

MICROWAVE PATH SURVEY REPORT

RADIO FREQUENCY INTERFERENCE (RFI) MEASUREMENT REPORT

Prepared For

ViaSat

Las Vegas, Nevada

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

AUGUST 24, 2015

19700 Janelia Farm Boulevard. - Ashburn, Virginia 20147, USA - 703.726.5500 - Fax 703.726.5597

TABLE OF CONTENTS

<u>SECTION 1</u> Introduction and Background

- **1.1 Introduction**
- 1.2 Background
- **1.3 Constraints**

SECTION 2 Test Procedure

- 2.1 Calibration
- 2.2 Methodology

SECTION 3 Data Presentation

SECTION 4 Summary of Results

<u>SECTION 5</u> Conclusions and Recommendations

- 5.1 Conclusions
- 5.2 Recommendations

Addendum 1

Addendum 1 contains spectral scans of interference detected at this location

ONE

INTRODUCTION AND BACKGROUND

1.1 Introduction

On-site Radio Frequency Interference (RFI) measurements were performed on behalf of ViaSat, Inc. on August 24, 2015 at their proposed site in Las Vegas, Nevada. 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:

- Andrew 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 $36^{0} 8'$ 33.6" N and $115^{0} 4' 38.2$ " W ViaSat, Inc had requested that Comsearch conduct RFI measurements at the facility to assess the interference potential. This facility is currently nonoperational 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.

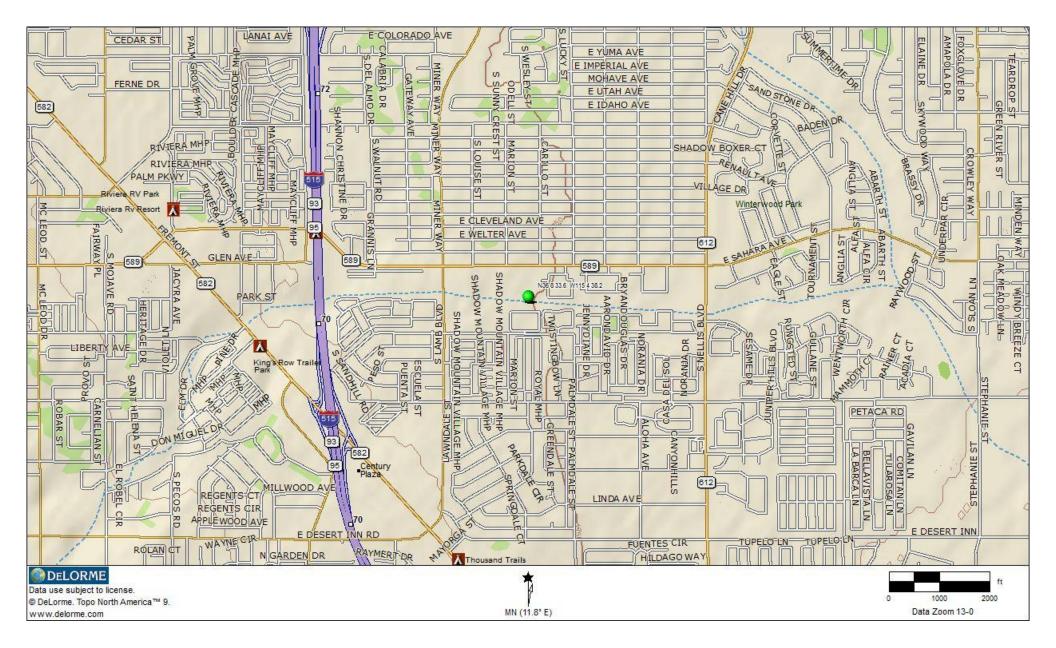


Figure 1.2-1 – Topographic Map

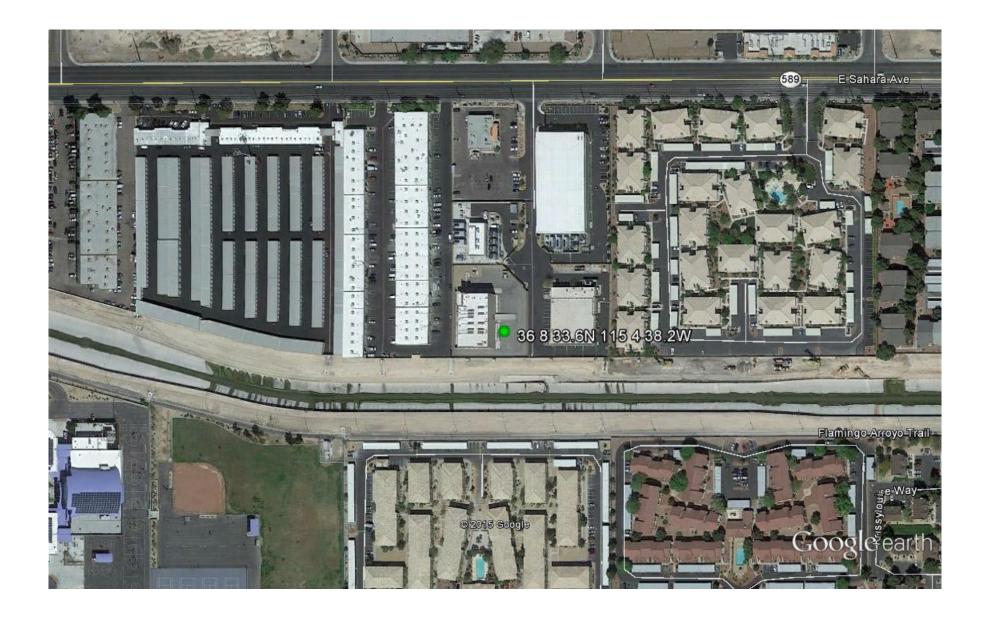


Figure 1.2-2 – Aerial Photograph

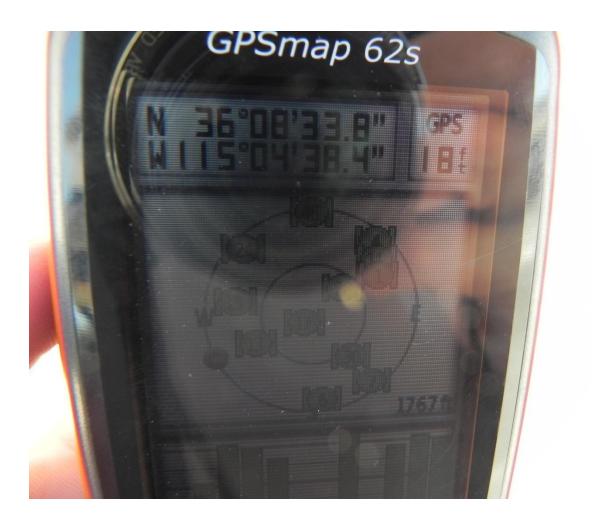


Figure 1.2-3 – GPS Photograph

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 reference signal (-60 dBm) by utilizing the reference level offset function of the Anritsu –MS2720T spectrum analyzer. Upon completion of the calibration process, a known reference level was obtained for the measurements that correspond to 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

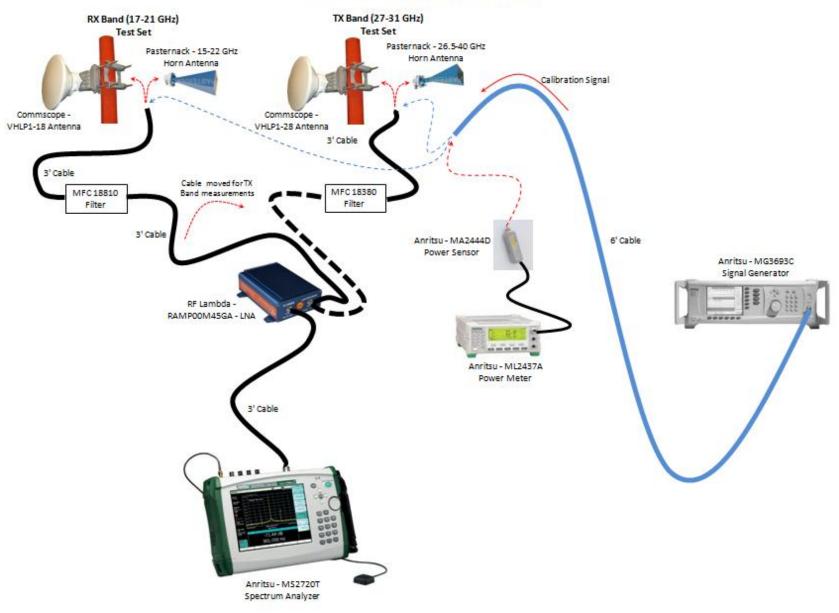
-30 =Conversion factor from dBm to dBW

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

/INFILSU 08/24	/2015 09:29:00 a	m			-	:	Save
					Spectrum	Analyzer	
RefL∨l 120.0 dBm	M1 -122.47 dBi -120.0 dBm	m @17.500 GHz	\$				
90.0 dB Ext Gain			1				
n put Atten 1.0 dB	-130.0						
Detection Peak	-140.0						
≭RBW IMHz	-150.0				·		
VBW 300 kHz	s-fflygrademidda	bad work the her have	manter	mun hanne		Nethersphy	
Sweep Time 50 ms	-170.0				a a a		
Fraces A: Max Hold							
	-180.0						Change
	-190.0						Quick Name
Sweep (Fast) Continuous	-200.0			_		1	Change
Johunuous	-200.0						Save Location
F req Ref nt Std Accy	-210.0 dBm						Change Type
nt Siù Accy	17.000 GHz		Center 17.500 (Span 1.000 G		1	3.000 GHz	Setup/JPEG/
Freq		Amplitude	Span		BW		Marker

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

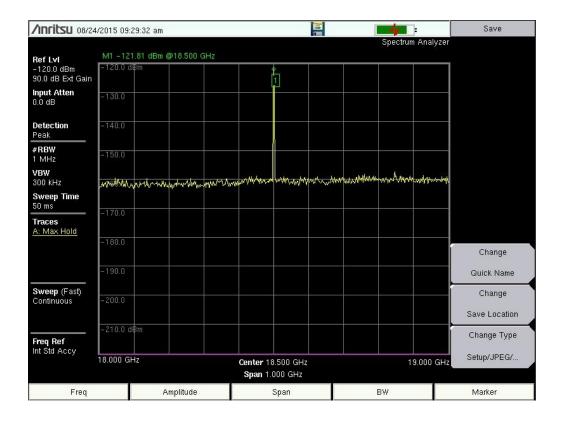


Figure 2.1-2 (B) Calibration Spectrum Photo 18.5 GHz

/INFILSU 08/24	/2015 09:30:3	0 am			=		4		Save
			Letter 1				Spectrum	Analyzer	
Ref Lvi -120.0 dBm 90.0 dB Ext Gain	M1 -121.46 -120.0 dBm	dBm @19.500 0	aHz	1					
nput Atten 1.0 dB	-130.0					-			
Detection Peak	-140.0					6. O		c.	
≭RBW I MHz	-150.0					8	55		
/BW 300 kHz	Anna Martin	www.	warder	mar warman	haran an a	humhunn	Proventational	producerspl	
Sweep Time 50 ms	-170.0					0			
Fraces A: Max Hold					τ.	c	c.	0.	
	-180.0								Change
	-190.0								Quick Name
Sweep (Fast) Continuous	-200.0								Change Save Location
Freq Ref	-210.0 dBm								Change Type
nt Std Accy	19.000 GHz			.er 19.500 GH an 1.000 GHz			20.	000 GHz	Setup/JPEG/
Freq		Amplitude		Span		B	W		Marker

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

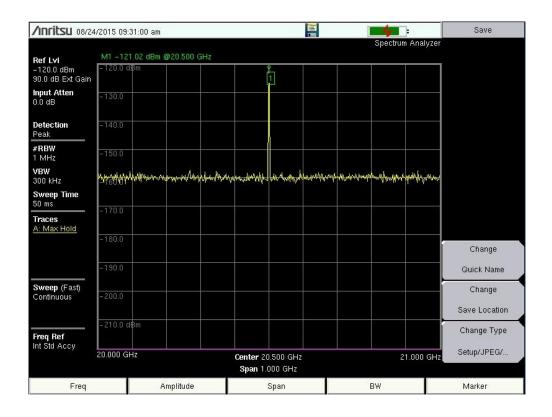


Figure 2.1-2 (D) Calibration Spectrum Photo 20.5 GHz

/Inritsu 08/24	2015 09:31:57 am			Save
			Spectrum Analyzer	
Ref Lvl	M1 -122.07 dBm @27.500 GHz			
-120.0 dBm 30.0 dB Ext Gain	-120.0 dBm	1		
nput Atten).0 dB	-130.0			
Detection ^D eak	-140.0			
#RBW I MHz	-150.0		0 0 0	
VBW 300 kHz	and for a part of the second second second	mallower warman	Ampananana	
Sweep Time 67 ms	-170.0		0 0 0	
Traces A: Max Hold	- 170.0			
	-180.0			Change
	-190.0			Quick Name
Sweep (Fast)				Change
Continuous	-200.0			Save Location
	-210.0 dBm			Change Type
F req Ref Int Std Accy				
	27.000 GHz Center 27	.500 GHz	28.000 GHz	Setup/JPEG/
		000 GHz		

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

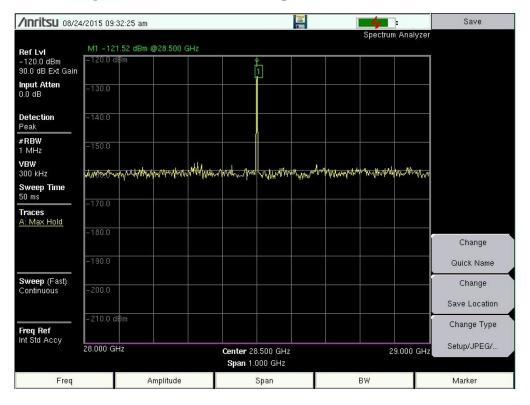


Figure 2.1-2 (F) Calibration Spectrum Photo 28.5 GHz

/INCITSU 08/24	/2015 09:32:53 am				-	Save
Ref Lvi	M1 -121.09 dBm @2	9.500 GHz			Spectrum Anal	yzer
120.0 dBm 0.0 dB Ext Gain	–120.0 dBm		¢ []			
n put Atten .0 dB	-130.0					
)etection 'eak	-140.0					\neg
RBW MHz	-150.0				<i>Q</i> 4	
/BW 100 kHz	and all and a support of the support	white when when	Winner Annum	human half a short	mhnumnumm	aller b
Sweep Time 13 ms	-170.0					
races A: Max Hold	-170.0					
	-180.0					Change
	-190.0					Quick Name
weep (Fast) Continuous	-200.0				5	Change
						Save Location
req Ref nt Std Accy	-210.0 dBm					Change Type
n starrioty	29.000 GHz		Center 29.500 GHz Span 1.000 GHz		30.000	GHz Setup/JPEG/
Freq	Amı	litude	Span		BW	Marker

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

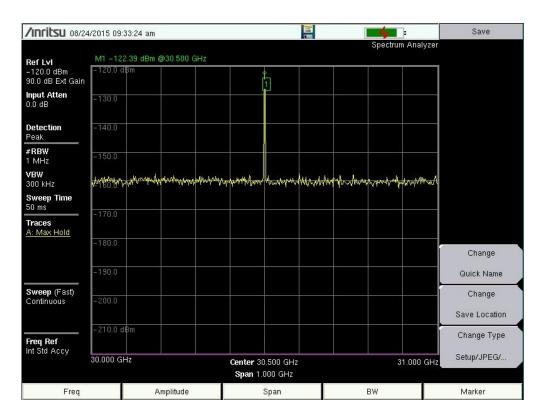


Figure 2.1-2 (H) Calibration Spectrum Photo 30.5 GHz

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 Las Vegas, Nevada

- 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

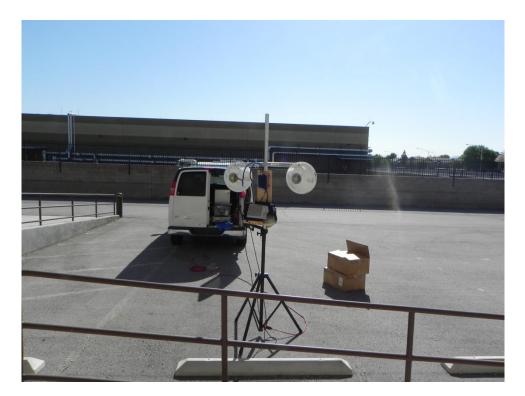
MEASUREMENT SITE DATA SHEET

1.	SYSTEM NAME:	ViaSat, Inc	
2.	CITY AND STATE:	Las Vegas, Nevad	a
3.	SITE IDENTIFICATION:	Las Vegas	
4.	COORDINATES: (NAD 1983)	LATITUDE: LONGITUDE:	
5.	GROUND ELEVATION:	1752.32 feet AMS	SL
6.	MEASUREMENT DATE AND TIMES:	AUGUST 24, 201	5
7.	GEOSTATIONARY ARC RANGE: SATELLITE POSITIONS: AZIMUTH: ELEVATION:	55W – 115W 108.8° – 179.9° 15.4° / 48.1°	

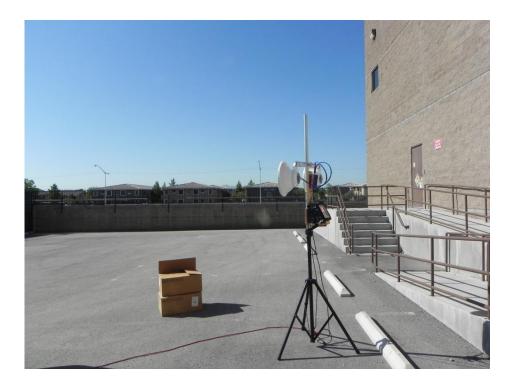
8. GEOSTATIONARY ARC VISIBILITY: Satellite arc has no blockage at this time



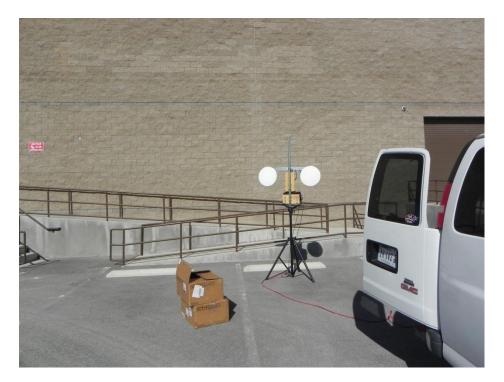
North



East



South



West







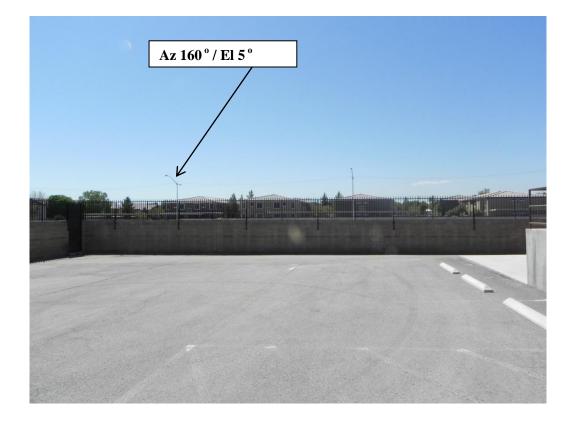


Figure 3.1-2 (cont.) Horizon Photographs of Earth Station Site



/INFILSU 01/22	/2015 11:23:11 am		4	Save
lef Lvl	M1 -158.38 dBm @17.500 G	Hz	Spectrum Analyzer	
-120.0 dBm 10.0 dB Ext Gain	–120.0 dBm			
n put Atten .0 dB	-130.0			
etection eak	-140.0			
RBW MHz	-150.0			
BW 00 kHz	- Carry March March All all readings	al manufacture and a second second	monorespectuations	
weep Time O ms				
races A: Max Hold	-170.0			
	-180.0			Change
	-190.0			Quick Name
weep (Fast) Continuous	-200.0			Change
, chanacao				Save Location
Treq Ref Int Std Accy	-210.0 dBm			Change Type
n ota nocy	17.000 GHz	Center 17.500 GHz Span 1.000 GHz	18.000 GHz	Setup/JPEG/
Freq	Amplitude	Span	BW	Marker

Figure 3.1-3 (A) Spectrum Photos 17-18 GHz 1MHz Res BW Horizontal Pol 360⁰

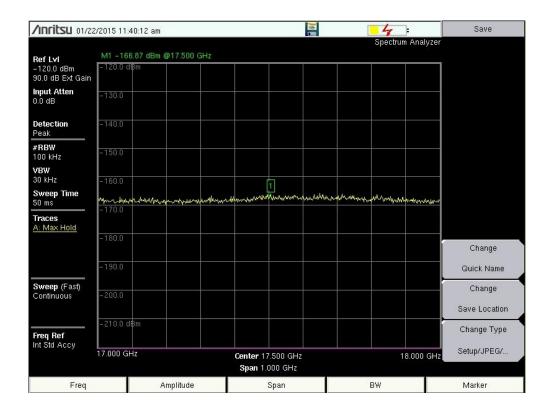


Figure 3.1-3 (B) Spectrum Photos 17-18 GHz 100 kHz Res BW Horizontal Pol 360°

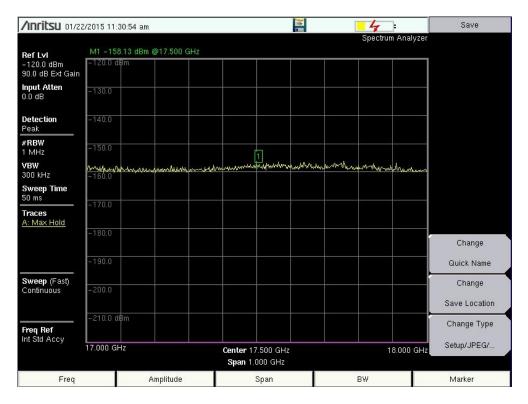


Figure 3.1-3 (C) Spectrum Photos 17-18 GHz 1 MHz Res BW Horizontal Pol Worst Case

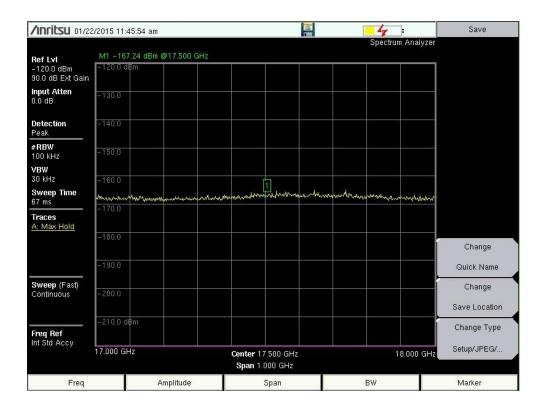
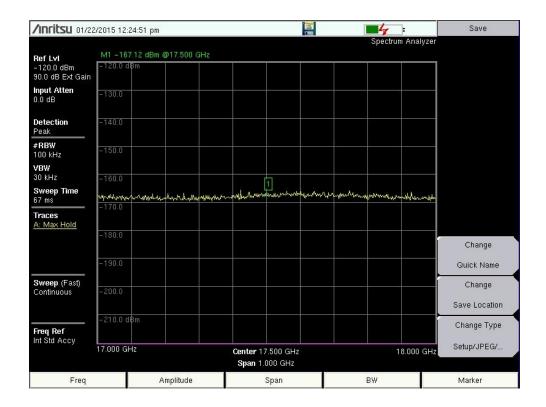


Figure 3.1-3 (D) Spectrum Photos 17-18 GHz 100 kHz Res BW Horizontal Pol Worst Case

/INFILSU 01/22	/2015 12:10:04	l pm			-4		Save
lef Lvl	M1 -158.98	dBm @17.500 GHz			Spect	rum Analyzer	
120.0 dBm 0.0 dB Ext Gain	–120.0 dBm						
put Atten 0 dB	-130.0						
etection eak	-140.0				0	_	
RBW MHz	-150.0			1			
BW JO KHZ	- 160.0	maladonnaharan	mandergrander	www.yohrowita	anderlynamic	www.	
w eep Time) ms	-170.0						
aces Max Hold						5) 53	
	-180.0					1	Change
	-190.0						Quick Name
veep (Fast) ontinuous	-200.0					1	Change Save Location
eq Ref	-210.0 d8m						Change Type
Std Accy	17.000 GHz		Center 17.5 Span 1.00			18.000 GHz	Setup/JPEG/
Freq		Amplitude	SI	pan	BW		Marker

Figure 3.1-3 (E) Spectrum Photos 17-18 GHz 1MHz Res BW Vertical Pol 360⁰





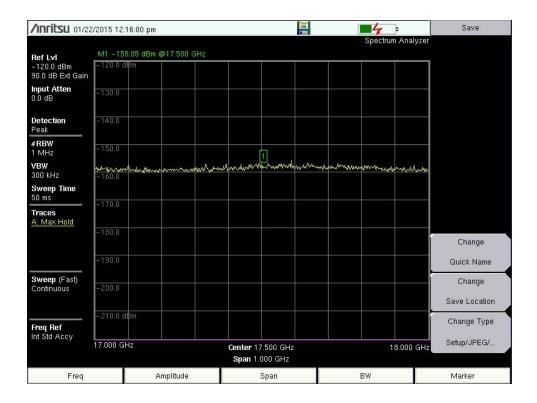


Figure 3.1-3 (G) Spectrum Photos 17-18 GHz 1 MHz Res BW Vertical Pol Worst Case

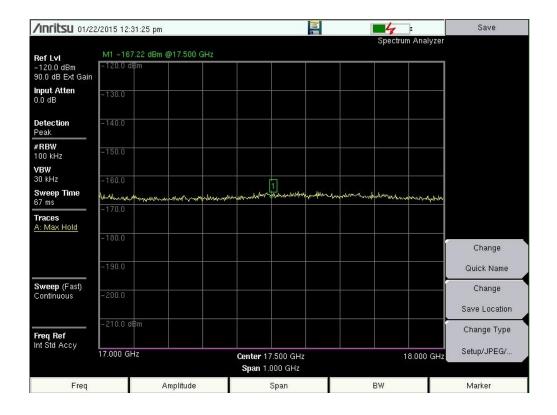


Figure 3.1-3 (H) Spectrum Photos 17-18 GHz 100 kHz Res BW Vertical Pol Worst Case

/INFILSU 01/22	/2015 11:24	4:07 am						4		Save
lef Lvl		75 dBm @18	3.500 GHz					Spectrum	Analyzer	
120.0 dBm 0.0 dB Ext Gain	–120.0 dB	m.								
put Atten 0 dB	-130.0									
e tection eak	-140.0							б. — С		
RBW MHz	-150.0			<u>.</u>	<u> </u>				<u>.</u>	
3W 10 kHz	zapagina.ma	atter the action of the	mound have	en have	ntighter	handh allaiden	manut	Mondard	Myunah	
weep Time I ms	-170.0			-		-			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
aces Max Hold				2.8				c. 7.	5	
	-180.0								1	Change
3	-190.0									Quick Name
veep (Fast) ontinuous	-200.0							5		Change Save Location
eq Ref Std Accy	-210.0 dB	m								Change Type
Sid Acty	18.000 GH	z			18.500 GHz .000 GHz			1	9.000 GHz	Setup/JPEG/
Freq		Ampl	itude		Span		E	3W		Marker

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

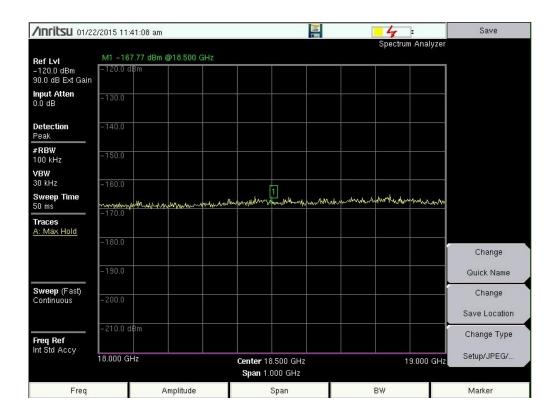


Figure 3.1-4 (B) Spectrum Photos 18-19 GHz 100 kHz Res BW Horizontal Pol 360⁰

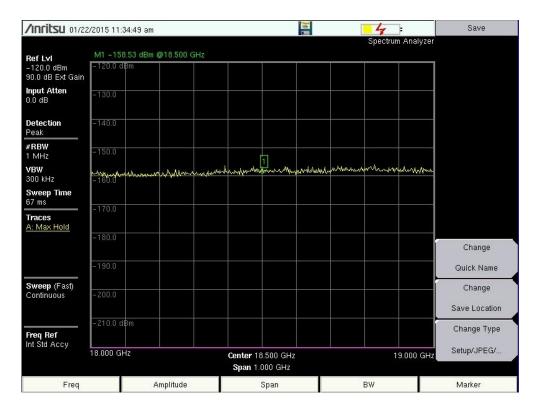


Figure 3.1-4 (C) Spectrum Photos 18-19 GHz 1 MHz Res BW Horizontal Pol Worst Case

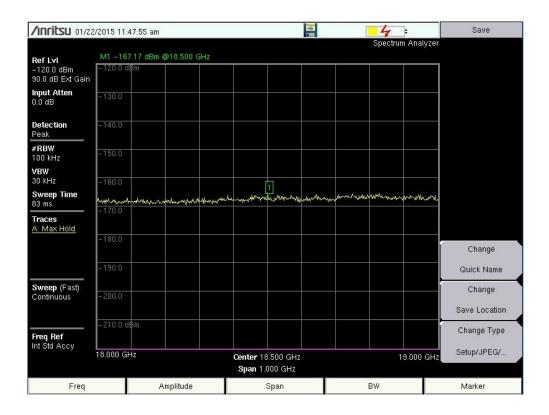


Figure 3.1-4 (D) Spectrum Photos 18-19 GHz 100 kHz Res BW Horizontal Pol Worst Case

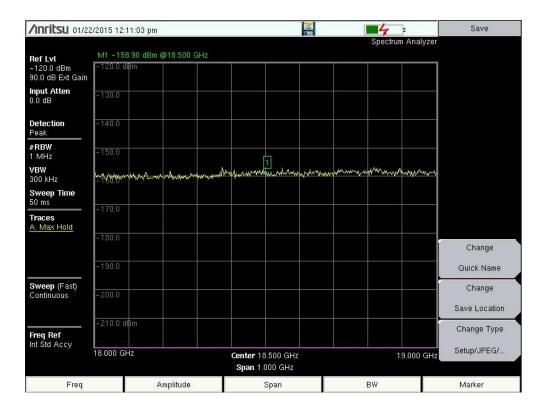
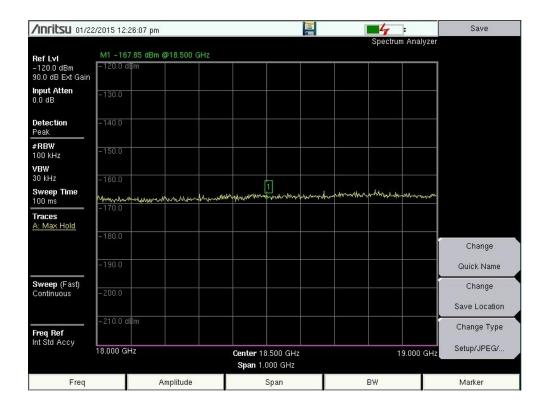
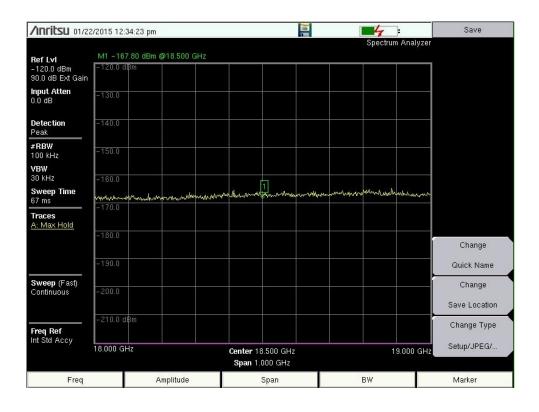


Figure 3.1-4 (E) Spectrum Photos 18-19 GHz 1 MHz Res BW Vertical Pol 360⁰



/INFITSU 01/22	2/2015 12:18:45 p	n			and the second s]	Save
Ref Lvl	M1 -158.94 dBi	n @18.500 GHz			Spectru	m Analyzer	
120.0 dBm 0.0 dB Ext Gain	–120.0 dBm						
put Atten .0 dB	-130.0						
etection eak	-140.0						
RBW MHz	-150.0		 				
3W 10 kHz	-160.0	and the second	manderstrates	wheel which whe	Mannon	munthing	
w eep Time) ms	-170.0						
races Max Hold	-170.0						
	-180.0						Change
	-190.0						Quick Name
veep (Fast) ontinuous	-200.0						Change
							Save Location
req Ref t Std Accy	-210.0 dBm						Change Type
	18.000 GHz		Center 18.500 GF Span 1.000 GH:			19.000 GHz	Setup/JPEG/
Freq		Amplitude	Span		BW		Marker

Figure 3.1-5 (G) Spectrum Photos 18-19 GHz 1 MHz Res BW Vertical Pol Worst Case





/INFITSU 01/22	/2015 11:25:10 am				4):	Save
Ref Lvi	M1 -158.92 dBm @1	9.500 GHz			Spectrun	n Analyzer	
120.0 dBm 0.0 dB Ext Gain	–120.0 dBm						
n put Atten .0 dB	-130.0						
etection eak	-140.0				c c		
RBW MHz	-150.0		 []	<u> </u>	<u>e</u> 4	<u> </u>	
'BW 00 kHz	- 160.0	When the many Alters	www.wt.when	human	monthemation	withhim	
Sweep Time 10 ms							
races :: Max Hold	-170.0						
	-180.0						Change
	-190.0						Quick Name
weep (Fast) ontinuous	-200.0						Change
							Save Location
req Ref nt Std Accy	-210.0 dBm						Change Type
n old Hety	19.000 GHz		enter 19.500 GH Span 1.000 GHz	2	2	0.000 GHz	Setup/JPEG/
Freq	Amp	litude	Span		BW		Marker

Figure 3.1-5 (A) Spectrum Photos 19-20 GHz 1MHz Res BW Horizontal Pol 360^{0}

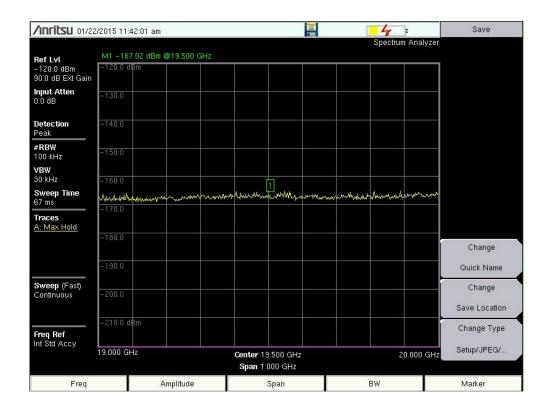


Figure 3.1-5 (B) Spectrum Photos 19-20 GHz 100 kHz Res BW Horizontal Pol 360°

/Inritsu 01/22	/2015 11:36:34 am	i			-4	Save
					Spectrum A	nalyzer
ef Lvi	M1 -158.17 dBn	0@19.500 GHz				
120.0 dBm 0.0 dB Ext Gain	–120.0 dBm					
p ut Atten) dB	-130.0					
e tection ak	-140.0				0	
RBW MHz	-150.0		 [1]			
3W IO kHz	4	apply and man	resulting any second and any	monteringthing	mannahangandah	num
veep Time ms	-170.0					
aces Max Hold	-120.0					
	-180.0					Change
45	-190.0					Quick Name
veep (Fast) Intinuous	-200.0					Change
						Save Location
eq Ref Std Accy	−210.0 d₿m					Change Type
Sill Acty	19.000 GHz		Center 19.500 G Span 1.000 GF		20.0	00 GHz Setup/JPEG/
Freq		Amplitude	Span		BW	Marker

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

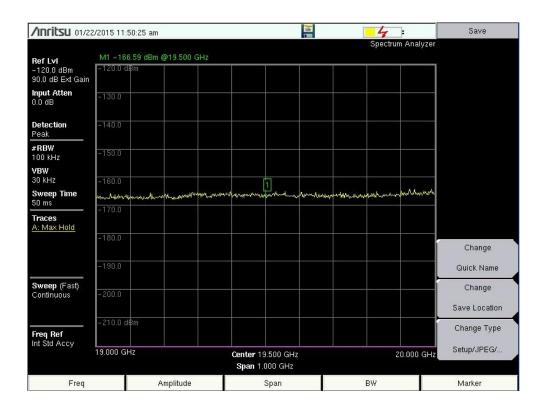


Figure 3.1-5 (D) Spectrum Photos 19-20 GHz 100 kHz Res BW Horizontal Pol Worst Case

/INCIESU 01/22	/2015 12:11:5	iO pm						Save
	M1 - 159 07	dBm @19.500 G⊦	47			Specti	um Analyzer	
ef Lvi 120.0 dBm 0.0 dB Ext Gain	-120.0 dBm							
put Atten D dB	-130.0					1		
e tection eak	-140.0					Ċ.		
RBW MHz	-150.0		50 			2	<u> </u>	
3W O KHZ	-160.0	and the second shall be	mound	wanthemati	MA-MANALA	yohr mar mar mar mar mar mar mar mar mar ma	www.wh	
veep Time I ms	-170.0					÷		
aces Max Hold						5	- <u>-</u>	
	-180.0							Change
(5)	-190.0							Quick Name
veep (Fast) intinuous	-200.0							Change Save Location
eq Ref	-210.0 dBm					2		Change Type
Std Accy	19.000 GHz			19.500 GHz 1.000 GHz			20.000 GHz	Setup/JPEG/
Freq		Amplitude		Span		BW		Marker

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

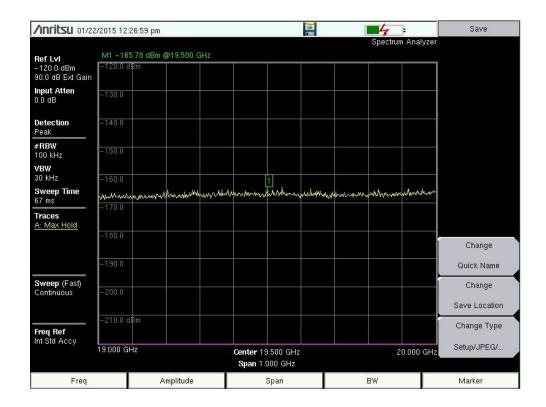


Figure 3.1-5 (F) Spectrum Photos 19-20 GHz 100 kHz Res BW Vertical Pol 360°

/Inritsu 01/22	/2015 12:21:35 pm				-4	Save
lef Lvl	M1 -158.42 dBm @19.500 GHz					Analyzer
120.0 dBm 0.0 dB Ext Gain	-120.0 dBm					
put Atten 0 dB	-130.0					
e tection eak	-140.0				6	
R BW MHz	-150.0				<u>9</u> 5:	
BW 30 kHz	-160.0	normalication	mathinghamatic	malummunu	mounderwork	howard
weep Time) ms						
aces Max Hold	-170.0					
	-180.0					Change
	-190.0					Quick Name
Sweep (Fast) Continuous	-200.0					Change
						Save Location
req Ref t Std Accy	–210.0 d₿m					Change Type
-onenooy	19.000 GHz		Center 19.500 Span 1.000 G		20.	000 GHz Setup/JPEG/
Freq	F F	mplitude	Span		BW	Marker

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

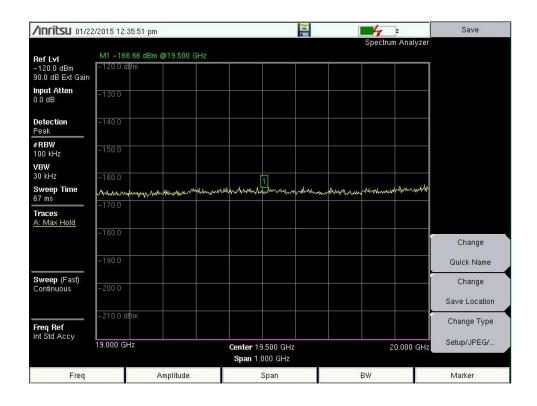
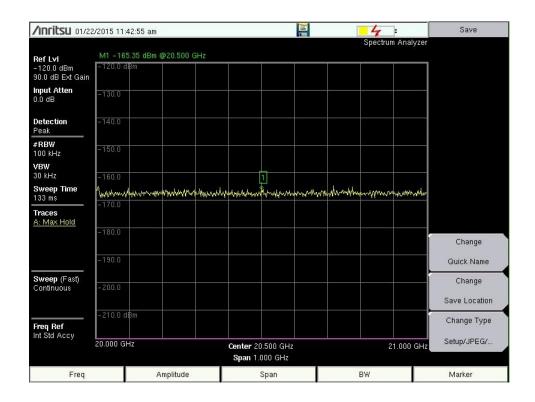


Figure 3.1-5 (H) Spectrum Photos 19-20 GHz 100 kHz Res BW Vertical Pol Worst Case

/INFILSU 01/22	/2015 11:26:12 am				-4	•	Save
					Spectru	um Analyzer	
Ref Lvi 120.0 dBm 10.0 dB Ext Gain	M1 -157.71 dBm @ -120.0 dBm	20.500 GHz					
n put Atten .0 dB	-130.0						
)etection 'eak	-140.0						
RBW MHz	-150.0		1		ia		
/BW 100 kHz	<u>~</u>	manyahangagaant		ummunul	mynamina	and the property of the second	
Sweep Time i0 ms	-170.0				82 03		
Fraces A: Max Hold					e	3 3	
	-180.0						Change
-	-190.0						Quick Name
Sweep (Fast) Continuous	-200.0					Î	Change
							Save Location
req Ref nt Std Accy	-210.0 d₿m						Change Type
n olu Hocy	20.000 GHz		Center 20.500 GF Span 1.000 GHz			21.000 GHz	Setup/JPEG/
Freq	Am	plitude	Span		BW		Marker

Figure 3.1-6 (A) Spectrum Photos 20-21 GHz 1MHz Res BW Horizontal Pol 360°



/Inritsu 01/22	/2015 11:38:45 am			4	Save
				Spectrum Anal	yzer
Ref Lvl 120.0 dBm 10.0 dB Ext Gain	M1 -157.65 dBm @20 -120.0 dBm	.500 GHz			
put Atten .0 dB	-130.0				
etection eak	-140.0				\dashv
RBW MHz	-150.0		1		
/BW 100 kHz	Митрини и Мит -160.0	walking	www.anytheregene		Avan V
Sweep Time 10 ms	=170.0				
races :: Max Hold	(- .1.50.0				
	-180.0				Change
-	-190.0				Quick Name
weep (Fast) Continuous	-200.0				Change
					Save Location
req Ref nt Std Accy	–210.0 dBm				Change Type
	20.000 GHz		20.500 GHz 1.000 GHz	21.000	GHz Setup/JPEG/
Freq	Ampl	tude	Span	BW	Marker

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

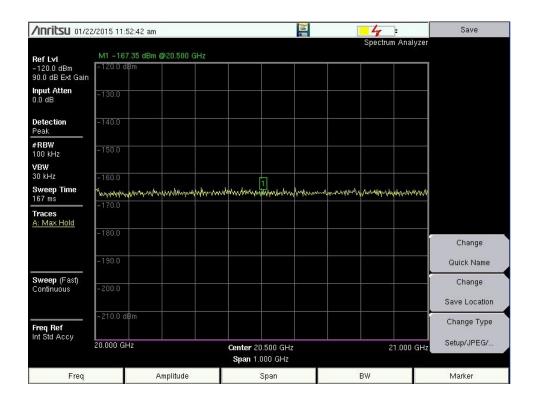


Figure 3.1-6 (D) Spectrum Photos 20-21 GHz 100 kHz Res BW Horizontal Pol Worst Case

/Inritsu 01/22	/2015 12:12:55 pm	i		-	-4	Save
					Spectrum Ana	alyzer
Ref Lvl	M1 -158.79 dBn	n @20.500 GHz				
-120.0 dBm 30.0 dB Ext Gain	–120.0 dBm					
nput Atten).0 dB	-130.0					
Detection ^D eak	-140.0				. 0. P	
≭RBW I MHz	-150.0		 		· <i>p</i> 9	
48W 300 kHz	4000 - 160.0	n hander der name	hale and the second	Luppmann	which the second of the second	Annon
Sweep Time 33 ms						
Traces A: Max Hold	-170.0					
	-180.0					Change
	-190.0					Quick Name
Sweep (Fast)						Change
Continuous	-200.0					Save Location
F req Ref nt Std Accy	-210.0 d8m					Change Type
n ou Accy	20.000 GHz		Center 20.500 G Span 1.000 GH		21.000) GHz Setup/JPEG/
Freq		Amplitude	Span		BW	Marker

Figure 3.1-6 (E) Spectrum Photos 20-21 GHz 1MHz Res BW Vertical Pol 360^{0}

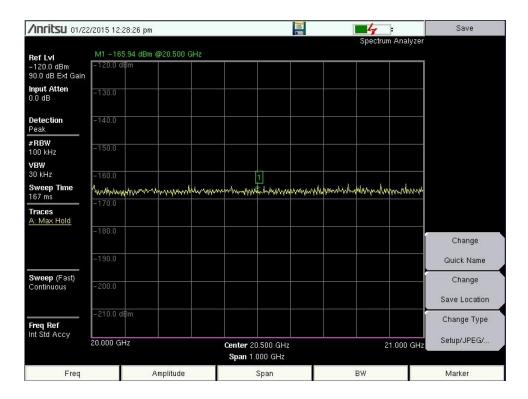


Figure 3.1-6 (F) Spectrum Photos 20-21 GHz 100 kHz Res BW Vertical Pol 360⁰

/Inritsu 01/22	/2015 12:23:31 pm		-4	Save
Ref Lvl	M1 -157.41 dBm @20.500 GHz		Spectrum Analyzer	
-120.0 dBm 90.0 dB Ext Gain	–120.0 dBm			
Input Atten 0.0 dB	-130.0			
Detection Peak	-140.0			
#RBW 1 MHz	-150.0	1		
VBW 300 kHz	-160.0	and and an	www.wew.well.well.	
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 dBm			Change Type Setup/JPEG/
	20.000 GHz	Center 20.500 GHz Span 1.000 GHz	21.000 GHz	Jeapor Edv
Freq	Amplitude	Span	BW	Marker

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

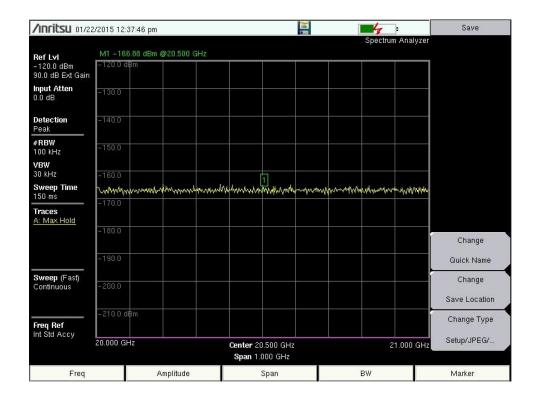


Figure 3.1-6 (H) Spectrum Photos 20-21 GHz 100 kHz Res BW Vertical Pol Worst Case

/Inritsu 01/22	:/2015 12:46:59 pm		E 1	Save
			Spectrum An	alyzer
Ref Lvi -120.0 dBm 30.0 dB Ext Gain	M1 -158.79 dBm @27.500 -120.0 dBm) GHz		
nput Atten 1.0 dB	-130.0			
Detection Peak	-140.0			
≭RBW IMHz	-150.0			
VBW 300 kHz	-160.0	Margar margaret an and and a second and	some water and the second and the second	manager
Sweep Time 50 ms Traces	H170.0			
A: Max Hold	-180.0			Change
	-190.0			Quick Name
Sweep (Fast) Continuous	- 200.0			Change Save Location
Freq Ref	-210.0 dBm			Change Type
Int Std Accy	27.000 GHz	Center 27.500 GHz Span 1.000 GHz	28.00	D GHz Setup/JPEG/
Freq	Amplitude	e Span	BW	Marker

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

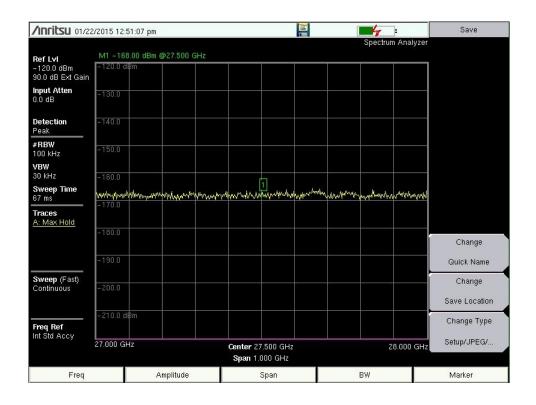


Figure 3.1-7 (B) Spectrum Photos 27-28 GHz 100 kHz Res BW Horizontal Pol 360⁰

/INFITSU 01/22	/2015 12:55:	49 pm						4	•	Save
Ref Lvi - 120.0 dBm	M1 -159.5; -120.0 dBm	2 dBm @27.500	GHz	1			1	Spectrur	n Analyzer	
90.0 dB Ext Gain										
nput Atten).0 dB	-130.0									
Detection Peak	-140.0									
RBW MHz	-150.0				-	<u></u>		<i></i>		
'BW 100 kHz	-160.0	underland	renderstart	ether the standay	munnin	physiana	manyana	person and	und work with	
Sweep Time O ms	-170.0									
races A: Max Hold									5	
	-180.0									Change
	-190.0									Quick Name
weep (Fast) Continuous	-200.0								[Change
onandodo										Save Location
req Ref It Std Accy	-210.0 dBm									Change Type
rola necy	27.000 GHz			Center 27 Span 1,1	7.500 GHz 000 GHz			2	8.000 GHz	Setup/JPEG/
Freq		Amplitude			Span		1	BW		Marker

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

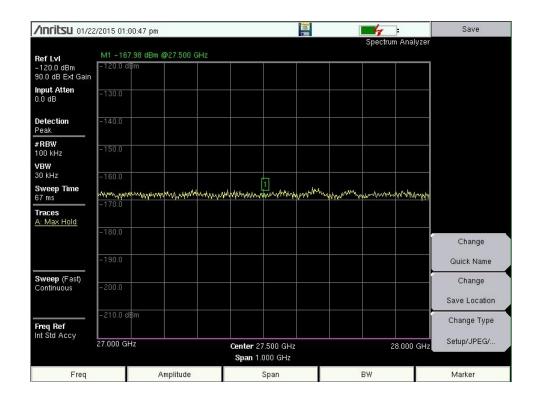


Figure 3.1-7 (D) Spectrum Photos 27-28 GHz 100 kHz Res BW Vertical Pol 360°

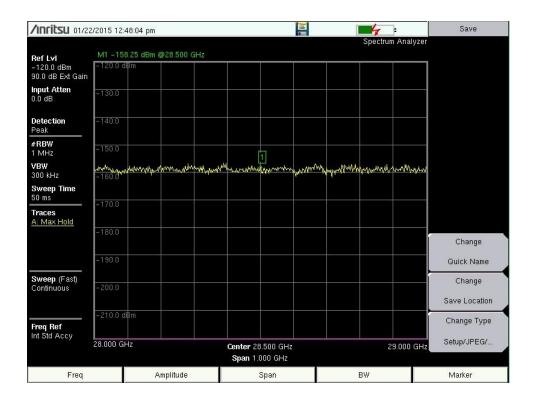


Figure 3.1-8 (A) Spectrum Photos 28-29 GHz 1MHz Res BW Horizontal Pol 360⁰

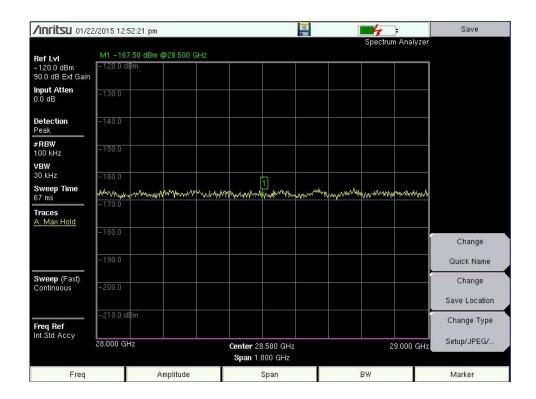


Figure 3.1-8 (B) Spectrum Photos 28-29 GHz 100 kHz Res BW Horizontal Pol 360⁰

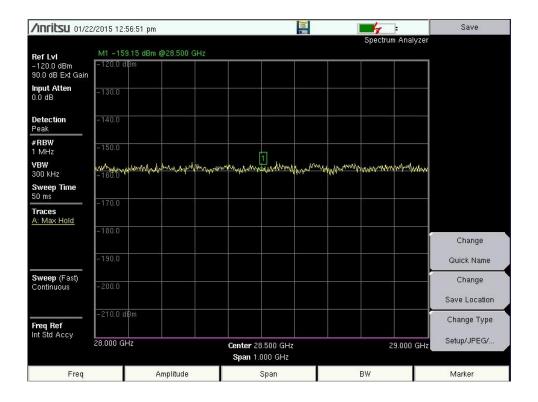


Figure 3.1-8 (C) Spectrum Photos 28-29 GHz 1MHz Res BW Vertical Pol 360⁰

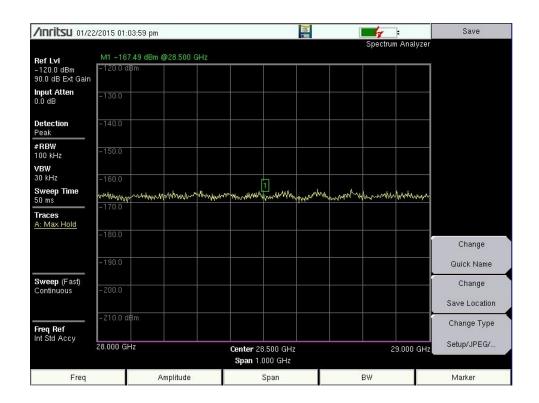


Figure 3.1-8 (D) Spectrum Photos 28-29 GHz 100 kHz Res BW Vertical Pol 360⁰

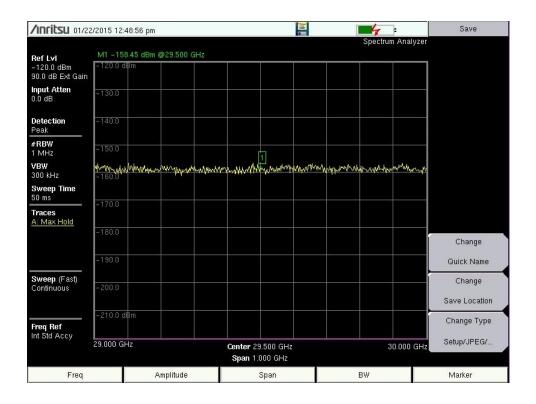


Figure 3.1-9 (A) Spectrum Photos 29-30 GHz 1MHz Res BW Horizontal Pol 360⁰

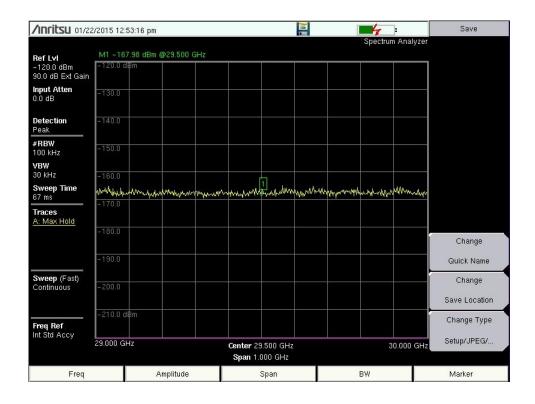


Figure 3.1-9 (B) Spectrum Photos 29-30 GHz 100 kHz Res BW Horizontal Pol 360⁰

/Inritsu 01/22	:/2015 12:58:24 pm			Save
			Spectrum Analyze	r
Ref Lvi -120.0 dBm 30.0 dB Ext Gain	M1 -158.26 dBm @29.500 GHz -120.0 dBm			1
n put Atten 1.0 dB	-130.0			
)etection 'eak	-140.0			
RBW MHz	-150.0			
/BW 300 kHz	-160.0	any manufacture and the second s	warmanyanananan	b
Sweep Time 50 ms	170.0			
Fraces	-170.0			
	-180.0			Change
45	-190.0			Quick Name
Sweep (Fast) Continuous	-200.0			Change Save Location
i req Ref nt Std Accy	-210.0 dBm			Change Type
n olu riocy	29.000 GHz	Center 29.500 GHz Span 1.000 GHz	30.000 GH	z Setup/JPEG/
Freq	Amplitude	Span	BW	Marker

Figure 3.1-9 (C) Spectrum Photos 29-30 GHz 1MHz Res BW Vertical Pol 360⁰

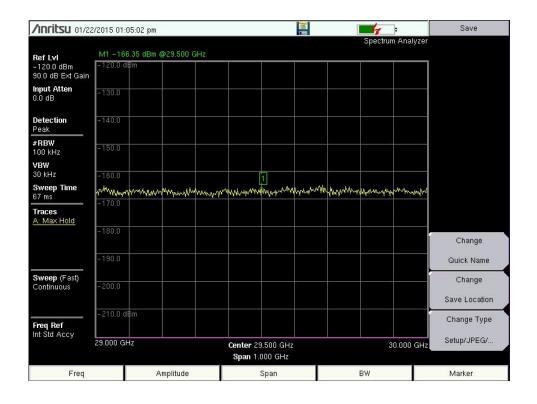


Figure 3.1-9 (D) Spectrum Photos 29-30 GHz 100 kHz Res BW Vertical Pol 360⁰

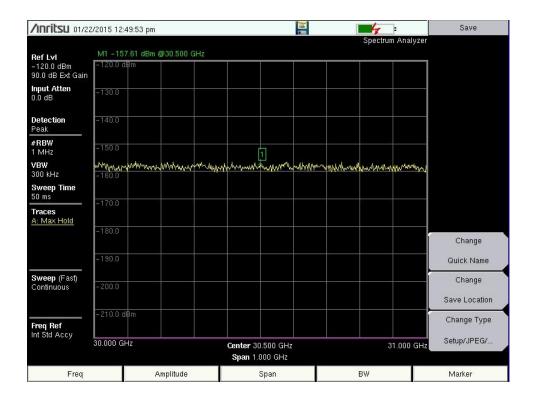


Figure 3.1-10 (A) Spectrum Photos 30-31 GHz 1MHz Res BW Horizontal Pol 360⁰

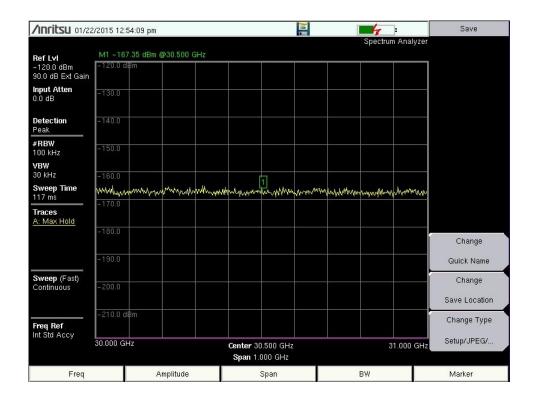


Figure 3.1-10 (B) Spectrum Photos 30-31 GHz 100 kHz Res BW Horizontal Pol 360⁰

/INFILSU 01/22	/2015 12:59:18 pm					Save
	M1 -158.95 dBm @	30 500 GHz			Spectrum	Analyzer
Ref Lvi -120.0 dBm 30.0 dB Ext Gain	-120.0 dBm					
n put Atten 1.0 dB	-130.0					
Detection Peak	-140.0			-	,	
≠ RBW MHz	-150.0					
/BW 300 kHz	-160.0	manna	and many and the second of the	when when	www.www.www.www	mon
Sweep Time 50 ms	-170.0					
Fraces A: Max Hold	-170.0					
	-180.0					Change
	-190.0					Quick Name
Sweep (Fast) Continuous	-200.0					Change
						Save Location
F req Ref nt Std Accy	–210.0 dBm					Change Type
	30.000 GHz		Center 30.500 G Span 1.000 GH		31.	000 GHz Setup/JPEG/
Freq	Ar	nplitude	Span		BW	Marker

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

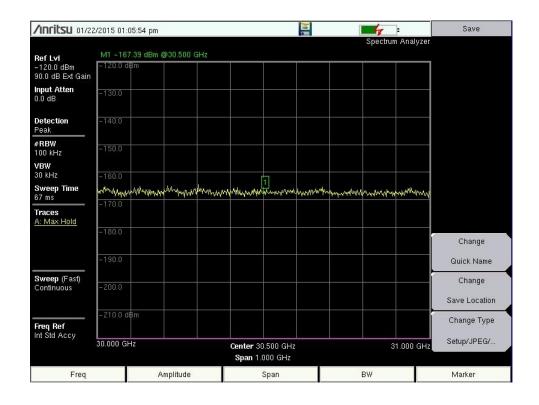


Figure 3.1-10 (D) Spectrum Photos 30-31 GHz 100 kHz Res BW Vertical Pol 360⁰

FOUR

SUMMARY OF RESULTS

The results of the measurements conducted at the proposed ViaSat, Inc site in Las Vegas, Nevada 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 radio frequency interference cases measured at this site above the noise floor of the test equipment. There were 4 transmissions measured at this location. Two were predicted, and two were from unknown sources. However, the two unknown transmissions were both detected from the same azimuth as the expected one known as VG08260A. At issue is that the expected azimuth of VG08260A is shown in our database as 156.7⁰, but no transmission was seen at that azimuth. The correct frequency for VG08260A of 17.801 GHz is detected at approximately 12⁰ azimuth along with the two unknown signals of 17.905 GHz and 17.932 GHz. The signal from VG03XC081 at 19.385 GHz was detected at 158⁰ azimuth and matches both the frequency and direction from our database.

FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 <u>Conclusions</u>

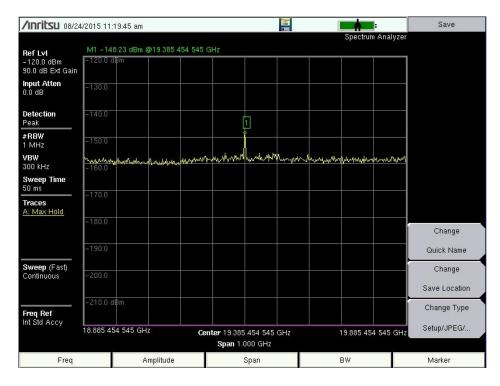
There were signals measured above the -156 dBW/ 1 MHz interference objective for digital reception at this site.

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

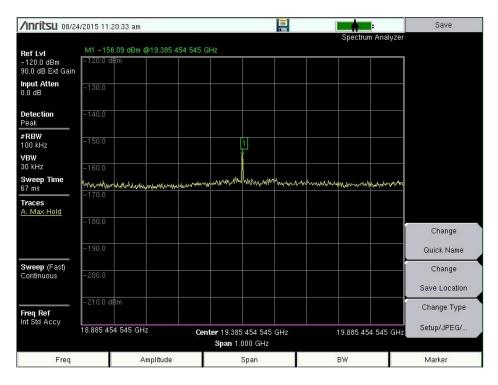
5.2 <u>Recommendations</u>

RF Signals were measured above the objective of -156 dBW. Images of the spectrum analyzer are presented in the appendix showing these signals. ViaSat will need to review their earth station plans to determine whether or not the signals seen in the 17 & 19 GHz band would interfere with proposed operations. If the RF interference is deemed to be too great then it would be recommended to perform measurements at a new location.

ADDENDUM 1



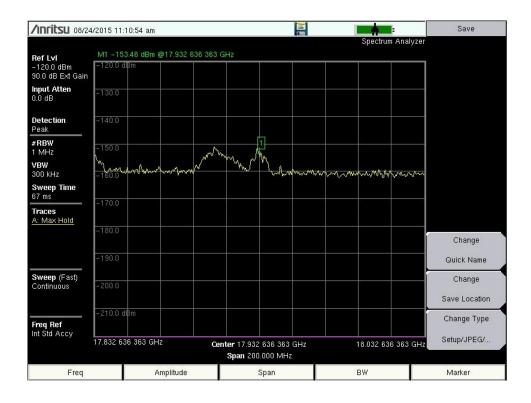
Transmission from VG03XC081 at 158° Azimuth @ 1MHz RBW



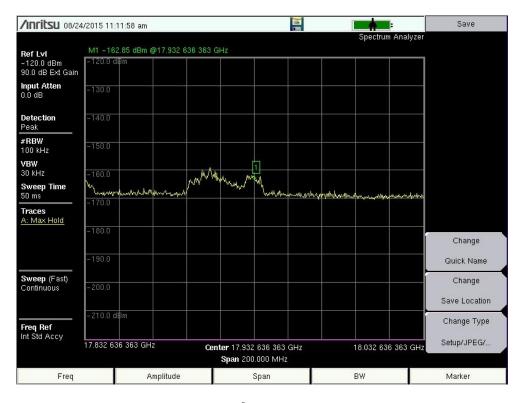
Transmission from VG03XC081 at 158° Azimuth @h 100 kHz RBW

/Inritsu 08/24	/2015 11:21:47 am			Save
	M1 -155.74 dBm @19.383 636 36	33 CU7	Spectrum Analyzer	
Ref Lvi -120.0 dBm 30.0 dB Ext Gain	-120.0 dBm			
n put Atten 1.0 dB	-130.0			
Detection Peak	-140.0			
RBW 00 kHz	-150.0	1		
/BW 30 kHz	-160.0			
Sweep Time 67 ms	Howard Margan Markan Markan 1990	waarda waxaana	man Marthan Angel	
Fraces A: Max Hold				
	-180.0			Change
	-190.0			Quick Name
Sweep (Fast) Continuous	- 200.0			Change Save Location
req Ref	-210.0 dBm			Change Type
nt Std Accy	19.335 454 545 GHz	Center 19.385 454 545 GHz Span 100.000 MHz	19.435 454 545 GHz	Setup/JPEG/
Freq	Amplitude	Span	BW	Marker

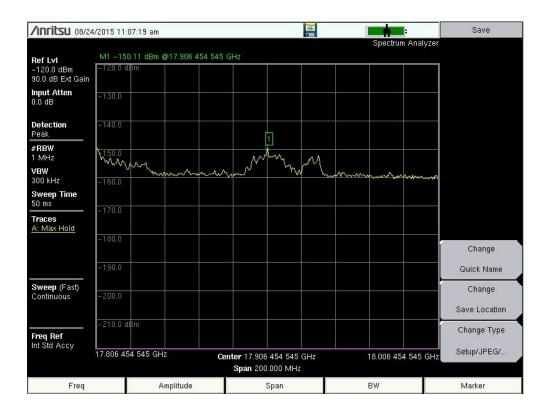
Transmission from VG03XC081 at 158⁰ Azimuth @ 100kHz RBW and Span of 100 MHz



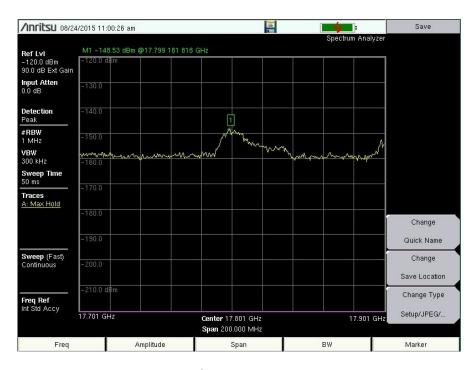
Transmission from Unknown Source at 12⁰ Azimuth @ 1MHz RBW and Span of 200 MHz



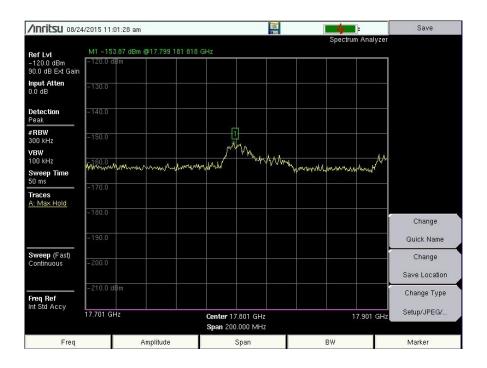
Transmission from Unknown Source at 12⁰ Azimuth @ 1MHz RBW and Span of 200 MHz



Transmission from Unknown Source at 12⁰ Azimuth @ 1MHz RBW and Span of 200 MHz



Transmission from VG08260A at 12⁰ Azimuth @ 1MHz RBW and Span of 200 MHz



Transmission from VG08260A at 12⁰ Azimuth @ 100kHz RBW and Span of 200 MHz