



MICROWAVE PATH SURVEY REPORT

RADIO FREQUENCY INTERFERENCE (RFI) MEASUREMENT REPORT

Prepared For

ViaSat

Bozeman, MT

Transmit and Receive Earth Station 17-21 GHz and 27-31 GHz

October 13, **201**4

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5.1 Conclusions

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ONE

INTRODUCTION AND BACKGROUND

1.1 Introduction

On-site Radio Frequency Interference (RFI) measurements were performed on behalf of ViaSat, Inc. on October 9, 2014 at their proposed site in Bozeman, MT. The purpose of these measurements was to determine the relative RFI levels in the 17-21 and 27-31 GHz common carrier frequency band and their impact on digital down-link satellite reception. Measurements were performed at one designated location. The purpose of this report is to document the results of these measurements and to present recommendations.

The analysis in this report is based upon the following:

- 4.1 Meter Antenna
- Satellite Arc: 55 to 115 Degrees West Longitude
- Frequency Range Considered: 17 to 21 GHz and 27-31 GHz
- Interference Objective: -156 dBW/1 MHz
- Type of Reception: Digital
- Measured Antenna Center Line: 6.5 Feet Above Ground Level

1.2 Background

ViaSat, Inc is proposing to locate a new transmit/receive antenna at an existing location of 45^{0} 40' 33.35" N and 111^{0} 08' 33.75 W ViaSat, Inc had requested that Comsearch conduct RFI measurements at the facility to assess the interference potential. This facility is currently operational and measurements were done at a point near the proposed antenna locations.

The measured site is identified on a portion of a topographic map shown in Figure 1.2-1. An aerial photo of the site location is shown in Figure 1.2-2. A photo of the measurement using a GPS is shown in Figure 1.2-3.

1.3 Constraints

The analysis in this report is based upon the following assumptions and constraints.

- The antenna selected will conform to the FCC reference pattern 32-25 Log θ as specified in 47CFR 25.209(a)(2).
- It is assumed that during the measurement period all of the terrestrial transmitters were active and operating at full transmit power for the licensed frequencies unless otherwise noted.
- The signal identification and frequencies analyzed are based upon information obtained from the various common carriers as to what frequencies were active at the time of the measurements and the traffic these frequencies were supposed to be carrying.
- The actual ground elevation of the site is based on the data from the topographic map.
- The interference objective of -156 dBW/1 MHz used throughout this report is based upon estimated link budget parameters and is subject to change. ViaSat, Inc should review the system parameters for this down-link in order to verify the viability of this objective.

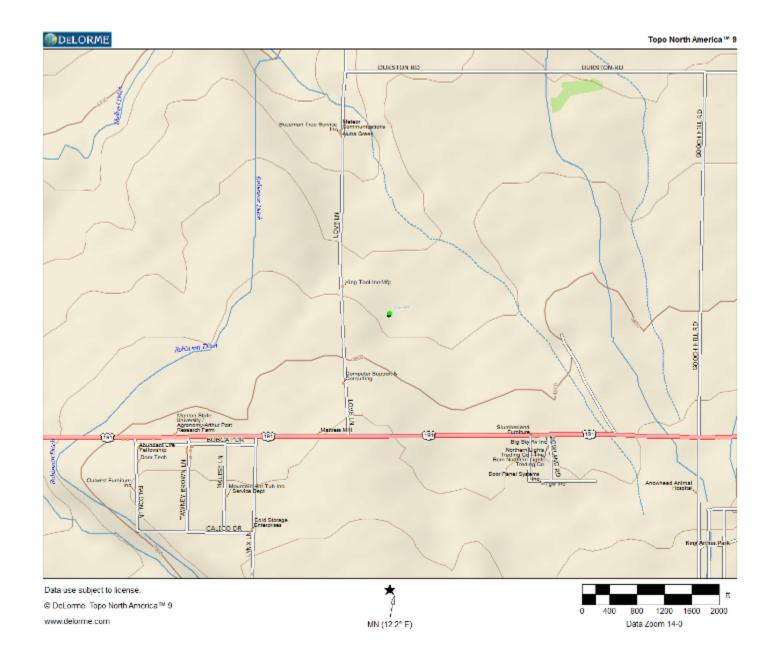




Figure 1.2-2 – Aerial Photograph



Figure 1.2-3 – GPS Photograph

TWO

TEST PROCEDURE

2.1 Calibration

Figures 2.1-1 is the block diagram of the test set for all bands to be tested. All test equipment used was allowed a proper warm-up period prior to calibration. The test set was calibrated by the signal substitution method, as recommended by NSMA, utilizing a synthesized signal generator. The reference signal from the signal generator was adjusted for the center frequency of each band to be tested and measured with a thermal power meter for calibrated reference test level (-60 dBm). This calibrated reference signal from the signal generator was then injected into the end of the coaxial cable of the test set at the point, which normally connects to the test antenna. A spectrum analyzer then measured the reference test signal level after passing through the test set. At this point, the spectrum analyzer was calibrated such that the top graticule of the spectrum analyzer display (-60 dBm) corresponded to the injected reference signal (-60 dBm) by utilizing the reference level offset function of the Anritsu –M52720T spectrum analyzer. Upon completion of the calibration process, a known reference level was obtained for the measured in a given set of spectrum analyzer display readings.

The following formula is used to transform the measured signal level as read on the spectrum analyzer display (dBm) to an isotropic reference signal level (dBW_I) as seen at the point of test:

 $dBW_I = LI - GA - 30$

Where: $dBW_I = Isotropic level in dBW$

LI = Level (dBm) of injected signal

GA = Test antenna gain

-30 =Conversion factor from dBm to dBW

at 19.5 GHz: $dBW_I = -60 dBm - 30 dB - 30 dB$

 $= -120 \text{ dBW}_{\text{I}}$

In this instance, the spectrum analyzer displayed measured signal level of -60 dBm equates to an isotropic signal level of -120 dBW_I.

Figures 2.1-2(A-H) displays the spectrum photographs of the described calibration procedure employed during these measurement.

Test Set Equipment Diagram

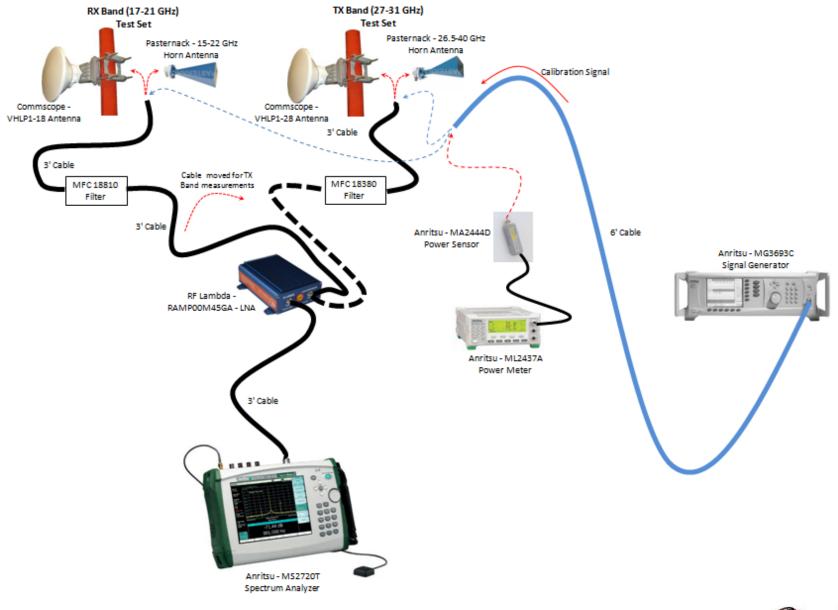




Figure 2.1-1 Receive Test Equipment Block

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Ref Lvl	M1 -12	2.15 dBm (@17.500 @	iHz					Spectrun	n Analyzer	
-120.0 dBm 90.0 dB Ext Gain	-120.0 o	Bm				1					
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
#VBW 1 MHz	-160.0	myndaw	Napager	Yn h han 19	munum	haventy	winning	Marthay Mar	Month	munit	
Sweep Time 50 ms	-170.0										
Traces A: Max Hold											
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change
											Save Location
Freq Ref Int Std Accy	-210.0 c	Bm									Change Type
	17.000 G	Hz				7.500 GHz 000 GHz			1	8.000 GHz	Setup/JPEG/
Freq		A	mplitude			Span			ЗW		Marker

Figure 2.1-2 (A) Calibration Spectrum Photo 17.5 GHz

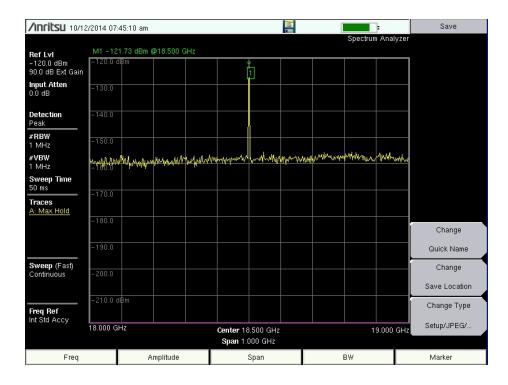


Figure 2.1-2 (B) Calibration Spectrum Photo 18.5 GHz

/Inritsu 10/12	/2014 07:	:44:26 am						l		=	Save
Ref Lvl	M1 -12	0.44 dBm (@19.500 G	iHz					Spectrum	ı Analyzei	r
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Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
#VBW 1 MHz	₩₩₩₩₩ -160.0	mmun	www.	Workerstal	www.wyw	CANNA MA	r-M.M.M.W.	man	Minhola	havender	
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Traces <u>A: Max Hold</u>											
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change
											Save Location
Freq Ref Int Std Accy	-210.0 d	dBm									Change Type
in our recy	19.000 G	Hz			Center 19 Span 1.1).500 GHz 000 GHz			2	0.000 GH2	Setup/JPEG/
Freq		A	mplitude			Span			BW		Marker

Figure 2.1-2 (C) Calibration Spectrum Photo 19.5 GHz

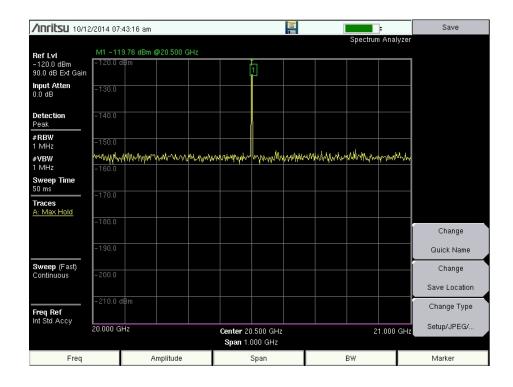


Figure 2.1-2 (D) Calibration Spectrum Photo 20.5 GHz

/INFITSU 10/12	/2014 07:	41:30 am]		•	Save
Ref Lvl		2.69 dBm (@27.500 G	iHz					Spectrum) Analyzer	
-120.0 dBm 90.0 dB Ext Gain	-120.0 o	IBm				• 1					
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
#VBW 1 MHz	W///www -160.0	holompon	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	William	nnahndr	WWWWW	www.	wmm	wheneyer and	Manyakaka	
Sweep Time 67 ms	170.0										
Traces <u>A: Max Hold</u>	-170.0										
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change
											Save Location
Freq Ref Int Std Accy	–210.0 c	IBm									Change Type
Int Stu Accy	27.000 G	Hz			Center 27 Snan 1	7.500 GHz 000 GHz			2	8.000 GHz	Setup/JPEG/
Freq		A	mplitude			Span			BW		Marker

Figure 2.1-2 (E) Calibration Spectrum Photo 27.5 GHz

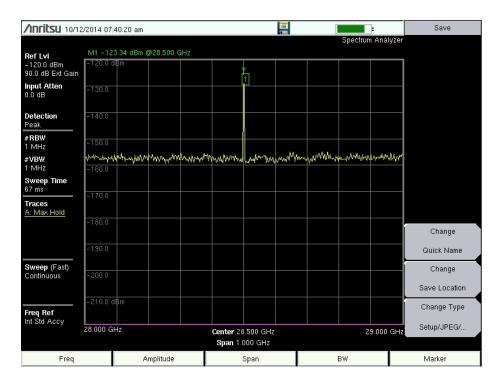


Figure 2.1-2 (F) Calibration Spectrum Photo 28.5 GHz

/INCIESU 10/12	/2014 07:	38:49 am]		•	Save
Ref Lvl		2.29 dBm (⊉29.500 G	iHz					Spectru	n Analyzer	
-120.0 dBm 90.0 dB Ext Gain	-120.0 d	iBm				1					
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
#VBW 1 MHz	МүүМµ∧ −160.0	MANNA	hannad	n www.	hymnhaillithi	app. Al Maller	www.wh	nlumun	www.	MMM	
Sweep Time 67 ms											
Traces A: Max Hold	-170.0										
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change
											Save Location
Freq Ref Int Std Accy	-210.0 d	18m									Change Type
Int Stu Accy	29.000 G	Hz			Center 29 Span 1.1				3	0.000 GHz	Setup/JPEG/
Freq		А	mplitude			Span			B₩		Marker

Figure 2.1-2 (G) Calibration Spectrum Photo 29.5 GHz

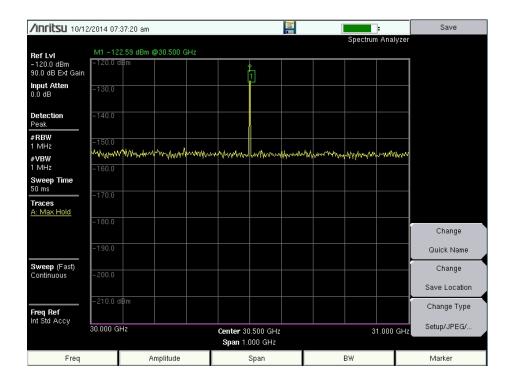


Figure 2.1-2 (H) Calibration Spectrum Photo 30.5 GHz

2.2 Methodology

Upon arriving at the existing earth station site, azimuth and horizon elevation measurements were performed to evaluate if any satellite arc obstructions exist. The coordinates of the existing earth station site were verified on the DeLorme topographic map. Photographs were taken to document the satellite arc (clearance) and are included in this report.

After site coordinates and horizon elevations were verified, the test equipment was set up and calibrated to measure the RF environment. Measurements were conducted at the proposed earth station location for the 17-21 and 27-31 GHz band. After the equipment calibration was completed, the test antenna was mounted on an extendable tower and elevated to a height of 6.5 feet. This height is greater than the centerline of the earth station antenna. The antenna was rotated 360 degrees (scanning), once in each polarization, while activating the peak hold function of the spectrum analyzer. This enabled the analyzer to maintain and display the maximum signal level received for all frequencies under consideration. After the initial documentation of interference, all interference conflicts if observed were peaked on to determine the azimuth and the level of the interference source.

Upon completion of the RF testing, the measured signal levels were transposed to earth station interference levels after accounting for the addition of the corresponding earth station antenna gain.

THREE

DATA PRESENTATION

The following section contains the tables and spectrum photos pertaining to the site location measured.

3.1 Bozeman, MT

- Table 3.1-1 presents a site data sheet including all pertinent site information.
- Figures 3.1-1 and 3.1-2 are the photographs depicting the existing earth station site and satellite arc.
- Figures 3.1-3 through 3.1-10 are the RF spectrum photographs depicting the interference environment at the test site.

TABLE 3.1-1

MEASUREMENT SITE DATA SHEET

1.	SYSTEM NAME:	ViaSat, Inc	
2.	CITY AND STATE:	Bozeman, MT	
3.	SITE IDENTIFICATION:	Bozeman	
4.	COORDINATES: (NAD 1983)		45° 40' 33.35" N 111° 08' 33.75" W
5.	GROUND ELEVATION:	4780 feet AMSL	
6.	MEASUREMENT DATE AND TIMES:	October 13, 2014	
7.	GEOSTATIONARY ARC RANGE: SATELLITE POSITIONS: AZIMUTH: ELEVATION:	55W – 115W 115.6 – 185.4 14.5 / 37.3	
8.	GEOSTATIONARY ARC VISIBILITY:	Satellite arc has n	o blockage at this time









Figure 3.1-1 Earth Station Site Photographs

South



West



Figure 3.1-1 (cont.) Earth Station Site Photographs

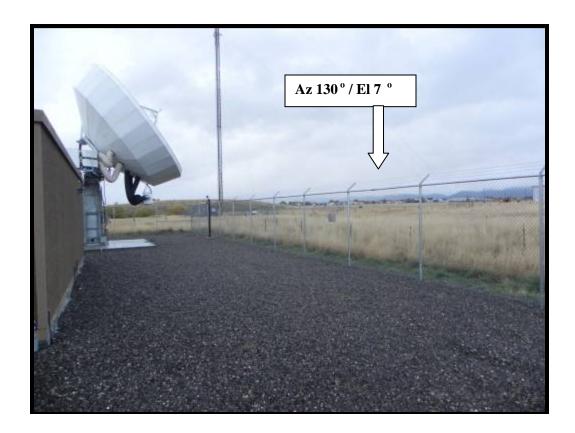




Figure 3.1-2 Horizon Photographs of Earth Station Site





Figure 3.1-2 (cont.) Horizon Photographs of Earth Station Site



/Inritsu 10/1:	3/2014 07:	56:00 am						[-	•	Save
Ref L∨I -120.0 dBm 90.0 dB Ext Gain	-120.0 (IBm							Spectrur	n Analyzer	
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0				mmm	1 hu	A14 1				
#VBW 1 MHz	-160.0	um Map	nsor the	ryound	WWWWWWWW	New Karley	r-Incarrage	hala. An Kalada	4r. Andre Andrewski Andrew	manne	
Sweep Time 50 ms	-170.0										
Traces <u>A: Max Hold</u>											
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change
											Save Location
Freq Ref Int Std Accy	-210.0 d	18m									Change Type
	17.000 G	Hz			Center 17 Span 1.(1	8.000 GHz	Setup/JPEG/
Freq		A	mplitude			Span			BW		Marker

Figure 3.1-3 (A) Spectrum Photos 17-18 GHz 1MHz Res BW Horizontal Pol 360^{0}

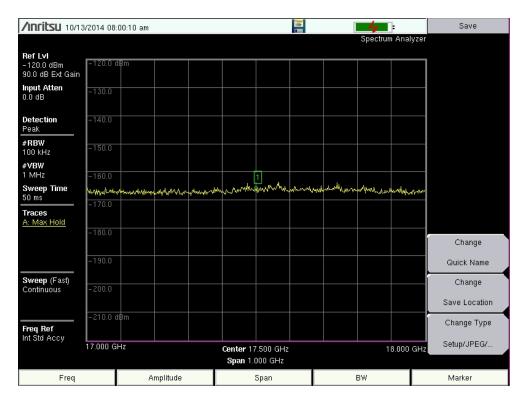


Figure 3.1-3 (B) Spectrum Photos 17-18 GHz 100 KHz Res BW Horizontal Pol 360°

/Inritsu 10/13	/2014 07:	56:00 am						[4	F	Save
Ref LvI -120.0 dBm 90.0 dB Ext Gain Input Atten	-120.0 c	18m							Spectrum	1 Analyzer	
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1 MHz Sweep Time 50 ms	-160.0		ndfatase (tidi	40.400.							
Traces <u>A: Max Hold</u>	-180.0										Change
Sweep (Fast)	-190.0										Quick Name Change
Continuous	-200.0 -210.0 c	Rm									Save Location
Freq Ref Int Std Accy	17.000 G				Center 17	7.500 GHz			1	8.000 GHz	Change Type Setup/JPEG/
					Span 1.	000 GHz					
Freq		A	mplitude			Span			BW		Marker

Figure 3.1-3 (C) Spectrum Photos 17-18 GHz 1 MHz Res BW Horizontal Pol Worst Case

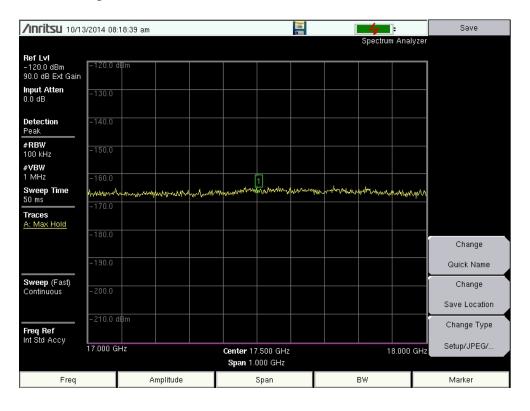


Figure 3.1-3 (D) Spectrum Photos 17-18 GHz 100 KHz Res BW Horizontal Pol Worst Case

/INFILSU 10/13	3/2014 07:	21:18 am						[4		Save
Ref LvI -120.0 dBm 90.0 dB Ext Gain Input Atten	-120.0 d	IBm							Spectrun	n Analyzer	
0.0 dB Detection Peak #RBW	-140.0										
1 MHz # VBW 1 MHz	-150.0	-Mayer March	Anary	Mappy Mary	www.	1 KAAMA	handrage	promini	manaph	mpanellha	
Sweep Time 50 ms Traces A: Max Hold	-170.0										
	-180.0 -190.0										Change Quick Name
Sweep (Fast) Continuous	-200.0										Change Save Location
Freq Ref Int Std Accy	-210.0 c					7.500 GHz			1	8.000 GHz	Change Type Setup/JPEG/
Freq		А	mplitude			000 GHz Span			BW		Marker

Figure 3.1-3 (E) Spectrum Photos 17-18 GHz 1MHz Res BW Vertical Pol 360°

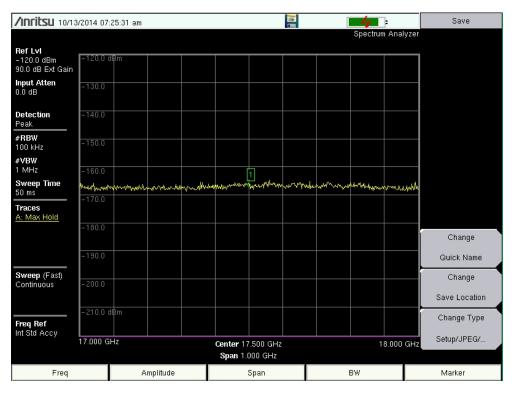
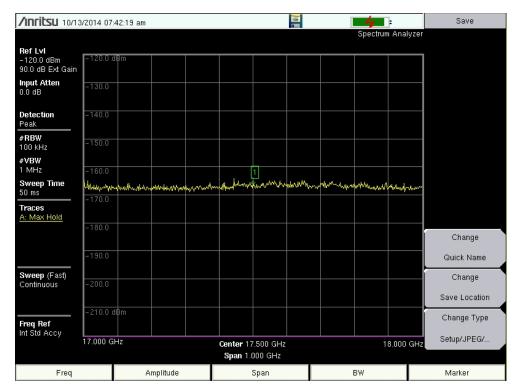


Figure 3.1-3 (F) Spectrum Photos 17-18 GHz 100 KHz Res BW Vertical Pol 360⁰

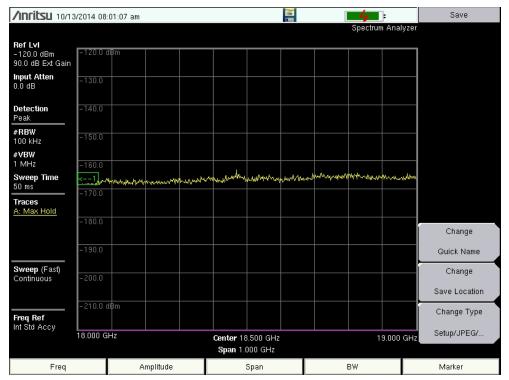
/INCIESU 10/13	3/2014 07:	38:27 am						[4		Save
Ref Lvi -120.0 dBm	-120.0 c	l₿m							Spectrun	n Analyzer	
90.0 dB Ext Gain											
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
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Sweep Time 50 ms	-170.0										
Traces A: Max Hold											
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change
Commission											Save Location
Freq Ref Int Std Accy	-210.0 c	l₿m									Change Type
	17.000 G	Hz			Center 17 Span 1.1	7.500 GHz 000 GHz			1	8.000 GHz	Setup/JPEG/
Freq		A	mplitude			Span			BW		Marker

Figure 3.1-3 (G) Spectrum Photos 17-18 GHz 1 MHz Res BW Vertical Pol Worst Case



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Ref Lvl									Spectrun	n Analyzer	
-120.0 dBm 90.0 dB Ext Gain	-120.0 o	IBm									
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
#VBW 1 MHz	<mark>иныңы</mark> м -160.0	enter and a state of the second s	Waterward	hingente	manter	handroduli	ws~ww	www.apmWrM	white	www.www.w	
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Traces <u>A: Max Hold</u>	-170.0										
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change
											Save Location
Freq Ref Int Std Accy	-210.0 c	IBm									Change Type
int old Heey	18.000 G	Hz			Center 18 Span 1.0				1	9.000 GHz	Setup/JPEG/
Freq		A	mplitude			Span			BW		Marker

Figure 3.1-4 (A) Spectrum Photos 18-19 GHz 1 MHz Res BW Horizontal Pol 360^{0}



/Inritsu 10/13	/2014 08:	15:34 am						[4	•	Save
Ref Lvl									Spectrum	n Analyzer	
–120.0 dBm 90.0 dB Ext Gain	-120.0 d	l₿m									
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
#VBW 1 MHz	-160.0	rwww	www.alw	hologonalistiky	howhen	han Marting	patrophylic	www.www	www.wyAynd	Windhaudha	
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Traces <u>A: Max Hold</u>	-170.0										
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change
											Save Location
Freq Ref Int Std Accy	-210.0 c	l₿m									Change Type
- Me Blu Accy	18.000 G	Hz			Center 18 Span 1.(1	9.000 GHz	Setup/JPEG/
Freq		A	mplitude			Span			BW		Marker

Figure 3.1-4 (C) Spectrum Photos 18-19 GHz 1 MHz Res BW Horizontal Pol Worst Case

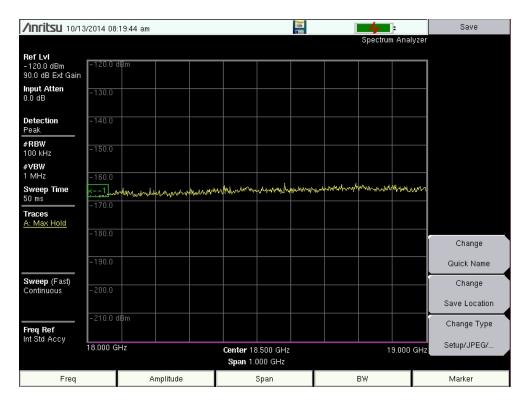


Figure 3.1-4 (D) Spectrum Photos 18-19 GHz 100 KHz Res BW Horizontal Pol Worst Case

/INFILSU 10/13	3/2014 07:	22:02 am						[4		Save
Ref Lvi -120.0 dBm 90.0 dB Ext Gain	-120.0 c	IBm							Spectrum) Analyzer	
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
#VBW 1 MHz	~~~~~~~ -160.0	anggad par	sater Apple M	madeler	how to	wwww	k-Annapan	whether was	MMWWYM	www.	
Sweep Time 50 ms Traces	<1 -170.0										
A: Max Hold	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change Save Location
Freq Ref	-210.0 c	IBm									Change Type
nt Std Accy	18.000 G	Hz			Center 18 Span 1.0	 3.500 GHz 000 GHz			1:	9.000 GHz	Setup/JPEG/
Freq		A	Amplitude			Span			BW		Marker

Figure 3.1-4 (E) Spectrum Photos 18-19 GHz 1 MHz Res BW Vertical Pol 360⁰

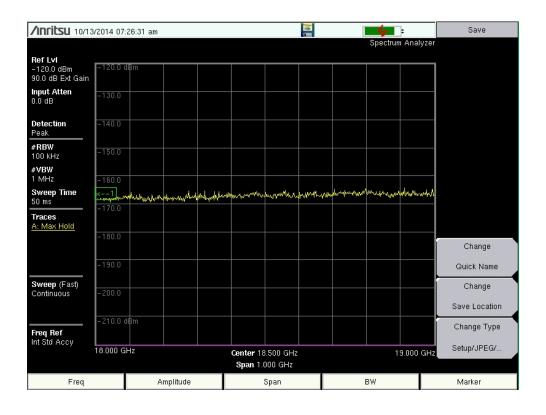


Figure 3.1-4 (F) Spectrum Photos 18-19 GHz 100 KHz Res BW Vertical Pol 360⁰

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Ref L∨I -120.0 dBm 90.0 dB Ext Gain	-120.0 c	Bm							Spectrun	n Analyzer	
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
#VBW 1 MHz	-160.0	ergha permetan	Mynummy	where the second	www.parterstally.	wanny	whenh	n an	r""WWW.	MAYAUMAR	
Sweep Time 50 ms	<1										
Traces <u>A: Max Hold</u>	-170.0										
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change
Contandodo	200.0										Save Location
Freq Ref	-210.0 c	Bm									Change Type
Int Std Accy	18.000 G	Hz			Center 18 Span 1.1				1	9.000 GHz	Setup/JPEG/
Freq		A	mplitude			Span			BW		Marker

Figure 3.1-4 (G) Spectrum Photos 18-19 GHz 1 MHz Res BW Vertical Pol Worst Case

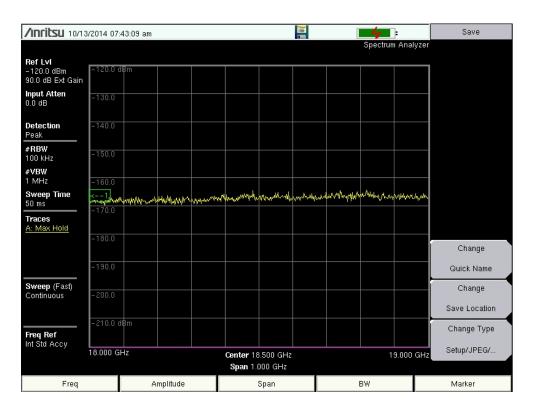
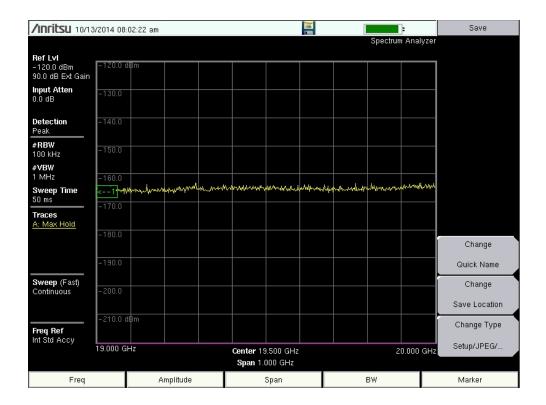


Figure 3.1-4 (H) Spectrum Photos 18-19 GHz 100 KHz Res BW Vertical Worst Case

/INFILSU 10/13	/2014 07:	57:39 am						[4	:	Save
Ref LvI									Spectrum	Analyzer	
-120.0 dBm 90.0 dB Ext Gain	-120.0 c	lBm									
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0	<u> </u>									
#VBW		unimation	presiden Nethold	mm	Law an Ward	ntethententer	www.	product the regulation	www.	1.J. WWW	
1 MHz	-160.0										
Sweep Time 50 ms	<1										
Traces A: Max Hold	-170.0										
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast)											Change
Continuous	-200.0										Save Location
Freq Ref Int Std Accy	-210.0 c	IBm									Change Type
Int Sta Acty	19.000 G	Hz			Center 19 Span 1.0		·	·	2	0.000 GHz	Setup/JPEG/
Freq		А	mplitude			Span			BW		Marker

Figure 3.1-5 (A) Spectrum Photos 19-20 GHz 1MHz Res BW Horizontal Pol 360⁰



/Inritsu 10/13	/2014 08:	16:45 am						[-	=	Save
Ref Lvi -120.0 dBm 90.0 dB Ext Gain	-120.0 c	Bm							Spectrum	ı Analyzer	
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0			Le dure .	k ben underen u	h 41 - 411		. ku		war i states	
#VBW 1 MHz	₩ ₩₩₩₩₩₩ -160.0	vwww.mpwe	794 ₃₋₁₀ 1051/94214741	ng water of	N.M. WYWWWWW	ywww.vy	n-unnun	and Yor, why m	hada nuntua data	ada dan Qali a. c	
Sweep Time 33 ms	<1 -170.0										
Traces A: Max Hold	-180.0										
											Change
Sweep (Fast)	-190.0										Quick Name Change
Continuous	-200.0										Save Location
Freq Ref Int Std Accy	-210.0 c	IBm									Change Type
	19.000 G	Hz			Center 19 Span 1.0	9.500 GHz 000 GHz			21	0.000 GHz	Setup/JPEG/
Freq		Ą	mplitude			Span			BW		Marker

Figure 3.1-5 (C) Spectrum Photos 19-20 GHz 1 MHz Res BW Horizontal Pol Worst Case

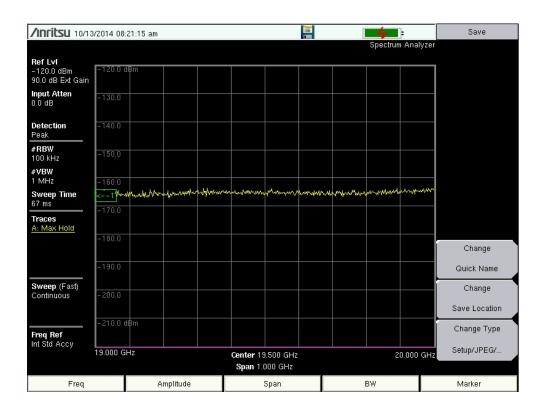


Figure 3.1-5 (D) Spectrum Photos 19-20 GHz 100 KHz Res BW Horizontal Pol Worst Case

/Inritsu 10/1:	3/2014 07:2	22:55 am						[4		Save
lef Lvl									Spectrun	n Analyzer	
120.0 dBm 0.0 dB Ext Gain	-120.0 d	Bm									
n put Atten .0 dB	-130.0										
etection eak	-140.0										
RBW MHz	-150.0					L .					
VBW MHz	Мунила -160.0	pre normality	n had been a	yyw~~white	www.www.hom	wither within	ninghan	mann	Vinnand	www.	
weep Time 3 ms	<1										
races : Max Hold	-170.0										
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change
	-210.0 d	Bm									Save Location
req Ref t Std Accy											Change Type
	19.000 Gł	Ηz			Center 19 Span 1.0	9.500 GHz 000 GHz			2	0.000 GHz	Setup/JPEG/
Freq		A	mplitude		Span			BW			Marker

Figure 3.1-5 (E) Spectrum Photos 19-20 GHz 1MHz Res BW Vertical Pol 360⁰

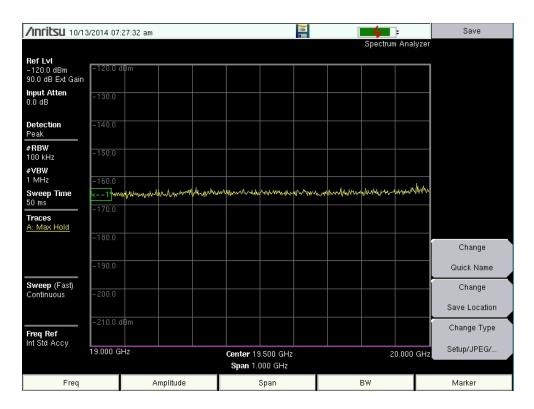


Figure 3.1-5 (F) Spectrum Photos 19-20 GHz 100 KHz Res BW Vertical Pol 360⁰

/INFITSU 10/13	/2014 08:	16:45 am						[•	Save
Ref L∨i -120.0 dBm	-120.0 c	Bm							Spectrun	1 Analyzer	
90.0 dB Ext Gain Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
#VBW 1 MHz	-160.0	www.alphar	teennen Merrel	www.yd	Mannaha	phinne	manund	nd Viran m	how hat Mayor	ana na mana na Na mana na mana n	
Sweep Time 33 ms	<1										
Fraces A: Max Hold	-170.0										
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change Save Location
req Ref	-210.0 c	IBm									Change Type
nt Std Accy	19.000 G	Hz			Center 19 Span 1.0				2	0.000 GHz	Setup/JPEG/
Freq		A	mplitude			Span			BW		Marker

Figure 3.1-5(G) Spectrum Photos 19-20 GHz 1MHz Res BW Vertical Pol Worst Case

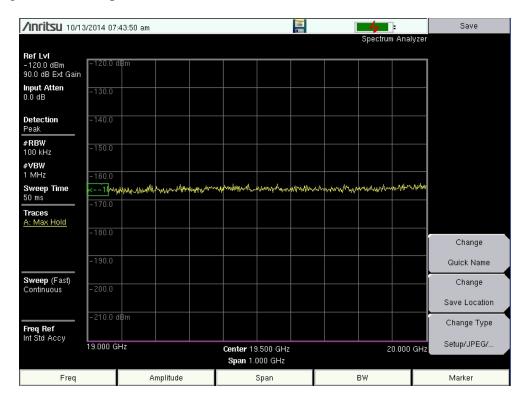
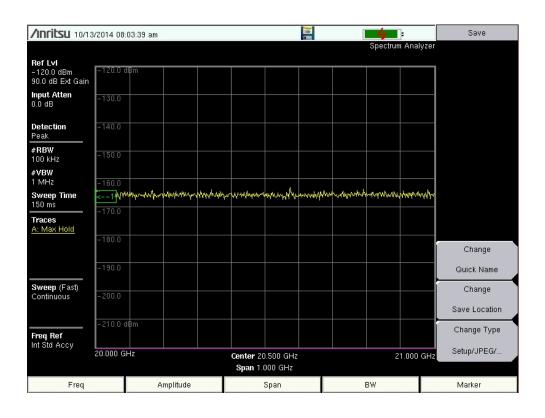


Figure 3.1-5 (H) Spectrum Photos 19-20 GHz 100 KHz Res BW Vertical Pol Worst Case

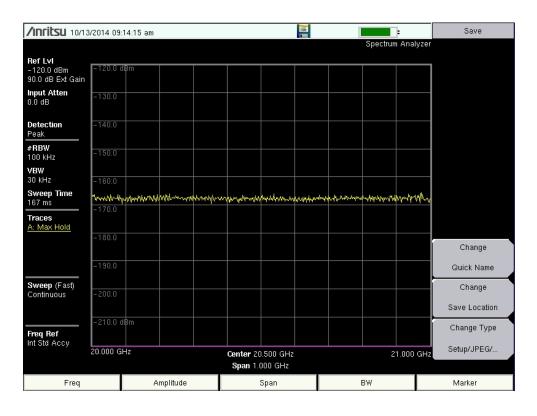
/INFITSU 10/13	/2014 07:	58:48 am						[-):	Save
Ref LvI - 120.0 dBm	-120.0 d	Bm							Spectrun	1 Analyzer	
90.0 dB Ext Gain Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
#VBW 1 MHz	₩ ₩₩₩ -160.0	handre	ann ann	MANN	Kating Arius	pullippin	444provently44proven	Nymena	NANANIA	www.hww	
Sweep Time 50 ms	<1										
Traces A: Max Hold											
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change Save Location
Freq Ref	-210.0 d	IBm									Change Type
nt Std Accy	20.000 GI	Hz			Center 20 Span 1.0				2	1.000 GHz	Setup/JPEG/
Freq		A	mplitude			Span			BW		Marker

Figure 3.1-6 (A) Spectrum Photos 20-21 GHz 1MHz Res BW Horizontal Pol 360⁰



/Inritsu 10/13	/2014 08:	17:26 am						[-	=	Save
Ref Lvi - 120.0 dBm 90.0 dB Ext Gain Input Atten 0.0 dB	-120.0 d -130.0	Bm							Spectrun	n Analyzer	
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
# VBW 1 MHz	-160.0	manpand	manten	manyah	Northang	NAMAN	nunpatropali	Marrow	w/www.hom	p.MMMylu	
Sweep Time 33 ms	<1										
Traces A: Max Hold											
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change Save Location
Freq Ref	-210.0 d	Bm									Change Type
Int Std Accy	20.000 Gł	Hz			Center 20 Span 1.1).500 GHz 000 GHz			2	1.000 GHz	Setup/JPEG/
Freq		A	mplitude			Span			BW		Marker

Figure 3.1-6 (C) Spectrum Photos 20-21 GHz 1 MHz Res BW Horizontal Pol Worst Case



/INFITSU 10/13	3/2014 07:	23:42 am						[4	:	Save
Ref Lvi -120.0 dBm 90.0 dB Ext Gain	-120.0 c	Bm							Spectrum	Analyzer	
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
#VBW 1 MHz	-160.0	handerhand	www.Whyty	wyknyk	ALALANSAN	howhite	rwww.	MAMAN	No. Ant May	www.vww.h	
Sweep Time 50 ms	<1										
Traces <u>A: Max Hold</u>	100.0										
	-180.0										Change
Sweep (Fast)	-190.0										Quick Name
Continuous	-200.0										Change Save Location
Freq Ref Int Std Accy	-210.0 c	IBm									Change Type
Int Stu Accy	20.000 G	Hz			Center 20 Span 1.1).500 GHz 000 GHz			2	1.000 GHz	Setup/JPEG/
Freq		A	mplitude			Span			BW		Marker

Figure 3.1-6 (E) Spectrum Photos 20-21 GHz 1MHz Res BW Vertical Pol 360⁰

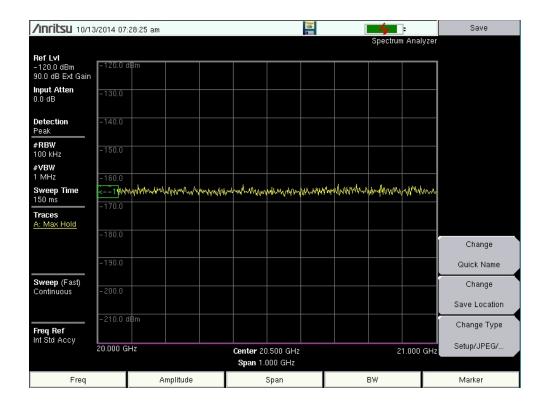
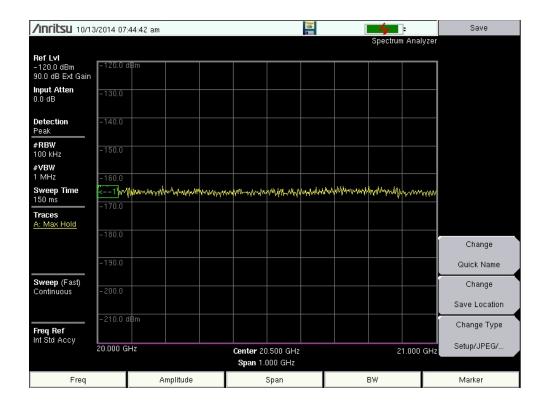
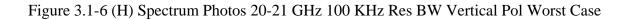


Figure 3.1-6 (F) Spectrum Photos 20-21 GHz 100 KHz Res BW Vertical Pol 360⁰

/Inritsu 10/13	3/2014 07:	41:04 am						[4		Save
Ref Lvl -120.0 dBm 90.0 dB Ext Gain	-120.0 c	l B m							Spectrum	n Analyzer	
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
#VBW 1 MHz	160.0	al Marine	hteryteter (1994)	uhun (huhn)	with with	hymni	adder where	Mapharak	MANANAN	discould have	
Sweep Time 50 ms	<1										
Traces A: Max Hold											
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change Save Location
Freq Ref	-210.0 c	IBm									Change Type
Int Std Accy	20.000 G	Hz			Center 20 Span 1.1				2	1.000 GHz	Setup/JPEG/
Freq		A	mplitude			Span			ЗW		Marker

Figure 3.1-6 (G) Spectrum Photos 20-21 GHz 1MHz Res BW Vertical Pol Worst Case





/INCIESU 10/18	3/2014 10:	00:01 am						[•	Save
Ref Lvl									Spectrum	n Analyzer	
-120.0 dBm 90.0 dB Ext Gain	-120.0 c	Bm									
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
VBW 300 kHz	-160.0	www.ww	nn h	mungebb	nanna	non the the	que alternation	hter the second second	4 m My hours	and the second second	
Sweep Time 50 ms	-170.0										
Traces A: Max Hold	-180.0										
	100.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change Save Location
	-210.0 c	Bm									
F req Ref Int Std Accy											Change Type Setup/JPEG/
	27.000 G	HZ			Center 27 Span 1.0	'.500 GHz 000 GHz			2	8.000 GHz	actup/or Ed/
Freq		A	mplitude			Span			BW		Marker

Figure 3.1-7 (A) Spectrum Photos 27-28 GHz 1MHz Res BW Horizontal Pol 360°

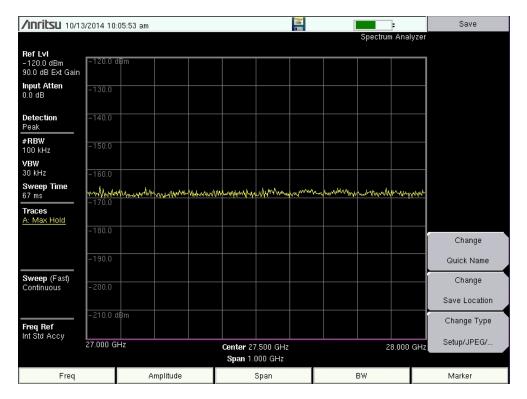


Figure 3.1-7 (B) Spectrum Photos 27-28 GHz 100 KHz Res BW Horizontal Pol 360⁰

/INCIESU 10/13	3/2014 09:	21:21 am						l		;	Save
Ref Lvi -120.0 dBm	-120.0 c	l₿m							Spectrun	n Analyzer	
90.0 dB Ext Gain Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
VBW 300 kHz	γγίγγιμ γ -160.0	ware warder	a yyyddydara	Mangharm	habasahaup	Warnahan	Month	MANNAN	montapp	www.~~M	
Sweep Time 50 ms	-170.0										
Traces <u>A: Max Hold</u>											
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change
											Save Location
Freq Ref Int Std Accy	-210.0 c	IBW									Change Type
	27.000 G	Hz				7.500 GHz 000 GHz			2	8.000 GHz	Setup/JPEG/
Freq		А	mplitude			Span			BW		Marker

Figure 3.1-7 (C) Spectrum Photos 27-28 GHz 1MHz Res BW Vertical Pol 360⁰

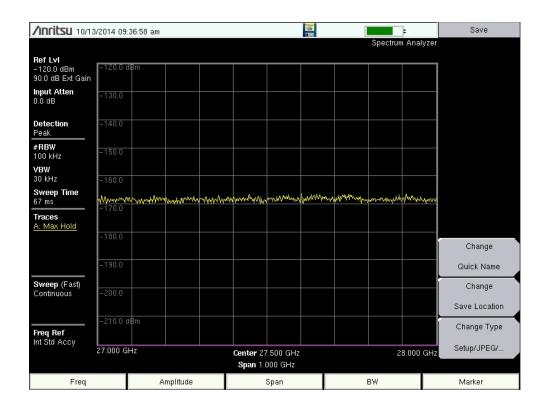


Figure 3.1-7 (D) Spectrum Photos 27-28 GHz 100 KHz Res BW Vertical Pol 360⁰

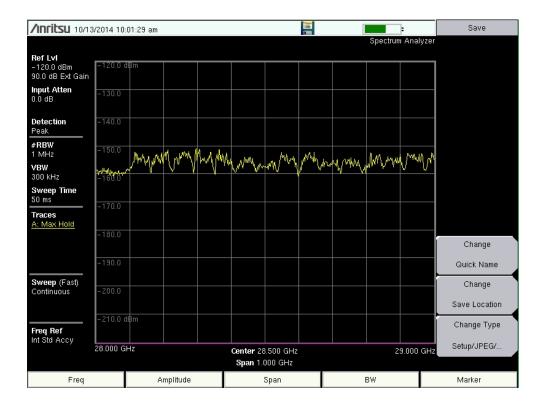


Figure 3.1-8 (A) Spectrum Photos 28-29 GHz 1MHz Res BW Horizontal Pol 360⁰

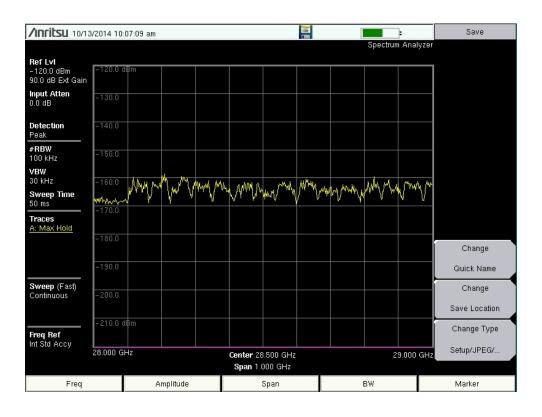


Figure 3.1-8 (B) Spectrum Photos 28-29 GHz 100 KHz Res BW Horizontal Pol 360⁰

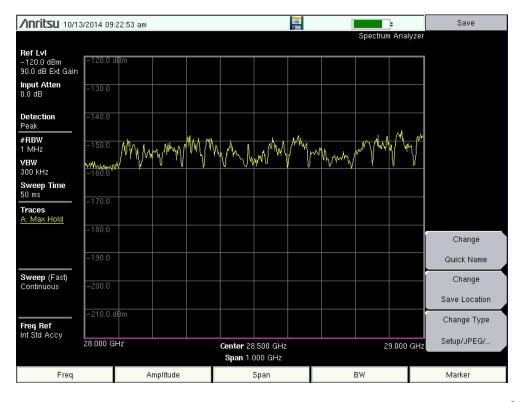


Figure 3.1-8 (C) Spectrum Photos 28-29 GHz 1MHz Res BW Vertical Pol 360⁰

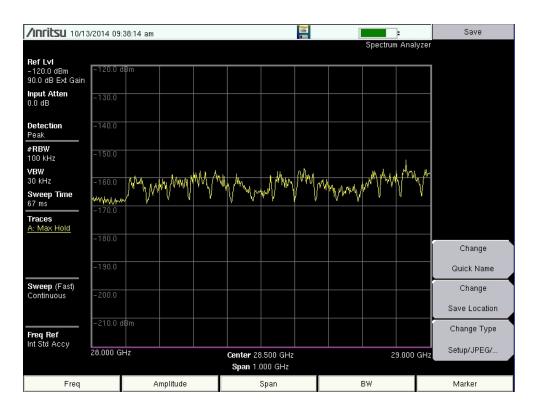


Figure 3.1-8 (D) Spectrum Photos 28-29 GHz 100 KHz Res BW Vertical Pol 360⁰

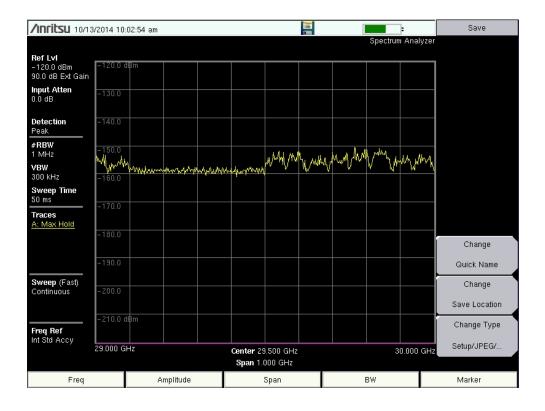


Figure 3.1-9 (A) Spectrum Photos 29-30 GHz 1MHz Res BW Horizontal Pol 360°

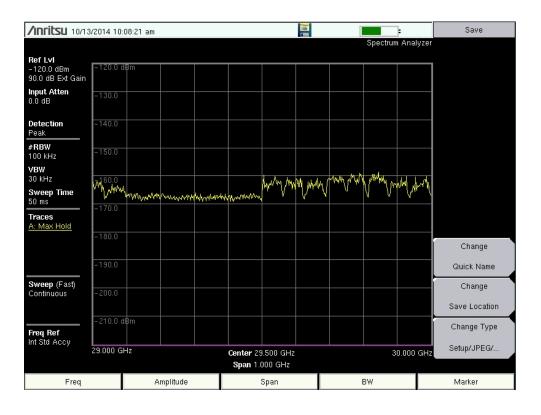


Figure 3.1-9 (B) Spectrum Photos 29-30 GHz 100 KHz Res BW Horizontal Pol 360⁰

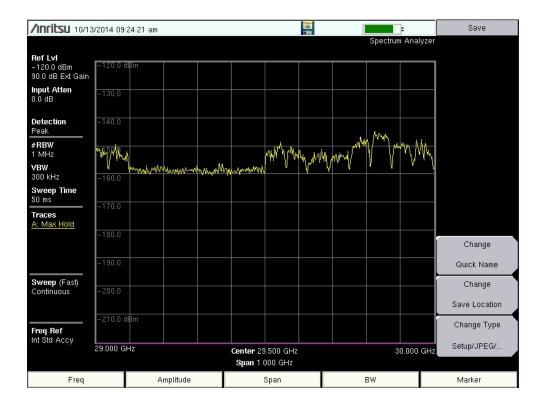


Figure 3.1-9 (C) Spectrum Photos 29-30 GHz 1MHz Res BW Vertical Pol 360°

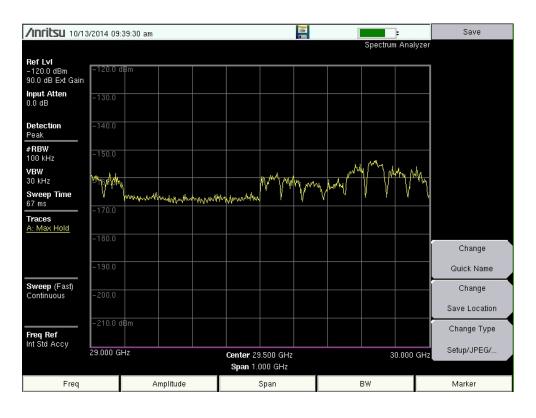


Figure 3.1-9 (D) Spectrum Photos 29-30 GHz 100 KHz Res BW Vertical Pol 360⁰

/Inritsu 10/13	3/2014 10:	04:34 am						[:	Save
Ref Lvl									Spectrum	Analyzer	
–120.0 dBm 90.0 dB Ext Gain	-120.0 d	lBm									
Input Atten 0.0 dB	-130.0										
Detection Peak	-140.0										
#RBW 1 MHz	-150.0										
VBW 300 kHz	- 160.0	NMMM-NN	unuhnuhn	an a	www	homenan	windowship	ANNA ANNO	www.www.w	www.	
Sweep Time 50 ms											
Traces <u>A: Max Hold</u>	-170.0										
	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change
											Save Location
Freq Ref Int Std Accy	-210.0 d	IBm									Change Type
- Me Bid Hooy	30.000 G	Hz			Center 30 Span 1.1				3	1.000 GHz	Setup/JPEG/
Freq		A	mplitude			Span			BW		Marker

Figure 3.1-10 (A) Spectrum Photos 30-31 GHz 1MHz Res BW Horizontal Pol 360⁰

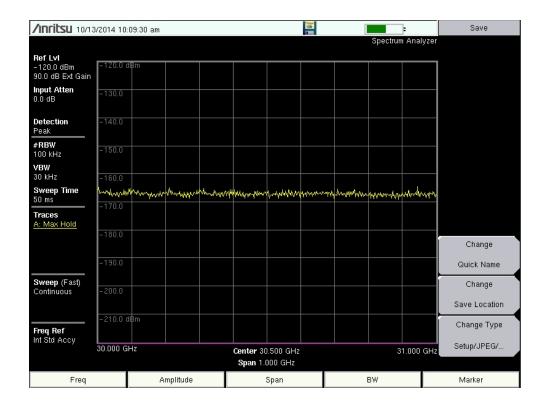


Figure 3.1-10 (B) Spectrum Photos 30-31 GHz 100 KHz Res BW Horizontal Pol 360⁰

/INFILSU 10/13	/2014 09:	34:45 am)=	Save
Ref Lvi 120.0 dBm 00.0 dB Ext Gain nput Atten 1.0 dB	-120.0 d -130.0	Bm							Spectrum	Analyzer	
Detection Peak	-140.0										
RBW MHz	-150.0										
/BW 300 kHz	-160.0	Winnin	mound	MWHWMM	montempe	www.humal	www.waraha	manula	Winghmang	million	
Sweep Time 60 ms F races A: Max Hold	-170.0										
<u>. Max Hold</u>	-180.0										Change
	-190.0										Quick Name
Sweep (Fast) Continuous	-200.0										Change Save Location
req Ref t Std Accy	-210.0 d										Change Type
	30.000 GH	Ηz			Center 30 Span 1.0				3	1.000 GHz	Setup/JPEG/
Freq		F	mplitude			Span			BW		Marker

Figure 3.1-10 (C) Spectrum Photos 30-31 GHz 1 GHz Res BW Vertical Pol 360⁰

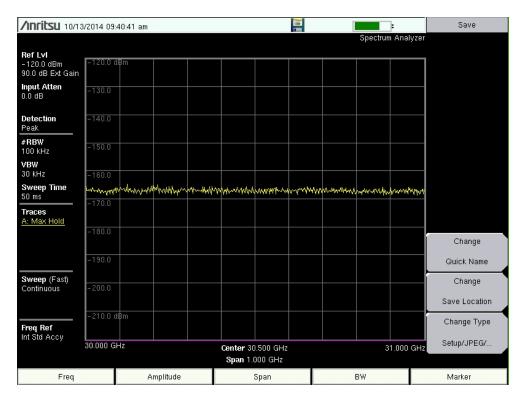


Figure 3.1-10 (D) Spectrum Photos 30-31 GHz 100 KHz Res BW Vertical Pol 360°

FOUR

SUMMARY OF RESULTS

The results of the measurements conducted at the proposed ViaSat, Inc site in Bozeman, MT are presented in this section.

Arc Clearance:

There is no potential satellite arc blockage at this site. Final arc clearance will depend on antenna placement.

Ka-Band Measurements:

There was no radio frequency interference measured at this site above the noise floor of the test equipment. One case was predicted but was not seen.

FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 <u>Conclusions</u>

There were no signals measured above the -156 dBW/ 1 MHz interference objective for digital reception at this site.

The satellite arc has no potential blockage from 55W through 115W.

5.2 <u>Recommendations</u>

•

It is recommended that frequency coordination of this site be initiated to protect this location at the more stringent digital receive interference objective.