



Engineering and Testing for EMC and Safety Compliance



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Class II Permissive Change Report

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Model: SkyMASTR 700 MHz Base Station
FCC ID: BV8MBS700A100

October 18, 2009

Standards Referenced for this Report			
Part 2: 2008	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations		
Part 90: 2008	Private Land Mobile Radio Services		
ANSI TIA-603-C-2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards		
ANSI/TIA/EIA – 102.CAAA; 2002	Digital C4FM/CQPSK Transceiver Measurement Methods		

Frequency Range	Maximum Measured Output Power (W) Conducted	Measured Frequency Tolerance (ppm)	Emission Designator
764-776 MHz	100	0.01	12K1F9W (4-Level TDMA voice/data)
764-776 MHz	100	0.01	8K40F9W (NBOTF)

Report Prepared by Test Engineer: Daniel W. Baltzell

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1 General Information

The following Certification Report is prepared on behalf of **Harris Corporation** in accordance with the Federal Communications Commission. The Equipment Under Test (EUT) was the **SkyMASTR 700 MHz Base Station, FCC ID: BV8MBS700A100**. The test results reported in this document relate only to the item that was tested.

All measurements contained in this application were conducted in accordance with the applicable FCC Rules and Regulations in CFR 47. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

1.1 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia, 20170. This site has been fully described in a report submitted to and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing.

1.2 Related Submittal(s)/Grant(s)

This is a Class II Permissive Change which adds an emission designator, 8K40F9W for the Narrow Band OpenSky Trunking Protocol (NBOTP), and also requests that the full range of 764–776 MHz be listed on the FCC grant to reflect the full band allowed at this time. The original grant was issued June 28, 2004.

2 Tested System Details

The test sample was received on September 3, 2009. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

Table 2-1: Test System Details

Model Tested	SkyMASTR Base Station
Frequency Band	764-776 MHz
Modulation Type	4-level Frequency Shift Keying (FSK)
Channel Step Size	6.25 kHz
Channel Bandwidth	12.5 kHz
Primary Power	48 VDC
Rated Transmitter Output Power	10-100 W
Duty Cycle	100% maximum

Table 2-2: Equipment Under Test (EUT)

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
SkyMASTR 700 MHz Base Station	Harris Corp.	MASK-700HC	MASK-700HC	BV8MBS700A100	19193
SkyMASTR Power Supply	Lineage Power	MASK-NPS2N	PS-013374-048	N/A	N/A

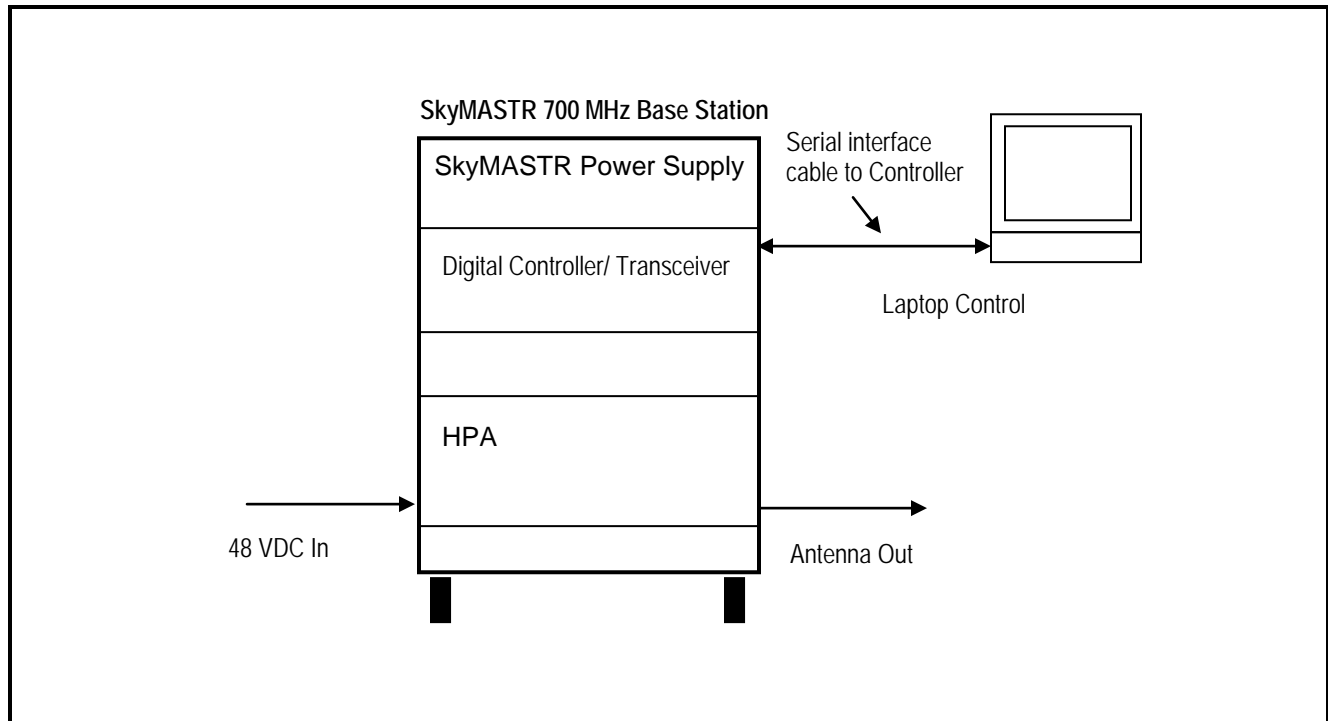
Table 2-3: Ports and Cabling (EUT)

Port	Cable Type	Quantity	Length (feet)	Shield
RF In/Out	N type	1	N/A	Yes
Terminal	DB-9	1	N/A	No
RS-485	DB-9	1	N/A	No
Com-1	DB-9	1	N/A	No
Network	DB-9	1	N/A	No

Table 2-4: Support Equipment

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Notebook Computer	Dell	Latitude	N/A	N/A	16951
Serial Interface Cable	N/A	N/A	N/A	N/A	N/A
Power Supply	Mean Well	SE-600-48	CA 50051062	N/A	N/A

Figure 2-1: Configuration of Tested System



3 FCC Rules and Regulations Part 2 §2.1033(c)(8) Voltages and Currents Through The Final Amplifying Stage

Nominal DC Voltage: 28.0 VDC
Current: 11.0 AMPS

4 FCC Rules and Regulations Part 90 §90.1215(a) and Part 2 §2.1046(a): Peak Output Power

4.1 Test Procedure

ANSI TIA-603-2004, section 2.2.1.

The EUT was connected to a coaxial attenuator having a 50 Ω load impedance.

4.2 Test Data

Table 4-1: RF Power Output: Carrier Output Power – NBOTP – High Power

Frequency (MHz)	Full Duplex Version RF Power Measured (Watt)*
764.0125	100.9
766.9875	100.2
773.0125	101.2
775.9875	100.7

* Measurement accuracy: +/-0.02 dB (logarithmic mode)

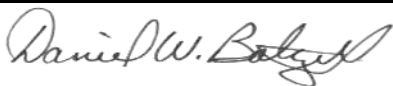
Table 4-2: RF Power Output (Rated Power)

Rated Power - Duplex Mode
10-100.0 W

Table 4-3: Test Equipment for Testing RF Power Output - Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901356	Agilent Technologies	E9323A	Power Sensor	31764-264	11/5/09
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	11/5/09
901138	Weinschel Corp.	48-40-34 DC-18GHz	Attenuator, 100W 40dB	BK5883	12/3/09

Test Personnel:

Daniel W. Baltzell		September 8, 2009
Test Engineer	Signature	Date Of Tests

5 FCC Rules and Regulations Part 2 §2.1051: Spurious Emissions at Antenna Terminals; Part 90 §90.210: Emissions Masks

5.1 Test Procedure

ANSI TIA-603-C-2004, Section 2.2.13.

The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer. The device uses digital modulation modulated to its maximum extent using a pseudo random data sequence of 9600 bps for NBOTP (Narrow Band OpenSky Trunking Protocol) mode.

5.2 Test Data

Frequency range of measurement per Part 2.1057: 9 kHz to 10x F_c .

Limit: $P(\text{dBm}) - (43 + 10 \times \text{LOG } P(\text{W}))$


The worst case (unwanted emissions) channels are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

No emissions were found within 20 dBc of the limit.

Table 5-1: Test Equipment for Testing Conducted Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz – 12.8 GHz)	3826A00144	10/23/09
901138	Weinschel Corp.	48-40-34 DC-18GHz	Attenuator, 100W 40dB	BK5883	12/3/09
901517	Insulated Wire Inc.	KPS-1503-360-KPS-09302008	RF cable 36"	NA	10/17/09
900948	Weinschel Corporation	47-10-43	Attenuator DC-18 GHz 10 dB 50W	BH1487	12/3/09
901132	Par Electronics	806-902 (25W)	UHF Notch Filter	N/A	3/10/12

Test Personnel:

Daniel W. Baltzell		September 17, 2009
Test Engineer	Signature	Date Of Tests

6 FCC Rules and Regulations Part 90 §90.543(a): Emission Limitations: ACP Requirements

Transmitters designed to operate in the 764-776 MHz and 794-806 MHz frequency bands must meet the emission limitations of this section.

6.1 Test Procedure

Device with digital modulation: modulated to its maximum extent using a pseudo-random data sequence – 9600 bps.

For a base transmitter designed to operate with a 12.5 kHz channel bandwidth, the ACP shall be in accordance with the following table:

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Maximum ACCP (dBc)
9.375	6.25	-40
15.625	6.25	-60
21.875	6.25	-60
37.5	25	-60
62.5	25	-65
87.5	25	-65
150	100	-65
250	100	-65
350	100	-65
$400 < f_d \leq 12 \text{ MHz}$	30(s)	-80
$12 \text{ MHz} < f_d \leq \text{paired receive band}$	30(s)	-80
In the paired receive band	30(s)	-100

FCC Rules and Regulations Part 90 §90.543(b)

Setting Reference Level - Part 90 §90.543(b)(1): Set transmitter to maximum output power. Using a spectrum analyzer capable of ACP measurements, set the measurement bandwidth to the channel size. For example, for a 6.25 kHz transmitter set the measurement bandwidth to 6.25 kHz. Set the frequency offset of the measurement bandwidth to zero and adjust the center frequency of the instrument to the assigned center frequency to measure the average power level of the transmitter. Record this power level in dBm as the "reference power level".

Measuring the power level at the frequency offset <400 kHz - Part 90 §90.543(b)(2): Using a spectrum analyzer capable of ACP measurements, set the measurement bandwidth and frequency offset from the assigned center frequency as shown in the table above. Any value of resolution bandwidth may be used as long as it does not exceed 2 percent of the specified measurement bandwidth. Measure the power level in dBm. These measurements should be made at maximum power. Calculate ACP by subtracting the reference power level measured in above from the measurements made in this step. The absolute value of the calculated ACP must be greater than or equal to the absolute value of the ACP given in the table for each condition above.

Measuring the power level at the frequency offset >400 kHz - Part 90 §90.543(b)(3): Set a spectrum analyzer to 30 kHz resolution bandwidth, 1 MHz video bandwidth and average, sample, or RMS detection. Set the reference level of the spectrum analyzer to the RMS value of the transmitter power. Sweep above and below the carrier frequency to the limits defined in the tables. Calculate ACP by subtracting the reference power level measured in the first step above from the measurements made in this step. The absolute value of the calculated ACP must be greater than or equal to the absolute value of the ACP given in the table for each condition above.

6.2 Test Data

Table 6-1: Narrowband Adjacent Channel Power

			764.0125 MHz	764.0125 MHz	769.9875 MHz	769.9875 MHz	775.9875 MHz	775.9875 MHz
Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP Low Offset (dBc)	Max ACP High Offset (dBc)	Max ACP Low Offset (dBc)	Max ACP High Offset (dBc)	Max ACP Low Offset (dBc)	Max ACP High Offset (dBc)
(+/-)9.375	6.25	-40	-41.6	-40.5	-42.4	-47.8	-41.1	-40.7
(+/-)15.625	6.25	-60	-68.7	-68.4	-70.9	-68.3	-69.2	-68.8
(+/-)21.875	6.25	-60	-72.0	-71.0	-73.0	-71.2	-71.7	-71.0
(+/-)37.5	25	-60	-68.4	-65.1	-69.1	-66.3	-68.5	-65.0
(+/-)62.5	25	-65	-72.5	-68.7	-72.1	-69.0	-72.5	-68.9
(+/-)87.5	25	-65	-76.5	-74.3	-76.3	-74.7	-76.6	-74.2
(+/-)150	100	-65	-73.7	-72.1	-76.1	-76.3	-75.4	-74.4
(+/-)250	100	-65	-82.3	-80.7	-81.9	-82.5	-83.2	-81.5
(+/-)350	100	-65	-84.4	-84.3	-90.5	-90.5	-86.1	-85.3

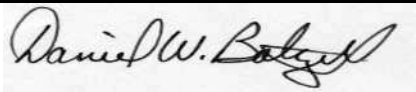
Table 6-2: Narrowband Adjacent Channel Power Swept Mode

			764.0125 MHz	769.9875 MHz	775.9875 MHz
Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP (dBc)	Max ACP (dBc)	Max ACP (dBc)
>400 to 12 MHz	30(s)	-80	-84.7	-87.0	-84.9
12 MHz to receive band	30(s)	-80	-89.1	-96.0	-96.1
In receive band	30(s)	-100	-103.6	-103.3	-100.6

Table 6-3: Test Equipment for Testing ACCP Requirements

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
Telogy 95448	Agilent Technologies	E4448A	Spectrum Analyzer	MY46180621	5/29/11
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159	6/8/10
900914	Hewlett Packard	85460A	RF Filter Section, (100 KHz - 6.5 GHz)	3330A00107	6/8/10
900928	Hewlett Packard	83752A	Synthesized Sweeper, 0.01 to 20 GHz	3610A00866	2/9/10
N/A	Kiwa Filter	8.3 FM	Mixer Filter	N/A	N/A
N/A	Mini-Circuits	ZFM-2000	455 kHz Mixer	15542	N/A
900948	Weinschel Corporation	47-10-43	Attenuator DC-18 GHz 10 dB 50W	BH1487	12/3/09
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/3/09
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	3/13/10

Test Personnel:

Dan Baltzell		October 10, 2009
Test Engineer	Signature	Date of Tests

7 FCC Rules and Regulations Part 90 §90.210(g) and Part 2 §2.543(c & e): Field Strength of Spurious Radiation

7.1 Test Procedure

ANSI TIA-603-C-2004, section 2.2.12.

The device uses digital modulation modulated to its maximum extent using a pseudo-random data sequence of 9600 bps for NBOTP (Narrow Band OpenSky Trunking Protocol) mode.

The spurious emissions levels were measured and the device under test was replaced by a substitution antenna connected to a signal generator. This maximized signal generator level was then corrected by subtracting the cable loss from the substitution antenna to the signal generator, and the gain of the antenna was further corrected to a half wave dipole.

7.2 Test Data

7.2.1 CFR 47 Part 90.210 Requirements

The worst-case emissions test data are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

Limit: $P(\text{dBm}) - (43 + 10 \times \log P(\text{W}))$

Table 7-1: Field Strength of Spurious Radiation - 764.0125 MHz (8K40F9W)

$$\text{Limit} = 43 + 10 \log (100.9) = 63.0 \text{ dBc}$$

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Antenna Gain (dBd)	EIRP (dBc)	Margin (dB)
1528.0250	76.9	-22.4	6.9	5.0	74.3	-11.3
2292.0375	71.7	-24.1	8.4	6.7	75.9	-12.8
3056.0500	82.5	-25.4	9.9	7.5	77.9	-14.8
3820.0625	55.0	-32.8	10.8	7.4	86.3	-23.3
4584.0750	40.0	-44.1	12.1	8.4	97.9	-34.8
5348.0875	51.4	-30.9	13.2	8.3	85.9	-22.9
6112.1000	28.2	-53.3	13.7	8.9	108.1	-45.1
6876.1125	30.6	-51.9	14.8	9.3	107.4	-44.4
7640.1250	29.6	-44.7	15.4	8.7	101.3	-38.3

Table 7-2: Field Strength of Spurious Radiation - 775.9875 MHz (8K40F9W)

$$\text{Limit} = 43 + 10 \log (100.7) = 63.0 \text{ dBc}$$

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Antenna Gain (dBd)	EIRP (dBc)	Margin (dB)
1551.9750	74.1	-25.0	7.0	5.1	76.9	-13.9
2327.9625	72.9	-23.9	8.8	6.8	75.9	-12.9
3103.9500	87.8	-19.7	10.0	7.5	72.3	-9.3
3879.9375	52.9	-34.8	11.5	7.4	88.9	-25.9
4655.9250	36.9	-47.2	12.8	8.4	101.6	-38.6
5431.9125	49.2	-33.0	13.0	8.3	87.8	-24.8
6207.9000	30.4	-50.5	14.0	9.0	105.6	-42.5
6983.8875	29.2	-49.1	14.9	9.4	104.7	-41.7
7759.8750	30.6	-49.1	15.6	8.8	106.0	-43.0

Table 7-3: Field Strength of Spurious Radiation in the Band 1559-1610 MHz


$$\text{Limit} = -70 \text{ dBW/MHz } (-40 \text{ dBm}) \text{ EIRP wideband; } -80 \text{ dBW/MHz } (-50 \text{ dBm}) \text{ EIRP discrete}$$

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Antenna Gain (dBd)	EIRP (dBc)	Limit (dBc)	Margin (dB)
1560.790	25.0	-73.2	7.1	8.7	121.6	100.0	-21.6
1561.806	23.8	-74.4	7.1	8.7	122.8	90.0	-32.8
1563.720	32.5	-65.7	7.1	8.8	114.0	90.0	-24.0
1572.900	29.7	-68.7	7.1	8.8	117.0	90.0	-27.0
1584.500	22.7	-75.7	7.1	8.8	124.0	90.0	-34.0
1588.710	24.7	-74.0	7.1	8.8	122.3	90.0	-32.3
1591.800	23.1	-75.8	7.1	8.8	124.1	90.0	-34.1
1594.830	25.3	-73.8	7.1	8.8	122.1	90.0	-32.1
1601.755	25.4	-73.6	7.1	8.8	121.9	100.0	-21.9
1605.030	25.3	-73.7	7.2	8.8	122.1	90.0	-32.1
1607.718	34.4	-64.6	7.2	8.8	113.0	100.0	-13.0

Table 7-4: Test Equipment for Testing Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz - 12.8 GHz)	3826A00144	10/23/09
900928	Hewlett Packard	83752A	Synthesized Sweeper, (0.01 - 20 GHz)	3610A00866	2/9/10
900791	Chase	CBL6111B	Bilog Antenna (30 MHz – 2000 MHz)	N/A	12/12/10
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	6/14/10
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	6/14/10
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1054	6/14/10
901262	ETS	3160-9	Double ridged Guide Antenna (1 - 18 GHz)	6748	5/1/11
901426	Insulated Wire Inc.	KPS-1503-3600-KPS	RF cable, 30'	NA	10/17/09
901516	Insulated Wire, Inc.	KPS-1503-2400-KPS-09302008	RF cable, 20'	NA	10/17/09
901517	Insulated Wire Inc.	KPS-1503-360-KPS-09302008	RF cable 36"	NA	10/17/09
901365	MITEQ	JS4-00102600-41-5P	Amplifier, 0.1 - 26 GHz, 30dB gain	N/A	3/4/10

Test Personnel:

Daniel W. Baltzell		September 12, 2009
Test Engineer	Signature	Date Of Test

8 FCC Rules and Regulations Part 2 §2.202: Necessary Bandwidth and Emission Bandwidth

Type of Emission: F9W

Digital Voice and Data: 9600 BPS

Calculations:

$$B(n) = (R/\text{Log}_2(S) + 2DK)$$

8K40F9W:

where

R = 9.6 kilobits per second [raw data rate]

S = 4 [4-level FSK]

D = 2.77 [Peak FM Deviation]

K = 0.65

B(n) = 8.4 kHz

FCC Emission Designator: 8K40F9W

9 Conclusion

The data in this measurement report shows that the **Harris Corporation Model SkyMASTR Base Station, FCC ID: BV8MBS700A100**, complies with all the applicable requirements of FCC Parts 90, 15 and 2.