



# DATE: 9 December 2013

# I.T.L. (PRODUCT TESTING) LTD. FCC Radio Test Report

# for

# Corning Optical Communication Wireless

Equipment under test:

# Mobile AccessHX High-Power DAS Remote Unit MIMO

HX-C85P19L70MA17M-AC-A (AWS Section)

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# Measurement/Technical Report for Corning Optical Communication Wireless

Mobile AccessHX High-Power DAS Remote Unit MIMO

# (AWS Section)

# HX-C85P19L70MA17M-AC-A

# FCC ID: OJFHXCPL70MAM

This report concerns:	Original Grant:
	Class II change: X
	Class I change:

Equipment type: PCS Licensed Transmitter

Limits used: 47CFR Parts 2; 27

Measurement procedure used is ANSI C63.4-2003. Substitution Method used as in ANSI/TIA-603-C: 2004

Application for Certification prepared by: R. Pinchuck ITL (Product Testing) Ltd. 1 Bat Sheva St. Lod 7120101 Israel e-mail rpinchuck@itl.co.il

Applicant for this device: (different from "prepared by") Habib Riazi Corning Optical Communication Wireless 13221 Woodland Park Rd., Suite #400 Herndon, VA. 20171 U.S.A. Tel: +1-541-758-2880 Fax: +1-703-848-0260 e-mail: RiaziH@corning.com



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# **1. General Information**

## 1.1 Administrative Information

Manufacturer:	Corning Optical Communication Wireless
Manufacturer's Address:	13221 Woodland Park Rd., Suite #400 Herndon, VA. 20171 Vienna, VA 22182 U.S.A. Tel: +1-541-758-2880 Fax: +1-703-848-0260
Manufacturer's Representative:	Habib Riazi
Equipment Under Test (E.U.T):	Mobile AccessHX High-Power DAS Remote Unit MIMO
Equipment Model No.:	HX-C85P19L70MA17M-AC-A
Equipment Serial No.:	0B422A0
Date of Receipt of E.U.T:	12.11.13
Start of Test:	12.11.13
End of Test:	14.11.13
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Parts 2; 27





# 1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

- 1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
- 2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
- 3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
- The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
- 5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025B-1.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.





MobileAccess**HX** is a high power, remote solution for the MobileAccess**1000** (MA1000) and MobileAccess**2000** (MA2000) Distributed Antenna Systems. It is a fiber-fed, compact and scalable multi-service platform designed to complement the MA1000 and MA2000 and provide complete RF open space coverage for large-scale public venues, such as campuses, stadiums, convention centers, hotels, airports, and train stations. The solution can be deployed in new sites or alongside existing MA1000 and MA2000 systems, sharing a common head-end and element management system (EMS).

MobileAccess**HX** will support multiple wireless technologies and operator services over a single broadband infrastructure. Using low loss fiber optic cabling, remote units can cover distances of up to 2Km from the BTS signal sources at the head-end.

Alongside MA1000 and MA2000 deployments, MobileAccess**HX** provides a comprehensive indoor and outdoor coverage solution for varying site requirements, supporting everything from high-rise buildings and campus topologies, to stadiums and airports.

#### **Features & Benefits:**

**Multi-Service Platform:** Accommodates GSM, UMTS, HSPA, LTE, EDGE, EV-DO, AWS, and more. Provides MIMO configuration for LTE700, AWS and UMTS band.

**Cost-Effective High Power**: Optimizes and reduces the number of antennas required to cover open areas by offering 33dBm (2W) composite power per frequency band.

**Indoor Models:** Supports either SISO or MIMO service in a single compact enclosure.

**Outdoor Models:** Outdoor enclosures are compliant to IP65/NEMA standard.

**Carrier-Grade Operation**: Advanced signal handling and management ensures carrier-grade performance in multi-operator deployments.

**Design and Deployment Flexibility:** Remote unit supports both SM and MM fiber connections and are available in AC or DC power supply options. Antenna splitting schemes are possible due to the higher power output capability.

**Backwards Compatible:** Connects to an existing MobileAccess**1000** or MobileAccess**2000** deployment (Shares a common head-end and EMS in a single deployment).



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## System Architecture

MobileAccess**HX** provides a complete solution consisting of HX remote units at the remote locations, and head-end elements that are shared with any MA1000 or MA2000 system that is either installed or being installed at the site. In the downlink, at the head-end, the BTS or BDA signal is conditioned by the **RIU**, ensuring a constant RF level. The conditioned signal is then converted by the Base Unit to an optical signal for transport over single or multi-mode fiber to the HX remote units, which are located at the remote locations. In the uplink, the process is reversed. The **SC-450 Controller** enables local and remote management, as well as controls all MA1000, MA2000, and HX elements from a single, centralized location.

The **MobileAccessHX Remote Unit** (indoor-SISO/MIMO and outdoor-SISO models) consists of a compact enclosure that houses the RF module, power elements, and the required interfaces. The RF module supports three bands (GSM, DCS, and UMTS) and two types of quad bands (Type 1: LTE700, CELL, PCS, and AWS or Type 2: CELL, EGSM, DCS, or UMTS) All mobile services are combined and distributed through a single antenna port over antennas installed at the remote locations.

## 1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.



# 1.5 Test Facility

Both conducted and radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing September 3, 2009). I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

# 1.6 Measurement Uncertainty

## **Radiated Emission**

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

 $\pm 4.96 \text{ dB}$ 



# 2. System Test Configuration

## 2.1 Justification

A FCC Grant was issued for the E.U.T. on 2/15/2012. The LTE modulation has been added to the CELL, PCS and AWS band requiring a C2PC. The following tests were performed:

RF power output

Occupied bandwidth

Spurious emissions at antenna terminals

Band edge spectrum

Spurious radiated emissions

# 2.2 EUT Exercise Software

The Element Management System EngGUI ver. 1.00 build 10 used for commands delivery.

These commands are used to enable / disable of EUT transmission. EUT Embedded SW version 01.00 build 14

# 2.3 Special Accessories

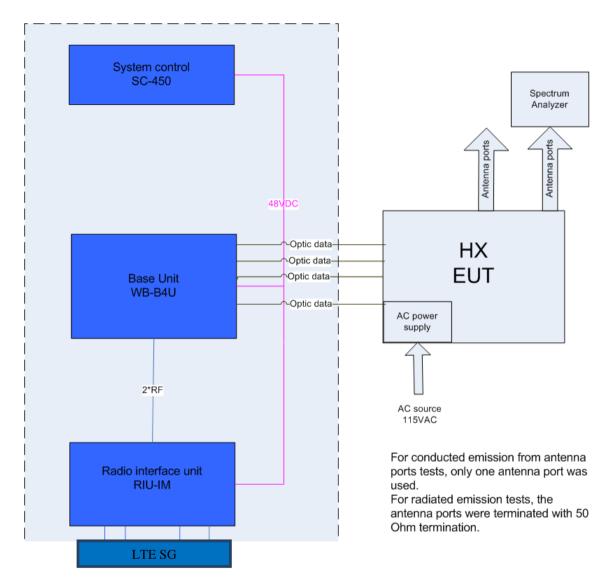
No special accessories were needed in order to achieve compliance.

## 2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.



# 2.5 Configuration of Tested System



#### Figure 1. Test Set-up

Unit	Model	S.N
HX MIMO	702A047111	0012430001E
BTSE	<b>RV-BDAC-AWS</b>	0AS120A
BU	WB—B8U	0B09SC0
SC-450	SC-450	0A429SE
RIU	RIU-IM	0B10A8S



# 3. Measurement Test Set-ups Photos

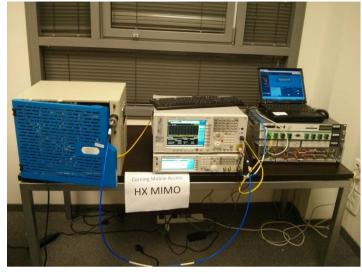


Figure 2. Conducted Emission From Antenna Ports Tests



Figure 3. Radiated Emission Test





Figure 4. Radiated Emission Test



Figure 5. Radiated Emission Test





Figure 6. Radiated Emission Test



# 4. **RF Power Output AWS**

## 4.1 Test Specification

FCC Part 27, Subpart C (27.50(d))

## 4.2 Test procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (30 dB) and an appropriate coaxial cable (1 dB). The E.U.T. RF output was modulated as follows:

LTE at 10 MHz BW channels (2115.0 MHz, 2135.0 MHz and 2150.0 MHz) Special attention was taken to prevent Spectrum Analyzer RF input overload. Signal generator input level 1dBm.

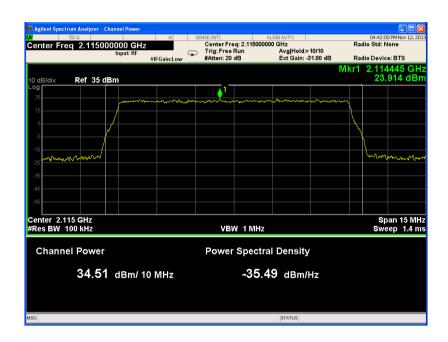


Figure 7 - 16QAM (LOW)



	um Analyzer - 50 Q	Channel Power	AC	SENSE:INT		ALIGNAUTO			04:44:31 PM	ANox 12, 2
		00000 GH Input: RF	z						io Std: Non io Device: E	e
0 dB/div	Ref 35 (	dBm						Mkr1	2.136	
og 25						▲1				
15		from	man han har	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	m	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~		
5		1								
-5		f"						× 1		
-5										
	mm								hours	مرارير
35										
-35										
-55										
enter 2.13 Res BW 1				VE	3W 1 MH:	z			Spar Sweep	n 15 M ⊳ 1.4
Channe	el Power			Powe	er Spect	ral Density	1			
	34.1	2 dBm/	10 MHz		-35	. <b>88</b> dBm/	Hz			
G						STATUS				

Figure 8 - 16QAM (MID)



Figure 9 - 16QAM (HIGH)



	50 Ω		AC		ALIGNAUTO			9 PM Nov 12, 2
ef Value	35.00 dB	Input: RF		Center Freq: 2.115 Trig: Free Run	000000 GHz Avg Hold:>10	/10	Radio Std: N	lone
		Inpuc RF	#IFGain:Low	#Atten: 20 dB	Ext Gain: -31.		Radio Devic	e: BTS
						Mk	r1 2.131	
) dB/div	Ref 35	dBm						dE
25								
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15								
5							<b>\</b>	
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-15	n n nhard						her new	mar
25	www.							1994 Q
35								
-45								
-55								
enter 2.1	15 GHz						Sr	an 15 N
Res BW 1				VBW 1 M	Hz		Swe	ep 1.4
Channe	el Power	r		Power Spe	ctral Density			
	33 9	5 dBm/	10 MHz	-3	6.05 dBm/H	,		
	00.0	e abiii/	10-10112					

Figure 10 - 64QAM (LOW)

	50 Ω	Channel Power	AC	SENSE:INT		GNAUTO			04:44:59 PM N	ov 12, 2
enter Fre	q 2.1350	Input: RF		Center Fre Trig: Free I #Atten: 20		GHz Avg Hold: Ext Gain:			o Std: None o Device: BT:	s
dB/div	Ref 35	dBm	#IFGalm:LOW	Pricen. 20		Ext Oall.	-01.00 UB		2.1367	7 G
	Kei JJ					<b>↓</b> <sup>1</sup>				
15		mm	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	www.www	· · · · · · · · · · · · · · · · · · ·	and and a second		~~~~		
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-5										
15										
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45										
55										
enter 2.1 Res BW 1				VBV	V 1 MHz				Span 1 Sweep	15 M 1.4 ∣
Channe	el Power	ŕ		Power	Spectral	Densit	У			
	34.1	5 dBm/	10 MHz		-35.85	dBm	/Hz			
3						STATUS				

Figure 11 - 64QAM (MID)



	rum Analyzer - 50 ฉ :q 2.1500		AC	SENSE:INT Center Freq: 2.150000	ALIGNAUTO	Ra	04:36:09 dio Std: No	PMNov 12, 2
enter Fre	q 2.1500	Input: RF		Trig: Free Run #Atten: 20 dB	Avg Hold>10/10 Ext Gain: -31.00 dB		dio Device	
	<b>D</b> -6.05	15				Mkr1	2.131	985 G dE
) dB/div og 📊	Ref 35 (	1BM						
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25	mond						mm	~~~~~
35								
45								
55								
33								
enter 2.1							Spa	an 15 M
Res BW 1	00 kHz			VBW 1 MHz			Swee	ep 1.4
Channe	el Power			Power Spect	ral Density			
	32.82	2 dBm/	10 MHz	-37.	18 dBm/Hz			

Figure 12 - 64QAM (HIGH)



Figure 13 - QPSK (LOW)



Agilent Spect	rum Analyzer -	Channel Power	AC	SENSE:INT	ALIGNAUTO		04:45:29 PMNov 12, 2
		00000 GH	z	Center Freq: 2.13	5000000 GHz		io Std: None
		Input: RF	#IFGain:Low	#Atten: 20 dB	Avg Hold:>10/10 Ext Gain: -31.00	dB Rad	io Device: BTS
0 dB/div	Ref 35 (	dBm				Mkr1	2.13677 GI 20.897 dB
-og 25					<b>1</b>		
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5		1				L I	
5						N.	
-15		ń					
	mon						www.whomen
-25							
-35							
-45							
-55							
Center 2.1 Res BW 1				VBW 1N	ſHz		Span 15 M Sweep 1.4 r
Channe	el Power			Power Spe	ctral Density		
	33.93	3 dBm/	10 MHz	-3	6.07 dBm/Hz		
SG					STATUS		

Figure 14 - QPSK (MID)

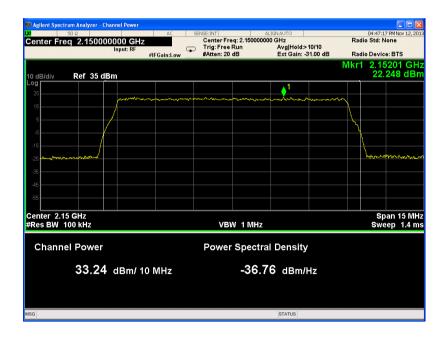


Figure 15 - QPSK (HIGH)



# 4.3 Results

E.U.T. Description: Mobile AccessHX High-Power DAS Remote Unit MIMO Model No.: HX-C85P19L70MA17M-AC-A Serial Number: 0B422A0 Specification: FCC Part 27, Subpart C, Section 27.50 (d)

Modulation	Operation	Reading	2 Ports
	Frequency	_	MIMO
			(dBm)
	(MHz)	(dBm)	
16 QAM	Low	34.51	37.51
16 QAM	Mid	34.12	37.12
16 QAM	High	33.47	36.47
64 QAM	Low	33.95	36.95
64 QAM	Mid	34.15	37.15
64 QAM	High	32.82	35.82
QPSK	Low	34.31	37.31
QPSK	Mid	33.93	36.93
QPSK	High	33.24	36.24

#### Figure 16 RF Power Output AWS

**TEST PERSONNEL:** 

Tester Signature:

Date: 10.12.13

Typed/Printed Name: A. Sharabi



# 4.4 Test Equipment Used.

RF Power Output AWS

				Calibration	
Instrument	Manufacturer	Model	Serial Number	Last Calibration	Period
Spectrum Analyzer	Agilent	N9010A EXA	MY49061070	July 28, 2013	1 year
Spectrum Analyzer	HP	8564E	3313U00346	February 28, 2013	1 year
Signal Generator	Agilent	N5172B EXG	MY51350549	December 28, 2012	1 year
Attenuator	MCE	46-30-34	BN4927	November 12, 2013	1 year
Cable	Mini-Circuits	30091	-	November 12, 2013	1 year

Figure 17 Test Equipment Used



# 5. Occupied Bandwidth AWS

# 5.1 Test Specification

FCC Part 2, Section 1049

# 5.2 Test Procedure

The E.U.T. was set to the applicable test frequency and modulation. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (at the output test) and an appropriate coaxial cable. The spectrum analyzer was set to proper resolution B.W.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limit, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.

Occupied bandwidth measured was repeated in the input terminal of the E.U.T.

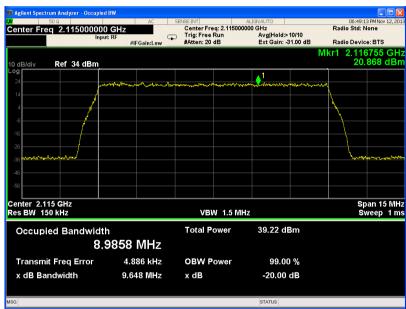


Figure 18.— 16QAM (LOW) IN

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💴 Agilent Spectrum Analyzer - Occupie				
<mark>₩</mark> 50 Ω Ref Value 34.00 dBm	AC	SENSE:INT Center Freq: 2.115000	ALIGN AUTO	06:42:57 PM Nov 12, 2013 Radio Std: None
	ut: RF	Trig: Free Run #Atten: 20 dB	Avg Hold:>10/10 Ext Gain: -31.00 dB	Radio Device: BTS
				Mkr1 2.116755 GHz
10 dB/div Ref 34 dBm				25.907 dBm
Log 24			• • • • • • • • • • • • • • • • • • •	
r i i i i i i i i i i i i i i i i i i i	Care Lot with full and and a share			
14				
-6				
-16 -26 -26				www.www.
-36				
-46				
-56				
-30				
Center 2.115 GHz Res BW 150 kHz		VBW 1.5 MI	Hz	Span 15 MHz Sweep 1 ms
Occupied Bandwidt	:h	Total Power	41.20 dBm	
	9876 MHz			
Transmit Freq Error	11.659 kHz	OBW Power	99.00 %	
x dB Bandwidth	9.616 MHz	x dB	-20.00 dB	
MSG			STATUS	

Figure 19.— 16QAM (LOW) OUT

50 Ω	AC	SENSE:INT	ALIGNAUTO	06:50:04 PMNov 12, 2
enter Freq 2.13500000		Center Freq: 2.135000 Trig: Free Run #Atten: 20 dB	000 GHz Avg Hold:>10/10 Ext Gain: -31.00 dB	Radio Std: None Radio Device: BTS
	#IFGain:Low	PARTER IN US		Akr1 2.116755 GI
dB/div Ref 34 dBm				dB
og 1				
24	and and a second se		and the second s	~
14				
4				
-6				
16				
26				
36 mannament				humansharen
46				
56				
enter 2.135 GHz				Span 15 M
es BW 150 kHz		VBW 1.5 MI	lz	Sweep 1
Occupied Bandwidt	h	Total Power	39.91 dBm	
8.	9940 MHz			
Transmit Freq Error	9.096 kHz	OBW Power	99.00 %	
x dB Bandwidth	9.665 MHz	x dB	-20.00 dB	
3			STATUS	

Figure 20.— 16QAM (MID) IN



Agilent Spectrum Analyzer - Occupier  K 50 Ω	1 BW	SENSE:INT	ALIGNAUTO	06:43:28 PM Nov 12, 201
Center Freq 2.13500000		Center Freq: 2.135000	0000 GHz	Radio Std: None
Inpu	it: RF ///////////////////////////////////	☐ Trig: Free Run #Atten: 20 dB	Avg Hold:>10/10 Ext Gain: -31.00 dB	Radio Device: BTS
	Wi Guilleow			Mkr1 2.116755 GH
10 dB/div Ref 34 dBm				dBm
Log				
24	with man hand more the	Marrie and	monterman	~~
14				
4				<u>\</u>
				<b>N</b>
-6				
-16 monten with John W				handrown
-26				and a d for the floor for days
-36				
-46				
-56				
Center 2.135 GHz				Span 15 MH
Res BW 150 kHz		VBW 1.5 M	Hz	Sweep 1 ms
Occupied Bandwidt	h	Total Power	40.28 dBm	
	 9890 MHz			
0.				
Transmit Freq Error	9.640 kHz	OBW Power	99.00 %	
x dB Bandwidth	9.579 MHz	x dB	-20.00 dB	
			07.1710	
MSG			STATUS	

Figure 21.— 16QAM (MID) OUT

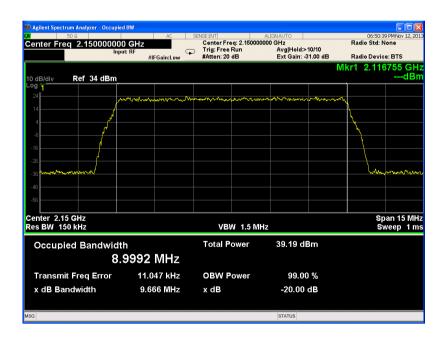


Figure 22.— 16QAM (HIGH) IN



50 Ω	AC		ALIGNAUTO	06:44:09 PMNov 12,
enter Freq 2.15000000		Center Freq: 2.150000 Trig: Free Run #Atten: 20 dB	000 GHz Avg Hold:>10/10 Ext Gain: -31.00 dB	Radio Std: None Radio Device: BTS
	#IFGain.Low			Mkr1 2.116755 G
dB/div Ref 34 dBm				dE
og 1				
14		and a first of the second s	and and a fail of the second	
				1 L
				- <b>N</b>
-6				
16 Murahan Mingor				when any an any and
-26				
36				
46				
-56				
enter 2.15 GHz				Span 15 N
es BW 150 kHz		VBW 1.5 MH	Iz	Sweep 1
Occupied Bandwidth	1	Total Power	40.55 dBm	
8.9	9942 MHz			
Transmit Freg Error	14.297 kHz	OBW Power	99.00 %	
x dB Bandwidth	9.584 MHz	x dB	-20.00 dB	

Figure 23.— 16QAM (HIGH) OUT

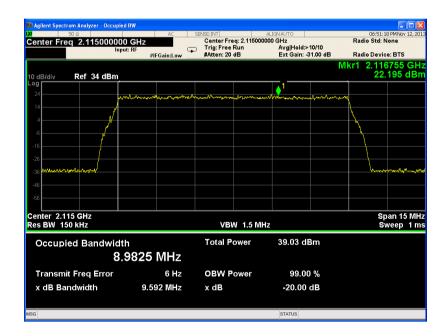


Figure 24.— 64QAM (LOW) IN



Jeff Agilent Spectrum Analyzer - Occu	pied BW	SENSE:INT	ALIGNAUTO	06:44:59 PM Nov 12, 2013
Center Freq 2.1150000		Center Freq: 2.11500 Trig: Free Run #Atten: 20 dB	0000 GHz Avg Hold:>10/10 Ext Gain: -31.00 dB	Radio Std: None Radio Device: BTS
				Mkr1 2.116755 GHz
10 dB/div Ref 34 dBm Log	ļ			23.656 dBm
24	10. 1. 10. A. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10	A		
14				
/*				
-6				
-16 home man was				WWWWWWWWWWWW
-26				
-36				
-46				
-56				
Center 2.115 GHz Res BW 150 kHz		VBW 1.5 M	Hz	Span 15 MHz Sweep 1 ms
Occupied Bandwid	dth	Total Power	40.90 dBm	
8	3.9745 MHz			
Transmit Freq Error	9.690 kHz	OBW Power	99.00 %	
x dB Bandwidth	9.549 MHz	x dB	-20.00 dB	
MSG			STATUS	

Figure 25.— 64QAM (LOW) OUT

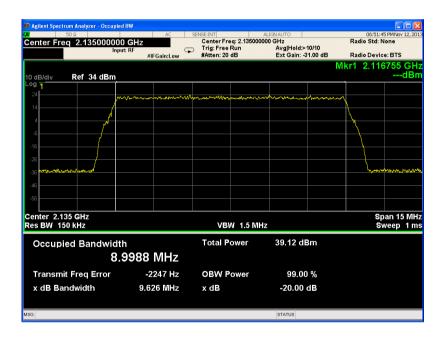


Figure 26.— 64QAM (MID) IN



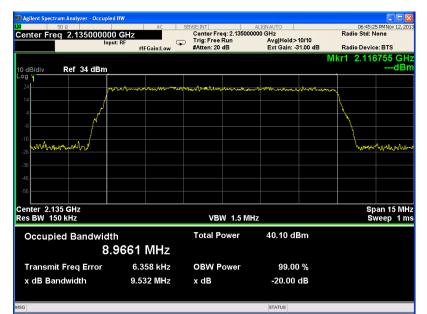


Figure 27.— 64QAM (MID) OUT

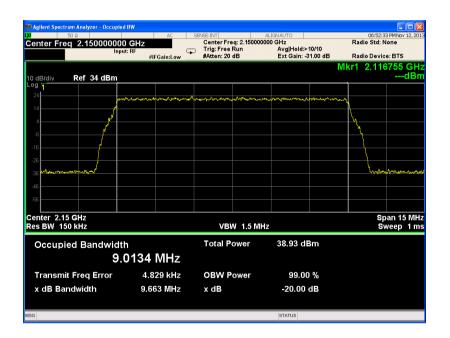


Figure 28.— 64QAM (HIGH) IN



💷 Agilent Spectrum Analyzer - Occupied	BW			
Center Freg 2.15000000	CH-z	SENSE:INT Center Freg: 2.150000	ALIGN AUTO	06:45:55 PM Nov 12, 201 Radio Std: None
Center Freq 2.15000000	: RF G	Trig: Free Run	Avg Hold:>10/10	
	#IFGain:Low	#Atten: 20 dB	Ext Gain: -31.00 dB	Radio Device: BTS
			I	Vlkr1 2.116755 GHz dBm
10 dB/div Ref 34 dBm				aBir
24				
	Jan Marina and Anton	and the second	and an operation of the second s	~~~
14				
				- W.
-16				
-26 monora Marine				hannam
-36				
-46				
-56				
Center 2.15 GHz Res BW 150 kHz		VBW 1.5 M	u <b>-</b>	Span 15 MHz Sweep 1 ms
Res BW 150 KHZ			12	Sweep This
Occupied Bandwidth	1	Total Power	40.42 dBm	
8.9	941 MHz			
Transmit Freq Error	4.373 kHz	OBW Power	99.00 %	
x dB Bandwidth	9.593 MHz	x dB	-20.00 dB	
MSG 🧼 Aligning 1 of 3			STATUS	

Figure 29.— 64QAM (HIGH) OUT

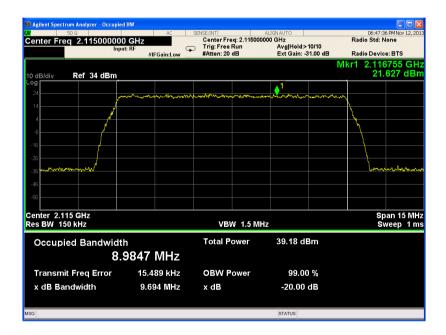


Figure 30.— QPSK (LOW) IN





Figure 31.— QPSK (LOW) OUT

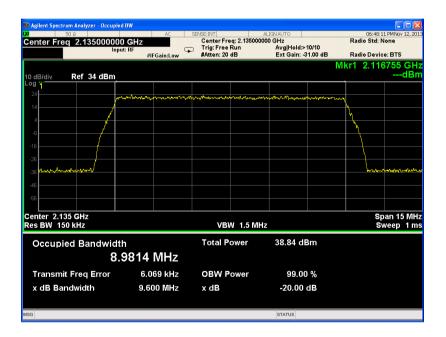


Figure 32.— QPSK (MID) IN



Agilent Spectrum Analyzer - Occupied 50 Ω	AC	SENSE:INT	ALIGNAUTO	05:41:04 PMNov 12,
enter Freg 2.13500000		Center Freq: 2.135000	0000 GHz	Radio Std: None
Inpu	t: RF	Trig: Free Run #Atten: 20 dB	Avg Hold:>10/10 Ext Gain: -31.00 dB	Radio Device: BTS
				Mkr1 2.148935 G
0 dB/div Ref 30 dBm				dE
مر مر	monormo	mmmmmm	www.www.www.www.	~
1				
10				
10				
20 Marmhan Mart				WWW WWW
30				i hi washin
40				
50				
60				
enter 2.135 GHz				Span 15 N
es BW 150 kHz		VBW 1.5 M	Hz	Sweep 1
Occupied Bandwidtl	า	Total Power	40.16 dBm	
	9742 MHz			
Transmit Freq Error	2.229 kHz	OBW Power	99.00 %	
x dB Bandwidth	9.609 MHz	x dB	-20.00 dB	
G			STATUS	

Figure 33.— QPSK (MID) OUT

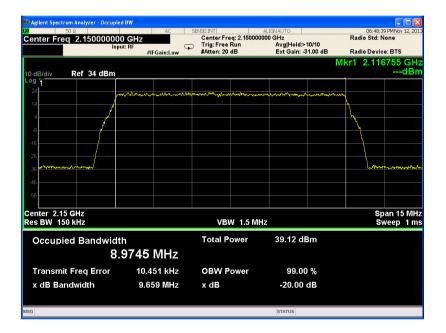


Figure 34.— QPSK (HIGH) IN



Agilent Spectrum Analyzer - Occupied				
۵ دور کی دور Center Freg 2.15000000	GHz	SENSE:INT Center Freq: 2.150000		06:42:02 PM Nov 12, 201 Radio Std: None
Inpu		Trig: Free Run #Atten: 20 dB	Avg Hold:>10/10 Ext Gain: -31.00 dB	Radio Device: BTS
10 dB/div Ref 30 dBm				Vkr1 2.148935 GH: 24.679 dBn
Log			man	
20				
10				
-10 -20 nonegaleman				manne
-30				
-40				
-50				
-60				
Center 2.15 GHz Res BW 150 kHz		VBW 1.5 M	Hz	Span 15 MHz Sweep 1 ms
Occupied Bandwidtl	h	Total Power	41.01 dBm	
8.9	9871 MHz			
Transmit Freq Error	8.210 kHz	OBW Power	99.00 %	
x dB Bandwidth	9.731 MHz	x dB	-20.00 dB	
MSG			STATUS	

Figure 35.— QPSK (HIGH) OUT



# 5.3 Results

E.U.T. Description: Mobile AccessHX High-Power DAS Remote Unit MIMO Model No.: HX-C85P19L70MA17M-AC-A Serial Number: 0B422A0

Specification: FCC Part 2, Section 1049

Modulation		Operating	Reading
		Frequency	
		(MHz)	(MHz)
	Input	Low	8.9858
	Output	Low	8.9876
ITE 160AM	Input	Mid	8.9940
LTE-16QAM	Output	Mid	8.9890
	Input	High	8.9992
	Output	High	8.9942
	Input	Low	8.9825
	Output	Low	8.9745
	Input	Mid	8.9988
LTE-64QAM	Output	Mid	8.9661
	Input	High	9.0134
	Output	High	8.9941
	Input	Low	8.9847
	Output	Low	8.9935
	Input	Mid	8.9814
LTE-QPSK	Output	Mid	8.9742
	Input	High	8.9745
	Output	High	8.9871

#### Figure 36 Occupied Bandwidth AWS

JUDGEMENT:

Passed

TEST PERSONNEL:

Tester Signature: \_\_\_\_

1585

Date: 10.12.13

Typed/Printed Name: A. Sharabi



# 5.4 Test Equipment Used; Occupied Bandwidth

	Serial		Q - vi - 1	Calibration		
Instrument	Manufacturer	Model	Number	Last Calibration	Period	
Spectrum Analyzer	Agilent	N9010A EXA	MY49061070	July 28, 2013	1 year	
Spectrum Analyzer	HP	8564E	3313U00346	February 28, 2013	1 year	
Signal Generator	Agilent	N5172B EXG	MY51350549	December 28, 2012	1 year	
Attenuator	MCE	46-30-34	BN4927	November 12, 2013	1 year	
Cable	Mini-Circuits	30091	-	November 12, 2013	1 year	

Figure 37 Test Equipment Used



# 6. Spurious Emissions at Antenna Terminals AWS

# 6.1 Test Specification

FCC Part 27, Subpart C, Section 27.53 (g)

## 6.2 Test procedure

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + \log (P) dB$ , yielding -13 dBm.

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (31.0 dB).

## 6.3 Results

JUDGEMENT:

Passed

**TEST PERSONNEL:** 

Tester Signature:

Date: 10.12.13

Typed/Printed Name: A. Sharabi



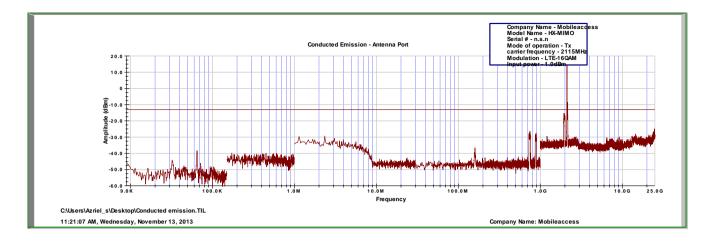
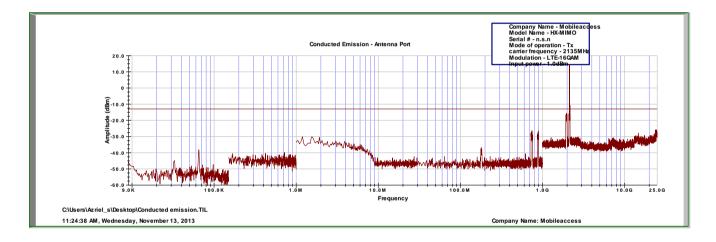
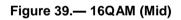


Figure 38.— 16QAM (Low)





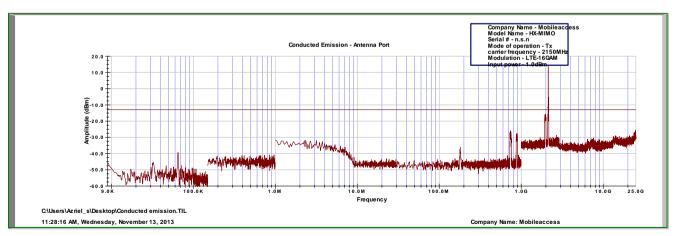


Figure 40.— 16QAM (High)



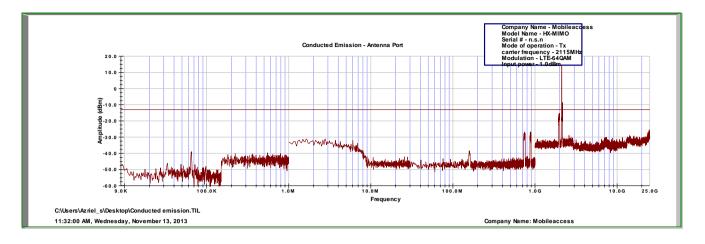
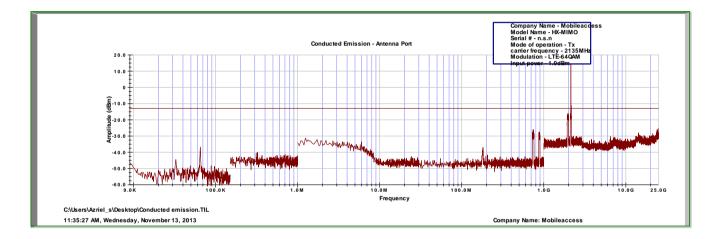


Figure 41.— 64QAM (Low)



#### Figure 42.— 64QAM (Mid)

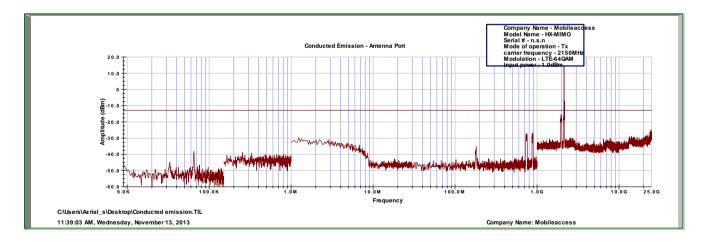
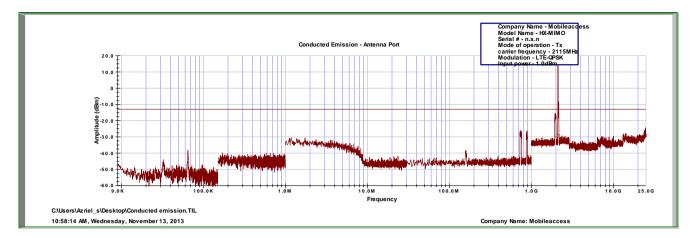
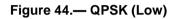
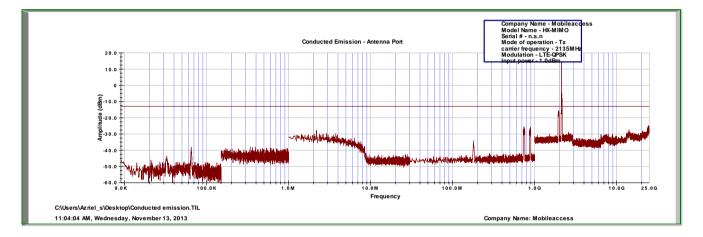


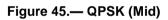
Figure 43.— 64QAM (High)











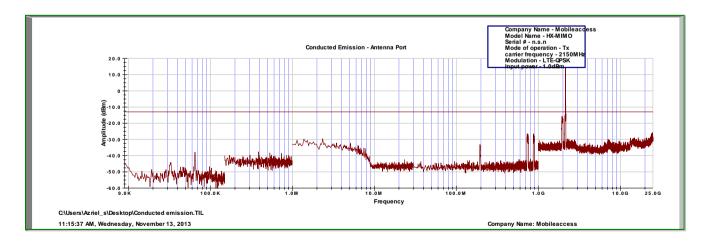


Figure 46.— QPSK (High)



# 6.4 Test Equipment Used; Spurious Emissions at Antenna Terminals AWS

-		Serial	Calibration		
Instrument	Manufacturer	Model	Number	Last Calibration	Period
Spectrum Analyzer	Agilent	N9010A EXA	MY49061070	July 28, 2013	1 year
Spectrum Analyzer	HP	8564E	3313U00346	February 28, 2013	1 year
Signal Generator	Agilent	N5172B EXG	MY51350549	December 28, 2012	1 year
Attenuator	MCE	46-30-34	BN4927	November12, 2013	1 year
Cable	Mini-Circuits	30091	-	November 12, 2013	1 year

Figure 47 Test Equipment Used



## 7. Band Edge Spectrum AWS

## 7.1 Test Specification

FCC Part 27, Subpart C, Section 27.53 (m 4-6)

## 7.2 Test procedure

Enclosed are spectrum analyzer plots for the lowest operation frequency and the highest operation frequency in which the E.U.T. is planned to be used.

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + \log (P) dB$ , yielding -13 dBm.

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (31.0 dB).



Figure 48.— 16QAM - LOW





Figure 49.— 16QAM HIGH



Figure 50.— 64QAM LOW





Figure 51.— 64QAM HIGH

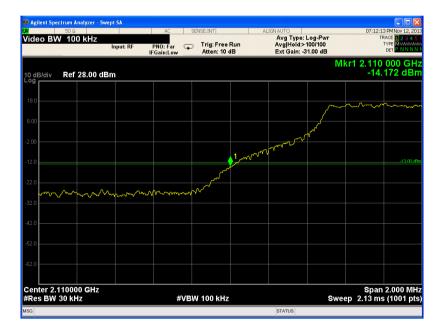


Figure 52.— QPSK LOW





Figure 53.— QPSK HIGH

## 7.3 Results

E.U.T. Description: Mobile AccessHX High-Power DAS Remote Unit MIMO Model No.: HX-C85P19L70MA17M-AC-A Serial Number: 0B422A0 Specification: FCC Part 27, Subpart C, Section 27.53 (m 4-6)

Modulation	Operation	Band Edge	Reading	Specification
	Frequency	Frequency		
	(MHz)	(MHz)	(dBm)	(dBm)
16QAM	2110.00	2110.0	-14.754	-13.0
16QAM	2155.00	2155.0	-16.649	-13.0
64QAM	2110.00	2110.0	-14.285	-13.0
64QAM	2155.00	2155.0	-14.278	-13.0
QPSK	2110.00	2110.0	-14.172	-13.0
QPSK	2155.00	2155.0	-15.372	-13.0

### Figure 54 Band Edge Spectrum Results AWS

JUDGEMENT:

Passed

TEST PERSONNEL:

Tester Signature:

Typed/Printed Name: A. Sharabi

Date: 10.12.13



## 7.4 Test Equipment Used; Band Edge Spectrum AWS

				Calibration	
Instrument	Manufacturer	Model	Serial Number	Last Calibration	Period
Spectrum Analyzer	Agilent	N9010A EXA	MY49061070	July 28, 2013	1 year
Spectrum Analyzer	HP	8564E	3313U00346	February 28, 2013	1 year
Signal Generator	Agilent	N5172B EXG	MY51350549	December 28, 2012	1 year
Attenuator	MCE	46-30-34	BN4927	November12, 2013	1 year
Cable	Mini-Circuits	30091	-	November12, 2013	1 year

Figure 55 Test Equipment Used



## 8. Spurious Radiated Emission AWS

#### 8.1 Test Specification –

FCC, Part 27, Subpart C Section 27.53 (g)

#### 8.2 Test Procedure

The test method was based on ANSI/TIA-603-C: 2004, Section 2.2.12 Unwanted Emissions: Radiated Spurious.

The power of any emission outside of the authorized operating frequency ranges (2110-2155 MHz) must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P) dB$ , yielding -13 dBm.

(a) The E.U.T. operation mode and test set-up are as described in Section 2. A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 1.

The frequency range 9 kHz-20 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. The emissions were measured at a distance of 3 meters.

(b) The E.U.T. was replaced by a substitution antenna (dipole 30MHz-1GHz, Horn Antenna above 1GHz) driven by a signal generator. The height was readjusted for maximum reading. The signal generator level was adjusted to obtain the same reading on the EMI receiver as in step (a).

The signals observed in step (a) were converted to radiated power using:

 $P_d(dBm) = P_g(dBm) - Cable Loss (dB) + Substitution Antenna Gain (dB)$ 

 $P_d$  = Dipole equivalent power (result).

 $P_g$  = Signal generator output level.

#### 8.3 Test Results

### JUDGEMENT:

Passed by 37.29 dB

The E.U.T met the requirements of the FCC, Part 27, Subpart C, Section 27.53 (g) specifications.

**TEST PERSONNEL:** 

1585 Tester Signature:

Date: 10.12.13

Typed/Printed Name: A. Sharabi



Carrier	Freq.	Antenna	Maximum	Signal	Cable	Antenna	Effective	Spec.	Margin
Channel		Pol.	Peak Level	Generator RF	Loss	Gain	Radiated		
				Output			Power Level		
(MHz)	(MHz)		(dBµV/m)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
2115.0	4230.0	V	47.9	-55.49	4.45	9.12	-50.82	-13.0	-37.82
2115.0	4230.0	Н	47.9	-55.25	4.45	9.12	-50.58	-13.0	-37.58
2135.0	4270.0	V	47.8	-56.27	4.45	9.38	-51.34	-13.0	-38.34
2135.0	4270.0	Н	46.9	-56.71	4.45	9.38	-51.78	-13.0	-38.78
2150.0	4300.0	V	46.7	-57.37	4.45	9.38	-50.29	-13.0	-37.29
2150.0	4300.0	Η	46.9	-56.71	4.45	9.38	-51.78	-13.0	-38.78

Figure 56 Out of Band Emission (Radiated) AWS



## 8.4 Test Instrumentation Used, Radiated Measurements AWS

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1Year
Antenna Biconical	ЕМСО	3104	2606	August 30, 2013	1Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS- 0411N313	013	August 21, 2013	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A



## 9. APPENDIX A - CORRECTION FACTORS

## 9.1 Correction factors for

CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY	CORRECTION FACTOR	FREQUENCY	CORRECTION FACTOR
(MHz)	(dB)	(MHz)	(dB)
10.0	0.3	1200.0	7.3
20.0	0.6	1400.0	7.8
30.0	0.8	1600.0	8.4
40.0	0.9	1800.0	9.1
50.0	1.1	2000.0	9.9
60.0	1.2	2300.0	11.2
70.0	1.3	2600.0	12.2
80.0	1.4	2900.0	13.0
90.0	1.6		
100.0	1.7		
150.0	2.0		
200.0	2.3		
250.0	2.7		
300.0	3.1		
350.0	3.4		
400.0	3.7		
450.0	4.0		
500.0	4.3		
600.0	4.7		
700.0	5.3		
800.0	5.9		
900.0	6.3		
1000.0	6.7		

NOTES:

- 1. The cable type is RG-214.
- 2. The overall length of the cable is 27 meters.
- 3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".



9.2 Correction factors for

from EMI receiver to test antenna at 3 meter range.

CABLE

FREQUENCY	CORRECTION
	FACTOR
(GHz)	(dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.

2. The overall length of the cable is 10 meters.



## 9.3 Correction factors for

## CABLE

from spectrum analyzer to test antenna above 2.9 GHz

	CORRECTION	FREQUENCY	CORRECTION
	FACTOR		FACTOR
(GHz)	(dB)	(GHz)	(dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

- 1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.
- 2. The cable is used for measurements above 2.9 GHz.
- *3. The overall length of the cable is 10 meters.*



9.4 C	orrection	factors	for
-------	-----------	---------	-----

## LOG PERIODIC ANTENNA Type SAS-200/511 at 3 meter range.

FREQUENCY	ANTENNA
	FACTOR
(GHz)	(dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY	ANTENNA
	FACTOR
(GHz)	(dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

### NOTES:

1. Antenna serial number is 253.

2. The above lists are located in file number SAS3M0.ANT for a 3 meter range.

3. The files mentioned above are located on the disk marked "Antenna Factors".



## 9.5 Correction factors for Double-Ridged Waveguide Horn Model: 3115, S/N 29845 at 3 meter range.

FREQUENCY	ANTENNA FACTOR	ANTENN A Gain	FREQUENCY	ANTENNA FACTOR	ANTENNA Gain
(GHz)	(dB 1/m)	(dBi)	(GHz)	(dB 1/m)	(dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			