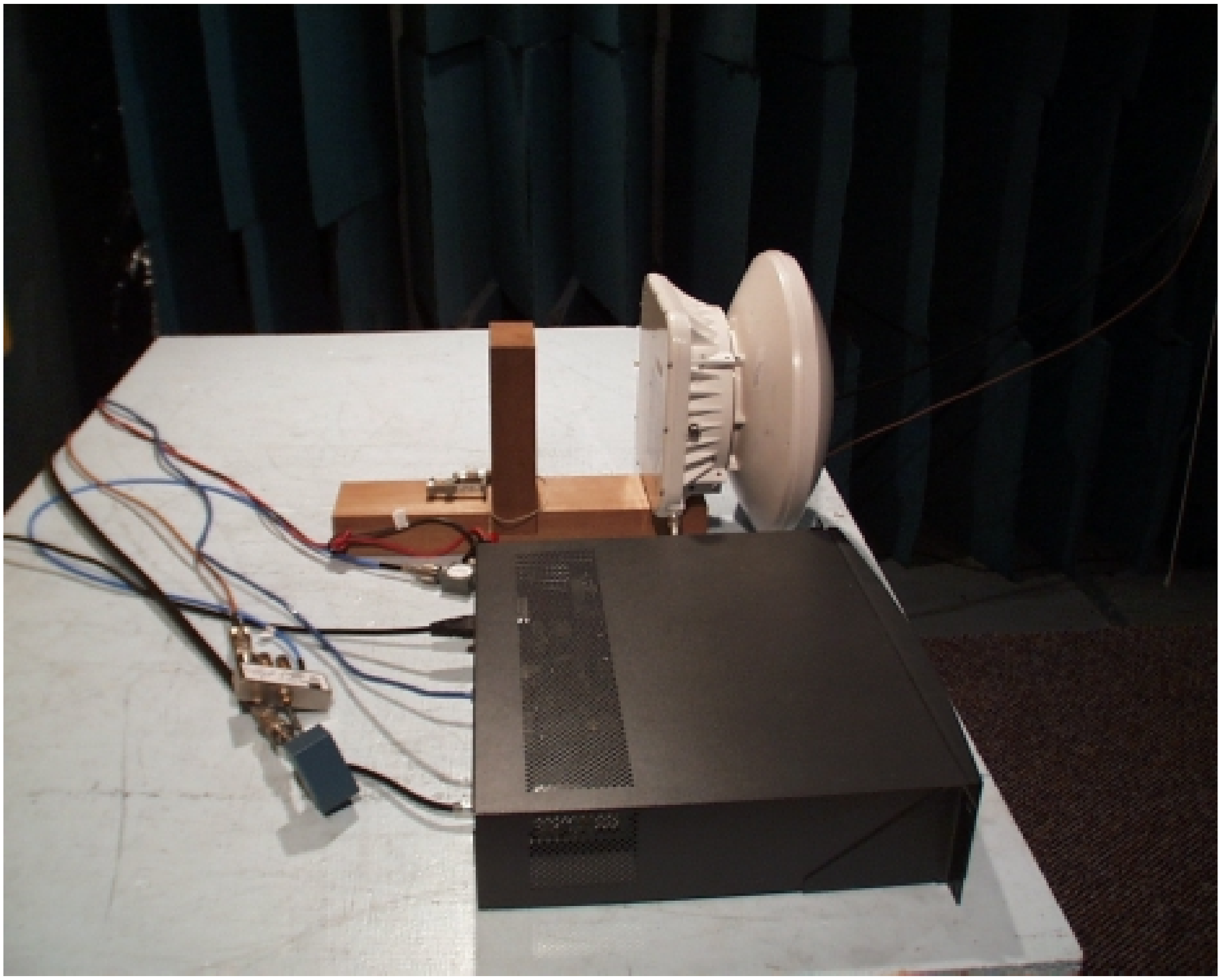
The system was setup in maximum configuration as indicated below.


BTS 36170
shelf
Diplexer
NIU
Downstream
ARIC
Power Supply
+35Vdc
Variable
attenuator
Splitter
Bias-Tee
OTRU
Anechoic Chamber



Radiated Spurious measurement setup

Radiated Spurious Setup front view in a Semi- Anechoic Chamber at KTL Ottawa Laboratories



Radiated Spurious setup, side view of the 28110 T1 NIU and OTRU with Splitter and Diplexer in a Semi- Anechoic Chamber at KTL Ottawa Laboratories

Radiated Spurious Setup in a Semi- Anechoic Chamber at KTL Ottawa Laboratories with OTRU terminated

4.3.5 Test Equipment and Support Equipment

Instrument	Mfr./Model / S/N	Range	Calibration
Spectrum Analyzer	HP 8565E SN #FA000981	9kHz to 50GHz	Last: 99/06/16 Due: 00/06/16
Biconical Antenna	EMCO/ 3109 SN #9204-2708	20 MHz to 300Mhz	Last: 98/09/24 Due: 99/09/24
Log Periodic Antenna	EMCO/ LPA-25 SN #1141	200MHz to 1GHz	Last: 98/07/27 Due: 99/09/24
Horn Antenna	EMCO/ 3115 SN #4336	1GHz to 18GHz	Last: 98/10/30 Due: 99/10/30
Horn Antenna	Electro-Metrics/ SH-50/60-1 SN # FA000479	18GHz to 26.5GHz	Last: 97/07/29 Due: 00/07/29
Horn Antenna	Electro-Metrics/ SH-50/60-2 SN # FA000485	26.5GHz to 40GHz	Last: 97/07/29 Due: 00/07/29
Horn Antenna	Millitech/ SGH-19-RP000 SN #021	40GHz to 60GHz	Last: 97/04/25 Due: 00/04/25
Horn Antenna	Millitech/ SGH-12-RP000 SN #031	60GHz to 90GHz	Last: 97/04/25 Due: 00/04/25
Horn Antenna	Millitech/ SGH-08-RP000 SN #FA001296	90GHz to 140GHz	Last: 98/10/13 Due: 01/10/13
Harmonic Mixer	HP 11970V SN #2521A01150	50GHz to 75GHz	Last: 97/02/25 Due: 00/02/25
Harmonic Mixer	HP 11970W SN #2521A01465	75GHz to 110GHz	Last: 98/10/13 Due: 01/10/13

4.3.6 Results - Test Data

***Note 1**: Ignore the limit lines on the plots specified in Appendix A, for the calculations during the measurements were wrong. The new levels are calculated and specified in the Table below for a spurious measured or mid-band of each graph that does not display a spurious.*

The spurious were verified from 30MHz to 100GHz and were below the limits.
See Appendix A for plots.
Antenna Gain = 36dBi
Total Output Power = +19dBm (-11dBW) or 0.08W
A= 43+10log(Pmean in watts) ; therefore, A= 32dB

The total power measured at a distance of 3 meters was 112.5dBuV over a 9MHz bandwidth (1 carrier) using a 36dBi, directional antenna in the vertical polarization. Total output power at the antenna port = +19dBm (0.08watts)

NOTE 2:

When a RBW of 10kHz was used, a correction factor of 4 dB was subtracted to the spurious measured (10log 4/10 =- 4dB).

When a RBW of 3kHz was used, a correction factor of 1.25 dB was added to the spurious measured. (10 log 4/3 = 1.25dB).

Cables losses were not taken into consideration for the calculations, but would be used if spurious were within 5 dBs of the limits. (Above 50GHz a correction factor was added into the HP spectrum analyzer according to the harmonic mixer specifications).

Calculations

Absolute Level = (measured level) + (Propagation loss) – (Receiver Antenna Gain) – (RBW correction factor)

Limit Level = Absolute Level – A;

where A= 43+10log (Pmean in watts) therefore, A= 43 + 10 log 0.08= 32dB

Propagation Loss = 32 dB + 20 log f(MHz) + 20 log d (km)

(All measurements were taken at 3 meters distance)

i.e.: Reference level at 27.505GHz

Absolute Reference Level = 112.5dBuV + (32 + 88.79 - 50.46) – 15.22dB = 167.61dBuV

Limit Level = 167.61- 32 = 135.61dBuV

Frequency (MHz)	Measured Level (dBuV)	Polarization (V/H)	Propagation Losses (dB)	RX Antenna Gain (dBi)	RBW correction Factor (dB)	**Spurious Measured (dBuV)**	Limit Level (dBuV)
Radiated Spurious Measurements							
Spurious Measured = (measured level) + (Propagation loss) – (Receiver Antenna Gain) – (RBW correction factor)							
Reference level at 27.505GHz Absolute Reference Level = 112.5dBuV + (32 + 88.79 - 50.46) – 15.22dB = 167.61dBuV Limit Level = 167.61- 32 = **135.61dBuV**							
57	31.3	V	16.6599222	-2.7	4	**46.66**	135.61
650	22	V	37.8006922	6.9	4	**48.90**	135.61
9500	25	V	61.0968972	10.1	4	**72.00**	135.61
28250	35	V	70.5627941	15.39	4	**86.17**	135.61
32500	40	V	71.7800923	16.33	4	**91.45**	135.61
35500	40	V	72.5469922	17	4	**91.55**	135.61
37000	38	V	72.9064596	17.33	-1.25	**94.83**	135.61
39000	40	V	73.3637172	17.78	4	**91.58**	135.61
45000	42	V	74.6066754	23.1	4	**89.51**	135.61
55000	50	V	76.3496789	23.6	4	**98.75**	135.61
67500	24	V	78.1285006	23	4	**75.13**	135.61
82500	32	V	79.8715041	23.6	4	**84.27**	135.61
95000	34	V	81.0968972	22.7	4	**88.40**	135.61

Radiated Spurious Measurements							
Spurious Measured = (measured level) + (Propagation loss) – (Receiver Antenna Gain) – (RBW correction factor)							
Reference level at 27.505GHz Absolute Reference Level = 112.5dBuV + (32 + 88.79 - 50.46) – 15.22dB = 167.61dBuV Limit Level = 167.61- 32 = **135.61dBuV**							
Frequency (MHz)	Measured Level (dBuV)	Polarization (V/H)	Propagation Losses (dB)	RX Antenna Gain (dBi)	RBW correction Factor (dB)	**Spurious Measured (dBuV)**	Limit Level (dBuV)
56.6	32.17	H	16.5987537	-2.7	4	**47.47**	135.61
650	22	H	37.8006922	6.9	4	**48.90**	135.61
9500	23	H	61.0968972	10.1	4	**70.00**	135.61
22250	35	H	68.4890254	16.61	4	**82.88**	135.61
28250	32	H	70.5627941	15.39	4	**83.17**	135.61
32500	37	H	71.7800923	16.33	4	**88.45**	135.61
35500	40	H	72.5469922	17	4	**91.55**	135.61
37000	38	H	72.9064596	17.33	-1.25	**94.83**	135.61
39000	40	H	73.3637172	17.78	4	**91.58**	135.61
45000	43	H	74.6066754	23.1	4	**90.51**	135.61
55000	50	H	76.3496789	23.6	4	**98.75**	135.61
67500	22	H	78.1285006	23	4	**73.13**	135.61
82500	32	H	79.8715041	23.6	4	**84.27**	135.61
95000	32	H	81.0968972	22.7	4	**86.40**	135.61

Type Examination

The same setup and equipment was also tested according to the FCC Part 15 Subpart B and Bellcore GR-1089 standards and met Class B for radiated emission measurements.

4.4 Conducted Spurious

4.4.1 Test Specification

Standard	FCC Part 101 section 101.111(a)(2)(iii) (edition 10-1-98)
Limit	+10log Pmean

4.4.2 Test Location

Test Laboratory KTL Ottawa Inc.

Address 3325 River Road R.R.5
Ottawa, Ontario K1V 1H2

Prime Contact Ted Grant, Manager Electromagnetic Services

4.4.3 Tested by

Test Engineer Vito Scaringi, Wireless Approvals Specialist

Company Newbridge Networks Corporation

4.4.4 Test Procedure

The conducted spurious are measured at the antenna port of the OTRU in normal operation.

The measurements were done with one NIU interconnected to a diplexer and the basestation to achieve traffic at the IF level. The IF upstream was split to feed a modulated IF output to the OTRU. The upstream was attenuated (variable) at the IF level, where the Basestation then provided a command to the NIU via the downstream to boost or reduce the output power level for the upstream. The attenuation was adjusted to maintain a RF output to approximately +19dBm.

Measured emissions at the frequencies, which are outside the occupied bandwidth up to 100GHz.

Conducted Spurious measurement setup

Conducted Spurious Setup at KTL Ottawa Laboratories

4.4.5 Test Equipment and Support Equipment

Instrument	Mfr./Model / S/N	Range	Calibration
Harmonic Mixer	HP 11970V SN #2521A01150	50GHz to 75GHz	Last: 97/02/25 Due: 00/02/25
Harmonic Mixer	HP 11970W SN #2521A01465	75GHz to 110GHz	Last: 98/10/13 Due: 01/10/13
Spectrum Analyzer	HP 8565E SN #FA000981	9kHz to 50GHz	Last: 99/06/16 Due: 00/06/16

4.4.6 Results - Test Data

The spurious were verified from 30MHz to 100GHz and were below the limits.

See Appendix B for plots and calculations of limit lines.

Total Output Power = +19dBm (-11dBW) or 0.08W

A= 43+10log(Pmean in watts)

Therefore, A= 32dB

***Note*: A correction factor of 4dB for the different resolution bandwidth used from RBW= 10kHz to 4kHz; (10log 10/4 = 4dB) was ignored and taken as worst conditions. Cables losses were not taken into consideration for the calculations, but would be used if spurious were within 5 dBs of the limits. (Above 50GHz a correction factor was added into the HP spectrum analyzer according to the harmonic mixer specifications).**

The reference output power measured was –6.7dBm over a 9MHz bandwidth after the attenuators and cable losses. Total output power at the antenna port = +19dBm (0.08watts)

Limit = (measured level) – A; where A= 43+10log (Pmean in watts)

A= 43 + 10 log 0.08= 32dB

i.e.: -6.7dBm – 32 = -38.7dBm (reference level)

4.5 Frequency Stability

4.5.1 Test Specification

Standard	FCC Part 101 section 101.107
Limit	+/- 10ppm

4.5.2 Test Location

Test Laboratory Newbridge Networks Corporation,
Design Integrity Laboratory

Address 600 March Road
Kanata, Ontario K2K 2E6

Prime Contact Vito Scaringi, Wireless Approvals Specialist

4.5.3 Tested by

Test Engineer Vito Scaringi, Wireless Approvals Specialist

Company Newbridge Networks Corporation

4.5.4 Test Procedure

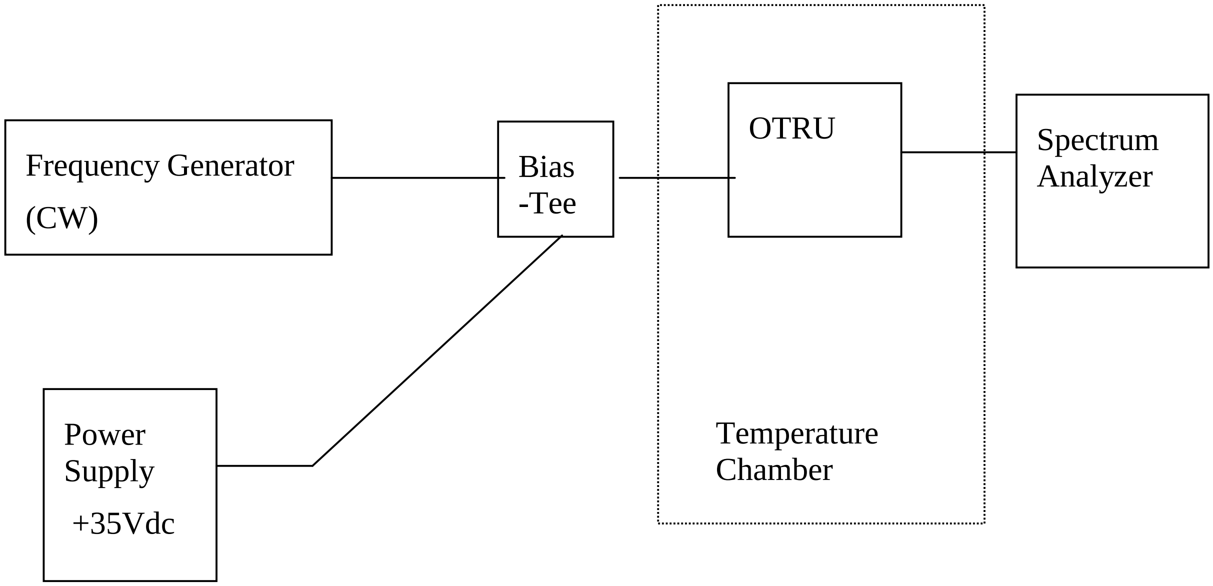
For the frequency stability measurements, an external source was used to provide an IF CW to the radio unit. Only the OTRU was placed in the temperature chamber during this specific test. The NIU will usually be in a temperature-controlled environment, but can operate within a range of –10C to +55C.

The NIU was not in the setup, due to the software will not support in sending a CW to the OTRU. Also the transmitter will not operate if the system, including the basestation, is not receiving traffic from the downstream forming a closed loop.

An algorithm has been designed that will correct the frequency when the system is operating in a closed loop; upstream and downstream fully functional (synchronized). This algorithm has been designed to achieve the +/-10ppm limits**. The tests were done without the closed loop, therefore the algorithm does not come into play and is considered the worst case for the OTRU.**

All measurements were taken according to the method mentioned in the FCC Part 2, where a reading was taken at every 10^{o} C intervals and the supply voltage was varied to the range of +22Vdc to +36Vdc.

<u>**Note:**</u> **The CPE operates on AC, but an external supply was used to vary the DC source to the OTRU, due to the NIU changes the secondary source (DC) very little when the primary (AC) is varied. Therefore the DC supply was varied to show that the frequency is not affected by voltage fluctuation. The AC source is capable of handling from 85 to 264Vac keeping the +35Vdc constant. i.e.: 85Vac= +35.155Vdc (worst case)**



Frequency Stability measurement setup

4.5.5 Test Equipment and Support Equipment

Instrument	Mfr./Model / S/N	Range	Calibration
Spectrum Analyzer	Hewlett Packard/ Model 8564/ Tool # 738	9kHz to 40GHz	Last: 98/11/13 Due: 99/11/13
Frequency Generator	Hewlett Packard/ Model 8648C/ Tool # 8323	9kHz to 3.2GHz	Last: 98/04/06 Due: 00/04/06

4.5.6 Results - Test Data

Nominal DC Supply Voltage to Radio is +35Vdc

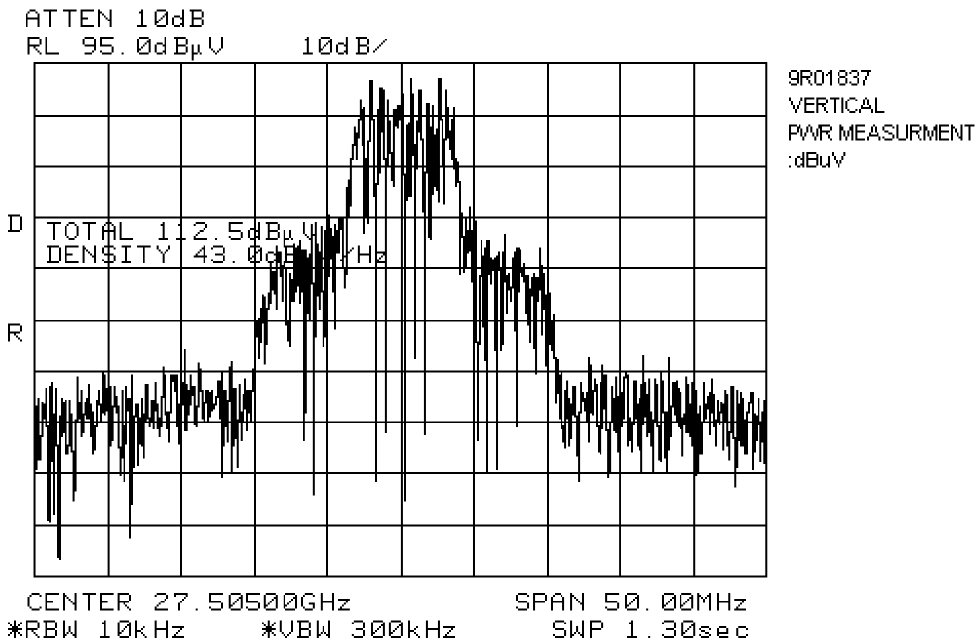
Note: An external supply was used to vary the DC source from +22V to +36V.

Temperature (°C)	Frequency (kHz)	Measured Frequency (kHz)		Tolerance
		Supply voltage Note: An external supply was used to vary the DC source, due to the NIU changes the secondary source (DC) very little when the primary (AC) is varied. The AC source is capable of handling from 85 to 264Vac keeping the +35Vdc constant. i.e.: 85Vac= +35.155Vdc (worst case)		Limit (+/-10ppm) (+/-275kHz)
		+22Vdc	+36Vdc	
-30	27,500,000	27,500,063.2	27,500,063.2	<2.5ppm
-20	27,500,000	27,500,064.8	27,500,064.8	<2.5ppm
-10	27,500,000	27,500,075.3	27,500,075.3	<3ppm
0	27,500,000	27,500,090.0	27,500,090.0	<4ppm
10	27,500,000	27,500,097.0	27,500,097.0	<4ppm
20	27,500,000	27,500,102.7	27,500,102.7	<4ppm
30	27,500,000	27,500,117.7	27,500,117.7	<5ppm
40	27,500,000	27,500,150.2	27,500,150.2	<6ppm
50	27,500,000	27,500,185.5	27,500,185.5	<7ppm

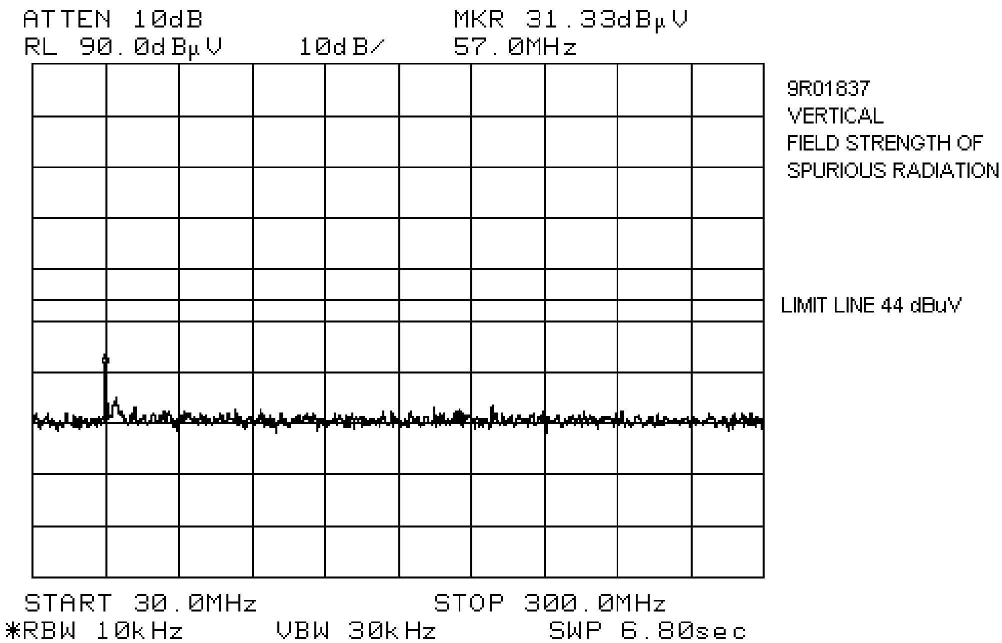
APPENDIX A: RADIATED SPURIOUS PLOTS - VERTICAL

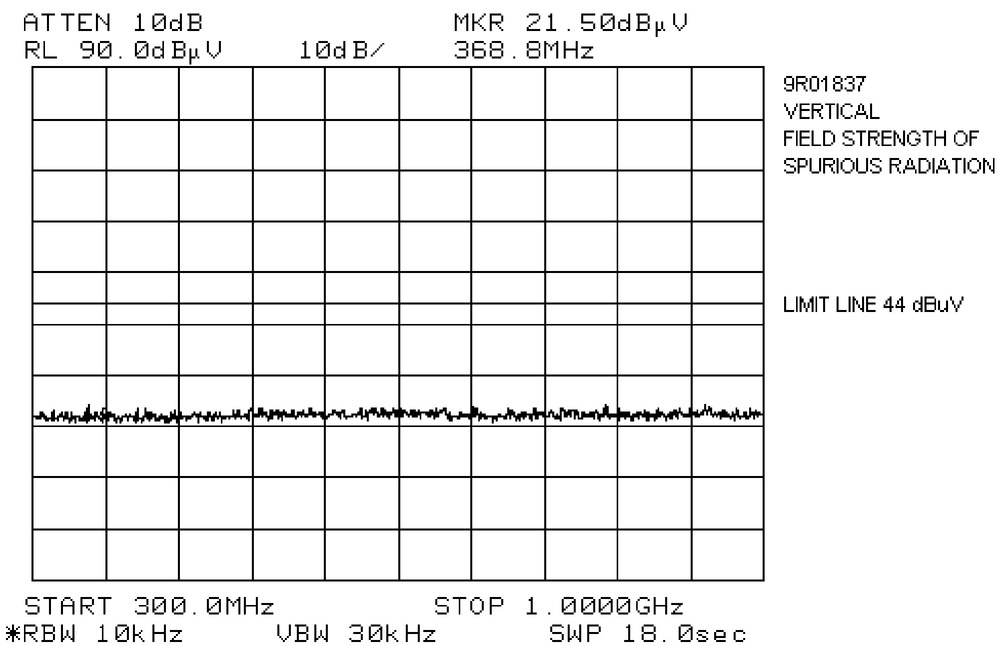
(Vertical Polarization)

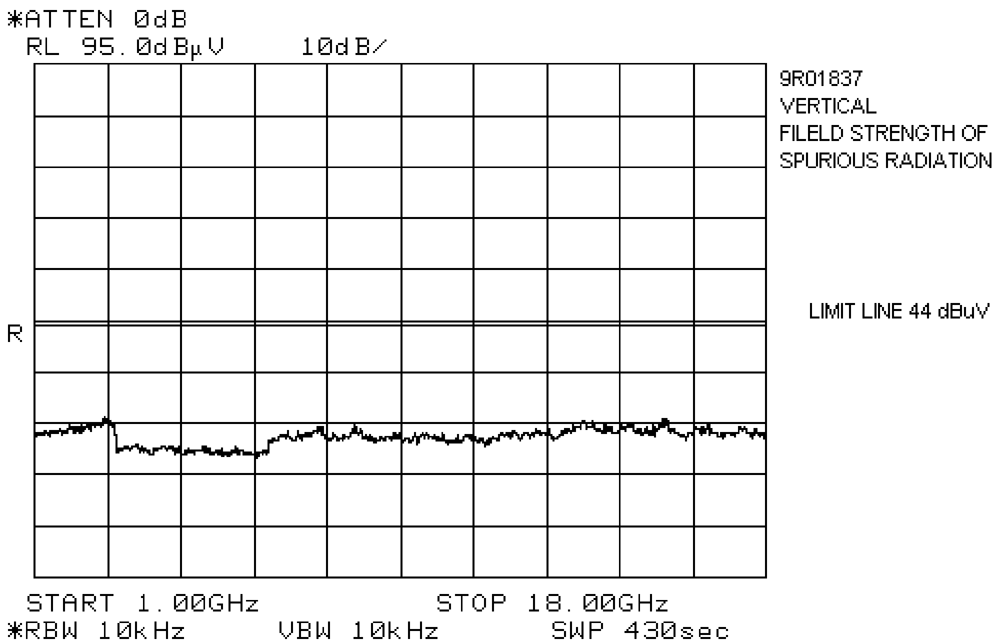
REFERENCE LEVEL

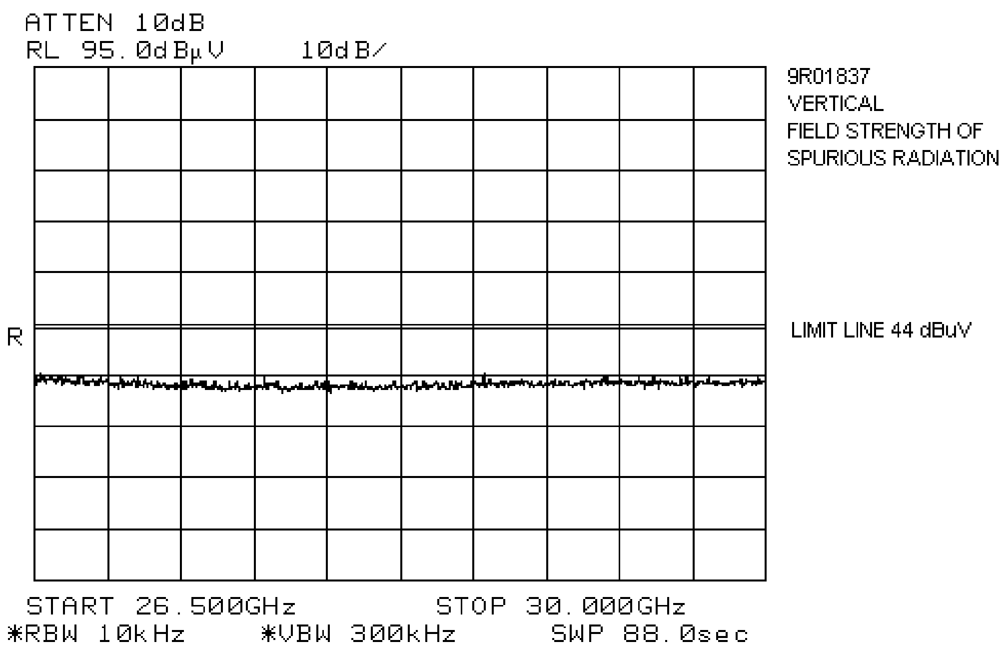


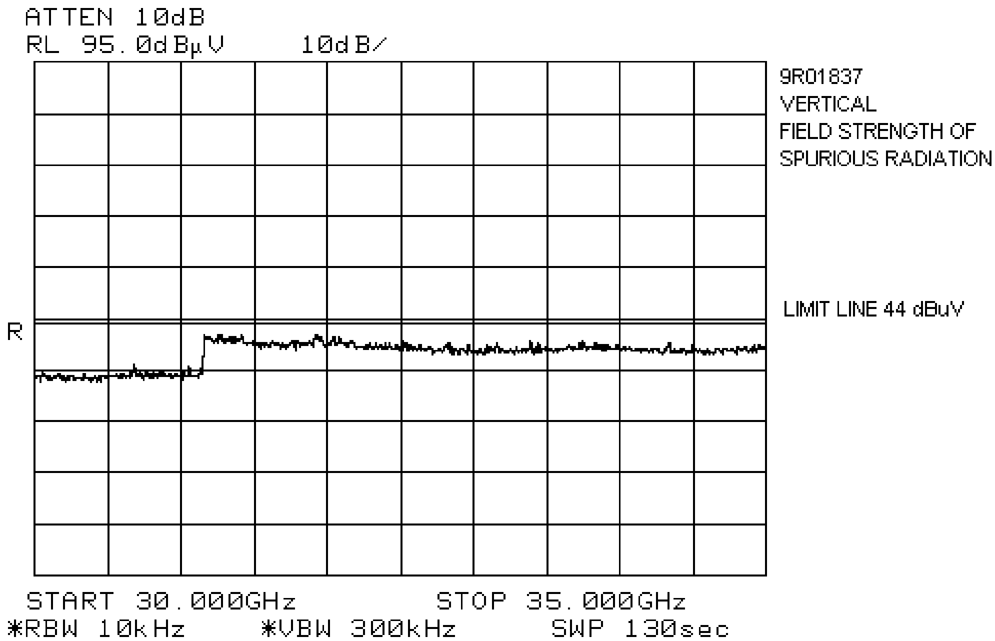
The total power measured at a distance of 3 meters was 112.5dBuV over a 9MHz bandwidth using a 36dBi, one-foot antenna in the vertical polarization. Total output power at the antenna port = +19dBm (0.08 watts)

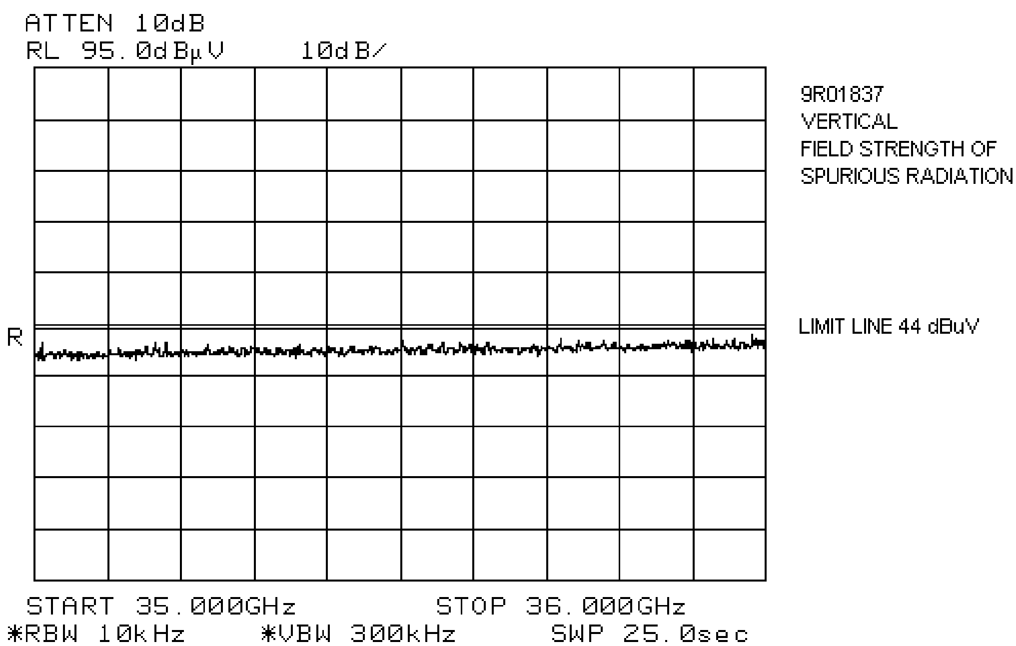

ATTEN 10dB
MKR 31.33dBμV
RL 90.0dBμV
10dB/
57.0MHz
9R01837
VERTICAL
FIELD STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
START 30.0MHz
STOP 300.0MHz
*RBW 10kHz
VBW 30kHz
SWP 6.80sec

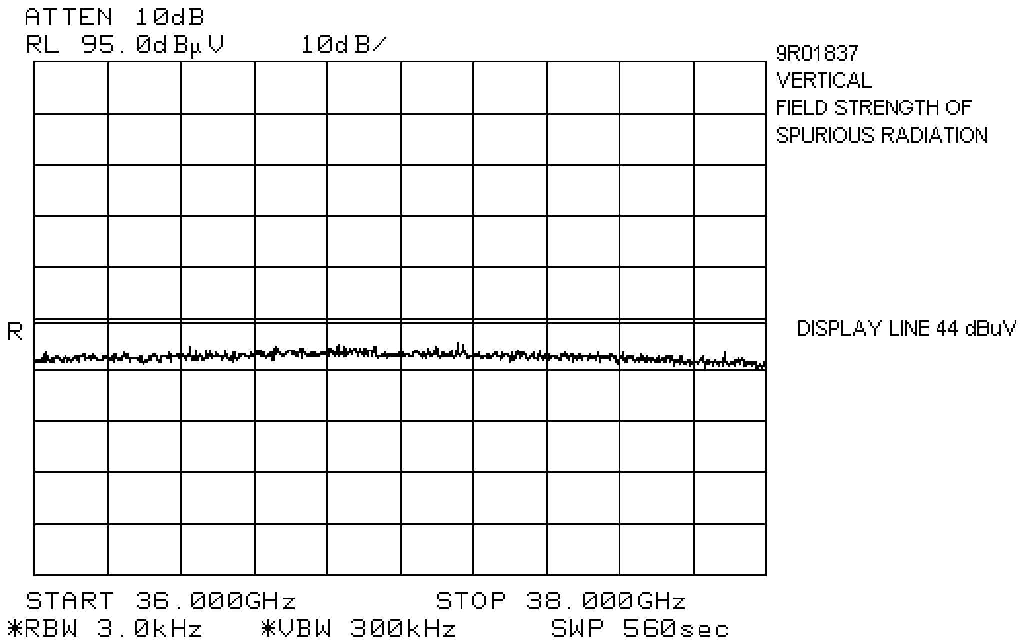

ATTEN 10dB
MKR 21.50dBμV
RL 90.0dBμV
10dB/
368.8MHz
9R01837
VERTICAL
FIELD STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
START 300.0MHz
STOP 1.0000GHz
*RBW 10kHz
VBW 30kHz
SWP 18.0sec

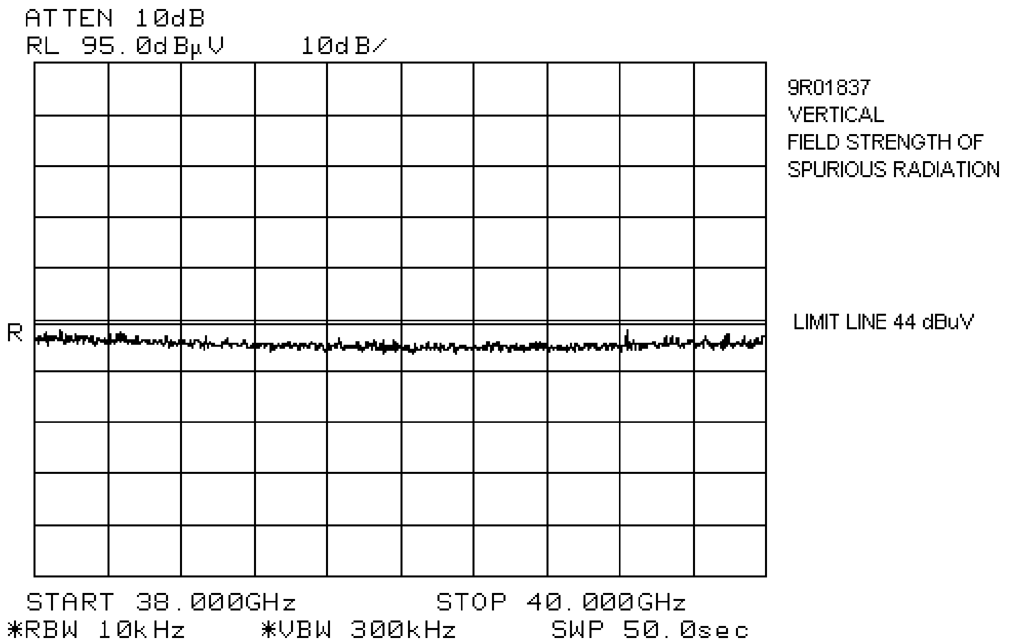

*ATTEN 0dB
RL 95.0dBµV 10dB/
9R01837
VERTICAL
FILELD STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
R
START 1.00GHz STOP 18.00GHz
*RBW 10kHz VBW 10kHz SWP 430sec

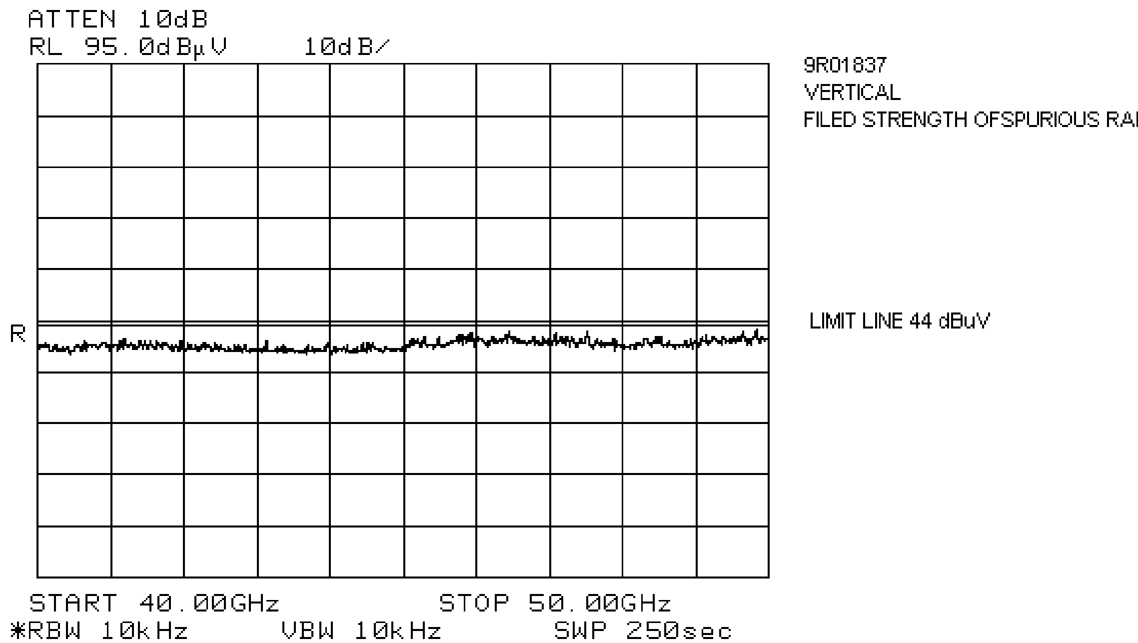

ATTEN 10dB
RL 95.0dBµV 10dB/
9R01837
VERTICAL
FIELD STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
R
START 26.500GHz STOP 30.000GHz
*RBW 10kHz *VBW 300kHz SWP 88.0sec

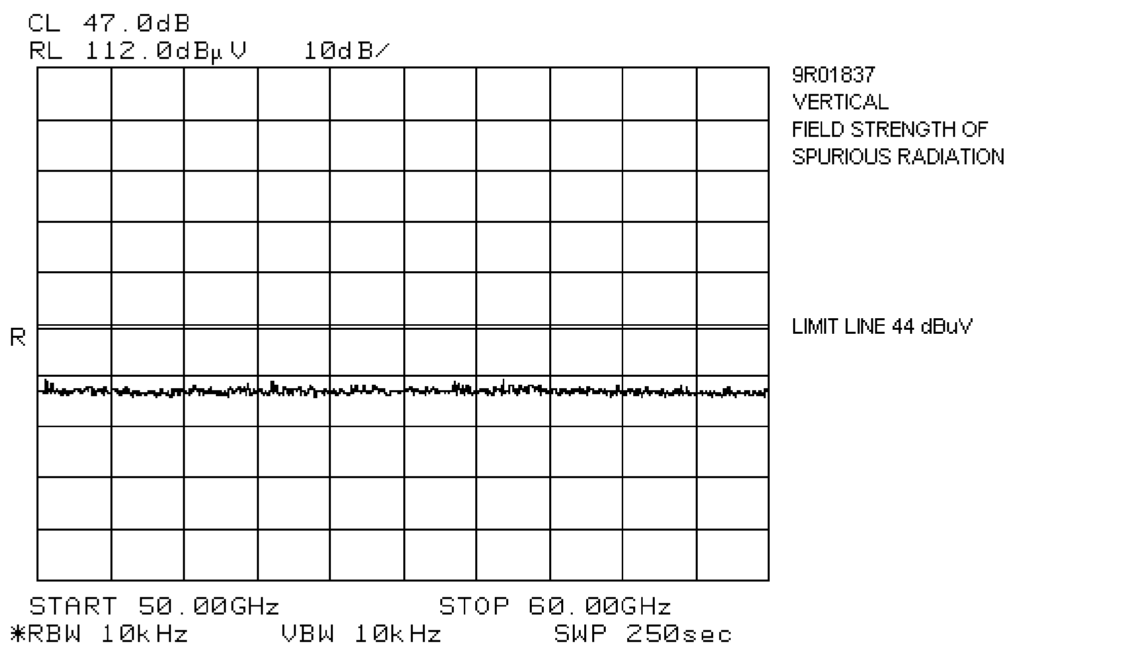

ATTEN 10dB
RL 95.0dBμV 10dB/
9R01837
VERTICAL
FIELD STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
R
START 30.000GHz STOP 35.000GHz
*RBW 10kHz *VBW 300kHz SWP 130sec

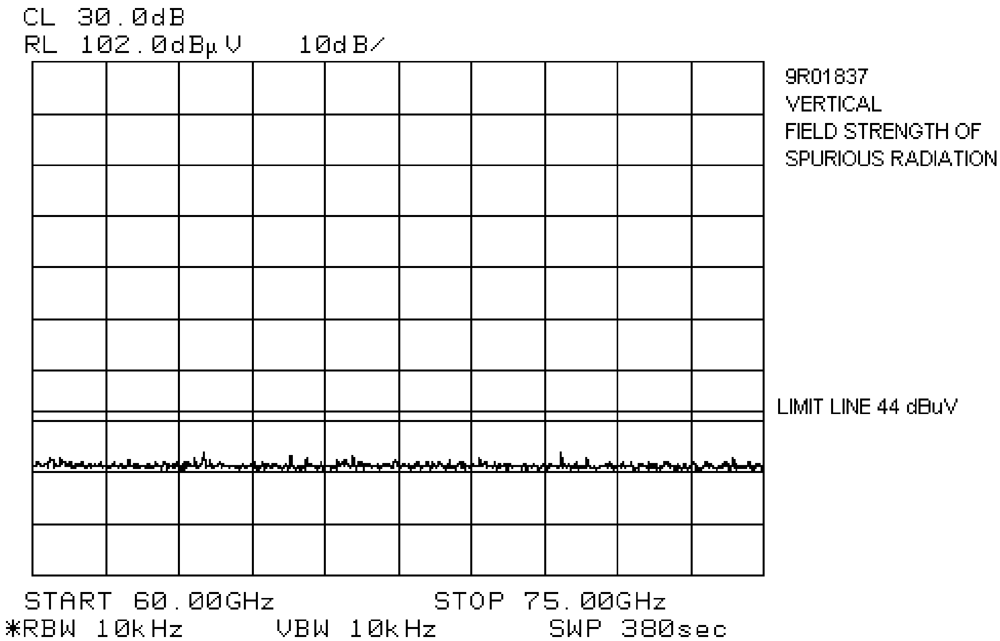

ATTEN 10dB
RL 95.0dBμV 10dB/
9R01837
VERTICAL
FIELD STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
R
START 35.000GHz STOP 36.000GHz
*RBW 10kHz *VBW 300kHz SWP 25.0sec

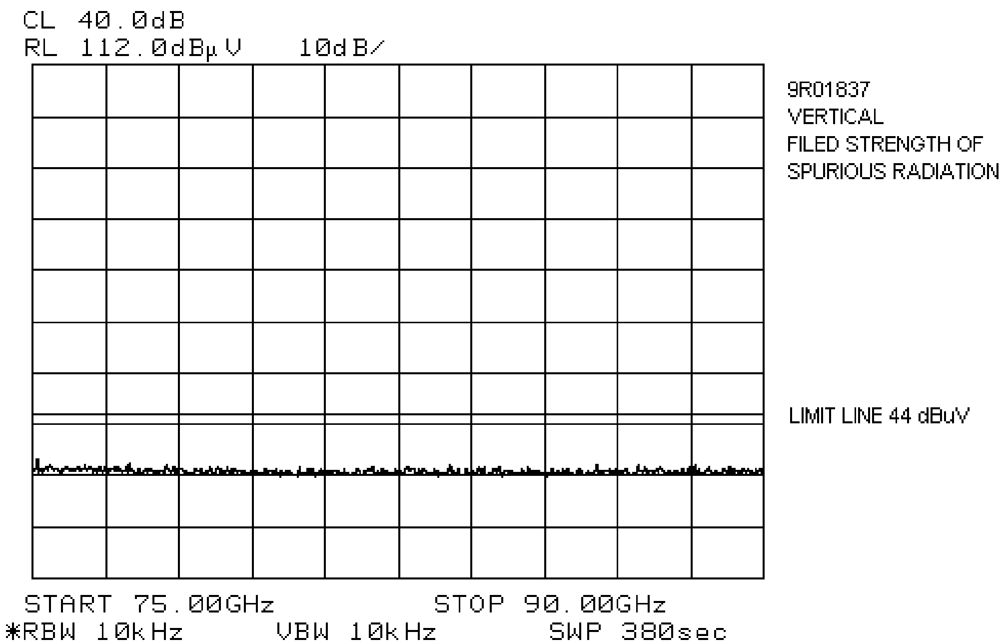

ATTEN 10dB
RL 95.0dBμV 10dB/
R
9R01837
VERTICAL
FIELD STRENGTH OF
SPURIOUS RADIATION
DISPLAY LINE 44 dBuV
START 36.000GHz STOP 38.000GHz
*RBW 3.0kHz *VBW 300kHz SWP 560sec

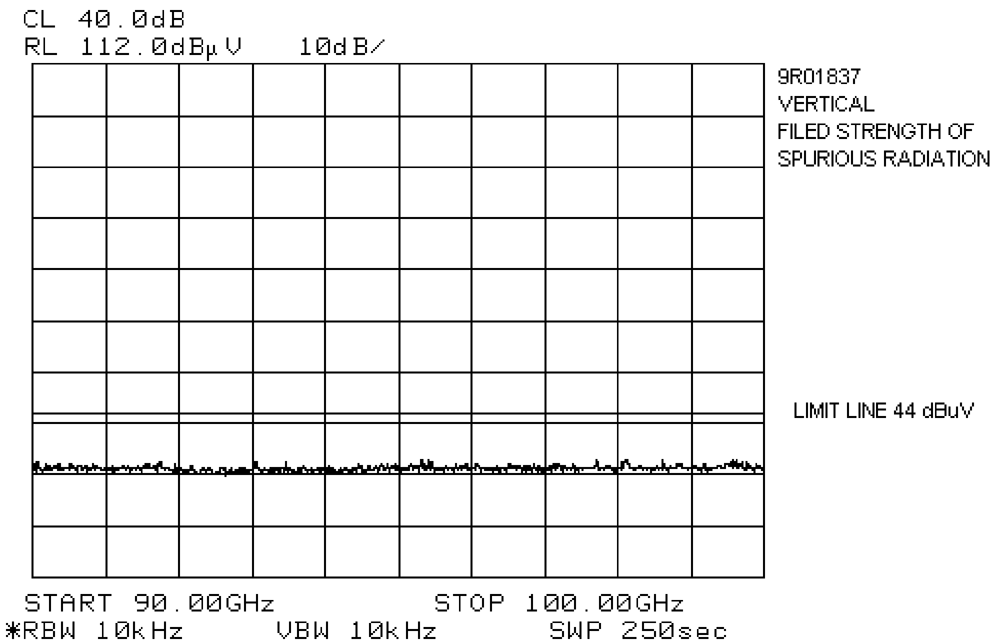

ATTEN 10dB
RL 95.0dBμV 10dB/
R
9R01837
VERTICAL
FIELD STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
START 38.000GHz STOP 40.000GHz
*RBW 10kHz *VBW 300kHz SWP 50.0sec


ATTEN 10dB
RL 95.0dBμV 10dB/
9R01837
VERTICAL
FILED STRENGTH OFSPURIOUS RAI
LIMIT LINE 44 dBuV
R
START 40.00GHz STOP 50.00GHz
*RBW 10kHz VBW 10kHz SWP 250sec


CL 47.0dB
RL 112.0dBμV 10dB/
9R01837
VERTICAL
FIELD STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
R
START 50.00GHz STOP 60.00GHz
*RBW 10kHz VBW 10kHz SWP 250sec

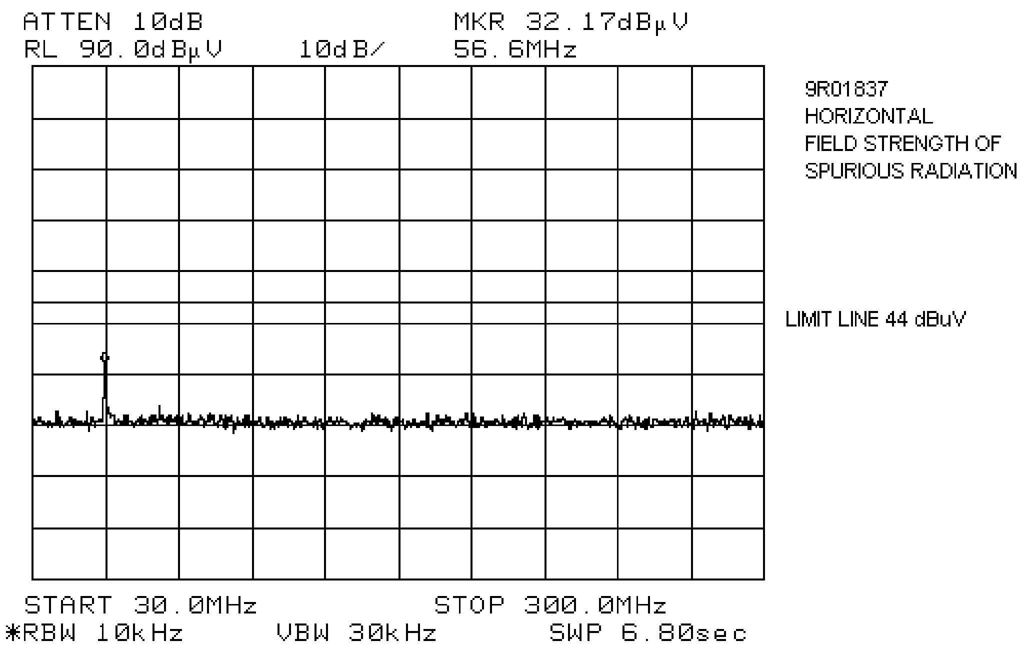

CL 30.0dB
RL 102.0dBµV 10dB/
9R01837
VERTICAL
FIELD STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
START 60.00GHz STOP 75.00GHz
*RBW 10kHz VBW 10kHz SWP 380sec

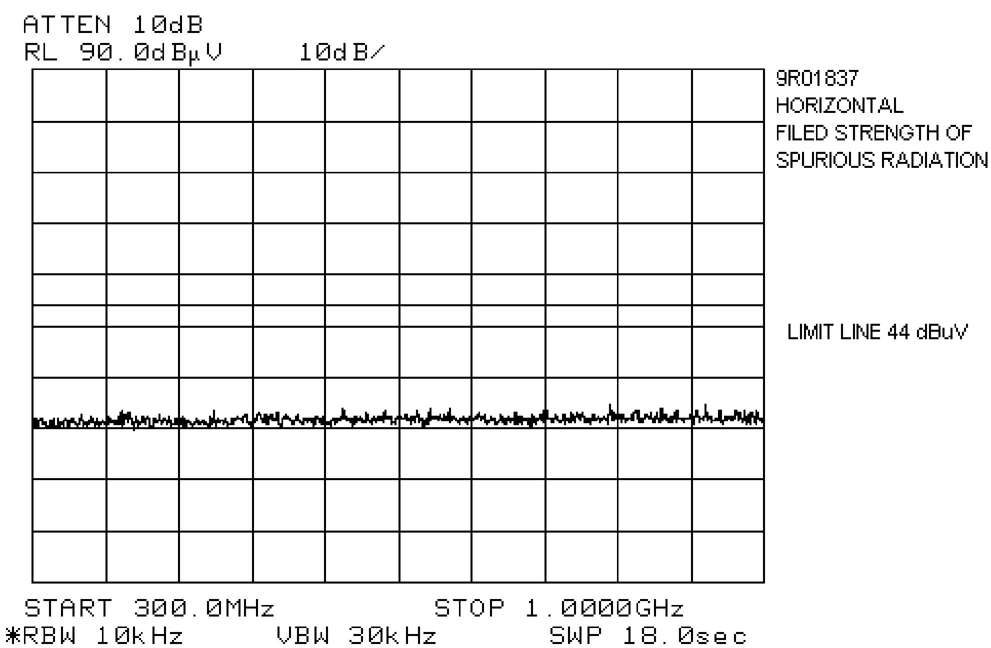

CL 40.0dB
RL 112.0dBµV 10dB/
9R01837
VERTICAL
FILED STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
START 75.00GHz STOP 90.00GHz
*RBW 10kHz VBW 10kHz SWP 380sec

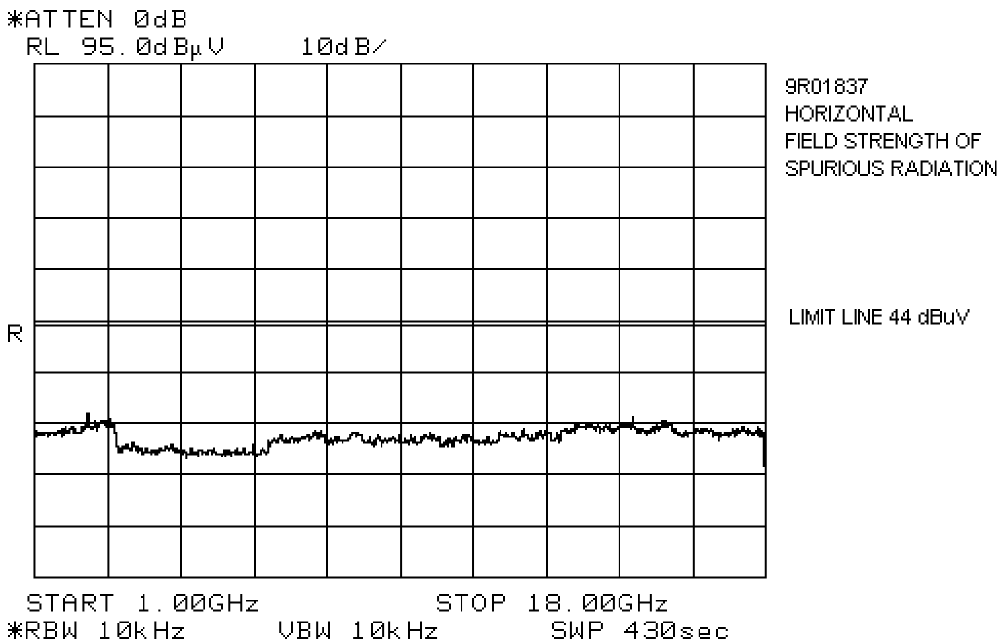

CL 40.0dB
RL 112.0dBμV 10dB/
9R01837
VERTICAL
FILED STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
START 90.00GHz STOP 100.00GHz
*RBW 10kHz VBW 10kHz SWP 250sec

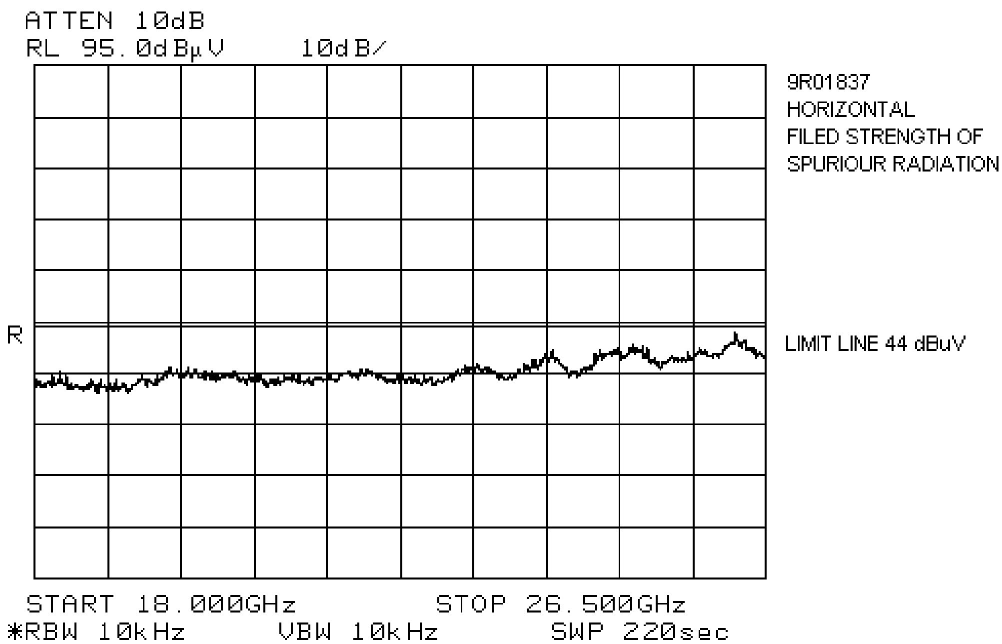
Radiated Spurious Plots - Horizontal

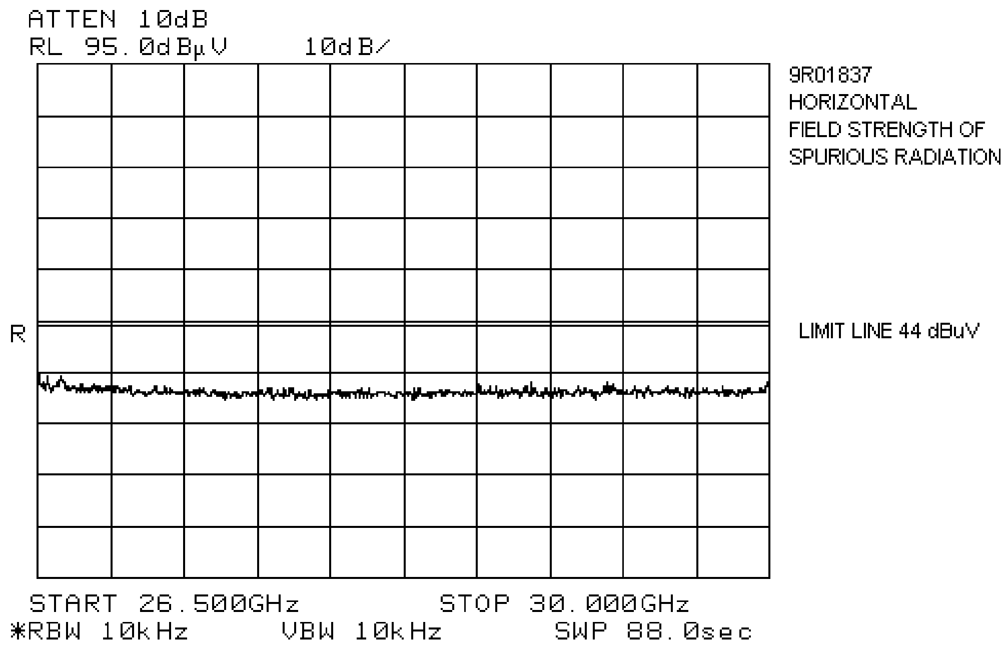
(Horizontal Polarization)

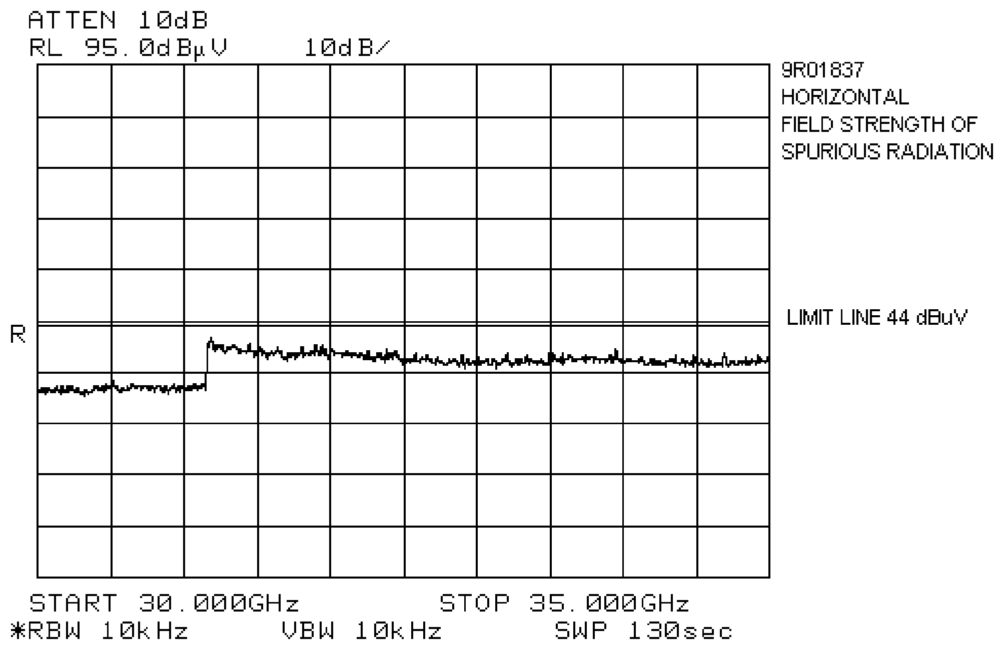


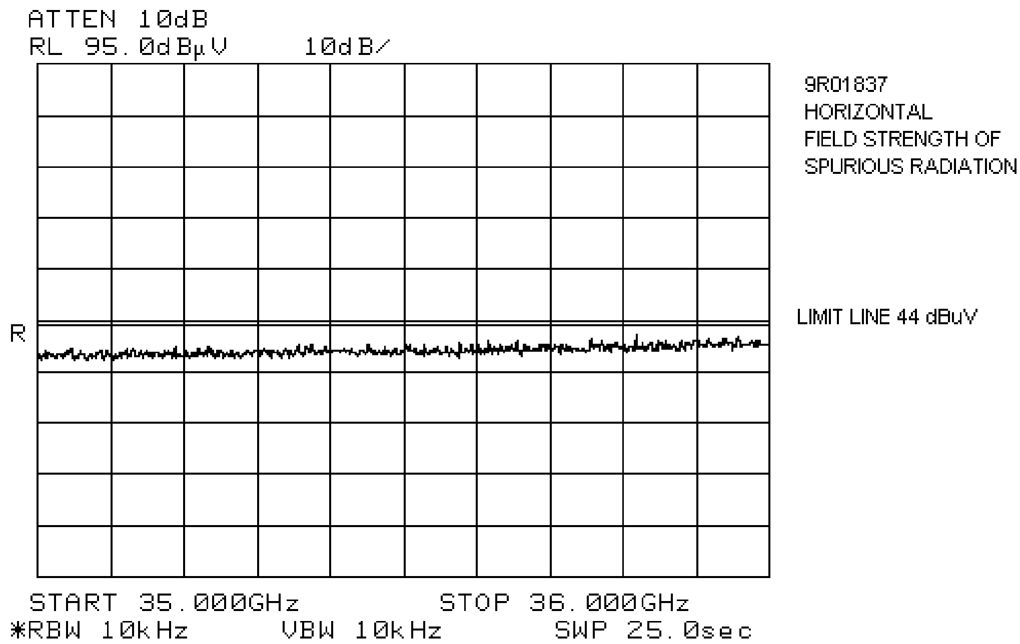


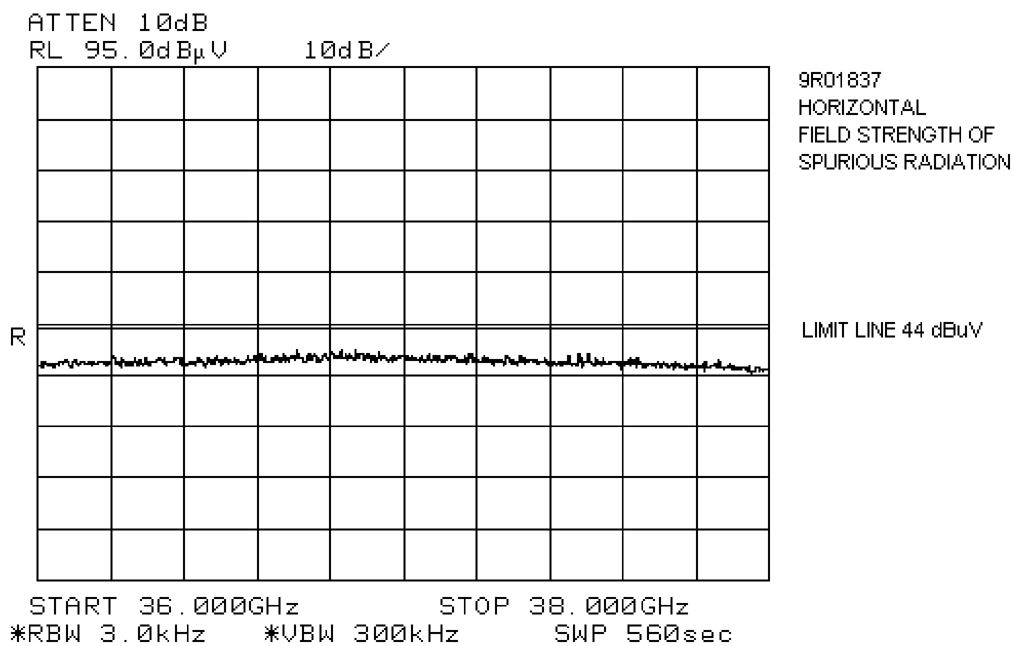

*ATTEN 0dB
RL 95.0dBμV 10dB/
9R01837
HORIZONTAL
FIELD STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
R
START 1.00GHz STOP 18.00GHz
*RBW 10kHz VBW 10kHz SWP 430sec

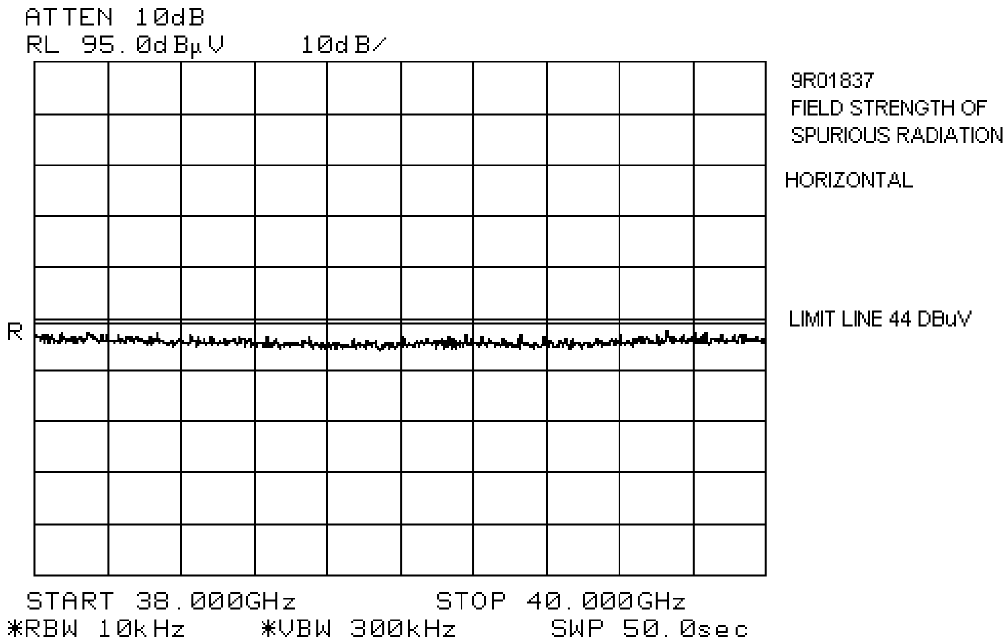

ATTEN 10dB
RL 95.0dBμV 10dB/
9R01837
HORIZONTAL
FILED STRENGTH OF
SPURIOUR RADIATION
LIMIT LINE 44 dBuV
R
START 18.000GHz STOP 26.500GHz
*RBW 10kHz VBW 10kHz SWP 220sec

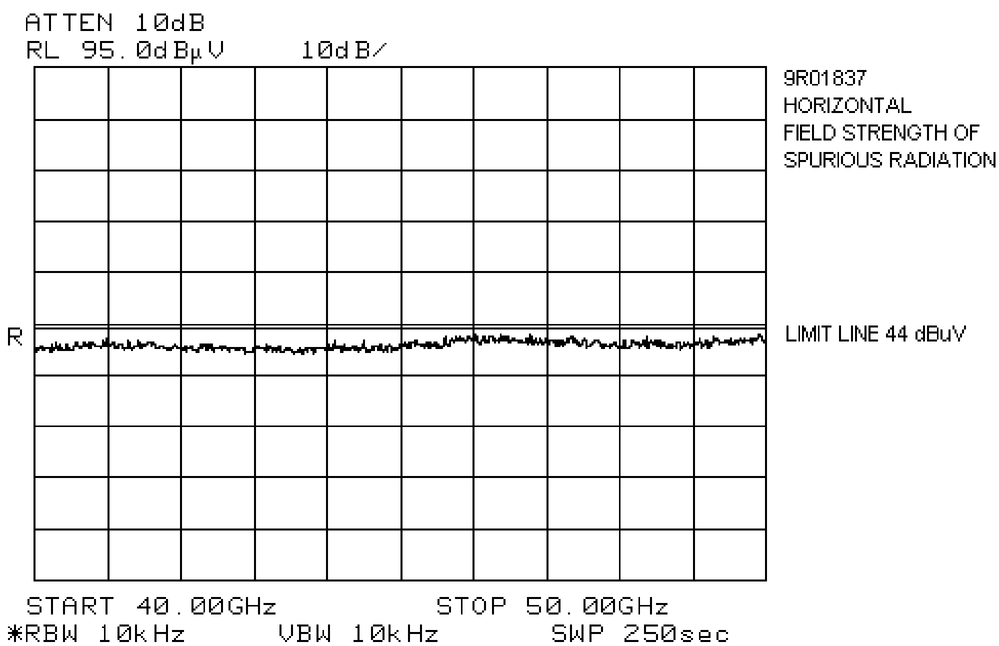

ATTEN 10dB
RL 95.0dBμV 10dB/
9R01837
HORIZONTAL
FIELD STRENGTH OF
SPURIOUS RADIATION
R
LIMIT LINE 44 dBuV
START 26.500GHz STOP 30.000GHz
*RBW 10kHz VBW 10kHz SWP 88.0sec

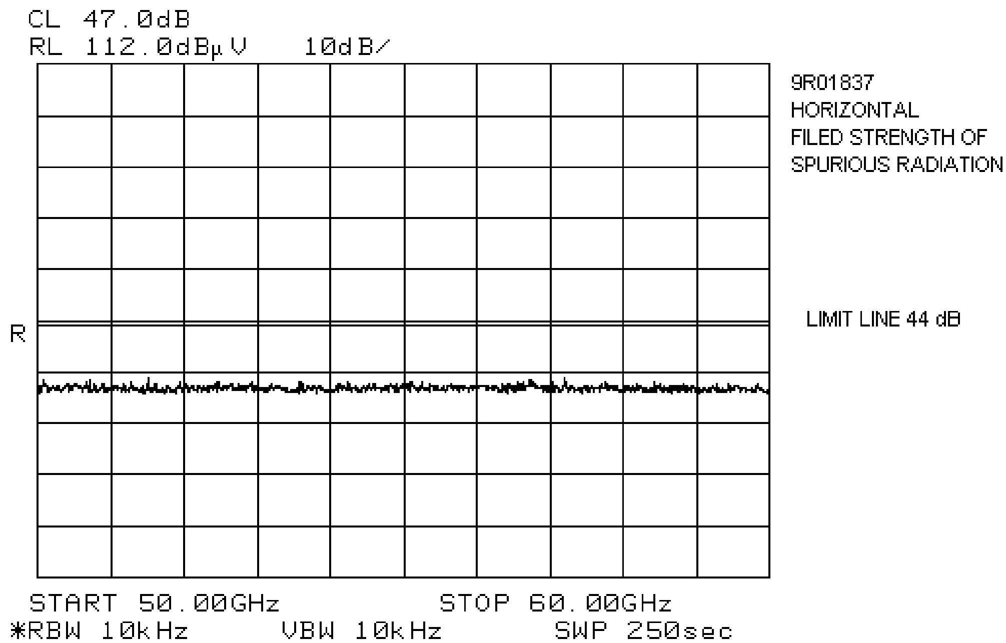

ATTEN 10dB
RL 95.0dBμV 10dB/
9R01837
HORIZONTAL
FIELD STRENGTH OF
SPURIOUS RADIATION
R
LIMIT LINE 44 dBuV
START 30.000GHz STOP 35.000GHz
*RBW 10kHz VBW 10kHz SWP 130sec

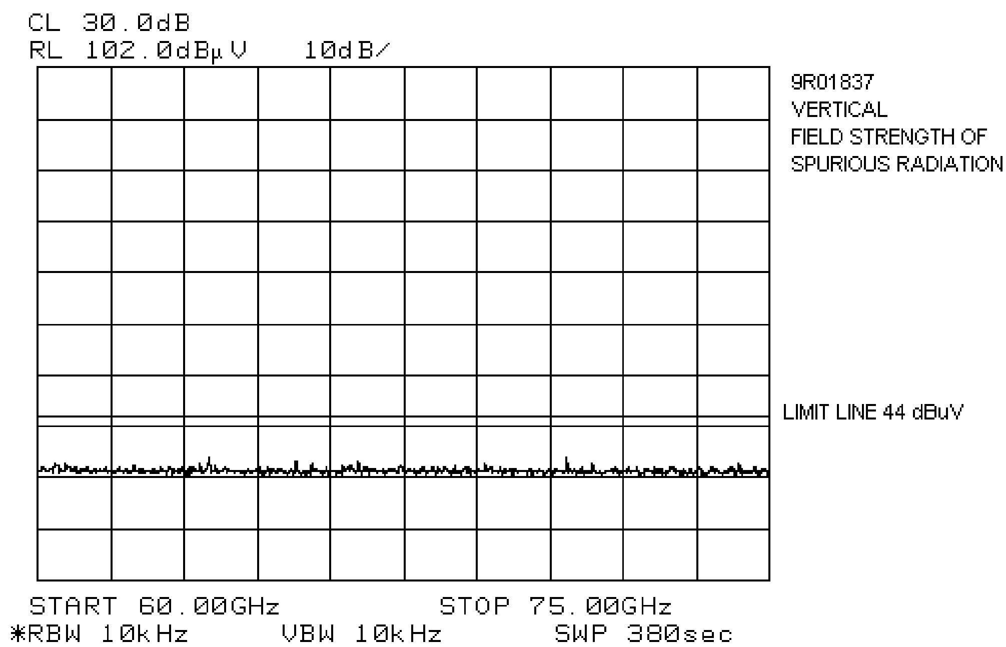

ATTEN 10dB
RL 95.0dBμV 10dB/
9R01837
HORIZONTAL
FIELD STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
R
START 35.000GHz STOP 36.000GHz
*RBW 10kHz VBW 10kHz SWP 25.0sec

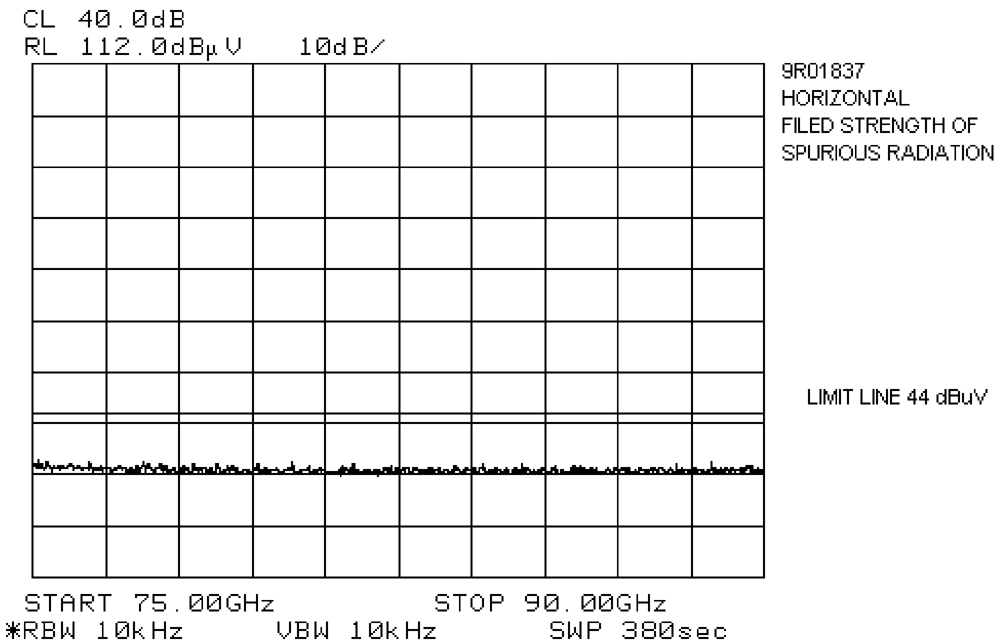

ATTEN 10dB
RL 95.0dBμV 10dB/
9R01837
HORIZONTAL
FIELD STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
R
START 36.000GHz STOP 38.000GHz
*RBW 3.0kHz *VBW 300kHz SWP 560sec

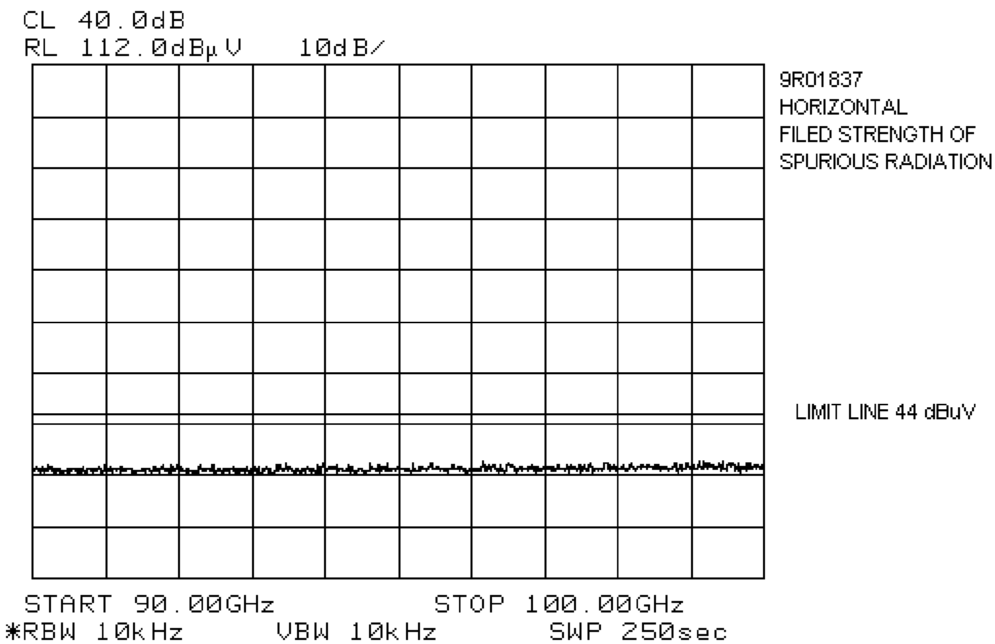

ATTEN 10dB
RL 95.0dBμV 10dB/
9R01837
FIELD STRENGTH OF
SPURIOUS RADIATION
HORIZONTAL
R
LIMIT LINE 44 DBuV
START 38.000GHz STOP 40.000GHz
*RBW 10kHz *VBW 300kHz SWP 50.0sec


ATTEN 10dB
RL 95.0dBμV 10dB/
9R01837
HORIZONTAL
FIELD STRENGTH OF
SPURIOUS RADIATION
R
LIMIT LINE 44 dBuV
START 40.00GHz STOP 50.00GHz
*RBW 10kHz VBW 10kHz SWP 250sec


CL 47.0dB
RL 112.0dBµV 10dB/
9R01837
HORIZONTAL
FILED STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dB
R
START 50.00GHz STOP 60.00GHz
*RBW 10kHz VBW 10kHz SWP 250sec

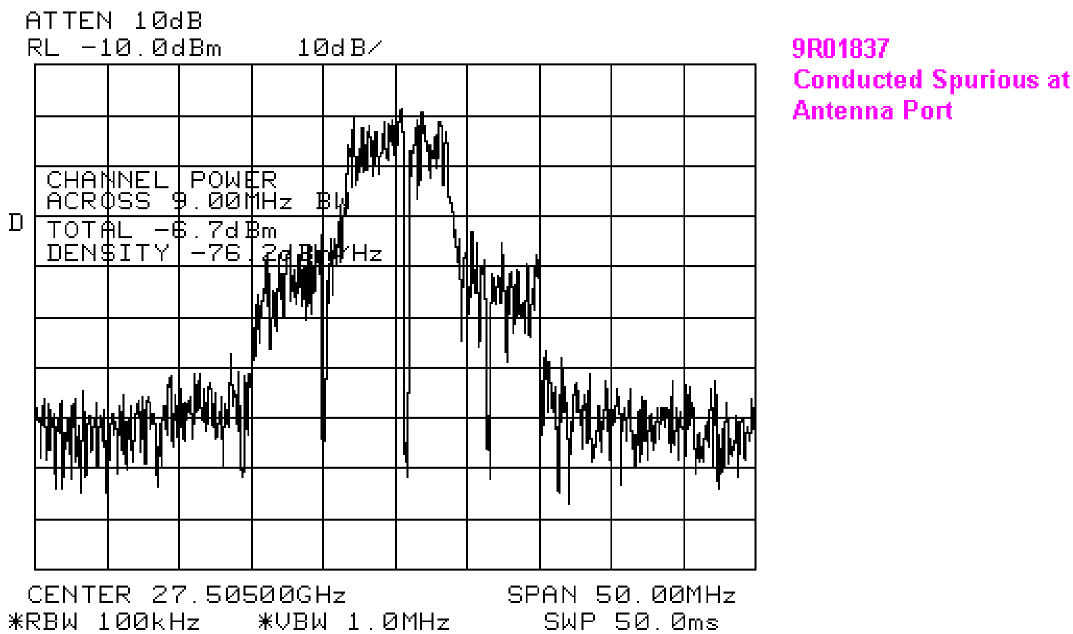

CL 30.0dB
RL 102.0dBµV 10dB/
9R01837
VERTICAL
FIELD STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
START 60.00GHz STOP 75.00GHz
*RBW 10kHz VBW 10kHz SWP 380sec


CL 40.0dB
RL 112.0dBμV 10dB/
9R01837
HORIZONTAL
FILED STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
START 75.00GHz STOP 90.00GHz
*RBW 10kHz VBW 10kHz SWP 380sec


CL 40.0dB
RL 112.0dBμV 10dB/
9R01837
HORIZONTAL
FILED STRENGTH OF
SPURIOUS RADIATION
LIMIT LINE 44 dBuV
START 90.00GHz STOP 100.00GHz
*RBW 10kHz VBW 10kHz SWP 250sec

APPENDIX B: CONDUCTED SPURIOUS PLOTS

REFERENCE LEVEL



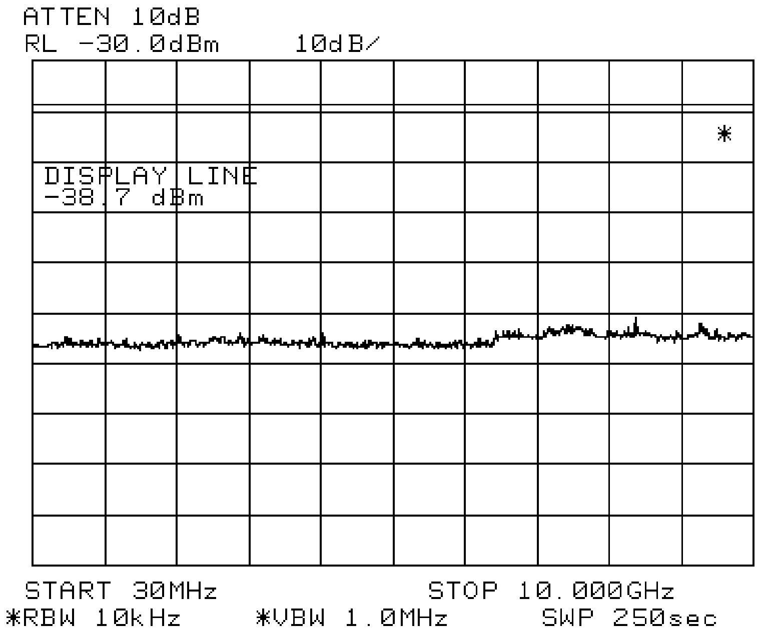
The reference output power measured was –6.7dBm over a 9MHz bandwidth after the attenuators and cable losses. Total output power at the antenna port = +19dBm (0.08watts)

Limit = (measured level) – A; where A= 43+10log (Pmean in watts)

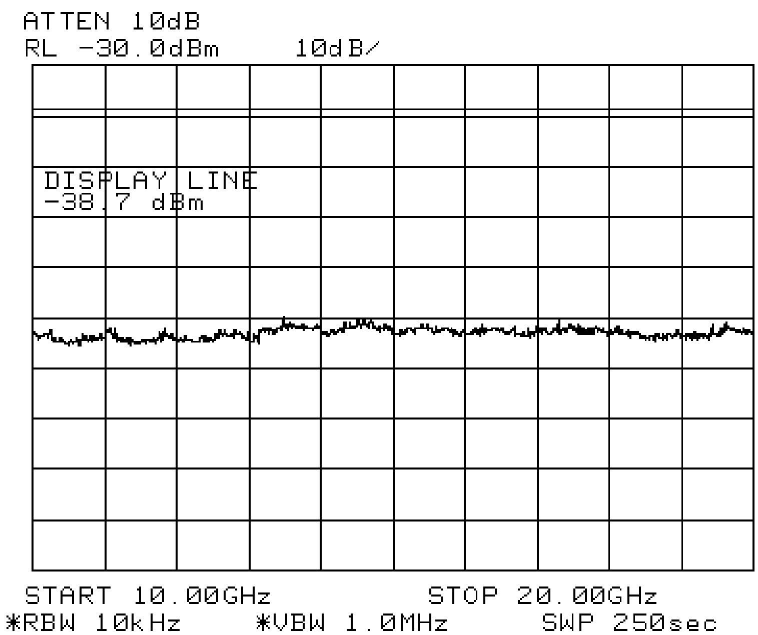
A correction factor of 4dB for the different resolution bandwidth used from RBW= 10kHz to 4kHz; (10log 10/4 = 4dB) was ignored and taken as worst conditions.

A= 43 + 10 log 0.08= 32dB

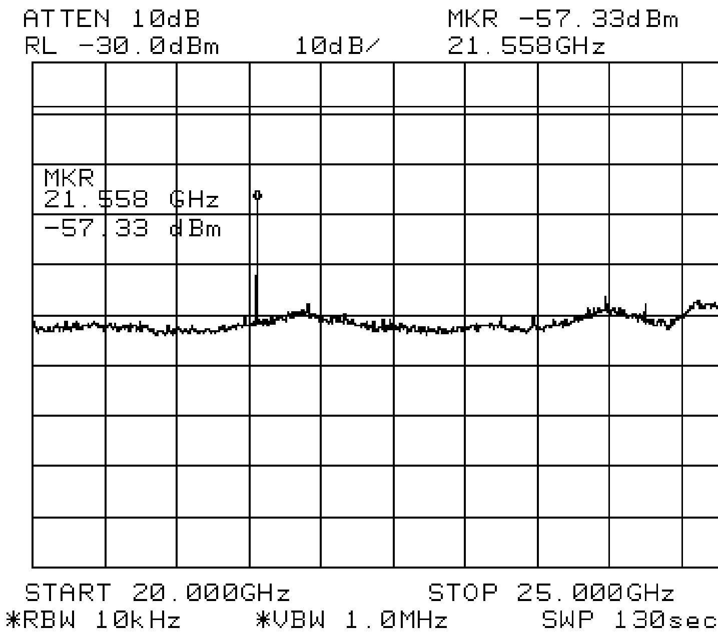
i.e.: -6.7dBm – 32 = -38.7dBm (reference level)



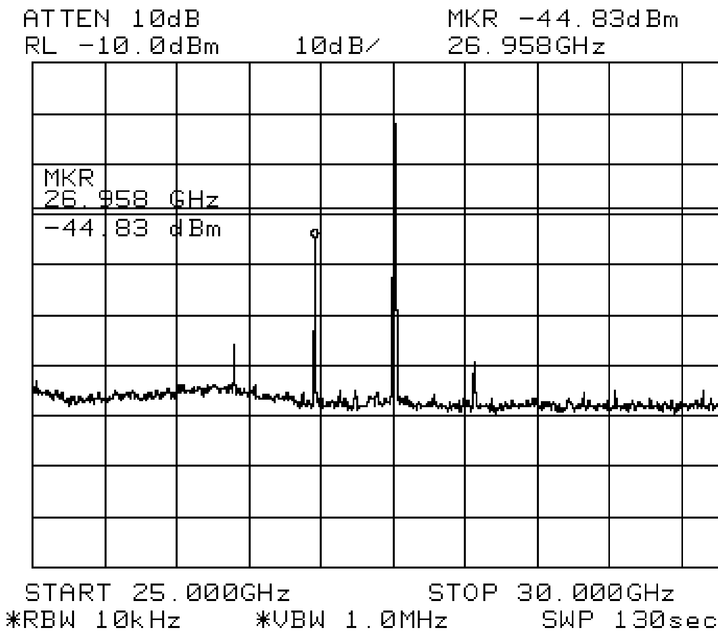
9R01837
Conducted Spurious at Antenna Port



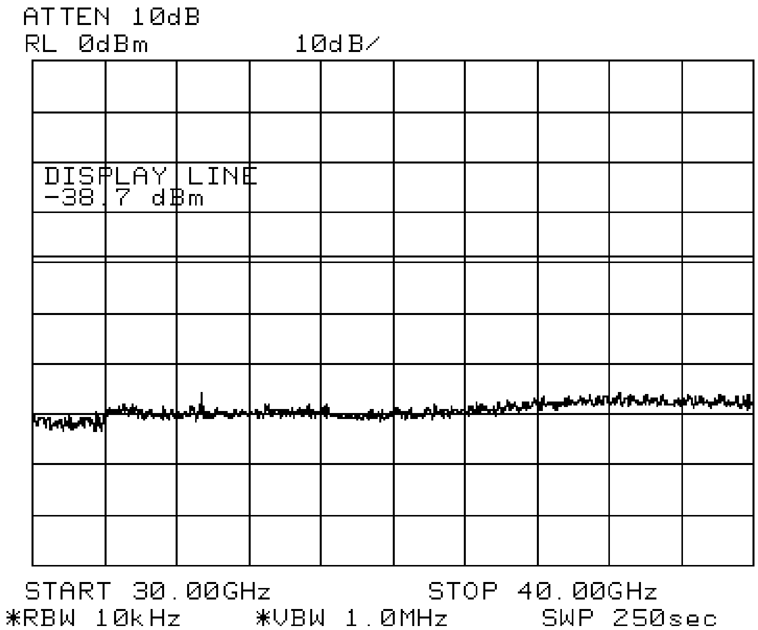
9R01837
Conducted Spurious at Antenna Port



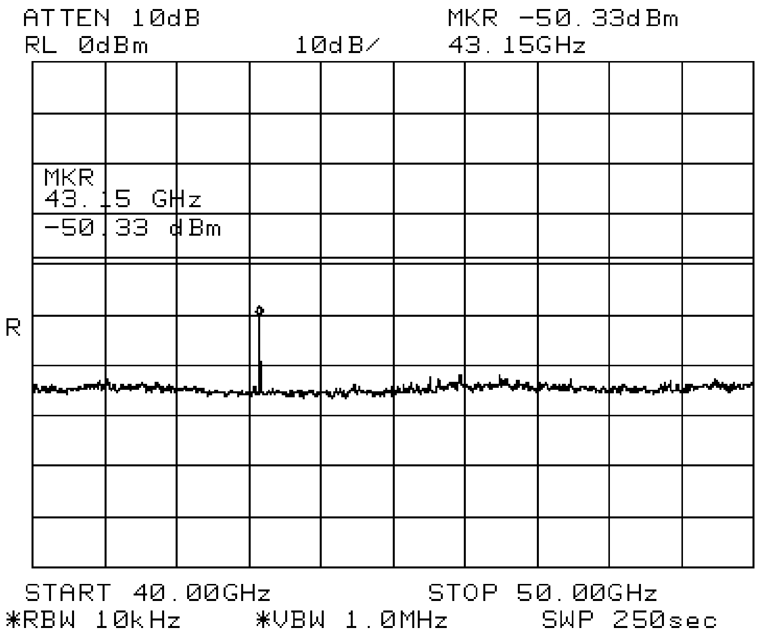
9R01837
Conducted Spurious at Antenna Port



9R01837
Conducted Spurious at Antenna Port

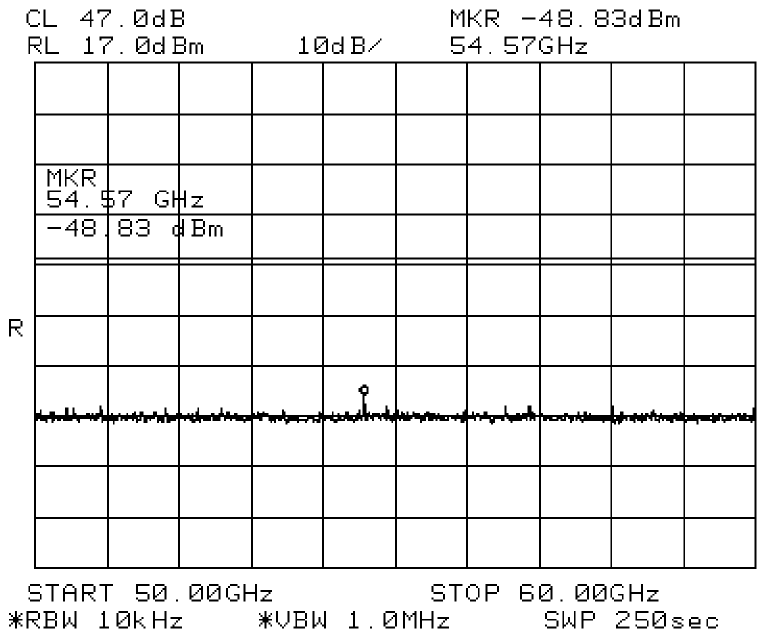


9R01837
Conducted Spurious at Antenna Port

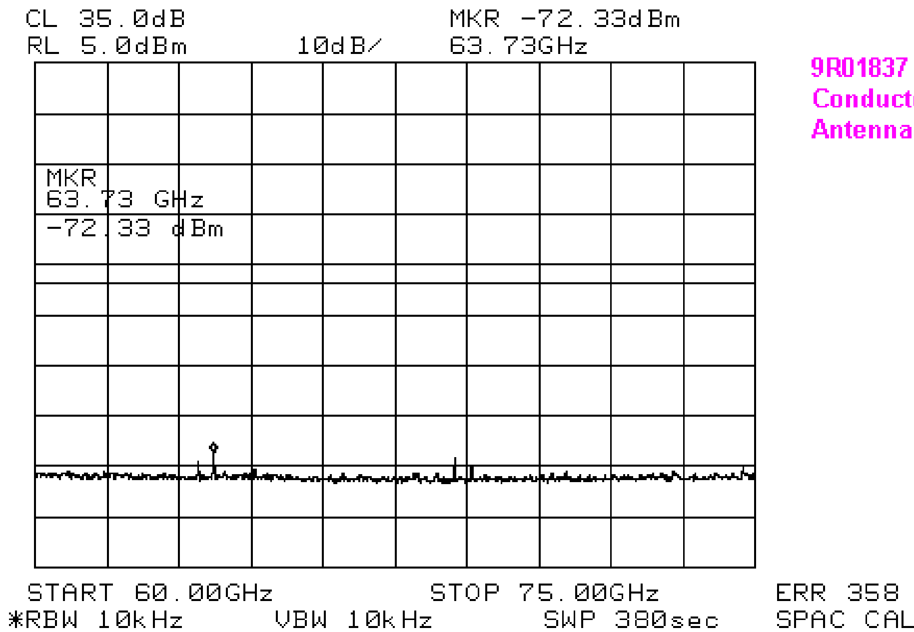


9R01837
Conducted Spurious at Antenna Port

display line
-38.7dBm



9R01837
Conducted Spurious at Antenna Port



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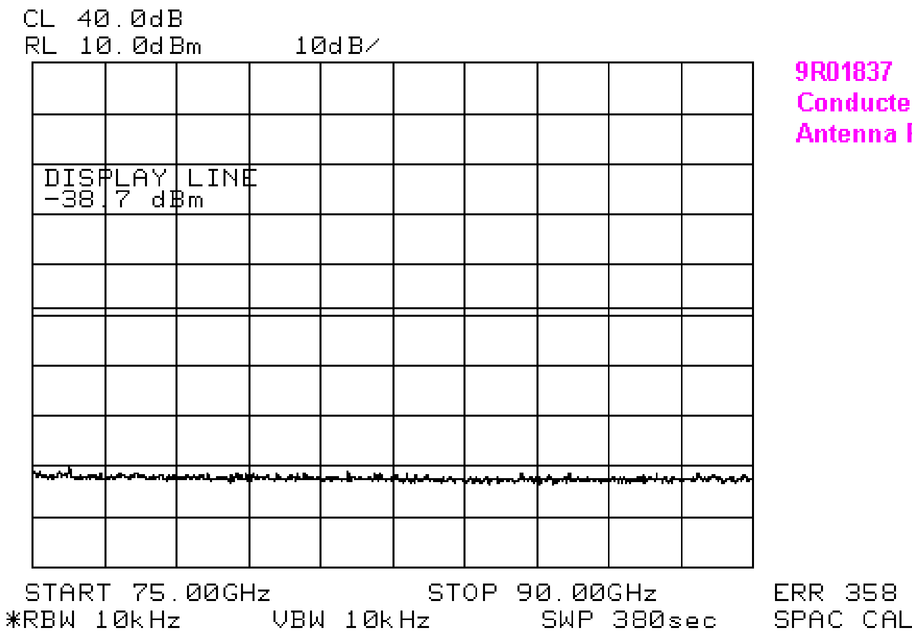
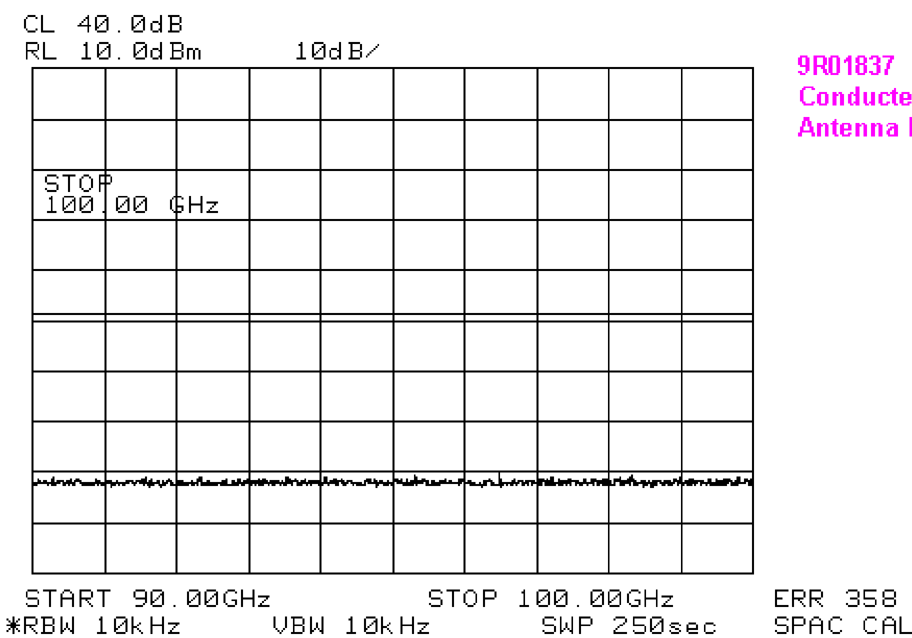
Conducted Spurious at Antenna Port



9R01837
Conducted Spurious at Antenna Port



9R01837
Conducted Spurious at Antenna Port

APPENDIX C: ANTENNA SPEC SHEETS

Gain and Antenna Factors for Biconical Antenna
Manufactured by EMC Test Systems
Model Number: 3109 Serial Number: 2708
3.0 Meter Calibration Polarization: Horizontal

Frequency (MHz)	Antenna Factor (dB)	Gain Numeric	Gain dBi
20	16.7	0.01	-20.5
30	13.5	0.04	-13.9
40	12.0	0.11	-9.7
50	10.3	0.24	-6.2
60	8.5	0.54	-2.7
70	9.1	0.64	-1.9
80	7.5	1.20	0.8
90	8.5	1.19	0.8
100	9.7	1.12	0.5
110	10.6	1.05	0.2
120	11.6	1.05	0.2
130	12.0	1.12	0.5
140	12.5	1.16	0.7
150	12.5	1.31	1.2
160	12.3	1.57	2.0
170	12.4	1.75	2.4
180	12.2	2.06	3.1
190	12.6	2.08	3.2
200	13.6	1.84	2.6
210	14.3	1.71	2.3
220	15.3	1.51	1.8
230	15.9	1.44	1.6
240	16.4	1.37	1.4
250	16.9	1.35	1.3
260	17.0	1.42	1.5
270	17.2	1.47	1.7
280	17.5	1.45	1.6
290	18.2	1.33	1.2
300	19.1	1.17	0.7

Specification compliance testing factor (3.0 meter spacing) to be added to receiver meter reading in dBV to convert to field intensity in dBV/meter. Calibrated 03 Aug 99 (DD/MM/YYYY). Calibration per ANSI C63.5.

ETS

Gain and Antenna Factors for Log Periodic Antenna
Manufactured by Electro - Metrics
Model Number: LPA-25 **Serial Number: 1141**
3.0 Meter Calibration **Polarization: Horizontal**

Frequency (MHz)	Antenna Factor (dB)	Gain Numeric	Gain dBi
200	11.6	2.88	4.9
225	11.1	4.08	6.1
250	12.2	3.96	6.0
275	13.3	3.75	5.7
300	14.6	3.13	5.0
325	14.8	3.68	5.7
350	15.0	4.02	6.0
375	15.3	4.39	6.4
400	15.9	4.29	6.3
425	16.1	4.65	6.7
450	16.6	4.64	6.7
475	17.1	4.60	6.6
500	17.8	4.33	6.4
525	17.8	4.81	6.8
550	18.3	4.73	6.7
575	18.6	4.76	6.8
600	18.8	4.94	6.9
625	19.1	5.02	7.0
650	19.6	4.84	6.9
675	21.1	3.73	5.7
700	21.4	3.75	5.7
725	21.5	3.91	5.9
750	21.4	4.26	6.3
775	21.4	4.54	6.6
800	21.5	4.72	6.7
825	22.0	4.49	6.5
850	22.3	4.44	6.5
875	22.7	4.36	6.4
900	22.8	4.41	6.4
925	23.1	4.41	6.4
950	23.6	4.17	6.2
975	24.2	3.77	5.8
1000	24.6	3.69	5.6

Specification compliance testing factor (3.0 meter spacing) to be added to receiver meter reading in dBV to convert to field intensity in dBV/meter. Calibrated 04 Aug 99 (DD/MM/YYYY). Calibration per ANSI C63.5.

EMC TEST SYSTEMS L.P.

A Subsidiary of ESCO Electronics Corporation

Gain and Antenna Factors for Double Ridged Guide Antenna
Manufactured by EMC Test Systems
Model Number: 3115 Serial Number: 4336
3.0 Meter Calibration

Frequency (MHz)	Antenna Factor (dB)	Gain Numeric	Gain dBi
1000	25.7	2.80	4.5
1500	27.0	4.76	6.8
2000	29.0	5.24	7.2
2500	29.9	6.65	8.2
3000	31.6	6.47	8.1
3500	32.9	6.53	8.1
4000	33.8	6.98	8.4
4500	34.3	7.90	9.0
5000	35.4	7.51	8.8
5500	36.1	7.83	8.9
6000	36.4	8.58	9.3
6500	36.5	9.84	9.9
7000	37.5	9.22	9.6
7500	38.3	8.75	9.4
8000	38.4	9.61	9.8
8500	38.8	10.03	10.0
9000	38.5	9.50	9.8
9500	38.7	10.15	10.1
10000	40.0	10.50	10.2
10500	40.1	11.37	10.6
11000	40.2	12.05	10.8
11500	39.9	14.37	11.6
12000	39.5	15.98	12.0
12500	40.9	13.21	11.2
13000	41.4	12.89	11.1
13500	41.6	13.25	11.2
14000	41.1	15.87	12.0
14500	41.6	15.42	11.9
15000	41.3	15.29	11.8
15500	39.6	27.70	14.4
16000	39.4	30.93	14.9
16500	40.5	25.42	14.1
17000	42.6	16.58	12.2
17500	44.2	12.30	10.9
18000	44.9	11.10	10.5

Specification compliance testing factor (3.0 meter spacing) to be added to receiver meter reading in dBµV to convert to field intensity in dBµV/meter. Calibrated 30 Oct 97 (DD/MM/YYYY). Calibration per ANSI C63.5.

10/28/87 09:54 MULTILEK INC OTTAWA 002
10-27 07 15:44 T- 2733 8826 P02

ELECTRO-METRICS
STANDARD
GAIN AND ANTENNA FACTORS
MODEL BH-50-1
HORN ANTENNA

FREQUENCY (MHz)	ANTENNA FACTOR (dB)	GAIN (dB)
18.00	40.28	15.02
18.25	40.31	15.11
18.50	40.34	15.20
18.75	40.37	15.29
19.00	40.40	15.38
19.25	40.42	15.46
19.50	40.45	15.55
19.75	40.47	15.64
20.00	40.49	15.73
20.25	40.51	15.82
20.50	40.53	15.91
20.75	40.55	15.99
21.00	40.56	16.08
21.25	40.58	16.17
21.50	40.59	16.26
21.75	40.60	16.35
22.00	40.61	16.44
22.25	40.62	16.52
22.50	40.63	16.61
22.75	40.64	16.70
23.00	40.65	16.79
23.25	40.65	16.88
23.50	40.66	16.96
23.75	40.66	17.05
24.00	40.66	17.14
24.25	40.66	17.23
24.50	40.67	17.32
24.75	40.67	17.41
25.00	40.66	17.49
25.25	40.66	17.58
25.50	40.66	17.67
25.75	40.66	17.76
26.00	40.65	17.85
26.25	40.65	17.94
26.50	40.64	18.02

10/08/87 09:54 MULTILEK INC OTTAWA 003
10-07-87 15:45 7753 #825 P03

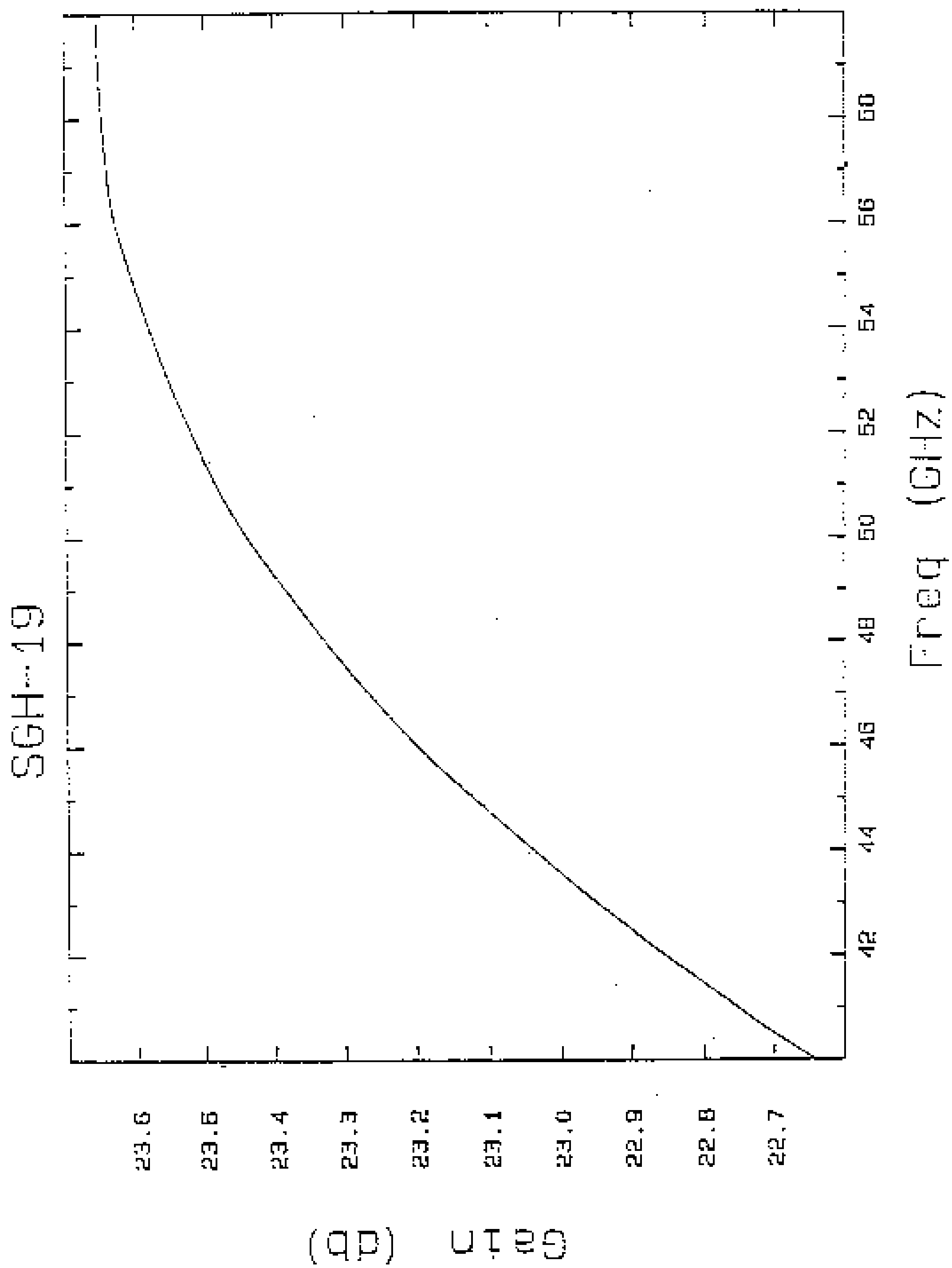
ELECTRO-METRICS
STANDARD
GAIN AND ANTENNA FACTORS
MODEL SH-50-2
HORN ANTENNA

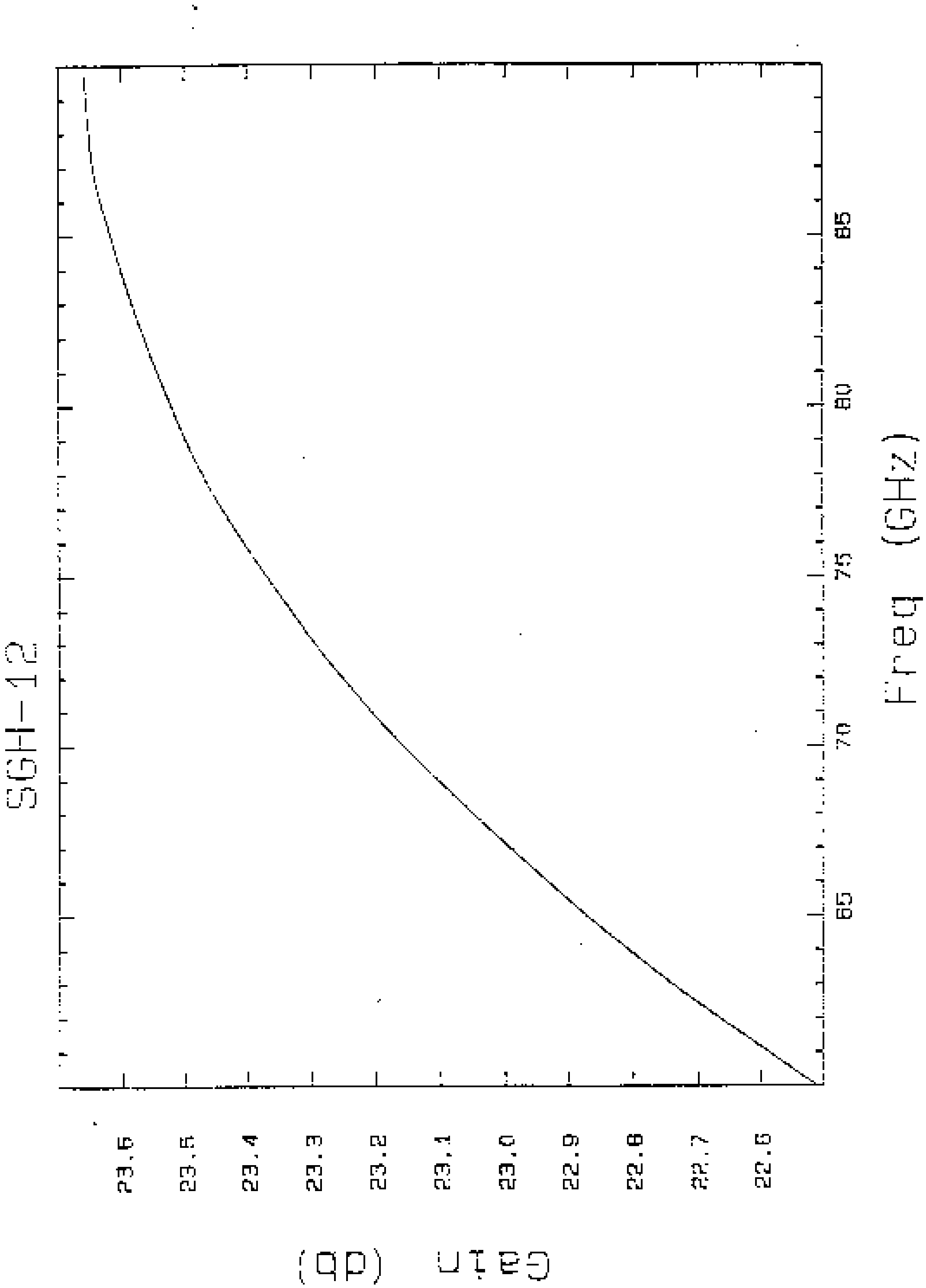
FREQUENCY (MHz)	ANTENNA FACTOR (dB)	GAIN (dB)
26.50	43.66	15.00
26.75	43.69	15.06
27.00	43.72	15.11
27.25	43.74	15.17
27.50	43.76	15.22
27.75	43.79	15.28
28.00	43.81	15.33
28.25	43.83	15.39
28.50	43.85	15.44
28.75	43.87	15.50
29.00	43.89	15.56
29.25	43.91	15.61
29.50	43.93	15.67
29.75	43.95	15.72
30.00	43.96	15.78
30.25	43.98	15.83
30.50	44.00	15.89
30.75	44.01	15.94
31.00	44.03	16.00
31.25	44.04	16.06
31.50	44.06	16.11
31.75	44.07	16.17
32.00	44.08	16.22
32.25	44.09	16.28
32.50	44.10	16.33
32.75	44.12	16.39
33.00	44.13	16.44
33.25	44.14	16.50
33.50	44.15	16.56
33.75	44.15	16.61
34.00	44.16	16.67
34.25	44.17	16.72
34.50	44.18	16.78
34.75	44.19	16.83
35.00	44.19	16.89
35.25	44.20	16.94
35.50	44.20	17.00
35.75	44.21	17.06
36.00	44.21	17.11
36.25	44.22	17.17
36.50	44.22	17.22
36.75	44.23	17.28
37.00	44.23	17.33
37.25	44.23	17.39

10-07-97 15:46 T- 2753 #826 P04

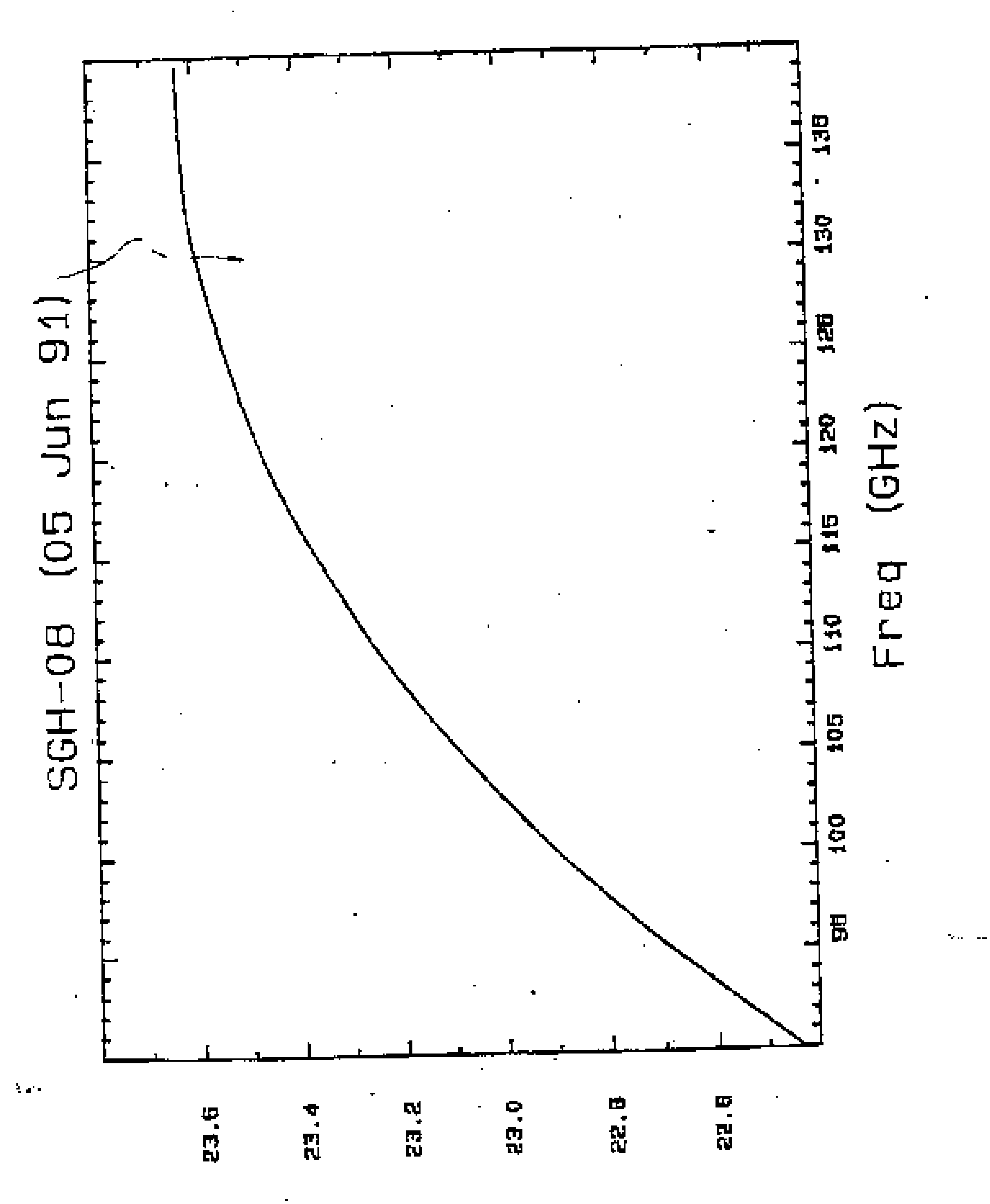
ELECTRO-METRICS
STANDARD
GAIN AND ANTENNA FACTORS
MODEL GH-50-2
HORN ANTENNA
(CONT'D)

FREQUENCY (MHz)	ANTENNA FACTOR (dB)	GAIN (dB)
37.50	44.24	17.44
37.75	44.24	17.50
38.00	44.24	17.56
38.25	44.24	17.61
38.50	44.24	17.67
38.75	44.24	17.72
39.00	44.24	17.78
39.25	44.24	17.83
39.50	44.24	17.89
39.75	44.24	17.94
40.00	44.24	18.00


SGH-19
Freq (GHz)
Gain (db)
42 44 46 48 50 52 54 56 58
23.6 23.5 23.4 23.3 23.2 23.1 23.0 22.9 22.8 22.7


SGH-12
Freq (GHz)
65
70
75
80
85
Gain (db)
23.6
23.5
23.4
23.3
23.2
23.1
23.0
22.9
22.8
22.7
22.6

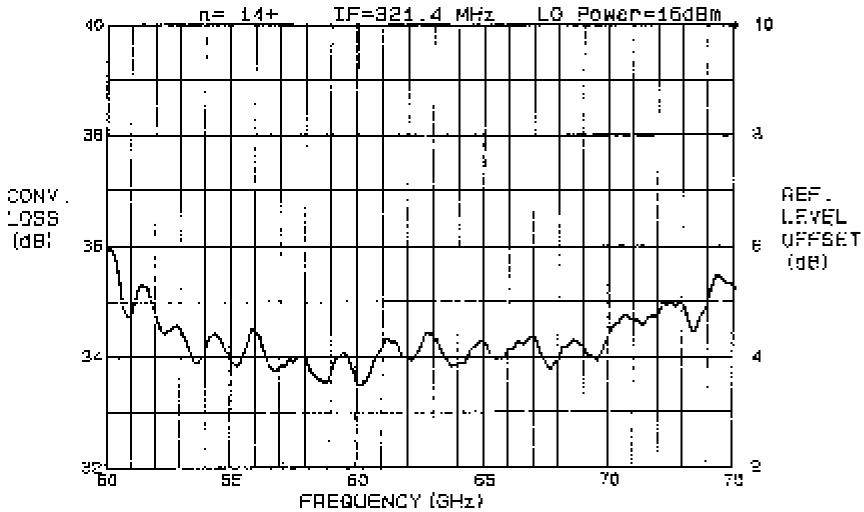
SEP-24-1999 08:32 KIL UTTWR 15137379691 P.02/02



HEWLETT PACKARD

11970V CALIBRATION (See cal. sticker)

SER NO. : 2521A01150 FEB. ~~21~~ 25, 1997



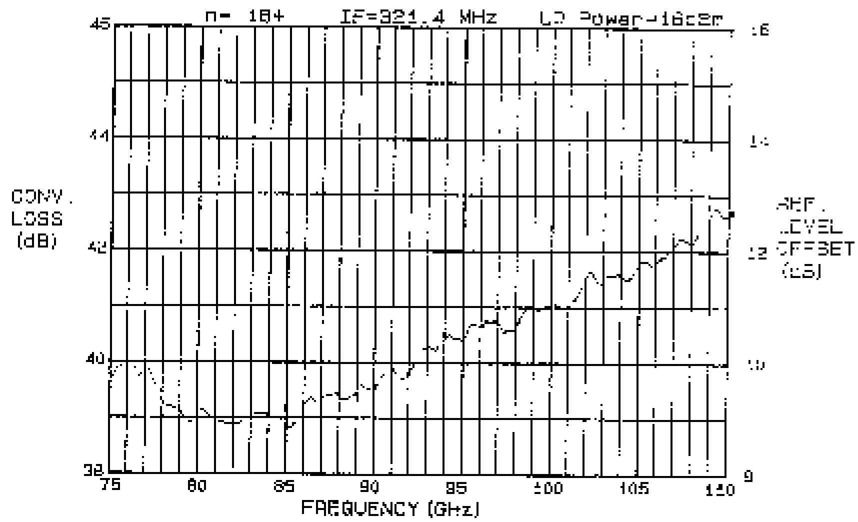
FREQ.	CONV. LOSS	REF. LVL OFS	FREQ.	CONV. LOSS	REF. LVL OFS
50.00	35.9	5.9	63.00	34.4	4.4
50.50	35.4	5.4	63.50	34.0	4.0
51.00	34.8	4.8	64.00	33.9	3.9
51.50	35.3	5.3	64.50	34.2	4.2
52.00	34.8	4.8	65.00	34.3	4.3
52.50	34.5	4.5	65.50	34.0	4.0
53.00	34.5	4.5	66.00	34.2	4.2
53.50	34.0	4.0	66.50	34.3	4.3
54.00	34.2	4.2	67.00	34.4	4.4
54.50	34.4	4.4	67.50	33.9	3.9
55.00	34.0	4.0	68.00	34.0	4.0
55.50	34.0	4.0	68.50	34.3	4.3
56.00	34.5	4.5	69.00	34.2	4.2
56.50	33.9	3.9	69.50	34.0	4.0
57.00	33.9	3.9	70.00	34.5	4.5
57.50	33.9	3.9	70.50	34.7	4.7
58.00	34.0	4.0	71.00	34.7	4.7
58.50	33.6	3.6	71.50	34.7	4.7
59.00	33.7	3.7	72.00	34.8	4.8
59.50	34.1	4.1	72.50	35.0	5.0
60.00	33.5	3.5	73.00	34.9	4.9
60.50	33.7	3.7	73.50	34.5	4.5
61.00	34.2	4.2	74.00	35.1	5.1
61.50	34.3	4.3	74.50	35.5	5.5
62.00	34.0	4.0	75.00	35.3	5.3
62.50	34.2	4.2			

RECOMMENDED CALIBRATION CYCLE: THREE YEARS

HEWLETT PACKARD

11970W CALIBRATION

SER NO. : 2521A01465 OCT. 13. 1988



FREQ.	CONV. LOSS	REF. LVL OFS	FREQ.	CONV. LOSS	REF. LVL OFS
75.00	39.7	9.7	93.00	40.3	10.3
76.00	40.0	10.0	94.00	40.5	10.5
77.00	38.9	9.9	95.00	40.4	10.4
78.00	38.2	9.2	96.00	40.6	10.6
79.00	39.1	9.1	97.00	40.7	10.7
80.00	39.1	9.1	98.00	40.7	10.7
81.00	38.9	8.9	99.00	40.9	10.9
52.00	38.9	8.9	100.00	41.1	11.1
23.00	39.1	8.1	101.00	41.1	11.1
84.00	39.0	9.0	102.00	41.6	11.8
85.00	38.8	8.8	103.00	41.5	11.5
96.00	39.3	9.3	104.00	41.5	11.5
87.00	39.4	9.4	105.00	41.8	11.8
88.00	39.3	9.3	106.00	41.8	11.8
89.00	39.6	9.6	107.00	42.1	12.1
90.00	39.6	9.6	108.00	42.1	12.1
91.00	39.9	9.9	109.00	42.7	12.7
92.00	39.9	9.9	110.00	42.7	12.7

RECOMMENDED CALIBRATION CYCLE: THREE YEARS

REFERENCES

[1] FCC, 47 CFR Part101 Fixed Microwave Services, edition 10-1-98

[2] FCC, 47 CFR Part 2 Frequency Allocation and Radio Treaty Matters: General Rules and Regulations, edition 10-1-98

[3] ANSI, C63.4, Methods of Measurement of Radio Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40GHz, 1992.

[4] Bellcore**,** GR-1089-CORE Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunication Equipment, Issue 1, November 1994.

[5] Bellcore**,** GR-1089-ILR Revised and Additional Criteria for GR-1089-CORE, Issue 1A, JULY 1996.

[6] Bellcore, TR-NWT-001089 Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunication Equipment, Issue 1, October, 1991.

[7] FCC, 47 CFR Part 15 Radio Frequency Devices, 1995

[8] Industry Canada, ICES-003 Interference-Causing Equipment Standard DIGITAL APPARATUS, Issue 2, Revision 1, 1995.

[9] ISO, GUIDE 25 General requirements for the competence of calibration and testing laboratories, Third Edition, 1990.

HISTORY

This document was created from the document template GQP0001, version 8.2.

Version	Date	Person	Reason
1.0	99.11.03	V.Scaringi	Issued