

### **Spurious Emissions at Antenna** 8. **Terminals**

### 8.1 **Test Specification**

FCC Part 27, Section: 53(a)(1)

#### 8.2 **Test Procedure**

The power of any emission outside of the authorized operating frequency ranges (2345-2360 MHz) must be attenuated below the transmitting power (P) by a factor of at least as specified in this section.

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (31.3 dB).

The evaluation was done in frequency band from 9K-24GHz without band edges tests, and for each modulation separately.

Frequency Band	Calculated
(MHz)	Factor (dBc)
f<2285.0	75+10*log(10.5)=85.2
2285.0MHz <f<2287.5mhz< td=""><td>72+10*log(10.5)=82.2</td></f<2287.5mhz<>	72+10*log(10.5)=82.2
2287.5MHz <f<2300.0mhz< td=""><td>70+10*log(10.5)=80.2</td></f<2300.0mhz<>	70+10*log(10.5)=80.2
2300.0MHz <f<2305.0mhz< td=""><td>43+10*log(10.5)=53.2</td></f<2305.0mhz<>	43+10*log(10.5)=53.2
2305.0MHz <f<2320.0mhz< td=""><td>43+10*log(10.5)=53.2</td></f<2320.0mhz<>	43+10*log(10.5)=53.2
2320.0MHz <f<2345.0mhz< td=""><td>75+10*log(10.5)=85.2</td></f<2345.0mhz<>	75+10*log(10.5)=85.2
2345.0MHz <f<2360.0mhz< td=""><td>43+10*log(10.5)=53.2</td></f<2360.0mhz<>	43+10*log(10.5)=53.2
2360.0MHz <f<2362.50mhz< td=""><td>43+10*log(10.5)=53.2</td></f<2362.50mhz<>	43+10*log(10.5)=53.2
2362.5MHz <f<2365.0mhz< td=""><td>55+10*log(10.5)=65.2</td></f<2365.0mhz<>	55+10*log(10.5)=65.2
2365.0MHz <f<2367.5mhz< td=""><td>70+10*log(10.5)=80.2</td></f<2367.5mhz<>	70+10*log(10.5)=80.2
2367.5MHz <f<2370.0mhz< td=""><td>72+10*log(10.5)=82.2</td></f<2370.0mhz<>	72+10*log(10.5)=82.2
2370.0 <f< td=""><td>75+10*log(10.5)=85.2</td></f<>	75+10*log(10.5)=85.2

### Figure 38 Mask Limit Table

#### 8.3 **Test Results**

JUDGEMENT: Passed

See additional information in Figure 39 to Figure 76.



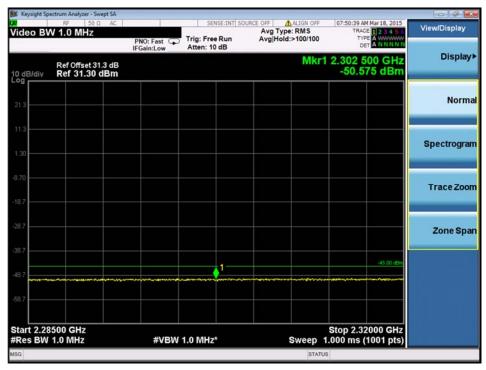
top Freq	RF 50 Ω AC 1.000000000 G	PNO: Fast	SENSE:INT	Avg Type: Log-Pwr Avg Hold:>100/100	06:51:05 PM Mar 15, 2015 TRACE 1 2 3 4 5 TYPE M	Frequency
0 dB/div	Ref Offset 31.3 dB Ref 31.30 dBm	IFGain:Low	Atten: 10 dB	MI	kr1 2.294 5 GHz dBm	Auto Tur
og						Center Fre 500.004500 MH
.30						Start Fre 9.000 ki
70 3.7						Stop Fro 1.000000000 G
3.7				n	<b>~</b>	CF Ste 99.999100 Mi Auto Mi
	worthesportheterror	an a	strumberistikketsprung	للعل كالمرجعة ويتعاول العال	1 -45.00 dBm -45.00 dBm -45.00 dBm	Freq Offs 01
tart 9 kHz		#VBW 1	A MUL		Stop 1.0000 GHz 92.33 ms (1001 pts)	

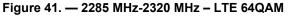
Figure 39. — 0.009 MHz-1000.0 MHz - LTE 64QAM



Figure 40. — 1000 MHz-2285 MHz – LTE 64QAM







	RF         50 Ω         AC           .ine         -45.00 dBm		SENSE:INT S	OURCE OFF ALIGN OFF	03:56:48 PM Mar 16, 2015 TRACE 1 2 3 4 5 1	Display
spiay L	.ine -45.00 uBin	PNO: Fast 😱 IFGain:High	Trig: Free Run #Atten: 0 dB	Avg Hold:>100/100		
dB/div	Ref Offset 35 dB Ref 15.00 dBm			Mkr1	2.344 825 GHz -52.245 dBm	Annotation
.00						Title
						Graticu
5.0						<u>On</u> (
5.0						Display Lin -45.00 dB On (
.0					-45.00 dBm	
5.0	a	alanaster fransjere konstanter			Anna and and and and and and and and and	
5.0						System Display Settings
5.0						
	000 GHz 1.0 MHz	#VBW	1.0 MHz*	Sweep 1	Stop 2.34500 GHz 1.000 ms (1001 pts)	

Figure 42. — 2320 MHz-2345 MHz – LTE 64QAM



SO Ω AC SENSE:INT ALIGN OFF 07:35:36 PM Mar 15, 2015 Disp	1
PNO: Fast C Trig: Free Run Avg Hold:>100/100 TYPE	nay
Anno Alterit. 10 dB Mkr1 2.361 752 GHz	otation
.30 dBm dBm	
	Title
	Faticu
<u>On</u>	(
	Display Lin
<u>9</u>	0.00 02
المراجع	
per an and the second	
	System Display ettings
GHz Stop 2.3460000 GHz #VBW 1.0 MHz* Sweep 1.000 ms (1001 pts)	

Figure 43. — 2345 MHz-2346 MHz – LTE 64QAM



Figure 44. — 2346 MHz-2349MHz – LTE 64QAM



Agilent Spectrum Analyzer - Channel Power     RF 50 Q AC	SENSE:INT	ALIGN OFF	07:01:37 PM Mar 15, 2015	0 0 2
Center Freq 2.361500000 GHz #FGain:	Center Freq: 2.361500 Trig: Free Run		Radio Std: None Radio Device: BTS	Frequency
10 dB/div Ref 10.00 dBm				
20.00				Center Freq 2.361500000 GHz
30.0 <b>mmmmmmm</b>	m m		m	
50.0 50.0 70.0				
80 0 Center 2.362 GHz			Span 1.5 MHz	
Res BW 100 kHz	VBW 1 MHz		Sweep 1 ms	CF Step 150.000 kHz Auto Man
Channel Power	Power	Spectral Dens	sity	Freq Offset
-22.99 dBm / 1 м	Hz -8	82.99 dBm	/Hz	0 Hz
				7:01 PM
			•	7:01 PM 3/15/2015

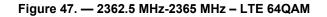
Figure 45. — 2361 MHz-2362 MHz – LTE 64QAM



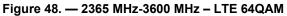
Figure 46. — 2361.5 MHz-2362.5 MHz – LTE 64QAM



Agilent Spectr	RF 50 Q AC	1	60	NSE:INT		ALIGN OFF	07-1	7-50 PM M	ar 15, 2015	-	67
Span 3.00	1 3.00000000 MHz			enter Freq: 2.364000000 GHz F			Radio Std: None		Spa	n	
		IFGain:Low	Trig: Fre #Atten: 1		Avg Hol	d:>10/10	Radi	o Device	BTS		Spar
10 dB/div	Ref Offset 31.3 Ref 10.00 dE									3.00000	000 MH:
Log	Rei 10.00 uL	1									
0.00			-45.4	dBm	=			_			
-10.0	4.2 dBc						-0.9 d	Bc			
-20.0											
-30.0											
40.0										Full Sp	ll Spar
-50.0	www.menningen	and share the same tak			Service of the				Average		
-60.0			a service and a service a				-				
-70.0											
-80.0											
Center 2.3	364 GHz					_		Span	3 MHz		
#Res BW	220 kHz		VB	N 22 kHz			5		20 ms	La	st Spar
Total Carri	er Power 45.3	359 dBm/ 1.00 MH	z	ACP-I	3W						
					Lo	ower	Up	per			
Carrier Po	wer	Filter Off	set Freq	Integ BW	dBc	dBm	dBc	dBm	Filter		
1 -45.35	59 dBm / 1.000 MH	z OFF 1.0	00 MHz	1.000 MHz	4.172	-41.19 -	0.916	-46.27	OFF		
Date:											
											7:17 PM /15/2015









deo BW 1.0 MHz		SENSE:INT SO Trig: Free Run #Atten: 10 dB	Avg Type: RMS Avg Hold:>100/100	07:32:42 AM Mar 16, 2015 TRACE 2 3 4 5 TYPE A DET A N N N N N	BW
Ref Offset 31.3 dB dB/div Ref 11.30 dBm			Mkr	1 23.573 0 GHz dBm	1.0 Auto
30					Video 1.0 Auto
7					VBW:3dB F Auto
7					Span:3dB I Auto
7	~			-45 00 dBay	RBW Cont [Gaussian,-3
7					
7					
art 3.600 GHz es BW 1.0 MHz	#VBW 1	.0 MHz*	Sweep 1	Stop 10.000 GHz 0.67 ms (1001 pts)	

Figure 49. — 3600 MHz-10000 MHz – LTE 64QAM



Figure 50. — 10000 MHz-20000 MHz – LTE 64QAM



	RF 50 Q AC		SENSE:INT S	Avg Type: RMS Avg Hold:>100/100	07:47:02 AM Mar 16, 2015 TRACE 1 2 3 4 5 0 Type A	Attenuation	
		PNO: Close C	#Atten: 0 dB	Avginoid.>100/100	DET A NNNN	Mech Atter	
0 dB/div	Ref Offset 31.3 dB Ref 11.30 dBm			I	/kr1 23.573 GHz -49.235 dBm	0 di Auto <u>Ma</u>	
.30						Enabl Elec Atte	
.70						en: <u>e</u>	
8.7						Elec Atte	
3,7							
3.7							
3.7					1 _45.00 dBm		
.7							
.7.						Mech Atten Ste 2dB 10d	
3.7						Max Mixer L	
	000 GHz				Stop 24.000 GHz	-10.00 dB	
kes BW	1.0 MHz	#VBW	1.0 MHz*	Sweep	10.00 ms (1001 pts)		

Figure 51 .- 20000 MHz-24000 MHz - LTE 64QAM



Figure 52. — 0.009 MHz-1000 MHz - GSM

	RF 50 Ω AC		SENSE:INT	A Al	IGN OFF	07:45:01 P	4 Mar 15, 2015	-	
BW 1.0		PNO: Fast 😱 IFGain:Low	Trig: Free Run Atten: 10 dB	Avg Type: R Avg Hold:>1	MS	TRAC	E 1 2 3 4 5 6 E A WINNIN A NNNNN		BW Res B
dB/div	Ref Offset 31.3 dB Ref 31.30 dBm				Mk	r1 2.36	1 8 GHz dBm	Auto	1.0 MH <u>Ma</u>
.3								Auto	Video B 1.0 Mi M
3								VBW	V:3dB RB ( M
7							1	Spar Auto	n:3dB RB 10 M
7					$\frown$	$\int$			<b>N Contro</b> ssian,-3 dB
7							-45.00 dBn		
7									
	000 GHz 1.0 MHz	#\/B\//	1.0 MHz*		veen 2	Stop 2.2	2850 GHz 1001 pts)		

Figure 53 — 1000 MHz-2285 MHz - GSM

ton Fre	RF 50 Ω AC q 2.320000000 G	Hz	SENSE:INT	Aug Type: RMS	07:46:12 PM Mar 15, 2015 TRACE 1 2 3 4 5 0	Frequency	
		PNO: Fast G	Trig: Free Run Atten: 10 dB	Avg Hold:>100/100	DET A NNNNN		
0 dB/div	Ref Offset 31.3 dB Ref 31.30 dBm			Mkr1	2.361 752 GHz dBm	Auto Tun	
21.3						Center Fre 2.302500000 GF	
.30						Start Fre 2.285000000 GF	
70					1 →	Stop Fre 2.320000000 GF	
3.7						CF Ste 3.500000 M <u>Auto</u> M	
					-45.00 dBm	Freq Offs	
8.7						01	
	3500 GHz 1.0 MHz	#VBW	1.0 MHz*	Sweep 1	Stop 2.32000 GHz .000 ms (1001 pts)		

Figure 54. — 2285 MHz-2320 MHz - GSM



Display	03:59:46 PM Mar 16, 2015 TRACE 2 3 4 5 TYPE A 4 5 DET A NNNNN	FF ALIGN OFF vg Type: RMS vg Hold:>100/100	SENSE:INT SOUR Trig: Free Run #Atten: 0 dB	ctrum Analyzer - Swept SA RF 50 Q AC ine -45.00 dBm PNO: Fast IFGain:High	
Annotation	2.344 825 GHz -53.974 dBm	Mkr		Ref Offset 35 dB Ref 15.00 dBm	) dB/div
Title					00
Graticu On C					5.0
Display Lin -45.00 dBr On 0					.0
	-45.00 dBm				.0
System Display Settings			ine and the second s		.0
	Stop 2.34500 GHz			000 GHz	art 2.320
	.000 ms (1001 pts)	Sweep	1.0 MHz*	1.0 MHz #VBW 1 Screen 18.png> saved	Res BW 1

Figure 55. — 2320 MHz-2345 MHz - GSM



Figure 56. - 2345 MHz-2349 MHz - GSM



Frequency	07:53:05 PM Mar 15, 2015 TRACE 1 2 3 4 5 5 TYPE A WWWWW DET A NNNNN	ALIGN OFF Type: RMS Hold:>100/100		O: Fast G Atten: 1	ctrum Analyzer - Swept SA RF 50 Ω AC q 2.362000000 GHz PNO: IFGai	
Auto Tur	2.345 000 GHz dBm	Mkr1			Ref Offset 31.3 dB Ref 36.30 dBm	0 dB/div
Center Fre 2.361500000 GF						6.3
Start Fre 2.361000000 GF						.30
<b>Stop Fre</b> 2.362000000 GH	-13.00 dBm					3,7
CF Ste 100.000 kł Auto Ma		4-9997-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-	*			3.7
Freq Offs 0 F						3.7 <mark>1</mark> 3.7 <del>(</del> -
						3.7
7.53 PM	p 2.3620000 GHz 000 ms (1001 pts)	Sweep 1	Z*	#VBW 1.0 MHz	10000 GHz 1.0 MHz	

Figure 57. — 2361 MHz-2362.5 MHz - GSM

requent spec	trum Analyzer - Swept SA RF 50 Ω AC		cruce and	A HITCH OFF	07-54-12 0000-015 2015	0 8
rker 1	2.362500000000	GH <sub>7</sub>	SENSE:INT	Avg Type: RMS	07:54:43 PM Mar 15, 2015 TRACE 1 2 3 4 5 0	Marker
	2.30230000000	PNO: Fast C	Trig: Free Run Atten: 16 dB	Avg Hold:>100/100	DET A NNNNN	Select Marker
dB/div	Ref Offset 31.3 dB Ref 36.30 dBm			Mkr1 2	.362 500 0 GHz -35.394 dBm	ocicotimano
3						Norm
.3 ———						Del
10 0 						Fixed
7						Fixed
7					-25 20 dBm	C
7	Construction and an and an and					Properties
7						Мо 1 о
	2500 GHz 1.0 MHz	#VBW	1.0 MHz*	Sweep 1	Stop 2.365000 GHz .000 ms (1001 pts)	

Figure 58. — 2362.5 MHz-2365 MHz - GSM



0 0			1		Agilent Spectrum Analyze
Marker	07:57:24 PM Mar 15, 2015 TRACE 2 3 4 5 6 TYPE A WINN N N DET A N N N N N	Avg Type: RMS Avg Hold:>100/100	SENSE:INT Trig: Free Run #Atten: 12 dB	RF 50 Ω AC 3.194890000000 GHz PNO: Fast ↓ IFGain:Low	
Select Marke	r1 3.194 9 GHz -46.721 dBm	M	WAtten: 12 db	Ref Offset 31.3 dB Ref 33.30 dBm	Ref Offs dB/div Ref 33
Norm					3
De					3 0 
Fixe					7
					7
Propertie	-45.00 dBm	1			7
<b>M</b> d 1 d	Stop 3.6000 GHz .933 ms (1001 pts)	Sween 1	1.0 MHz*		art 2.3650 GHz es BW 1.0 MHz

Figure 59. — 2365 MHz-3600 MHz - GSM



Figure 60. — 3600 MHz-10000 MHz - GSM



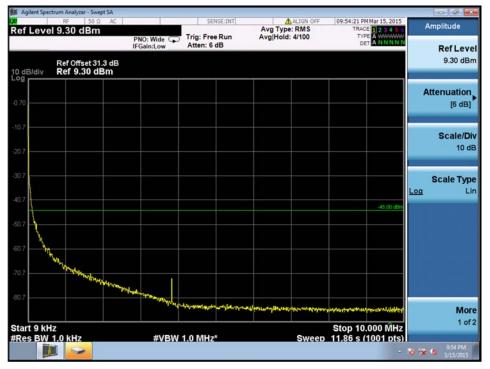
0 6 8	07:42:04 AM Mar 16, 2015	ALIGN OFF	SENSE:INT SOURCE	SE	ectrum Analyzer - Swept SA RF 50 Ω AC	Keysight Spi
Attenuation Mech Atten	TRACE 2 3 4 5 6 TYPE A WWWW DET A NNNNN	Type: RMS Hold:>100/100	Free Run		ch Atten 6 dB	Input Me
6 dB Auto <u>Man</u>	Mkr1 23.57 GHz dBm	I			Ref Offset 31.3 dB Ref 27.30 dBm	10 dB/div
Enable Elec Atter on <u>of</u>						17.3
Elec Atter 0 de						7.30 -2.70
						-12.7
	1					-22.7
Mech Atten Step	-45 UU d2m	~~~~				-42.7
2dB 10dE Max Mixer Lv						-62.7
-10.00 dBm	Stop 20.000 GHz 25.00 ms (1001 pts)	Sweep 2	Hz*	#VBW 1.0 MHz		Start 10.0 #Res BW
	5	STATU				MSG



1	ectrum Analyzer - Swept SA RF 50 Q AC		SENSE:INT SO	URCE OFF	0FF 07:43:23	AM Mar 16, 2015	-	9 🛛
nput Me	ch Atten 2 dB	PNO: Close 😱	Trig: Free Run	Avg Type: RM Avg Hold:>100	S TR	ACE 1 2 3 4 5 6 YPE A WWWW DET A N N N N N	Attenu	ation
		IFGain:Low	#Atten: 2 dB			DETANNNN	Me	ch Atter
0 dB/div	Ref Offset 31.3 dB Ref 23.30 dBm				Mkr1 23. -46.	573 GHz 509 dBm	Auto	2 di <u>Ma</u>
								Enablec Atter
13.3							an.	
.30							EI	ec Atte
.70								
6.7								
6.7								
6.7								
6.7								
							Mech At	ten Ste
6,7							<u>2dB</u>	10d
6.7							Max	/lixer L
tart 20.0	000 GHz				Stop 2	4.000 GHz	114,154,051,713	0.00 dB
Res BW	1.0 MHz	#VBW	1.0 MHz*	Swe	ep 10.00 ms	(1001 pts)		
G					STATUS			

Figure 62. — 20000 MHz-24000 MHz - GSM







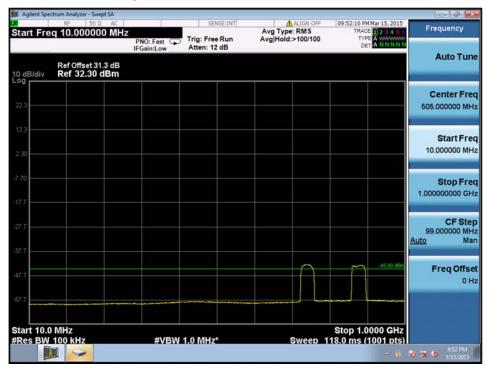


Figure 64. — 10 MHz-1000 MHz – W-CDMA





Figure 65. — 1000 MHz-2285 MHz – W-CDMA



Figure 66. — 2285 MHz-2320 MHz – W-CDMA



Display Line -45.00 dBm PNO: Fast IFGain:High PNO: Fast Frig: Free Run #Atten: 0 dB Mkr1 2.344 825 GHz -53.934 dBm -53.934 dBm -0 -0 -0 -0 -0 -0 -0 -0 -0 -0	Keysight Spect	trum Analyzer - Swept SA		L cruer and co			- 6
Ref Offset 35 dB       Miki 17 2.344 820 GHz         0 dB/div       Ref 15.00 dBm       -53.934 dBm         600       -53.934 dBm         600       -60       -60         600       -60       -60         600       -60       -60         600       -60       -60         600       -60       -60         600       -60       -60         600       -60       -60         600       -60       -60         600       -60       -60         600       -60       -60         600       -60       -60         600       -60       -60         600       -60       -60         600       -60       -60         600       -60       -60         600       -60       -60         610       -60       -60         620       -60       -60         630       -60       -60         640       -60       -60         650       -60       -60         650       -60       -60         650       -60       -60         650	isplay Li	RF 50 Ω AC ne -45.00 dBm		Trig: Free Run	Avg Type: RMS	04:00:37 PM Mar 16, 2015 TRACE 2 3 4 5 0 TYPE A DET A NNNNN	
Title	0 dB/div	Ref Offset 35 dB Ref 15.00 dBm			Mkr1	2.344 825 GHz -53.934 dBm	Annotation
50 50 50 50 50 50 50 50 50 50 50 50 50 5							Title
50							Graticul <u>On</u> O
50							Display Lin -45.00 dBi On O
50 System Display							
		- and a state of the	wdaynayay dan yn fer fan ar fey byg de	1994a 1944 prili			System
50							Settings
tart 2.32000 GHz Stop 2.34500 GHz Res BW 1.0 MHz #VBW 1.0 MHz* Sweep 1.000 ms (1001 pts)			#VBW	1.0 MHz*	Sweep 1	Stop 2.34500 GHz 1.000 ms (1001 pts)	

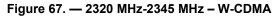


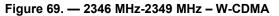


Figure 68. — 2345 MHz-2346 MHz - W-CDMA



ISRAEL TESTING LABORATORIES Global Certifications You Can Trust

Agilent Spectrum Analyzer - ACP					00
Center Freq 2.347500005 GHz IFGain:L	SENSE:INT Center Freq: 2.347500 Trig: Free Run #Atten: 10 dB	ALIGN OF 0005 GHz Avg Hold:>10/10	F 10:11:59 PM Radio Std: I Radio Devic	None	Frequency
Ref Offset 31.3 dB 10 dB/div Ref 0.00 dBm					
10.0 -4.9 dBc	-24.6 dBm		3.5 dBc	Average	Center Freq 2.347500005 GHz
30.0	entertarial for a second specific specific de la d	and a star a	ordoneoraplisma	norradiumba	
50.0					
60.0 70.0					
90.0 					
Center 2.348 GHz #Res BW 220 kHz	VBW 22 kHz			n 3 MHz p 20 ms	CF Step 300.000 kHz
Total Carrier Power -24.619 dBm/ 1.0	00 MHz ACP-I				<u>Auto</u> Man
Carrier Power Filter	Offset Freq Integ BW	Lower dBc dBm	Upper dBc dBm	Filter	Freq Offset
1 -24.619 dBm / 1.000 MHz OFF	1.000 MHz 1.000 MHz	-4.893 -29.51	3.482 -21.14	OFF	0 Hz
				•	8 😿 (s 10-11 PM 3/15/2015



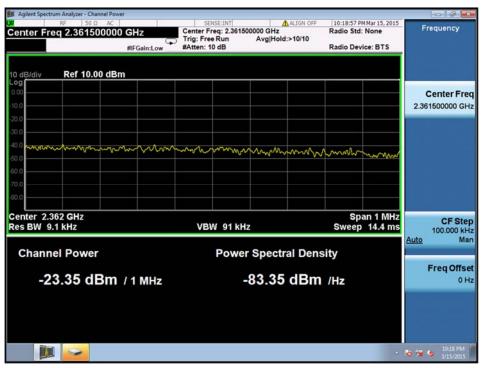
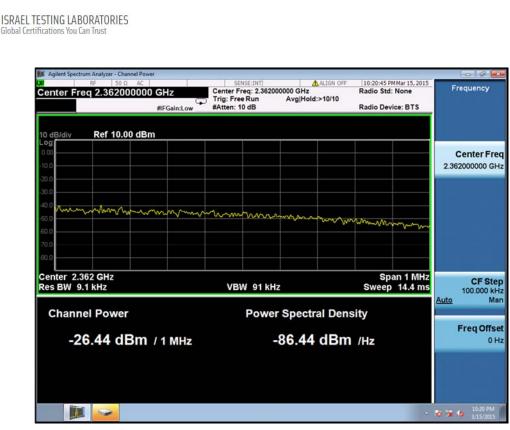


Figure 70. — 2361 MHz-2362MHz – W-CDMA



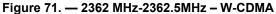




Figure 72. — 2362.5 MHz-2365MHz – W-CDMA



Marker	10:25:58 PM Mar 15, 2015 TRACE 1 2 3 4 5 6	ALIGN OFF	SENSE:INT	50 Ω AC 955000000 GHz	
Select Marke	DET A NNNNN	Avg Hold:>100/100	Trig: Free Run #Atten: 10 dB	PNO: Fast IFGain:Low	1 5.1005550
	r1 3.189 0 GHz -48.374 dBm	Mł		fset 31.3 dB .30 dBm	Ref Offset 3 Ref 9.30 d
Norm					
De					
Fixe					
	-45.00 dBm	1			
Propertie					
Ма 1 а					
	Stop 3.6000 GHz .933 ms (1001 pts)	Sween 1	1.0 MHz*		3650 GHz W 1.0 MHz

Figure 73.—2365 MHz-3600MHz - W-CDMA



Figure 74. — 3600 MHz-10000 MHz – W-CDMA



Attenuation	07:45:53 AM Mar 16, 2015		SENSE:INT SOURC	RF 50 Ω AC	
Mech Atte	TRACE 2 3 4 5 9 TYPE A MININA DET A NNNNN	vg Hold:>100/100	Trig: Free Run #Atten: 6 dB	PNO: Close IFGain:Low	nput Mech Atten
6 d Auto <u>Ma</u>	/kr1 23.57 GHz dBm	I		Ref Offset 31.3 dB Ref 23.30 dBm	Ref Offse 0 dB/div Ref 23.3
Enabl Elec Atte					13.3
Elec Atte					3.30
					16.7
	1				26.7
	-45.00 dBin				6.7
Mech Atten Ste 2dB 10d					i6.7
Max Mixer L -10.00 dB	Stop 20.000 GHz				tart 10.000 GHz
	5.00 ms (1001 pts)	Sweep 2	1.0 MHz*	0 MHz #VBW	Res BW 1.0 MHz

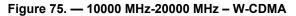




Figure 76. — 20000 MHz-24000 MHz – W-CDMA



			G : 1	Calibration	1
Instrument	Manufacturer	Model	Serial Number	Last Calibration	Period
Signal Analyzer	Agilent	N9020A	A27058	February 12, 2015	1 year
Band Stop Filter	RF Com	RWC2355R10 M01	15030001	March 1, 2015	1 year
Vector Signal Generator	Agilent	N5182A	MY48180244	July 16, 2014	1 year
30 dB Attenuator	JFW	50FHC-030-50	43608 46-140-1	March 8, 2015	1 month

### 8.4 Test Equipment Used; Out of Band Emission at Antenna Terminals

Figure 77 Test Equipment Use
------------------------------



# 9. Band Edge Spectrum

### 9.1 Test Specification

FCC Part 27, Section 53(a)(1)

### 9.2 Test procedure

The power of any emission in the 1 MHz bands immediately outside and adjacent to the channel blocks (2350-2360MHz) was attenuated below the transmitting power (P) by a factor as specified in this section. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (31.3 dB). The spectrum analyzer RBW was set to 1% from OBW. The evaluation was repeated for all modulations.

### 9.3 Test Results

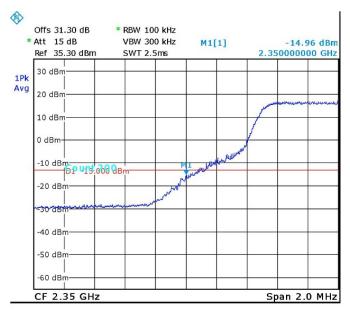
Modulation	Operation Frequency	Band Edge Frequency	Reading	Specification	Margin
	(MHz)	(MHz)	(dBm)	(dBm)	(dB)
LTE	2355.0	2350	-15.0	-13.0	-2.0
64QAM	2355.0	2360	-14.8	-13.0	-1.8
CSM	2351.2	2350	-18.0	-13.0	-5.0
GSM	2358.8	2360	-18.5	-13.0	-5.5
W-CDMA	2352.5	2350	-21.9	-13.0	-8.9
w-CDMA	2357.5	2360	-23.0	-13.0	-10.0

### Figure 78 Band Edge Spectrum Results

JUDGEMENT: Passed by 1.8 dB

See additional information in Figure 79 to Figure 84.





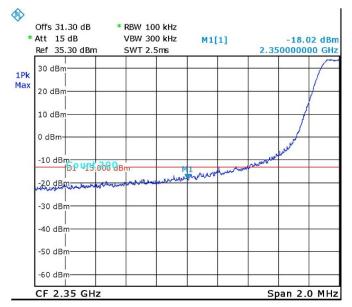
Date: 12.MAR.2015 15:25:23



### Figure 79. — Lower Block Edge -1MHz – LTE 64QAM

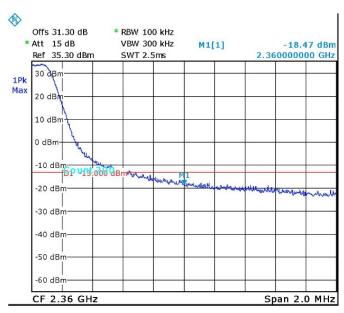
Figure 80. — Upper Band Edge +1MHz – LTE 64QAM





Date: 12.MAR.2015 15:28:24

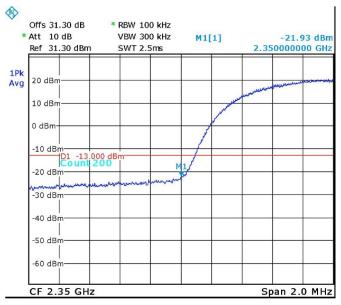




Date: 12.MAR.2015 15:29:16

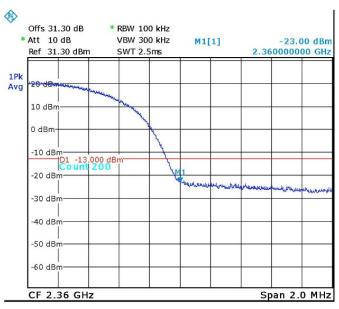
Figure 82. — Upper Band Edge +1MHz - GSM





Date: 12.MAR.2015 15:34:20





Date: 12.MAR.2015 15:35:33

Figure 84. — Upper Band Edge +1MHz – W-CDMA



### 9.4 Test Equipment Used; Band Edge Spectrum

				Calibration	ı
Instrument	Manufacturer	Model	Serial Number	Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Vector Signal Generator	Agilent	N5182A	MY48180244	July 16, 2014	1 year
30 dB Attenuator	JFW	50FHC-030-50	43608 46-140-1	March 8, 2015	1 month

Figure 85 Test Equipment Used



## 10. Spurious Emissions (Radiated)

### 10.1 Test Specification

FCC Part 27.53

### 10.2 Test Procedure

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

(a) The E.U.T. operation mode and test set-up are as described in Section 3. 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 nonmetallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 1.

The frequency range 9 kHz-24 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.

AVERGE trace was used +RMS detector for this test.



Frequency Band	Calculated
(MHz)	Factor (dBc)
f<2285.0	75+10*log(10.5)=85.2
2285.0MHz <f<2287.5mhz< td=""><td>72+10*log(10.5)=82.2</td></f<2287.5mhz<>	72+10*log(10.5)=82.2
2287.5MHz <f<2300.0mhz< td=""><td>70+10*log(10.5)=80.2</td></f<2300.0mhz<>	70+10*log(10.5)=80.2
2300.0MHz <f<2305.0mhz< td=""><td>43+10*log(10.5)=53.2</td></f<2305.0mhz<>	43+10*log(10.5)=53.2
2305.0MHz <f<2320.0mhz< td=""><td>43+10*log(10.5)=53.2</td></f<2320.0mhz<>	43+10*log(10.5)=53.2
2320.0MHz <f<2345.0mhz< td=""><td>75+10*log(10.5)=85.2</td></f<2345.0mhz<>	75+10*log(10.5)=85.2
2345.0MHz <f<2360.0mhz< td=""><td>43+10*log(10.5)=53.2</td></f<2360.0mhz<>	43+10*log(10.5)=53.2
2360.0MHz <f<2362.50mhz< td=""><td>43+10*log(10.5)=53.2</td></f<2362.50mhz<>	43+10*log(10.5)=53.2
2362.5MHz <f<2365.0mhz< td=""><td>55+10*log(10.5)=65.2</td></f<2365.0mhz<>	55+10*log(10.5)=65.2
2365.0MHz <f<2367.5mhz< td=""><td>70+10*log(10.5)=80.2</td></f<2367.5mhz<>	70+10*log(10.5)=80.2
2367.5MHz <f<2370.0mhz< td=""><td>72+10*log(10.5)=82.2</td></f<2370.0mhz<>	72+10*log(10.5)=82.2
2370.0 <f< td=""><td>75+10*log(10.5)=85.2</td></f<>	75+10*log(10.5)=85.2

Figure 86 Mask Limit Table

10.3	Test Results
10.5	restnesuits

Freq.	Antenna Pol.	Maximum Peak Level	Signal Generator RF Output	Cable Loss	Antenna Gain	Effective Radiated Power Level	Spec.*	Margin
(GHz)		(dBµV/m)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
2.335	V	47.5	-49.3	9.0	7.7	-50.6	-45.0	-5.6
2.335	Н	45.4	-52.3	9.0	8.5	-52.8	-45.0	-7.8
4.700	V	54.1	-43.3	12.1	9.9	-45.5	-45.0	-0.5
4.700	Н	53.3	-44.3	12.1	10.8	-45.6	-45.0	-0.6
4.705	V	50.8	-44.8	12.1	9.9	-47.0	-45.0	-2.0
4.705	Н	50.9	-45.0	12.1	10.8	-46.3	-45.0	-1.3

\*Note - Limit calculation for freq>2370.0MHz: factor=75+10\*log(10.5)=85.2dBc Limit=40.2-85.2=-45.0dBm

### Figure 87 Spurious Emission (Radiated)

JUDGEMENT; Passed by 0.5 dB

The E.U.T met the requirements of the FCC Part 27, Section 917; FCC Part 2.1053 specifications.



#### Serial Instrument Manufacturer Model Calibration Period Number EMI Receiver R&S ESIB7 100120 January 4, 2015 1 year Spectrum 3826A01204 8592L HP March 4, 2015 1 year Analyzer Active Loop EMCO 6502 2950 November 4, 2014 1 year Antenna **Biconical** Log EMCO 3142B 1078 May 22, 2014 2 years Antenna Horn Antenna ETS 3115 6142 March 14, 2012 3 years\* Horn Antenna 1007 ARA **SWH-28** March 30, 2014 2 years 40dB attenuator Weinschel WA-39-40-33 A1323 March 1, 2015 1 year Engineering Signal Generator GB40051245 HP E4433B July 16, 2014 1 year Signal Generator 119196015 MARCONI 2022D February 23, 2015 1 year Signal Generator GB40050702 HP E4433B May 16, 2013 2 years Signal Generator US39260774 HP E4436B January 7, 2015 2 years Signal Generator 1782 HP ESG-4000A February 24, 2015 1 year Low Noise Sophia Wireless LNA 28-B 232 August 29, 2014 1 Year Amplifier DBS LNA-DBS-Low Noise 013 August 22, 2014 1 Year MICROWAVE Amplifier 0411N313 Antenna Mast N/A N/A ETS 2070-2 \_ Turntable N/A N/A ETS 2087 Mast & Table 9608-1456 N/A N/A ETS/EMCO 2090 Controller

### 10.4 Test Instrumentation Used, Radiated Measurements

\*Note - Extended to May 19, 2015

### Figure 88 Test Equipment Used





## **11. Intermodulation Conducted**

### 11.1 Test Procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable(loss = 31.3dB). The spectrum analyzer was set to 1 kHz resolution BW for the frequency range 9.0-150.0 kHz, 10 kHz for the frequency range 150 kHz–1.0 MHz, 100 kHz for the frequency range 1.0 MHz – 30 MHz, and 1MHz for the frequency range 30 MHz - 24.0 GHz.

5 input signals were sent simultaneously to the E.U.T. as follows:

LTE 747 MHz CW 0 dBm CELL 881 MHz CW 0 dBm PCS 1960 MHz CW 0 dBm AWS: 2135 MHz CW 0 dBm WCS: 2355MHz CW 0 dBm

The frequency range of 9 kHz – 24.0 GHz was scanned for unwanted signals.

### 11.2 Test Results

JUDGEMENT: Passed

See additional information in Figure 89 to Figure 92.

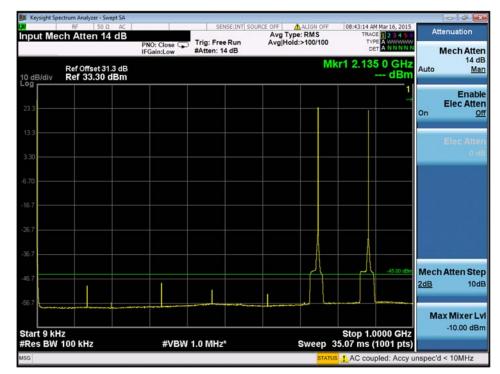


Figure 89 0.009M-1000M

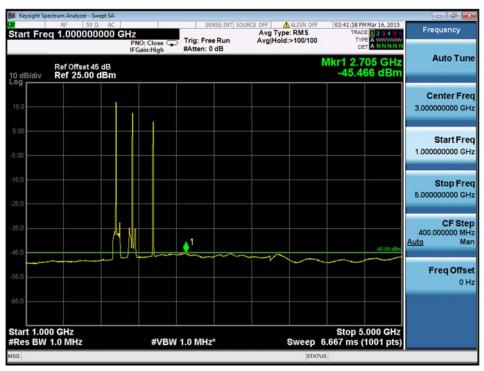


Figure 90 1000M-5000M



Res BW 1.0 MHz	#VBW 1.0 MHz*	Sweep 4	2.00 ms (1001 pts)	
art 5.000 GHz			Stop 16.000 GHz	1 of
				Mor
7				
7				Mkr→RefL
7			m	
7.			45.00 m	Mkr→C
,				marker De
				Marker Del
0				Next Pk Le
0				
3				
				Next Pk Rig
dB/div Ref 21.30 dBm			-46.062 dBm	
Ref Offset 41.3 dB	iroani:nign	м	kr1 15.714 GHz	NextPe
arker 1 15.7140000000	PNO: Close Trig: Free Run IFGain:High #Atten: 0 dB	Avg Hold:>100/100	TYPE A A WWWW DET A S N N N N	
RF 50 Ω AC		SOURCE OFF AVG Type: RMS	02:38:55 PM Mar 16, 2015 TRACE 1 2 3 4 5	Peak Search

Figure 91 5000M-16000M



Figure 92 16000M-24000M



	Serial Serial		Calibration	1	
Instrument	Manufacturer	Model	Number	Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Vector Signal Generator	Agilent	N5182A	MY48180244	July 16, 2014	1 year
Vector Signal Generator	Agilent	N5172B	MY51350518	May 03, 2013	3 years
Vector Signal Generator	Agilent	N5172B	MY51350584	May 07, 2013	3 years
Signal Generator	HP	E4433B	GB40050702	May 16, 2013	2 years
Signal Generator	HP	E4436B	US39260774	January 07 2015	2 years
30 dB Attenuator	JFW	50FHC-030-50	43608 46-140-1	March 8, 2015	1 month

### 11.3 Test Equipment Used; Intermodulation Conducted

Figure 93 Test Equipment Used



## 12. Intermodulation Radiated

### 12.1 Test Procedure

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

(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 E.U.T. was operated in Downlink mode at 4 different channels at center frequency of each band at the same time, transmitting at CW signal.

(b) The frequency range 9 kHz-24 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.

In the frequency range 7-24.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100 Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

- (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: Pd(dBm) = Pg(dBm) Cable Loss (dB) + Substitution Antenna Gain (dB)
  - $P_d$  = Dipole equivalent power (result).
  - $P_g = Signal$  generator output level.

Average trace +RMS detector was used for this test.

5 input signals were sent simultaneously to the E.U.T. as follows:

LTE 747 MHz 0 dBm CELL 881 MHz 0 dBm PCS 1960 MHz 0 dBm AWS: 2135 MHz 0 dBm WCS: 2355 MHz CW 0 dBm



### 12.2 Test Results

Freq.	Antenna Pol.	Maximum Peak Level	Signal Generator RF Output	Cable Loss	Antenna Gain	Effective Radiated Power Level	Spec.	Margin
(MHz)		(dBµV/m)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
1565.0	V	48.1	-51.9	6.7	7.6	-51.0	-45.0	-6.0
1565.0	Н	48.8	-51.5	6.7	8	-50.2	-45.0	-5.2
3039.0	V	43.4	-53.1	9.9	8.4	-54.6	-45.0	-9.6
3039.0	Н	44.0	-53.8	9.9	9.6	-54.1	-45.0	-9.1
3434.0	V	44.5	-52.2	9.9	8.4	-53.7	-45.0	-8.7
3434.0	Н	44.7	-53.8	9.9	9.6	-54.0	-45.0	-9.0
4118.0	V	46.9	-48.4	11.2	9.5	-50.0	-45.0	-5.0
4118.0	Н	47.8	-48.8	11.2	8.6	-51.4	-45.0	-6.4
5303.0	V	50.5	-43.9	13.1	9.7	-47.3	-45.0	-2.3
5303.0	Н	50.3	-42.8	13.1	10.4	-45.5	-45.0	-0.5
3523.0	V	45.5	-49.4	10.2	8.7	-50.9	-45.0	-5.9
3523.0	Н	45.9	-50.2	10.2	9.8	-50.6	-45.0	-5.6
2249.0	V	40.1	-53.8	9	8.5	-54.3	-45.0	-9.3
2249.0	Н	42.6	-52.8	9	7.7	-54.1	-45.0	-9.1
1915.0	V	50.2	-47.9	9	7.7	-49.2	-45.0	-4.2
1915.0	Н	50.0	-49.4	9	8.5	-49.9	-45.0	-4.9
5571.0	V	50.0	-43.9	13.5	9.9	-47.5	-45.0	-2.5
5571.0	Н	52.1	-43.3	13.5	10.8	-46.0	-45.0	-1.0
3303.0	V	43.5	-53.1	9.9	8.4	-54.6	-45.0	-9.6
3303.0	Н	43.6	-54.4	9.9	9.6	-54.7	-45.0	-9.7

Figure 94 Intermodulation Radiated Results

JUDGEMENT:

Passed



# 12.3 Test Instrumentation Used; Radiated Measurements Intermodulation

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	R&S	ESIB7	100120	December 15, 2014	1 year
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	1 year
Biconical Log Antenna	EMCO	3142B	1078	May 22, 2014	2 years
Horn Antenna	ETS	3115	6142	March 14, 2012	3 years*
Horn Antenna	A.R.A	SWH-28	1007	March 30, 2014	2 years
40dB attenuator	Weinschel Engineering	WA-39-40-33	A1323	March 1, 2015	1 year
Signal Generator	HP	E4433B	GB40051245	July 16, 2014	1 year
Signal Generator	MARCONI	2022D	119196015	February 23, 2015	1 year
Signal Generator	HP	E4433B	GB40050702	May 16, 2013	2 years
Signal Generator	HP	E4436B	US39260774	January 7, 2015	2 years
Signal Generator	HP	ESG-4000A	1782	February 24, 2015	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS- 0411N313	013	August 22, 2014	1 Year
Antenna Mast	ETS	2070-2	-	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

\*Note - Extended to May 19, 2015

### Figure 95 Test Equipment Used



## **13. APPENDIX A - CORRECTION FACTORS**

### 13.1 Correction factors for

CABLE

from EMI receiver to test antenna at 3 meter range.

-		 1	
Frequency	Cable Loss	Frequency	Cable Loss
(MHz)	(dB)	(MHz)	(dB)
0.010	0.4	50.00	1.2
0.015	0.2	100.00	0.7
0.020	0.2	150.00	20.1
0.030	0.3	200.00	2.3
0.050	0.3	300.00	2.9
0.075	0.3	500.00	3.8
0.100	0.2	750.00	4.8
0.150	0.2	1000.00	5.4
0.200	0.3	1500.00	6.7
0.500	0.4	2000.00	9.0
1.00	0.4	2500.00	9.4
1.50	0.5	3000.00	9.9
2.00	0.5	3500.00	10.2
5.00	0.6	4000.00	11.2
10.00	0.8	4500.00	12.1
15.00	0.9	5000.00	13.1
20.00	0.8	5500.00	13.5
		6000.00	14.5

NOTES:

1. The cable type is SPUMA400 RF-11N(X2) and 39m long

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2. The cable is manufactured by Huber + Suhner



### 13.2 Correction factors for

### Bilog ANTENNA

Model: 3142 *Antenna serial number: 1250* 3 meter range

FREQUENCY	AFE	FREQUENCY	AFE
(MHz)	(dB/m)	(MHz)	(dB/m)
30	18.4	1100	25
40	13.7	1200	24.9
50	9.9	1300	26
60	8.1	1400	26.1
70	7.4	1500	27.1
80	7.2	1600	27.2
90	7.5	1700	28.3
100	8.5	1800	28.1
120	7.8	1900	28.5
140	8.5	2000	28.9
160	10.8		
180	10.4		
200	10.5		
250	12.7		
300	14.3		
400	17		
500	18.6		
600	19.6		
700	21.1		
800	21.4		
900	23.5		
1000	24.3		



### 13.3 Correction factors for Hor

### Horn ANTENNA

Model: 3115 *Antenna serial number: 6142* 3 meter range

FREQUENCY	Antenna Factor	FREQUENCY	Antenna Factor
(MHz)	(dB/m)	(MHz)	(dB/m)
1000	23.9	10500	38.4
1500	25.4	11000	38.5
2000	27.3	11500	39.4
2500	28.5	12000	39.2
3000	30.4	12500	39.4
3500	31.6	13000	40.7
4000	33	14000	42.1
4500	32.7	15000	40.1
5000	34.1	16000	38.2
5500	34.5	17000	41.7
6000	34.9	17500	45.7
6500	35.1	18000	47.7
7000	35.9		
7500	37.5		
8000	37.6		
8500	38.3		
9000	38.5		
9500	38.1		
10000	38.6		



### 13.1 Correction factors for Horn A

### Horn ANTENNA

Model: SWH-28 *Antenna serial number: 1007* 1 meter range

FREQUENCY	Antenna Factor
(MHz)	(dB/m)
18000	33.0
18500	32.9
19000	33.1
19500	33.3
20000	33.6
20500	33.6
21000	33.4
21500	33.8
22000	33.7
22500	33.9
23000	34.8
23500	34.5
24000	34.2
24500	34.8
25000	34.4
25500	35.2
26000	35.9
26500	36.0



## 13.2 Correction factors for ACTIVE LOOP ANTENNA Model 6502 S/N 9506-2950

	Magnetic	Electric
FREQUENCY	Antenna	Antenna
	Factor	Factor
(MHz)	(dB)	(dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2